TECHNICAL SPECIFICATION

ISO/IEC TS 24192-1

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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)

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

Partie 1: Exigences d'implémentation pour l'ISO/IEC 14443 (toutes les parties)

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Foreword

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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 or www.iec.ch/members_experts/refdocs).

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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 and IEC 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 and www.iec.ch/national-committees.

Introduction

This document defines the requirements related to the use of ISO/IEC 14443 (all parts) to ensure interoperability between fare management system terminals and multiple-form-factor contactless fare media (smartcards, e-tickets, mobile phones, USB keys, tablets, etc.).

These implementation requirements are not designed to repeat or duplicate the referenced specifications, essentially ISO/IEC 14443 (all parts) and ISO/IEC 10373-6, but to complement those specifications with public transport specific considerations.

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)

1 Scope

This document defines the technical requirements to be met by contactless public transport (PT) devices in order to be able to interface together using the ISO/IEC 14443 (all parts) contactless communications protocol.

This document applies to PT devices:

— 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 addresses interoperability of consumer-market NFC mobile devices, compliant to NFC Forum specifications, with above mentioned PT devices, aligns with ISO/IEC 14443 (all parts) and does not seek to limit compliance for PT readers with EMV Contactless Interface Specification.

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 24192-2, *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)*

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

ISO/IEC 14443 (all parts), *Cards and security devices for personal identification — Contactless proximity objects*

ISO/IEC 15693-2, *Cards and security devices for personal identification — Contactless vicinity objects — Part 2: Air interface and initialization*

ISO/IEC 18092, *Information technology — Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1)*

3 Terms and definitions

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

3.1
common reader
PT reader (3.8) used in interoperable fare management system terminals with reduced performance requirements

Note 1 to entry: See 8.1.

3.2
IFM reader
PT reader (3.8) used in interoperable fare management system terminals

Note 1 to entry: See 8.1.

3.3
NFC mobile device
mobile device capable of near field communication that is offered in the consumer market and is used by PT customers as a contactless object or a contactless reader

3.4
NFC mobile device in card emulation mode
mobile device used as a *PT object* (3.7)

3.5
NFC mobile device in reader/writer mode
mobile device used as a *PT reader* (3.8)

3.6
PT device
PT reader (3.8) or *PT object* (3.7)

3.7
PT object
PICC specifically designed for the use in PT systems

Note 1 to entry: PICC is defined in ISO/IEC 14443 (all parts).

3.8
PT reader
PCD specifically designed for the use in PT systems

Note 1 to entry: PCD is defined in ISO/IEC 14443 (all parts).

4 Symbols and abbreviations

For the purposes of this document, the abbreviations given in ISO/IEC 14443-1, ISO/IEC 14443-2, ISO/IEC 14443-3, ISO/IEC 14443-4, ISO/IEC 10373-6 and the following apply.

ICS implementation conformance statements

NFC near field communication

PT public transport

t_{detect} maximum reference PICC time-to-detection

5 Conformance

To claim conformance to this document, the following requirements shall be met:

— for a PT reader, all the requirements listed in Clause 8 that are applicable according to the applicant's ICS, under the test conditions stipulated in Clause 11 and following the PCD test plan defined in ISO/IEC TS 24192-2;

— for a PT object, all the requirements listed in Clause 9 that are applicable according to the applicant's ICS, under the test conditions stipulated in Clause 11 and following the PICC test plan defined in ISO/IEC TS 24192-2.

Conformance of NFC mobile devices is tested according to NFC Forum specifications and is out of scope of this document.

The description of the certification or qualification processes to be carried out for demonstrating the conformance of PT devices to this document is out of scope of this document.

6 Dual conformance of PT devices to ISO/IEC TS 24192 (all parts) and EMV Contactless Interface Specification

It is acknowledged that next to this document there is also EMV Contactless Interface Specification[1] relevant for many PT devices; therefore this document is developed such that PT devices can comply with the requirements of both EMV Contactless Interface Specification[1] and this document.

7 Interoperability of PT devices and NFC mobile devices

7.1 Description of the “concept for interoperability”

The contactless interface for NFC mobile devices follows the implementation and test specifications of the NFC Forum as specified by the NFC Forum and referenced in GSMA TS.26[3] and TS.27[4].

The ISO/IEC 14443 (all parts) contactless interface of PT devices is designed and tested according to the rules defined in this document.

The concept for interoperability is established to synchronise the specifications for the contactless interface of NFC mobile devices and those for the contactless interface of PT devices in order to:

— facilitate interoperability between NFC mobile devices and PT devices;

— avoid unnecessary test and certification effort.

The NFC Forum conducted a comparison of NFC Analog Specification[5] and NFC Digital Specification[6] with ISO/IEC 14443 (all parts) and ISO/IEC 10373-6. Procedures that support correlation between results from tests according to NFC Forum specifications and those according to ISO/IEC 10373-6 have been defined.

The correlation is used to translate test results from the NFC Forum’s terminology into ISO/IEC 10373-6’s method for describing the relevant parameters. This is the foundation for the following characteristics of the concept for interoperability:

a) Development of PT devices and NFC mobile devices

Despite the fact that different methods for describing the relevant parameters are used, this document and the relevant implementation specifications from the NFC Forum can be synchronised. By synchronising the implementations’ specifications, interoperability is integrated into the design processes of NFC mobile devices and PT devices and makes it a common feature for both types of devices.

b) Test and certification of PT devices and NFC mobile devices

Based on the concept for interoperability it is possible to judge if an NFC mobile device that went through NFC Forum testing is interoperable with a PT device that complies with the requirements for ISO/IEC 14443 (all parts) set out in this document. Therefore, it is sufficient evidence of interoperability to test and certify ISO/IEC 14443 (all parts) conformant PT devices according to ISO/IEC TS 24192-2 and to test and certify NFC mobile devices according to NFC Forum's test and certification procedures.

The detailed methodology used to demonstrate the concept of interoperability between NFC Forum compliant devices and ISO/IEC 14443 (all parts) compliant devices is described in Reference [8].

Table 1 summarizes how contactless communication can be ensured either via conformity testing between PT readers and PT objects or via interoperability testing between PT devices and NFC mobile devices.

Table 1 — Conformity and interoperability matrix for NFC Forum specifications

		Contactless objects	
		PT objects Specified and tested according to ISO/IEC TS 24192	NFC mobile devices in card emulation mode Specified and tested according to NFC Forum specifications
Contactless readers	PT readers (IFM readers and common readers) Specified and tested according to ISO/IEC TS 24192 (all parts)	Conformity based on ISO/IEC TS 24192 (all parts)	Interoperability
	NFC mobile devices in reader/writer mode Specified and tested according to NFC Forum specifications	Interoperability	Conformity based on NFC Forum specifications

7.2 References for implementation and test of NFC mobile devices

The applicable NFC Forum specifications for designing and testing the contactless communication of NFC mobile devices are listed in the Bibliography (References [2] to [7]).

Conformance of NFC mobile devices to these specifications is a prerequisite to ensure interoperability of NFC mobile devices with PT devices as presented in Table 1.

7.3 Limitations

Only parameters, parameter settings or modes of operations that are relevant for PT use cases have been regarded and aligned with for both NFC mobile and PT devices. These use cases are described in the STA document "Documentation of Use Cases for NFC Mobile Devices in Public Transport"[2].

The following parameters, settings or modes are currently not covered by the harmonization of specifications according to the concept for interoperability described in 7.1:

a) communication bit rates higher than $f_c/128$ (~106 kbit/s);

b) peer-to-peer mode according to NFC Forum specifications;

c) ISO/IEC 18092 mode of communication;

d) ISO/IEC 15693-2 mode of communication.

8 Requirements and recommendations applicable to PT readers

8.1 General

8.1.1 Overview

8.2 and 8.3 define requirements; and 8.4 defines recommendations for PT readers.

The requirements and recommendations on PT readers are identified by a numbering format that reads [Rdrnn] where nn is the number of the requirement or recommendation.

There are two categories of PT readers:

— IFM reader;

— common reader.

All implementation requirements and tests that are necessary to achieve interoperability between PT readers and PT objects are mandatory for both PT reader categories.

8.1.2 IFM reader

The first category, the "IFM reader", covers use cases where performances (i.e. operating distance, transaction time, etc.) are key. As shown in Figure 1 and Figure 2, the IFM reader shall offer an operating range that covers the full scope of range A and range B defined in 11.3.3.2 and 11.3.3.4 respectively. All the test positions are defined in Table 3 and Table 4.

Position A1 of range A and Position B1 of range B may be at a different position on the IFM reader, see 11.3.3.

