TECHNICAL SPECIFICATION

ISO/TS 16403-2

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

Part 2:
Abstract test suite

Perception du télépéage — Évaluation de conformité de l'équipement à l'ISO/TS 17575-4 —

Partie 2: Suite d'essai abstraite

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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:

— 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;

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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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 16403-2 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 electronic fee collection (EFC) systems. These include ISO/TS 17575, which defines EFC systems' 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.

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;

— facilitate communications between parties.

ISO/TS 16403 is based on:

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

— 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*.

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

Part 2:
Abstract test suite

1 Scope

The objective of this part of ISO/TS 16403 is to provide a basis for conformance tests for Front End and Back End in electronic fee collection, based on autonomous on-board equipment. This supports interoperability between different equipment supplied by different manufacturers.

The present abstract test suite (ATS) is directly derived from ISO/TS 16403-1.

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 16403-1:2012, *Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-4 — Part 1: Test suite structure and test purposes*

ISO/TS 17575-1:2010, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging*

ISO/TS 17575-2:2010, *Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connection to the lower layers*

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, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 16403-1 and the following apply.

3.1.1
Back End
BE
generic name for the computing and communication facilities of the Service Provider and/or the Toll Charger

[ISO/TS 17575-4:2011, definition 3.4]

3.1.2
conformance testing
testing the extent to which an IUT is a conforming implementation

[ISO/IEC 9646-1:1994, definition 3.3.23]

3.1.3
equipment access port
eaPort
port used to control the implementation under test

3.1.4
Front End
FE
part(s) of the toll system where usage data for an individual user are collected, processed and delivered to the Back End

NOTE 1   The Front End comprises the on-board equipment and an optional proxy.

NOTE 2   Adapted from ISO/TS 17575-4:2011.

3.1.5
IUT
implementation under test
an implementation of one or more OS1 protocols in an adjacent user/provider relationship, being that part of a real open system which is to be studied by testing

[ISO/IEC 9646-1:1994, definition 3.3.43]

3.1.6
system under test
SUT
the real open system in which the IUT resides

[ISO/IEC 9646-1:1994, definition 3.3.103]

3.1.7
test case
TC
an abstract or executable test case

[ISO/IEC 9646-1:1994, definition 3.3.107]

3.2   Abbreviated terms

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

ADU   Application data unit

ASN.1   Abstract Syntax Notation One (see ISO/IEC 8824-1)

ATM	Abstract test method
ATS	Abstract test suite
DUT	Device under test
EUT	Equipment under test
pco	Point of control and observation
PIXIT	Protocol Implementation Extra Information for Testing
SAP	Service access point
TP	Test purpose

4 Abstract test method

4.1 General

This clause describes the ATM used to test the layers at the FE side and at the BE side.

4.2 Test architecture

The implementation under test is either the FE or the BE. The system under test comprises also the communication sub-layer, which is necessary to perform the IUT tests.

The tester shall execute the TTCN-3 test cases as defined in Annex A of the present test specification, running on an emulated communication sub-layer.

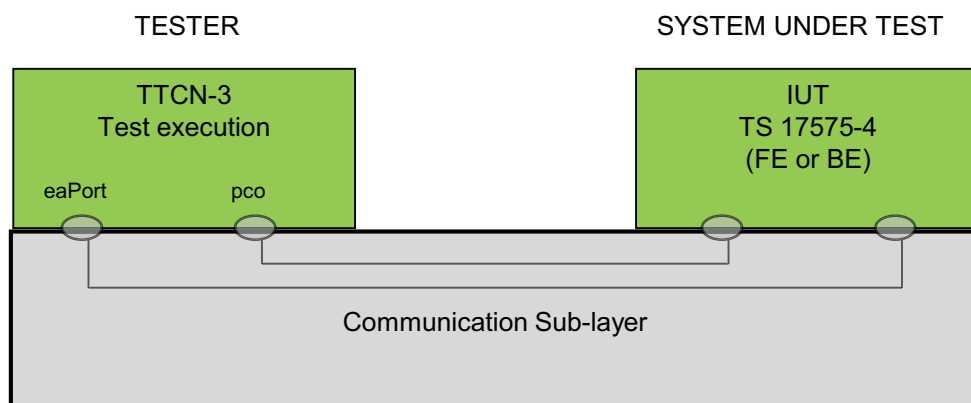The figure below depicts the test architecture.

