



OCPP Certification Program
Document 2

OCPP 2.0.1

Test Procedure & Test Plans

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V3.1

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1. Introduction

This document describes the test procedure and the test plans of the OCPP Certification Program.

The test procedure covers testing of:

- a Charging Station
- a Charging Station Management System (CSMS)
- a Charging Station software stack

Currently the OCPP versions eligible for certification are:

- OCPP 1.6 edition 2, described in separate document (see reference 2)
- OCPP 2.0.1, the focus of this document.

2. Terms and definitions

Term / abbreviation	Definition / description
Certification Profile	A set of OCPP functionalities developed by the OCA to target the needs of a specific business driver accredited by the Alliance.
Charging Station	Refers to a Charge Point (OCPP 1.6 terminology) or Charging Station (OCPP 2.0 terminology)
Charging Station software stack	A Charging Station software stack in this document is defined as software that: <ul style="list-style-type: none"> - supports OCPP communication - is run and tested separately, without being in a physical Charging Station - can show all required behavior of a Charging Station supporting OCPP as specified in the OCPP specification (for example: executing (virtual) charging transactions, combining Charging Profiles in a composite schedule, not allowing charging on unavailable connectors etc.).
CSMS	Central System (OCPP1.6 terminology) or Charging Station Management System (OCPP2.0.1 terminology)
Device	An OCPP based device eligible for OCPP certification. In this document, this refers to a Charging Station Management System or a Charging Station.
DUT	Device Under Test: The device submitted by the vendor for OCPP certification.
OCA	Open Charge Alliance
Participants	Any company involved in the OCPP certification program.
PICS	Protocol Implementation Conformance Statement. The completed PICS document is provided by the vendor to the Test Laboratory, asserting which OCPP specific requirements are met by its device.

Test Laboratory	An independent test laboratory authorized by the Open Charge Alliance to administer the approved OCPP tests and to assess eligibility of devices for OCPP certification.
Vendor	A manufacturer (OEM) of a Charging Stations or developer of a CSMS or Charging Station Software Stack, submitting devices for certification.

3. References

No	Title
1	OCPP Certification Procedure
2	Test Procedure & Test Plans for OCPP 1.6
3	Protocol Implementation Conformance Statement OCPP 2.0.1 for Charging Station
4	Protocol Implementation Conformance Statement OCPP 2.0.1 for CSMS

4. Test overview

4.1 Test coverage

To become OCPP certified, the tested Device Under Test (DUT), has to successfully pass the following parts:

- **Conformance tests:** the tested DUT is tested against the OCPP Compliance Testing Tool. The tool has built in validations that should not fail during certification tests. With these validations the Tool verifies whether the DUT has implemented the OCPP specification correctly. The optional features of the OCPP protocol are also covered by the certification, if supported by the DUT. The set of optional features is listed in the OCPP 2.0.1 specification part 5.
- **Performance measurements:** a number of performance values of the tested DUT are measured and give an idea how the device behaves in a lab environment. The performance parameters are stated by the vendor in the Protocol Implementation Conformance Statement (PICS).

4.2 Test prerequisites

The following prerequisites are applicable for certification testing:

- A Protocol Implementation Conformance Statement (PICS) has to be completed by the vendor of a DUT when submitting a solution for OCPP certification (See separate PICS documents [3] and [4]). This should include all relevant limits and non-OCPP settings that are relevant for the test laboratory and for the correct functioning of the Charging Station / CSMS / software stack.

- When starting the certification process of an OCPP Product Family, all family members must be added to the PICS so that the test lab can choose a representative product.
- As a part of the certification process, the test lab will verify the PICS and in case of a Charging Station or software stack, all configuration variables will be read, validated where applicable and added to the test report.
- For CSMS:
 - o The vendor shall supply either a running copy of a CSMS on a server / laptop to the test laboratory or give the test laboratory access to a running copy of the CSMS on a separate environment that is accessible via the Internet (e.g. a cloud environment). In the latter case, an Internet connection from the test laboratory to the CSMS shall be made available. This environment shall be “handed over” to the test laboratory and not updated by the vendor without knowledge of the test laboratory.
 - o The test laboratory must have insight in the OCPP Software version at all times, during certification testing, e.g. by showing this version on the CSMS UI.
- For Charging Station:
 - o A network connection to the Charging Station should be available via a telecom connection or wired ethernet connection.
 - o To be able to test actual transactions, an EV is needed or has to be simulated. In the current EV market multiple types of sockets exist and no affordable EV simulators for all types of sockets are available at the time of writing. If an EVSE tester is available, this can be used (e.g. a type 2 socket to regular household socket with a dummy device (e.g. heater)). If no EV test socket or other test device is available at the testlab for a socket type, an EV is used. Please refer to Appendix B for examples of Evs that could be used per socket type.
 - o The test laboratory must have insight that the Firmware version has not changed at all times, during certification testing, e.g. by showing this version on the Charging Station UI or by showing the firmware version in the BootNotification.
- For a Charging Station software stack
 - o The vendor must supply a software stack, running on a machine (this can be a laptop or a specific device running the software)
 - o The vendor must implement a prescribed OCA API (that will be distributed separately) to trigger “manual” actions in the Charging Stations stack or a simple UI for triggering the functions:
 - Plugin / plugout
 - Authorize (e.g. simulate swipe an RDIF card)
 - When executing ISO 15118 test cases:
 - Start ISO15118 Certificate Installation / Update
 - Start / stop ISO 15118 PnC session
- For both Charging Stations and Charging Station Software Stacks, the OCTT will determine which Firmware version / OCPP Software Version is running during testing. This is done by reading the firmwareVersion field in the BootNotification field that must be implemented and filled by the vendor. The OCTT will automatically log the value.

