INTERNATIONAL STANDARD

ISO 14907-2

First edition

Electronic fee collection — Test procedures for user and fixed equipment —

Part 2: Conformance test for the on-board unit application interface

Perception du télépéage — Modes opératoires relatifs aux équipements embarqués et aux équipements fixes —

Partie 2: Essai de conformité de l'interface d'application de l'unité embarquée

PROOF/ÉPREUVE

Reference number
ISO 14907-2:2021(E)

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Published in Switzerland

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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).

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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 first edition cancels and replaces the third edition (ISO/TS 14907-2:2016), which has been technically revised.

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

— EFC application interface (i.e. 6.1) has been added;

— the terms have been revised and aligned with ISO/TS 17573-2:2020.

A list of all parts in the ISO 14907 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

This document describes tests which verify on-board unit (OBU) conformance of functions and data structures implementations for electronic fee collection (EFC) applications.

The purpose of this document is to define tests which:

— assess OBU capabilities,

— assess OBU behaviour,

— serve as a guide for OBU 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.

Electronic fee collection — Test procedures for user and fixed equipment —

Part 2: Conformance test for the on-board unit application interface

1 Scope

This document describes tests which verify on-board unit (OBU) conformance of functions and data structures implementations, as defined in the implementation conformance statement (ICS) based on ISO 14906 for EFC applications.

This document defines tests for assessing OBU conformance in terms of :

— basic dedicated short-range communication (DSRC) L7 functionality,

— EFC application functions,

— EFC attributes (i.e. EFC application information),

— the addressing procedures of EFC attributes and (hardware) components,

— the EFC transaction model, which defines the common elements and steps of any EFC transaction, and

— the behaviour of the interface so as to support interoperability on an EFC-DSRC application interface level.

After the tests of isolated data items and functions (C.2 to C.4), an example is given for testing a complete EFC transaction (C.3). Although this document defines examples of test cases for DSRC and EFC functionality (see Annex C), it does not intend to specify a complete test suite for a certain implementation. To compose a test suite for a specific EFC implementation, the test cases can have to be modified and new test cases can have to be defined and added for the conformance test suite to be complete. It can be useful to consider the following when defining a complete test suite:

— small range: “exhaustive testing” of critical interoperability/compatibility features,

— large range: testing of boundaries and random values, and

— composite types: testing of individual items in sequence or parallel.

This document does not define tests which assess:

— performance,

— robustness, and

— reliability of an implementation.

NOTE 1 ISO 14907-1 defines test procedures that are aimed at assessing performance, robustness and reliability of EFC equipment and systems.

NOTE 2 The ISO/IEC 10373 series defines test methods for proximity, vicinity, integrated circuit(s) cards and related devices that can be relevant for OBUs which support such cards.

Annex D provides an informative overview of Japanese on-board equipment (OBE) conformance tests which are based on the ISO 14907 series, in order to illustrate how these can be applied in practice.

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

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

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
authenticator
data, possibly encrypted, that is used for authentication

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

3.4
channel
information transfer path

[SOURCE: ISO/IEC 7498-2:1989, 3.3.13]

3.5
electronic fee collection
EFC
fee collection by electronic means

Note 1 to entry: Fee and toll are synonyms within the context of standardization of EFC in ISO/TC 204.

[SOURCE: ISO/TS 17573-2:2020, 3.70, modified — Note 1 to entry added.]

3.6
Element
DSRC directory containing application information in the form of *attributes* (3.2)

[SOURCE: ISO 14906:2018, 3.8]

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
implementation conformance statement proforma
document, in the form of a questionnaire, which when completed for an implementation or system becomes an *implementation conformance statement* (ICS) (3.7)

[SOURCE: ISO/IEC 9646-1:1994, 3.3.40]

3.9
implementation extra information for testing
IXIT
statement containing all of the information related to the *implementation under test (IUT)* (3.11) 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
implementation of extra information for testing proforma
document, in the form of a questionnaire, which when completed for an *implementation under test (IUT)* (3.11) becomes an *implementation extra information for testing (IXIT)* (3.9)

[SOURCE: ISO/TS 17573-2:2020, 3.93]

3.11
implementation under test
IUT
implementation of one or more open systems interconnection (OSI) protocols in an adjacent user/provider relationship, being part of a real system, which is to be studied by testing

[SOURCE: ISO/TS 17573-2:2020, 3.94]

3.12
on-board equipment
OBE
all required equipment on-board a vehicle for performing required *electronic fee collection (EFC)* (3.5) functions and communication services

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

3.13
on-board unit
OBU
electronic unit on-board a vehicle for performing specific *electronic fee collection (EFC)* (3.5) functions and for communication with external systems

Note 1 to entry: An OBU always includes, in this context, at least the support of the DSRC interface.