Figure 1 — Test system architecture

4.3 Protocol Implementation Extra Information for Testing

The supplier of the Front End and Back End, respectively, is responsible for providing a Protocol Implementation Extra Information for Testing (PIXIT).

The supplier of the Front End and the Back End shall complete a PIXIT; see Annex B for a proforma.

5   Untestable test purposes

This clause identifies TPs which are not implemented in the abstract test suite due to the chosen ATM or other restrictions.

Table 1 — Untestable TPs

Test purpose	Reason
(empty)	(empty)

NOTE   Currently no untestable TPs have been identified.

6   Abstract test suite data structures

6.1   ASN.1 description

The ATS is based on the following ASN.1 description.

— ContextDataModule: provides the ASN.1 description for ContextData support, including ISO/TS 17575-3 ADU descriptions.

— ChargingModule: provides the ASN.1 description for charging support, including ChargeReport and ChargeReportResponse.

— EfcModule: provides the ASN.1 description for dedicated short-range communication.

— CccModule: provides the ASN.1 description for radio communication between road-side equipment and on-board equipment.

— DSRCModule: provides the ASN.1 description for dedicated short-range communication.

— AVIAEINumberingAndDataStructures: provides the ASN.1 description for automatic vehicle and equipment identification.

— RoamingModule: provides the ASN.1 description for roaming.

6.2   Common data types

The "Common_TypesAndValues" module contains a TTCN-3 enumerated type to define the communication function error codes (see ISO/TS 17575-2:2010, Annex D).

7   External functions

7.1   General

All external functions are part of the common TTCN-3 source code.

7.2   Functions for communications

The two following external functions are defined to initialize the communication stack as described in ISO/TS 17575-2. These functions are called during preamble (initialization) and postamble (termination) processing.

Table 2 — Communication initialization functions

Number	Computation	Role
1	fx_com_Initialize()	Initializes the communication stack
2	fx_com_DeInitialize()	De-initializes the communication stack

8   Message filtering

As indicated in ISO/TS 16403-1:—, A.1.1, the ADUs exchanged between the IUT and the tester, which are not part of the test purpose, shall be ignored.

Thus, a receive event statement was added in the default behaviour to ignore messages received on the "pco" port, which have a valid ADU and which were not handled in the test case behaviour.

The corresponding TTCN-3 code is as follows:

```
[] pco.receive(mw_Iso17575_4Adu_default) {
    repeat; // Ignore ADU
 }
```

9   ATS naming conventions

9.1   General

The ATS naming conventions are intended to facilitate reading of the ATS.

9.2   Definition naming conventions

To define the ATS naming conventions, the following principles are taken into consideration:

— prefixes shall be short alphabetic strings indicating the type of TTCN-3 element represented (see Table 3);

— suffixes should not be used, except in those specific cases identified in Table 3;

— prefixes and suffixes should be separated from the body of the identifier by an underscore ("_");

EXAMPLE 1   c_sixteen, t_wait_max.

— only module names, data type names and module parameters should begin with an upper-case letter (all other names, i.e. the part of the identifier following the prefix, should begin with a lower-case letter);

— the start of second and subsequent words in an identifier should be indicated by capitalizing the first character (underscores should not be used for this purpose).

EXAMPLE 2   f_compareDateAndTime.

Table 3 specifies the naming guidelines for each element of the TTCN-3 language, indicating the recommended prefix, suffixes (if any) and capitalization.

Table 3 — TTCN-3 naming convention

Language element	Naming convention	Prefix	Suffix	Example
Module	Use upper-case initial letter	none	none	ContextData_TE
Test suite structure grouping	Use all upper-case letters	none	none	TP_RT_PS_TR
Item group within a module	Use upper-case initial letter	none	none	Valid_Behaviour
Data type	Use upper-case initial letter	none	none	ChargeReport
List type identifiers	Use upper-case initial letter	none	none	TimeClassesGroups
Message template	Use lower-case initial letter	m_	none	m_Iso17575_4Adu
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	none	mw_Iso17575_4Adu_default
Port instance	Use lower-case initial letter	none	none	pco
External function	Use lower-case initial letter	fx_	none	fx_getCurrentTime()
Constant	Use lower-case initial letter	c_	none	c_attr_11
Function	Use lower-case initial letter	f_	none	f_authentication()
Altstep	Use lower-case initial letter	a_	none	a_receiveContextData()
Altstep (Default)	Use lower-case initial letter	d_	none	d_ADU_filter()
Variable	Use lower-case initial letter	v_	none	v_idx
Timer	Use lower-case initial letter	t_	_min[a] _max[a]	t_wait
Module parameters PICS values PIXIT values	Use all upper case letters	none	none	PIC_time[b] PX_ORGINATOR_RECIPIENT[b]
Parameterization	Use lower-case initial letter	p_	none	p_beginOfPeriod
Enumerated Value	Use lower-case initial letter	e_	none	e_ERNoError

[a]   If a time window is needed, the suffixes "_min" and "_max" should be appended.

