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Title: Draft BS ISO 15118-9 Road vehicles - Vehicle to grid communication interface

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

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## Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are invited and will assist in the preparation of the consequent standard. Comments submitted will be reviewed by the relevant BSI committee before sending the consensus UK vote and comments to the international secretariat, which will then decide appropriate action on the draft and the comments received.

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## Template for comments and secretariat observations

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| 1  | 2                                          | (3)                           | 4               | 5                                                                                                                                  | (6)                                                                      | (7)                                                |
|----|--------------------------------------------|-------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/ Figure/ Table/Note | Type of comment | Comment (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                  | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                   | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



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IEC TC 69 : ELECTRICAL POWER/ENERGY TRANSFER SYSTEMS FOR ELECTRICALLY PROPELLED ROAD VEHICLES AND INDUSTRIAL TRUCKS

SECRETARIAT:

Belgium

SECRETARY:

Mr Peter Van den Bossche

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

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TITLE:

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

NOTE FROM TC/SC OFFICERS:

NC also active in the ISO TC22 SC31 committee are invited to supply the same comments to both ISO and IEC.

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ISO/TC 22/SC 31 N

Date: 2020-06-15

ISO/CD 15118-9:2020(E)

ISO/TC 22/SC 31/WG 1

Secretariat: DIN

## **Road vehicles — Vehicle to grid communication interface — Part 9: Physical and data link layer conformance test for wireless communication**

*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*

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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 ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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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, Electric road vehicles and electric industrial trucks.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

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

Resulting from the wireless physical and data link layer requirements defined in the eighth part of the standard, a corresponding set of test cases is required in order to verify 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 necessary prerequisite for downstream interoperability tests. Since interoperability furthermore involves the actual application logic of an implementation, those tests are beyond the scope of this document. Hence, this document focuses on the interface aspects and the corresponding requirements given in part eight 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 Edition 2. These conformance tests specify the testing of capabilities and behaviors of an SUT, as well as checking what is observed against the conformance requirements specified in ISO 15118-8 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 behavior tests of the ATS examine an implementation as thoroughly as is practical over the full range of dynamic conformance requirements defined in ISO 15118-8 and within the capabilities of the SUT (see NOTE 1).

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

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 test cases defined in this document only consider the communication protocol and the system's behavior defined ISO 15118-8. Power flow between the EVSE and the EV is not considered.

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

## 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 15118-8:2018, Road Vehicles – Vehicle to grid communication interface – Part 8: Physical layer and data link layer requirements for wireless communication (March 2018)

ETSI ES 201 873-5 V4.8.1, TTCN-3: TTCN-3 Runtime Interface (May 2017)

ETSI ES 201 873-6 V4.12.1, TTCN-3: TTCN-3 Control Interface (May 2020)

IEEE Std 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

Editorial Note1: ISO 15118-8:2018 (Edition 1) will be replaced by ISO 15118-8:2020 (Edition 2) as soon as it is published

### 3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 15118-1, ISO 15118-2, ISO 15118-8 and the following apply.

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

— IEC Electropedia: available at <http://www.electropedia.org/>

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

#### 3.1

##### **abstract test case**

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

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

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

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

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

#### 3.2

##### **abstract test suite**

##### **ATS**

test suite composed of abstract test cases

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

#### 3.3

##### **access point under test**

##### **APUT**

ISO/OSI layer 1 and 2 component of the SECC (SUT) for establishing a wireless communication connection.

#### 3.4

##### **black box testing**

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

#### 3.5

##### **conformance requirements**

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

Note 1 to entry: Set of interrelated requirements which together define the behavior of the system and its communication. Conformance of a real system will, therefore, be expressed at two levels, conformance to each individual requirement and conformance to the set. Applicable ISO 15118-9 conformance tests include requirements and transfer syntax requirements as far as they can be validated by black box testing.

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

98 **3.6**  
99 **conforming implementation**

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

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

103 **3.7**  
104 **dynamic conformance requirements**

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

107 Note 1 to entry: The requirements for this conformance specification are defined in ISO 15118-8.

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

109 **3.8**  
110 **executable test case**  
111 realization of an abstract test case

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

113 **3.9**  
114 **expected behavior**  
115 exact response of the SUT according to the underlying protocol specification to the stimulus defined in  
116 the test behavior

117 **3.10**  
118 **implementation conformance statement**  
119 **ICS**  
120 statement made by the supplier of an implementation or system claimed to conform to a given  
121 specification, stating which capabilities have been implemented

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

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

124 **3.11**  
125 **implementation extra information for testing**  
126 **IXIT**

