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Road vehicles — Vehicle to grid communication interface —

Part 21: Common 2nd generation network layer and application layer requirements conformance test plan

Véhicules routiers — Interface de communication entre véhicule et réseau électrique —

Partie 21: Plan de test de conformité aux exigences communes de la couche réseau et de la couche application de 2ème génération

Reference number
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Foreword

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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 document 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 or www.iec.ch/members_experts/refdocs).

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A list of all parts in the ISO 15118 series series can be found on the ISO and IEC websites.

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Introduction

Resulting from the 2nd generation network layer and application layer requirements for the vehicle to grid communication interface specified in ISO 15118-20, a corresponding set of abstract test cases is necessary to verify the conformance of implementations. Hence, this document specifies a conformance test suite for the 2nd generation network layer and application layer protocols to derive a common basis for conformance tests. The resulting test suite is a prerequisite for downstream interoperability tests. Since interoperability tests also involve the actual application logic of an implementation, such tests are beyond the scope of this document (see NOTE 1). Therefore, this document focuses on the communication interface aspects and the corresponding requirements given in ISO 15118-20 only.

The layered structure of the conformance test documents with reference to ISO 15118-20 is shown in Figure 1. The complete set of relevant conformance test documents per charging type is composed of all the documents within its column according to Figure 1.

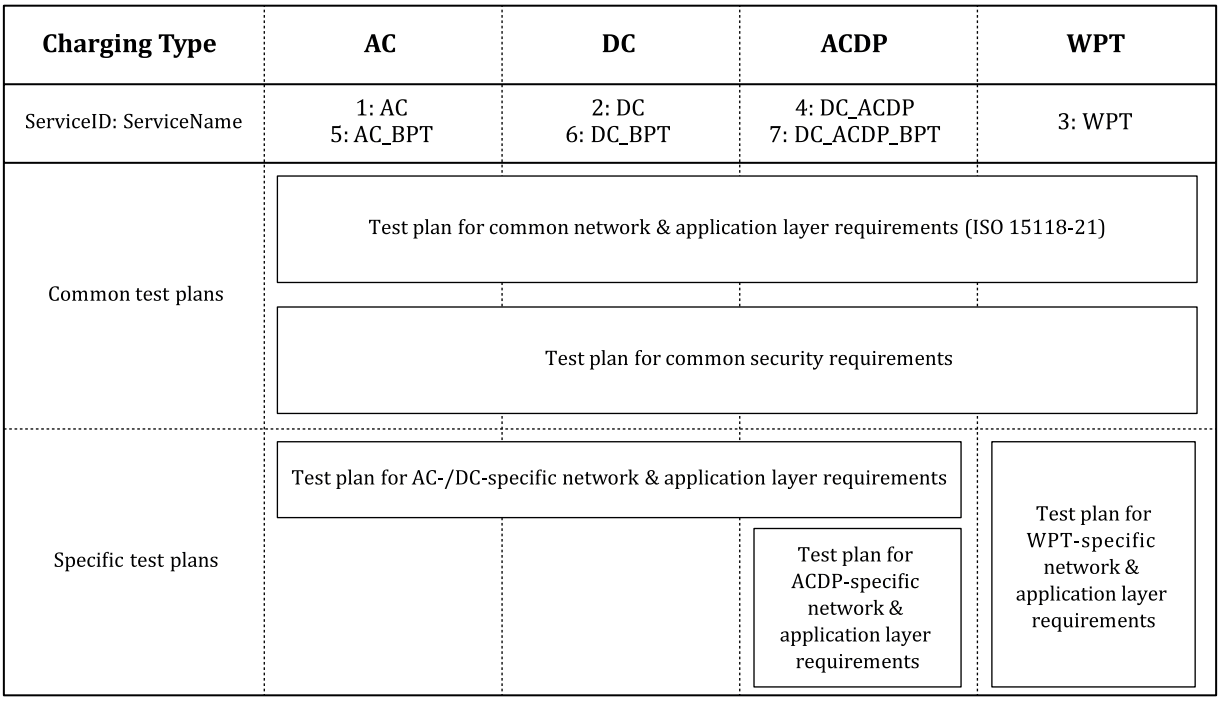


Figure 1 — Overview of relevant conformance test plans for ISO 15118-20 per charging type

EXAMPLE For a SUT supporting DC-charging, the following conformance test plan documents apply:

— test plan for common network and application layer requirements (this document);

— test plan for common security requirements;

— test plan for AC-/DC-specific network and application layer requirements (only DC-specific subset applies).