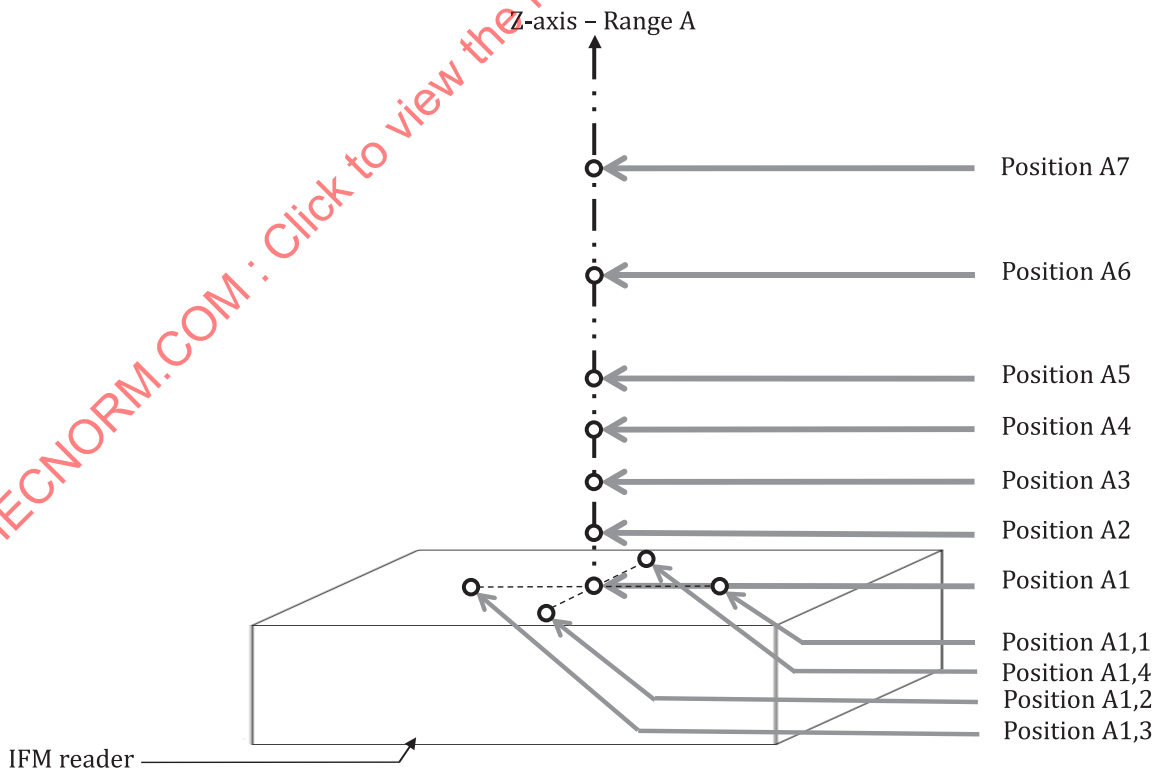

Figure 1 — Range A test positions for IFM reader

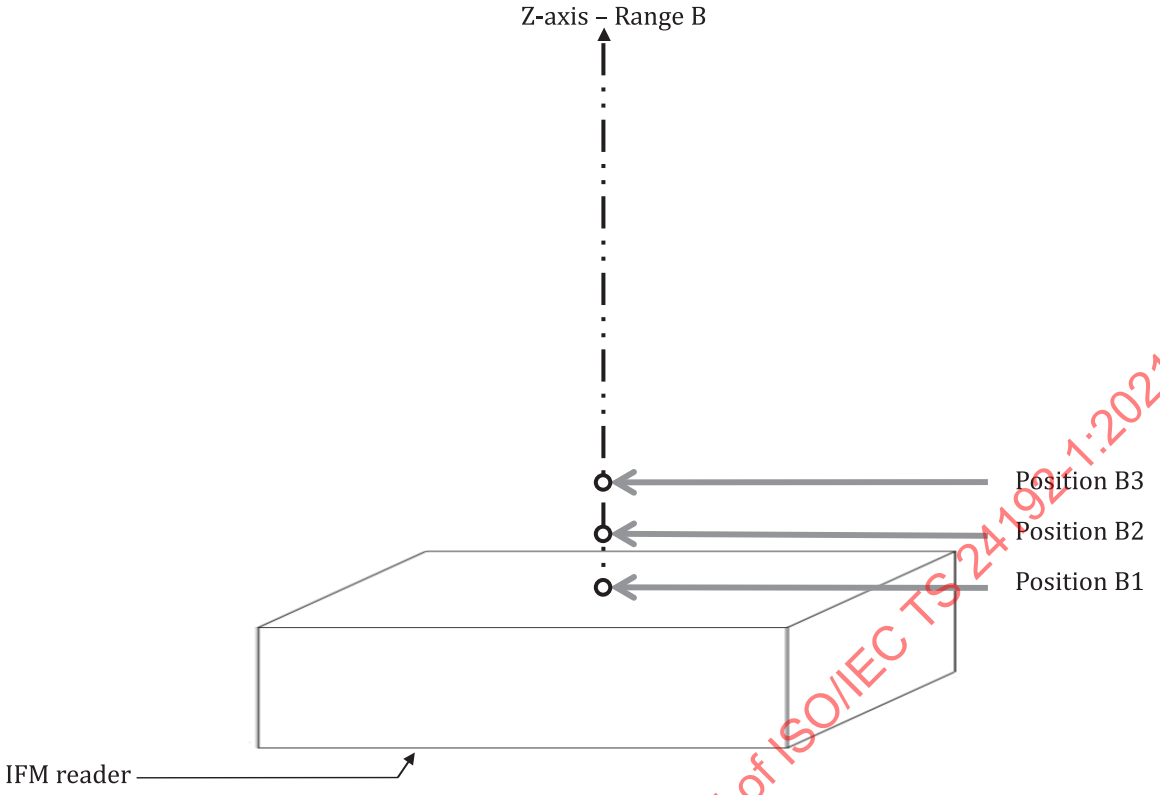

Figure 2 — Range B test positions for IFM reader

8.1.3 Common reader

The second category, the “common reader", is defined for scenarios that impose requirements on the contactless interface such as minimization of cost or maximization of battery life of the PT reader. These requirements have been derived from use cases from the following parts of the PT operator’s system implementation which are described in the STA document “Documentation of Use Cases for NFC Mobile Devices in Public Transport”[2].

a) sales infrastructure;

b) customer’s home infrastructure;

c) mobile inspection terminals.

Some requirements given in this document are adapted for common readers.

As shown in Figure 3, the common reader shall offer an operating range that covers a limited subset of range A defined in 11.3.3.2. All the test positions are defined in Table 3.

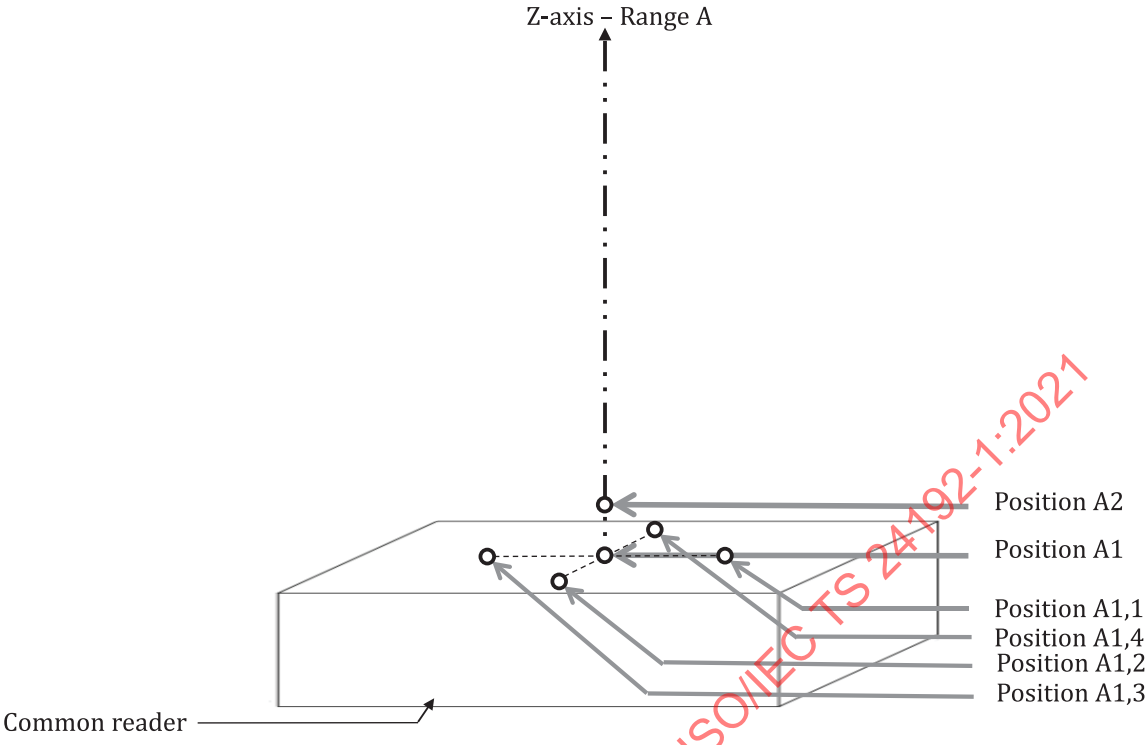

Figure 3 — Range A test positions for common reader

8.2 General requirements

[Rdr1] The PT reader shall meet the requirements for PCD defined in the ISO/IEC 14443 (all parts) and pass associated ISO/IEC 10373-6 test methods.

