
**Electronic fee collection — Evaluation
of on-board and roadside equipment
for conformity to ISO 12813 —**

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

iTeh STANDARD PREVIEW
*Perception de télépéage — Évaluation des équipements embarqués et
en bord de route quant à la conformité avec l'ISO 12813 —
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Partie 1: Structure de suite d'essais 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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 13143-1:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

- amendments to reflect changes to the underlying requirements standards, in particular ISO 12813 and ISO 14906;
- amendment of terms to reflect the harmonization of terms across electronic fee collection (EFC) standards.

A list of all parts in the ISO 13143 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

On-board equipment (OBE) that uses satellite-based positioning technology to collect data required for charging for the use of roads operates in an autonomous way (i.e. without relying on dedicated roadside infrastructure). The OBE records the amount of road usage in all toll charging systems it passes through.

This document defines the process and tests for evaluation of OBE and roadside equipment (RSE) for conformity to ISO 12813.

ISO 12813 defines requirements for dedicated short-range communication (DSRC) between OBE and an interrogator for the purpose of checking conformance of road use with a local toll regime. It assumes an electronic fee collection (EFC) services architecture according to ISO 17573-1.

This document 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.

This document is based on:

- ISO 12813,
- the set of DSRC standards defining the communication stack, and
- ISO/IEC 9646.

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Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO 12813 —

Part 1: Test suite structure and test purposes

1 Scope

This document specifies the test suite structure (TSS) and test purposes (TPs) for evaluating the conformity of on-board equipment (OBE) and roadside equipment (RSE) to ISO 12813.

It provides a basis for conformance tests for dedicated short-range communication (DSRC) OBE and RSE to support interoperability between different equipment supplied by different manufacturers.

ISO 12813 defines requirements on the compliance check communication (CCC) interface level, but not for the RSE or OBE internal functional behaviour. Consequently, tests regarding OBE and/or RSE functional behaviour remain outside the scope of this document.

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 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 12813:2019, *Electronic fee collection — Compliance check communication for autonomous systems*

ISO 14816, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO 14906:2018, *Electronic fee collection — Application interface definition for dedicated short-range communication*

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 12834:2003, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — DSRC application layer*

EN 13372:2004, *Road Transport and Traffic Telematics (RTTT) — Dedicated short-range communication — Profiles for RTTT applications*

EN 15509:2014, *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.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 access credentials

AC-CR

trusted attestation or secure module that establishes the claimed identity of an object or application

[SOURCE: ISO/TS 17573-2:2020, 3.4]

3.2 attribute

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

[SOURCE: ISO/TS 17573-2:2020, 3.13]

3.3 authentication

security mechanism allowing verification of the provided identity

[SOURCE: ISO/TS 17573-2:2020, 3.15] (standards.iteh.ai)

3.4 authenticator

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

[SOURCE: ISO/TS 17573-2:2020, 3.16]

3.5 data group

class of closely related *attributes* (3.2)

[SOURCE: ISO/TS 17573-2:2020, 3.55]

3.6 Element

dedicated short-range communication (DSRC) directory containing application information in the form of *attributes* (3.2)

3.7 implementation conformance statement

ICS

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

[SOURCE: ISO/TS 17573-2:2020, 3.90]

3.8 protocol implementation conformance statement

PICS

ICS (3.7) for an implementation or system claimed to conform to a given protocol specification

[SOURCE: ISO/IEC 9646-1:1994, 3.3.80]

3.9**on-board equipment****OBE**

all required equipment on-board a vehicle for performing required electronic fee collection (EFC) functions and communication services

[SOURCE: ISO/TS 17573-2:2020, 3.126]

3.10**on-board unit****OBU**

electronic unit on-board a vehicle for performing specific electronic fee collection (EFC) functions and for communication with external systems

[SOURCE: ISO/TS 17573-2:2020, 3.127]

3.11**roadside equipment****RSE**

fixed or moveable electronic fee collection (EFC) equipment located along or on the road

[SOURCE: ISO/TS 17573-2:2020, 3.161, modified — Note 1 to entry deleted.]

