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Nationales Vorwort

Dieses Dokument (EN ISO 15118-9:2023) wurde vom Technischen Komitee ISO/TC 22 „Road vehicles“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 301 „Straßenfahrzeuge“, dessen Sekretariat von AFNOR (Frankreich) gehalten wird, erarbeitet.

Das zuständige deutsche Normungsgremium ist der Arbeitsausschuss NA 052-00-31 AA „Datenkommunikation“ des DIN-Normenausschusses Automobiltechnik (NAAutomobil).

Dieses Dokument enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 1/2004 nur die Englische Fassung von EN ISO 15118-9:2023.

Für die in diesem Dokument zitierten Dokumente wird im Folgenden auf die entsprechenden deutschen Dokumente hingewiesen:

ISO 15118-1	siehe	DIN EN ISO 15118-1
ISO 15118-2	siehe	DIN EN ISO 15118-2
ISO 15118-8:2020	siehe	DIN EN ISO 15118-8:2021-02
ISO 15118-20	siehe	DIN EN ISO 15118-20

Um den Energieverbrauch von Fahrzeugen zu senken, werden Fahrzeuge mit elektrischem Teil- oder Komplettantrieb entwickelt. Um die Batterien dieser Fahrzeuge aufladen zu können, wird eine spezielle Lade-Infrastruktur benötigt.

Während verschiedene Teilaspekte in der Normung von Elektrofahrzeugen und Infrastruktur bei ISO und IEC bereits behandelt wurden, beschäftigt sich diese Normenreihe mit dem Informationsaustausch zwischen Elektrofahrzeug und Lade-Infrastruktur. Kommunikation ist für das effektive Aufladen von Fahrzeugen sowie die Entwicklung effizienter und komfortabler Abrechnungssysteme unabdingbar.

Dieser Teil der Normenreihe beschreibt spezifische Prüfungen basierend auf den Kommunikationsanforderungen, die in DIN EN ISO 15118-8:2021-02 beschrieben sind. Die Norm dient Systemlieferanten als Grundlage, um die Systemkonformität von Kommunikationssteuerungen entweder in Elektrofahrzeugen oder in Ladesäulen nachzuweisen.

Nationaler Anhang NA (informativ)

Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- IEC Electropedia: verfügbar unter <https://www.electropedia.org/>
- ISO Online Browsing Platform: verfügbar unter <https://www.iso.org/obp>

3.1

abstrakter Prüffall

en **abstract test case**

vollständige und unabhängige Spezifikation von Aktionen, die notwendig sind, um einen speziellen *Prüfzweck* (3.25) sicherzustellen, der auf dem Abstraktionsniveau für eine bestimmte abstrakte Prüfmethode festgelegt ist, wobei in einem stabilen Prüfzustand gestartet und in einem stabilen Prüfzustand geendet wird und dabei eine oder mehrere nachfolgende oder gleichzeitige Verbindungen eingebunden werden

Anmerkung 1 zum Begriff: Die Spezifikation sollte in der Art und Weise vollständig sein, um ein *Prüfurteil* (3.29) zu ermöglichen, welches eindeutig jedem potenziell überwachbaren Prüfergebnis zugeordnet werden kann (d.h. Reihe von Prüfergebnissen).

Anmerkung 2 zum Begriff: Die Spezifikation sollte in der Art und Weise unabhängig sein, dass es möglich ist, den abgeleiteten *ausführbaren Prüffall* (3.7) isoliert von anderen Prüffällen dieser Art auszuführen (d.h. die Spezifikation sollte immer die Möglichkeit des Startens und Beendens im Zustand „Leerlauf“ beinhalten).

