International Civil Aviation Organization

WORKING PAPER

TAG-MRTD/17-WP/15
6/3/07
English only

TECHNICAL ADVISORY GROUP ON MACHINE READABLE TRAVEL DOCUMENTS (TAG-MRTD)

SEVENTEENTH MEETING

Montréal, 20 to 22 March 2007

Agenda Item: 2 Implementation of ePassports
Agenda Item: 2.1 Progress and Issues

REPORT ON TEST METHODOLOGY BEING DEVELOPED FOR MRTDs AND e-MRTDs

Presented by the New Technologies Working Group (NTWG)

. INTRODUCTION

1.1 This document describes the work ongoing within WG3 to develop a test methodology for electronic machine-readable travel documents (e-MRTDs). The history of the work to date and the work programme moving forward are described.

2. BACKGROUND

2.1 In September 2003 WG3 agreed that a task force should be created to look at a test methodology for supporting the e-Passport. This new task force (Task Force 4 or as it is often referred to, TF4) determined that work should initially focus on durability testing for machine readable passports in general as well as those that incorporate contactless integrated circuits. That work has continued since its inception and has realized a final Working Draft (see **Attachment A** to this Working Paper).

2.2 At the third meeting of TF4, which was held in September 2004 the focus of the work expanded to include RF, protocol, and system-related testing. This expanded work effort has resulted in the creation of a multi-part standard on Test Methods for MRTDs made up of:

Part 1: Durability of Machine Readable Passports;

Part 2: RF Protocol and Application Test Standard for ePassport – Tests for Air Interface, Initialisation, Anti-collision and Transport Protocol. The current Working Draft of Part 2 is included as **Attachment B** to this Working Paper;

Part 3: RF Protocol and Application Test Standard for ePassport – Tests for Application Protocol and Logical Data Structure,. The current Working Draft of Part 3 is included as **Attachment C** to this Working Paper; and

Part 4: RF Protocol and Application Test Standard for ePassport – E-Passport Reader Tests for Air Interface, Initialisation, Anti-collision and Transport Protocol. The current Working Draft of Part 4 is included as **Attachment D** to this Working Paper.

2.3 Based on discussion with the NTWG during its meeting in Kingston (Canada) on 11-14 September 2006 WG3 approached ISO with a request that the multi-part standard on Test Methods for MRTDs be subdivided into two (2) distinct publications: the first to be a multi-part International Standard that defines the Test Methods themselves, whilst the second would set out the performance expectations that correspond to each test specified in the International Standard. The multi-part International Standard would be developed collaboratively by ICAO and ISO and once ready would be published as an ISO Standard. The performance expectations would not be published by ISO, but by ICAO within the ICAO Doc 9303 Series of MRTD Standards.

2.4 ISO/IEC JTC1/SC17 considered and approved WG3s request to ballot a new work item proposal (NP) to cover the creation of a multi-part ISO Standard for Test Methods for Machine Readable Travel Documents at its 19th Plenary Meeting, held in St. Denis, France from 4 to 6 October 2006. The approval to ballot the NP is set out in SC17 Resolution 571/06:

RESOLUTION 571/06 - NEW WORK ITEM PROPOSAL FOR WG3
ISO/IEC JTC1/SC17 agrees that a NP for Test Methods for Machine Readable Travel Documents (WG3) shall be raised. The NP will be for a multipart standard, three parts of which will undergo concurrent NP and CD ballot, as follows:

Part 1: Durability of the ePassport Booklets
Part 2: Contactless interface
Part 3: Logical Data Structure and PKI protocols

SC17 notes that further parts of this standard will also be developed in the future. SC17 thanks all the contributors to the work on the above NP including, SC17/WG1, WG4, WG8, SC37.

2.5 TF4 is advancing this work within ISO, as well as, on a collaborative basis with the NTWG.

3. ACTION BY THE TAG/MRTD

3.1 The TAG/MRTD is invited to:

a) note the work done to date on test methodologies; and
b) endorse the continuing work plan on this topic.

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MACHINE READABLE TRAVEL DOCUMENTS

TECHNICAL REPORT

DURABILITY OF MACHINE READABLE PASSPORTS

Version: **3.2**
Date: 2006-08-30

Published by authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

File: WG3TF4_N0232_CurrentDraftTestingSpecificationMRTDs V3.2.doc
Author: ISO/IEC/JTC1/SC17/WG3/TF4 for ICAO-NTWG
TF4 Doc: N0232

Preface

Document History

This document is based on decisions taken at WG3 Meeting Singapore, October 6 - 8, 2003. As a consequence, new taskforces were created, one of these dealing with the test methods and requirements for MRTDs with contactless integrated circuits. The initial discussion in this taskforce resulted in a proposal to create a strawman draft specification using the work done by another team of experts as presented to the ICAO TAG-MRTD during its 14th session as Working Paper 22.

WP/22 is composed of TF documents WG3TF4_N0003_TAGMRTD.14.WP.022.App.en.doc and WG3TF4_N0002_TAGMRTD.14.WP.022.en.rtf

The original TF proposal is described in TF document WG3TF4_N0008_eMail_Otto_Rationale_ePassportTest.pdf

At ICAO/TAG 16, Montreal, Canada, September 26-28, 2005, WG3/TF4 presented working paper 14 (TF4 document WG3TF4_N0116_TAG16 WP Durability NTWG V2.DOC). This document asked the TAG to acknowledge the work already accomplished by WG3/TF4 and to endorse the continued development of a minimum durability specification – in the form of a Technical Report.

Editorial Explanatory note

Italic style is used for explanatory comments in the drafting stage and is not meant to remain in the final text. The color of text used is not of significance. Color is used in some instances to better visualize insertions and definitions, etc.

Revision History

Version	Date	TF4 Doc No.	Description
0.1	2003-11-17	0022	Critical review and adaptation of basic principles using TF doc no 002
0.1a	2004-01-20	0023	Revision of v. 0.1 Content added to sections 3 upward (Definitions, Stress Methods, Evaluation Methods, Test Procedures, _Test Scenarios)
0.2	2004-03-14		Dealing with comments implied in v.0.1a
0.3	2004-03-19		Some editorial and opinion comments
0.4	2005-03-04		Major revision introducing test plan concept and removing direct source tracking references to WP22
0.5	2005-09-26	0117	First draft to include all submissions from contributing editors
0.6	2005-11-23		Result of editorial session in Paris, November, 2005
1.0	2006-02-10	N0147	Output from Ottawa meeting. Re-worked document
2.0	2006-05-12	N0182	Technical re-write contribution from ISO SC17/WG1 from ad-hoc meeting
3.0	2006-08-16	N225	Results from meeting in Graz, June 2006
3.1	2006-08-23	N0230	Final Committee draft from TF4D after Ottawa meeting
3.2	2006-08-30	N0232	Update of dynamic bend method

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1 Introduction

1.1 Scope and Purpose

ICAO Doc. 9303, [R7], provides the basic functional specification for Machine Readable Travel Documents (MRTDs) and, together with the Supplement, [R10], which is published from time to time, describes all relevant properties of MRTD's. Machine Readable Passports (MRP's) are a subset of all MRTD's. The publication of the Part 1 of the 6th edition of Doc 9303 introduces the contactless integrated circuit to the MRP. Such a passport containing a contactless integrated circuit is commonly referred to as an e-Passport.

This Test Specification provides a set of instructions for prototype evaluation of MRP's which may incorporate contactless integrated circuits. Prototype evaluation is an instrument to establish the ability in principle of a specific type of document to fulfil the requirements of use. The procedure of prototype evaluation, therefore, is also referred to as "Type Evaluation".

This document is a companion to ICAO Doc. 9303. It specifies the minimum criteria that shall be achieved in order to meet ICAO's expectations for durability of fully personalized MRP's. Therefore, by it's existence, and endorsement by ICAO, this document implicitly defines additional requirements for Passports above and beyond Doc. 9303. Some of the tests described herein are also intended to serve as an instrument for the assessment of the ageing behaviour of the MRP and its components.

1.2 Future Considerations

Where technologies or combinations of technologies are to be applied in a MRP, which are not covered by the test methods described below, it is recommended to define such test methods based on available methods described in ISO/IEC, ANSI or any other accepted international standard organization in cooperation with the suppliers of such technologies.

Today, there is no stable state of the art regarding the correlation between stress and ageing, neither for previously existing nor for oncoming types of MRP. Related work by SC17/WG1/TF2 is still under way. The tests that can be described at the present stage may contribute to improve such knowledge but need to be considered preliminary. It is important to notice that ultimately, reliable and predictably useful correlations can only be achieved by continuously comparing the ageing behaviour of documents in real use to the predictions made. Such predictions are based on assumptions that, in particular if novel and unusual technologies and components are used, are in many cases unproven and preliminary in nature. It is one of the aims of this standard to help in the task of establishing sound correlations. This is done by providing tools for executing tests with comparable results for a multitude of acting parties. Comparable results are a prerequisite to encourage the execution of field surveys in quality related research and their use for a continuous improvement not only of this standard but also of the quality of MRP's on a global basis.

1.3 Other Uses for this Document

The tests defined in this document may also be appropriate for other forms of MRTD, however, they may require modification before use.

Where applicable, tests may be used to evaluate characteristics of non-personalized MRP's or materials used to make MRP's.

Type Evaluation is usually a one-time exercise in the life cycle of a specific type of document. However the same test procedures may be useful for the proper definition of quality assurance procedures during the regular production of MRTD's. In the framework of the contractual relationship between a manufacturer and his customer(s) it is common practice to establish an expected quality level for the MRTD's in the delivery contract, and also to specify acceptance criteria for individual deliveries in executing the contract. On the other hand, it is good practice to leave it with the manufacturer to decide on the production quality measures to assure this quality level.

This specification has been carefully designed to provide the user with a set of tools for evaluating MRP's, whether it be Prototype Evaluation, Delivery Acceptance, or any other purpose.

Because of the paramount importance of a common understanding between manufacturer and customer of the role of testing procedures in the production of security documents, an informative

annex A may be included in a future version of the standard which gives a more detailed best practice survey of the principles of quality assurance and of the role that the present standard is expected to play in this context.

1.4 Terminology

For ICAO, keywords are SHALL, which means mandatory, and SHOULD, which is optional but is considered best practices.

1.5 Abbreviations

ICAO	International Civil Aviation Organization
MRP	Machine Readable Passport
MRTD	Machine Readable Travel Document
PIC	Proximity Integrated Circuit (note, Doc 9303 uses CIC (contactless integrated circuit) and PIC interchangeably)

1.6 Terms and Definitions

Constant	Fixed values that can be given to parameters (within methods) when defining a sequence or test plan.
Evaluation Method	method to measure numerical values for specific document properties
Evaluation Result	All numerical values related to document properties measured upon performing a Test Sequence.
Method	Instruction or set of instructions defining equipment and related tools and materials in an experimental setup, including general advice on their use in a specific test procedure.
Page	indicates any single side of an individual sheet of the MRP.
Parameter	A variable quantity within a test procedure that is not part of the instructions describing the procedure. In particular experimental parameters that need to be controlled during the test sequence but whose values and/or tolerances are not explicitly defined in a specific Stress or Evaluation Method or sequence.
Sheet	any structure having a free edge and an opposite edge attached to the spine making up the MRP including covers, datapage, visa pages, observation pages, and chip sheet. Each sheet has 2 pages.
Stress Method	An experimental setup and procedure that may or may not deteriorate or destroy the document under examination.
Test instruction	A distinct piece of information required within the framework of test execution.
Test plan	A list of Test Sequences and their specific Test Parameters and expected Evaluation Results.
Test procedure	Set of instructions to be followed in order to obtain a test result.
Test sequence	Test procedure that comprises a number of different methods in a defined order of execution.

Type Evaluation or Type Approval	Type approval is the process of testing a design (type of documents produced while using a common material and component basis and the same manufacturing processes, including same production quality assurance process) to ensure it is compliant-in-principle with the specifications.

1.7 References

The following normative documents contain provisions that, through reference in this text, constitute provisions of this technical report. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical report are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

[R1] ISO/IEC 10373-1:2006, Test methods — Part 1: General characteristics

[R2] ISO/IEC 10373-6:2001, Test methods – Proximity cards

[R3] ISO/IEC 10373-6:2001/FDAM1, Test methods – Proximity cards (Amendment 1: Protocol Test Methods for Proximity Cards)

[R4] ISO/IEC 10373-6:2001/AM2:2003, Test methods – Proximity cards (Amendment 2: Improved RF Test Methods)

[R5] ISO/IEC 10373-6:2001/FDAM4, Test methods – Proximity cards (Amendment 4: Additional Test Methods for PCD RF Interface and PICC Alternating Field Exposure)

[R6] ISO/IEC 10373-6:2001/FDAM5, Test methods – Proximity cards (Amendment 5: Bit Rates of fc/64, fc/32 and fc/16)

[R7] ICAO Doc 9303, Part 1, 6th edition, 2005, Machine Readable Travel Documents.

[R8] ISO 105-E04:1994, Textiles - Tests for colour fastness - Part E04: Colour fastness to perspiration.

[R9] ISO/IEC 7816-1, Identification cards – Integrated circuit cards – Part 1: Cards with contacts – Physical characteristics

[R10] ICAO Supplement to Doc 9303 as published from time to time.

[R11] ISO/IEC 7810, Identification cards - Physical characteristics.

[R12] TAG-MRTD/14-WP/22: Recommendations on Durability Measurement of Travel Documents, May 2003

[R13] ISO 12757: Ball point pens and refills

[R14] ISO 1817: Rubber, vulcanized - Determination of the effect of liquids

[R15] ISO 9227:1990: Corrosion tests in artficial atmoshpheres – salt spray tests

[R16] ISO 1302: Geometrical Product Specification (GPS) – Indication of surface texture in technical product documentation

[R17] RF Protocol and Application Test Standard for e-Passport – Part 2, WG3TF4_N0163, Version 0.9, 2006-02-10

[R18] ASTM E 832 – 81 (Reapproved 2003): Standard Specification for Laboratory Filter Papers

[R19] ISO 105-A02:1993: Textiles – Tests for colour fastness – Part A02: Grey scale for assessing change in colour

[R20] ISO 105-A02:1993 TECHNICAL CORRIGENDUM 2 (2005): Textiles – Tests for colour fastness – Part A02: Grey scale for assessing change in colour TECHNICAL CORRIGENDUM 2

[R21] ISO 105-B02:1994: Textiles – Tests for colour fastness – Part B02: Colour fastness to artificial light: Xenon arc fading lamp test

[R22] ISO 105-B02:1994 AMENDMENT 1 (1998): Textiles – Tests for colour fastness – Part B02: Colour fastness to artificial light: Xenon arc fading lamp test AMENDMENT 1

[R23] ISO 105-B02:1994 AMENDMENT 2 (2000): Textiles – Tests for colour fastness – Part B02: Colour fastness to artificial light: Xenon arc fading lamp test AMENDMENT 2

[R24] ISO 12040:1997: Graphic technology – Prints and printing inks – Assessment of light fastness using filtered xenon arc light

2 Methodology

The systemic approach used in this document provides three structural levels to define a complete test specification for MRP's.

The first level deals with methods to exert defined stresses to documents and to evaluate the results of such stresses. The second level deals with predefined sequences of stresses and related evaluations using the methods defined in level 1. The third level specifies the lists of test sequences and the individual quantities of test specimens to be subject to each sequence. The purpose is to include in such lists all sequences that are considered necessary to achieve type approval for a specific type of MRP with specific lifetime and usage expectations. This is referred to as a test plan.

This approach provides flexibility in creating individual test plans appropriate for varying user requirements and MRP specifications without increasing the variety of basic testing methods beyond a strict minimum. It also allows the use of a parameterized method description; parameters, which may be explicitly specified on the sequence and/or test, plan level.

In this way this Test Specification provides the entire toolset for prototype evaluation of MRP's.

Level	Subject	Description	Degree of variance	Chapter
1	Stress methods	The purpose is to submit the document(s) under evaluation to specific stress or environmental conditions in a well-defined experimental setup that ensures reproducibility.	Parameters	4
1	Evaluation methods	The purpose is to measure numerical values for specific document properties using well-defined and reproducible experimental setups that may or may not deteriorate or destroy the document under examination.	Parameters	5
2	Test sequences	Sequence of use of the above methods in performing a complete test.	Constants and Parameters	6
3	Test plans	Scenarios which link the user requirements to specific test sequences and related parameters used for the tests on the one hand and to specific test results on the other.	Constants	7

Table 1: Hierarchical Approach for Test Methodology

Each sequence is composed of stress methods and evaluation methods executed in a specific order. A test plan is composed of one or more individual sequence(s) that is linked to a specific set of documents and user requirements.

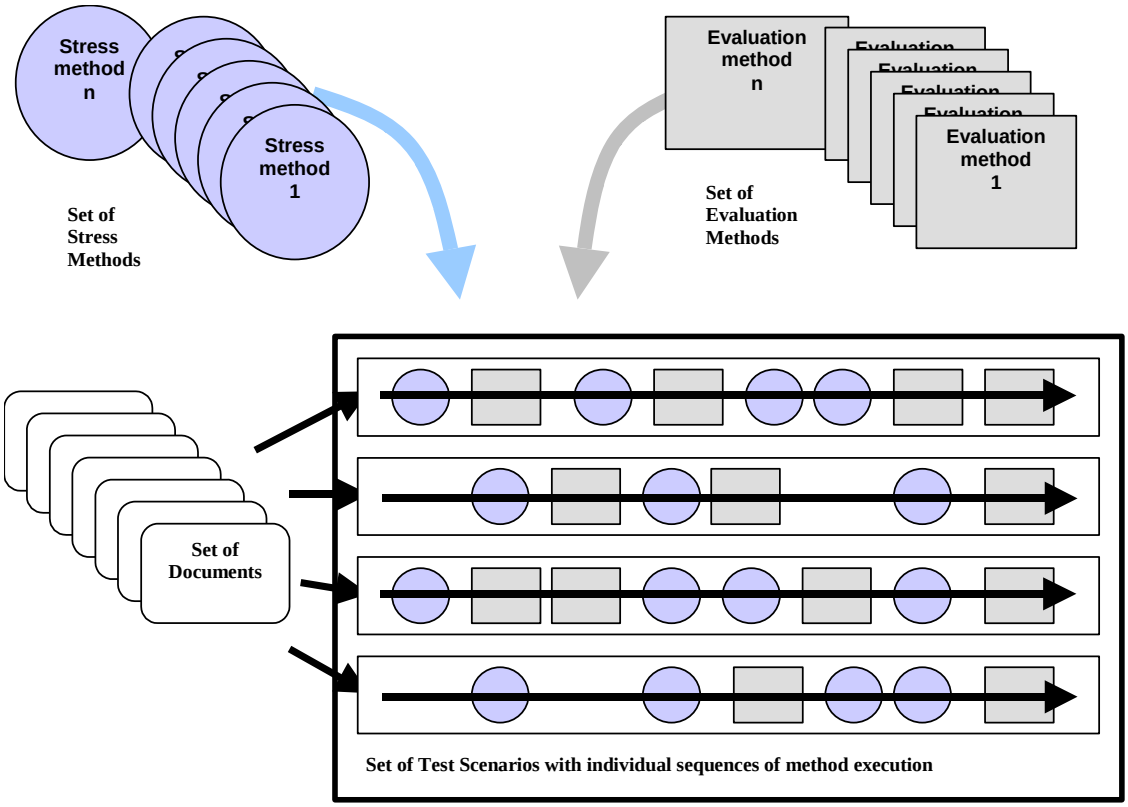


Figure 1: - Relationship Between Methods, Sequences and Test Plans

3 Guidance to the Tester

3.1 Number of Samples

References are given to a single MRP. However, multiple MRP samples may be tested simultaneously depending on the size and construction of the test apparatus.

3.2 Preparation

Test samples shall, wherever applicable, be either finished MRP's or be prepared from finished MRP's having passed the entire production process including visual personalisation with a dataset considered typical for the specific type of passport. Initialisation and personalisation of the chip may be done in an arbitrary way as long as the chip is able to support the necessary tests within the intended test sequence.

MRP’s shall be conditioned in accordance with 4.1.

Test pieces shall, as necessary, be prepared from the test samples in the particular form required by the test apparatus used.

3.3 Sampling

In certain cases samples may be taken from the base material before MRP manufacture if it can be demonstrated that no significant change in the property to be tested can arise during subsequent processing. The samples used to prepare a set of test pieces shall be taken from the same batch of MRP base materials.

3.4 Storage

Any test samples or test pieces retained for reference shall be stored under the environmental conditions specified in 4.1 Default Environment.

All such samples shall be clearly cross-referenced to the test report and any relevant supplementary documentation.

4 Common Method Information

4.1 Default Environment

Unless otherwise specified, testing shall take place in an environment having a default temperature of 23 °C ± 3 °C (73 F ± 5 F) and relative humidity of 40% RH to 60% RH (ISO/IEC 10373-1).

4.2 Climatic conditions

Climatic conditions defined in the test methods given below are the conditions within the chamber. The resulting temperature in the MRP is not specified or defined in the methods.

4.3 Tolerances

Unless otherwise specified, a tolerance of ± 5% shall be applied to the quantity values given to specify the characteristics of the test equipment (e.g. linear dimensions) and the test method procedures (e.g. test equipment adjustments).

4.4 Default MRP holder

A structure for holding the MRP while maximizing air space around the MRP during testing shall have the general construction as shown in Figure 2. There are no size or quantity limitations for the holder rack, any number of MRP positions may be used.

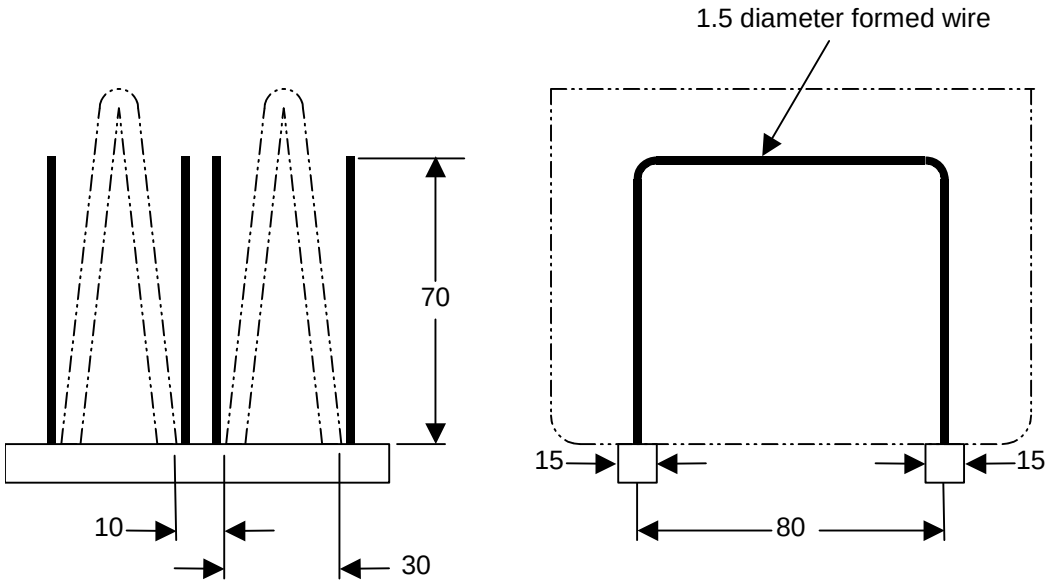


Figure 2 MRP rack

5 Stress Methods

Instructions and methods described below are designed to apply reproducible stresses to the travel document. Instructions and methods that describe how to measure the effect of these stresses are given in 6 Evaluation methods.

The fundamental philosophy behind all stress methods is to define conditions that mimic real daily use (as much as possible). In cases where the correlation between real life and the stress method is tenuous, every attempt has been made to define conditions that produce similar rates of deterioration.

5.1 Conditioning Stress Method

5.1.1 Introduction

The MRP's to be tested shall be conditioned to the test environment as described below.

5.1.2 Input Parameters

t = time of conditioning. If t is not specified, assume 24 hours.

5.1.3 Apparatus

- Default MRP holder.

5.1.4 Method

- Remove MRP from any box and protective packaging.
- Place MRP in default MRP holder with spine up. MRP shall not be forced open but may open on its own. Minimum spacing between MRP and any other MRP shall be 10 mm in all directions.
- Expose MRP to a temperature of 23 °C ± 3 °C and relative humidity of 40%RH to 60%RH for at least time t.

5.2 Thermal Cycling Method

5.2.1 Introduction

This stress method subjects the MRP to cycling between two temperature extremes. This stress simulates the thermal shock the MRP could experience due to thermal expansion and contraction of each MRP component. The test is conducted over a short period of time for each stress cycle.

5.2.2 Input Parameters

n = number of cycles

5.2.3 Apparatus

- Two climate controlled chambers. Where applicable, a single fast-response climate controlled chamber may be used in place of a second test chamber.
- Default MRP holder

5.2.4 Method

- Control of relative humidity in the climate chambers is not required for this test.
- Place in a climate controlled chamber at temperature of 77 °C ± 3 °C for 15 minutes.
- Transfer the MRP in the default MRP holder to a second climate controlled chamber held at a temperature of –32 °C ± 3 °C in less than 60 seconds (a transfer time of 15 seconds is recommended). The position of the MRP in the holder should not be modified during the transfer process.
- Subject the MRP to a temperature of –32 °C ± 3 °C for 15 minutes.
- Repeat the process for n cycles as depicted in Figure 3.
- At the end of the cycling process remove MRP and return to the default environment. Leave MRP in holder and condition according to 4.1.

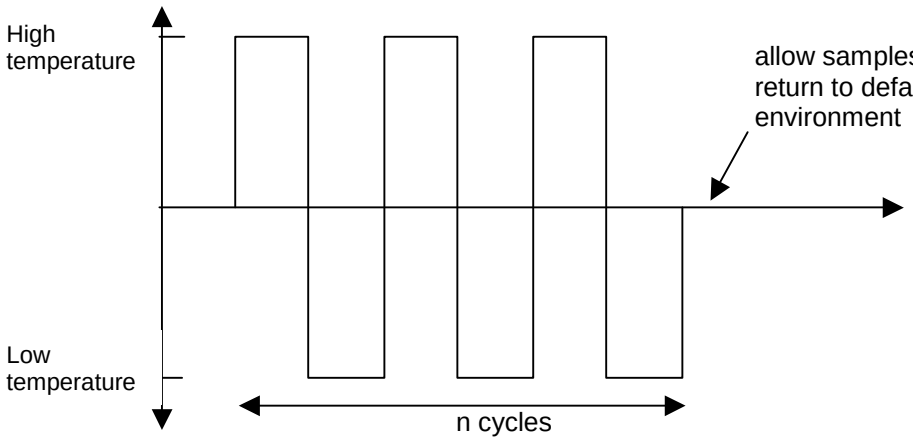


Figure 3: Thermal Cycling

5.3 Storage Temperature Stress Method

5.3.1 Introduction

This stress method applies high or low temperature and humidity to the document for specified amounts of time. This stress simulates a document's exposure to various storage conditions. The purpose of the test is to demonstrate the resistance of MRP construction to such conditions in principle.

The test refers to temperature stability in Doc 9303: "2.4 Temperature stability. The MRP shall remain machine readable at operating temperatures ranging from –10/C to +50/C (14/F to 122/F). The MRP should not lose its reliability after being stored or exposed at temperatures ranging from –35/C to +80/C (–31/F to 176/F)."

Note that extremes of temperature may affect various security features, especially inks. Changes in these features shall not be considered a failure unless they render the document unrecognisable as belonging to the bearer.

5.3.2 Input Parameters

T = temperature at which the passport is stored

H = relative humidity for storage

5.3.3 Apparatus

- Climate controlled chamber.
- Default MRP holder

5.3.4 Method

- Place MRP in climate controlled chamber at temperature T ± 3°C and H Relative Humidity for 168 hours.
- Remove MRP

5.4 Operational Temperature Stress Method

5.4.1 Introduction

This stress method applies high or low temperature and humidity to the document for specified amounts of time. This stress simulates a document's exposure to various climatic conditions. The purpose of the test is to demonstrate the resistance of MRP construction to such conditions in principle.

The test refers to temperature stability in Doc 9303: "2.4 Temperature stability. The MRP shall remain machine readable at operating temperatures ranging from –10/C to +50/C (14/F to 122/F). The MRP should not lose its reliability after being stored or exposed at temperatures ranging from –35/C to +80/C (–31/F to 176/F)."

Note that extremes of temperature may affect various security features, especially inks. Changes in these features shall not be considered a failure unless they render the document unrecognisable as belonging to the bearer.

5.4.2 Input Parameters

T = temperature at which the passport is expected to operate

5.4.3 Apparatus

- Climate controlled chamber.
- Default MRP holder

5.4.4 Method

- Place MRP in climate controlled chamber at temperature T ± 3°C for 1 hour.
- Evaluate the MRP within the climate chamber.

5.5 Impact Stress Method

5.5.1 Introduction

This stress method applies a certain forced impact to the sample to simulate stamping of the document at a border control point.

5.5.2 Input Parameters

S = sheet to be affected by impact. Note, as only visa pages will be impacted, sheet S may not be impacted directly.

5.5.3 Output Parameters

None

5.5.4 Apparatus

- Stamp:

  The face of the stamp is a flat solid surface, steel or equivalent, with a diameter 29 mm.

  Concentric circles are etched into the surface. The profile of the grooves is rectangular, with a minimum groove depth 0.3 mm. The width of the grooves is 1 mm ± 0.1 mm, and the nominal distance between grooves is 1.5 mm.

  The nominal diameter of the central circular groove is 1 mm.

  The accumulated tolerances of groove distances is ± 0.5 mm.

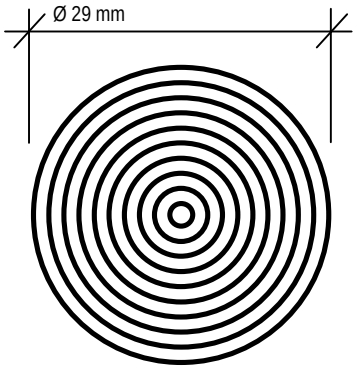


Figure 4: Impact Pattern Resulting from Specified Stamp

- The stamp/weight may be constructed as one of:
  - Single-piece stamp of mass M
  - Stamp that is placed on document and then struck by a weight of mass M.
- Flat surface made of steel at least 12 mm thick with a 2mm rubber blanket
- The rubber blanket shall have a Shore D value of 50.
- Suitable guiding for stamp to maintain stamping face parallel to MRP surface at the point of impact.
- Holder for retaining pages of the MRP against the flat surface during testing.

- Description of stamp parameters:

  H = nominal height (mm) from which an impact stamp is dropped onto the document or weight is dropped onto the stamp, thereby defining an impact velocity according to the formula for acceleration of inert bodies under earth gravitation.

  H shall be between 0.05 m and 0.20 m

  M = weight (kg) of the impact stamp

  D = displacement between two impacts

  The product P = H·M shall have a value of 0.02 kg·m.

  If the apparatus is composed of a stamp that is impacted by a separate weight, the weight shall have mass M, and be dropped from a height H above the stamp. The mass of the stamp is not considered.

5.5.5 Method

- Locate the sheet S.
- Locate the nearest visa page that could require stamping and turn this over on top of the sheet under test. Depending on location, it is possible that there could be several sheets between the sheet S and the nearest visa page.
- Open MRP to 180 degrees and place on flat hard surface covered with a rubber coating so the outer cover is directly against the flat surface.
- Drop impact stamp of mass M from a height H at each of the locations as shown in Figure 5. Move from first to last location progressing from left to right and from top to bottom.
- If there are visa pages that could require stamping on the opposite side of the sheet under test, repeat the above process on the other side, but using a different MRP.

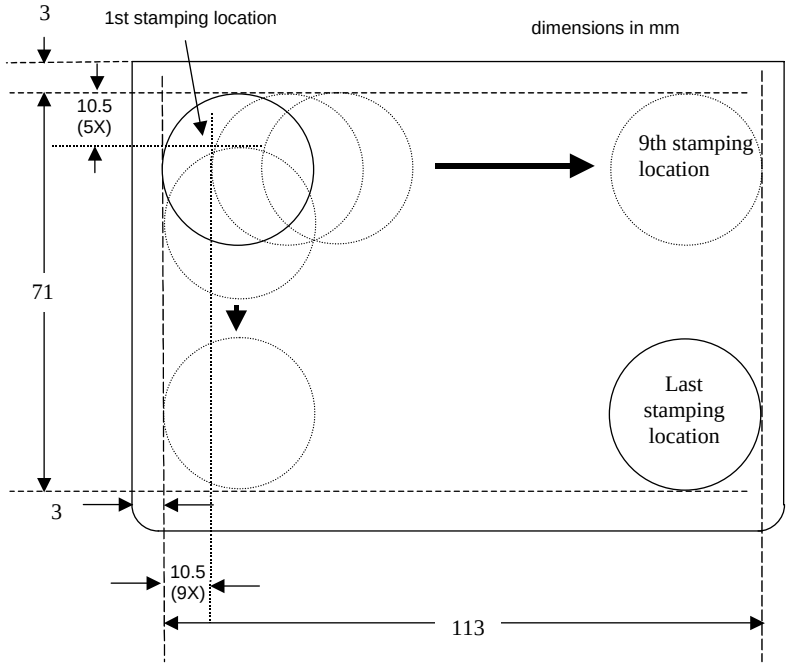


Figure 5: Impact stamp locations

5.5.6 Alternate Method

- If the fragile area is obvious it is acceptable to exclude drops that do not impact this obvious area.

5.6 Book Bend Stress Method (Back Pocket)

5.6.1 Introduction

This test simulates on the stresses of sitting on a MRP, This method applies a force to the MRP and forces it to bend around a curved surface. The resulting stresses acting on the MRP are a combination of compression and bending stresses.

5.6.2 Input Parameters

n = number of cycles to apply force

5.6.3 Output Parameters

None

5.6.4 Apparatus

- A test apparatus to load the MRP in a manner consistent with Figure 6 below.
- An anvil with spherical impact area of radius r = 150 mm.
- A cushion having elastic properties equivalent to an air cushion inflated to a pressure of 30 kPa, or to foam having density of 40-50 g/l and hardness of 20-30 kg/cm^2 as defined in ISO 2439. The minimum thickness of the cushion is 0.1 m. The minimum dimension, in any direction, of the cushion surface on which the sample is placed shall be be larger than 0.2 m and shall be larger than the anvil.
- Notes:
  The test results do not depend on the exact properties of the cushion as long as (a) its resistance to the force exerted by the sample under the anvil is sufficient to so that the force is not deviated from the sample (i.e. the activated anvil shall not touch the cushion directly as long as the bending of the sample is not entirely following the anvil shape),
  (b) its elasticity is sufficient to follow the anvil shape without irregular deformations, and
  (c) its resistance to the exerted pressure is not subject to local deviations or irregularities.

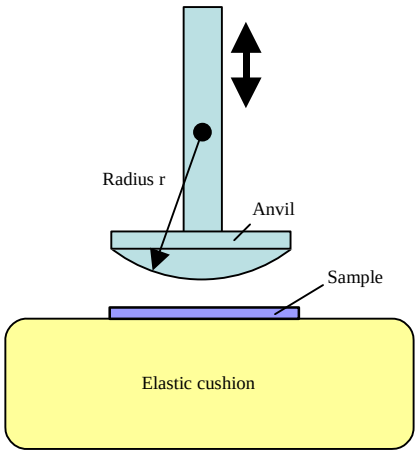


Figure 6: Schematic of the test apparatus to load the MRP in the Back Pocket Bending Method

5.6.5 Method

- Place and center the MRP with respect to the cushion and the spherical anvil.
- Secure the MRP on the test machine so that the centered placement can be maintained during testing. A flexible support pocket constructed from fabric such as denim may be used.

- Press the spherical anvil into the MRP and cushion support to a maximum force of 350 N. Maintain the applied force of 350 N for 5 s.
- Lift the spherical anvil so that it does not touch the MRP or cushion. The net external force acting on the MRP shall be less than 0.2 N.
- Repeat the loading and unloading process for a total of n times.
- Turn the MRP over and repeat the loading and unloading process n times.

5.7 Dynamic Bend Stress Method

5.7.1 Introduction

The purpose of this test is to determine the bending fatigue resistance of the booklet construction to fully reversed loading. This method differs from the back pocket stress method by avoiding directly applied pressure. This method accelerates fatigue due to imposed bending, especially in the area of the antenna and associated connections if present.

5.7.2 Input Parameters

n = Number of bending cycles with the MRP

O = orientation of book in the bender

5.7.3 Output Parameters

None

5.7.4 Apparatus

- Dynamic flexion machine as illustrated below.

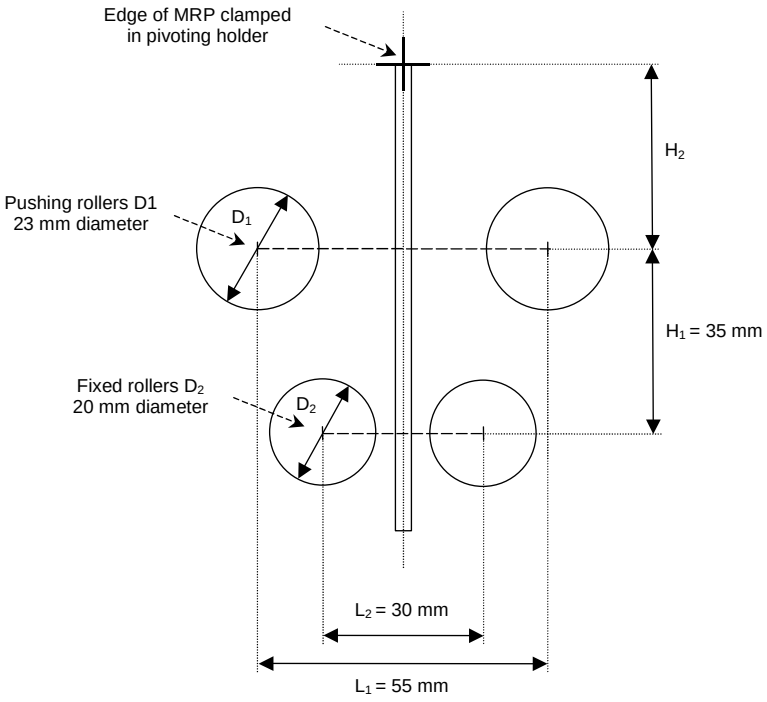


Figure 7: Apparatus to impose cyclic motion

- The pushing rollers shall be set to ensure that the centreline deflection of the MRP is equal on each segment of the stroke.
- The distance H_2 between the clamped edge of the MRP and the pushing rollers on center is adjustable between 40 and 58 mm.
- Pushing rollers and fixed rollers are separated by 35 mm (H_1) on center.
- Pushing rollers have an outer diameter D_1 of 23 mm and are separated by 55 mm (L_1) on center.
- Fixed rotating rollers are separated by a distance of 30 mm (L_2)on center and have an outer diameter D_2 of 20 mm.

5.7.5 Calibration of movement Method

- Taking into account, the specified orientation, O, the MRP shall be clamped at one extremity and allowed to freely move at the opposite edge.
- H_2 should be adjusted depending on the orientation of the book

Orientation (O)	H_2
Spine clamped	40 mm
Top clamped	58 mm

- Move the pushing rollers so that they just push the passport up against the fixed rollers without bending the passport as illustrated below. The amount of roller movement is b0 and is called the initial position.

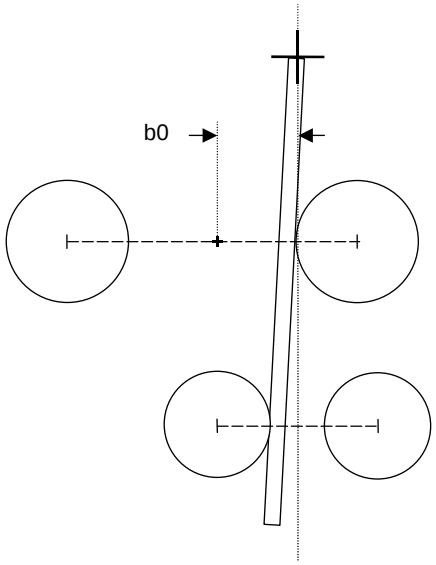


Figure 8: Initial position of Pushing Rollers

- Allow the pushing rollers to move freely, however set the maximum travel of the pushing rollers to b0 + 20 mm.
- Apply a force of 40 N in the direction of the bold arrow in Figure 9 for 1 minute.

