CHAdeMO- Technical WG- PNC

May 2019, CHAdeMO Europe

Overview information

1. Current meeting status
2. Introduction PNC
3. First results
    1. CHAdeMO member proposals
    2. Result meeting 15.01.2019
    3. Result meeting 28.03.2019
4. Next steps

1. Current Meeting Status

Project schedule start in January 2019

Date	Place and Format
15.01.2019	F2F- at Mitsubishi Motor R&D Europe, Germany
28.03.2019	Telco- 2h
21.05.2019	F2F- atEVS32, Lyon
TBD	Telco- 2h- CHAdeMO EU Team will make the DOODLE
TBD	

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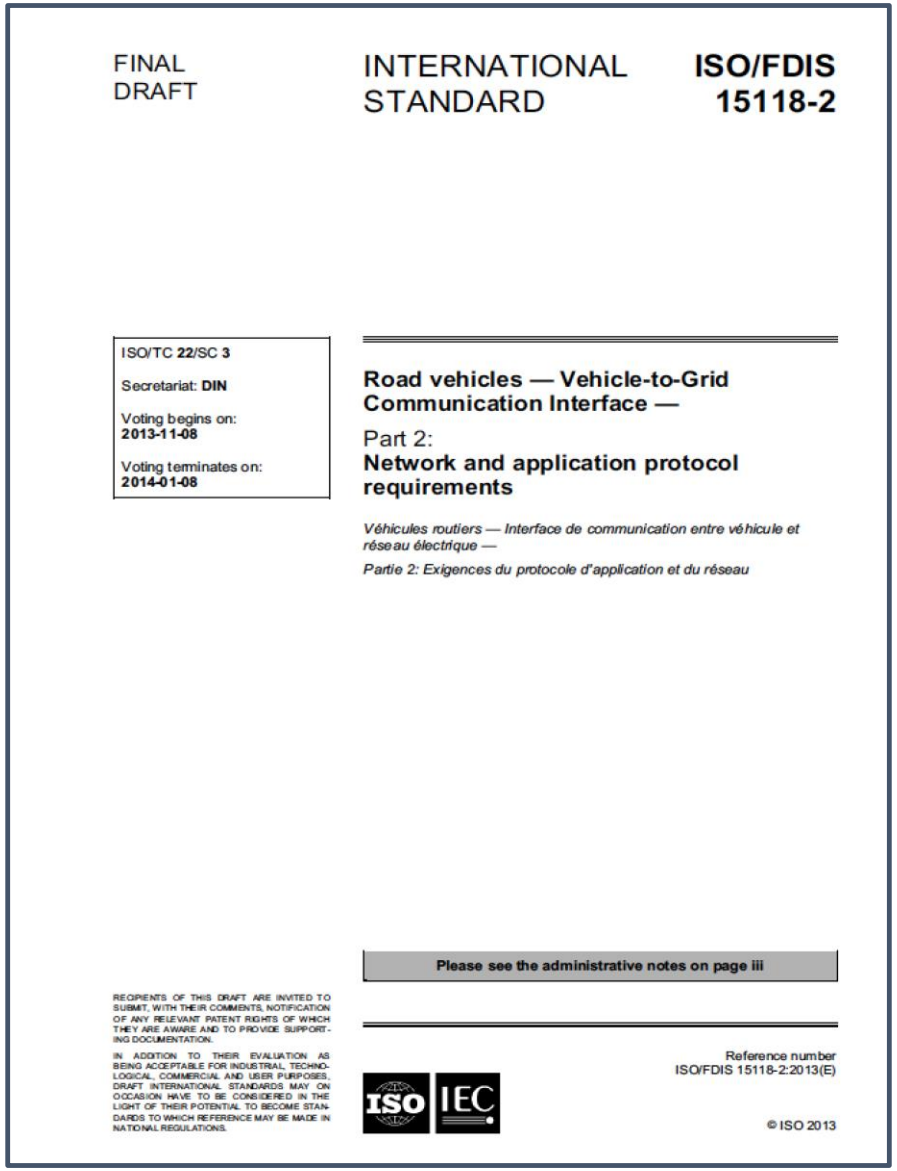
2. IEC/ ISO 15118 Overview facts-Status