[SOURCE: ISO/TS 17573-2:2020, 3.127, modified — Note 1 to entry added.]

3.14
roadside equipment
RSE
fixed or movable *electronic fee collection (EFC)* (3.5) equipment located along or on the road

Note 1 to entry: Movable RSE can be mounted temporarily along the road or in a vehicle.

[SOURCE: ISO/TS 17573-2:2020, 3.161]

3.15
service primitive
elementary communication service provided by the application layer protocol to the application processes (AP)

[SOURCE: ISO/TS 17573-2:2020, 3.173]

3.16
transaction
whole of the exchange of information between two physically separated communication facilities

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

3.17
transaction model
functional model describing the general structure of electronic payment *transactions* (3.16)

[SOURCE: ISO/TS 17573-2:2020, 3.213]

4 Abbreviated terms

ACn	acknowledged command/response
APDU	application protocol data unit
AP	application process
ARIB	Association of Radio Industries and Businesses
	NOTE A Japanese standards development organization.
ASCII	American Standard Code for Information Interchange
ASP	application service primitive
AVI	automatic vehicle identification
BST	beacon service table
DSRC	dedicated short-range communication
DUT	device under test
eid	Element identifier
FTP	file transfer protocol
ICS	implementation conformance statement
I-Kernel	Initialization Kernel
iid	invoker identifier

ind	indication
IUT	implementation under test
L1	layer 1 of DSRC (physical layer)
L2	layer 2 of DSRC (data link layer)
L7	application layer core of DSRC
LID	logical link control identifier
LLC	logical link control
LSDU	link layer service data unit
MMI	man-machine nterface
n.a.	not applicable
NE_OK	command accepted/response LSDU not yet available
PoC	point of control
PoO	point of observation
PrWA	private window allocation
PrWRq	private window request
req	request
ret	return
rs	response
SAM	secure application module
TC	test case
T-Kernel	transfer kernel
TTI	traffic and traveller information
VST	vehicle service table

5 OBU and supporting information

5.1 General

The supplier shall provide the OBU, i.e. the DUT, and the associated information, including:

— the OBU personalized to be able to perform tests according to the ICS and IXIT as defined in 5.2 and 5.3, respectively. At least five samples shall be submitted for test. More samples can be needed if several different data structures and data contents are required in the tests;

— user's manual for the OBU, which shall include instructions on how to handle the equipment, and can include further detailed information about the protocol functions;

— ICS according to 5.2. The ICS shall include statements regarding the following:

  — L7 services that are implemented in the OBU;

  — EFC functions (action types) that are implemented in the OBU;

  — whether or not data elements are used;

— IXIT according to 5.3 The IXIT shall, if applicable, include:

  — a statement regarding which L2 services shall be used to transfer the L7 services (and EFC services);

  — a description of security calculations in the OBU including a specification of the encryption algorithm used;

  — values of the test master keys for calculation and verification of OBU security data such as authenticators and access credentials.

The supplier should also provide configuration/personalization equipment for the OBU if this ensures effective testing.

Figure 1 gives a more detailed picture of the interface between the entity performing the conformance test and the supplier of the DUT. By the EFC application specification, the ICS proforma and the IXIT proforma, the supplier is requested to provide the DUT (OBU), which contains the IUT, as well as the documentation needed to perform the tests. More details on the content of the different documents are given in Clause 5 on OBU and supporting information.

NOTE The DUT contains the IUT.

Figure 1 shows the overall procedure of conformance testing. Figure 2 shows the exchange of information between the supplier of the DUT and the test house.