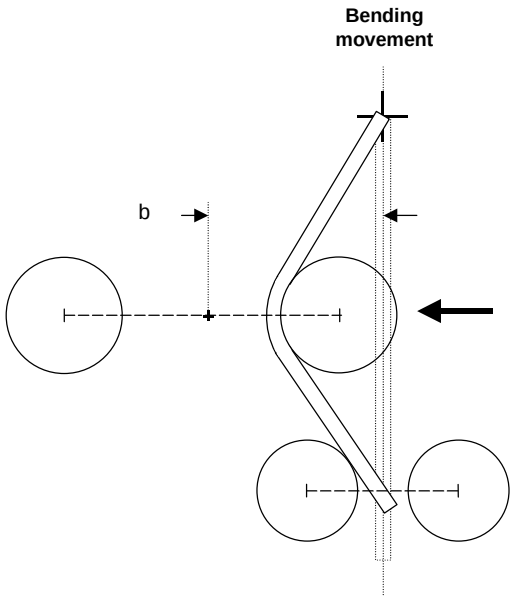


Figure 9: Bending movement

- Measure the amount of travel of the pushing rollers. If the maximum travel is reached with a force of less than 40 N then the travel to be used for the test is b = b0 + 20 mm; otherwise measure the amount of travel of the pushing rollers, b, as shown in the figure above.
- Remove 40 N load.
- Note, alternate equipment may be used for calibration.

5.7.6 Method

- Set the travel of the pushing rollers to ±b as measured above.
- Flex the book n times at 0.5 Hz. One cycle is a one deflection in each direction.

5.8 Torsion Stress Method

5.8.1 Introduction

The purpose of this test is to determine adverse mechanical or functional effects in the MRP arising from torsional fatigue. This method differs from the back pocket stress method by applying only torsional stresses to the MRP.

5.8.2 Input parameters

n = Number of torsion cycles

5.8.3 Output parameters

None

5.8.4 Apparatus

- The test apparatus shall impose torsional motion in a manner consistent with Figure 10 shown below.

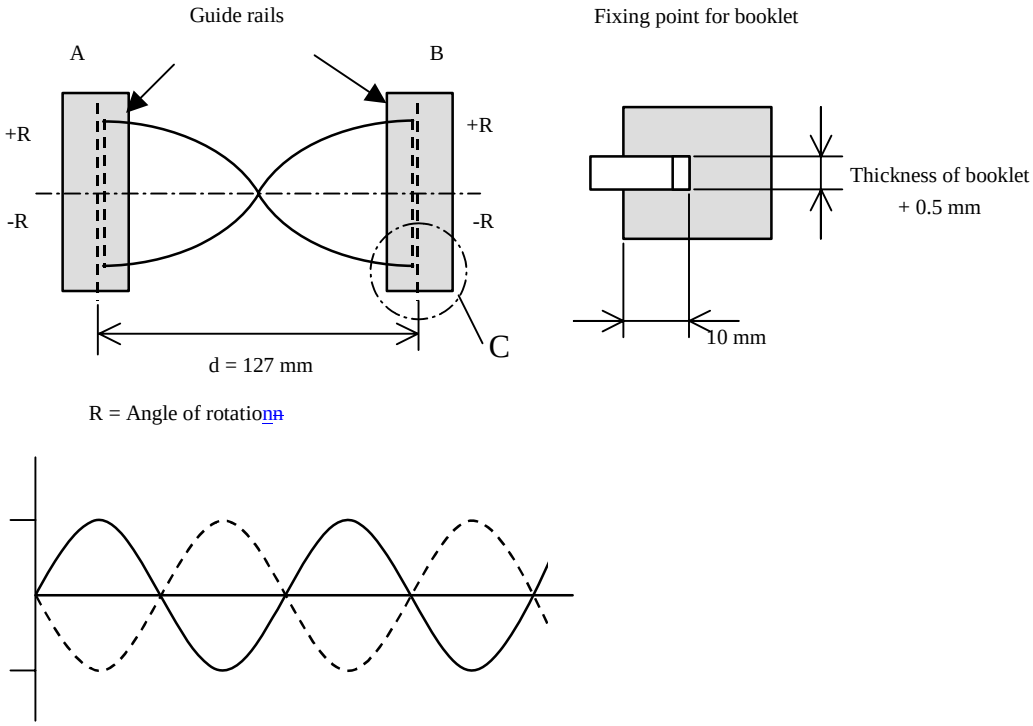


Figure 10: Schematic of the apparatus and the associated motion for torsion

5.8.5 Calibration

- Adjust separation of guide rails to thickness of book plus a maximum of 1 mm.
- Place MRP in test apparatus
- Set maximum travel of holders to 15 degrees.
- Apply a torque of 0.3 N-m for 1 minute.
- Measure amount of travel and reset maximum travel, R, of holder to amount measured.

- Remove 0.3 N-m torque load.
- Note, alternate equipment may be used for calibration.

5.8.6 Method

- Place MRP in test apparatus
- One cycle consists of the following continuous steps (movement is not stopped at the 0 position except at that start and end of the test):
    - Start from a point where both holder A and holder B are at angle 0
    - Rotate holder A to angle +R, while simultaneously rotating holder B to angle –R.
    - Rotate holder A to angle –R, while simultaneously rotating holder B to angle +R.
    - Rotate holder A to angle 0, while simultaneously rotating holder B to angle 0.
- Operate the test apparatus at a speed of 0.5 Hz for n cycles.

5.9 Sheet Turning Stress Method

5.9.1 Introduction

The purpose of the test is to determine the folding resistance of a sheet of a machine readable passport (MRP) at the spine.

5.9.2 Input Parameters

P = Sheet under test

n = Number of cycles

5.9.3 Output Parameters

None

5.9.4 Apparatus

- Fixture for clamping the fixed sheet or MRP
- Arm for rotation of sheet or MRP
- Device to apply force to sheet or MRP being tested.
- Note that no constraints are placed on machine design, including which clamp is fixed, which clamp moves, and which clamp force the force is applied to.
- Note also that the apparatus should prevent bending of the booklet in any other place than the axis of the booklet spine.

5.9.5 Method

- The entire book except the sheet to be tested is folded back and held in a clamp. The sheet to be tested is held in another clamp allowing for the rotation of the sheet or MRP under test around the spine between the defined angle positions:

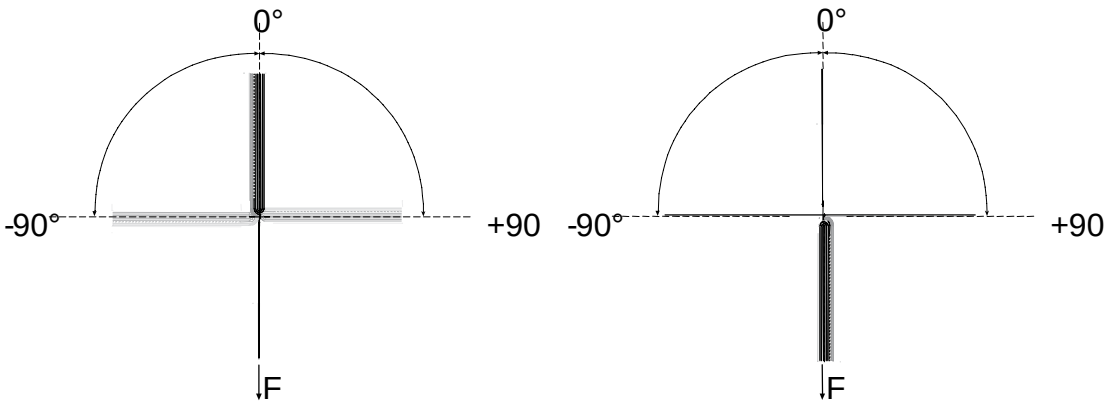


Figure 11: Sheet Bending Illustration

- Bending Parameters
  - Bending frequency: f = 0.5 Hz
  - Bending angle: a = ± 90°
  - Tensile force: F= 1 N/cm ± 25% (force per length of sheet)

5.10 Sheet Pull Stress Method

5.10.1 Introduction

The purpose of the test is to determine the tearing resistance of the booklet pages and the sewing part during the usage of a machine readable passport (MRP).

5.10.2 Input Parameters

P = Sheet under test

5.10.3 Output Parameters

S = Maximum tearing strength in N/cm

5.10.4 Apparatus

- Clamp to hold MRP in a fixed position, minimum width of clamping area 130 mm
- Movable clamp for pulling on the page under test, minimum width of clamping area 130 mm

5.10.5 Method

- Cut the opposite sheet of the one under test. The cutting distance from the spine should be of 10 mm.
- Place all the other sheets including cover in the fixed clamp of the apparatus.
- The fixed clamp shall be set at a distance from the spine so that it does not clamp any portion of the sheet under test.
- Apply a force of 60 N at a maximum velocity of 5 mm/s.

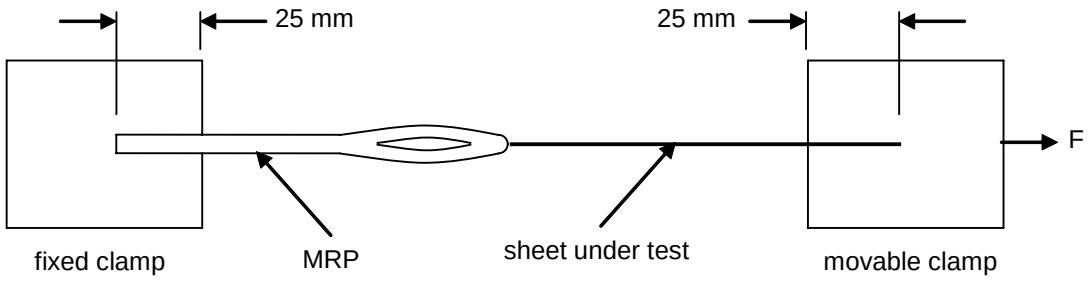


Figure 12: Sheet Pull Apparatus

5.11 Abrasion Stress Method

5.11.1 Introduction

The purpose of this test is to determine the effect of a specified mechanical abrasion to the Passport Data Page of an ICAO-compliant document. The main purpose is to test the machine-readable zone (MRZ) but the test might also be used for the Visual Inspection Zone (VIZ) or visa entries (sticker) of the passport. In order to perform this test, the datapage (visa page) shall be personalized.

The abrasive material to be used should be the material of the facing page.

5.11.2 Input Parameters

n = number of test cycles (double strokes)

5.11.3 Output Parameters

None

5.11.4 Apparatus

test load L = *14000* ± 5 % *N/m2*

length (or diameter) of test load D = 15 mm (width shall cover MRZ)

test speed v = between 2.5 and 25 cm/s

- The abrasive material has to be attached to the test load without protruding beyond the edge of the passport. If increased adhesion is required a double sided adhesive tape can be used.
- Test Load Movement: -The abrasion axis is parallel to the MRZ of the MRP. The amplitude of the test load movement shall cover at least 20 mm. Test equipment may move/rotate the test load during the test between cycles.

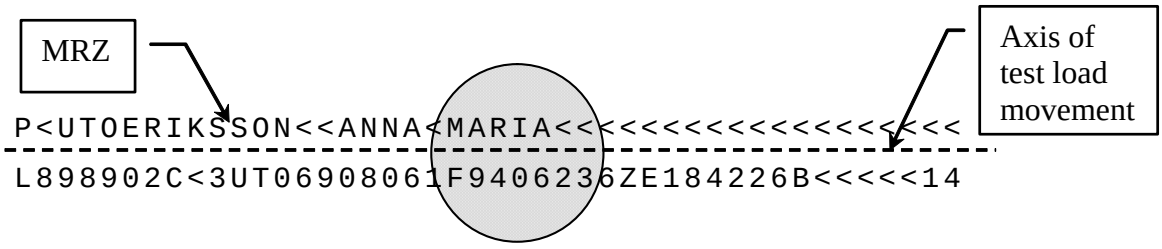


Figure 13: Illustration of the Abrasion Test

5.11.5 Method

- Fix the Passport Data Page on a level rigid plate (i.e. sample carrier of the test equipment). Apply the test load and start the apparatus at specified speed and amplitude for the specified number of test cycles.
- Alternative equipment may be used as long as it provides equivalent results (e.g. Taber method from ISO 9352 using CS10F wheel).

5.12 Pen Stress Method

5.12.1 Introduction

The purpose of the test is to simulate writing over the PIC with a ball point pen simulating manual entries on visa pages. It is felt that depending on the construction of the passport, a pen might damage components of the passport (IC, inlay or paper).

The page to be written on shall be one that is normally written on and shall provide maximum stress to the chip (if present). In the case where it is possible to write on pages on both sides of the chip sheet, separate MRP's should be evaluated.

Note, this method may not be suitable when devices like rivets are used. I.e. the pen may become damaged or stuck if features protrude from the page under test.

5.12.2 Input parameters

n = number of cycles

P = page to test

5.12.3 Output parameters

None

5.12.4 Apparatus

- Pen with ball point of diameter 0.7 mm compliant with ISO 12757-2.
- Pen positioning apparatus capable of pen movement in X and Y direction over the area shown in Figure 14. Pen shall be held at an angle of 90 degrees to the page under test.

5.12.5 Method

- Choose a Page P to write on. It shall be a Page that is normally written on and shall provide maximum stress to the chip. In the case where it is possible to write on pages on both sides of the chip page, both sides will be tested.
- Clamp MRP in suitable holding fixture so pages do not move during testing.
- Apply a load to pen of 250 g downward toward pages under test.
- Apply a series of strokes, each in the form of a double line (movement back and forth along the same straight line and across the dimension of the sample) and at a nominal distance of 1.5 mm between lines.

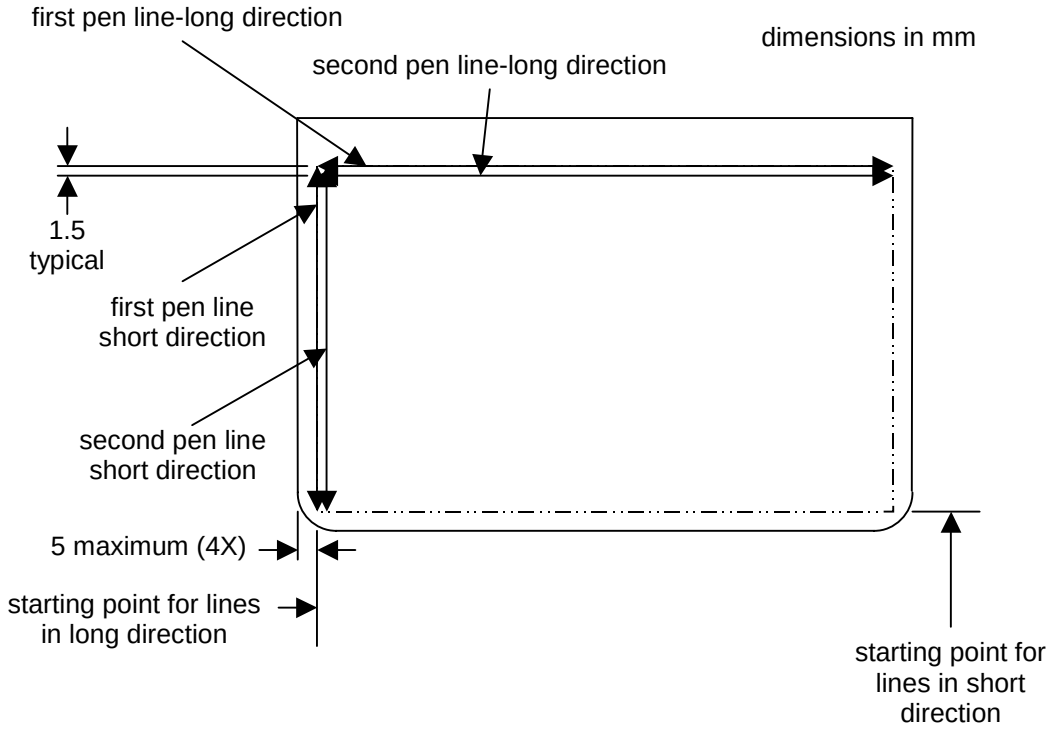


Figure 14: Pen stress test area

- Move pen with a maximum speed of 150 mm/sec from left to right and back again on the same line as shown in Figure 14 for lines in the long direction.
- When the pen has returned to the starting point, move to the next line as shown. It is not necessary to lift the pen when moving from one line location to the next.
- After completing the last line in the long direction, begin to make lines in the short direction.
- Move pen with a maximum speed of 150 mm/sec from bottom to top and back again on the same line as shown in Figure 14 for lines in the short direction.
- When the pen has returned to the starting point, move to the next line as shown. It is not necessary to lift the pen when moving from one line location to the next.
- Replace pen as soon as ink is exhausted, lines shall not be made with no ink.
- Outer margin of 5 mm from the edge of the page under test may be disregarded. This margin may be used to stabilize the page under test by e.g. clamping or taping it to the support.
- The surface coverage may be reached in a single run or by consecutive runs covering sub-areas of the page under test.
- Repeat the sequence n times.
- If critical areas are obvious, the pen test may be performed only over those areas.

5.13 Resistance to chemicals Evaluation Method

5.13.1 Introduction

The purpose of this test is to determine any adverse effects of a range of chemical contaminants on an MRP test sample. It is possible that the document may not be useable for travel after this test, but it is expected that the book shall be identifiable as belonging to the bearer.

Certain security features incorporated into MRP's are designed to react to reagents in order to show taat tampering has taken place. The action of these security features under the influence of the reagents shall not constitute a failure.

5.13.2 Input Parameters

None

5.13.3 Output Parameters

None

5.13.4 Apparatus

- MRP holder
- Solutions as required

5.13.5 Short Term Contamination Test

5.13.5.1 Short Term Reagents (list provided here for information only, defined in ISO/IEC 10373-1)

a) 5% by mass aqueous solution of sodium chloride (NaCl, 98% minimum assay);

b) 5% by mass aqueous solution of acetic acid (CH3COOH, 99% minimum assay);

c) 5% by mass aqueous solution of sodium carbonate (Na2CO3, 99% minimum assay);

d) 60% by mass aqueous solution of ethyl alcohol (CH3CH2OH, 93% minimum assay);

e) 10% by mass aqueous solution of sucrose (C12H22O11, 98% minimum assay);

f) Fuel B (according to ISO 1817);

g) 50% by mass aqueous solution of ethylene glycol (HOCH2CH2OH, 98% minimum assay).

5.13.5.2 Short Term Contamination Method

- Use solutions as defined in ISO/IEC 10373-1.
- Use a different sample MRP for each solution.
- Prior to immersion in the test solution, fan the pages of the MRP such that the sheets of the MRP are exposed.
- Standing the MRP upright (spine is in a vertical orientation), submerge the MRP for 60 seconds in one of the solutions listed above. The solutions shall be kept at a temperature between 20 °C and 25 °C.
- Remove MRP from solution and place in default MRP holder for 24 hours at default temperature and humidity conditions. For those samples immersed in organic solvents (including fuel), this procedure should be performed within the confines of a fume hood.

5.13.6 Long Term Contamination Test

5.13.6.1 Long Term Reagents (list provided here for information only, defined in ISO/IEC 10373-1)

a) salt mist;

b) artificial perspiration (both solutions shall be prepared in accordance with ISO 105-E04:1994): (i) alkaline solution; (ii) acid solution.

5.13.6.2 Method for Salt Mist

- Use neutral solution as defined in ISO/IEC 10373-1.
- Use a different sample MRP for each test.
- For the salt mist exposure, mount the sample MRP vertically in a cabinet in accordance with ISO 9227:1990 for 24 hours.
- Remove MRP from solution and place in default MRP holder for 24 hours at default temperature and humidity conditions.

5.13.6.3 Method for Synthetic Perspiration

- The filter paper shall be compliant with ASTM E 832. Any Type I filter paper for qualitative analysis may be selected.
- Soak filter paper in the artificial perspiration solution. Allow excess liquid to drain for 10 seconds then place it on a flat non-absorbent surface (glass plate) to stabilise for 1minute.
- Wrap the sample MRP in the wetted filter paper and place this in a sealed plastic bag in an environment kept between 20 °C and 25 °C. The plastic bag shall be placed between flat plates with a 5 kg weight positioned on top.
- Leave the sample in this environment for 24 hours.
- Remove MRP from solution and place in default MRP holder for 24 hours at default temperature and humidity conditions.

5.14 Artificial Daylight Exposure Stress Method

5.14.1 Introduction

This test is derived from ISO 105-B02 and exposes the sample to illumination from an artificial light source that represents natural daylight in the visible and near UV (UV A) spectral region. The aim of this test is to assess the resistance of the MRP to fading.

Note: The blue wool reference numbers refer to those preferred in Europe (1-8) and not those preferred in the US (L2-L9)

Note that this method is difficult to apply to ordinary security printing backgrounds due to the fine structure of the linework. It is acceptable to print samples using test patterns for each ink used in production to facilitate this test.

5.14.2 Input Parameters

P = page to expose

S = blue wool scale to measure exposure

5.14.3 Output Parameters

None

5.14.4 Apparatus

- An air-cooled xenon arc lamp apparatus with a well-ventilated exposure chamber and a xenon arc lamp of correlated colour temperature 5500 K – 6500 K shall be used. A light filter (glass filter) placed between light source and samples shall cut all radiation with wavelengths smaller than 310 nm. A heat filter placed between light source and samples shall be used in order to reduce IR radiation contained in the xenon arc spectrum.

5.14.5 Method

- Cut a sample from the MRP to required size for the test machine and place an opaque cover over a portion of the sample (for comparison purposes)
- Prepare the appropriate blue wool reference in the same way. Strips cut from the blue wool references 1 to S shall be used.
- Place samples together with the blue wool reference set in the accelerated daylight test apparatus and expose to artificial daylight according to Method 2 (ref. ISO 105 B-02) until the exposed part of the blue wool reference S has faded to the equivalent of gray scale 4

5.15 X-Ray Stress Method

5.15.1 Introduction

The purpose of this test is to determine any adverse effects to the MRP by X-rays levels that might be encountered during border control screening. The MRP shall comply with the requirement in ISO/IEC 7816-1 when tested in accordance with ISO/IEC 10373-1.

5.15.2 Input parameter

None

5.15.3 Output Parameter

None

5.15.4 Apparatus

- Use apparatus defined by ISO/IEC 10373-3 for X-rays.

5.15.5 Method

- Follow the procedure in ISO/IEC 7816-1 for x-ray testing. (Substitute MRP for card, wherever it appears in the procedure in ISO/IEC 7816-1).

6 Evaluation methods

Evaluation methods are instructions describing how to measure specific attributes of the passport. Wherever applicable, the output of the evaluation method should be a numerical value that can be compared against a pass/fail criterion.

6.1 Functional PIC Evaluation Method

6.1.1 Introduction

This method evaluates the function of the Proximity Integrated Circuit (PIC). The method determines that chip is still sane and that it operates within normal and reasonable conditions. There is always a tradeoff between the execution time of this method and the completeness of the test.

If the MRP does not contain a chip, this evaluation method returns a Pass result.

6.1.2 Input Parameters

None

6.1.3 Output Parameters

R = Pass/Fail

6.1.4 Apparatus

- Commercial PIC reader.

6.1.5 Method

- Evaluate the PIC as per reference [9], RF Protocol and Application Test Standard for e-Passport – Part 2, WG3TF4_N0163, Version 0.9, 2006-02-10, section C.2.

6.2 Physical Damage Evaluation Method

6.2.1 Introduction

The intent of this method is to verify that the passport is (still) suitable for use as a travel document. To pass the evaluation method, the document shall be intact, and shall still be machine readable. Some security features may be degraded or altered, however, the evaluation of these features may be subjective and specific to individual passports and are therefore outside the scope of this method.

6.2.2 Input Parameters

None

6.2.3 Output Parameters

R = Pass/Fail

6.2.4 Apparatus

None

6.2.5 Method

Physical damage and related acceptability levels are best evaluated by comparing the sample(s) under test to a set of evaluation samples that is considered to be just at the limit of acceptability. However as the authors need to put something prescriptive on paper, the following limits should be placed on a MRP for it to be useable. Future versions of this document will hopefully contain a more complete list of requirements.

- The picture shall be reconizeable.
- Written information shall be legible, with no missing letters or words.
- The MRZ shall be machine readable.
- The MRP shall be Intact – no pages shall be separated.
- Opening the MRP to the datapage (180 degrees) shall not incur any further damage.
- opening the MRP to a visa page (180 degrees) shall not incur any further damage.
- The PIC containing part (Cover, Data Page, Special visa page) does not allow direct access to the chip or the antenna.
- No part of the datapage shall be missing.
- For datapages, more than 90% of the binding shall be intact.
- For other pages, more than 50% of the binding shall be intact.
- At least 50% of the hot-stamp on the cover shall be intact.
- Any holes in any sheets shall be less than 2mm in diameter.
- Areas of delamination along the edges shall be less than 3 mm deep, and 3 mm in length. Delaminations within the sheet shall be less than 3 mm in length.

6.3 Peel Strength Evaluation Method

6.3.1 Introduction

The purpose of this test is to measure the peel strength between different layers used in passport constructions according to ISO/IEC 10373-1/5.3.

If the sheet to be evaluated is composed of multiple layers, the peel strength evaluation should be conducted on all layers. A separate document should be used for each layer so that a consistent number of strips will be cut from the sheet.

6.3.2 Input Parameters

P = sheet to perform test on

6.3.3 Output Parameters

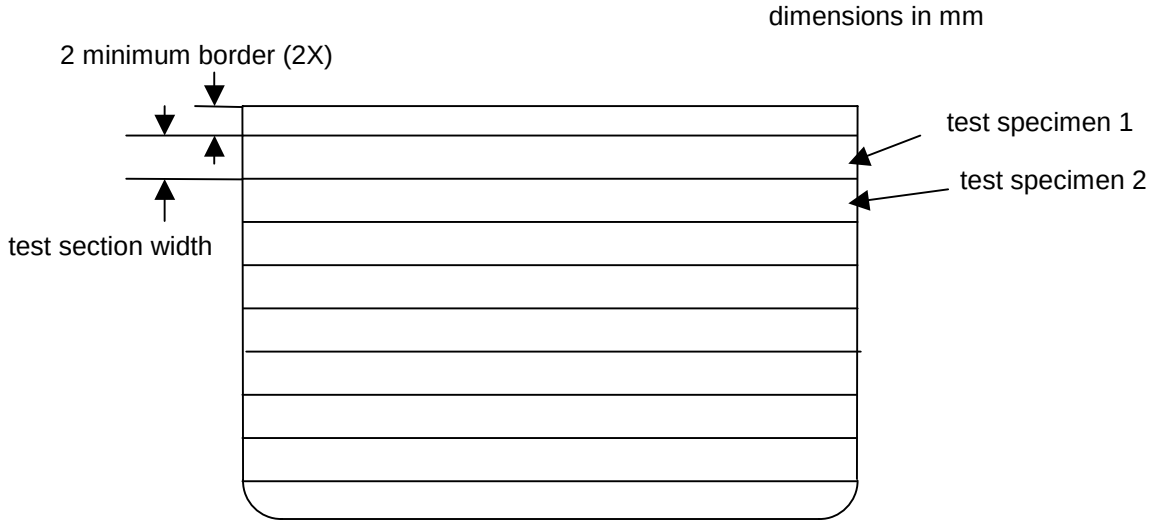
F = strength (N/mm)

6.3.4 Apparatus

- Use apparatus defined in ISO/IEC 10373-1 Peel test method. References to “card” shall mean “sheet” for this test. If a stabilizing plate is required, a suitable size would be 95 mm x 130 mm.

6.3.5 Method

- Remove the sheet to be tested from the MRP
- Follow the method for peel strength measurements as outlined in ISO/IEC 10373-1, Peel test method, except for preconditioning and the direction and quantity of sample sections.
- Following Figure 15, cut the sample, or score through the layer, to produce sections of width 10.0 mm ± 0.2 mm. The top reference edge is the edge closest to the spine



- Figure 15: Peel test sample preparation

6.4 Colour Fastness Evaluation Method

6.4.1 Introduction

This evaluation method determines the change in appearance of the sample following exposure to artificial daylight. This evaluation method relies on the sample being subjected to 5.14 Artificial Daylight Exposure Stress Method.

6.4.2 Input Parameters

P = Page to evaluate

6.4.3 Output Parameters

R = Pass/Fail

6.4.4 Apparatus

None

6.4.5 Method

- Colour fastness evaluation derived from ISO 105-B02.
- The evaluation procedure is as follows:
- Visually evaluate fading or colour changes. For this purpose samples shall be illuminated by a D65 light source.
- Compare the contrast between exposed and unexposed sample with the contrast of gray scale 4.
- If the sample contrast is higher then the test result is Fail. If the sample contrast is less or equal then the test result is Pass.

6.5 Datapage Warpage Evaluation Method

6.5.1 Introduction

The purpose of this test is to measure the extent of warpage in the MRP. The amount of warping in a MRP is important to ensure contactless IC and MRZ chip readability.

6.5.2 Input Parameters

None

6.5.3 Output Parameters

R = Pass/Fail

6.5.4 Apparatus:

- A level rigid surface whose roughness is not greater than 3.2 µm in accordance with ISO 1302.
- A flattening plate weighing 200 g measuring 88 mm x 125 mm.
- A height gauge or similar measuring device with a minimum accuracy of 0.1 mm.

6.5.5 Method

- Open the MRP and place only the datapage and cover on a level rigid surface, with the nearest visa page positioned 3 mm from the edge of the level rigid plate as shown in Figure 16.
- Apply and centre the 200 g flattening plate directly on top of the pages. Align long edge of flattening plate with edge of rigid surface.
- Using a height gauge, measure the maximum combined thickness of the combined pages. Record this value as *D1.*
- Measure the maximum total combined thickness of the pages that were measured for warpage in Figure 16. Record this value as D2.
- The result R is Pass if D1 – D2 is less than or equal to 3 mm.

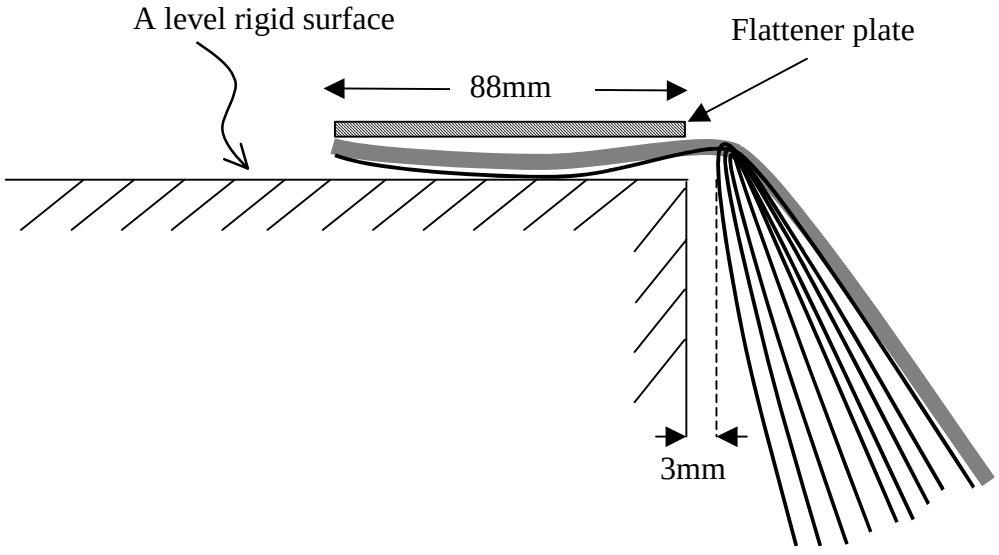


Figure 16: Datapage Warpage Measuring Arrangement

6.6 Book Warpage Evaluation Method

6.6.1 Introduction

The purpose of this test is to measure the extent of warpage in the MRP. The amount of warping in the MRP is important to ensure contactless IC chip readability. This method is similar to the Datapage Warpage Evaulation Method but measures the amount of warpage with the MRP in the closed position.

6.6.2 Input Parameters

None

6.6.3 Output Parameters

R = Pass/Fail

6.6.4 Apparatus:

- A level rigid surface whose roughness is not greater than 3.2 µm in accordance with ISO 1302.
- A flattening plate weighing 200 g measuring 88 mm x 125 mm.
- A height gauge or similar measuring device with a minimum accuracy of 0.1 mm.

6.6.5 Method

- Measure the maximum thickness of the MRP. Record this value as D1.
- Place the closed MRP on a level rigid plate.
- Center the 200 g flattening plate directly on top of the MRP.
- Using a height gauge, measure the maximum height of the MRP. Record this value as *D2.*
- The result R is Pass if D2 – D1 is less than or equal to 10 mm.

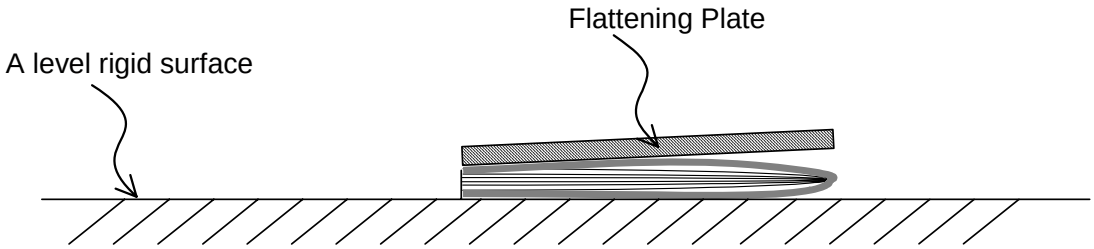


Figure 17: Book Warpage Measuring Arrangement

7 Test sequences

7.1 General

Sequences are defined to specify the order in which stress methods and evaluation methods are to be performed in order to execute a specific test.

7.2 Instructions for using the Sequence Table

The headings of a sequence table is reproduced below:

Step No.	S/E	Method	Parameters	Output Parameters Measured	Pass/Fail Criteria

This table defines the order of the methods to be performed. The content of each column is defined below.

Step No.	The reference number for the step within the sequence. The order of the methods within the sequence table determines the order in which the methods are to be executed – not the step number.
S/E	Indicates whether the method is a Stress method or an Evaluation method.
Method	The name of the method to be performed
Parameters	Defines the values of the input parameters. Method parameters not assigned at the sequence level shall be assigned at the test plan level.
Output Parameters	List of the output parameters of the method that will be used to determine the pass/fail criteria for the test.
Pass/Fail Criteria	Specifies the limits of the output parameter that will be considered a Pass for the test sequence.

7.3 Sheet Binding Sequence

7.3.1 Introduction

The purpose of this tests sequence is to simulate normal book handling over its lifetime. Real-life stresses include opening and closing the book and manipulating data and visa pages.

7.3.2 Input Parameters

n = Number of sheet bend cycles

P = Sheet to test

7.3.3 Output Parameters

R = Pass/Fail

7.3.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.9	Sheet Turning Stress Method	P, n	-	-
3	E	5.10	Sheet Pull Stress Method	P	S	S > 5 N/cm
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.4 Storage Climate Sequence

7.4.1 Introduction

The purpose of this tests sequence is to subject the MRP to various climate stresses at which it is expected to be stored.

7.4.2 Input Parameters

T = Temperature at which the passport is can be stored

H = Relative humidity for storage

7.4.3 Output Parameters

R = Pass/Fail

7.4.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.3	Storage Temperature Stress Method	T, H	-	-
3	S	5.1	Conditioning Stress Method	-	-	-
5	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
6	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.5 Operational Climate Sequence

7.5.1 Introduction

The purpose of this tests sequence is to subject the MRP to various climate stresses at which it is expected to operate.

7.5.2 Input Parameters

None

7.5.3 Output Parameters

R = Pass/Fail

7.5.4 Sequence

Step No.	S/ E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.4	Operational Temperature Stress Method	T = -7	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	S	5.4	Operational Temperature Stress Method	T = 47	-	-
5	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
6	S	5.1	Conditioning Stress Method	-	-	-
7	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.6 Impact Sequence

7.6.1 Introduction

The purpose of this tests sequence is to subject the document to simulated border inspection stamping.

7.6.2 Input Parameters

None

7.6.3 Output Parameters

R = Pass/Fail

7.6.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.5	Impact Stress Method	S = chip sheet	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.7 Back Pocket Sequence

7.7.1 Introduction

The purpose of this tests sequence is to subject the document to simulated back-pocket stresses. Note that the number of cycles is quite low as sitting on a passport is considered accidental in “normal use”.

7.7.2 Input Parameters

None

7.7.3 Output Parameters

R = Pass/Fail

7.7.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.6	Book Bend Stress Method (Back Pocket)	n = 10	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass
5	E	6.5	Datapage Warpage Evaluation Method	-	R	R = Pass
6	E	6.6	Book Warpage Evaluation Method	-	R	R = Pass

7.8 Torsion Fatigue Sequence

7.8.1 Introduction

The purpose of this tests sequence is to subject the document to torsional forces.

7.8.2 Input Parameters

n = number of twisting cycles

7.8.3 Output Parameters

R = Pass/Fail

7.8.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.8	Torsion Stress Method	n	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass
5	E	6.5	Datapage Warpage Evaluation Method	-	R	R = Pass
6	E	6.6	Book Warpage Evaluation Method	-	R	R = Pass

7.9 Delamination Sequence

7.9.1 Introduction

The purpose of this tests sequence is to evaluate the inner layer bonds within a passport.

Note: limits are set to ensure book mechanical quality. They are not intended to satisfy any security concerns. (put in the introduction)

7.9.2 Input Parameters

None

7.9.3 Output Parameters

R = Pass/Fail

7.9.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	E	6.3	Peel Strength Evaluation Method	P = cover sheet	F	F > 0.5 N/cm
3	E	6.3	Peel Strength Evaluation Method	P = data page	F	F > 0.5 N/cm
4	E	6.3	Peel Strength Evaluation Method	P = chip sheet	F	F > 0.5 N/cm

7.10 Bending Fatigue Sequence

7.10.1 Introduction

The purpose of this tests sequence is to evaluate the susceptibility to fatigue of the passport.

7.10.2 Input Parameters

n = number of bending cycles

7.10.3 Output Parameters

R = Pass/Fail

7.10.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.7	Dynamic Bend Stress Method	O = spine n	-	-
3	S	5.7	Dynamic Bend Stress Method	O = top n	-	-
4	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
5	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass
6	E	6.5	Datapage Warpage Evaluation Method	-	R	R = Pass
7	E	6.6	Book Warpage Evaluation Method	-	R	R = Pass

7.11 Thermal Cycling Sequence

7.11.1 Introduction

The purpose of this tests sequence is to evaluate the susceptibility to fatigue due to thermal stresses.

7.11.2 Input Parameters

None

7.11.3 Output Parameters

R = Pass/Fail

7.11.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.2	Thermal Cycling Method	n = 20	-	-
3	S	5.1	Conditioning Stress Method	-	-	-
4	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
5	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.12 Colour Fastness Sequence

7.12.1 Introduction

The purpose of this tests sequence is to evaluate the susceptibility of the document to sunlight.

7.12.2 Input Parameters

None

7.12.3 Output Parameters

R = Pass/Fail

7.12.4 Sequence

Step No.	S/ E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.14	Artificial Daylight Exposure Stress Method	P = cover S = blue wool scale 6	-	-
3	E	6.4	Colour Fastness Evaluation Method	-	R	R = Pass
4	S	5.14	Artificial Daylight Exposure Stress Method	P = datapage S = blue wool scale 3	-	-
5	E	6.4	Colour Fastness Evaluation Method	-	R	R = Pass
6	S	5.14	Artificial Daylight Exposure Stress Method	P = chip sheet S = blue wool scale 3	-	-
7	E	6.4	Colour Fastness Evaluation Method	-	R	R = Pass

7.13 Resistance to Chemicals Sequence

7.13.1 Introduction

This sequence subjects passports to a range of chemicals that are commonly found in day-to-day situations.

