TECHNICAL SPECIFICATION

ISO/TS 16401-1

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Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-2 —

Part 1:
Test suite structure and test purposes

Perception du télépéage — Évaluation de conformité de l'équipement à l'ISO/TS 17575-2 —

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

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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

ISO/TS 16401-1 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with Technical Committee CEN/TC 278, *Road transport and traffic telematics*.

ISO/TS 16401 consists of the following parts, under the general title *Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-2*:

— *Part 1: Test suite structure and test purposes*

— *Part 2: Abstract test suite*

Introduction

This part of ISO/TS 16401 is part of a set of standards that supports interoperability of autonomous EFC-systems, which includes ISO/TS 17575 parts 1 to 4 that define the EFC context data, their *charge report*s and their use of communication infrastructure.

Within the suite of EFC standards this conformance evaluation procedure defines the process and tests for conformity evaluation of Front End Communications API and *Front End application* that comply with the requirements in ISO/TS 17575-2.

This part of ISO/TS 16401 is intended to

— assess Front End Communications API and *Front End application* capabilities,

— assess Front End Communications API and *Front End application* behaviour,

— serve as a guide for Front End Communications API and *Front End application* conformance evaluation and type approval,

— achieve comparability between the results of the corresponding tests applied in different places at different times, and

— facilitate communications between parties.

This part of ISO/TS 16401 is based on

— ISO/TS 17575-2, and

— the ISO/IEC 9646 family of standards on conformance test methodology.

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Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-2 —

Part 1:
Test suite structure and test purposes

1   Scope

This part of ISO/TS 16401 specifies the test suite structure (TSS) and test purposes (TP) to evaluate the conformity of Front End Communications API and *Front End application* to ISO/TS 17575-2.

The objective of this part of ISO/TS 16401 is to provide a basis for conformance tests for Front Ent Communications API and *Front End application* in Electronic Fee Collection based on autonomous on-board equipment (OBE) to enable interoperability between different equipment supplied by different manufacturers.

This part of ISO/TS 16401 covers the test purposes for Front End Communications API covering functionalities related to instance handling, session handling, communication service primitives (i.e. sending/receiving of ADUs) and visible state transitions. It fully covers EFC communication services claimed in ISO/TS 17575-2 clause 7 and PICS proforma Clause B.2 ISO/TS 17575-2. Claims related to Front End Storage capacity are outside of the scope of this part of ISO/TS 16401.

This part of ISO/TS 16401 covers the test purposes for *Front End application* related to session establishment on *Back End* request and related to session re-establishment when session requested by *Back End* failed. There are no other claims with respect to *Front End application* claimed in ISO/TS 17575-2.

The underlying communication technology requirements for layer 1-4 specified in Clause 8 ISO/TS 17575-2 is outside of the scope of this part of ISO/TS 16401.

Similarly *Back End* communications API is outside of the scope of this part of ISO/TS 16401. According to ISO/TS 17575-2 it is expected that these Front End Communications API will be reflected in the BE, however BE Communications API is outside of the scope of ISO/TS 17575-2.

2   Normative references

The following referenced documents are indispensable for the application 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/TS 17575-1, *Electronic fee collection — Application interface definition for autonomous systems — Part 2: Charging*

ISO/TS 17575-2, *Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connection to the lower layers*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 17575-1 and the following apply.

3.1
contract
expression of an agreement between two or more parties concerning the use of the road infrastructure

[ISO 14906:2011, definition 3.7]

NOTE   A *contract* specifies obligations, permissions and prohibitions for the objects involved.

3.2
Front End application
part of the Front End above the API

3.3
service provider
operator that accepts the user's payment means and in return provides a *road*-use service to the user

NOTE   Taken from ISO 14906:2004.

3.4
toll charger
legal entity charging toll for vehicles in a *toll domain*

[ISO/TS 17574:2009, definition 3.27]

4   Abbreviations

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For the purposes of this document, the following abbreviations apply throughout the document unless otherwise specified.

ADU   Application Data Unit

API   Application Programming Interface

ASN.1   Abstract Syntax Notation One

ATS   Abstract Test Suite

BE   *Back End*

BI   Invalid Behaviour

BV   Valid Behaviour

CCC   Compliance Check Communication

CN   Cellular Network

DUT   Device Under Tests

EFC   Electronic Fee Collection

FE   Front End

GNSS   Global Navigation Satellite Systems

HMI   Human Machine Interface

ID   Identifier

OBE	On-Board Equipment
PCTR	Protocol Conformance Test Report
PICS	Protocol Implementation Conformance Statements
TP	Test Purposes
TSS	Test Suite Structure
VAT	Value Added Tax

5 Test Suite Structure (TSS)

5.1 Structure

Table 1 — Test Suite Structures shows the Test Suite Structure (TSS).

