

TECHNICAL SPECIFICATION

ISO/TS 16407-2

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

Part 2: Abstract test suite

*Perception de télépéage — Évaluation de conformité de l'équipement à
l'ISO/TS 17575-1 —*

Partie 2: Suite de test abstraite



Reference number
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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.

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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 16407-2 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 16407 consists of the following parts, under the general title *Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-1*:

- *Part 1: Test suite structure and test purposes*
- *Part 2: Abstract test suite*

Introduction

This part of ISO/IEC 16407 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 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 17575-1.

This part of ISO/IEC 16407 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/IEC 16407 is based on

- ISO/TS 17575-1, and
- the ISO/IEC 9646 family of standards on conformance test methodology.

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Part 2: Abstract test suite

1 Scope

This part of ISO/IEC 16407 specifies the Abstract Test Suite (ATS) to evaluate the conformity of Front End and Back End to ISO/TS 17575-1.

The objective of this part of ISO/IEC 16407 is to provide a basis for conformance tests for the Front End and the Back End in Electronic Fee Collection to enable interoperability between different equipment supplied by different manufacturers.

The present abstract test suite is directly derived from ISO/TS 17575-1.

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 17575-1, *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.

3.1 conformance testing

testing the extent to which an IUT is a conforming implementation

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

3.2 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]

3.3 system under test

the real open system in which the IUT resides

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

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3.4

test case

an abstract or executable test case

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

4 Abbreviations

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

BE	Back End
DUT	Device Under Test
EUT	Equipment Under Test
FE	Front End
IUT	<i>Implementation under test</i>
PIXIT	Protocol Implementation Extra Information for Testing
SCS	Semiconductor Characterization System
SUT	<i>System under test</i>
TC	<i>Test case</i>

5 Abstract Test Method (ATM)

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

5.1 Implementations Under Tests

5.1.1 Front-End (FE)

The part(s) of the toll system where usage data for an individual user are collected, processed and delivered to the Back End. The Front End comprises the on-board equipment and optionally a proxy.

5.1.2 Back-End (BE)

Generic name for the computing and communication facilities of the Service Provider and/or the Toll Charger.

5.2 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 executes the TTCN-3 *test cases* of the present Test Specification, running on an emulated communication sub-layer.

The figure below describes the test architecture.

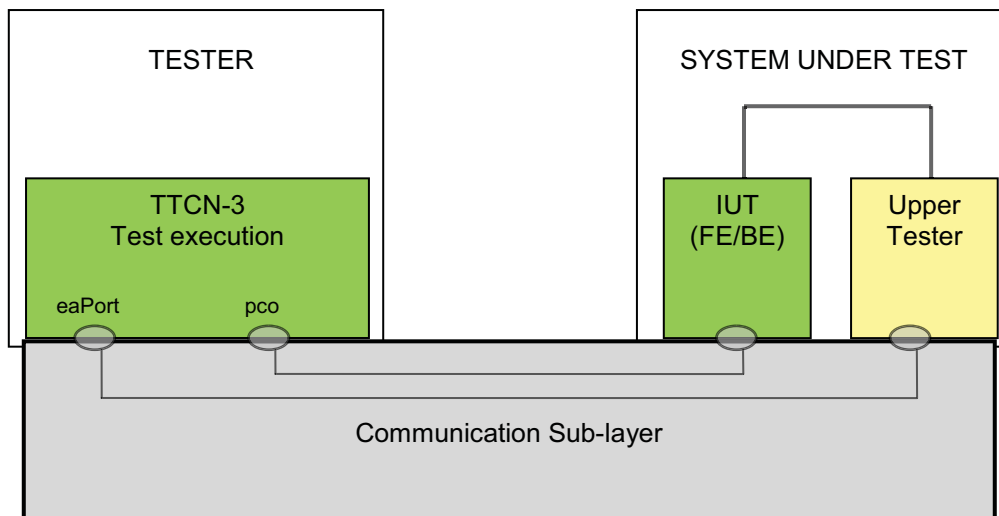


Figure 1 — Test system architecture

5.3 Protocol Implementation Extra Information for Testing (PIXIT)

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.

6 Untestable Test Purposes (TP)

This clause gives a list of TPs which are not implemented in the Abstract Test Suite due to the chosen Abstract Test Method or other restrictions.

Table 1 — Untestable TPs

Test purpose	Reason
(empty)	(empty)

NOTE Currently no untestable TPs have been identified.

7 ATS data structures

7.1 ASN.1 description

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

- ContextDataModule: it provides the ASN.1 description for ContextData, including Iso17575-3 ADU descriptions
- ChargingModule: it provides the ASN.1 description for charging support, including ChargeReport and ChargeReportResponse

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- EfcModule: it provides the ASN.1 description for dedicated short-range communication
- CccModule: it provides the ASN.1 description for Radio Communication between Road-side Equipment and Onboard Equipment
- DSRCModule: it provides the ASN.1 description for dedicated short-range communication
- AVIAEINumberingAndDataStructures: it provides the ASN.1 description for Automatic vehicle and equipment identification

8 External functions

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

8.1 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

Nbr	Computation	Role
1	fx_com_Initialize()	These function initializes the communication stack
2	fx_com_DeInitialize()	These function de-initializes the communication stack

8.2 Functions for timing

The two following external functions are defined to support time functionality.

