INTERNATIONAL STANDARD

**ISO 15118-2**

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# 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*

Reference number
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# Foreword

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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 3, *Electrical and electronic equipment*.

ISO 15118-2 was developed in conjunction with IEC TC 69, *Electric road vehicles and electric industrial trucks*.

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 and data link layer requirements*[1]

[1] To be published.

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# Introduction

The pending energy crisis and 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. Those vehicles will reduce the dependency on oil, improve the global energy efficiency and reduce the total $CO_2$ emissions for road transportation if the electricity is produced from renewable sources. To charge the batteries of such vehicles, specific charging infra-structure 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 EV and the EVSE has not been treated sufficiently.

Such communication is necessary for the optimization of energy resources and energy production systems so that vehicles can recharge in the most economical or most energy efficient way. It is also required to develop efficient and convenient billing 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 and economically.


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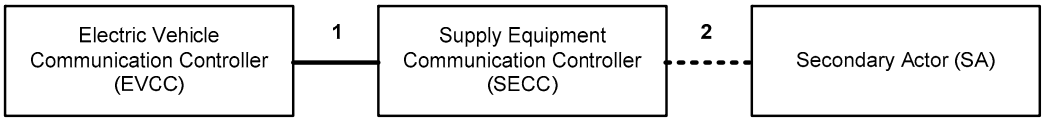
# Road vehicles — Vehicle-to-Grid Communication Interface — Part 2: Network and application protocol requirements

## 1 Scope

This part of ISO 15118 specifies the communication between battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV) and the Electric Vehicle Supply Equipment. The application layer message set defined in this part of ISO 15118 is designed to support the energy transfer from an EVSE to an EV. ISO 15118-1 contains additional use case elements (Part 1 Use Case Element IDs: F4 and F5) describing the bidirectional energy transfer. The implementation of these use cases requires enhancements of the application layer message set defined herein. The definitions of these additional requirements will be subject of the next revision of this International Standard.

The purpose of this part of ISO 15118 is to detail the communication between an EV (BEV or a PHEV) and an EVSE. Aspects are specified to detect a vehicle in a communication network and enable an Internet Protocol (IP) based communication between EVCC and SECC.




**Key**

1 Scope of ISO/IEC FDIS 15118-2:2013(E)

2 Message definition considers use cases defined for communication between SECC to SA

**Figure 1 — Communication relationship among EVCC, SECC and secondary actor**

This part of ISO 15118 defines messages, data model, XML/EXI based data representation format, usage of V2GTP, TLS, TCP and IPv6. In addition, it describes how data link layer services can be accessed from a layer 3 perspective. The Data Link Layer and Physical Layer functionality is described in ISO 15118-3.

## 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 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

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

IEC 61851-1, *Electric vehicle conductive charging system — Part 1: General requirements (Ed 2.0 2010)*

IEC 61851-22, *Electric vehicle conductive charging system - Part 22: AC electric vehicle charging station*

IEC CDV 61851-23, *Electric vehicle conductive charging system - Part 23: D.C. electric vehicle charging station (Ed 1.0 2012)*

IEC 62196, *Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles*

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W3C EXI 1.0, *Efficient XML Interchange (EXI) Format 1.0, W3C Recommendation (March 2011)*

W3C XML Signature Syntax and Processing Version 1.1, - W3C Recommendation (April 2013)

IETF RFC 768, *User Datagram Protocol (August 1980)*

IETF RFC 793, *Transmission Control Protocol - DARPA Internet Program - Protocol Specification (September 1981)*

IETF RFC 1981, *Path MTU Discovery for IP version 6 (August 1996)*

IETF RFC 2460, *Internet Protocol, Version 6 (IPv6) Specification (December 1998)*

IETF RFC 6960, *X.509 Internet Public Key Infrastructure Online Certificate Status Protocol - OCSP (June 2013)*

