Guideline for DC CCS 1.0 Implementation according to DIN SPEC 70121:2014

V1.6

06.12.2017 M. Schwaiger/BMW

CCS 1.0 System Description
Scope of document

The following document shall

- serve as a Guideline for DC CCS 1.0 implementation for Vehicles and Charging Stations
- give hints and tips on CCS 1.0 HW and SW development according to DIN SPEC 70121:2014
- address common errors found in DC CCS 1.0 charging stations and vehicles over the last 3 years
- resolve unclear or inconsistent requirements in DIN SPEC 70121:2014
- shall be discussed within CharIN to come to a common understanding with all stakeholders and provide baseline for Conformance Testing

Full information on requirements can be found in DIN SPEC 70121:2014

CCS 1.0 System Description
Scope of document

- DIN SPEC 70121:2014 does not specify Sleep and Wake-Up of vehicles and charging stations
- Dual – and Triple Charger (E.g. AC, ChaDeMo, CCS) requires possibility to Sleep and wake-Up vehicles

  -> Additional requirements must be given
- Upcoming vehicles and charging stations with ISO15118 support will use 5% Control Pilot Duty Cycle for AC and DC Charging Stations

  -> Start of SLAC must work for all combinations of DIN SPEC 70121 and/or ISO15118 Vehicles and Charging Stations

  -> Additional Requirements must be given

CCS 1.0 System Description
Control Pilot handling – 5% PWM start

EVSE requirements:

- The charging station shall apply 5% PWM on Control Pilot Line immediately (<1s) after state B1 detected and shall not delay it because of missing authentication (e.g. RFID wipe) but can be delay for other reason (EVSE busy, self-check in progress, NMK change…).
(See V2G-DC-561, -564, -733 and V2G-DC-024)
- If authorization is missing and charging has to be delayed charging station shall run up to "ContractAuthenticationRes" message and loop there with "EVSEProcessing = Ongoing" until Authentication is done (e.g. RFID wipe)
- Please consider "ReadyToCharge_Timeout" of 150s, this means if no Authentication is done within 150s the communication is stopped
- For Dual-or Triple charger start of 5% PWM can be delayed when charging process is already initiated on another outlet (e.g. including outlet HMI selection by the user, authentication, charging , end of charge …).

CCS 1.0 System Description
Control Pilot handling – 5% PWM start

EV requirements:

- The vehicle shall send CM_SLAC_PARM.REQ message with detecting Control Pilot State B2 (5% Duty Cycle). Details see DIN SPEC 70121:2014
- For future CCS 2.0 support Vehicles and Charging Stations shall implement SLAC according to ISO15118-3:2015

CCS 1.0 System Description
Control Pilot handling – Vehicle Wake Up

EV requirements:

- CCS vehicle shall wake-up on a Control Pilot State
  A-> B or B1 -> B2 transition (12V -> 9V or 9V steady -> 9V PWM signal).
  Details see ISO15118-3
- CCS vehicle shall wake up on a Control Pilot State B1-> B2 transition when charging cable was not plugged out
- 5% and 10-96% are valid Duty cycles for AC charging with HLC
- Consideration of Proximity Pin for Wake-Up to be discussed by CharIN FG
- Above behaviour is applicable for AC and DC vehicles supporting DIN SPEC 70121 and/or ISO15118

CCS 1.0 System Description

Control Pilot handling – Charging Station Wake Up

EVSE requirements:

- CCS charging station shall wake up on Control Pilot Line B->C->B transition.
  Details see ISO15118-3:2015
- CCS charging station shall be able to apply State E (0V) or F (-12V) on Control Pilot Line.
  This is necessary to support legacy vehicles wake up.

CCS 1.0 System Description
Control Pilot Check – Safety

EV requirements:

- The vehicle must check for 5% Control Pilot Duty cycle continuously during power transfer. Emergency Shutdown must be done if failed.

CCS 1.0 System Description
Control Pilot and Proximity Check – Safety

EVSE requirements:

- The Charging Station must check for Control Pilot State C (6V) before power transfer is started (See [V2G-DC-547])
- The charging station must continuously check Control Pilot State C (6V) during power transfer. Emergency Shutdown must be done if failed.
- Charging Stations using Combo Type 1 connector must check for valid Proximity value before power transfer is started. For Combo Type 2 this is not required.
- The Charging Station must continuously check for valid Proximity value during power transfer. Emergency Shutdown must be done if failed.

CCS 1.0 System Description

Current reduction by charging station.

