


<b>V2G Conformance Test Specifications</b>	<b>Public</b>	<b>Copyright PowerUp Contract N. 285285</b>
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7<sup>th</sup> Framework Programme

INFSO-ICT 285285

## V2G Conformance Test Specifications

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## TABLE OF CONTENTS

<b>LIST OF ABBREVIATIONS .....</b>	<b>6</b>
<b>LIST OF FIGURES.....</b>	<b>7</b>
<b>LIST OF TABLES .....</b>	<b>8</b>
<b>REVISION CHART AND HISTORY LOG.....</b>	<b>9</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>10</b>
<b>1. INTRODUCTION.....</b>	<b>11</b>
<b>2. METHODOLOGY .....</b>	<b>12</b>
2.1. CONFORMANCE TESTING .....	12
2.2. POWERUP IMPLEMENTATIONS UNDER TEST .....	13
2.3. ETSI TESTING METHODOLOGY .....	14
<b>3. V2G TEST SPECIFICATIONS .....</b>	<b>16</b>
3.1. PROTOCOL IMPLEMENTATION STATEMENT CONFORMANCE (PICS) .....	16
3.2. TEST SUITE STRUCTURE AND TEST PURPOSES (TSS&TP) .....	18
3.2.1 <i>Test Suite Structure</i> .....	19
3.2.2 <i>Test Configurations</i> .....	20
3.2.3 <i>Test Purpose Identifier Naming Convention</i> .....	21
3.2.4 <i>Test Purpose Template</i> .....	23
3.3. ABSTRACT TEST SUITE (ATS) .....	25
3.3.1 <i>Point of Control and Observation</i> .....	26
3.3.2 <i>V2G Abstract Protocol Tester</i> .....	27
3.3.3 <i>V2G General Test Architecture</i> .....	28
3.3.4 <i>V2G Test Architecture Design</i> .....	29
3.3.5 <i>Ports and Primitives</i> .....	31
3.3.6 <i>TTCN-3 Test Cases</i> .....	33
<b>4. V2G CONFORMANCE TEST PLATFORM .....</b>	<b>36</b>

4.1	CONSTRAINTS .....	36
4.2	HARDWARE AND TEST TOOL.....	37
4.3	CODECS .....	38
4.3.1	<i>Advanced details</i> .....	38
4.4.1	<i>Lower Tester</i> .....	40
4.4.2	<i>Platform Adapter</i> .....	41
4.4.3	<i>Upper Tester</i> .....	41
<b>5.</b>	<b>CONCLUSIONS.....</b>	<b>42</b>
	<b>REFERENCES.....</b>	<b>43</b>
	<b>ANNEX A: PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENTS (PICS) .....</b>	<b>44</b>
A.1	V2G ENTITY ROLE .....	44
A.2	CHARGING MODE.....	44
A.3	IDENTIFICATION MODE .....	44
A.4	OPTIONAL SETS.....	44
A.5	PROTOCOL STACK .....	45
A.6	SECC DISCOVERY PROTOCOL (SDP) .....	45
A.7	V2G APPLICATION LAYER PROTOCOL HANDSHAKE.....	46
A.8	V2G APPLICATION LAYER MESSAGES .....	46
	<b>ANNEX B: TEST PURPOSES FOR EVCC .....</b>	<b>47</b>
B.1	SECC DISCOVERY.....	48
B.2	APPLICATION LAYER MESSAGES.....	51
B.2.1.	<i>Handshake Protocol</i> .....	51
B.2.2	<i>Session Setup</i> .....	53
B.2.3	<i>Service Discovery</i> .....	55
B.2.4	<i>Service Details</i> .....	58
B.2.5	<i>Service and Payment Selection</i> .....	62

<b>V2G Conformance Test Specifications</b>	<b>Public</b>	<b>Copyright PowerUp Contract N. 285285</b>
--------------------------------------------	---------------	-------------------------------------------------

<i>B.2.6 Certificate Update .....</i>	<i>69</i>
<i>B.2.7 Certificate Installation .....</i>	<i>72</i>
<i>B.2.8 Payment Details .....</i>	<i>74</i>
<i>B.2.9 Contract Authentication .....</i>	<i>79</i>
<i>B.2.10 Charge parameter Discovery .....</i>	<i>84</i>
<i>B.2.11 Power Delivery.....</i>	<i>89</i>
<i>B.2.12 Session Stop.....</i>	<i>96</i>
<i>B.2.13 Charging status .....</i>	<i>98</i>
<i>B.2.14 Metering Receipt .....</i>	<i>101</i>
<i>B.2.15 Cable Check .....</i>	<i>103</i>
<i>B.2.16 Pre Charge .....</i>	<i>106</i>
<i>B.2.17 Current Demand .....</i>	<i>109</i>
<i>B.2.18 Welding Detection.....</i>	<i>112</i>
<b>ANNEX C: TEST PURPOSES FOR SECC.....</b>	<b>114</b>
<i>C.1 SECC DISCOVERY.....</i>	<i>114</i>
<i>C.2 APPLICATION LAYER MESSAGES.....</i>	<i>118</i>
<i>C.2.1. Handshake Protocol.....</i>	<i>118</i>
<i>C.2.2 Session Setup .....</i>	<i>121</i>
<i>C.2.3 Service Discovery .....</i>	<i>122</i>
<i>C.2.4 Service Details.....</i>	<i>124</i>
<i>C.2.5 Service and Payment Selection .....</i>	<i>126</i>
<i>C.2.6 Certificate Update .....</i>	<i>128</i>
<i>C.2.7 Certificate Installation .....</i>	<i>133</i>
<i>C.2.8 Payment Details.....</i>	<i>136</i>
<i>C.2.9 Contract Authentication .....</i>	<i>138</i>
<i>C.2.10 Charge parameter Discovery .....</i>	<i>140</i>

<i>C.2.11 Power Delivery</i> .....	144
<i>C.2.12 Session Stop</i> .....	152
<i>C.2.13 Charging status</i> .....	154
<i>C.2.14 Metering Receipt</i> .....	156
<i>C.2.15 Cable Check</i> .....	158
<i>C.2.16 Pre Charge</i> .....	160
<i>C.2.17 Current Demand</i> .....	162
<i>C.2.18 Welding Detection</i> .....	164
<b>ANNEX D: ATS CONVENTIONS</b> .....	<b>166</b>
<b>ANNEX E: V2G PROTOCOL EXCHANGE</b> .....	<b>168</b>
E.1 OVERVIEW OF AC V2G PROTOCOL MESSAGE EXCHANGE .....	168
E.2 OVERVIEW OF DC V2G PROTOCOL MESSAGE EXCHANGE .....	169
<b>ANNEX F: WHAT IS TTCN-3?</b> .....	<b>170</b>
F.1 TTCN-3 IS EASY TO LEARN .....	170
F.2 TTCN-3 IS INTERNATIONALLY STANDARDIZED .....	171
F.3 THE TTCN-3 APPROACH TO TESTING IS EXTREMELY FLEXIBLE .....	171
F.4 TTCN-3 CAN BE USED IN MANY TYPES OF TESTING .....	172

## LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ATS	Abstract Test Suite
ETSI	European Telecommunication Standard Institute
EVCC	Electric Vehicle Communication Controller
ISO	International Organization for Standardization
IUT	Implementation Under Test
PICS	Protocol Implementation Conformance Statement
SDP	SECC Discovery Protocol
SECC	Supply Equipment Communication Controller
SUT	System Under Test
TCP	Transmission Control Protocol
TP	Test Purpose
TSS	Test Suite Structure
TTCN-3	Testing and Test Control Notation version 3
UDP	User Datagram Protocol
V2G	Vehicle to Grid
V2GTP	V2G Transfer Protocol
WP	Work Package

## LIST OF FIGURES

Figure 1. PowerUp System Architecture .....	11
Figure 2. General Conformance Testing Architecture .....	12
Figure 3. Detailed General Conformance Testing Architecture.....	12
Figure 4. Conformance Test Methodology .....	15
Figure 5. Elements for PICS development .....	16
Figure 6. Generic Test Suite Structure.....	18
Figure 7. Elements for TSS&TP development.....	19
Figure 8. Test configuration 1.....	20
Figure 9. Test configuration 2.....	21
Figure 10. Test configuration 3.....	21
Figure 11. Elements for ATS development.....	26
Figure 12. PCOs' location.....	27
Figure 13. Abstract Protocol Tester for V2G Application Layer protocol .....	27
Figure 14. Abstract Protocol Tester for Session Discovery protocol .....	28
Figure 15. High level V2G Test Architecture .....	29
Figure 16. V2G Test Architecture .....	30
Figure 17. Test case architecture .....	34
Figure 18. Relationship between CODECS java classes .....	39



## LIST OF TABLES

Table 1. Test Suite Structure.....	19
Table 2. Test Purpose Identifiers .....	21
Table 3. Test Purpose Template.....	23
Table 4. Test Purpose - Example 1.....	24
Table 5. Test Purpose - Example 2.....	25
Table 6. Points of Control and Observation.....	26
Table 7. ETSI generic TTCN-3 naming conventions .....	166



## REVISION CHART AND HISTORY LOG

REV	DATE	REASON
0.1	2012-10-05	First draft
0.2	2012-10-16	Second draft
0.3	2012-11-20	Third draft
0.4	2012-12-10	Fourth draft
0.5	2012-12-19	Core document - Final draft
0.6	2012-12-21	Annexes – Final Draft
0.7	2012-02-01	Update from peer review

## EXECUTIVE SUMMARY

Users' needs are changing rapidly, generating new challenges and leading to systems that are increasingly complex. This complexity compromises interoperability but, from a consumers point of view, interoperability becomes a must.

With the desire to achieve this interoperability, standardization is crucial in a multi-vendor, multi-network and multi-service environment. Once standards are defined prototypes and products can be developed, but the interpretation of these standards can vary, and different products from different manufacturers are sometimes not able to work together. Testing is an essential tool to mitigate this problem; first defining a robust test methodology, then creating a complete set of test specifications, and finally developing test tools to test against those specifications.

PowerUp aims to develop the Vehicle-To-Grid (V2G) interface for Electric Vehicle charging, involving a full development cycle of physical/link-layer specification, charging control protocol design, prototyping, conformance testing, field trials, and standardization. WP6, and more specifically task 6.1, aims to develop a complete set of conformance test specifications for the V2G interface. These conformance test specifications rely on the V2G base specifications from the standard ISO/IEC 15118-2 [1] augmented with those developed in PowerUp WP4.

This deliverable includes a complete set of conformance test specifications for the V2G interface; Protocol Implementation Conformance Statements (PICS), Test Suite Structure and Test Purposes (TSS&TP) and Abstract Test Suite (ATS) by following the ISO 9646 testing methodology and ETSI recommendations.

The deliverable is arranged in 5 chapters:

- Chapter 1 gives an introduction to Conformance testing
- Chapter 2 provides an overview of the conformance testing methodology used for these test specifications
- Chapter 3 presents the different parts of the V2G test specifications
- Chapter 4 gives detailed information about the V2G test platform implementation
- Finally, Chapter 5 concludes the deliverable.

## 1. INTRODUCTION

Testing is one of the most important activities during the development of a system, and diverse techniques exist to completely cover all the functionality specified and developed in specific systems. The more complex the system, the more complex the testing techniques that are needed.

The PowerUp project has defined a complex, heterogeneous, system shown in Figure 1 below, and described in other PowerUp deliverables ([2], [5], [7]). Therefore, the range of testing techniques that can be applied to this vehicular environment is very high.

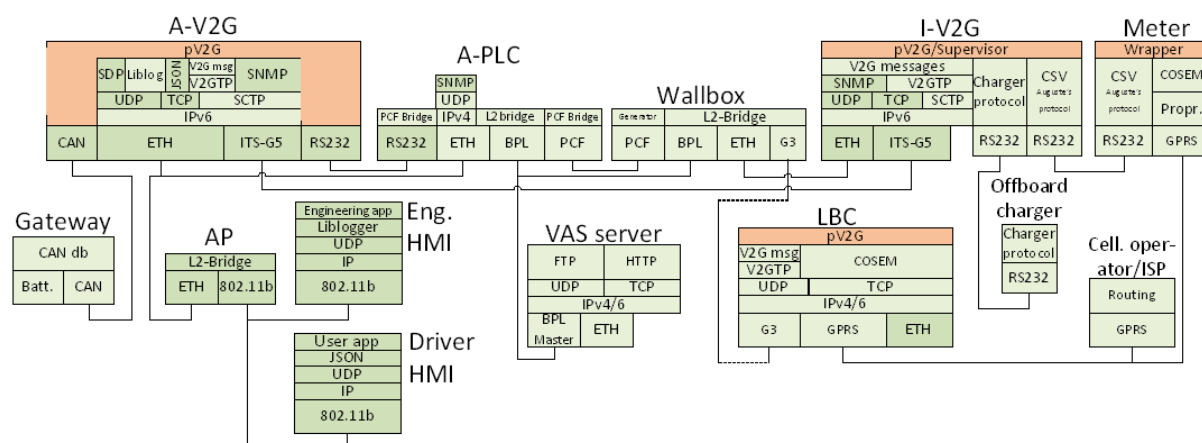


Figure 1. PowerUp System Architecture

From a testing perspective, this architecture demands a range of testing techniques covering software, performance, integration, robustness etc. PowerUp covers some of these approaches in other Work Packages (WP7 covers integration testing, and WP5 covers software testing, for example).

WP6 deals with conformance and interoperability testing for **the V2G standard interface between the A-VG2 and the I-V2G based on ISO 15118-2** [1].

This deliverable addresses the development of the conformance test specification following the methodology described in section 2. Interoperability testing is covered by the PowerUp D6.2 [3].

## 2. METHODOLOGY

### 2.1. Conformance testing

Conformance testing checks a specific (part of a) product for compliance to requirements in a Base Standard. This technique is mainly applied in protocol testing, and PowerUp has used it in WP6.

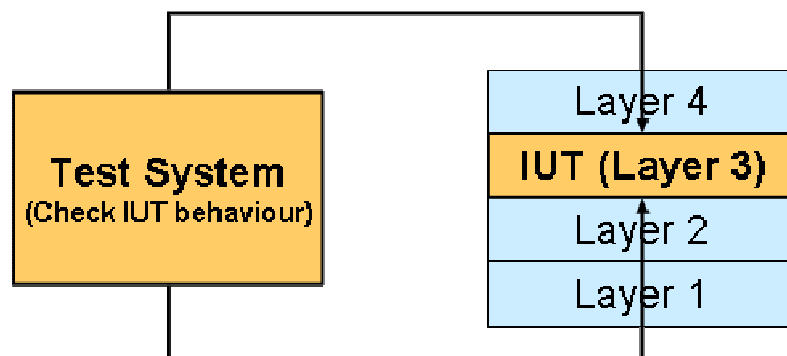
Figure 2 illustrates the generic view of a conformance testing architecture, and Figure 3 shows a real example of a typical test system.



**Figure 2. General Conformance Testing Architecture**

This architecture is divided into two basic components; the Implementation Under Test (IUT) is the specific product to be tested, and the Test System executes the tests (i.e. executing test scripts) having full or partial control of the IUT and observing its behaviour. The Test System and the IUT are usually connected over at least one single interface.

The Test System can usually access the lower layers of the IUT in order to check the protocol messages generated, and may get access upper layers of the IUT in order to have more control of it, and sometimes get relevant information for the tests.



**Figure 3. Detailed General Conformance Testing Architecture**

Conformance testing provides a high degree of control and observation of the IUT, even provoking and testing non-normal scenarios and error behaviours. In addition, conformance testing gives a high level of confidence that the standardized functionality of a product is working as specified. This confidence is achieved because conformance tests are detailed, they focus on single requirements and they can be executed in an automated and repeatable manner under controlled conditions.

**Conformance testing does not necessarily prove interoperability with other products.** Depending on how precisely the technical specification (or standard) has been written, it may be open to multiple interpretations, meaning that implementations from different vendors might be compliant but may not fully interwork. From an end-user perspective these devices might just have well have been implemented according to proprietary specifications. Good technical specifications are unambiguous and leave no margin for misinterpretation, but conformance test specifications developed from a poorly written base standard may lead to products which conform to the standard but do not interoperate.

Conformance testing has historically been seen as an expensive tool, especially for radio environments such as GSM or DECT. Of late this perception has changed with organizations like ETSI working to improve the test specification development process through methodology improvements and test languages such as TTCN-3.

TTCN-3 provides both a standardized language for test cases and an architecture for developing test systems. TTCN-3 is now widely used as a testing language for standards such as WiMAX and LTE in telecommunications, and it is even used in ITS (Intelligent Transport Systems). TTCN-3 is mostly used for protocol testing but other test areas (software, system, etc.) and verification objectives (interoperability, robustness, etc.) are starting to use TTCN-3. PowerUp uses TTCN-3 for the test cases implementation.

## ***2.2. PowerUp Implementations Under Test***

Within PowerUp two different IUTs are clearly identified: the EVCC (Electronic Vehicle Communication controller) as part of the A-V2G, and the SECC (Supply Equipment Communication Controller) as part of the I-V2G. From the protocol point of view, a "client-server" model is used, where the EVCC takes the role of the "client" of the protocol, initiating the communications, and the SECC takes the role of the "server".

These two IUTs implementations (specified in WP4 and implemented in WP5) are based on the ISO/IEC 15118-2 standard, and more concretely the application layer protocols: **SECC Discovery Protocol (SDP) and V2G protocol (pV2G)**. The underlying protocols, such as V2GTP, UDP, TCP, etc., are out of scope for the PowerUp conformance test specifications. The conformance test specifications developed in PowerUp are focused on SDP and pV2G.

### ***2.3. ETSI testing methodology***

The main objective of this work is to define a formal procedure to develop a complete set of test specifications in order to:

- Ensure that equipment and systems claiming compliance to the standard have been sufficiently tested to demonstrate that compliance.
- Guarantee that equipments from multiple vendors have been tested the same way, to the same interpretation of the standard, thus increasing the interoperability of the equipment.

The conformance test methodology followed in WP6 is based on the ITS framework [4] and ETSI recommendations. This methodology is divided into different activities as shown in Figure 4.

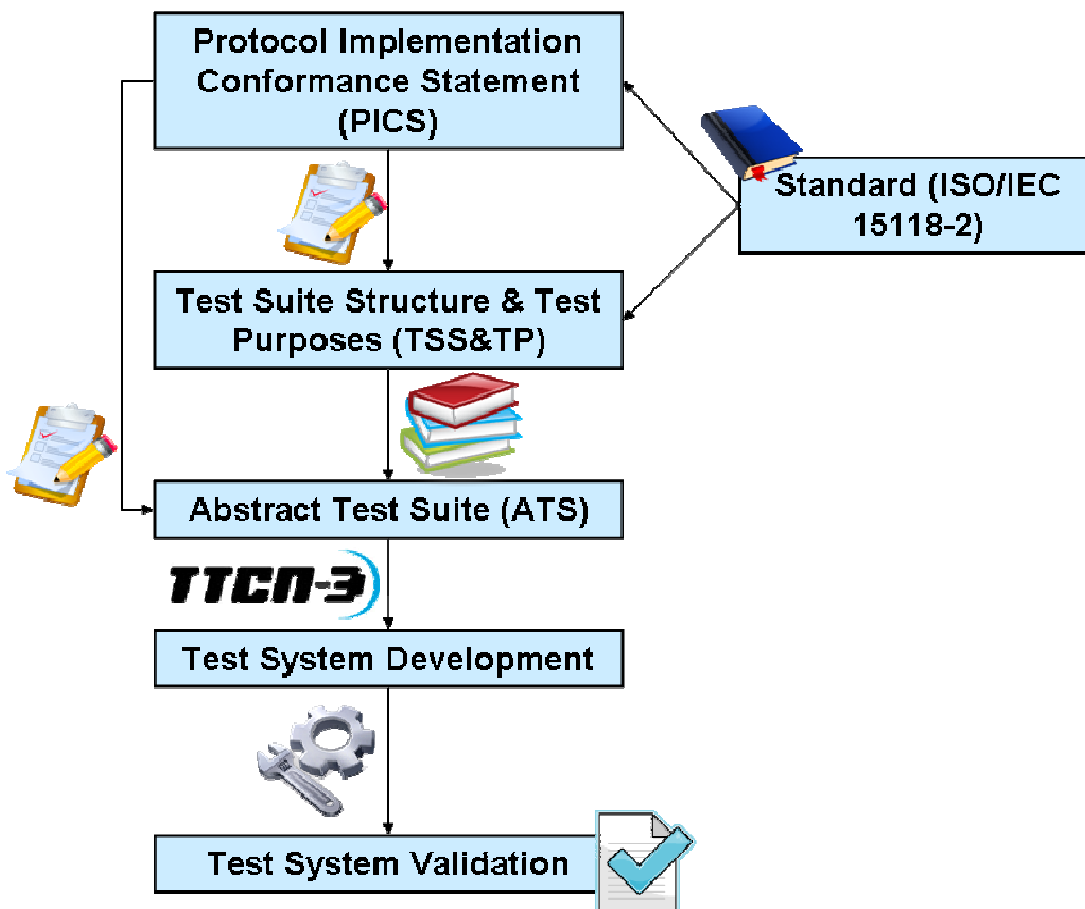


Figure 4. Conformance Test Methodology

- **Activity 1 - Production of the PICS proforma:** PICS provides an overview of the features, capabilities, functionalities and options that are supported by a IUT conforming to the ISO/IEC 15118-2 standard.
- **Activity 2 - Development of the Test Suite Structure and Test Purpose (TSS & TP):** Test Purposes (TPs) provides a short description of each test objective using words, focusing on the meaning of the test rather than detailing how it may be achieved. TSS provides a logical grouping for the TPs.
- **Activity 3 – Development of the ATS (Abstract Test Suite):** An ATS is a collection of Test Cases. Each Test Case specifies the preconditions for setting up the test and the steps that must be taken in order to perform the test. As previously discussed, TTCN-3 is the language selected and used for writing the test cases.