2. Overview facts IEC/ ISO 15118- Status in IEC/ ISO

- IEC/ ISO 15118 is a standardized protocol that define the communication between the EV and the EVSE. It is published as a standard worldwide.
- It allows higher bandwidth information as current AC MODE 3 communication using PWM signals and CAN communication on CHAdeMO DC
- The ISO/ IEC 15118 is taking care of the following mechanism for the communication (use cases)
    - Authentication
    - Authorisation
    - Billing
    - Charge scheduling and control (DSM- Demand Side Management)- etc
- As an method for communication the power line communication was selected. Here the information is modulated to the power transfer line eg in the charging cable. As a protocol the “Home Plug Green Phy” standard solution from the US open platform “Home Plug” was selected. This solution allows open source developments on this physical layer
- As a consequence for the EVSE and EV some chipset / controller need to be developed to secure the communication.

2. Information IEC/ ISO 15118- Status in IEC/ ISO



FINAL DRAFT

INTERNATIONAL STANDARD

ISO/FDIS 15118-2

ISO/TC **22**/SC **3**

Secretariat: **DIN**

Voting begins on:
2013-11-08

Voting terminates on:
2014-01-08

Road vehicles — Vehicle-to-Grid Communication Interface —

Part 2:
Network and application protocol requirements

Véhicules routiers — Interface de communication entre véhicule et réseau électrique —

Partie 2: Exigences du protocole d'application et du réseau

Please see the administrative notes on page iii

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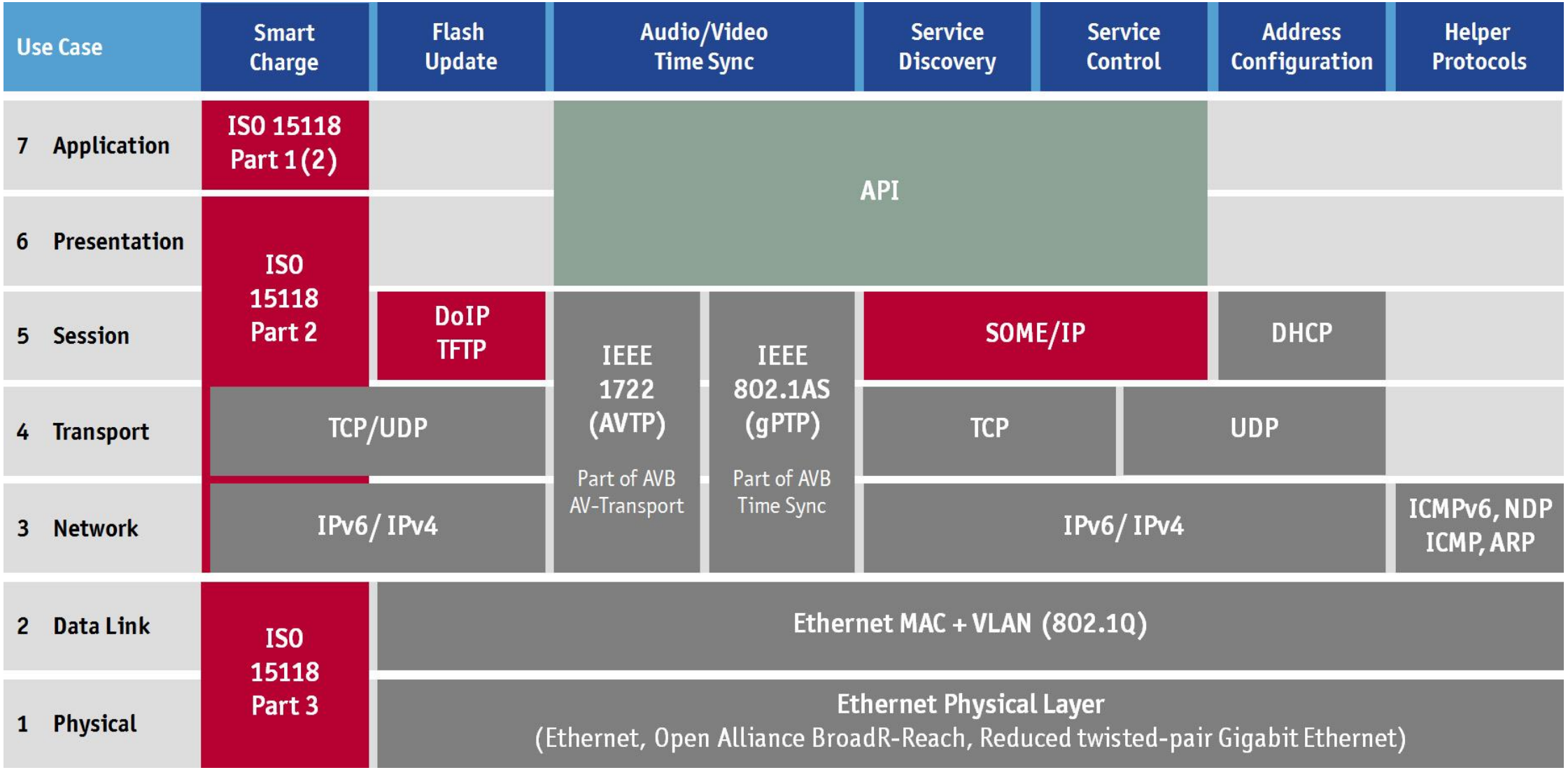
Reference number
ISO/FDIS 15118-2:2013(E)

