ChargeX-CharIN Prescribed Test Plan

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Intended Use: During the CharIN June 2024 Testival in Cleveland, OH

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1. Scope of Document

This document details the conditions for the prescribed test plan scenarios to be used for the upcoming CharIN June 2024 Testival in Cleveland, OH.

2. Testing Conditions

2.1. Goals

- To demonstrate the effectiveness of the *EV-EVSE Interoperability Test Plan (EEITP)* ChargeX deliverable through a subset of tests to be included in a prescribed test plan.
- To reflect industry-desirable test cases based on industry feedback throughout Testing TF meetings and the EEITP workshop hosted at Argonne National Laboratory on April 29th.
- To encourage the testing of advanced charging features such as ISO 15118-2 & ISO 15118-20 implementations, Plug&Charge capabilities, authentication methods, and fallback mechanisms.
- To provide a well-structured prescribed testing approach with technical details decisions based on industry input and previous prescribed testing experiences.
- To collect comparable results through the outcomes of prescribed testing, and to benchmark the technological advancements & common issues of pre-production equipment /software from those participating in this program.

2.2. Test Participants

- This event targets manufacturers and CPOs of EVs and EVSEs capable of DC fast charging attending the CharIN Testival who have opted to participate in the prescribed testing program.
- Every participating company shall provide staff who can set up, configure, and execute the test scenarios according to the test plan and categorize potentially found interoperability issues according to the test reporting template.

2.3. Test Process

- Tests will be conducted in test couples based on a test schedule that is derived through a technical matchmaking system. This matchmaking is based on registration information and prescribed testing program signup that will be provided by each participating company before the event.
- During each test slot the registered participants will be testing in parallel to one another. Test pairings will change in Round Robin procedure between test slots according to the provided test schedule.
- A ChargeX moderator will be assigned to each test pairing during the prescribed testing period to relieve the testers from additional duties such as recording results, relaying test case steps & setup details, providing clarification, etc.

- All pairings will be designated as either “Group 1” or “Group 2” for each specific timeslot. This is done to minimize the necessary ChargeX moderator work force staff. The time breakdown between adhoc testing and prescribed testing for the two groups is as follows:
    - Group 1: 30-minutes adhoc, 30-minutes prescribed, 30-minutes adhoc
    - Group 2: 30-minutes adhoc, 30-minutes adhoc, 30-minutes prescribed
- Testers should aim to complete all included test scenarios during the prescribed testing period if they have the technical capabilities to do so. If tests scenarios were not able to be performed or completed by the end of the testing period, it should be noted in the results of that test scenario.
- Testers are not limited to the number of attempts at completing a test scenario to achieve success if desired, however it should be noted in the results section if a test was performed multiple times, as well as the issues that arose during the prior unsuccessful test attempts.

2.4. Test Report Submission

- Each test couple is required to work with their assigned moderator to submit a test report until the end of each prescribed testing period according to the online survey method provided by the technical organizer.

3. Test Scenarios

The test scenarios are designed to be completed in sequential order, with tabular details surrounding the test case description. An online version (i.e. LimeSurvey) of this test plan for collecting results will be provided prior to the event. Further details around testing setup and conditions may be provided if necessary closer to the event date. The prescribed test plan includes the following 9 test scenarios:

- TS1: EIM Authentication Types after Plug-in (DIN 70121)
- TS2: EIM Authentication Types before Plug-In (DIN 70121)
- TS3: Timeout after Plug-in (DIN 70121)
- TS4: Timeout after Authentication (DIN 70121)
- TS5: EIM Authentication types after Plug-in (ISO 15118-2)
- TS6: PnC with Valid Certificates (ISO 15118-2)
- TS7: PnC with EV Contract Certificates having Incorrect Fields (ISO 15118-2)
- TS8: PnC with EV Contract Certificates being Expired (ISO 15118-2)
- TS9: EIM Authentication types after Plug-in (ISO 15118-20)

TS1: EIM Authentication Types after Plug-in (DIN 70121)

Test Identifier:	TS1			
Test Name:	EIM Authentication Types after Plug-in (DIN 70121)			
Test Type:	Intentional Charging			
Test Category:	Authentication Types, Methods & Timeouts			
Purpose:	To ensure "Plug-first" option is available. To ensure alternative authentication methods are accepted.			
Pre-Test Conditions:	Authentication Type (choose):	• Credit Card INSERT • ~~Credit Card TAP~~ • ~~RFID~~ • ~~App~~ • ~~Other EIM~~		
	Plug-in or authenticate first:	Plug-in		
	Communication protocol:	DIN 70121		
	Involved Systems:	EV, EVSE		
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**		
	2	Plug-in EV.		
	3	Within 30 seconds, provide '**Authentication Type'.**		
	4	Observe session initialization into power transfer.		
	5	Terminate charge session 30-60 seconds into power transfer.		
	6	Unplug EV.		
Pass Criteria:	Plug-first method is accepted.		Pass	Fail
	Authentication method is accepted.		Pass	Fail
	Session initialization begins and reaches power transfer stage.		Pass	Fail
Observed Metrics:	Session initialization stages			
Intended MRECs/Errors:	None			
Possible MRECs/Errors:	"Payment Failure", "AuthorizationTimeout", "Invalid Sequence"			
Recorded Test Results:	• Pass/Fails. • Point of failure (if applicable)			

