TECHNICAL SPECIFICATION

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Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-4 —

Part 1: Test suite structure and test purposes

Perception du télépéage — Évaluation de conformité de l'équipement à l'ISO/TS 17575-4 —
Partie 1: Structure de la suite d'essais et objectif d'essai

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Foreword

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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:

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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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 16403-1 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 16403 consists of the following parts, under the general title *Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-4*:

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

— *Part 2: Abstract test suite*

Introduction

This part of ISO/TS 16403 is part of a set of standards that supports interoperability of autonomous EFC-systems, which includes ISO/TS 17575 that defines the EFC context data, their charge reports 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 and Back End that comply with the requirements in ISO/TS 17575-4.

This part of ISO/TS 16403 is intended to

— assess Front End and Back End capabilities,

— assess Front End and Back End behaviour,

— serve as a guide for Front End and Back End 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 16403 is based on ISO/TS 17575-4.

Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-4 —

Part 1: Test suite structure and test purposes

1 Scope

This part of ISO/TS 16403 specifies the test suite structure (TSS) and test purposes (TP) to evaluate the conformity of Front End and Back End to ISO/TS 17575-4.

The objective of the present document is to provide a basis for conformance tests for the Front End and the Back End in Electronic Fee Collection based on autonomous on-board equipment (OBE) to enable interoperability between different equipment supplied by different manufacturers.

Autonomous OBE operate without relying on dedicated road-side infrastructure by employing wide-area technologies such as Global Navigation Satellite Systems (GNSS) and Cellular Communications Networks (CN). These EFC systems are referred to by a variety of names. Besides the terms autonomous systems and GNSS/CN systems, also the terms GPS/GSM systems, and wide-area charging systems are in use.

Autonomous systems use satellite positioning, often combined with additional sensor technologies such as gyroscopes, odometers, and accelerometers to localise 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.

Test Purposes applicable for the Back End focus on the output produced by the Back End, i.e. Roaming Rules data element. Test Purposes related to Front End focus on the main scenarios defined in ISO/TS 17575-4 6.2.4. To verify the Front End behaviour it is needed to observe Charge Reports which are defined in ISO/TS 17575-1.

The dependencies between Context Data (defined in ISO/TS 17575-3), Charge Report (defined in ISO/TS 17575-1) and Roaming (defined in ISO/TS 17575-4) to support a particular pricing scheme scenario are outside of the scope of this part of ISO/TS 16403.

As ISO/TS 17575-4 does not specify any invalid behaviour of Front End and Back End, BI test purposes are not applicable for any Test Purpose group.

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 14906, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO 17573, *Electronic fee collection — Systems architecture for vehicle-related tolling*

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

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

ISO/TS 17575-4, *Electronic fee collection — Application interface definition for autonomous systems — Part 4: Roaming*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17573, 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

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

[ISO 14906:2011, definition 3.7]

3.2
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.

3.3
toll charger
legal entity charging toll for vehicles in a toll domain

[ISO/TS 17574:2009, definition 3.27]

4 Abbreviations

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

ADU	Application Data Unit
ASN.1	Abstract Syntax Notation One
ATS	Abstract Test Suite
BI	Invalid Behaviour
BV	Valid Behaviour
CCC	Compliance Check Communication
CN	Cellular Network
DUT	Device Under Tests
EFC	Electronic Fee Collection
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
General	Front End	Valid Behaviour
		Invalid Behaviour not applicable
	Back End	Valid Behaviour
		Invalid Behaviour not applicable
Combined Charge Report	Front End	Valid Behaviour
		Invalid Behaviour not applicable
Relevant EFC Contexts	Front End	Valid Behaviour
		Invalid Behaviour not applicable
Data Elements	Back End	Valid Behaviour
		Invalid Behaviour 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 specification 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 has to be modified for the profile conformance testing.

c) For test purposes that are **specific** to ISO/TS 17575-4, 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. The data structures that shall be used are specified in Annex C and defined in ISO/TS 17575-3 and ISO/TS 17575-4.

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. FE or BE);

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 and BE	GEN	General
applicable for FE	CCR	Combined Charge Report
applicable for FE	REC	Relevant EFC Contexts
applicable for BE	DAT	Data elements
<dut> = type of DUT	FE	Front End
	BE	Back End
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 D and Annex E for the proformas.

Annex A
(normative)

Test Purposes for Front End

A.1 Introduction

This annex contains the Test Purposes (TP) for the conformity evaluation of Front End to ISO/TS 17575-4.

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.rq ⇒	The Tester sends the XXX.rq to the DUT
XXX.rq(arg1=value1) ⇒	The Tester sends the XXX.rq to DUT with argument arg1 equal to value value1.
roamingRules = **RoamingRulesX** ⇒	The Tester sends RoamingRuleX data element defined in Annex C to the DUT
⇐ YYY.rs	It is expected DUT sends the YYY.rs to the Tester
⇐ YYY.rs (arg1=value1)	It is expected DUT sends the YYY.rs to the Tester. Received value of argument arg1 shall be stored by the tester as value1.
A ≡ B	A "is equal to" B
A → B	A "is transformed" into B
Ø	Means "empty" or "not set".
A != B	A is not equal B

A.2 General Test Purposes

These Test Purposes apply to requesting update of RoamingRules when recognizing the event requiring new roaming data as claimed in ISO/TS 17575-4 clause B.5.4 Table B.3/1.

A.2.1 BV test purposes

Test subgroup objective:

— to test the behaviour of the DUT in relation to requesting roaming rule update

by means of the syntactically and contextual correct ADU consisting of RoamingRules and ChargeReportResponse ADU.