Comment:
The IEC/ ISO 15118-2 is an existing standard and open. Every stakeholder can receive the standard from ISO/ IEC on limited cost

2. ISO 15118 – OSI model



2. Information IEC/ ISO 15118- use cases

Possible use cases- Sample by MRDE

Function	**Format- Eg**	**Use cases**
Authentication (PNC)	VIN, Contract ID	Identify vehicle at EVSE
Authorisation (PNC)	Contract ID, Credit	EVSE can judge if the vehicle has contract to charge.
Billing (PNC)	Credit, used energy	EVSE can decide credit, for payment used energy is submitted
Charge Schedule	Time, personal schedule	Customer give his requested leave time, customer decides how much energy is charged
Control of energy flow DSM	Grid requirement	DSO (utility) requested charge slot time and power based on GRID requirements
Vehicle/ customer request	Energy amount –kWh, time	Type of charging (quick/ slow), cost based charging
HEMS requirements- EEBUS requirements	EEBUS protocol (SPINE and SHIP)	EEBUS use cases

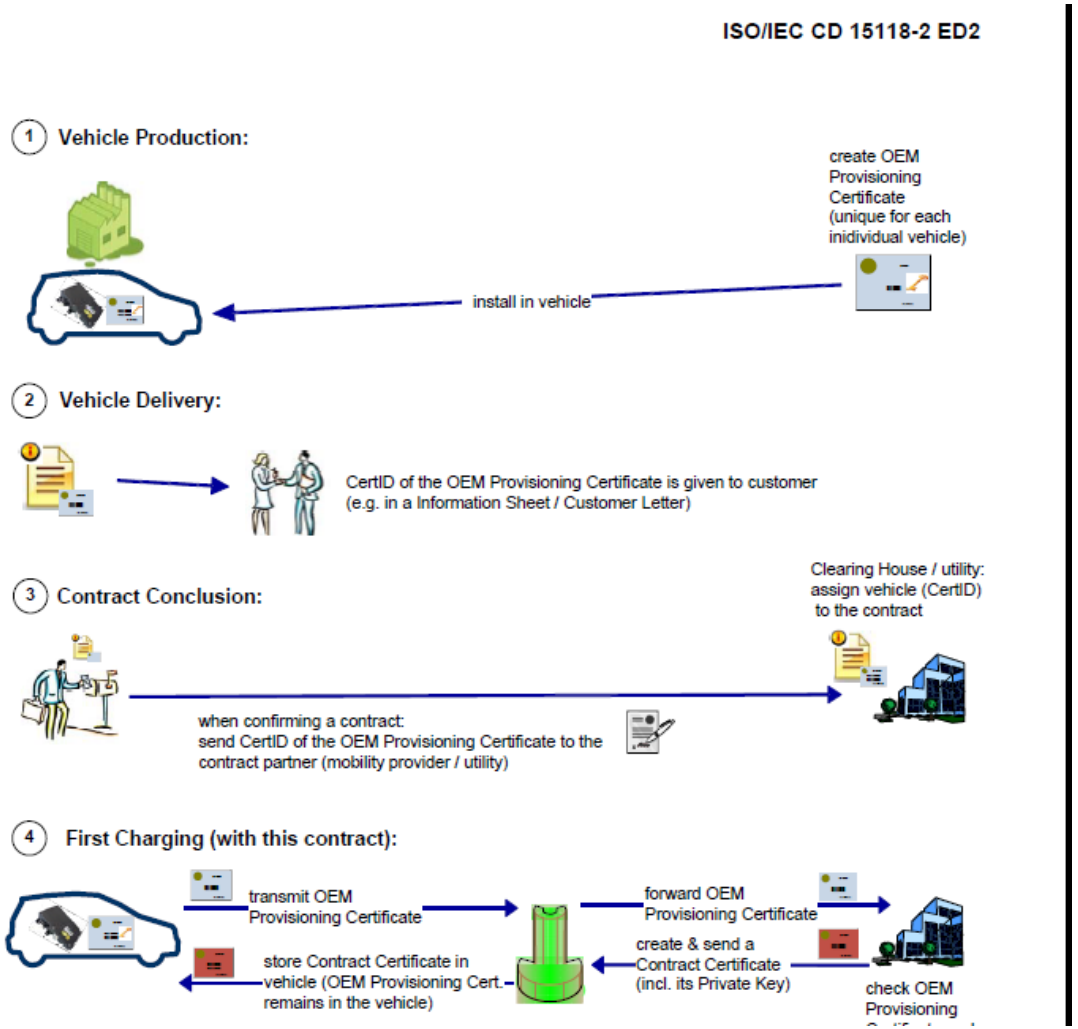
2. Other then PNC High Level Use Cases E- Mobility- EEBUS using 15118 (Example)

Use Cases	Use Case Description	Use Case Target/ Mission
1. Coordinated Charging	This use case describe and aims at adjusting the charging process of an EV such that higher-level constraints or optimization goals are met, whereby the final charging plan of the EV is the result of a negotiation between EV and EMS (Energy Management System). It is also considering constraints and demand of other devices at the customer's site	1) The reduction of the electricity costs associated with a charging process 2) The reduction of the CO_2-Footprint associated with a charging process 3) compliance with constraints of higher grid levels or the coordinated realization of demand response set points from higher-level aggregators
2. Optimized Self Consumption	This use case aims at increasing the usage of locally produced electricity (eg house with PV) by adopting the EV charging current according to excess of locally produced electricity available at any particular moment	1) Use locally produced green power 2) optimize energy costs for E-mobility 3) Save country and energy regulation dependent power grid energy transportation fees
3.Commissioning and Configuration	As the basis for other use cases related to the support of EV charging, this use case specifies the initial setup process and later configuration of the charging infrastructure, consisting of EVSE, EV, EMS and the electrical circuit, potentially also including electrical meter devices	To allow current and future use cases to be installed.
4. Overload Protection	This use case specifies the data model and interaction sequences needed for curtailing an ongoing charging process of an electrical vehicle (EV) and the connected charging station (EVSE) by means of a local energy management system (EMS).	It aims at preventing an ongoing charging process from tripping a fuse of the supply side infrastructure (e.g. mains fuse).

