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Road vehicles — Vehicle to grid communication interface — Part 6: General information and use-case definition for wireless communication

Véhicules routiers - Interface de communication entre véhicule et réseau électrique

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15118-6 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

ISO/IEC 15118 consists of the following parts, under the general title *Road vehicles — Vehicle to grid communication interface*:

- *Part 1: General information and use-case definition*
- *Part 2: Network and application protocol requirements*
- *Part 3: Physical layer and Data Link layer requirements*
- *Part 4: Network and application protocol conformance tests*
- *Part 5: Physical layer and data link layer conformance test*
- *Part 6: General information and use-case definition for wireless communication*
- *Part 7: Network and application protocol requirements for wireless communication*
- *Part 8: Physical layer and data link layer requirements for wireless communication*

Introduction

The pending energy crisis and the necessity to reduce greenhouse gas emissions have led vehicle manufacturers to make a very significant effort to reduce the energy consumption of their vehicles.

They are presently developing vehicles partly or completely propelled by electric energy. Those vehicles will reduce the dependency on oil, improve global energy efficiency and reduce the total CO₂ emissions for road transportation if the electricity is produced from renewable sources. To charge the batteries of such vehicles, specific charging infrastructure is required.

Much of the standardization work on dimensional and electrical specifications of the charging infrastructure and the vehicle interface is already treated in the relevant ISO or IEC groups. However, the question of information transfer between the vehicle, the local installation and the grid has not been treated sufficiently.

Such communication is beneficial for the optimization of energy resources and energy production systems as vehicles can recharge at the most economic or most energy-efficient instants. It is also required to develop efficient and convenient payment systems in order to cover the resulting micro-payments. The necessary communication channel may serve in the future to contribute to the stabilization of the electrical grid as well as to support additional information services required to operate electric vehicles efficiently.

In ISO/IEC 15118-3 the messages exchanged between the vehicle and the infrastructure are transported by the cable used for power transfer. With the inception of wireless power transfer technologies and the tremendous development of wireless communication in our societies, the need for a wireless communication between vehicle and charging infrastructure becomes imperative. This is the main focus of the new series of ISO/IEC 15118-6-7-8 standards.

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Road vehicles — Vehicle to grid communication interface — Part 6: General information and use-case definition for wireless communication

1 Scope

This part of ISO/IEC 15118 International Standard specifies a wireless communication link as an alternative to the existing conductive communication link included in ISO/IEC 15118-3 standard. Although wireless link shall comply with any applicable requirements and use cases of ISO/IEC 15118 standards, additional requirements and use cases derived from the use of wireless communication link are described.

This standard defines general information and use case definition for wireless communication, including extensions to existing use cases described in ISO/IEC 15118-1 and additional specific use cases for wireless applications. This standard is applicable to conductive power transfer technologies and wireless power transfer technologies

A particular attention has been paid to the EV-EVSE communication interface association process to ensure that the EV is correctly associated with the unique EVSE which the EV is currently, or is willing to be, attached to for the power transfer process.

This standard is based on existing standardised wireless communication technologies, suitable to vehicle to grid communication.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this standard and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050, *International electrotechnical vocabulary*

IEC 61851-1:2010, *Electric vehicle conductive charging system — Part 1: General requirements*

ISO/TR 8713, *Electrically propelled road vehicles — Vocabulary*

ISO 15118-1, *Road vehicles — Vehicle to grid communication interface — Part 1: General information and use case definition*

ISO 15118-2, *Road vehicles — Vehicle to grid communication interface — Part 2: Network and application protocol requirements*

ISO 15118-3, *Road Vehicles — Vehicle to grid communication interface — Part 3: Physical and data link layer requirements*

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

ISO 15118-5, *Road vehicles — Vehicle to grid communication interface — Part 5: Physical layer and data link layer conformance test*

IEC 61980-1 , *Electric vehicle wireless power transfer (WPT) systems - Part 1 General Requirements*

IEC 61980-2, *Electric vehicle wireless power transfer (WPT) systems - Part 2 specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO/IEC 15118-1 and the following apply.

3.1

Association

association is the process of the establishment of the wireless communication between the SECC controlling the charging infrastructure (e.g. coils for WPT) and the EVCC

3.2

charging session

sequence between the beginning of power transfer (either through a cable connection or through a WPT)) and the end of the power transfer (either with the disconnection of the cable or with the stop of WPT)

Note 1 to entry: During a charging session the EV may have none, one, or many periods of charging the battery, doing pre-conditioning or post-conditioning.

3.3

Discovery

refers to the phase in which an EV obtains a list of available SECCs in its wireless communication range.

3.4

Electric Vehicle (EV)

any vehicle propelled by an electric motor drawing current from a rechargeable storage battery or from other portable energy storage devices (rechargeable, using energy from a source off the vehicle such as a residential or public electric service), which is manufactured primarily for use on public streets, roads or highways

3.5

Electric Vehicle Communication Controller (EVCC)

embedded system, within the vehicle, that implements the communication between the vehicle and the SECC in order to support specific functions

Note 1 to entry: Such specific functions could be e.g. controlling input and output channels, encryption, or data transfer between vehicle and SECC.[SOURCE: ISO 15118-1:2013]

3.6

Electric Vehicle Supply Equipment (EVSE)

in case of conductive power transfer: conductors, including the phase(s), neutral and protective earth conductors, the EV couplers, attached plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them as necessary. [Source ISO/IEC15118-1:2013].

in case of Wireless power transfer (IEC 61980): EVSE is designated by Off-board electronics. Off-board electronic includes a frequency converter that converts the mains voltage and supplies the electric power through the primary and secondary device to the EV including all housings and covers,

Note 1 to entry: This standard will keep the wording “EVSE” whatever the power transfer process in use but the definition will depend on the power transfer technology in use.

