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BSI Standards Publication

Road vehicles — Vehicle to grid communication interface

Part 9: Physical and data link layer conformance test for wireless communication

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National foreword

This British Standard is the UK implementation of EN ISO 15118-9:2023. It is identical to ISO 15118-9:2022. It supersedes BS ISO 15118-9:2022, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/69, Electric vehicles.

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EN ISO 15118-9

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English Version

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

Véhicules routiers - Interface de communication entre véhicule et réseau électrique - Partie 9: Essai de conformité relatif à la couche physique et à la couche liaison de données pour la communication sans-fil (ISO 15118-9:2022)

Straßenfahrzeuge - Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation - Teil 9: Konformitätsprüfungen der Bitübertragungs- und Sicherungsschicht für die drahtlose Kommunikation (ISO 15118-9:2022)

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European foreword

The text of ISO 15118-9:2022 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 15118-9:2023 by Technical Committee CEN/TC 301 "Road vehicles" the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by April 2024, and conflicting national standards shall be withdrawn at the latest by April 2024.

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Endorsement notice

The text of ISO 15118-9:2022 has been approved by CEN as EN ISO 15118-9:2023 without any modification.

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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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This document was prepared jointly by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*, and Technical Committee IEC/TC 69, *Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks*.

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

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Introduction

Resulting from the wireless physical and data link layer requirements defined in ISO 15118-8, a corresponding set of abstract test cases is necessary to verify the conformance of implementations. This document, therefore, defines a conformance test suite for the wireless physical and data link layer protocols in order to derive a common and agreed basis for conformance tests. The resulting test suite is a 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 ISO 15118-8 only.

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Road vehicles — Vehicle to grid communication interface —

Part 9: Physical and data link layer conformance test for wireless communication

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 WLAN-based high-level communication (HLC) according to ISO 15118-8 and against the background of ISO 15118-1. 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 15118-8 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 15118-8. The behaviour tests of the ATS examine an implementation as thoroughly as practical over the full range of dynamic conformance requirements defined in ISO 15118-8 and within the capabilities of the SUT (see NOTE below).

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 for the ISO/OSI physical and data link layers (layers 1 and 2).

In terms of coverage, this document only covers normative sections and requirements in ISO 15118-8. This document can additionally refer to specific tests for requirements on referenced standards (e.g. IEEE, or industry consortia standards, like WiFi Alliance) as long as they are relevant in terms of conformance for implementations according to ISO 15118-8. 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 15118-8. 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 abstract test cases defined in this document only consider the communication protocol and the system's behaviour defined ISO 15118-8. The power flow between the EVSE and the EV is not considered.

NOTE 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. Instead, it gives confidence that an implementation has the required capabilities and that its behaviour conforms consistently in representative instances of communication.

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.

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

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

ISO 15118-8:2020, *Road vehicles — Vehicle to grid communication interface — Part 8: Physical layer and data link layer requirements for wireless communication*

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

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)*

IEEE 802.11-2012, *IEEE Standard for Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — specific requirements: Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15118-1, ISO 15118-2, 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), 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 optionally involves one or more consecutive or concurrent connections

Note 1 to entry: The specification should be 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 2 to entry: The specification should be independent in the sense that it should be possible to execute the derived *executable test case* (3.7) in isolation from other such test cases (i.e. the specification should always include the possibility of starting and finishing in the 'idle' state).

[SOURCE: ITU-T X.290:1995, 3.3.3].

3.2
ATS
abstract test suite
test suite composed of *abstract test cases* (3.1)

[SOURCE: ITU-T X.290:1995, 3.3.6]

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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3.3
APUT
access point under test
ISO/OSI layer 1 and 2 component of the SECC [*system under test (SUT)* (3.19)] for establishing a wireless communication connection

3.4
black box test
method of testing that examines the behaviour of a *system under test (SUT)* (3.19) without considering the internal implementation and structure of the SUT, thus relying on the SUT's open interface for testing

3.5
conformance requirement
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 behaviour 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 conformance tests defined in this document, include requirements and transfer syntax requirements as far as they can be validated by *black box tests* (3.4).

Note 2 to entry: See also *static conformance requirement* (3.17) and *dynamic conformance requirement* (3.6).

3.6
dynamic conformance requirement
one of the requirements which specifies what observable behaviour 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 15118-8.

[SOURCE: ITU-T X.290:1995, 3.3.29, modified — Note 1 to entry has been added.]

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

[SOURCE: ITU-T X.290:1995, 3.3.31]

3.8
expected behaviour
exact response of the *system under test (SUT)* (3.19) according to the underlying protocol specification to the stimulus defined in the *test behaviour* (3.20)

3.9
ICS
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

Note 1 to entry: The given specification for this conformance specification is ISO 15118-8.

[SOURCE: ITU-T X.290:1995, 3.3.39, modified — "The ICS can take several forms: protocol ICS, profile ICS, profile specific ICS, and information object ICS." has been removed from the definition and Note 1 to entry has been added.]