Source: EEBUS

2. ISO 15118- Flow -Information by HUBJECT

- At CHAdeMO Kobe (October 2018) meeting non member HUBJECT explained the ISO 15118 – ECO System with a flow diagram
- Flow diagram was given to CHAdeMO



Source: Standard document

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3. Result overview

3. CHAdeMO member proposal PNC 15.01.2019- recap

	ABB	BP	Plugsurfing	Subaru	Tritium	Wallbox
General usage of IEC/ ISO 15118	No comment	Ensuring compliance to IEC 15118	Yes it is base of proposal	Yes as only existing system- new development is unlikely	Yes it is first choice	Yes as possible allowing common libraries and platforms
Possible layer PLC	No comment	No comment	Yes as described in 15118	Yes use of HPGP	Need to be backward compatible	No comment
Possible layer CAN	-Use the existing CAN channel and add Ethernet over CAN - Bandwidth can be handled	-Solution should be CAN based -CAN performance on higher power scenario (150kw) has the risk of noise	No comment	No comment	Utilizing the existing CAN with adding another protocol SAEJ1939	Prior handshake va CAN
Possible layer Wifi (Ethernet .802 family	It has the disadvantage which is a) additional hardware b) radiates c) precaution to secure	No comment	No comment	It is optional and not yet established in standard. Adoption is just possible after establishment of standards	No comment – need to be backward compatible	For main data after CAN handshake
Encryption	For Wifi there is precaution to secure	It is related to ISO 15118. It is pushing CHAdeMO to be secure	Based on digital certificate handling (Private Key, Public Key, X509	No comment	No comment	No comment

3. CHAdeMO discussion PNC 15.01.2019

Discussion point/ theme	Understanding / next steps
Focus of the WG is on PNC not on other possible connection method like smartphone or RFID or card system	It was common understanding
ISO 15118 is the base of the discussion as there is no other standard in the moment	It was common understanding
Current used ISO 15118 physical layer HPGP (Home Plug Green Phy) has some issues/ problems, Controller for OEM using HPGP is lacking at CHAdeMO – OEM. Basically there are some on the market for smaller application (example VECTOR)- more integrated ones with mass market chipset need to be developed by the OEM	Some opinion consider it as feasible way others do not.
As for replacing the HPGP by another layer we discussed CAN and WiFi (802.11..). We collected the argument and boundary condition for each layer. There are different opinion in the group	It was different understanding, we should work out some listing pro/ con for the layer. We have to investigate more (next step)

3. CHAdeMO discussion PNC 15.01.2019- Security ID- HSM- follow up

Discussion point/ theme	Understanding / next steps

As for the **security and vehicle ID** there is not a clear and common understanding therefore some questions arise:
• Vehicles has to store and communicate some secure information/ certificates?
• This information must be linked with some contract information/ certificates ?
• It needed certain (safe) hardware module and stakeholder to make and handle the information/ certificates?
• This certificate need to be added to the vehicle in-production and post-productoin (flashing/ writing in memory)?
• We might or might not need a SIM card and some back-end connection in each car ?
	We understand it is undefined.
	• In the next meeting we need to work out a proper work plan to achieve common understanding (next step).
	• Task is to work this plan with detailed information, including:
	  • type of information (description),
	  • hardware,
	  • software,
	  • responsibilities within the eco system

Scope of meeting- work on the questions- next step
make the work plan

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3. CHAdeMO PNC layer Pro- cons matrix

	CAN 2.0B	Wired Ethernet BroadRreach/ IEEE100Base-T1	…802-11N WiFi	Bluetooth 5		Reference: HPGP
Possible Performance						
Required Performance (use case PNC)						
Hardware availability/Software availability / development for EV side						
Hardware availability/Software availability / development for EVSE side						
Standards- de facto standards						
System Cost/ Hardware Cost						
Possible reuse of exiting vehicle controller						
Feasibility in the existing CHAdeMO plug						
Security						
Reliability of the signals						
Matching of vehicle and chargers						
Own idea 1 +++						

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- Comment (neutral)

(+) Advantage (positive)

(-) Disadvantage (negative)

3. CHAdeMO PNC further use case sampling- wider band EV/ EVSE communication- ISO 15118

Use Case	Description
PNC	Just Plug and Charge. The identification and contract handling is done in the background by certificates
Incorporation of the EV in the household electric system– Sample EEBUS	EEBUS use cases
New Idea 1	
New Idea 2	
New Idea 3	
etc	