EV requirements:

- CCS vehicle shall follow “EVSEMaximumCurrentLimit” in “CurrentDemandRes” message .
- If charging stations reduces value of “EVSEMaximumCurrentLimit” vehicle must draw less current and has to adopt its “EVTargetCurrent” in “CurrentDemandReq” message within 1s.
- This is necessary for Dual- and Triple Charger to support CCS and ChaDeMo charging in parallel
- It can also be used to charge with reduced transmission power if one power module is defect. E.g. 5 Power Modules, each 10kW in charger, one broken, vehicle still can charge with 40kW

CCS 1.0 System Description

Tariff and power tables.

EV and EVSE requirements:

- PMAX tables in “ChargeParameterDiscoveryRes” message shall not be considered for charging.
- 32kW limitation in “PMax” parameter of “ChargeParameterDiscoveryRes” message caused by data type “short” shall not be considered by vehicle, “EVSEMaximumPowerLimit”, “EVSEMaximumCurrentLimit” and “EVSEMaximumVoltageLimit” in “ChargeParameterDiscoveryRes” shall be used instead .
- Parameters in “ChargeParameterDiscovery” and “CurrentDemand” messages to be used by vehicle and charging station to agree on voltage, current and power limits.
- Tariff tables in “ChargeParameterDiscoveryRes” message shall not be sent from charging station.

CCS 1.0 System Description
Ready to Charge Indication

EVSE requirements:

- “ReadyToChargeState” in PowerDeliveryReq shall be used by charging station to detect if vehicle is ready for Power Transfer

CCS 1.0 System Description
Stop Button

EV requirements:

- The CCS vehicle shall implement a Stop button/function to allow the customer to stop communication/charging session at any time.
- This is needed if charging stations display hangs and customer can not stop charging from charging station side or if customer can not authorize it’s charge.

CCS 1.0 System Description
Stop Button

EVSE requirements:

- It is recommended for the CCS charging station to implement a Stop button/function to allow the customer to stop communication/charging session at any time. This does not have to be a physical Stop button but can be done in Display.
- This is especially needed if customer can't authorize (e.g. RFID missing) to avoid 150s waiting time for customer before "ReadyToCharge_Timeout" happens.
- The DC CCS charging station manufacturer should offer a start button/function.
  The operator can choose to use it.
- The operator can choose to require authorization to interrupt an active charging session, e.g. bef ore the Stop button can be used.

CCS 1.0 System Description
Emergency Stop Button

EVSE requirements:

- The DC charging station may not have a Emergency Stop button.
- “Normal” Stop button is sufficient because charging station and vehicles are “self-safe”. ChaDeMo also removed Emergency Stop button from requirements list. For CCS it was never required.
- Unintended pressing of emergency stop buttons is one of the most often charging errors in field (e.g. passing passengers on way home pressing emergency stop button for fun)

CCS 1.0 System Description
PLC PSD Transmission Power

EV and EVSE requirements:

- The PLC transmission power at the Charging Station Connector shall be adjusted to **-75dBm/Hz**. Tolerance is +/- 3dB. For details see DIN SPEC 70121.
- The PLC transmission power at the Vehicle Inlet shall be adjusted to

  -75dBm/Hz. Tolerance is +/- 3dB. For details see DIN SPEC 70121.
- This is important for successful SLAC operation, to avoid EMC problems and assure a robust communication even under heavy interference from switching circuits of power electronics.
- PLC PSD adjustment must be made with a Spectrum Analyzer.
  Can not be done with a oscilloscope.

CCS 1.0 System Description
SLAC, Validation and AMP Map Exchange

EV requirements:

- Vehicle shall use 20dB as SLAC limit to distinguish a direct connected charging station. (See “EVSE_FOUND” in DIN SPEC 70121)
- Missing accuracy of Link Setup report from GreenPHY chipset can cause problems with AMP MAP Exchange. It is recommended to extend timeout used for AMP Map Exchange. Details to be discussed by CharIN FG.

EVSE requirements:

- Missing accuracy of Link Setup report from GreenPHY chipset can cause problems with AMP MAP Exchange. It is recommended to extend timeout used for AMP Map Exchange. Details to be discussed by CharIN FG .

CCS 1.0 System Description
PLC robustness – EMC requirements

EVSE requirements:

- Charging Stations shall be tested according to IEC61851-21-2 for conducted emission on DC+/DC- lines.

CCS 1.0 System Description

Display information and Charging Station labeling

EVSE requirements:

- It is recommended for the DC CCS Charging Station to offer at least two languages. English and local language. This is needed for customers to be able for worldwide charging.
- The DC CCS Charging Station may show charging information (e.g. SoC, Time, Cost …) according to CharIN guideline for Display Information.
- It is recommended for the DC CCS Charging Station to mark the connector housing according to CharIN guideline (under work).

Thank You