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3.10
IXIT
implementation extra information for testing
statement made by a supplier or implementer of a *system under test (SUT)* (3.19) which contains or references all of the information [in addition to that given in the *implementation conformance statement (ICS)* (3.9)] related to the SUT and its testing environment, which will enable the test laboratory to run an appropriate test suite against the SUT

[SOURCE: ITU-T X.290:1995, 3.3.41, modified — "An IXIT can take several forms: protocol IXIT, profile IXIT, profile specific IXIT, and information object IXIT, TMP implementation statement." removed from the defintiion and IUT replaced by SUT.]

3.11
MTC
main test component
single *test component* (3.21) in a test component configuration responsible for creating and controlling *parallel test components* (3.12) and computing and assigning the *test verdict* (3.29)

[SOURCE: ITU-T X.292:2002, 3.6.43]

3.12
parallel test component
PTC
test component (3.21) created by the *main test component* (3.11)

[SOURCE: ITU-T X.292:2002, 3.6.53]

3.13
post-condition
test steps needed to define the path from the end of the *test behaviour* (3.20) up to the finishing stable state for the test case

3.14
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 bevaviour* (3.20) will start

3.15
PICS
protocol implementation conformance statement
implementation conformance statement (ICS) (3.9) 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 15118-8.

[SOURCE: ITU-T X.290:1995, 3.3.80, modified — Note 1 to entry has been added.]

3.16
PIXIT
protocol implementation extra information for testing
implementation extra information for testing (IXIT) (3.10) related to testing for conformance to a given protocol specification

Note 1 to entry: The given protocol specification for this conformance specification is ISO 15118-8.

[SOURCE: ITU-T X.290:1995, 3.3.81, modified — Note 1 to entry has been added.]

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3.17
static conformance requirement
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)

[SOURCE: ITU-T X.290:1995, 3.3.95]

3.18
STAUT
station under test
ISO/OSI layer 1 and 2 component of the EVCC [*system under test (SUT)* (3.19)] for establishing a wireless communication connection

3.19
SUT
system under test
real open system in which the implementation of one or more OSI protocols in an adjacent user/provider relationship are to be studied by testing.

Note 1 to entry: Adapted from ITU-T X.290:1995, 3.3.103 and 3.3.43.

3.20
test behaviour
set of test steps (test body) which are essential in order to achieve the *test purpose* (3.25) and assign verdicts to the possible outcomes

3.21
test component
named subdivision of a concurrent test case capable of being executed in parallel and declared as having a fixed number of points of control and observation and a fixed or maximal number of co-ordination points

[SOURCE: ITU-T X.292:2002, 3.6.72, modified — "in parallel with other test components" has been replaced by "in parallel".]

3.22
TCI
TTCN-3 control interfaces
four interfaces that define the interaction of the TTCN-3 Executable with the test management, the coding and decoding, the *test component* (3.21) handling and the logging in a *test system* (3.27)

[SOURCE: ETSI ES 201 873-6 V4.13.1:2022, 3.1]

3.23
test execution
interpretation or execution of an *abstract test suite* (3.2)

Note 1 to entry: Conceptually, the test execution can be decomposed into three interacting entities: an executable test suite, a *test framework* (3.24) and an optional internal encoding/decoding system entity.

3.24
test framework
entity to perform all actions of test cases or functions

Note 1 to entry: The test framework interacts with the test management, *system under test (SUT)* (3.19) adaptor and platform adaptor entities via *TTCN-3 control interfaces (TCI)* (3.22) and *test runtime interface (TRI)* (3.26) and additionally manages the executable test suite and encoding/decoding system entities. It initializes adaptors as well as executable test suite and encoding/decoding system entities. This entity performs all the actions necessary to properly start the execution of a test case or function with parameters in the executable test suite entity. It queries the test management entity for module parameter values required by the executable test suite and sends logging information to it. It also collects and resolves associated verdicts returned by the executable test suite entity.

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Note 2 to entry: In this document, the TTCN-3 runtime system is used to explain a test framework functionality.

3.25
test purpose
prose description of a well-defined objective of testing, focusing on a single *conformance requirement* (3.5) 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.

[SOURCE: ITU-T X.290:1995, 3.3.118]

3.26
TRI
test runtime interface
two interfaces that define the interaction of the TTCN-3 executable between the *system under test (SUT)* (3.19) and the platform adapter (PA) and the system adapter (SA) in a *test system* (3.27)

[SOURCE: ETSI ES 201 873-5 V4.9.1:2022, 3.1, modified — The term was originally TTCN-3 runtime interface.]

3.27
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: Typically, also containing a common runtime environment based on an operating system.

3.28
TSI
test system interface
test component (3.21) that provides a mapping of the ports available in the (abstract) TTCN-3 *test system* (3.27) to those offered by a real test system

[SOURCE: ETSI ES 201 873-5 V4.9.1:2022, 3.1]

3.29
test verdict
statement of 'pass', 'fail' or 'inconclusive', as specified in an *abstract test case* (3.1), concerning conformance of a *system under test (SUT)* (3.19) with respect to that test case when it is executed

[SOURCE: ITU-T X.290:1995, 3.3.124, modified — IUT was replaced by SUT.]