- **Activity 4 – Development and Validation of the Test System:** The test cases developed in activity 3 must run on a test system, and must be validated against samples which implement the ISO/IEC 15118-2 standard.

The PowerUp Conformance Test Specification is composed of the following documents:

- PICS Document (See Section 3.1)
- TSS & TP Document (See Section 3.2)
- ATS document (See Section 3.3)
- Test System Document (See Section 4).

This test specification is extracted from ISO/IEC 18115-2, and specifically DIS\_Candidate 3.

### 3. V2G TEST SPECIFICATIONS

#### 3.1. Protocol Implementation Statement Conformance (PICS)

The purpose of the PICS proforma is to provide a mechanism whereby a supplier of an EVCC or a SECC claiming to meet the requirements defined in ISO/IEC 15118-2 [1] may provide information about the implementation in a standardized manner.

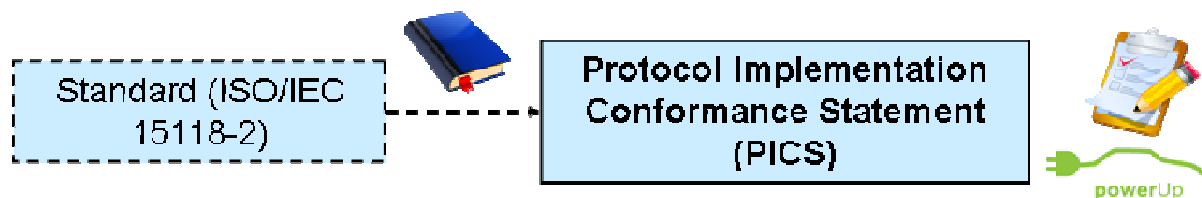


Figure 5. Elements for PICS development

The complete set of PICS for the EVCC and the SECC have been defined in Annex A using a tabular format shown in the next table.

Item	Feature	Reference	Status	Mnemonic	Support
[x]	[Feature]	[Section]	[M   o   o.iX]	[Mnemonic]	[Y   N]



Where each column has the following purpose;

- **Item:** a number which identifies the item in the table.
- **Feature:** a free text representation of each respective item (e.g. parameters, timers, etc.). It implicitly means "is <feature> supported by the implementation?".
- **Reference:** reference to clauses in ISO 15118-2 [6] relevant to the feature (except where explicitly stated otherwise).
- **Status:** Optionality status of the feature. The following notations are used;
  - M (mandatory): the capability MUST be supported.
  - O (optional): the capability MAY be supported.
  - O.X (qualified optional) – for mutually exclusive or selectable options from a set. "X" is an integer which identifies a unique group of related optional items and the logic of their selection which is defined immediately following the table.
- **Mnemonic:** a key word that is used in conditional status expressions as a Boolean value which is true if the item identified by the mnemonic is supported and false in any other case.
- **Support:** filled in by the supplier of the implementation to indicate if a particular implementation supports the feature. The following common notations are used for the support column:
  - Yes – Supported by the implementation.
  - No – Not supported by the implementation.

The PICS proforma is subdivided into 8 categories which can contain sub clauses:

- **Category 1 – V2G Entity Role:** this category identifies what role is implemented by the IUT (either EVCC or SECC).
- **Category 2 – Charging Mode:** this category indicates what charging modes are supported: AC or DC. One of these two modes MUST be supported.
- **Category 3 – Identification Mode:** this category indicates what identification modes are supported: EIM or PnC. One of these two modes MUST be supported.

- **Category 4 – Optional Sets:** this category represent a set of capabilities that the IUT could support or could not related to Value Added Services and Certificates.
- **Category 5 – Protocol Stack:** this category indicates what protocols are supported.
- **Category 6 – SECC Discovery Protocol (SDP):** this category is specific to the SDP protocol, and indicates what features are supported by the IUT.
- **Category 7 – V2G Application Layer Protocol Handshake:** this category is specific for the Handshake protocol, and indicates what features are supported by the IUT.
- **Category 8 – V2G Application Layer Messages:** this category is specific for the V2G protocol, and indicates what features are supported by the IUT.

### 3.2. Test Suite Structure and Test Purposes (TSS&TP)

The aim of the Test Purposes (TPs) is to provide a short description of each test objective using natural or pseudo language (i.e. TPLan, a standardized notation for expressing test purposes), focusing on the meaning of the test rather than detailing how it may be achieved; Test Suite Structure (TSS) provides a logical and structured grouping of the TPs.

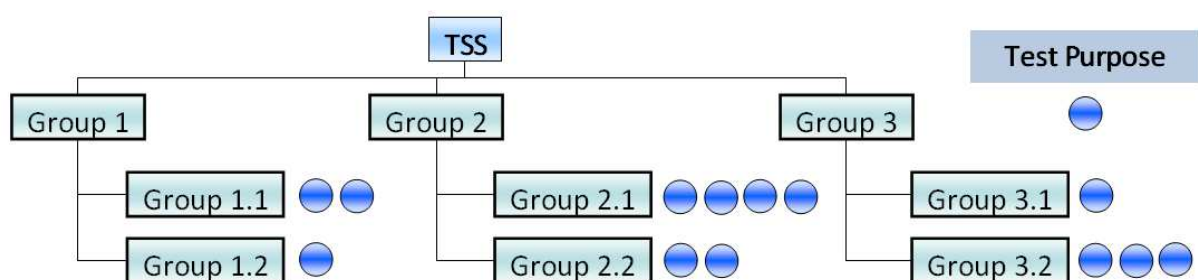


Figure 6. Generic Test Suite Structure

Around 150 test purposes have been specified in PowerUp and can be found in Annex B and Annex C.

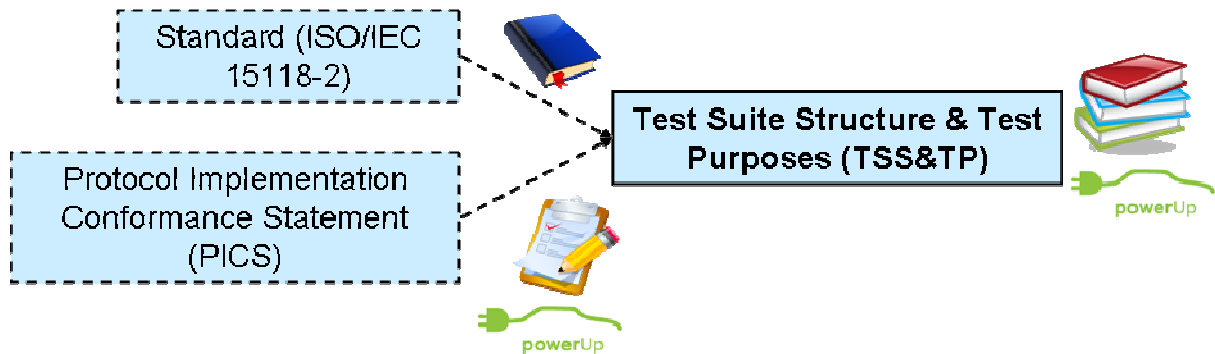


Figure 7. Elements for TSS&TP development

### 3.2.1 Test Suite Structure

Defining the Test Suite Structure requires the grouping of the Test Purposes according to some criteria.

The Test Suite Structure is structured as a tree divided into two levels. The higher level represents the protocol to be tested, either SDP or V2G (hereinafter called Application Layer Messages). The lower level, in case of SDP, represents the difference in term of the role implemented in the SDP protocol; either client or server. For Application Layer Messages, the second level identifies the different states of the V2G protocol.

The following table shows the TSS specified.

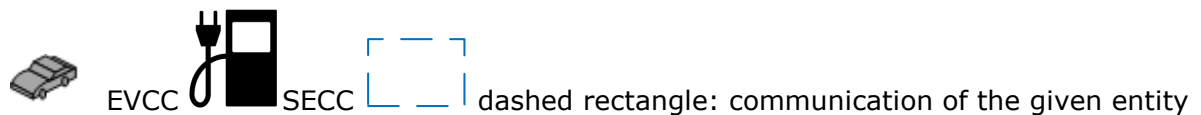
Table 1. Test Suite Structure

Group	Sub-group
SECC Discovery Protocol	Client
	Server
Application Layer Messages	Handshake Protocol
	Session Setup
	Session Discovery
	Service Detail
	Service and Payment Selection
	Certificate Update
	Certificate Installation
	Payment Details

	Contract Authentication
	Charge Parameter Discovery
	Power Delivery
	Session Stop
	Charging Status
	Metering Receipt
	Cable Check
	Pre Charging
	Current Demand
	Welding detection

### 3.2.2 Test Configurations

This section introduces the test configurations that have been used for the definition of test purposes. The test configurations cover the various scenarios of ISO/IEC 15118-2 [1]. The test configuration elements are:



#### Test Configuration 1: CF01

The EVCC connects to the SECC directly establishing an end to end connection based on V2G protocol. In this case the EVCC is the IUT.

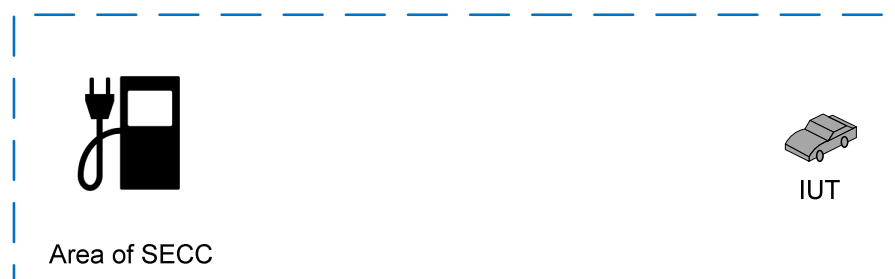


Figure 8. Test configuration 1

#### Test Configuration 2: CF02

The EVCC connects to the SECC directly establishing an end to end connection based on V2G protocol. In this case the SECC is the IUT.



Figure 9. Test configuration 2

### Test Configuration 3: CF03

This configuration is used for a special case in SDP (SECC Discovery Protocol) testing. In this configuration the IUT and EVCCNodeA connect to the SECC.

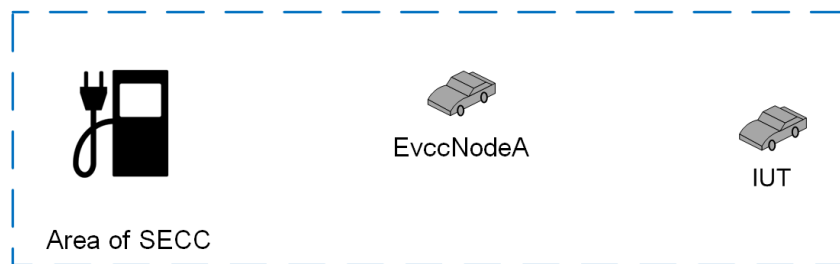


Figure 10. Test configuration 3

### 3.2.3 Test Purpose Identifier Naming Convention

The TP identifier serves to uniquely identify a test purpose. The naming convention ensures uniqueness of the TP identifier.

The identifier of the TP is built according to the following table.

Table 2. Test Purpose Identifiers

Identifier:	TP/<ent>/<gr>/<sgr>/<x>/<nn>		
	<ent> = entity	EVCC	
		SECC	
	<gr> = group	SDP	SECC Discovery Protocol
		ALM	Application Layer

			Message
	<sgr> = sub-group	CLI	Client
		SRV	Server
		HP	Handshake Protocol
		SSE	Session Setup
		SDI	Session Discovery
		SDE	Service Detail
		SPS	Service and Payment Selection
		CU	Certificate Update
		CI	Certificate Installation
		PDT	Payment Details
		CA	Contract Authentication
		CPD	Charge Parameter Discovery
		PWD	Power Delivery
		SST	Session Stop
		CHS	Charging Status
		MR	Metering Receipt
		CCK	Cable Check
		PCH	Pre Charging
		CD	Current Demand
		WD	Welding detection
	<x> = type of testing	BV	Valid behaviour tests
		BO	Inopportune behaviour
		BI	Invalid Syntax o Behaviour tests
	<nn> = sequential number		01 to 99

### 3.2.4 Test Purpose Template

A test purpose is an informal description of the expected test behavior. As such it is written in prose.

Several types of presentation of the test purposes are possible. These include combining text with graphical presentations, mainly tables, and sometimes include message sequence charts.

The template for specifying the TP follows a tabular format as the ITS framework [4] suggests, using recommendations concerning the wording and the organization of the TPs.

In addition, it is important to remark that the TP Behaviour has been written using a formal language so-called TPLan specified by ETSI.

**Table 3. Test Purpose Template**

TP Header	
TP ID	The TP ID is a unique identifier. It is specified according to the TP naming conventions defined in the above sub-clause.
Test objective	Short description of test purpose objective according to the requirements from the base standard.
Reference	The reference indicates the sub-clauses of the reference standard specifications in which the conformance requirement is expressed.
Reference requirement	The reference requirement indicates the sub-clauses of the reference standard specification requirement.
Config Id	The Config Id references the ISO/IEC 15118-2 configuration selected for this TP
PICS Selection	Reference to the PICS statement involved for selection of the TP. Contains a Boolean expression.
TP Behaviour	
Initial conditions	The initial conditions define which state the IUT has to be to apply the actual TP. In the corresponding Test Case, when the execution of the initial condition does not succeed, it leads to the assignment of an Inconclusive verdict.
Expected behaviour (TP body)	Definition of the events, which are parts of the TP objective, and the IUT are expected to perform in order to conform to the base specification. In the corresponding Test Case, Pass or Fail verdicts can be assigned there.

Defining the initial conditions, separately from the expected behavior, makes the reading of the TP easier and avoids misinterpretation.

Two TPs are provided as examples of how this template should be used.

Table 4. Test Purpose - Example 1

TP Id	TP/EVCC/ALM/SSE/BV/01
Test objective	Checks Session Setup Request message is sent after receiving SupportedAppProtocol Response message
Reference	ISO/IEC 15118-DIS-2, section 8.4.1.2.2
Reference requirement	[V2G2-184], [V2G2-185], [V2G2-186], [V2G2-187], [V2G2-188]. [V2G2-189]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent SupportedAppProtocol Request message }	
Expected behaviour	
ensure that { when { the IUT receives the SupportedAppProtocol Response message containing ResponseCode field indicating value 'OK_SuccessfullNegotiation' } then { the IUT sends a Session Setup Request message containing a <b>valid Header</b> containing a Body containing EVCCID field before V2G_EVCC_Sequence_Performance_Time expires } }	

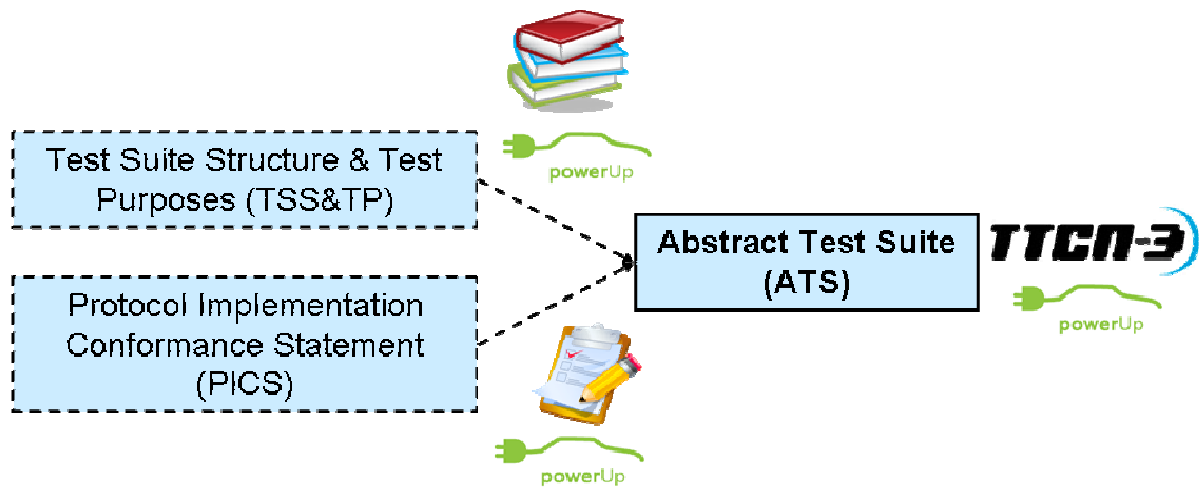


**Table 5. Test Purpose - Example 2**

TP Id	TP/SECC/ALM/SDI/BV/01
Test objective	Checks Service discovery Response message is sent after receiving Service discovery Request message
Reference	Section 8.4.1.3.3
Reference requirement	[V2G2-195], [V2G2-196], [V2G2-543], [V2G2-544]
Config Id	CF02
PICS Selection	PICS_SECC
Initial conditions	
with { the IUT having sent Session Setup response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service discovery Request message } then { the IUT sends a Service Discovery Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing PaymentOption type field containing Charge Service containing service type containing Service Tag containing Service ID field containing Free Service field containing EnergyTransfer type field containing Service list Before V2G_SECC_Sequence_Performance_Time expires } }	

### 3.3. Abstract Test Suite (ATS)

The last phase of the test specification is the detailed description of each test case or Abstract Test Suite (ATS). The ATS is a collection of detailed test cases or scripts that implement the test purposes. The ATS specifies HOW to test and assign test verdicts. Although ATS and Test Systems get usually mixed up, they have different roles; The ATS is focused on the IUT behavior, whereas the test system handles test case management, message encoding and decoding, adaptation layers, transporting, etc.



**Figure 11. Elements for ATS development**

### 3.3.1 Point of Control and Observation

It is necessary to identify the points in the test environment where the test events have to be controlled and observed. These points are called Points of Control and Observation (PCOs).

After analysing the TSS&TP (Annex B and Annex C), two PCOs have been identified, one associated with the SECC Discovery Protocol called PCO.SDP, and the other associated to the V2G message protocol and so-called PCO.V2Gproto.

The table below summarises the two PCOs associated with their corresponding test events;

**Table 6. Points of Control and Observation**

PCO	Protocol Under Test	Test Events
PCO.SDP	SDP	SDP messages
PCO.V2Gproto	V2G protocol	V2G messages

The following diagram depicts an OSI model representation of the PowerUp terminal device in all of the scenarios where IEC/ISO 15118-2 is involved.

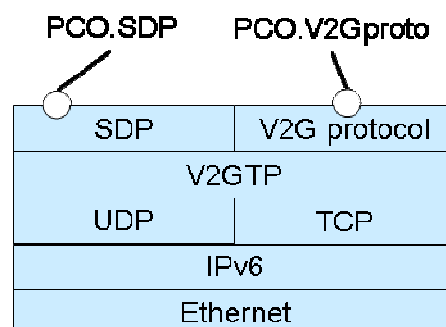


Figure 12. PCOs' location

### 3.3.2 V2G Abstract Protocol Tester

The abstract protocol tester is a process that provides behaviours for testing an IUT by emulating a peer IUT at the same layer, and enabling to address a single test objective.

The TSS&TP is grouped into two groups; one addressing the SDP protocol, and the other the V2G application layer protocol. Therefore two abstract protocol testers have been specified according to the protocol to be tested.

