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**Road vehicles — Vehicle to grid
communication interface —**

**Part 5:
Physical layer and data link layer
conformance test**

iTeh STANDARD PREVIEW
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*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](https://standards.iteh.ai/catalog/standards/sist/9d6af811-f45e-4793-9175-920c89a81dfe/iso-15118-5-2018)

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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

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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 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 the following URL: www.iso.org/iso/foreword.html

This document was prepared jointly by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*, and Technical Committee IEC/TC 69, *Electric road vehicles and electric industrial trucks*. The draft was circulated for voting to the national bodies of both ISO and IEC.

A list of all parts in the ISO 15118 series can be found on the ISO website.

This corrected version of ISO 18541-6:2018 incorporates the following corrections:

- the foreword has been revised to indicate joint development with IEC/TC 69, *Electric road vehicles and electric industrial trucks*.

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.

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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

Note 1 to entry: Compare with ITU-T X.290.

3.3

black box testing

method of testing that examines the behavior of an SUT without considering the internal implementation and structure of the SUT, thus relying on the SUT's open interface for testing

3.4

conformance requirements

conformance of a real system consisting of conformance to each requirement and conformance to the set

Note 1 to entry: Set of interrelated requirements which together define the behavior of the system and its communication. Conformance of a real system will, therefore, be expressed at two levels, conformance to each individual requirement and conformance to the set. Applicable ISO 15118-4 conformance tests include requirements and transfer syntax requirements as far as they can be validated by black box testing.

Note 2 to entry: See also *static conformance requirements* (3.20) and *dynamic conformance requirements* (3.6).

3.5

conforming implementation

IUT which satisfies both static and dynamic conformance requirements, consistent with the capabilities stated in the PICS(s)

Note 1 to entry: Compare with ITU-T X.290.

3.6

dynamic conformance requirements

one of the requirements which specifies what observable behavior is permitted by the relevant specification(s) in instances of communication

Note 1 to entry: The requirements for this conformance specification are defined in ISO 15118-3.

Note 2 to entry: Compare with ITU-T X.290.

3.7

executable test case

realization of an abstract test case

Note 1 to entry: Compare with ITU-T X.290.

3.8

expected behavior

exact response of the SUT according to the underlying protocol specification to the stimulus defined in the test behavior

3.9

implementation conformance statement

ICS

statement made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities have been implemented

Note 1 to entry: The given specification for this conformance specification is ISO 15118-3.

Note 2 to entry: Compare with ITU-T X.290.

3.10

implementation extra information for testing

IXIT

statement made by a supplier or implementer of an IUT which contains or references all of the information (in addition to that given in the ICS) related to the IUT and its testing environment, which will enable the test laboratory to run an appropriate test suite against the IUT

Note 1 to entry: Compare with ITU-T X.290.

3.11

implementation under test

IUT

implementation of one or more OSI protocols in an adjacent user/provider relationship, being that part of a real open system which is to be studied by testing

Note 1 to entry: Compare with ITU-T X.290.

3.12

main test component

MTC

single test component in a test component configuration responsible for creating and controlling *parallel test components* and computing and assigning the test verdict

Note 1 to entry: Compare with ITU-T X.292.

3.13

parallel test component

PTC

test component created by the main test component

Note 1 to entry: Compare with ITU-T X.292. <https://standards.iteh.ai/catalog/standards/sist/9d6afe11-f45e-4793-9175-920c89a81dfe/iso-15118-5-2018>

3.14

post-condition

test steps needed to define the path from the end of the *test behavior* up to the finishing stable state for the test case

Note 1 to entry: See also *test behavior* (3.23).

3.15

pre-condition

test steps needed to define the path from the starting stable state of the test case up to the initial state from which the *test behavior* will start

Note 1 to entry: See also *test behavior* (3.23).

3.16

protocol implementation conformance statements

PICS

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

Note 1 to entry: The given protocol specification for this conformance specification is ISO 15118-3.

Note 2 to entry: Compare with ITU-T X.290.

3.17

protocol implementation extra information for testing

PIXIT

IXIT related to testing for conformance to a given protocol specification

Note 1 to entry: The given protocol specification for this conformance specification is ISO 15118-3.

Note 2 to entry: Compare with ITU-T X.290.

3.18

runtime environment

environment that describes the operating system and corresponding platform requirements of a system

EXAMPLE *Test system.*

3.19

semantically invalid test behavior

SemITB

test steps where the test system sends stimuli to the SUT that are semantically invalid according to the protocol requirements

Note 1 to entry: This type of test behavior is defined in this document and explicitly includes requirements which define the appropriate error handling of the SUT.