Normally, a sequence would be applied in exactly the same manner to all samples. However for editorial convenience, this sequence covers all of the different solutions, and therefore will require at least 10 passport samples for evaluation.

7.13.2 Input Parameters

None

7.13.3 Output Parameters

R = Pass/Fail

7.13.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.13	Resistance to chemicals Evaluation Method	-	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.14 Pen Sequence

7.14.1 Introduction

The purpose of this tests sequence is to simulate writing on the passport. As currently defined, the pen test may be destructive to the visa page; therefore, only the chip is evaluated.

7.14.2 Input Parameters

None

7.14.3 Output Parameters

R = Pass/Fail

7.14.4 Sequence

Step No.	S/ E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.12	Pen Stress Method	n =1 P = writeable page nearest chip (both sides if possible)	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass
4	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.15 Datapage Abrasion Sequence

7.15.1 Introduction

The purpose of this tests sequence is to determine the wear characteristics of the MRZ.

7.15.2 Input Parameters

n = number of abrasion cycles

7.15.3 Output Parameters

R = Pass/Fail

7.15.4 Sequence

Step No.	S/ E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.11	Abrasion Stress Method	N P = datapage	-	-
3	E	6.2	Physical Damage Evaluation Method	-	R	R = Pass

7.16 X-Ray Sequence

7.16.1 Introduction

The purpose of this tests sequence is to simulate putting a passport through an airport security X-Ray inspection station.

7.16.2 Input Parameters

None

7.16.3 Output Parameters

R = Pass/Fail

7.16.4 Sequence

Step No.	S/E	Method		Input Parameters	Output Parm. Measured	Pass/Fail Criteria
1	S	5.1	Conditioning Stress Method	-	-	-
2	S	5.15	X-Ray Stress Method	-	-	-
3	E	6.1	Functional PIC Evaluation Method	-	R	R = Pass

8 Test plans

8.1 General

The test plan is the top level of the test specification. It specifies values for any undefined sequence parameters, and defines the number of books that need to be subjected to each sequence.

Different test plans are defined depending on what is being tested and why. The default test plan is the “minimum durability required by ICAO”. Other test plans can be defined that might set other requirements. For example a 10-year normal use book, or a 5-year heavy use book

Each Lot is composed of new books. Books from one lot shall not be used in the test sequence of another lot.

The lot sizes specify the minimum number of books to be subjected to the test sequence. In general, small lot sizes do not give good statistical results, however very large lot sizes can become expensive to produce and to test. Only absolute minimums are given here. The customer and the tester are free to agree on other lot sizes that are larger than the minimum.

The reader is again reminded that this document is designed to provide a method of prototype testing (Type Approvals). It is not intended to be used to determine if individual documents meet specific standards.

The tester is reminded that while book manufacturers strive for perfect quality, it is possible that faulty samples may be subjected to testing. In the case of a failure, the tester should evaluate the failure, and in consultation with the manufacturer, should decide whether to select another sample for testing.

8.2 Minimum Level Test Plan

This test plan specifies the list of test sequences that shall be passed in order for the document to be considered to meet ICAO's minimum durability level.

Lot No.	Minimum Lot Size	Sequence		Parameters
1	3	7.3	Sheet Binding Sequence	P = cover n = 1000
2	3	7.3	Sheet Binding Sequence	P = datapage n = 1000
3	3	7.3	Sheet Binding Sequence	P = visa page n = 1000
4	3	7.3	Sheet Binding Sequence	P = chip page n = 1000
5	3	7.8	Torsion Fatigue Sequence	n = 500
6	3	7.12	Colour Fastness Sequence	-
7	3	7.11	Thermal Cycling Sequence	-
8	3	7.10	Bending Fatigue Sequence	n = 1000
9	3	7.9	Delamination Sequence	-
10	3	7.6	Impact Sequence	-
11	3	7.4	Storage Climate Sequence	T = 77 H = 50%
11	3	7.4	Storage Climate Sequence	T = -32 H = not specified
12	3	7.5	Operational Climate Sequence	-
13	3	7.6	Impact Sequence	-
14	3	7.7	Back Pocket Sequence	-
15	10 (1 per solution)	7.13	Resistance to Chemicals Sequence	-
16	3	7.14	Pen Sequence	-
17	3	7.15	Datapage Abrasion Sequence	n = 500
18	3	7.16	X-Ray Sequence	-
19	3	7.11	Thermal Cycling Sequence	-

MACHINE READABLE TRAVEL DOCUMENTS

TECHNICAL REPORT

RF PROTOCOL AND APPLICATION TEST STANDARD FOR E-PASSPORT - PART 2

TESTS FOR AIR INTERFACE, INITIALISATION, ANTICOLLISION AND TRANSPORT PROTOCOL

Version: **1.02**
Date – Feb 20, 2007

Published by authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

File	: RF protocol Part 2 V1.02.doc
Author	: ISO/JTC1/SC17/WG3/TF4 for ICAO-NTWG

Release Control

Release	Date	Description
0.1	2005-11-23	First draft based on the German WG3 TF4 contribution "e-Passport Conformity Testing" version 1.02 presented at TF4 meeting in Paris Nov 21-23, 2005
0.2	2005-12-09	Updated version with comments made during Paris meeting and new ICAO TR layout.
0.9	2006-02-10	Updated version including accepted comments from the Ottawa meeting Jan 29 – Feb 01, 2006 and editorial changes.
0.91	2006-06-28	Intermediate draft, updated version with resolved comments from the Graz meeting Jun 12-13, 2006 and editorial changes. Some comments from Graz still unresolved.
0.95	2006-08-31	Updated version, editorial changes
0.96	2006-11-21	Internal draft version including all resolved comments from the Bled meeting, Oct 25-26, 2006 with a proposal to resolve comments on chapter 5.6. New test case 5.7 introduced.
1.0	2006-11-30	Final version including editorial changes in test case 5.7.
1.01	2006-12-07	Version update due to editorial corrections in the following test cases: Chapter 5.7: Timing after SCIC EOF (TR2) (type B only). The minimum TR2 is changed according to [R16]. Chapter 6.1.4: Handling of PPS. Wrong references are replaced. Chapter 6.3.5: Data exchange protocol tests. Test scenarios G53 / G54 SHOULD be omitted.
1.02	2007-02-20	Annex A removed.

Release Note:

Release 2007-02-20 is the official version of the technical report by SC17 WG3 TF4 endorsed by ICAO-NTWG at the Portugal meeting. It replaces version 1.01.

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1 Introduction

1.1 Scope and purpose

An essential element of the new ICAO compliant e-Passport [R15] is the addition of a Secure Contactless Integrated Circuit (SCIC) that securely holds biometric data of the passport bearer within the ICAO defined Logical Data Structure (LDS).

Successful integration of the SCIC into the e-Passport depends upon active international cooperation between many companies and organizations.

The e-Passport has been specified and designed to operate correctly across a wide variety of reading infrastructures worldwide. The risk profile for the e-Passport indicates a high impact if that design includes a widespread error or fault. Therefore, it is essential that all companies and organizations involved make all reasonable efforts to minimize the probability that this error or fault remains undetected before that design is approved and e-Passports are issued.

This document defines a test plan for the contactless part of the e-Passport. These tests are divided into tests of the physical and electrical parameters according to ISO/IEC14443-1 and -2, and tests of the initialization & anticollision and the transport protocol according to ISO/IEC14443-3 and -4.
In order for the SCIC to operate correctly, many functional layers of technology MUST work together. The purpose of this document is to define in depth the tests to be performed to minimize the probability that an error or fault remain undetected before the design is approved.

1.2 Assumptions

1.2.1 Maintenance of this TR regarding ISO standards

This technical report is based on the currently available versions of ISO standards and amendments as they are referenced in chapter 1.6. Based on the further development of these referenced ISO standards and their amendments, this report will be revised by SC17/WG3/TF4.

1.3 Terminology

The key words "MUST", "SHALL", "REQUIRED", "SHOULD", "RECOMMENDED", and "MAY" in this document are to be interpreted as described in [R3].

MUST This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.

MUST NOT This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.

SHOULD This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

SHOULD NOT This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.

MAY — This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

1.4 Glossary

TR0	TR0 defines the guard time between the end of a PCD transmission and the start of the SCIC subcarrier generation.
TR1	TR1 defined the synchronization time between the start of the SCIC subcarrier generation and the start of the SCIC subcarrier modulation.
TR2	TR2 defines the synchronization time between the start of the SCIC's EOF and the start of the PCD's next SOF.
Sample	A sample is one piece of the total number of e-Passports required and presented for testing according to this specification.
DUT	A device under test is a sample that has been placed in the test apparatus.
Room temperature	Room temperature (RT) is defined as any convenient temperature within the range of 23 °C ± 3 °C (73 °F ± 5 °F).
Modulation index	The modulation index m is calculated as follows: $m = \frac{maxlevel - minlevel}{maxlevel + minlevel}$
Threshold field strength	The threshold field strength is the minimum field strength to operate the SCIC as intended (operational mode).

1.5 Abbreviations

Abbreviation	
AA	Active authentication
ATQB	Answer to a request of modulation type B
ATS	Answer to select
ATTRIB	SCIC selection command for type B
BAC	basic access control
CID	Card identifier (layer 4)
DUT	Device under test
EAC	Extended access control
EGT	Extra guard time
EOF	End of frame

Abbreviation	
ESD	Electrostatic discharge
etu	Elementary time unit
fc	Carrier frequency (13.56MHz)
FDT	Frame delay time
fs	Subcarrier frequency (847.5 kHz)
FSD	Frame size for proximity coupling device
hf	Overshoot of the falling edge of the type B modulation
hr	Overshoot of the rising edge of the type B modulation
LDS	Logical Data Structure
m	Modulation index
MCRD-D	Multi chip reference detuning device
NAD	Node address
PCD	Proximity coupling device
PICC	Proximity integrated circuit card
PUPI	Pseudo-unique PICC identifier
RATS	Request for an answer to select
REQA	Request command type A
REQB	Request command type B
RF	Radio frequency
RT	Room temperature
SCIC	Secure contactless integrated circuit
SOF	Start of frame
t_r, t_f	Rise time, fall time

1.6 Reference documentation

The following documentation serves as a reference for this technical report:

[R1] *Technical Report: Development of a Logical Data Structure – LDS for optional capacity expansion technologies, version 1.7*

[R2] *Technical Report: PKI for Machine Readable Travel Documents offering ICC Read-Only access, version 1.1*

[R3] *RFC 2119, S. Bradner, "Key Words for Use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997*

[R4] *CD ISO/IEC 14443-1:2005, Proximity Cards: Physical Characteristics*

[R5] *ISO/IEC 14443-2:2001, Proximity Cards: Radio Frequency Power and Signal Interface*

[R6] *ISO/IEC 14443-3:2001, Proximity Cards: Initialization and Anticollision*

[R7] *ISO/IEC 14443-4:2001, Proximity Cards: Transmission protocol*

[R8] *ISO/IEC 14443-2:2001/AM1:2005, Proximity Cards: Radio Frequency Power and Signal Interface (Amendment 2: Bit Rates of fc/64, fc/32 and fc/16)*

[R9] *ISO/IEC 14443-3:2001/AM1:2005, Proximity Cards: Initialization and Anticollision (Amendment 1: Bit Rates of fc/64, fc/32, and fc/16)*

[R10] *ISO/IEC 10373-6:2001, Test Methods for Proximity Cards*
[R11] *ISO/IEC 10373-6:2001/FDAM1: Test Methods for Proximity Cards. Amendment 1: Protocol Test Methods for Proximity Cards.*
[R12] *ISO/IEC 10373-6:2001/AM2:2003: Test Methods for Proximity Cards. Amendment 2: Improved RF Test Methods.*
[R13] *ISO/IEC 10373-6:2001/AM4, Test Methods for Proximity Cards. Amendment 4: Additional Test Methods for PCD RF Interface and PICC Alternating Field Exposure.*
[R14] *ISO/IEC 10373-6:2001/FPDAM5.2, Test Methods for Proximity Cards. Amendment 5: Bit Rates of fc/64, fc/32, and fc/16.*
[R15] *ICAO Doc 9303 Part 1 Volume 2, 6th edition, 2005.*
[R16] *Defect Report and Technical Corrigendum 1 for - International Standard ISO/IEC 14443-3:2001/AM1: Identification cards – Contactless integrated circuit(s) cards – Proximity cards – Part 3: initialization and anticollision – Amendment 1: Bit rates for fc/64, fc/32 and fc/16*

2 General test requirements

The following sub-clauses specify the different test setups, the nominal values used for the tests, and a recommendation for the format of the test report.

Tests for bit rates of fc/128 and fc/32 are mandatory and SHALL be applied. Other bit rates indicated in the ATS/ATQB SHALL also be tested.

Depending on the implementation statement of the applicant, type A or type B tests SHALL be performed.

All tests are mandatory unless specified as “optional” or “conditional”. Conditional tests MUST be performed if they are applicable.

For tests of layers 1 and 2, the minimum number of samples provided for testing is three. The applicant MAY request that a larger number of samples be tested.

2.1 Test setup

The PCD assembly (Test Apparatus) that is defined in [R10] is the basis for the physical and electrical tests. When testing at higher bit rates, the matching network in [R14], annex A2.2, is used together with the PCD assembly from [R10].

For layer 2 tests (communication stability and operating field strength), the existing ISO test setup has to be adapted to carry the e-Passport with the additional ability to center the ID-1 sized antenna[1] of the e-Passport in the test PCD assembly according to [R10].

The test PCD in the test setup is intended to be used in time-limited measurements to avoid any overheating of the individual components (e.g. SCIC). For all functional tests, the chip’s self-heating effect SHOULD not exceed 25°C over ambient temperature.

2.2 Equipment

Most of the tests need some additional equipment, such as an arbitrary waveform generator and an RF amplifier. The oscilloscope probes MUST have an input capacitance C < 12 pF.

[1] Some of the following tests are based on Class-1 sized antennas [R13]. If the e-Passports antenna does not comply with the Class-1 specification, those tests might not generate accurate results.

2.3 Nominal values

Unless otherwise specified, the following environmental parameters and nominal values SHALL be used:

Table 1: Nominal values

Parameter	**Value**	**To be applied to**
Environment temperature	RT	Type A and B
Relative humidity	25 % to 75 %[2]	Type A and B
Bit rate	fc/128	Type A and B
Modulation index m	100 %	Type A
Modulation index m	12 %	Type B
t1	3 µs	Type A
t2	0.5 µs	Type A
t3	≤ 1.5 µs	Type A
t4	400ns	Type A
Overshoot	0%	Type A and B
Rise time t_r, fall time t_f	≤ 1 µs	Type B
Start-of-Frame timing (SOF)	10.5 etu “0” followed by 2.5 etu “1”	Type B
End-of-Frame timing (EOF)	10.5 etu “0”	Type B
Extra Guard Time (EGT)	1 etu	Type B

Table 1 defines the parameters in accordance with [R5].

2.4 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 MUST be included.

For all functionality check tests, the report has to state what tools and methods have been used to verify the functionality of the e-Passport.

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

2.5 Implementation conformance statement

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

Table 2: Test precondition table "Information on the product"

Information for test setup	**Applicant declaration**
Location of antenna in e-Passport • which page • which area in the page	
Size of antenna • dimensions • compliance to Class-1 definition [R4]	
Electrical parameters of antenna • Resonance frequency range (if optional test is performed)	
Modulation type • Type A or B	
e-Passport shielded or not and how	
Bit rates supported as claimed by the ATS/ATQB • From PCD to SCIC o 106 kbps o 212 kbps o 424 kbps o 848 kbps • From SCIC to PCD o 106 kbps o 212 kbps o 424 kbps o 848 kbps	
Random or fixed UID (Type A) or PUPI (Type B)	
Access control applied • Plaintext • Basic Access Control • Extended Access Control	
Authentication supported • Passive Authentication • Active Authentication	
Commands supporting WTX	

2.6 Test sequence

In order to minimize efforts, it is RECOMMENDED to perform the tests with all samples in the same order as mentioned in this test specification. If the layer tests are carried out separately or are carried out with different samples, additional tests will be necessary. For destructive tests such as mechanical and electrical (layer 1) stress tests, it is often required to check if the SCIC “operates as intended”. ISO standards do not define these tests further, and thus this specification leaves them to the responsibility of the test laboratories. Annex B specifies two optional tests to verify the SCIC’s functionality on the electrical and on the application level.

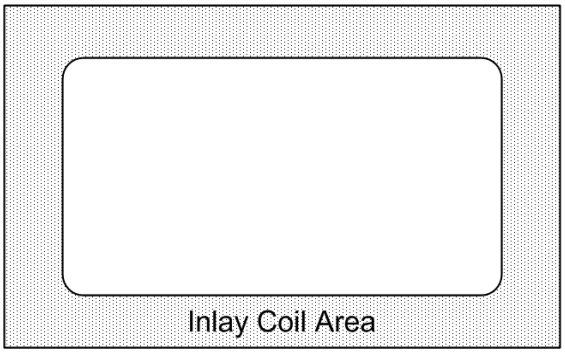
3 Layer 1 tests

3.1 Class-1 verification test (conditional)

The optional test SHALL be applied if the applicant claims compliance with Class-1 in Table 2.

Test description: The purpose of this test is to check if the physical coil dimensions meet the requirements according to [R4]. The SCIC antenna SHALL be entirely located within a zone defined by two rectangles:

- external rectangle: 81mm x 49mm
- internal rectangle: 64mm x 34mm, 3mm radius



Conditions: Minimum number of samples: 3

Report: The test report SHALL state whether the coil geometry of the e-Passport is in accordance with Class-1 definition.

3.2 Static electricity (ESD) test

Test description: The purpose of this test is to check the behavior of the SCIC after an electrostatic discharge (ESD) on the test sample (according to [R13]). The device under test is exposed to a simulated electrostatic discharge (ESD, human body model). Its basic operation is checked after the exposure.

The test SHALL be performed according to the procedures defined in [R13], clause 5.3, “Static Electricity Test”.

Test setup: The test setup SHALL be according to [R13].

Conditions: Minimum number of samples: 3

Report: The test report SHALL state whether the e-Passport operates as intended after exposure to the electrostatic discharge.

3.3 Alternating magnetic field test

Test description: The purpose of this test is to check the behavior of the e-Passport in relation to alternating magnetic field exposure according to [R13].

Alternating magnetic field SHALL be tested at 13.56 MHz. No tests are required at other frequencies.

Perform the test according to the test procedure defined in [R13], clause 5.1.2 "Alternating magnetic field; 12A/m test".

Test setup: The test PCD assembly according to [R10] SHALL be used.

Conditions: Minimum number of samples: 3

Parameters: Field strength: 0 A/m, 10 A/m, 12A/m

Report: The test report SHALL state whether the e-Passport operates as intended after exposure to an alternating magnetic field.

4 Layer 2 tests

Combinations of the following layer 2 and 3 tests are possible if it does not test influence the coverage; e.g. combining the frame delay time test with the operating field strength test or the operating field strength test with testing the load modulation amplitude is possible.

4.1 Load modulation amplitude test

Test description: The purpose of this test is to determine the load modulation amplitude of the e-Passport according to [R12] (amplitude [mV] $\geq 30/H^{1.2}$ mVpeak). Perform the test according to Figure 1 below.

For a detailed description of the load modulation test, see

- ISO/IEC 14443-2 Load modulation ($30/H^{1.2}$ mVpeak) [R5]
- ISO/IEC 10373-6 AM2, PICC load modulation amplitude [R12]

Test setup: For this test, it is RECOMMENDED to have signal patterns that start with the RF off, and then produce an unmodulated field with nominal 13.56MHz carrier at the field level required by the test for 5ms prior to modulating this field with a REQA or REQB command according to the used type. The nominal 13.56 MHz carrier SHALL continue without modulation following the command for a RECOMMENDED one second.

It is RECOMMENDED to switch off the carrier for sufficient time before continuing at the next field level.

For this procedure, the ISO test setup has to be used as a PCD antenna. The field strength has to be calibrated in advance. Then, the e-Passport has to be placed at the DUT position. Afterwards, the field strength has to be readjusted.

Conditions:	Minimum number of samples:	3
Parameters:	Field strength:	At temperatures -10°C and RT: • mandatory: 1.5 A/m, 4.5 A/m, 7.5 A/m • optional : 2.5 A/m, 3.5 A/m, 5.5 A/m, 6.5 A/m At temperature 50°C: • mandatory: 1.5 A/m, 4.5 A/m, 6.0 A/m • optional : 2.5 A/m, 3.5 A/m, 5.5 A/m
	Bit rate:	fc/128
	Temperature:	-10°C, RT, 50°C
Report:	The test report SHALL include the load modulation amplitudes, the number of passed tests versus the total number of tests, a test description and the number of samples and the date.	

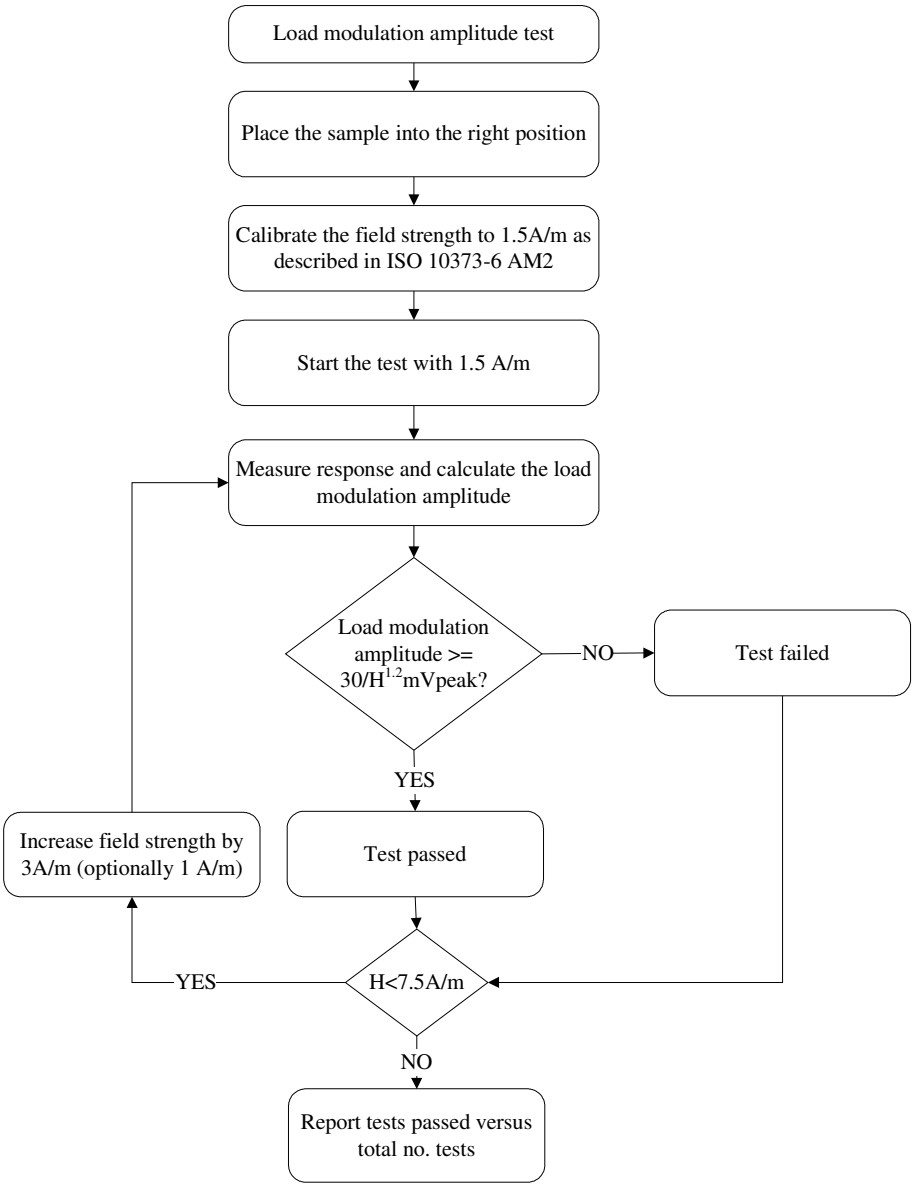


Figure 1: Test procedure for the load modulation amplitude test

4.2 Operating field strength test

The operating field strength test for type A or B MAY be combined with the following test "communication stability" (see chapter 4.3). Since the operating field strength MAY be used as an isolated functionality check test, it is specified in a separate chapter of this document.

4.2.1 Type A

Test description: The purpose of this test is to check if the e-Passport meets the energy performance requirements according to [R5]. The e-Passport SHALL operate as intended within 1.5 A/m and 7.5 A/m. Perform the test according to Figure 2 below.

Modifications done according:

- Reference ISO/IEC 10373-6 AM4 [R13], Conditions for type A
- Operating field strength ([R5]): H_{min} - H_{max}

Test setup: For this test, it is RECOMMENDED to have signal patterns that start with the RF off, and then produce an unmodulated field with nominal 13.56MHz carrier at the field level required by the test for 5ms prior to modulating this field with the command sequences below. The nominal 13.56 MHz carrier SHALL continue without modulation following the final response of each sequence for a RECOMMENDED one second.

It is RECOMMENDED to switch off the carrier for sufficient time before continuing at the next field level and / or bit rate.

For this procedure, the ISO test setup has to be used as a PCD antenna. The calibration of the field strength has to be done in advance. Then, the e-Passport has to be placed at the DUT position. Afterwards, the field strength has to be readjusted.

The high bit rate antenna SHALL be used for testing.

The ISO Test Setup (test apparatus) when used with a power amplifier necessary to establish the higher field levels does not have the possibility to test more than a request command. The test apparatus has to be augmented to provide a signal path for the responses to be routed to the controlling apparatus to enable two-way communication. The method used has to be documented in the test report.

The following command sequence has to be executed at least five times for each combination of parameters and each sample:

REQA → ANTICOL → SELECT → RATS → PPS → TEST_COMMAND_SEQUENCE1

See for annex A for a list of possible test command sequences depending on the operation mode, e.g. plain text, BAC, AA, EAC.

Conditions: Minimum number of samples: 3

Parameters:	Field strength:	At temperatures -10°C and RT: • 1.5 A/m, 2.5 A/m, 3.5 A/m, 4.5 A/m, 5.5 A/m, 6.5 A/m, 7.5 A/m At temperature 50°C: • 1.5 A/m, 2.5 A/m, 3.5 A/m, 4.5 A/m, 5.5 A/m, 6.0 A/m
	Bit rate:	fc/128, fc/64, fc/32, fc/16[3]
	Signal waveform:	See Table 3 and Table 4
	Temperature:	-10°C, RT, 50°C
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description and the number of samples and the date.	

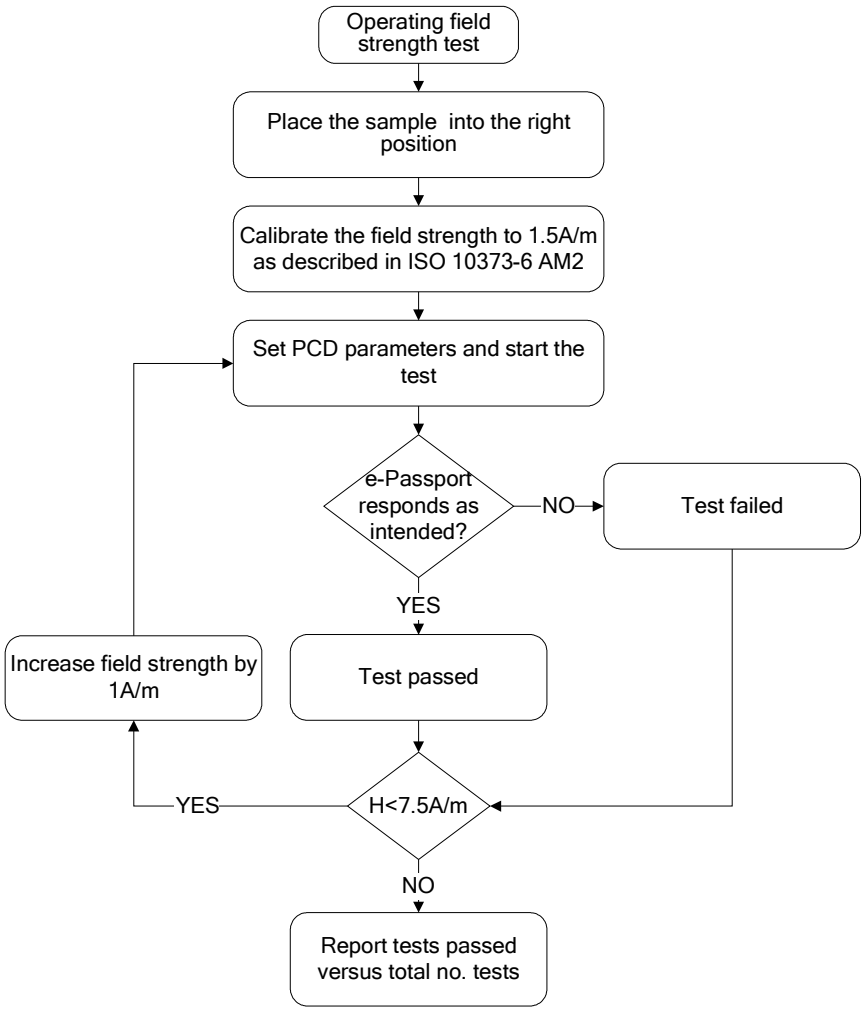


Figure 2: Test procedure for the operating field strength test

[3] All combinations of SCIC supported bit rates SHALL be tested.

Table 3: Fix Parameter Table for fc/128

Parameter	**Value**
Modulation index m	100 %
Bit rate	fc/128
t1	3 µs
t2	0.5 µs
t3	≤ 1.5 µs
t4	400ns
Overshoot	0

Table 4: Fix Parameter Table for fc/64, fc/32, fc/16

Parameter	**Values**		
Bit rate	fc/64	fc/32	fc/16
a	0.15	0.30	0.55
t1	20/fc	10/fc	5/fc
t2	14/fc	6/fc	3/fc
t3	6/fc	6/fc	6/fc
Overshoot	0	0	0

Note:
For each bit rate, the corresponding table SHALL be taken into account. In addition to bit rates higher than fc/128, it is also necessary to implement more than a request command (REQA). For bit rates higher than fc/128, several commands at fc/128 have to be executed before starting with higher bit rate tests.

For bit rates higher than fc/128, the sequence of test commands defined above has to be executed at the different magnetic field strengths and temperatures.

4.2.2 Type B

Test description: The purpose of this test is to check if the e-Passport meets the energy performance requirements according to [R5]. The e-Passport SHALL operate as intended within 1.5 A/m and 7.5 A/m. Perform the test according to Figure 2 above.

Test setup: For this test, it is RECOMMENDED to have signal patterns that start with the RF off, and then produce an unmodulated field with nominal 13.56MHz carrier at the field level required by the test for 5ms prior to modulating this field with the command sequences below. The nominal 13.56 MHz carrier SHALL continue without modulation following the final response of each sequence for a RECOMMENDED one second.

It is RECOMMENDED that the carrier is switched off for sufficient time before continuing at the next field level and / or bit rate.

For this procedure, the ISO test setup has to be used as a PCD antenna. The calibration of the field strength has to be done in advance. Then, the e-Passport has to be placed at the DUT position. Afterwards, the field strength has to be readjusted.

The high bit rate antenna SHALL be used for testing.

The ISO Test Setup (Test apparatus) when used with a power amplifier necessary to establish the higher field levels does not have the possibility to test more than a request command. The test apparatus has to be augmented to provide a signal path for the responses to be routed to the controlling apparatus to enable two-way communication. The method used has to be documented in the test report.

The following command sequence has to be executed at least five times for each combination of parameters and each sample:

REQB → ATTRIB → TEST_COMMAND_SEQUENCE1

See for annex A for a list of possible test command sequences depending on the operation mode, e.g. plain text, BAC, AA, EAC.

Conditions: Minimum number of samples: 3

Parameters:

Field strength:	At temperatures -10°C and RT: • 1.5 A/m, 2.5 A/m, 3.5 A/m, 4.5 A/m, 5.5 A/m, 6.5 A/m, 7.5 A/m At temperature 50°C: • 1.5 A/m, 2.5 A/m, 3.5 A/m, 4.5 A/m, 5.5 A/m, 6.0 A/m
Bit rate:	fc/128, fc/64, fc/32, fc/16[4]
Signal waveform:	See Table 5 and Table 6
Temperature:	-10°C, RT, 50°C

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description and the number of samples and the date.

Table 5: Bit rates fc/128 and fc/64

Parameter	**Value**
Modulation index m	12 %
t_r, t_f	≤ 1µs
h_r, h_f	0

[4] All combinations of SCIC supported bit rates SHALL be tested.

Table 6: Bit rates fc/ 32 and fc/16

Parameter	Value
Modulation index m	12 %
t_r, t_f	≤ 0.8µs
h_r, h_f	0

4.3 Communication stability test

4.3.1 Type A

Test description: The purpose of this test is to determine the communication stability of type A versus field strength and rise and fall times according to ISO/IEC 14443-2 [R5] and AM1 [R8] and ISO/IEC 10373-6 AM4 [R13] and AM5 [R14]. The e-Passport SHALL operate as intended within 1.5 A/m and 7.5 A/m. Perform the test according to Figure 3 below.

Modifications done according:

- Reference ISO/IEC 10373-6 AM2 [R12]
- Reference ISO/IEC 10373-6 AM4 [R13] - PICC reception - Conditions for type A
- Reference ISO/IEC 10373-6 AM5 [R14]
- Reference ISO/IEC 14443-2 [R5]
- Reference ISO/IEC 14443-2 AM1 2001 [R8]

Test setup: For this test, it is RECOMMENDED to have signal patterns that start with the RF off, and then produce an unmodulated field with nominal 13.56MHz carrier at the field level required by the test for 5ms prior to modulating this field with a command sequence according to the used type. The nominal 13.56 MHz carrier SHALL continue without modulation following the final response of each sequence for a RECOMMENDED one second.

It is RECOMMENDED to switch off the carrier for sufficient time before continuing at the next field level and / or bit rate.

For this procedure, the ISO test setup has to be used as a PCD antenna. The calibration of the field strength has to be done in advance. Then, the e-Passport has to be placed at the DUT position. Afterwards, the field strength has to be readjusted.

The ISO Test Setup (Test apparatus) when used with a power amplifier necessary to establish the higher field levels does not have the possibility to test more than a request command. The test apparatus has to be augmented to provide a signal path for the responses to be routed to the controlling apparatus to enable two-way communication. The method used has to be documented in the test report.

The following command sequence has to be executed at least five times for each combination of parameters and each sample:

REQA → ANTICOL → SELECT → RATS → PPS → TEST_COMMAND_SEQUENCE1

See for annex A for a list of possible test command sequences depending on the operation mode, e.g. plain text, BAC, AA, EAC.

Conditions:	Minimum number of samples:	3
Parameters:	Field strength:	At temperatures -10 °C and RT: • 1.5 A/m, 4.5 A/m, 7.5 A/m At temperature 50 °C: • 1.5 A/m, 4.5 A/m, 6.0 A/m
	Bit rate:	fc/128, fc/64, fc/32, fc/16
	Signal waveform:	See Table 7, Table 8, Table 9, and Table 10
	Temperature:	-10°C, RT, 50°C
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description and the number of samples and the date.	

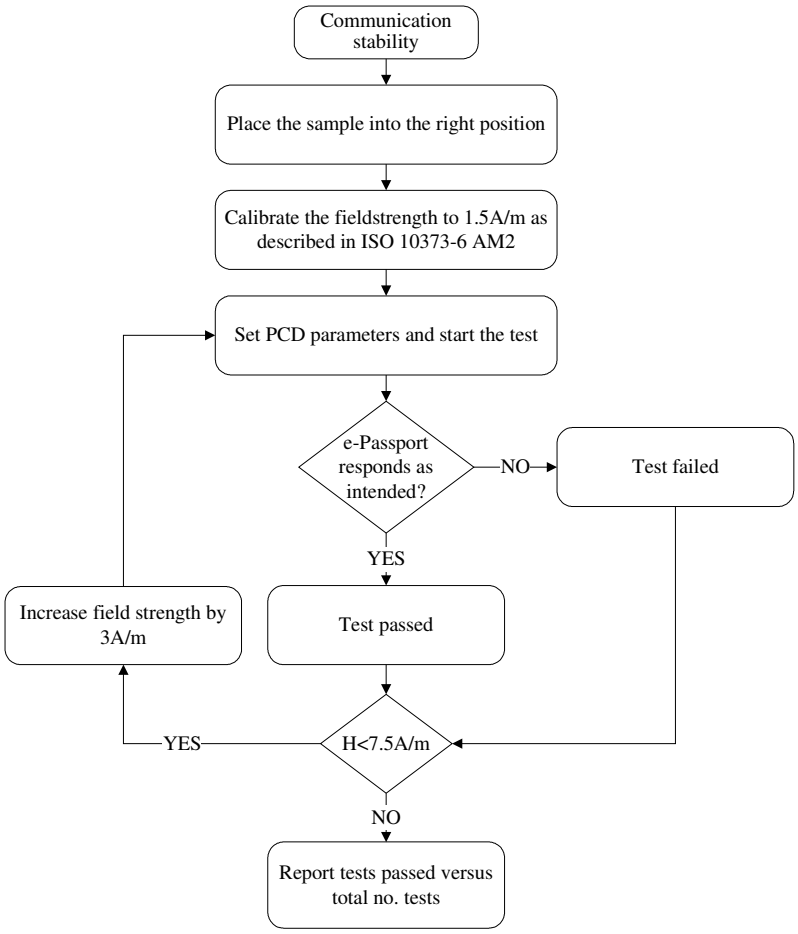


Figure 3: Test procedure for the communication stability test

Table 7: Test conditions for fc/128

Condition	**H** [A/m]	**t1** [µs]	**t2** [µs]	**t3** [µs]	**t4** [µs]	**m** [%]
1	1.5	3	0.5	≤1.5	0.4	95
2	1.5	3	0.5	0.8	0.4	100
3	4.5	3	0.5	≤1.5	0.4	95
4	4.5	3	0.5	0.8	0.4	100
5	7.5	3	0.5	≤1.5	0.4	95
6	7.5	3	0.5	0.8	0.4	100

Table 8: Test conditions for fc/64

Condition	**H** [A/m]	**t1**	**t2**	**t3**	**a**
1	1.5	20/fc	14/fc	6/fc	0.2
2	1.5	20/fc	16/fc	7/fc	≤ 0.05
3	4.5	20/fc	14/fc	6/fc	0.2
4	4.5	20/fc	16/fc	7/fc	≤ 0.05
5	7.5	20/fc	14/fc	6/fc	0.2
6	7.5	20/fc	16/fc	7/fc	≤ 0.05

Table 9: Test conditions for a bit rate of fc/32

Condition	**H** [A/m]	**t1**	**t2**	**t3**	**a**
1	1.5	10/fc	6/fc	6/fc	0.35
2	1.5	10/fc	7/fc	7/fc	≤ 0.15
3	4.5	10/fc	6/fc	6/fc	0.35
4	4.5	10/fc	7/fc	7/fc	≤ 0.15
5	7.5	10/fc	6/fc	6/fc	0.35
6	7.5	10/fc	7/fc	7/fc	≤ 0.15

Table 10: Test conditions for a bit rate of fc/16

Condition	**H** [A/m]	**t1**	**t2**	**t3**	**a**
1	1.5	5/fc	3/fc	6/fc	0.6
2	1.5	5/fc	3/fc	7/fc	≤ 0.3
3	4.5	5/fc	3/fc	6/fc	0.6
4	4.5	5/fc	3/fc	7/fc	≤ 0.3
5	7.5	5/fc	3/fc	6/fc	0.6
6	7.5	5/fc	3/fc	7/fc	≤ 0.3

Note:
For each bit rate, the corresponding table SHALL be taken into account. In addition, it is also necessary for bit rates higher than fc/128 to implement more than a request command (REQA). For bit rates higher than fc/128, several commands at fc/128 have to be executed before starting with higher bit rate tests.

For bit rates higher than fc/128, the sequence of test commands defined above has to be executed at the different magnetic field strengths, temperatures, and waveforms.