Table 1 — Test Suite Structures

Group	Type of DUT	Behaviour
Instance Handling	Front End Communications API	Valid Behaviour
		Invalid Behaviour
Session Handling	Front End Communications API	Valid Behaviour
		Invalid Behaviour
	Front End application	Valid Behaviour
Communication Service Primitives	Front End Communications API	Valid Behaviour
		Invalid Behaviour
State Transitions	Front End Communications API	Valid Behaviour

5.2 Reference to conformance test specifications

This part of ISO/TS 16401 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 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 has to be modified for the profile conformance testing.

c) For test purposes that are **specific** to ISO/TS 17575-2, a complete description is given.

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 — TP Definition Rules below. All Test Purposes are defined in Annex A and Annex B, including the special notation and symbol conventions that shall be used.

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 the sub-clause below.
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 DUT 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 DUT 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>/<dut>/<x>-<nn>

TP   : to indicate that it is a Test Purpose;

<group> : which group TP belongs to;

<dut>   : type of DUT (i.e. API or APPL);

X   : type of testing (i.e. Valid Behaviour tests – BV, or Invalid Behaviour 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>/<dut>/<x>-<nn>

<group>		
applicable for FE Communications API	IH	Instance Handling
applicable for FE Communications API	SH	Session Handling
applicable for FE Application	SH	Session Handling
applicable for FE Communications API	CSP	Communications Service Primitives
applicable for FE Communications API	ST	State Transitions
<dut> = type of DUT	API	Front End Communications API
	APPL	*Front End application*
x = Type of testing	BV	Valid Behaviour Tests
	BI	Invalid Behaviour Tests
<nn> = sequential number	(01-99)	Test Purpose Number

5.4 Protocol Conformance Test Report (PCTR)

The supplier of the Front End and Back End, respectively, is responsible for providing a Protocol Conformance Test Report (PCTR).

The supplier of the Front End and the Back End shall complete a PCTR; see Annex C and Annex D for the proformas.

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b63f008eff1a/iso-ts-16401-1-2012

Annex A
(normative)

TP for Front End Communications API

A.1 Introduction

This annex contains the Test Purposes (TP) for the conformity evaluation of Front End Communications API to ISO/TS 17575-2.

A.1.1 TP symbols conventions

A special notation and symbol convention is used, as defined in what follows.

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

Table A.1 — Description of TP Symbols

SYMBOL	DESCRIPTION
XXX(Type1=value1)	The Tester executes an XXX method of Front End Communications API with argument of Type1 having value value1. Value1 shall be stored in tester's memory for further TP processing.
R:ReturnedType	The DUT returns a value of type ReturnedType
C:CallbackName (Type1)	The DUT provides a callback CallbackName receiving variable of type Type1.
Type ISO/TS 17575-2	Anytime Type defined in ISO/TS 17575-2 is used, it means a variable of Type.
A → B	A "is transformed" into B
Ø	Means "empty" or "not set".
A | B	A OR B
A != B	A is not equal B
i = i+1	Increment variable i by 1

Testing Front End Communications API it is needed to trigger operations and observe the DUT feedback both from the *Front End application* and Remote End (i.e. *Back End*) perspective. Thus there are two test points located as shown in Figure A.1.

Application emulation test point is using directly with DUT and emulates the *Front End application* layer. It is identified in the following test purposes by AppEm discriminator.