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

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

131 **3.12**  
132 **implementation under test**  
133 **IUT**

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

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

137 **3.13**

138 **main test component**

139 **MTC**

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

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

143 **3.14**

144 **parallel test component**

145 **PTC**

146 test component created by the main test component

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

148 **3.15**

149 **post-condition**

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

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

153 **3.16**

154 **pre-condition**

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

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

158 **3.17**

159 **protocol implementation conformance statements**

160 **PICS**

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

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

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

164 **3.18**

165 **protocol implementation extra information for testing**

166 **PIXIT**

167 IXIT related to testing for conformance to a given protocol specification

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

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

170 **3.19**

171 **runtime environment**

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

173 EXAMPLE *Test system.*

- 174 **3.20**  
175 **semantically invalid test behavior**  
176 **SemITB**  
177 test steps where the test system sends stimuli to the SUT that are semantically invalid according to the  
178 protocol requirements
- 179 Note 1 to entry: This type of test behavior is defined in this document and explicitly includes requirements which  
180 define the appropriate error handling of the SUT.
- 181 **3.21**  
182 **static conformance requirements**  
183 one of the requirements that specify the limitations on the combinations of implemented capabilities  
184 permitted in a real open system which is claimed to conform to the relevant specification(s)
- 185 Note 1 to entry: Compare with ITU-T X.290.
- 186 **3.22**  
187 **station under test**  
188 **STAUT**  
189 ISO/OSI layer 1 and 2 component of the EVCC (SUT) for establishing a wireless communication  
190 connection
- 191 **3.23**  
192 **system under test**  
193 **SUT**  
194 real open system in which the IUT resides
- 195 Note 1 to entry: Compare with ITU-T X.290.
- 196 **3.24**  
197 **syntactically invalid test behavior**  
198 **SynITB**  
199 test steps where the test system sends stimuli to the SUT that are syntactically invalid according to the  
200 protocol requirements
- 201 Note 1 to entry: This type of test behavior is not defined in this conformance standard, see codec requirements.
- 202 **3.25**  
203 **test behavior**  
204 set of test steps (test body) which are essential in order to achieve the test purpose and assign verdicts  
205 to the possible outcomes
- 206 **3.26**  
207 **test execution**  
208 interpretation or execution of an abstract test suite
- 209 Note 1 to entry: Conceptually, the TE can be decomposed into three interacting entities: an Executable Test Suite  
210 (ETS), a Test Framework (TFW) and an optional internal Encoding/Decoding System (EDS) entity.
- 211 Note 2 to entry: See also ETSI ES 201 873-5 V4.8.1.

212 **3.27**213 **test framework**214 **TFW**

215 entity to perform all actions of test cases or functions

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

222 Note 2 to entry: See also ETSI ES 201 873-5 V4.8.1.

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

225 **3.28**226 **test purpose**

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

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

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

231 **3.29**232 **test system**

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

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

236 **3.30**237 **test control interface**238 **TCI**

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

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

242 Note 2 to entry: Compare with ETSI ES 201 873-5 V4.8.1.

243 **3.31**244 **test runtime interface**245 **TRI**

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

248 Note 1 to entry: Compare with ETSI ES 201 873-5 V4.8.1.

- 249 **3.32**  
250 **test system interface**  
251 **TSI**  
252 test component that provides a mapping of the ports available in the (abstract) TTCN-3 test system to  
253 those offered by a real test system
- 254 Note 1 to entry: Compare with ETSI ES 201 873-5 V4.8.1.
- 255 **3.33**  
256 **valid test behavior**  
257 **VTB**  
258 test steps where the test system sends stimuli to the SUT that are valid (syntactically and semantically)  
259 according to the protocol requirements
- 260 Note 1 to entry: This type of test behavior is defined in this conformance document.
- 261 Note 2 to entry: The protocol requirements for this conformance specification are defined in ISO 15118-8.
- 262 **3.34**  
263 **verdict**  
264 **test verdict**  
265 statement of “pass”, “fail” or “inconclusive”, as specified in an abstract test case, concerning conformance  
266 of an IUT with respect to that test case when it is executed
- 267 Note 1 to entry: Compare with ITU-T X.290.
- 268

