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**Cards and security devices  
for personal identification —  
Communication between contactless  
readers and fare media used in public  
transport —**

**Part 2:  
Test plan for ISO/IEC 14443 (all parts)**

*Cartes et dispositifs de sécurité pour l'identification personnelle —  
Communication entre terminaux et objets sans contact utilisés en  
transport public —*

*Partie 2: Plan de test pour l'ISO/IEC 14443 (toutes les parties)*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html). In the IEC, see [www.iec.ch/understanding-standards](http://www.iec.ch/understanding-standards).

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology, Information technology*, Subcommittee SC 17, *Cards and security devices for personal identification*.

A list of all parts in the ISO/IEC TS 24192 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html) and [www.iec.ch/national-committees](http://www.iec.ch/national-committees).

## Introduction

This test plan represents a necessary step in a process designed to ensure contactless communications interoperability between fare management system terminals and any fare media liable to be accepted by them. The end-purpose of this document is to provide the test conformance plan that needs to be performed to ensure compliancy of fare management system terminals and any fare media in accordance with ISO/IEC TS 24192-1.

This test plan is not designed to repeat or duplicate the referenced specifications and associated test method, essentially ISO/IEC 14443 (all parts) and ISO/IEC 10373-6, but to list the test conditions to be performed in addition to the ones already described in the ISO/IEC 10373-6 and to define their testing and use conditions.

This document comes as a complement to the technical requirements expressed in ISO/IEC TS 24192-1, for ensuring contactless communication interoperability between public transport (PT) devices or between PT devices compliant to ISO/IEC TS 24192-1 and NFC mobiles devices compliant to NFC Forum specifications.

The list of test conditions applicable to the PT device under test is conditioned by the information conformance statement (ICS) declaration made by the device manufacturer. For each test case, the test conditions are clearly specified in order to determine the pertinence to run or not the test case in accordance with the device capabilities or in accordance with the device manufacturer's choice.

In order to facilitate the test report issuance, a test report template is included in [Annex A](#).

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# Cards and security devices for personal identification — Communication between contactless readers and fare media used in public transport —

## Part 2: Test plan for ISO/IEC 14443 (all parts)

### 1 Scope

This document lists all the test conditions to be performed on a PT reader or a PT object in order to ensure that all the requirements specified in ISO/IEC TS 24192-1 are met for the PT device under test.

This document applies to PT devices only:

- PT readers which are contactless fare management system terminals acting as a PCD contactless reader based on ISO/IEC 14443 (all parts);
- PT objects which are contactless fare media acting as a PICC contactless object based on ISO/IEC 14443 (all parts).

This document applies solely to the contactless communication layers described in ISO/IEC 14443 (all parts). Application-to-application exchanges executed once contactless communication has been established at RF level fall outside the scope of this document. However, a test application is used to make end-to-end transactions during tests on the RF communication layer.

This document does not duplicate the contents of ISO/IEC 14443 (all parts) or ISO/IEC 10373-6. It makes reference to the ISO/IEC 10373-6 applicable test methods, specifies the test conditions to be used and describes the additional specific test conditions that can be run.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC/TS 24192-1:2021, *Cards and security devices for personal identification — Communication between contactless readers and fare media used in public transport — Part 1: Implementation requirements for ISO/IEC 14443 (all parts)*

ISO/IEC 10373-6:2020, *Cards and security devices for personal identification — Test methods — Part 6: Contactless proximity objects*

ISO/IEC 14443-1:2018, *Cards and security devices for personal identification — Contactless proximity objects — Part 1: Physical characteristics*

ISO/IEC 14443-2:2020, *Cards and security devices for personal identification — Contactless proximity objects — Part 2: Radio frequency power and signal interface*

ISO/IEC 14443-3:2018, *Cards and security devices for personal identification — Contactless proximity objects — Part 3: Initialization and anticollision*

ISO/IEC 14443-4, *Cards and security devices for personal identification — Contactless proximity objects — Part 4: Transmission protocol*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC TS 24192-1, ISO/IEC 14443-1, ISO/IEC 14443-2, ISO/IEC 14443-3, ISO/IEC 14443-4 and ISO/IEC 10373-6 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC TS 24192-1, ISO/IEC 14443-1, ISO/IEC 14443-2, ISO/IEC 14443-3, ISO/IEC 14443-4 and ISO/IEC 10373-6 apply.

### 5 Description of the test environment

#### 5.1 Test bench

The test bench shall conform to the specifications defined in ISO/IEC 10373-6:2020, Clause 5.

#### 5.2 Tolerances applicable to ambient-environment tests

The ambient temperature and relative humidity shall conform to the specifications defined in ISO/IEC 10373-6:2020, 4.1. The tolerance for minimum and maximum temperatures is  $\pm 3$  °C.