TS2: EIM Authentication Types before Plug-In (DIN 70121)

Test Identifier:	TS2			
Test Name:	EIM Authentication Types before Plug-in (DIN 70121)			
Test Type:	Intentional Charging			
Test Category:	Authentication Types, Methods & Timeouts			
Purpose:	To ensure "Authenticate-first" option is available. To ensure alternative authentication methods are accepted.			
Pre-Test Conditions:	Authentication Type (choose):	~~• Credit Card INSERT~~ • Credit Card TAP ~~• RFID~~ ~~• App~~ ~~• Other EIM~~		
	Plug-in or authenticate first:	Authenticate		
	Communication protocol:	DIN 70121		
	Involved Systems:	EV, EVSE		
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**		
	2	Provide '**Authentication Type'.**		
	3	Within 30 seconds, Plug-in EV.		
	4	Observe session initialization into power transfer.		
	5	Terminate charge session 30-60 seconds into power transfer.		
	6	Unplug EV.		
Pass Criteria:	Authentication-first method is accepted.		Pass	Fail
	Authentication method is accepted.		Pass	Fail
	Session initialization begins and reaches power transfer stage.		Pass	Fail
Observed Metrics:	Session initialization stages			
Intended MRECs/Errors:	None			
Possible MRECs/Errors:	"Payment Failure", "AuthorizationTimeout", "Invalid Sequence"			
Recorded Test Results:	• Pass/Fails. • Point of failure (if applicable)			

TS3: Timeout after Plug-in (DIN 70121)

Test Identifier:	TS3				
Test Name:	Timeout after Plug-in (DIN 70121)				
Test Type:	Timeouts				
Test Category:	Authentication Types, Methods & Timeouts				
Purpose:	To test for "provide authentication" timeout time. To ensure clear instructions are delivered to EV driver upon timeout. To ensure "AuthorizationTimeout" MREC is produced from timeout (Optional).				
Pre-Test Conditions:	Authentication Type (choose):	~~Credit Card INSERT~~ ~~Credit Card TAP~~ ~~RFID~~ ~~App~~ ~~Other EIM~~			
	Plug-in or authenticate first:	Plug-in			
	Communication protocol:	DIN 70121			
	Involved Systems:	EV, EVSE			
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**			
	2	Plug-in EV.			
	3	Do not provide **'Authentication Type'**, wait 5-minutes or until timeout.			
	4	Upon timeout, log timeout time, log EV & EVSE instructions for user after timeout			
	5	Unplug EV.			
Pass Criteria:	Timeout occurs.			Pass	Fail
	User is prompted with instructions through EV and/or EVSE after timeout.			Pass	Fail
Observed Metrics:	EVSE user interface, EV user interface, Time after plug-in				
Intended MRECs/Errors:	"AuthorizationTimeout"				
Possible MRECs/Errors:	"Payment Failure"				
Recorded Test Results:	• Pass/Fails. • Session timeout time. • Instructions after timeout, where they were provided. • Point of failure (if applicable)				

TS4: Timeout after Authentication (DIN 70121)

Test Identifier:	TS4				
Test Name:	Timeout after Authentication (DIN 70121)				
Test Type:	Timeouts				
Test Category:	Authentication Types, Methods & Timeouts				
Purpose:	To test for "provide plug-in" timeout time. To ensure clear instructions are delivered to EV driver upon timeout. To ensure "AuthorizationTimeout" MREC is produced from timeout (Optional).				
Pre-Test Conditions:	Authentication Type (choose):	~~• Credit Card INSERT~~ ~~• Credit Card TAP~~ ~~• RFID~~ • App ~~• Other EIM~~			
	Plug-in or authenticate first:	Authenticate			
	Communication protocol:	DIN 70121			
	Involved Systems:	EV, EVSE			
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**			
	2	Provide **'Authentication Type'**.			
	3	Do not plug-in, wait 5-minutes or until timeout.			
	4	Upon timeout, log timeout time, log EV & EVSE instructions for user after timeout			
	5	Unplug EV.			
Pass Criteria:	Timeout occurs.			Pass	Fail
	User is prompted with instructions through EV and/or EVSE after timeout.			Pass	Fail
Observed Metrics:	EVSE user interface, EV user interface, Time after authentication				
Intended MRECs/Errors:	""AuthorizationTimeout"				
Possible MRECs/Errors:	"Plug-in Failure"				
Recorded Test Results:	• Pass/Fails. • Session timeout time. • Instructions after timeout, where they were provided. • Point of failure (if applicable)				