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

EDCA enhanced distributed channel access

ETSI european telecommunications standards institute

EV electric vehicle

EVCC electric vehicle communication controller

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EVSE	electric vehicle supply equipment
HAL	hardware abstraction layer
ICS	implementation conformance statement
ITB	invalid test behaviour
MAC	media access control
MTC	main test component
PICS	protocol implementation conformance statement
PIXIT	protocol implementation extra information for testing
PTC	parallel test component
SECC	supply equipment communication controller
STA	(wireless) station
STAUT	station under test
SUT	system under test
TC	test case
TCI	TTCN-3 control interface
TCI-CD	TCI-coding and decoding
TE	test execution
TRI	TTCN-3 runtime interface
TSI	TTCN-3 system interface
TSS	test suite structure
TTCN-3	testing and test control notation version 3
V2G	vehicle-to-grid
VTB	valid test behaviour

5 Conventions

5.1 Requirement structure

This document uses unique number identifiers for each individual requirement. This requirement structure allows for easier requirement tracking and management. The following format is used throughout this document:

'[V2G'Y'-'XXX']' requirement text

Where:

— 'V2G' represents the ISO 15118 series;

— Y represents the document part of the ISO 15118 series, for this document Y = 9;

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— XXX represents the individual requirement number; and

— 'requirement text' includes the actual text of the requirement.

5.2 Test system description

TTCN-3 is used in this document to define/specify the test system architecture and test suite conventions, where applicable. TTCN-3 is, however, not mandatory for the implementation of a conformance test system according to this document.

[V2G9-001] The implementers of conformance tests shall verify that the test purposes implemented in their executable test cases are identical to the abstract test cases described in this document.

NOTE In this document, test cases are not programmatically specified in TTNC-3 core language. This will be revisited for the next edition of the document.

6 Test architecture reference model

6.1 General information

Figure 1 provides an overview of the test architecture for this document. The following subclauses define the interface requirements for platform and SUT adapters (see 6.2, 6.3) as well as the codecs (see 6.4). The test suite is defined in detail in the remainder of this document.

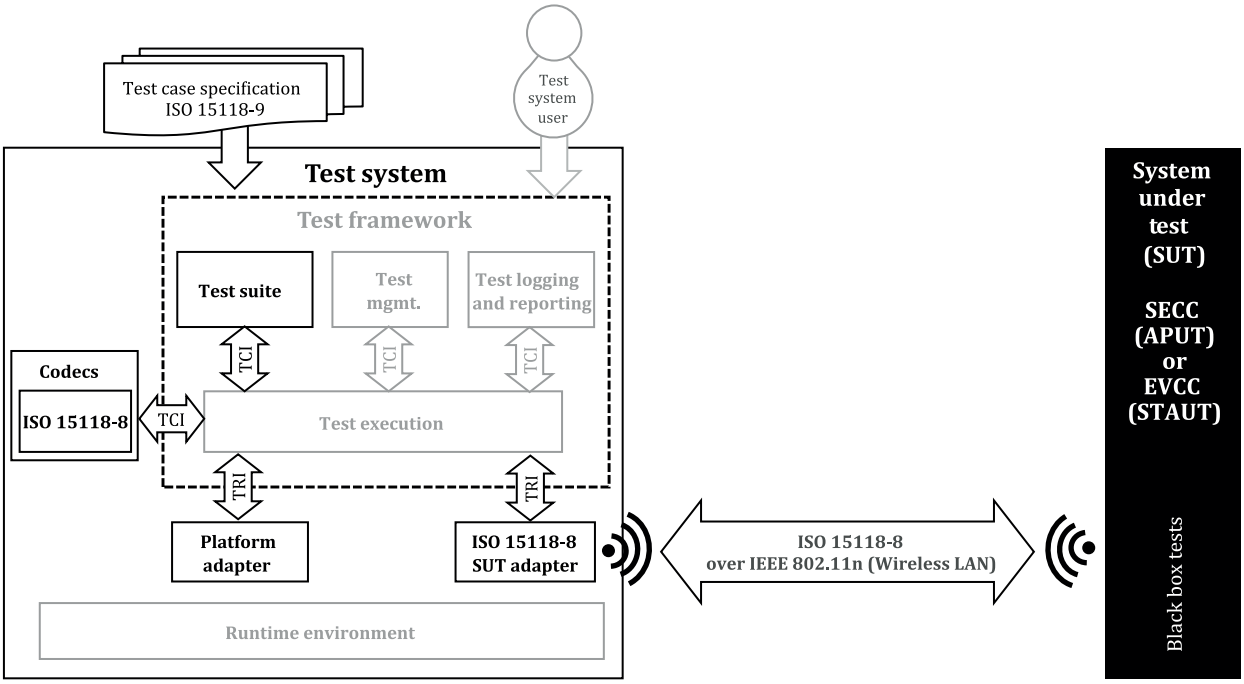

Figure 1 — Test architecture reference model

6.2 Platform adapter interface

The platform adapter within the test system is responsible for timers and external functions. Besides means for timers, which are typically provided as part of the test framework, no external functions are defined for this document.

