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

Part 2:
Abstract test suite

*Perception du télépéage — Évaluation de conformité de l'équipement
embarqué et de l'équipement au sol à l'ISO/TS 12813 —*

Partie 2: Suite d'essais abstraite





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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

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 normative 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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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 13143-2 was prepared by European Committee for Standardization (CEN) CEN/TC 278, *Road transport and traffic telematics* in collaboration with ISO Technical Committee ISO/TC 204, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO/TS 13143-2 consists of the following parts, under the general title *Electronic fee collection — Evaluation of on-board and roadside equipment for conformity to ISO/TS 12813*:

- *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 12813:2009.

Within the set of EFC standards, this part of ISO/TS 13143 defines the process and tests for conformity evaluation of OBE and roadside equipment (RSE) that comply with the requirements in ISO/TS 12813:2009.

This part of ISO/TS 13143 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 communication between parties (for example between equipment manufacturers and test houses).

This part of ISO/TS 13143 is based on:

- ISO/TS 12813:2009,
- the set of dedicated short range communication (DSRC) standards defining the communication stack, and
- ISO/IEC 9646.

This part of ISO/TS 13143 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 12813 —

Part 2: Abstract test suite

1 Scope

This part of ISO/TS 13143 specifies the abstract test suite (ATS) to evaluate the conformity of on-board equipment (OBE) and roadside equipment (RSE) to ISO/TS 12813.

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

In order to ascertain that OBE and RSE fulfil essential radio requirements, they are also likely to be subject to additional factory, site and system acceptance testing (e.g. of physical and environmental endurance, quality assurance and control at manufacturing, and charge point integration), which is outside the scope of this part of ISO/TS 13143.

NOTE For example, within the European market, the essential radio requirements are set out in European Directives, compliance with which is a prerequisite for CE marking and placing on the European market.

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)*

ETSI TS 102 486-2-3 V1.1.1 (2006-08), *Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment; Part 2: DSRC application layer; Sub-Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma*

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 14906:2004]

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 14906:2004, 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 14906:2004]

**3.4
channel**
information transfer path

[ISO 14906:2004]

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

[ISO 14906:2004]

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

[ISO 14906:2004]

**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 or/and prevent its unauthorised use

[ISO 14906:2004]

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

[ISO 14906:2004]

**3.9
data integrity**
property that data has not been altered or destroyed in an unauthorised manner

[ISO 14906:2004]

**3.10
element**
<DSRC> directory containing application information in form of attributes

[ISO 14906:2004]

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 14907-2:2006]

3.12**implementation conformance statement proforma**

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

[ISO/TS 14907-2:2006]

3.13**implementation extra information for testing****IXIT**

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 14907-2:2006.

3.14**implementation extra information for testing proforma**

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 14907-2:2006.

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

equipment located within the vehicle and supporting the information exchange with the roadside equipment

NOTE 1 It is composed of the on-board unit and other sub-units whose presence are considered optional for the execution of a transaction.

NOTE 2 Adapted from ISO 14906:2004, 3.12. The additional information in the definition has been moved into Note 1.

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 14906:2004]

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

equipment located at a fixed position along the road transport network, for the purpose of communication and data exchanges with the on-board equipment of passing vehicles

[ISO 14906:2004]

3.18

service (EFC)

road transport related facility provided by a service provider

NOTE 1 Normally, this is a type of infrastructure, the use of which is offered to the user and for which the user may be requested to pay.

NOTE 2 Adapted from ISO 14906:2004, 3.15. The additional information in the definition has been moved into Note 1.

3.19

service primitive (communication)

elementary communication service provided by the application layer protocol to the application processes

NOTE The invocation of a service primitive by an application process implicitly calls upon and uses services offered by the lower protocol layers.

[ISO 14906:2004]

3.20

service provider (EFC)

operator that accepts the user's payment means and in return provides a road-use service to the user

[ISO 14906:2004]

3.21

session

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

[ISO 14906:2004]

3.22

transaction

whole of the exchange of information between the roadside equipment and the on-board equipment necessary for the completion of an EFC operation over the DSRC

[ISO 14906:2004]

3.23

transaction model

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

[ISO 14906:2004]

3.24

tester

combination of equipment and processes which is able to perform conformance tests according to ISO/TS 13143-2

3.25

user

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

4 Abbreviated terms

AC_CR	Access Credentials
ADU	Application Data Unit
AP	Application Process
APDU	Application Protocol Data Unit
ASN.1	Abstract Syntax Notation One (ISO/IEC 8824-1)
ASP	Abstract Service Primitive
ATM	Abstract Test Method
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
CM	Communication Module
DLC	Data Link Control
DSRC	Dedicated Short Range Communication
DUT	Device Under Test (ISO/TS 14907-2)
EFC	Electronic Fee Collection
EID	Element Identifier
EVENT-RT	EVENT-REPORT
ICS	Implementation Conformance Statement
IUT	Implementation Under Test
IXIT	Implementation eXtra Information for Testing
LLC	Logical Link Control
MAC	Medium Access Control
OBU	On-Board Unit
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
RSE	Roadside Equipment
SAP	Service Access Point
SCS	System Conformance Statement
TC	Test Case

TP	Test Purpose
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 protocol 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 referred to in ISO/TS 13143-1, the test architectures presented there are relevant for the corresponding TCs. For all specific TPs introduced in ISO/TS 13143-1, the test architecture defined in ETSI TS 102 486-2-3 is also relevant.