- A technical representative of the Vendor is allowed to participate to the tests. If not physically present, a remote support from the technical team of the vendor *must* be arranged between the vendor and the test laboratory to help solving any issue raised during the certification tests.
- A Charging Station or Charging Station software stack has to be delivered with the lowest supported security level. During certification it will be upgraded if needed.
- To successfully execute the mandatory conformance test cases, the prerequisites for these tests have to be met.

5. Test procedure and Responsibilities

5.1 Certification Documents & Support

Test plans, configuration guides and engineering support are made available by the Test Laboratory to vendors in all stages of a vendor's preparation for certification. The responsibility for the test plans lies with the Open Charge Alliance.

5.2 Test Instrumentation & Test Plan

The Test Laboratory will distribute information to vendors regarding the test instruments that will be used during the certification tests if requested, including the OCTT version used for certification testing.

5.3 Test Procedures

Testers of the test laboratory will execute all tests and test procedures adhering strictly to the OCPP tests plans. Engineering staff from vendor companies may be present. Their presence may be required to resolve issues that may arise in the course of testing.

5.4 Pass Criteria

To be certified a vendor must successfully pass all tests described in chapter 4 and as defined in the OCPP test plans for the CSMS, Charging Station or Charging Station software stack submitted for certification.

In exceptional cases (e.g. in case of bugs in OCPP Compliance Testing Tool) the OCA Compliance Working group can decide that a vendor is certified despite not passing all tests according to the test plans.

5.5 Retesting

Testers of the test laboratory will execute all tests and test procedures that are applicable for the Protocol Implementation Conformance Statement (PICS) that is reported by the

vendor prior to the certification. If one or more tests fail, this will be reported back to the vendor and no certificate will be awarded (yet).

The policy for re-testing for the certification testing by the test laboratories is described below.

- Certificates are only valid for the device tested by the test laboratories and apply for a specific hardware feature set and a specific Firmware / OCPP software version;
- It is not allowed during the test to change the software. In that case all certification tests should be started over again;
- Any change on the device (hardware feature set or Firmware / OCPP software version) during the course of testing is not allowed and will require a full re-test of the DUT by the test laboratory;
- If a DUT “crashes” and requires a reset during conformance testing, this is considered as failing the conformance tests (and thus certification) and will thus require a re-test of the certification laboratory. This excludes crashes or problems caused by improper handling of the device by the test laboratory.

In case of un-clarity regarding the re-testing procedure, only the CWG of the Open Charge Alliance is authorized to decide on the procedure to be followed and this is not to be discussed between the Test Laboratory and the vendor.

5.6 Issue handling

Handling issues during tests can be separated in the following types:

- Configuration / setup issues. These are solved during testing, if necessary with the help of the technical representative of the vendor. When during the testing of a device a non-OCPP configuration is changed, all certification tests should be started over again;
- Bugs in software / hardware. This is considered as failing the certifications tests. See also 5.5 for handling of this situation.

6. Test Setup

6.1 General setup

The test setup used for Conformance testing is similar to the setup for the performance measurements. In order to have a fair comparison the connection properties are measured as part of the test. The test setups for testing are displayed in Figure 1 to Figure 5.

6.1.1 CSMS

In Figure 1 the setup for a CSMS with a fixed ethernet connection is displayed. The CSMS is connected to the internet as well as the machine running the OCPP Compliance Testing Tool. Before starting the actual tests, the bandwidth as well as the latency for the network connection are measured. Please refer to the next paragraph for more information on the Test laboratory connection tester. Testing is done manually (so not using an API).