3.12**tester**

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

[SOURCE: ISO/TS 17573-2:2020, 3.188]

3.13**transaction**

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

[SOURCE: ISO/TS 17573-2:2020, 3.211]

4 Abbreviated terms

| | |
|------|--|
| APDU | application protocol data unit |
| AP | application process |
| ATS | abstract test suite |
| BI | behaviour invalid (i.e. invalid behaviour tests) |
| BST | beacon service table |
| BV | behaviour valid (i.e. valid behaviour tests) |
| CCC | compliance check communication |
| DLC | data link control |
| DSRC | dedicated short-range communication |
| DUT | device under test |
| EFC | electronic fee collection |
| EID | Element identifier |

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| | |
|--------|---|
| LLC | logical link control |
| MAC | medium access control |
| PCTR | protocol conformance test report |
| PDU | protocol data unit |
| PIXIT | protocol implementation extra information for testing |
| SCTR | system conformance test report |
| T-APDU | transfer-application protocol data unit |
| TP | test purpose |
| TSS | test suite structure |
| VST | vehicle service table |

5 Test suite structure (TSS)

5.1 Structure

Table 1 shows the test suite structure (TSS) including its subgroups that are inherited from other specifications.

Table 1 — Test suite structure

| Group | Type of DUT | Behaviour |
|---|-------------|-----------|
| Physical layer | OBE | BV |
| | | BI |
| | RSE | BV |
| | | BI |
| Data link Control (DLC) Medium Access Control (MAC) sublayer | OBE | BV |
| | | BI |
| | RSE | BV |
| | | BI |
| DLC Logical Link Control (LLC) sublayer | OBE | BV |
| | | BI |
| | RSE | BV |
| | | BI |
| Application layer | OBE | BV |
| | | BI |
| | RSE | BV |
| | | BI |

Physical layer tests are to be performed in a radio wave laboratory. They will not form part of the abstract test suite (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 CCC application are identical to 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, for example, the parameters values, according to what is stated in the profile standard. Finally, specific conformance test cases for the CCC application are identified for statements contained in the CCC 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 the 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 been 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 (TPs)

5.3.1 TP definition conventions

The TPs are defined following the rules shown in [Table 2](#). All TPs are defined in [Annex A](#) and [Annex 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 is specified according to the TP naming conventions defined in 5.3.2 . |
| Title | Short description of TP objective. |
| Reference | Contains the reference (document, clause, paragraph) to the subject to be validated by the actual 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 the required initial state of the DUT at the time of launching of 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> : to which group among those defined in [Table 1](#) the TP applies;
- <dut> : type of DUT (i.e. OBE or RSE);
- <x> : type of testing (i.e. Valid behaviour tests, BV, or Invalid behaviour tests, BI);
- <nn> : sequential TP number (01 to 99).

The naming conventions are as described in [Table 3](#).

Table 3 — TP naming conventions

| <group> | <dut> | <x> |
|-------------------------------|---------|--|
| <i>applicable for OBU/RSE</i> | PHY | Physical layer |
| <i>applicable for OBU/RSE</i> | MAC/LLC | MAC/LLC sublayer |
| <i>applicable for OBU/RSE</i> | AP-BAS | Application layer – I Kernel support |
| <i>applicable for OBU</i> | AP-FUN | Application layer – T Kernel support |
| <i>applicable for OBU</i> | AP-DAT | Application layer – Data attributes support |
| <i>applicable for OBU</i> | AP-SEC | Application layer – Security Level 1 support |
| <i>applicable for RSE</i> | AP-GET | Application layer - GET-rq protocol data unit (PDU) test purposes, |
| <i>applicable for RSE</i> | AP-STA | Application layer - GET-STAMPED-rq PDU test purposes |
| <i>applicable for RSE</i> | AP-MMI | Application layer - SET-MMI-rq PDU test purposes |
| <i>applicable for RSE</i> | AP-ECH | Application layer - ECHO-rq PDU test purposes |
| <i>applicable for RSE</i> | AP-REL | Application layer - EVENT-REPORT-rq PDU test purposes |