Each Abstract Protocol Tester is based on the Abstract Protocol Tester defined in the ETSI EG 202 798 [4]. These abstract protocol testers are shown below for each protocol;

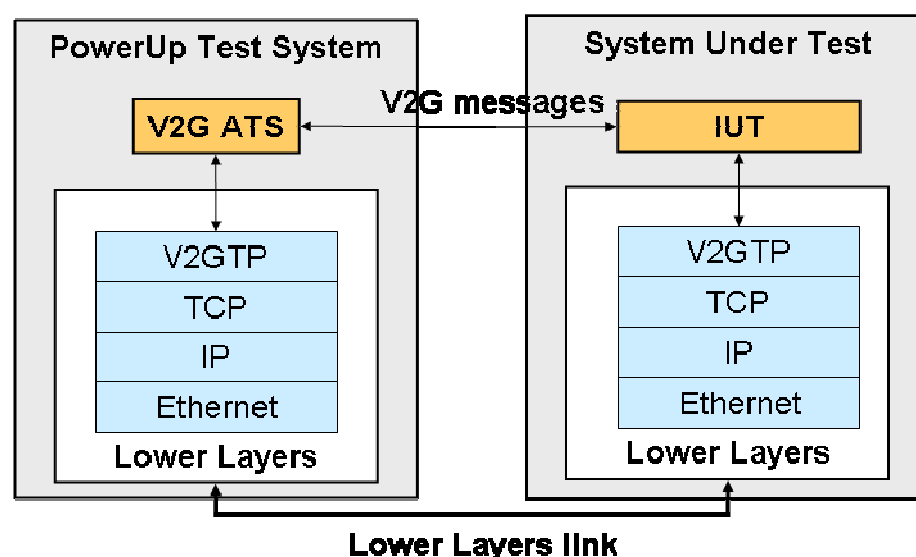


Figure 13. Abstract Protocol Tester for V2G Application Layer protocol

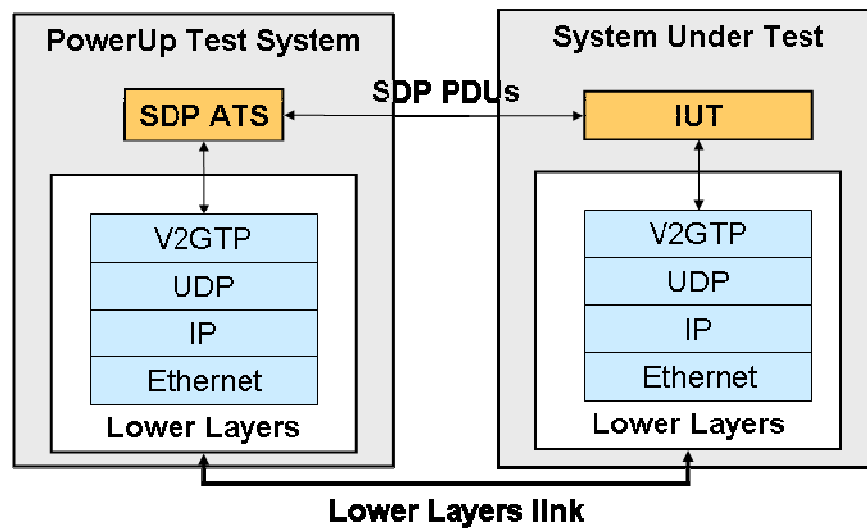


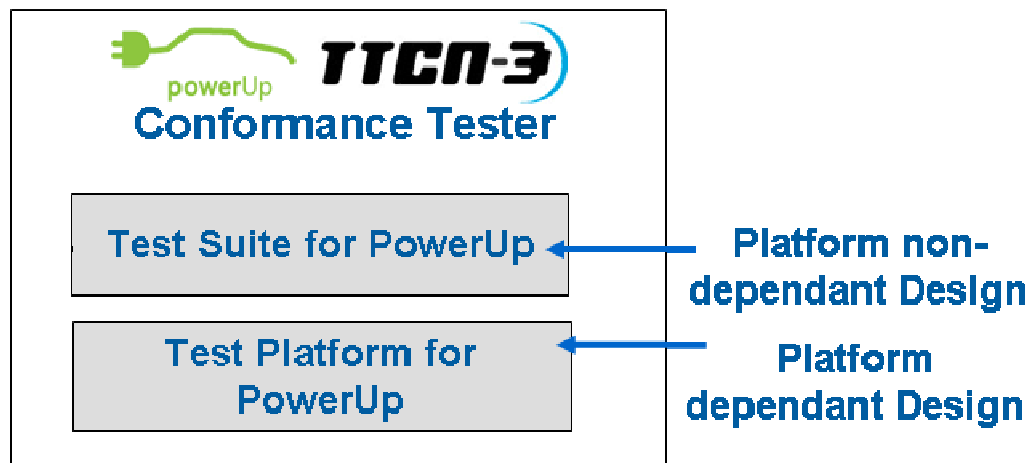
Figure 14. Abstract Protocol Tester for Session Discovery protocol

As the figure above illustrates, the corresponding ATS needs to use lower layers to establish a proper connection to the system under test (SUT) over a physical link (Lower layers link). The lower layer for SDP is based on V2GTP over UDP, and the lower layer for V2G messages is V2GTP over TCP.

### 3.3.3 V2G General Test Architecture

The approach for the implementation of the Abstract Protocol Tester selected in PowerUp follows the recommendation of the EG 202 798 where the **TTCN-3 language and its architecture** are recommended (see Annex F for further information about TTCN-3 language). TTCN-3 and its architecture have been already successfully used in other ITS protocols such as GeoNetworking, CAM (Cooperative Awareness Messages), etc.

Following this recommendation the PowerUp tester architecture comprises a non-technology dependent *Test Suite*, and a technology dependent *Test Platform*.



**Figure 15. High level V2G Test Architecture**

- TTCN-3 Test Suite for PowerUp: the test suite is platform independent, and it is the cornerstone of the architecture. It allows a complete decoupling between test suites and the rest of the tester. The test suite is composed of a complete set of test cases covering application layer requirements specified by [1].
- TTCN-3 Test Platform for PowerUp: this is the platform dependent part that includes adaptors and drivers. This part of the architecture definition depends on the specific platform (e.g., Windows or Linux) on which the tester is going to run.

### **3.3.4 V2G Test Architecture Design**

By following EG 202 798, the V2G test architecture can be integrated into the existing ETSI ITS test platform. This allows the efficient use of the existing platform as well as allowing it to be enriched.

Figure 16 shows the TTCN-3 test architecture design used for the V2G ATS. The Test Suite must interact with the Test Platform to implement the collection of TTCN-3 test cases that are intended to be used to test the PowerUp IUTs.

The V2G TTCN-3 test cases implement the test algorithms specified in the TSS&TP document, including verdict logic that allows pass/fail diagnosis.

The test algorithms use the PCOs identified in section 3.3.1 (PCO.SDP and PCO.V2Gproto) in order to

- 1) control the test event to be sent towards the IUT, and
- 2) observe the test events received from the IUT.

In TTCN-3 these two PCOs have been implemented through a logical TTCN-3 concept called port (v2gPort) which allows SDP and V2G message exchange with the IUT.

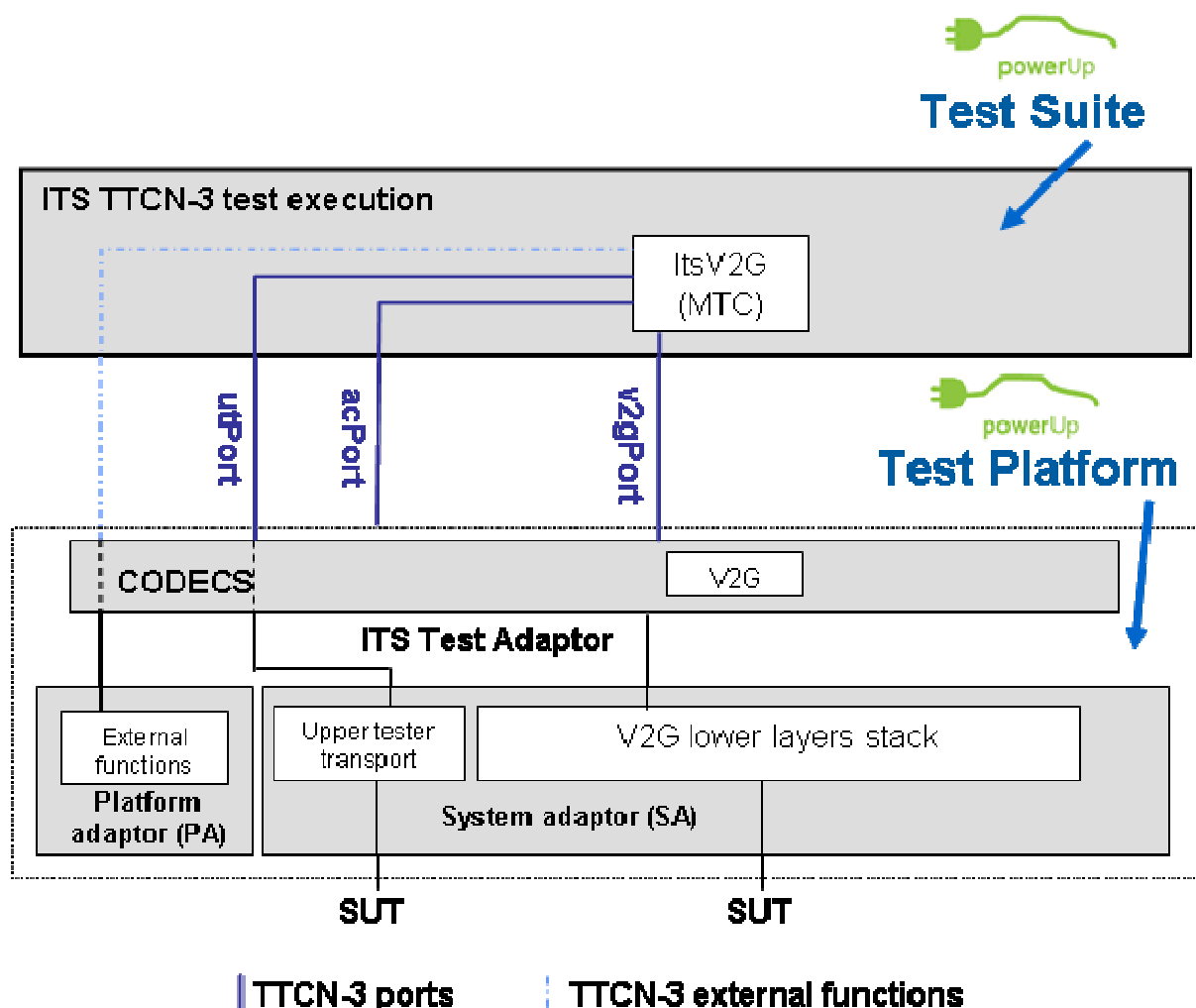


Figure 16. V2G Test Architecture

The SDP and V2G messages have been mapped into TTCN-3 structure. Through this mapping, the TTCN-3 is able to build and send these messages, as well as receive them via the v2gport.

Additionally, the test cases are able to control and configure the test platform through a dedicated port called acPort.

To build up a tester, the test platform must be also developed (see Section 4). This test platform is composed of three adaptation layers:

- PA (Platform Adaptor) layer functionality implements the communication between the TTCN-3 modules and external elements that constitute the test tool such as reference node implementations, timers, external functions, etc. The External functions are a powerful resources supported by TTCN-3 language. An External function is a function declared at the TTCN-3 level but implemented at the native level.
- SA (System Adaptor) layer functionality is divided into two modules:
  - V2G lower layer stack module implements the communication with the IUT and carries out either the SDP or the V2G message sent to or received from the IUT. In case of SDP, this module is based on V2GTP over UDP; and in case of V2G message, the module is based on V2GTP over TCP.
  - Upper Tester Transport module implements functions that enable triggering V2G functionalities by simulating primitives from other entities such as smart meters, load balancing controller, etc in the SUT.
- CODECS layer is the part of the tester to encode and decode messages between the TTCN-3 internal data representation and the format required by the related base standard. Two CODECS are required in this tester, one for SDP, and one for V2G messages.

Further description of these layers is provided in section 4.3.

### ***3.3.5 Ports and Primitives***

The PowerUp Test Suite implements three ports to be used by the V2G ATS:

- The V2Gport
- The utPort
- The acPort

#### **3.3.5.1 V2Gport**

This port is used to send and receive the following message sets;

- SECC Discovery Protocol messages in accordance with ISO/IEC 15118-2 standard.
- V2G Handshake Protocol messages in accordance with ISO/IEC 15118-2 standard.

- V2G application layer protocol messages in accordance with ISO/IEC 15118-2 standard.

Two primitives are currently defined for this port:

- 1) The V2Greq primitive - to send SDP, V2G Handshake and V2G application layer messages to the IUT. Depending on the IUT to be tested:
  - a. If the IUT is an EVCC, the messages sent by the tester will be the messages associated with the SECC role, thus response messages such as SessionSetupRes, ServiceDiscoveryRes, etc.
  - b. If the IUT is a SECC, the messages sent by the tester will be the messages associated with the EVCC role, thus request messages such as SessionSetupReq, ServiceDiscoveryReq, etc.
- 2) The V2Gind primitive - to receive SDP, V2G Handshake and V2G application layer protocol messages from the IUT. Depending on the IUT to be tested:
  - a. If the IUT is an EVCC, the messages received by the tester will be messages associated with request messages.
  - b. If the IUT is the SECC, the messages received by the tester will be messages associated with response messages.

Primitive	TTCN-3 Message	Direction	IUT
V2Greq	SDP Request	→	SECC
	Handshake protocol Request		
	V2G message Request		
	SDP Response	→	EVCC
	Handshake protocol Response		
	V2G message Response		
V2Gind	SDP Request	←	EVCC



	Handshake protocol Request		
	V2G message Request		
	SDP Response	←	SECC
	Handshake protocol Response		
	V2G message Response		

#### 3.3.5.2 utPort

The utPort has been included in the V2G ATS in order to be able to stimulate the IUT and receive extra information from IUT upper layers.

The utPort is not used in the current implementation and is provided for future expansion.

#### 3.3.5.3 acPort

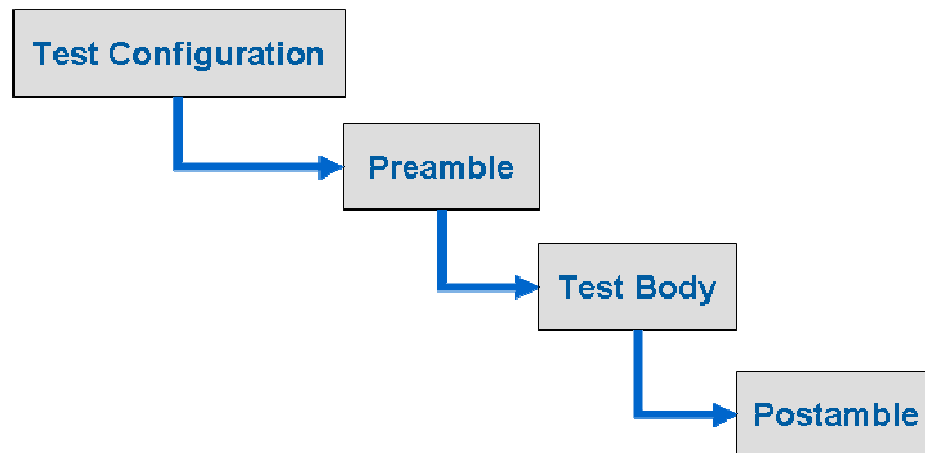
The acPort has been included in the V2G ATS in order to be able to control and configure the test adapter for specific cases.

The acPort is not used in the current implementation and is provided for future expansion.

### 3.3.6 TTCN-3 Test Cases

TTCN-3 test cases have been mostly structured into two groups; one focuses on the test cases related to the EVCC, and the other focuses on the SECC. Each group implements SDP and V2G application layer protocol test cases specified in the TSS&TP document.

The diagram below shows the test case architecture which has been defined for the implementation of all test cases:



**Figure 17. Test case architecture**

- Test Configuration: this step configures and activates the TTCN-3 ports to be used during the test case. In addition, if the test platform requires any specific configuration, this is done in this phase.
- Preamble: this step implements the 'Initial conditions' indicated in the test purpose. During this phase, the test case brings the IUT into a state from which the test body will start.
- Test Body: this step implements the 'Expected behavior' description indicated in the test purpose. During this phase the test case analyzes the sequence of messages to be exchanged between the tester and the IUT, checking the messages sent by the IUT, and stimulating the IUT by sending specific messages. In addition, the test verdict is assessed at the end of this phase.
- Postamble: this step finalizes the test case in a proper way so that IUT is ready for further test cases.

As indicated above, the preamble brings the IUT up to a V2G application protocol state which the test body will start from. The test suite must be able to emulate the behavior of the ISO/IEC 15118-2 protocol both from the SECC perspective when the IUT is an EVCC, and from the EVCC perspective when the IUT is a SECC.

The preamble has been divided into two phases. The first phase addresses the common charge protocol states, which are independent of the selected charge mode; the second phase is specific to the selected charge mode (AC or DC).

The common part covers the following charge protocol states: SDP, Supported Application Protocol, Session Setup, Service Discovery, Service Details, Service and Payment Selection, Certificate Update, Certificate Install, Payment Details, Contract Authentication and Charge Parameter Discovery.

The specific part for AC charge mode covers the following charge protocol states: Power Delivery, Charging Status, Metering Receipt and Session Stop.

The specific part for DC charge mode covers the following charge protocol states: Cable Check, Pre Charge, Power Delivery, Current Demand, Welding Detection and Session Stop.

In addition, the behavior of the preamble is controlled by specific conditions which indicate if either the EVCC emulator or the SECC emulator should emulate either a specific behavior or following a normal behavior, for instance: send a FAILED response code in a Service Discovery Response after receiving a Service Discovery Request.

The general pseudo-code for the preamble implementation is described below:

```

CurrentChargeState = InitialChargeState;
While (CurrentChargeState != EndChargeState)
{
    If not message received belonging to CurrentChargeState then
        FAIL;
    else
    {
        Process message received;
        Send reply message belonging to CurrentChargeState depending on the specific conditions;
        CurrentChargeState = NextChargeState;
    }
}

```

An example of a TTCN-3 test case is shown below:

```

testcase TC_EVCC_ALM_SDI_BV_01() runs on ItsV2G system ItsV2Gsystem {

    // Local variables

    // Test control

    // Test component configuration
    f_cfUp();

    // Test adapter configuration

    // Preamble
    f_prV2G_secc_common(e_sessionSetup,e_noConditions);
}

```

```

// Test Body
tc_v2g_secc_sequence_timer.start;
alt {
  [] v2gPort.receive(mw_v2gInd (
    mw_v2gMsg(mw_v2gHeader(vc_sld),mw_serviceDiscoveryRequest_generic))) {
    tc_v2g_secc_sequence_timer.stop;
    log("*** TC_EVCC_ALM_SDI_BV_01: PASS: V2G Service Discovery request message received BEFORE
expiry of the sequence performance timer***");
    setverdict(pass);
  }
  [] tc_v2g_secc_sequence_timer.timeout {
    log("*** TC_EVCC_ALM_SDI_BV_01: FAIL: V2G Service Discovery request message not
received ***");
    setverdict(fail);
  }
}

// Postamble
f_poDefault();
f_cfDown();

} // end TC_EVCC_ALM_SDI_BV_01

```

The naming conventions used for the V2G ATS are based on the ITS framework [4] and ETSI recommendations. See Annex D for details.

## 4. V2G CONFORMANCE TEST PLATFORM

The purpose of the V2G conformance test platform is to provide a reliable set of software and hardware that can be used to validate TTCN-3 abstract test suites (ATS) developed in this project.

### 4.1 Constraints

The architecture of this test platform has been designed with respect to the following constraints:

- To be independent of the platform used to implement the test system;
- To be independent of the TTCN-3 tool provider;
- To be configurable and customizable;

- To provide tools and well defined interfaces to the system under test (SUT), allowing test automation;
- To be easily extensible for future protocol modification;
- To provide generic components that can be reused in other test platforms.

In order to ensure independence of hardware platforms, all software components running on the test platform have been implemented using Java™, using generic and widely used libraries.

Test tool independence has been achieved by isolating the tool specific interfaces from core functionalities of the platform. Adapting the current platform to a different test tool would only require the implementation of a very simple piece of software mapping tool-specific functions to generic functions defined in this project.

In addition, great care has been taken to separate PowerUp specific functionalities from generic test platform tasks in order to provide a maximum number of reusable components for future test platforms.

## **4.2 *Hardware and test tool***

Besides the components already shown in Figure 16, another two components should be considered when implementing the test platform:

- The hardware supporting TTCN-3 test execution and adaptation to SUTs;
- The TTCN-3 test tool providing the necessary software to execute the abstract test suites;

The main hardware component of the V2G test platform is a standard PC. Its role is to host the execution of the test suites using a commercial TTCN-3 test tool.

Whatever operating system is installed on the computer, it is necessary to ensure that the following points are taken into account:

- No firewall interference with traffic generated by the Test System and/or SUT
- Time synchronization between the SUT and the test system
- Test system processes (especially the test adapter) have to be granted unrestricted control to telecommunication hardware

The TTCN-3 test tools are usually provided by commercial companies and their description is out of the scope of this document. The implementation details of the other components are described in the following sections.

### 4.3 Codecs

The codec entity is responsible for the encoding and decoding of TTCN-3 abstract values into bitstrings suitable to be sent to the System Under Test (SUT).

In order to simplify implementation and to ease maintenance, coding and decoding tasks are handled by several codecs:

- One independent codec per protocol (SDP, Supported Application Protocol and V2G application protocol);
- One codec for TTCN-3 types that do not correspond to real protocol messages. It includes for example all auxiliary types used to carry information to/from Test Adapter, like the ones defined in TestSystem modules (V2Gind, V2Greq, ...).

For protocol messages defined using XSD schemes, usage of dedicated commercial XSD tools is recommended. XML messages also require EXI compression to be used. For this purpose and EXI helper using Exifcient<sup>1</sup> library has been developed.

Selection of correct codec for encoding a message at runtime is dictated by means of the "with encode" statement within TTCN-3 modules. For instance the following statement:

```
with {
    encode " LibItsV2G_TypesAndValues "
}
```

will cause `org.etsi.its.codec.ttcn.LibItsV2G_TypesAndValuesCodec` to be invoked.