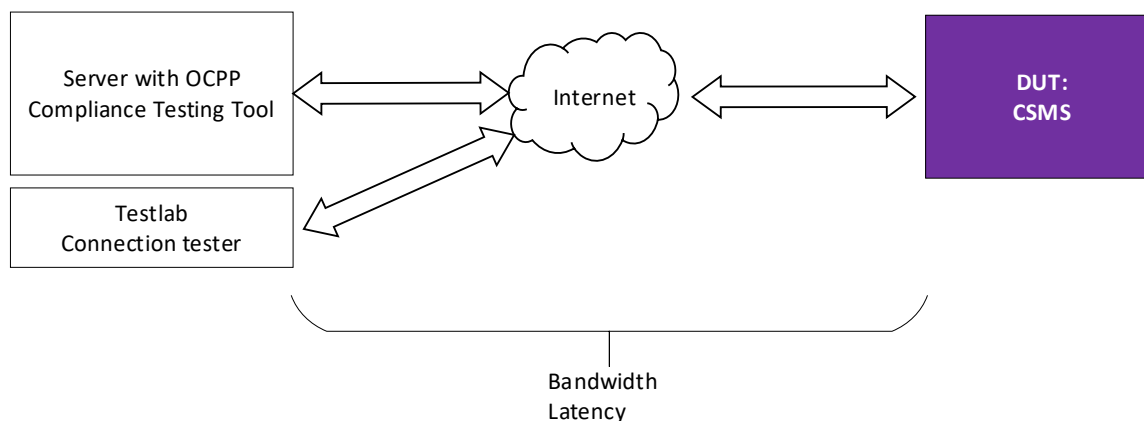


Figure 1: CSMS with fixed ethernet connection

6.1.2 Charging Station

In Figure 2 the setup for a Charging Station with a fixed ethernet connection or WiFi connection are displayed. In case of a fixed ethernet connection the Charging Station is connected via a UTP cable to a router that is connected to the internet. To be able to test actual transactions, actual EVs, EV test sockets or other test devices are used. This is visualised in a separate figure, with the test devices for the various types of Charging Stations. In the current EV market multiple types of sockets exist and no affordable EV simulators for all types of sockets are available at the time of writing. For this reason, if no EV test socket or other test device is available at the testlab, an EV is to be used (e.g. rented). Please refer to Appendix B for examples of EVs to use per socket type.

For both ethernet and WiFi connections, a limited access router is included in the setup. This is for enforcing a direct connection to the OCPP Compliance Test Tool, as it is

required for an OCPP Charging Station to speak OCPP directly, not - for example - via a cloud server.

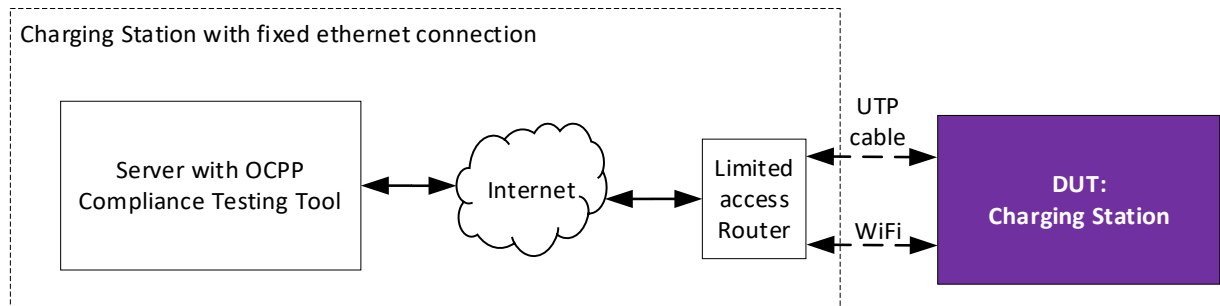


Figure 2: Test setup for a Charging Station with fixed ethernet connection

In Figure 3 the setup for a Charging Station with a telecom-only connection is displayed. The Charging Station is connected via mobile network to the OCPP Compliance Testing Tool. To be able to test bandwidth, 2 SIM cards (same network operator) are used: 1 for the Charging Station under test and 1 for testing the mobile internet connection at that location, with a Testlab Connection tester. The SIM cards will be provided by the test labs. To be able to test actual transaction, test sockets / test devices are used (see explanation above).

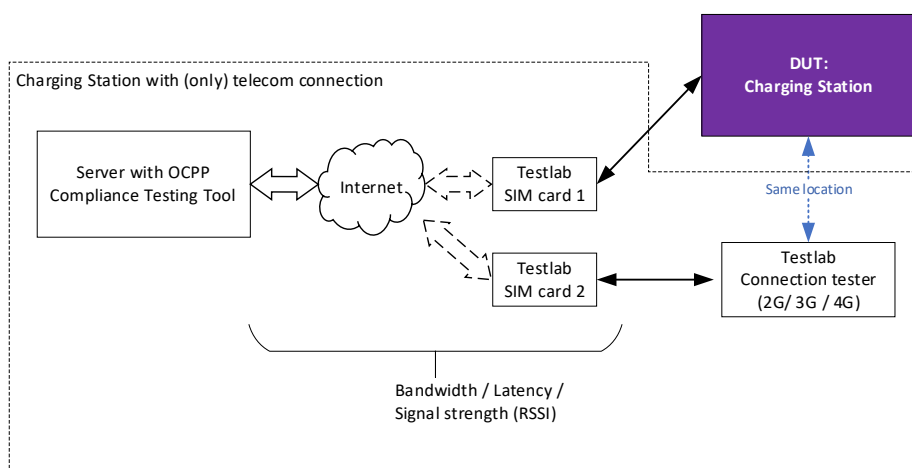


Figure 3: Test setup for a Charging Station with (only) telecom connection

For the tests where the DUT is a Charging Station, the OCA will provide test RFID cards that can be used in combination with the OCPP Compliance Testing Tool.