IETF RFC 3122, *Extensions to IPv6 Neighbor Discovery for Inverse Discovery Specification (June 2001)*

IETF RFC 3315, *Dynamic Host Configuration Protocol for IPv6 (DHCPv6) (July 2003)*

IETF RFC 3484, *Default Address Selection for Internet Protocol version 6 (IPv6) (February 2003)*

IETF RFC 6582, *The NewReno Modification to TCP's Fast Recovery Algorithm (April 2012)*

IETF RFC 4291, *IP Version 6 Addressing Architecture (February 2006)*

IETF RFC 4429, *Optimistic Duplicate Address Detection (DAD) for IPv6 (April 2006)*

IETF RFC 4443, *Internet Control Message Protocol (ICMP v6) for the Internet Protocol version 6 (IPv6) specification (March 2006)*

IETF RFC 4861, *Neighbor Discovery for IP version 6 (IPv6) (September 2007)*

IETF RFC 4862, *IPv6 Stateless Address Autoconfiguration (September 2007)*

IETF RFC 5095, *Deprecation of Type 0 Routing Headers in IPv6 (December 2007)*

IETF RFC 5116, *An Interface and Algorithms for Authenticated Encryption (January 2008)*

IETF RFC 5234, *Augmented BNF for Syntax Specifications: ABNF (January 2008)*

IETF RFC 5246, *The Transport Layer Security (TLS) Protocol Version 1.2 (August 2008)*

IETF RFC 5280, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile (May 2008)*

IETF RFC 5289, *TLS Elliptic Curve Cipher Suites with SHA-256/384 and AES Galois Counter Mode (GCM) (August 2008)*

IETF RFC 5480, *Elliptic Curve Cryptography Subject Public Key Information (March 2009)*

IETF RFC 5722, *Handling of Overlapping IPv6 Fragments (December 2009)*

IETF RFC 6066, *Transport Layer Security (TLS) Extensions: Extension Definitions (January 2011)*

IETF RFC 6106, *IPv6 Router Advertisement Options for DNS Configuration (November 2010)*

IETF RFC 6961, *The Transport Layer Security (TLS) Multiple Certificate Status Request Extension (June 2013)*



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IANA Service&PortRegistry, Service Name and Transport Protocol Port Number Registry [viewed 2011-01-16], Available from: http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml

NIST FIPS PUB 180-4: Secure Hash Standard (SHS) (March 2012)

NIST Special Publication 800-56A: Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography (Revised) (March 2007)

NIST Special Publication 800-38A: Recommendation for Block Cipher Modes of Operation - Methods and Techniques (2001)

## 3 Terms and definitions

For the purposes of this document, the terms in ISO 15118-1 and the following apply.

**3.1**
**Basic Charging**
**BC**
charging phase during a charging session controlled by IEC 61851-1 only

**3.2**
**charging limits**
set of physical constraints (e.g. voltage, current, energy, power) that is negotiated during a V2G Communication Session for a charging session

**3.3**
**Communication Setup Timer**
Timer monitoring the time from plug-in until the Session Setup message

**3.4**
**Contract Certificate**
certificate issued to EVCC either by V2G Root CA or by Sub-CA, which is used in XML Signatures in application layer so that SECC or secondary actor can verify the Contract issued to the EVCC and signatures issued by the EVCC

**3.5**
**CP State**
Control Pilot (Vehicle) State according to IEC 61851-1 signalled on Control Pilot Line

**3.6**
**credentials**
anything that provides the basis for confidence, belief, credit, etc.

EXAMPLE Examples include certificates, passwords, user names etc.

**3.7**
**Data Link Setup**
setup phase for establishing the data link

Note 1 to entry: Entry Condition: Any valid control pilot signal according to IEC 61851-1; Exit Condition: D-LINK_READY.indication(DLINKSTATUS=LinkEstablished).