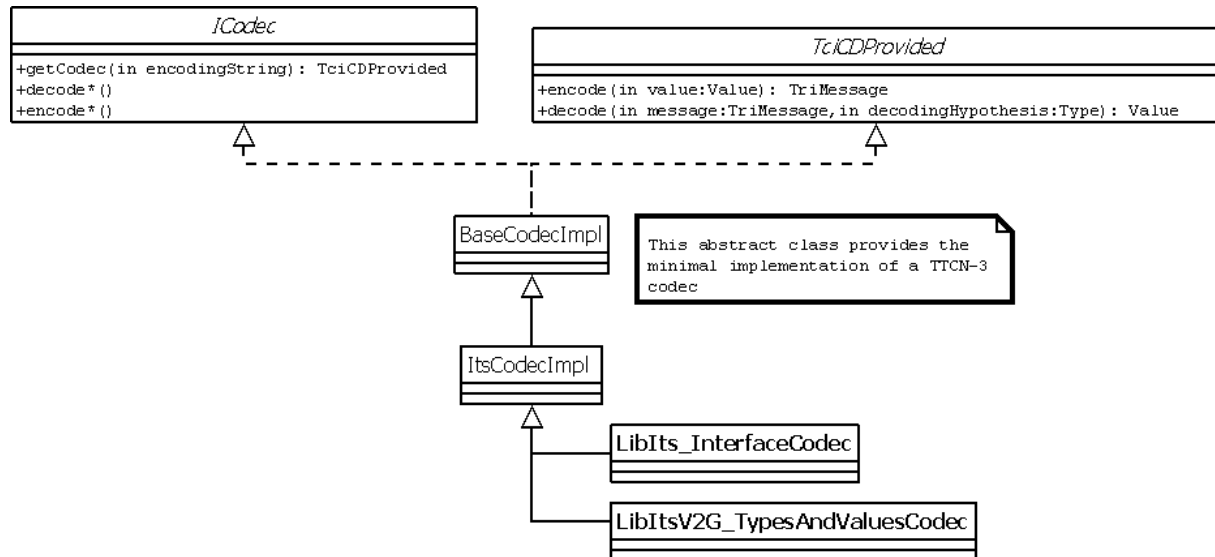
#### 4.3.1 Advanced details

The figure below gives an overview of the relations between the different java classes implementing the codec. The structure is relatively simple. Connection with the tool-

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<sup>1</sup> <http://exifcient.sourceforge.net>

dependent classes is realized through the ICodec interface and is not depicted in this figure.



**Figure 18. Relationship between CODECS java classes**

Each codec implements the standard TCI interface TciCDProvided as described in [6]. In addition, codecs have to implement the ICodec interface, which provides a tool-independent instantiation of an API to TTCN-3 tools.

The BaseCodecImpl class implements the minimal functionalities of a codec and is used as a base class for further codec development. For extensibility purpose, this class is not ITS-specific, and it can be used as-is in other platform projects.

The ItsCodecImpl class directly extends BaseCodecImpl and provides ITS common codec functionalities. Each PowerUp codec derives from this class.

#### 4.4 Test Adapter

The test adapter is conceptually splits into three parts:

- a lower test adapter
- a TTCN-3 platform adapter implementing timers
- an upper test adapter

#### **4.4.1 Lower Tester**

TTCN-3 test suites are usually focussed on a single protocol layer and designed to be executed against real implementations (IUT). However, it is unusual to find standalone implementations as they are commonly integrated as an internal component of a physical device (SUT).

The purpose of a lower test adapter is to prepare and adapt the protocol messages used by TTCN-3 test suites so that they can be transmitted successfully to the SUT. One way to achieve this goal is, for example, to implement lower layers and encapsulate protocol messages accordingly. For instance, SDP messages need to be encapsulated in UDP datagrams. The higher up the IUT is located in the OSI stack, the more complex the test adapter.

For PowerUp, and in the field of conformance testing, SDP messages shall be transferred using UDP/IPv6 datagrams and V2G application layer messages shall be transferred over a TCP/IPv6 connection. To achieve this purpose, the Test Adapter has been implemented as follows:

- If Test System is acting as a SECC:
  - o Handling of SDP messages:
    - Join IPv6 multicast group "all-nodes multicast" (FF02::1)
    - Open a UDP socket for incoming datagrams on well-known port 15118 and wait for messages
    - Send all outgoing SDP messages to the SUT using link-local address or global address of Test System, depending on SUT's first message.
    - Transfer received message on this socket to Test Management
  - o Handling of V2G application layer messages:
    - Open TCP socket using port and address specified in TTCN-3 module parameters `PXT_SECC_IP_ADDRESS` and `PXT_SECC_PORT`
    - Wait for incoming connection requests
    - Send outgoing V2G messages using pre-established connection



- Transfer received message on this socket to Test Management
- If Test System is acting as EVCC:
  - Handling of SDP messages:
    - Send first SDP message to IPv6 "all-nodes-multicast" address (FF02::1) on well-known UDP port 15118
    - Record SUT's address on its first response
    - Send following SDP messages to SUT's address
    - Transfer received message on this socket to Test Management
  - Handle V2G application layer messages:
    - Initiate TCP/IPv6 connection using port and address specified in TTCN-3 module parameters PXT\_SECC\_IP\_ADDRESS and PXT\_SECC\_PORT
    - Send outgoing V2G messages using this connection
    - Transfer received message on this socket to Test Management

All connections and communication sockets are closed after execution of each test case.

#### ***4.4.2 Platform Adapter***

All TTCN-3 commercial tools provide generic Platform Adapter implementations for managing TTCN-3 timers. These implementations are well tested and usually accurate enough for most uses. In the case of PowerUp protocols, the protocol timer value is in the order of thousands of milliseconds. This can be handled well with the built in test system timers. As a consequence no specific development is required for this component.

#### ***4.4.3 Upper Tester***

The upper tester is used to interact with the upper interface of the implementation under test (IUT). It is typically used for:

- Initializing SUT
- Triggering events in SUT
- Triggering messages

All Upper Tester primitives are implemented within the upperTesterPort module.

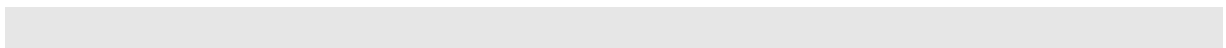
## 5. CONCLUSIONS

This deliverable contains the conformance test specifications for ISO/IEC15118-2 standard which have been developed by following the ISO 9646 testing methodology and ETSI recommendations.

These conformance test specifications consist of three parts:

- 1) Protocol Information Conformance Statements (PICS) which permits a supplier to provide information about their products or implementations.
- 2) Test Suite Structure and Test Purposes (TSS&TP) which provides in a structured manner a short description of each test objective. Around 150 test purposes have been written.
- 3) Abstract Test Suite (ATS) which provides a collection of test cases or scripts which implement the test purposes. These tests have been written by using TTCN-3, an international and standardized testing technology specifically designed for testing and certification.

In addition, the V2G conformance test platform has been developed in order to provide reliable test scripts. After test scripts validation, the conformance test platform may be used to run the conformance tests against V2G implementations so that vendors can assess the level of compliance of their equipments. Further use of the conformance test platform might be certification and in-house testing purposes.



## REFERENCES

- [1] ISO/IEC CD 15118-2 Road vehicles — Vehicle-to-Grid Communication Interface — Part 2.
- [2] PowerUp Delivery 4.1: V2G Interface specifications between the electric vehicle, the local smart meter, and ITS service providers (2012-06).
- [3] PowerUp Delivery 6.2: V2G Interoperability testing framework (2012-12).
- [4] ETSI EG 202 798: Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing (2011-01).
- [5] PowerUp Delivery 5.1: Automotive prototyping of V2G adapters (2012-12).
- [6] ETSI ES 201 873-6 4.4.1 TTCN-3: TTCN-3 Control Interface
- [7] PowerUp Delivery 3.2: Final V2G Architecture (2012-09).

## ANNEX A: PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENTS (PICS)

### A.1 V2G Entity Role

Table A.1: V2G Entity Role

Item	Role	Reference	Status	Mnemonic	Support
1	EVCC	1	o.101	PICS_EVCC	
2	SECC	1	o.101	PICS_SECC	

o.101: It is mandatory to support at least one of these roles.

### A.2 Charging Mode

Table A.2: Charging Modes

Item	Mode	Reference	Status	Mnemonic	Support
1	AC	8.5.3	o.201	PICS_AC	
2	DC	8.5.4	o.201	PICS_DC	

o.201: It is mandatory to support at least one of these modes.

### A.3 Identification Mode

Table A.3: Identification Modes

Item	Mode	Reference	Status	Mnemonic	Support
3	EIM	8.6	o.302	PICS_EIM	
4	PnC	8.6	o.302	PICS_PnC	

o.301: It is mandatory to support at least one of these modes.

### A.4 Optional Sets

Table A.4: Optional Sets

Item	Set	Reference	Status	Mnemonic	Support
1	Value Added Service	8.6	o	PICS_VAS	
2	Certification Update	8.6	c.401	PICS_CU	
3	Certification Installation	8.6	c.402	PICS_CI	

c.401: IF PICS\_PnC THEN o ELSE n/a

c.402: IF PICS\_PnC THEN o ELSE n/a

## ***A.5 Protocol Stack***

Table A.5: Protocol Stack

Item	Protocol	Reference	Status	Mnemonic	Support
1	Application Layer Messages and Handshake	8	m	PICS_ALM	
2	SDP	7.10	m	PICS_SDP	
3	EXI	7.9	m	PICS_EXI	
4	V2GTP	7.8	m	PICS_V2GTP	
4	TLS	7.7	c.501	PICS_TLS	
5	TCP	7.7	m	PICS_TCP	
6	UDP	7.7	m	PICS_UDP	
7	IPv6	7.6.2.1	m	PICS_IPv6	
8	ICMPv6	7.6.2.4	m	PICS_ICMPv6	
9	SLAAC	7.6.3.2	m	PICS_SLAAC	

c.501: IF (PICS\_EVCC AND PICS\_EIM AND NOT PICS\_VAS) THEN o ELSE m

## ***A.6 SECC Discovery Protocol (SDP)***

Table A.6.1: SDP role

Item	Name	Reference	Status	Mnemonic	Support
1	Client	7.10.1	c.601	PICS_SDP_cli	
2	Server	7.10.1	c.602	PICS_SDP_srv	

c.601: IF PICS\_EVCC THEN m ELSE n/a

c.602: IF PICS\_SECC THEN m ELSE n/a

Table A.6.1: SDP PDU

Item	Name	Reference	Status	Mnemonic	Support
1	SECC Discovery Request	7.10.1.4	m	PICS_SECC_Dis_Req	
2	SECC Discovery Response	7.10.1.5	m	PICS_SECC_Dis_Res	

Table A.6.2: SDP Features

	Page 45 of 172
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Item	Name	Reference	Status	Mnemonic	Support
1	Retransmission Handling	7.10.1.6	c.801	PICS_SECC_Dis_rtx	
2	Security Negotiation for Transport Protocol	7.10.1.7	m	PICS_SECC_Dis_sec	

c.801: IF PICS\_EVCC THEN m ELSE n/a

## A.7 V2G Application Layer Protocol Handshake

Table A.7.1: Application Protocol Handshake messages

Item	Name	Reference	Status	Mnemonic	Support
1	supportedAppProtocolReq	8.2.2	m	PICS_sAPReq	
2	supportedAppProtocolRes	8.2.2	m	PICS_sAPRes	

Table A.7.2: Handshake features and error handling

Item	Name	Reference	Status	Mnemonic	Support
1	Protocol selection	8.2.2	c.Hiba! A hivatkozási forrás nem található.01	PICS_ProtSel	
2	Minor protocol version deviation	8.2.2	m	PICS_MinorProtVDev	
3	No protocol agreement	8.2.2	m	PICS_NProtAgr	

c.801.01: IF PICS\_SECC THEN m ELSE n/a

## A.8 V2G Application Layer Messages

Table A.8: V2G Application Layer Features

Item	Feature	Reference	Status	Mnemonic	Support
1	Session Setup	8.4.1.2.2	m	PICS_SSE	
2	Service Discovery	8.4.1.3.2	m	PICS_SDI	
3	Service Detail	8.4.1.4.2	c.1101	PICS_SDE	
4	Service and Payment Selection	8.4.1.5.2	m	PICS_SPS	
5	Payment Details	8.4.1.6.2	c.1102	PICS_PDT	
6	Contract Authentication	8.4.1.7.2	m	PICS_CA	
7	Charge Parameter Discovery	8.4.1.8.2	m	PICS_CPD	

8	Power Delivery	8.4.1.9.2	m	PICS_PWD	
9	Certificate Update	8.4.1.10.2	c.1103	PICS_CU	
10	Certificate Installation	8.4.1.11.2	c.1104	PICS_CI	
11	Session Stop	8.4.1.12.2	m	PICS_SST	
12	Charging Status	8.4.2.2.2	c.1105	PICS_CHS	
13	Metering Receipt	8.4.2.3.2	c.1106	PICS_MR	
14	Cable Check	8.4.3.2.2	c.1107	PICS_CCK	
15	Pre Charging	8.4.3.3.2	c.1108	PICS_PCH	
16	Current Demand	8.4.3.4.2	c.1109	PICS_CD	
17	Welding detection	8.4.3.5.2	c.1110	PICS_WD	

c.1101: IF PICS\_VAS OR PICS\_CU OR PICS\_CI THEN m ELSE n/a

c.1102: IF PICS\_PnC THEN m ELSE n/a

c.1103: IF PICS\_CU THEN m ELSE n/a

c.1104: IF PICS\_CI THEN m ELSE n/a

c.1105: IF PICS\_AC THEN m ELSE n/a

c.1106: IF PICS\_AC and PICS\_PnC THEN m ELSE n/a

c.1107: IF PICS\_DC THEN m ELSE n/a

c.1108: IF PICS\_DC THEN m ELSE n/a

c.1109: IF PICS\_DC THEN m ELSE n/a

c.1110: IF PICS\_DC THEN m ELSE n/a

## ANNEX B: TEST PURPOSES FOR EVCC

This annex shows the complete list of test purposes developed for the EVCC.

## B.1 SECC discovery

TP Id	TP/EVCC/SDP/CLI/BV/01
Test objective	Check that the IUT starts the discovery process when IP address is assigned.
Reference	ISO/IEC 15118-2, 7.10.1.4
Reference requirement	[V2G2-140], [V2G2-141], [V2G2-142], [V2G2-622], [V2G2-623], [V2G2-018]
Config Id	CF01
PICS Selection	
Initial conditions	
with{ the IUT having assigned an IP address }	
Expected behaviour	
ensure that { the IUT sends a <b>valid SECC Discovery Request</b> }	

TP Id	TP/EVCC/SDP/CLI/BV/02
Test objective	Checks SECC Discovery Request retransmissions interval
Reference	ISO/IEC 15118-2, 7.10.1.6
Reference requirement	[V2G2-159], [V2G2-160]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT having sent a <b>valid SECC Discovery Request</b> }	
Expected behaviour	
ensure that { when { the IUT does not receive a SECC Discovery Response } then { the IUT retransmits a <b>valid SECC Discovery Request</b> after 250 ms } }	



TP Id	TP/EVCC/SDP/CLI/BV/03
Test objective	Check the SECC Discovery Request maximum number of retransmissions
Reference	ISO/IEC 15118-2, 7.10.1.6
Reference requirement	[V2G2-160], [V2G2-161]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT having sent a <b>valid SECC Discovery Request</b> }	
Expected behaviour	
ensure that { when { the IUT does not receive a <b>valid SECC Discovery Response</b> } then { the IUT retransmits a <b>valid SECC Discovery Request</b> 4 times } }	

TP Id	TP/EVCC/SDP/CLI/BV/04
Test objective	Check SECC Discovery Request security encoding validity with TLS selected
Reference	ISO/IEC 15118-2, 7.10.1.6
Reference requirement	[V2G2-623]
Config Id	CF01
PICS Selection	PICS_TLS
Initial conditions	
with { the IUT having assigned an IP address and the IUT supporting TLS and intending to use it }	
Expected behaviour	
ensure that { the IUT sends a <b>valid SECC Discovery Request</b> containing Security Encoding field indicating value "0x00" containing Transport Protocol field indicating value "0x00" }	

TP Id	TP/EVCC/SDP/CLI/BV/05
Test objective	Check SECC Discovery Request security encoding validity with TLS not selected
Reference	ISO/IEC 15118-2, 7.10.1.6
Reference requirement	<b>[V2G2-623]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT not supporting TLS or not intending to use it }	
Expected behaviour	
ensure that { the IUT sends a <b>valid SECC Discovery Request</b> containing Security Encoding field indicating value "0x10" containing Transport Protocol field indicating value "0x00" }	

TP Id	TP/EVCC/SDP/CLI/BO/01
Test objective	Check that the IUT does not reply to SECC Discovery Request
Reference	ISO/IEC 15118-2, 7.10.1.5
Reference requirement	<b>[V2G2-145]</b>
Config Id	CF03
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT having sent a <b>valid SECC Discovery Request</b> and the IUT not having received a <b>valid SECC Discovery Response</b> }	
Expected behaviour	
ensure that { when { the EvccNodeA sends a SECC Discovery Request with the IUT UDP destination port } then { the IUT does not reply the received SECC Discovery Request } }	

## B.2 Application layer messages

### B.2.1. Handshake Protocol

<b>TP Id</b>	TP/EVCC/ALM/HP/BV/01
<b>Test objective</b>	Checks SupportedApp Request message is sent after receiving SECC Discovery Response message
<b>Reference</b>	ISO/IEC 15118-DIS-2, section 8.2.1, 8.2.2, 8.4.2
Reference requirement	[V2G2-165], [V2G2-166], [V2G2-167], [V2G2-175], [V2G2-178], [V2G2-483]
<b>Config Id</b>	CF01
<b>PICS Selection</b>	
<b>Initial conditions</b>	
with { the IUT having sent SECC Discovery Request message }	
<b>Expected behaviour</b>	
ensure that { when { the IUT receives the SECC Discovery Response message } then { the IUT sends a SupportedApp Request message containing at least a charging protocol element containing ProtocolNamespace containing VersionNumberMajor containing VersionNumberMinor containing SchemaID containing Priority before V2G_EVCC_Sequence_Performance_Time expires } }	

<b>TP Id</b>	TP/EVCC/ALM/HP/BV/02
<b>Test objective</b>	Check that the IUT does not initiate a session if a SupportedApp Response message contains a 'Failed_NoNegotiation' Response Code
<b>Reference</b>	ISO/IEC 15118-DIS-2 section 8.2.2
Reference requirement	[V2G2-173], [V2G2-175], [V2G2-178], [V2G2-484]
<b>Config Id</b>	CF01
<b>PICS Selection</b>	
<b>Initial conditions</b>	
with { the IUT having sent SupportedApp Request message }	
<b>Expected behaviour</b>	
ensure that { when { the IUT receives a SupportedApp Response containing Response Code field indicating value 'Failed_NoNegotiation'. } then { the IUT does not initiate a session } }	

### B.2.2 Session Setup

TP Id	TP/EVCC/ALM/SSE/BV/01
Test objective	Check that Session Setup Request message is sent after receiving SupportedAppProtocol Response message
Reference	ISO/IEC 15118-DIS-2, section 8.4.1.2.1, 8.4.1.2.2, 8.8.4.2.1,
Reference requirement	[V2G2-184], [V2G2-186], [V2G2-188]. [V2G2-189], [V2G2-485]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent SupportedAppProtocol Request message }	
Expected behaviour	
ensure that { when { the IUT receives the SupportedAppProtocol Response message containing ResponseCode field indicating value 'OK_SuccessfullNegotiation' } then { the IUT sends a Session Setup Request message containing a <b>valid Header</b> containing a Body containing EVCCID field before V2G_EVCC_Sequence_Performance_Time expires }}	

TP Id	TP/EVCC/ALM/SSE/BV/02
Test objective	Check that the IUT closes session if a Session Setup Response message containing a 'FAILED' type Response Code
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.2.1. 8.8.3.1
Reference requirement	[V2G2-486],
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Session Setup Response containing Response Code field indicating value 'FAILED'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SSE/BV/03
Test objective	Checks that the IUT closes session if a Session Setup Response message containing a 'FAILED_SequenceError' type Response Code is received
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.2.1. 8.8.3.1
Reference requirement	[ [V2G2-486]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Session Setup Response containing Response Code field indicating value 'FAILED_SequenceError'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SSE/BV/04
Test objective	Check that the IUT closes session if a Session Setup Response message containing a 'FAILED_SignatureError' type Response Code is received
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.2.1. 8.8.3.1
Reference requirement	[V2G2-486]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Session Setup Response containing Response Code field indicating value 'FAILED_SignatureError'. } then { the IUT sends a Session Stop Request message } }	

### B.2.3 Service Discovery

TP Id	TP/EVCC/ALM/SDI/BV/01
Test objective	Check that Service Discovery Request message is sent after receiving Session Setup Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.3.2, 8.8.4.2.1
Reference requirement	[V2G2-193], [V2G2-194], [V2G2-487]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Session Setup Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service Discovery Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SDI/BV/02
Test objective	Check that the IUT stops session if a Service Discovery Response message containing a 'FAILED' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-488]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Discovery Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDI/BV/03
Test objective	Check that the IUT stops session if a Service Discovery Response message containing a 'FAILED_SequenceError' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-488]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Discovery Response message containing Response Code field indicating value 'FAILED_SequenceError' } then { the IUT stops the V2G Communication Session } }	



TP Id	TP/EVCC/ALM/SDI/BV/04
Test objective	Check that the IUT stops session if a Service Discovery Response message containing a 'FAILED_SignatureError' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-488]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Discovery Response message containing Response Code field indicating value 'FAILED_SignatureError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDI/BV/05
Test objective	Check that the IUT stops session if a Service Discovery Response message containing a 'FAILED_UnknownSession' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	[V2G2-488]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Discovery Response message containing Response Code field indicating value 'FAILED_UnknownSession' } then { the IUT stops the V2G Communication Session } }	