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

3.2

abstrakte Prüfreihe

ATS, en: abstract test suite

Prüfreihe, die sich aus *abstrakten Prüffällen* (3.1) zusammensetzt

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

3.3

zu prüfender Zugriffspunkt

APUT, en: access point under test

ISO/OSI-Schicht 1 und 2-Komponente der Kommunikationssteuerung Ladeeinrichtung (en: supply equipment communication controller, SECC) [zu *prüfendes System (SUT)* (3.19)] zum Aufbau einer drahtlosen Kommunikationsverbindung

3.4

Black-Box-Prüfung

en **black box test**

Prüfverfahren, welches das Verhalten eines *zu prüfenden Systems (SUT)* (3.19) untersucht, ohne dabei die interne Implementierung und Struktur des SUT zu berücksichtigen und sich somit auf die offenen Prüfschnittstellen am SUT verlässt

3.5

Konformitätsanforderung

en **conformance requirement**

Konformität eines realen Systems, bestehend aus der Konformität zu jeder Anforderung und der Konformität zur Reihe

Anmerkung 1 zum Begriff: Reihe von zusammenhängenden Anforderungen, die zusammen das Verhalten des Systems und dessen Kommunikation festlegen. Konformität eines realen Systems wird deshalb auf zwei Ebenen ausgedrückt: Konformität zu jeder individuellen Anforderung und Konformität zur Reihe. Anwendbare Konformitätsprüfungen, die in diesem Dokument definiert sind, beinhalten Anforderungen und Anforderungen an die Übertragungssyntax, soweit diese mittels *Black-Box-Prüfung* (3.4) bestätigt werden können.

Anmerkung 2 zum Begriff: Siehe auch *statische Konformitätsanforderungen* (3.17) und *dynamische Konformitätsanforderungen* (3.6).

3.6

dynamische Konformitätsanforderung

en **dynamic conformance requirement**

eine der Anforderungen, die festlegt, welches überwachbare Verhalten nach der (den) relevanten Spezifikation(en) in Bezug auf die Kommunikation erlaubt ist

Anmerkung 1 zum Begriff: Die Anforderungen für diese Konformitätsspezifikation sind in ISO 15118-8 festgelegt.

[QUELLE: ITU-T X.290:1995, 3.3.29, modifiziert — Anmerkung 1 zum Begriff wurde ergänzt]

3.7

ausführbarer Prüffall

en **executable test case**

Umsetzung eines *abstrakten Prüffalls* (3.1)

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

3.8

erwartetes Verhalten

en **expected behavior**

genaue Antwort des zu prüfenden Systems (*SUT*) (3.19), anhand der zugrundeliegenden Protokollspezifikation, auf den Stimulus, der im *Prüfverhalten* (3.20) festgelegt ist

3.9

Konformitätsaussage zur Implementierung

ICS, en: implementation conformance statement

Aussage des Lieferanten einer Implementierung oder eines Systems, deren (dessen) Konformität mit einer gegebenen Spezifikation erklärt wird, die ausdrückt, welche Fähigkeiten implementiert wurden

Anmerkung 1 zum Begriff: Das gegebene Dokument für diese Konformitätsspezifikation ist ISO 15118-8.

[QUELLE: ITU-T X.290:1995, 3.3.39, modifiziert — „Die ICS kann verschiedene Formen annehmen: Protokoll-ICS, Profil-ICS, profilspezifische ICS, sowie Informationsobjekt-ICS“ wurde aus der Definition gelöscht und Anmerkung 1 zum Begriff ergänzt]

3.10**zusätzliche Prüfinformation zur Implementierung****IXIT**, en: implementation extra information for testing

Aussage, die von einem Lieferanten oder Umsetzer eines zu *prüfenden Systems (SUT)* (3.19) getroffen wurde, die alle Informationen [zusätzlich zu den in der *Konformitätsaussage zur Implementierung (ICS)* (3.9) gegebenen] bezogen auf die SUT und deren Testumgebung beinhaltet oder referenziert und dem Prüflabor ermöglicht, eine geeignete Prüfreihe gegen die SUT durchzuführen

[QUELLE: ITU-T X.290:1995, 3.3.41, modifiziert — „Eine IXIT kann verschiedene Formen annehmen: Protokoll-IXIT, Profil-IXIT, profilspezifische IXIT, sowie Informationsobjekt-IXIT, TMP-Implementierungsaussage“ wurde aus der Definition gelöscht und IUT durch SUT ersetzt]