NOTE 1 Practical limitations make it impossible to specify 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. Instead, it gives confidence that a conforming implementation has the required capabilities and that its behaviour conforms consistently in representative instances of communication.

NOTE 2 This document generally refers to SUT instead of implementation under test (IUT), due to the black box testing paradigm adopted in this document and related certification processes.

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NOTE 3 This document has some interdependencies to the conformance tests specified in ISO 15118-5 and ISO 15118-9 which result from ISO/OSI cross layer dependencies in the underlying protocol specification (e.g. for sleep mode).

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Road vehicles — Vehicle to grid communication interface —

Part 21:
Common 2nd generation network layer and application layer requirements conformance test plan

1 Scope

This document specifies conformance tests in the form of an abstract test suite (ATS) for a system under test (SUT) that implements an electric-vehicle communication controller (EVCC) or a supply-equipment communication controller (SECC) for all common requirements specified in ISO 15118-20 that are independent of a particular charging type (AC, DC, ACD, WPT charging). These conformance tests specify the testing of capabilities and behaviours of an SUT, as well as checking what is observed against the conformance requirements specified in ISO 15118-20 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 specified in ISO 15118-20. The behaviour tests of the ATS examine an implementation as thoroughly as practical over the full range of dynamic conformance requirements specified in ISO 15118-20 and within the capabilities of the SUT.

A test architecture is described in correspondence to the ATS. The abstract test cases in this document are described leveraging this test architecture and are specified in descriptive tabular format covering the ISO/OSI layer 3 to 7 (network to application layers).

In terms of coverage, this document only covers normative sections and requirements in ISO 15118-20. This document additionally refers to specific tests for requirements on referenced standards (e.g. IETF RFCs, W3C Recommendation, etc.) if they are relevant in terms of conformance for implementations according to ISO 15118-20. 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 15118-20. 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, or the environment of the protocol implementation. Furthermore, the abstract test cases specified in this document only consider the communication protocol and the system's behaviour specified in ISO 15118-20. Power flow between the EVSE and the EV is no prerequisite for the test cases specified in 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 15118-1, *Road vehicles — Vehicle to grid communication interface — Part 1: General information and use-case definition*

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

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

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ISO 15118-8, *Road vehicles — Vehicle to grid communication interface — Part 8: Physical layer and data link layer requirements for wireless communication*

ISO 15118-9:2022, *Road vehicles — Vehicle to grid communication interface — Part 9: Physical and data link layer conformance test for wireless communication*

ISO 15118-20:2022, *Road vehicles — Vehicle to grid communication interface — Part 20: 2nd generation network layer and application layer requirements*

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

IEC 61851-23, *Electric vehicle conductive charging system — Part 23: DC electric vehicle charging station*

ETSI ES 201 873-5 V4.9.1[1)], *Methods for Testing and Specification (MTS) — The Testing and Test Control Notation version 3 — Part 5: TTCN-3 Runtime Interface (TRI) (April 2022)*

ETSI ES 201 873-6 V4.13.1[2)], *Methods for Testing and Specification (MTS) — The Testing and Test Control Notation version 3 — Part 6: TTCN-3 Control Interface (TCI) (April 2022)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15118-1, ISO 15118-3, ISO 15118-8, ISO 15118-20 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
abstract test case
complete and independent specification of the actions required to achieve a specific *test purpose* (3.25)

Note 1 to entry: See ITU-T X.290.

Note 2 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 can involve one or more consecutive or concurrent connections.

Note 3 to entry: The specification is complete in the sense that it is sufficient to enable a *test verdict* (3.29) to be assigned unambiguously to each potentially observable test outcome (i.e. sequence of test events).

Note 4 to entry: The specification is independent in the sense that it is possible to execute the derived *executable test case* (3.7) in isolation from other such test cases (i.e. the specification always includes the possibility of starting and finishing in the "idle" state).

3.2
abstract test suite
ATS
collection of *abstract test cases* (3.1) with reference to a given requirement specification

Note 1 to entry: See ITU-T X.290.

3.3
black box testing
method of testing that examines the behaviour of an *system under test (SUT)* (3.20) without considering the internal implementation and structure of the SUT, thus relying on the SUT's open interface for testing

1) Available at https://www.etsi.org/deliver/etsi_es/201800_201899/20187305/04.09.01_60/es_20187305v040901p.pdf.

2) Available at https://www.etsi.org/deliver/etsi_es/201800_201899/20187306/04.13.01_60/es_20187306v041301p.pdf.