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[V2G9-002] The platform adapter of the test system shall implement the TriPlatformPA and the TriPlatformTE interfaces as defined in ETSI ES 201 873-5 V4.9.1:2022, 6.5.3.

6.3 SUT adapter interfaces

The SUT adapter within the test system adapts the TTCN-3 communication operations to the SUT based on an abstract test system interface and implements the real test system interface. It is responsible of propagating message requests and procedure-based calls from the test execution (see Figure 1) to the SUT, and of notifying the test execution of any received test events by appending them to its port queues.

[V2G9-003] Any SUT adapter of the test system shall implement the TriCommunicationSA and the TriCommunicationTE interfaces as defined in ETSI ES 201 873-5 V4.9.1:2022, 6.5.2.

NOTE 1 The actual implementation of these adapters is out of scope of this document.

[V2G9-004] The ISO 15118-8 SUT adapter of the test system shall send/receive the encoded MAC frame format to/from the SUT as defined in IEEE 802.11-2012, section 8.

NOTE 2 For association support according to ISO 15118-8 the management frames according to IEEE 802.11-2012, section 8.3.3 are used and embedded in the frame body field of the MAC frame format.

[V2G9-005] The wireless communication module of the ISO 15118-8 SUT adapter of the test system shall be certified by WiFi Alliance ('Wi-Fi CERTIFIED n').

The majority of requirements in ISO 15118-8 are based on IEEE 802.11n. WiFi Alliance certification is therefore required for the ISO 15118-8 SUT adapter in order to ensure the test system complies with IEEE 802.11n.

[V2G9-006] In case SUT is a STAUT, the ISO 15118-8 SUT adapter of the test system shall support operation at both the 2,4 GHz and 5 GHz frequency bands in parallel (simultaneous dual band support).

[V2G9-007] The wireless communication module of the ISO 15118-8 SUT adapter of the test system shall at least support all allowed channels per frequency band that are applicable for the SUT according to ISO 15118-8:2020, Tables 1, 2, and Annex D.

NOTE 3 Depending on the target market of the SUT, not all the channels listed in ISO 15118-8:2020, Tables 1 and 2 are allowed to be used due to national regulation.

NOTE 4 A collection of national regulations in usage of the U-NII band channels is listed in ISO 15118-8:2020, Annex D.

[V2G9-008] The ISO 15118-8 SUT adapter of the test system shall support active and passive scanning procedure according to IEEE 802.11-2012.

6.4 Codecs

A codec is responsible for the external encoding and decoding of TTCN-3 values into bit strings suitable to be sent to the SUT. The test execution (TE) determines which codec shall be used and passes the TTCN-3 data to the appropriate encoder to obtain the encoded data. Received data is decoded in this entity by using the appropriate decoder, which translates the received data into TTCN-3 values cf. ETSI ES 201 873-5 that can be matched against expected values or templates.

[V2G9-009] All codecs in this document shall implement the TCI-CD interface as defined in ETSI ES 201 873-6 V4.13.1:2022, 7.3.2.

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NOTE 1 For conformance testing in this document, the IEEE 802.11n codec (see Figure 1) is used to encode or decode messages consumable by the tester into bit strings consumable by the SUT.

NOTE 2 The exact implementation of the IEEE 802.11n codec is out of scope of this document.

[V2G9-010] The ISO 15118-8 codec shall encode message values of the test system into corresponding MAC frames consumable by the SUT as defined in ISO 15118-8:2020, 7.2.6 and 7.3.5 and IEEE 802.11-2012.

[V2G9-011] The ISO 15118-8 codec shall decode MAC frames as defined in ISO 15118-8:2020, 7.2.6 and 7.3.5 and IEEE 802.11-2012 into message values consumable by the test system.

7 Test suite conventions

7.1 General information

This clause defines all conventions that are relevant for conformance tests of SUTs implementing ISO 15118-8.

7.2 Test suite structure (TSS)

A test suite is a complete set of test cases, possibly combined into groups or modules, that are necessary to perform conformance testing for a given SUT.

Each executable test case stimulates the SUT with specific inputs and the reactions are observed and evaluated. Depending on the test purpose different pre-conditions and post-conditions shall be considered for the formulation of the test behaviour. The pre-conditions, post-conditions as well as test behaviours are encapsulated into individual functions and stored within separate modules. Thus, a complete test case is composed by the actual test behaviour enveloped by pre- and post-conditions. The corresponding grouping of functions can therefore be assigned to the lowest abstract hierarchical level (see Figure 2). The test cases are defined on the second level.