TS5: EIM Authentication types after Plug-in (ISO 15118-2)

Test Identifier:	TS5			
Test Name:	EIM Authentication Types after Plug-in (ISO 15118-2)			
Test Type:	Intentional Charging			
Test Category:	Authentication Types, Methods & Timeouts			
Purpose:	To ensure "Plug-first" option is available. To ensure alternative authentication methods are accepted. To ensure ISO 15118-2 session initialization is functional.			
Pre-Test Conditions:	Authentication Type (choose):	• Credit Card INSERT • Credit Card TAP • RFID • App • Other EIM		
	Plug-in or authenticate first:	Plug-in		
	Communication protocol:	ISO 15118-2 (TLS or No-TLS)		
	Involved Systems:	EV, EVSE		
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**		
	2	Plug-in EV.		
	3	Within 30 seconds, provide '**Authentication Type'.**		
	4	Observe session initialization into power transfer.		
	5	Terminate charge session 30-60 seconds into power transfer.		
	6	Unplug EV.		
Pass Criteria:	Plug-first method is accepted.		Pass	Fail
	Authentication method is accepted.		Pass	Fail
	Session initialization begins and reaches power transfer stage.		Pass	Fail
Observed Metrics:	Session initialization stages			
Intended MRECs/Errors:	None			
Possible MRECs/Errors:	"Payment Failure", "AuthorizationTimeout", "Invalid Sequence"			
Recorded Test Results:	• Pass/Fails. • Authentication type used. • TLS or No-TLS used. • Point of failure (if applicable)			

TS6: PnC with Valid Certificates (ISO 15118-2)

Test Identifier:	TS6				
Test Name:	PnC with Valid Certificates (ISO 15118-2)				
Test Type:	Intentional Charging				
Test Category:	Single PKI: Basic Certificate Validity Testing				
Purpose:	To ensure Plug&Charge functionality works with valid certificates.				
Pre-Test Conditions:	Authentication Type (choose):	• Plug & Charge (PnC)			
	Communication protocol:	ISO 15118-2 (TLS or No-TLS)			
	Involved Systems:	EV, EVSE, ProvServ			
	EV Provisioning certificate	Valid	n/a		
	EV Contract certificate	Valid	n/a		
	EVSE Contract certificate	Valid	n/a		
	ProvServ Contract certificate	Valid	n/a		
	Fallback method	n/a			
Steps:	1	Ensure EV Provisioning certificate is valid.			
	2	Ensure EV Contract certificate is valid.			
	3	Ensure EVSE Contract certificate is valid.			
	4	Ensure Provisioning Service Contract certificate is valid.			
	5	Set EVSE authentication option to '**Authentication Type**'.			
	6	Plug-in EV			
	7	Observe session initialization into power transfer.			
	8	Terminate charge session 30-60 seconds into power transfer.			
	9	Unplug EV.			
Pass Criteria:	Plug&Charge method is accepted.			Pass	Fail
	Session initialization begins and reaches power transfer stage.			Pass	Fail
Observed Metrics:	Session initialization stages, HLC Messages				
Intended MRECs/Errors:	None				
Possible MRECs/Errors:	"Invalid Certificate", "Payment Failure"				
Recorded Test Results:	• Pass/Fails. • TLS or No-TLS used. • Point of failure (if applicable)				

TS7: PnC with EV Contract Certificates having Incorrect Fields (ISO 15118-2)

Test Identifier:	TS7			
Test Name:	PnC with EV Contract Certificates having Incorrect Fields (ISO 15118-2)			
Test Type:	Fallback methods			
Test Category:	Single PKI: Basic Certificate Validity Testing			
Purpose:	To ensure Plug&Charge functionality fails with invalid certificates (incorrect fields). To ensure fallback method to EIM functions properly.			
Pre-Test Conditions:	Authentication Type (choose):	• Plug & Charge (PnC) • Other EIM		
	Communication protocol:	ISO 15118-2 (TLS or No-TLS)		
	Involved Systems:	EV, EVSE, ProvServ		
	EV Provisioning certificate	Valid	n/a	
	EV Contract certificate	Invalid	Incorrect Fields	
	EVSE Contract certificate	Valid	n/a	
	ProvServ Contract certificate	Valid	n/a	
	Fallback method	EIM (ISO 15118-2 or DIN 70121)		
Steps:	1	Ensure EV Provisioning certificate is valid.		
	2	Ensure EV Contract certificate is invalid (This can be achieved by changing 'Subject' field to 'null').		
	3	Ensure EVSE Contract certificate is valid.		
	4	Ensure Provisioning Service Contract certificate is valid.		
	5	Set EVSE authentication option to '**Authentication Type'**.		
	6	Plug-in EV.		
	7	Observe fallback to EIM after PnC failure.		
	8	Provide **'Authentication Type'**.		
	9	Observe session initialization into power transfer.		
	10	Terminate charge session 30-60 seconds into power transfer.		
	11	Unplug EV.		
Pass Criteria:	Plug&Charge method is not accepted due to invalid certificate.		Pass	Fail
	Session initialization fallback method to EIM functions correctly.		Pass	Fail
Observed Metrics:	Session initialization stages, HLC Messages			
Intended MRECs/Errors:	None			
Possible MRECs/Errors:	"Invalid Certificate", "Payment Failure"			
Recorded Test Results:	• Pass/Fails. • HLC protocol for Fallback method • TLS or No-TLS used. • Point of failure (if applicable)			