#### 5.3 Test conditions for PCD

Unless otherwise specified:

- test positions and References PICCs as specified in ISO/IEC TS 24192-1:2021, 8.2 shall be used;
- the values defined in ISO/IEC 10373-6:2020, Table 4 shall be used to adjust PCD-test-apparatus parameters.

#### 5.4 Test conditions for PICC

Unless otherwise specified:

- the PICC shall be tested with a field strength of  $H_{\min}$ , 2 A/m, 2,5 A/m, 3,5 A/m, 4,5 A/m, 6 A/m and  $H_{\max}$ ;
- the values defined in ISO/IEC 10373-6:2020, Table 7 shall be used to adjust PICC-test-apparatus parameters.

#### 5.5 Positional tolerance

The positional tolerance shall be better than  $\pm 1$  mm.

#### 5.6 Admissible setup tolerances

Setup tolerances specified in ISO/IEC 10373-6:2020, 4.3 shall be used.

## 6 PCD – Test plan

### 6.1 PCD conformance to ISO/IEC 14443 (all parts)

#### 6.1.1 Tests defined in ISO/IEC 10373-6

Apply ISO/IEC 10373-6:2020, 0.1 with the following:

- Alternating magnetic field test (ISO/IEC 10373-6:2020, Table 0.8) shall be performed with Reference PICC 1 and Reference PICC 3.
- The minimum field strength specified in ISO/IEC TS 24192-1 for range B shall be used instead of  $H_{\min}$  for tests performed within range B with Reference PICC 3.
- Modulation index  $m$  and waveform test (ISO/IEC 10373-6:2020, Table 0.9) shall be performed with:
  - Reference PICC 1 and Reference PICC 2 in Position A1,
  - Reference PICC 3 in Position B1 for IFM readers and Position A1 for common readers,
  - the calibration coil as defined in ISO/IEC 10373-6.
- Phase stability test shall be performed with Reference PICC 1 in Position A1.
- Load modulation reception test (ISO/IEC 10373-6:2020, Table 0.9) shall be performed:
  - at ambient temperature, see [5.3](#);
  - at minimum and maximum temperatures with:
    - Reference PICC 1 in Position A2,
    - Reference PICC 3 in Position B2 for IFM readers and Position A2 for common readers.
- PCD EMD immunity test (ISO/IEC 10373-6:2020, Table 0.9) shall be performed with Reference PICC 1 in Position A1 and Position A2.
- Position A1 shall be used for tests defined in ISO/IEC 10373-6:2020, Table 0.11 and Table 0.12.

#### 6.1.2 RFU bits and values reception test

##### 6.1.2.1 Purpose

This test verifies that the PCD complies with the requirements defined in ISO/IEC 14443 (all parts) on reception of bits and values reserved for future use.

##### 6.1.2.2 Test procedures

Perform the following test procedures.

##### 6.1.2.2.1 Test procedure 1 (ATQA)

Perform the 3 test procedures defined in ISO/IEC 10373-6:2020, H.2.4.3.2, H.2.4.3.3 and H.2.4.3.4, with the following:

- step c), the LT answers with ATQA = 'FFB0' for triple, 'FF70' for double and 'FF30' for single UID size.

##### 6.1.2.2.2 Test procedure 2 (FSCI)

Perform the test procedure defined in ISO/IEC 10373-6:2020, H.2.7.3 with FSCI set to 'D', 'E' and 'F'.

**6.1.2.2.3 Test procedure 3 (SFGI, Type A)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, H.2.8.3 with the following:

- step c), the LT answers with ATS including interface byte TB(1) equal '0F' indicating SFGI = 15;
- step e), the PCD shall send the first I-block after a minimum delay of ~ 302 μs.

**6.1.2.2.4 Test procedure 4 (Maximum Frame Size Code in ATQB)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, H.3.2.3 with the following:

- step c), The LT answers with ATQB. For the purpose of this test the LT returns in the second protocol info byte (see ISO/IEC 14443-3:2018, 7.9.4) the Maximum Frame Size Code set to 'D', 'E' and 'F' in ATQB parameter and indicates compliancy with ISO/IEC 14443-4.

**6.1.2.2.5 Test procedure 5 (SFGI, Type B)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, H.3.2.3 with the following:

- step b), check if the extended ATQB option is supported or not by the PCD (bit 5 of REQW/WUPB PARAM byte);
- step c), if the extended ATQB option is supported by the PCD then the LT answers with ATQB including the optional Extended ATQB byte (optional 4th byte of protocol info field) indicating SFGI = 15;
- step h), the PCD shall send the first I-block after a minimum delay of ~ 302 μs.

