



# SLOVENSKI STANDARD

## SIST-TS CEN/TS 16794-1:2017

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**Javni prevoz - Komunikacija med brezkontaktnimi čitalniki/terminali in prevoznimi mediji - 1. del: Zahteve za izvajanje ISO/IEC 14443**

Public transport - Communication between contactless readers and fare media - Part 1: Implementation requirements for ISO/IEC 14443

Öffentlicher Verkehr - Kommunikation zwischen berührungsslosen Lesegeräten und Fahrscheinmedien - Teil 1: Implementierungsanforderungen zur ISO/IEC 14443

Transport Public - Système billettique interopérable - Communication entre terminaux et objets sans contact - Partie 1: Exigences d'implémentation pour ISO/IEC 14443

**Ta slovenski standard je istoveten z: CEN/TS 16794-1:2017**

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**ICS:**

03.220.01	Transport na splošno	Transport in general
35.240.15	Identifikacijske kartice. Čipne kartice. Biometrija	Identification cards. Chip cards. Biometrics
35.240.60	Uporabniške rešitve IT v prometu	IT applications in transport

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TECHNICAL SPECIFICATION  
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**CEN/TS 16794-1**

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Supersedes CEN/TS 16794-1:2015

English Version

**Public transport - Communication between contactless  
readers and fare media - Part 1: Implementation  
requirements for ISO/IEC 14443**

Transport Public - Système billettique interopérable -  
Communication entre terminaux et objets sans contact  
- Partie 1: Exigences d'implémentation pour l'ISO/IEC  
14443

Öffentlicher Verkehr - Kommunikation zwischen  
berührungslosen Lesegeräten und Fahrscheinmedien -  
Teil 1: Implementierungsanforderungen zur ISO/IEC  
14443

This Technical Specification (CEN/TS) was approved by CEN on 17 April 2017 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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## European foreword

This document (CEN/TS 16794-1:2017) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 16794-1:2015.

This version updates the requirements applicable to the contactless interface of PT readers and objects to introduce interoperability with NFC mobile devices compliant to NFC Forum specifications.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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**CEN/TS 16794-1:2017 (E)****1 Scope**

This Technical Specification constitutes the 2nd edition of CEN/TS 16794-1. It sets out 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 standard contactless communications protocol.

This Technical Specification applies to PT devices:

PT readers which are contactless fare management system terminals acting as a PCD contactless reader based on ISO/IEC 14443 standard series;

PT objects which are contactless fare media acting as a PICC contactless object based on ISO/IEC 14443 standard series.

This new version also addresses interoperability of consumer-market NFC mobile devices, compliant to NFC Forum specifications, with above mentioned PT devices.

An interface-oriented test approach is used to evaluate the conformity of PT devices and is defined in CEN/TS 16794-2.

Application-to-application exchanges executed once contactless communication has been established at RF level fall outside the scope of this document. In line with the rules on independency between OSI protocol layers, this document works on the assumption that application-to-application exchanges are not contingent on the type of contactless communication established or by the parameters used for the low-level protocol layers that serve as the platform for these application-to-application exchanges.

**2 Normative references**

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

CEN/TS 16794-2, *Public transport - Communication between contactless readers and fare media - Part 2: Test plan for ISO/IEC 14443*

ISO/IEC 10373-6, *Identification cards - Test methods - Part 6: Proximity cards*

ISO/IEC 14443 (all parts), *Identification cards - Contactless integrated circuit cards - Proximity cards*

**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.

**3.1****common reader**

PT reader used in interoperable fare management system terminals with reduced performance requirements

Note 1 to entry: See 8.2.

**3.2****IFM reader**

PT reader used in interoperable fare management system terminals

Note 1 to entry: See 8.2.

**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

**3.5****NFC mobile device in reader/writer mode**

mobile device used as a PT reader

**3.6****non ISO/IEC 14443-3 frame coding**

frame using either:

ISO/IEC 14443-2 Type A modulation, with coding different from REQA or WUPA; or

ISO/IEC 14443-2 Type B modulation, with coding different from REQB or WUPB; or

ISO/IEC 18092 modulation; or

ISO/IEC 15693-2 modulation

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**3.7****Test PCD assembly**

