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IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications

IEEE Communications Society

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Power Line Communications Standards Committee

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USA

IEEE Std 1901.2™-2013

IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications

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Power Line Communications Standards Committee
of the
IEEE Communications Society

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Abstract: A worldwide standard for narrowband power line communications (PLC) via alternating current, direct current, and nonenergized electric power lines using frequencies below 500 kHz. Data rates of up to 500 kb/s are supported. The field of use includes Smart Grid applications. Coexistence mechanisms that can be used by other PLC technologies operating below 500 kHz are also included. These coexistence mechanisms may be used separately from the rest of the standard.

Keywords: coexistence, G3-PLC, IEEE 1901.2™, IFFT OFDM, MAC, medium access control, narrowband, PHY, physical layer, PLC, power line communications, PRIME

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The Working Group gratefully acknowledges the contributions of many individual and entities. Without their assistance and dedication, this standard would not have been completed. The following individuals submitted technical contributions or commented on the standard at various stages of the project development:

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Introduction

This introduction is not part of IEEE Std 1901.2-2013, IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications.

This standard is designed to enable low-frequency (<500 kHz) narrowband power line communications (PLC) over indoor and outdoor electrical wiring. The standard supports data rates of up to 500 kb/s and was developed as the result of a collaborative effort undertaken by a large cross section of the PLC industry's technical experts and stakeholders.

It also contains a coexistence mechanism that was developed based on the requirements provided by the industry and with the input from the Smart Grid Interoperability Panel (SGIP) Priority Action Plan 15 (PAP15). This coexistence mechanism may be used by any PLC technology in this band without implementing the rest of the standard and will be maintained through the IEEE-SA.

The project was authorized 25 March 2010. The first draft was available in early January 2011. The first letter ballot was started in January 2012 and received final working group approval on 29 May 2013. Sponsor ballot was completed on 7 September 2013. The document was approved by the IEEE-SA Standards Board on 31 October 2013.

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1. Overview

1.1 Scope

This standard specifies communications for low-frequency (less than 500 kHz) narrowband power line devices via alternating current and direct current electric power lines. This standard supports indoor and outdoor communications over low-voltage (less than 1000 V) (LV) and medium-voltage (1000 V to 72 kV) (MV) power lines and through associated transformers in both urban and long-distance rural applications. The standard uses transmission frequencies less than 500 kHz. Data rates will be scalable to 500 kb/s depending on the application requirements and network conditions. This standard addresses grid to utility meter, grid automation, electric vehicle to charging station, and within home area networking communications scenarios. Lighting and solar panel power line communications (PLC) are also potential uses of this communications standard. This standard focuses on the balanced and efficient use of the PLC channel by all classes of low-frequency narrowband devices, defining detailed mechanisms for coexistence between different low-frequency narrowband standards developing organization (SDO) technologies, assuring that desired bandwidth may be delivered. This standard assures coexistence with broadband power line devices by minimizing out-of-band emissions in frequencies greater than 500 kHz. The standard addresses the necessary security requirements that assure communication privacy and allow use for security-sensitive services. This standard defines the physical layer (PHY) and the medium access control (MAC) sublayer of the data link layer, as defined by the International Organization for Standardization (ISO) open systems interconnection (OSI) basic reference model as shown in 4.3.