6.1.3 Charging Station software stack

In Figure 4 the test setup for a Charging Station software stack is displayed. If only the software stack is tested, parts of the Charging Station must be available in simulated / emulated form to enable the test laboratory tester to perform a full certification test. It is up to the vendor to provide a running copy (e.g. on a laptop, in cloud), the only requirement is that it is possible to setup a network connection to OCPP Compliance Testing Tool. This should be available via a telecom connection, WiFi or wired ethernet connection.

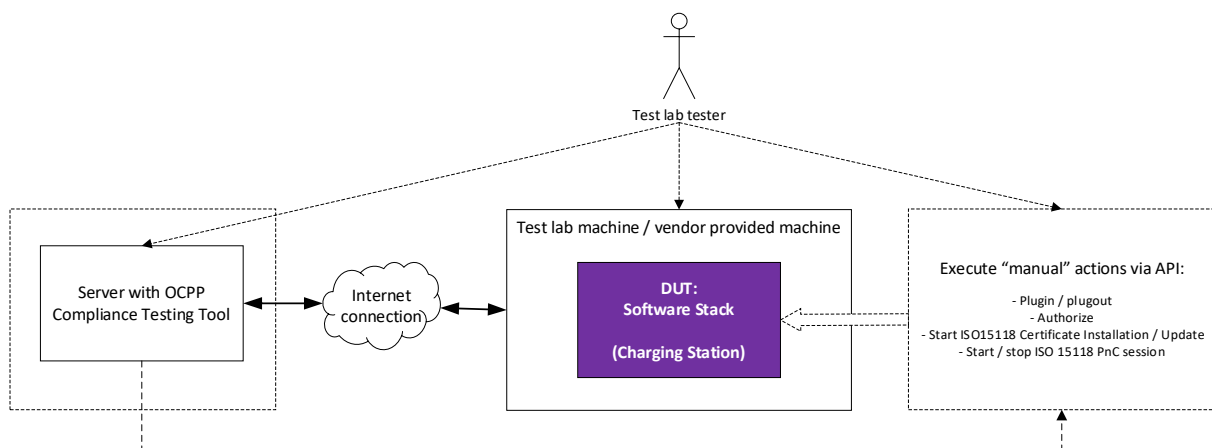


Figure 4: Test setup for testing Charging Station software stacks

In this test setup, the tester from the test laboratory will control the OCPP Compliance Testing Tool, but must also be enabled *by the vendor* to perform the manual actions that would be needed to control a physical Charging Station *using an OCA prescribed API*. This is the API belonging to the OCTT for OCPP 2.0.1 that will be distributed separately when applying for certification¹. This means that a vendor must provide this API implementation to allow the test laboratory tester to perform the following actions:

- Plugin / plugout for all (virtual) connectors
- (De)authorize (e.g. simulate swiping an RFID card). When simulating RFID card swiping, it should be possible to use at least 2 different idTokens.
- Suspending charging on EV & EVSE side

¹ only in exceptional cases, if approved by OCA and if the test lab agrees, an alternative can be used.

- If the TxStart / Stop point ParkingBayOccupancy is implemented: Drive EV in/out of parking bay
- Cold booting a Charging Station (only restarting the software stack suffices)

In addition, the following rules specifically apply for a Charging Station Software Stack:

- During a charging session, the DUT must also be able to send Metervalues.
- Resetting: the rebooting / reconnection as defined in the requirements must be triggered by the OCPP implementation (i.e. the stack must initiate this). In this case there are 2 options for the reset:
 - Rebooting is done automatically by the software stack restarting itself.
 - Rebooting can be done manually by the test lab tester, but only by a clear notification of the implementation (-> not the OCPP message, but the message to the hardware or a simple UI).
- Updating firmware: the software stack must be able to go through all OCPP specified steps that are part of a firmware update, including the download, notifications, described security validations (e.g. firmware signing certificate and signature check) and reboot / reconnect.
- Uploading charger logs: a software stack must be able to go through all OCPP specified steps that are part of uploading logfiles. It is not required that logfiles contain hardware related information.

