

Road vehicles - Vehicle to grid communication interface
- Part 5: Physical layer and data link layer conformance
test (ISO 15118-5:2018)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 15118-5:2019 sisaldab Euroopa standardi EN ISO 15118-5:2019 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 15118-5:2019 consists of the English text of the European standard EN ISO 15118-5:2019.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.02.2019.	Date of Availability of the European standard is 13.02.2019.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 43.120

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Road vehicles - Vehicle to grid communication interface -
Part 5: Physical layer and data link layer conformance test
(ISO 15118-5:2018)

Véhicules routiers - Interface de communication entre
véhicule et réseau électrique - Partie 5: Essai de
conformité relatif à la couche physique et à la couche
liaison de données (ISO 15118-5:2018)

This European Standard was approved by CEN on 28 December 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of ISO 15118-5:2018 has been prepared by Technical Committee ISO/TC 22 "Road vehicles" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 15118-5:2019 by Technical Committee CEN/TC 301 "Road vehicles" the secretariat of which is held by AFNOR.

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 August 2019, and conflicting national standards shall be withdrawn at the latest by August 2019.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 15118-5:2018 has been approved by CEN as EN ISO 15118-5:2019 without any modification.

Contents

Foreword.....	vii
Introduction.....	viii
1 Scope	1
2 Normative references	2
3 Terms and definitions.....	2
4 Symbols (and abbreviated terms)	7
5 Conventions	8
5.1 Requirement structure.....	8
5.2 Test system description	8
6 Test architecture reference model.....	8
6.1 General information	8
6.2 Platform adapter interface.....	9
6.3 SUT adapter interfaces	9
6.4 Codecs	10
7 Test suite conventions	10
7.1 General information	10
7.2 Test suite structure (TSS).....	10
7.3 Test profiles.....	12
7.3.1 Test configurations	12
7.3.2 Components and ports.....	13
7.3.3 Protocol implementation conformance statement (PICS) definition.....	14
7.3.4 Protocol implementation extra information for testing (PIXIT) definition.....	15
7.3.5 Test control.....	17
Table 12 — SECC AC PICS/PIXIT configuration.....	17
Table 13 — SECC DC PICS/PIXIT configuration.....	18
Table 14 — EVCC AC PICS/PIXIT configuration	19
Table 15 — EVCC DC PICS/PIXIT configuration	20
7.4 Test suite identifiers.....	22
7.4.1 Module identifiers	22
7.4.2 Test case identifiers.....	22
7.4.3 Template identifiers	24
7.4.4 Function identifiers	25
7.4.5 Timer identifiers.....	26
7.4.6 PICS/PIXIT identifiers.....	26
7.4.7 Verdict identifiers	27
7.5 Test suite coverage	27
Table 29 — ATS coverage of requirements in ISO 15118-3	28
Table 30 — Groups for a simplified TC Id representation (see Table 29)	46
7.6 Test case description.....	56
7.7 Test case specification	57
7.7.1 Data types	57
7.7.2 Templates.....	57
7.7.3 Timeouts and timers	58
7.7.4 Library functions	58

7.7.5	Test case modelling	58
7.7.6	SLAC Message handling for different SUT types.....	59
7.7.7	IEC 61851-1 PWM event handling and control.....	59
7.7.8	Data link status control functionality.....	61
7.7.9	EIM status control functionality	61
7.7.10	Transmission power limitation functionality.....	61
7.7.11	Attenuator injection functionality	61
8	Test case descriptions for ISO 15118-3 HPGP PLC signal measurement.....	62
8.1	General information.....	62
8.2	Test case for PLC signal measurement for ISO 15118-3	62
8.3	SECC + PLC bridge test cases	62
8.3.1	SECC test cases for CmSlacParm.....	62
8.3.2	SECC test cases for AttenuationCharacterization	69
8.3.3	SECC test cases for CmValidate.....	79
8.3.4	SECC test cases for CmSlacMatch	86
8.3.5	SECC test cases for PLCLinkStatus.....	98
8.3.6	SECC test cases for CmAmpMap.....	110
8.4	EVCC + PLC bridge test cases	114
8.4.1	EVCC test cases for CmSlacParm	114
8.4.2	EVCC test cases for AttenuationCharacterization.....	122
8.4.3	EVCC test cases for CmValidate	130
8.4.4	EVCC test cases for CmValidateOrCmSlacMatch.....	142
8.4.5	EVCC test cases for CmSlacMatch.....	142
8.4.6	EVCC test cases for PLCLinkStatus	148
8.4.7	EVCC test cases for CmAmpMap	159
Annex A	(normative) Configuration specifications.....	164
A.1	Timer configuration	164
A.2	PICS configuration	165
A.3	PIXIT configuration	165
Annex B	(normative) Control part specification.....	167
B.1	SECC control parts.....	167
B.1.1	AC specific control parts.....	167
B.1.2	DC specific control parts.....	172
B.2	EVCC control parts	177
B.2.1	AC specific control parts	177
B.2.2	DC specific control parts.....	181
Annex C	(normative) Test-case specifications for 15118-3	186
C.1	SECC + PLC bridge test cases	186
C.1.1	SECC test cases for CmSlacParm.....	186
C.1.2	SECC test cases for AttenuationCharacterization	190
C.1.3	SECC test cases for CmValidate.....	197
C.1.4	SECC test cases for CmSlacMatch	202
C.1.5	SECC test cases for PLCLinkStatus.....	209
C.1.6	SECC test cases for CmAmpMap.....	212
C.2	EVCC + PLC bridge test cases	214