Test PCD assembly (test reader) as defined in test method ISO/IEC 10373-6

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**3.8****PT device**

PT reader or PT object

**3.9****PT object**

ISO/IEC 14443 PICC specifically designed for the use in PT systems

**3.10****PT reader**

ISO/IEC 14443 PCD specifically designed for the use in PT systems

**3.11****Reference PICC**

Reference PICC (test card) as defined in test method ISO/IEC 10373-6

**CEN/TS 16794-1:2017 (E)****4 Symbols and abbreviations**

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

ICS	Implementation Conformance Statements
NFC	Near Field Communication
PT	Public Transport
$t_{\text{detect}}$	Maximum Reference PICC time-to-detection

**5 Conformance**

Conformance to this document carries a number of requisites:

- For a PT reader, to meet all the [Rdr $n$ ] requirements listed herein that are applicable according to the applicant's stated implementation characteristics (ICS), under the test conditions stipulated in Clause 9 and following the PCD test plan set out in CEN/TS 16794-2.
- For a PT object, to meet all the [Obj $n$ ] requirements listed herein that are applicable according to the applicant's stated implementation characteristics (ICS), under the test conditions stipulated in Clause 9 and following the PICC test plan set out in CEN/TS 16794-2.

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 CEN/TS 16794-1 is out of scope of this document.

**6 Interoperability of PT devices and NFC mobile devices****6.1 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 and TS.27.

The ISO/IEC 14443 conformant contactless interface of PT devices is designed and tested according to the rules set out in this technical specification.

The concept for interoperability was 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:

- ensure the interoperability between NFC mobile devices and PT devices; and
- avoid unnecessary test and certification effort.

The NFC Forum conducted a comparison of NFC Forum Analog and Digital specifications with ISO/IEC 14443 and ISO/IEC 10373-6 standards. 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:

1. Development of PT devices and NFC mobile devices

Despite the fact that different methods for describing the relevant parameters are used, this technical specification and the relevant implementation specifications from the NFC Forum can be synchronised. The necessary alignment is conducted by a liaison between CEN TC278 and the NFC Forum. By synchronising the implementations' specifications, interoperability is integrated in the design processes of NFC mobile devices and PT devices and makes it a common feature for both types of devices.

2. 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 ISO/IEC 14443 requirements set-out in this document. Therefore, it will be sufficient evidence of interoperability to test and certify ISO/IEC 14443 conformant PT devices according to CEN/TS 16794-2 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 compliant devices is described in [NFC Forum™ - Document describing the methodology used to demonstrate the concept of interoperability].

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**

		SIST-TS CEN/TS 16794-1:2017 <a href="https://standards.iteh.ai/catalog/standards/sist/781da988-0531-493d-a1a6-b84e0383a60d/sist-ts-cen-ts-16794-1-2017">https://standards.iteh.ai/catalog/standards/sist/781da988-0531-493d-a1a6-b84e0383a60d/sist-ts-cen-ts-16794-1-2017</a>		
		PT Objects <i>Specified and tested according to CEN/TS 16794</i>	Contactless Objects NFC mobile devices in card emulation mode <i>Specified and tested according to NFC Forum specifications</i>	
Contactless readers	PT readers <i>Specified and tested according to CEN/TS 16794</i>	IFM reader	Conformity based on CEN/TS 16794	Interoperability
		Common reader		
	NFC mobile devices in reader/writer mode <i>Specified and tested according to NFC Forum specifications</i>		Interoperability	Conformity based on NFC Forum specifications

## 6.2 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.

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

**CEN/TS 16794-1:2017 (E)****6.3 Limitations**

Only parameters, parameter settings or modes of operations that are relevant for PT use cases have been regarded and synchronized 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 synchronisation of specifications according to the concept for interoperability described in 6.1:

1. communication bit rates higher than 106 kbit/s;
2. peer-to-peer mode according to NFC Forum specifications;
3. ISO/IEC 18092 mode of communication;
4. ISO/IEC 15693 mode of communication.

**7 Requirements applicable to PT readers****7.1 General**

This clause sets out the requirements applicable to **PT readers**.

Requirements described in 7.3, 7.4 and 7.5 are normative and mandatory to achieve interoperability.

Requirement described in 7.6 is informative only, hence not necessary to achieve interoperability.

Requirements on PT readers are identified by a numbering format that reads [Rdrnn] where nn is the number of the requirement.

PT readers shall be able to read contactless objects, i.e. PT objects or NFC mobile devices in card emulation mode.

This clause does not set out the requirements applicable to consumer market NFC mobile devices which follow NFC Forum specifications and certification.