TS8: PnC with EV Contract Certificates being Expired (ISO 15118-2)

Test Identifier:	TS8			
Test Name:	PnC with EV Contract Certificates having Incorrect Fields (ISO 15118-2)			
Test Type:	Fallback methods			
Test Category:	Single PKI: Basic Certificate Validity Testing			
Purpose:	To ensure Plug&Charge functionality fails with invalid certificates (expired). To ensure fallback method to EIM functions properly.			
Pre-Test Conditions:	Authentication Type (choose):	• Plug & Charge (PnC) • Other EIM		
	Communication protocol:	ISO 15118-2 (TLS or No-TLS)		
	Involved Systems:	EV, EVSE, ProvServ		
	EV Provisioning certificate	Valid	n/a	
	EV Contract certificate	Invalid	Expired 'After' date	
	EVSE Contract certificate	Valid	n/a	
	ProvServ Contract certificate	Valid	n/a	
	Fallback method	EIM (ISO 15118-2 or DIN 70121)		
Steps:	1	Ensure EV Provisioning certificate is valid.		
	2	Ensure EV Contract certificate is expired (This can be achieved by changing 'Expire After' field to 'Jan 01 00:00:00 2024 GMT').		
	3	Ensure EVSE Contract certificate is valid.		
	4	Ensure Provisioning Service Contract certificate is valid.		
	5	Set EVSE authentication option to '**Authentication Type'**.		
	6	Plug-in EV.		
	7	Observe fallback to EIM after PnC failure.		
	8	Provide **'Authentication Type'**.		
	9	Observe session initialization into power transfer.		
	10	Terminate charge session 30-60 seconds into power transfer.		
	11	Unplug EV.		
Pass Criteria:	Plug&Charge method is not accepted due to invalid certificate.		Pass	Fail
	Session initialization fallback method to EIM functions correctly.		Pass	Fail
Observed Metrics:	Session initialization stages, HLC Messages			
Intended MRECs/Errors:	None			
Possible MRECs/Errors:	"Invalid Certificate", "Payment Failure"			
Recorded Test Results:	• Pass/Fails. • HLC protocol for Fallback method • TLS or No-TLS used. • Point of failure (if applicable)			

TS9: EIM Authentication types after Plug-in (ISO 15118-20)

Test Identifier:	TS9				
Test Name:	EIM Authentication Types after Plug-in (ISO 15118-20)				
Test Type:	Intentional Charging				
Test Category:	Authentication Types, Methods & Timeouts				
Purpose:	To ensure "Plug-first" option is available. To ensure alternative authentication methods are accepted. To ensure ISO 15118-20 session initialization is functional.				
Pre-Test Conditions:	Authentication Type (choose):	• Credit Card INSERT • Credit Card TAP • RFID • App • Other EIM			
	Plug-in or authenticate first:	Plug-in			
	Communication protocol:	ISO 15118-20 (TLS or No-TLS)			
	Involved Systems:	EV, EVSE			
Steps:	1	Set EVSE authentication option to '**Authentication Type'.**			
	2	Plug-in EV.			
	3	Within 30 seconds, provide '**Authentication Type'.**			
	4	Observe session initialization into power transfer.			
	5	Terminate charge session 30-60 seconds into power transfer.			
	6	Unplug EV.			
Pass Criteria:	Plug-first method is accepted.			Pass	Fail
	Authentication method is accepted.			Pass	Fail
	Session initialization begins and reaches power transfer stage.			Pass	Fail
Observed Metrics:	Session initialization stages				
Intended MRECs/Errors:	None				
Possible MRECs/Errors:	"Payment Failure", "AuthorizationTimeout", "Invalid Sequence"				
Recorded Test Results:	• Pass/Fails. • Authentication type used. • TLS or No-TLS used. • Point of failure (if applicable)				