BS EN ISO 13140-2:2016

BSI Standards Publication

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

Part 2: Abstract test suite (ISO 13140-2:2016)

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National foreword

This British Standard is the UK implementation of EN ISO 13140-2:2016. It supersedes PD CEN ISO/TS 13140-2:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2016

ISBN 978 0 580 92833 8

ICS 03.220.20; 35.240.60

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 13140-2

December 2016

ICS 03.220.20; 35.240.60

Supersedes CEN ISO/TS 13140-2:2012

English Version

Electronic fee collection - Evaluation of on-board and roadside equipment for conformity to EN ISO 13141 - Part 2: Abstract test suite (ISO 13140-2:2016)

Perception du télépéage - Évaluation des équipements embarqués et en bord de route quant à la conformité avec l'ISO 13141 - Partie 2: Suite d'essais abstraite (ISO 13140-2:2016)

Elektronische Gebührenerhebung - Bewertung der Konformität von fahrzeuginternen und straßenseitigen Ausrüstungen nach EN ISO 13141 - Teil 2: Zusammengefasstes Prüfprogramm (ISO 13140-2:2016)

This European Standard was approved by CEN on 6 December 2016.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

This document (EN ISO 13140-2:2016) has been prepared by Technical Committee ISO/TC 204 “Intelligent transport systems” in collaboration with Technical Committee CEN/TC 278 “Intelligent transport systems” the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN ISO/TS 13140-2:2012.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 13140-2:2016 has been approved by CEN as EN ISO 13140-2:2016 without any modification.

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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 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 13140-2 cancels and replaces ISO/TS 13140-2:2012, 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 ISO 13140-1 due to changes to the underlying base standards, in particular ISO 13141;

— 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 spot checks for the enforcement process. The application interface is defined in ISO 13141:2015.

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 13141:2015.

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 (for example, between equipment manufacturers and test houses).

This document is based on

— ISO 13141:2015,

— 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.

INTERNATIONAL STANDARD ISO 13140-2:2016(E)

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

Part 2: Abstract test suite

1 Scope

This document specifies the abstract test suite (ATS) to evaluate the conformity of on-board equipment (OBE) and roadside equipment (RSE) to ISO 13141:2015 in accordance with the test suite structure and test purposes defined in ISO 13140-1:2016.

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

NOTE The OBE and RSE are subject to additional testing in order to ascertain that they fulfil the essential radio requirements as set out in European Directives, a pre-requisite for CE marking and placing on the European market. They are also likely to be subject to additional testing of physical, environmental endurance, quality assurance and control at manufacturing, charge point integration, as part of factory, site and system acceptance testing. The definition of these tests is 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/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 V1.2.1 (2008-10), 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
base standard
approved international standard, technical specification or ITU-T Recommendation

Note 1 to entry: This includes but is not limited to approved standard deliverables from ISO, ITU, CEN, CENELEC, ETSI and IEEE.

[SOURCE: ISO/IEC/TR 10000-1:1998, 3.1.1, modified]

3.2
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]

3.3
implementation conformance statement proforma
document, in the form of a questionnaire, which when completed for an implementation or a system becomes an implementation conformance statement (ICS)

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

3.4
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/IEC 19015:2000, 3.20]

3.5
implementation extra information for testing proforma
document, in the form of a questionnaire, which when completed for an implementation under test (IUT) becomes an implementation extra information for testing (IXIT)

[SOURCE: ISO/IEC 9646-1:1994, 3.3.42, modified]

3.6
on-board equipment
all required equipment on-board a vehicle for performing required EFC functions and communication services

3.7
on-board unit
single electronic unit on-board a vehicle for performing specific EFC functions and for communication with external systems

3.8
roadside equipment
equipment located along the road, either fixed or mobile

3.9
tester
combination of equipment, humans and processes able to perform specified conformance tests

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

4 Abbreviated terms

AP	Application Process (ISO 14906)
ASN.1	Abstract Syntax Notation One (ISO/IEC 8824-1)
ATS	Abstract Test Suite
BI	Behaviour Invalid (i.e. Invalid Behaviour tests)
BV	Behaviour Valid (i.e. Valid Behaviour tests)