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3.4
conformance requirement
requirement for implementation of a real open system which is claimed to conform to the relevant specification(s) that can be validated by *black box testing* (3.3)

Note 1 to entry: The set of conformance requirements together define the behaviour of the system and its communication. Conformance of a real open system is, therefore, expressed at two levels, conformance to each individual requirement and conformance to the set. In this document, applicable conformance tests include requirements as far as they can be validated by black box testing.

Note 2 to entry: See also *static conformance requirements* (3.19) and *dynamic conformance requirements* (3.6).

Note 3 to entry: The requirements for this conformance specification are specified in ISO 15118-20.

3.5
conforming implementation
system under test (3.20) which satisfies both *static conformance requirements* (3.19) and *dynamic conformance requirements* (3.6), consistent with the capabilities stated in the *protocol implementation conformance statements* (3.16)

Note 1 to entry: See ITU-T X.290.

3.6
dynamic conformance requirement
requirement which specifies what observable behaviour is permitted by the relevant specification(s) in instances of communication

Note 1 to entry: See ITU-T X.290.

Note 2 to entry: The requirements for this conformance specification are specified in ISO 15118-20.

3.7
executable test case
realization of an *abstract test case* (3.1)

Note 1 to entry: See ITU-T X.290.

3.8
expected behaviour
exact response of the *system under test* (3.20) according to the underlying protocol specification to the stimulus defined in the *test behaviour* (3.21)

3.9
implementation conformance statement
ICS
statement made by the supplier of a *system under test* (3.20) claimed to conform to a given specification, stating which capabilities have been implemented

Note 1 to entry: See ITU-T X.290.

Note 2 to entry: The given document for this conformance specification is ISO 15118-20.

3.10
implementation extra information for testing
IXIT
statement made by a supplier or implementer of a *system under test (SUT)* (3.20) which contains or references all information [in addition to that given in the *implementation conformance statement* (3.9)] related to the SUT and its testing environment, which enables the test laboratory to run an appropriate test suite against the SUT

Note 1 to entry: See ITU-T X.290.

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

Note 1 to entry: See 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* (3.13) and computing and assigning the *test verdict* (3.29)

Note 1 to entry: See ITU-T X.292.

3.13
parallel test component
PTC
test component created by the *main test component* (3.12)

Note 1 to entry: See ITU-T X.292.

3.14
post-condition
test steps needed to define the path from the end of the *test behaviour* (3.21) up to the finishing stable state for the *abstract test case* (3.1)

3.15
pre-condition
test steps needed to define the path from the starting stable state of the *abstract test case* (3.1) up to the initial state from which the *test behaviour* (3.21) starts

3.16
protocol implementation conformance statement
PICS
implementation conformance statement (3.9) for an implementation or system claimed to conform to a given protocol specification

Note 1 to entry: See ITU-T X.290.

Note 2 to entry: The given protocol document for this conformance specification is ISO 15118-20.

3.17
protocol implementation extra information for testing
PIXIT
implementation extra information for testing (3.10) related to testing for conformance to a given protocol specification

Note 1 to entry: See ITU-T X.290.

Note 2 to entry: The given protocol document for this conformance specification is ISO 15118-20.

3.18
runtime environment
environment that describes the operating system and corresponding platform requirements of a system

3.19
static conformance requirement
requirement that specifies 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: See ITU-T X.290.

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3.26
test system
real system combining the *test framework* (3.24), *abstract test suite* (3.2), *test execution* (3.23) and adapters as well as codecs

Note 1 to entry: The test system typically also contains a common *runtime environment* (3.18) based on an operating system.

3.27
test runtime interface
TRI
two interfaces that define the interaction of the TTCN-3 executable between the *system under test* (3.20) and the platform adapter and the system adapter in a *test system* (3.26)

Note 1 to entry: See ETSI ES 201 873-6 V4.13.1.

3.28
test system interface
TSI
test component that provides a mapping of the ports available in the (abstract) TTCN-3 *test system* (3.26) to those offered by a real test system

Note 1 to entry: See ETSI ES 201 873-6 V4.13.1.

3.29
verdict
test verdict
statement of "pass", "fail" or "inconclusive", as specified in an *abstract test case* (3.1), concerning conformance of a *system under test* (3.20) with respect to that test case when it is executed

Note 1 to entry: See ITU-T X.290.

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply:

AP	(wireless) access point
APUT	access point under test
ATS	abstract test suite
CP	control pilot
ETT	energy transfer types
EV	electric vehicle
EVCC	electric vehicle communication controller
EVSE	electric vehicle supply equipment
EXI	efficient XML interchange
HAL	hardware abstraction layer
HPGP	Homeplug Green PHY
ICS	implementation conformance statement
IUT	implementation under test

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