Recommendation of Charging Interface Initiative e.V.

CharIN Guide ISO 15118 Service HPC1

V1.3

10.06.2021

Contents

1. Introduction

ISO 15118-2 and ISO 15118-3 specify the communication between an electrical vehicle and an AC or DC charging station according to the Combined Charging System (CCS). ISO 15118-2 was published in 2014 and specifies functionalities for automatic authorization also referred to as Plug and Charge (PnC) and load management based on power schedules and tariff tables. Power schedules allow the prediction of the charging process over time. For changing an existing schedule during the charging process, ISO 15118-2 also introduces a renegotiation mechanism that allows both sides to agree on new charging limits.

Compared to DIN SPEC 70121, ISO 15118-2 adds the following requirement definitions for DC charging (see Figure 1):

- Plug and Charge: Automatic Payment
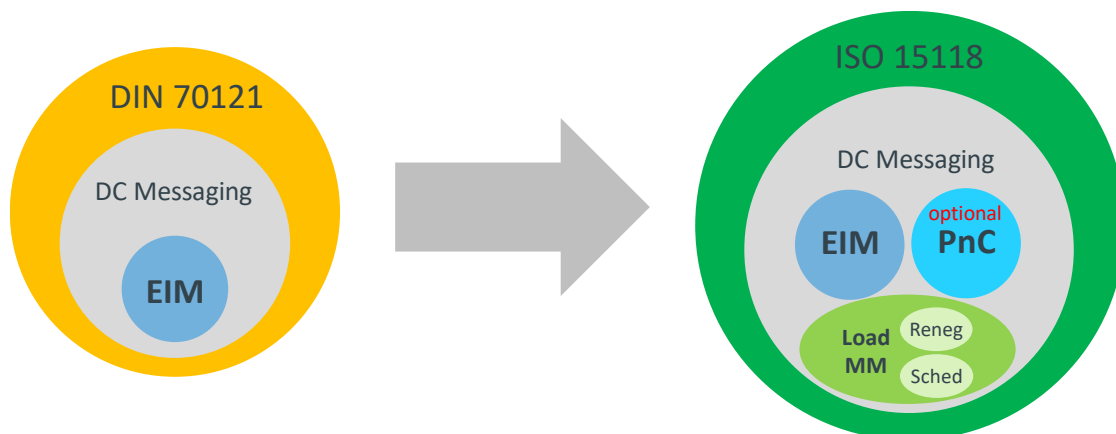- Load Management: Renegotiation and Schedules for power and tariffs over time

Figure 1: Difference between DIN SPEC 70121 and ISO 15118-2

For the application of ISO 15118-2, additional requirements for renegotiation and schedule handling are mandatory while automatic authorization is optional. This is also tested by the conformance tests as defined in ISO 15118-4. If automatic authorization is used, the vehicle and the charging station have to implement the requirements for renegotiation and schedule handling.

2. Scope of Document

As described in chapter 1, the application of PnC requires the implementation of ISO 15118-2 with the mandatory requirements for renegotiation and schedule handling. For some uses cases, load management may not be required. However, omitting the mandatory requirements only in the vehicle or in the charging station may lead to non-interoperable implementation ending up in charge breaks. This is because of the nature of mandatory requirements: each side assumes the other side to support schedules and renegotiation and has no mechanisms to identify a reduced implementation. Additionally, such an implementation would not be able to pass the conformance tests in ISO 15118-4.

This guide specifies requirements for a special service allowing to reduce the implementation of ISO 15118-2 to a minimum without causing interoperability issues to other devices with reduced implementations and full implementation of ISO 15118-2 (see Chapter 4). Based on this approach it is also possible to define adopted conformance tests.

This guide focuses on the use case high power charging (HPC) where power is always available on EVSE side to perform CableCheckReq/Res and PreChargeReq/Res. This behavior is also assumed in case the EVSE sends 0W in the first Element of SASchedule (for definition, see: ISO 15118-2), which causes a first PowerDeliveryReq message with ChargeProgress set to 'Stop'.

While the guide focuses on HPC use cases, the definitions are also applicable to other use cases as long as the following assumptions hold:

- Application of PnC with DC charging
- Reduced application of schedules with max. 2 entries is required
- No renegotiation required

The guide is designed for use as recommendation to ISO 15118-2 and not as stand-alone specification. The requirements, terms and definitions of ISO 15118-2 apply if not stated differently.