4.3.2 Type B

Test description: The purpose of this test is to determine the communication stability of type B versus field strength and rise and fall times according to ISO/IEC 14443-2 [R5] and AM1 [R8] and ISO/IEC 10373-6 AM4 [R13] and AM5 [R14]. The e-Passport SHALL operate as intended within 1.5 A/m and 7.5 A/m. Perform the test according to Figure 3 above.

Modifications done according:

- Reference ISO/IEC 10373-6 AM2 [R12]
- Reference ISO/IEC 10373-6 AM4 [R13] - PICC reception - Conditions for type B
- Reference ISO/IEC 10373-6 AM5 [R14]
- Reference ISO/IEC 14443-2 [R5]
- Reference ISO/IEC 14443-2 AM1 2001 [R8]

Test setup: For this test, it is RECOMMENDED to have signal patterns that start with the RF off, and then produce an unmodulated field with nominal 13.56MHz carrier at the field level required by the test for 5ms prior to modulating this field with a command sequences according to the used type. The nominal 13.56 MHz carrier SHALL continue without modulation following the final response of each sequence for a RECOMMENDED one second.

It is RECOMMENDED to switch off the carrier for sufficient time before continuing at the next field level and / or bit rate.

For this procedure, the ISO test setup has to be used as a PCD antenna. The calibration of the field strength has to be done in advance. Then, the e-Passport has to be placed at the DUT position. Afterwards, the field strength has to be readjusted.

The ISO Test Setup (Test apparatus) when used with a power amplifier necessary to establish the higher field levels does not have the possibility to test more than a request command. The test apparatus has to be augmented to provide a signal path for the responses to be routed to the controlling apparatus to enable two-way communication. The method used has to be documented in the test report.

The following command sequence has to be executed at least five times for each combination of parameters and each sample:

REQB → ATTRIB → TEST_COMMAND_SEQUENCE1

	See for annex A for a list of possible test command sequences depending on the operation mode, e.g. plain text, BAC, AA, EAC.	
Conditions:	Minimum number of samples:	3
Parameters:	Field strength:	At temperatures -10 °C and RT: • 1.5 A/m, 4.5 A/m, 7.5 A/m At temperature 50 °C: • 1.5 A/m, 4.5 A/m, 6.0 A/m
	Bit rate:	fc/128, fc/64, fc/32, fc/16
	Signal waveform:	See Table 11 and Table 12
	Temperature:	-10°C, RT, 50°C
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description and the number of samples and the date.	

Table 11: Bit rates fc/128 and fc/64

Condition	**H** [A/m]	**m** [%]	$\mathbf{t_r}$, $\mathbf{t_f}$ [µs]
1	1.5	8	1
2	1.5	14	1
3	4.5	8	1
4	4.5	14	1
5	7.5	8	1
6	7.5	14	1

Table 12: Bit rates fc/32 and fc/16

Condition	**H** [A/m]	**m** [%]	$\mathbf{t_r}$, $\mathbf{t_f}$ [µs]
7	1.5	8	0.8
8	1.5	14	0.8
9	4.5	8	0.8
10	4.5	14	0.8
11	7.5	8	0.8
12	7.5	14	0.8

4.4 Resonance frequency test (optional)

Test description:	The purpose of this test is to determine the resonance frequency of the e-Passport. The resonance frequency SHALL be within the range that has been specified in the implementation conformance specification.	
Test setup:	An LCR meter MAY be used: a coil that is connected to the device's output generates the magnetic field. The setup SHALL be calibrated in advance. The e-Passport coil SHALL be positioned in a close distance concentrically above the field-generating coil. The resonance frequency is defined as the frequency, where the real part of the field generating coil impedance reaches its maximum under threshold conditions of the e-Passport.	
Conditions:	Minimum number of samples:	3
Parameters:	Temperature:	RT
Report:	The test report SHALL state whether the resonance frequencies measured are within the specified range of resonance frequencies.	

5 Layer 3 timing and framing tests

Test Setup:
Setup as defined for the electrical tests can be used also for timing and framing tests. However, the test laboratory can select an alternative setup for the timing and framing related tests, as long as the setup meets the specified parameters of the test signal. Independently of the selected test setup, the setup is called “test apparatus” in this clause.

The Test apparatus SHALL be able to emulate the protocol, to measure and monitor the timing of the logical Input/Receive line relative to the CLK frequency, and to be able to analyze the I/O-bit stream in accordance with the protocol.

All tests SHALL be performed with one specific field strength between 1.5 A/m and 7.5 A/m if not further specified. All tests SHALL be performed at RT if not further specified.

5.1 Startup time - Polling

5.1.1 Type A

Test description:	The purpose of this test is to check the correct behavior after switching the RF field on and during alternate receiving of REQB and REQA (polling). Perform test as defined in ISO 10373-6 AM1, Annex G 3.2 [R11] but change the time parameter in steps 4, 8 and 9 to 10 ms. The e-Passport SHALL respond to a REQA 10 ms after switching on the RF field and it SHALL respond to a REQA 10 ms after an REQB.	
Conditions:	Minimum number of samples:	3
Parameters:	Bit rate:	fc/128
Report:	The test report SHALL state whether the e-Passport meets the startup timing requirements.	

5.1.2 Type B

Test description:	The purpose of this test is to check the correct behavior after switching the RF field on and during alternate receiving of REQA and REQB (polling). Perform test as defined in ISO 10373-6 AM1, Annex G 4.2 [R11] but change the time parameter in steps 4, 8 and 9 to 10 ms. The e-Passport SHALL respond to a REQB 10 ms after switching on the RF field and it SHALL respond to a REQB 10 ms after an REQA.	
Conditions:	Minimum number of samples:	3
Parameters:	Bit rate:	fc/128

Report: The test report SHALL state whether the e-Passport meets the startup timing requirements.

5.2 Frame delay time (type A only)

Test description: This test shall check if the frame delay time (FDT) is correct. The purpose of this test is to determine the FDT of the e-Passport according to ISO 10373-6 AM1 [R11].

Modifications done according:

- Reference ISO/IEC 14443-3 [R6], Frame delay time PCD to PICC
- Reference ISO/IEC 14443-3 AM1 [R9]

Perform test as defined in ISO 10373-6 AM1, scenario 2 of Annex G 3.4 [R11]. Check the FDT of the SCIC response frame.

Depending on the last bit of the command the FDT SHALL be as follows:

(1)b → FDT = 1236 / fc
(0)b → FDT = 1172 / fc

Conditions: Minimum number of samples: 3

Parameters: Bit rate: fc/128

Report: The test report SHALL state whether the e-Passport meets the requirements concerning FDT timing.

5.3 Start-Of-Frame and End-Of-Frame timing (type B only)

Test description: The purpose of this test is to check whether the e-Passport meets the SOF and EOF timing requirements according to Annex G of [R11].

Perform test for each condition as defined in ISO 10373-6 AM1, Annex G 4.3 [R11]. Set the frame parameters of the test apparatus according to the conditions defined in Table 13 and Table 14. Check the values SOF and EOF of the SCIC response frame.

The values of SOF and EOF SHALL conform to the following:

- SOF logic 0 timing SHALL be between 10 and 11 etu.
- SOF logic 1 timing SHALL be between 2 and 3 etu.
- EOF logic 0 timing shall be between 10 and 11 etu.

Conditions: Minimum number of samples: 3

Parameters: Bit rate: fc/128

Report: The test report SHALL state whether the e-Passport meets the SOF and EOF timing requirements.

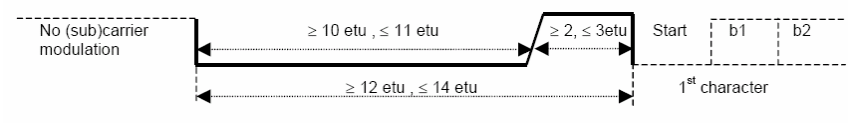


Figure 4: SOF

Table 13: SOF timing

Condition	SOF "0"	SOF "1"
1	10 etu	2 etu
2	11 etu	3 etu

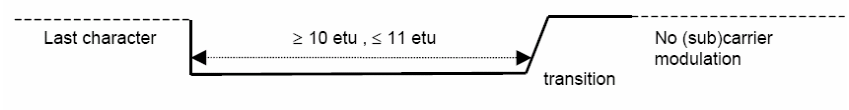


Figure 5: EOF

Table 14: EOF timing

Condition	EOF
1	10 etu
2	11 etu

5.4 Extra guard time (type B only)

Test description: The purpose of this test is to check whether the e-Passport meets the EGT requirements according to [R6].

Table 15: EGT test conditions

Condition	EGT
1	1 etu
2	3.4 etu
3	6 etu

Perform test for each condition as defined in ISO 10373-6 AM1, Annex G 4.3 [R11]. Set the frame parameters of the test apparatus according to the conditions defined in Table 15. Check the values of the EGT of the SCIC response frame.

The EGT SHALL be between 0 and 2 etu.

Conditions:	Minimum number of samples:	3
Parameters:	Bit rate:	fc/128
Report:	The test report SHALL state whether the e-Passport meets the requirements concerning EGT timing.	

5.5 Timing before SCIC SOF (TR0 and TR1) (type B only)

Test description: The purpose of this test is to check whether the e-Passport meets the TR0 and TR1 requirements according to [R6].

Perform test as defined in ISO 10373-6 AM1, Annex G 4.3 [R11]. Check the values of TR0 and TR1 before SCIC SOF; see Figure 6.

TR0 and TR1 SHALL be between the minimum and maximum values defined in Table 16.

Table 16: TR0 and TR1 boundaries

	Min	**Max**
TR0	64/fs	256/fs
TR1	80/fs	200/fs

Conditions:	Minimum number of samples:	3
Parameters:	Bit rate:	fc/128
Report:	The test report SHALL state whether the e-Passport meets the requirements concerning TR0 and TR1 timing.	

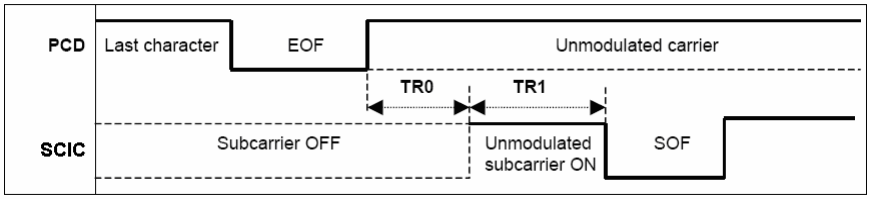


Figure 6: TR0 and TR1

5.6 Timing after SCIC EOF (subcarrier turn-off time) (type B only)

Test description: The purpose of this test is to check whether the e-Passport meets the subcarrier turn-off time after SCIC EOF.

Perform test as defined in ISO 10373-6 AM1, Annex G 4.3 [R11]. Check the subcarrier turn-off time; see Figure 7.

The SCIC SHALL turn off the subcarrier between 0 and 2 etu after SCIC EOF.

Conditions: Minimum number of samples: 3

Parameters: Bit rate: fc/128

Report: The test report SHALL state whether the e-Passport meets the requirement concerning the subcarrier turn-off time after SCIC EOF.

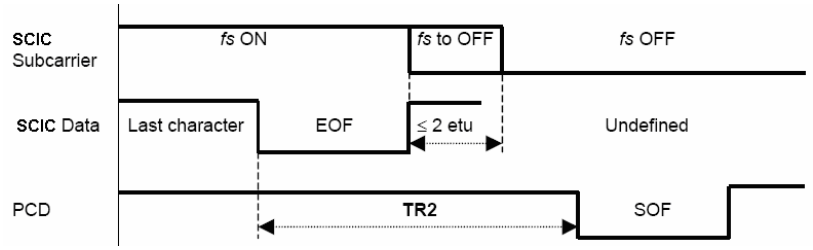


Figure 7: SCIC EOF timings

5.7 Timing after SCIC EOF (TR2) (type B only)

Test description: The purpose of this test is to check whether the e-Passport meets the minimum TR2 timing requirement as defined in the protocol byte of the SCIC's ATQB, see ISO 14443-3 [R6], its amendment 1 [R9] and the corresponding defect report [R16].

Perform the test as follows (in accordance with [R11]):

- Place the SCIC into the field.
- Set the frame parameters of the test apparatus according to Table G.31 — Type B specific timing table [R11] and Table 1.
- Then send REQB(0).
- After the ATQB do a delay of minimum TR2 as defined in [R16].
- Send ATTRIB(0,0) command.
- Record the presence, contents and timings of the SCIC responses.

The SCIC's response to the ATTRIB command SHALL be a valid Answer to ATTRIB.

Conditions: Minimum number of samples: 3

Parameters: Bit rate: fc/128

Report: The test report SHALL state whether the e-Passport meets the minimum TR2 timing requirement.

6 Layer 3 and 4 protocol tests

These tests provide a basic set of tests to be performed to check the compliance to ISO/IEC 14443 protocol layers 3 [R6], [R9] and 4 [R7]. All tests are based on and SHALL be evaluated according to the referenced versions of standards.

Test Setup:
Setup as defined for the electrical tests can be used also for protocol tests. However, the test laboratory can select an alternative setup for the protocol related tests, as long as the setup meets the specified parameters of the test signal. Independently of the selected test setup, the setup is called "test apparatus" in this clause.

The Test apparatus SHALL be able to emulate the protocol, to measure and monitor the timing of the logical Input/Receive line relative to the CLK frequency, and to be able to analyze the I/O-bit stream in accordance with the protocol.

All tests SHALL be performed with one specific field strength between 1.5 A/m and 7.5 A/m if not further specified. All tests SHALL be performed at RT if not further specified.

The tests are based on the ISO/IEC10373-6 AM1 specification [R11]. For the test, commands defined in [R11] commands that are typical for an application SHOULD be used. Therefore, refer to annex A for a list of TEST COMMANDS that MUST be used for testing the e-Passport.

RFU fields SHOULD be constantly monitored during the testing and SHALL always be verified to contain the assigned default value in accordance with Annex G1.5 of [R11].

6.1 Type A activation

These tests SHALL ensure that the start-up and the activation are in accordance with [R6]. These tests are split up to state transitions and the handling of RATS and PPS.

6.1.1 State transitions

Test description:	The purpose of this test is to check the correct behavior during state transitions as defined in [R6]. Additionally possible proprietary paths of the "Select sequence flow chart" specified in [R6] MUST NOT negatively affect the test. Perform test as defined in ISO 10373-6 AM1, Annex G 3.4 [R11]. The tests specified in the sub-clause "Testing of the PICC type A state transitions" of [R11] SHALL be used. The detailed test procedure is not specified further herein.
Report:	The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.1.2 Handling of type A anticollision

Test description: The purpose of this test is to check the correct behavior during anticollision as defined in [R6].

Perform test as defined in ISO 10373-6 AM1, Annex G 3.5 [R11]. The tests specified in the sub-clause "Handling of type A anticollision" of [R11] SHALL be used. The detailed test procedure is not specified further herein.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.1.3 Handling of RATS

Test description: The purpose of this test is to check the correct behavior on a RATS as defined in [R6].

Perform test as defined in ISO 10373-6 AM1, Annex G 3.6 [R11]. The tests specified in the sub-clause "Handling of RATS" of [R11] SHALL be used where a valid and an invalid RATS is sent. The detailed test procedure is not further specified herein.

In addition, it SHALL be verified if the bit rates as defined in the interface byte TA(1) of the ATS are equal to the bit rates claimed in the implementation conformance statement.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11]. It SHALL state if the ATS correctly encodes the bit rates.

6.1.4 Handling of PPS

Test description: The purpose of this test is to check the correct behavior on a PPS as defined in [R6].

Perform test as defined in ISO 10373-6 AM1, Annex G 3.7 [R11]. The tests specified in the sub-clause "Handling of PPS request" of [R11] SHALL be used where a valid and an invalid PPS is sent. The detailed test procedure is not further specified herein.

Test Scenario 17: PPS without PPS1 as defined in [R11] SHALL NOT be performed.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.1.5 Handling of FSD

Test description: The purpose of this test is to check if the SCIC correctly handles FSD negotiated by the RATS as defined in [R6].

Perform test as defined in ISO 10373-6 AM1, Annex G 3.8 [R11]. The tests specified in the sub-clause "Handling of FSD" of [R11] SHALL be used. The detailed test procedure is not further specified herein.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.2 Type B activation

The following tests regarding type B activation are required according to [R11] and SHALL ensure that the activation is in accordance with [R6].

6.2.1 State transitions

Test description: These tests are to verify the correct implementation of a type B SCIC's state machine. Perform test as defined in ISO 10373-6 AM1, Annex G 4.4 [R11]. The procedure specified in "Testing of the PICC Type B State Transition" of [R11] SHALL be used.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.2.2 Handling of type B anticollision

Test description: This test is to determine the handling of a SCIC type B anticollision. Perform test as defined in ISO 10373-6 AM1, Annex G 4.5 [R11]. The procedure specified in "Handling of Type B Anticollision" of [R11] SHALL be used.

Report: The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.2.3 Handling of ATTRIB

Test description: This test is to determine the behavior of the SCIC type B on ATTRIB command. Perform test as defined in ISO 10373-6 AM1, Annex G 4.6 [R11]. The procedure specified in "Handling of ATTRIB" of [R11] SHALL be used.

In addition, it SHALL be verified if the bit rates as defined in the protocol info byte of the ATQB are equal to the bit rates claimed in the implementation conformance statement.

Report: The test report SHALL state whether the SCIC responds as indicated in the

procedures according to [R11]. It SHALL state if the ATQB correctly encodes the bit rates.

6.2.4 Handling of maximum frame size

Test description:	The purpose of this test is to check if the SCIC correctly handles FSD negotiated by the ATTRIB as defined in [R6]. Perform test as defined in ISO 10373-6 AM1, Annex G 4.7 [R11]. The procedure specified in "Handling of Maximum Frame Size" of [R11] SHALL be used.
Report:	The test report SHALL state whether the SCIC responds as indicated in the procedures according to [R11].

6.3 Data exchange protocol tests

These tests SHALL ensure the logical operation is in accordance with [R7]. They are valid for both, type A and type B, whereas the activation before running these tests is different and listed below.

All tests SHALL be performed with one specific field strength between 1.5 A/m and 7.5 A/m if not further specified. All tests SHALL be performed at RT if not further specified.

The activation for type A SHALL be:
1. Activation using: REQA, ANTICOLISSION, SELECT as defined in [R6]
2. Activation using: RATS as defined in [R7]
3. Check that activation has been correct (response has been correct for all commands)

The activation for type B SHALL be:
1. Activation using: REQB with number of timeslots set to 0 as defined in [R6]
2. Activation using: ATTRIB as defined in [R6]
3. Check that activation has been correct (response has been correct for all commands)

6.3.1 Exchange of I-blocks

Test description:	The purpose of this test is to check the correct behavior of I-blocks as defined in [R7]. Perform tests as defined in ISO 10373-6 AM1, Annex G 5.2 [R11]. These tests include both correct and erroneous transactions and are described in [R7] and with the scenario caption "Exchange of I-blocks" in [R11]. The general TEST_COMMAND1 as defined by [R11] is specified in annex A. The detailed test procedure is not specified further herein.
Report:	The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

6.3.2 Chaining of I-blocks

The purpose of this test is to check the correct behavior of chained I-blocks as defined in [R7]. These tests are divided into two parts, the first one where the PCD (Test apparatus) uses chaining and the second one where the e-Passport uses chaining.

Test description:	**PCD uses chaining** The PCD chaining tests can be performed without knowing dedicated command behavior on the device under test. The purpose of this test is to check the correct behavior of chained I-blocks from PCD side as defined in [R7]. Perform tests as defined in ISO 10373-6 AM1, Annex G 5.2 [R11]. These tests include both correct and erroneous transactions and are described in [R7] and with the scenario caption “PCD uses chaining” in [R11]. The general TEST_COMMAND1 as defined by [R11] is specified in annex A. The detailed test procedure is not specified further herein.
Report:	The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

Test description:	**SCIC uses chaining (optional)** The SCIC chaining is harder to achieve. If the higher layer functionality is not known in detail (knowing a command which by default responds with a chained block), this test can not be performed. Therefore, this test is optional. If applicable, the general TEST_COMMAND2 as defined by [R11] is specified in annex A. The purpose of this test is to check the correct behavior of chained I-blocks from SCIC side as defined in [R7]. Perform tests as defined in ISO 10373-6 AM1, Annex G 5.2 [R11]. These tests include both correct and erroneous transactions and are described in [R7] and with the scenario caption “PICC uses chaining” in [R11]. The general TEST_COMMAND2 as defined by [R11] is specified in annex A. The detailed test procedure is not specified further herein.
Report:	The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

6.3.3 DESELECT

.

Test description: The purpose of this test is to check the correct behavior of DESELECT as defined in [R7].

Perform tests as defined in ISO 10373-6 AM1, Annex G 5.2 [R11]. These tests include both correct and erroneous transactions and are described in [R7] and with the scenario caption “DESELECT” in [R11]. The general TEST_COMMAND1 as defined by [R11] is specified in annex A. The detailed test procedure is not specified further herein.

Report: The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

6.3.4 Request for waiting time extension (optional)

Test description: If the SCIC does not support a command which by default responds with a waiting time extension, this test cannot be performed. Therefore, it is optional.

The purpose of this test is to check the correct behavior of request waiting time extension command as defined in [R7].

Perform tests as defined in ISO 10373-6 AM1, Annex G 5.2 [R11]. These tests include both correct and erroneous transactions and are described in [R7] and with the scenario caption “Request for waiting time extension” in [R11]. The general TEST_COMMAND3 as defined by [R11] is specified in annex A which by default responds with the waiting time extension command. The detailed test procedure is not specified further herein.

Report: The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

6.3.5 Handling of SCIC error detection (optional)

Test description: The purpose of this test is to check the correct behavior of the SCIC’s error detection as defined in [R7].

Perform tests as defined in ISO 10373-6 AM1, Annex G 5.3 [R11]. The general TEST_COMMAND1 and TEST_COMMAND3 as defined by [R11] are specified in annex A. The detailed test procedure is not specified further herein.

Scenarios G 53 “Bad block number on I-Block” and G 54 “Bad block number on chained I-Block” as defined in [R11] SHOULD NOT be performed.

Report: The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

6.3.6 SCIC reaction on CID

Test description:	The purpose of this test is to check the correct reaction of the SCIC to CID coding as defined in [R7]. This test can be applied to all e-Passports even if they do not support CID. Perform tests as defined in ISO 10373-6 AM1, Annex G 5.4 [R11]. The general TEST_COMMAND1, TEST_COMMAND2 and TEST_COMMAND3 as defined by [R11] are specified in annex A. The detailed test procedure is not specified further herein.
Report	The test report SHALL state whether the response is in accordance with [R7]. The report SHALL include the test commands used.

Annex A List of test command sequences (normative)

A.1 General

This annex contains sequences of test commands on the application level that are employed in several test cases defined in this technical report, e.g. chaining in the frame protocol layer. Since the ISO 10373-6 AM1 test standard [R11] does only define generic test commands, this technical report provides mandatory test commands that are specific to the e-Passport's LDS application and its variants.

A.2 Test commands for e-Passports without access control (plain)

A.2.1 TEST_COMMAND_SEQUENCE1

References:

- Operating Field Strength Test, chapter 4.2
- Communication Stability Test, chapter 4.3

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 07 A0 00 00 02 47 10 01
2	READ BINARY	00 B0 81 00 00

A.2.2 TEST_COMMAND1

References:

- Exchange of I-blocks, chapter 6.3.1
- Chaining of I-blocks, chapter 6.3.2
- DESELECT, chapter 6.3.3
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 0C A0 00 00 02 47 10 01 00 00 00 00 00[5]

[5] The application will not process this command successfully but it can be used for PCD chaining.

A.2.3 TEST_COMMAND2

References:

- Chaining of I-blocks, chapter 6.3.2
- Handling of SCIC error detection, chapter 6.3.5

Preconditions:

- RATS and PPS / ATTRIB are successfully performed
- LDS application "A0 00 00 02 47 10 01" is successfully selected

APDU definition:

Step	Command	C-APDU
1	READ BINARY	00 B0 82 00 00

A.2.4 TEST_COMMAND3

References:

- Request for waiting time extension (optional), chapter 6.3.4
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- To be defined by applicant.

APDU definition:

- To be defined by applicant.

A.3 Test commands for e-Passport with BAC

A.3.1 TEST_COMMAND_SEQUENCE1

References:

- Operating Field Strength Test, chapter 4.2
- Communication Stability Test, chapter 4.3

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition[6]:

Step	Command	C-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	READ BINARY	0C B0 81 00 0D 97 01 00 8E 08 <mac> 00

[6] Apply basic access control as defined in [R2]

A.3.2 TEST_COMMAND1

References:

- Exchange of I-blocks, chapter 6.3.1
- Chaining of I-blocks, chapter 6.3.2
- DESELECT, chapter 6.3.3
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 0C A0 00 00 02 47 10 01 00 00 00 00 00[7]

A.3.3 TEST_COMMAND2

References:

- Chaining of I-blocks, chapter 6.3.2
- Handling of SCIC error detection, chapter 6.3.5

Preconditions:

- RATS and PPS / ATTRIB are successfully performed
- LDS application “A0 00 00 02 47 10 01” is successfully selected
- Basic access is granted

APDU definition:

Step	Command	C-APDU
1	READ BINARY	0C B0 82 00 0D 97 01 00 8E 08 <mac> 00

A.3.4 TEST_COMMAND3

References:

- Request for waiting time extension (optional), chapter 6.3.4
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- To be defined by applicant.

APDU definition:

- To be defined by applicant.

[7] The application will not process this command successfully but it can be used for PCD chaining.

A.4 Test commands for e-Passport with AA

A.4.1 TEST_COMMAND_SEQUENCE1

References:

- Operating Field Strength Test, chapter 4.2
- Communication Stability Test, chapter 4.3

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 07 A0 00 00 02 47 10 01
2	INTERNAL AUTHENTICATE	00 88 00 00 08 F1 73 58 99 74 BF 40 C6 00

A.4.2 TEST_COMMAND1

See TEST_COMMAND1 in chapter A.2.2

A.4.3 TEST_COMMAND2

See TEST_COMMAND2 in chapter A.2.3

A.4.4 TEST_COMMAND3

See TEST_COMMAND3 in chapter A.2.4

A.5 Test commands for e-Passport with BAC+AA

A.5.1 TEST_COMMAND_SEQUENCE1

References:

- Operating Field Strength Test, chapter 4.2
- Communication Stability Test, chapter 4.3

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 07 A0 00 00 02 47 10 01
2	INTERNAL AUTHENTICATE	00 88 00 00 08 F1 73 58 99 74 BF 40 C6 00

A.5.2 TEST_COMMAND1

References:

- Exchange of I-blocks, chapter 6.3.1
- Chaining of I-blocks, chapter 6.3.2
- DESELECT, chapter 6.3.3
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- RATS and PPS / ATTRIB are successfully performed

APDU definition:

Step	Command	C-APDU
1	SELECT	00 A4 04 0C 0C A0 00 00 02 47 10 01 00 00 00 00 00[8]

A.5.3 TEST_COMMAND2

References:

- Chaining of I-blocks, chapter 6.3.2
- Handling of SCIC error detection, chapter 6.3.5

Preconditions:

- RATS and PPS / ATTRIB are successfully performed
- LDS application "A0 00 00 02 47 10 01" is successfully selected
- Basic access is granted

APDU definition:

Step	Command	C-APDU
1	READ BINARY	0C B0 82 00 0D 97 01 00 8E 08 <mac> 00

A.5.4 TEST_COMMAND3

References:

- Request for waiting time extension (optional), chapter 6.3.4
- Handling of SCIC error detection, chapter 6.3.5
- SCIC reaction on CID, chapter 6.3.6

Preconditions:

- To be defined by applicant.

APDU definition:

- To be defined by applicant.

[8] The application will not process this command successfully but it can be used for PCD chaining.

Annex B Functionality check test (informative)

B.1 General

For destructive tests such as mechanical and electrical (layer 1) stress tests, it is often required to check if the e-Passport "operates as intended". These tests are not defined further by the ISO 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 annex specifies two optional tests to verify the e-Passports functionality on the electrical and on the application level without performing all these, sometimes time-consuming tests specified in this technical report.

On the electrical level, 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.

B.2 Application functionality check test

Test description: This test is a basic functionality check test. The purpose of this test is to check if the e-Passport's mandatory LDS application data as specified in [R1] can be retrieved from the SCIC. It has to be verified that this information has not been altered by the destructive tests.

The test procedure SHOULD be performed with all given samples as follows:

1. Put the e-Passport on the contactless reader of the tests setup.
2. Select the e-Passport's SCIC using the initialization and anticollision procedure defined in [R6].
3. Select the LDS application as specified in [R1].
4. Perform basic access control as specified in [R2] if indicated in the implementation conformance statement.
5. Read data of file EF.COM as specified in [R1].
6. Read data of file EF.DG1 as specified in [R1].
7. Read data of file EF.DG2 as specified in [R1].
8. Read the document security object of file EF.SOD as specified in [R1].
9. Verify the digital signature contained in the document security object as specified in [R2].

Test setup: The test MAY be performed with standard PC/SC readers and any software that is able to send commands to the e-Passport and that can verify the integrity of the data retrieved.

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

B.3 Electrical functionality check test

Test description: The purpose of this test is to check the electrical functionality of the e-Passport and MAY be used in addition to the Application functionality check test specified in chapter B.2.

The test procedure SHOULD be performed with all given samples using at lest one of the following methods:

1. Apply the Resonance Frequency Test as specified in chapter 4.4.
2. Apply the Operating Field Strength Test as specified in chapter 4.2.
3. Apply an alternative method comparing relative values of the threshold field strength before and after the mechanical or electrical stress test.

Test setup: For this test, the test setup defined in the corresponding chapters SHALL be used.

Report: The test report SHALL state whether the resonance frequency is in the range specified in the implementation conformance statement or whether the e-Passport operates as intended for all combinations of temperatures and field strengths, see chapter 4.2.

MACHINE READABLE TRAVEL DOCUMENTS

TECHNICAL REPORT

RF PROTOCOL AND APPLICATION TEST STANDARD FOR E-PASSPORT - PART 3

TESTS FOR APPLICATION PROTOCOL AND LOGICAL DATA STRUCTURE

Version: **1.01**
Date – Feb 20, 2007

Published by authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

File	: RF protocol Part 3 V1.01.doc
Author	: ISO/JTC1/SC17/WG3/TF4 for ICAO-NTWG

Release Control

Release	Date	Description
0.1	23-11-2005	First draft based on the German WG3 TF4 contribution "e-Passport Conformity Testing" version 1.02 presented at TF4 meeting in Paris Nov 21-23, 2005
0.2	21-12-2005	Updated version with new ICAO TR layout.
0.9	17-03-2006	Changes according to resolved comments from the WG3 TF4 meeting in Ottawa, Jan 30 – Feb 02, 2006. The following major changes have been introduced: • Less restrictive verification of status words • Introduction of profiles to be tested
0.95	2006-08-31	Intermediate draft, updated version with resolved comments from the Graz meeting Jun 12-13, 2006 and editorial changes. Some comments from Graz still unresolved. Test suites D and E have been modified as follows: There will be one test suite to check the protected command and one to check the unprotected commend. Test suites D and E will no longer check the correctness of the SM implementation since this is handled in test suite C New test suites F and G for testing unprotected SelectFile and ReadBinary. Test suites D and E will check the protected SelectFile and ReadBinary commands respectively. Redefined test cases (proposal) for test unit LDS_B – tests for DG1 – MRZ Redefined test cases E_1 – E_3 and E_5 – E_22 because of unspecified EOF reading.
0.96	2006-11-29	Final internal draft version including all resolved comments from the Bled meeting, Oct 25-26, 2006. Editorial changes in test suites C_9 and C_11 to clarify the encoding of offsets with tag 54. Editorial changes in test suites B and C. Former tests C_20 to C_36 have been moved to test suite B because these tests cover security condition tests.
1.0	2006-12-18	Editorial changes in 7816_C_8, C_9, and C_11 (sequence of steps to be performed) and in LDS_D_4 (reference changed to DOC9303, Annex A3.2)
1.01	2007-02-20	Test case 7816_C_16: verification of Postconditions removed

Release Note:

Release 2007-02-20 is the official version of the technical report by SC17 WG3 TF4 endorsed by ICAO-NTWG at the Portugal meeting. It replaces version V1.0.

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1 Introduction

1.1 Scope and purpose

An essential element of the new ICAO compliant e-Passport is the addition of a Secure Contactless Integrated Circuit (SCIC) that holds securely biometric data of the e-Passport bearer within the ICAO defined Logical Data Structure (LDS).

Successful integration of the SCIC into the e-Passport depends upon active international cooperation between many companies and organizations.

The e-Passport has been specified and designed to operate correctly across a wide variety of reading infrastructures worldwide. The risk profile for the e-Passport indicates a high impact if that design includes a widespread error or fault. Therefore it is essential, that all companies and organizations involved make all reasonable efforts to minimize the probability that this error or fault remains undetected before that design is approved and e-Passports are issued.

This test specification covers the application interface, i.e. the ISO7816 conformance of the e-Passport Chip and the conformance of the LDS.

The ISO7816 conformance tests are restricted to the commands defined in the LDS 1.7 [R1] and PKI 1.1 [R2] specifications. Other commands especially file creation and personalization commands are beyond the scope of this document.

The logical data structure test layer analyses the encoding of the LDS objects stored on an e-Passport. This layer contains several test units, one for each LDS object (DG 1 - 16, EF.COM and EF.SOD). Another test unit verifies the integrity and consistency of the different data structures. The tests specified for this layer can be performed using a regular e-Passport or with given input data from a different source (e.g. file). The test configuration document specifies the source of the data.

1.2 Assumptions

It is assumed that the electrical interface and the underlying transport protocol are functionally tested. Thus, failures introduced by the RF protocol are out of scope of the test cases defined here.

1.3 Terminology

The key words "MUST", "SHALL", "REQUIRED", "SHOULD", "RECOMMENDED", and "MAY" in this document are to be interpreted as described in [R3].

MUST This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.

MUST NOT This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.

SHOULD This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

SHOULD NOT This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.

MAY This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

1.4 Glossary

Command data field	The command data field defines the data of a command APDU that follows the command header and the Lc field – except the Le field. Its length is defined by Lc.
Command header	The command header comprises the first four bytes of the command APDU sent to the e-Passport in compliance with ISO 7816-4 [R6]. The header consists of the bytes CLA, INS, P1, and P2.
Lc	Length field of the command APDU encoding the number of bytes in the command data field. In this specification, Lc is encoded in one byte (short length).
Le	Length field of the command APDU encoding the maximum number of bytes expected in the response data field. In this specification, Le is encoded in one byte (short length).
Response data	Response data is the string of bytes that is encoded in the response data field.
Response data field	The response data field defines the data – except the response trailer – that the e-Passport returns in the response APDU in compliance with ISO 7816-4 [R6].
Response trailer	The response trailer defines the last two bytes that the e-Passport returns in the response APDU. The response trailer consists of two status bytes in compliance with ISO 7816-4 [R6].
Status bytes	The status bytes SW1-SW2 indicate the processing state of the LDS application in compliance with ISO 7816-4 [R6].
‘80’, ‘AB CD’	Bytes or byte strings encoded in Hex-ASCII will be denoted in apostrophes.

1.5 Abbreviations

Abbreviation	
AA	Active authentication
AID	Application identifier
APDU	Application protocol data unit
BAC	Basic access control
CLA	Class byte
DF	Dedicated file
DG	Data group
DO	Data object

Abbreviation	
EAC	Extended access control
EF	Elementary file
FID	File identifier
INS	Instruction byte
LDS	Logical data structure
MRZ	Machine-readable zone
OID	Object identifier
P1, P2	Parameter bytes
PCD	Proximity coupling device
PICC	Proximity integrated circuit card
PKD	Public-key directory
PKI	Public-key infrastructure
RF	Radio frequency
SCIC	Secure contactless integrated circuit
SFI	Short file identifier
SOD	Security data object
SW1, SW2	Status bytes
TBD	To be defined
TLV	Tag, length, value

1.6 Reference documentation

The following documentation served as reference for this technical report:

[R1] *Technical Report: Development of a Logical Data Structure – LDS for optional capacity expansion technologies, version 1.7*

[R2] *Technical Report: PKI for Machine Readable Travel Documents offering ICC Read-Only access, version 1.1*

[R3] *RFC 2119, S. Bradner, "Key Words for Use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997*

[R4] *ICAO Doc 9303 Part 1 Volume 2, 6th edition, 2005.*

[R5] *ICAO Supplement to Doc 9303 Part 1 Volume 2, 6th edition, Release 4. Jun 4, 2005.*

[R6] *ISO/IEC 7816-4:2005. Identification cards -- Integrated circuit cards -- Part 4: Organization, security and commands for interchange.*

[R7] *ISO/IEC 19794-5:2005. Information technology -- Biometric data interchange formats -- Part 5: Face image data.*

2 General test requirements

The tests in this layer require a fully personalized e-Passport. This means that all mandatory data groups MUST be present.

This layer tests all mandatory ISO 7816 commands of the SCIC. There are additional test units for tests for optional features like BAC.

All tests are mandatory unless marked as optional or conditional.

2.1 Test setup

For setting up these tests, any contactless reader supporting type A and type B protocols can be used. One personalized e-Passport sample is needed for executing the tests.

2.2 Implementation conformance statement

In order to set up the tests properly, an applicant SHALL provide the information specified in Table 1 below.

The ICAO specification defines several optional elements that an e-Passport can support. This includes security mechanisms like BAC and AA as well as additional data groups (DG 3 to DG 16). Since these elements are optional, it is not possible to define the corresponding tests as mandatory for each e-Passport. Therefore, this document specifies a set of profiles. Each profile covers a specific optional element. A tested e-Passport MUST be assigned to the supported profiles in the implementation conformance statement, and a test MUST only be performed if the e-Passport belongs to this profile. The ICAO profile contains the mandatory feature set for ICAO compliant e-Passports. Therefore, this profile and its tests are mandatory for all e-Passports.

Note there are no profile ID's explicitly defined for DG 14 and DG 15 because the AA and EAC profiles cover these data groups implicitly.

Table 1: Test precondition table "Information on the product"

Information for test setup	**Profile**	**Applicant declaration**
Access control applied: • Plaintext • Basic Access Control • Extended Access Control (TBD)	Plain BAC EAC	
Read Binary with odd instruction byte supported	OddIns	
e-Passport contains elementary file with LDS Data Group 3	DG3	
e-Passport contains elementary file with LDS Data Group 4	DG4	
e-Passport contains elementary file with LDS Data Group 5	DG5	
e-Passport contains elementary file with LDS Data Group 6	DG6	
e-Passport contains elementary file with LDS Data Group 7	DG7	
e-Passport contains elementary file with LDS Data Group 8	DG8	
e-Passport contains elementary file with LDS Data Group 9	DG9	
e-Passport contains elementary file with LDS Data Group 10	DG10	

Information for test setup	Profile	Applicant declaration
e-Passport contains elementary file with LDS Data Group 11	DG11	
e-Passport contains elementary file with LDS Data Group 12	DG12	
e-Passport contains elementary file with LDS Data Group 13	DG13	
e-Passport contains elementary file with LDS Data Group 16	DG16	
Authentication supported: • Passive Authentication • Active Authentication	ICAO AA	
MRZ provided with the samples	ICAO	
Country signing certificate	ICAO	
Document signer certificate if not contained in SOD	ICAO	

The test cases reference all profiles which define a precondition for the test execution. Therefore, "BAC, DG3" and "BAC, DG4" refer to e-Passports which protect DG3 and DG4 with BAC respectively. "BAC, EAC, DG3" and "BAC, EAC, DG4" refer to e-Passports which protect DG3 and DG4 with BAC and EAC respectively.

2.3 Verification of ISO 7816-4 status bytes

For most of test cases defined in this document, the status bytes returned by the e-Passport are not exactly defined in the ICAO specification. In these cases the result analysis uses the scheme defined in the ISO 7816-4 [R6] in order to specify the expected result. It is only checked that the response belongs to the specified category. In cases where the expected result is unambiguously defined in the ICAO specification, the exact value is specified in the test case.

Proprietary status bytes outside the range of defined ISO status bytes will be treated as failures in the test cases.