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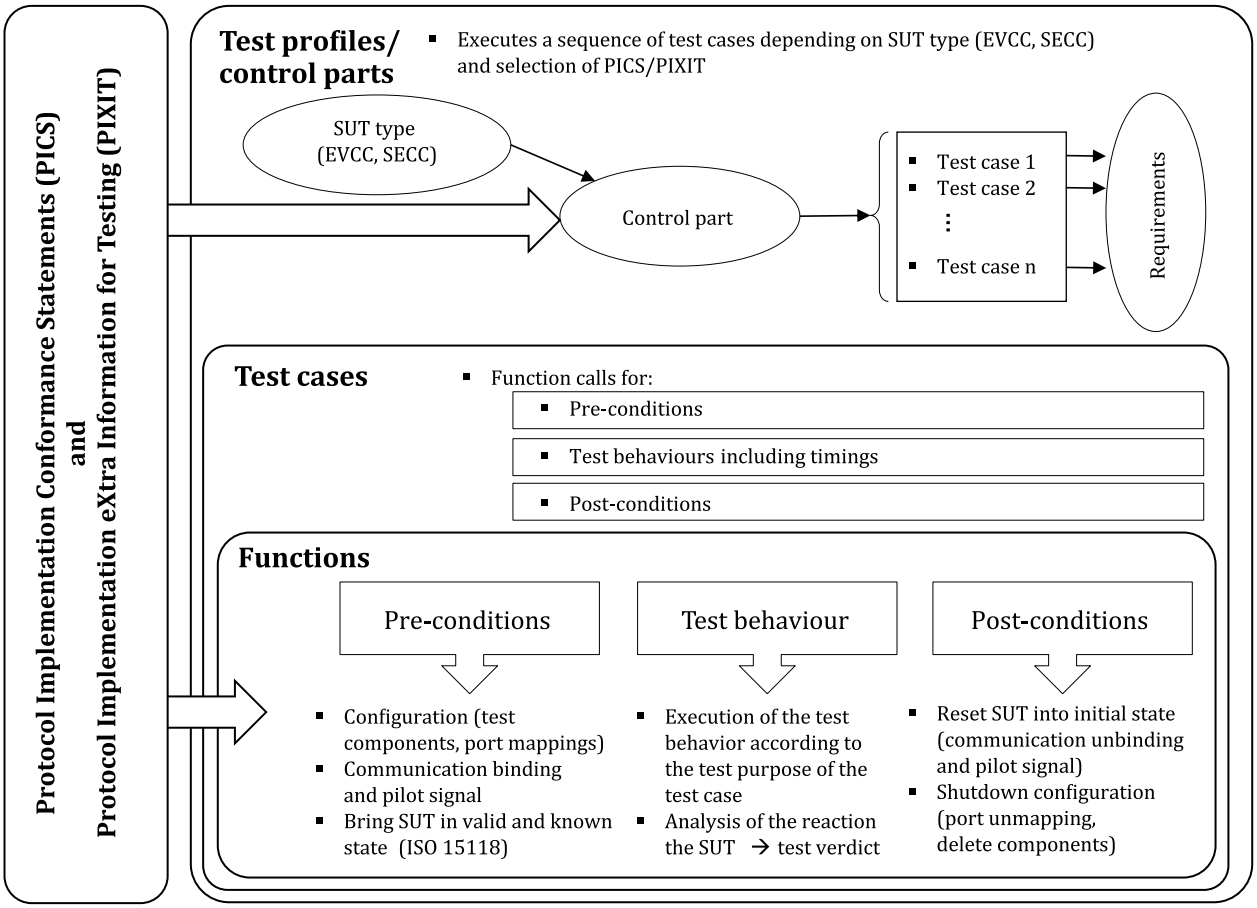

Figure 2 — General overview of the test suite structure (TSS)

The test profile is a collection of self-contained test cases as well as PICS (see 7.3.3) and PIXIT (see 7.3.4) in order to represent a given use case. The selection is based on the use cases of the ISO 15118 series and its corresponding requirements.

Hence, the test suite structure (TSS) is segmented into subgroups defined according to ISO 15118 use cases for conformance testing. Table 1 shows these subgroups, which are used for the organization of the test case specifications as well as for the test suite identifiers (see 7.4 for detail).

Table 1 — Identifiers within the test suite structure (TSS)

Identifiers	Values	Description
<sut>		System under test
	EVCC	Electric vehicle communication controller
	SECC	Supply equipment communication controller
<ctx>	{fullname}	Context (e.g. name of message pattern signal name according to standard)

7.3 Test profiles

This subclause defines test profiles for conformance with ISO 15118-8. A test profile consists of a test configuration as well as a selection and assignment of PICS/PIXIT. Depending on the test configuration a set of test components and ports are defined. The test profile furthermore includes a test group defining the set of relevant test cases and the sequence in which they are executed in order to perform a conformance test for a given use case.

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7.3.1 Test configurations

The test configuration reflects various ISO 15118 scenarios. The main entities for the system under test (SUT) are:

— electric vehicle communication controller (EVCC),

— supply equipment communication controller (SECC).

The combination of entities and additionally used test components are grouped by test configuration IDs (CF_Part_ID). Table 2 shows the test configurations for this document.