**6.1.2.2.6 Test procedure 6 (Protocol\_Type, Type B)**

Place the LT into the PCD operating volume and record the presence and the content of the PCD commands.

Use the following sequence:

- a) The UT performs the activation procedure according to ISO/IEC 10373-6:2020, H.1.9.1.
- b) The LT waits until the PCD sends the REQW/WUPB command.
- c) The LT sends ATQB with Protocol\_Type bit b4 set to (1)b.
- d) The LT checks that the PCD does not continue communicating.

**6.1.2.2.7 Test procedure 7 (WTXM)**

After the protocol activation procedure in accordance with ISO/IEC 10373-6:2020, H.1.9.2 for Type A or ISO/IEC 10373-6:2020, H.1.9.3 for Type B using FWI = 1, perform the test procedure defined in ISO/IEC 10373-6:2020, H.4.3.3 with WTXM set to 0, 60 and 63.

**6.1.2.2.8 Test procedure 8 (FWI)**

After the protocol activation procedure in accordance with ISO/IEC 10373-6:2020, H.1.9.2 for Type A or ISO/IEC 10373-6:2020, H.1.9.3 for Type B using FWI = 15, perform the test procedure defined in ISO/IEC 10373-6:2020, H.4.3.3 with WTXM set to 1, 3 and 59.

**6.1.2.2.9 Test procedure 9 (Bit\_Rate\_capability)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, I.3.2 with Bit\_Rate\_capability byte set to 'FF'.

### 6.1.2.3 Test report

The test report shall state whether the PCD complies with the requirements defined in ISO/IEC 14443 (all parts) on reception of bits and values reserved for future use.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 1](#).

**Table 1 — Result criteria for RFU bits and values reception test**

Explanation	Test result
Only when the PCD complies with ISO/IEC 14443 (all parts) requirements on reception of bits and values reserved for future use in each of the test procedures	PASS
Any other case	FAIL

## 6.2 PCD conformance to ISO/IEC TS 24192-1

### 6.2.1 AFI value sent by the PCD

#### 6.2.1.1 Purpose

This test verifies that the PCD uses an AFI of '00' in at least one REQB/WUPB command in its polling sequence as defined in ISO/IEC TS 24192-1:2021, 8.2 [Rdr4].

#### 6.2.1.2 Test procedure

Perform the test procedure defined in [6.2.3.2](#) to verify that the PCD uses an AFI of '00' in at least one REQB/WUPB command in its polling sequence.

#### 6.2.1.3 Test report

The test report shall state whether the PCD was using an AFI of '00' in at least one REQB/WUPB command in its polling sequence.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 2](#).

**Table 2 — Result criteria for AFI value sent by the PCD test**

Explanation	Test result
Only when the PCD uses an AFI of '00' in at least one REQB/WUPB command in its polling sequence	PASS
Any other case	FAIL

### 6.2.2 PCD Type A time-to-detection

#### 6.2.2.1 Purpose

This test verifies that the PCD detects and selects a Type A Reference PICC entering the field and indicating no SFGT needed, in less than  $t_{\text{detect}}$  on average, regardless of the moment when the Reference PICC is placed within range A or B of the contactless reader.  $t_{\text{detect}}$  value is defined in ISO/IEC TS 24192-1:2021, 8.3 [Rdr5].

#### 6.2.2.2 Test procedure

For apparatus, see ISO/IEC 10373-6:2020, H.1.

Place the LT into the PCD operating volume and record the presence and the content of the PCD commands.

Use the following sequence:

- a) The UT performs the activation procedure according to ISO/IEC 10373-6:2020, H.1.9.1.
- b) The LT is disabled (not sending any response) until the start of timing measurement. If the polling cycle is continuous, the start of timing measurement is a point of time randomly chosen, independently from the PCD polling cycle. If the polling cycle is not continuous, the start of timing measurement is the moment when the polling cycle starts. When enabled, the LT answers to the first valid REQA/WUPA command.
- c) The LT answers relevant anticollision messages and waits until the PCD sends a valid RATS command.
- d) The LT answers with a valid ATS using FDT less than 1 ms. This maximum timing also applies to PPS response in case the PCD sends a PPS command.
- e) The UT sends the SEND\_UT\_APDU(UT\_TEST\_COMMAND2) to the PCD where the data length shall be more than the maximum size of a frame accepted by the LT. If the UT interface delay is not negligible, it may be subtracted from the measurement.
- f) The PCD shall send an I(1)<sub>0</sub> block with its maximum length in accordance with FSCI. The end of timing measurement corresponds to the beginning of the frame containing this I(1)<sub>0</sub> block.
- g) Repeat at least 10 times to get the average value for the Reference PICC time-to-detection.

