# TECHNICAL SPECIFICATION

**ISO/TS 13140-2**

First edition
2012-03-01

# Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO/TS 13141 —

## Part 2:
## Abstract test suite

*Perception du télépéage — Évaluation des équipements embarqués et en bord de route quant à la conformité avec l'ISO/TS 13141 —*

*Partie 2: Suite d'essai abstraite*

Reference number
ISO/TS 13140-2:2012(E)

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# Foreword

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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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 13140-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Road transport and traffic telematics,* in collaboration with Technical Committee ISO/TC 204, *Intelligent transport systems,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO/TS 13140 consists of the following parts, under the general title *Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO/TS 13141*:

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

⎯ *Part 2: Abstract test suite*

# Introduction

ISO/TS 17575 is part of a set of standards that supports interoperability of autonomous EFC-systems. It defines the EFC context data, their charge reports and their use of communication infrastructure.

The set of standards also supports short range communication links in the context of autonomous electronic fee collection (EFC) on-board equipment (OBE) to enable spot checks for the enforcement process. The application interface is defined in ISO/TS 13141:2010.

Within the set of EFC standards this part of ISO/TS 13140 defines the process and tests for conformity evaluation of OBE and roadside equipment (RSE) that comply with the requirements in ISO/TS 13141:2010.

This part of ISO/TS 13140 is intended to

— assess OBE and RSE capabilities,

— assess OBE and RSE behaviour,

— serve as a guide for OBE and RSE conformance evaluation and type approval,

— achieve comparability between the results of the corresponding tests applied in different places at different times, and

— facilitate communication between parties (for example between equipment manufacturers and test houses).

This part of ISO/TS 13140 is based on

— ISO/TS 13141:2010,

— the set of dedicated short range communication (DSRC) standards defining the communication stack, and

— ISO 9646.

This part of ISO/TS 13140 is based on using the tree and tabular combined notation (TTCN) that is a standardized language suitable for specification of test cases and steps for assessment of protocol and application behaviour. The TTCN language is also supported by modern automated tools that accelerate software design, implementation and testing.

# Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO/TS 13141 —

## Part 2:
## Abstract test suite

## 1   Scope

This part of ISO/TS 13140 specifies the abstract test suite (ATS) to evaluate the conformity of on-board equipment (OBE) and roadside equipment (RSE) to ISO/TS 13141:2010.

It provides a basis for conformance tests for dedicated short range communication (DSRC) equipment (on-board equipment and roadside equipment) to enable interoperability between different equipment supplied by different manufacturers.

NOTE        The OBE and RSE are subject to additional testing in order to ascertain that they fulfil the essential radio requirements as set out in European Directives, a pre-requisite for CE marking and placing on the European market. They are also likely to be subject to additional testing of physical, environmental endurance, quality assurance and control at manufacturing, charge point integration, as part of factory, site and system acceptance testing. The definition of these tests is outside the scope of this part of ISO/TS 13140.

## 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/IEC 9646-3:1998, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 3: The Tree and Tabular Combined Notation (TTCN)*

ISO/TS 13141:2010, *Electronic fee collection — Localisation augmentation communication for autonomous systems*

## 3   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**access credentials**
data that is transferred to on-board equipment (OBE), in order to establish the claimed identity of a roadside (RSE) application process entity

[ISO 14906:2011, definition 3.1]

NOTE        The access credentials carry information needed to fulfil access conditions in order to perform the operation on the addressed element in the OBE. The access credentials can carry passwords as well as cryptographic based information such as authenticators.

**3.2**
**attribute**
application information formed by one or by a sequence of data elements, which is managed by different actions used for implementation of a transaction

[ISO 14906:2011, definition 3.3]

**3.3**
**authenticator**
data appended to, or a cryptographic transformation of, a data unit that allows a recipient of the data unit to prove the source and/or the integrity of the data unit and protect against forgery

[ISO 14906:2011, definition 3.4]

**3.4**
**channel**
information transfer path

[ISO 14906:2011, definition 3.5]

NOTE        This term originally appeared in ISO/IEC 7498-2:1989, definition 3.3.13.