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5.4 Conformance test report

<https://standards.iteh.ai/catalog/standards/sist/217c7475-d0ed-410e-a876-349685a72291/iso-13143-1-2020>

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

The manufacturer of the OBE shall complete the protocol conformance test report (PCTR) for OBE 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 equipment

A.1 Introduction

A.1.1 General

This annex contains the test purposes (TPs) for the conformity evaluation of OBE to ISO 12813.

A.1.2 Symbols in TP descriptions

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

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 protocol data unit (PDU) to the device under test (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 TP, any reference of Table X should be changed into a reference 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 TP, means “change all occurrences in which the field accessCredentials has not been assigned to a calculation of the value accessCredentials to a given value”. |

A.2 Physical layer

As per ISO 12813:2019, 5.5.2, all test purposes TP/PHY/OBU/Bx/yy defined in EN 15876-1 are applicable for the conformity evaluation of OBE to CEN-DSRC based CCC as defined in ISO 12813:2019, Table B.8, Item 1.

A.3 MAC and LLC

As per ISO 12813:2019, 5.5.2, all test purposes TP/MAC/OBU/Bx/yy (except TP/MAC/OBU/BV/09, see NOTE) and TP/LLC/OBU/Bx/yy defined in EN 15876-1 are applicable for the conformity evaluation of OBE to CEN-DSRC based CCC as defined in ISO 12813:2019, Table B.8, Item 1.

NOTE Test purpose TP/MAC/OBU/BV/09 has been excluded from this document as this TP does not apply for profiles 0/1 of EN 13372.

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 OBE, is described in [Table A.2](#).

Table A.2 — BST general structure

| | | Length | Allowed values | |
|---------------------------------------|--|---|---|-----------------------------|
| T-APDUs | | 4 bits | '1000' indicating initialisation-request (BST) | |
| Option indicator | | 1 bit (nonmandApplications opt.) | 0/1 | |
| RSE | manufacturerid | 16 bits | As per ISO 14816 | |
| | individualid | 27 bits | As specified by manufacturer | |
| Time | | 32 bits | UNIX real time | |
| Profile | | 1 bit (Profile ext.) | 0 (= no extension) | |
| | | 7 bits | As per Profile in EN 13372:2004, 6.3.2 | |
| MandAp- plications | 1 bit (mandApplications ext.) | | 0 (= no extension) | |
| | 7 bits (number of applications) | | M | |
| | <i>CCC application</i> | 1 bit (eid opt.) | 0 (= eid not present) | |
| | | 1 bit (parameter opt.) | 0 (= parameter not present) | |
| | Aid | 1 bit (aid ext.) | 0 (= no extension) | |
| | | 5 bits | 20 (= CCC application) | |
| | <i>Applica- tion 2 (not CCC)</i> | 1 bit (eid opt.) | 0/1 | |
| | | 1 bit (parameter opt.) | 0/1 | |
| | | Aid | 1 bit (aid ext.) | 0 (= no extension) |
| | | | 5 bits | ≠ 20 (= no CCC application) |
| | | Eid | 1 bit (eid ext.) | 0 (= no extension) |
| | | | 7 bits | Any |
| | | parameter | Refer to ApplicationContextMark as per EN 12834:2003, Annex A | |
| | | ... | ... | ... |
| | <i>Application M (not CCC)</i> | 1 bit (eid opt.) | 0/1 | |
| | | 1 bit (parameter opt.) | 0/1 | |
| | | Aid | 1 bit (aid ext.) | 0 (= no extension) |
| | | | 5 bits | ≠ 20 (= no CCC application) |
| Eid | | 1 bit (eid ext.) | 0 (= no extension) | |
| | | 7 bits | Any | |
| parameter | | Refer to ApplicationContextMark as per EN 12834:2003, Annex A | | |
| Nonmand Applica- tions | | 1 bit (mandApplications ext.) | | 0 (= no extension) |
| | 7 bits (number of applications) | | N | |
| | <i>Application 1 (not CCC)</i> | See “Application 2 (not CCC)” of mandApplications | | |
| | ... | ... | | |
| | <i>Application N (not CCC)</i> | See “Application 2 (not CCC)” of mandApplications | | |
| profileList | 1 bit (profileList ext.) | | 0 (= no extension) | |

