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

Part 1:
Test suite structure and test purposes

Perception du télépéage — Évaluation des équipments embarqués et en bord de route quant à la conformité avec ISO 13141 —

Partie 1: Structure de suite d'essai et buts des essais

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems.*

This first edition of ISO 13140-1 cancels and replaces ISO/TS 13140-1:2011, which has been technically revised. This first edition incorporates the following main modifications compared to the Technical Specification:

— conversion from a Technical Specification to an International Standard;

— amendment of terms, in order to reflect harmonization of terms across electronic fee collection (EFC) standards;

— amendments to reflect changes in the underlying base standards, in particular, ISO 13141 and ISO 14906;

— editorial and formal corrections.

A list of all parts in the ISO 13140 series can be found on the ISO website.

Introduction

ISO 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 localization augmentation process. The application interface is defined in ISO 13141.

Within the set of EFC standards, this document defines the process and tests for conformity evaluation of OBE and roadside equipment (RSE) that comply with the requirements in ISO 13141.

This document 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 document is based on

— ISO/TS 13141,

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

— ISO 9646.

This document 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 13141 —

Part 1:
Test suite structure and test purposes

1 Scope

This document 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 13141.

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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13141:2015, *Electronic fee collection — Localisation augmentation communication for autonomous systems*

ISO 14906:2011/Amd 1:2015, *Electronic fee collection — Application interface definition for dedicated short-range communication/Amendment 1*

ISO/TS 14907-2:2016, *Electronic fee collection — Test procedures for user and fixed equipment — Part 2: Conformance test for the on-board unit application interface*

EN 15509:2014, *Electronic fee collection — Interoperability application profile for DSRC*

EN 15876-1:2016, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp/

3.1
access credentials
trusted attestation or secure module that establishes the claimed identity of an object or application
property that ensures that the actions of an entity may be traced uniquely to that entity

Note 1 to entry: Access credentials carry information needed to fulfil access conditions in order to perform the
operation on the addressed *element* (3.7) in the *OBE* (3.10). Access credentials can carry passwords, as well as
cryptography-based information such as *authenticators* (3.4).

[SOURCE: EN 15509:2014, 3.1]

3.2
attribute
addressable package of data consisting of a single data element or structured sequences of data
elements

[SOURCE: ISO 17575-1:2016, 3.2]

3.3
authentication
security mechanism allowing verification of the provided identity

[SOURCE: EN 301 175]

3.4
authenticator
data, possibly encrypted, that is used for *authentication* (3.3)

[SOURCE: EN 15509:2014, 3.3]

3.5
cryptography
principles, means and methods for the transformation of data in order to hide its information content,
prevent its undetected modification or prevent its unauthorized use

[SOURCE: EN 15509:2014, 3.6]

3.6
data group
class of closely related *attributes* (3.2)

[SOURCE: ISO 17575-1:2016, 3.10]

3.7
element
<DSRC> directory containing application information in the form of *attributes* (3.2)

[SOURCE: ISO 14906:2011, 3.11, modified]

3.8
implementation conformance statement
statement of capabilities and options that have been implemented defining to what extent the
implementation is compliant with a given specification

[SOURCE: ISO/TS 14907-2:2016, 3.6, modified]

3.9
implementation extra information for testing
statement containing all of the information related to the implementation under test (IUT) and its
corresponding system under test (SUT) which will enable the testing laboratory to run an appropriate
test suite against that IUT

[SOURCE: ISO/TS 14907-2:2016, 3.8]

3.10
on-board equipment
OBE
all required equipment on-board a vehicle for performing required EFC functions and communication services

3.11
on-board unit
OBU
single electronic unit on-board a vehicle for performing specific EFC functions and for communication with external systems

3.12
roadside equipment
RSE
equipment located along the road either fixed or mobile

[SOURCE: ISO/TS 19299:2015, 3.34]

3.13
tester
combination of equipment, humans and processes able to perform specified conformance tests

[SOURCE: EN 15876-1:2016, 3.12]

3.14
transaction
whole of the exchange of information between two physically separated communication facilities

[SOURCE: ISO 17575-1:2016, 3.21]

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4   Abbreviated terms

AC_CR	Access Credentials
ADU	Application Data Unit
APDU	Application Protocol Data Unit (ISO 14906)
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 (ISO 14906)
BV	Behaviour Valid (i.e. valid behaviour Tests)
cf	Confirm
DLC	Data Link Control
DSRC	Dedicated Short-Range Communication (ISO 14906)
DUT	Device Under Test (ISO/TS 14907-2)

EID	Element Identifier
EFC	Electronic Fee Collection (ISO 17573)
ICS	Implementation Conformance Statement
LLC	Logical Link Control (EN 12795)
MAC	Medium Access Control (EN 12795)
PCTR	Protocol Conformance Test Report
PDU	Protocol Data Unit
PIXIT	Protocol Implementation eXtra Information For Testing
TSS	Test Suite Structure
VST	Vehicle Service Table (ISO 14906)

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 readers' 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

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

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 subclause 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 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	PHY	Physical layer
applicable for OBU/RSE	MAC/LLC	MAC/LLC sublayer
applicable for OBU/RSE	AP-BAS	Application layer — I Kernel support
applicable for OBU	AP-FUN	Application layer — T Kernel support
applicable for OBU	AP-DAT	Application layer — Data attributes support
applicable for OBU	AP-SEC	Application layer — Security Level 1 support
applicable for RSE	AP-SET	Application layer — SET-rq PDU test purposes,
applicable for RSE	AP-REL	Application layer — EVENT-REPORT-rq PDU test purposes
<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

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 protocol conformance test report (PCTR) for on-board units as defined in Annex C.

The manufacturer of the RSE shall complete the PCTR for roadside equipment as defined in Annex D.

Annex A
(normative)

Test purposes for on-board units

A.1 General

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

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.
Ø	Means "empty" or "not set". So, a notation like "accessCredentials = Ø → 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 13141:2015, 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 13141:2015, Table B.8, Item 1.

A.3 MAC and LLC

Per ISO 13141:2015, 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 13141:2015, Table B.8, Item 1.