**6.2.2.3 Test report**

The test report shall give the average value for the Type A Reference PICC time-to-detection.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 3](#).

**Table 3 — Result criteria for PCD Type A time-to-detection test**

Explanation	Test result
Only when the average duration between the moment when the Type A Reference PICC is enabled and the beginning of the first I-block sent by the PCD is less than $t_{detect}$	PASS
Any other case	FAIL

**6.2.3 PCD Type B time-to-detection**

**6.2.3.1 Purpose**

This test verifies that the PCD detects and selects a Type B Reference PICC entering the field and indicating no SFGT needed, in less than  $t_{detect}$  on average, regardless of the moment when the Reference PICC is placed within range A or B of the contactless reader.  $t_{detect}$  value is defined in ISO/IEC TS 24192-1:2021, 8.3 [Rdr5].

**6.2.3.2 Test procedure**

For apparatus, see ISO/IEC 10373-6:2020, H.1.

Place the LT into the PCD operating volume and record the presence and the content of the PCD commands.

Use the following sequence:

- a) The UT performs the activation procedure according to ISO/IEC 10373-6:2020, H.1.9.1.
- b) The LT is disabled (not sending any response) until the start of timing measurement. If the polling cycle is continuous, the start of timing measurement is a point of time randomly chosen,

independently from the PCD polling cycle. If the polling cycle is not continuous, the start of timing measurement is the moment when the polling cycle starts. When enabled, the LT answers to the first valid REQB/WUPB command using an AFI of '00'.

- c) The LT answers with an ATQB not including the optional Extended ATQB byte (optional 4th byte of protocol info field) whatever the Extended ATQB support indicated by the PCD in its REQB/WUPB command.
- d) The PCD shall send a valid ATTRIB command.
- e) The LT sends Answer to ATTRIB command using TR0 less than 1 ms.
- f) The UT sends the SEND\_UT\_APDU(UT\_TEST\_COMMAND2) to the PCD where the data length shall be more than the maximum size of a frame accepted by the LT. If the UT interface delay is not negligible, it may be subtracted from the measurement.
- g) The PCD shall send an I(1)<sub>0</sub> block with its maximum length in accordance with the Maximum Frame Size Code in ATQB indicated by the PICC. The end of timing measurement corresponds to the beginning of the frame containing this I(1)<sub>0</sub> block.
- h) Repeat at least 10 times to get the average value for the Reference PICC time-to-detection.

### 6.2.3.3 Test report

The test report shall give the average value for the Type B Reference PICC time-to-detection.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 4](#).

**Table 4 — Result criteria for PCD Type B time-to-detection test**

Explanation	Test result
Only when the average duration between the moment when the Type B Reference PICC is enabled and the beginning of the first I-block sent by the PCD is less than $t_{\text{detect}}$	PASS
Any other case	FAIL

### 6.2.4 ATQA sent after modulated field

#### 6.2.4.1 Purpose

This test verifies the behaviour of the PCD when receiving modulated field before receiving ATQA as defined in ISO/IEC TS 24192-1:2021, 8.3 [Rdr6].

#### 6.2.4.2 Procedure

Place the LT into the PCD operating volume.

Use the following sequence:

- a) The UT performs the activation procedure according to ISO/IEC 10373-6:2020, H.1.9.1.
- b) The LT waits until the PCD sends a valid REQA/WUPA command.
- c) The LT answers a Type A frame containing more than 1024 bytes.
- d) The LT waits for 5 ms.

NOTE The PCD may perform a field reset before continuation.

- e) The LT waits until the PCD sends a valid REQA/WUPA command.
- f) The LT answers with a valid ATQA.

g) The LT waits until the PCD sends a valid anticollision command according to ISO/IEC 14443-3.

### 6.2.4.3 Test report

The test report shall state whether the PCD correctly detects a Type A PICC after having previously received modulated field.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 5](#).

**Table 5 — Result criteria for handling of bit collision during ATQA**

Explanation	Test result
Only when the PCD sends a valid anticollision command	PASS
Any other case	FAIL

### 6.2.5 ATQB sent after modulated field

#### 6.2.5.1 Purpose

This test verifies the behaviour of the PCD when receiving modulated field before receiving ATQB as defined in ISO/IEC TS 24192-1:2021, 8.3 [Rdr6].

#### 6.2.5.2 Procedure

Place the LT into the PCD operating volume.

Use the following sequence:

- a) The UT performs the activation procedure according to ISO/IEC 10373-6:2020, H.1.9.1.
- b) The LT waits until the PCD sends a valid REQB/WUPB command.
- c) The LT answers a Type B frame containing more than 1024 bytes.
- d) The LT waits for 5 ms.