NOTE 1 The PT reader is tested against Reference PICC 1, Reference PICC 2 and Reference PICC 3 only, corresponding to the mandatory PICC classes "Class 1", "Class 2" and "Class 3". No test is required with Reference PICC 4, Reference PICC 5 and Reference PICC 6 corresponding to the optional PICC classes "Class 4", "Class 5" and "Class 6".

NOTE 2 There are no particular restrictions to PT readers for accepting contactless objects using any value for Application data field (Type B).

NOTE 3 EMV Contactless Interface Specification[1] imposes that the extended ATQB option not be supported. ISO/IEC 14443-3 considers that the support of this feature is optional.

[Rdr2] For IFM readers:

— In all range A test positions (see Figure 1), the IFM reader shall comply with all the [Rdr1] requirements when tested with Reference PICC 1, Reference PICC 2 and Reference PICC 3.

— In all range B test positions (see Figure 2) when tested with Reference PICC 3, the IFM reader shall:

  — comply with all the [Rdr1] requirements;

  — provide a field strength of at least 2 A/m (rms).

[Rdr3] For common readers:

— In Position A1, Position A1,1, Position A1,2, Position A1,3, Position A1,4 and Position A2 (see Figure 3), the common reader shall comply with all the [Rdr1] requirements when with Reference PICC 1, Reference PICC 2 and Reference PICC 3.

— There are no requirements applicable to range B.

NOTE 4 These minimum operating distance ranges are added as complementary requirements to ISO/IEC 14443-2. Operating distance ranges A and B are defined in 11.3.

NOTE 5 The minimum field strength requirement in range B is set to anticipate future acceptance of objects of optional classes “Class 4”, “Class 5” and “Class 6”.

[Rdr4] The PT reader shall use an AFI of '00' in at least one REQB/WUPB command in its polling sequence.

8.3 Requirements on polling and recognizing contactless objects

This subclause defines the requirements on the polling sequence of contactless objects.

NOTE 1 EMV Contactless Interface Specification[1] defines specific polling requirements which can impact the transaction time.

[Rdr5] The time-to-detection of a Reference PICC requiring minimum SFGT (no SFGI or SFGI = 0) by the PT reader shall be less than t_{detect} = 250 ms. This remains a valid requirement regardless of the moment when the Reference PICC is placed within range A or B of the PT reader. The Reference PICC time-to-detection is defined between the moment when the Reference PICC is placed into the field and the send-out of the first I-block sent by the PT reader. The Reference PICC time-to-detection shall be the average value measured on 10 consecutive measurements and shall be provided by the testing laboratory as part of the result report.

NOTE 2 Some PT networks can require a maximum applicative transaction time that imposes a time-to-detection much shorter than t_{detect}.

PT readers may also poll for objects non-compliant with ISO/IEC 14443 (all parts).

When inserting operating field resets in the polling sequence, the PT reader should take care that a contactless object using a random identifier responds with a different identifier and therefore should not consider such an object as two different objects.

When getting no response from a contactless object despite error detection and recovery defined in ISO/IEC 14443-4, PT readers not using any operating field reset in their polling sequence should use an operating field reset to put the silent contactless object in IDLE state, allowing it to receive and answer request commands without the need to manually remove it from the field.

[Rdr6] The PT reader shall resume its polling sequence after the removal of any disturbance caused by an ISO/IEC 14443-2 or ISO/IEC 15693-2 or ISO/IEC 18092 object.

NOTE 3 Disturbance is defined as an unexpected ISO/IEC 14443-2 or ISO/IEC 15693-2 or ISO/IEC 18092 modulated or unmodulated field.

[Rdr7] The PT reader may give priority to applications using a non-ISO/IEC 14443-4 protocol initiated by ISO/IEC 14443-3 polling commands (REQA/WUPA and/or REQB/WUPB), but shall look for applications using the ISO/IEC 14443-4 protocol when no suitable application using such a non-ISO/IEC 14443-4 protocol is found.

NOTE 4 This requirement is intended to ensure that the PT reader does not lock onto a non-ISO/IEC 14443-4 protocol when processing contactless objects supporting one or several other non-ISO/IEC 14443-4 protocols initiated by ISO/IEC 14443-3 polling commands (REQA/WUPA and/or REQB/WUPB), in addition to ISO/IEC 14443-4 protocol.

Annex A gives examples of polling sequences and scenarios for PT readers.

8.4 Performance recommendations

The following recommendation is providing performance indications.

[Rdr8] The frame size supported by the PT reader in receiver mode should be at least 256 bytes. Consequently, the PT reader should indicate an FSDI (Type A) or a Maximum Frame Size Code in ATTRIB (Type B) greater than or equal to 8.

NOTE The aim of this recommendation is to avoid forcing the contactless object to segment its long answers into small frames, which would slow the transaction.

9 Requirements and recommendations applicable to PT objects

9.1 General

9.2 defines requirements; and 9.3 defines recommendations for PT objects.

The requirements and recommendations on PT objects are identified by a numbering format that reads [Objnn] where nn is the number of the requirement or recommendation.

9.2 Requirements

[Obj1] The PT object shall meet the requirements for PICC defined in ISO/IEC 14443 (all parts) and pass associated ISO/IEC 10373-6 test methods.

NOTE 1 PT objects also conforming to the EMV Contactless Interface Specification[1] requirements limit the bit rate capabilities indication to $f_c/128$ (~106 kbit/s) in both directions.

[Obj2] If the PT object claims compliancy to one of the PICC classes “Class 1”, “Class 2” or “Class 3”, it shall meet the corresponding requirements for PICCs of “Class 1”, “Class 2” or “Class 3” as defined in ISO/IEC 14443 (all parts) and ISO/IEC 10373-6.

NOTE 2 If the PT object does not claim to meet the requirements of one particular PICC class, the definitions for PICCs which do not claim to meet the requirements of one particular PICC class in ISO/IEC 14443 (all parts) and ISO/IEC 10373-6 apply.

9.3 Performance recommendations

The following recommendation is providing performance indications.

[Obj3] The frame size supported by the PT object in receiver mode should be at least 64 bytes. Consequently, the PT object should indicate an FSCI (Type A) or a Maximum Frame Size Code in ATQB (Type B) greater than or equal to 5.

NOTE 1 The aim of this recommendation is to avoid forcing the PT reader to segment its long commands into small frames, which would slow the transaction.

The FWI should be optimized for any PT object in order to avoid excessive reaction times when withdrawing a PT object or in response to communication bugs.

NOTE 2 PT object vendors are free to conform to the EMV Contactless Interface Specification[1] requirements, which limits the FWI to 7.

10 Implementation characteristics

10.1 General

This subclause describes the ICS that vendors shall provide, and lists the characteristics of the hardware to be tested:

— the ICS for PT readers – PCD;

— the ICS for PT objects – PICC.

If a contactless device supports both modes (PCD and PICC) and the aim is to check its conformance under both these modes, the vendor shall run through two separate test campaigns and complete two ICSs.

NOTE This document is focused solely on the protocol conformance and interoperability aspects. It does not describe performance tests or tests on the transaction times achieved with the PT reader or PT object under test.

10.2 ICS for PT readers – PCD

10.2.1 General

This subclause defines the information that shall be provided by PT reader vendors when filing a product validation request.

In addition to the ICS describing the characteristics of the PT reader to be tested, the vendor shall also provide the test laboratories with the additional tools that enable the tests to be executed.

This ICS is referencing some technical characteristics for PCD defined in 11.3.

10.2.2 PCD general technical characteristics

[PCD.1] General technical characteristics

[PCD1.1] PT reader type:

IFM reader ☐

Common reader ☐

[PCD1.2] Operational temperature class supported as defined in 11.2:

Class A ☐

Class D ☐

[PCD1.3] PT readers with a continuous polling cycle: Yes ☐ No ☐

If no, precise event triggering polling cycle activation: .....

[PCD1.4] Antenna diagram and position on the PT reader under test:

Range A:

[PCD1.5] Reference of PCD Zero Point – Range A (target ID marked on sample or photo or diagram):

[PCD1.6] Orientation of the Z-axis – Range A (photo or diagram):

[PCD1.7] Positions and orientations of the X-axis and Y-axis of the Reference PICC above PCD Zero Point – Range A (photo or diagram)

Range B:

[PCD1.8] Reference of PCD Zero Point – Range B (target ID-marked on sample or photo or diagram):

[PCD1.9] Orientation of the Z-axis – Range B (photo or diagram):

[PCD1.10] Positions and orientations of the X-axis and Y-axis of the Reference PICC above PCD Zero Point – Range B (photo or diagram)

10.2.3 PCD supported options

[PCD.2] General supported options

The communication signal interfaces supported by the PT reader under test shall compulsorily be Type A and Type B. The only declaration shall be the option to indicate whether other communication signal interfaces or protocols on top of Type A and Type B are also supported.

