INTERNATIONAL STANDARD

ISO/IEC/IEEE 8802-15-4

Second edition
2018-03

Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements —

Part 15-4: Wireless medium access control (MAC) and physical layer (PHY) specifications for low-rate wireless personal area networks (WPANs)

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Réseaux locaux et métropolitains — Exigences spécifiques —

Partie 15-4: Spécifications du contrôle d'accès du milieu sans fil (MAC) et de la couche physique (PHY) pour les réseaux personnels sans fil de faible débit (WPAN)

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

stds.ipr@ieee.org
www.ieee.org

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This second edition cancels and replaces the first edition (ISO/IEC/IEEE 8802-15-4:2010), which has been technically revised.

A list of all parts in the ISO/IEC/IEEE 8802 series can be found on the ISO website.

IEEE Std 802.15.4™-2015
(Revision of
IEEE Std 802.15.4-2011)

IEEE Standard for Low-Rate Wireless Networks

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 5 December 2015

IEEE-SA Standards Board

Abstract: The protocol and compatible interconnection for data communication devices using low-data-rate, low-power, and low-complexity short-range radio frequency (RF) transmissions in a wireless personal area network (WPAN) are defined in this standard. A variety of physical layers (PHYs) have been defined that cover a wide variety of frequency bands.

Keywords: ad hoc network, IEEE 802.15.4™, low data rate, low power, LR-WPAN, mobility, PAN, personal area network, radio frequency, RF, short range, wireless, wireless personal area network, WPAN

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Mineo Takai
Kou Togashi
Billy Verso
Gabriel Villardi
Brian Weis
Makoto Yaita
Peter Yee
Yu Zeng
Chunhui (Allan) Zhu

Major contributions in the revision process were received from the following individuals:

Philip Beecher
Monique Brown
Edgar Callaway
Soo-Young Chang
James P. K. Gilb
Tim Godfrey
Jussi Haapola
Timothy Harrington
Jeritt Kent
Patrick W. Kinney
Tero Kivinen
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Ruben E. Salazar Cardozo
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Mathew Welborn
Richard Wilson
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Edward G. Woodrow
Hirohisa Yamaguchi
Amos Young
Song-Lin Young
Nakache Yves-paul
Jim Zyren

Major contributions were received from the following individuals:

Tony Adamson
David Archer
David Avery
Venkat Bahl
Daniel Bailey
Edul Batliwala
Pratik Bose
Boaz Carmeli
Farron Dacus
Martin Digon
Ian C. Gifford
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Su-Khiong Yong
Zhan Yu
Serdar Yurdakul
Mahmoud Zadeh
Bin Zhen

Major contributions in the revision process were received from the following individuals:

Jon Adams
Helmut P. Adamski
Jonathan Avey
Jon Beniston
Bernd Grohmann
José A. Gutierrez
Jesper Holm
ZhiJian Hu
Phil A. Jamieson
Yuen-Sam Kwok
Colin Lanzl
Myung Lee
Zhongding Lei
Liang Li
Yong Liu
Frederick Martin
Frank Poegel
Matthias Scheide
D. C. Seward
Huai-Rong Shao
Mark Shea
Stephen J. Shellhammer
Mark A. Tillinghast
Johannes Van Leeuwen
Richard Wilson
Ping Xiong
Bing Xu
ChenYang Yang
Chunhui Zhu

The following members of the IEEE P802.15 Working Group participated in the development of the second revision, IEEE Std 802.15.4-2011:

Robert F. Heile, *Chair*
Rick Alfvin, *Co-Vice Chair*
Patrick W. Kinney, *Co-Vice Chair*
James P. K. Gilb, *Working Group Technical Editor*
Patrick W. Kinney, *Secretary*

James P. K. Gilb, *Task Group 4i Chair and Technical Editor*

Emad Afifi
Gahng-Seop Ahn
Roberto Aiello
Arthur Astrin
Taehan Bae
Michael Bahr
John Barr
Anuj Batra
Tuncer Baykas
Philip E. Beecher
Ashutosh Bhatia
Ghulam Bhatti
Gary Birk
Mathew Boytim
Peter David Bradley
Nancy Bravin
David Britz
Monique B. Brown
Sverre Brubk
Brian Buchanan
John Buffington
Kiran Bynam
Brent Cain
Edgar H. Callaway
Chris Calvert
Ruben E. Salazar Cardozo
Douglas Castor
Jaesang Cha
Russell Chandler
Kuor-Hsin Chang
Soo-Young Chang
Clint Chaplin
Hind Chebbo
Chang-Soon Choi
Sangsung Choi
Ciaran Connell
David Cypher
Matthew Dahl
David Davenport
Mark Dawkins
Hendricus de Ruijter
Upkar Dhaliwal
Gang Ding
Paul Dixon
Guido Dolmans
Igor Dotlic
Michael Dow
Dietmar Eggert
David Evans
Charles Farlow
John Farserotu
Jeffrey Fischbeck
Mike Fischer
George Flammer
Ryosuke Fujiwara
Noriyasu Fukatsu
Kiyoshi Fukui
John Geiger
Gregory Gillooly
Tim Godfrey
Paul Gorday
Elad Gottlib
Robert Hall
Shinsuke Hara
Hiroshi Harada
Timothy Harrington
Rodney Hemminger
Marco Hernandez
Garth Hillman
Jin-Meng Ho
Wei Hong
Srinath Hosur
David Howard
Jung-Hwan Hwang
Taeho Hwang