3.7**High level communication**

bidirectional digital communication using protocol and messages specified in ISO/IEC 15118-2 IS and ISO/IEC 15118-7 and physical and data link layer specified in ISO/IEC 15118-3 and ISO/IEC 15118-8

3.8**Pairing**

process by which a vehicle is correlated with the unique EVSE at which it is located and from which the power will be transferred either through a cable or through a wireless technology

3.9**Wireless Power Transfer (WPT)**

transfer of electrical energy from a power source to an electrical load via electric and or magnetic fields or waves between a primary and a secondary device

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4 Symbols and abbreviated terms

CSO	Charging Spot Operator
DCH	Demand Clearing House
EIM	External Identification Means
EMOCH	E-Mobility Operator Clearing House
EMSP	E-Mobility Service Provider
EV	Electric Vehicle
EVCC	Electric Vehicle Communication Controller
EVSE	Electric Vehicle Supply Equipment
HMI	Human Machine Interface
HLC	High Level Communication
OEM	Original Equipment Manufacturer
PLC	Power Line Communication
PWM	Pulse Width Modulation
SECC	Supply Equipment Communication Controller
USER	Vehicle User
VAS	Value-Added Services
WC	Wireless Communication
WPT	Wireless Power Transfer

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5 Requirements

5.1 General

The ISO/IEC 15118-1 general requirements are mandatory if applicable for wireless communication. Readers may refer to ISO/IEC 15118-1 for more details. However, some additional requirements are introduced when using wireless communication interface since in the case of conductive power transfer High Level Communication may start before the driver has plugged-in. In the case of WPT, no action of plug-in is present and specific requirements also arise.

5.2 Communication infrastructure requirements

Wireless Discovery and Association is a process known by users of wireless mobile or Wi-Fi devices. The same principle applies to EVs when using wireless communication interface to find a charging spot.

When a large number of access points are in range, the Discovery and Association usually may require to select a particular service in a list of sometime more than 20 items. This situation can be acceptable for mobile users but is certainly not applicable for user driving their EV. Actually in some countries, this kind of driver manipulation is forbidden if the EV is not stopped.

In order to simplify and make the driver experience safer, and considering that Discovery should not lead to a long list of available SECCs, it is required that:

- On SECC side:
 - SECCs may broadcast their identification and necessary information for Discovery and Association (e.g. unique id...),
 - Each SECC may control one or many EVSEs. The specification of this communication link is out of scope of this standard however its data rate shall not degrade the overall system performance,
 - Each EVSE shall have a communication link with one SECC only.
- On the EV side:
 - Discovery and Association shall be possible without any driver action

Note 1 to entry: The SECC's list in range received by EVCC may be limited by application (not in scope) provided by OEM in order to make the driver experience more simple.

Figure 1 gives an example of Infrastructure where a unique SECC controls 4 EVSEs. EV #1 is in communication only with the SECC.

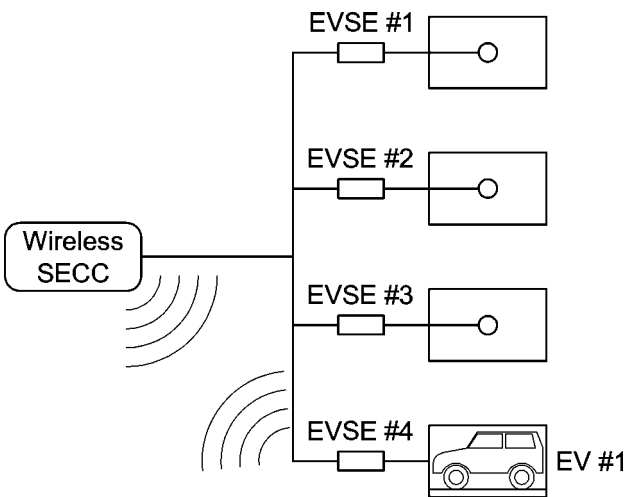


Figure 1 —infrastructure with a unique SECC

6 Actors

Actors described in this standard don't differ from the ones described in ISO/IEC 15118-1.

7 Use case elements

7.1 General description and wireless specificity

Wireless communication described in this standard is an alternative solution to the existing PLC communication described in ISO/IEC 15118-3. This means that wireless communication should support High Level Communication messages described in ISO/IEC 15118-2 as if they were transported with PLC means.

However, ISO/IEC 15118-2 message set refers to use cases described in ISO/IEC 15118-1 and developed in the sequence A to H detailed in the figure 2:

A	Start of charging process
B	Communication setup
C	Certificate Handling
D	Identification, Authentication and Authorisation
E	Target setting and charge scheduling
F	Charge controlling and Re-scheduling
G	Value-added services
H	End of charging process

Figure 2 — Use case function groups as defined in ISO/IEC 15118-1

The first group of use case A, namely “Start of charging process”, refers to 2 elements detailed in Table 1.