TP/GEN/FE/BV/01	**Verify whether Front End requests an update of the roaming rule attribute**
TP Origin	Specific
Reference	ISO/TS 17575-4, Clause 7.1
Initial Condition	Front End is initialized and can accept Context Data (including Roaming Rules). Front has already received the following context data: – for EFC Context #1:: –11'D – TollContextOverview ▪ tollContext.countryCode = countryCode1 ▪ tollContext.providerIdentifier = 1 ▪ tollCharger.countryCode = countryCode1 ▪ tollCharger.providerIdentifier = 1000 –21'D – TariffTable –22'D – TariffClassDefinition –23'D - LocalVehicleClassDefinition –24'D - TimeClassDefinition –25'D - UserClassDefinition –31'D - TollContextLayout –41'D – ChargeReportingEvents –42'D - ChargeReportConfiguration (regimeId of usageStatement is enabled) OBU belonging to the Front End is located within geographic area of EFC Context #1. No authentication is required by the Front End.

Stimulus and Expected Behaviour

	Tester		DUT
1	Iso17575-3Adu = {aduHeader, roamingRules = **RoamingRules6**}	⇒	
2	**At least one UsageStatement can be reported by Front End for EFC Context #1 AND event defined in** 41'D – ChargeReportingEvents **of EFC Context #1 occurred.**		
3		⇐	ChargeReport = { obeId, vehicleLPNr, paymentMeans, serviceProviderContract, tol ha ger, timeOfReport, reportPeriod, versionInfo, usageStatementList, vatForThisSession, accountStatus, transactionCounter, mileage, listOfCCCAttributes, authenticator}
4	**IF** ChargeReport **not received** **THEN TP failed** **ENDIF**		
5	ChargeReportResponse = { reportRecipientId = any, dataReceived = (ChargeReport.timeOfReport | ChargeReport.mileage | ChargeReport.transactionCounter) , versionsResponse = verResp1, obeStatusForDriver = 0, accountUpdate = ø, responseAuthenticator = ø} NOTE verResp1 indicates that new roaming rules are available. ISO/TS 17575-4 does not specify versionsResponse syntax.	⇒	

		⇐	**DUT requests an update of roaming rules attribute as defined in ISO/TS 17575-4.**
6	**IF request received THEN TP passed ELSE TP failed ENDIF**		

A.2.2 BI test purposes

No BI test purposes are applicable for this TP group.

A.3 Relevant EFC Context Test Purposes

These Test Purposes apply to relevant EFC Contexts as claimed in ISO/TS 17575-4 Clause B.5.4 Table B.5/2, reuse of tariff information as claimed in ISO/TS 17575-4 Clause B.5.4 Table B.6/2, reuse of reporting rules as claimed in ISO/TS 17575-4 Clause B.5.4 Table B.6/3, precedence level as claimed in ISO/TS 17575-4 Clause B.5.4 Table B.6/6, and sending charge report if entering EFC context as claimed in ISO/TS 17575-4 Clause B.5.4 Table B.6/7.

A.3.1 BV test purposes

Test subgroup objective:

— to test the behaviour of the DUT in relation to roaming rule update;

— to test the behaviour of the DUT in relation to ignoring not listed EFC Contexts;

— to test the behaviour of the DUT in relation to re-use of tariff class and reporting rules from another EFC Context;

— to test the behaviour of the DUT in relation to precedence level handling;

— to test the behaviour of the DUT in relation to sending charge report when entering particular EFC Context

by means of the syntactically and contextual correct ADU consisting of RoamingRules.

TP/REC/FE/BV/01	**Roaming Rules update**
TP Origin	Specific
Reference	ISO/TS 17575-4, Clause 6.2.2.1
Initial Condition	Front End is initialized and can accept Context Data (including Roaming Rules). Front has already received the following context data: – for EFC Context #1: –11'D – TollContextOverview ▪ tollContext.countryCode = countryCode1 ▪ tollContext.providerIdentifier = 1 –21'D – TariffTable –22'D – TariffClassDefinition –23'D - LocalVehicleClassDefinition –24'D - TimeClassDefinition –25'D - UserClassDefinition –31'D - TollContextLayout –41'D - ChargeReportingEvents (different than in EFC Context #2) –42'D - ChargeReportConfiguration (different than in EFC Context #2, but regimeId of usageStatement is enabled). – for EFC Context #2:: –11'D – TollContextOverview ▪ tollContext.countryCode = countryCode1 ▪ tollContext.providerIdentifier = 2 –21'D – TariffTable –22'D – TariffClassDefinition –23'D - LocalVehicleClassDefinition –24'D - TimeClassDefinition –25'D - UserClassDefinition –31'D - TollContextLayout –41'D - ChargeReportingEvents (different than in EFC Context #1) –42'D - ChargeReportConfiguration (different than in EFC Context #1, but regimeId of usageStatement is enabled). – for EFC Context #3: –11'D – TollContextOverview ▪ tollContext.countryCode = countryCode1 ▪ tollContext.providerIdentifier = 3 –31'D - TollContextLayout OBU belonging to the Front End is located within geographic borders of EFC Context #3. Geographic area of EFC Context #1, #2 and #3 do not overlap. No authentication is required by the Front End.

Stimulus and Expected Behaviour

	Tester		DUT
1	Iso17575-3Adu = {aduHeader, roamingRules = — RoamingRules1 }	⇒	
2	**At least one UsageStatement can be reported by Front End and Event defined in** 41'D – ChargeReportingEvents **of EFC Context #1**		