When the vendor of the Charging Station stack wants to be certified for the ISO 15118 Certification Profile, the test laboratory tester should also be enabled *by the vendor* to execute the required ISO 15118 test cases that would normally be done by an ISO 15118 emulator. The necessary actions are:

- Start ISO15118 Certificate Installation / Update
- Start / stop ISO 15118 PnC session
- Start / stop ISO 15118 EIM session

It is the responsibility of the vendor to provide a running setup of the stack (including the API) at the testing laboratory location.

6.2 Test setup for re-certification

When re-certifying it is allowed - but not required - to use the API, to save time for the manual actions on a DUT by the test lab. The test setup-for a Charging Station and CSMS when re-certifying an implementation is similar to the general test setup described in 6.1. However, the manual actions that are performed in the DUT are now done via the API of the OCTT to the DUT. For Charging Stations, a vendor must provide the OCTT API implementation to allow the test laboratory tester to perform the following actions:

- Plugin / plugout for all (virtual) connectors
- (De)authorize (e.g. simulate swiping an RFID card). When simulating RFID card swiping, it should be possible to use at least 2 different idTokens.
- Suspending charging on EV & EVSE side

For CSMS a separate OCTT API is available that triggers messages from a CSMS towards the Charging Station that are required by the test cases.

6.3 Test setup for re-certification

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- Plugin / plugout for all (virtual) connectors
- (De)authorize (e.g. simulate swiping an RFID card). When simulating RFID card swiping, it should be possible to use at least 2 different idTokens.
- Suspending charging on EV & EVSE side

For CSMS a separate OCTT API is available that triggers messages from a CSMS towards the Charging Station that are required by the test cases.

6.4 Test laboratory tools

In order to perform the certification tests, the test laboratory will use several different testing tools for emulating an EV, depending on the type of Charging Stations. The various test tools for this purpose are visualised in [Figure 5](#).

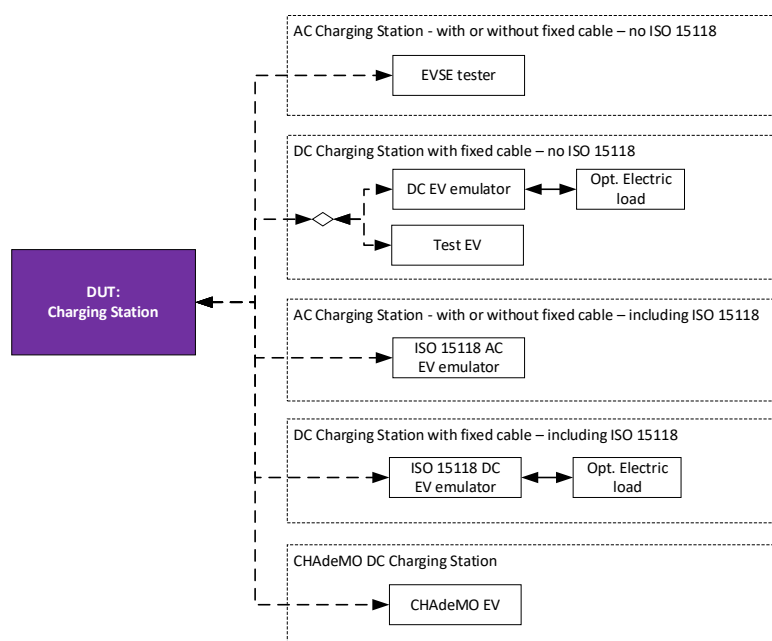


Figure 5: Test tools to enable the test labs to simulate an EV

The Test laboratory will use the following test tools:

For emulating an EV:

Test tool	Type of Charging Station	Provided by OCA
(Mode 3) EVSE tester plug for AC type 1	AC Charging Station with or without a fixed cable and no ISO 15118	Yes
(Mode 3) EVSE tester plug for AC type 2	AC Charging Station with or without a fixed cable and no ISO 15118	Yes
DC EV emulator	DC Charging Station with fixed cable - no ISO 15118 (CCS)	Yes
Test EV (e.g. rental car)	DC Charging Station with fixed cable - no ISO 15118 (CHAdeMO)	N.a.
ISO 15118 AC EV emulator	AC Charging Station with or without a fixed cable, including ISO 15118	Yes
ISO 15118 DC EV emulator + opt. electric load / source	DC Charging Station with a fixed cable, including ISO 15118	Emulator: yes Opt. load: no

Other testing tools:

Test tool
Ocpp Compliance Testing Tool (OCTT) for OCPP 2.0.1
Test laboratory connection tester

Mobile communication dongle that supports enabling and disabling 2G, 3G and 4G

Please refer to Appendix A: Test tools for the details on the test tools (brand / types).

Test laboratory connection tester

The test laboratory shall use a “connection tester”, which refers to hardware / software that can measure:

- the internet connection from the server with OCPP Compliance Testing Tool to the CSMS under test. This will be done by executing an online internet speed test on both the CSMS as well as the machine running the OCPP Compliance Testing Tool.
- the properties of the internet connection (2G and / or 3G and / or 4G) from the server with OCPP Compliance Testing Tool to the location of the Charging Station under test.