Table 2 — Test configurations

CF_Part_ID	SUT	Tester	PTCs
CF_09_001	SECC including wireless LAN interface	EVCC with ISO 15118-8 SUT adapter	none
CF_09_002	EVCC including wireless LAN interface	SECC with ISO 15118-8 SUT adapter	none

Figure 3 and Figure 4 illustrate configurations as defined in Table 2.

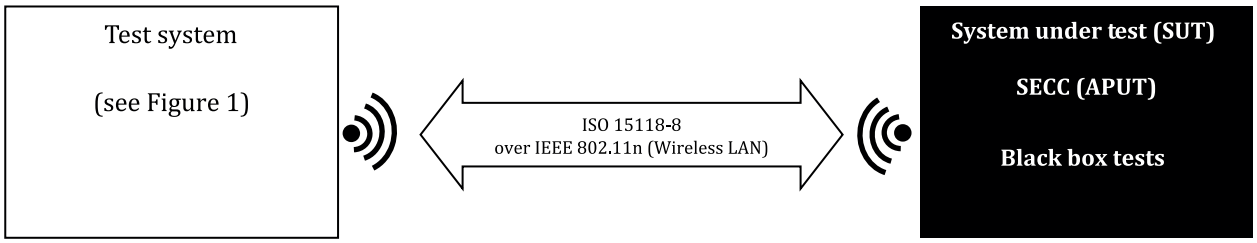

Figure 3 — Test configuration CF_09_001 for SUT SECC (APUT)

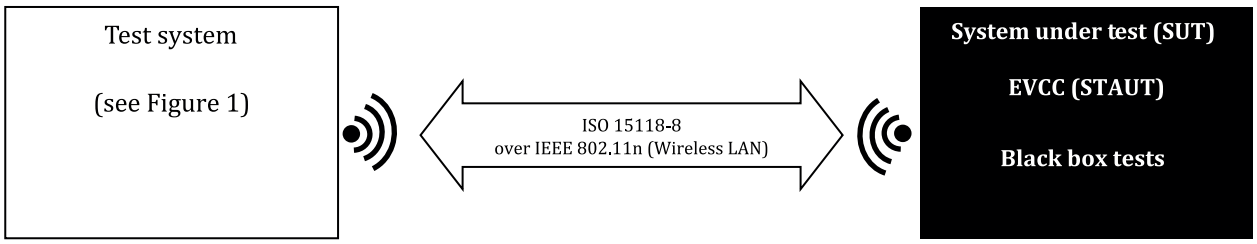

Figure 4 — Test configuration CF_09_002 for SUT EVCC (STAUT)

7.3.2 Components and ports

In correspondence to the identified set of relevant test configurations, this subclause defines test components which reflect the main entities needed for stimulation of the SUT with respect to the ISO 15118 series. Ports are used to connect these components with each other and the SUT. Port types define what kind of messages can be sent or received by this port. All relevant components and ports are defined in Table 3 and Table 5 respectively.

Table 3 — Component definitions

Components	Description
SECC_Tester (MTC)	This component type is the main type for the tests of an SECC. A WLAN_Port (see Table 4) is assigned to this component type.

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Table 3 *(continued)*

Components	Description
EVCC_Tester (MTC)	This component type is the main type for the tests of an EVCC. A WLAN_Port (see Table 4) is assigned to this component type.

Table 4 — Port type definitions

Port Type	Description
WLAN_Port	This port is used to send/receive WLAN MAC Frames defined in ISO 15118-8 and IEEE 802.11-2012 to/from the EVCC/SECC.

These components and ports comprise relevant test configurations for this document. Whether the type EVCC_Tester or SECC_Tester is to be used as MTC depends on the type of the SUT.

[V2G9-012] If the SUT is an EVCC, the MTC shall use the type EVCC_Tester.

[V2G9-013] If the SUT is an SECC, the MTC shall use the type SECC_Tester.

The MTC always contains a TTCN-3 test configuration and delimits the lifeline during test execution. Next to using ports for communication purposes, local timers, variables or constants may be assigned to components to store dynamic information during test case execution.

A test configuration also consists of respective test system interfaces (TSI). An abstract TSI is specified as a collection of ports. A TSI has no local timers, constants or variables; only ports are assigned to it. During the test case execution, test components ports can be mapped dynamically to the TSI ports to establish communication channel to the real test system interface.

In the test configuration the TSI uses the type System_EVCC or System_SECC depending on the type of the SUT.

— If the SUT is an EVCC, the TSI uses the type System_EVCC.

— If the SUT is an SECC, the TSI uses the type System_SECC.

The test configuration is illustrated in Figure 5. The type of the V2G components and ports (EVCC or SECC) depends on the SUT type.