[PCD2.1] Other supported communication signal interface(s) or protocol(s): …

[PCD.3] Type A supported options

[PCD3.1] PCD to PICC bit rates supported: $f_c/128$ (~106 kbit/s) ☒
Other: …

[PCD3.2] PICC to PCD bit rates supported: $f_c/128$ (~106 kbit/s) ☒
Other: …

[PCD3.3] FSDI:

[PCD3.4] CID support: Yes ☐ No ☐

[PCD3.5] NAD support: Yes ☐ No ☐

[PCD3.6] S(PARAMETERS) support: Yes ☐ No ☐

[PCD3.7] Frames with error correction support: Yes ☐ No ☐

[PCD.4] Type B supported options

[PCD4.1] PCD to PICC bit rates supported: $f_c/128$ (~106 kbit/s) ☒
Other: …

[PCD4.2] PICC to PCD bit rates supported: $f_c/128$ (~106 kbit/s) ☒
Other: …

[PCD4.3] Maximum Frame Size Code in ATTRIB:

[PCD4.4] Extended ATQB support: Yes ☐ No ☐

[PCD4.5] “Minimum TR0” field of Param1 (2 bits) in ATTRIB:

[PCD4.6] “Minimum TR1” field of Param1 (2 bits) in ATTRIB:

[PCD4.7] “EOF/SOF” field of Param1 (2 bits) in ATTRIB:

[PCD4.8] CID support: Yes ☐ No ☐

[PCD4.9] NAD support: Yes ☐ No ☐

[PCD4.10] S(PARAMETERS) support: Yes ☐ No ☐

[PCD4.11] Frames with error correction support: Yes ☐ No ☐

10.2.4 PCD test parameters

[PCD.5] General test parameters

[PCD5.1a] UT_TEST_COMMAND1 APDU definition: … (hexadecimal value)

[PCD5.1b] UT_TEST_COMMAND1 Answer to ADPU definition: … (hexadecimal value)

[PCD5.2a] UT_TEST_COMMAND2 APDU definition: … (hexadecimal value)

[PCD5.2b] UT_TEST_COMMAND2 Answer to ADPU definition: … (hexadecimal value)

[PCD.6] Proprietary test parameters

[PCD6.1] PROPRIETARY_COMMAND APDU(s) definition(s): … (hexadecimal value)

[PCD6.2] PROPRIETARY_COMMAND Answer to ADPU(s) definition(s): … (hexadecimal value)

NOTE Usages of UT_TEST_COMMAND1 and UT_TEST_COMMAND2 for PCD tests are defined in ISO/IEC 10373-6.

When the support of non-ISO/IEC 14443-4 protocol initiated by ISO/IEC 14443-3 polling commands is indicated in [PCD2.1] and when the PT reader may give priority to applications using such non-ISO/IEC 14443-4 protocol compared to applications using ISO/IEC 14443-4 protocol, in order to perform the testing of [Rdr7], the PT reader vendor shall describe:

— in [PCD6.1], the non-ISO/IEC 14443 command(s) used to select an application using a non-ISO/IEC 14443-4 protocol initiated by ISO/IEC 14443-3 polling commands;

— in [PCD6.2] the expected response(s) to these commands:

  — compliant with the non-ISO/IEC 14443-4 protocol;

  — indicating that no suitable application is available.

10.3 ICS for PT objects - PICC

10.3.1 General

This subclause defines the information that shall be provided by PT object vendors when filing a product validation request.

This ICS is referencing some technical characteristics for PICC defined in 11.4.

10.3.2 PICC general technical characteristics

[PICC.1] General technical characteristics

[PICC1.1] Antenna diagram and position on the PT object under test:

[PICC1.2] Reference of PICC zero point (target ID-marked on sample or photo or diagram):

[PICC1.3] Operational temperature class supported as defined in 11.2:
Class A ☐
Class I ☐

[PICC1.4] PICC class according to ISO/IEC 14443:
"Class 1" ☐ "Class 2" ☐ "Class 3" ☐
Does not claim to meet the requirements of one particular PICC class ☐

10.3.3 PICC supported options

[PICC.2] General supported options

[PICC2.1] Supported communication signal interface(s) and protocol(s):
Type A ☐ Type B ☐ Other: …

[PICC.3] Type A supported options (where applicable)

[PICC3.1] PCD to PICC bit rates supported: $f_c/128$ (~106 kbit/s) ☒ Other: …

[PICC3.2] PICC to PCD bit rates supported: $f_c/128$ (~106 kbit/s) ☒ Other: …

[PICC3.3] Only symmetrical bit rates supported: Yes ☐ No ☐

[PICC3.4] UID: Single size (4 bytes) random ☐ Single size (4 bytes) fixed ☐
Double size (7 bytes) ☐
Triple size (10 bytes) ☐

[PICC3.5] FWI:

[PICC3.6] SFGI:

[PICC3.7] FSCI:

[PICC3.8] CID support: Yes ☐ No ☐

[PICC3.9] NAD support: Yes ☐ No ☐

[PICC3.10] S(PARAMETERS) support: Yes ☐ No ☐

[PICC3.11] Frames with error correction support: Yes ☐ No ☐

[PICC.4] Type B supported options (where applicable)

[PICC4.1] PCD to PICC bit rates supported: $f_c/128$ (~106 kbit/s) ☒ Other: …

[PICC4.2] PICC to PCD bit rates supported: $f_c/128$ (~106 kbit/s) ☒ Other: …

[PICC4.3] Only symmetrical bit rates supported: Yes ☐ No ☐

[PICC4.4] PUPI value: Fixed number ☐ Random number ☐

[PICC4.5] FWI:

[PICC4.6] Maximum Frame Size Code in ATQB:

[PICC4.7] Extended ATQB support: Yes ☐ No ☐

If yes, SFGI:

[PICC4.8] List of supported AFI values:

[PICC4.9] REQB/WUPB with N > 1 support: Yes ☐ No ☐

[PICC4.10] CID support: Yes ☐ No ☐

[PICC4.11] NAD support: Yes ☐ No ☐

[PICC4.12] S(PARAMETERS) support: Yes ☐ No ☐

[PICC4.13] Frames with error correction support: Yes ☐ No ☐

10.3.4 PICC test parameters

[PICC.5] Test parameters

[PICC5.1a] TEST_COMMAND1 APDU definition: … (hexadecimal value)

[PICC5.1b] TEST_COMMAND1 Answer to ADPU definition: … (hexadecimal value)

[PICC5.1c] Precondition sequence for TEST_COMMAND1: …

Is there a command which expects a response consisting of n chained I-blocks? Yes ☐ No ☐

[PICC5.2a] TEST_COMMAND2 APDU definition: … (hexadecimal value)

[PICC5.2b] TEST_COMMAND2 Answer to ADPU definition: … (hexadecimal value)

[PICC5.2c] Precondition sequence for TEST_COMMAND2: …

Is there a command which needs more than FWT time for execution? Yes ☐ No ☐

[PICC5.3a] TEST_COMMAND3 APDU definition: … (hexadecimal value)

[PICC5.3b] TEST_COMMAND3 Answer to ADPU definition: … (hexadecimal value)

[PICC5.3c] Precondition sequence for TEST_COMMAND3: …

[PICC5.4a] TEST_COMMAND4 APDU definition: … (hexadecimal value)

[PICC5.4b] TEST_COMMAND4 Answer to ADPU definition: … (hexadecimal value)

[PICC5.4c] Precondition sequence for TEST_COMMAND4: …

[PICC5.5] TEST_COMMAND_SEQUENCE1: …

NOTE Usages of TEST_COMMAND_SEQUENCE1, TEST_COMMAND1, TEST_COMMAND2, TEST_COMMAND3 and TEST_COMMAND4 for PICC tests are defined in ISO/IEC 10373-6.

If the PICC requires additional sequences to be ready to accept TEST_COMMAND1, TEST_COMMAND2, TEST_COMMAND3 or TEST_COMMAND4, those sequences should be described in the precondition sequence fields.

TEST_COMMAND_SEQUENCE1 shall contain at minimum 2 APDUs with their respective expected answers. It shall also include application specific cryptographic functions, if applicable.

11 Test conditions for PT reader and PT objects

11.1 General

This subclause defines the conditions under which tests are performed to determine the conformance of a PT reader or PT object to the requirements of this document.

11.2 Temperature

Given that PT readers or objects operate under only short distances, it is necessary to verify that the PT reader or PT object are able to respect this operating distance regardless of temperature.

For PT readers and objects, the vendor shall indicate in the PCD or PICC ICS whether she or he wishes to get a conformance for ambient temperature only or for ambient and extreme temperatures. This is determined by the temperature class that the PCD or PICC under test shall conform to.

Three temperature classes are defined in Table 2.

The tests are executed at ambient temperature (+23 °C) in all cases. According to the temperature class to which the PT reader or PT object belongs, additional tests are performed at minimum and maximum temperatures of the temperature class indicated in Table 2.

The list of tests to be run at ambient and extreme temperature on PT readers and objects is identified in ISO/IEC TS 24192-2.

Table 2 — Temperature classes for PT readers and PT objects

Temperature class	PT readers - PCD	PT objects - PICC
A	— Ambient: +23 °C — Minimum: N/A — Maximum: N/A	— Ambient: +23 °C — Minimum: N/A — Maximum: N/A
D	— Ambient: +23 °C — Minimum: −25 °C — Maximum: +55 °C	N/A
I	N/A	— Ambient: +23 °C — Minimum: −10 °C — Maximum: +50 °C

11.3 Test conditions for PT readers

11.3.1 General

The PT reader under test can be either an end-user product or an OEM reader module.

