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Edition 1.0 2018-12

INTERNATIONAL STANDARD

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Electricity metering data exchange – the DLMS/COSEM suite – Part 8-4: Communication profiles for narrow-band OFDM PLC PRIME neighbourhood networks

Échange des données de comptage de l'électricité – la suite DLMS/COSEM – Partie 8-4: Profils de communication pour réseaux de voisinage OFDM PLC PRIME à bande étroite

IEC 62056-8-4:2018-12(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 8-4: Communication profiles for narrow-band OFDM PLC PRIME neighbourhood networks

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www.prime-alliance.org.com

International Standard IEC 62056-8-4 has been prepared by IEC technical committee 13: Electrical energy measurement and control.

The text of this standard is based on the following documents:

CDV	Report on voting
13/1749/CDV	13/1763/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLMS/COSEM suite*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

As defined in IEC 62056-1-0, the IEC 62056 DLMS/COSEM suite provides specific communication profile standards for communication media relevant for smart metering.

Such communication profile standards specify how the COSEM data model and the DLMS/COSEM application layer can be used on the lower, communication media-specific protocol layers.

Communication profile standards refer to communication standards that are part of the IEC 62056 DLMS/COSEM suite or to any other open communication standard.

This International Standard specifies DLMS/COSEM communication profiles using Recommendation ITU-T G.9904:2012 *Narrow-band orthogonal frequency division multiplexing power line communication transceivers for PRIME networks*. It applies for devices installed on the neighbourhood network.

It follows the rules defined in IEC 62056-5-3:2017, Annex A, and in IEC 62056-1-0 and the IEC TS 62056-1-1 recommendations for its structure.

The communication profile specified in this document is based on the results of the European OPEN Meter project, Topic Energy 2008.7.1.1, Project no.: 226369, www.openmeter.com, and has been prepared by the PRIME Alliance Technical Working Group, www.prime-alliance.org.

ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 8-4: Communication profiles for narrow-band OFDM PLC PRIME neighbourhood networks

1 Scope

This part of IEC 62056 specifies DLMS/COSEM communication profiles for narrow-band OFDM power line carrier PRIME neighbourhood networks using the modulation as specified in Recommendation ITU-T G.9904:2012.

Three communication profiles are specified:

- a profile using the IEC 61334-4-32 LLC layer;
- a profile using TCP-UDP/IPv4;
- a profile using TCP-UDP/IPv6.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61334-4-32:1996, *Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 32: Data link layer – Logical link control (LLC)*

IEC 61334-4-511:2000, *Distribution automation using distribution line carrier systems – Part 4-511: Data communication protocols – Systems management – CIASE protocol*

IEC 62056-1-0, *Electricity metering data exchange – The DLMS/COSEM suite – Part 1-0: Smart metering standardization framework*

IEC TS 62056-1-1, *Electricity metering data exchange – The DLMS/COSEM suite – Part 1-1: Template for DLMS/COSEM communication profile standards*

IEC 62056-4-7:2015, *Electricity metering data exchange – The DLMS/COSEM suite – Part 4-7: DLMS/COSEM transport layer for IP networks*

IEC 62056-5-3:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

IEC 62056-6-1, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object identification system (OBIS)*

IEC 62056-6-2:2017, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*

IEC 62056-9-7:2013, *Electricity metering data exchange – The DLMS/COSEM suite – Part 9-7: Communication profile for TCP-UDP/IP networks*

Recommendation ITU-T G.9904:2012, *Series G: Transmission systems and media, digital systems and networks Access networks – In premises networks. Narrowband orthogonal frequency division multiplexing power line communication transceivers for PRIME networks*

STD0005 – Internet Protocol
Author: J. Postel
Date: September 1981
Also: RFC0791, RFC0792, RFC0919, RFC0922, RFC0950, RFC1112
Available from: http://www.ietf.org/rfc/rfc0791.txt

STD0006 – User Datagram Protocol
Author: J. Postel
Date: 28 August 1980
Also: RFC 768
Available from: http://www.ietf.org/rfc/rfc0768.txt

STD0007 – Transmission Control Protocol
Author: J. Postel
Date: September 1981
Available from: http://www.ietf.org/rfc/rfc0793.txt

RFC 1144, Compressing TCP/IP Headers for Low Speed serial Link
Author: V. Jabobson
Date: February 1990
Available from https://tools.ietf.org/rfc/rfc1144.txt

RFC 2460, Internet Protocol, Version 6 (IPv6) Specification
Authors: S. Deering, Cisco, R. Hinden Nokia
Date: December 1998
Available from: http://www.ietf.org/rfc/rfc2460.txt

RFC 2464, Transmission of IPv6 Packets over Ethernet Networks
Authors M. Crawford Fermilab
Date: December 1998
Available from: http://www.ietf.org/rfc/rfc2464.txt

