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Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-1 —

Part 1: Test suite structure and test purposes

Perception du télépéage — Évaluation de la conformité de l'équipement à l'ISO 17575-1 —

Partie 1: Structure de la suite d'essais et objectifs des essais

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

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

This first edition cancels and replaces ISO/TS 16407-1:2011, which has been technically revised.

The main changes compared to the previous edition are as follows:

- this document has been converted from a Technical Specification to an International Standard;
- this document has been amended to reflect changes to the underlying base standards, especially ISO 17575;
- this document contains major changes regarding
  - data element changes introduced by ISO 17575-1 and ISO 17575-3,
  - new test purposes related to protocol version handling and authenticated data elements,
  - removed test purposes related to rules with respect to charging which are not anymore required by ISO 17575-1,
  - revised terms and definitions, and
  - editorial and formal corrections, as well as changes to improve readability.

A list of all parts in the ISO 16407 series can be found on the ISO website.

Introduction

This document, is part of a series of International Standards that supports interoperability of autonomous electronic fee collection (EFC) systems. Autonomous systems use satellite positioning, often combined with additional sensor technologies, such as gyroscopes, odometers and accelerometers, to localize the vehicle and to find its position on a map containing the charged geographic objects, such as charged roads or charged areas. From the charged objects, the vehicle characteristics, the time of day and other data that are relevant for describing road use, the tariff and ultimately, the road usage fee is determined.

Autonomous on-board equiment (OBE) operates without relying on dedicated road-side infrastructure by employing wide-area technologies such as Global Navigation Satellite Systems (GNSS) and Cellular Communications Networks (CN). Therefore, autonomous systems can also be referred to as GNSS/CN systems.

Within the series of EFC standards, this document defines tests for conformity evaluation of Front End and Back End that comply with the requirements towards the charging specified in ISO 17575-1.

This document is based on ISO 17575-1 and the ISO/IEC 9646 series of standards on conformance test methodology.

Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-1 —

Part 1:
Test suite structure and test purposes

1 Scope

The ISO 16407 series of standards specifies a suite of tests in order to assess the Front End and Back End behaviour compliancy towards the requirements listed in ISO 17575-1. This document contains the definition of such tests in the form of test purposes, listing the required initial conditions, references and individual steps in a structured textual manner.

Test purposes defined in this document reflect the structural and semantical requirements stated in ISO 17575-1:

— presence/absence of particular data elements;

— semantics related to various data elements:

  — data group General (see ISO 17575-1:2016, 7.3);

  — data group Security (see ISO 17575-1:2016, 7.4);

  — data group Contract (see ISO 17575-1:2016, 7.5);

  — data group Usage (see ISO 17575-1:2016, 7.6);

  — data group Account (see ISO 17575-1:2016, 7.7);

  — data group Versioning (see ISO 17575-1:2016, 7.8).

With regard to the individual data sets and EFC attributes defined in ISO 17575-1, the test purposes have been organized into the test suite groups designated for the Front End and Back End, respectively.

Besides the test purposes, this document also specifies proforma conformance test report templates for both the Front End and Back End test purposes.

For more information regarding the requirements against which the conformance is evaluated in this document, see ISO 17575-1.

Testing of the following behaviours and functionalities is outside of the scope of this document:

— dynamic behaviour, i.e. sequence of messages and triggering events that can be exchanged/happen to fulfil certain charging scenarios;

— profiles and business logic built on top of particular pricing schemas;

— as ISO 17575-1 does not specify any Behaviour Invalid of Front End and Back End, BI test purposes are not applicable for any test purpose group.

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 17575-1:2016, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
area charging
charging based on road usage within a given area

[SOURCE: ISO 17575-1:2016, 3.1]

3.2
attribute
addressable package of data consisting of a single *data element* (3.9) or structured sequences of data elements

[SOURCE: ISO 17575-1:2016, 3.2]

3.3
authenticator
data, possibly encrypted, that is used for authentication

[SOURCE: EN 15509:2014, 3.3]

3.4
Back End
part of a back office system interfacing to one or more *Front Ends* (3.11)

[SOURCE: ISO 17575-1:2016, 3.4]

3.5
charge object
geographic or road related object for the use of which a charge is applied

[SOURCE: ISO 17575-1:2016, 3.5]

3.6
charge report
information containing road usage and related information originated at the *Front End* (3.11)

[SOURCE: ISO 17575-1:2016, 3.6]

3.7
cordon
border line of an area

[SOURCE: ISO 17575-1:2016, 3.7]

3.8
cordon charging
charging for the crossing of a *cordon* (3.7)

[SOURCE: ISO 17575-1:2016, 3.8]

3.9
data element
coded information, which might itself consist of lower level information structures

[SOURCE: ISO 17575-1:2016, 3.9]

3.10
data set
logical set of *data elements* (3.9) with a semantic relation

[SOURCE: ISO 17575-1:2016, 3.10, modified — Note 1 to entry has been deleted.]

