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Intelligent transport systems — Interoperability between interoperable fare management (IFM) systems and near field communication (NFC) mobile devices

Systèmes de transport intelligents — Interopérabilité entre les systèmes de gestion tarifaire interopérables (IFM) et les dispositifs mobiles à communication en champ proche (NFC)

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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).

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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.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

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.

Introduction

Globally, the increasing use of mobile devices and mobile services is one of the most visible trends. Public transport can benefit from this development since new products and services, such as multi-modal travel and traveller information, can be addressed more easily if the customer uses his or her mobile device as the interface to his or her service provider.

In order to take advantage of these new opportunities, the public transport industry can integrate customers' mobile devices with existing public transport fare management systems and ensure technical interoperability with the existing public transport infrastructure of contactless readers and media.

Today, the vast majority of mobile devices are equipped with a near field communication (NFC) interface and can in principle communicate with contactless public transport readers and media. However, globally there are several specifications for contactless interfaces in the industry which can deviate in some details from those for mobile devices. If no precautions are in place, such deviations have the potential to lead to interoperability issues.

A joint working group with participants from the global public transport sector, ISO, the NFC Forum, GSMA and CEN has started to address this issue over the past few years. As a result, there are now specifications and certification schemes in place that will make sure that mobile devices which follow the newly developed specifications for the NFC interface will support technical interoperability with the globally relevant standards for contactless interfaces of public transport devices.

This document presents the results of this work and can provide guidance to owners of interoperable fare management systems [interoperable fare management system suppliers, public transport (PT) operators, PT authorities] on how technical interoperability with NFC mobile devices can be achieved.

Intelligent transport systems — Interoperability between interoperable fare management (IFM) systems and near field communication (NFC) mobile devices

1 Scope

This document presents methods to establish technical interoperability between the contactless interfaces of NFC mobile devices and those of public transport readers and customer media. It provides information on how to apply these for public transport fare management systems which are using ISO/IEC 14443 and/or ISO/IEC 18092 and/or EMV® Contactless Interface Specification[1)] [9] as a basis for contactless communication.

This document deals with the application of standards, specifications and certification schemes from other organizations and standards bodies. These organizations and standards bodies are solely responsible for the content and the maintenance of these standards, specifications and certification schemes.

This document focuses on the technical interoperability of the contactless interfaces of NFC mobile devices and public transport devices. The goal is to reliably support communication and the exchange of data. Syntactic and semantic interoperability, i.e. the support for a particular public transport fare management application, is not covered by this document. However, practical experience shows that if technical interoperability is established successfully, the adoption of a specific public transport application can typically be achieved by loading the fare management system's particular application software onto the NFC mobile device.

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

ISO/IEC 22536, *Information technology — Telecommunications and information exchange between systems — Near Field Communication Interface and Protocol (NFCIP-1) — RF interface test methods*

ISO/IEC 23917, *Information technology — Telecommunications and information exchange between systems — NFCIP-1 — Protocol Test Methods*

ISO 24014-1, *Public transport — Interoperable fare management system — Part 1: Architecture*

ISO/IEC/TS 24192-1, *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) This trade name is provided for reasons of public interest or public safety. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO.

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)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 10373-6, the ISO/IEC 14443 series, ISO/IEC 18092, ISO/IEC 22536, ISO/IEC 23917, ISO 24014-1, ISO/IEC TS 24192-1 and ISO/IEC TS 24192-2 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
Type F
communication signal interface

Note 1 to entry: Conforms with the requirements for bit rates of *fc*/64 and *fc*/32 in ISO/IEC 18092.

3.2
technical interoperability
ability to establish communication between devices and support data exchange

4 Abbreviated terms

GCF	Global Certification Forum
GSMA	GSM Association
IFM	interoperable fare management
JRE	East Japan Railway Company
NFC	near field communication
PT	public transport

5 General considerations

5.1 Interoperability across different specifications

Globally, four different standards or specifications for the contactless interface cover most of the deployed public transport fare management systems:

a) ISO/IEC 14443 series;

b) ISO/IEC 18092;

c) EMV Contactless Interface Specification[9];

d) NFC Forum specifications (Analog, Digital, Activity)[2]–[6].

NFC mobile devices are designed for the global market. Adaptations for single markets or technologies are typically not supported by the mobile industry. In order to take advantage of the existing global public transport fare management infrastructures, the NFC interface of mobile devices supports interoperability with all the previously mentioned contactless specifications.

5.2 Need for continuous, synchronized maintenance

The standards or specifications mentioned in 5.1 are owned and maintained by individual bodies and working parties. In order to guarantee interoperability for current and future versions, the responsible bodies establish continuous working relationships that support alignment and synchronization before any changes are released.

Liaisons which established harmonization of contactless specification releases are in place between the bodies that maintain the NFC Forum specifications, the ISO/IEC TS 24192 series, ISO/IEC 18092 and the EMV Contactless Interface Specification, as well as the related communication signal interfaces.