RFC 3315, Dynamic Host Configuration Protocol for IPv6 (DHCPv6)
Authors R. Droms, E J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney
Date: July 2003
Available from: www.ietf.org/rfc/rfc3315.txt

RFC 4291, IP Version 6 Addressing Architecture
Authors R. Hinden Nokia, S. Deering Cisco Systems
Date: February 2006.
Available from: http://www.ietf.org/rfc/rfc4291.txt

RFC 4862, IPv6 Stateless Address Configuration
Authors S. Thomson, Cisco, T. Narten IBM, T. Jinmei, Toshiba
Date: September 2007.
Available from: www.ietf.org/rfc/rfc4862.txt

RFC 6282, Compression Format for IPv6 Datagrams over IEEE 802.15.4–Based Networks
Authors J. Hui, Ed. Arch Rock Corporation P. Thubert Cisco
Date: September 2011.
Available from: http://www.ietf.org/rfc/rfc6282.txt

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE See also Recommendation ITU-T G.9904:2012.

3.1.1
base node
master node which controls and manages the resources of a subnetwork

3.1.2
registration
process by which a service node is accepted as member of the subnetwork and allocated with an LNID

3.1.3
service node
any one node of a subnetwork which is not a base node

3.1.4
unregistration
process by which a service node leaves a subnetwork

3.2 Abbreviated terms

Abbreviation	Meaning
AA	Application Association
AARE	Application Association Response
AARQ	Application Association Request
ACSE	Application Control Service Element
AL	Application Layer
AP	Application Process
APDU	Application Protocol Data Unit
ARQ	Automatic Repeat Request
CL	Convergence Layer
.cnf	Confirm service primitive
COSEM	Companion Specification for Energy Metering
CPCS	Common Part Convergence Sublayer
CSMA/CA	Carrier Sense Multiple Access – Collision Avoidance
D8PSK	Differential Eight-Phase Shift Keying
DBPSK	Differential Binary Phase Shift Keying
DGW	Default Gateway

Abbreviation	Meaning
DHCP	Dynamic Host Configuration Protocol
DLMS	Device Language Message Specification
DQPSK	Differential Quaternary Phase Shift Keying
EUI-48	48-bit Extended Unique Identifier
FU	Firmware Upgrade
FW	Firmware
IANA	Internet Assigned Numbers Authority
IGMP	Internet Group Management Protocol
.ind	Indication service primitive
IP	Internet Protocol
IPv4	Internet Protocol, version 4
IPv6	Internet Protocol version 6
LCID	Local Connection Identifier
LD	Logical Device
LLC	Logical Link Control (sub-layer)
LNID	Local Node Identifier
MAC	Medium Access Control, MAC sublayer entity
MLME	MAC Layer Management Entity
MPDU	MAC Protocol Data Unit
NAT	Network Address Translation
NHC	Next Header Compression
NL	Noise Level
OBIS	OBject Identification System
OFDM	Orthogonal Frequency Division Multiplexing
OSI	Open System Interconnection
PHY	Physical Layer entity
PLC	Power Line Communication
PIB	PLC Information Base
PLME	Physical Layer Management Entity
PPDU	PHY Protocol Data Unit
.req	Request service primitive
RFC	Request For Comment
.rsp	Response service primitive
SDU	Service Data Unit
SID	Switch Identifier
SNA	Subnetwork Address
SNR	Signal-to-Noise Ratio
SSCS	Service Specific Convergence Sublayer

Abbreviation	Meaning
TCP	Transmission Control Protocol
TOS	Type Of Service
UDP	User Datagram Protocol
xDLMS_ASE	extended DLMS Application Service Element
ZCT	Zero Crossing Time

4 Targeted communication environments

The DLMS/COSEM communication profiles for narrow-band OFDM PLC PRIME neighbourhood networks are intended for remote data exchange on Neighbourhood Networks (NN) between Neighbourhood Network Access Points (NNAPs) and Local Network Access Points (LNAPs) or End Devices using OFDM PLC technology over the low voltage electricity distribution network as a communication medium. The functional reference architecture is shown Figure 1.

