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

Part 2: Abstract test suite

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

Partie 2: Suite d'essais abstraite

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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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 16410-2 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 16410 consists of the following parts, under the general title *Electronic fee collection — Evaluation of equipment for conformity to ISO/TS 17575-3*:

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

Introduction

This part of ISO/TS 16410 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 17575-3.

This part of ISO/TS 16410 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 16410 is based on

- ISO/TS 17575-3, 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 17575-3 —

Part 2: Abstract test suite

1 Scope

This part of ISO/TS 16410 specifies the Abstract Test Suite (ATS) to evaluate the conformity of Front End and Back End to ISO/TS 17575-3.

The objective of this part of ISO/TS 16410 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 17575-1:2010, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging*

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

ISO/TS 17575-3, *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.

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]

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 *Implementation Under Test*

PIXIT Protocol Implementation Extra Information for Testing

SCS Semiconductor Characterization System

SUT *System Under Test*

TC *Test Case*

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 (see ISO/TS 17575-3).

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.

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.

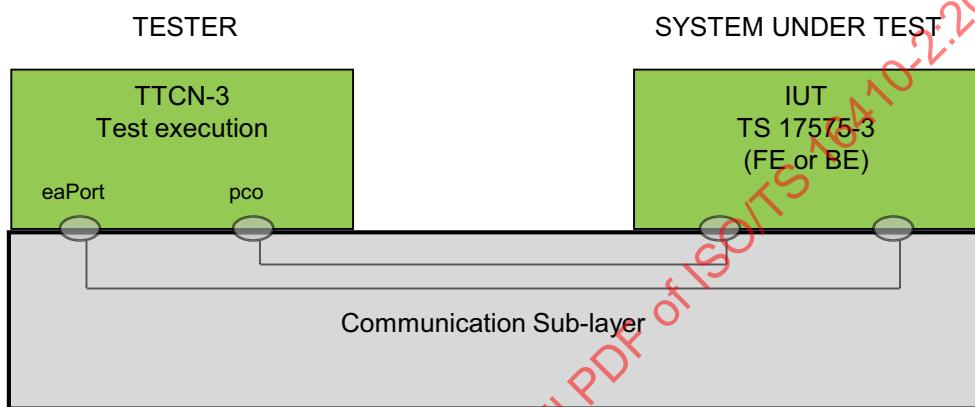


Figure 1 — Test system architecture

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 support, including ISO/TS17575-3 ADU descriptions,
- ChargingModule: it provides the ASN.1 description for charging support, including ChargeReport and ChargeReportResponse,

- 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 shall be 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()	This function initializes the communication stack
2	fx_com_DeInitialize()	This function de-initializes the communication stack

9 Message filtering

As indicated in the relevant TSS and TP document, Electronic fee collection — Evaluation of equipment for conformity to CEN 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 3 below).
- Suffixes should not be used except in those specific cases identified in Table 3 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 3 below 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	Notes
Module	Use upper-case initial letter	none	none	ContextData_TE	
TSS 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_3Adu	
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	none	mw_Iso17575_3Adu_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 _max	t_wait	Note 1
Module parameters	Use all upper case letters	none	none	PIC_time	Note 2
PICS values				PX_ORIGINATOR_RECIPIENT	
PIXIT values					
Parameterization	Use lower-case initial letter	p_	none	p_beginOfPeriod	
Enumerated Value	Use lower-case initial letter	e_	none	e_ERNoError	
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.					

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_FE: this module provides PICS definitions for the Front End
- <set>_PICS_BE: this module provides PICS definitions for the Front 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 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 ContextData_ttcn3_asn1.zip, which contains:

- The ContextData 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 ContextData_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:	

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:	