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

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

iTeh STANDARD PREVIEW
*Perception du télépéage — Évaluation des équipements embarqués et
en bord de route quant à la conformité avec l'ISO/TS 13141 —
(standards.iteh.ai)
Partie 1. Structure de suite d'essai et buts des essais*

ISO/TS 13140-1:2011

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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.

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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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 13140-1 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 OBU and RSE capabilities,
- assess OBU and RSE behaviour,
- serve as a guide for OBU 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 communications between parties.

This part of ISO/TS 13140 is based on [ISO/TS 13140-1:2011](https://standards.iteh.ai/catalog/standards/sist/dd1eb676-3c34-4e1a-ac08-ca7181063582/iso-ts-13140-1-2011)

- 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.

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

Part 1: Test suite structure and test purposes

1 Scope

This part of ISO/TS 13140 specifies the test suite structure (TSS) and test purposes (TP) to evaluate the conformity of on-board units (OBU) 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 units and roadside units) to enable interoperability between different equipment supplied by different manufacturers.

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2 Normative references (standards.iteh.ai)

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

ISO 14906:2011, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO/TS 14907-2:2011, *Road transport and traffic telematics — Electronic fee collection — Test procedures for user and fixed equipment — Part 2: Conformance test for the onboard unit application interface*

EN 15509:2007, *Road transport and traffic telematics — Electronic fee collection — Interoperability application profile for DSRC*

EN 15876-1, *Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to EN 15509 — Part 1: Test suite structure and test purposes*

ETSI TS 102 486-2-2 V1.2.1 (2008-10), *Intelligent transport systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 2: DSRC application layer; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)*

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 equipment (RSE) application process entity

[ISO 14906:2011, definition 3.1]

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

3.2 attribute
application information formed by one or by a sequence of data elements, used for implementation of a transaction

NOTE Adapted from ISO 14906:2011.

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 <https://standards.iteh.ai/catalog/standards/sist/dd1eb676-3c34-4e1a-ac08-ca7181063582/iso-ts-13140-1-2011>

[ISO 7498-2:1989, definition 3.3.13]

3.5 component
logical and physical entity composing an on-board equipment, 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 cryptography
discipline which embodies principles, means, and methods for the transformation of data in order to hide its information content, prevent its undetected modification and/or prevent its unauthorized use

[ISO 7498-2:1989, definition 3.3.20]

3.8 data group
collection of closely related EFC data attributes which together describe a distinct part of an EFC transaction

[ISO 14906:2011, definition 3.9]

3.9**data integrity**

property that data has not been altered or destroyed in an unauthorized manner

[ISO 7498-2:1989, definition 3.3.21]

3.10**element**

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

[ISO 14906:2011, definition 3.11]

3.11**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 3.12]

3.12**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 14907-2:2011, definition 3.13]

3.13**implementation extra information for testing**

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

NOTE Adapted from ISO/TS 14907-2:2011.

3.14**implementation extra information for testing pro forma**

document, in the form of a questionnaire, which when completed for a DUT becomes an implementation extra information for testing

NOTE Adapted from ISO/TS 14907-2:2011.

3.15**on-board equipment****OBE**

equipment fitted within or on the outside of a vehicle and used for toll purposes

NOTE The OBE does not need to include payment means.

[ISO 14906:2011, definition 3.13]

3.16**on-board unit****OBU**

minimum component of an on-board equipment, whose functionality always includes at least the support of the DSRC interface

[ISO 14906:2011, definition 3.14]

3.17**roadside equipment****RSE**

equipment located along the road transport network, for the purpose of communication and data exchanges with on-board equipment

[ISO 14906:2011, definition 3.16]

**3.18
session**

exchange of information and interaction occurring at a specific electronic fee collection station between the roadside equipment and the user/vehicle

[ISO 14906:2011, definition 3.19]

**3.19
transaction**

whole of the exchange of information between the roadside equipment and the on-board equipment necessary for the completion of an electronic fee collection operation over the dedicated short range communication

[ISO 14906:2011, definition 3.24]

**3.20
transaction model**

functional model describing the general structure of electronic payment fee collection transactions

[ISO 14906:2011, definition 3.25]