**3.5**
**component**
logical and physical entity composing an on-board equipment (OBE), supporting a specific functionality

[ISO 14906:2011, definition 3.6]

**3.6**
**contract**
expression of an agreement between two or more parties concerning the use of the road infrastructure

[ISO 14906:2011, definition 3.7]

**3.7**
**element**
⟨DSRC⟩directory containing application information in the form of attributes

[ISO 14906:2011, definition 3.11]

**3.8**
**implementation conformance statement**
statement made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities have been implemented

 [ISO/TS 14907-2:2011, definition 3.10]

**3.9**
**implementation conformance statement pro forma**
document, in the form of a questionnaire, which when completed for an implementation or system becomes an implementation conformance statement

[ISO/TS 14907-2, definition 3.11]

**3.10**
**implementation extra information for testing**
statement made by the supplier or an implementer of an implementation under test (IUT) which contains or references all of the information (in addition to that given in the implementation conformance statement) related to the IUT and its testing environment, which will enable the test laboratory to run an appropriate test suite against the IUT

[ISO/TS 14907-2, definition 3.12]

**3.11**
**implementation extra information for testing pro forma**
document, in the form of a questionnaire, which when completed for an implementation under test (IUT) becomes an implementation extra information for testing

[ISO/TS 14907-2, definition 3.13]

**3.12**
**on-board equipment**
equipment located within the vehicle and supporting the information exchange with the RSE, it is composed of the on-board unit (OBU) and other sub-units whose presence are considered optional for the execution of a transaction

NOTE       Adapted from ISO 14906:2011, definition 3.13.

**3.13**
**on-board unit**
minimum component of an on-board equipment  (OBE), whose functionality always includes at least the support of the DSRC interface

[ISO 14906:2011, definition 3.14]

**3.14**
**roadside equipment**
equipment located along the road transport network, for the purpose of communication and data exchanges with on-board equipment (OBE)

[ISO 14906:2011, definition 3.16]

**3.15**
**session**
exchange of information and interaction occurring at a specific EFC station between the roadside equipment and the user/vehicle

[ISO 14906:2011, definition 3.19]

**3.16**
**transaction**
whole of the exchange of information between the roadside equipment (RSE) and the on-board equipment (OBE) necessary for the completion of an EFC operation over the dedicated short range communication (DSRC)

[ISO 14906:2011, definition 3.24]

**3.17**
**tester**
combination of equipment and processes which is able to perform conformance tests according to ISO/TS 13140-2

**3.18**
**user**
entity that uses transport services provided by the service provider according to the terms of a contract

NOTE       Adapted from ISO 14906:2011, definition 3.26.

## 4    Abbreviated terms

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

AC_CR        Access Credentials

ADU          Application Data Unit

ASN.1        Abstract Syntax Notation One

ATS          Abstract Test Suite

BI           Behaviour Invalid (i.e. Invalid Behaviour tests)

B-Kernel     Broadcast Kernel

BST          Beacon Service Table

BV           Behaviour Valid (i.e. Valid Behaviour tests)

Cf           Confirm

DSRC         Dedicated Short-Range communication

DUT          Device Under Test

EID          Element Identifier

EFC          Electronic Fee Collection

ICS          Implementation Conformance Statement

IUT          Implementation Under Test

MAC          Medium Access Control

PIXIT        Protocol Implementation extra Information for Testing

SAP          Service Access Point

SCS          Semiconductor Characterization System

TC           Test Case

TSS          Test Suite Structure

VST          Vehicle Service Table

## 5    Abstract Test Method (ATM)

### 5.1    General

This clause describes the ATM used to test the layers at the OBU side and at the RSE side.

### 5.2    Test architecture

Section 4 in ETSI TS 102 486-2-3 describes the test architecture for application layer testing. As TPs from ETSI TS 102 486-2-3 are referenced to in ISO/TS 13140-1, the test architectures presented there are also relevant for the corresponding TCs. For all specific TPs introduced in ISO/TS 13140-1, the test architecture defined in ETSI TS 102 486-2-3 is relevant too.

### 5.3    Protocol Implementation Extra Information for Testing (PIXIT)

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

The supplier of the OBU and RSE shall complete a PIXIT; see Annex C and Annex D for examples of proformas.

# 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 conventions

## 7.1 General

The ATS conventions are intended to give a better understanding of the ATS but they also describe the conventions made for the development of the ATS. These conventions shall be considered during any later maintenance or further development of the ATS.