3.11
Front End
part of a tolling system consisting of an *OBE* (3.13) and possibly, a *proxy* (3.14) where road tolling information and usage data are collected and processed for delivery to the *Back End* (3.4)

[SOURCE: ISO/TS 19299:2015, 3.17, modified — The term "road" has been added in the definition as well as Note 1 to entry.]

Note 1 to entry: The Front End comprises the OBE and an optional proxy.

3.12
layout
technical description of the location of tolled objects including their borders

[SOURCE: ISO 17575-3:2016, 3.12]

3.13
on-board equipment
OBE
all required equipment on-board a vehicle for performing required EFC functions and communication services

[SOURCE: ISO 17575-3:2016, 3.13]

3.14
proxy
optional part of a *Front End* (3.11) that communicates with external equipment and processes the data received into an agreed format to be delivered to the *Back End* (3.4)

[SOURCE: ISO 17575-1:2016, 3.13]

3.15
road section charging
tolling principle where the fee is due if predefined sections of roads are used

[SOURCE: ISO 17575-1:2016, 3.14]

3.16
toll
charge, tax, or duty levied in connection to using a vehicle in a *toll domain* (3.20)

Note 1 to entry: The definition is the generalization of the classic definition of a toll as a charge, a tax, or a duty for permission to pass a barrier or to proceed along a road, over a bridge, etc. The definition also includes fees regarded as an (administrative) obligation, e.g. a tax or a duty.

[SOURCE: ISO/TS 19299:2015, 3.42, modified — The phrase “in relation with” has been changed to “in connection to” in the definition.]

3.17
tolled area
geographic area where a *toll* (3.16) is charged for road usage

[SOURCE: ISO 17575-3:2016, 3.17]

3.18
toll context
logical view as defined by *attributes* (3.2) and functions of the basic elements of a *toll scheme* (3.22) consisting of a single basic tolling principle, a spatial distribution of the *charge objects* (3.5) and a single behaviour of the related *Front End* (3.11)

[SOURCE: ISO 17575-1:2016, 3.17]

3.19
toll context data
information defined by the responsible toll charger necessary to establish the *toll* (3.16) due for using a vehicle on a particular *toll context* (3.18) and to conclude the toll transaction

[SOURCE: ISO 12855:2015, 3.15]

3.20
toll domain
area or part of a road network where a certain *toll regime* (3.21) is applied

[SOURCE: ISO 17573:2010, 3.18]

3.21
toll regime
set of rules, including enforcement rules, governing the collection of *toll* (3.16) in a *toll domain* (3.20)

[SOURCE: ISO 17573:2010, 3.20]

3.22
toll scheme
organizational view of a *toll regime* (3.21), including the actors and their relationships

[SOURCE: ISO 17575-3:2016, 3.22]

4 Abbreviated terms

ADU	application data unit (see ISO 14906)
ASN.1	Abstract Syntax Notation One (see ISO/IEC 8824-1)
ATS	abstract test suite
BI	behaviour invalid
BV	behaviour valid (see EN 15876-1)
CCC	compliance check communication (see ISO 12813)
CN	cellular network
DUT	device under test

EFC	electronic fee collection (see ISO 14906)
GNSS	Global Navigation Satellite Systems
HMI	human machine interface
ID	identifier
IUT	implementation under test
OBE	on-board equipment (see ISO 14906)
PCTR	proforma conformance test report
PICS	protocol implementation conformance statements
TP	test purposes
TSS	test suite structure
TTCN	testing and test control notation
VAT	value added tax

5 Test suite structure

5.1 Structure

Table 1 shows the test suite structure (TSS).