C.2.1	EVCC test cases for CmSlacParm.....	214
C.2.2	EVCC test cases for AttenuationCharacterization	219
C.2.3	EVCC test cases for CmValidate.....	224
C.2.4	EVCC test cases for CmValidateOrCmSlacMatch	232
C.2.5	EVCC test cases for CmSlacMatch	232
C.2.6	EVCC test cases for PLCLinkStatus.....	236
C.2.7	EVCC test cases for CmAmpMap	244
Annex D (normative) Function specifications for supporting test execution.....		248
D.1	Configuration functions.....	248
D.2	Pre-condition functions.....	250
D.2.1	SECC + PLC bridge functions	250
D.2.2	EVCC + PLC bridge functions.....	253
D.3	Post-condition functions.....	256
D.3.1	SECC + PLC bridge functions	256
D.3.2	EVCC + PLC bridge functions.....	257
D.4	Library functions	257
Annex E (normative) Function specifications for 15118-3.....		259
E.1	SECC + PLC bridge functions	259
E.1.1	SECC functions for CmSlacParm	259
E.1.2	SECC functions for AttenuationCharacterization	266
E.1.3	SECC functions for CmValidate.....	281
E.1.4	SECC functions for CmSlacMatch	298
E.1.5	SECC functions for CmSetKey.....	303
E.1.6	SECC functions for PLCLinkStatus.....	304
E.1.7	SECC functions for CmAmpMap	313
E.2	EVCC + PLC bridge functions.....	318
E.2.1	EVCC functions for CmSlacParm.....	319
E.2.2	EVCC functions for AttenuationCharacterization.....	324
E.2.3	EVCC functions for CmValidate	346
E.2.4	EVCC functions for CmValidateOrCmSlacMatch	367
E.2.5	EVCC functions for CmSlacMatch.....	370
E.2.6	EVCC functions for CmSetKey	373
E.2.7	EVCC functions for PLCLinkStatus	373
E.2.8	EVCC functions for CmAmpMap.....	379
Annex F (normative) Template specifications for 15118-3		385
F.1	Common + PLC bridge templates.....	385
F.1.1	CMN templates for CmSlacParm.....	386
F.1.2	CMN templates for CmStartAttenCharInd.....	387

F.1.3	CMN templates for CmMnbcSoundInd	387
F.1.4	CMN templates for CmAttenCharRsp	387
F.1.5	CMN templates for CmValidate.....	388
F.1.6	CMN templates for CmSlacMatch	389
F.1.7	CMN templates for CmSetKey	390
F.1.8	CMN templates for CmAmpMap	391
F.1.9	CMN templates for CmNwStats	394
F.2	SECC + PLC bridge templates.....	394
F.2.1	SECC templates for CmAttenCharInd	395
F.3	EVCC + PLC bridge templates	395
F.3.1	EVCC templates for CmAttenProfileInd.....	395
F.3.2	EVCC templates for CmAttenCharInd	395
Annex G (normative)	Data type definitions.....	397
G.1	Data types for PICS.....	397
G.2	Data types for PIXIT	397
G.3	Data types for SLAC.....	398
Bibliography.....		403

Introduction

The first two parts of ISO 15118 describe the use cases and the technical specification of the Vehicle-to-Grid Communication Interface which is intended for the optimized use of energy resources so that electric road vehicles can recharge in the most economic or most energy efficient way. It is furthermore required to develop efficient and convenient billing systems in order to cover micro-payments resulting from charging processes. The necessary communication channel may serve in the future to contribute to the stabilization of the electrical grid, as well as to support additional information services required to operate electric vehicles efficiently and economically.

Resulting from the physical and data link layer requirements defined in the third part of the standard, a corresponding set of test cases are required in order to verify conformance of implementations. This document therefore defines a conformance test suite for the physical and data link layer protocols in order to derive a common and agreed basis for conformance tests. The resulting test suite is a necessary prerequisite for downstream interoperability tests. Since interoperability furthermore involves the actual application logic of an implementation, those tests are beyond the scope of this document. Hence this document focuses on the interface aspects and the corresponding requirements given in part three only.