Remote End emulation test point is linked with DUT over communications channel. Depending on the test purposes it emulates application, presentation and session layer. It is identified in the following test purposes by RemEnd discriminator.
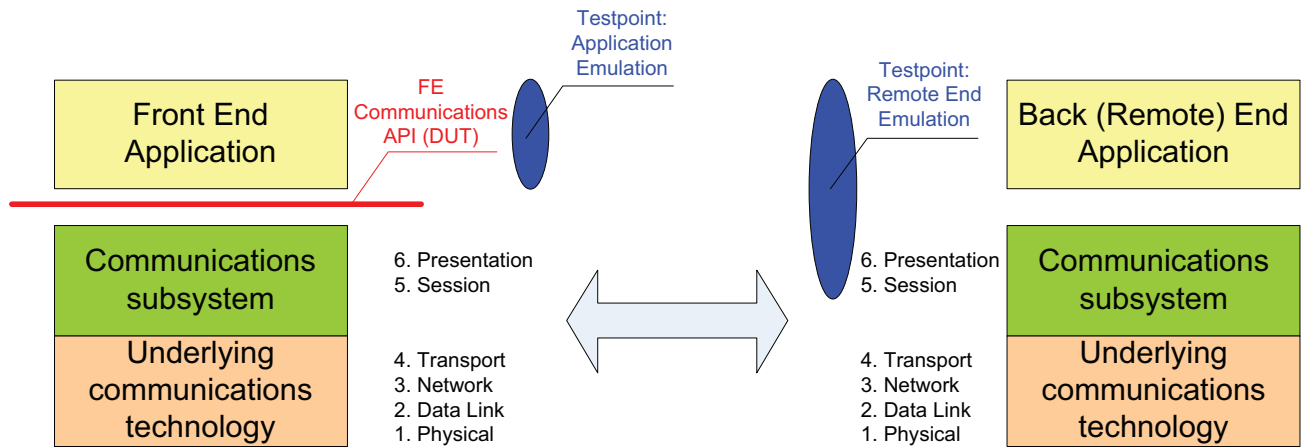

Figure A.1 — Handling of ADUs applicable for particular TP

A.2 Instance Handling

These Test Purposes apply to instance handling as claimed in ISO/TS 17575-2 clause B.2 with respect to following PICS proforma entries:

— API supports InitialiseInstance;

— API supports SetParameter;

— API supports GetParameter;

— API supports DeleteParameter;

— API supports DropInstance;

— API supports StackAvail.

A.2.1 BV test purposes (Valid Behaviour tests)

Test subgroup objective:

— to test DUT behaviour with respect to instance initialization including multiple instance handling in parallel;

— to test DUT behaviour with respect to parameter setting and updating;

— to test DUT behaviour with respect to parameter getting;

— to test DUT behaviour with respect to parameter deleting;

— to test DUT behaviour with respect to availability of communications stack;

— to test DUT behaviour with respect to dropping the session with following severities:

— SENormal;

— SEUrgent;

— SEUnconditional.

<table>
<tr><td colspan="2">TP/IH/API/BV/01</td><td colspan="4">Verify the communications interface initialization</td></tr>
<tr><td colspan="2">TP Origin</td><td colspan="4">Specific</td></tr>
<tr><td colspan="2">Reference</td><td colspan="4">ISO/TS 17575-2, Clause 7.2.1</td></tr>
<tr><td colspan="2">Initial Condition</td><td colspan="4">Front End Communications API must handle at least one underlying communications stack which StackID equals to stack1.

Set of Callback instances is instantiated.</td></tr>
<tr><td colspan="6">Stimulus and Expected Behaviour</td></tr>
<tr><td></td><td>Tester</td><td>Test Point</td><td></td><td colspan="2">DUT</td></tr>
<tr><td>1</td><td>InitialiseInstance (StackID = stack1, Callbacks = cb1)</td><td>AppEm</td><td></td><td colspan="2"></td></tr>
<tr><td>2</td><td></td><td>AppEm</td><td></td><td colspan="2">R: Instace</td></tr>
<tr><td>3</td><td>Verify whether Instance is valid</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>4</td><td>IF verify OK   THEN TP passed
        ELSE TP failed
ENDI</td><td></td><td></td><td colspan="2"></td></tr>
</table>

		Test Point		DUT
	TP/IH/API/BV/02			**Verify the multiple instance communications interface initialization based on the same communications stack**

TP Origin	Specific
Reference	ISO/TS 17575-2, Clause 7.2.1
Initial Condition	Front End Communications API must handle at least one underlying communications stack which StackID equals to stack1. Sets of Callback instances are instantiated.

Stimulus and Expected Behaviour

	Tester	Test Point		DUT
1	InitialiseInstance **(StackID = stack1, Callbacks = cb1)**	**AppEm**		
2		**AppEm**		R: Instance
3	**Verify whether** Instance **is valid**			

4	**IF verify OK**
	    THEN GOTO step5
	    ELSE TP failed
	ENDIF			

5	InitialiseInstance **(StackID = stack1, Callbacks = cb2)**	**AppEm**		
6		**AppEm**		R: Instance
7	**Verify whether** Instance **is vali**			

8	**IF verify OK**
	    THEN GOTO step 9
	    ELSE TP failed
	ENDIF			

9	InitialiseInstance **(StackID = stack1, Callbacks = cb3)**	**AppEm**		
10		**AppEm**		Instance
11	**Verify whether** Instance s valid			
12	**IF verify OK** **THEN TP passed ELSE TP failed** **ENDIF**			

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