3.11**Hauptprüfkomponente****MTC**, en: main test component

einzelne *Prüfkomponente* (3.21) in einer Prüfkomponentenkonfiguration, verantwortlich für die Erstellung und Steuerung *paralleler Prüfkomponenten* (3.12) sowie für die Berechnung und Zuordnung des *Prüfurteils* (3.29)

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

3.12**parallele Prüfkomponente****PTC**, en: parallel test component

Prüfkomponente (3.21), die von der *Hauptprüfkomponente* (3.11) erstellt wurde

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

3.13**Nachbedingung**en **post-condition**

Prüfschritte, die für die Festlegung des Weges vom Ende des *Prüfverhaltens* (3.20) bis zum finalen stabilen Zustand des Prüffalls benötigt werden

3.14**Vorbedingung**en **pre-condition**

Prüfschritte, die für die Festlegung des Weges vom beginnenden stabilen Zustand des Prüffalls bis zum initialen Zustand, an dem das *Prüfverhalten* (3.20) beginnt, benötigt werden

3.15**Erklärung zur Konformität der Protokollimplementierung****PICS**, en: protocol implementation conformance statement

Konformitätsaussage zur Implementierung (ICS) (3.9) für eine Implementierung oder ein System, deren (dessen) Konformität mit einer gegebenen Protokollspezifikation erklärt wird

Anmerkung 1 zum Begriff: Das gegebene Protokolldokument für diese Konformitätsspezifikation ist ISO 15118-8.

[QUELLE: ITU-T X.290:1995, 3.3.80, modifiziert — Anmerkung 1 zum Begriff wurde ergänzt]

3.16

Zusatzinformation für die Prüfung der Protokollimplementierung

PIXIT, en: protocol implementation extra information for testing

zusätzliche Prüfinformation zur Implementierung (IXIT) (3.10), die auf die Konformitätsprüfung nach einer gegebenen Protokollspezifikation bezogen ist

Anmerkung 1 zum Begriff: Das gegebene Protokolldokument für diese Konformitätsspezifikation ist ISO 15118-8.

[QUELLE: ITU-T X.290:1995, 3.3.81, modifiziert — Anmerkung 1 zum Begriff wurde ergänzt]

3.17

statische Konformitätsanforderungen

en **static conformance requirements**

eine der Anforderungen, die festlegt, welche Limitierungen der zulässigen Kombinationen von implementierten Fähigkeiten in einem realen offenen System bestehen, dessen Konformität mit der (den) relevanten Spezifikation(en) behauptet wird

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

3.18

zu prüfende Station

STAUT, en: station under test

ISO/OSI-Schicht 1 und 2-Komponente der Kommunikationssteuerung Elektrofahrzeug (en: electric vehicle communication controller, EVCC) [*zu prüfendes System (SUT)* (3.19)] zum Aufbau einer drahtlosen Kommunikationsverbindung

3.19

zu prüfendes System

SUT, en: system under test

reales offenes System, in dem die Implementierung von einem oder mehreren OSI-Protokoll(en) in einer angrenzenden Nutzer/Anbieter-Beziehung durch Prüfungen zu untersuchen ist

Anmerkung 1 zum Begriff: Übernommen von ITU-T X.290:1995, 3.3.103 und 3.3.43.

3.20

Prüfverhalten

en **test behavior**

Reihe von Prüfschritten (Prüfkörper), die notwendig sind, um den *Prüfzweck* (3.25) sicherzustellen und um Urteile den möglichen Ergebnissen zuzuordnen

3.21

Prüfkomponente

en **test component**

benannte Untereinheit eines gleichzeitigen Prüffalls, der die Fähigkeit besitzt, parallel ausgeführt zu werden und mit einer festen Anzahl von Kontroll- und Beobachtungspunkten ausgewiesen ist sowie eine feste oder maximalen Anzahl von Koordinierungspunkten aufweist

[QUELLE: ITU-T X.290:1995, 3.3.80, modifiziert — „parallel mit anderen Prüfkomponenten“ wurde durch „parallel“ ersetzt]

3.22

TTCN-3-Steuerungsschnittstelle

TCI, en: TTCN-3 control interface

vier Schnittstellen, welche die Interaktion der TTCN-3-Software mit der Prüfsteuerung, die Kodierung und Dekodierung, den Umgang mit den *Prüfkomponenten* (3.21) und die Aufzeichnung in einem *Prüfsystem* (3.27) festlegen

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

3.23

Prüfausführung

en **test execution**

Interpretation oder Ausführung einer *abstrakten Prüfreihe* (3.2)

Anmerkung 1 zum Begriff: Konzeptionell kann die Prüfausführung in drei interagierende Einheiten unterteilt werden: eine ausführbare Prüfreihe, einen *Prüfrahmen* (3.24) und ein optionales internes Kodierungs-/Dekodierungssystem.