If the PT reader under test is an OEM reader module, the PT reader vendor shall provide the OEM reader module embedded into a casing representative of an end-user product.

In this document, the PT reader surface means the actual PT reader surface if the PT reader under test is an end-user product or an OEM reader module provided with a casing,

11.3.2 Initial positions template

The initial positions template is a plate used to determine Position A1 and Position B1 respectively on the Z-axis – Range A and the Z-axis – Range B, as explained in 11.3.3.2 and 11.3.3.4. The initial positions template has a width and a length of 195 mm and the point of intersection between the Z-axes and this template is named "Z-axes position" and situated at 55 mm from the left side and the top side as illustrated in Figure 4.

X-, Y- and Z-axes positions and orientations for range A are defined in 11.3.3.2.

X-, Y- and Z-axes positions and orientations for range B are defined in 11.3.3.4.

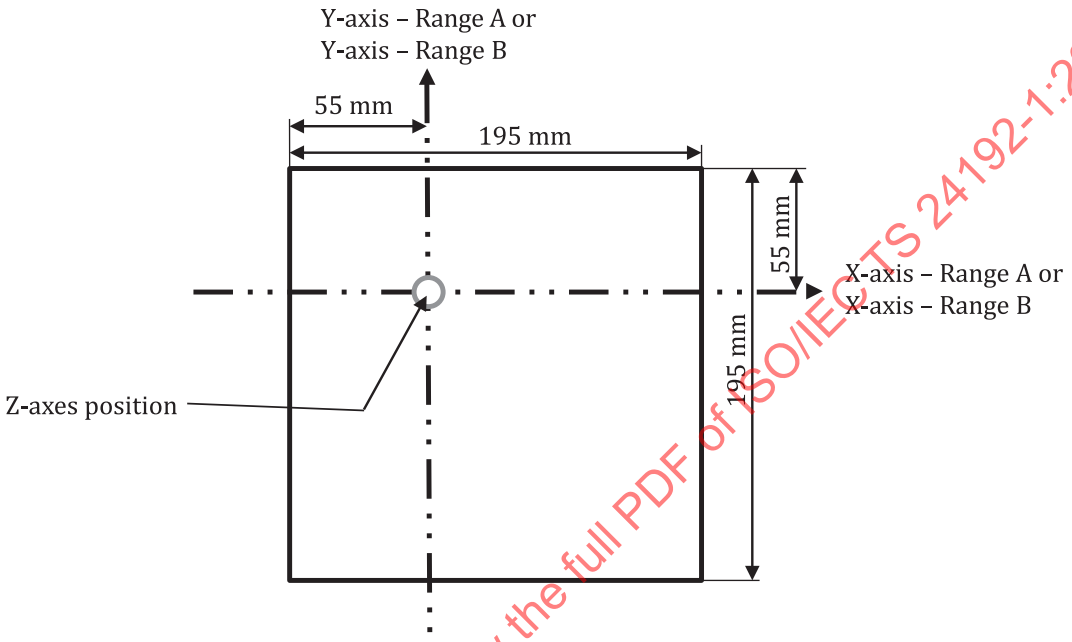

Figure 4 — Initial positions template dimensions — overhead view

11.3.3 Test positions

11.3.3.1 General

This document defines two operating ranges, A and B, for PT reader testing.

These two ranges do not necessarily localise to the same positions on the PT reader under test. They may correspond to two distinctly separate targets where PCD zero point – Range A and PCD zero point – Range B are the centres, as illustrated in Figure 5.

NOTE For common readers, range A is limited (see [Rdr3]).

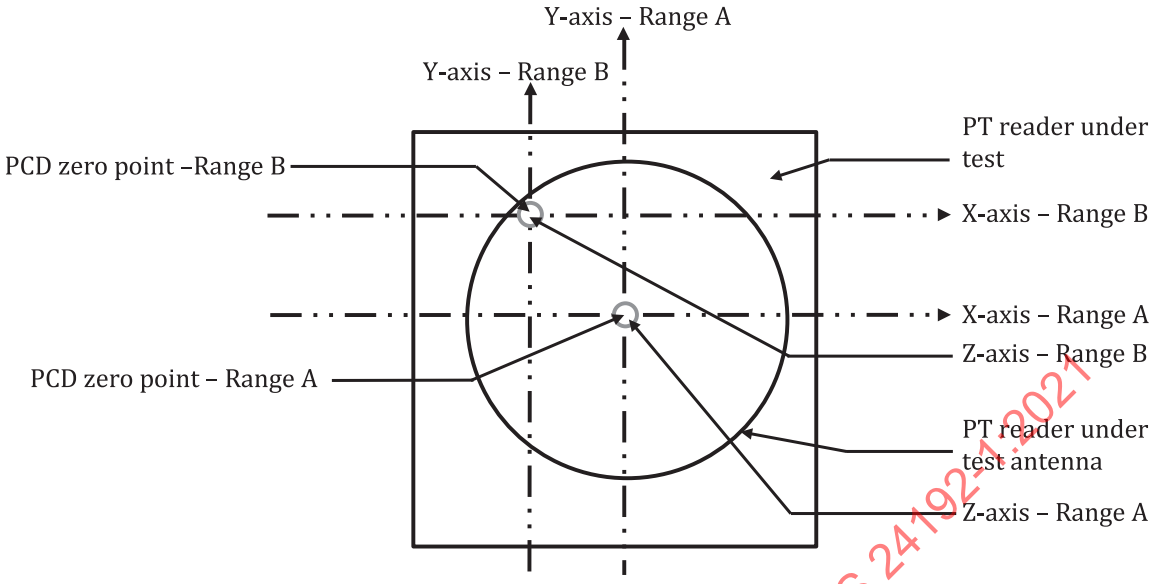

Figure 5 — Example of a PT reader with different A and B ranges — overhead view

11.3.3.2 Operating distance – Range A

This document defines range A under which measurements shall be taken for PT readers to be tested with Reference PICCs 1, 2 and 3 (see [Rdr2] and [Rdr3]). This subclause details how range A is defined.

The following characteristics are defined to determine the PT reader range A:

— PCD zero point – Range A: This is a point on the PT reader surface. The position of this point is determined by the PT reader vendor. The centre of the Reference PICC main coil is positioned in front of this point for most of the tests. It is recommended that it correspond to the centre of the PT reader antenna.

— X- and Y-axes – Range A: The positions and orientations of these axes are defined by the PT reader vendor in the ICS of the PT reader under test. The orientation of the X- and Y-axes should be determined unambiguously by an arrow in the diagram given in the ICS by the PT reader vendor. In the figures for test positions, the orientation of the axes is described with an arrow to allow an unambiguous positioning of the Reference PICC onto the surface of the PT reader under test.

— Z-axis – Range A:

  — For a PT reader with a flat surface, Z-axis – Range A is the axis perpendicular to the PT reader surface through PCD zero point – Range A.

  — For a PT reader that does not have a flat surface, the Z-axis – Range A is defined by the manufacturer taking into account the intended user interaction.

— Position A1: This is the first test position for range A defined under the rules below:

  — Position A1 is defined by placing the “Z-axes position” of the initial positions template on the Z-axis – Range A with the plane of the template positioned perpendicular to the Z-axis – Range A and by moving the template along the Z-axis – Range A as close as possible to the PT reader surface.

  — Under no circumstances may Position A1 be situated below the PT reader-surface (which would equate to artificially reducing the maximum operating distance).

Range A is mapped by all the points located in the pyramid defined by Position A1,1, Position A1,2, Position A1,3, Position A1,4 and Position A7 (for IFM reader) or Position A2 (for common reader).

The antenna position of the PT reader under test shall be communicated to the test laboratory, for information purposes.

The plane of the Reference PICC is positioned perpendicular to the Z-axis – Range A. The orientation of the Reference PICC along the X- and Y-axes in relation to the PT reader under test is defined in Figure 13 and Figure 14 for range A.

Figure 7, Figure 8, Figure 9, Figure 10 and Figure 11 illustrate a number of examples of how PCD zero point – Range A, Z-axis – Range A and Position A1 are defined according to ergonomics of the PT reader under test.

In this document, the Reference PICC is represented as in Figure 6.

