

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

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Low-Frequency (less than 500 kHz)  
Narrowband Power Line Communications  
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**Power Line Communications Standards Committee  
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IEEE Communications Society**

Approved 31 October 2013

**IEEE-SA Standards Board**

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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 Institute of Electrical and Electronics Engineers, Inc.  
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PDF: ISBN 978-0-7381-8793-8 STD98470  
Print: ISBN 978-0-7381-8794-5 STDPD98470

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**James LeClare**, *Chair*  
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**Oleg Logvinov**, *PHY/MAC up to 500 kHz Chair*  
**Vijay Dhingra**, *Coexistence Subgroup Chair*  
**Michael Koch**, *EMC Subgroup Chair*  
**Tom McLaughlin**, *End-user Technical Requirements Subgroup Chair*  
**Gordon Gregg**, *Channel Model Chair*  
**J. P. Vasseur**, *Service Access Point (SAP) Definition Subgroup Chair*  
**James D. Allen**, *Editor*  
**Sherman Gavette**, *Technical Editor*

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:

Tommy Aizawa	Paul Heitman	Andriè Perino
Danie Algera	Ulrich Herberg	Nicolas Pigeon
Keith Bargroff	Michael Himmels	Shmulik Pisanty
James Bates	Jeremy Hirsch	Qi Qu
Anuj Batra	Jin-Meng Ho	Purva Rajkotia
Yoav Ben-Yehezkel	Stephan Horvath	Rob Ranck
Inigo Berganza	Jean-Philippe Huet	Sathya Rao
Ulrich Berold	Amir Kamalizad	Matt Rhodes
Paul Bertrand	Il Han Kim	David Ribner
Paola Bisaglia	Joon Bae Kim	Markus Rindchen
Simone Bois	Neal King	Beiyu Rong
Vladimir Borisov	Sravana Krishna	Roger Samy
Paul Bromley	Sharad Kumar	Alfredo Sanz
Roberto Cappelletti	Albert Kuo	Thomas Schaub
Henri Chabrier	Lutz Lampe	Maik Seewald
Philippe Chiummiento	Nien-Chuan	Manu Sharma
Joseph Choghi	Alessandro Lasciandare	Donald Shaver
Joseph Chou	Ken Laudel	Afshin Shaybani
Thomas Clausen	Angus Lee	Shakti Shenoy
Zeev Collins	Bill Lichtensteiger	Joel Silverman
Nicola Crespi	Fenghua Liu	Kiwi Smit
Jean Marc Darchy	Weilin Liu	Daniel Smolinski
Andrew David	Oleg Logvinov	Nedo Speroni
Gabriele Dell'amico	Xiaolin Lu	Gary Stuebing
Karl Dietrich	Eddie Luaces	David Su
Dacfey Ding	Thierry Lys	Phil Sutterlin
Ed Eckert	Patrick Melet	Keith Tilley
Jean-Philippe Fauré	Anil Mengi	Kevin Traylor
Ullrich Feuchtinger	Ross Mitchell	Paolo Trefiletti
Roberto Francesconi	Olivier Monnier	Badri Varadarajan
Ajay Gammar	Alessandro Moscatelli	Thierry Vernet
Alex Gelman	Andrés Muñoz	Nanci Vogtli
Andrea Giorgi	Michael Navid	Khurram Waheed
Angad Gill	Vladimir Oksman	C. Scott Willy
Bill Godwin	Verne Olson	Michael Wilson
Nathan Goldstick	Jamshid Ourmazdi	Janez Zavasnik
Lorenzo Guerrieri	Prasad Panchangam	Bo Zhang
Eleonora Guerrini	Mallet Patrice	Jin Zhang

The Working Group Chair gratefully acknowledges the following individuals for their significant technical contributions to this standard:

Anand Dabak  
Ronen Gazit  
Cédric Lavenu  
Victor Loginov  
Afshin Niktash

Tarkesh Pande  
Daniel Popa  
Kaveh Razazian  
Shimon Solodkin

Mihai Stanciv  
Maher Umari  
Ramanuja Vedantham  
Kumaran Vijayasankar  
Jiang Yue

The following industry entities participated in the development of this standard:

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Accent S.p.A.  
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Gary Hoffman  
Paul Houzé  
Jim Hughes  
Michael Janezic  
Joseph L. Koepfinger\*  
Oleg Logvinov

Ron Petersen  
Gary Robinson  
Jon Walter Rosdahl  
Adrian Stephens  
Peter Sutherland  
Yatin Trivedi  
Phil Winston  
Yu Yuan

\*Member Emeritus

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Don Messina  
*IEEE Standards Program Manager, Document Development*

Brenda Mancoske  
*IEEE Client Services Manager, Professional Services*

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

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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.