Table 2: ISO 7816-4 status bytes

Status bytes category	Category name	Valid value range	Process behavior
Normal processing	Normal processing status bytes	'90 00' '61 XX'	Process completed
Warning processing	ISO warning	'62 XX' '63 XX'	Process completed
Execution error	ISO execution error	'64 XX' '65 XX' '66 XX'	Process aborted
Checking error	ISO checking error	'67 XX' '68 XX' '69 XX' '6A XX' '6B XX' '6C XX' '6D XX' '6E XX' '6F XX'	Process aborted

Note: There is a significant difference between normal and warning processing on the one side and execution and checking error on the other side. The first group is returned if the process has been fully completed, and the e-Passport MAY return some additional data. The “process aborted” categories are issued if the command cannot be performed. Therefore, response data MUST NOT be returned. In all test cases where an execution or checking error is expected, it MUST be verified that the e-Passport does not return any response data except SM protocol elements (DO ‘99’ / ‘8E’).

3 Security and Command Tests

3.1 Unit Test ISO_7816_A – SelectApplication Command

This test unit covers all tests about the SelectApplication command. The LDS specification requires the selection of the LDS application by its AID. Since the AID is unique, selecting the application SHOULD be possible regardless of the previously selected DF or EF. Selecting the LDS Application SHOULD also reset the cards security state but this scenario is tested in the access control unit test.

3.1.1 Test Case 7816_A_1

Purpose	Selecting the LDS Application using the AID (positive test)
References	ICAO LDS 1.7 [R1]
Profile	ICAO, Plain
Preconditions	LDS application MUST NOT be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 04 0C 07 A0 00 00 02 47 10 01'
Expected results	1. According to the ICAO recommendation, the P2 denotes "return no file information", and there is no Le byte present. Therefore, the response data field MUST be empty. The e-Passport MUST return status bytes '90 00'.
Postconditions	LDS application is selected.

3.1.2 Test Case 7816_A_2

Purpose	Selecting the LDS Application using the AID (robustness tests)
References	ICAO LDS 1.7 [R1]
Profile	ICAO, Plain
Preconditions	LDS application MUST NOT be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '8F A4 04 0C 07 A0 00 00 02 47 10 01' 2. Send the following SelectApplication APDU to the e-Passport. => '00 A4 04 0C 07 A0 00 00 02 47 10 02' 3. Send the following SelectApplication APDU to the e-Passport. => '00 A4 84 0C 07 A0 00 00 02 47 10 01' 4. Send the following SelectApplication APDU to the e-Passport. => '00 A4 04 8C 07 A0 00 00 02 47 10 01' 5. Send the following SelectApplication APDU to the e-Passport. => '00 A4 04 0C 08 A0 00 00 02 47 10 01' 6. Send the following SelectApplication APDU twice to the e-Passport. => '00 A4 04 0C 07 A0 00 00 02 47 10 01' => '00 A4 04 0C 07 A0 00 00 02 47 10 01'
Expected results	1. The given APDU has an invalid class byte that is explicitly defined as invalid in ISO 7816-4 [R6]. Therefore, the e-Passport MUST return an ISO checking error. 2. The APDU has an invalid AID that does not belong to LDS application. Therefore, the e-Passport MUST return an ISO checking error. 3. The APDU has an invalid P1 parameter. Therefore, the e-Passport chip MUST return an ISO checking error. 4. The APDU has an invalid P2 parameter. Therefore, the e-Passport chip MUST return an ISO checking error. 5. The APDU has an invalid LC parameter. Therefore, the e-Passport chip

	MUST return an ISO checking error. 6. The application MUST be selected successfully even it was already selected before. Therefore, the e-Passport MUST return the status bytes '90 00' twice.
Postconditions	LDS application is selected.

3.2 Unit Test ISO_7816_B – Security conditions of BAC protected e-Passports

This unit tests the security conditions of a BAC protected e-Passport. It MUST NOT be possible read the content of any present file. The tests of this unit try to access the files with an explicit SelectFile command, a ReadBinary command with implicit file selection via the short file identifier (SFI), and unsecured ReadBinary while access is granted. Note: Some e-Passports allow selection of a protected file but no read access to this file, which complies with [R4] and the latest draft of [R5].

The tests in this unit only apply to BAC protected e-Passports (profile BAC).

The tests in this unit do not test the secure messaging implementation including postconditions (e.g. SM termination); therefore, status bytes MAY be returned in secure messaging or without it. Unit 7816_C handles this. In the following test cases, "basic access is refused" means that protected data cannot be accessed. The term "basic access is granted" means that the inspection system has successfully authenticated to the e-Passport.

3.2.1 Test Case 7816_B_1

Purpose	Accessing the EF.COM file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 1E'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.2 Test Case 7816_B_2

Purpose	Accessing the EF.SOD file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 1D'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.3 Test Case 7816_B_3

Purpose	Accessing the EF.DG1 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 01'
Expected results	1. The e-Passport MUST return status bytes '69 82' or 90 00.
Postconditions	Preconditions remain unchanged.

3.2.4 Test Case 7816_B_4

Purpose	Accessing the EF.DG2 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 02'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.5 Test Case 7816_B_5

Purpose	Accessing the EF.DG3 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG3
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 03'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.6 Test Case 7816_B_6

Purpose	Accessing the EF.DG4 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG4
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 04'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.7 Test Case 7816_B_7

Purpose	Accessing the EF.DG5 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG5
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 05'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.8 Test Case 7816_B_8

Purpose	Accessing the EF.DG6 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG6
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 06'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.9 Test Case 7816_B_9

Purpose	Accessing the EF.DG7 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG7
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 07'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.10 Test Case 7816_B_10

Purpose	Accessing the EF.DG8 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG8
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 08'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.11 Test Case 7816_B_11

Purpose	Accessing the EF.DG9 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG9
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 09'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.12 Test Case 7816_B_12

Purpose	Accessing the EF.DG10 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG10
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0A'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.13 Test Case 7816_B_13

Purpose	Accessing the EF.DG11 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG11
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0B'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.14 Test Case 7816_B_14

Purpose	Accessing the EF.DG12 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG12
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0C'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.15 Test Case 7816_B_15

Purpose	Accessing the EF.DG13 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG13
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0D'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.16 Test Case 7816_B_16

Purpose	Accessing the EF.DG14 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0E'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.17 Test Case 7816_B_17

Purpose	Accessing the EF.DG15 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, AA
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 0F'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.18 Test Case 7816_B_18

Purpose	Accessing the EF.DG16 file with explicit file selection
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG16
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectApplication APDU to the e-Passport. => '00 A4 02 0C 02 01 10'
Expected results	1. The e-Passport MUST return status bytes '69 82' or '90 00'.
Postconditions	Preconditions remain unchanged.

3.2.19 Test Case 7816_B_19

Purpose	Accessing the EF.COM file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 9E 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.20 Test Case 7816_B_20

Purpose	Accessing the EF.SOD file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 9D 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.21 Test Case 7816_B_21

Purpose	Accessing the EF.DG1 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 81 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.22 Test Case 7816_B_22

Purpose	Accessing the EF.DG2 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 82 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.

Postconditions	Preconditions remain unchanged.

3.2.23 Test Case 7816_B_23

Purpose	Accessing the EF.DG3 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG3
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 83 00 00'
Expected results	1. Since read access is prohibited without BAC/EAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.24 Test Case 7816_B_24

Purpose	Accessing the EF.DG4 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG4
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 84 00 00'
Expected results	1. Since read access is prohibited without BAC/EAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.25 Test Case 7816_B_25

Purpose	Accessing the EF.DG5 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG5
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 85 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.26 Test Case 7816_B_26

Purpose	Accessing the EF.DG6 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG6
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport.

	=> '00 B0 86 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.27 Test Case 7816_B_27

Purpose	Accessing the EF.DG7 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG7
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 87 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.28 Test Case 7816_B_28

Purpose	Accessing the EF.DG8 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG8
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 88 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.29 Test Case 7816_B_29

Purpose	Accessing the EF.DG9 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG9
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 89 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.30 Test Case 7816_B_30

Purpose	Accessing the EF.DG10 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG10
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8A 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.31 Test Case 7816_B_31

Purpose	Accessing the EF.DG11 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG11
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8B 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.32 Test Case 7816_B_32

Purpose	Accessing the EF.DG12 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG12
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8C 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.33 Test Case 7816_B_33

Purpose	Accessing the EF.DG13 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG13
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8D 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.

Postconditions	Preconditions remain unchanged.

3.2.34 Test Case 7816_B_34

Purpose	Accessing the EF.DG14 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, EAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8E 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.35 Test Case 7816_B_35

Purpose	Accessing the EF.DG15 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, AA
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 8F 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.36 Test Case 7816_B_36

Purpose	Accessing the EF.DG16 file with implicit file selection (ReadBinary with SFI)
References	ICAO LDS 1.7 [R1] ICAO PKI 1.1 [R2]
Profile	BAC, DG16
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport. => '00 B0 90 00 00'
Expected results	1. Since read access is prohibited without BAC, the response data field MUST be empty. The e-Passport MUST return status bytes '69 82'.
Postconditions	Preconditions remain unchanged.

3.2.37 Test Case 7816_B_37

Purpose	Accessing the EF.COM file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.COM encoded as a

	valid SM APDU to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.38 Test Case 7816_B_38

Purpose	Accessing the EF. SOD file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.SOD encoded as a valid SM APDU to the e-Passport. => '0C B0 9D 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.39 Test Case 7816_B_39

Purpose	Accessing the EF. DG1 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG1 encoded as a valid SM APDU to the e-Passport. => '0C B0 81 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.40 Test Case 7816_B_40

Purpose	Accessing the EF. DG2 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.

Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG2 encoded as a valid SM APDU to the e-Passport. => '0C B0 82 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.41 Test Case 7816_B_41

Purpose	Accessing the EF. DG3 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic or extended access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG3
Preconditions	The LDS application MUST be selected and basic (extended) access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG3 encoded as a valid SM APDU to the e-Passport. => '0C B0 83 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.42 Test Case 7816_B_42

Purpose	Accessing the EF. DG4 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic or extended access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, EAC, DG4
Preconditions	The LDS application MUST be selected and basic (extended) access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG4 encoded as a valid SM APDU to the e-Passport. => '0C B0 84 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.43 Test Case 7816_B_43

Purpose	Accessing the EF. DG5 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG5
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG5 encoded as a valid SM APDU to the e-Passport. => '0C B0 85 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.44 Test Case 7816_B_44

Purpose	Accessing the EF. DG6 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG6
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG6 encoded as a valid SM APDU to the e-Passport. => '0C B0 86 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.45 Test Case 7816_B_45

Purpose	Accessing the EF. DG7 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG7
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG7 encoded as a valid SM APDU to the e-Passport. => '0C B0 87 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.46 Test Case 7816_B_46

Purpose	Accessing the EF. DG8 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG8
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG8 encoded as a valid SM APDU to the e-Passport. => '0C B0 88 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.47 Test Case 7816_B_47

Purpose	Accessing the EF. DG9 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG9
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG9 encoded as a valid SM APDU to the e-Passport. => '0C B0 89 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.48 Test Case 7816_B_48

Purpose	Accessing the EF. DG10 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG10
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG10 encoded as a valid SM APDU to the e-Passport. => '0C B0 8A 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.49 Test Case 7816_B_49

Purpose	Accessing the EF. DG11 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG11
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG11 encoded as a valid SM APDU to the e-Passport. => '0C B0 8B 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.50 Test Case 7816_B_50

Purpose	Accessing the EF. DG12 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG12
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG12 encoded as a valid SM APDU to the e-Passport. => '0C B0 8C 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.51 Test Case 7816_B_51

Purpose	Accessing the EF. DG13 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG13
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG13 encoded as a valid SM APDU to the e-Passport. => '0C B0 8D 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.52 Test Case 7816_B_52

Purpose	Accessing the EF. DG14 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, EAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG14 encoded as a valid SM APDU to the e-Passport. => '0C B0 8E 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.53 Test Case 7816_B_53

Purpose	Accessing the EF. DG15 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, AA
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG15 encoded as a valid SM APDU to the e-Passport. => '0C B0 8F 00 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.2.54 Test Case 7816_B_54

Purpose	Accessing the EF. DG16 file with ReadBinary. The test verifies the enforcement of Secure Messaging while basic access is granted.
References	ICAO PKI 1.1 [R2]
Profile	BAC, DG16
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following "Read Binary (SFI)" APDU for EF.DG16 encoded as a valid SM APDU to the e-Passport. => '0C B0 '90 00' 0D 97 01 06 8E 08 <checksum> 00' 2. Send the following ReadBinary APDU as a plain unprotected APDU to the e-Passport. => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3 Unit Test ISO_7816_C – Basic Access Control

This unit checks the BAC implementation of the e-Passport. The complete BAC access mechanism is tested, including robustness tests with invalid input data.

Since the tests in this unit apply to BAC protected e-Passports, they are only mandatory for e-Passports complying with the BAC profile.

In the following test cases, "basic access is refused" means that there are no valid session keys for secure messaging available and that access to any BAC protected file is refused. The term "basic access is granted" means that the inspection system has successfully authenticated to the e-Passport and that valid session keys are available for secure messaging.

The READ BINARY command in SM mode is used in the following test cases to verify that the session keys are no longer valid. Alternatively, the command SELECT FILE in SM mode MAY be used.

3.3.1 Test Case 7816_C_1

Purpose	This function verifies the GetChallenge command (positive test).
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused.
Test scenario	1. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 2. Send the same GetChallenge APDU to the e-Passport. => '00 84 00 00 08'
Expected results	1. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 2. The e-Passport MUST return 8 different random bytes and the status bytes '90 00'.
Postconditions	Preconditions remain unchanged.

3.3.2 Test Case 7816_C_2

Purpose	This test checks the response to the MutualAuthenticate command (positive test).
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused.
Test scenario	1. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 2. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 1. => '00 82 00 00 28 <data> 28'
Expected results	1. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 2. The response from the e-Passport MUST be verified as specified in [R2]. The returned status bytes MUST be '90 00'.
Postconditions	Basic access is granted.

3.3.3 Test Case 7816_C_3

Purpose	This test checks the authentication failure response to the MutualAuthenticate command
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused.
Test scenario	1. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 2. Send the MutualAuthenticate APDU to the e-Passport. Same as 7816_C_2, but for the <data> calculation data from a different MRZ MUST be used. To achieve this, the document number MUST be increment by 1 before the <data> is calculated. => '00 82 00 00 28 <data> 28'
Expected results	1. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 2. The e-Passport MUST respond with an ISO warning or ISO checking error.
Postconditions	Preconditions remain unchanged.

3.3.4 Test Case 7816_C_4

Purpose	This test checks the authentication failure response to the MutualAuthenticate command
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused. The GetChallenge command MUST NOT have been executed.
Test scenario	1. Send the MutualAuthenticate APDU to the e-Passport. Same as 7816_C_2, but for the <data> calculation the challenge '00 00 00 00 00 00 00 00' MUST be used. => '00 82 00 00 28 <data> 28' 2. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 3. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 4. Send the MutualAuthenticate APDU to the e-Passport. Same as 7816_C_2, but for the <data> calculation the challenge of step 2 MUST be used. => '00 82 00 00 28 <data> 28'
Expected results	1. The e-Passport MUST respond with an ISO warning or ISO checking error. 2. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 3. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 4. The e-Passport MUST respond with an ISO warning or ISO checking error.
Postconditions	Preconditions remain unchanged.

3.3.5 Test Case 7816_C_5

Purpose	This test checks the response for the MutualAuthenticate command (robustness test)
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused.
Test scenario	1. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 2. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 1. The class byte is set to a wrong value. => '8F 82 00 00 28 <data> 28' 3. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 4. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 3. The P1 byte is set to a wrong value. => '00 82 60 00 28 <data> 28' 5. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 6. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 5. The P2 byte is set to a wrong value. => '00 82 00 60 28 <data> 28' 7. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 8. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 7. The LC byte is set to a wrong value. => '00 82 00 00 29 <data> 28'
Expected results	1. The e-Passport MUST return 8 random bytes and a '90 00' status byte. 2. The e-Passport MUST respond with an ISO checking error. 3. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 4. The e-Passport MUST respond with an ISO checking error. 5. The e-Passport MUST return 8 random bytes and a '90 00' status byte. 6. The e-Passport MUST respond with an ISO checking error. 7. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 8. The e-Passport MUST respond with an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.3.6 Test Case 7816_C_6

Purpose	This test checks the response for the MutualAuthenticate command with a corrupted MAC.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be refused.
Test scenario	1. Send the following GetChallenge APDU to the e-Passport. => '00 84 00 00 08' 2. Send the MutualAuthenticate APDU to the e-Passport. The <data> MUST be calculated from the given MRZ data and the challenge returned in step 1. In the calculated MAC the very last byte is incremented by one.

	=> '00 82 00 00 28 <data> 28'
Expected results	1. The e-Passport MUST return 8 random bytes and the status bytes '90 00'. 2. The e-Passport MUST respond with an ISO warning or ISO checking error.
Postconditions	Preconditions remain unchanged.

Note: this test case differs from test case ISO17816_C_3. In this test case, only the MAC is manipulated but the cryptogram is valid.

3.3.7 Test Case 7816_C_7

Test case deleted because the GetChallenge command using secure messaging is not defined. The test case may be added again when the EAC specification is finalized.

3.3.8 Test Case 7816_C_8

Purpose	This test checks the Secure Messaging coding of a ReadBinary (B0) with SFI (positive tests)
References	ICAO PKI 1.1 [R2] Supplement S3.0-20050531-PKI0033 [R5].
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following ReadBinary (SFI) APDU encoded as a valid SM APDU to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00' 2. Search for the cryptogram DO encoded in tag '87' and decrypt it with current session key. 3. Search for the processing status DO encoded in tag '99' and verify status bytes received. 4. Search for the cryptographic checksum DO encoded in tag '8E' and verify it with current session key.
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The response of step 1 MUST contain the read data in a valid cryptogram encoded in tag '87'. 3. The response of step 1 SHOULD contain SW1-SW2 encoded in tag '99' that equals the status bytes of the secured response. 4. The response of step 1 MUST contain a valid cryptographic checksum encoded in tag '8E'.
Postconditions	Preconditions remain unchanged.

3.3.9 Test Case 7816_C_9

Purpose	This test checks the Secure Messaging coding of a ReadBinary ('B1') with SFI (positive tests)
References	ICAO PKI 1.1 [R2] ISO 7816-4 for TLV encoded data objects [R6] Supplement S3.0-20050531-PKI0033 [R5]
Profile	BAC, OddIns
Preconditions	The LDS application MUST be selected and basic access MUST be granted.

Test scenario	1. Send the following ReadBinary (SFI) APDU encoded as a valid SM APDU to the e-Passport. The offset (0) MUST be encoded in a DO '54'[1], which is then encrypted in a SM '85' object. => '0C B1 00 1E 17 85 08 <cryptogram> 97 01 06 8E 08 <checksum> 00' 2. Search for the cryptogram DO encoded in tag '85' and decrypt it with current session key. 3. Search for the processing status DO encoded in tag '99' and verify status bytes received. 4. Search for the cryptographic checksum DO encoded in tag '8E' and verify it with current session key.
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The response of step 1 MUST contain the read data in a valid cryptogram encoded in tag '85'. The data MUST be encapsulated in a tag '53' object. 3. The response of step 1 SHOULD contain SW1-SW2 encoded in tag '99' that equals the status bytes of the secured response. 4. The response of step 1 MUST contain a valid cryptographic checksum encoded in tag '8E'.
Postconditions	Preconditions remain unchanged.

3.3.10 Test Case 7816_C_10

Purpose	This test checks the Secure Messaging coding of a SelectFile and ReadBinary (B0) w/o SFI (positive tests)
References	ICAO PKI 1.1 [R2] Supplement S3.0-20050531-PKI0033 [R5]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a valid SM APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Search for the processing status DO encoded in tag '99' and verify status bytes received. 3. Search for the cryptographic checksum DO encoded in tag '8E' and verify it with current session key. 4. Send the following ReadBinary APDU encoded as a valid SM APDU to the e-Passport. => '0C B0 00 00 0D 97 01 06 8E 08 <checksum> 00' 5. Search for the cryptogram DO encoded in tag '87' and decrypt it with current session key. 6. Search for the processing status DO encoded in tag '99' and verify status bytes received. 7. Search for the cryptographic checksum DO encoded in tag '8E' and verify it with current session key. 8. Search for further DO.
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The response of step 1 MUST contain SW1-SW2 encoded in tag '99' that MUST equal the received status bytes of the secured response. 3. The response of step 1 MUST contain a valid cryptographic checksum

[1] It is RECOMMENDED to encode the offset in tag 54 in one byte, i.e. '54 01 00'. This issue requires further clarification and will be forwarded to TF1/TF5.

	encoded in tag '8E'. 4. The e-Passport MUST return the status bytes '90 00'. 5. The response of step 4 MUST contain the read data in a valid cryptogram encoded in tag '87'. 6. The response of step 4 SHOULD contain SW1-SW2 encoded in tag '99' that equals the received status bytes of the secured response. 7. The response of step 4 MUST contain a valid cryptographic checksum encoded in tag '8E'. 8. The response MUST NOT contain any further data but the response trailer.
Postconditions	Preconditions remain unchanged.

3.3.11 Test Case 7816_C_11

Purpose	This test checks the Secure Messaging coding of a SelectFile and ReadBinary (B1) w/o SFI (positive tests)
References	ICAO PKI 1.1 [R2] ISO 7816-4 [R6] for TLV encoded data objects Supplement S3.0-20050531-PKI0033 [R5]
Profile	BAC, OddIns
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a valid SM APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Search for the processing status DO encoded in tag '99' and verify status bytes received. 3. Search for the cryptographic checksum DO encoded in tag 8E and verify it with current session key. 4. Send the following ReadBinary APDU encoded as a valid SM APDU to the e-Passport. The offset (0) MUST be encoded in a DO '54'[2], which is then encrypted in a SM '85' object. => '0C B1 00 00 17 85 08 <cryptogram> 97 01 06 8E 08 <checksum> 00' 5. Search for the cryptogram DO encoded in tag '85' and decrypt it with current session key. 6. Search for the processing status DO encoded in tag '99' and verify status bytes received. 7. Search for the cryptographic checksum DO encoded in tag '8E' and verify it with current session key. 8. Search for further DO.
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The response of step 1 MUST contain SW1-SW2 encoded in tag '99' that MUST equal the received status bytes of the secured response. 3. The response of step 1 MUST contain a valid cryptographic checksum encoded in tag '8E'. 4. The e-Passport MUST return the status bytes '90 00'. 5. The response of step 4 MUST contain the read data in a valid cryptogram encoded in tag '85'. The data MUST be encapsulated in a tag '53' object. 6. The response of step 4 SHOULD contain SW1-SW2 encoded in tag '99' that equals the received status bytes of the secured response. 7. The response of step 4 MUST contain a valid cryptographic checksum

[2] It is RECOMMENDED to encode the offset in tag 54 in one byte, i.e. '54 01 00'. This issue requires further clarification and will be forwarded to TF1/TF5.

	encoded in tag '8E'. 8. The response MUST NOT contain any further data but the response trailer.
Postconditions	Preconditions remain unchanged.

3.3.12 Test Case 7816_C_12

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the SelectFile Command (checksum missing)
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a SM APDU but without the checksum SM object to the e-Passport. => '0C A4 02 0C 0B 87 09 01 <cryptogram> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.13 Test Case 7816_C_13

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the SelectFile Command (checksum corrupted)
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a valid SM APDU to the e-Passport. The last byte of the checksum is incremented by one. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <corrupted checksum> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return status bytes '69 88' or '69 82'. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.14 Test Case 7816_C_14

Purpose	The tests verifies the Secure Messaging handling while basic access is granted for the SelectFile Command (bad send sequence counter)
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a valid SM APDU to the e-Passport. During the coding of the SM APDU the SendSequenceCounter is not incremented. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <corrupted checksum> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return status bytes '69 88' or '69 82'. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.15 Test Case 7816_C_15

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the SelectFile Command (invalid class byte)
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU encoded as a SM APDU to the e-Passport. The class byte is set to '00'. => '00 A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.16 Test Case 7816_C_16

Purpose	The test verifies the enforcement of Secure Messaging while basic access is granted for the SelectFile Command.
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU as a plain unprotected APDU to the e-Passport. => '00 A4 02 0C 02 01 1E'
Expected results	1. The e-Passport MUST return an ISO checking error or status bytes '90 00'.

Postconditions	Postcondition depends on the status bytes returned by the e-Passport.

3.3.17 Test Case 7816_C_17

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the ReadBinary Command (checksum missing).
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following ReadBinary APDU encoded as a SM APDU but without the checksum SM object to the e-Passport. => '0C B0 9E 00 03 97 01 06 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.18 Test Case 7816_C_18

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the ReadBinary Command (checksum corrupted).
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following ReadBinary APDU encoded as a valid SM APDU to the e-Passport. The last byte of the checksum is incremented by one. => '0C B0 00 00 0D 97 01 06 8E 08 <checksum> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport. => '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return status bytes '69 88' or '69 82'. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.3.19 Test Case 7816_C_19

Purpose	The test verifies the Secure Messaging handling while basic access is granted for the ReadBinary Command (invalid class byte).
References	ICAO PKI 1.1 [R2]
Profile	BAC
Preconditions	The LDS application MUST be selected and basic access MUST be granted.
Test scenario	1. Send the following ReadBinary APDU encoded as a SM APDU to the e-Passport. The class byte is set to '00'. => '00 B0 00 00 0D 97 01 06 8E 08 <checksum> 00' 2. To verify that the error in step 1 has terminated the SM session, send a valid SM APDU (ReadBinary) to the e-Passport.

	=> '0C B0 9E 00 0D 97 01 06 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. Since the session keys are no longer valid, the e-Passport MUST return an ISO checking error.
Postconditions	Basic access is refused.

3.4 Unit Test ISO_7816_D – Protected SelectFile Command

This unit verifies the implementation of the protected SelectFile command.

The e-Passport MUST be BAC protected. For all test cases of unit test ISO_7816_D, basic access MUST be granted as tested in 7816_C_2. All APDUs MUST be correctly encoded for Secure Messaging and the e-Passport response MUST be correctly decoded again. The expected results of the test cases are plain text data after decoding the protected response APDU.

The tests in this unit do not test the secure messaging implementation including postconditions (e.g. SM termination); therefore, status bytes MAY be returned in secure messaging or without it. Unit 7816_C handles this.

3.4.1 Test Case 7816_D_1

Purpose	This test case verifies the SelectFile (EF.COM) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.COM is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte 60 and the status bytes '90 00'.
Postconditions	EF.COM MUST be selected.

3.4.2 Test Case 7816_D_2

Purpose	This test case checks the robustness of the SelectFile command (invalid class byte).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following APDU to the e-Passport. The class tag is set to the invalid value of '8F'. => '8F A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error.

	2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.4.3 Test Case 7816_D_3

Purpose	This test case checks the robustness of the SelectFile command (invalid parameter P1).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. The parameter P1 is set to the invalid value of '12'. => '0C A4 12 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.4.4 Test Case 7816_D_4

Purpose	This test case checks the robustness of the SelectFile command (invalid parameter P2).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. The parameter P2 is set to the invalid value of '1C'. => '0C A4 02 1C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.4.5 Test Case 7816_D_5

Purpose	This test case checks the robustness of the SelectFile command (invalid Lc).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the malformed file identifier '01 1E 01' (Lc = '03'). Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to

	the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.4.6 Test Case 7816_D_6

Purpose	This test case verifies the SelectFile (EF.SOD) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.SOD SHALL be selected. Therefore, the cryptogram MUST contain the file identifier 01 1D. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.SOD is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '77' and the status bytes '90 00'.
Postconditions	EF.SOD is selected.

3.4.7 Test Case 7816_D_7

Purpose	This test case verifies the SelectFile (EF.DG1) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG1 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 01'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG1is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '61' and the status bytes '90 00'.
Postconditions	EF.DG1 is selected.

3.4.8 Test Case 7816_D_8

Purpose	This test case verifies the SelectFile (EF.DG2) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG2 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 02'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG2 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'

Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '75' and the status bytes '90 00'.
Postconditions	EF.DG2 is selected.

3.4.9 Test Case 7816_D_9

Purpose	This test case verifies the SelectFile (EF.DG3) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG3
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG3 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 03'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG3 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '63' and the status bytes '90 00'.
Postconditions	EF.DG3 is selected.

3.4.10 Test Case 7816_D_10

Purpose	This test case verifies the SelectFile (EF.DG4) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG4
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG4 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 04'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG4 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '76' and the status bytes '90 00'.
Postconditions	EF.DG4 is selected.

3.4.11 Test Case 7816_D_11

Purpose	This test case verifies the SelectFile (EF.DG5) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG5
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG5 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 05'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG5 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '65' and the status bytes '90 00'.

Postconditions	EF.DG5 is selected.

3.4.12 Test Case 7816_D_12

Purpose	This test case verifies the SelectFile (EF.DG6) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG6
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG6 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 06'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG6 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '66' and the status bytes '90 00'.
Postconditions	EF.DG6 is selected.

3.4.13 Test Case 7816_D_13

Purpose	This test case verifies the SelectFile (EF.DG7) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG7
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG7 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 07'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG7 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '67' and the status bytes '90 00'.
Postconditions	EF.DG7 is selected.

3.4.14 Test Case 7816_D_14

Purpose	This test case verifies the SelectFile (EF.DG8) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG8
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG8 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 08'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG8 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '68' and the status bytes '90 00'.
Postconditions	EF.DG8 is selected.

3.4.15 Test Case 7816_D_15

Purpose	This test case verifies the SelectFile (EF.DG9) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG9
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG9 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 09'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG9 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '69' and the status bytes '90 00'.
Postconditions	EF.DG9 is selected.

3.4.16 Test Case 7816_D_16

Purpose	This test case verifies the SelectFile (EF.DG10) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG10
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG10 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0A'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG10 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6A' and the status bytes '90 00'.
Postconditions	EF.DG10 is selected.

3.4.17 Test Case 7816_D_17

Purpose	This test case verifies the SelectFile (EF.DG11) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG11
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG11 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0B'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG11 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6B' and the status bytes '90 00'.
Postconditions	EF.DG11 is selected.

3.4.18 Test Case 7816_D_18

Purpose	This test case verifies the SelectFile (EF.DG12) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG12
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG12 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0C'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG12 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6C' and the status bytes '90 00'.
Postconditions	EF.DG12 is selected.

3.4.19 Test Case 7816_D_19

Purpose	This test case verifies the SelectFile (EF.DG13) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG13
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG13 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0D'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG13 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6D' and the status bytes '90 00'.
Postconditions	EF.DG13 is selected.

3.4.20 Test Case 7816_D_20

Purpose	This test case verifies the SelectFile (EF.DG14) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, EAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG14 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG14 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6E' and the status bytes '90 00'.
Postconditions	EF.DG14 is selected.

3.4.21 Test Case 7816_D_21

Purpose	This test case verifies the SelectFile (EF.DG15) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, AA
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG15 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 0F'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG15 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6F' and the status bytes '90 00'.
Postconditions	File EF.DG15 is selected.

3.4.22 Test Case 7816_D_22

Purpose	This test case verifies the SelectFile (EF.DG16) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG16
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG16 SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 10'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. To verify that EF.DG16 is selected, send a valid ReadBinary APDU to the e-Passport. => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '70' and the status bytes '90 00'.
Postconditions	EF.DG16 is selected.

3.4.23 Test Case 7816_D_23

Purpose	This test case verifies the SelectFile command when the file to be selected does not exist.
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. A not existing file SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '02 02'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.5 Unit Test ISO_7816_E – Protected ReadBinary Command

This unit verifies the implementation of the protected ReadBinary command.

The e-Passport MUST be BAC protected. For all test cases of unit test ISO_7816_E, basic access MUST be granted as tested in 7816_C_2. All APDUs MUST be correctly encoded for Secure Messaging and the e-Passport response MUST be correctly decoded again. The expected results of the test cases are plain text data after decoding the protected response APDU.

The tests in this unit do not test the secure messaging implementation including postconditions (e.g. SM termination); therefore, status bytes MAY be returned in secure messaging or without it. Unit 7816_C handles this.

Note: For the ReadBinary command in Secure Messaging mode, there is no clear definition in the ISO specification if the Le byte in DO '97' = '00'. Test cases E_1 to E_3 and E_5 to E_22 use Le = '01' in order to avoid unspecified EOF situations.

3.5.1 Test Case 7816_E_1

Purpose	This test case verifies the ReadBinary command (w/o SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Send the ReadBinary APDU to the e-Passport and read the first bytes of EF.COM => '0C B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return response data '60' and the status bytes '90 00'.
Postconditions	Preconditions remain unchanged.

3.5.2 Test Case 7816_E_2

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (invalid class byte).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_D_1, otherwise this test will fail.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Send the ReadBinary APDU to the e-Passport and read the first byte of EF.COM, The class byte is set to the invalid value of '8F'. => '8F B0 00 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.5.3 Test Case 7816_E_3

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (offset beyond EOF).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_D_1, otherwise this test will fail.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Send the ReadBinary APDU to the e-Passport. The offset is beyond the end of the EF.COM file. Note: Since the actual file on the e-Passport could be larger than necessary, the e-Passport may return valid data in this case. If this happens, the test may have to be repeated with an appropriated offset. => '0C B0 7F FF 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.5.4 Test Case 7816_E_4

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (Le beyond EOF).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_D_1, otherwise this test will fail.
Test scenario	1. EF.COM SHALL be selected. Therefore, the cryptogram MUST contain the file identifier '01 1E'. Send the following SelectFile APDU to the e-Passport. => '0C A4 02 0C 15 87 09 01 <cryptogram> 8E 08 <checksum> 00' 2. Send the ReadBinary APDU to the e-Passport. The Le Byte requests more data than available in the EF.COM file Note: Since the actual file on the e-Passport could be larger than necessary, the e-Passport may return valid data in this case. If this happens, the test may have to be repeated with an appropriated offset. => '0C B0 00 00 0D 97 01 E0 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return status bytes '90 00' or an ISO warning or an ISO checking error.[3]
Postconditions	Preconditions remain unchanged.

3.5.5 Test Case 7816_E_5

Purpose	This test case verifies the ReadBinary command (EF.COM SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.

[3] Currently there is a task for TF1 and TF5 to define correct responses for this test case and publish them in the next DOC9303 supplement.

Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.COM. => '0C B0 9E 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.COM is selected.

3.5.6 Test Case 7816_E_6

Purpose	This test case verifies the ReadBinary command (EF.SOD SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.SOD. => '0C B0 9D 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.SOD is selected.

3.5.7 Test Case 7816_E_7

Purpose	This test case verifies the ReadBinary command (EF.DG1 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. EF.DG1 MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG1. => '0C B0 81 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG1 is selected.

3.5.8 Test Case 7816_E_8

Purpose	This test case verifies the ReadBinary command (EF.DG2 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG2. => '0C B0 82 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG2 is selected.

3.5.9 Test Case 7816_E_9

Purpose	This test case verifies the ReadBinary command (EF.DG3 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG3
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of

	the EF.DG3. => '0C B0 83 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG3 is selected.

3.5.10 Test Case 7816_E_10

Purpose	This test case verifies the ReadBinary command (EF.DG4 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG4
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG3. => '0C B0 84 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG4 is selected.

3.5.11 Test Case 7816_E_11

Purpose	This test case verifies the ReadBinary command (EF.DG5 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG5
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG5. => '0C B0 85 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG5 is selected.

3.5.12 Test Case 7816_E_12

Purpose	This test case verifies the ReadBinary command (EF.DG6 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG6
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG6. => '0C B0 86 00 0D 97 01 E0 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG6 is selected.

3.5.13 Test Case 7816_E_13

Purpose	This test case verifies the ReadBinary command (EF.DG7 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG7
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG7.

	=> '0C B0 87 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG7 is selected.

3.5.14 Test Case 7816_E_14

Purpose	This test case verifies the ReadBinary command (EF.DG8 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG8
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG8. => '0C B0 88 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG8 is selected.

3.5.15 Test Case 7816_E_15

Purpose	This test case verifies the ReadBinary command (EF.DG9 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG9
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG9. => '0C B0 89 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG9 is selected.

3.5.16 Test Case 7816_E_16

Purpose	This test case verifies the ReadBinary command (EF.DG10 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG10
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG10. => '0C B0 8A 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG10 is selected.

3.5.17 Test Case 7816_E_17

Purpose	This test case verifies the ReadBinary command (EF.DG11 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG11
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG11. => '0C B0 8B 00 0D 97 01 01 8E 08 <checksum> 00'

Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG11 is selected.

3.5.18 Test Case 7816_E_18

Purpose	This test case verifies the ReadBinary command (EF.DG12 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG12
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG12. => '0C B0 8C 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG12 is selected.

3.5.19 Test Case 7816_E_19

Purpose	This test case verifies the ReadBinary command (EF.DG13 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG13
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG13. => '0C B0 8D 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG13 is selected.

3.5.20 Test Case 7816_E_20

Purpose	This test case verifies the ReadBinary command (EF.DG14 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, EAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG14. => '0C B0 8E 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG14 is selected.

3.5.21 Test Case 7816_E_21

Purpose	This test case verifies the ReadBinary command (EF.DG15 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, AA
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG15. => '0C B0 8F 00 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.

Postconditions	EF.DG15 is selected.

3.5.22 Test Case 7816_E_22

Purpose	This test case verifies the ReadBinary command (EF.DG16 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	BAC, DG16
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first byte of the EF.DG16. => '0C B0 '90 00' 0D 97 01 01 8E 08 <checksum> 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG16 is selected.

3.6 Unit Test ISO_7816_F – Unprotected SelectFile Command

This unit verifies the implementation of the unprotected SelectFile command. It is only applicable to the plain profile.

3.6.1 Test Case 7816_F_1

Purpose	This test case verifies the SelectFile (EF.COM) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 01 1E' 2. To verify that EF.COM is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '60' and the status bytes '90 00'.
Postconditions	File EF.COM is selected.

3.6.2 Test Case 7816_F_2

Purpose	This test case checks the robustness of the SelectFile command (invalid class byte).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU to the e-Passport. The class tag is set to the invalid value of '8F'. => '8F A4 02 0C 02 01 1E' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return an ISO checking error.

	2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.6.3 Test Case 7816_F_3

Purpose	This test case checks the robustness of the SelectFile command (invalid parameter P1).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU to the e-Passport. The parameter P1 is set to the invalid value of '12'. => '00 A4 12 0C 02 01 1E' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.6.4 Test Case 7816_F_4

Purpose	This test case checks the robustness of the SelectFile command (invalid parameter P2).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU to the e-Passport. The parameter P2 is set to the invalid value of '1C'. => '00 A4 02 1C 02 01 1E' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.6.5 Test Case 7816_F_5

Purpose	This test case checks the robustness of the SelectFile command (Invalid Lc).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.COM SHALL be selected. Send the following SelectFile APDU to the e-Passport. The parameter Lc is set to '03'. => '00 A4 02 0C 03 01 1E' 2. To verify that EF.COM is not selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return an ISO checking error.

	2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.6.6 Test Case 7816_F_6

Purpose	This test case verifies the SelectFile (EF.SOD) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF. SOD SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 1D' 2. To verify that EF.SOD is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '77' and the status bytes '90 00'.
Postconditions	File EF.SOD is selected.

3.6.7 Test Case 7816_F_7

Purpose	This test case verifies the SelectFile (EF.DG1) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG1 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 01' 2. To verify that EF.DG1 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '61' and the status bytes '90 00'.
Postconditions	File EF.DG1 is selected.

3.6.8 Test Case 7816_F_8

Purpose	This test case verifies the SelectFile (EF.DG2) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG2 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 02' 2. To verify that EF.DG2 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '75' and the status bytes '90 00'.
Postconditions	File EF.DG2 is selected.

3.6.9 Test Case 7816_F_9

Purpose	This test case verifies the SelectFile (EF.DG3) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG3
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG3 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 03' 2. To verify that EF.DG3 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '63' and the status bytes '90 00'.
Postconditions	File EF.DG3 is selected.

