Road vehicles - Vehicle-to-grid communication Interface - Part 2: Network and application protocol requirements (ISO 15118-2:2014)



EESTI STANDARDI EESSÕNA NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 15118-2:2016 sisaldab Euroopa standardi EN ISO 15118-2:2016 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 15118-2:2016 consists of the English text of the European standard EN ISO 15118-2:2016.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 20.04.2016.	Date of Availability of the European standard is 20.04.2016.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile <u>standardiosakond@evs.ee</u>.

ICS 43.120

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega: Aru 10, 10317 Tallinn, Eesti; koduleht <u>www.evs.ee</u>; telefon 605 5050; e-post <u>info@evs.ee</u>

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Aru 10, 10317 Tallinn, Estonia; homepage <u>www.evs.ee</u>; phone +372 605 5050; e-mail <u>info@evs.ee</u>

EUROPEAN STANDARD NORME EUROPÉENNE **EUROPÄISCHE NORM**

EN ISO 15118-2

April 2016

ICS 43.120

English Version

Road vehicles - Vehicle-to-grid communication Interface -Part 2: Network and application protocol requirements (ISO 15118-2:2014)

Véhicules routiers - Interface de communication entre véhicule et réseau électrique - Partie 2: Exigences du protocole d'application et du réseau (ISO 15118-2:2014)

Straßenfahrzeuge - Kommunikationsschnittstelle zwischen Fahrzeug und Ladestation - Teil 2: Anforderungen an das Netzwerk- und Anwendungsprotokoll (ISO 15118-2:2014)

This European Standard was approved by CEN on 21 February 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION COMITÉ EUROPÉEN DE NORMALISATION EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of ISO 15118-2:2014 has been prepared by Technical Committee ISO/TC 22 "Road vehicles" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 15118-2:2016 by Technical Committee CEN/TC 301 "Road vehicles" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 15118-2:2014 has been approved by CEN as EN ISO 15118-2:2016 without any modification.

y constant of the second secon

Contents

Forewo	ord	v
Introdu	iction	vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	3
4	Symbols and abbreviated terms	7
5 5.1 5.2	Conventions Definition of OSI based services Requirement structure	8 8 8
5.3	Usage of RFC references	8
5.4	Notation used for XML schema diagrams	9
6	Document overview	9
7	Basic requirements for V2G communication	11
7.1	General information	11
7.2	Service primitive concept of OSI layered architecture	11
7.3 7.4	V2G communication states and data link handling	12 21
7.5	Data Link Layer	26
7.6	Network Layer	26
7.7	Transport Layer	28
7.8	V2G Transfer Protocol	32
7.9 7 10	Presentation Layer	36 16
7.10		40
8	Application Layer messages	55
0.1 8.2	Protocol bandsbake definition	33 56
8.3	V2G Message Definition	60
8.4	V2G Communication Session and BodyElement Definitions	62
8.5	Complex data types	104
8.6	Identification Modes and Message Set definitions	137
8.7	V2G communication timing	170
8.8	Message sequencing and error handling	184
8.9	Request-Response Message Sequence examples	206
Annex	A (informative) Mapping of Part 1 use case elements	214
Annex	B (informative) Mapping of ISO 15118 message element names to SAE J2847/2 terms	250
Annex	C (normative) Schema definition	254
Annex	D (informative) Message examples	278
Annex	E (informative) Application of certificates	299
Annex	F (normative) Certificate profiles	313
Annex	G (informative) Encryption for the Distribution of Secret Keys	321
Annex	H (normative) Specification of Identifiers	323
Annex	I (informative) Message sequencing for renegotiation	326
Annex	J (informative) Overview on XML Signatures	330

ex K (informative) Summary of requirements	
ography	
71	
J.	
2	
3	
Q	
Оx	
\mathcal{O}	
\diamond	
0.	
	2
	0
	R
	-7
	Q
	Q.
	0
	0,
	1
	0,

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 le, to cc. red to op. 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.

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

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)

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-portnumbers.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