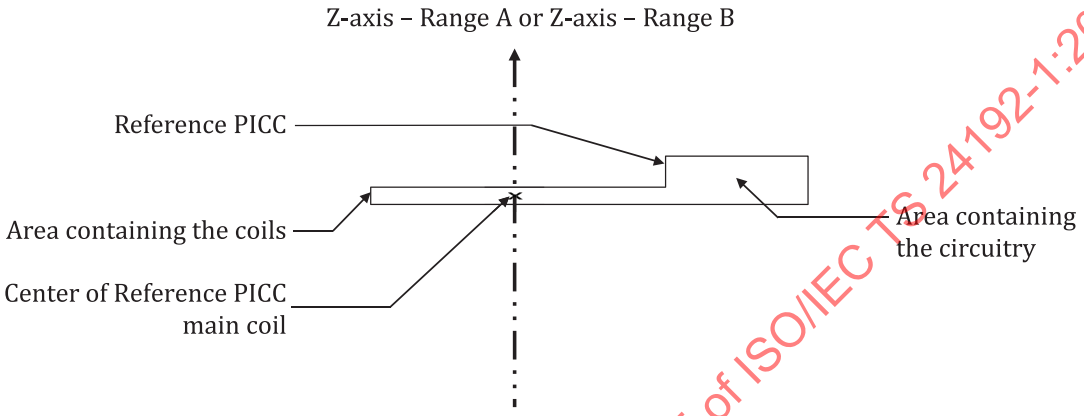

Figure 6 — Reference PICC

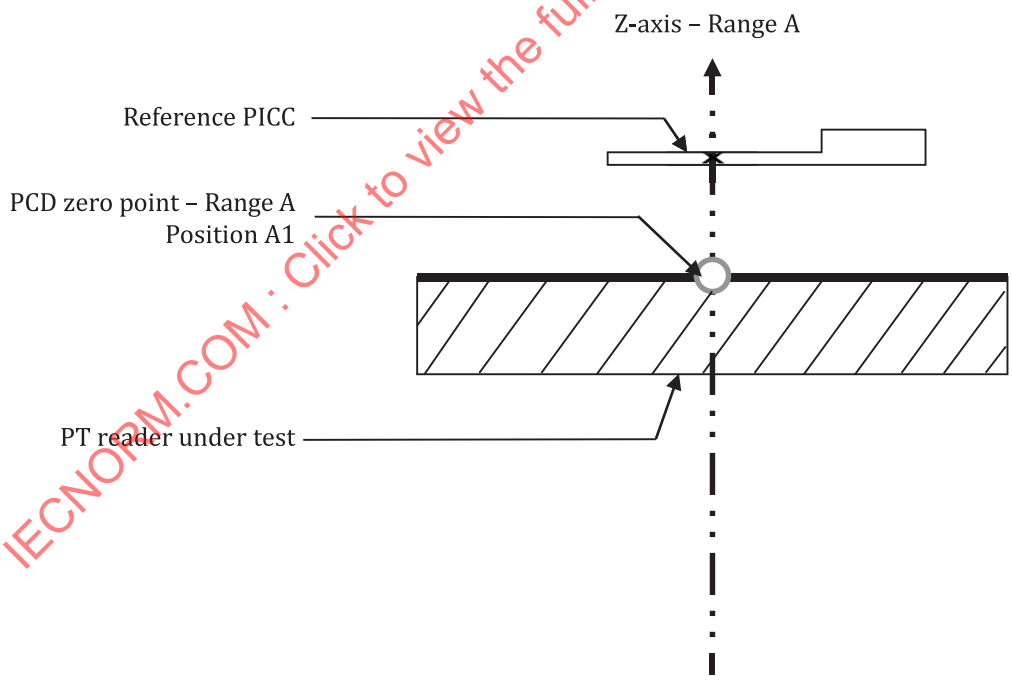

Figure 7 — Testing a flat-surface PT reader

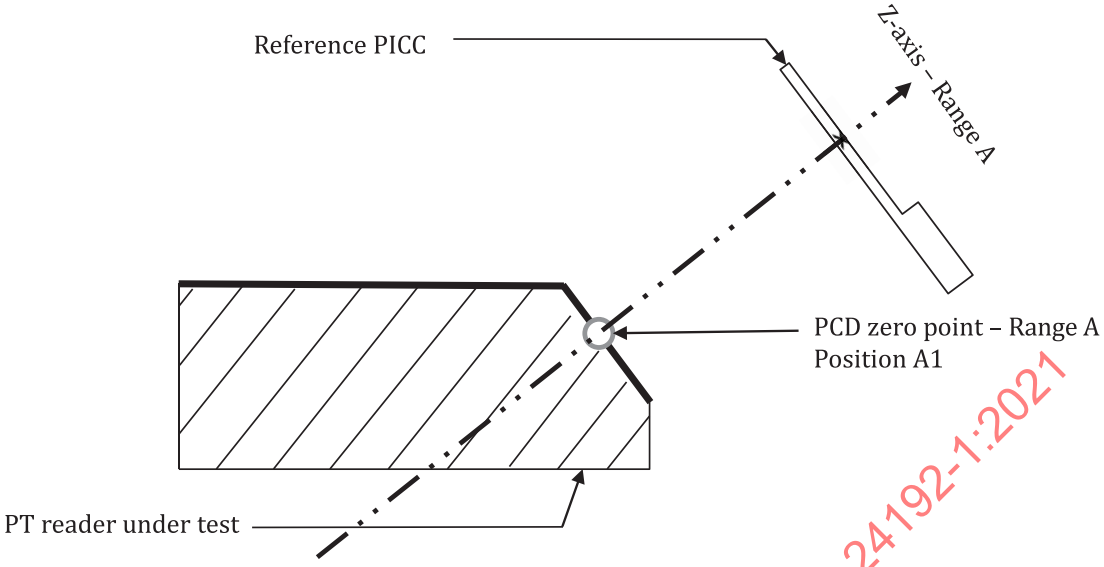

Figure 8 — Testing a flat and tilted-surface PT reader

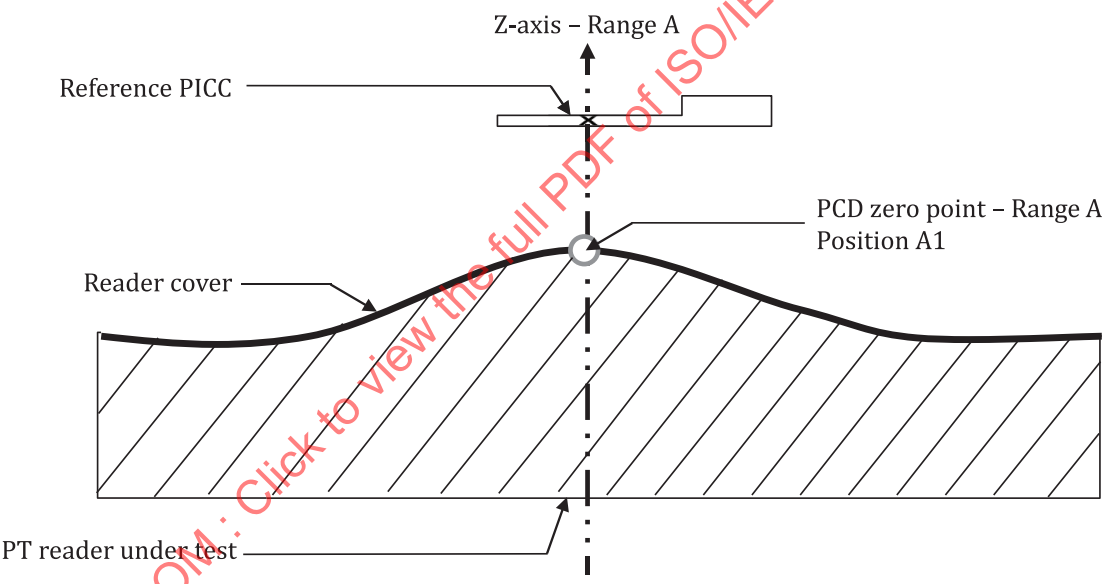

Figure 9 — Testing a convex-surface PT reader

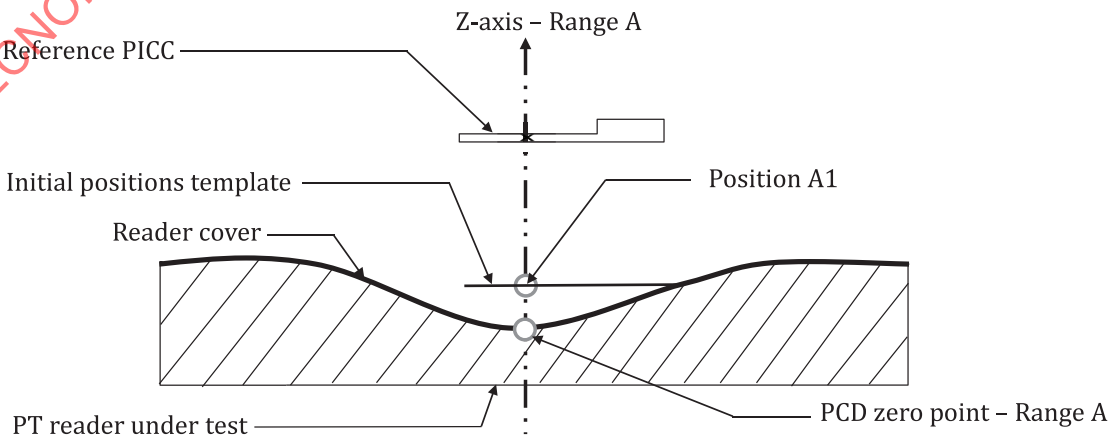

Figure 10 — Testing a symmetric concave-surface PT reader

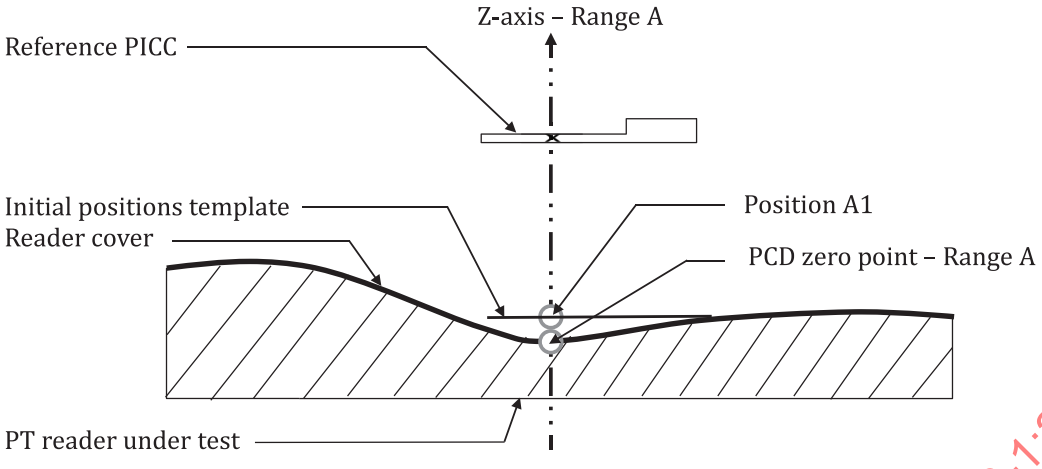

Figure 11 — Testing a dissymmetric concave-surface PT reader

11.3.3.3 Table of test positions – Range A

The tests are performed from Position A1 and while moving the Reference PICC away along the Z-axis – Range A up to the maximum test distance for range A.

The tests are also performed with translations of 10 mm in each direction from Position A1 along the X- and Y-axes. These test positions correspond to Position A1,1, Position A1,2, Position A1,3 and Position A1,4 illustrated in Figure 1 and Figure 3.

