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Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-3 —

Part 1:
Test suite structure and test purposes

Perception du télépéage — Évaluation de la conformité de l'équipement à l'ISO 17575-3 —

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.

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

This first edition of ISO 16410-1 cancels and replaces the first edition of ISO/TS 16410-1:2011, which has been technically revised.

The following changes have been made:

— this document has been converted from a Technical Specification to an International Standard;

— amendments have been made to reflect changes to the underlying base standards, especially ISO 17575 (all parts);

— major changes have been made regarding:

— data element changes introduced by ISO 17575-1 and ISO 17575-3;

— new test purposes related to:

— protocol version handling;

— toll context partitions;

— fee calculation algorithm;

— rounding rules;

— alternative currency;

— test purposes related to the following have been removed:

— communications services;

— rules with respect to support of context data which are no longer required by ISO 17575-3;

— the terms and definitions have been revised;

— editorial and formal corrections, as well as changes to improve readability, have been made.

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Introduction

This document is part of a series of standards that supports interoperability of autonomous 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 equipment (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 may 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 context data specified in ISO 17575-3.

This document is based on

— ISO 17575-3, and

— the ISO 9646 series on conformance test methodology.

Electronic fee collection — Evaluation of equipment for conformity to ISO 17575-3 —

Part 1:
Test suite structure and test purposes

1 Scope

The ISO 16410 series provides a suite of tests in order to assess compliance of the Front End and Back End behaviours in relation to the requirements in ISO 17575-3. 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. ISO 16410-2 contains the identical tests written in testing and test control notation version 3 (TTCN v3).

The test purposes defined in this document reflect the structural and semantic requirements stated in ISO 17575-3.

— Presence/absence of particular data elements (see ISO 17575-3:2016, 8.5.5);

— Semantics related to various data elements, e.g.:

    — Activation of context data and handling multiple contexts (see ISO 17575-3:2016, 8.3);

    — Handling the precedence and priority levels (see ISO 17575-3:2016, 8.5.2 to 8.5.4);

    — Uniqueness of relevant data elements (see ISO 17575-3:2016, 8.5.2 to 8.5.4);

    — Correct definition of the charge objects (see ISO 17575-3:2016, 8.5.4);

    — Fee calculation algorithm (see ISO 17575-3:2016, 8.5.3.7);

— Security (see ISO 17575-3:2016, 7.2).

With regard to the individual data sets and EFC attributes defined in ISO 17575-3, the test purposes have been organized into the test suite groups, designated for the Front End and Back End respectively.

In addition to the test purposes, this document also provides proforma conformance test report templates for both the Front End and Back End test purposes and an informative statement on the usage of this document for the European electronic toll service (EETS).

For more information regarding the requirements against which the conformance is evaluated in this document, refer to ISO 17575-3.

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

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

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

— behaviour invalid of Front End and Back End, BI test purposes are not applicable for any test purpose group (as ISO 17575-3 does not specify behaviour invalid).

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

ISO 17575-3:2016, *Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data*

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 or structured sequences of *data elements* (3.9)

[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 17575-3:2016, 3.10]

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]

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)

[SOURCE: ISO/TS 19299:2015, 3.42]

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.

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

ASN.1   Abstract syntax notation one

ATS   Abstract test suite

BI   Behaviour invalid

BV   Behaviour valid (EN 15876-1)

CCC   Compliance check communication

CN   Cellular network

DUT   Device under test

EFC   Electronic fee collection

GNSS   Global navigation satellite systems

HMI   Human machine interface

ID   Identifier

IUT   Implementation under test

OBE   On-board equipment

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
Procedural	Back End	Behaviour Valid
		Behaviour Invalid not applicable
ADU Header	Back End	Behaviour Valid
		Behaviour Invalid not applicable
ADU Body – Attribute general	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Toll Context Overview and Toll Context Partition Overview	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Tariff Table and Currency Conversion Table	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Tariff Class Definition	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Local Vehicle Class Definition	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Time Class Definition	Back End	Behaviour Valid
		Behaviour Invalid not applicable

Table 1 *(continued)*

Group	Type of IUT	Behaviour
User Class Definition	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Toll Context Layout	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Toll Context Layout for Section Pricing	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Toll Context Layout for Area Pricing	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Toll Context Layout for Cordon Pricing	Back End	Behaviour Valid
		Behaviour Invalid not applicable
Context Handling	Front End	Behaviour Valid
		Behaviour Invalid not applicable
Charge Report	Front End	Behaviour Valid
		Behaviour Invalid not applicable

Front End related test purposes uses Charge Report message for validation which is specified in ISO 17575-1. As a precondition to run those test purposes, compliance to ISO 17575-1 shall be validated.

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, a direct reference is reported; for the 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 has to be modified for the profile conformance testing,

c) for test purposes that are **specific** to ISO 17575-3, 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 and ISO 17575-3.

Table 2 — TP definition rules

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

Table 2 *(continued)*

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 defined 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 the 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 BE	PRO	Procedural
applicable for BE	ADUH	ADU Header
applicable for BE	ADUB	ADU Body – EFC Attribute general
applicable for BE	TC	Toll Context Overview and Toll Context Partition Overview
applicable for BE	TT	Tariff Table and Currency Conversion Table
applicable for BE	TACD	Tariff Class Definition
applicable for BE	LVCD	Local Vehicle Class Definition
applicable for BE	TICD	Time Class Definition
applicable for BE	USCD	User Class Definition
applicable for BE	TCL	Toll Context Layout
applicable for BE	TCL-S	Toll Context Layout for Section Pricing
applicable for BE	TCL-A	Toll Context Layout for Area Pricing
applicable for BE	TCL-C	Toll Context Layout for Cordon Pricing
applicable for FE	CH	Context Handling
applicable for FE	CR	Charge Report
\<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 (notably Tables D.1 to D.4).

The supplier of the Back End shall complete the proforma conformance test report (PCTR) for Back End as defined in Annex E (notably Tables E.1 to E.4).