Cf	Confirm (ISO 14906)
CM	Co-ordination message
DSRC	Dedicated Short-Range communication (ISO 14906)
DUT	Device Under Test (ISO/TS 14907-2)
EFC	Electronic Fee Collection (ISO 17573)
ICS	Implementation Conformance Statement (EN 15509)
IXIT	Implementation eXtra Information for Testing (ISO/TS 14907-2)
IUT	Implementation Under Test (ISO/TS 14907-2)
MAC	Medium Access Control (EN 12795)
OBE	On-board equipment
OBU	On-board unit
PIXIT	Protocol Implementation extra Information for Testing
RSE	Roadside equipment
SAP	Service Access Point
SCS	Semiconductor Characterization System
TC	Test Case
TSS	Test Suite Structure (EN 15876-1)

5 Abstract Test Method (ATM)

5.1 General

This clause describes the abstract test method (ATM) used to test the layers at the OBE side and at the RSE side.

5.2 Test architecture

Clause 4 in ETSI/TS 102 486-2-3 describes the test architecture for application layer testing. As test purposes (TPs) from ETSI/TS 102 486-2-3 are referenced to in ISO 13140-1, the test architectures presented there are also relevant for the corresponding test cases (TCs). For all specific TPs introduced in ISO 13140-1, the test architecture defined in ETSI/TS 102 486-2-3 is also relevant.

5.3 Protocol Implementation Extra Information for Testing (PIXIT)

The supplier of the OBE and RSE, respectively, is responsible for providing a Protocol Implementation Extra Information for Testing (PIXIT).

The supplier of the OBE and RSE shall complete a PIXIT; see Annex C and Annex D for examples of proformas.

6 Untestable Test Purposes (TP)

This clause gives a list of TPs which are not implemented in the abstract test suite (ATS) due to the chosen abstract test method (ATM) or other restrictions.

NOTE The abbreviation OBU, rather than OBE, is used in the naming of test purposes for historical reasons and for direct correspondence with ETSI/TS 102 486–1-3, ETSI/TS 102 486–2-3 and ISO 13140-1.

Table 1 — Untestable TPs

Test purpose	Reason
(empty)	(empty)

NOTE Currently no untestable TPs have been identified.

7 Abstract test suite (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.

ATSs for OBE and RSE are specified in Annex A and Annex B respectively. The partial PIXIT proformas for OBE and RSE are specified in Annex C and Annex D respectively.

7.2 Naming conventions

7.2.1 Declarations part

This clause describes the naming conventions chosen for the elements of the ATS declarations part.

7.2.1.1 General

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 as defined in ISO/IEC 9646-5) are never used in structured type definitions, application service point ASP type definitions or protocol data unit (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 Application service point (ASP) type definitions

The general conventions in 7.2.1.1 apply for application service point (ASP) type definitions. 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 Protocol data unit (PDU) type definitions

The general conventions in 7.2.1.1 apply for protocol data unit (PDU) type definitions. 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 for coordination message (CM) type definitions.

7.2.1.12 Alias definitions

Alias definitions are not used.

7.2.2 Constraints part

This clause describes the naming conventions chosen for the elements of the ATS constraints part.

7.2.2.1 General

Constraints shall be written with all lowercase letters.

7.2.3 Dynamic part

This clause describes the naming conventions used for the elements of the ATS dynamic part.

7.2.3.1 General

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 (TC) is built in a similar way as for the test purpose.

The identifier of a TC is built according to Table 2.

NOTE The abbreviation OBU, rather than OBE, is used in the naming of test cases for historical reasons and for direct correspondence with ETSI/TS 102 486–1-3, ETSI/TS 102 486–2-3 and ISO 13140-1.

Table 2 — TC naming convention

Identifier:	**TC_ <layer> _ <dut> _ <x> _ <nn>**		
	<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 Equipment
		RSE	Roadside Equipment
	x = Type of testing	BV	Valid Behaviour Tests
		BI	Invalid Behaviour Tests
	<nn> = sequential number	(01–99)	Test Purpose Number

EXAMPLE TP identifier: TP/AP-0DAT/OBU/BV/01

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 if 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 a way that all relevant parameters/fields are parameterized. That 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 an 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 causes a preliminary verdict PASS if the requirement is met.