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Attachment

3. Definition and scope of Cert ID in the literature

Asset name	Origin	Use(s)	Lifetime Issue(s)
Cert ID [61] (Boot- strap Cert.in [60])	Installed by OEM in production process	Used to link vehicle to a mobility contract when conclude a mobility contract. Not used for charging communication	Lifetime of the vehicle. Unique for each vehicle

Source: Master Thesis Privacy-Preserving Charging for eMobility, 10 January 2013 Christina H•ofer MSc Computer Science Specialization Computer Security

3. ISO 15118- extract from document

E.3 Use of OEM Provisioning Certificates

E.3.1 Introduction

The difficulty with the handling of Contract Certificates (as defined in this document) for the OEM is to bring such a certificate into a vehicle. This becomes necessary in many situations as e.g. vehicle hand-over to customer, energy contract conclusion, changing the mobility provider, exchanging the component containing the Contract Certificate at vehicle repair, expired Contract Certificates, etc.

Using a diagnosis tool to write a file containing a Contract Certificate (that the customer received from the mobility provider at contract conclusion) into the vehicle is impractical, since such a manual procedure in a garage causes high costs. Other solutions, like installation via a customer web page, also cause effort, can be error-prone, and require the existence of a communication channel into the vehicle.

Therefore, an automatic procedure for the installation of such a Contract Certificate is required: certificate provisioning. This procedure is supported by the charge protocol by offering the messages Certificate Installation Req/Res. These messages transmit a Contract Certificate from a secondary actor (e.g. mobility provider) to the vehicle for installation and are secure by using encrypted communication. In order to enable certificate provisioning, activities which happen outside the charge protocol are required additionally. These activities are sketched in Figure E.3 and described in the following:

3. Controller hardware for IEC/ ISO 15118 PNC (existing)

- For the powerline communication the protocol is so called “Home Plug Green Phy” (HPGP)
- Connecting the EVSE can be done by existing controller. As example a controller by company INSYS is show (just reference !!)
- Connecting the vehicle need the vehicle controller. For small/ middle series application there is the controller from CHAdeMO member VECTOR- mass market controller are still open
- Following controller as discussed in the meeting 15.01.2019
    - Small middle series VECTOR PLC
    - Mass Series Qualcomm 7000 Series
    - Mass Series from China/ South Korea - ??
- The discussion on the meeting was further (compare next steps):
    - For 15118 bandwidth and handling it need another module (SECC ?) Yes/ No ?
    - Such module need to be connected via SIM ?
    - Such module need to read only or read/ write ?

3. Information IEC/ ISO 15118- EVSE Equipment- sample

INSYS Controller for EVSE

Features

- Communication via powerline standard HomePlug Green PHY™
- Coupling of the powerline Green PHY™ signal to the pilot line
- SLAC protocol as per ISO/IEC 15118-3 (in preparation)
- Coupling of the powerline signal to the powerline (on request)
- Extended temperature range
- Designed for DIN rail mounting

Applications

- Communication between electric vehicle (PEV) and charging station (EVSE) as per ISO/IEC 15118 via powerline standard HomePlug Green PHY™

Source: Insys

3. Information IEC/ ISO 15118- EVSE Equipment- sample

INSYS Controller for EVSE

Technical Data
INSYS Powerline GP

Industrielle Datenkommunikation

Interfaoes	
LAN	Ethernet 10/100 BT (autosense), MDI/MDI-X
Pilot line	HomePlug Green PHY™: on 12 V pilot signal (IEC 61851-1); up to 10 Mbit/s Integrated coupling filter as per ISO/IEC 15118-3
Protocol	HomePlug Green PHY™ as per ISO/IEC 15118-3 SLAC protocol as per ISO/IEC 15118-3 in preparation*
Configuration	Plug & Play with SLAC* - Configuration tool on request
Approvals / Standards	DIN EN 55022 Class B, DIN EN 61000-6-2, DIN EN 60950-1, EMV (2004/108/EG), LV (2006/95/EG) and RoHS (2011/65/EG)
Eleotrioal Features	
Supply voltage	10 ... 60 V DC
Power consumption	Idle: approx. 1.5 W Connection: approx. 2 W
Physioal features	
Dimensions (L x W x H)	110 x 45 x 75 mm
Weight	160 g
Protection class	Housing IP40, Terminals IP20
Operating temperature	-20 °C ... +55 °C
Humidity	0 ... 95% (non-condensing)
Assembly	DIN rail