**3.8**
**Distinguished Encoding Rules = ASN-1 encoding rule**
**DER**
method for encoding a data object, such as an X.509 certificate, to be digitally signed or to have its signature verified

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**3.9**
**global address**
IP address with unlimited scope

**3.10**
**High Level Communication Charging**
**HLC-C**
charging phase during a charging session controlled by ISO 15118

**3.11**
**link-local address**
IP address with link-only scope that can be used to reach neighbouring interfaces attached to the same link

**3.12**
**Identification Mode**
mandatory and optional messages and parameters with respect to charging scenarios using External Identification Means (EIM) and charging scenarios using Plug and Charge (PnC) for identification

Note 1 to entry: An Identification Mode covers a set of similar charging scenarios for a specific identification means.

**3.13**
**(IP) address**
IP-layer identifier for an interface or a set of interfaces

**3.14**
**Maximum Transfer Unit**
**MTU**
maximum size (in bytes) of the largest protocol data unit that the Data Link Layer that can be pass onwards

**3.15**
**Message Set**
set of mandatory V2G messages and parameters for the EVCC or SECC covering one or multiple use case elements

**3.16**
**Message Timer**
Timer monitoring the exchange of a Request-Response-Pair

**3.17**
**network segment**
collection of devices that can exchange data on Data Link Layer level directly via Data Link Addresses

EXAMPLE Ethernet: all devices which can see each other via MAC addresses.

**3.18**
**node**
device that implements IPv6

**3.19**
**OEM Provisioning Certificate**
certificate issued to the EVCC, so that a Contract Certificate can be securely requested and received from a secondary actor

**3.20**
**Performance Time**
non-functional timing requirement defining the time a V2G Entity shall not exceed when executing or processing certain functionality

Note 1 to entry: This is a fixed time value.


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**3.21**
**private environment**
area with (physical) access limited to a small number of vehicles (EVs), which may be a private parking garage or a garage / parking lot of a company with its own EV fleet, where one or several private wall-box(es) are used instead of public charging stations as EVSE, and where in order to keep the private wall-box simple and cheap in production and operation it is allowed to stay offline permanently, which allows a private wall-box to use leaf certificates with a longer maximum validity than allowed for public charging stations and using a private root certificate which is different to the V2G root certificates and which has to be installed into each EV that is allowed to charge within this specific private environment, resulting in a limited number of EVs belonging to one private environment, the difference to a “trusted environment” being that in a (pure; i.e. not additionally “trusted”) private environment TLS and the corresponding data encryption at connection level is always used, and solely certificate handling is simplified for the private wall-box (EVSE) since it may stay offline permanently, resulting in unrestricted certificate validity periods, shorter certificate chain length, omitting OCSP, and an additional “pairing mode”

**3.22**
**Identification Mode**
group of mandatory and optional Message Sets covering a set of similar charging scenarios for a specific identification means

**3.23**
**renegotiation**
messaging for updating the agreement on the charging schedule between EV and EVSE during a V2G Communication Session by retransmitting the parameters SASchedule and ChargingProfile

**3.24**
**Request-Response Message Pair**
request message and the corresponding response message

**3.25**
**Request-Response Message Sequence**
predefined sequence of Request-Response Message Pairs

**3.26**
**SDP Client**
V2G Entity that uses the SDP server to get configuration information about the SECC to be able to access the SECC

**3.27**
**SDP Server**
V2G Entity providing configuration information for accessing the SECC

**3.28**
**SECC Certificate**
certificate issued to SECC either by V2G Root CA or by Sub-CA, which is used in TLS so that the EVCC can verify the authenticity of the SECC

**3.29**
**Sequence Timer**
Timer monitoring a Request-Response Message Sequence

**3.30**
**Sub-CA**
subordinate certificate authority who issues SECC Certificates and/or Contract Certificates on behalf of the V2G Root CA

Note 1 to entry: The ability of issuing the certificates are delegated from V2G Root CA, and V2G Root CA can revoke the Sub-CA at any time.

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