#### B.2.4 Service Details

TP Id	TP/EVCC/ALM/SDE/BV/01
Test objective	Check that Service Details Request message is sent after receiving Service Discovery Response message offering a Service List
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.4.1, 8.8.4.2.1
Reference requirement	[V2G2-197], [V2G2-198], [V2G2-489]
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Discovery Response message containing ResponseCode field indicating value 'OK' containing ServiceList field } then { the IUT sends a Service Details Request message containing a <b>valid Header</b> containing a Body containing ServiceID field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SDE/BV/02
Test objective	Check that Service Details Request message is sent after receiving Service Detail Response message when further detailed information is required
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.4.1, 8.8.4.2.1
Reference requirement	<b>[V2G2-197], [V2G2-198], [V2G2-494]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Details Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service Details Request message containing a <b>valid Header</b> containing a Body containing ServiceID field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SDE/BV/03
Test objective	Check that the IUT stops session if a Service Detail Response message containing a 'FAILED'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-491]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Detail Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Detail Response message containing Response Code field indicating value ' <b>FAILED</b> ' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDE/BV/04
Test objective	Check that the IUT stops session if a Service Detail Response message containing a 'FAILED_SequenceError'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-491]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Detail Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Detail Response message containing Response Code field indicating value 'FAILED_SequenceError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDE/BV/05
Test objective	Check that the IUT stops session if a Service Detail Response message containing a 'FAILED_SignatureError'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-491]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Detail Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Detail Response message containing Response Code field indicating value 'FAILED_SignatureError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDE/BV/06
Test objective	Check that the IUT stops session if a Service Detail Response message containing a 'FAILED_UnknownSession'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-491]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Detail Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Detail Response message containing Response Code field indicating value 'FAILED_UnknownSession' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SDE/BV/07
Test objective	Check that the IUT stops session if a Service Detail Response message containing a 'FAILED_ServiceIDInvalid' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-491]</b>
Config Id	CF01
PICS Selection	PICS_SDE and (PICS_VAS or PICS_CI or PICS_CU)
Initial conditions	
with { the IUT having sent Service Detail Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service Detail Response message containing Response Code field indicating value 'FAILED_ServiceIDInvalid' } then { the IUT stops the V2G Communication Session } }	

### B.2.5 Service and Payment Selection

TP Id	TP/EVCC/ALM/SPS/BV/01
Test objective	Checks Service and Payment Selection Request message is sent after receiving Service Details Response message in PnC identification mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.5.2, 8.6.3.6, 8.8.4.2.1, 8.6.3.2
Reference requirement	[V2G2-201], [V2G2-202], [V2G2-431], [V2G2-432], [V2G2-493], [V2G2-404]
Config Id	CF01
PICS Selection	PICS_SDE and PICS_PnC
Initial conditions	
with { the IUT having sent Service Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Details Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service and Payment selection Request message containing a <b>valid Header</b> containing a Body containing Selected ServiceList containing ServiceID field containing Selected PaymentOption field indicating value 'contract' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SPS/BV/02
Test objective	Checks Service and Payment Selection Request message is sent after receiving Service Details Response message in EIM identification mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.5.2, 8.6.3.6, 8.8.4.2.1, 8.6.3.2
Reference requirement	[V2G2-201], [V2G2-202], [V2G2-431], [V2G2-432], [V2G2-493], [V2G2-402], [V2G2-403]
Config Id	CF01
PICS Selection	PICS_SDE and PICS_EIM
Initial conditions	
with { the IUT having sent Service Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Details Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service and Payment selection Request message containing a <b>valid Header</b> containing a Body containing Selected ServiceList field containing ServiceID field containing Selected PaymentOption field indicating value 'External Payment' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SPS/BV/03
Test objective	Check that Service and Payment Selection Request message is sent after receiving Service Discovery Response message in PnC identification mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.5.2, 8.6.3.6, 8.8.4.2.1, 8.6.3.2
Reference requirement	<b>V2G2-201</b> , <b>[V2G2-202]</b> , <b>[V2G2-431]</b> , <b>[V2G2-432]</b> , <b>[V2G2-490]</b> , <b>[V2G2-404]</b>
Config Id	CF01
PICS Selection	PICS_PnC
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Discovery Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service and Payment selection Request message containing a <b>valid Header</b> containing a Body containing Selected ServiceList field containing Selected PaymentOption field indicating value 'contract' before V2G_EVCC_Sequence_Performance_Time expires } }	



TP Id	TP/EVCC/ALM/SPS/BV/04
Test objective	Check that Service and Payment Selection Request message is sent after receiving Service Discovery Response message in EIM identification mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.5.2, 8.6.3.6, 8.8.4.2.1, 8.6.3.2
Reference requirement	<b>V2G2-201</b> , <b>V2G2-202</b> , <b>V2G2-431</b> , <b>V2G2-432</b> , <b>V2G2-490</b> , <b>V2G2-402</b> , <b>V2G2-403</b> ,
Config Id	CF01
PICS Selection	PICS_EIM
Initial conditions	
with { the IUT having sent Service Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Service Discovery Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Service and Payment selection Request message containing a <b>valid Header</b> containing a Body containing Selected ServiceList field containing Selected PaymentOption field indicating value 'External Payment' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SPS/BV/05
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a ' <b>FAILED</b> '-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>V2G2-492</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value ' <b>FAILED</b> ' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SPS/BV/06
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a 'FAILED_SequenceError'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-492]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value 'FAILED_SequenceError' } then { the IUT sends a Session Stop Request message } }	

TP Id	TP/EVCC/ALM/SPS/BV/07
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a 'FAILED_SignatureError'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-492]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value 'FAILED_SignatureError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SPS/BV/08
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a 'FAILED_UnknownSession'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-492]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value 'FAILED_UnknownSession' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SPS/BV/09
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a 'FAILED_ServiceSelectionInvalid'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-492]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value 'FAILED_ServiceSelectionInvalid'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/SPS/BV/10
Test objective	Check that the IUT stops session if a Service and Payment Selection Response message containing a 'FAILED_PaymentSelectionInvalid'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-492]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Service and Payment Selection Response message containing Response Code field indicating value 'FAILED_PaymentSelection Invalid'. } then { the IUT stops the V2G Communication Session } }	

### B.2.6 Certificate Update

TP Id	TP/EVCC/ALM/CU/BV/01
Test objective	Check that Certificate update Request message is sent after receiving Service and Payment Selection Response message containing Response Code indicating value 'OK'
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.10.2, 8.8.4.2.1
Reference requirement	[V2G2-228], [V2G2-229], [V2G2-497]
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { <div style="margin-left: 40px;">the IUT having sent Service and Payment Request message containing SelectedServiceList containing SelectedService field containing Service ID field indicating value ' 2'</div> (Certificate Update/install) }	
Expected behaviour	
ensure that { <div style="margin-left: 40px;">when { <div style="margin-left: 40px;">the IUT receives the Service and Payment Selection Response message containing ResponseCode field indicating value 'OK'</div> } then { <div style="margin-left: 40px;">the IUT sends a Certificate update Request message containing a <b>valid Header</b> containing a Body containing Contract_id containing ChallengeSignature containing ListOfRootCertificateIDs containing RootCertificateID before V2G_EVCC_Sequence_Performance_Time expires</div> } } </div>	

TP Id	TP/EVCC/ALM/CU/BV/02
Test objective	Check that the IUT closes session if a Certificate Update Response message containing a ' <b>FAILED</b> '-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-555]</b>
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Update Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CU/BV/03
Test objective	Check that the IUT closes session if a Certificate Update Response message containing a 'FAILED_CertChainError' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-555]</b>
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Update Response message containing Response Code field indicating value 'FAILED_CertChainError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CU/BV/04
Test objective	Check that the IUT closes session if a Certificate Update Response message containing a 'FAILED_NoCertificateAvailable' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-555]</b>
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Update Response message containing Response Code field indicating value 'FAILED_NoCertificateAvailable'  then { the IUT stops the V2G Communication Session  } }	

TP Id	TP/EVCC/ALM/CU/BV/05
Test objective	Check that the IUT closes session if a Certificate Update Response message containing a 'FAILED_ContractCanceled' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-555]</b>
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Update Response message containing Response Code field indicating value 'FAILED_ContractCanceled' } then { the IUT stops the V2G Communication Session  } }	

TP Id	TP/EVCC/ALM/CU/BV/06
Test objective	Check that the IUT closes session if a Certificate Update Response message containing a 'FAILED_CertificateExpired' -type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-555]</b>
Config Id	CF01
PICS Selection	PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Update Response message containing Response Code field indicating value 'FAILED_CertificateExpired' } then { the IUT stops the Communication Session } }	

### ***B.2.7 Certificate Installation***

TP Id	TP/EVCC/ALM/CI/BV/01
Test objective	Check that Certificate Install Request message is sent after receiving Service and Payment Selection Response message containing Response Code indicating value 'OK'
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.11.2, 8.8.4.2.1
Reference requirement	<b>[V2G2-235], [V2G2-236], [V2G2-496]</b>
Config Id	CF01
PICS Selection	PICS_CI and PICS_PnC
Initial conditions	
with { the IUT having sent Service and Payment Request message containing SelectedServiceList containing SelectedService field containing Service ID field indicating value ' 2' (Certificate Update/install) }	
Expected behaviour	
ensure that { when { the IUT receives the Service and Payment selection Res message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Certificate install Request message containing a <b>valid Header</b> containing a Body } }	



```

        containing OEMProvisioningCert
        containing ListOfRootCertificateIDs
    before V2G_EVCC_Sequence_Performance_Time expires
    }
}

```

TP Id	TP/EVCC/ALM/CI/BV/02
Test objective	Check that the IUT stops session if a Certificate Install Response message containing a <b>'FAILED'</b> Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-498]</b>
Config Id	CF01
PICS Selection	PICS_CI and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Install Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Install Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CI/BV/03
Test objective	Check that the IUT closes session if a Certificate Install Response message containing a 'FAILED_NoCertificateAvailable' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-498]</b>
Config Id	CF01
PICS Selection	PICS_CI and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Install Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Install Response message containing Response Code field indicating value 'FAILED_NoCertificateAvailable' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CI/BV/04
Test objective	Check that the IUT closes session if a Certificate Install Response message containing a 'FAILED_CertificateExpired' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-498]</b>
Config Id	CF01
PICS Selection	PICS_CI and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Install Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Certificate Install Response message containing Response Code field indicating value 'FAILED_CertificateExpired' } then { the IUT stops the V2G Communication Session } }	

### ***B.2.8 Payment Details***

TP Id	TP/EVCC/ALM/PDT/BV/01
Test objective	Check that Payment Details Request message is sent after receiving Service and Payment Selection Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.6.2, 8.8.4.2.1
Reference requirement	[V2G2-205], [V2G2-206], [V2G2-495]
Config Id	CF01
PICS Selection	PICS_PDT and PICS_PnC
Initial conditions	
with { the IUT having sent Service and Payment selection Request message containing PaymentOption indicating value 'contract' }	
Expected behaviour	
ensure that { when { the IUT receives the Service and Payment Selection Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Payment Details Request message containing a <b>valid Header</b> containing a Body containing ContractID field containing ContractSignatureCertChain field containing Certificate containing SubCertificates containing Certificate before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PDT/BV/02
Test objective	Check that Payment Details Request message is sent after receiving Certificate Installation Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.6.2, 8.8.4.2.1
Reference requirement	[V2G2-205], [V2G2-206], [V2G2-500]
Config Id	CF01
PICS Selection	PICS_PDT and PICS_CI and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Installation Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Certificate installation Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Payment Details Request message containing a <b>valid Header</b> containing a Body containing ContractID field containing ContractSignatureCertChain field containing Certificate containing SubCertificates containing Certificate before V2G_EVCC_Sequence_Performance_Time expires } }	

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TP Id	TP/EVCC/ALM/PDT/BV/03
Test objective	Check that Payment Details Request message is sent after receiving Certificate Update Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.6.2, 8.8.4.2.1
Reference requirement	[V2G2-205], [V2G2-206], [V2G2-501]
Config Id	CF01
PICS Selection	PICS_PDT and PICS_CU and PICS_PnC
Initial conditions	
with { the IUT having sent Certificate Update Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Certificate Update Res message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Payment Details Request message containing a <b>valid Header</b> containing a Body containing ContractID field containing ContractSignatureCertChain field containing Certificate containing SubCertificates containing Certificate before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PDT/BV/04
Test objective	Check that the IUT stops session if a Payment Details Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-502]</b>
Config Id	CF01
PICS Selection	PICS_PDT and PICS_PnC
Initial conditions	
with { the IUT having sent Payment Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Payment Details Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/PDT/BV/05
Test objective	Check that the IUT stops session if a Payment Details Response message containing a 'FAILED_CertificateExpired'-type Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-502]</b>
Config Id	CF01
PICS Selection	PICS_PDT and PICS_PnC
Initial conditions	
with { the IUT having sent Payment Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Payment Details Response message containing Response Code field indicating value 'FAILED_CertificateExpired'. } then { the IUT stops the V2G Communication Session } }	

### B.2.9 Contract Authentication

TP Id	TP/EVCC/ALM/CA/BV/01
Test objective	Check that Contract Authentication Request message is sent after receiving Payment Details Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.7.1, 8.8.4.2.1
Reference requirement	[V2G2-210], [V2G2-211], [V2G2-503]
Config Id	CF01
PICS Selection	PICS_PDT and PICS_PnC
Initial conditions	
with { the IUT having sent Payment Details Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Payment Details Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Contract Authentication Request message containing a <b>valid Header</b> containing a Body containing ID field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CA/BV/02
Test objective	Check that Contract Authentication Request message is sent after receiving Service and Payment Selection Response message (External payment case)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.7.1, 8.8.4.2.1
Reference requirement	[V2G2-210], [V2G2-211], [V2G2-509]
Config Id	CF01
PICS Selection	PICS_EIM
Initial conditions	
with { the IUT having sent Service and Payment Request message containing SelectedPaymentOption field indicating value 'External Payment' }	
Expected behaviour	
ensure that { when { the IUT receives the Service and Payment selection message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Contract Authentication Request message containing a <b>valid Header</b> containing a Body containing ID field before V2G_EVCC_Sequence_Performance_Time expires } }	



TP Id	TP/EVCC/ALM/CA/BV/03
Test objective	Check that Contract Authentication Request message is sent after receiving Contract Authentication Response message when the parameter EVSEProcessing is equal to 'Ongoing'
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.7.1, 8.8.4.2.1
Reference requirement	[V2G2-210], [V2G2-211], [V2G2-684]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Contract Authentication Resoponse message containing ResponseCode field indicating value 'OK' containing EVSEProcessing field indicating value 'Ongoing' } then { the IUT sends a Contract Authentication Request message containing a <b>valid Header</b> containing a Body containing ID field before V2G_EVCC_Sequence_Perfomance_Time expires } }	

TP Id	TP/EVCC/ALM/CA/BV/04
Test objective	Check that the IUT stops session if a Contract Authentication Response message containing a 'FAILED_ChallengeInvalid' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	[V2G2-504]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Contract Authentication Response message containing ResponseCode field indicating value 'FAILED_ChallengeInvalid' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CA/BV/05
Test objective	Check that the IUT stops session if a Contract Authentication Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-504]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Contract Authentication Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CA/BV/06
Test objective	Check that the IUT stops session if a Contract Authentication Response message containing a 'FAILED_SequenceError' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-504]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Contract Authentication Response message containing Response Code field indicating value 'FAILED_SequenceError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CA/BV/07
Test objective	Check that the IUT stops session if a Contract Authentication Response message containing a 'FAILED_SignatureError' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-504]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Contract Authentication Response message containing Response Code field indicating value 'FAILED_SignatureError' } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CA/BV/08
Test objective	Check that the IUT stops session if a Contract Authentication Response message containing a 'FAILED_UnknownSession' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	<b>[V2G2-504]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Contract Authentication Response message containing Response Code field indicating value 'FAILED_UnknownSession' } then { the IUT stops the V2G Communication Session } }	

### B.2.10 Charge parameter Discovery

TP Id	TP/EVCC/ALM/CPD/BV/01
Test objective	Check that Charge Parameter Discovery Request message is sent after receiving Contract Authentication Response message with parameter 'EVSEProcessing' set to 'Finished' in AC mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.2, 8.8.4.2.1
Reference requirement	[V2G2-214], [V2G2-216], [V2G2-217], [V2G2-505]
Config Id	CF01
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Contract Authentication Response message containing ResponseCode field indicating value 'OK' containing EVSEProcessing field indicating value 'Finished' } then { the IUT sends a Charge Parameter Discovery Request message containing a <b>valid Header</b> containing a Body containing EVRequestedEnergyType indicating value 'AC_three_phase_core' or 'AC_single_phase_core' containing AC_EVChargeParameter type containing Departure time indicating containing EAmount containing Multiplier field containing Value field containing PEVMaxVoltage containing Multiplier field containing Value field containing PEVMaxCurrent containing Multiplier field containing Value field containing PEVMinCurrent containing Multiplier field containing Value field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CPD/BV/02
Test objective	Check that Charge Parameter Discovery Request message is sent after receiving Contract Authentication Response message with parameter 'EVSEProcessing' set to 'Finished' in DC mode
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.2, 8.8.4.2.1
Reference requirement	[V2G2-214], [V2G2-216], [V2G2-217], [V2G2-505]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Contract Authentication Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Contract Authentication Response message containing ResponseCode field indicating value 'OK' containing EVSEProcessing field indicating value 'Finished' } then { the IUT sends a Charge Parameter Discovery Request message containing a <b>valid Header</b> containing a Body containing EVRequestedEnergyType indicating value 'DC_core' or 'DC_extended' or 'DC_combo_core' or 'DC_unique' containing DC_EVChargeParameter type containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSSOC containing EVMaximumCurrentLimit containing Multiplier field containing Value field containing EVMaximumVoltageLimit containing Multiplier field containing Value field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CPD/BV/03
Test objective	Check that Charge Parameter Discovery Request message is resent after receiving Charge Parameter Discovery Response message (EVSEProcessing: ongoing)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.2, 8.8.4.2.1
Reference requirement	[V2G2-214], [V2G2-216], [V2G2-217], [V2G2- 685]
Config Id	CF01
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Charge Parameter Discovery Response message containing EVSEProcessing field indicating value 'Ongoing' } then { the IUT resends a Charge Parameter Discovery Request message containing a <b>valid Header</b> containing a Body containing EVRequestedEnergyType indicating value 'AC_three_phase_core' or 'AC_single_phase_core' containing AC_EVChargeParameter type containing Departure time indicating value 'Time in UTC' containing EAmount containing Multiplier field containing Value field containing PEVMaxVoltage containing Multiplier field containing Value field containing PEVMaxCurrent containing Multiplier field containing Value field containing PEVMinCurrent containing Multiplier field containing Value field  before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CPD/BV/04
Test objective	Check that the IUT stops session if a Charge Parameter Discovery Response message containing a ' <b>FAILED</b> ' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.3
Reference requirement	<b>[V2G2-506]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Charge Parameter Discovery Response message containing Response Code field indicating value 'FAILED'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CPD/BV/05
Test objective	Check that the IUT stops session if a Charge Parameter Discovery Response message containing a 'FAILED_WrongEnergyTransferType' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.3
Reference requirement	<b>[V2G2-506]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Charge Parameter Discovery Response message containing Response Code field indicating 'FAILED_WrongEnergyTransferType' . } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/CPD/BV/06
Test objective	Check that the IUT stops session if a Charge Parameter Discovery Response message containing a 'FAILED_WrongChargeParameter' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.8.3
Reference requirement	<b>[V2G2-506]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Charge Parameter Discovery Response message containing Response Code field indicating value 'FAILED_WrongChargeParameter'. } then { the IUT stops the V2G Communication Session } }	