Table 3 — Communication initialization functions

Nbr	Computation	Role
1	fx_getCurrentTime()	This function provides the current local time when this function is called
2	fx_addCurrentTimeOffset()	This function add the offset to the current local time when this function is called

9 Message filtering

As indicated in the relevant TSS and TP document, Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-1 — Part 1: Test suite structure and test purpose – clause 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 structure and were not handled in the *test case* behaviour.

The corresponding TTCN-3 code is as following:

```

[] pco.receive(mw_Iso17575_3Adu_default) {
    repeat; // Ignore ADU
}

```

10 ATS naming conventions

The ATS naming conventions are intended to provide an easier reading of the ATS by using rules for naming objects.

10.1 Definition naming conventions

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

- Prefixes are short alphabetic string indicating the type of TTCN-3 element it represents (see table 4 below).
- Suffixes should not be used except in those specific cases identified in table 4 below.
- Prefixes and suffixes should be separated from the body of the identifier with 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.

The table 4 below specifies the naming guidelines for each element of the TTCN-3 language indicating the recommended prefix, suffixes (if any) and capitalization.

Table 4 — TTCN-3 naming convention

Language element	Naming convention	Prefix	Suffix	Example	Notes
Module	Use upper-case initial letter	<i>none</i>	<i>none</i>	ContextData_TE	
TSS grouping	Use all upper-case letters	<i>none</i>	<i>none</i>	TP_RT_PS_TR	
Item group within a module	Use upper-case initial letter	<i>none</i>	<i>none</i>	Valid_Behaviour	

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Data type	Use upper-case initial letter	<i>none</i>	<i>none</i>	ChargeReport	
List type identifiers	Use upper-case initial letter	<i>none</i>	<i>none</i>	TimeClassesGroups	
Message template	Use lower-case initial letter	m_	<i>none</i>	m_Iso17575_3Adu	
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	<i>none</i>	mw_Iso17575_3Adu_default	
Port instance	Use lower-case initial letter	<i>none</i>	<i>none</i>	pco	
External function	Use lower-case initial letter	fx_	<i>none</i>	fx_getCurrentTime()	
Constant	Use lower-case initial letter	c_	<i>none</i>	c_attr_11	
Function	Use lower-case initial letter	f_	<i>none</i>	f_authentication()	
Altstep	Use lower-case initial letter	a_	<i>none</i>	a_receiveContextData()	
Altstep (Default)	Use lower-case initial letter	d_	<i>none</i>	d_ADU_filter ()	
Variable	Use lower-case initial letter	v_	<i>none</i>	v_idx	
Timer	Use lower-case initial letter	t_	_min _max	t_wait	Note 1
Module parameters PICS values PIXIT values	Use all upper case letters	<i>none</i>	<i>none</i>	PIC_time PX_ORGINATOR_RECIPIENT	Note 2
Parameterization	Use lower-case initial letter	p_	<i>none</i>	p_beginOfPeriod	
Enumerated Value	Use lower-case initial letter	e_	<i>none</i>	e_ERNoError	
<p>NOTE 1: If a time window is needed, the suffixes "_min" and "_max" should be appended. NOTE 2: In this case it is acceptable to use underscore as a word delimiter.</p>					

10.2 Test Case identifier

The *test case* naming conventions follow the TP naming conventions.

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

TC : to indicate that it is a *Test case*;

<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)

EXAMPLE TC_BEF_FE_BV_31

10.3 TTCN-3 modules identifier

The following naming conventions are 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: this module provides PICS definitions
- <set>_TCs: this module provides all the *test cases* of the project
- <set>_TE: this module provides the control part

EXAMPLE Charging_Templates.ttcn or ContextData_TE.ttcn

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

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

Then definitions specific to Charging, are included in the modules of the charging set.

For convenience, the TTCN-3 file names are identical as module name 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 parts of the present standard, are contained in the archive Charging_ttcn3_asn1.zip, which contains:

- The Charging 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 parts of the present standard, is contained in the archive Charging_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 protocol implementation extra information for testing (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:	

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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:	
SCS Number:	
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 shall be provided by the manufacturer of the DUT in an ASCII file, using the TTCN-3 files: charging_pixit.ttcn3 and common_pixit.ttcn3 contained in the electronic annex of the clause A.1 above.

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

Bibliography

- [1] ISO/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*
- [2] ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*
- [3] ISO/IEC 9646-1:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts*
- [4] ISO/IEC 9646-2, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 2: Abstract Test Suite specification*
- [5] ISO/IEC 9646-3:1998, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 3: The Tree and Tabular Combined Notation (TTCN)*
- [6] ISO/IEC 9646-4:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 4: Test realization*
- [7] ISO/IEC 9646-5:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 5: Requirements on test laboratories and clients for the conformance assessment process*
- [8] ISO/IEC 9646-6:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 6: Protocol profile test specification*
- [9] ISO/IEC 9646-7, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 7: Implementation Conformance Statements*
- [10] ISO/TS 12813, *Electronic fee collection — Compliance check communication for autonomous systems*
- [11] ISO 14906, *Electronic fee collection — Application interface definition for dedicated short-range communication*
- [12] ISO 17573, *Electronic fee collection — Systems architecture for vehicle-related tolling*
- [13] ISO/TS 17575-2, *Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connection to the lower layers*
- [14] ISO/TS 17575-3, *Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data*
- [15] ISO/TS 17575-4, *Electronic fee collection — Application interface definition for autonomous systems — Part 4: Roaming*

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