NOTE The PCD may perform a field reset before continuation

- e) The LT waits until the PCD sends a valid REQB/WUPB command.
- f) The LT answers with a valid ATQB.
- g) The LT waits until the PCD sends a valid ATTRIB command according to ISO/IEC 14443-3.

#### 6.2.5.3 Test report

The test report shall state whether the PCD correctly detects a Type B PICC after having previously received modulated field.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 6](#).

**Table 6 — Result criteria for handling of bit collision during ATQA**

Explanation	Test result
Only when the PCD sends a valid ATTRIB command	PASS
Any other case	FAIL

## 6.2.6 Non-ISO/IEC 14443-4 protocol management by the PCD

### 6.2.6.1 Purpose

This test verifies that the PCD comes back to applications using the ISO/IEC 14443-4 protocol when no suitable application using such a non-ISO/IEC 14443-4 protocol is found as defined in ISO/IEC TS 24192-1:2021, 8.3 [Rdr7].

### 6.2.6.2 Test procedure

For each supported non-ISO/IEC 14443-4 protocol, perform the appropriate protocol activation procedure defined in ISO/IEC 10373-6:2020, H.1.9 with the following:

- the LT answers only to the non-ISO/IEC 14443-4 protocol, until the PCD decides no relevant application is available,
- the LT then enables the ISO/IEC 14443-4 protocol (in addition to the non-ISO/IEC 14443-4 protocol), until the PCD activates the ISO/IEC 14443-4 protocol.

### 6.2.6.3 Test report

The test report shall state whether the PCD comes back to applications using the ISO/IEC 14443-4 protocol when no suitable application using such a non-ISO/IEC 14443-4 protocol is found.

Fill the appropriate row in [Table A.1](#) in accordance with [Table 7](#).

**Table 7 — Result criteria for non-ISO/IEC 14443-4 protocol management by the PCD**

Explanation	Test result
Only when the PCD comes back to applications using the ISO/IEC 14443-4 protocol when no suitable application using such a non-ISO/IEC 14443-4 protocol is found	PASS
Any other case	FAIL

## 7 PICC – Test plan

### 7.1 PICC conformance to ISO/IEC 14443 (all parts)

#### 7.1.1 Tests defined in ISO/IEC 10373-6

Apply ISO/IEC 10373-6:2020, O.2 with the following:

- At ambient temperature, see [5.4](#).
- At minimum and maximum temperatures, PICC operating field strength test and PICC transmission test (ISO/IEC 10373-6:2020, Table O.14) shall be performed at  $H_{\min}$  and  $H_{\max}$ .

#### 7.1.2 Unexpected or RFU bits and values reception test

##### 7.1.2.1 Purpose

This test verifies that the PICC complies with the requirements defined in ISO/IEC 14443 (all parts) on reception of unexpected or RFU bits and values as defined in ISO/IEC TS 24192-1:2021, 9.2 [Obj1].

### 7.1.2.2 Test procedures

In all the following procedures, the PICC behaviour shall be recorded and compared with the requirements defined in ISO/IEC 14443 (all parts). The expected PICC behaviour may not be the one defined in these test procedures.

#### 7.1.2.2.1 Test procedures for PICC Type A

##### 7.1.2.2.1.1 Test procedure 1 (REQA)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.3.3.3.2, REQA row, replacing the REQA by short frames containing all RFU values.

##### 7.1.2.2.1.2 Test procedure 2 (RATS)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.3.3.7.2, RATS row, with all RATS parameter byte RFU values (FSDI and CID RFU values).

##### 7.1.2.2.1.3 Test procedure 3 (PPS0)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.3.3.13.2, PPS row, with all PPS0 RFU values.

##### 7.1.2.2.1.4 Test procedure 4 (PPS1)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.3.3.13.2, PPS row, with all PPS1 values containing any bit b8 to b5 set to (1)b.

##### 7.1.2.2.1.5 Test procedure 5 (CID)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.5.4.2, with all CID field RFU values.

#### 7.1.2.2.2 Test procedures for PICC Type B

##### 7.1.2.2.2.1 Test procedure 1 (REQB)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.4.4.3.2, REQB rows, with all PARAM RFU values (including N RFU values).

##### 7.1.2.2.2.2 Test procedure 2 (ATTRIB Param 1)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.4.4.5.2, ATTRIB row, with all Param 1 RFU values (including minimum TR0 and TR1 RFU values).

##### 7.1.2.2.2.3 Test procedure 3 (ATTRIB Param 2)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.4.4.5.2, ATTRIB row, with all Param 2 RFU values (Maximum Frame Size Code in ATTRIB RFU values).