### B.2.11 Power Delivery

TP Id	TP/EVCC/ALM/PWD/BV/01
Test objective	Check that Power Delivery Request message is sent after receiving Charge Parameter Discovery Response message with parameter 'EVSEProcessing' set to 'Finished'
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.2
Reference requirement	<b>[V2G2-221], [V2G2-222], [V2G2-510]</b>
Config Id	CF01
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Charge Parameter Discovery Response message containing ResponseCode field indicating value 'OK' containing EVSEProcessing field indicating value 'Finished' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'TRUE' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/02
Test objective	Check that Power delivery Request message is sent after receiving Charging status Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.2
Reference requirement	[V2G2-221], [V2G2-222], [V2G2-521]
Config Id	CF01
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charging status Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Charging Status Response message containing Receipt Required field indicating value 'FALSE' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'FALSE' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/03
Test objective	Check that Power delivery Request message is sent after receiving Metering Receipt Response message (stop charging case)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.2
Reference requirement	<b>[V2G2-221], [V2G2-222], [V2G2-519]</b>
Config Id	CF01
PICS Selection	PICS_AC and PICS_MR and PICS_PnC
Initial conditions	
with { the IUT having sent Metering Receipt Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Metering Receipt Response message containing AC_EVSEStatus containing EVSENotification indicating 'StopCharging' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'FALSE' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/04
Test objective	Check that Power delivery Request message is sent after receiving Metering Receipt Response message (scheduling renegotiation case)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.2
Reference requirement	<b>[V2G2-221], [V2G2-222], [V2G2-522]</b>
Config Id	CF01
PICS Selection	PICS_AC and PICS_MR and PICS_PnC
Initial conditions	
with { the IUT having sent Metering Receipt Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Metering Receipt Response message containing AC_EVSEStatus containing EVSENotification indicating 'ReNegotiation' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'FALSE' containing ChargeProfile field indicating 'renegotiation requested values' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/05
Test objective	Check that Power Delivery Request message is sent after receiving Pre charge Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.3
Reference requirement	[V2G2-221], [V2G2-222], [V2G2-528]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Pre charging Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Pre charge Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'TRUE' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/06
Test objective	Check that Power Delivery Request message is sent after receiving Current Demand Response message (stop charging case)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.2, 8.8.4.2.3
Reference requirement	<b>[V2G2-221], [V2G2-222], [V2G2-527]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Current Demand Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Current Demand Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Power Delivery Request message containing a <b>valid Header</b> containing a Body containing Ready to charge State field indicating value 'FALSE' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/PWD/BV/07
Test objective	Check that the IUT stops session if a Power Delivery Response message containing a ' <b>FAILED</b> ' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.3, 8.8.4.2.2
Reference requirement	<b>[V2G2-515]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Power Delivery Response message containing Response Code field indicating value ' <b>ALM_FAIL</b> '. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/PWD/BV/08
Test objective	Check that the IUT stops session if a Power Delivery Response message containing a 'FAILED_ChargingProfileInvalid' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.3, 8.8.4.2.2
Reference requirement	<b>[V2G2-515]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Power Delivery Response message containing Response Code field indicating value 'FAILED_ChargingProfileInvalid'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/PWD/BV/09
Test objective	Check that the IUT stops session if a Power Delivery Response message containing a 'FAILED_TariffSelectionInvalid' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.3, 8.8.4.2.2
Reference requirement	<b>[V2G2-515]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Power Delivery Response message containing Response Code field indicating value 'FAILED_TariffSelectionInvalid'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/PWD/BV/10
Test objective	Check that the IUT stops session if a Power Delivery Response message containing a 'FAILED_PowerDeliveryNotApplied' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.9.3, 8.8.4.2.2
Reference requirement	<b>[V2G2-515]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Power Delivery Response message containing Response Code field indicating value 'FAILED_PowerDeliveryNotApplied'. } then { the IUT stops the V2G Communication Session } }	

### ***B.2.12 Session Stop***

TP Id	TP/EVCC/ALM/SST/BV/01
Test objective	Check that Session Stop Request message is sent after receiving Power Delivery Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.12.2, 8.8.4.2.2, 8.8.4.2.3
Reference requirement	<b>[V2G2-239], [V2G2-520], [V2G2-619]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Power Delivery Request message containing ReadyToChargeState field indicating value 'FALSE' }	
Expected behaviour	
ensure that { when { the IUT receives the Power Delivery Response message containing Response Code field indicating value 'OK' } then { the IUT sends a Session Stop Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	



TP Id	TP/EVCC/ALM/SST/BV/02
Test objective	Check that Session Stop Request message is sent after receiving Welding Detection Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.1.12.2, 8.8.4.2.3
Reference requirement	[V2G2-239], [V2G2-535]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Welding Detection Request message containing EVReady field indicating value 'FALSE' }	
Expected behaviour	
ensure that { when { the IUT receives the Welding Detection Response message containing Response Code field indicating value 'OK' } then { the IUT sends a Session Stop Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/SST/BV/03
Test objective	Check that the IUT closes session if a Session Stop Response message containing a ' <b>FAILED</b> ' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.1
Reference requirement	[V2G2-507]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent Session Stop Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Session Stop Response message containing Response Code field indicating value ' <b>FAILED</b> '. } then { the IUT stops the V2G Communication Session } }	

### B.2.13 Charging status

TP Id	TP/EVCC/ALM/CHS/BV/01
Test objective	Check that Charging Status Request message is sent after receiving Power Delivery Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.2.2.2, 8.8.4.2.2
Reference requirement	[V2G2-242], [V2G2-514]
Config Id	CF01
PICS Selection	PICS_CHS and PICS_AC
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Power Delivery Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Charging status Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CHS/BV/02
Test objective	Check that Charging Status Request message is sent after receiving Charging Status Response message (charge loop)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.2.2.1, 8.8.4.2.2
Reference requirement	[V2G2-242], [V2G2-516]
Config Id	CF01
PICS Selection	PICS_CHS and PICS_AC
Initial conditions	
with { the IUT having sent Charging Status Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Charging Status Response message containing ResponseCode field indicating value 'OK' containing ReceiptRequired field indicating value 'FALSE' } then { the IUT sends a Charging status Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CHS/BV/03
Test objective	Check that Charging Status Request message is sent after receiving Metering Receipt Response message (charge continues)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.2.2.1, 8.8.4.2.2
Reference requirement	[V2G2-242], [V2G2-518]
Config Id	CF01
PICS Selection	PICS_CHS and PICS_MR and PICS_AC
Initial conditions	
with { the IUT having sent Metering Receipt Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Metering Receipt Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Charging status Request message containing a <b>valid Header</b> containing a Body before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CHS/BV/04
Test objective	Check that the IUT stops session if a Charging status Response message containing a 'ALM_FAIL' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.4.2.2.2
Reference requirement	<b>[V2G2-511]</b>
Config Id	CF01
PICS Selection	PICS_CHS and PICS_AC
Initial conditions	
with { the IUT having sent Charging status Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Charging status Response message containing Response Code field indicating value 'FAILED'.  then { the IUT stops the V2G Communication Session } }	

### B.2.14 Metering Receipt

TP Id	TP/EVCC/ALM/MR/BV/01
Test objective	Check that Metering Receipt Request message is sent after receiving Charging status Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.2.3.2, 8.8.4.2.2
Reference requirement	[V2G2-245], [V2G2-246], [V2G2-512]
Config Id	CF01
PICS Selection	PICS_MR and PICS_AC and PICS_PnC
Initial conditions	
with { the IUT having sent Charging status Request message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Charging Status Response message         containing ResponseCode field indicating value 'OK'         containing ReceiptRequired field indicating value 'TRUE'     }     then {         the IUT sends a Metering Receipt Request message         containing a <b>valid Header</b>         containing a Body         containing SessionID         containing Meterinfo         containing MeterID         containing MeterReading         containing Multiplier field         containing Value field         containing SigMeterReading         containing Meterstatus         containing TMeter         before V2G_EVCC_Sequence_Performance_Time expires     } } </pre>	

TP Id	TP/EVCC/ALM/MR/BV/02
Test objective	Check that the IUT stops session if a Metering Receipt Response message containing a 'FAILED_MeteringSignatureNotValid' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.2
Reference requirement	<b>[V2G2-517]</b>
Config Id	CF01
PICS Selection	PICS_MR and PICS_AC and PICS_PnC
Initial conditions	
with { the IUT having sent Metering receipt Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Metering Receipt Response message containing Response Code field indicating value a 'FAILED_MeteringSignatureNotValid'. } then { the IUT stops the V2G Communication Session } }	

TP Id	TP/EVCC/ALM/MR/BV/03
Test objective	Check that the IUT stops session if a Metering Receipt Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.2
Reference requirement	<b>[V2G2-517]</b>
Config Id	CF01
PICS Selection	PICS_MR and PICS_AC and PICS_PnC
Initial conditions	
with { the IUT having sent Metering Receipt Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Metering Receipt Response message containing Response Code field indicating value 'FAILED'.  then { the IUT stops the V2G Communication Session } }	

### B.2.15 Cable Check

TP Id	TP/EVCC/ALM/CCK/BV/01
Test objective	Check that Cable Check Request message is sent after receiving Charge Parameter Discovery Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.2.2, 8.8.4.2.3
Reference requirement	[V2G2-249], [V2G2-250], [V2G2-599]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Charge Parameter Discovery Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Cable Check Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSSOC before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CCK/BV/02
Test objective	Check that Cable Check Request message is resent after receiving Cable Check Response message (SECC needs extra time for request processing)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.2.2, 8.8.4.2.3
Reference requirement	[V2G2-249], [V2G2-250], [V2G2-617]
Config Id	CF01
PICS Selection	PICS_EVCC
Initial conditions	
with { the IUT having sent Cable Check Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Cable Check Response message containing ResponseCode field indicating value 'OK' containing EVSEProcessing field incating value 'Ongoing' } then { the IUT resends a Cable Check Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSSOC before V2G_EVCC_Sequence_Performance_Time expires } }	



TP Id	TP/EVCC/ALM/CCK/BV/03
Test objective	Check that the IUT stops session if a Cable Check Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.3
Reference requirement	<b>[V2G2-524]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Cable Check Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Cable Check Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

### B.2.16 Pre Charge

TP Id	TP/EVCC/ALM/PCH/BV/01
Test objective	Check that Pre Charge Request message is sent after receiving Cable Check Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.3.2, 8.8.4.2.3
Reference requirement	[V2G2-253], [V2G2-254], [V2G2-525]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Cable Check Request message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Cable Check Response message             containing ResponseCode field indicating value 'OK'             containing EVSEProcessing indicating value 'Finished'     }     then {         the IUT sends a Pre Charge Request message             containing a <b>valid Header</b>             containing a Body                 containing DC_EVStatus                 containing EVReady                 containing EVErrorCode                 containing EVRESSSOC                 containing EVTargetVoltage                 containing Multiplier field                 containing Value field             containing EVTargetCurrent                 containing Multiplier field                 containing Value field         before V2G_EVCC_Sequence_Performance_Time expires     } } </pre>	

TP Id	TP/EVCC/ALM/PCH/BV/02
Test objective	Check that Pre Charge Request message is sent after receiving Pre Charge Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.3.2, 8.8.4.2.3
Reference requirement	[V2G2-253], [V2G2-254], [V2G2-618]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Pre Charge Request message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Pre Charge Response message             containing EVSEPresentVoltage indicating a value which does not fulfil the voltage threshold requirement of the EV.     }     then {         the IUT sends a Pre charge Request message             containing a <b>valid Header</b>             containing a Body                 containing DC_EVStatus                 containing EVReady                 containing EVErrorCode                 containing EVRESSSOC                 containing EVTargetVoltage                 containing Multiplier field                 containing Value field             containing EVTargetCurrent                 containing Multiplier field                 containing Value field         before V2G_EVCC_Sequence_Performance_Time expires     } } </pre>	

TP Id	TP/EVCC/ALM/PCH/BV/03
Test objective	Check that the IUT stops session if a Pre Charge Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.3
Reference requirement	<b>[V2G2-526]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Pre Charge Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Pre Charge Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

### B.2.17 Current Demand

TP Id	TP/EVCC/ALM/CD/BV/01
Test objective	Check that Current Demand Request message is sent after receiving Power Delivery Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.4.2, 8.8.4.2.3
Reference requirement	[V2G2-257], [V2G2-258], [V2G2-530]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Power Delivery Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Power Delivery Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Current Demand Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSSOC containing ChargingComplete containing EVTargetCurrent containing Multiplier field containing Value field containing EVTargetVoltage containing Multiplier field containing Value field  before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CD/BV/02
Test objective	Check that Current Demand Request message is sent after receiving Current Demand Response message (metering loop) while continuing charging process
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.4.2, 8.8.4.2.3
Reference requirement	[V2G2-257], [V2G2-258], [V2G2-531]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Current Demand Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Current Demand Response message containing ResponseCode field indicating value 'OK' } then { the IUT sends a Current Demand Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSOC containing ChargingComplete indicating value 'FALSE' containing EVTargetCurrent containing Multiplier field containing Value field containing EVTargetVoltage containing Multiplier field containing Value field before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/CD/BV/03
Test objective	Check that the IUT stops session if a Current Demand Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.3
Reference requirement	<b>[V2G2-532]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Current Demand Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Current Demand Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

### B.2.18 Welding Detection

TP Id	TP/EVCC/ALM/WD/BV/01
Test objective	Check that Welding Detection Request message is sent after receiving Power Delivery Response message (end of charge process)
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.5.2, 8.8.4.2.3
Reference requirement	[V2G2-261], [V2G2-262], [V2G2-533]
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Power Delivery Request message containing ReadyToChargeState field, indicating value 'FALSE' } }	
Expected behaviour	
ensure that { when { the IUT receives the Power Delivery Response message containing ResponseCode field, indicating value 'OK' } then { the IUT sends a Welding Detection Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorCode containing EVRESSSOC before V2G_EVCC_Sequence_Performance_Time expires } }	



TP Id	TP/EVCC/ALM/WD/BV/02
Test objective	Check that Welding Detection Request message is sent after receiving Welding Detection Response message
Reference	ISO/IEC 15118-DIS-2, Section 8.4.3.5.2, 8.8.4.2.3
Reference requirement	<b>[V2G2-261], [V2G2-262], [V2G2-620]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Welding Detection Request message }	
Expected behaviour	
ensure that { when { the IUT receives the Welding Detection Response message } then { the IUT sends a Welding Detection Request message containing a <b>valid Header</b> containing a Body containing DC_EVStatus containing EVReady containing EVErrorcode containing EVRESSSOC before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/EVCC/ALM/WD/BV/03
Test objective	Check that the IUT stops session if a Welding Detection Response message containing a 'FAILED' Response Code is received
Reference	ISO/IEC 15118-DIS-2, Section 8.8.4.2.3
Reference requirement	<b>[V2G2-534]</b>
Config Id	CF01
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Welding Detection Request message }	
Expected behaviour	
ensure that { when { the IUT receives a Welding Detection Response message containing Response Code field indicating value 'FAILED' } then { the IUT stops the V2G Communication Session } }	

## ANNEX C: TEST PURPOSES FOR SECC

### *C.1 SECC discovery*

TP Id	TP/SECC/SDP/SRV/BV/01
Test objective	Check that the IUT replies to a SECC Discovery Request indicating SECC IP and Port
Reference	ISO/IEC 15118-2, 7.10.1.5
Reference requirement	[V2G2-144], [V2G2-146], [V2G2-147], [V2G2-150], [V2G2-151], [V2G2-152], [V2G2-153], [V2G2-154], [V2G2-155], [V2G2-156]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address }	
Expected behaviour	
ensure that { when { the IUT receives a <b>valid SECC Discovery Request</b> } then { the IUT sends a <b>valid SECC Discovery Response</b> } }	

TP Id	TP/SECC/SDP/SRV/BV/02
Test objective	Check that the IUT replies to N consecutive SECC Discovery Request indicating SECC IP and Port
Reference	ISO/IEC 15118-2, 7.10.1.5
Reference requirement	[V2G2-146], [V2G2-147], [V2G 2-150], [V2G2-151], [V2G2-152], [V2G2-153], [V2G2-154], V2G2-155], [V2G2-156]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address }	
Expected behaviour	
ensure that { when { the IUT receives N consecutive <b>valid SECC Discovery Request</b> } then { the IUT sends N <b>valid SECC Discovery Responses</b> } }	

TP Id	TP/SECC/SDP/SRV/BV/03
Test objective	Check that if the IUT replies with TLS-security option to a SECC Discovery Request requesting TLS
Reference	ISO/IEC 15118-2, 7.10.1.8
Reference requirement	<b>[V2G2-624], [V2G2-626]</b>
Config Id	CF02
PICS Selection	PICS_TLS
Initial conditions	
with { the IUT having assigned an IP address and the IUT supporting TLS }	
Expected behaviour	
ensure that { when { the IUT receives a <b>valid SECC Discovery Request</b> containing Security Encoding field indicating value "0x00" containing Transport Protocol field indicating value "0x00" } then { the IUT sends a <b>valid SECC Discovery Response</b> containing Security Encoding field indicating value "0x00" containing Transport Protocol field indicating value "0x00" } }	

TP Id	TP/SECC/SDP/SRV/BV/04
Test objective	Check that if the IUT does not support TLS, it replies with no-security option to a SECC Discovery Request requesting TLS
Reference	ISO/IEC 15118-2, 7.10.1.8
Reference requirement	<b>[V2G2-624], [V2G2-627]</b>
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT not supporting TLS }	
Expected behaviour	
ensure that { when { the IUT receives a <b>valid SECC Discovery Request</b> containing Security Encoding field indicating value "0x00" containing Transport Protocol field indicating value "0x00" } then { the IUT sends a <b>valid SECC Discovery Response</b> containing Security Encoding field indicating value "0x10" containing Transport Protocol field indicating value "0x00" } }	

TP Id	TP/SECC/SDP/SRV/BV/05
Test objective	Check that the IUT replies with no-security option to a SECC Discovery Request requesting no TLS
Reference	ISO/IEC 15118-2, 7.10.1.8
Reference requirement	
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having assigned an IP address and the IUT not supporting TLS }	
Expected behaviour	
ensure that { when { the IUT receives a <b>valid SECC Discovery Request</b> containing Security Encoding field indicating value "0x10" containing Transport Protocol field indicating value "0x00" } then { the IUT sends a <b>valid SECC Discovery Response</b> containing Security Encoding field indicating value "0x10" containing Transport Protocol field indicating value "0x00" } }	

## C.2 Application layer messages

### C.2.1. Handshake Protocol

TP Id	TP/SECC/ALM/HP/BV/01
Test objective	Check that SupportedApp Response message is sent after receiving SupportedApp Request message
Reference	ISO/IEC 15118-DIS-2, section 8.2.1, 8.2.2, 8.8.4.3
Reference requirement	[V2G2-168], [V2G2-169], [V2G2-176], [V2G2-178], [V2G2-541]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent SECC Discovery Response message }	
Expected behaviour	
ensure that { when { the IUT receives the SupportedApp Request message } then { the IUT sends a SupportedApp Response message containing SchemaID } }	

```

    containing ResponseCode field indicating value
    'OK_SuccessfullNegotiation'
    before V2G_EVCC_Sequence_Performance_Time expires
  }
}

```

TP Id	TP/SECC/ALM/HP/BV/02
Test objective	Check that SupportedApp Response with minor version support message is sent after receiving SupportedApp Request message
Reference	ISO/IEC 15118-DIS-2, section 8.2.2
Reference requirement	<b>[V2G2-170]</b>
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent SECC Discovery Response message }	
Expected behaviour	
ensure that { when { the IUT receives the SupportedApp Request message the major version number is not supported by IUT } then { the IUT sends a SupportedApp Response message containing a <b>valid Header</b> containing a Body containing SchemaID containing ResponseCode field indicating value 'OK_SuccessfulNegotiationWithMinorDeviation' before V2G_EVCC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/HP/BV/03
Test objective	Check that SupportedApp Response message failed is sent after receiving SupportedApp Request message
Reference	ISO/IEC 15118-DIS-2, section 8.2.2
Reference requirement	[V2G2-172], [V2G2-549]
Config Id	CF01
PICS Selection	
Initial conditions	
with { the IUT having sent SECC Discovery Response message }	
Expected behaviour	
ensure that { when { the IUT receives the SupportedApp Request message the major version number is not supported by IUT } then { the IUT sends a SupportedApp Response message containing a <b>valid Header</b> containing a Body containing ResponseCode field indicating value 'Failed_NoNegotiation' before V2G_EVCC_Sequence_Performance_Time expires } }	



### C.2.2 Session Setup

TP Id	TP/SECC/ALM/SSE/BV/01
Test objective	Check that Session Setup Response message is sent after receiving Session Setup Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.2.3, 8.8.4.3.1
Reference requirement	[V2G2-184], [V2G2-190], [V2G2-191], [V2G2-543]
Config Id	CF02
PICS Selection	PICS_SECC
Initial conditions	
with { the IUT having sent SupportedAppProtocol response message }	
Expected behaviour	
ensure that { when { the IUT receives the Session Setup Request message containing SessionID '00' } then { the IUT sends a Session Setup Response message containing a <b>valid Header</b> containing a Body containing ResponseCode field indicating value 'OK_NewSessionEstablished' containing EVSEID field before V2G_SECC_Sequence_Performance_Time expires } }	

### C.2.3 Service Discovery

TP Id	TP/SECC/ALM/SDI/BV/01
Test objective	Check that Service discovery Response message is sent after receiving Service discovery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.3.3, 8.8.4.3.1
Reference requirement	[V2G2-195], [V2G2-196], [V2G2-545]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service discovery Request message } then { the IUT sends a Service Discovery Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing PaymentOption type field containing Charge Service containing service type containing Service Tag containing Service ID field containing Free Service field containing EnergyTransfer type field Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/SDI/BV/02
Test objective	Check that Service discovery Response message fail is sent after receiving Service discovery Request message which is not processed successfully
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.3.3, 8.8.4.3.1
Reference requirement	[V2G2-546]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Session Setup response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service discovery Request message } then { the IUT sends a Service Discovery Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value ' <b>FAIL</b> ' Before V2G_SECC_Sequence_Performance_Time expires } }	

#### C.2.4 Service Details

TP Id	TP/SECC/ALM/SDE/BV/01
Test objective	Check that Service details Response message is sent after receiving Service details Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.4.2, 8.8.4.3.1
Reference requirement	[V2G2-199], [V2G2-200], [V2G2-426], [V2G2-548]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service details Request message } then { the IUT sends a Service Details Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'OK' containing ServiceID containing ServiceParameterList Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/SDE/BV/02
Test objective	Check that Service details Response message fail is sent after receiving Service details Request message with invalid Service ID
Reference	ISO/IEC 15118-DIS-2 Section 8.6.3.6, 8.8.3.1
Reference requirement	<b>[V2G2-425], [V2G2-464]</b>
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Service Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service details Request message containing invalid service ID } then { the IUT sends a Service Details Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'FAILED_ServiceIDInvalid' Before V2G_SECC_Sequence_Performance_Time expires } }	