3.24

Prüfrahmen

en **test framework**

Einheit, die alle Aktionen von Prüffällen oder Funktionen ausführt

Anmerkung 1 zum Begriff: Der Prüfrahmen interagiert mit den Einheiten Prüfsteuerung, zu *prüfenden System* (SUT) (3.19) Adapter und Plattformadaptereinheiten über *TTCN-3-Steuerungsschnittstellen* (TCI) (3.22) und die *Prüflaufzeitschnittstelle* (TRI) (3.26) sowie zusätzlich die ausführbare Prüfreihe und das Kodierungs-/Dekodierungssystem handhabt. Der Prüfrahmen initialisiert die Adapter sowie die ausführbare Prüfreihe und Kodierungs-/Dekodierungssystem Einheiten. Diese Einheit führt alle notwendigen Aktionen aus, um einen Prüffall oder eine Funktion mit Parametern in der ETS-Einheit ordnungsgemäß auszuführen. Er befragt die Prüfsteuerungseinheit nach Modulparameterwerten, die für die ETS notwendig sind und sendet aufgezeichnete Informationen dorthin. Der Prüfrahmen sammelt und löst zugeordnete Urteile, die von der ausführbaren Prüfreiheinheit zurückgegeben werden.

Anmerkung 2 zum Begriff: In diesem Dokument wird das TTCN-3-Laufzeitsystem verwendet, um eine Prüfrahmen-Funktionalität zu erläutern.

3.25

Prüfzweck

en **test purpose**

Prosabeschreibung eines hinreichend festgelegten Prüfziels, welche sich auf eine einzelne *Konformitätsanforderung* (3.5) oder einen Satz von in Beziehung stehenden Konformitätsanforderungen konzentriert, die in der entsprechenden OSI-Spezifikation festgelegt sind

BEISPIEL Überprüfung, ob ein spezifischer Wert eines spezifischen Parameters unterstützt wird.

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

3.26

Prüflaufzeitschnittstelle

TRI, en: test runtime interface

zwei Schnittstellen, welche die Interaktion der TTCN-3-Prüfsystem Software zwischen dem zu *prüfenden System* (SUT) (3.19) und dem Programmadapter (PA) sowie dem Systemadapter (SA) in einem *Prüfsystem* (3.27) festlegen

[QUELLE: ETSI ES 201 873-5 V4.9.1:2022, 3.1, modifiziert — der Begriff war ursprünglich TTCN-3-Laufzeitschnittstelle.]

3.27

Prüfsystem

en **test system**

reales System, welches den *Prüfrahmen* (3.24), die *abstrakte Prüfreihe* (3.2), die *Prüfausführung* (3.23) und die Adapter sowie die Codecs umfasst

Anmerkung 1 zum Begriff: Typischerweise beinhaltet es auch eine gemeinsame Laufzeitumgebung, basierend auf einem Betriebssystem.

3.28

Prüfsystemschnittstelle

TSI, en: test system interface

Prüfkomponente (3.21), welche die Zuordnung der im (abstrakten) TTCN-3-*Prüfsystem* (3.27) verfügbaren Ports zu denjenigen bereitstellt, welche von einem realen System angeboten werden

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

3.29

Urteil

Prüfurteil

en **verdict, test verdict**

Aussage „bestanden“, „fehlgeschlagen“ oder „ergebnislos“, wie in einem *abstrakten Prüffall* (3.1) festgelegt, hinsichtlich der Konformität eines zu *prüfenden Systems (SUT)* (3.19) bezogen auf diesen Prüffall, wenn dieser gerade ausgeführt wird