##### 7.1.2.2.2.4 Test procedure 4 (ATTRIB Param 3)

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.4.4.5.2, ATTRIB row, with all Param 3 RFU values.

**7.1.2.2.2.5 Test procedure 5 (ATTRIB Param 4)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.4.4.5.2, ATTRIB row, with all Param 4 RFU values (including CID RFU value).

**7.1.2.2.2.6 Test procedure 6 (CID)**

Perform the test procedure defined in ISO/IEC 10373-6:2020, G.5.4.2, with all CID field RFU values.

**7.1.2.3 Test report**

The test report shall state whether the PICC complies with the requirements defined in ISO/IEC 14443 (all parts) on reception of unexpected or RFU bits and values.

Fill the appropriate row in [Table A.4](#) in accordance with [Table 8](#).

**Table 8 — Result criteria for RFU bits and values reception test**

Explanation	Test result
Only when the PICC complies with ISO/IEC 14443 (all parts) requirements on reception of unexpected or RFU bits and values in each of the test procedures	PASS
Any other case	FAIL

**7.2 PICC conformance to ISO/IEC TS 24192-1****7.2.1 Field ramp-ups and shut-offs****7.2.1.1 Purpose**

As defined in ISO/IEC TS 24192-1:2021, 9.2 [Obj1], this test checks that a PICC does not shut down or produce incorrect answers regardless of field rise time.

**7.2.1.2 Test procedure**

Re-run the scenario ISO/IEC 10373-6:2020, G.3.2 Scenario G.1: Polling for Type A and/or ISO/IEC 10373-6:2020, G.4.2 Scenario G.21: Polling for Type B replacing steps b) and c) with the following steps:

- b) Decrease the field strength at a rate of 1 A/m/s until 0 A/m. Afterwards keep the RF field off for the minimum time for resetting a PICC (see ISO/IEC 14443-3:2018, 5.2.4).
- c) Increase the field strength at a rate of 1 A/m/s until the initial field strength of step a) is reached.

**7.2.1.3 Test report**

Fill the appropriate row in [Table A.4](#) in accordance with [Table 9](#).

**Table 9 — Result criteria for PICC concerning field ramp-ups and shut-offs**

Explanation	Test result
Only when all steps of the test procedure succeed	PASS
Any other case	FAIL

## Annexe A (informative)

### Test report templates

The templates for registering the test results are defined in [Table A.1](#), [Table A.2](#), [Table A.3](#), [Table A.4](#), [Table A.5](#) and [Table A.6](#).

**Table A.1 — PCD - Test results summary**

Test reference	Test title	Test result (PASS, FAIL or N/A)	Comments when FAIL or N/A
<b>From ISO/IEC 10373-6:2020</b>			
6.1.1	Alternating magnetic field (Table 0.8)		
N/A	Carrier frequency $f_c$ as defined in ISO/IEC 14443-2:2020, 6.2 (Table 0.9)		
7.1.1	PCD field strength (Table 0.9)		
7.1.4	Modulation index $m$ and waveform (Table 0.9)		
7.1.5	Phase stability test		
7.1.6	Load modulation reception for PICC to PCD bit rates of $f_c/128, f_c/64, f_c/32$ and $f_c/16$ (Table 0.9)		
7.1.7	Load modulation reception for PICC to PCD bit rates of $f_c/8, f_c/4$ and $f_c/2$ (Table 0.9)		
7.1.8	PCD EMD immunity test (Table 0.9)		
H.1.7	Measuring timing (Table 0.11)		
8.1.1	PCD EMD recovery test (Table 0.11)		
H.2.1	Frame Delay Time PICC to PCD (Table 0.11)		
H.2.2	Request Guard Time (Table 0.11)		
H.2.3	Handling of bit collision during ATQA (Table 0.11)		
H.2.4	Handling of anticollision loop (Table 0.11)		
H.2.5	Handling of RATS and ATS (Table 0.11)		
H.2.7	Frame size selection mechanism (Table 0.11)		
H.2.8	Handling of Start-up Frame Guard Time (Table 0.11)		
H.2.9	Handling of the CID during activation by the PCD (Table 0.11)		
H.2.10	Handling of parity bit (Table 0.11)		
H.3.2	Frame size selection mechanism (Table 0.11)		
H.3.3	Handling of the CID during activation by the PCD (Table 0.11)		
H.3.4	Frame Delay Time PICC to PCD (TR2) (Table 0.11)		
H.3.5	Handling of Start-up Frame Guard Time (Table 0.11)		
H.3.6	Type B PCD framing tests (Table 0.11)		
H.4.2	Handling of the polling loop (Table 0.11)		
H.4.3	Reaction of the PCD to request for waiting time extension (Table 0.12)		
H.4.4	Error detection and recovery (Table 0.12)		