3.6.10 Test Case 7816_F_10

Purpose	This test case verifies the SelectFile (EF.DG4) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG4
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG4 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 04' 2. To verify that EF.DG4 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '76' and the status bytes '90 00'.
Postconditions	File EF.DG4 is selected.

3.6.11 Test Case 7816_F_11

Purpose	This test case verifies the SelectFile (EF.DG5) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG5
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG5 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 05' 2. To verify that EF.DG5 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '65' and the status bytes '90 00'.
Postconditions	File EF.DG5 is selected.

3.6.12 Test Case 7816_F_12

Purpose	This test case verifies the SelectFile (EF.DG6) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG6
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG6 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 06' 2. To verify that EF.DG6 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '66' and the status bytes '90 00'.
Postconditions	File EF.DG6 is selected.

3.6.13 Test Case 7816_F_13

Purpose	This test case verifies the SelectFile (EF.DG7) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG7
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG7 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 07' 2. To verify that EF.DG7 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '67' and the status bytes '90 00'.
Postconditions	File EF.DG7 is selected.

3.6.14 Test Case 7816_F_14

Purpose	This test case verifies the SelectFile (EF.DG8) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG8
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG8 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 08' 2. To verify that EF.DG8 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '68' and the status bytes '90 00'.
Postconditions	File EF.DG8 is selected.

3.6.15 Test Case 7816_F_15

Purpose	This test case verifies the SelectFile (EF.DG9) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG9
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG9 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 09' 2. To verify that EF.DG9 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '69' and the status bytes '90 00'.
Postconditions	File EF.DG9 is selected.

3.6.16 Test Case 7816_F_16

Purpose	This test case verifies the SelectFile (EF.DG10) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG10
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG10 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0A' 2. To verify that EF.DG10 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6A' and the status bytes '90 00'.
Postconditions	File EF.DG10 is selected.

3.6.17 Test Case 7816_F_17

Purpose	This test case verifies the SelectFile (EF.DG11) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG11
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG11 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0B' 2. To verify that EF.DG11 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6B' and the status bytes '90 00'.
Postconditions	File EF.DG11 is selected.

3.6.18 Test Case 7816_F_18

Purpose	This test case verifies the SelectFile (EF.DG12) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG12
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG12 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0C' 2. To verify that EF.DG12 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6C' and the status bytes '90 00'.
Postconditions	File EF.DG12 is selected.

3.6.19 Test Case 7816_F_19

Purpose	This test case verifies the SelectFile (EF.DG13) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG13
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG13 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0D' 2. To verify that EF.DG13 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6D' and the status bytes '90 00'.
Postconditions	File EF.DG13 is selected.

3.6.20 Test Case 7816_F_20

Purpose	This test case verifies the SelectFile (EF.DG14) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, EAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG14 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0E' 2. To verify that EF.DG14 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6E' and the status bytes '90 00'.
Postconditions	File EF.DG14 is selected.

3.6.21 Test Case 7816_F_21

Purpose	This test case verifies the SelectFile (EF.DG15) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, AA
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG15 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 0F' 2. To verify that EF.DG15 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '6F' and the status bytes '90 00'.
Postconditions	File EF.DG15 is selected.

3.6.22 Test Case 7816_F_22

Purpose	This test case verifies the SelectFile (EF.DG16) command (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG16
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. EF.DG16 SHALL be selected. Send the following APDU to the e-Passport. => '00 A4 02 0C 02 01 10' 2. To verify that EF.DG16 is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return byte '70' and the status bytes '90 00'.
Postconditions	File EF.DG16 is selected.

3.6.23 Test Case 7816_F_23

Purpose	This test case verifies the SelectFile command when the file to be selected does not exist.
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application is selected. An EF MUST NOT be selected.
Test scenario	1. A not existing file SHALL be selected. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 02 02' 2. To verify that no file is selected, send a valid ReadBinary APDU to the e-Passport. => '00 B0 00 00 01'
Expected results	1. The e-Passport MUST return an ISO checking error. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.7 Unit Test ISO_7816_G – Unprotected ReadBinary Command

This unit verifies the implementation of the unprotected ReadBinary command. It is only applicable to the plain profile.

3.7.1 Test Case 7816_G_1

Purpose	This test case verifies the ReadBinary command (w/o SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected.
Test scenario	1. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 01 1E' 2. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 at maximum) of the EF.COM => '00 B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return the status bytes '90 00' or an ISO warning.
Postconditions	Preconditions remain unchanged.

3.7.2 Test Case 7816_G_2

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (invalid class byte).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application is selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_F_1, otherwise this test will fail.
Test scenario	1. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 01 1E' 2. Send the ReadBinary APDU to the e-Passport. The class byte is set to the invalid value of '8F'. => '8F B0 00 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.7.3 Test Case 7816_G_3

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (offset beyond EOF).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_F_1, otherwise this test will fail.
Test scenario	1. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 01 1E' 2. Send the ReadBinary APDU to the e-Passport. The offset is beyond the end of the EF.COM file. Note: Since the actual file on the e-Passport could be larger than necessary, the e-Passport may return valid data in this case. If this happens, the test may have to be repeated with an appropriated offset.

	=> '00 B0 7F FF 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return an ISO checking error.
Postconditions	Preconditions remain unchanged.

3.7.4 Test Case 7816_G_4

Purpose	Test the robustness of the ReadBinary command (w/o SFI) (Le beyond EOF).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. This test case implicitly tests the SelectFile command; so it is required that the e-Passport has previously passed the SelectFile Test 7816_F_1, otherwise this test will fail.
Test scenario	1. Send the following SelectFile APDU to the e-Passport. => '00 A4 02 0C 02 01 1E' 2. Send the ReadBinary APDU to the e-Passport. The Le Byte requests more data than available in the EF.COM file Note: Since the actual file on the e-Passport could be larger than necessary, the e-Passport may return valid data in this case. If this happens, the test may have to be repeated with an appropriated offset. => '00 B0 00 00 E0'
Expected results	1. The e-Passport MUST return the status bytes '90 00'. 2. The e-Passport MUST return status bytes '90 00', an ISO warning or an ISO checking error.[4]
Postconditions	Preconditions remain unchanged.

3.7.5 Test Case 7816_G_5

Purpose	This test case verifies the ReadBinary command (EF.COM SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.COM. => '00 B0 9E 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.COM is selected.

3.7.6 Test Case 7816_G_6

Purpose	This test case verifies the ReadBinary command (EF.SOD SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.SOD. => '00 B0 9D 00 00'

[4] Currently there is a task for TF1 and TF5 to define correct responses for this test case and publish them in the next DOC9303 supplement.

Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.SOD is selected.

3.7.7 Test Case 7816_G_7

Purpose	This test case verifies the ReadBinary command (EF.DG1 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG1. => '00 B0 81 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG1 is selected.

3.7.8 Test Case 7816_G_8

Purpose	This test case verifies the ReadBinary command (EF.DG2 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG2. => '00 B0 82 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG2 is selected.

3.7.9 Test Case 7816_G_9

Purpose	This test case verifies the ReadBinary command (EF.DG3 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG3
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG3. => '00 B0 83 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG3 is selected.

3.7.10 Test Case 7816_G_10

Purpose	This test case verifies the ReadBinary command (EF.DG4 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG4
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG3. => '00 B0 84 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.

Postconditions	EF.DG4 is selected.

3.7.11 Test Case 7816_G_11

Purpose	This test case verifies the ReadBinary command (EF.DG5 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG5
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG5. => '00 B0 85 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG5 is selected.

3.7.12 Test Case 7816_G_12

Purpose	This test case verifies the ReadBinary command (EF.DG6 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG6
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG6. => '00 B0 86 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG6 is selected.

3.7.13 Test Case 7816_G_13

Purpose	This test case verifies the ReadBinary command (EF.DG7 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG7
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG7. => '00 B0 87 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG7 is selected.

3.7.14 Test Case 7816_G_14

Purpose	This test case verifies the ReadBinary command (EF.DG8 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG8
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG8. => '00 B0 88 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG8 is selected.

3.7.15 Test Case 7816_G_15

Purpose	This test case verifies the ReadBinary command (EF.DG9 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG9
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG9. => '00 B0 89 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG9 is selected.

3.7.16 Test Case 7816_G_16

Purpose	This test case verifies the ReadBinary command (EF.DG10 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG10
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG10. => '00 B0 8A 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG10 is selected.

3.7.17 Test Case 7816_G_17

Purpose	This test case verifies the ReadBinary command (EF.DG11 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG11
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG11. => '00 B0 8B 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG11 is selected.

3.7.18 Test Case 7816_G_18

Purpose	This test case verifies the ReadBinary command (EF.DG12 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG12
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG12. => '00 B0 8C 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG12 is selected.

3.7.19 Test Case 7816_G_19

Purpose	This test case verifies the ReadBinary command (EF.DG13 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG13
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG13. => '00 B0 8D 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG13 is selected.

3.7.20 Test Case 7816_G_20

Purpose	This test case verifies the ReadBinary command (EF.DG14 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, EAC
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG14. => '00 B0 8E 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG14 is selected.

3.7.21 Test Case 7816_G_21

Purpose	This test case verifies the ReadBinary command (EF.DG15 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, AA
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG15. => '00 B0 8F 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG15 is selected.

3.7.22 Test Case 7816_G_22

Purpose	This test case verifies the ReadBinary command (EF.DG16 SFI) (positive test).
References	ICAO LDS 1.7 [R1]
Profile	Plain, DG16
Preconditions	The LDS application MUST be selected. An EF MUST NOT be selected.
Test scenario	1. Send the ReadBinary APDU to the e-Passport, this will read the first bytes (256 bytes at maximum) of the EF.DG16. => '00 B0 90 00 00'
Expected results	1. The e-Passport MUST return the status bytes '90 00'.
Postconditions	EF.DG16 is selected.

4 Logical Data Structure Tests

The "logical data structure" test layer analyses the encoding of the LDS objects stored on an e-Passport. This layer contains several test units, one for each LDS object (DG 1 - 16, EF.COM and EF.SOD). Another test unit verifies the integrity and consistency of the different data structures. The tests specified in this layer can be performed using a regular e-Passport or with following input data from a different source (e.g. file). The test configuration document specifies the source of the data.

4.1 Unit Test LDS_A - Tests for the EF.COM LDS Object

This unit includes all test cases concerning the EF.COM element. The general LDS header encoding is tested as well as the referred LDS and Unicode version numbers. The consistency of the data group list with respect to the available data group objects is checked in a different test unit.

4.1.1 Test Case LDS_A_01

Purpose	This test checks the template tag; the encoded LDS element starts with.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.COM object in binary format as read from the e-Passport.
Test scenario	1. Check the very first byte of the EF.COM element
Expected results	1. First byte MUST be '60'
Postconditions	None

4.1.2 Test Case LDS_A_02

Purpose	This test checks the encoding of LDS element length.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.COM object in binary format as read from the e-Passport.
Test scenario	1. Analyze the encoding of the bytes that follow the template tag 2. Verify the length of the given LDS object
Expected results	1. The bytes that follow the template tag MUST contain a valid length encoding (According to ASN.1 encoding rules). 2. The encoded length MUST match the size of the given LDS object.
Postconditions	None

4.1.3 Test Case LDS_A_03

Purpose	This test checks the LDS version referred by the EF.COM element
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.COM object in binary format as read from the e-Passport.
Test scenario	1. Search for configured tag '5F 01' 2. Verify the length of the tag '5F 01' 3. Verify the length of LDS version DE. 4. Verify the LDS version.
Expected results	1. Tag MUST be present. 2. The bytes that follow the tag MUST contain a valid length encoding.

	3. Length MUST be 4. 4. The specified LDS version MUST be '30 31 30 37'
Postconditions	None

4.1.4 Test Case LDS_A_04

Purpose	This test checks the Unicode version referred by the EF.COM element
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.COM object in binary format as read from the e-Passport.
Test scenario	1. Search for configured tag '5F 36' 2. Verify the length of the tag '5F 36' 3. Verify the length of the Unicode version DE. 4. Verify the Unicode version.
Expected results	1. Tag MUST be present. 2. The bytes that follow the tag MUST contain a valid length encoding. 3. The length MUST be 6. 4. The specified Unicode version MUST be '30 34 30 30 30 30'.
Postconditions	None

4.1.5 Test Case LDS_A_05

Purpose	This test checks the Unicode version referred by the EF.COM element
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.COM object in binary format as read from the e-Passport.
Test scenario	1. Search for configured tag '5C' 2. Verify the length of the tag '5C' 3. Verify if mandatory data groups are present. 4. Verify the validity of present data groups.
Expected results	1. Tag MUST be present. 2. The bytes that follow the tag MUST contain a valid length encoding 3. The list MUST at least contain the tags for the mandatory data groups '61', '75'. 4. The list MUST contain only valid data group tags as specified in [R1], i.e. '61', '75', '63', '76', '65', '66', '67', '68', '69', '6A', '6B', '6C', '6D', '6E', '6F', '70'
Postconditions	None

4.2 Unit Test LDS_B - Tests for the DataGroup 1 LDS object

This unit includes all test cases concerning the DG 1 element (MRZ). The general LDS header encoding is tested as well as the format of the MRZ and the calculation of the check digits.

Unit test B uses the following definitions in accordance with [R1]:

- A denotes the set of ASCII encoded alphabetic characters {“A”, “B”, … , “Z”}
- N denotes the set of ASCII encoded numeric characters {“0”, “1”, … , “9”}
- S denotes the set of ASCII encoded special characters {“<”}

4.2.1 Test Case LDS_B_01

Purpose	This test verifies the template tag with which the encoded LDS element starts.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Check the very first byte of the EF.DG1 element
Expected results	1. First byte MUST be ‘61’
Postconditions	None

4.2.2 Test Case LDS_B_02

Purpose	This test verifies the encoding of LDS element length.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the encoding of the bytes that follow the template tag 2. Verify the length of the given LDS object
Expected results	1. The bytes that follow the template tag MUST contain a valid length encoding (According to ASN.1 encoding rules). 2. The encoded length MUST match the size of the given LDS object.
Postconditions	None

4.2.3 Test Case LDS_B_03

Purpose	This test verifies the encoding of the MRZ data object.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Verify the length of the tag ‘5F 1F’ 2. Verify that the length encoding is correct. 3. Verify that the encoded length equals the remaining size of DG1.
Expected results	1. The first bytes of the LDS element data MUST be the tag for the MRZ data object. 2. The bytes that follow the MRZ data object tag MUST contain a valid length encoding (According to ASN.1 encoding rules). 3. The encoded length MUST match the remaining size of the given DG1 object.
Postconditions	None

4.2.4 Test Case LDS_B_04

Purpose	This test checks the format of the document type.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the first two characters of the MRZ (document type).
Expected results	1. The first character MUST be an element of {"P"} as defined in [R4]. The second character MUST be an element of A or S.
Postconditions	None

4.2.5 Test Case LDS_B_05

Purpose	This test checks the format of the issuing state of the MRZ.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next three characters of the MRZ (issuing state).
Expected results	1. The characters of the issuing state MUST be elements of A that MAY be followed by elements of S.
Postconditions	None

4.2.6 Test Case LDS_B_06

Purpose	This test verifies the format of the holder name of the MRZ.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next 39 characters of the MRZ (holder name).
Expected results	1. The characters of the holder name MUST be elements of A or S. The holder name MUST start with a character that is an element of A.
Postconditions	None

4.2.7 Test Case LDS_B_07

Purpose	This test verifies the format of the document number.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next 9 characters of the MRZ (document number). 2. Analyze the next character of the MRZ (check digit).
Expected results	1. The characters of the document number MUST be elements of A or N followed by fillers that are elements of S. 2. The document number's check digit MUST be an element of N and it MUST be correct.
Postconditions	None

4.2.8 Test Case LDS_B_08

Purpose	This test verifies the format of the nationality.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next three characters of the MRZ (nationality).
Expected results	1. The characters of the nationality MUST be elements of A that MAY be followed by elements of S.
Postconditions	None

4.2.9 Test Case LDS_B_09

Purpose	This test verifies the format of the date of birth.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next 6 characters of the MRZ (date of birth). 2. Analyze the next character of the MRZ (check digit).
Expected results	1. The six characters MUST be elements of N. 2. The check digit of the date of birth MUST be an element of N and MUST be correct.
Postconditions	None

4.2.10 Test Case LDS_B_10

Purpose	This test verifies the format of the sex.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next character of the MRZ (sex).
Expected results	1. The character of the sex MUST be an element of {“F”, “M”, “<”}.
Postconditions	None

4.2.11 Test Case LDS_B_11

Purpose	This test verifies the format of the date of expiry.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next 6 characters of the MRZ (date of expiry). 2. Analyze the next character of the MRZ (check digit).
Expected results	1. The six characters MUST be elements of N. 2. The check digit of the date of expiry MUST be an element of N and MUST be valid.
Postconditions	None

4.2.12 Test Case LDS_B_12

Purpose	This test verifies the format of the optional data.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next 14 characters of the MRZ (optional data). 2. Analyze the next character of the MRZ (check digit).
Expected results	1. The characters of the optional data MUST be elements of A, N or S. 2. If the optional data is not empty, the optional data's check digit MUST be element of N and MUST be correct. Else, the optional data's check digit MUST be an element of {"0" or "<"}.
Postconditions	None

4.2.13 Test Case LDS_B_13

Purpose	This test verifies the format of composite check digit.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG1 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the next character of the MRZ (composite check digit).
Expected results	1. The composite check digit MUST be an element of N and it MUST be valid.
Postconditions	None

4.3 Unit Test LDS_C - Tests for the DataGroup 2 LDS object

This unit includes all test cases concerning the DG 2 element (Face). The general LDS header encoding is tested as well as the CBEFF encoded biometric template and ISO 19794 coding [R7] of the biometric object itself. Since the CBEFF and the ISO specification allow a very high degree of freedom, this unit contains tests for the mandatory elements as specified in the LDS.

Some additional (optional) tests verify the encoding optional elements. The general rule for this optional test is that if an optional element is present, it MUST be encoded according to the corresponding specification otherwise the test fails.

4.3.1 Test Case LDS_C_01

Purpose	This test checks the template tag; the encoded DataGroup 2 element starts with.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the very first byte of the EF.DG2 element
Expected results	1. First byte MUST be '75'
Postconditions	None

4.3.2 Test Case LDS_C_02

Purpose	This test checks the encoding of LDS element length.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Analyze the encoding of the bytes that follow the template tag 2. Verify the length of the given LDS object
Expected results	1. The bytes that follow the template tag MUST contain a valid length encoding (According to ASN.1 encoding rules). 2. The encoded length MUST match the size of the given LDS object.
Postconditions	None

4.3.3 Test Case LDS_C_03

Purpose	This test checks the encoding of the Biometric Information Group Template.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the first tag in the DG 2 data. 2. Verify the length of the DG 2 data. 3. Verify that the encoded length is less than size of DG 2.
Expected results	1. Tag MUST be '7F 61'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The encoded length MUST NOT exceed the remaining bytes of the DG 2 data element.
Postconditions	None

4.3.4 Test Case LDS_C_04

Purpose	This test checks the encoding of the number of instances stored in the Biometric Information Group Template.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the first tag inside the group template 2. Verify the length of the "number of instances" data object. 3. Verify that the encoded length is less than rest of size of DG 2.
Expected results	1. Tag MUST be '02'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The number of instances MUST be 1.
Postconditions	None

4.3.5 Test Case LDS_C_05

Purpose	This test checks the encoding of the first biometric information template.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the tag of the biometric information template. 2. Verify the length of the "biometric information template" data object. 3. Verify that the encoded length is less than rest of size of DG 2.
Expected results	1. Tag MUST be '7F 60'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The encoded length MUST NOT exceed the remaining bytes of the DG 2 element.
Postconditions	None

4.3.6 Test Case LDS_C_06

Purpose	This test checks the encoding of the biometric header template tag.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the presence of the biometric header template tag with the configured tag. 2. Verify the length of the "biometric header template" data object. 3. Verify that the encoded length is less than rest of size of DG 2.
Expected results	1. Tag MUST be 'A1'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The encoded length MUST NOT exceed the remaining bytes of the DG 2 element.
Postconditions	None

4.3.7 Test Case LDS_C_07

Purpose	This test checks the presence/encoding of the CBEFF element "format owner".
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport. The tested CBEFF element is part of biometric header template located in LDS_C_06.
Test scenario	1. Check the presence of the "format owner" tag. 2. Verify the length of the "format owner" data object. 3. Check the length of the "format owner" value. 4. Verify the "format owner" value.
Expected results	1. Tag MUST be '87'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The length of the value field MUST be 2 bytes. 4. The value of the format owner MUST be a registered CBEFF owner. It MUST be '01 01'.
Postconditions	None

4.3.8 Test Case LDS_C_08

Purpose	This test checks the presence/encoding of the CBEFF element "format type".
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport. The tested CBEFF element is part of biometric header template located in LDS_C_06.
Test scenario	1. Check the presence of the format type tag. 2. Verify the length of the "format type" data object. 3. Check the length of the "format type" value. 4. Verify the "format type" value.
Expected results	1. Tag MUST be '88'. 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The length of the value field MUST be 2 bytes. 4. The value of the format type MUST be a registered CBEFF type. It MUST be '00 08'.
Postconditions	None

4.3.9 Test Case LDS_C_09

Purpose	This test checks the encoding of the biometric data object tag.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport. The biometric data object is part of the biometric information template tested in LDS_C_05.
Test scenario	1. Check the presence of the biometric data object tag. 2. Verify the length of the biometric data object. 3. Verify that the encoded length is less than rest of size of DG 2.
Expected results	1. Tag MUST be '5F 2E' 2. This element MUST have a valid encoded length (According to ASN.1 encoding rules). 3. The encoded length MUST NOT exceed the remaining bytes of the DG 2 element.
Postconditions	None

4.3.10 Test Case LDS_C_10

Purpose	This test checks the encoding of the facial header block.
References	ICAO LDS 1.7 [R1] ISO 19794-5 [R7]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport. The biometric data object is part of the biometric data object tested in LDS_C_09.
Test scenario	1. Check the first 4 bytes of the header block (Format identifier) 2. Check the next 4 bytes of the header block (Version number) 3. Check the record length element. 4. Check the Number of Facial Images element.
Expected results	1. The format identifier MUST be '46 41 43 00'. 2. The version number MUST be '30 31 30 00'.

	3. The length MUST NOT exceed the remaining bytes of the DG2 element and MUST match the encoded length of the biometric data object. 4. The number of facial images MUST at least be 1.
Postconditions	None

4.3.11 Test Case LDS_C_11

Purpose	This test checks the encoding of the facial information block. This test is mandatory for the first facial information block and SHOULD be repeated for further optional facial images.
References	ICAO LDS 1.7 [R1] ISO 19794-5 [R7]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the Facial Record Data Length. 2. Check the number of facial feature points. 3. Check the gender element. 4. Check the eye colour element. 5. Check the hair colour element. 6. Check Pose Angle - Yaw. 7. Check Pose Angle - Pitch. 8. Check Pose Angle - Roll. 9. Check Pose Angle Uncertainty –Yaw. 10. Check Pose Angle Uncertainty –Pitch. 11. Check Pose Angle Uncertainty –Roll.
Expected results	1. The Facial Record Data Length MUST be at least 32 bytes and MUST NOT exceed the remaining size of the biometric data object. 2. The size of the feature point structures (8 * number of facial feature points) MUST NOT exceed the remaining size of the biometric data object 3. The gender MUST be encoded as ‘00’, ‘01’, ‘02’, or ‘FF’. 4. The eye colour MUST be encoded as ‘00’, ‘01’, ‘02’, ‘03’, ‘04’, ‘05’, ‘06’, ‘07’, or ‘FF’. 5. The hair colour MUST be encoded as ‘00’, ‘01’, ‘02’, ‘03’, ‘04’, ‘05’, ‘06’, ‘07’, or ‘FF’. 6. The Pose Angle - Yaw MUST be equal or less than 181. 7. The Pose Angle - Pitch MUST be equal or less than 181. 8. The Pose Angle - Roll MUST be equal or less than 181. 9. The Pose Angle Uncertainty - Yaw MUST be equal or less than 181. 10. The Pose Angle Uncertainty - Pitch MUST be equal or less than 181. 11. The Pose Angle Uncertainty - Roll MUST be equal or less than 181.
Postconditions	None

4.3.12 Test Case LDS_C_12

Purpose	This test checks the encoding of the facial feature points. It is conditional and applies only if there are feature points encoded. This test SHOULD be repeated for every present feature point. See LDS_C_11 for the number of feature points.
References	ICAO LDS 1.7 [R1] ISO 19794-5 [R7]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the feature point type.

Expected results	1. The feature point type MUST be 1.
Postconditions	None

4.3.13 Test Case LDS_C_13

Purpose	This test checks the encoding of the image information block. This test is mandatory for the first image information block and SHOULD be repeated for further optional facial images.
References	ICAO LDS 1.7 [R1] ISO 19794-5 [R7]
Profile	ICAO
Preconditions	Encoded EF.DG2 object in binary format as read from the e-Passport.
Test scenario	1. Check the face image type. 2. Check the image data type.
Expected results	1. The face image type MUST be encoded as '00', '01', or '02'. 2. The image data type MUST be encoded as '00' or '01'.
Postconditions	None

4.4 Unit Test LDS_D - Tests for the SOD LDS object

This unit includes all test cases concerning the EF.SOD element. The general LDS header encoding is tested as well as the contained CMS (PKCS#7) signed content object.

In order verify the signing certificate signature the corresponding country signing certificate is needed. For the verification of the LDS security object, the binary data group objects and the EF.COM is needed as read from the e-Passport.

4.4.1 Test Case LDS_D_01

Purpose	This test checks the template tag; the encoded DataGroup 2 element starts with.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport.
Test scenario	1. Check the very first byte of the EF.SOD element.
Expected results	1. First byte MUST be '77'.
Postconditions	None

4.4.2 Test Case LDS_D_02

Purpose	This test checks the encoding of LDS element length.
References	ICAO LDS 1.7 [R1]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport.
Test scenario	1. Analyze the encoding of the bytes that follow the template tag 2. Verify the length of the given LDS object
Expected results	1. The bytes that follow the template tag MUST contain a valid length encoding (According to ASN.1 encoding rules). 2. The encoded length MUST match the size of the given LDS object.
Postconditions	None

4.4.3 Test Case LDS_D_03

Purpose	This test checks the ASN#1 encoding of a PCKS#7 signedData object.
References	ICAO PKI 1.1 [R2]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport.
Test scenario	1. Check that the element has a sound ASN.1 structure.
Expected results	1. The PKCS#7 signed data object included as the value in the LDS true template MUST be encoded according to the DER format.
Postconditions	None

4.4.4 Test Case LDS_D_04

Purpose	This test checks the value that is encoded into the signedData element.
References	ICAO PKI 1.1 [R2] and DOC9303 [R4]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport.
Test scenario	1. Check the SignedData version value. 2. Check the digestAlgorithms list. 3. Check the eContentType. 4. Check the certificates list.
Expected results	1. The version number MUST be 3. 2. All OIDs MUST be valid. This list SHOULD contain all used digestAlgorithms in this signedData container. It MUST contain only digestAlgorithms specified in the PKI report: 1.3.14.3.2.26 (SHA1) 2.16.840.1.101.3.4.2.1 (SHA-2 256) 2.16.840.1.101.3.4.2.2 (SHA-2 384) 2.16.840.1.101.3.4.2.3 (SHA-2 512) 2.16.840.1.101.3.4.2.4 (SHA-2 224) 3. The eContentType MUST have OID id-icao-ldsSecurityObject, see [R4] Annex A3.2. 4. According to the PKI Report; the certificate list MAY contain the Document Signer Certificate. If this is the case, the Document Signer Certificate is tested in LDS_D_7. Other certificates SHOULD NOT be included in this list.
Postconditions	None

4.4.5 Test Case LDS_D_05

Purpose	This test checks the SignerInfo element of the signedData structure. The signedData Structure MUST at least contain one signer info. If there is more than one signer info, although this is not recommended in the PKI report, this test MUST be repeated for each element.
References	ICAO PKI 1.1 [R2]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport.
Test scenario	1. Check the signer info version value. 2. Check the choice of the sid element. 3. Check if the certificate identified in the sid is included in the signed data certificates list or available in the PKD.

	4. Check the digestAlgorithm identifier. 5. Check the signedAttrs element. 6. Check the MessageDigest Attribute. 7. Check the SigningTime attribute if present. 8. Check the signatureAlgorithm element. 9. Check the signature element. It is verified with the signer certificates public key and the hash value produced over the signedAttributes.
Expected results	1. The version number MUST be 1 or 3. 2. The choice of the sid element MUST match the signer info version value. (Version 1 if issuerandSerialNumber is used and 3 if subjectKeyIdentifier is used). 3. Certificate MUST be available. 4. The digestAlgorithmID MUST be included in the algorithm list. 5. The signed attributes list MUST contain the MessageDigest attribute. 6. The value of the message digest attribute MUST match the hash value of the eContent element. (Using the digestAlgorithm specified above) 7. If there's a SigningTime attribute present, the signing time MUST be within the validity period of the signing certificate. 8. The signature algorithm MUST refer to an algorithm specified in [R2]: RSA, DSA, or ECDSA. 9. The signature MUST be valid.
Postconditions	None

4.4.6 Test Case LDS_D_06

Purpose	This test checks the LDS Security Object stored as eContent in the signedData Object. The LDS Security Object is stored as the eContent element in the signedData Structure.
References	ICAO PKI 1.1 [R2]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport. For the data group hash verification this test needs also the binary data group objects as read from the e-Passport.
Test scenario	1. Check the ASN.1 encoding of the LDS Security Object. 2. Check the security object version element. 3. Check the digestAlgorithm identifier. 4. Check the DataGroupHash Sequence. 5. Check the dataGroup numbers in the DataGroup Hash Sequence. 6. Check the dataGroup numbers in the DataGroup Hash Sequence. 7. Check the dataGroup hash values in the Hash Sequence. Compare the hash value with the corresponding data group binary objects.
Expected results	1. The object MUST be encoded according to the DER syntax. 2. The version number MUST be 0. 3. The digestAlgorithm identifier MUST be one of the algorithms specified in [R2]: SHA1, SHA-224, SHA-256, SHA-384, and SHA-512. 4. The Sequence MUST contain at least 2 entries for DG 1 and 2. 5. The Sequence MUST contain a hash value for all present data groups. There MUST be no additional hash value for non-existing data groups. 6. The referred dataGroups MUST match the DataGroup list in the EF.COM. 7. All hash values MUST be valid.
Postconditions	None

4.4.7 Test Case LDS_D_07

Purpose	This test checks the signing certificate used to verify the EF.SOD object. The certificate can be read from the SOD object or MUST be retrieved from the PKD.
References	ICAO PKI 1.1 [R2]
Profile	ICAO
Preconditions	Encoded EF.SOD object in binary format as read from the e-Passport. For the verification of the signing certificate signature, the country signing certificate is required.
Test scenario	1. Check the ASN.1 encoding of the signing certificate. 2. Check the signing certificate version element. 3. Check the signature element. 4. Check the certificates validity period element. 5. Check the certificates issuer element. 6. Check the subjectPublicKeyInfo element. 7. Check the AuthorityKeyIdentifier extension in the signing certificate. 8. Check that the SubjectKeyIdentifier extension of the country signing certificate matches the AuthorityKeyIdentifier of the signing certificate. 9. Check the keyUsage extension of the signing certificate. 10. Check the signatureAlgorithm element. 11. Verify the signatureValue of the signing certificate with the public key of the country signing certificate.
Expected results	1. The object MUST be encoded according to the DER syntax. 2. The version MUST be v3 (Value for v3 is 2). 3. The algorithm specified here MUST match the OID in the signatureAlgorithm field. 4. It MUST use UTC time until 2049 from the on GeneralisedTime. NOTE: It is not necessary that the certificate is still valid; it MUST only have been valid at signing time, which is tested in LDS_D_5. 5. The issuer MUST match the subject of the provided country signing certificate. 6. This element MUST refer to an algorithm specified in [R2]: RSA, ECDSA, or DSA. 7. This extension MUST be present and MUST contain a keyIdentifier value. 8. AuthorityKeyIdentifier MUST match the SubjectKeyIdentifier of the country signing certificate. 9. The keyUsage extension MUST be “critical” and the digitalSignature bit MUST be asserted. 10. The signatureAlgorithm element MUST be one of the algorithms specified in [R2]: RSA, ECDSA, or DSA. 11. The certificate signature MUST be valid.
Postconditions	None

MACHINE READABLE TRAVEL DOCUMENTS

TECHNICAL REPORT

RF PROTOCOL AND APPLICATION TEST STANDARD FOR E-PASSPORT - PART 4

E-PASSPORT READER TESTS FOR AIR INTERFACE, INITIALISATION, ANTICOLLISION AND TRANSPORT PROTOCOL

Version: **1.01**
Date – Feb 20, 2007

Published by authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

File	: RF protocol Part 4 V1.01.doc
Author	: ISO/JTC1/SC17/WG3/TF4 for ICAO-NTWG

Release Control

Release	Date	Description
0.1	2006-02-01	First draft based on the German WG3 TF4 contribution "e-Passport Conformity Testing" version 0.5.2 presented at TF4 meeting in Ottawa Jan 30- Feb 01, 2006
0.2	2006-05-19	Updated version based on "e-Passport Conformity Testing" PCD, layer 1-4, version 0.6, and new ICAO TR layout. Changes in chapters 3.3.1 and 3.3.2 concerning reference SCIC.
0.3	2006-09-27	Updated version based on disposition of comments from July 14th, 2006 (resolutions of Graz meeting).
0.9	2006-11-23	Updated version based on disposition of comments from October 30th, 2006 (resolutions of Bled meeting)
1.0	2006-12-12	Final version including editorial comments from the WG8 editor meeting in Graz.
1.01	2007-02-20	Annex A and corresponding chapter 2.1 removed. Editorial error in table 4 removed.

Release Note:

Release 2007-02-20 is the official version of the technical report by SC17 WG3 TF4 endorsed by ICAO-NTWG at the Portugal meeting. It replaces version V1.0.

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1 Introduction

1.1 Scope and purpose

An essential element of the new ICAO compliant e-Passport is the addition of a Secure Contactless Integrated Circuit (SCIC) that securely holds biometric data of the passport bearer within the ICAO defined Logical Data Structure (LDS).

Successful integration of the SCIC into the e-Passport depends upon an active international cooperation between many companies and organizations.

The e-Passport and the e-Passport reader (proximity coupling device or PCD) have been specified and designed to operate correctly across a wide variety of infrastructures worldwide. The risk profile for the e-Passport and the reader indicates a high impact if that design includes a widespread error or fault. Therefore, it is essential that all companies and organizations involved make all reasonable efforts to minimize the probability that this error or fault remains undetected before that design is approved and e-Passports and e-Passport readers are issued.

This document defines a test plan for the contactless part of the PCD. These tests are divided into tests of the electrical parameters, according to ISO/IEC14443-2 and tests of the initialisation & anticollision and the frame protocol according to ISO/IEC14443-3 and -4.

In order for the PCD to operate correctly, many functional layers of technology must work together. The purpose of this document is to define in depth the tests to be performed to minimize the probability that an error or fault remain undetected before the design is approved.

1.2 Assumptions

1.2.1 Maintenance of this TR regarding ISO standards

This technical report is based on the currently available versions of ISO standards and amendments as they are referenced in chapter 1.6. Based on the further development of these referenced ISO standards and their amendments, this report will be revised by SC17/WG3/TF4.

1.3 Terminology

The key words "MUST", "SHALL", "REQUIRED", "SHOULD", "RECOMMENDED", and "MAY" in this document are to be interpreted as described in [R3].

MUST This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.

MUST NOT This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.

SHOULD This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.

SHOULD NOT This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.

MAY This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

1.4 Glossary

ATTRIB	Activation command used with modulation type B.
TR0	TR0 defines the guard time between the end of a PCD transmission and the start of the SCIC subcarrier generation.
TR1	TR1 defined the synchronization time between the start of the SCIC subcarrier generation and the start of the SCIC subcarrier modulation.
TR2	TR2 defines the synchronization time between the start of the SCIC's EOF and the start of the PCD's next SOF.
Sample	A sample is one piece of the total number of e-Passports required and presented for testing according to this specification.
DUT	A device under test is a sample that has been placed in the test apparatus.
Room temperature	Room temperature (RT) is defined as any convenient temperature within the range of 23 °C ± 3 °C (73 °F ± 5 °F).
Modulation index	The modulation index m is calculated as follows: $m = \frac{maxlevel - minlevel}{maxlevel + minlevel}$

1.5 Abbreviations

Abbreviation	
AC	Anti-collision command
APDU	Application protocol data unit
ATQA	Answer to REQA
ATQB	Answer to REQB
ATS	Answer to select
CID	Card identifier
DUT	Device under test
EGT	Extra guard time
EOF	End of frame
etu	Elementary time unit
fc	Carrier frequency (13.56 MHz)

Abbreviation	
FDT	Frame delay time
fs	Sub-carrier frequency (847.5 kHz)
LMA	Load modulation amplitude
m	Modulation index
PCD	Proximity coupling device
PICC	Proximity integrated circuit card
PPS	Protocol and parameter selection
RATS	Request for ATS
REQA	Request A command
REQB	Request B command
RT	Room temperature
SCIC	Secure contactless integrated circuit
SOF	Start of frame
TM-PDU	Test management protocol data unit
t_r, t_f	Rise time, fall time

1.6 Reference documentation

The following documentation serves as a reference for this technical report:

[R1] *Technical Report: Development of a Logical Data Structure – LDS for optional capacity expansion technologies, version 1.7*

[R2] *Technical Report: PKI for Machine Readable Travel Documents offering ICC Read-Only access, version 1.1*

[R3] *RFC 2119, S. Bradner, "Key Words for Use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997*

[R4] *CD ISO/IEC 14443-1:2005, Proximity Cards: Physical Characteristics*

[R5] *ISO/IEC 14443-2:2001, Proximity Cards: Radio Frequency Power and Signal Interface*

[R6] *ISO/IEC 14443-3:2001, Proximity Cards: Initialization and Anticollision*

[R7] *ISO/IEC 14443-4:2001, Proximity Cards: Transmission protocol*

[R8] *ISO/IEC 14443-2:2001/AM1:2005, Proximity Cards: Radio Frequency Power and Signal Interface (Amendment 2: Bit Rates of fc/64, fc/32 and fc/16)*

[R9] *ISO/IEC 14443-3:2001/AM1:2005, Proximity Cards: Initialization and Anticollision (Amendment 1: Bit Rates of fc/64, fc/32 and fc/16)*

[R10] *ISO/IEC 10373-6:2001, Test Methods for Proximity Cards*

[R11] *ISO/IEC 10373-6:2001/AM1:2006, Test Methods for Proximity Cards (Amendment 1: Protocol Test Methods for Proximity Cards)*

[R12] *ISO/IEC 10373-6:2001/AM2:2006, Test Methods for Proximity Cards (Amendment 2: Improved RF Test Methods)*

[R13] *ISO/IEC 10373-6:2001/AM3:2006, Test Methods for Proximity Cards (Amendment 32: Protocol test methods for proximity coupling devices)*

[R14] *ISO/IEC 10373-6:2001/AM4:2006, Test Methods for Proximity Cards (Amendment 4: Additional Test Methods for PCD RF Interface and PICC Alternating Field Exposure)*

[R15] *ISO/IEC 10373-6:2001/AM5:2006, Test Methods for Proximity Cards (Amendment 5: Bit Rates of fc/64, fc/32 and fc/16)*

[R16] *ICAO Doc 9303 Part 1 Volume 2, 6th edition, 2005.*

[R17] *Defect Report and Technical Corrigendum 1 for - International Standard ISO/IEC 14443-3:2001/AM1: Identification cards – Contactless integrated circuit(s) cards – Proximity cards – Part 3: initialization and anticollision – Amendment 1: Bit rates for fc/64, fc/32 and fc/16*

2 General test requirements

Following sub-clauses specify the different test setups, the nominal values used for the tests and a recommendation of the report. Tests for bit rates of fc/128 and fc/32 are mandatory and SHALL be applied. Other bit rates indicated in the PPS/ATTRIB command SHALL also be tested.

This test specification refers to the ISO/IEC standard 10373-6 and its corresponding amendments.