The ATS conventions contain: the naming conventions (see 7.2) and the implementation conventions (see 7.3). The naming conventions describe the structure of the naming of all ATS elements. The implementation conventions describe the functional structure of the ATS.

ATSs for OBU and RSE are specified in Annex A and Annex B respectively. The partial PIXIT proformas for OBU and RSE are specified in Annex C and Annex D respectively.

## 7.2 Naming conventions

### 7.2.1 Declarations part

This clause describes the naming chosen for the elements of the ATS declarations part.

#### 7.2.1.1 General

The following general rules apply for the names given in the declarations part.

Names of ASN.1 types imported from the base standard are preserved.

Predefined types (e.g. BITSTRING [8]) are never used in structured type definitions, ASP type definitions or PDU type definitions. Simple types are used instead.

All declarations in the test suite are listed in alphabetical order. A different order of listing should be used for only maintenance reasons.

#### 7.2.1.2 Test suite operations

The test suite operation identifiers are prefixed with "TSO_".

EXAMPLE    TSO_substring.

#### 7.2.1.3 Test suite parameter declarations

If the test suite parameter references a Protocol Implementation Conformance Statement (PICS) item, the test suite parameter identifiers are prefixed "TSPC_".

EXAMPLE 1     TSPC_extended_rf_carriers.

If the test suite parameter references a PIXIT item, the suite parameter identifiers are prefixed "TSPX_".

EXAMPLE 2     TSPX_pmid.

If the test suite parameter represents a system parameter, the complete name defined in the protocol is used.

#### 7.2.1.4     Test case selection expression definition

The test case selection expression identifiers begin with the prefix "SEL_".

#### 7.2.1.5     Test suite constant declarations

The test suite constant identifiers are prefixed "TSC_".

If the test suite constant represents a system parameter, the complete name defined in the protocol is used.

#### 7.2.1.6     Test suite variable declarations

The test suite variable identifiers are prefixed "TSV_".

Complete names as defined in the protocol are used.

#### 7.2.1.7     Test case variable declarations

The test case variable identifiers are prefixed "TCV_".

Complete names as defined in the protocol are used.

#### 7.2.1.8     Timer declarations

Timers begin with the prefix "T_".

#### 7.2.1.9     ASP type definitions

The general conventions in clause 7.1.1.1 apply. All capital letters shall be used.

The identifier of an ASP type uses the same name as the name defined in the protocol.

#### 7.2.1.10     PDU type definitions

The general conventions in clause 7.1.1.1 apply. All capital letters shall be used.

The identifier of a PDU type uses the same name as the name defined in the protocol.

#### 7.2.1.11     Co-ordination Message (CM) type definitions

All capital letters shall be used.

#### 7.2.1.12     Alias definitions

Alias definitions are not used.

### 7.2.2   Constraints part

This clause describes the naming conventions chosen for the elements of the ATS constraints part.

#### 7.2.2.1   General

Constraints shall be written with all lowercase letters.

### 7.2.3   Dynamic part

This clause describes the naming conventions used for the elements of the ATS dynamic part.

#### 7.2.3.1   General

All test cases shall be listed in the order in which they appear in the Test Suite Structure (TSS) and TP document.

#### 7.2.3.2   Test Case (TC) identifier

The identifier of the test case is built in a similar way as for the test purpose.

The identifier of a TC is built according to Table 2.

**Table 2 — TC naming convention**

| Identifier: | TC_<layer>_<dut>_<x>_<nn> | | |
|---|---|---|---|
| | <layer> | AP-0BAS | Application layer – I Kernel support Security level 0 |
| | | AP-1BAS | Application layer – I Kernel support Security level 1 |
| | | … | … |
| | <dut> = type of DUT | OBU | On Board Unit |
| | | RSE | Roadside Equipment |
| | x = Type of testing | BV | Valid Behaviour Tests |
| | | BI | Invalid Behaviour Tests |
| | <nn> = sequential number | (01-99) | Test Purpose Number |

EXAMPLE      TP identifier: TP/AP-0DAT/OBU/BV/01

TC identifier: TC_AP_0DAT_OBU_BV_01

#### 7.2.3.3   Test step identifier

The test step identifier is built of substrings in lowercase letters, preceded by a string of uppercase letters. The substrings are joined by underscore characters. The first substring indicates the main function of the test step; e.g. PR for PReamble, PO for POstamble, LTS for Local Tree and STP for general test step. The second substring indicates the purpose of the step.