3. References

DIN SPEC 70121, DIN SPEC 70121:2014-12 Electromobility - Digital communication between a D.C. EV charging station and an electric vehicle for control of D.C. charging in the Combined Charging System;

ISO 15118-2 ISO 15118-2:2014 Road vehicles -- Vehicle-to-Grid Communication Interface -- Part 2: Network and application protocol requirements

ISO 15118-3 ISO 15118-3:2015 Road vehicles -- Vehicle to grid communication interface -- Part 3: Physical and data link layer requirements

ISO 15118-4 ISO 15118-4:2018 Road vehicles — Vehicle to grid communication interface — Part 4: Network and application protocol conformance test

4. Definitions for Application of Service HPC1

By indicating a special service, the EVSE and the EV can choose to use a simplified implementation or processing in case of a full implementation compared to the standard message set as defined in ISO 15118-2. The defined service HPC1 covers a reduced message set for typical fast charging use cases.

Note: Whenever the EVSE does not indicate the Service HPC1, it is recommended to support the standard behavior as defined in ISO 15118-2 on EV and EVSE side to avoid interoperability issues with future standard conform implementations

4.1. General

Type of change	Addition
Requirement as specified in ISO 15118-2	Not applicable

Extension	Service HPC1 support:
	
	• For ISO 15118 EIM and PnC the following limitations are applied:
	
	    o The complexity of SASchedule is limited to allow two maximum power values in SASchedule.
	
	    o Renegotiation mechanisms is not used by EV and EVSE

Description	This addition specifies a well-defined service which allows to reduce the complexity to the needs of the limited service. Focus of Service HPC1 is to support basic charging and support of EIM and PnC. If PnC shall be supported in a DC fast charging use case without the full complexity for renegotiation and SASchedule processing the EV and EVSe can apply a reduced implementation if the EVSE indicates the HPC1 service.

4.2. ServiceDiscovery

To enable the application of Service HPC1 and differentiate this service from the normal service applying the standard message set and functionalities, the EVSE has to indicate that it is supporting HPC1. The defined service discovery mechanism is backward compatible to an EV that is conform to ISO 15118-2 and ISO 15118-4, respectively.

4.2.1. EV

Type of change	New Requirement
Requirement as specified in ISO 15118-2	See 4.2.2
Extension	See 4.2.2

[V2G2-PnC-CharIN-012] If the EVCC supports the HPC1 service, it shall only apply its requirements after the SECC indicated the support of the HPC1 service in the ServiceDiscoveryRes. as defined in chapter 4.2.2.

NOTE The SECC shall indicate the support of the HPC1 service by adding a Service element in the ServiceList of ServiceDiscoveryRes. The Service element for HPC1 shall have ServiceID set to '63000', ServiceCategory set to "OtherCustom" and FreeService set to "true". |
| Description | See 4.2.2 |

4.2.2. EVSE

Type of change	New Requirement
Requirement as specified in ISO 15118-2	**Table 105 — Definition of ServiceID, Service Category, Service Name, and Service Scope**
Extension	Table 105 — Definition of ServiceID, Service Category, Service Name, and Service Scope _(see table below)_

Table 105 — Definition of ServiceID, Service Category, Service Name, and Service Scope

ServiceID (unsignedshort)	ServiceName	ServiceCategory	Description
0			Reserved by ISO/IEC
1	AC_DC_Charging	EVCharging	All charging services as defined by SupportedEnergyTransferMode in subclause 8.5.2.3.
2	Certificate	ContractCertificate	Service allowing to update or install Contract Certificates.
3	InternetAccess	Internet	Service for standard protocols like HTTP, HTTPs, FTP, etc.
4	UseCaseInformation	EVSEInformation	Service enabling the exchange of service specific information about the EVSE.
5 – 60000			Reserved by ISO/IEC
63000	UseCaseDefinition	OtherCustom	Service HPC1. Defines application with reduced complexity for SASchedule and suppression of renegotiation at high power chaging stations
60001 – 65535			Reserved for implementation specific use

[V2G2-PnC-CharIN-013]   If the SECC supports the HPC1 service, it shall only apply its requirements after indicating its support in the ServiceDiscoveryRes.