[QUELLE: ITU-T X.290:1995, 3.3.124, modifiziert — IUT wurde durch SUT ersetzt]

Nationaler Anhang NB (informativ)

Literaturhinweise

DIN EN ISO 15118-1, *Straßenfahrzeuge — Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation — Teil 1: Allgemeine Informationen und Festlegungen der Anwendungsfälle*

DIN EN ISO 15118-2, *Straßenfahrzeuge — Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation — Teil 2: Anforderungen an das Netzwerk- und Anwendungsprotokoll (ISO 15118-2:2014); Englische Fassung EN ISO 15118-2:2016, nur auf CD-ROM*

DIN EN ISO 15118-8:2021-02, *Straßenfahrzeuge — Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation — Teil 8: Anforderungen an Bitübertragungs- und Sicherungsschicht für die drahtlose Kommunikation*

DIN EN ISO 15118-20, *Straßenfahrzeuge — Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation — Teil 20: Anforderungen der 2. Generation an das Netzwerk- und Anwendungsprotokoll*

— Leerseite —

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 für die
Bitübertragungs- und Sicherungsschicht für
drahtlose Kommunikation (ISO 15118-9:2022)

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

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

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

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*.

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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.

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.

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 V4.9.1¹⁾, *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 V4.13.1²⁾, *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.

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.]

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 definition 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 behaviour* (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.]

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.

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

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;

- 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.

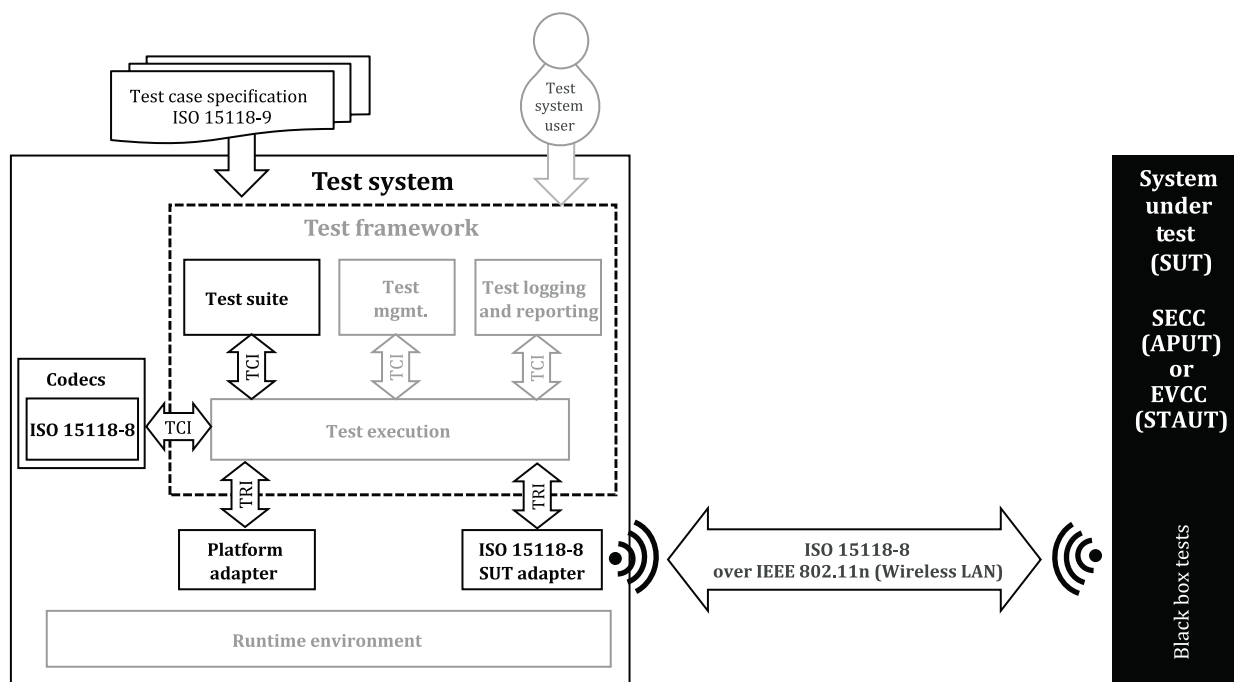


Figure 1 — Test architecture reference model

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.