Road vehicles — Vehicle to grid communication interface — Part 5: Physical and data link layer conformance tests

1 Scope

This document specifies conformance tests in the form of an Abstract Test Suite (ATS) for a System Under Test (SUT) implementing an Electric Vehicle or Supply Equipment Communication Controller (EVCC or SECC) with support for PLC-based High Level Communication (HLC) and Basic Signaling according to ISO 15118-3. These conformance tests specify the testing of capabilities and behaviors of an SUT, as well as checking what is observed against the conformance requirements specified in ISO 15118-3 and against what the implementer states the SUT implementation's capabilities are.

The capability tests within the ATS check that the observable capabilities of the SUT are in accordance with the static conformance requirements defined in ISO 15118-3. The behavior tests of the ATS examine an implementation as thoroughly as is practical over the full range of dynamic conformance requirements defined in ISO 15118-3 and within the capabilities of the SUT (see NOTE 1).

A test architecture is described in correspondence to the ATS. The conformance test cases in this part of the standard are described leveraging this test architecture and are specified in TTCN-3 Core Language for the ISO/OSI Physical and Data Link Layers (Layers 1 and 2). The conformance test cases for the ISO/OSI Network Layer (Layer 3) and above are described in ISO 15118-4.

In terms of coverage, this document only covers normative sections and requirements in ISO 15118-3. This document can additionally include specific tests for requirements of referenced standards (e.g. IEEE, or industry consortia standards) as long as they are relevant in terms of conformance for implementations according to ISO 15118-3. However, it is explicitly not intended to widen the scope of this conformance specification to such external standards, if it is not technically necessary for the purpose of conformance testing for ISO 15118-3. Furthermore, the conformance tests specified in this document do not include the assessment of performance nor robustness or reliability of an implementation. They cannot provide judgments on the physical realization of abstract service primitives, how a system is implemented, how it provides any requested service, nor the environment of the protocol implementation. Furthermore, the test cases defined in this document only consider the communication protocol and the system's behavior defined ISO 15118-3. Power flow between the EVSE and the EV is not considered.

NOTE 1 Practical limitations make it impossible to define an exhaustive test suite, and economic considerations can restrict testing even further. Hence, the purpose of this document is to increase the probability that different implementations are able to interwork. This is achieved by verifying them by means of a protocol test suite, thereby increasing the confidence that each implementation conforms to the protocol specification. However, the specified protocol test suite cannot guarantee conformance to the specification since it detects errors rather than their absence. Thus conformance to a test suite alone cannot guarantee interworking. What it does do is give confidence that an implementation has the required capabilities and that its behavior conforms consistently in representative instances of communication.

NOTE 2 This document has some interdependencies to the conformance tests defined in ISO 15118-4 which result from ISO/OSI cross layer dependencies in the underlying protocol specification (e.g. for sleep mode)

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.

IEC 61851-1:2017, *Electric vehicle conductive charging system — Part 1: General requirements (Ed 3.0, 2017)*

ISO 15118-1:2013, *Road vehicles — Vehicle to grid communication interface — Part 1: General information and use-case definition*

ISO 15118-2:2014, *Road vehicles — Vehicle-to-Grid Communication Interface — Part 2: Network and application protocol requirements*

ISO 15118-3:2015, *Road vehicles — Vehicle to grid communication interface — Part 3: Physical and data link layer requirements*

ETSI ES 201 873-5 V4.6.1, *TTCN-3: TTCN-3 Runtime Interface (June 2014)*

ETSI ES 201 873-6 V4.6.1, *TTCN-3: TTCN-3 Control Interface (June 2014)*

HomePlug Green PHY Specification, release version 1.1.1, July 4, 2013

NOTE 1 Even though ISO 15118-3:2015, which is the baseline for this conformance test document, explicitly references IEC 61851-1:2011, this document references IEC 61851-1:2017 because of applicability on the market.

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 15118-1, ISO 15118-2, ISO 15118-3 and the following apply.

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

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

3.1

abstract test case

complete and independent specification of the actions required to achieve a specific test purpose

Note 1 to entry: This specification is defined at the level of abstraction of a particular Abstract Test Method, starting in a stable testing state and ending in a stable testing state and may involve one or more consecutive or concurrent connections.

Note 2 to entry: The specification should be complete in the sense that it is sufficient to enable a test verdict to be assigned unambiguously to each potentially observable test outcome (i.e. sequence of test events).

Note 3 to entry: The specification should be independent in the sense that it should be possible to execute the derived executable test case in isolation from other such test cases (i.e. the specification should always include the possibility of starting and finishing in the “idle” state).

Note 4 to entry: Compare with ITU-T X.290.

3.2

abstract test suite

ATS

test suite composed of abstract test cases