[V2G2-PnC-CharIN-037]   The SECC shall indicate the support of the HPC1 service by adding a Service element in the ServiceList of ServiceDiscoveryRes. The Service element for HPC1 shall have ServiceID set to '63000', ServiceCategory set to

"OtherCustom" and FreeService set to "true".

Description	Today, the EV and EVSE cannot identify a specific service and adapt its processing or functionality to the needs of the target service. If there is a service that requires only limited functionality for load balancing, the EV has to identify if the implementation is limited to what is needed or if the implementation covers all functionality as defined in ISO 15118-2.
	Example: If there is no need for renegotiation in HPC service, the EV and EVSE may decide to not implement renegotiation messaging. If the very same EV is charging at an EVSE that supports renegotiation, the EVSE may request a renegotiation message from the EV within a time limit. If the EV does not send the message, the EVSE may interrupt the charging.
	An indication of the current service overcomes this interoperability issue because the EV and the EVSE have a common understanding on the required functionality and behaviour.

Example for a ServiceDiscoveryRes message indicating the HPC1 service:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<V2G_Message xmlns="urn:iso:15118:2:2013:MsgDef" xmlns:v2gci_h="urn:iso:15118:2:2013:MsgHeader"
            xmlns:v2gci_b="urn:iso:15118:2:2013:MsgBody" xmlns:v2gci_t="urn:iso:15118:2:2013:MsgDataTypes"
            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="urn:iso:15118:2:2013:MsgDef
            ./V2G_CI_MsgDef.xsd">
    <Header>
        <v2gci_h:SessionID>1234</v2gci_h:SessionID>
    </Header>
    <Body>
        <v2gci_b:ServiceDiscoveryRes>
            <v2gci_b:ResponseCode>OK</v2gci_b:ResponseCode>
            <v2gci_b:PaymentOptionList>
                <v2gci_t:PaymentOption>Contract</v2gci_t:PaymentOption>
            </v2gci_b:PaymentOptionList>
            <v2gci_b:ChargeService>
                <v2gci_t:ServiceID>1</v2gci_t:ServiceID>
                <v2gci_t:ServiceCategory>EVCharging</v2gci_t:ServiceCategory>
                <v2gci_t:FreeService>false</v2gci_t:FreeService>
                <v2gci_t:SupportedEnergyTransferMode>
                    <v2gci_t:EnergyTransferMode>DC_extended</v2gci_t:EnergyTransferMode>
                </v2gci_t:SupportedEnergyTransferMode>