### C.2.5 Service and Payment Selection

TP Id	TP/SECC/ALM/SPS/BV/01
Test objective	Check that Service and Payment Selection Response message is sent after receiving Service and Payment Selection Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.5.3, 8.8.4.3.1
Reference requirement	<b>[V2G2-203], [V2G2-204], [V2G2-551]</b>
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Service Details response or service discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Service and Payment Selection Request message } then { the IUT sends a Service and Payment Selection Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'OK' Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/SPS/BV/02
Test objective	Check that the IUT sends a Service and Payment selection Response message with Response Code 'FAILED_PaymentSelectionInvalid' if the SelectedPaymentOption (contained in the ServicePaymentSelectionReq message) is not part of the offered PaymentOptions of ServiceDiscoveryRes
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.5.3, 8.8.3.1
Reference requirement	<b>[V2G2-465], [V2G2-466]</b>

Config Id	CF02
PICS Selection	0
Initial conditions	
with { the IUT having sent Service Details response or service discovery response message }	
ensure that { when { the IUT receives the Service and Payment selection request message containing SelectedPaymentOption field indicating 'Selected PaymentOption not contained in the Service and Payment selection message' } then { the IUT sends a Service and Payment selection Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_PaymentSelectionInvalid' } }	

TP Id	TP/SECC/ALM/SPS/BV/03
Test objective	Check that the IUT sends a Service and Payment selection Response message with Response Code 'FAILED_ServiceSelectionInvalid' if Service and payment selection Request message contains an invalid Service ID
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-467]</b>
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Service Details response or service discovery response message } 	
ensure that { when { the IUT receives the Service and Payment selection Request message containing SelectedServiceList containing a ServiceID which was not contained in the offered ServiceList of Service Discovery Response } then { the IUT sends a Service and Payment selection Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_ServiceSelectionInvalid' } }	

### C.2.6 Certificate Update

TP Id	TP/SECC/ALM/CU/BV/01
Test objective	Check that Certificate update response message is sent after receiving Certificate update Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.10.3, 8.8.4.3.1
Reference requirement	[V2G2-231], [V2G2-232], [V2G2-557]
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CU
Initial conditions	
with { the IUT having sent Service and Payment Selection response message }	
Expected behaviour	
ensure that { when { the IUT receives the Certificate update Request message } then { the IUT sends a Certificate update Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing ContractSignatureCertChain containing ContractSignaturePrivateKey containing ContractEncryptionPrivateKey containing ContractID containing RetryCounter containing DHParams } Before V2G_SECC_Sequence_Performance_Time expires } }	



TP Id	TP/SECC/ALM/CU/BV/02
Test objective	Check that the IUT sends a Certificate Update Response message with Response Code 'FAILED_CertChainError' if the ContractSignatureCertChain contained in the Certificate Update request message is not valid.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-470]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CU
Initial conditions	
with { IUT having sent Service and Payment Selection response message }	
<pre> ensure that {   when {     the IUT receives the Certificate Update Request message       containing an invalid ContractSignatureCertChain   }   then {     the IUT sends a Certificate Update Response message       containing a <b>valid Header</b>       containing a Body         containing Response Code field           indicating value 'FAILED_CertChainError'       }     Before V2G_SECC_Sequence_Performance_Time expires   } }</pre>	

TP Id	TP/SECC/ALM/CU/BV/03
Test objective	Check that the IUT sends a Certificate Update Response message with Response 'FAILED_NoCertificateAvailable' if the new certificate can't be retrieved from secondary actor
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-471]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CU
Initial conditions	
with { IUT having sent Service and Payment Selection response message }	
<pre> ensure that {   when {     the IUT receives the Certificate Update Request message   }   then {     the IUT sends a Certificate Update Response message       containing a <b>valid Header</b>       containing a Body         containing Response Code field           indicating value 'FAILED_NoCertificateAvailable'         }       } } </pre>	

TP Id	TP/SECC/ALM/CU/BV/04
Test objective	Check that the IUT sends a Certificate Update Response message with Response Code 'FAILED_ContractCanceled' if the provided ContractID in CertificateUpdateReq is not accepted by secondary actor.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-472]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CU
Initial conditions	
with { IUT having sent Service and Payment Selection response message }	
<p>ensure that {</p> <p>    when {</p> <p>        the IUT receives the Certificate Update Request message containing a ContractID not acceptable for a secondary actor</p> <p>    }</p> <p>    then {</p> <p>        the IUT sends a Certificate Update Response message containing a <b>valid Header</b></p> <p>        containing a Body</p> <p>            containing Response Code field</p> <p>                indicating value 'FAILED_ContractCanceled'</p> <p>    }</p> <p>}</p>	

TP Id	TP/SECC/ALM/CU/BV/05
Test objective	Check that the IUT sends a Certificate Update Response message with Response Code 'FAILED_CertificateExpired' if the contract certificate contained in the CertificateUpdate Request message is not valid.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-473]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CU
Initial conditions	
with { IUT having sent Service and Payment Selection response message }	
<pre> ensure that {   when {     the IUT receives the Certificate Update Request message       containing an invalid contract certificate   }   then {     the IUT sends a Certificate Update Response message       containing a <b>valid Header</b>       containing a Body         containing Response Code field           indicating value 'FAILED_CertificateExpired'       }   } }</pre>	

### *C.2.7 Certificate Installation*

TP Id	TP/SECC/ALM/CI/BV/01
Test objective	Check that Certificate Install response message is sent after receiving Certificate Install Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.11.3, 8.8.4.3.1
Reference requirement	[V2G2-237], [V2G2-238], [V2G2-554]
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CI
Initial conditions	
with { the IUT having sent Service and Payment Selection response message }	
Expected behaviour	
ensure that { when { the IUT receives the Certificate Install Request message } then { the IUT sends a Certificate Install Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing ContractSignatureCertChain containing ContractSignatureEncryptedPrivateKey containing ContractID containing DHParams } Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/CI/BV/02
Test objective	Check that the IUT sends a Certificate Install Response message with Response Code 'FAILED_CertificateExpired' if the OEMProvisioningCert contained in the CertificateInstallationReq message is not valid.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-468]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CI
Initial conditions	
with { the IUT having sent Service and Payment Selection response message }	
ensure that { when { the IUT receives the Certificate Install Request message containing an invalid OEMProvisioningCert } then { the IUT sends a Certificate Install Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_CertificateExpired' } }	

TP Id	TP/SECC/ALM/CI/BV/03
Test objective	Check that the IUT sends a Certificate Install Response message with Response Code 'FAILED_NoCertificateAvailable' if the new certificate cannot be retrieved from secondary actor
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-469]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_CI
Initial conditions	
with { the IUT having sent Service and Payment Selection response message }	
ensure that { when { the IUT receives the Certificate Install Request message } then { the IUT sends a Certificate Install Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_NoCertificateAvailable' } }	

### C.2.8 Payment Details

TP Id	TP/SECC/ALM/PDT/BV/01
Test objective	Check that Payment details Response message is sent after receiving Payment details Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.6.3, 8.8.4.3.1
Reference requirement	[V2G2-208], [V2G2-209], [V2G2-560]
Config Id	CF02
PICS Selection	PICS_PnC and PICS_PDT
Initial conditions	
with { the IUT having sent Service and Payment Selection Response message }	
Expected behaviour	
ensure that { when { the IUT receives the Payment details Request message } then { the IUT sends a Payment details Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'OK' containing Genchallenge containing DateTimeNow Before V2G_SECC_Sequence_Performance_Time expires } }	



TP Id	TP/SECC/ALM/PDT/BV/02
Test objective	Check that the IUT sends a Payment Details Response message with Response Code 'FAILED_CertificateExpired' if the contract certificate contained in the PaymentDetailsReq message in attribute ContractSignatureCertChain is not valid.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-474]</b>
Config Id	CF02
PICS Selection	PICS_PnC and PICS_PDT
Initial conditions	
with { the IUT having sent Service and Payment Selection Response message }	
<p>ensure that {              when {                  the IUT receives the Payment Details request message                  containing contract certificate in the PaymentDetails Request message in                  attribute ContractSignatureCertChain is not valid.              }              then {                  the IUT sends a Payment Details selection Response message                  containing a <b>valid Header</b>                  containing a Body                  containing Response Code field                  indicating value 'FAILED_CertificateExpired'              }              Before V2G_SECC_Sequence_Performance_Time expires          }</p>	

### C.2.9 Contract Authentication

TP Id	TP/SECC/ALM/CA/BV/01
Test objective	Check that Contract Authentication Response message is sent after receiving Contract Authentication Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.7.2, 8.8.4.3.1,
Reference requirement	[V2G2-212], [V2G2-213], [V2G2-563], [V2G2-687]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Service and Payment Selection response message or Payment Details response message }	
Expected behaviour	
ensure that { when { the IUT receives the Contract Authentication Request message } then { the IUT sends a Contract Authentication Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'OK' containing EVSEProcessing indicating value 'Finished' Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/CA/BV/02
Test objective	Check that the IUT sends a Contract Authentication Response message with Response Code 'FAILED_ChallengeInvalid' if the challenge response contained in the ContractAuthenticationReq message in attribute GenChallenge is not valid versus the provided GenChallenge in PaymentDetailsRes
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	[V2G2-475]
Config Id	CF02
PICS Selection	PICS_PnC and PICS_PDT
Initial conditions	
with { the IUT having sent a PaymentDetails response message containing a valid GenChallenge	
ensure that { when { the IUT receives the ContractAuthentication Request message containing a GenChallenge different to the one sent in PaymentDetails response } then { the IUT sends a ContractAuthentication Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_ChallengeInvalid' Before V2G_SECC_Sequence_Performance_Time expires    } }	

### C.2.10 Charge parameter Discovery

TP Id	TP/SECC/ALM/CPD/BV/01
Test objective	Check that Charge Parameter Discovery response message is sent after receiving Charge Parameter Discovery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.8.3, 8.8.4.3.2
Reference requirement	[V2G2-218], [V2G2-220], [V2G2-573]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Contract Authentication response message containing EVSEProcessing indicating value 'Finished' }	
Expected behaviour	
ensure that { when { the IUT receives the Charge Parameter Discovery Request message } then { the IUT sends a Charge Parameter Discovery Response message containing a <b>valid Header</b> containing a Body containing Response Code indicating value 'OK' containing AC_EVSECharge parameter containing AC_EVSEStatus indicating value 'ready to charge' containing EVSEMaxVoltage containing Multiplier field containing Value field containing EVSEMaxCurrent containing Multiplier field containing Value field containing EVSEVoltage containing Multiplier field containing Value field containing SAScheduleTupleList containing SAScheduleTupleID containing PMaxSchedule containing PMaxScheduleID containing PMaxScheduleEntry containing Timeinterval containing Relative Time interval containing PMAX containing Multiplier field containing Value field } Before V2G_SECC_Sequence_Performance_Time expires }	

TP Id	TP/SECC/ALM/CPD/BV/02
Test objective	Check that Charge Parameter Discovery response message is sent after receiving Charge Parameter Discovery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.8.3, , 8.8.4.3.2
Reference requirement	[V2G2-218], [V2G2-220], [V2G2-573]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Contract Authentication response message containing EVSEProcessing indicating value 'Finished'}	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Charge Parameter Discovery Request message     }     then {         the IUT sends a Charge Parameter Discovery Response message         containing a <b>valid Header</b>         containing a Body             containing Response code indicating value 'OK'             containing EVSEProcessing             containing DC_EVSECharge parameter             containing DC_EVSEStatus             containing EVSEStatusCode             containing NotificationMaxDelay             containing EVSENotification             containing EVSEMaxVoltageLimit             containing Multiplier field             containing Value field             containing EVSEMaxCurrentLimit             containing Multiplier field             containing Value field             containing EVSEMinVoltageLimit             containing Multiplier field             containing Value field             containing EVSEMinCurrentLimit             containing Multiplier field             containing Value field              containing EVSEPeakCurrentRipple             containing Multiplier field             containing Value field             containing SAScheduleTupleList             containing SAScheduleTupleID field             containing PMaxSchedule field             containing PMaxScheduleID             containing PMaxScheduleEntry             containing Timeinterval             containing Relative Time interval             containing PMAX             containing Multiplier field             containing Value field         Before V2G_SECC_Sequence_Performance_Time expires     } } </pre>	

TP Id	TP/SECC/ALM/CPD/BV/03
Test objective	Check that the IUT sends a Charge Parameter Discovery Response message with Response Code 'FAILED_WrongEnergyTransferType' if the content of attribute 'EVRequestedEnergyTransferType' in the ChargeParameterDiscoveryReq message is not valid, or does not fit to the content of attribute EVChargeParameter.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1,
Reference requirement	[V2G2-476]
Config Id	CF02
PICS Selection	
Initial conditions	
<pre> with {     the IUT having sent Contract Authentication response message     containing EVSEProcessing indicating value 'Finished' } </pre>	
<pre> ensure that {     when {         the IUT receives the Charge Parameter Discovery Request message         containing EVRequestedEnergyTransferType field         indicating a value not contained in the Charge Parameter Discovery Response         message'     then {         the IUT sends a Charge Parameter Discovery Response message         containing a <b>valid Header</b>         containing a Body         containing Response Code field         indicating value 'FAILED_WrongEnergyTransferType'         Before V2G_SECC_Sequence_Performance_Time expires     } } </pre>	

TP Id	TP/SECC/ALM/CPD/BV/04
Test objective	Check that the IUT sends a Charge Parameter Discovery Response message with Response Code 'FAILED_WrongChargeParameter', if the content of attribute 'EVChargeParameter' in the ChargeParameterDiscoveryReq message is not valid
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1,
Reference requirement	[V2G2-477]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Contract Authentication response message containing EVSEProcessing indicating value 'Finished' } }	
ensure that { when { the IUT receives the Charge Parameter Discovery Request message containing EVChargeParameter field indicating a wrong parameter set, or one or multiple parameters that cannot be interpreted } then { the IUT sends a Charge Parameter Discovery Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_WrongChargeParameter'. } }	

### C.2.11 Power Delivery

TP Id	TP/SECC/ALM/PWD/BV/01
Test objective	Check that Power delivery response message is sent after receiving Power delivery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.9.3, 8.8.4.3.2
Reference requirement	[V2G2-223], [V2G2-226], [V2G2-576]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Power delivery Request message containing ReadyToChargeState field set to 'TRUE' } then { the IUT sends a Power delivery Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing AC_EVSEStatus containing PowerSwitch closed indicating value 'TRUE' containing RCD indicating value 'FALSE' containing NotificationMaxDelay containing EVSENotification } Before V2G_SECC_Sequence_Performance_Time expires }	



TP Id	TP/SECC/ALM/PWD/BV/01a
Test objective	Check that Power delivery response message is sent after receiving Power delivery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.9.3
Reference requirement	[V2G2-223], [V2G2-226], [V2G2-568]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Power delivery Request message containing ReadyToChargeState field set to 'FALSE' } then { the IUT sends a Power delivery Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing AC_EVSEStatus containing PowerSwitch closed indicating value 'TRUE' containing RCD indicating value 'FALSE' containing NotificationMaxDelay containing EVSENotification } Before V2G_SECC_Sequence_Performance_Time expires }	

TP Id	TP/SECC/ALM/PWD/BV/02
Test objective	Check that Power delivery response message is sent after receiving Power delivery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.9.3, 8.8.4.3.3
Reference requirement	[V2G2-223], [V2G2-226], [V2G2-590]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Pre charging response message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Power delivery Request message         containing ReadyToChargeState field set to 'TRUE'     }     then {         the IUT sends a Power delivery Response message         containing a <b>valid Header</b>         containing a Body             containing Response code indicating value 'OK'             containing DC_EVSEStatus             containing EVSEStatusCode             containing NotificationMaxDelay             containing EVSENotification         }     Before V2G_SECC_Sequence_Performance_Time expires } </pre>	

TP Id	TP/SECC/ALM/PWD/BV/02a
Test objective	Check that Power delivery response message is sent after receiving Power delivery Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.9.3, 8.8.4.3.3
Reference requirement	<b>[V2G2-223], [V2G2-226], [V2G2-601]</b>
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Pre charging response message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Power delivery Request message         containing ReadyToChargeState field set to 'FALSE'     }     then {         the IUT sends a Power delivery Response message         containing a <b>valid Header</b>         containing a Body             containing Response code indicating value 'OK'             containing DC_EVSEStatus             containing EVSEStatusCode             containing NotificationMaxDelay             containing EVSENotification     }      Before V2G_SECC_Sequence_Performance_Time expires } </pre>	

TP Id	TP/SECC/ALM/PWD/BV/03
Test objective	Check that the IUT sends a Power Delivery Response message with Response 'FAILED_ChargingProfileInvalid', if the charging profile is different from SAscheduleTuple (charging profile is an optional parameter in power delivery request)
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.9.3, 8.8.3.1
Reference requirement	[V2G2-225], [V2G2-478]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
<p>ensure that {</p> <p>    when {</p> <p>        the IUT receives the Power Delivery Request message</p> <p>        containing 'ChargingProfile' field that violates a power limitation provided in 'Charge Parameter Discovery Response'</p> <p>    }</p> <p>    then {</p> <p>        the IUT sends a Power Delivery Response message</p> <p>        containing a <b>valid Header</b></p> <p>        containing a Body</p> <p>        containing Response Code field</p> <p>        indicating value 'FAILED_ChargingProfileInvalid'.</p> <p>        Before V2G_SECC_Sequence_Performance_Time expires</p> <p>    }</p> <p>}</p>	

TP Id	TP/SECC/ALM/PWD/BV/04
Test objective	Check that the IUT sends a Power Delivery Response message with Response 'FAILED_TariffSelectionInvalid', if the selected tariff is invalid
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	[V2G2-479]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
ensure that { when { the IUT receives the Power Delivery Request message containing 'ChargingProfile' field containing a SATupleID which was not contained in the 'SASchedules' attribute provided in 'Charge Parameter Discovery Response'. } then { the IUT sends a Power Delivery Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_TariffSelectionInvalid'. Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/PWD/BV/05
Test objective	Check that the IUT sends a Power Delivery Response message with Response 'FAILED_PowerDeliveryNotApplied' if the EVSE is not able to deliver energy.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	<b>[V2G2-480]</b>
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message and the IUT not being able to deliver energy }	
ensure that { when { the IUT receives the Power Delivery Request message } then { the IUT sends a Power Delivery Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_PowerDeliveryNotApplied'. Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/PWD/BV/06
Test objective	Check that the IUT sends a Power Delivery Response message with Response 'FAIL' if the processing of the information is not successful.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.3
Reference requirement	<b>[V2G2-591]</b>
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message //TODO How to simulate non successful information processing } 	
ensure that { when { the IUT receives the Power Delivery Request message } then { the IUT sends a Power Delivery Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAIL'. Before V2G_SECC_Sequence_Performance_Time expires } } 	

### C.2.12 Session Stop

TP Id	TP/SECC/ALM/SST/BV/01
Test objective	Check that Session Stop response message is sent after receiving Session Stop Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.12.3, 8.8.4.3.1
Reference requirement	[V2G2-240], [V2G2-241], [V2G2-571]
Config Id	CF02
PICS Selection	PICS_AC
Initial conditions	
with { <div>the IUT having received Power Delivery request message containing ReadyToChargeStatus indicating value 'FALSE' and the IUT having sent Power Delivery response message</div> }	
Expected behaviour	
ensure that { <div>when {<div>the IUT receives Session stop Request message</div>}</div> <div>then {<div>the IUT sends a Session stop Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK'</div><div>Before V2G_SECC_Sequence_Performance_Time expires</div>}</div> }}	



TP Id	TP/SECC/ALM/SST/BV/02
Test objective	Checks Session stop response message fail is sent after receiving Session stop Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.1.12.3
Reference requirement	[V2G2-572]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having received Power Delivery request message containing ReadyToChargeStatus indicating value 'FALSE' and the IUT having sent Power Delivery response message }	
Expected behaviour	
ensure that { when { the IUT receives Session stop Request message } then { the IUT sends a Session stop Response message containing a <b>valid Header</b> containing a Body //TODO How to trigger FAIL response code from the IUT containing Response code indicating value 'FAIL' Before V2G_SECC_Sequence_Performance_Time expires } }	

containing Response code indicating value 'FAIL'

Before V2G\_SECC\_Sequence\_Performance\_Time expires

### C.2.13 Charging status

TP Id	TP/SECC/ALM/CHS/BV/01
Test objective	Check that Charging status response message is sent after receiving Charging status Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.2.2.3, 8.8.4.3.2
Reference requirement	[V2G2-243], [V2G2-244], [V2G2-577]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Power delivery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Charging status Request message } then { the IUT sends a Charging status Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing EVSEID containing AC_EVSEStatus containing PowerSwitch closed indicating value 'TRUE' containing RCD indicating value 'FALSE' containing NotificationMaxDelay containing EVSENotification containing Receipt Required indicating value 'TRUE' Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/CHS/BV/02
Test objective	Checks Charging status response message fail is sent after receiving Charging status Request message if the processing of the information is not successful
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.2
Reference requirement	<b>[V2G2-578]</b>
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Power delivery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Charging status Request message } then { the IUT sends a Charging status Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'FAIL' Before V2G_SECC_Sequence_Performance_Time expires } }	

