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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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ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

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# Contents

Page

|                                                                       |           |
|-----------------------------------------------------------------------|-----------|
| Foreword .....                                                        | iv        |
| Introduction.....                                                     | v         |
| <b>1 Scope .....</b>                                                  | <b>1</b>  |
| <b>2 Normative references .....</b>                                   | <b>1</b>  |
| <b>3 Terms, definitions and abbreviated terms .....</b>               | <b>1</b>  |
| 3.1 Terms and definitions .....                                       | 1         |
| 3.2 Abbreviated terms .....                                           | 2         |
| <b>4 Abstract test method.....</b>                                    | <b>3</b>  |
| 4.1 General .....                                                     | 3         |
| 4.2 Test architecture.....                                            | 3         |
| 4.3 Protocol Implementation Extra Information for Testing.....        | 3         |
| <b>5 Untestable test purposes .....</b>                               | <b>4</b>  |
| <b>6 Abstract test suite data structures .....</b>                    | <b>4</b>  |
| 6.1 ASN.1 description.....                                            | 4         |
| 6.2 Common data types .....                                           | 4         |
| <b>7 External functions .....</b>                                     | <b>4</b>  |
| 7.1 General .....                                                     | 4         |
| 7.2 Functions for communications.....                                 | 4         |
| <b>8 Message filtering .....</b>                                      | <b>5</b>  |
| <b>9 ATS naming conventions .....</b>                                 | <b>5</b>  |
| 9.1 General .....                                                     | 5         |
| 9.2 Definition naming conventions.....                                | 5         |
| 9.3 Test case identifier .....                                        | 6         |
| 9.4 TTCN-3 modules identifier.....                                    | 7         |
| <b>Annex A (normative) TTCN-3 library modules for FE and BE .....</b> | <b>8</b>  |
| <b>Annex B (informative) PIXIT Proforma for FE and BE.....</b>        | <b>9</b>  |
| <b>Bibliography.....</b>                                              | <b>11</b> |

## 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 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*.

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# 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.

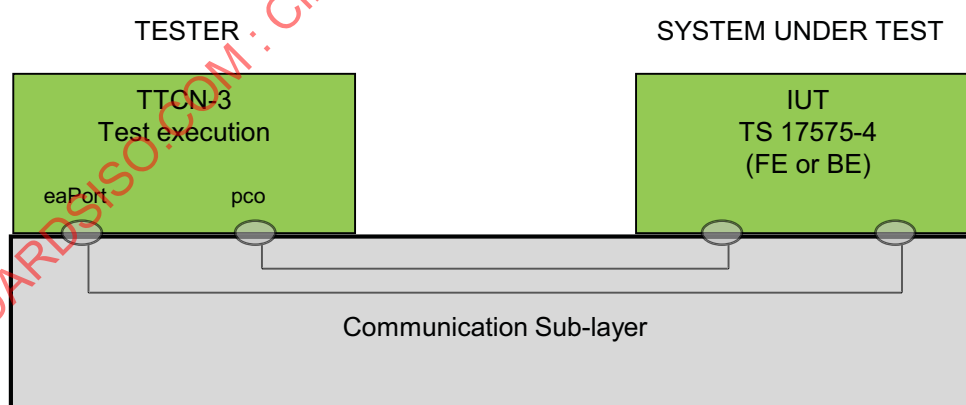


Figure 1 — Test system architecture

### 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_Isol7575_4Adu                                              |
| Message template with wildcard or matching expression | Use lower-case initial letters | mw_    | none                                   | mw_Isol7575_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 <sup>a</sup><br>_max <sup>a</sup> | t_wait                                                       |
| Module parameters<br>PICS values<br>PIXIT values      | Use all upper case letters     | none   | none                                   | PIC_time <sup>b</sup><br>PX_ORGINATOR_RECIPIENT <sup>b</sup> |
| Parameterization                                      | Use lower-case initial letter  | p_     | none                                   | p_beginOfPeriod                                              |
| Enumerated Value                                      | Use lower-case initial letter  | e_     | none                                   | e_ERNoError                                                  |

<sup>a</sup> If a time window is needed, the suffixes "\_min" and "\_max" should be appended.

<sup>b</sup> 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.

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