            </v2gci_b:ChargeService>
            <v2gci_b:ServiceList>
                <v2gci_t:Service>
                    <v2gci_t:ServiceID>63000</v2gci_t:ServiceID>
                    <v2gci_t:ServiceCategory>OtherCustom</v2gci_t:ServiceCategory>
                    <v2gci_t:FreeService>true</v2gci_t:FreeService>
                </v2gci_t:Service>
            </v2gci_b:ServiceList>
        </v2gci_b:ServiceDiscoveryRes>
    </Body>
</V2G_Message>
```

4.3. Renegotiation

In HPC1, the EVSE and the EV do not use the renegotiation mechanism.

4.3.1. EV

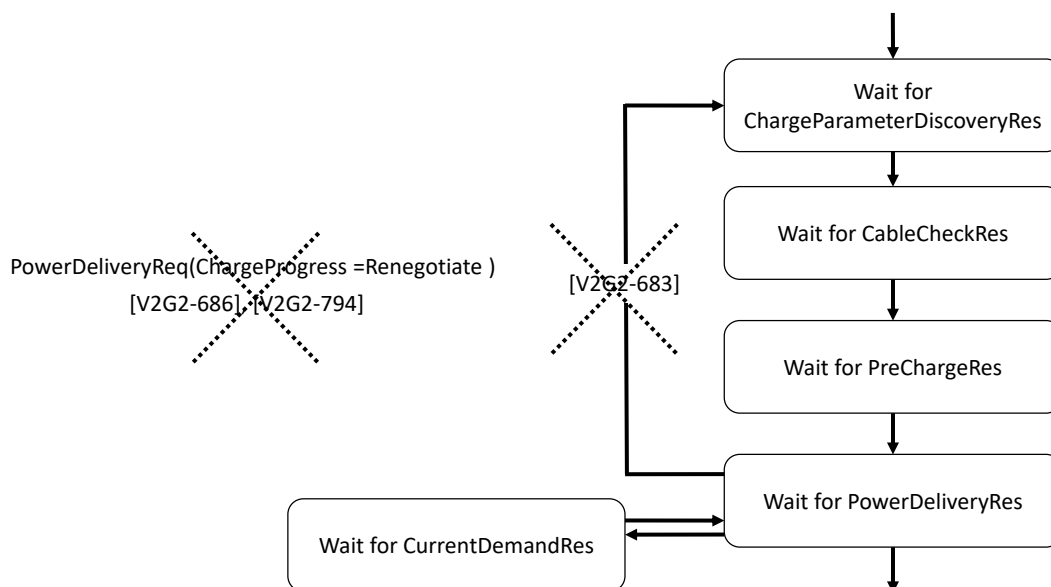Figure 2 shows the changed transition behavior using Service ID 63000 (ServiceCategory HPC1).

Figure 2: Overview on limited transition handling for renegotiation in EVCC

Type of change	Addition
Requirement as specified in ISO 15118-2	**[V2G2-675]**, **[V2G2-680]**, **[V2G2-683]**, **[V2G2-686]**, **[V2G2-749]**, **[V2G2-840]**, **[V2G2-841]**, **[V2G2-842]**, **[V2G2-794]**
Extension	**[V2G2-PnC-CharIN-014]** If the EV received the ServiceID service 63000, Service Name and ServiceCategory for HPC1 as defined in Table 105 it shall not apply the requirements **[V2G2-675]**, **[V2G2-680]**, **[V2G2-683]**, **[V2G2-786]**, **[V2G2-786]**, **[V2G2-686]**, **[V2G2-749]** , **[V2G2-840]** , **[V2G2-841]** , **[V2G2-842]** , **[V2G2-794]**.
Description	For service HPC1, the EV does not use any of the mechanisms defined for renegotiation.

4.3.2. EVSE

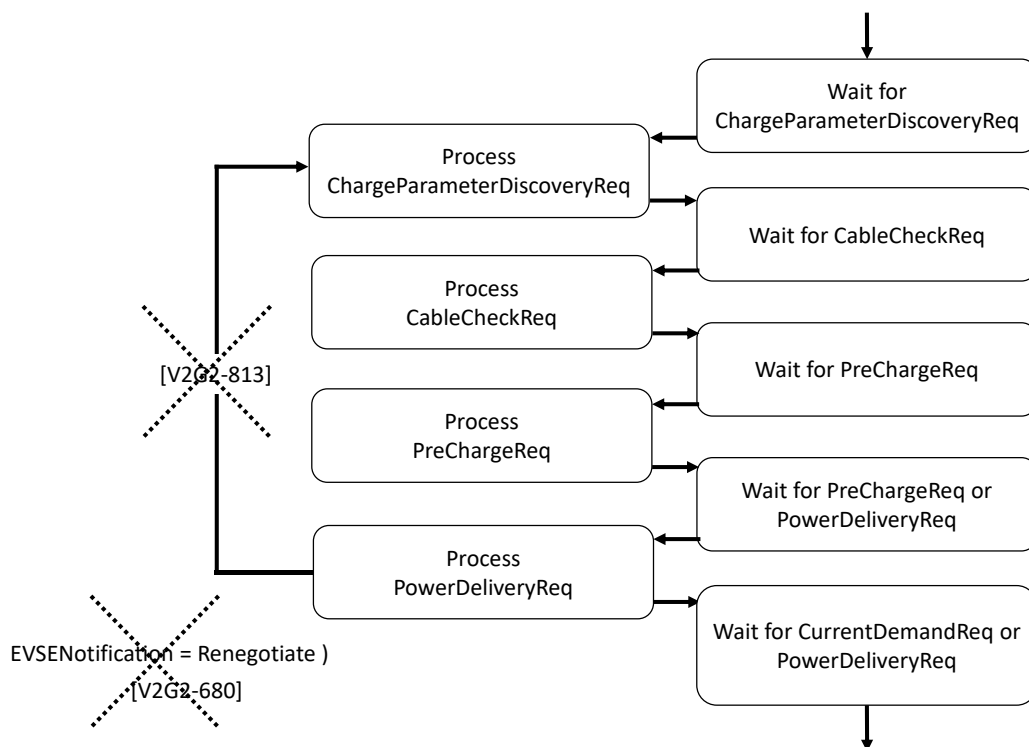Figure 3 shows the changed transition behavior using Service ID 63000 (ServiceCategory HPC1).

Figure 3: Overview on limited transition handling for renegotiation in SECC

Type of change	Addition
Requirement as specified in ISO 15118-2	**[V2G2-755]**, **[V2G2-813]**
Extension	**[V2G2-PnC-CharIN-015]** If the SECC sent the ServiceID service 63000, Service Name and ServiceCategory for HPC1 as defined in Table 105 it shall not apply the requirements **[V2G2-755]**, **[V2G2-813]** **[V2G2-PnC-CharIN-016]** If the SECC sent the ServiceID service 63000, Service Name and ServiceCategory for HPC1 as defined in Table 105 it shall not use EVSENotification = Renegotiate.
Description	For service HPC1, the EVSE does not use any of the mechanisms defined for renegotiation.

4.4. SASchedules

4.4.1. Max Entries PMaxScheduleEntry

4.4.1.1. EV

Type of change	Modification
Requirement as specified in ISO 15118-2	**[V2G2-784]**