This can for example be done by using a mobile communication dongle and a laptop. This dongle must support enabling and disabling 2G, 3G and 4G. For each type, an online internet speed test will be executed, to determine the bandwidth / latency. For determining the signal strength, separate software could in this setup be used to determine the signal strength (actual results depends on the dongle used, but it is merely to get an indication of the signal strength).

For uniformity, the same device is to be used for this by all labs. Please refer to Appendix A for the exact device that will be used.

7. Conformance test plan

7.1 Introduction

This chapter describes the conformance test plan for vendors to successfully complete as part of the OCPP certification program.

7.1.1 Objective

The objective of the conformance tests is to verify and validate the correct implementation of the OCPP protocol of a Charging Station, CSMS or Charging Station software stack.

7.1.2 Scope of tests

The scope of the conformance tests is to verify and validate the correct implementation of the OCPP protocol of a Charging Station, CSMS or Charging Station software stack by testing the DUT against the OCPP Compliance Testing Tool (OCTT) which automatically validates the responses by the DUT. Furthermore, the basic functionalities that are a consequence of messages in the OCPP protocol of a Charging Station, CSMS or Charging Station software stack are verified and validated during these OCTT tests. These tests are done by doing manual checks while running scenarios from the OCPP Compliance Testing Tool.

7.1.3 Acceptant and acceptance criteria

The Test Laboratory that executes the conformance test is not responsible for accepting or rejecting an OCPP implementation, but only responsible for executing the conformance test and reporting the results to the vendor and OCA.

The acceptance criteria for the conformance test is that all mandatory and applicable conditional tests for certification are executed successfully.

7.1.4 Optional functionalities

OCPP holds some optional CSMS and Charging Station functionalities within the functional blocks. On a Charging Station (Software Stack) these functionalities are managed by Read-only / Optional Variables and Device Model components. An issued certificate contains the following information:

- The optional features that are implemented and successfully tested.
- Whether the optional variables that are listed in the Referenced Components and Variables from the OCPP 2.0.1 specification are implemented or not.
- What value the implemented “Read-only” variables contain.

7.2 Conformance tests

7.2.1 Test basis

OCPP 2.0.1

The basis for testing conformance is the OCPP 2.0.1 specification 2nd edition (date: 2022-12-15) and the latest OCPP 2.0.1 Errata sheet.

Additionally, the following documentation is used:

- the test cases for conformance testing are listed in the OCPP Specification part 5. This document contains the list of mandatory and conditional scenarios from the OCPP Compliance Testing Tool. The details of the test cases can be found in the OCPP Specification part 6.

7.2.2 Test approach

The approach of testing is to test the DUT using the OCPP Compliance Testing Tool, manual functional verifications are executed during these conformance tests. Between tests, a utility test case from the OCPP Compliance Testing Tool can be used to set the Charging Station to a basic idle state to prevent test cases influencing each other.

The overall test process consists of the following steps:

- The Internet connection properties are measured.
- Test scenarios are started using the OCPP Compliance Testing Tool.
- Messages are automatically exchanged.
- Manual actions are executed by a test laboratory tester.
- Manual / on screen validations are executed by a test laboratory tester.

Intake DUT

As part of the conformance test, the following intake is done:

- A short pre-test is done to show that the DUT is functioning and is not, for example, damaged during transport.

Entry and exit criteria

Entry criteria for executing conformance test:

- All prerequisites that are documented in the OCPP Certification Procedure shall be met.
- All prerequisites that are documented in the OCPP Certification Test Procedure shall be met.
- Sufficient documentation about the DUT is available to the test laboratory in order to execute the manual actions for the test scenarios.

Exit criteria for executing conformance test:

- All mandatory test scenarios for the selected certification profiles as referred in the OCPP specification part 5 (and can be determined using the PICS) shall be executed successfully.
- All Conditional test cases for the selected certification profiles as referred in the OCPP specification part 5 belonging to the vendor provided implementation details (as can be determined using the PICS) shall be executed successfully.

7.3 Test script certification run

The actions that are executed for the conformance tests are the following:

Preparation:

1. A running instance of the OCPP Compliancy Testing Tool is provided to the test laboratory (once)
2. The OCPP Compliancy Testing Tool UI is opened in a browser
3. The tester chooses the system that is tested
4. The information from the PICS is uploaded in the OCTT
5. The remaining configuration is entered in the OCTT
6. The test configuration is (automatically) added to the “OCPP Certification Report”.

