
**Road vehicles — Vehicle to grid
communication interface —**

**Part 3:
Physical and data link layer
requirements**

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

*Partie 3: Exigences relatives à la couche physique et à la couche
liaison de données*





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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.

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

ISO 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*

The following parts are under preparation:

- *Part 4: Network and application protocol conformance test*
- *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 has led the vehicle manufacturers to a very significant effort to reduce the energy consumption of their vehicles. They are presently developing vehicles partly or completely propelled by electric energy. Thus, vehicles will reduce the dependency on oil, improve the 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 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 might 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.

Road vehicles — Vehicle to grid communication interface —

Part 3:

Physical and data link layer requirements

1 Scope

This part of ISO 15118 specifies the requirements of the physical and data link layer for a high-level communication, directly between battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV), termed as EV (electric vehicle) [ISO-1], based on a wired communication technology and the fixed electrical charging installation [Electric Vehicle Supply Equipment (EVSE)] used in addition to the basic signalling, as defined in [IEC-1].

It covers the overall information exchange between all actors involved in the electrical energy exchange. ISO 15118 (all parts) is applicable for manually connected conductive charging.

Only “[IEC-1] modes 3 and 4” EVSEs, with a high-level communication module, are covered by this part of ISO 15118.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document 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.

ISO 15118-1:2013, *Road vehicles — Vehicle to grid communication interface — Part 1: General information and use-case definition*

ISO 15118-2:2014, *Road vehicles — Vehicle to grid communication interface — Part 2: Network and application protocol requirements*

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

IEC/TS 62763:2013, *Pilot function through a control pilot circuit using PWM (pulse width modulation) and a control pilot wire*

3 Terms and definitions

For the purposes of this document, the terms and definition in [ISO-1] and the following apply.

3.1

amplitude map

specifies a transmit power-reduction factor for each subcarrier related to the tone mask

3.2

central coordinator

manager of a HomePlug Green PHY network

3.3

channel access priority

CAP

method to prioritize the channel access

Note 1 to entry: See [HPGP].

3.4

coexistence

ability of different low-layer communication systems to share the same physical media and to function simultaneously

3.5

communication media

physical media carrying the low-layer communication signal is given by the cable assembly, which connects the charging infrastructure and the EV

3.6

communication node

device equipped with a low-layer communication modem chip; it characterizes one logical and physical communication device that is attached to a physical media and is capable of sending, receiving, or forwarding information over a communication channel

3.7

connection coordination

entity which provides the whole functionality for EV to EVSE matching and initialization, through the data link control SAP, described in [Clause 6](#)

Note 1 to entry: This entity also controls the relationships between the basic signalling and the upper layers.

3.8

crosstalk

capacitive or inductive coupling between two individual electric circuits, each providing a media for a low-layer communication network, in a way that the two networks are influenced by each other

3.9

data link control SAP

service access point which defines the interface between the connection coordination module and the low-layer communication technology for managing the link status

3.10

DATA SAP

service access point that defines the interface between layer 2 and layer 3 for exchange of v2g-related payload

3.11

ETH SAP

Ethernet II-class SAP supports applications using Ethernet II class packets, including IEEE 802.3 with or without IEEE 802.2 (LLC), IEEE 802.1H (SNAP) extensions, and/or VLAN tagging

3.12

external identification means

EIM

any external means that enable the user to identify his contract or the car

3.13

initialization

process of interaction between the EV, EVSE, and an external trigger, beginning from plug-in of the cable assembly until the decision for the charging mode to be applied

Note 1 to entry: This process is used for the charging modes 3 and 4, as described in *[IEC-1]*.

3.14

IO SAP

IO control path interfaces hardware i/o control (e.g. control pilot duty cycle) and the control pilot wire

Note 1 to entry: This entity provides an IO SAP, which is defined in [Clause 12](#).

3.15**inter system protocol**

enables various broadband power line systems to share power line communication resources in time (time domain multiplex), in frequency (frequency domain multiplex), or both

Note 1 to entry: For more information, refer to [IEEE].

3.16**logical network**

set of low-layer communication stations which use the same network key

Note 1 to entry: Only members of the same logical network are able to exchange encrypted payload data and are visible for each other on higher layers. Different logical networks might exist on the same physical media at the same time and are typically used for network segmentation.

Note 2 to entry: A logical network is defined for layer 2.

3.17**low-layer communication**

functions managed by the OSI layer 1 and layer 2 of the modem

3.18**low-layer communication module**

functional assembly behind each socket outlet or each connector, depending on the type of EV connection ([IEC-1]), which includes the communication node and the connection coordination functionality

3.19**MAC address**

unique identifier assigned to network interfaces for communication on the data link layer

3.20**management message entry****MME**

messages exchanged between PLC nodes or a PLC node and higher layers for control purposes

3.21**matching**

process to determine the low-layer communication modules of EV and EVSE, where EV is physically connected to, in a direct way

Note 1 to entry: “Matching” refers to “Association” (use-case A) in ISO 15118-1.

3.22**nominal duty cycle**

10 % to 96 % control pilot duty cycle, according to [IEC-1], generated by the EVSE

3.23**pilot function controller**

system that manages the control pilot line on the EVSE side, according to [IEC-1]

3.24**plug and charge**

identification mode where the customer just has to plug their vehicle into the EVSE and all aspects of charging are automatically taken care of with no further intervention from the customer

3.25**QPSK modulation**

phase modulation technique that transmits two bits in four modulation states

3.26

ROBO mode

communication mode which uses QPSK only for carrier modulation within the orthogonal frequency division multiplexing (OFDM) to achieve higher robustness in transmission

Note 1 to entry: The ROBO mode can be set to three different performance levels: Mini-ROBO, Standard ROBO, and High-speed ROBO.

3.27

shared bandwidth

in cases where different systems use the same physical media to transmit data, the data rate for each system might be limited, depending on the mechanism used to allocate it

3.28

signal coupling

method of coupling the signal on the communication media

3.29

signal level attenuation characterization

SLAC

protocol to measure the signal strength of a signal between HomePlug Green PHY stations

3.30

tone mask

defines the set of tones (or carriers) that can be used in a given regulatory jurisdiction or given application

3.31

valid duty cycle

duty cycle that is 5 % or 10 % to 96 %, according to [IEC-1], generated by the EVSE

4 Symbols and abbreviated terms

ARIB	Association of Radio Industries and Businesses
CAP	Channel Access Priority
CCo	Central Coordinator
D-LINK	Data Link
EIM	External Identification Mean (as defined in ISO 15118-1)
ERDF	Electricité et Réseau de France
FCC	Federal Communications Commission
HLE	Higher Layers Entities
HPGP	HomePlug Green PHY
ID	Identification
IEEE	Institute of Electrical and Electronics Engineers
ISP	Intersystem Protocol
ITU	International Telecommunication Union
MAC	Media Access Control