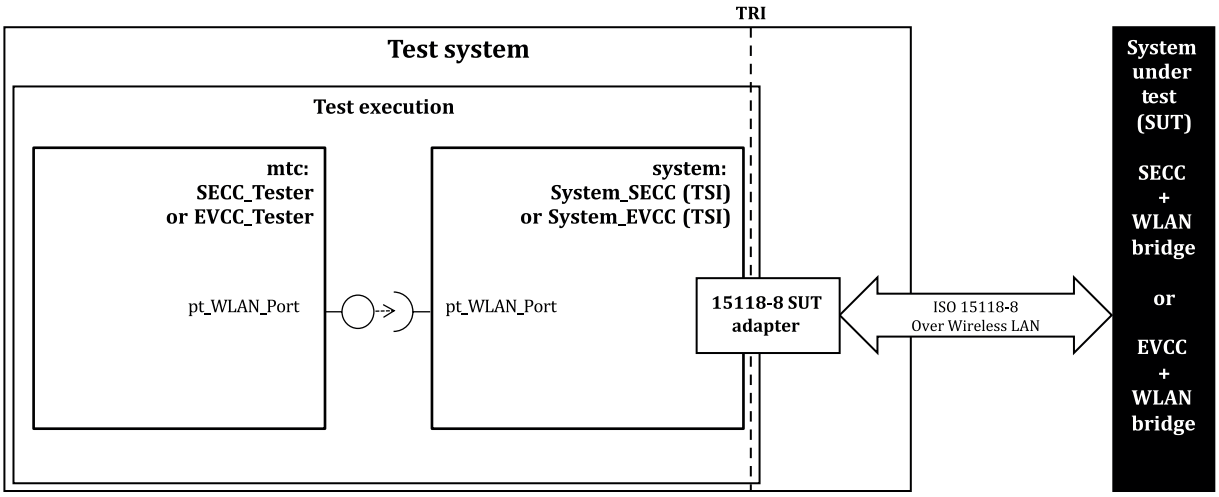

Figure 5 — Test configuration of this document

As shown in Figure 5 the port mappings are defined statically as follows:

— the port pt_WLAN_Port of the TSI is always mapped to port pt_WLAN_Port of the MTC.

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7.3.3 Protocol implementation conformance statement (PICS) definition

To evaluate the conformance of a particular SUT, it is necessary to have implementation conformance statements (ICS) of the capabilities and options which have been implemented, and any features which have been omitted, so that the implementation can be tested for conformance against relevant requirements, and against those requirements only. Such a statement is called a protocol implementation conformance statement (PICS), compare to ITU-T X.290.

In this document, no PICS are defined in the ATS.

7.3.4 Protocol implementation extra information for testing (PIXIT) definition

In addition to the ICS, further statements (IXIT) made by a supplier or implementer may be required related to the SUT and its testing environment to enable the test laboratory to run the test suite against the SUT. With reference to ISO 15118-8 protocol conformance, the following set of PIXIT is defined in addition to the PICS in this document.

NOTE Due to the black box test paradigm in this document, it is not defined how to ensure that a corresponding PIXIT is set on the SUT side for a given test case execution.

All PIXIT defined in the ATS are summarized in Table 5 to Table 7

Table 5 — Selected PIXIT for test system configurations CF_09_001 and CF_09_002 (SUT either SECC or EVCC)

PIXIT	Description
PIXIT_CMN_MACADDR_2_4GHz	MAC address of the 2,4 GHz network interface of the SUT
PIXIT_CMN_MACADDR_5GHz	MAC address of the 5 GHz network interface of the SUT
PIXIT_CMN_ ETT	Indication which energy transfer types are supported by the SUT One octet with bitfield according to ISO 15118-8:2020, Table 4, e.g.: — 00000011 or 0x3 (→ AC & DC support) — 00000100 or 0x4 (→ WPT support) — 00001000 or 0x8 (→ ACD support)
PIXIT_CMN_ADDINF	Indication which additional information is provided by the SUT Hexbinary according to ISO 15118-8:2020, Table 5
PIXIT_CMN_COUNTRY_CODE	Indication for a two-character country code according to ISO 3166-1
PIXIT_CMN_OPERATOR_ID	Indication for an operator ID as defined in ISO 15118-2:2014, Annex H (see also ISO 15118-8:2020, Table 4 for further information)
PIXIT_CMN_CHARGING_SITE_ID	Indication for a unique identifier of the CS (see also ISO 15118-8:2020, Table 4 for further information)

[V2G9-014] For the purpose of testing the values of country code, operator id and charging site id should be compatible between the test system and SUT regarding the values of PIXIT_CMN_COUNTRY_CODE, PIXIT_CMN_OPERATOR_ID, and PIXIT_CMN_CHARGING_SITE_ID.

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Table 6 — Selected PIXIT for test system configuration CF_09_001 (SUT equals SECC)

PIXIT	Description
PIXIT_SECC_NUMOUTLETS	Indication of whether the SECC supports one or multiple outlets Choice: i) one, ii) multiple
PIXIT_SECC_SUPPORTED_CHANNEL_LIST	List of supported channels in the 2,4 GHz and 5 GHz band according to ISO 15118-8:2020, Tables 1, 2 and national/regional regulations in ISO 15118-8:2020, Annex D as key value pairs list
PIXIT_SECC_CHANNEL_SELECTED	Selected Channel ID in the either 2,4 GHz or 5 GHz band Enumeration with reference to Channel IDs according to ISO 15118-8:2020, Tables 1 and 2.