- [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.

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.

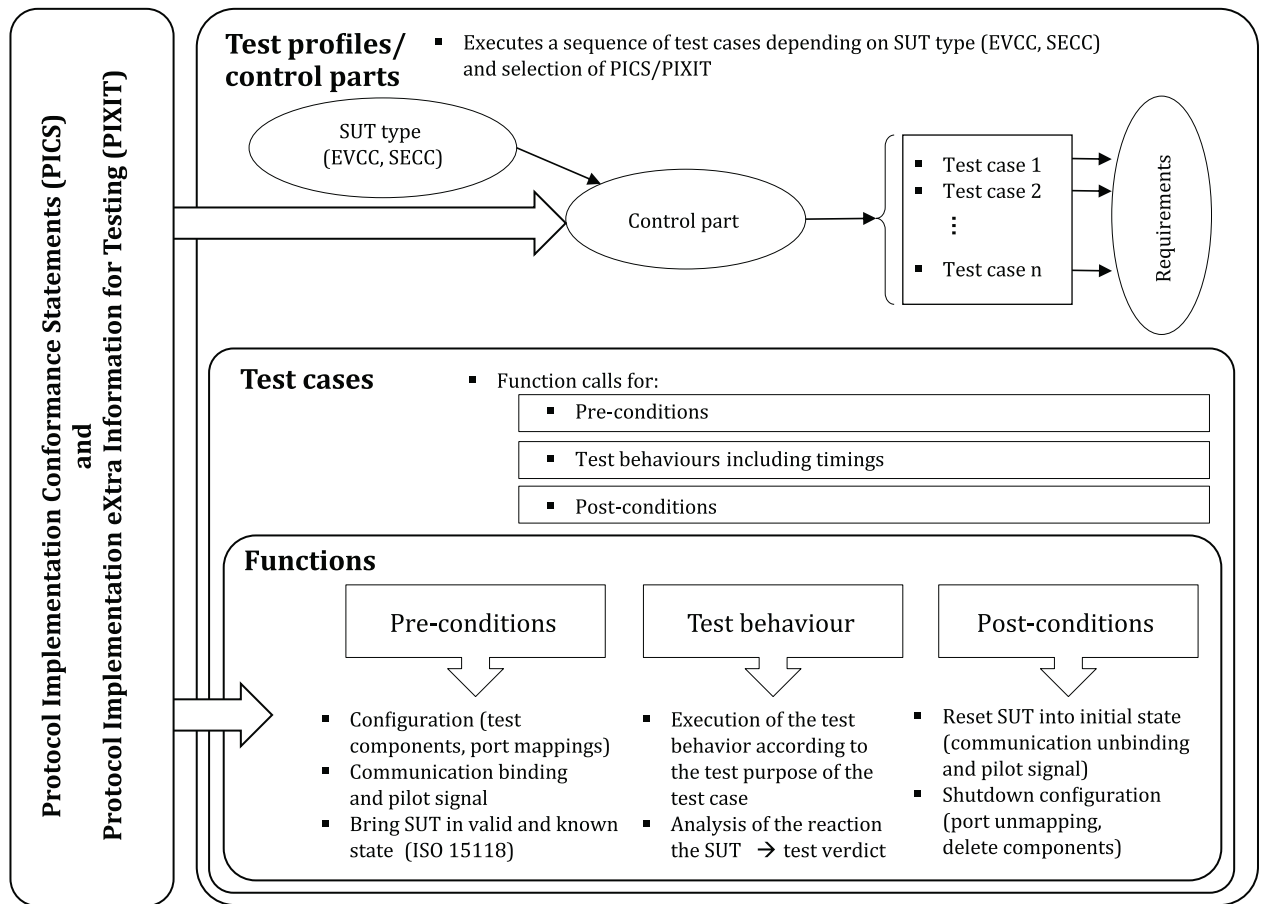


Figure 2 — General overview of the test suite structure (TSS)

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.