Execution will be done for each test. The list of test cases that needs to be performed based on the PICS, is pre-filtered by the OCTT for the test lab and presented randomized by the OCTT. For each test case the following steps are performed:

1. If testing a Charging Station:
 - a. The charging station is returned to basic state of operations using the OCTT restore mechanism (must be executed *successfully* before continuing)
2. If a transaction is running, the OCTT attempts to stop the transaction.
3. The test case is started in the OCTT. The Id and name used in the test tool user interface can be found in OCPP Specification part 5 and 6 for more details and, if applicable, the conditions for this test case.
4. The steps in the scenario details in the OCPP Specification part 6 and the instructions given by the tool user interface are followed. Tool validations are done automatically.
5. After finishing the test case in the OCTT: based on the outcome of the test (PASS / FAIL / INCONC) and the OCTT test rules (see Appendix B), the result of the scenario is determined.

The Test Report is updated accordingly and can be exported after the certification run. A test report is generated including the OCTT configuration used and - for charging stations only - a hash of the firmware that was installed during test case TC_L_01_CS.

This hash will also be printed on the OCPP Certificate. Please note that the image provided by the vendor to the test lab therefore must be a full image of the firmware for allowing an initial install (without any dependencies).

7.4 Vendor Declaration of Conformance

When a vendor wants to create a Vendor Declaration of Conformance for a product that is part of a product family, the following steps must be followed:

1. The PICS must be filled in correctly (please note: this cannot be changed during a run!)
2. The PICS must be loaded in the OCTT which means that it automatically selects the certification profiles, applicable test cases and configuration for the Charging Station
3. The OCTT will automatically run all test cases in PICS mode. All test cases must be run automatically, without human intervention, within 1 day, without interruptions.
4. Some test cases are (automatically) run multiple times, e.g. the test cases related to the authorization options.
5. If all test cases are passed, the OCTT will generate a Vendor Declaration of Conformance Report, which is digitally signed by OCTT.

8. Performance measurements

8.1 Introduction

This chapter describes the performance measurements that are performed by the test laboratory as part of the OCPP certification program.

8.1.1 Objective

The objectives of the Performance measurements are to measure the performance of a DUT within a lab context and to provide these as additional information to the certificate. The purpose of the Performance measurement is to measure the performance parameters that are stated by a vendor in the Protocol Implementation Conformance Statement (PICS).

8.1.2 Scope of tests

The scope of the performance measurement is to measure a number of performance parameters that are stated by a vendor in the Protocol Implementation Conformance Statement (PICS). The template PICS related to performance will be provided by the test lab as a separate document (see [3] and [4]). The values that are stated by the vendor in the PICS do not have to fall within a set of upper / lower boundaries for certification, but will only be included in the test report to provide information to buyers of a device. These performance parameters are listed in paragraph 8.2.1.

8.1.3 Acceptant and acceptance criteria

The Test Laboratory that executes the performance measurement is not responsible for accepting or rejecting an OCPP implementation, but only responsible for executing the performance measurement and reporting the results to the vendor and OCA.

The only acceptance criterium for the performance measurement is that all parameters from the PICS are measured.

8.2 Performance measurements

8.2.1 Test basis

The basis for the measurements is the OCPP 2.0.1 specification (see 7.2.1 for exact version).

The following list of performance parameters is used:

Name	Description
OCPP triggered function time (non reporting)	The response time for when waiting for an OCPP response message after sending an OCPP request message. This entails all OCPP messages. Messages to the DUT can be handled within this timeout.
OCPP triggered function time (asynchronous reporting)	The response time used when waiting for an asynchronous OCPP report after requesting this report (the time between receiving a GetReportRequest, GetBaseReportRequest or CustomerInformationRequest and the last corresponding NotifyReportRequest or NotifyCustomerInformationRequest).
OCPP response time	The timeout used for when waiting for an OCPP response message after sending an OCPP request message. This entails all OCPP messages, excluding Authorize and RequestStartTransaction. Messages to the DUT can be handled within this time.
Response time Authorize	The response time for the Authorize message.
Transaction authorization time by RequestStartTransactionRequest	The time between a RequestStartTransactionRequest and the corresponding TransactionEventRequest (with triggerReason RemoteStart). Only cases where the RequestStartTransactionRequest immediately results in an authorization followed by a TransactionEventRequest (with triggerReason RemoteStart), without the need of any additional manual actions or chargingState transitions inbetween are included.
Transaction authorization end time by RequestStopTransactionRequest	The time between a RequestStopTransactionRequest and the corresponding TransactionEventRequest (with triggerReason RemoteStop). Only cases where the RequestStopTransactionRequest immediately results in an end of the authorization followed by a TransactionEventRequest (with triggerReason RemoteStop), that do not contain transactionInfo.chargingState = EVConnected (to exclude chargingState transitions) are included.

8.2.2 Test approach

Performance measurements will be done in the following way: for measuring message timeouts the OCPP Compliance Testing Tool for OCPP is used. This tool logs all messaging. Based on this logging, the response times are determined.