**3.21
tester**

a combination of equipment and processes which is able to perform conformance tests according to ISO/TS 13140-1

**3.22
user**

generic term used for the customer of a toll service provider, one liable for toll, the owner of the vehicle, a fleet operator, a driver, etc., depending on the context

[ISO 14906:2011, definition 3.26]

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4 Abbreviated terms

AC_CR	Access Credentials
ADU	Application Data Unit
APDU	Application Protocol Data Unit
AP	Application Process
ASN.1	Abstract Syntax Notation One (ISO/IEC 8824-1)
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
DLC	Data Link Control
DSRC	Dedicated Short Range Communication

DUT	Device Under Test (ISO/TS 14907-2)
EID	Element Identifier
EFC	Electronic Fee Collection
EVENT-RT	EVENT-REPORT
ICS	Implementation Conformance Statement
IXIT	Implementation eXtra Information for Testing
LLC	Logical Link Control
MAC	Medium Access Control
PCTR	Proforma Conformance Test Report
TSS	Test Suite Structure
VST	Vehicle Service Table

5 Test suite structure (TSS)

5.1 Structure

The Test Suite Structure (TSS) including its subgroups that are inherited from other specifications is given in Table 1.

Table 1 — Test Suite Structure

Group	Type of DUT	Behaviour
Physical layer	On-Board Unit	Valid Behaviour
		Invalid Behaviour
	Roadside Equipment	Valid Behaviour
		Invalid Behaviour
DLC MAC sublayer	On-Board Unit	Valid Behaviour
		Invalid Behaviour
	Roadside Equipment	Valid Behaviour
		Invalid Behaviour
DLC LLC sublayer	On-Board Unit	Valid Behaviour
		Invalid Behaviour
	Roadside Equipment	Valid Behaviour
		Invalid Behaviour
Application layer	On-Board Unit	Valid Behaviour
		Invalid Behaviour
	Roadside Equipment	Valid Behaviour
		Invalid Behaviour

Physical layer tests are to be performed in a radio wave lab. They will not form part of the ATS.

5.2 Reference to conformance test specifications

Conformance to a profile standard implies conformance to the related base standards; hence, a number of test cases for the LAC application are exactly the same as the conformance test cases for the related base standards. Other test cases are derived from the base standards conformance test cases, by applying some restrictions or choices in e.g. the parameters values, according to what is stated in the profile standard. Finally, specific conformance test cases for the LAC application are identified for statements contained in the LAC application, which have no equivalence in the base standards. These latter cases cover for example the application layer data test purposes. This document takes into account already defined test purposes for conformance to the base standards by referencing them, so that:

- a) For test purposes that are identical to those defined in the base standards conformance test cases (see e.g. [ETSI TS 102 486-2-2] or [EN 15876-1]) a direct reference is reported. For reader's convenience, the title or a verbal description of the referenced test purpose is given, together with the reference.
- b) For test purposes that are **derived** from those defined in the base standards conformance test cases, a direct reference is reported, plus an indication on how the referred test purpose has to be modified for the profile conformance testing.
- c) For test purposes that are **specific to the standard profile**, a complete description is given.

An indication on whether a test purpose is **identical**, **derived**, or **specific** is given in each test purpose.

5.3 Test Purposes (TP)

5.3.1 TP Definition conventions

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The TPs are defined following the rules shown in Table 2 below. All Test Purposes are defined in Annex A and Annex B.

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Table 2 — TP Definition Rules

TP ID according to the TP naming conventions	Title
	Reference
	TP origin
	Initial condition
	Stimulus and expected behaviour
TP ID	The TP ID is a unique identifier. It shall be specified according to the TP naming conventions defined in the sub-clause below.
Title	Short description of Test Purpose objective.
Reference	The reference should contain the references of the subject to be validated by the actual TP (specification reference, clause, paragraph), or the reference to the standard document defining the TP.
TP origin	Indicates if the TP is identical to a TP defined in another test standard, derived from a TP defined in another test standard, or specific for this standard profile.
Initial condition	The condition defines in which initial state the DUT has to be to apply the actual TP.
Stimulus and expected behaviour	Definition of the events the tester performs, and the events that are expected from the DUT to conform to the base specification.