These test positions are also illustrated with overhead view in Figure 12.

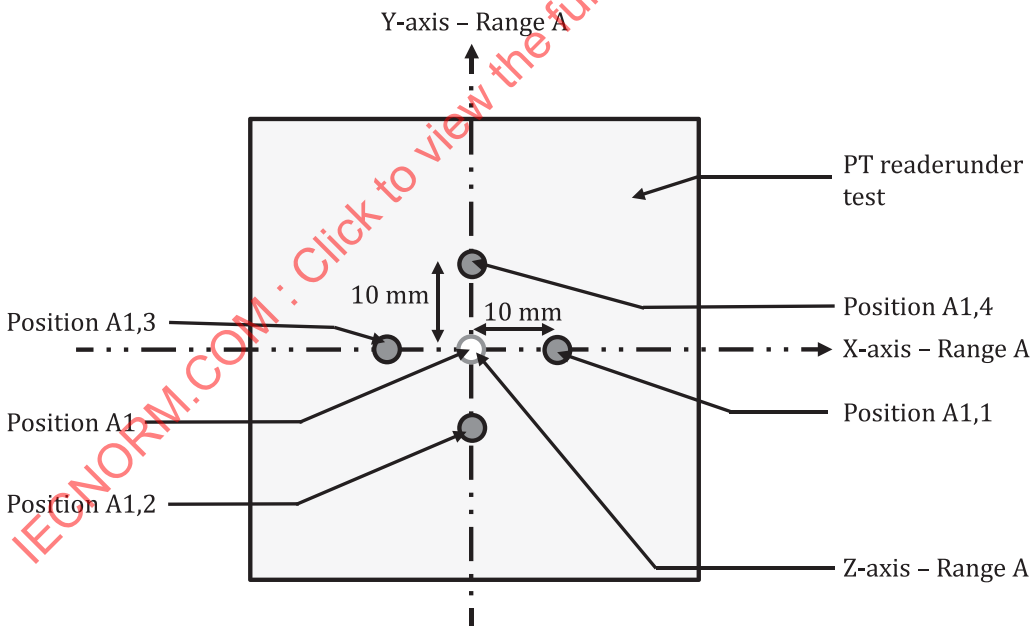

Figure 12 — Test positions at 0 mm along the Z-axis – Range A — overhead view

The tests are also performed with a Reference PICC rotation of 90° at some test positions. Figure 13 describes the positioning of test with the Reference PICC at 0°.

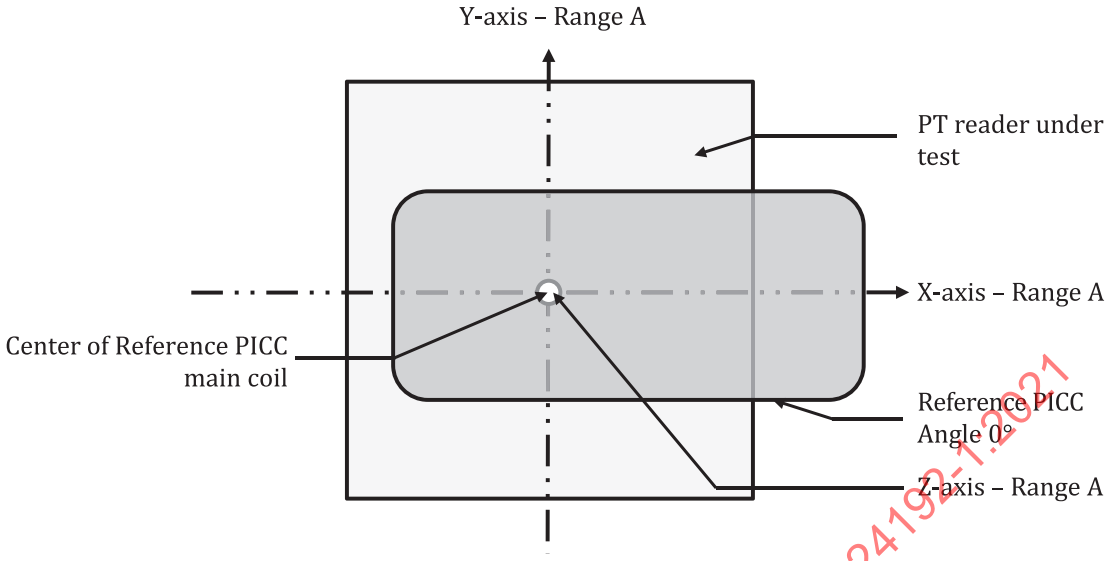

Figure 13 — PCD testing with Reference PICC - Angle 0° (Position A1) — overhead view

Figure 14 describes the positioning of test with the Reference PICC at 90°.

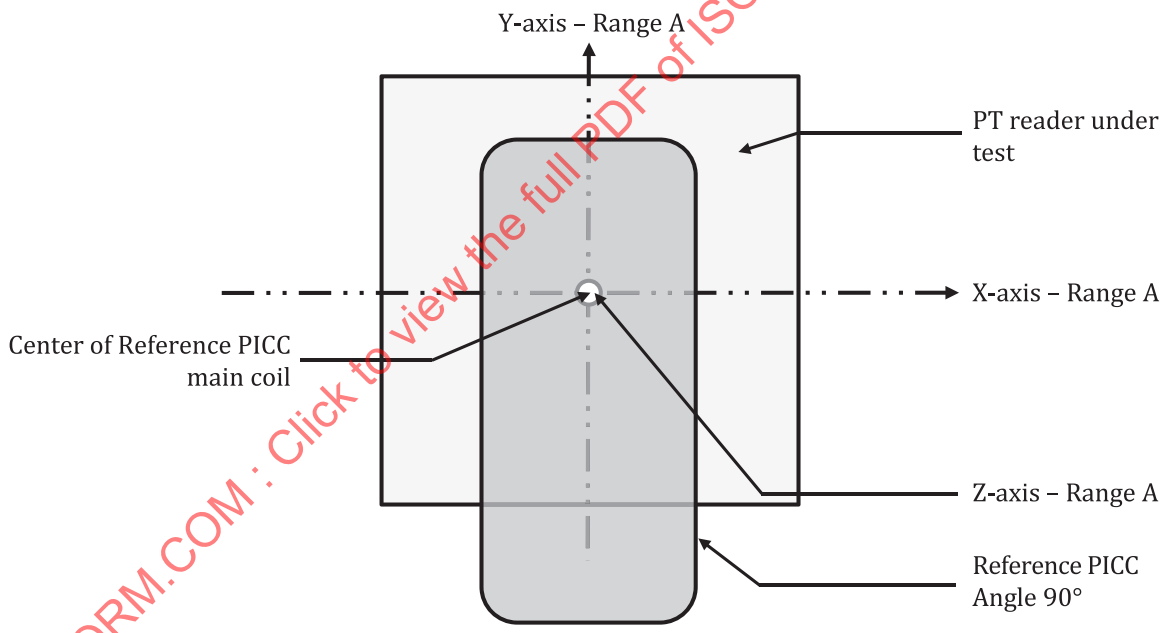

Figure 14 — PCD testing with Reference PICC - Angle 90° (Position A1) — overhead view

The tests are performed with Reference PICC - Angle 0° at all test positions and with Reference PICC - Angle 90° only at the following test positions:

— Position A1;

— Position A1,1;

— Position A1,2;

— Position A1,3;

— Position A1,4;

— Position A7.