Table A.2 (continued)

| | | Length | Allowed values |
|--|-----------|-----------------------------|---|
| | | 7 bits (number of profiles) | K |
| | Profile 1 | 1 bit (Profile ext.) | 0 (= no extension) |
| | | 7 bits | Refer to Profile as per EN 12834:2003, Annex A and EN 13372:2004, 6.3.2 |
| | ... | ... | ... |
| | Profile K | 1 bit (Profile ext.) | 0 (= no extension) |
| | | 7 bits | Refer to Profile as per EN 12834:2003, Annex A and EN 13372:2004, 6.3.2 |

A.4.1.2 VST

The general structure for a VST indicating one CCC-application as is transmitted by the OBE is described in Table A.3.

Table A.3 — VST1 (security level 1): valid VST indicating one CCC application

| | | | | Length | Allowed value | | |
|---------------------|------------------------------|--------------------|------------------------------|----------------------------|--|---------------------------|--------------------|
| Fill | | | | 4 bits | Any | | |
| Profile | | | | 1 bit (Profile ext.) | 0 (= no extension) | | |
| | | | | 7 bits | Refer to Profile as per EN 12834:2003, Annex A | | |
| Applications | CCC application | parameter | aid | 1 bit (applications ext.) | 0 (= no extension) | | |
| | | | | 7 bits (number of applic.) | M | | |
| | | | | 1 bit (eid opt.) | 1 (= eid present) | | |
| | | | | 1 bit (parameter opt.) | 1 (= parameter present) | | |
| | | | | 1 bit (aid ext.) | 0 (= no extension) | | |
| | | | | 5 bits | 20 (= CCC application) | | |
| | | | | 1 bit (eid ext.) | 0 (= no extension) | | |
| | | | | 7 bits | Any (≠ other eid used in this VST) | | |
| | | | | 1 bit (Container ext.) | 0 (= no extension) | | |
| | | | | 7 bits (Container CHOICE) | 2 (= OCTET STRING) | | |
| | 1 bit (octet string ext.) | 0 (= no extension) | | | | | |
| | 7 bits (octet string length) | 16 | | | | | |
| | | parameter | CCC-ContextMark | Contract Provider | 10 bits (CountryCode) | As per ISO 3166-1 | |
| | | | | 14 bits (IssuerIdentifier) | As per ISO 14816 | | |
| | | | typeOf Contract | 16 bits | Any | | |
| | | | | context Version | 1 bit (contextVersion ext.) | 0 (= no extension) | |
| | | | | parameter | | 7 bits | Any |
| | | | | | | 1 bit (Container ext.) | 0 (= no extension) |
| | | | | | | 7 bits (Container CHOICE) | 2 (= OCTET STRING) |
| | | | | | | 1 bit (octet string ext.) | 0 (= no extension) |
| | parameter | | 7 bits (octet string length) | 2 | | | |
| | | | AC_CR-Reference | AC_Master KeyRef | 8 bits | Any | |
| | | | AC_CR-Diversifier | 8 bits | Any | | |
| | | | | 1 bit (Container ext.) | 0 (= no extension) | | |