Table 7 — Selected PIXIT for test system configuration CF_09_002 (SUT equals EVCC)

PIXIT	Description
PIXIT_EVCC_SCANNING_MODE	Indication whether SUT (EVCC) uses ACTIVE or PASSIVE scanning mode Choice: i) active, ii) passive

7.3.5 Test control

For test control the following requirements or recommendations apply for this document:

[V2G9-015] Test control shall execute all applicable test cases listed in 8.2 for SUT SECC and 8.3 for SUT EVCC.

[V2G9-016] Test control should execute test cases in the order as they appear in Table 19 for each SUT.

[V2G9-017] Test control shall implement the PICS and PIXIT parameters as defined in 7.3.3 and 7.3.4 and assign them as defined in each test case definition for SUT SECC (8.2) and for SUT EVCC (8.3).

7.4 Test suite identifiers

The selection of common naming conventions is one simple and often used mechanism to implement test suites which are consistent, maintainable and understandable for multiple users. Therefore, based on common ETSI naming conventions more specific naming conventions for the ISO 15118 conformance test suite are defined.

7.4.1 Module identifiers

All modules defined in the TSS start with a capital letter. The ISO 15118 test suite specific module identifier for template, function or test case modules is defined as:

<modtype>_<sut>_<ctx>

The segments of this identifier are defined in Table 8. An example for test case module identifier is:

TestCases_SECC_VendorSpecificElement

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Table 8 — ISO 15118 test suite naming convention for modules

Identifier	Values	Description
<modtype>		Module type
	TestCases	Module including test cases
	Functions	Module including functions
	Templates	Module including templates
<sut>		System under test
	EVCC	Electric vehicle communication controller
	SECC	Supply equipment communication controller
	CMN	Common (exclusively for template modules)
<ctx>	{fullname}	Context (e.g. name of message pattern signal name according to standard)

NOTE For module types other than templates, functions or test cases there is no identifier format defined.

7.4.2 Test case identifiers

The naming conventions for test cases are using a prefix, which is defined by ETSI as shown in Table 9.

Table 9 — ETSI naming convention for test case names

Keyword	Definition	Example
testcase name	Every test case begins with TC (TC_) TC_TestCaseName	TC_DNSResponse

The ISO 15118 test suite specific test case identifier is defined as:

TC_<sut>_<ctx>_<nn>

The segments of this identifier are described in Table 10. An example for test case identifier is:

TC_SECC_ VendorSpecificElement_001

Table 10 — ISO 15118 test suite naming convention for test case identifiers

Identifier	Values	Description
<prefix>	TC	See Table 9
<sut>		System under test
	EVCC	Electric vehicle communication controller
	SECC	Supply equipment communication controller
<ctx>	{fullname}	Context (e.g. name of message pattern signal name according to standard)
<nn>	{xxx}	Sequential number from 001 to 999

7.4.3 Template identifiers

The naming conventions for templates are using a prefix, which is defined by ETSI as shown in Table 11.

Table 11 — ETSI naming convention for templates

Keyword	Context	Definition	Example
template name	Templates with concrete attribute values	Every template begins with keyword m (m_)	m_DNSRequest

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Table 11 *(continued)*

Keyword	Context	Definition	Example
template name	Templates with wildcards or matching expression	If a template contains or refers to templates with wildcards {*|?} then template name begins with keyword mw (mw_)	mw_DNSResponse
template name	Templates with parameters, which do not assign or refer to templates with wildcards or matching expression	If a template contains attributes which are defined by parameters or constant values, then template name begins with keyword md (md_)	md_DNSResponse (integer ip)
template name	Templates with parameters, which do assign or refer to templates with wildcards or matching expression	If a template contains attributes which are defined by parameters, constant values or wildcards, then template name begins with keyword mdw (mdw_)	mdw_DNSResponse (integer ip)

The ISO 15118 test suite specific template identifier is defined as:

<prefix>_<sut>_<dtyp>_<nn>

The segments of this identifier are described in Table 12. An example for template identifier is:

md_EVCC_VendorSpecificElement_001

Table 12 — ISO 15118 test suite naming convention for template identifiers

Identifier	Values	Description
<prefix>		Type of template (see Table 11)
<sut>		System under test
	EVCC	Electric vehicle communication controller
	SECC	Supply equipment communication controller
	CMN	Common
<dtyp>	{fullname}	Label of (root) data type according to standard
<nn>	{xxx}	Sequential number from 001 to 999

7.4.4 Function identifiers

The naming conventions for functions are using a prefix, which is defined by ETSI as shown in Table 13.

Table 13 — ETSI naming convention for function names

Keyword	Context	Definition	Example
function name	All functions	Every function begins with f (f_)	f_functionName

The ISO 15118 test suite naming convention for test case functions is defined as:

<prefix>_<sut>_<ctx>_<nn>

The segments of this identifier are described in Table 14. An example for template identifier is:

f_EVCC_ VendorSpecificElement_001

Table 14 — ISO 15118 test suite naming convention for function names

Identifier	Values	Description
<prefix>		f_ (see Table 13)

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