Change	**[V2G2-PnC-CharIN-017]** An EVCC shall support at most 2 entries for PMaxScheduleEntry. **[V2G2-PnC-CharIN-018]** An EVCC shall not send MaxEntriesSAScheduleTuple transmitted in ChargeParameterDiscoveryReq if it only supports service HPC1.
Description	For HPC1, the EV supports only two entries in maximum.

4.4.1.2. EVSE

Type of change	Modification
Requirement as specified in ISO 15118-2	**[V2G2-786]**
Change	**[V2G2-PnC-CharIN-019]** An SECC shall support 2 entries for PMaxScheduleEntry. Note: Starting with charge break is not supported in the guide. **[V2G2-PnC-CharIN-022]** An SECC shall ignore MaxEntriesSAScheduleTuple in ChargeParameterDiscoveryReq for service HPC1.
Description	For HPC1, the EVSE supports only two entries in maximum.

4.4.2. SAScheduleList

4.4.2.1. EV

Type of change	Clarification
Requirement as specified in ISO 15118-2	**[V2G2-296]**
Change	**[V2G2-PnC-CharIN-036]** An EV shall at least support the default SAScheduleTuple as defined in **[V2G2-297]**.
Description	In service HPC1, the EV always uses the first schedule. Also refer to **[V2G2-297]** NOTE: Delayed charging requires at least two elements. The first element defines the pause. The second element defines the duration of the pause and the value for the available power afterwards.

4.4.2.2. EVSE

Type of change	Modification
Requirement as specified in ISO 15118-2	**[V2G2-294]**
Change	**[V2G2-PnC-CharIN-023]** An SECC shall use only 1 SAScheduleTuple in SAScheduleList. **[V2G2-PnC-CharIN-024]** An SECC shall not use the optional field "Sales Tariff" in an SAScheduleTuple. **[V2G2-PnC-CharIN-025]** In case charging is not delayed, the SECC shall send a SASchedule containing a PMaxSchedule with one PMaxScheduleEntry containg the value of Pmax = EVSEMaximumPowerLimit and a valid duration (see PMaxScheduleEntry) **[V2G2-PnC-CharIN-026]** In case charging is delayed, the SECC shall send a SASchedule containing a PMaxSchedule with two PMaxScheduleEntry,the first entry Pmax = 0W and the second entry

	indicating (Start time) when the power Pmax = EVSEMaximumPowerLimit is available. Note: Starting with charge break is not described in the guide.
Description	In service HPC1, an EVSE sends only one power value in the schedule, containing the maximum available power over time. NOTE: Delayed charging requires at least two elements. The first element defines the pause. The second element defines the duration of the pause and the value for the available power afterwards.