6 Untestable test purposes (TPs)

This clause is intended to give a list of TPs which are not implemented in the ATS due to the chosen ATM 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.

The 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

7.2.1.1 General

Subclause 7.2.1 describes the naming conventions chosen for the elements of the ATS declarations part.

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 [3]) 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 maintenance reasons only.

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 7.2.1.1 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 7.2.1.1 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

Subclause 7.2.2 describes the naming conventions chosen for the elements of the ATS constraints part.

Constraints shall be written with all lowercase letters.

7.2.3 Dynamic part

7.2.3.1 General

Subclause 7.2.3 describes the naming conventions used for the elements of the ATS dynamic part.

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 to 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>	Group identifier	Group description
	<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 1 TP identifier: TP/AP-0DAT/OBU/BV/01.

EXAMPLE 2 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.

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 whether 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 such a way that all relevant parameters/fields are parametrized. This 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 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 cause a preliminary verdict PASS if the requirement is met.

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

Except for local trees, test steps do not contain a default. 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.

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Annex A (normative)

Abstract test suite (ATS) for on-board units (OBU)

A.1 General

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 TTCN graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in an HTML file (CEN_ISO_TS_13143-2_AP_OBU.html contained in the folder CEN_ISO_TS_13143-2_AP_OBU) in the electronic insert which accompanies this document.

Where an ATS (in TTCN-2) is published in both graphical and machine processable format, these two forms shall be considered equivalent. In the event that there appear to be syntactical or semantic differences between the two, the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

A.3 TTCN machine processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (CEN_ISO_TS_13143-2_AP_OBU.mp contained in the folder CEN_ISO_TS_13143-2_AP_OBU) in the electronic insert which accompanies this document.

Where an ATS (in TTCN-2) is published in both graphical and machine processable format, these two forms shall be considered equivalent. In the event that there appear to be syntactical or semantic differences between the two, the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

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Annex B (normative)

Abstract test suite (ATS) for roadside equipment (RSE)

B.1 General

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 TTCN graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in an HTML file (CEN_ISO_TS_13143-2_AP_RSE.html contained in the folder CEN_ISO_TS_13143-2_AP_RSE) in the electronic insert which accompanies this document.

Where an ATS (in TTCN-2) is published in both graphical and machine processable format, these two forms shall be considered equivalent. In the event that there appear to be syntactical or semantic differences between the two, the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

B.3 TTCN machine processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII file (CEN_ISO_TS_13143-2_AP_RSE.mp contained in the folder CEN_ISO_TS_13143-2_AP_RSE) in the electronic insert which accompanies this document.

Where an ATS (in TTCN-2) is published in both graphical and machine processable format, these two forms shall be considered equivalent. In the event that there appear to be syntactical or semantic differences between the two, the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

Annex C (normative)

Partial PIXIT proforma for on-board units (OBU)

C.1 General

The PIXIT proforma is based on ISO/IEC 9646-6. Any additional information needed can be found in this International Standard.

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:	

C.5 Client identification

Table C.4 — Client identification

Client Identification:	
Client Test Manager:	
Test Facilities Required:	

C.6 DUT

Table C.5 — DUT

Name:	
Version:	
SCS Number:	
Machine Configuration:	
Operating System Identification:	
DUT Identification:	
PICS Reference for DUT:	
Limitations of the DUT:	
Environmental Conditions:	

C.7 Protocol layer information

C.7.1 Protocol identification

Table C.6 — Protocol identification

Name:	
Version:	
PICS References:	

C.7.2 DUT information

The DUT information shall be provided by the manufacturer of the DUT in an ASCII file. The DUT information required can be found in the HTML file CEN_ISO_TS_13143-2_AP_OBU.html (in the folder CEN_ISO_TS_13143-2_AP_OBU) in the Declarations Part, subsection “Test Suite Parameter Declarations”. See the electronic insert which accompanies this document.

Annex D (normative)

Partial PIXIT proforma for roadside equipment (RSE)

D.1 Introduction

The PIXIT Proforma is based on ISO/IEC 9646-6. Any additional information needed can be found in this International Standard.

D.2 Identification summary

Table D.1 — Identification summary

PIXIT Number:	
Test Laboratory Name:	
Date of Issue:	
Issued to:	

D.3 ATS summary

Table D.2 — ATS summary

Protocol Specification:	
Protocol to be Tested:	
ATS Specification:	
Abstract Test Method:	

D.4 Test laboratory

Table D.3 — Test laboratory

Test Laboratory Identification:	
Test Laboratory Manager:	
Means of Testing:	
SAP Address:	

D.5 Client identification

Table D.4 — Client identification

Client Identification:	
Client Test Manager:	
Test Facilities Required:	

D.6 DUT

Table D.5 — DUT

Name:	
Version:	
SCS Number:	
Machine Configuration:	
Operating System Identification:	
DUT Identification:	
PICS Reference for DUT:	
Limitations of the DUT:	
Environmental Conditions:	

D.7 Protocol layer information

D.7.1 Protocol identification

Table D.6 — Protocol identification

Name:	
Version:	
PICS References:	

D.7.2 DUT information

The DUT information shall be provided by the manufacturer of the DUT in an ASCII file. The DUT information required can be found in the HTML file CEN_ISO_TS_13143-2_AP_RSE.html (in the folder CEN_ISO_TS_13143-2_AP_RSE) in the Declarations Part, subsection “Test Suite Parameter Declarations”. See the electronic insert which accompanies this document.

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