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

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

Annex A
(normative)

Abstract test suite (ATS) for on-board equipment

A.1 General

This abstract test suite has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3. The abstract test suite was developed on a separate TTCN software tool and is attached to this document in an electronic insert. It contains the TTCN tables and a test suite overview part that 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_13140-2_AP_OBE. html in the folder "OBE" contained in archive ISO13140-2(2016)v2.zip) in the electronic insert which accompanies this present document.

NOTE 1 The above referenced file (i.e. ISO13140-2(2016)v2.zip) is freely available for download at http://standards.iso.org/iso/13140.

NOTE 2 The SHA-256 cryptographic hash digest of the above referenced file is 27f633c80a412fbd0ddf31e37a225695afe288418d86759676c433419e2275f3, which can be used to verify its integrity. The SHA-256 algorithm is specified in NIST 180-4[21]. Software for this type of computation is freely available for download on the web, for example, OpenHashtool and RHash. Be aware that pasting the text of the file into one of the hash digest computation pages available on the Web can result in a non-matching hash digest due to changes in the underlying coding.

A.3 TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this abstract test suite (ATS) is contained in an ASCII file (CEN_ISO_TS_13140-2_AP_OBE.mp in the folder "OBE" contained in archive ISO13140-2(2016) v2.zip) which accompanies this present document.

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

Annex B
(normative)

Abstract test suite (ATS) for roadside equipment

B.1 General

This abstract test suite has been produced using the Tree and Tabular Combined Notation (TTCN) according to ISO/IEC 9646-3. The abstract test suite was developed on a separate TTCN software tool and is attached to this document in an electronic insert. It contains the TTCN tables and a test suite overview part that 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_13140-2_AP_RSE.html in the folder "RSE" contained in the archive ISO13140-2(2016)v2.zip) in the electronic insert which accompanies this present document.

NOTE 1 The above referenced file (i.e. ISO13140-2(2016)v2.zip) is freely available for download at http://standards.iso.org/iso/13140.

NOTE 2 The SHA-256 cryptographic hash digest of the above referenced file is 27f633c80a412fbd0ddf31e37a225695afe288418d86759676c433419e2275f3, which can be used to verify its integrity. The SHA-256 algorithm is specified in NIST 180-4[21]. Software for this type of computation is freely available for download on the web, for example OpenHashtool and RHash. Be aware that pasting the text of the file into one of the hash digest computation pages available on the Web can result in a non-matching hash digest due to changes in the underlying coding.TTCN Machine Processable form (TTCN.MP)

B.3 TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this abstract test suite (ATS) is contained in an ASCII file (CEN_ISO_TS_13140-2_AP_RSE.mp contained in the folder "RSE" contained in archive ISO13140-2(2016)v2.zip) which accompanies this present document.

Note that where an abstract test suite (in TTCN-2) is published in both graphical and machine processable format these two forms shall be considered equivalent. In the event that there appears to be syntactical or semantic differences between the two then the problem shall be resolved and the erroneous format (whichever it is) shall be corrected.

Annex C
(informative)

PIXIT proforma for on-board equipment

C.1 General

The protocol implementation extra information for testing (PIXIT) proforma is based on ISO/IEC 9646-6, which can be consulted for any necessary additional information.

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_13140-2_AP_OBE.html in the Declarations Part, subsection Test Suite Parameter Declarations.

Annex D
(informative)

PIXIT proforma for roadside equipment

D.1 General

The protocol implementation extra information for testing (PIXIT) proforma is based on ISO/IEC 9646-6, which can be consulted for any necessary additional information.

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 _13140-2_AP_RSE.html in the Declarations Part, subsection Test Suite Parameter Declarations.

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[18] ETSI EN 300 674-1, *Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communication (DSRC) transmission equipment (500 kbit/s / 250 kbit/s) operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band; Part 1: General characteristics and test methods for Road Side Units (RSU) and On-Board Units (OBU)*

[19] ETSI/TS 102 486-1-2, *Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated Short Range*

Communication (DSRC) transmission equipment; Part 1: DSRC data link layer: medium access and logical link control; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)

[20] ETSI/TS 102 486-2-2, *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 2: Test Suite Structure and Test Purposes (TSS&TP)*

[21] National Institute of Standards and Technology. http://www.nist.gov), Federal Information Processing Standards (FIPS) 180-4 “Secure Hash Standard (SHS)”, August 2015

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