## 4 Symbols (and abbreviated terms)

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

|        |                                                       |
|--------|-------------------------------------------------------|
| AP     | (wireless) Access Point                               |
| APUT   | Access Point under Test                               |
| ATS    | Abstract Test Suite                                   |
| ETSI   | European Telecommunications Standards Institute       |
| EV     | Electric Vehicle                                      |
| EVCC   | Electric Vehicle Communication Controller             |
| EVSE   | Electric Vehicle Supply Equipment                     |
| HAL    | Hardware Abstraction Layer                            |
| ITB    | Invalid Test Behavior                                 |
| MME    | Management Message Entry                              |
| 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                                    |
| STUT   | Station under Test                                    |
| SUT    | System Under Test                                     |
| TC     | Test Case                                             |
| TCI    | TTCN-3 Control Interface                              |
| TCI-CD | TCI-Coding and Decoding                               |
| TE     | Test Execution                                        |
| TFW    | Test Framework                                        |
| TP     | Test Purpose                                          |
| 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 Behavior                                   |

## 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 set of standards;
- Y represents the document part of the ISO 15118 document set, 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 and the test cases inside the test suite. However, using TTCN-3 is not mandatory for the implementation of conformance tests for ISO 15118-8.

**[V2G9-001]** The implementers of conformance tests shall verify that the test objectives implemented in their environment are identical to those described in this document.

## 6 Test architecture reference model

### 6.1 General information

Figure 1 provides an overview on 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.

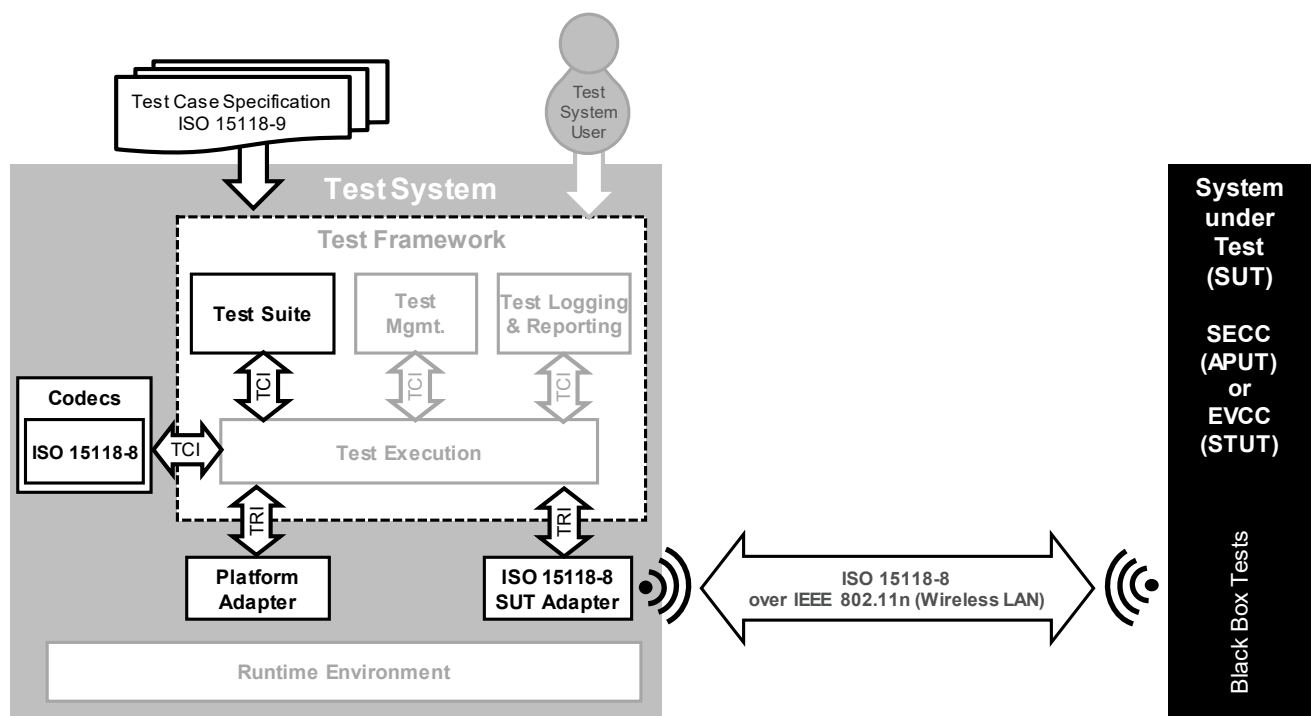


Figure 1 — Test architecture reference model for testing of ISO 15118-9

### 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 ISO 15118 conformance testing.

**[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 V4.8.1, 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 to propagate message requests and procedure based calls from the Test Execution (see Figure 1) to the SUT, and to notify the Test Execution of any received test events by appending them to its port queues.

**[V2G9-003]** The SUT adapters of the test system shall implement the TriCommunicationSA and the TriCommunicationTE interfaces as defined in ETSI ES 201 873-5 V4.8.1, 6.5.2.

Note 1 to entry The actual implementation of these adapters is out of scope of this document.