**7.2 Categories of PT reader**

This Technical Specification reflects that PT reader OT requirements depend on particular use cases. Those for mobile devices are documented in the STA document "Documentation of Use Cases for NFC Mobile Devices in Public Transport".

Therefore, two categories of PT readers are introduced:

- The first category, the "IFM reader", covers use cases where performance (i.e. operating distance, transaction time, etc) is key.
- 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":
  - a) sales infrastructure;
  - b) customer's home infrastructure;
  - c) mobile inspection terminals.

Some requirements given in this specification are adapted for Common readers.

There is no compromise against the cost of interoperability as all implementation requirements and tests that are necessary to achieve interoperability between PT readers and PT objects are mandatory for both PT reader categories.

### 7.3 Normative requirements applicable to PT readers

[Rdr1] The PT reader shall meet the mandatory normative requirements for PCD defined in the ISO/IEC 14443 standard series and associated ISO/IEC 10373-6 test methods standard.

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

NOTE 2 There are no particular restrictions to PT readers for accepting contactless objects using the UID values (Type A) or PUPI values (Type B) stipulated in the standard, including random UID/PUPI values.

NOTE 3 There are no particular restrictions to PT readers for accepting contactless objects using any value for Application data field (Type B).

EMV Contactless Specifications for Payment Systems — Book D imposes that the extended ATQB option shall not be supported. ISO/IEC 14443-3 considers that the support of this feature is optional.

NOTE 4 This document makes it possible for the PT reader to accept a broad spectrum of contactless objects, without distinction between form factors, but not smaller than Class 3, such as: contactless smartcards in ID-1 format (as defined in ISO/IEC 7810), contactless tickets, contactless USB keys and NFC mobile devices, or any other contactless fare media that is a PICC and is in conformance with the requirements stipulated in this document.

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### 7.4 Specific requirements applicable to PT readers

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[Rdr2] All the [Rdr1] requirements tested with the Reference PICCs 1, 2 and 3 shall be complied with within the operating distance range A.

For Common readers, the range A required is limited to positions A1 to A2. If those positions cannot be applied, because e.g. the fare media object shall be inserted into a card slot, a single position needs to be defined by the manufacturer of the Common reader and tested accordingly. This single position shall be either marked in such way that a user can clearly position his contactless object in this position or the mechanical construction shall control the positioning of the contactless object in this position.

[Rdr3] When tested with Reference PICC 3 all the [Rdr1] requirements tested shall be complied with within the operating distance range B. In addition, the PT reader shall provide a field strength of at least 2 A/m on all positions in this range B.

For Common readers, the range B required is limited to positions B1 to B2. If those positions cannot be applied, because e.g. the fare media object shall be inserted into a card slot, a single position needs to be defined by the manufacturer of the Common reader and tested accordingly. This single position shall be either marked in such way that a user can clearly position his contactless object in this position or the mechanical construction shall control the positioning of the contactless object in this position.

NOTE 1 These minimum operating distance ranges are added as complementary requirements to ISO/IEC 14443-2. Operating distance ranges A and B are defined in 9.2.3.

NOTE 2 The minimum field strength requirement in range B is necessary to ensure the interoperability with NFC mobile devices with antenna smaller than Class 3 which are compliant with NFCForum-TS-Analog-2.0 specification. A convergence with ISO/IEC 14443 minimum field strength value (to 1,5 A/m) is anticipated in a future edition of this document.

[Rdr4] The PT reader shall use an AFI of 00h (applicable to Type B only).

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[Rdr5] The PT reader shall comply with ISO/IEC 14443 recommendations on reception of bits and values reserved for future use.

NOTE 3 This requirement is intended to offer future proofed implementation that will allow the same behaviour to remain valid when new options in the ISO/IEC 14443 standard series use any of the currently RFU bits and/or values.

**7.5 Requirements on polling and recognizing contactless objects**

This subclause describes the “listen” strategy for polling contactless objects found present in the operational field but does not address how they are handled once detected.

EMV Contactless Specifications for Payment Systems — Book D stipulates that for EMVCo L1 certification, once a contactless object has been detected, polling shall continue for the other RF type and possible other contactless modulation schemes, codings and protocols on the same carrier frequency that the PT reader supports before opening a dialogue with the object first detected. This constraint slows the all-round transaction time, and consequently certain transport networks may prefer a response behaviour wherein the first object detected gets immediately treated rather than keep their terminal eligible for EMVCo L1 certification and thereby eligible for accepting payment cards.