Table A.1 (continued)

Test reference	Test title	Test result (PASS, FAIL or N/A)	Comments when FAIL or N/A
H.4.5	Handling of NAD during chaining (Table O.12)		
H.5	Continuous monitoring of packets sent by the PCD (Table O.11 and Table O.12)		
Annex I	High bit rate selection (Table O.12)		
L.1.1	Frame format selection (Table O.12)		
L.2.1	Error correction mechanism (Table O.12)		
<b>Defined in this document</b>			
<a href="#">6.1.2</a>	RFU bits and values reception test		
<a href="#">6.2.1</a>	AFI value sent by the PCD		
<a href="#">6.2.2</a>	PCD Type A time-to-detection		
<a href="#">6.2.3</a>	PCD Type B time-to-detection		
<a href="#">6.2.4</a>	Correct detection of a Type A PICC after having previously received modulated field		
<a href="#">6.2.5</a>	Correct detection of a Type B PICC after having previously received modulated field		
<a href="#">6.2.6</a>	Non-ISO/IEC 14443-4 protocol management by the PCD		

Table A.2 — PCD – Analog test results (detailed)

Test reference	Test title	Test conditions						Test result	Comments
		PCD to PICC bit rate	PICC to PCD bit rate	Reference PICC resonance frequency	Temperature	Reference PICC	Measurement positions		
<b>From ISO/IEC 10373-6:2020</b>									
6.1.1	Alternating magnetic field (Table 0.8)	N/A	N/A	19 MHz	Ambient	1	See 6.1.1		
N/A	Carrier frequency $f_c$ as defined in ISO/IEC 14443-2:2020, 6.2 (Table 0.9)	N/A	N/A	N/A	Ambient	N/A	N/A		
7.1.1	PCD field strength (Table 0.9)	N/A	N/A	19 MHz for maximum PCD field strength 13,56 MHz for minimum PCD field strength	Ambient	1	Range A		
						2	Range A		
						3	Range A		
							Range B		
7.1.4	Modulation index $m$ and waveform (Table 0.9)	All supported PCD to PICC bit rates	N/A	16,5 MHz	Ambient	1	Position A1		
						2	Position A1		
						3	Position B1 or Position A1		
						Cal. Coil	Arbitrary position		
7.1.5	Phase stability	N/A	N/A	13,56 MHz	Ambient	1	Position A1		
7.1.6	Load modulation reception for PICC to PCD bit rates of $f_c/128$ , $f_c/64$ , $f_c/32$ and $f_c/16$	One supported PCD to PICC bit rate	All supported PICC to PCD bit rates	N/A	Ambient	1	Range A		
						2	Range A		
						3	Range A		
							Range B		
						1	Position A2		
						3	Position B2 or Position A2		
						1	Position A2		
						3	Position B2 or Position A2		
						1	Position A2		
						3	Position B2 or Position A2		

Table A.2 (continued)

Test reference	Test title	PCD to PCD bit rate	PICC to PCD bit rate	Test conditions			Reference PICC	Measurement positions	Test result	Comments
				PICC to PICC bit rate	Reference PICC resonance frequency	Temperature				
7.1.7	Load modulation reception for PICC to PCD bit rates of $f_c/8$ , $f_c/4$ and $f_c/2$ (Table 0.9)	One supported PCD to PICC bit rate	All supported PICC to PCD bit rates	13,56 MHz	Ambient	1	Range A			
						2	Range A			
						3	Range A			
							Range B			
					1	Position A2				
					3	Position B2 or Position A2				
					1	Position A2				
					3	Position B2 or Position A2				
					Ambient	1	Range A			
						2	Range A			
						3	Range A			
							Range B			
15 MHz	1	Position A2								
	3	Position B2 or Position A2								
	1	Position A2								
	3	Position B2 or Position A2								
Maximum	1	Position A1								
	3	Position A2								
Ambient	1	Position A1								
	3	Position A2								
7.1.8	PCD EMD immunity test (Table 0.9)	One supported PCD to PICC bit rate	$f_c/128$ (~106 kbit/s)	13,56 MHz	Ambient	1	Position A2			
							Position A1			