Table 1 — Test suite structure

Group	Type of IUT	Behaviour
Charge report	Front End	Behaviour valid
		Behaviour invalid not applicable
Back end feedback	Front End	Behaviour valid
		Behaviour invalid not applicable
Charge report response	Back End	Behaviour valid
		Behaviour invalid not applicable

5.2 Reference to conformance test specifications

This document takes into account already defined test purposes for conformance to the base standards by referencing them, so that

a) for test purposes that are identical to those defined in this document or the base standards conformance test cases direct reference is reported; for reader's convenience, the title or a verbal description of the referenced test purpose is given, together with the reference,

b) for test purposes that are derived from those defined in the base standards conformance test cases, a direct reference is reported, plus an indication on how the referred test purpose shall be modified for the profile conformance testing,

c) for test purposes that are specific to ISO 17575-1, a complete description is given, and

d) an indication on whether a test purpose is identical, derived, or specific is given in each test purpose.

5.3 Test purposes (TP)

5.3.1 TP definition conventions

The TPs are defined following the rules shown in Table 2. All test purposes are defined in Annex A and Annex B, including the special notation and symbol conventions that shall be used. The data structures that shall be used are specified in Annex C and defined in ISO 17575-1.

Table 2 — TP definition rules

TP ID according to the TP naming conventions	Title
	Reference
	TP origin
	Initial condition
	Stimulus and expected behaviour

TP ID	The TP ID is a unique identifier. It shall be specified according to the TP naming conventions defined in 5.3.2.
Title	Short description of test purpose objective.
Reference	The reference should contain the references of the subject to be validated by the actual TP (specification reference, clause, paragraph) or the reference to the standard document defining the TP.
TP origin	Indicates if the TP is **identical** to a TP defined in another test standard, **derived** from a TP defined in another test standard or **specific** for this standard profile.
Initial condition	The condition defines in which initial state the IUT has to be to apply the actual TP.
Stimulus and expected behaviour	Definition of the events the tester performs and the events that are expected from the IUT to conform to the base specification.

5.3.2 TP naming conventions

Each TP is given a unique identification. This unique identification is built up to contain the following string of information:

TP_<group>_<iut>_<x>_<nn>

TP to indicate that it is a test purpose;

<group> which group TP belongs to;

<iut> type of IUT (i.e. FE or BE);

X type of testing [i.e. Behaviour Valid tests (BV) or Behaviour Invalid tests (BI)];

<nn> sequential TP number (01–99).

The naming conventions are as described in Table 3.

Table 3 — TP naming convention

Identifier: TP/<group>/<iut>/<x>-<nn>		
<group>		
applicable for FE	CR	Charge Report
applicable for FE	BEF	Back End Feedback
applicable for BE	CRR	Charge Report Response
<iut> = type of IUT	FE	Front End
	BE	Back End
x = Type of testing	BV	Behaviour Valid tests
	BI	Behaviour Invalid tests
<nn> = sequential number	(01–99)	test purpose number

5.4 Conformance test report

The supplier of the Front End and Back End, respectively, is responsible for providing a conformance test report.

The supplier of the Front End shall complete the proforma conformance test report (PCTR) for Front End as defined in Annex D.

The supplier of the Back End shall complete the proforma conformance test report (PCTR) for Back End as defined in Annex E.

Annex A
(normative)

Test purposes (TP) for Front End

A.1 General

This annex contains the test purposes (TP) for the conformity evaluation of Front End to ISO 17575-1.

A.2 TP symbols conventions

A special notation and symbol convention shall be used as defined in what follows.

Symbols are used in the description of the TPs with meanings according to Table A.1.

Table A.1 — Description of TP symbols

Symbol	Description
XXX.rq ⇒	The Tester sends the XXX.rq to the IUT
⇐ YYY.rs	The IUT sends the YYY.rs to the Tester
⇐ YYY.rs = {attribute1, attribute2, attribute3}	The IUT sends the YYY.rs to the Tester. YYY.rs shall not consist of any attributes different than attribute1, attribute2, attribute3. If any of attributes in the list is optional, it may be missing in YYY.rs.
⇐ YYY.rs = {attribute1 = value1}	The IUT sends the YYY.rs to the Tester with attribute1. Value of attribute1, i.e. value1 shall be stored by the tester and will be utilized in further TP steps.
A ≡ B	A “is equal to” B
A → B	A “is transformed” into B
Ø	Means “empty” or “not set”
A | B	A OR B
x → n^-	Value of parameter x is very close to n and x is less than n
x → n^+	Value of parameter x is very close to n and x greater than n

In addition, the sequence of ADUs issued by the Front End is not constrained by ISO 17575-1. This means that ADU cannot in general be forced to be generated by the IUT. To execute the test purposes it may be needed to filter out some ADUs, as they might not be applicable for TP, e.g. some ADUs are applicable for different toll context. This is illustrated in Figure A.1.