The PCD SHOULD support asymmetric communication speeds from/to the e-Passport if offered by the e-Passport to minimize transaction time.

The tolerance for the resonance frequency of reference e-Passport is ± 2 %.

All given temperature values MAY have a tolerance value of ± 0.5 °C.

All other value MAY have a tolerance value as specified in the base standards.

2.1 Test environment

2.1.1 Test setup

The PCD assembly (test apparatus) that is defined in [R10] is the basis for the physical and electrical tests. This test apparatus is used to calibrate the Reference e-Passports that are defined in [R10] (chapter 6.3).

In addition to [R10], the samples SHALL provide the features as described in chapter 2.3. The manufacturer provides a description how to switch the sample into the test mode and how to operate the sample for the test cases described in this document.

2.2 Implementation conformance statement

In order to set up the tests properly, an applicant SHALL provide the information specified in Table 1 below.

Table 1: Test precondition table "Information on the product"

Information for test setup	**Applicant declaration**
Reader class	
Bit rates supported as claimed by the PPS/ATTRIB • 106 kbit/sec • 212 kbit/sec • 424 kbit/sec • 848 kbit/sec	
Access control supported • Plaintext • Basic Access Control • Extended Access Control	
Authentication supported • Passive Authentication • Active Authentication	
Operating temperature range	

2.3 PCD test features

The test apparatus SHALL be capable of sending contiguous activation commands. For type A, these commands are REQA, AC, SELECT, RATS, and PPS. For type B, these are REQB, the optional Slot-MARKER and ATTRIB. If there is no response from the e-Passport, the communication type SHOULD be changed and the activation procedure SHALL start from beginning. If this is not possible, the dedicated commands SHALL be available to expose all commands to the upper tester. Therefore, it is possible to start each command from host side if necessary.

Additionally the ISO/IEC 144443-4 command set SHALL be available to exchange data. It SHALL also be possible to receive chained data, e.g. BlockExchange.

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

For synchronization purposes the PCD MAY provide a test pin output. The test apparatus MAY also be synchronized by probing the backscattered signal using an ISO pickup coil. This pickup coil MUST NOT influence the field significantly.

The applicant MAY provide the reader test interface specified in Annex C.

2.4 Nominal values

Unless otherwise specified, the following environment parameters and nominal values SHALL be used:

Table 2: Environment parameters

Parameter	Value	Applies to
Environment temperature	23 °C ± 3 °C (73 °F ± 5 °F)	Type A and B
Relative humidity	25 % to 75 %	Type A and B

Tests have to be done as the same temperature range as the e-Passport tests (-10 °C … 50 °C). The customer is free to specify a limited range (for example for indoor systems) in the implementation conformance statement.

2.5 Definition of measurement points

All layer 2 tests SHALL be performed over a certain set of points within the defined volume.

Volume definition:

Annex A specifies volume dimensions, so called “reader design types”. If due to the construction and/or normal use of the reader other dimension sizes are RECOMMENDED by the manufacturer of the reader, the test institute SHALL check if these dimension sizes are appropriate and define the dimensions of the volume accordingly.

Volume location:

The PCD manufacturer SHALL define the position of the volume in the technical documentation of the PCD. The volume MUST be located with one surface exactly on the surface of the reader device.

Alternatively, the volume MAY be located within the reader. In this case, the volume size definition MUST be adopted accordingly.

Readers MUST be tested inside of their housing, exactly as they are used in border control applications.

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

Measurement points:

Annex A specifies measurement points.

Height Z = 0 mm: The measuring antenna 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 test antenna 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).

2.6 Definition of the reference e-Passport for load modulation reception test

The reference e-Passport introduced for the load modulation reception test is based on ISO 10373-6 Annex E [R10] with improved functionality.

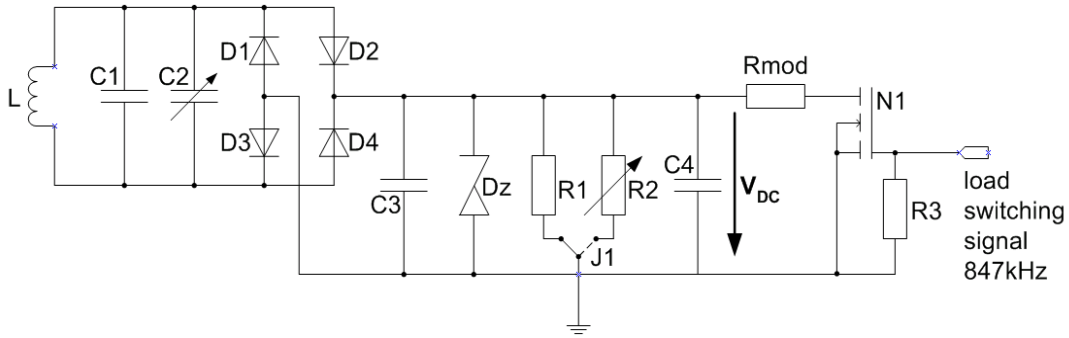

Figure 1: Reference e-Passport

The signal at pin ‘load switching signal 847 kHz’ shall have an amplitude value between 0 and 4 V, for stable switching of the recommended transistor. In order to reduce common-mode current, a balun MAY be used between the signal generator and the reference e-Passport.

Table 3: Reference e-Passport

Component	Value
L	See [R10], chapter 6.3.5
R1	4.3 kΩ
R2	Adjustable, see table below
R3	5 kΩ
R_{mod}	Adjustable, see table below
C1	10pF
C2	5 – 30 pF
C3	100 pF
C4	470 pF
D1, D2, D3, D4	Recommended: BAR43
Dz	Recommended: BZX84-C14 / T1, 300 mW, SMD 15 V
N1	N-MOS FET, 10 pF max. Output capacitance to ground. Recommended: BSS83

For X=30 and H = 2 A/m the load modulation amplitude ($X/H^{1.2}$) is 13.1 mV.

Adjustment of the R2 and R_{mod} values must be done in the Test PCD assembly [R12].

Adjustment of the Reference e-Passport load modulation amplitude level for V_{DC} = 6 V at field strength values from 2 A/m up to 6 A/m result in the following nominal modulation resistor values.

Table 4: Values of R_{mod} and R2

Load Modulation Amplitude	Freq	H	R2	R_{mod}
13.1 mV	15MHz	2 A/m	705 Ω	1.118 kΩ
13.1 mV	15MHz	2.5 A/m	525 Ω	1.047 kΩ
13.1 mV	15MHz	3 A/m	437 Ω	0.966 kΩ
13.1 mV	15MHz	3.5 A/m	370 Ω	0.898 kΩ
13.1 mV	15MHz	4 A/m	320 Ω	0.845 kΩ
13.1 mV	15MHz	4.5 A/m	285 Ω	0.800 kΩ
13.1 mV	15MHz	5 A/m	255 Ω	0.765 kΩ
13.1 mV	15MHz	5.5 A/m	230 Ω	0.745 kΩ
13.1 mV	15MHz	6 A/m	210 Ω	0.732 kΩ
13.1 mV	18MHz	2 A/m	5.1 kΩ	4.670 kΩ
13.1 mV	18MHz	2.5 A/m	703 Ω	1.376 kΩ
13.1 mV	18MHz	3 A/m	510 Ω	1.045 kΩ
13.1 mV	18MHz	3.5 A/m	380 Ω	0.941 kΩ
13.1 mV	18MHz	4 A/m	320 Ω	0.880 kΩ
13.1 mV	18MHz	4.5 A/m	285 Ω	0.825 kΩ
13.1 mV	18MHz	5 A/m	255 Ω	0.785 kΩ
13.1 mV	18MHz	5.5 A/m	230 Ω	0.760 kΩ
13.1 mV	18MHz	6 A/m	210 Ω	0.740 kΩ

Notes:

- These resistor values are nominal values and SHALL be used as a guideline when adjusting R2 and R_{mod}.
- V_{DC} SHALL be measured using reference e-Passport when no 847 KHz switching signal is applied to the probe.

2.7 Report

The test report SHALL include the number of passed tests versus the total number of tests. A description of each test, the information if the test was pass or fail, the number of different samples and the date of the tests SHOULD be included.

3 Layer 2 tests

3.1 Operating field strength test (Types A and B)

Test description: The purpose of this test is to check if the PCD meets the energy performance requirements according to [R5] (chapter 6.2) and [R10] (chapter 8.1). To include a margin of 0.5 A/m to the ISO limits, the field strength under loaded conditions SHALL be between 2.0 A/m (1.5 + 0.5) and 7.0 A/m (7.5 - 0.5) at all measurement positions defined in chapter 2.5. As a measurement device, the Reference e-Passport for field and power measurements defined in [R10], Annex D SHALL be used.

Additionally, the value of V_{DC} SHOULD be recorded for all positions. These values are required for the load amplitude modulation test in chapter 3.2.

For H_{min} perform the following steps:

1. Adjust the resonance frequency of the Reference e-Passport to **15 MHz** as described in [R12] (8.1.2).
2. Put the Reference e-Passport into the ISO test PCD assembly.
3. Adjust the resistor R2 to get a V_{DC} of 6 V at field strength of 2 A/m.
4. At any measurement position defined in chapter 2.5 the V_{DC} SHALL be greater or equal to 6 V.

For H_{max} perform the following steps:

1. Adjust the resonance frequency of the Reference e-Passport to **18 MHz** as described in [R12] (8.1.2).
2. Put the Reference e-Passport into the ISO test PCD assembly.
3. Adjust the resistor R2 to get a V_{DC} of 6 V at field strength of 7 A/m.
4. At any measurement position defined in chapter 2.5 the V_{DC} SHALL be less or equal to 6 V.

Modifications are done according:

- Reference: ISO/IEC 14443-2 [R5] (chapter 6.2), Operating field strength H_{min} - H_{max}
- Reference: ISO/IEC 10373-6 [R10] (chapter 8.1), PCD field strength H_{min} - H_{max}

Conditions:	Minimum number of samples:	1
Parameters:	Measurement position:	As defined in chapter 2.5
	Bit rate:	fc/128
	Temperature:	-10 °C, RT, 50 °C (see restriction in chapter 2.4 “Nominal Values”)
	Reference e-Passport resonance frequency:	15 MHz, 18 MHz

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

Notes:

- This test includes field strength and power measurements, see [R10] (chapter 8.1 and 8.2).
- H_{min} and H_{max} values are defined to keep a margin to the field strength range for the e-Passport test.
- In addition, the tests recommended by ISO 10373-6 MAY be performed using 13.56 MHz and 19 MHz.

3.2 Load modulation reception test (Type A and B)

An ISO Reference e-Passport for load modulation tests does not give the possibility to test the load modulation amplitude with each PCD. In order to adapt this test, the load-switching signal SHALL be a response to a request command and SHALL be synchronous to a request command as defined in [R12].

Test description:

The purpose of this test is to determine if the PCD is able to receive and demodulate signals with minimum load modulation amplitude. The PCD SHOULD provide a trigger signal (e.g. pulse at beginning or end of PCD command) to the load switching signal source (e.g. an arbitrary waveform generator) to send the response with required timings. The Reference e-Passport defined in chapter 2.6 SHALL be used.

For each measurement position and resonance frequency perform the following steps:

1. Adjust the resonance frequency of the Reference e-Passport to 15MHz as described in [R12], chapter 8.1.2.
2. Put the Reference e-Passport into the Test PCD assembly [R12].
3. Adjust the resistor R2 to get a V_{DC} of 6V at H = 2 A/m field strength according to AM4 [R14].
4. Adjust the resistor R_{mod} to get the required load modulation amplitude of 13.1 mV (for nominal resistor values see Table in chapter 2.6)
5. Put the Reference e-Passport to the measurement position defined in chapter 2.5.
6. Adjust the distance along z axis between the Reference e-Passport and PCD until V_{DC} reaches 6V.
7. Check if the PCD is able to receive and demodulate a valid response with required bit rate (see table below).
8. Repeat steps 2 to 7 where the field strength should be increased in 0.5 A/m steps up to H_{max}
9. Repeat steps 1 to 8 at Reference e-Passport resonance frequency of 18MHz.

Table 5: Communication sequences

Bit rate	PCD command	e-Passport response
fs/128	REQ	ATQ coding & framing according to higher bit rate spec.
fs/64	REQ	ATQ coding & framing according to higher bit rate spec.
fs/32	REQ	ATQ coding & framing according to higher bit rate spec.
fs/16	REQ	ATQ coding & framing according to higher bit rate spec.

Conditions:	Minimum number of samples:	1
Parameters:	Measurement position:	As defined in chapter 2.5
	Bit rate:	fc/128, fc/64, fc/32, fc/16
	Temperature:	-10 °C, RT, 50 °C (see restriction in chapter 2.4 "Nominal Values")
	Reference e-Passport resonance frequency:	15 MHz, 18 MHz
	Load modulation amplitude:	$LMA_{min} = 30/H^{1.2}$ mVpeak
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

Note: For bit rates higher than fc/128, the 'Transmit Pattern and Receive 14443' command as specified in Annex C.1.3.2 MAY be executed by the PCD.

3.3 Modulation index and waveform test

Digital amplitude demodulation SHALL be used for calculating the envelope of the modulated carrier amplitude, e.g. Hilbert transformation. For an example program of the Hilbert transformation, see Annex D.

3.3.1 Type A

This test shall verify if the modulated field of the PCD is complying with the described waveform explained in [R5] (chapter 8.1) and [R8] (8.1). The parameters are rise and fall times, modulation index, and overshoots

Modification done according:

- Reference: ISO/IEC 10373-6/Amd4 [R14](Annex I), Reference PICC for modulation index and waveform test
- Reference: ISO/IEC 14443-2 [R5] (chapter 8.1, 9.1)
- Reference ISO/IEC 14443-2/Amd 1 [R8] (8.1, 9.1)

Test conditions for fc/128 are shown in [R5] (chapter 8.1.2), the test conditions for fc/64, fc/32, fc/16 in [R8] (8.1.2).

Test description: The purpose of this test is to determine the compliance of the PCD regarding waveform shapes. The test SHALL show if the shapes of the modulated field is within the defined limits. The test SHALL be performed according to [R10] (chapter 8.3). The Reference e-Passport for modulation index and waveform test [R14] (Annex I) SHALL be used in addition to the calibration coil. A command with the required bit rate shall be sent by the PCD.

Adjust the resonance frequency of the Reference e-Passport to 16.5 MHz as described in [R12] (8.1.2).

For each measurement position perform the following steps:

1. Put the Reference e-Passport into position defined in chapter 2.1.1.
2. Adjust the resistor R2 to get a V_{DC} of 6 V at current position
3. Check if the waveform shapes are within the specified limits for all bit rates at current position.

Conditions:	Minimum number of samples:	1
Parameters:	Measurement position:	As defined in chapter 2.5
	Bit rate:	fc/128, fc/64, fc/32, fc/16
	Temperature:	-10 °C, RT, 50 °C (see restriction in chapter 2.4 “Nominal Values”)
	Reference e-Passport resonance frequency:	16.5 MHz
Report:	The test report shall include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

Notes:

- For better interoperability, a Reference e-Passport resonance frequency of 15 MHz SHOULD be used.
- For each bit rate, the corresponding table SHOULD be taken in account.
- For bit rates higher than fc/128, the ISO 14443-2 test command as specified in Annex C.1.3.1 MAY be executed with the PCD.

3.3.2 Type B

This test SHALL check if PCD meets the requirements concerning waveform shapes, i.e. rise and fall times, modulation index, and overshoots.

Test description:

The purpose of this test is to determine the compliance of the PCD regarding waveform shapes (see table 36 below). The test SHALL show if the shapes of the modulated field is within the defined limits. The test SHALL be performed according to [R10] (chapter 8.3). The Reference e-Passport for modulation index and waveform test [R14] (Annex I) SHALL be used in addition to the calibration coil. A command with the required bit rate shall be sent by the PCD.

1. Adjust the resonance frequency of the Reference PICC to 16.5 MHz as described in [R12] (8.1.2).

For each measurement position perform the following steps:

2. Put the reference e-Passport into position defined in chapter 2.1.1.
3. Adjust the resistor R2 to get a V_{DC} of 6 V at current position
4. Check at that position if the waveform shapes are within the specified limits for all bit rates, as defined in table below.

The ISO 14443-2 test command as specified in Annex C.1.3.1 MAY be executed with the PCD.

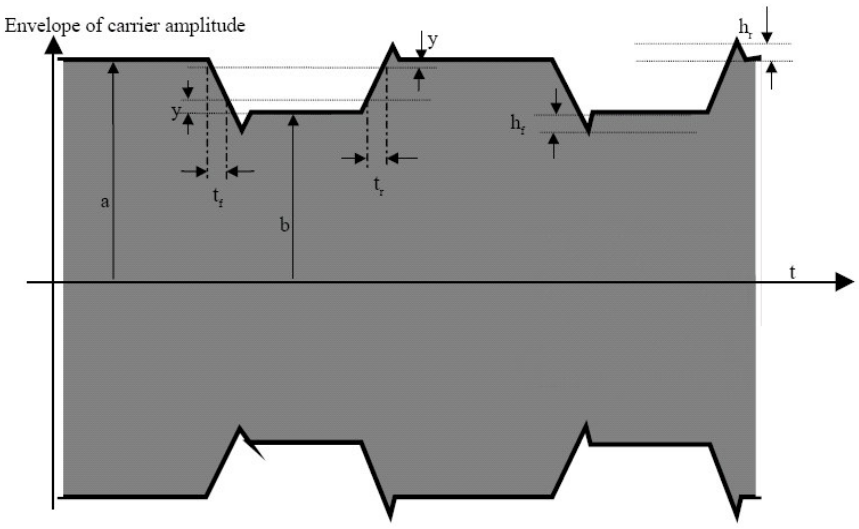

Figure 2: Envelope of type B carrier amplitude

Table 6: Waveform shape requirements

Parameter	min	max
m = (a-b)/(a+b)	10 %	14 %
t_r, t_f	0 µs	0.8 µs
h_r, h_f	0	0.1(a-b)

Conditions:	Minimum number of samples:	1
Parameters:	Measurement position:	As defined in chapter 2.5
	Bit rate:	fc/128, fc/64, fc/32, fc/16
	Reference e-Passport resonance frequency:	16.5 MHz
	Temperature:	-10 °C, RT, 50 °C (see restriction in chapter 2.4 “Nominal Values”)
Report:	The test report shall include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

Notes:

- For better interoperability a Reference e-Passport resonance frequency of 15 MHz SHOULD be used.
- For bit rates higher than fc/128, the ISO 14443-2 test command as specified in Annex C.1.3.1 MAY be executed with the PCD.
- The higher bit rate requirements of 0.8 µs are sufficient for all bit rates defined here because the higher bit rate of 424 kbps is mandatory for the e-Passport.

4 Layer 3 timing and framing tests

All tests SHALL be performed with one specific field strength between 2 A/m and 7 A/m within the operating volume of the PCD if not further specified.

All tests SHALL be performed at RT if not further specified.

4.1 Frame delay time (Type A only)

4.1.1 Frame delay time SCIC to PCD

This test SHALL check if the PCD can handle a FDT according to [R6]. For this test, the same setup SHALL be used as for the load modulation reception test.

Modification done according:

- Reference: ISO/IEC 14443-3 [R6] (chapter 6.1.3), Frame delay time SCIC to PCD

Test description:	This test SHALL check if a PCD command after a SCIC response is not sent before a minimum frame delay time of 1172/fc after the SCIC has sent ATQ. After ATQ the PCD SHALL send an AC frame.	
Conditions:	Minimum number of samples:	1
Parameters:	Bit rate:	fc/128
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

Note: If possible, this test SHOULD be done for all commands, even during the protocol test.

4.1.2 Frame delay time PCD to SCIC

This test SHALL check if the PCD can handle a FDT according to [R6]. For this test, the same setup SHALL be used as for the load modulation reception test.

Modification done according:

- Reference: ISO/IEC 14443-3 [R6] (chapter 6.1.2), Frame delay time PCD to SCIC

Test description: This test SHALL check if the PCD is able to receive a SCIC response within the FDT limits.

Table 7: FDT limits

Last Bit	Min FDT	Max FDT
0	1172/fc	1172/fc + 0.4 µs
1	1236/fc	1236/fc + 0.4 µs

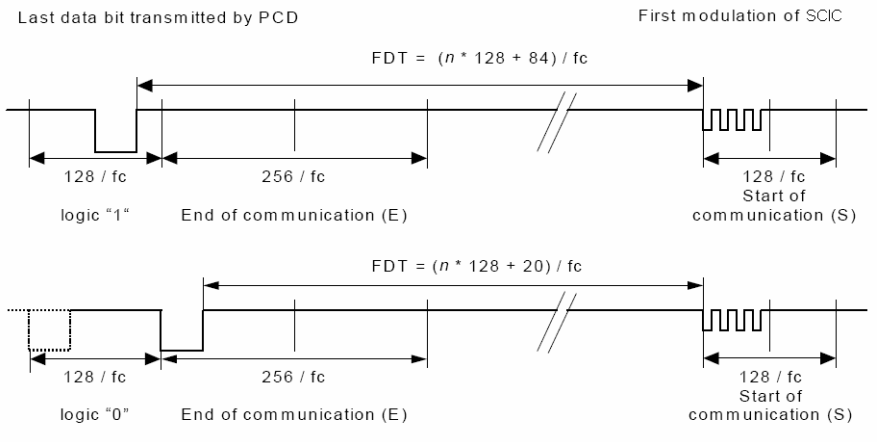

Figure 3: Frame Delay Time

Conditions: Minimum number of samples: 1

Parameters: Bit rate: fc/128

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

Note:

- The test SHALL be done for a REQA/WUPA command and SHOULD be carried out with other commands, too (see [R9]).
- In order to improve interoperability, the following values SHOULD be used (ISO limits ± 1 carrier period):

Table 8: Parameters for improved interoperability

Last Bit	Min FDT	Max FDT
0	1172/fc – **1/fc**	1172/fc + 0.4 µs + **1/fc**
1	1236/fc – **1/fc**	1236/fc + 0.4 µs + **1/fc**

4.2 Request guard time (Type A only)

This test SHALL check if the PCD can handle multiple REQA commands according to [R6]. For this test, the same setup SHALL be used as for the load modulation amplitude test.

Modification done according:

- Reference: ISO/IEC 14443-3 [R6] (chapter 6.1.4), Request Guard Time

Test description:	The purpose of this test is to determine the Request Guard Time of two consecutive REQA/WUPA commands.	
Conditions:	Minimum number of samples:	1
Parameters:	Bit rate:	fc/128
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

Note: This test is only relevant for PCD's, which send consecutive REQA/WUPA.

4.3 Bit boundaries (Type B only)

Test description: The purpose of this test is to check whether the PCD meets the bit boundary requirements according to [R9] (7.1.1).

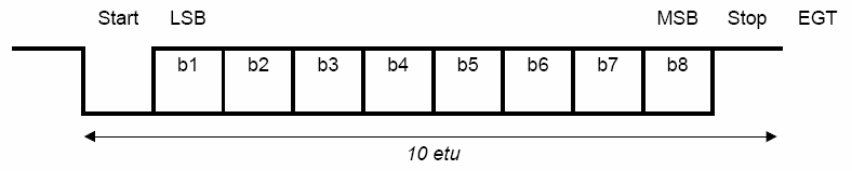

Figure 4: Bit boundary

Conditions:	Minimum number of samples:	1
Parameters:	Bit rate:	fc/128, fc/64, fc/32, fc/16
Report:	The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.	

4.4 Start-of-Frame & End-of-Frame-Timing (SOF & EOF) (Type B only)

Test description: The purpose of this test is to check whether the PCD meets SOF & EOF requirements according to [R6] (chapter 7.1.4 and 7.1.5).

Figure 5: SOF

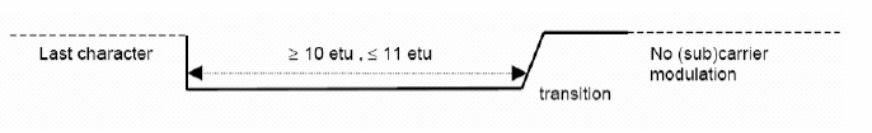

Figure 6: EOF

Conditions: Minimum number of samples: 1

Parameters: Bit rate: fc/128, fc/64, fc/32, fc/16

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

4.5 Extra guard time (EGT) (Type B only)

Test description: The purpose of this test is to check whether the PCD meets the EGT requirements according to [R9] (7.1.2).

Table 9: EGT limits

	min	**max**
EGT	1 etu	6 etu

Conditions: Minimum number of samples: 1

Parameters: Bit rate: fc/128, fc/64, fc/32, fc/16

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

4.6 Timing before SCIC Start-of-Frame (TR0 & TR1) (Type B only)

Test description: The purpose of this test is to check whether the PCD meets the TR0 and TR1 requirements according to [R6] (chapter 7.1.6).

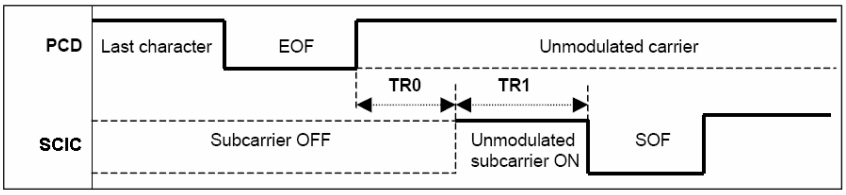

Figure 7: TR0 & TR1

Table 10: TR0 & TR1 limits

	min	max
TR0	64/fs	256/fs
TR1	80/fs	200/fs

Conditions: Minimum number of samples: 1

Parameters: Bit rate: fc/128, fc/64, fc/32, fc/16

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

Note: In order to improve interoperability, the following values SHOULD be used:

Table 11: TR0 & TR1 limits for improved interoperability

	min	max
TR0	60/fs	260/fs
TR1	76/fs	204/fs

4.7 Timing before PCD Start-of-Frame (TR2) (Type B only)

Test description: The purpose of this test is to check whether the PCD meets the minimum TR2 requirements. TR2 limits are tested according to the defect report [R17].

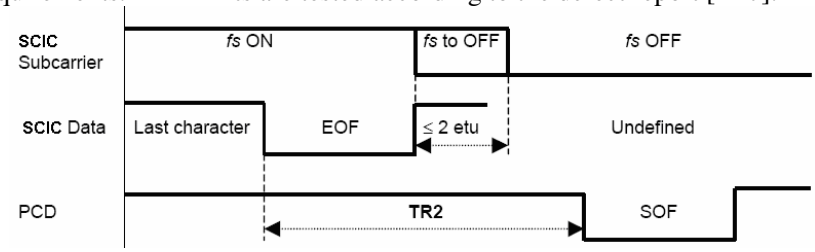

Figure 8: TR2

Table 12: TR2 limits

b3	b2	minimum TR2	maximum TR2
0	0	10etu +32/fs	n/a
0	1	10etu+128/fs	n/a
1	0	10etu+256/fs	n/a
1	1	10etu+512/fs	n/a

The bits b2 and b3 are negotiated in the SCIC ATQB 'Protocol Type' half byte.

Conditions: Minimum number of samples: 1

Parameters: Bit rate: fc/128, fc/64, fc/32, fc/16

Report: The test report SHALL include the number of passed tests versus the total number of tests, a test description, and the number of different samples and the date of the tests.

5 Layer 3 and layer 4 protocol tests

These tests provide a basic set of tests to be performed to check compliance to ISO/IEC 14443 protocol layers. All tests are based on and SHALL be evaluated according to the current ISO 10373-6 standards.

For all test cases, make sure that the physical and electrical tests as mentioned in the chapters above have passed.

Test setup:
Setup as defined for the electrical tests SHALL be used and is afterwards called “test apparatus”. All tests SHALL be performed with one specific field strength between 2 A/m and 7 A/m within the operating volume of the PCD if not further specified.

All tests SHALL be performed at RT if not further specified.

The test apparatus SHALL be able to emulate the protocol, to measure, monitor the timing of the logical Input/Receive line relative to the CLK frequency, and be able to analyze the I/O-bit stream in accordance with the protocol.

The tests are based on the ISO/IEC10373-6/Amd 3 [R13] specification. For the test commands defined in [R13], typical commands SHOULD be used. This could be for example for TEST_COMMAND1 the READ BINARY command. Other commands specified dependent on their expected behaviour might also be used. The command used MAY differ between different products and SHALL be documented in the report.

The functionality as described in clause 2.1.1 “Test setup” SHALL be used either with the final operating system (preferred way) or with dedicated test commands.

5.1 Type A activation

These tests SHALL ensure the start-up and the activation is according to [R6] (chapter 6). These tests are split up to collision handling, the handling of RATS and PPS, and the handling of CID during activation.

5.1.1 Handling of collisions

Test description:	The purpose of this test is to check the correct behaviour on collisions as defined in [R6]. The tests specified in the sub-clause “Handling of bit collision during ATQA” (chapter H.2.3) and “Handling of anticollision loop” (chapter H.2.4) of [R13] SHOULD be used. The detailed test procedure is not specified herein.
Report:	The test report SHALL state whether the response was according to [R6] respectively to [R13] or not. Additionally possible proprietary paths of the “Select sequence flow chart” specified in [R6] (chapter 6.4.1) SHALL not negatively affect the report. The report SHALL include the number of samples tested and the date.

5.1.2 Handling of RATS (including frame size selection)

Test description: The purpose of this test is to check the correct behaviour of RATS and the handling of ATS as defined in [R7] (chapter 5.6.1.1). The tests specified in the sub-clause "Handling of RATS and ATS" (chapter H.2.5) and "Frame size selection mechanism" (chapter H.2.7) of [R13] SHOULD be used. The detailed test procedure is not specified herein.

Report: The test report SHALL state whether the response was according to [R7] respectively to [R13] or not. The report SHALL include the number of samples tested and the date.

5.1.3 Handling of PPS

Test description: The purpose of this test is to check the correct behaviour on handling a PPS response as defined in [R7] (chapter 5.6.2.1). The tests specified in the sub-clause "Handling of PPS response" (chapter H.2.6) of [R13] SHOULD be used. The detailed test procedure is not specified herein.

Report: The test report SHALL state whether the response was according to [R7] respectively to [R13] or not. The report SHALL include the number of samples tested and the date.

5.1.4 Handling of CID during activation

Test description: The purpose of this test is to check the correct behaviour on handling CID during activation as defined in [R7] (chapter 5.6.3). The tests specified in the sub-clause "Handling of the CID during activation by PCD" [R13] (chapter H.2.9) of SHOULD be used. The detailed test procedure is not specified herein.

Report: The test report SHALL state whether the response was according to [R7] respectively to [R13] or not. The report SHALL include the number of samples tested and the date.

5.2 Type B activation

5.2.1 Frame size selection

Test description: The purpose of this test is to check the correct behaviour of the frame size selection mechanism as defined in [R6] (chapter 7.9). The tests specified in the sub-clause "Frame Size Selection Mechanism" (chapter H.3.2) of [R13] SHOULD be used.

Report: The test report SHALL state whether the response was according to the scenario defined in [R13] (chapter H.3.2). The report SHALL include the number of samples tested and the date.

5.2.2 Bit rate selection

Test description:	The purpose of this test is to check the correct behaviour of the bit rate selection mechanism as defined in [R9]. The tests specified in [R15] (Annex K) SHOULD be used.
Report:	The test report SHALL state whether the behaviour was according to [R9] respectively [R15]. The report SHALL include the number of samples tested and the date.

5.2.3 Handling of CID during activation

Test description:	The purpose of this test is to check the correct behaviour on handling CID during activation as defined in [R7]. The tests specified in the sub-clause "Handling of the CID during activation by the PCD" (chapter H.3.3) of [R13] SHOULD be used.
Report:	The test report SHALL state whether the response was according to [R7] respectively to [R13] or not. The report SHALL include the number of samples tested and the date.

5.3 Handling of the polling loop (Type A and B)

Test description:	The purpose of this test is to check the correct behaviour during polling for Type A and Type B SCIC's as defined in [R6] (chapter 5). The test specified in the sub-clause "Handling of the polling loop" of [R13] (chapter H.4.1) SHOULD be used. The detailed test procedure is not specified herein.
Report:	The test report SHALL state whether the response was according to [R6] respectively to [R13] or not. The report SHALL include the command set used for testing.

5.4 Data exchange protocol tests (Type A and B)

Data exchange protocol tests SHALL ensure the logical operation of the PCD is according to [R7]. These tests are valid for both, Type A, Type B whereas the activation before running these tests is different, and listed below. All tests are based on the currently available standards.

The activation for Type A SHALL be:

1. Configuration to emulate Type A protocol
2. Activation according to [R6] (Request, Anticollision loop, Select)
3. Activation according to [R7] (RATS, optional PPS)

The activation for Type B SHALL be:

1. Configuration to emulate Type B protocol

2. Activation according to [R6] (Request, Attrib, optional Slot-marker)

5.4.1 Error detection and recovery

The purpose of this test is to check the behaviour of PCD when transmission errors occur according to [R7] (chapter 7.5). These tests specified in [R13] cover standard communication blocks, blocks where the PCD uses chaining and blocks where the SCIC uses chaining.

The SCIC chaining tests could be performed without knowing dedicated command behaviour on the device under test. Any command could be divided into two parts e.g. the response to a READ BINARY could be sent in two chained packets.

The PCD chaining is harder to achieve. If the higher layer functionality is not known in detail or a chaining command is not used in the application these tests could not be performed. Therefore, it is optional.

Test description:	The purpose of this test is to check the behaviour of the PCD when transmission errors occur as defined in [R7] (chapter 7.5). The test specified in the sub-clause “Error detection and recovery” of [R13] (chapter H.4.3) SHOULD be used. The detailed test procedure is not specified herein.
Report:	The test report SHALL state whether the response was according to [R7] respectively to [R13]. The report SHALL include the command set used for testing.

5.4.2 Request for waiting time extension

Test description:	The purpose of this test is to check the behaviour of the PCD when the SCIC use a request for waiting time extension as defined in [R7] (chapter 7.3). The test specified in the sub-clause “Reaction of the PCD to request for waiting time extension” of [R13] (chapter H.4.2) SHOULD be used. The detailed test procedure is not specified herein.
Report:	The test report SHALL state whether the response was according to [R7] and [R13]. The report SHALL include the command set used for testing.

Annex A Measurement points

Table 13: Application specific measurement points

Application	Reader design type		Volume definition			Measurement points	
			X dimension	Y dimension	Z dimension	X-Y-plane	Height
ePassport	1	Single step readers[1]	Twice ID3 + 20 % (of ID3) for the size of an open passport booklet (ID3) enlarged by 10 %	Size of a passport booklet (ID3) enlarged by 10 %	7.5 mm	All four corners of both connected ID 3 + 10 % fields, additionally in the centre of both fields	Z_0 = 0 mm; Z_1 = 7.5 mm; Z_{max} as specified by manufacturer (if Z_{max} > 7.5 mm)
ePassport	1a	Similar to reader design type 1, but the two parts of the volume are arranged angularly, not in-line					
ePassport	2	Full page readers[2]	ID3 + 10 % for the size of a passport booklet (ID3) enlarged by 10 %	Size of a passport booklet (ID3) enlarged by 10 %	7.5 mm	All four corners of the ID 3 + 10 % field, additionally in the centre of the field	Z_0 = 0 mm; Z_1 = 7.5 mm; Z_{max} as specified by manufacturer (if Z_{max} > 7.5 mm)

[1] Document readers that are able to read the entire data page of an opened passport and that are able to read the data from the SCIC without any replacement of the passport on the reader, independently from the location of the chip inside the passport document (i.e., front cover, back cover, data page, middle page)

[2] Document readers that are able to read the entire data page of an opened passport as well as the data contained in the SCIC. A replacement of the passport may be required.