[Rdr6] The time-to-detection of a Reference PICC requiring minimum SFGT (no SFGI or SFGI = 0) by the PT reader shall be less than  $t_{\text{detect}} = 250$  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. (standards.iteh.ai)

NOTE 1 For PT readers that don't keep their field continuously active, the Reference PICC time-to-detection is counted from the moment when the field is started and assumes that the PICC is already in the operating volume.

NOTE 2 While complying with the full set of requirements stipulated in ISO/IEC 14443-3 using the commands of (REQA and/or WUPA) and of (REQB and/or WUPB) specified in ISO/IEC 14443-3, the polling sequence may also poll for other objects non compliant with ISO/IEC 14443-3 using non ISO/IEC 14443-3 frame coding.

NOTE 3 In cases where objects non compliant with ISO/IEC 14443-3 are also polled for, it is possible to extend the polling window for a given type to longer times (up to the maximum time to detection defined in [Rdr6]) rather than go for performance speeds. This application-layer option to extend the polling time for a different type may be dependent on the number of cards of each type deployed locally at street-level.

When inserting field shut-offs in the polling sequence, the PT reader should take care that contactless objects using a random identifier will respond 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 field shut-off in their polling sequence should use a field shut-off to put the silent contactless object in IDLE state, allowing it to receive and answer request commands without need to manually remove it from the field.

NOTE 4 PT readers implementing a B-then-A polling subsequence immediately followed by a field shut-off, will not comply with EMV Contactless Specifications for Payment Systems — Book D requirements and thereby cannot be eligible for EMVCo L1 certification.

[Rdr7] The PT reader shall resume its polling sequence after the removal of any contactless device causing any disturbance.

[Rdr8] The PT reader may give priority to applications using a proprietary protocol initiated by ISO/IEC 14443-3 polling commands (REQA/WUPA and/or REQB/WUPB), but shall come back to

applications using the ISO/IEC 14443-4 protocol when no suitable application using such a proprietary protocol is found.

NOTE 5 This requirement is intended to ensure that the PT reader will not lock on a proprietary protocol when processing contactless objects supporting one or several other proprietary protocols initiated by ISO/IEC 14443-3 polling commands (REQA/WUPA and/or REQB/WUPB), in addition to ISO/IEC 14443-4 protocol.

The PT reader may give priority to applications using a proprietary protocol initiated by a non ISO/IEC 14443-3 polling command (see A.1.1). When no suitable application using such a proprietary protocol is found, the PT reader should continue its polling cycle until it sends the ISO/IEC 14443-3 polling commands (REQA/WUPA and REQB/WUPB), preferably after a field shut-off as the object may have locked in one of its proprietary protocols initiated by a non ISO/IEC 14443-3 polling command. [Rdr8] then applies so that the PT reader returns to seek applications using the ISO/IEC 14443-4 protocol when no suitable application using a proprietary protocol is found.

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

## 7.6 Performance requirements (informative)

The following requirement is providing performance indications and is informative only.

[Rdr9] 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 requirement is to avoid forcing the contactless object to segment its long answers into small frames, which would slow the transaction.

## 8 Requirements applicable to PT objects

### 8.1 General

This clause sets out the requirements applicable to PT objects.

Requirements described in 8.2 and 8.3 are normative and mandatory for achieving interoperability.

Requirement described in 8.4 is informative only, hence not necessary to achieve interoperability.

Requirements on PT objects are identified by a numbering format that reads **[Obj $nn$ ]** where  $nn$  is the number of the requirement.

PT objects shall be readable from contactless readers, i.e. PT readers or NFC mobile devices in reader/writer mode.

This clause does not set out the requirements applicable to consumer market NFC mobile devices which follow NFC Forum specifications and certification.

### 8.2 Normative requirements applicable to PT objects

[Obj1] The PT object shall meet the mandatory normative requirements for PICC defined in the ISO/IEC 14443 standard series and associated ISO/IEC 10373-6 test methods standard.

NOTE 1 PT object manufacturers are free to opt to conform or not to the EMV Contactless Specifications for Payment Systems — Book D requirements (which cap the bit rates capabilities indicated during the initialisation at 106 kbit/s in both directions).

NOTE 2 This document does not deal with PT objects that do not comply with ISO/IEC 14443-4, such as contactless tickets (or emulators thereof). This case is excluded from the scope of application of this document.