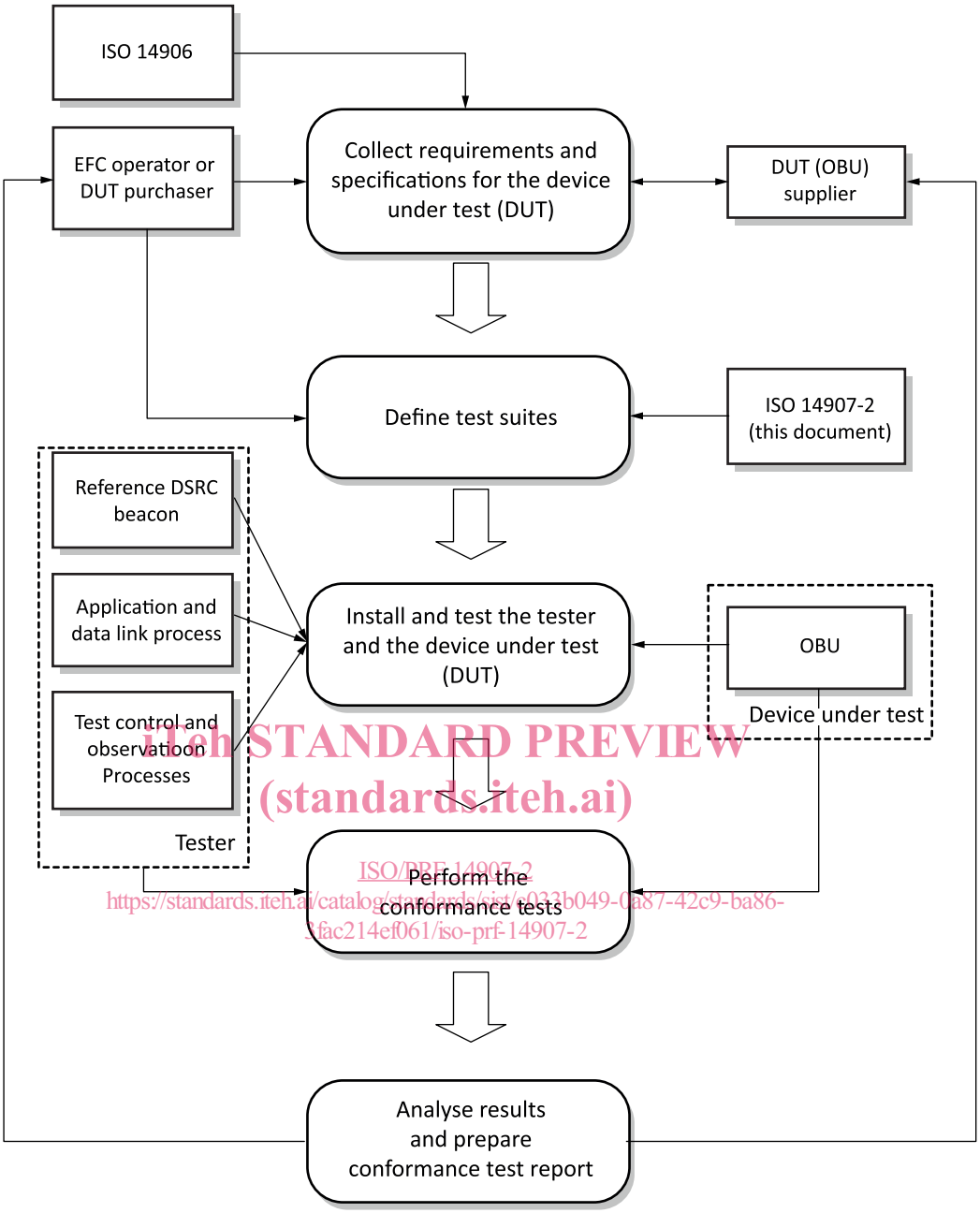

Figure 1 — Conformance testing process

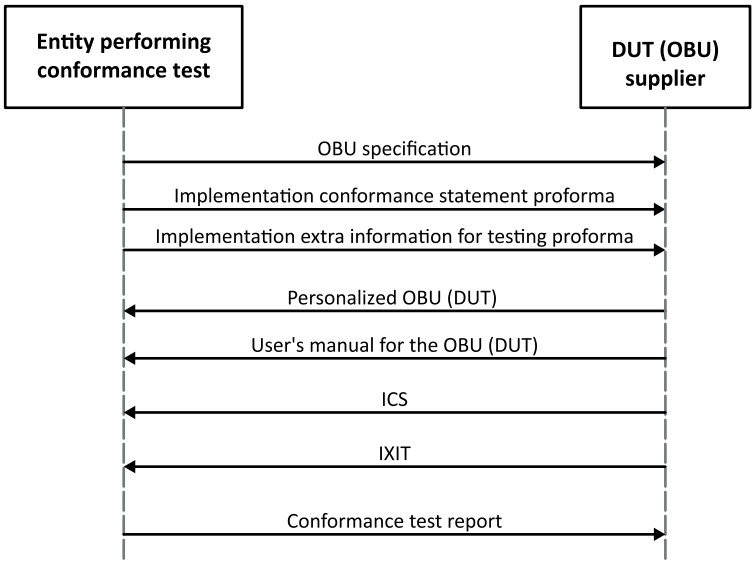

Figure 2 — Information exchange flow

5.2 ICS

The ICS is a statement made by the supplier that claims conformance to a certain specification. The ICS states which capabilities have been implemented in the specifications. It also states possible limitations in the implementation of the specification.