* The so-called SLAC mechanism (as per ISO/IEC 15118-3) for handling the association process between electric vehicle (PEV) and INSYS Powerline GP is in preparation. In particular tasks critical for timing are taken over by the INSYS Powerline GP. This reduces the real-time requirements for the EVSE controller and facilitates the control of several charging stations (see following image). The information exchange between INSYS Powerline GP and EVSE controller is limited to a minimum (e.g. “car connected”).

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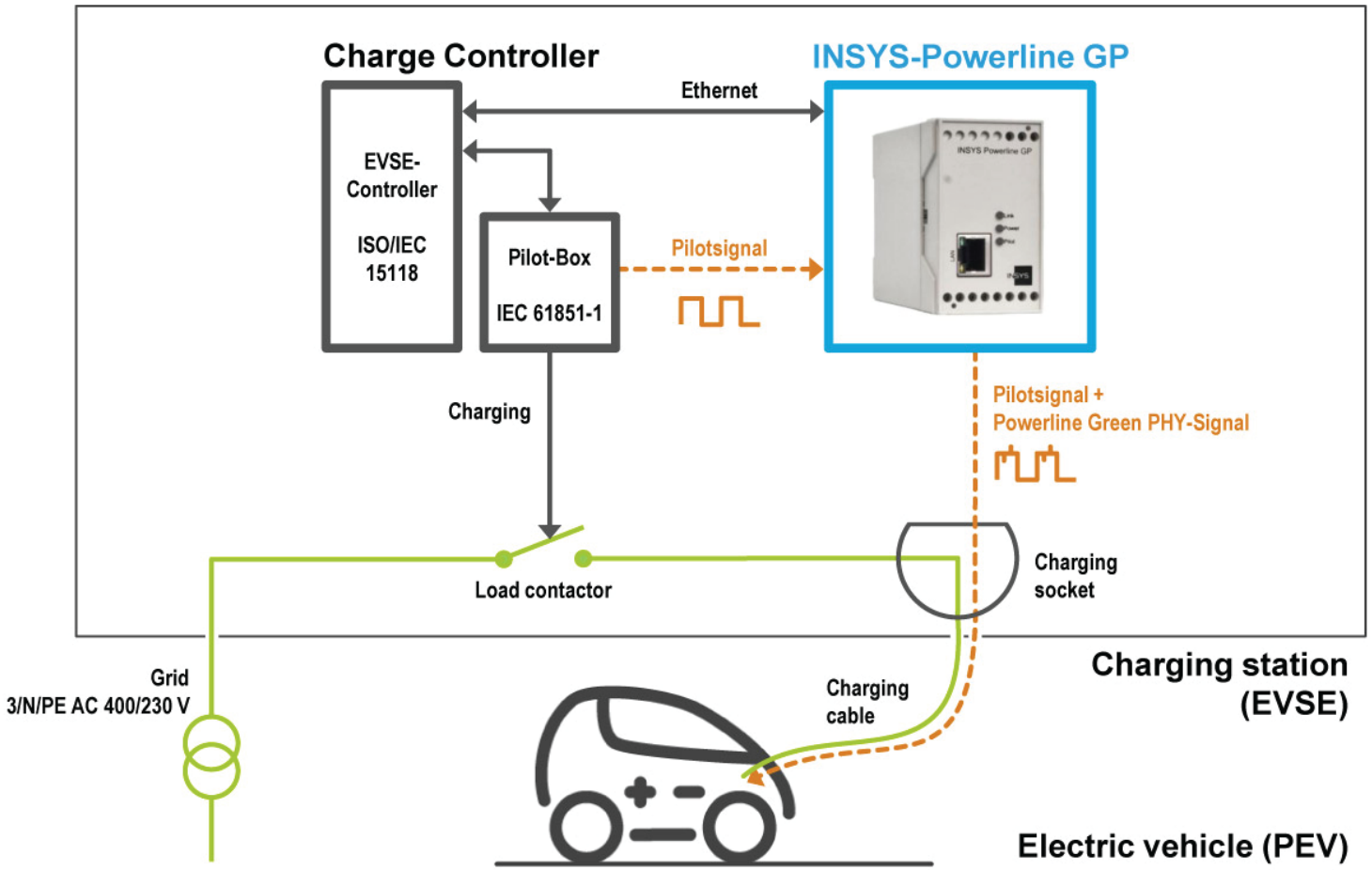
Source: Insys