### C.2.14 Metering Receipt

TP Id	TP/SECC/ALM/MR/BV/01
Test objective	Checks Metering receipt response message is sent after receiving Metering receipt Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.2.3.3, 8.8.4.3.2
Reference requirement	[V2G2-247], [V2G2-248], [V2G2-580]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the IUT having sent Charging status response message containing ReceiptRequired field set to 'TRUE' }	
Expected behaviour	
ensure that { when { the IUT receives Metering receipt Request message } then { the IUT sends a Metering receipt Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing AC_EVSEStatus containing PowerSwitch closed indicating value 'TRUE' containing RCD indicating value 'FALSE' containing NotificationMaxDelay containing EVSENotification Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/MR/BV/02
Test objective	Check that the IUT sends a Metering Receipt Response message with Response Code 'FAILED_MeteringSignatureNotValid' if IUT is not able to validate the signature, or the contained meter reading does not fit to the provided meter reading during 'ChargingStatusRes' and the IUT requires that the signature is valid.
Reference	ISO/IEC 15118-DIS-2 Section 8.8.3.1
Reference requirement	[V2G2-481]
Config Id	CF02
PICS Selection	
Initial conditions	
with { the EVCC having sent a Metering Receipt Request message }	
ensure that { when { the IUT receives the Metering Receipt Request message } then { the IUT sends a Metering Receipt Response message containing a <b>valid Header</b> containing a Body containing Response Code field indicating value 'FAILED_MeteringSignatureNotValid' Before V2G_SECC_Sequence_Performance_Time expires } }	

### C.2.15 Cable Check

TP Id	TP/SECC/ALM/CCK/BV/01
Test objective	Check that Cable Check response message is sent after receiving Cable Check Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.3.2.3, 8.8.4.3.3
Reference requirement	[V2G2-251], [V2G2-252], [V2G2-584]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Cable Check Request message } then { the IUT sends a Cable Check Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK' containing DC_EVSEStatus containing EVSEStatusCode containing NotificationMaxDelay containing EVSENotification containing EVSEProcessing indicating value 'Finished' } Before V2G_SECC_Sequence_Performance_Time expires }	

TP Id	TP/SECC/ALM/CCK/BV/02
Test objective	Check that Cable Check response message fail is sent after receiving Cable Check Request message if the processing of the information is not successful
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.3
Reference requirement	<b>[V2G2-585]</b>
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Charge Parameter Discovery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Cable Check Request message } then { the IUT sends a Cable Check Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'FAIL' } Before V2G_SECC_Sequence_Performance_Time expires }	

### C.2.16 Pre Charge

TP Id	TP/SECC/ALM/PCH/BV/01
Test objective	Check that Pre Charge response message is sent after receiving Pre Charge Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.3.3.3
Reference requirement	[V2G2-255], [V2G2-256], [V2G2-587]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Cable Check response message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Pre Charging Request message     }     then {         the IUT sends a Pre Charging Response message             containing a <b>valid Header</b>             containing a Body                 containing Response code indicating value 'OK'                 containing DC_EVSEStatus                     containing EVSEStatusCode                     containing NotificationMaxDelay                     containing EVSENotification                 containing EVSEPresentVoltage                 containing Multiplier field                 containing Value field     }     Before V2G_SECC_Sequence_Performance_Time expires } </pre>	



TP Id	TP/SECC/ALM/PCH/BV/02
Test objective	Check that Pre Charge response message fail is sent after receiving Pre Charge Request message if the processing of the information is not successful
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.3
Reference requirement	<b>[V2G2-588]</b>
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Cable Check response message }	
Expected behaviour	
ensure that { when { the IUT receives the Pre Charging Request message } then { the IUT sends a Pre Charging Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'FAIL' } Before V2G_SECC_Sequence_Performance_Time expires }	

### C.2.17 Current Demand

TP Id	TP/SECC/ALM/CD/BV/01
Test objective	Check that Current Demand response message is sent after receiving Current Demand Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.3.4.3, 8.8.4.3.3
Reference requirement	[V2G2-259], [V2G2-260], [V2G2-593]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Power delivery response message }	
Expected behaviour	
<pre> ensure that {     when {         the IUT receives the Current Demand Request message     }     then {         the IUT sends a Current Demand Response message         containing a <b>valid Header</b>         containing a Body             containing Response code indicating value 'OK'              containing DC_EVSEStatus                 containing DC_EVSEStatusCode                 containing NotificationMaxDelay                 containing EVSENotification             containing EVSEPresentVoltage                 containing Multiplier field                 containing Value field             containing EVSEPresentCurrent                 containing Multiplier field                 containing Value field             containing EVSECurrentLimitAchived              containing EVSEVoltageLimitAchieved              containing EVSEPowerLimitAchieved         }     Before V2G_SECC_Sequence_Performance_Time expires } </pre>	

TP Id	TP/SECC/ALM/CD/BV/02
Test objective	Check that Current Demand response message fail is sent after receiving Current Demand Request message if the processing of the information is not successful
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.3
Reference requirement	<b>[V2G2-595]</b>
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having sent Power delivery response message }	
Expected behaviour	
ensure that { when { the IUT receives the Current Demand Request message } then { the IUT sends a Current Demand Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'FAIL' } Before V2G_SECC_Sequence_Performance_Time expires }	

### C.2.18 Welding Detection

TP Id	TP/SECC/ALM/WD/BV/01
Test objective	Checkthat Welding Detection response message is sent after receiving Welding Detection Request message
Reference	ISO/IEC 15118-DIS-2 Section 8.4.3.5.3, 8.8.4.3.3
Reference requirement	[V2G2-263], [V2G2-264], [V2G2-597]
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having received Power Delivery request message containing ReadyToChargeParameter set to 'FALSE' and the IUT having sent Power delivery response message } 	
Expected behaviour	
ensure that { when { the IUT receives the Welding Detection Request message } then { the IUT sends a Welding Detection Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'OK'  containing DC_EVSEStatus containing DC_EVSEStatusCode containing NotificationMaxDelay containing EVSENotification containing EVSEPresentVoltage containing Multiplier field containing Value field } Before V2G_SECC_Sequence_Performance_Time expires } }	

TP Id	TP/SECC/ALM/WD/BV/02
Test objective	Checks Welding Detection response message fail is sent after receiving Welding Detection Request message if the processing of the information is not successful
Reference	ISO/IEC 15118-DIS-2 Section 8.8.4.3.3
Reference requirement	<b>[V2G2-598]</b>
Config Id	CF02
PICS Selection	PICS_DC
Initial conditions	
with { the IUT having received Power Delivery request message containing ReadyToChargeParameter set to 'FALSE' and the IUT having sent Power delivery response message } 	
Expected behaviour	
ensure that { when { the IUT receives the Welding Detection Request message } then { the IUT sends a Welding Detection Response message containing a <b>valid Header</b> containing a Body containing Response code indicating value 'FAIL' } Before V2G_SECC_Sequence_Performance_Time expires } }	

## ANNEX D: ATS CONVENTIONS

The following table shows the ETSI generic TTCN-3 naming conventions extracted from [4] which V2G ATS is based on:

**Table 7. ETSI generic TTCN-3 naming conventions**

Language element	Naming convention	Prefix	Example identifier
Module	Use upper-case initial letter	ItsV2G/ LibItsV2G	ItsV2G_TestCases
Group within a module	Use lower-case initial letter	none	messageGroup
Data type	Use upper-case initial letter	none	SetupContents
Message template	Use lower-case initial letter	m_	m_setupInit
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	mw_anyUserReply
Port instance	Use lower-case initial letter	none	signallingPort
Test component instance	Use lower-case initial letter	none	userTerminal
Constant	Use lower-case initial letter	c_	c_maxRetransmission
Constant (defined within component type)	Use lower-case initial letter	cc_	cc_minDuration
External constant	Use lower-case initial letter	cx_	cx_macId
Function	Use lower-case initial letter	f_	f_authentication()
External function	Use lower-case initial letter	xf_	xf_calculateLength()
Altstep (incl. Default)	Use lower-case initial letter	a_	a_receiveSetup()
Test case	Use ETSI numbering	TC_	TC_COR_0009_47_ND
Variable (local)	Use lower-case initial letter	v_	v_macId
Variable (defined within a component type)	Use lower-case initial letters	vc_	vc_systemName
Timer (local)	Use lower-case initial letter	t_	t_wait
Timer (defined within a component)	Use lower-case initial letters	tc_	tc_authMin
Module parameters for other parameters	Use all upper case letters	PXT_	PXT_MAC_ID
Formal Parameters	Use lower-case initial letter	p_	p_macId

Enumerated Values	Use lower-case initial letter	e_	e_syncOk
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Besides these naming conventions, other recommendations are proposed with regarding to:

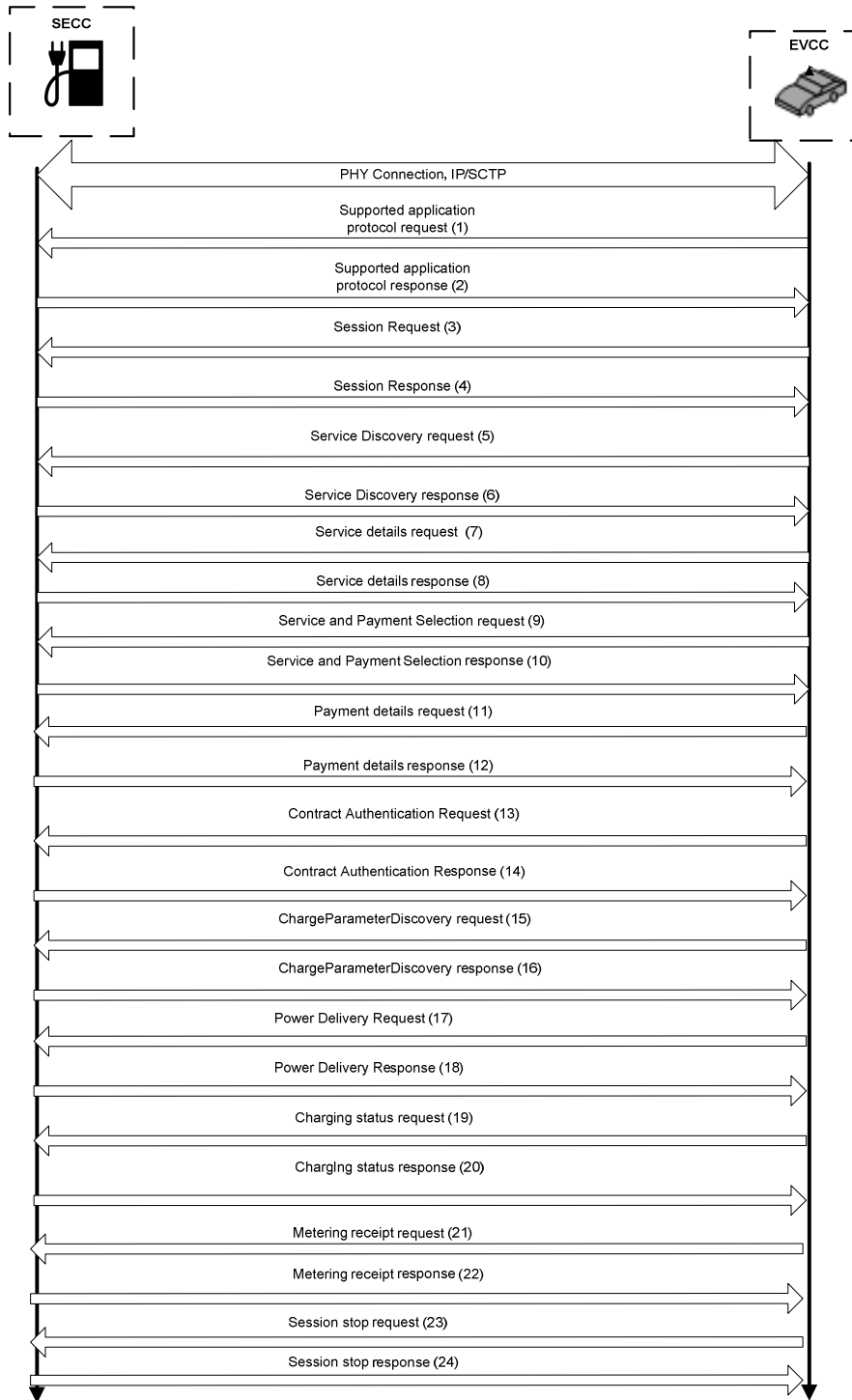
- Structure of data:
  - o Types should be defined in alphabetic order within TTCN-3 groups within the same TTCN-3 module
  - o All message types referenced in port type definitions and related to same interface should be defined in the same TTCN-3 group and in the same module
- Log Statement:
  - o All TTCN-3 log statements must follow the following format
    - Three asterisk should be used to precede the log text,
    - then the TTCN-3 testcase/function identifier in which the log statement is defined should follow,
    - then one of the categories INFO, WARNING, ERROR, PASS, FAIL, INCONC, TIMEOUT should follow,
    - then free text should follow,
    - and finally the log text should end with three asterisk
    -

EXAMPLE: `log("*** f_sendMsg: INFO: Message has been sent ***")`

- o Any invocation of an external function must be followed by log statement
- o Each TTCN-3 setverdict statement that sets a test component verdict to INCONC or FAIL should be preceded by a log statement or log statement feature as first defined in TTCN-3 version 3.4.1 should be used, where the comment is part of the setverdict statement

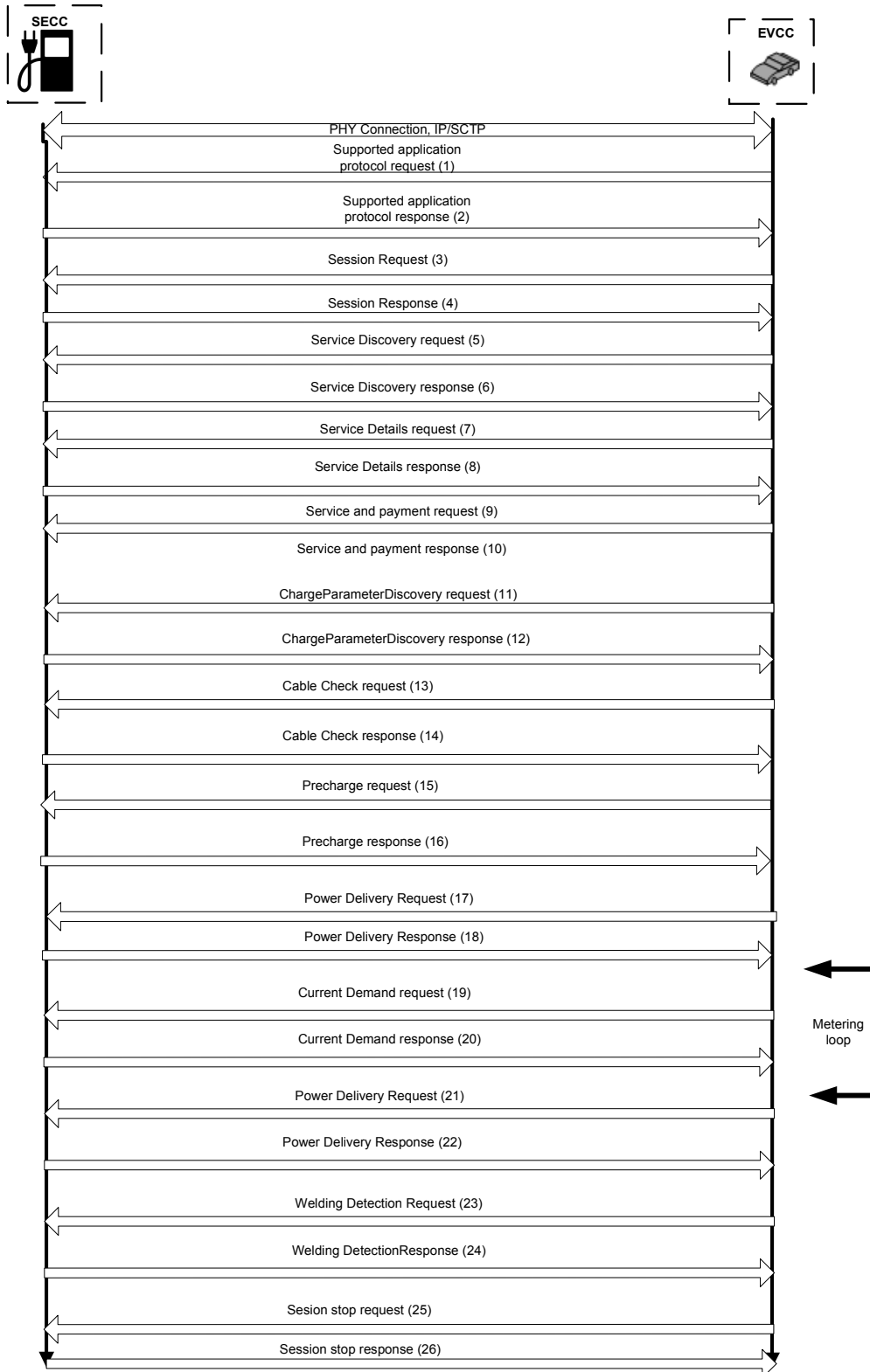
## ANNEX E: V2G PROTOCOL EXCHANGE

### *E.1 Overview of AC V2G protocol message exchange*





## E.2 Overview of DC V2G protocol message exchange



## ANNEX F: WHAT IS TTCN-3?

The Testing and Test Control Notation Version 3 (TTCN-3) is a standardized testing technology developed and maintained by the European Telecommunication Standards Institute (ETSI) and specifically designed for testing and certification. The ETSI TTCN-3 standards have also been adopted by the International Telecommunication Union (ITU-T) in the Z.160 series.

TTCN-3 is a test specification language that applies to a variety of application domains and types of testing. It has been used since 2000 in standardization as well as in industry, research, international projects and academia. In response to the demands of the user community TTCN-3 is being continuously improved and extended.

TTCN-3 provides all the constructs and features necessary for black box testing. It embodies a rich typing system and powerful matching mechanisms, support for both message-based and procedure-based communication, timer handling, dynamic test configuration including concurrent test behavior, the concept of verdicts and verdict resolution and much more.

As a result of its intrinsic extensibility, TTCN-3 is able to import external data and type specifications directly and external implementations can be integrated in order to extend the functionality specified in the TTCN-3 standards. Several mappings of external data and type specifications such as ASN.1, IDL and XML are already standardized. Others can easily be added.

A TTCN-3 documentation notation based on embedded tags is also standardized in ES 201 873-10.

The abstract definition of test cases which is fundamental to TTCN-3 makes it possible to specify a non-proprietary test system which is independent of both platform and operating system. The abstract definitions can be either compiled or interpreted for execution.

The TTCN-3 reference architecture defines standardized interfaces for test control for encoding and decoding of data and for test execution.

### ***F.1 TTCN-3 is easy to learn***

The standardized testing language has the look and feel of a regular programming language but without the complexity that such languages often introduce as it concentrates exclusively on testing.

There are many tutorial and courses to learn TTCN-3, as well as a certification program. The standard itself provides examples that demonstrate the usage of the specific features of the language.

The aim of TTCN-3 is to provide a well-defined syntax for the definition of tests independent of any application domain. The abstract nature of a TTCN-3 test system makes it possible to adapt a test system to any test environment. This separation significantly reduces the effort required for maintenance allows experts to concentrate on what to test and not on how.

The TTCN-3 language comprises:

- A well-defined static and operational semantics
- A rich type system
- A powerful built-in matching mechanism and matching expressions
- Snapshot semantics that ensure and preserve the order of external event arrival
- The ability to define tests with multiple test components
- Support for message-based as well as procedure-based communication paradigms
- Support for dynamic test configurations with test components that can be (re)created and (re)connected on-the-fly
- The ability to specify execution parameters at runtime to ease re-targeting of test suite execution in different testing environments
- Support for timers
- The ability to automate test execution driven by external sources using the TTCN-3 Test Management interface (TCI-TM)

## ***F.2 TTCN-3 is internationally standardized***

TTCN-3 was created by leading experts from industry and academia at the European Telecommunications Standards Institute (ETSI).

The standards address not only the language for specifying tests but also the interfaces that control and adapt a test to any given environment. The standardization of TTCN-3 means that users are not forced to rely on the use of one proprietary tool.

## ***F.3 The TTCN-3 approach to testing is extremely flexible***

- The language is completely independent of technology, operating system and implementation domain
- There are no practical limits to the extent that tests or test systems can be adapted to users' needs
  - Test systems can be integrated easily with the most appropriate test execution management software using TCI Test Management interface (TCI-TM)
  - Test execution traces can be visualized in any suitable format using the TCI Test Logging interface (TCI-TL)
  - Any encoding scheme can be implemented and integrated using the TCI Codec and value APIs
  - Test systems can be adapted to any communication mechanism using the TTCN-3 Runtime Interface (TRI) System Adapter

- Test systems can be adapted to any timing model using the TTCN-3 Runtime Interface (TRI) Platform Adapter
- It is scalable
  - Adaptations can be configured to the current needs while the test scripts remain unchanged and can be used in different development phases
  - Test components can be added to existing test cases to test new interfaces of the SUT
- Test components can be used both to test and to emulate interfaces
- Extensible
  - Standardized mappings to other external type systems available such as ASN.1 and XML
  - Integration of external functionality is possible using the TRI Platform Adapter
  - Multiple presentation formats are available - textual and graphical

#### ***F.4 TTCN-3 can be used in many types of testing***

It can be used for:

- Valid, invalid and inopportune testing
- Software module, unit, layer, protocol, integration and laboratory testing,
- Functional, load, distributed and testing
- Regression, certification and approval testing

More details on TTCN-3 at [www.ttcn-3.org](http://www.ttcn-3.org).