As introduced in chapter 6, the tests are executed in a predefined test setup. Especially for performance measurements, this setup is important to get accurate measurements. Furthermore; it is important to measure performance in detail, without including effects that are out of control of a DUT.

In case of the OCPP protocol the main bottleneck is the network connection between the Charging Station and the CSMS. For this reason a number of parameters related to bandwidth is measured in (and by) the test laboratory before and during the measurement when a mobile connection is used. This is done using a mobile communication dongle connected to a laptop at the same location. This is (of course) only an indication to make sure that the mobile communication network is available at that location.

The following table lists the parameters that are measured concerning the network connection:

Parameter	Unit	Minimum / maximum for test setup*
Bandwidth	kB per second	Minimum: 5 kB per second
Latency	ms	Maximum: 1000 ms
Signal strength (RSSI) if applicable	dBm	Minimum: -81 dBm (CSQ 16)

* If these values are not met, the test lab should change the setup to improve the connection, before executing the measurement.

Please note: only 1 communication technology is measured for performance, so if multiple technologies available in a Charging Station, the technology that has to be used for the measurements must be stated in the PICS for performance.

8.2.3 Intake DUT

As part of the performance measurement, the following intake is done:

- Connectivity between the OCPP Compliance Testing Tool to the DUT is setup and measured (bandwidth, latency, RSSI).
- If not done during previous tests, a short pre-test is done to show that the DUT is functioning and is not, for example, damaged during transport.

8.2.4 Entry and exit criteria

Entry criteria for executing performance measurements:

- All prerequisites that are documented in the OCPP Certification Procedure shall be met.
- All prerequisites that are documented in the OCPP Certification Test Procedure shall be met.
- Sufficient documentation about the DUT is available to the test laboratory in order to execute the manual actions for the test scenarios.

Exit criteria for executing performance measurements:

- All performance criteria that are listed in 8.2.1 shall be measured and the measured values are within the values filled in by the vendor in the PICS.

8.3 Test script

The actions that are executed for the performance measurements are the following:

Preparation for a Charging Station:

1. The Charging Station that is tested, must be configured in the OCPP Compliance Testing Tool.
2. The network parameters as described in paragraph 8.2.2 are measured. In case of a poor network connection, it is attempted to optimize the connection so that it does not influence the performance measurements results.

Preparation for a CSMS:

1. The CSMS must be configured in the OCPP Compliance Testing Tool.
2. The network parameters as described in paragraph 8.2.2 are measured. In case of a poor network connection, it is attempted to optimize the connection so that it does not influence the performance measurements results.

For the response time values, the OCPP Compliance Testing Tool logs are used to determine the measured values. The Test Report is updated accordingly.

8.4 Performance measurement for OCPP Product Family

When a vendor certifies for multiple products that belong to an OCPP product family, only the Representative Product for the OCPP family will be completely tested including a performance measurement by an OCA Designated test laboratory. The other OCPP family members will be added by validating a Vendor Declaration of Conformance. The performance measurement of the family members are *not* part of the Vendor Declaration of Conformance and thus not added to the certificate.

Appendix A: Test tools

The certification tests must be executed using an EV or the test tools listed below. It is not permitted to use other test tools.

- OCPP Compliance Testing Tool. This test tool is supplied to the Testing Laboratory and maintained by the Open Charge Alliance.
- Mobile communication dongle for performance measurements
 - Brand: Huawei
 - Type: E3372h LTE dongle
- EV emulator, the following types must be used
 - EV emulator for AC / DC Type 1/2 provided by OCA:
 - Brand / Type: Trialog / EVComboCS4M
 - An EV emulator owned by the test lab for AC / DC Type 1/2, one of the following:
 - Brand / Type: Keysight / Charge Discovery system
 - Brand / Type: Comemso / EVCA-system

It is not allowed to use vendor provided test tools.

Appendix B: Conformance tests - OCTT Test Rules

- If the validations from the OCTT are applied and the OCTT result is “FAIL” (or “INCONC” or “ERROR”)
 - If one or more tool validations have failed, the result of the scenario is considered as failed.
 - A retest of the scenario should be executed if it has been determined that this is due to the test setup or a human error.
- *Please note:* some of the OCTT conformance tests are performed with multiple configurations by the certification lab based on the PICS (RSA/ECDSA, authorization options etc).
- Currently no other rules are applicable.

Appendix C: Example EVs to use for testing

The following list contains example EVs that can be used for testing (non exhaustive):

Socket type	Possible EV (non-exhaustive list)
CHAdemo	Citroën Berlingo Electric Citroën C-Zero Kia Soul EV Mitsubishi Outlander PHEV Nissan Leaf 2 or e-NV200
CCS	BWM i3 Hyundai Ioniq Hyundai KONA Kia e-Niro Opel Ampera-e Tesla Model 3 Volkswagen e-Golf or e-up
Tesla	Tesla model S / X