5.3.2 TP naming conventions

Each TP is given a unique identification. This unique identification is built up to contain the following string of information:

TP/<group>/<dut>/<x>-<nn>

TP : to indicate that it is a Test Purpose;

<group> : which group among those defined in Table 1 – Test Suite Structure does the TP apply to;

<dut> : type of DUT (i.e. OBU or RSE);

X : type of testing (i.e. Valid Behaviour tests – BV, or Invalid Behaviour tests – BI)

<nn> : sequential TP number (01-99)

The naming conventions are as described in Table 3.

Table 3 — TP naming convention

Identifier:

TP/<group>/<dut>/<x>-<nn>

<group>

applicable for OBU/RSE

applicable for OBU/RSE

applicable for OBU/RSE

applicable for OBU

applicable for OBU

applicable for OBU

applicable for RSE

applicable for RSE

<dut> = type of DUT

x = Type of testing

<nn> = sequential
number

PHY

MAC/LLC

AP-BAS

AP-FUN

AP-DAT

AP-SEC

AP-SET

AP-REL

OBU

RSE

BV

BI

(01-99)

Physical layer

MAC/LLC sublayer

Application layer – I Kernel support

Application layer – T Kernel support

Application layer – Data attributes support

Application layer – Security Level 1 support

Application layer - SET-rq PDU test purposes,

Application layer - EVENT-REPORT-rq PDU test purposes

On-Board Unit

Roadside Equipment

Valid Behaviour Tests

Invalid Behaviour Tests

Test Purpose Number

5.4 Conformance test report

The manufacturer of the OBU and RSE, respectively, is responsible for providing a conformance test report.

The manufacturer of the OBU shall complete the proforma conformance test report for on-board units as defined in Annex C.

The manufacturer of the RSE shall complete the proforma conformance test report for roadside equipment as defined in Annex D.

Annex A (normative)

Test purposes for on-board units

A.1 Introduction

This annex contains the Test Purposes (TP) for the conformity evaluation of OBUs to ISO/TS 13141.

A.1.1 Symbols in TP Descriptions

For the application layer test purposes, a special notation and symbol convention is used, as defined in what follows.

Symbols are used in the description of the TPs, with meanings according to Table A.1 below.

Table A.1 — Description of TP Symbols

SYMBOL	DESCRIPTION
XXX.rq ⇒	The Tester sends the XXX.rq PDU to the DUT
⇐ YYY.rs	The DUT sends the YYY.rs PDU to the Tester
A ≡ B	Test Purpose A “is congruent to” Test Purpose B. The notation Test Purpose A ≡ Test Purpose B means that the Test Purpose A is the same as Test Purpose B. If differences in parameters or parameter values have to be applied, these differences are indicated in the text immediately below.
A → B	Object A “is transformed” into Object B. So a notation like “Table X → Table Y” means that, for the scope of the Test Purpose, any reference of Table X should be changed into references to Table Y.
=	Means “assignment”. That is, a notation like “accessCredentials = a value” means that the field accessCredentials is given a value.
∅	Means “empty” or “not set”. So, a notation like “accessCredentials = ∅ → accessCredentials = calculated value”, for a given Test Purpose, means “change all occurrences in which the field accessCredentials has not been assigned to calculation of the value accessCredentials to a given value.

A.2 Physical layer

Per ISO/TS 13141:2010, 5.5.2, all test purposes TP/PHY/OBU/Bx/yy defined in EN 15876-1 are applicable for the conformity evaluation of OBUs to CEN–DSRC based LAC as claimed in ISO/TS 13141:2010, Annex B Clause B.4.4 Table B.8 Item 1.

A.3 MAC & LLC

Per ISO/TS 13141:2010, 5.5.2, all test purposes TP/MAC/OBU/Bx/yy and TP/LLC/OBU/Bx/yy defined in EN 15876-1 are applicable for the conformity evaluation of OBUs to CEN–DSRC based LAC as claimed in ISO/TS 13141:2010, Annex B Clause B.4.4 Table B.8 Item 1.

A.4 Application Layer

A.4.1 Structure of BST and VST

A.4.1.1 BST

The BST general structure, as is transmitted to the OBU, is described in Table A.2.

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