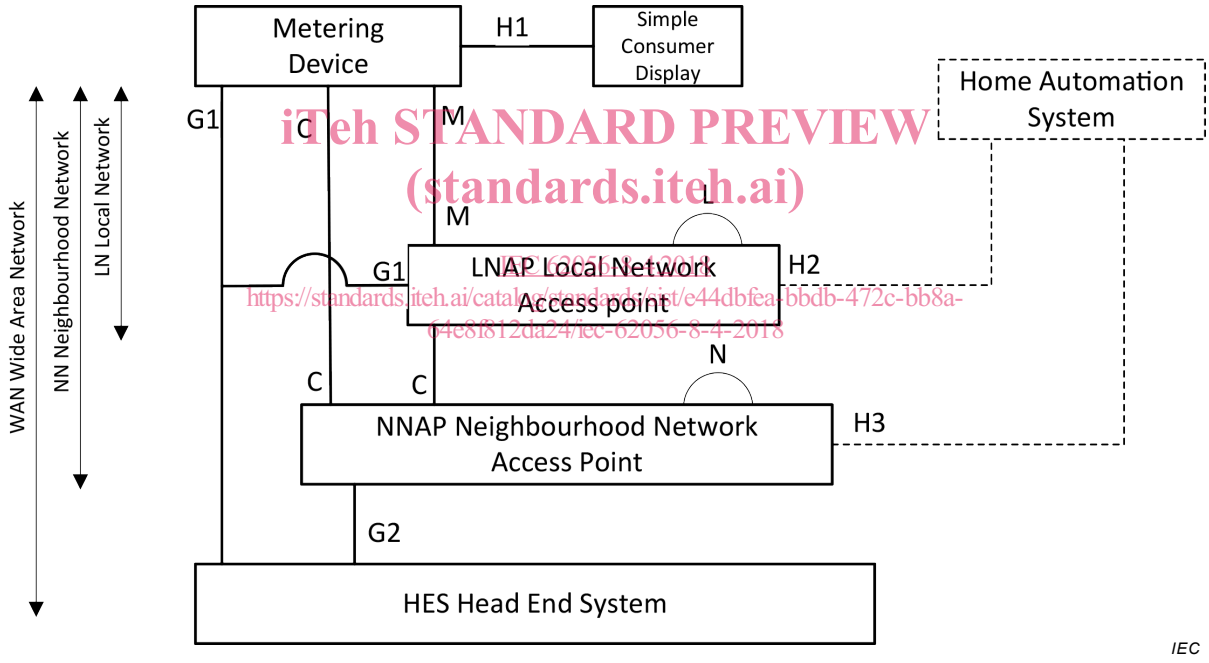

Figure 1 – Communication architecture

End devices – typically electricity meters – comprise application functions and communication functions. They may be connected directly to the NNAP via the C interface, or to an LNAP via an M interface, while the LNAP is connected to the NNAP via the C interface. The LNAP function may be co-located with the metering functions.

A NNAP comprises gateway functions and it may comprise concentrator functions. Upstream, it is connected to the Metering Head End System (HES) using suitable communication media and protocols.

End devices and LNAPs may communicate to different NNAPs, but to one NNAP only at a time. From the PLC communication point of view, the NNAP acts as the base node while end devices and LNAPs act as service nodes.

NNAPs and similarly LNAPs may communicate to each other, but this is out of the scope of this document, which covers the C interface only.

When the NNAP has concentrator functions, it acts as a DLMS/COSEM client. When the NNAP has gateway functionality only, then the HES plays the role of a DLMS/COSEM client. The end devices or the LNAPs play the role of DLMS/COSEM servers.

A mixed architecture is also possible, i.e. both the HES and the NNAP can act as a client.

5 Use of the communication layers for this profile

5.1 Information related to the use of the standard specifying the lower layers

Recommendation ITU-T G.9904:2012 defines PHY and MAC layers for power line communication using OFDM. At the top of the MAC layer it defines also a number of Convergence layers, the purpose of which is to match the lower protocol layers with the higher protocol layers.

This document makes use of the entire part of the PHY and MAC layers. Additionally, it defines – in 5.5 – the use of the respective Convergence layers.

5.2 The structure of the communication profiles

5.2.1 Overview

The proposed protocol stacks use the following OSI layers as shown in Figure 2.

- the DLMS/COSEM Application layer as specified in IEC 62056-5-3 covering the Application, Presentation and Session functionalities;
- the LLC sublayer as specified in IEC 61334-4-32, used with the DLMS/COSEM 61334-4-32 profile over PRIME networks;
- the DLMS/COSEM transport layer for IP networks as specified in IEC 62056-4-7:2015 used with the DLMS/COSEM TCP-UDP/IPv4 and TCP-UDP/IPv6 profiles over PRIME networks;
- the PRIME MAC layer, the CPCS and the corresponding SSCS, according to the selected profile (IEC 61334-4-32, TCP-UDP/IPv4 or TCP-UDP/IPv6);
- the PRIME Physical layer.

Following this reference model, three distinct profiles can be identified, all of them using the PRIME PHY, MAC layers as lower layers and the Common Part Convergence Sublayer on one hand, and the DLMS/COSEM Application layer specified in IEC 62056-5-3 and the COSEM object model specified in IEC 62056-6-1 and IEC 62056-6-2 on the other hand. Lower layers – meaning PHY and MAC – are based on the principles of IEEE 802.15.4.

NOTE The COSEM interface classes for setting up and managing data exchange over narrow-band OFDM PLC PRIME network are specified in IEC 62056-6-2.