The continuous working relationships between these specification bodies ensures future-proofed interoperability between PT devices and NFC mobile devices.

5.3 Relevance of certification

Public transport fare management systems which employ a variety of devices from different suppliers use specific measures to ensure technical interoperability of the contactless interfaces. This applies all the more if NFC mobile devices, which are external to the interoperable fare management system manager, will be used as a customer medium or as access devices to customer media:

a) To achieve technical interoperability, the contactless interfaces of the relevant devices conform with the same specifications or alternatively with specifications which are harmonized.

b) Practical experience shows that conformity to the necessary specifications can be reliably achieved if the devices pass specific testing. In that situation, test cases for these specifications and a neutral, trustworthy body that monitors testing and certifies the conformity to the requested specification can be used as a basis to establish conformity successfully.

6 Description of the solution for interoperability

6.1 Approach

The market-relevant standards and specifications for contactless proximity interfaces are implementing requirements from different markets or applications and are maintained by dedicated standardization or industry bodies. Deviations between particular parameters of these standards or different concepts for testing are justified by different device or application requirements. Current standards and specifications and the responsible bodies will keep their role in their markets.

Therefore, it was recognized that a complete harmonization of these standards would not be practical. Instead, the approach focused on establishing technical interoperability between the relevant standards and specifications by harmonization of just those parameters that are necessary for technical interoperability. The specifications and test concepts for the contactless proximity presented in Table 1 were included in this process.

Table 1 — Specifications and responsible bodies

Body	Specifications	Communication signal interface	Target devices
NFC Forum	NFC Forum specifications	Type F and ISO/IEC 14443	NFC mobile devices
ISO/IEC JTC1/SC17	ISO/IEC TS 24192-1 ISO/IEC TS 24192-2[a]	ISO/IEC 14443	ISO/IEC 14443-conformant PT readers and PT objects
ISO/IEC JTC1/SC6	ISO/IEC 18092	Type F and ISO/IEC 14443 Type A	Type F PT readers and PT objects

[a] Provides guidance to enable PT readers to achieve both the ISO/IEC TS 24192 series and EMVCo L1 certifications.

Table 1 *(continued)*

Body	Specifications	Communication signal interface	Target devices
EMVCo	EMV Contactless Interface Specification	ISO/IEC 14443	PT readers accepting EMV contactless payment applications on smart cards or mobile devices

[a] Provides guidance to enable PT readers to achieve both the ISO/IEC TS 24192 series and EMVCo L1 certifications.

An important goal of the concept is that NFC mobile devices support all contactless interface specifications which are relevant in public transport.

6.2 Partners, roles and responsibilities

In order to implement the approach in 6.1, the following activities were implemented:

a) The NFC Forum used its liaison relationships with ISO/IEC JTC1/SC17, which is responsible for ISO/IEC 14443, and EMVCo for harmonization of critical parameters of the NFC Forum's NFC Analog Specification with ISO/IEC 14443 and EMV Contactless Interface Specification.

b) GSMA and the NFC Forum established a joint PT working group which involved PT stakeholders from Japan, Europe, the US and CEN's activity for ISO/IEC TS 24192. This group identified the PT-specific requirements to the contactless proximity interfaces of mobile and PT devices and introduced these into the technical harmonization work.

c) ISO/IEC JTC1/SC17 generated the first edition of ISO/IEC TS 24192-1 and ISO/IEC TS 24192-2 which support implementation and testing of ISO/IEC 14443-conformant PT devices and are synchronized with the NFC Forum's Analog Specification.

d) JRE reviewed ISO/IEC 18092 in order to make sure that the requirements of Type F PT devices were fully covered.

e) Certification processes for NFC mobile devices and PT devices were established.

f) GSMA transferred all requirements for interoperability of NFC mobile devices into certification by the GCF.

As result, the following work split was defined:

— The contactless interface of NFC mobile devices was implemented and tested according to the NFC Forum's NFC Analog and Digital Specifications and Test Cases for Analog and Digital.

— The NFC Forum's specifications for the contactless interface and all other requirements to NFC mobile devices which apply to operate mobile services for PT are referenced by GSMA in TS.26[7].

— ISO/IEC TS 24192-1 and ISO/IEC TS 24192-2 apply to establish interoperability for ISO/IEC 14443-conformant PT devices.

NOTE Interoperability for ISO/IEC 14443-conformant PT devices was initially developed and based on CEN/TS 16794-1 and CEN/TS 16794-2. While these documents remain applicable, interoperability for ISO/IEC 14443-conformant PT devices is now being based on ISO/IEC TS 24192-1 and ISO/IEC TS 24192-2.

6.3 Implementation of interoperability of the contactless interface

6.3.1 Concept for NFC mobile devices

As stated in 5.1, NFC mobile devices support interoperability with the globally relevant contactless specifications for PT devices.