Table 3 gives the test positions that are eligible (unless otherwise stated) for all PT reader tests.

Table 3 — List of test positions for range A

Test positions	Reference PICC Angle	Height from Position A1 along the Z-axis – Range A
Position A1	0°	0 mm
	90°	
Position A1,1	0°	0 mm
	90°	
Position A1,2	0°	0 mm
	90°	
Position A1,3	0°	0 mm
	90°	
Position A1,4	0°	0 mm
	90°	
Position A2	0°	5 mm
Position A3	0°	10 mm
Position A4	0°	15 mm
Position A5	0°	20 mm
Position A6	0°	30 mm
Position A7	0°	40 mm
	90°	

For example, in Figure 15, the Reference PICC is in Position A7 of the PT reader under test, and measurements can be taken up to contact with the Reference PICC in Position A1.

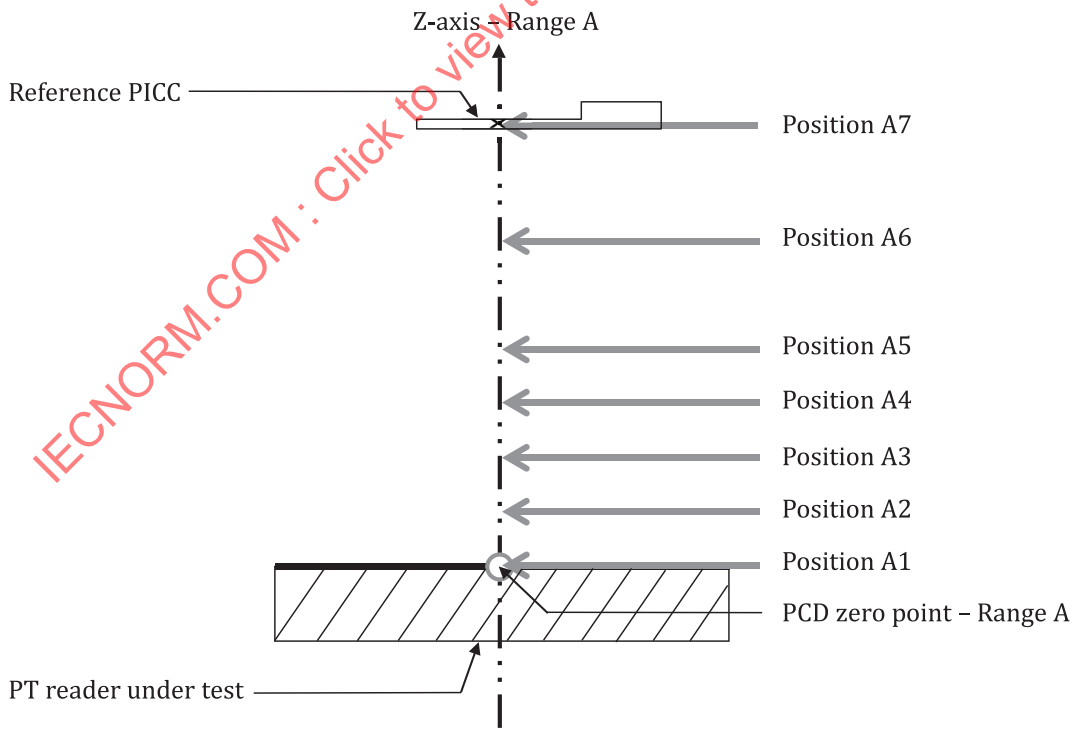

Figure 15 — Reference PICC in Position A7

11.3.3.4 Operating distance – Range B

This document defines range B under which measurements shall be taken for PT readers to be tested with Reference PICC 3 (see [Rdr2]). This subclause details how range B is defined.

The following characteristics are defined to determine the PT reader range B:

— PCD zero point – Range B: This is a point on the PT reader surface. The position of this point is determined by the PT reader vendor. The centre of the Reference PICC main coil is positioned in front of this point for the tests. It is recommended that this position be the same position as PCD zero point – Range A.

— X- and Y-axes – Range B: The positions and orientations of these axes are defined by the PT reader vendor in the ICS of the PT reader under test. The orientation of the X- and Y-axes should be determined unambiguously by an arrow in the diagram given in the ICS by the PT reader vendor. In the figures for test positions, the orientation of the axes is described with an arrow to allow an unambiguous positioning of the Reference PICC onto the surface of the PT reader under test.

— Z-axis – Range B:

  — For a PT reader with a flat surface, Z-axis – Range B is the axis perpendicular to the PT reader surface through PCD zero point – Range B.

  — For a PT reader that does not have a flat surface, the Z-axis – Range B is defined by the manufacturer taking into account the intended user interaction.

— Position B1: This is the first test position for range B defined under the rules below:

  — Position B1 is defined by placing the "Z-axes position" of the initial positions template on the Z-axis – Range B with the plane of the template positioned perpendicular to the Z-axis – Range B and by moving the template along the Z-axis – Range B as close as possible to the PT reader surface.

  — Under no circumstances may Position B1 be situated below the PT reader-surface (which would equate to artificially reducing the maximum operating distance).

Range B is mapped by all the points located between Position B1 and Position B3 of the PT reader under test (see Figure 16).

The plane of the Reference PICC is positioned perpendicular to the Z-axis – Range B. The orientation of the Reference PICC along the X- and Y-axes in relation to the PT reader under test is defined for range B as for range A (see Figure 13).

Figure 7, Figure 8, Figure 9, Figure 10 and Figure 11 illustrating a number of examples of how PCD zero point – Range A and Z-axis – Range A are determined according to PT reader under test ergonomics remain applicable for the determination of PCD zero point – Range B and Z-axis – Range B.

11.3.3.5 Table of test positions – Range B

The tests are performed from Position B1 and while moving the Reference PICC away along the Z-axis – Range B up to Position B3.

Table 4 gives the test positions that are eligible (unless otherwise stated) for all PT reader tests.

Table 4 — List of test positions for range B

Test positions	Reference PICC Angle	Height from Position B1 along the Z-axis – Range B
Position B1	0°	0 mm
Position B2	0°	5 mm

Table 4 *(continued)*

Test positions	Reference PICC Angle	Height from Position B1 along the Z-axis – Range B
Position B3	0°	10 mm

For example, in Figure 16, the Reference PICC is in Position B3 of the PT reader under test, and measurements can be taken up to contact with the Reference PICC in Position B1.

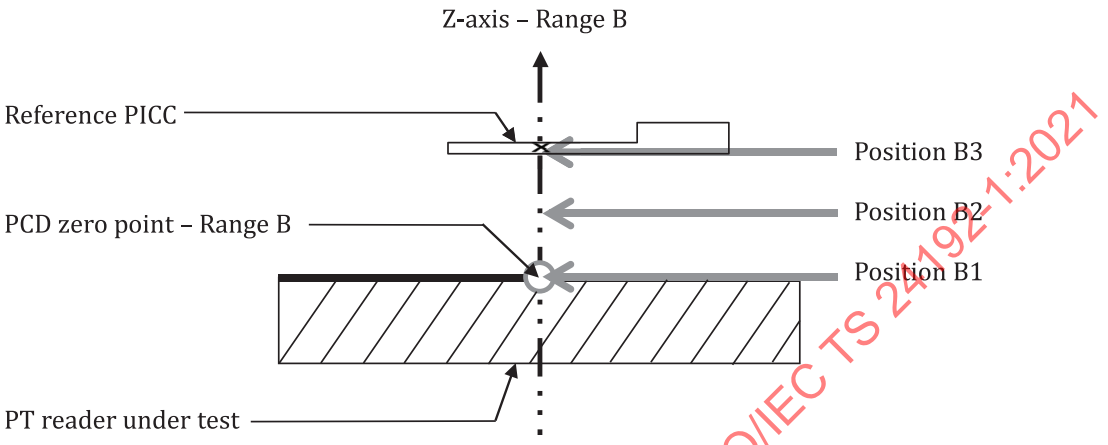

Figure 16 — Reference PICC in Position B3

11.3.4 Test mode

The PT reader under test shall propose a “test mode” offering the following functionalities:

a) nominal operation: places the sample under nominal PCD mode, polling activated;

b) control over the various test modes:

   1) possibility of activating the field continuously, without polling;

   2) polling sequence using only Type A polling commands;

   3) polling sequence using only Type B polling commands;

c) possibility of sending each of the following predefined APDU sequences:

   1) UT_TEST_COMMAND1 followed by UT_TEST_COMMAND1;

   2) UT_TEST_COMMAND2;

d) visual display of the transaction events log (for the PT reader sensitivity test).

UT_TEST_COMMAND1 and UT_TEST_COMMAND2 shall be indicated in the PCD ICS.

In order to ease the testing process (for saving time and reducing costs) it is recommended to implement a loopback interface in the PT reader under test. The requirements to be met by PT readers that choose to implement this loopback interface are described in Annex B.

11.4 Test conditions for PT objects

11.4.1 Test positions

The PT object under test shall be placed on the Test PCD assembly 1 which shall be operated according to ISO/IEC 10373-6.