**Table A.3 — PCD – Protocol and digital test results (detailed)**

Test reference	Test title	Test result (PASS, FAIL or N/A)	Comments when FAIL or N/A
<b>From ISO/IEC 10373-6:2020</b>			
H.1.7	Measuring timing (Table O.11)		
8.1.1	PCD EMD recovery test (Table O.11)		
H.2.1	Frame Delay Time PICC to PCD (Table O.11)		
H.2.2	Request Guard Time (Table O.11)		
H.2.3	Handling of bit collision during ATQA (Table O.11)		
H.2.4	Handling of anticollision loop (Table O.11)		
H.2.5	Handling of RATS and ATS (Table O.11)		
H.2.7	Frame size selection mechanism (Table O.11)		
H.2.8	Handling of Start-up Frame Guard Time (Table O.11)		
H.2.9	Handling of the CID during activation by the PCD (Table O.11)		
H.2.10	Handling of parity bit (Table O.11)		
H.3.2	Frame size selection mechanism (Table O.11)		
H.3.3	Handling of the CID during activation by the PCD (Table O.11)		
H.3.4	Frame Delay Time PICC to PCD (TR2) (Table O.11)		
H.3.5	Handling of Start-up Frame Guard Time (Table O.11)		
H.3.6	Type B PCD framing tests (Table O.11)		
H.4.2	Handling of the polling loop (Table O.11)		
H.4.3	Reaction of the PCD to request for waiting time extension (Table O.12)		
H.4.4	Error detection and recovery (Table O.12)		
H.4.5	Handling of NAD during chaining (Table O.12)		
H.5	Continuous monitoring of packets sent by the PCD (Table O.11 and Table O.12)		
Annex I	High bit rate selection (Table O.12)		
L.1.1	Frame format selection (Table O.12)		
L.2.1	Error correction mechanism (Table O.12)		
<b>Defined in this document</b>			
<a href="#">6.1.2</a>	RFU bits and values reception test		
<a href="#">6.2.1</a>	AFI value sent by the PCD		
<a href="#">6.2.2</a>	PCD Type A time-to-detection		
<a href="#">6.2.3</a>	PCD Type B time-to-detection		
<a href="#">6.2.4</a>	Correct detection of a Type A PICC after having previously received modulated field		
<a href="#">6.2.5</a>	Correct detection of a Type B PICC after having previously received modulated field		
<a href="#">6.2.6</a>	Non-ISO/IEC 14443-4 protocol management by the PCD		

Table A.4 — PICC - Test results summary

Test reference	Test title	Test result (PASS, FAIL or N/A)	Comments when FAIL or N/A
<b>From ISO/IEC 10373-6:2020</b>			
N/A	Antenna size and PICC class verification as defined in ISO/IEC 14443-1:2018, Annex A (Table O.13)		
6.2.1	Alternating magnetic field (Table O.13)		
7.2.1	PICC transmission (Table O.14)		
7.2.2	PICC EMD level and low EMD time test (Table O.14)		
7.2.3	PICC reception (Table O.14)		
7.2.5	PICC maximum loading effect (Table O.14)		
7.2.6	PICC operating field strength (Table O.14)		
G.1.6	RFU values (Table O.17)		
G.1.7	Measuring timing (Table O.16)		
G.3.2	Polling (Table O.16)		
G.3.3	Testing of the PICC Type A state transitions (Table O.16)		
G.3.4	Handling of Type A anticollision (Table O.16)		
G.3.6	Handling of PPS request (Table O.17)		
G.3.7	Handling of FSD (Table O.17)		
G.3.8	Handling of Frame Delay Time PICC to PCD and SFGT (Table O.16)		
G.3.9	PICC bit rates capability (Table O.17)		
G.4.2	Polling (Table O.16)		
G.4.3	PICC framing and bit rates capability (Table O.16)		
G.4.4	Testing of the PICC Type B state transitions (Table O.16)		
G.4.5	Handling of Type B anticollision (Table O.16)		
G.4.6	Handling of ATTRIB (Table O.16)		
G.4.7	Handling of Maximum Frame Size (Table O.16)		
G.4.8	Handling of TR2 and SFGT (Table O.16)		
G.5.2	PICC reaction to ISO/IEC 14443-4 scenarios (Table O.17)		
G.5.3	Handling of PICC error detection (Table O.17)		
G.5.4	PICC reaction on CID (Table O.17)		
G.5.5	PICC reaction on NAD (Table O.17)		
G.5.6	PICC reaction on S(PARAMETERS) blocks (Table O.17)		
G.5.7	PICC supporting Type A and Type B (Table O.16)		
L.1.2	Frame format selection (Table O.17)		
L.2.2	Error correction mechanism (Table O.17)		
L.3.1	PICC reaction to ISO/IEC 14443-4 scenarios when frame with error correction is activated (Table O.17)		
L.3.2	Reduction of bit rate during chaining when frame with error correction is activated (Table O.17)		
<b>Defined in this document</b>			
<a href="#">7.1.2</a>	Unexpected or RFU bits and values reception test		

**Table A.4** (continued)

Test reference	Test title	Test result (PASS, FAIL or N/A)	Comments when FAIL or N/A
<a href="#">7.2.1</a>	Field ramp-ups and shut-offs		

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