This document describes testing of implementations according to the following documents:

— EN 12834;

— ISO 14906.

Annex A contains the ICS proforma that shall be used for the ICS.

5.3 IXIT

The IXIT is a statement made by the supplier or an implementer of an IUT which contains or references all of the information, in addition to that given in the ICS, related to the DUT and its testing environment. The IXIT enables the test laboratory to run an appropriate test suite against the DUT.

In this document, the IXIT specifies the services in the lower communication layers that shall be used to perform the services to be tested. These services are described in EN 12795, EN 12253 and EN 13372, for example.

The IXIT shall also contain further information and describe algorithms and procedures that are not specified in the above listed documents but are prerequisites to perform the testing. Examples of such information are:

— content of the ApplicationContextMark in the VST,

— calculation of access credentials in DSRC services,

— use of returnCode in DSRC L7 services and EFC functions, and

— calculation of authenticators in EFC functions.

Annex B contains the IXIT proforma that shall be used for the declaration of the IXIT.

6 Testing requirements

6.1 EFC application interface

Figure 3 illustrates the scope of the conformance assessment of the EFC application interface covered by this document.

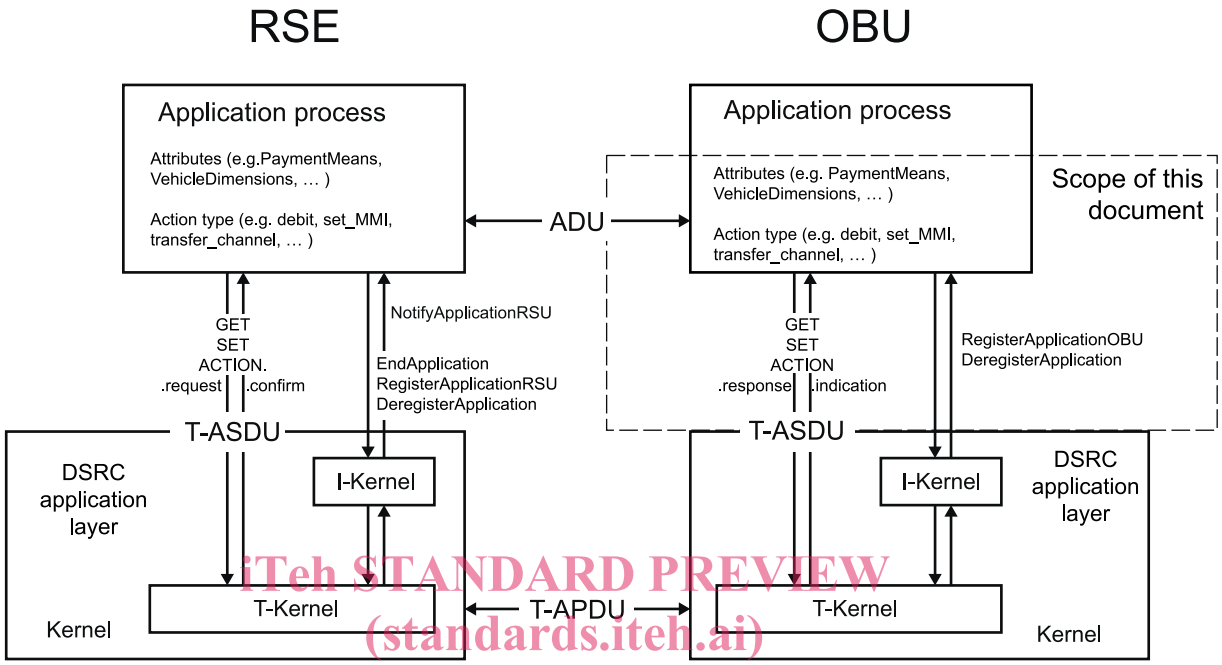

Figure 3 — The EFC application interface

6.2 Conceptual test architecture

A remote test method shall be used for the conformance test of OBUs (DUT). Figure 4 shows the conceptual testing architecture of tester and DUT. The conformance test is only related to the the PoC, which is the point where the test events are controlled. The PoC shall be implemented inside the tester on the interface between the application layer and the APs.

The PoO, which is the point where the occurrence of test events is to be observed, shall be implemented inside the tester on the interface between the application layer and the AP. The PoO must also interface the data link layer since some tests require observation of the behaviour on this layer.

The PoC and PoO are characterized by a set of application service primitives (ASPs), according to the specifications of the tests. The test events observed at the PoO may be supplemented by information provided by other sub-units, for example, MMI or an IC card, if available with the DUT.