3.20

static conformance requirements

one of the requirements that specify the limitations on the combinations of implemented capabilities permitted in a real open system which is claimed to conform to the relevant specification(s)

Note 1 to entry: Compare with ITU-T X.290.

3.21

system under test

SUT

real open system in which the IUT resides

Note 1 to entry: Compare with ITU-T X.290.

3.22

syntactically invalid test behavior

SynITB

test steps where the test system sends stimuli to the SUT that are syntactically invalid according to the protocol requirements

Note 1 to entry: This type of test behavior is not defined in this conformance standard, see codec requirements.

3.23

test behavior

set of test steps (test body) which are essential in order to achieve the test purpose and assign verdicts to the possible outcomes

3.24

test execution

interpretation or execution of an abstract test suite

Note 1 to entry: Conceptually, the TE can be decomposed into three interacting entities: an Executable Test Suite (ETS), a Test Framework (TFW) and an optional internal Encoding/Decoding System (EDS) entity.

Note 2 to entry: See also ETSI ES 201 873-5 V4.6.1.

3.25

test framework

TFW

entity to perform all actions of test cases or functions

Note 1 to entry: The Test Framework interacts with the Test Management (TM), SUT Adaptor (SA) and Platform Adaptor (PA) entities via Test Control Interface (TCI) and Test Runtime Interface (TRI) and additionally manages the Executable Test Suite (ETS) and Encoding/Decoding System (EDS) entities. It initializes adaptors as well as ETS and EDS entities. This entity performs all the actions necessary to properly start the execution of a test case or function with parameters in the ETS entity. It queries the TM entity for module parameter values required by the ETS and sends logging information to it. It also collects and resolves associated verdicts returned by the ETS entity.

Note 2 to entry: See also ETSI ES 201 873-5 V4.6.1.

Note 3 to entry: In this document, the Test Framework TTCN-3 Runtime System (T3RTS) is used to explain a Test Framework functionality.

3.26

test purpose

prose description of a well-defined objective of testing, focusing on a single conformance requirement or a set of related conformance requirements as specified in the appropriate OSI specification

EXAMPLE Verifying the support of a specific value of a specific parameter.

Note 1 to entry: Compare with ITU-T X.290.

3.27

test system

real system combining the test framework, abstract test suite, test execution and adapters as well as codecs

Note 1 to entry: Typically also containing a common runtime environment based on an operating system.

3.28

test control interface

TCI

four interfaces that define the interaction of the TTCN-3 Executable with the test management, the coding and decoding, the test component handling and the logging in a test system

Note 1 to entry: Compare with ITU-T X.290.

Note 2 to entry: Compare with ETSI ES 201 873-6 V4.6.1.

3.29

test runtime interface

TRI

two interfaces that define the interaction of the TTCN-3 Executable between the SUT and the Platform Adapter (PA) and the System Adapter (SA) in a test system

Note 1 to entry: Compare with ETSI ES 201 873-5 V4.6.1.

3.30

test system interface

TSI

test component that provides a mapping of the ports available in the (abstract) TTCN-3 test system to those offered by a real test system

Note 1 to entry: Compare with ETSI ES 201 873-6 V4.6.1.

3.31

valid test behavior

VTB

test steps where the test system sends stimuli to the SUT that are valid (syntactically and semantically) according to the protocol requirements

Note 1 to entry: This type of test behavior is defined in this conformance document.

Note 2 to entry: The protocol requirements for this conformance specification are defined in ISO 15118-3.

3.32

verdict

test verdict

statement of “pass”, “fail” or “inconclusive”, as specified in an abstract test case, concerning conformance of an IUT with respect to that test case when it is executed

Note 1 to entry: Compare with ITU-T X.290.

4 Symbols (and abbreviated terms)

For the purposes of this document, the following abbreviations apply:

AC	Alternating Current
ATS	Abstract Test Suite
CPL	Control Pilot Line
DC	Direct Current
EIM	External Identification Means
ETSI	European Telecommunications Standards Institute
EV	Electric Vehicle
EVCC	Electric Vehicle Communication Controller
EVSE	Electric Vehicle Supply Equipment
HAL	Hardware Abstraction Layer
HPGP	HomePlug GreenPHY
ITB	Invalid Test Behavior
MME	Management Message Entry
MTC	Main Test Component
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PLC	Power Line Communication
PnC	Plug and Charge
PTC	Parallel Test Component
PWM	Pulse Width Modulation
SECC	Supply Equipment Communication Controller
SLAC	Signal Level Attenuation Characterization