3. Information IEC/ ISO 15118- EVSE Equipment- sample



Source: Insys

3. Information IEC/ ISO 15118- Powerline Controller vehicle

VC-VCCU

VC-VCCU – Technical Details

VECTOR

Complete DC charging sequence via powerline
- Communication with infrastructure (ISO 15118, DIN 70121, IEC 61851)
- LEDs Outputs through external control
- Stop-charging via push-button

Control of
- Switch Box
- Coupler (lock and unlock)

ECU wake-up (CAN, COMBO-2, push-button, RTC, Terminal15)

Diagnostics communication (UDS/ISO 14229-1) on CAN

Re-programming of Software via UDS

Self-diagnostics of all inputs and outputs

J1939 CAN communication with vehicle

Generic application
- CAN signal mapping
- Precondition (charging start)
- Wake-up via output
- Vehicle specific communication

Optional customer specific implementation
- COMBO-2 Charging: AC charging (extension of software platform)
- Pantograph/Inductive Charging: WIFI (ext. of HW / software platform)

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Attachment CHAdeMO Status

CHAdeMO Status

No.	Type	Description
1	Kind of Use case	System UC
2	Use case ID - name	CHAdeMO - Charging with PnC
3	Objectives	To start charging the EV simply by connecting the plug to the EV. Thereby eliminating the need for a reading operation by a card reader or the like.
3.1	Use case context	An EVU plugs CHAdeMO compliant EV to CHAdeMO compliant EVSE.
4	Description	1. EV sends the Contract ID to EVSE. 2. The EVSE queries the CSMS for the authentication of the Contract ID. 3. If authentication is confirmed, the EVSE replies the corresponding Service code to the EV and start charging session.
5	Prerequisites	- EV and EVSE support ver.2 CHAdeMO Specification.
6	Requirements	- IEC 61851-23/24
7	End conditions	- Charging session is controlled between EV and EVSE.

CHAdeMO Status 2

No.	Type	Description
1	Kind of Use case	System UC
2	Use case ID - name	CHAdeMO - Charging with reservation and PnC
3	Objectives	An EVU reserves the charging in advance with smart phone. At the time of charging the EVU arrives at the charging station and connect the plug to the EV, charging starts automatically.
3.1	Use case context	An EVU can reserve usage of the EVSE and confirm the usage time and fee in advance. When the EVSE desired by the EVU is not available, a nearby available EVSEs are guided.
4	Description	1. An EVU logs in to the EMSP using smartphone and inquires whether the desired charging station and available time are valid. 2. The EMSP designates the EVSE to be used when the user's request can be made. If the EMSP can not make the reservation, the EMSP will guide a candidate list of alternative stations and the EVU will select another station. 3. EMSP sends the Contract ID and usage time of the user who made the reservation to the CSMS. 4. When the user connects the plug at the reserved time, EV sends the Contract ID to EVSE. 5. The EVSE queries the CSMS for the authentication of the Contract ID. 6. The CSMS confirms the reservation and notifies the EVSE. 7. The EVSE replies the corresponding Service code to the EV and start charging session.
5	Prerequisites	- EV and EVSE support ver.2 CHAdeMO Specification. - EMSP provides reservation service on the web site. - EVU is a subscriber to the reservation service.
6	Requirements	- IEC 61851-23/24
7	End conditions	- Charging session is controlled between EV and EVSE.