[b]   In this case it is acceptable to use underscore as a word delimiter.

9.3   Test case identifier

The test case naming conventions follow the TP naming conventions.

EXAMPLE 1   TC_<group>_<dut>_<x>_<nn>

The following principles are taken into consideration:

⎯ TC indicates that it is a test case;

⎯ <group> denotes which TP group it belongs to;

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> denotes the type of DUT, i.e. FE or BE;

⎯ X denotes the type of testing, i.e. Valid Behaviour tests (BV), or Invalid Behaviour tests (BI);

⎯ <nn> denotes the sequential TP number (01-99).

EXAMPLE 2   TC_GEN_FE_BV_01.

9.4   TTCN-3 modules identifier

The following naming conventions shall be applied for module naming, where <set> is the name of the set of modules.

— <set>_TypesAndValues: this module provides all types (record, set) and values (constants, enumerated).

— <set>_Functions: this module provides all TTCN-3 functions used for validations, comparisons.

— <set>_Templates: this module provides all templates, for sent and received messages.

— <set>_Pixits: this module provides the PIXITs for automatic configurations.

— <set>_PICS_FE: this module provides PICS definitions for the Front End.

— <set>_PICS_BE: this module provides PICS definitions for the Back End.

— <set>_TCs: this module provides all the test cases of the project.

— <set>_TE: this module provides the control part.

EXAMPLE   `ContextData_Templates.ttcn or ContextData_TE.ttcn`

For the purpose of this document, two sets of module apply: the common modules and the ContextData modules.

The set of common modules contains TTCN-3 definitions, which are used by several test suites (for ISO/TS 17575-1 to ISO/TS 17575-4).

Definitions specific to charging are included in the modules of the charging set.

For convenience, the TTCN-3 file names are identical to the module names they contain.

Annex A
(normative)

TTCN-3 library modules for FE and BE

A.1 Electronic annex, zip file with TTCN-3 and ASN.1 code

The TTCN-3 source code and the ASN.1 definitions, which form part of this Technical Specification, are contained in the archive Roaming_ttcn3_asn1.zip, which contains:

— the Roaming TTCN-3 files,

— the common TTCN-3 files,

— the ASN.1 Definitions.

A.2 Electronic annex, zip file with HTML documentation

The HTML documentation, which forms part of this Technical Specification, is contained in the archive Roaming_html_doc.zip. Start the index.htm file in any preferred web browser.

Annex B
(informative)

PIXIT Proforma for FE and BE

B.1 Introduction

The PIXIT Proforma is based on ISO/IEC 9646-6, which can be consulted for any necessary additional information.

B.2 Identification summary

Table B.1 — Identification summary

PIXIT number:	
Test laboratory name:	
Date of issue:	
Issued to:	

B.3 ATS summary

Table B.2 — ATS summary

Protocol specification:	
Protocol to be tested:	
ATS specification:	
Abstract test method:	

B.4 Test laboratory

Table B.3 — Test laboratory

Test laboratory identification:	
Test laboratory manager:	
Means of testing:	
Address:	

B.5 Client identification

Table B.4 — Client identification

Client identification:	
Client test manager:	
Test facilities required:	

B.6 DUT

Table B.5 — DUT

Name:	
Version:	
Machine configuration:	
Operating system identification:	
DUT identification:	
PICS reference for DUT:	
Limitations of the DUT:	
Environmental conditions:	

B.7 Protocol layer information

B.7.1 Protocol identification

Table B.6 — Protocol identification

Name:	
Version:	
PICS references:	

B.7.2 DUT information

The DUT information should be provided by the manufacturer of the DUT in an ASCII file, using the TTCN-3 files: contextData_pixit.ttcn3 and common_pixit.ttcn3 contained in the electronic annex mentioned in A.1.

Furthermore, HTML documentation for the PIXIT parameter, applying to the present DUT documentation, is available in the electronic annex mentioned in A.2.

Bibliography

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[6]   ISO/IEC 9646-7, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 7: Implementation Conformance Statements*

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

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