Application	Reader design type		Volume definition			Measurement points	
			X dimension	Y dimension	Z dimension	X-Y-plane	Height
ePassport	99	Other readers	ID3 +10 % for the size of a passport booklet (ID3) enlarged by 10 %	Size of a passport booklet (ID3) enlarged by 10 %	20 mm	All four corners of the ID 3 + 10 % field, additionally in the centre of the field	Z_0 = 0 mm; Z_1 = 7.5 mm; Z_{max} = 20 mm or as specified by manufacturer (if Z_{max} > 20 mm)

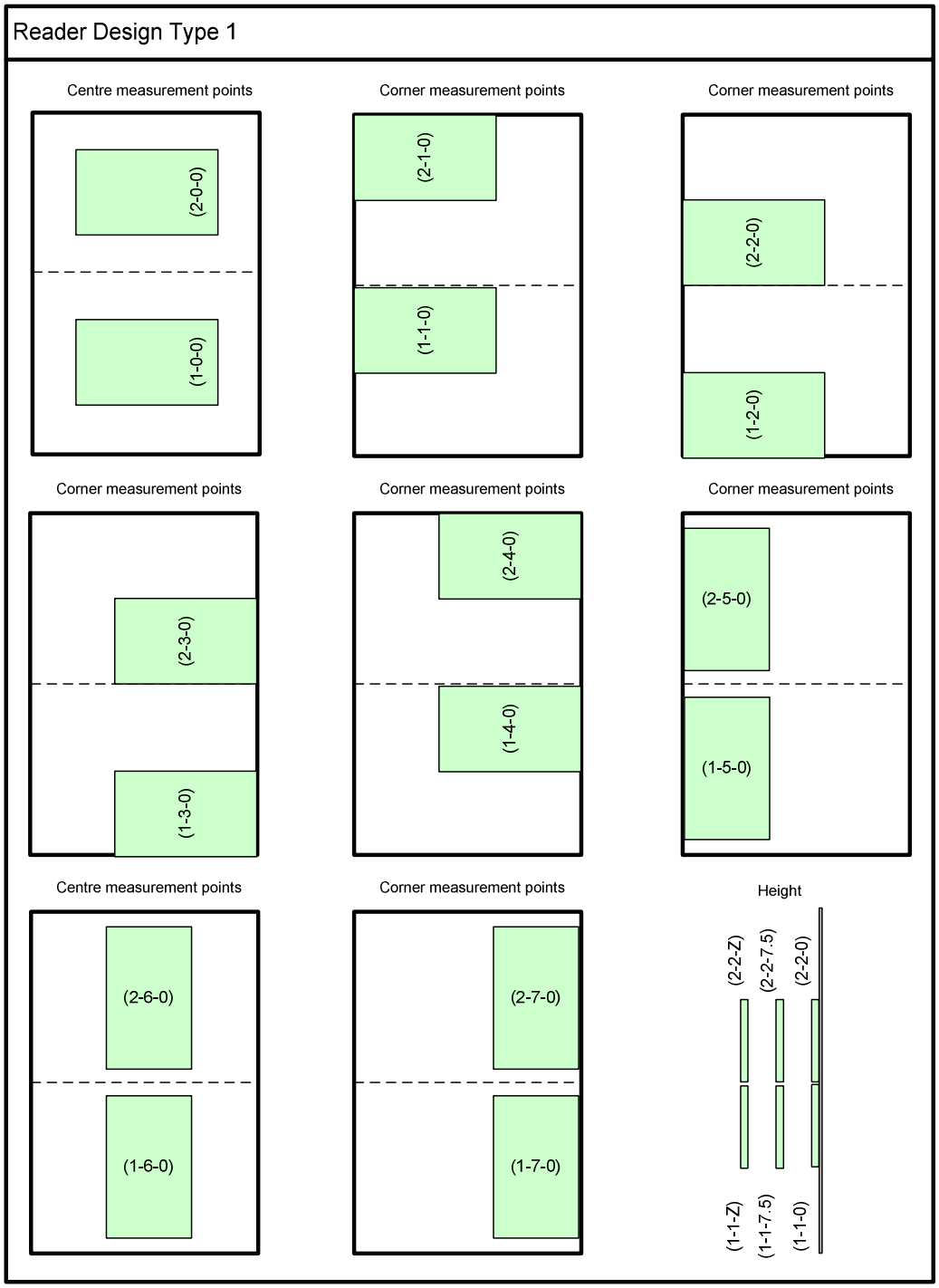

Figure 9: Measurement points e-Passport reader design type 1

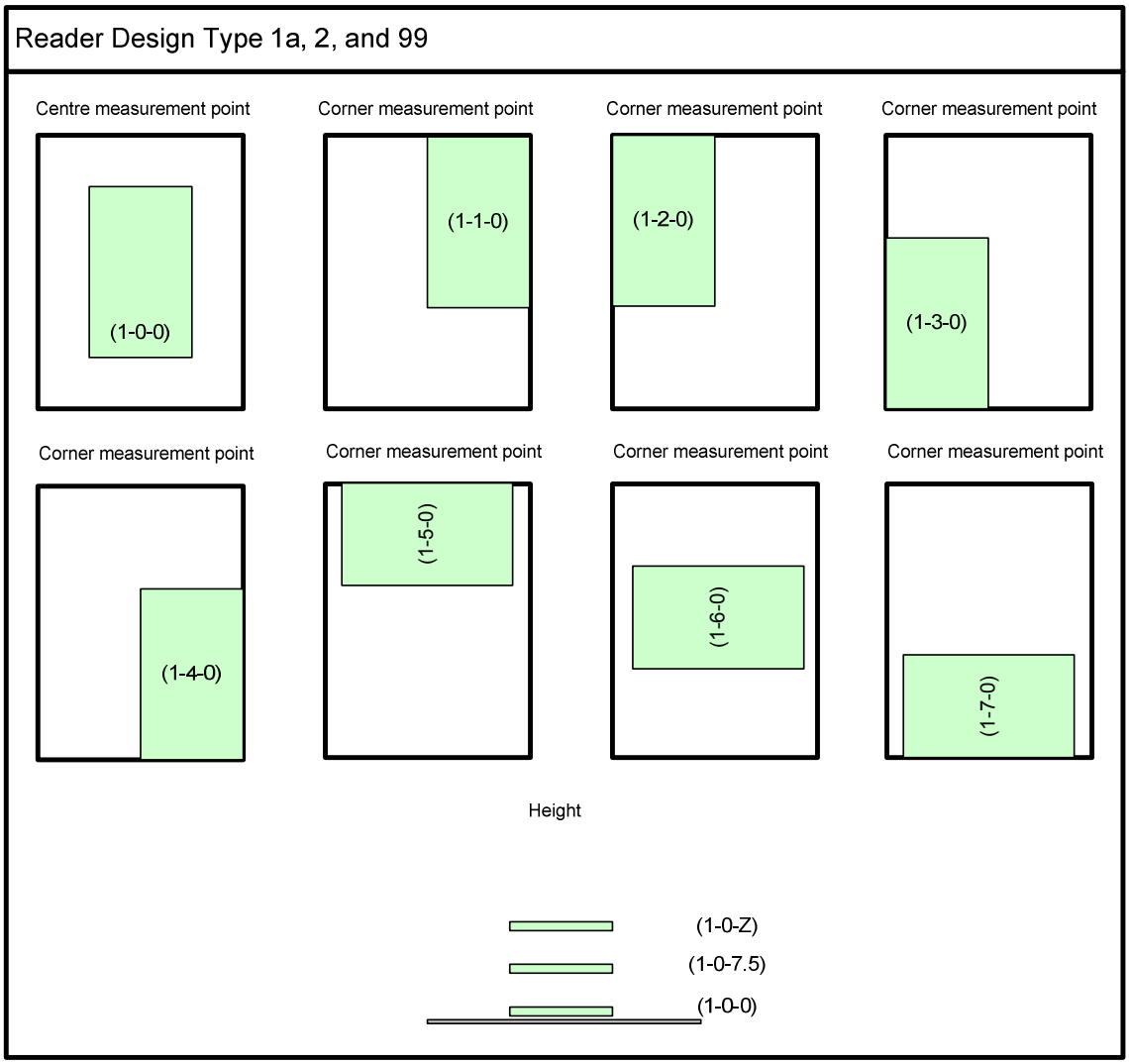

Figure 10: Measurement points e-Passport reader design type 1a, 2, and 99

Annex B Comparison PCD – e-Passport test

Table 14: Comparison PCD – e-Passport Test

ISO Layer	Test description	e-Passport	PCD
1	Coil Dimension Check	Conditional	No
	Static Electricity (ESD) Tests	Yes	No
	X-Ray Tests	No	No
	UV Tests	No	No
	H_{max} (12A/m) Test	Yes	No
2	Load modulation amplitude	Check if the load modulation amplitude is higher than the limit	Check if the PCD is able to handle the whole load modulation amplitude range
	Operating field strength	Check the whole range from 1.5 – 7.5 A/m	Check if the available power of the PCD is in-between 1.5 and 7.5 A/m
	Communication stability	Check the whole range of valid signal shapes, (modulation index, rising- and falling edges, overshoot and timings)	Check if the shape of the modulated field is in-between the valid limits (modulation index, rising- and falling edges, overshoot and timings)
	Threshold resonance frequency	Optional	No
3	Frame Delay Time (Type A)	Check if the response starts after the right time.	Check the whole range, ±200 ns
	Bit Boundaries (Type B)	No	Check if the bit boundaries are within the valid limits.
	Start-of-Frame & End-of-Frame Timings (SOF & EOF) (Type B)	Check if the SOF and EOF timings are within the valid limits.	Check if the SOF and EOF timings are within the valid limits.
	Extra Guard Time (EGT) (Type B)	Check if the EGT timing is within the valid limits.	Check if the EGT timing is within the valid limits.
	Timing Before SCIC Start of Frame (TR0 & TR1) (Type B)	Check if the TR0 & TR1 timings are within the valid limits.	Check if the TR0 & TR1 timings are within the valid limits.
	Timing Before PCD Start of Frame (TR2) (Type B)	Check if the TR2 timing is within the valid limits.	Check if the TR2 timing is within the valid limits.

Annex C Interface definition of TM-PDUs (informative)

C.1.1 Scope

This annex specifies a test management protocol according to ISO10373-6:AM3 [R13] to be applied to an e-Passport reader during conformity evaluations. The test commands, called test management protocol data units (TM-DPU), follow the architecture described in the PC/SC Part 3: Requirements for PC-Connected Interface Devices, Revision 2.01.05.

These test commands are persistent in each certified reader to perform tests in the field as well.

This PC/SC implementation is optional. Using the PC/SC framework, test houses can minimize their efforts to establish the evaluation environment. Reader providers can use universal test applications if there are any.

If a supplier provides a PC/SC implementation, it has to be compliant to the latest released version on the consortium website (http://www.pcscworkgroup.com/specifications/overview.php).

C.1.2 Command syntax and transportation

The structure of the TM-PDUs follows the byte sequential command structure for smart cards, so called APDUs (Application Protocol Data Unit) according to ISO-7618-4. The APDUs are distinguished by their direction, to or from the PCD:

- Command-APDU (C-APDU)
- Response-APDU (R-APDU)

For each C-APDU sent to the PCD by the test application, an R-APDU will be returned as a confirmation. R-APDUs will not be confirmed by the PCD.

C.1.2.1 Command APDU

C-APDUs are byte sequences consisting of two parts: Header and Body.

Table 15: Structure of a C-APDU

<table>
<tr><th colspan="7"><C-APDU></th></tr>
<tr><td colspan="7">Length: 4 ... ((0 … 3) + Lc + (0 … 3))</td></tr>
<tr><td colspan="4">Header
mandatory</td><td colspan="3">Body
[optional]</td></tr>
<tr><td colspan="4">Length: 4</td><td colspan="3">Length: 0 ... ((0 ... 3) + Lc + (0 ... 3))</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5 ... 7</td><td>((5 ... 7) + 1) ...
(Lc + ((5 ... 7) + 1))</td><td>(Lc + ((5 ... 7) + 2)) ...
(Lc + ((5 ... 7) + 2) +
(1 ... 3))</td></tr>
<tr><td rowspan="2">CLA</td><td rowspan="2">INS</td><td rowspan="2">P1</td><td rowspan="2">P2</td><td>[Lc]</td><td rowspan="2">[Data Field
<Lc Bytes of Data>]</td><td>[Le]</td></tr>
<tr><td>Max. Value indicated by
Lc < = 65535</td><td>Max. Value indicated by
Le < = 65536</td></tr>
</table>

The header only (first four bytes) is mandatory. The body is optional and MAY contain data with prior length indicator and/or length indicator for expected R-APDU. The presence depends on the command and application case or context.

C.1.2.2 Response APDU

The response to a C-APDU will be returned in general as R-APDU. Optionally the R-APDU MAY contain data. The two status bytes SW1SW2 are mandatory.

Table 16: Structure of the R-APDU

<R-APDU>		
Body [optional]	**Trailer mandatory**	
Requested Information	Status Word	
Length: 0 ... [<Le> of C-APDU]	Length: 2 Byte	
Position: 1 ... (1 + [<Le> of C-APDU])	Pos.: 1 ... (1 + [<Le> of C-APDU])	Pos.: 2 ... (2 + [<Le> of C-APDU])
[Information Field]	SW1	SW2

The trailer of the R-APDU transports the result of an operation. It has to be interpreted byte wise. SW1 classifies the result in general and SW2 gives an exact value for the indicated error class. The following classes are defined:

Table 17: Return Code Classes

Class (SW1)	**Description**
‘90’	Normal Processing
‘62’, ‘63’, ‘6C’	Warning
‘64’, ‘65’	Execution Error
‘67’ to ‘6F’	Checking Error

The value of SW2 is class specific.

C.1.2.3 Common return codes

Table 18: Common return codes

	SW1	**SW2**	**Description**
Success	‘90’	‘00’	Command successful
Warning	‘6C’	‘XX’	Le and available data are not same; ‘XX’ is the number of available data. If Le= 0x00, all available data is returned.
Error	‘64’	‘00’	Timeout, expecting response from card but no response within the time
	‘64’	‘01’	Internal error

	SW1	SW2	Description
	'67'	'00'	Wrong length
	'68'	'00'	Class byte is not correct
	'6A'	'81'	INS not supported
	'6A'	'82'	Function is not supported
	'6B'	'00'	Wrong parameter P1-P2

C.1.2.4 Command transportation

The commands can be transported via any interface. The applicant SHALL enable the test house to issue the specified test commands.

The applicant MAY provide the test houses with PC/SC drivers. In this case, all commands will be transported using the SCARD_Transmit function.

A reader (or its related driver) can distinct between e-Passport commands and PCD control commands via the class byte. The value 0xFF is reserved for other purposes and can never be used by an ISO compliant e-Passport. Therefore, the test commands can be sent on the same 'channel' as the e-Passport commands. In addition, there is no need for a special function call or address to indicate control commands.

Following this way, existing test equipment can be used to apply reader test commands and real e-Passport commands in parallel for testing.

C.1.3 Commands for testing

The following commands MAY be used to test the PCD.

Note: All RFU bits and bytes described here must be set to 0.

C.1.3.1 ISO 14443-2 test command

This command MAY be used to test the RF interface, the modulation index, framing and coding of the data, transmitted by the PCD. Testing with this command does not mandate the presence of an e-Passport but it MAY be inserted to the field in order to check the mutual induction to the magnetic field.

Table 19: C-APDU for ISO14443-2 Test Command

Command	CLA	INS	P1	P2	LC	Data in	Le
ISO14443-2 Test	0xFF	0x92	xx	RFU	xx	xx	-

Table 20: R-APDU for ISO14443-2 Test Command

Data out	SW1SW2
-	xxxx

Table 21: P1-Subcarrier and Data Coding Parameter

b7	b6	b5	b4	b3	b2	b1	b0	Description
0	0	------						No carrier, RF is turned off
0	1	------						No sub-carrier, just carrier, RF is turned on
1	0	------						Carrier modulated with sub-carrier, if there are some bytes to transmit, Lc = n, n≠ 0
1	1	------						RFU
-----		RFU	0	-------				ISO14443A type transmission *
-----			1	-------				ISO14443B type transmission *
-----				RFU		0	0	Transmission at 106 kbps
-----						0	1	Transmission at 212 kbps
-----						1	0	Transmission at 424 kbps
-----						1	1	Transmission at 848 kbps

Note: * The transmission according to the normal frame, which includes all framing e.g. start bit, stop bit, parity bit, SOF, EOF, CRC etc.

The following table lists the return codes in addition to the common return codes:

Table 22: Return Codes of ISO14443-2 Test Command

SW1SW2	Meaning
'6A83'	Transmission type not supported
'6A84'	Transmission speed is not supported

C.1.3.2 Transmit pattern and receive 14443 command

This command transmits a bit pattern independent from any SCIC command structure and coding. The pattern can be used to measure modulation index, rise and fall times, overshoots etc. This command can be used to test by using a reference e-Passport to receive any pattern by the SCIC.

Table 23: C-APDU for Transmit Pattern and Receive 14443

Command	CLA	INS	P1	P2	LC	Data in	Le
Tx Pattern	0xFF	0x94	xx	xx	xx	Pattern	xx

Table 24: R-APDU for Transmit Pattern and Receive 14443

Data out	SW1SW2
-	xxxx

Table 25: P1 of Transmit Pattern and receive 14443

b7	b6	b5	b4	b3	b2	b1	b0	Description
0	0	0	0	-	-	-	-	RFU
-	-	-	-	-	-	-	0	ISO 14443A type Transceive data coding
-	-	-	-	-	-	-	1	ISO 14443B type Transceive data coding
				xxx			-	No of bits of last byte will be transmitted, 0 means all bits will be transmitted

Note: The data in the 'data in' field is not interrupted; the complete data is sent to the air. No framing, e.g. start bit, stop bit, CRC, SOF, EOF is not added.

Table 26: P2 of Transmit Pattern and Receive (bit rate) 14443

b7	B6	b5	b4	b3	b2	b1	b0	Description
RFU		-	-	-	RFU	0	0	Transmit @106 kbps
		-	-	-		0	1	Transmit @212 kbps
		-	-	-		1	0	Transmit @424 kbps
		-	-	-		1	1	Transmit @848 kbps
		RFU	0	0	-	-	-	Receive @106 kbps
			0	1				Receive @212 kbps
			1	0				Receive @424 kbps
			1	1				Receive @848 kbps

Table 27: Return codes of Transmit Pattern and Receive 14443

SW1SW2	Meaning
'6A83'	Transmission type not supported
'6A84'	Transmission speed is not supported
'6A87'	Different bit rate is not supported
'6A8A'	Modulation index is not supported

C.1.3.3 ISO 14443-3 test command

This command transmits a 14443-3 command and returns the data received from the SCIC.

Table 28: C-APDU for ISO14443-3 Test Command

Command	CLA	INS	P1	P2	LC	Data in	Le
ISO14443-3 Test	0xFF	0x96	xx	xx	xx	xx	xx

Table 29: R-APDU for ISO14443-3 Test Command

Data out	SW1SW2
Response of the card	xxxx

Table 30: P1: Command byte

b7	b6	b5	b4	b3	b2	b1	b0	Description
--			0	ISO 14443A type command				
				0	0	0	1	REQA
				0	0	1	0	WUPA
				0	0	1	1	HLTA
				0	1	0	0	PCD does complete part 3 A type, returns UID+SAK
				1	Anti-collision is handled by user			
					0	0	1	ANTICOLLISION Sel_level 1
					0	1	0	ANTICOLLISION Sel_level 2
					0	1	1	ANTICOLLISION Sel_level 3
					1	0	0	SELECT (Data in field must be 70+ last 4-byte UID + BCC)
				Other values are RFU				
			1	ISO 14443B type command				
				0	0	0	1	REQB (P2 sets the number of slot)
				0	0	1	0	WUPB (P2 sets the number of slot)
				0	0	1	1	HLTB
				0	1	0	0	Slot-MARKER (slot number in P2)
				0	1	0	1	ATTRIB (P2 sets the communication speed)
	xx		----					No of repetitions of the command
x	---		----					0 means set all other parameters to the default value which is not stated in P2. 1 means send all data given in 'Data in' field with the command, P2 has no significance.

Lc: No of bytes has to be sent to the card within this command except the command itself.

Data in: The data byte has to be sent within the command.

Table 31: P2: Coding of Bit rate for ATTRIB command

b7	b6	b5	b4	b3	b2	b1	b0	Description
					RFU	0	0	PCD to SCIC 106 Kbps
						0	1	PCD to SCIC 212 Kbps
						1	0	PCD to SCIC 424 Kbps
						1	1	PCD to SCIC 848 Kbps
		RFU	0	0	--			SCIC to PCD 106 Kbps
			0	1	--			SCIC to PCD 212 Kbps
			1	0	--			SCIC to PCD 424 Kbps
			1	1	--			SCIC to PCD 848 Kbps
CID								Logical card identifier *

Only four cards are supported, for more cards, select option b7 of P1 =1.

Table 32: P2: Coding of Slot number of REQB/WUPB command

b7	b6	b5	b4	b3	b2	b1	b0	Description
RFU					xxx			Number of slot. N = $2^{(b2b1b0)}$; (b2b1b0 = 0 means N = 2^0 = 1)

Table 33: P2: Coding of slot number of Slot-MARKER command

b7	b6	b5	b4	b3	b2	b1	b0	Description
RFU				0	0	0	1	Slot number = 2
				0	0	1	0	Slot number = 3
				..	..	..	..	……..
				1	1	1	1	Slot number = 16

The return codes in addition to the common return codes are listed in the following table:

Table 34: Return codes of ISO14443-3 Test Command

SW1SW2	Meaning
'6A85'	The command is not supported
'6A86'	The repetition is not allowed
'6A87'	Different bit rate is not supported
'6A88'	Requested buffer size is bigger than the PCD buffer size

C.1.3.4 ISO 14443-4 test command

This command transmits a 14443-4 command and returns the data received from the SCIC.

Table 35: C-APDU for ISO14443-4 Test Command

Command	CLA	INS	P1	P2	LC	Data in	Le
ISO14443-4 Test	0xFF	0x98	xx	xx	xx	xx	xx

Table 36: R-APDU for ISO14443-4 Test Command

Data out	SW1SW2
Response of the card**	xxxx

** If there is a card response SW1SW2, this is considered as the 'Response of the card' data, e.g. if a 'select file' command returns '6A82', here the complete R-APDU will be '6A829000', similarly if the card returns '9000', the complete R-APDU will be '90009000'.

Table 37: P1 is structured as follows

b7	b6	b5	b4	b3	b2	b1	b0	Description
RFU						0	0	RATS (Type A only), P2 codes the parameter (FSDI and CID) according to ISO 14443-4
						0	1	PPS (Type A only), P2 codes the communication speed
						1	0	The complete data of 'Data in' field is transmitted to the card, user must add PCB and CID according to T=CL protocol.
						1	1	The complete data of 'Data in' field is transmitted to the card, PCD must take care of the PCB and CID, only I block is allowed in this mode.

P2: Is coded according to P1 or '00'.

Note: CRC is calculated by the PCD and appended to the end of the frame.

Table 38: P2 coded the communication speed for PPS command

b7	b6	b5	b4	b3	b2	b1	b0	Description
					RFU	0	0	PCD to SCIC 106 Kbps
						0	1	PCD to SCIC 212 Kbps
						1	0	PCD to SCIC 424 Kbps
						1	1	PCD to SCIC 848 Kbps
		RFU	0	0	--			SCIC to PCD 106 Kbps
			0	1	--			SCIC to PCD 212 Kbps
			1	0	--			SCIC to PCD 424 Kbps
			1	1	--			SCIC to PCD 848 Kbps
RFU								---

Table 39: P2 coded the Parameter byte of RATS command

b7	b6	b5	b4	b3	b2	b1	b0	Description
FSDI				CID				FSDI is according to the following table

Table 40: Coding of FSDI

FSDI	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'	'8'	'9'-'F'
FSD	16	24	32	40	48	64	96	128	256	RFU

Table 41: Return codes of ISO14443-4 Test Command

SW1SW2	Meaning
'6A87'	Different bit rate is not supported
'6A88'	Requested buffer size is bigger than the PCD buffer size

C.1.3.5 Miscellaneous command

This command can be used for proprietary purposes by the PCD vendor. A separated description has to be added by the vendor.

Table 42: Miscellaneous Command

Command	CLA	INS	P1	P2	LC	Data in	Le
Miscellaneous	0xFF	0x9A	xx	xx	xx	xx	xx

As example to retrieve the PCD information, the command MAY be interpreted as follows:

Table 43: P1 structure of the Miscellaneous Command

b7	b6	b5	b4	b3	b2	b1	b0	Description
0	0	0	0	0	0	0	1	Returns PCD information as requested through P2
0	0	0	0	0	0	1	0	Generate trigger signal for ISO 14443A*
0	0	0	0	0	0	1	1	Generate trigger signal for ISO 14443B*
RFU								Other values are RFU

*Reader manufacturer will provide a description about the trigger signal and the port/pin to acquire it. P2 = '00'.

Table 44: P2 structure of the Miscellaneous Command for P1 = '01'

b7	b6	b5	b4	b3	b2	b1	b0	Description
0	0	0	0	0	0	0	1	Returns vendor name
0	0	0	0	0	0	1	0	Returns vendor ID
0	0	0	0	0	0	1	1	Returns product name
0	0	0	0	0	1	0	0	Returns product ID
0	0	0	0	0	1	0	1	Returns product serial number
0	0	0	0	0	1	1	0	Returns product firmware version
0	0	0	0	0	1	1	1	Returns driver version
0	0	0	0	1	0	0	0	Returns PCD buffer size
0	0	0	0	1	0	0	1	Returns maximum bit rate supported by PCD
RFU								Other values are RFU

Note: All return values are in ASCII string format.

Table 45: Return codes of the Miscellaneous Command

SW1SW2	Meaning
'6A89'	Information not available
'6A90'	Trigger signal is not supported

Annex D Hilbert transformation (informative)

Example program for the evaluation of the waveform and modulation index:

The following programs written in C language extract the envelope of the modulated carrier using Hilbert transformation.

```
/ * * *                                                                          * * * /
/ * * * This program extract the envelope of modulated carrier                   * * * /
/ * * * Input:                                                                   * * * /
/ * * * File in text  format containing a table of two columns                   * * * /
/ * * * (time and test PCD output voltage vd)                                    * * * /
/ * * *                                                                          * * * /
/ * * * Data format of input-file:                                              * * * /
/ * * *                                                                          * * * /
/ * * * One data-point per line,                                                * * * /
/ * * *                                                                          * * * /
/ * * * {time[seconds], sense-coil-voltage[volts])                              * * * /
/ * * *                                                                          * * * /
/ * * *  Data-points shall be equidistant time                                   * * * /
/ * * * Minimum sampling rate: 100 MSamples/second                              * * * /
/ * * * example for spreadsheet file (start in next line):                      * * * /
/ * * * (time)          , (voltage )                                            * * * /
/ * * * 3.00000e-06,1.00                                                        * * * /
/ * * * 3.00200e-06,1.01                                                        * * * /
/ * * *                                                                          * * * /
/ * * * Run:                                                                    * * * /
/ * * * hilberttransformation Filename.txt                                      * * * /
/ * * * or                                                                       * * * /
/ * * * hilberttransformation  (default file name input.txt)                     * * * /
/ * * *                                                                          * * * /
/ * * *                                                                          * * * /
/ * * * Description:                                                            * * * /
/ * * *        HilbertTransformation.c--- Main program for extracting envelope  * * * /
/ * * *        fftrm.c --- Code to perform fourier and inverse fourier           * * * /
/ * * *        transformation                                                    * * * /
/ * * *        fftrm.h --- Header file for fftrm.c                               * * * /
/ * * *                                                                          * * * /


/*****************************************************************************/
/*HilberTrnsformation.c                                                      */
/*Main program                                                               */
/*****************************************************************************/


# include <stdio.h>
# include <math.h>
# include <malloc.h>
#include <ctype.h>
#include <string.h>
# include "fftrm.h"

#define MAX_POINT 5000
#define M_PI 3.14159265358979323846264338327795

int debug=0;
int fftdebug=0;

double *Gvalue;
double *Gtime;
double *Gr;
double *Gi;
double **G; /*Phase Changed*/
double *Gc;
doublecomplex *Gt_ifft;


/*File containing the input data*/

char *InputFileName     ="input.txt"  ;

/*This function reads the sampled data recorded in the file*/
int ReadData(void);
/*This function function performs the fourier transform*/
void Fft(void);
/*This function performs the necessary phase shift*/
```

```
void PhaseShifting(void);
/*This function performs the inverse fourier transfor*/
void Ifft(void);
/*Envelope reconstruction is done by this function*/
int EnvelopeReconstruction(void);

/*For fourier and inverse fourier transformation these two functions are used */
/*These functions are defined in fftrm.c                                      */
int zffts ( int debug,doublecomplex *X,int M );  /*Defined in fftrm.c*/
int ziffts( int debug,doublecomplex *X,int M );  /*Defined in fftrm.c*/


int SampledPoints=0;
int N;
int row;
const int col=2;

int ReadData(void)
{
        float a,b;
        int i=0,num1;
        FILE *fp1;
        i=0;

        if ((fp1 = fopen(InputFileName,"r")) == NULL)
        {
                printf("Cannot open input file.\n");
                return 1;
        }


        printf("\nReading data from file ... ... ...%s\n",fp1);

        while(!feof(fp1))
        {

                 fscanf(fp1,"%e,%e\n", &a, &b);

                 Gtime[SampledPoints]  = a;
                 Gvalue[SampledPoints] = b;
                 SampledPoints++;
                 if (SampledPoints>= MAX_POINT) break;

        }

        fclose(fp1);

        fp1=fopen("inputfile.txt","w");
    if (!fp1)
        {
         fprintf(stdout,"Cann't write the sampled data in inputfile.txt. \n");

                return 1;

        }
    for(i=0; i<SampledPoints; i++)
         fprintf(fp1,"%e\n",Gvalue[i]); /*Gtime[i] has been omitted*/
    fclose(fp1);

        if(debug)
        {
        fp1=fopen("inputtime.txt","w");
    if (!fp1)
        {
         fprintf(stdout,"Cann't write the sampled data in inputtime.txt. \n");

                return 1;

        }
    for(i=0; i<SampledPoints; i++)
         fprintf(fp1,"%e\n",Gtime[i]); /*Gtime[i] has been omitted*/
    fclose(fp1);
        }

        if(debug)
        {
        if((fp1=fopen("inputfile.bin","wb"))!=NULL)  {
                num1=fwrite(Gvalue,sizeof(double),SampledPoints,fp1);
        fclose(fp1);
        }
        }

        if(SampledPoints<N)
        {
```

```
                for(i=SampledPoints;i<=N;i++)
                {
                        Gvalue[i] = 0;
                }
        }

        fprintf(stdout,"\nInput file name = %s\n",InputFileName);
       fprintf(stdout,"Number of sampled data = %d\n",SampledPoints);
        return 0;

}/*End Of Function ReadData;*/


void Fft(void)
{
        doublecomplex *Gt_freq;

        FILE *fp1,*fp2,*fp3;
        int k,num1,num2,num3,z1;

        Gt_freq = (doublecomplex *)calloc(sizeof(doublecomplex),row);

        printf("\nPerforming FFT ... ... ...\n");

        /* FFT Procedure Starts for Sampled Data*/
        for(k=0;k<=N;k++){
                RE(Gt_freq[k])=Gvalue[k];
                IM(Gt_freq[k])=0.0;
        }

        if(debug){
                if((fp3=fopen("f.bin","wb"))!=NULL) {
                num3=fwrite(Gvalue,sizeof(double),row,fp3);
                fclose(fp3);
                }
        }

        z1=zffts(fftdebug,Gt_freq,row);/*FFT is done in spatial coordicate*/

        for (k=0;k<=N;k++)  {
                Gr[k]=RE(Gt_freq[k]);
                Gi[k]=IM(Gt_freq[k]);
        }
  /* FFT Procedure Ends for Sampled Data*/

  /* Writing The Real And Imaginary Part Of Reflected Part for Debuging*/
  /* Writing the real part of sampled data*/

        if(debug) {
                if((fp1=fopen("Gr.bin","wb"))!=NULL){
                        num1=fwrite(Gr,sizeof(double),row,fp1);
                        fclose(fp1);
                }
                else
                        fprintf(stdout,"Cann't Open Gr.bin");

                // Writing the img part of sampled data
                if((fp2=fopen("Gi.bin","wb"))!=NULL)  {
                        num2=fwrite(Gi,sizeof(double),row,fp2);
                        fclose(fp2);
                }
                else
                        fprintf(stdout,"Cann't Open Gi.bin");
                fprintf(stdout,"Num of Real Part Data after FFT  = %d\n",num1);
                        fprintf(stdout,"Num of Img  Part Data after FFT  = %d\n",num2);
        }

  free(Gt_freq);

}/* End Of The Function Fft */


void PhaseShifting(void)
{
        double *tempr, *tempi;
        int k,num1;
        FILE *fp1;

        printf("\nPerforming phase shift  ... ... ...\n");

        tempr = (double *)calloc(sizeof(double),row);
        tempi = (double *)calloc(sizeof(double),row);

        for ( k=0; k<=N; k++ )
```

```
        {
                tempr[k]=Gr[k];
                tempi[k]=Gi[k];
        }

        for ( k=0; k<=ceil(N/2); k++ )
        {
                Gr[k] =  tempi[k];
                Gi[k] = -tempr[k];
        }

        for ( k=(int)ceil(N/2)+1; k<=N; k++ )
        {
                Gr[k] = -tempi[k];
                Gi[k] = tempr[k];
        }

        if(debug){
                if((fp1=fopen("ffrpt.bin","wb"))!=NULL)      {
                        num1=fwrite(Gr,sizeof(double),row,fp1);
                        fclose(fp1);
                }
                if((fp1=fopen("ffipt.bin","wb"))!=NULL)      {
                        num1=fwrite(Gi,sizeof(double),row,fp1);
                        fclose(fp1);
                }
        }

        free (tempr);
        free (tempi);
}/*End of PhaseShift() function*/


void Ifft(void)
{
        double *Gt_tmp; /* It takes the real part of R_ifft*/
        double *Gt_tmpi;
        FILE *fp1;
        int k,i,z1,num1;

        Gt_tmp   = (double *)calloc(sizeof(double),row);
        Gt_tmpi   = (double *)calloc(sizeof(double),row);

        printf("\nPerforming IFFT ... ... ...\n");

        for (k=0;k<=N;k++){
                Gt_ifft[k].r=Gr[k];
                Gt_ifft[k].i=Gi[k];
        }

        z1=ziffts(fftdebug,Gt_ifft,row);/*IFFT of the signal in spatial coordinate*/

        printf("\nEnd of IFFT ... ...\n");

        for (k=0;k<=N;k++)  {
                Gt_tmp[k]=Gt_ifft[k].r;
        }

        if(debug){
        fp1=fopen("ifft.txt","w");
    if (!fp1)
         fprintf(stdout,"Cann't write in %s\n",fp1);
    for(i=0; i<=N; i++)
         fprintf(fp1,"%.4e\n",(Gt_ifft[i].r));
    fclose(fp1);
    }

        printf("\nPerforming IFFT writing... ... ...\n");

        if(debug){
                if((fp1=fopen("iffrpt.bin","wb"))!=NULL)     {
                        num1=fwrite(Gt_tmp,sizeof(double),row,fp1);
                        fclose(fp1);
                }
                if((fp1=fopen("iffipt.bin","wb"))!=NULL)     {
                        num1=fwrite(Gt_tmpi,sizeof(double),row,fp1);
                        fclose(fp1);
                }
        }

  free(Gt_tmp );
  free(Gt_tmpi );
}/* End Of Function Ifft*/
```

```
int EnvelopeReconstruction(void)
{
	FILE *fp1;
	int k;

	doublecomplex *G;	/*Input signal readed from input file in complex form*/
	doublecomplex *Ganalytical;/*Analytical function of our input signal*/

	double *test;
	double *sqrtr;
	double *sqrti;

	G = (doublecomplex *)calloc(sizeof(doublecomplex),row);
	Ganalytical = (doublecomplex *)calloc(sizeof(doublecomplex),row);

	test = (double *)calloc(sizeof(double),row);
	sqrtr=(double *)calloc(sizeof(double),row);
	sqrti=(double *)calloc(sizeof(double),row);

	printf("\nPerforming envelope extraction ... ... ...\n");

	for (k=0;k<=N;k++){
		RE(G[k]) = Gvalue[k];
		IM(G[k]) = 0.0;
	}

	for (k=0;k<=N;k++){
		RE(Ganalytical[k])=G[k].r;
		IM(Ganalytical[k])=Gt_ifft[k].r;
	}

	for (k=0;k<=N;k++){

	sqrtr[k]=sqrt(Ganalytical[k].r*Ganalytical[k].r+Ganalytical[k].i*Ganalytical[k].i);

	}
		fp1=fopen("output.txt","w");
		if (!fp1)
		{
			fprintf(stdout,"Cann't write extracted envelope in output.txt.\n");
			free(G);
			free(Ganalytical);
			free(test);
			free(sqrtr);
			free(sqrti);
			return 1;
		}
		for(k=0; k<SampledPoints; k++)
			fprintf(fp1,"%e,%e\n",Gtime[k],sqrtr[k]);

		printf("\nExtracted envelope is written in %s\n","output.txt");
		fclose(fp1);

	free(G);
	free(Ganalytical);
	free(test);
	free(sqrtr);
	free(sqrti);
	return 0;
}

/*Main Function*/

int main(int argc, char *argv[])
{
	int status=0,i=1;
	char fname[256],c;

	if(argc==2)
	{
		printf("\nInput File Name: ");
		//scanf("%s,InputFileName");
		strcpy(fname, argv[1]);
		InputFileName= fname;
		printf("%s\n",InputFileName);
	}
	else
	{
	printf("\nUse default file : %s\n", InputFileName);

	}

	//Reading the sampled data
```

```
        do
        {
                N=(int)pow(2,i)-1;
                i++;

        }while (MAX_POINT > N);

        if (debug)
        {
        printf("N= %d\n",N);
        }

        row=N+1;

        Gvalue = (double *)calloc(sizeof(double),row);
        Gtime  = (double *)calloc(sizeof(double),row);
        Gr     = (double *)calloc(sizeof(double),row);
        Gi     = (double *)calloc(sizeof(double),row);
        Gt_ifft= (doublecomplex *)calloc(sizeof(doublecomplex),row);
        Gc     = (double *)calloc(sizeof(double),row);

        status = ReadData();
        if (status== 1) goto MainExit;
        /*Does FFT*/
    Fft();
        /*Appropriate Phahe has been Shifted*/
    PhaseShifting();
        /*Does IFFT*/
     Ifft();
        /*Envelope Reconstruction */
    status = EnvelopeReconstruction();
        if (status== 1) goto MainExit;
        printf("\n\n==================================\n\n");
        printf("Input file name : %s \n",InputFileName);
        //printf("Gvalue[] has the input value\n");
        //printf("sqrtr[] has the output value\n");
        printf("Output file name output.txt\n");
        printf("\n==================================\n\n");

        MainExit:
        free(Gvalue);
        free(Gtime);
        free(Gr);
        free(Gi);
        free(Gt_ifft);
        free(Gc);
        printf("\n\nPress any key to exit.\n");

        scanf("%c",&c);

        return (0);
}/*End Of Main*/



/*******************************************************************************************/
/*fftrm.h                                                                                  */
/*This is the header file for fftrm.c                                                      */
/*******************************************************************************************/

#ifndef FFTRM_H
#define FFTRM_H


#define RE(z) ((z).r)
#define IM(z) ((z).i)

typedef float real;
typedef double doublereal;
typedef struct { real r, i; } complex;
typedef struct { doublereal r, i; } doublecomplex;

int zffts  (int debug, doublecomplex *X, int M);
int ziffts (int debug, doublecomplex *X, int M);
void  zfftrmc(doublecomplex *X, int M, int P, float D);
void rmpo  (int *rv, int *rvp );

#endif


/*******************************************************************************************/
/*fftrm.c                                                                                  */
/*This code contains the necessary function for fourier and inverse fourier transformation*/
/*******************************************************************************************/
```

```
#include <stdio.h>
#include <math.h>
#include <malloc.h>
#include "fftrm.h"
//#ifndef M_PI
#define M_PI 3.14159265358979323846264338327 95
//#endif

float  *WR;
float  *WI;

doublereal  *DWR;
doublereal  *DWI;

void rmpo( int *rv, int *rvp )

{
  int   value_h;
  int   n;

  n       =  1;
  *rvp    = -1;
  value_h =  1;

  while ( value_h > 0 )  {

    value_h = *rv - n;

    (*rvp)++;

    n += n;
  }
}


void  zfftrmc( doublecomplex *X, int M, int P, float D )
{
  int    MV2,MM1,J,I,K,L,LE,LE1,IP,IQ,IND,IND1,R;
  int    I1,J1,IPOTR;

  float  A,B;
  float  WCOS,WSIN;
  float  VR,VI;
  float  ARG;

  static int   IPOTC;
  static float DALT;

  IPOTR = 0;

  DWR = (doublereal *)calloc(M,sizeof(doublereal));
  DWI = (doublereal *)calloc(M,sizeof(doublereal));

/*  if (IPOTC == P & D == DALT) goto warmstart;  */

  IPOTC = P;
  DALT  = (float)D;
  LE    = 1;
  IND   = 0;

  for (L=1;L<=P;L++)  {
    LE1     = LE;
    LE      = LE*2;
    DWR[IND] = 1.0;
    DWI[IND] = 0.0;
    ARG     = (float)M_PI/(float)LE1;
    WCOS    = (float)cos(ARG);
    WSIN    = (float)(D*sin(ARG));

    for (R=1;R<=LE1;R++)  {
      IND1     = IND+1;
      A        = (float)DWR[IND];
      B        = (float)DWI[IND];
      DWR[IND1] = A*WCOS - B*WSIN;
      DWI[IND1] = B*WCOS + A*WSIN;
      ++IND;
    }
  }

  /* warmstart: */

  MV2=M/2;
```

```
  MM1=M-1;
  J=1;

  for (I=1; I<=MM1; I++) {
    if (I >= J)
      goto P1;

    J1     = J-1;
    I1     = I-1;

    VR     = (float)RE(X[J1]);
    VI     = (float)IM(X[J1]);

    RE(X[J1]) = RE(X[I1]);
    IM(X[J1]) = IM(X[I1]);

    RE(X[I1]) = VR;
    IM(X[I1]) = VI;

P1: K      = MV2;
P2: if (K >= J) goto P3;
    J = J-K;
    K = K/2;
    goto P2;
P3: J = J+K;

  }

  IND = 0;
  LE  = 1;

  for (L=1; L<=P; L++)  {
    LE1 = LE;
    LE  = LE*2;

    for (R=0; R<LE1; R++)  {
      WCOS = (float)DWR[IND];
      WSIN = (float)DWI[IND];
      IND  = IND+1;

      for (IQ=R; IQ<M; IQ+=LE)  {

        IP     = IQ+LE1;

        A      = (float)RE(X[IP]);
        B      = (float)IM(X[IP]);

        VR     = A*WCOS - B*WSIN;
        VI     = B*WCOS + A*WSIN;

        RE(X[IP]) = RE(X[IQ]) - VR;
        IM(X[IP]) = IM(X[IQ]) - VI;

        RE(X[IQ]) = RE(X[IQ]) + VR;
        IM(X[IQ]) = IM(X[IQ]) + VI;
      }
    }
  }

  free(DWR);
  free(DWI);
}

/*============================================================================*/
/*___1-D FFT with respect to a spatial coordinate____________________________*/
/*============================================================================*/
int zffts( int debug, doublecomplex *X, int M )
{
  int   P;
  float D;

  D = -1.0;

  rmpo( &M, &P);

  if ( debug ) {
    printf("P = %d\n",P);
    printf("FFT ...\n");
  }

  zfftrmc( X, M, P, D);                                        /* fftrm.c */

  return 0;
}
```

```
/*=============================================================================*/
/*___1-D Inverse FFT with respect to a spatial coordinate_____________________*/
/*=============================================================================*/
int ziffts( int debug, doublecomplex *X, int M )
{
  int   i;
  int   P;
  float D;

  D = 1.0;

  rmpo( &M, &P);

  if ( debug ) {
    printf("P = %d\n",P);
    printf("IFFT ...\n");
  }

  zfftrmc( X, M, P, D);                                    /* fftrm.c */


  /*___Multiply with 1/M____*/

  for (i=0; i<M; i++) {
    RE(X[i]) /= (doublereal)M;
    IM(X[i]) /= (doublereal)M;
  }

  return 0;
}/*End of fftrm.c*/
```