EXAMPLE      STP_emulate_mac.

#### 7.2.3.4   Default identifier

The default identifiers begin with the prefix "DF_", followed by a string in lowercase letters.

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## 7.3 Implementation conventions

### 7.3.1 Declaration part

The comment line of single element TTCN tables (e.g. test suite constants) is used to give a reference where the format and content of the element is described in the relevant protocol document. Any particularity of the element format or content is described in the comment line.

The detailed comments are used to describe any peculiarity of the table.

In the ASP, PDU, and CM type declarations, the comments column is used to identify if a parameter (in ASPs) or field (in PDUs) is mandatory or optional:

— M: mandatory;

— O: optional.

In the ASP and PDU declarations the comments column is further used to give information about the parameter/field value, in particular if the parameter/field contains a fixed spare value.

### 7.3.2 Constraint part

The ASPs and PDUs are defined in a way that all relevant parameters/fields are parameterized. That improves the transparency of the constraints in the dynamic part, as all values which are relevant for the test are always present.

Generally no modified constraints are used. This allows an easier reuse and adaptation of constraints if they are reused in other test specifications.

The detailed comments footer is used to describe any particularity of the table.

### 7.3.3 Dynamic part

All events which are defined as a conformance requirement by the TP, causes a preliminary verdict PASS if the requirement is met.

The preamble, the test body and the postamble have different defaults, which allow a specific verdict handling, e.g. only INCONC verdicts are assigned in the preamble.

Except for local trees, test steps do not contain a default. Then there are no restrictions regarding the error handling.

TPs which are listed in the untestable TP list in Clause 6 are not considered in the ATS, thus these TC identifiers are missing in the ATS and the numbering of the TCs may not always be continuous.

# Annex A
(normative)

# Abstract Test Suite (ATS) for on-board units

## A.1 Introduction

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3. The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the table of contents. The ATS itself contains a test suite overview part which provides additional information and references

## A.2 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in an HTML file (CEN_ISO_TS_13140-2_AP_OBU.html contained in archive CEN_ISO_TS_13140-2.zip) which accompanies the present document.

Note that where an Abstract Test Suite (in TTCN-2) is published in both graphical and machine processable format these two forms shall be considered equivalent. In the event that there appears to be syntactical or semantic differences between the two then the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

## A.3 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (CEN_ISO_TS_13140-2_AP_OBU.mp contained in archive CEN_ISO_TS_13140-2.zip) which accompanies the present document.

Note that where an Abstract Test Suite (in TTCN-2) is published in both graphical and machine processable format these two forms shall be considered equivalent. In the event that there appears to be syntactical or semantic differences between the two then the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

# Annex B
(normative)

# Abstract test suite (ATS) for roadside equipment

## B.1  Introduction

This ATS has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3. The ATS was developed on a separate TTCN software tool and therefore the TTCN tables are not completely referenced in the table of contents. The ATS itself contains a test suite overview part which provides additional information and references

## B.2  The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in an HTML file (CEN_ISO_TS_13140-2_AP_RSE.html contained in archive CEN_ISO_TS_13140-2.zip) which accompanies the present document.

Note that where an Abstract Test Suite (in TTCN-2) is published in both graphical and machine processable format these two forms shall be considered equivalent. In the event that there appears to be syntactical or semantic differences between the two then the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

## B.3  The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (CEN_ISO_TS_13140-2_AP_RSE.mp contained in archive CEN_ISO_TS_13140-2.zip) which accompanies the present document.

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# Annex C
## (informative)

# PIXIT proforma for on-board units

## C.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.

## C.2 Identification summary

**Table C.1 — Identification summary**

| | |
|---|---|
| **PIXIT Number:** | |
| **Test Laboratory Name:** | |
| **Date of Issue:** | |
| **Issued to:** | |

## C.3 ATS summary

**Table C.2 — ATS summary**

| | |
|---|---|
| **Protocol Specification:** | |
| **Protocol to be tested:** | |
| **ATS Specification:** | |
| **Abstract Test Method:** | |

## C.4 Test laboratory

**Table C.3 — Test laboratory**

| | |
|---|---|
| **Test Laboratory Identification:** | |
| **Test Laboratory Manager:** | |
| **Means of Testing:** | |
| **SAP Address:** | |