Ichirou Ida
Tetsushi Ikegami
Akio Iso
Yeong Min Jang
Adrian Jennings
Wuncheol Jeong
Steven Jillings
Noh-Gyoung Kang
Tae-Gyu Kang
Shuzo Kato
Tatsuya Kato
Jeritt Kent
Prithpal Khakuria
Dae Ho Kim
Dong-Sun Kim
Dukhyun Kim
Jaehwan Kim
Jeffrey King
Ryuji Kohno
Fumihide Kojima
Bruce Kraemer
Raymond Krasinski
Masahiro Kuroda
John Lampe
Zhou Lan
Khanh Le
Cheolhyo Lee
Hyungsoo Lee
Myung Lee
Daniel Lewis
Huan-Bang Li
Liang Li
Sang-Kyu Lim
Jeremy Link
Mike Lynch
Robert Mason
Tomokuni Matsumura
Jeff McCullough
Michael McGillan
Michael D. McInnis
Michael McLaughlin
Charles Millet
Siamak Mirnezami
Rishi Mohindra
Emmanuel Monnerie
Rajendra Moorti
Robert Moskowitz
Hamilton Moy
Peter Murray
Theodore Myers
Chiu Ngo
Paul Nikolich
Hirohito Nishiyama
David Olson
Okundu Omeni
Ryoji Ono
Laurent Ouvry
James Pace
Hyung-Il Park
Jahng Park
Seung-Hoon Park
Taejoon Park
Ranjeet Patro
Al Petrick
Dalibor Pokrajac
Daniel Popa
Stephen Pope
Clinton C. Powell
Richard Powell
Chang-Woo Pyo
Mohammad Rahman
Sridhar Rajagopal
Jayaram Ramasastry
Marc Reed
Ivan Reede
Richard Roberts
Craig Rodine
June Chul Roh
Benjamin A. Rolfe
Seung-Moon Ryu
Didier Sagan
Kentaro Sakamoto
Will San Filippo
H. Sanderford
Kamran Sayrafian
Timothy Schmidl
Michael Schmidt
Jean Schwoerer
Cristina Seibert
Neal Seidl
Kunal Shah
Steve Shearer
Stephen Shellhammer
Shusaku Shimada
Chang Sub Shin
Cheol Ho Shin
Michael Sim
Jonathan Simon
Jaeseung Son
Paul Stadnik
René Struik
Chin-Sean Sum
Hui-Hsia Sung
Gu Sungi
Kenichi Takizawa
Hirokazu Tanaka
Larry Taylor
Mark Thompson
James Tomcik
Ichihiko Toyoda
David Tracey
Khanh Tran
Jerry Upton
Jana van Greunen
Hartman van Wyk
Michel Veillette
Billy Verso
Bhupender Virk
Joachim Walewski
Junyi Wang
Quan Wang
Xiang Wang
Andy Ward
Scott Weikel
Nicholas West
Mark Wilbur
Ludwig Winkel
Eun Tae Won
Alan Chi Wai Wong
Tao Xing
Wen-Bin Yang
Yang Yang
Kazuyuki Yasukawa
Kamya Yazdandoost
Kaoru Yokoo
Mu Zhao
Bin Zhen

Major contributions in the revision process were received from the following individuals:

Philip E. Beecher
Vern Brethour
Monique B. Brown
Edgar H. Callaway
Kuor-Hsin Chang
Clint Chaplin
James P. K. Gilb
Patrick W. Kinney
Michael D. McInnis
Clinton C. Powell
Benjamin A. Rolfe
Timothy Schmidl
René Struik
Billy Verso

Introduction

This introduction is not part of IEEE Std 802.15.4™-2015, IEEE Standard for Low-Rate Wireless Networks.

This is the third revision of IEEE Std 802.15.4. From the beginning, the goal of the IEEE P802.15 Working Group was to produce a standard that enabled very low-cost, low-power communications. The initial standard, IEEE Std 802.15.4-2003, defined two optional physical layers (PHYs), operating in different frequency bands with a simple and effective medium access control (MAC).

In 2006, the standard was revised and added two more PHY options. The MAC remained backward compatible, but the revision added MAC frames with an increased version number and a variety of MAC enhancements, including the following:

— Support for a shared time base with a data time stamping mechanism
— Support for beacon scheduling
— Synchronization of broadcast messages in beacon-enabled personal area networks (PANs)
— Improved MAC layer security

In 2011, the standard was revised to include the three amendments approved subsequent to the 2006 revision. This effort added four more PHY options along with the MAC capability to support ranging. Additionally, the organization of the standard was changed so that each PHY would have a separate clause, and the MAC clause was split into functional description, interface specification, and security specification.

The current revision of the standard was created to roll in the amendments approved subsequent to the 2011 revision: six PHY amendments and one MAC amendment, with corrigenda and clarifications. The features added by the amendments include the following:

— Enhanced frame formats maintaining backward compatibility
— Information Elements (IEs)
— Channel agility
— Extended superframe options
— Low-energy mechanisms
— An enhanced acknowledgment frame that can carry data and can be secured
— Prioritized channel access
— A variety of new PHY modulation, coding, and band options to support a wide variety of application needs including radio frequency identification (RFID), smart utility networks (SUNs), television white space (TVWS) operation, low-energy critical infrastructure monitoring (LECIM), and rail communications and control (RCC).

Much of the corrigenda and clarifications were collected from requests from individuals after the revision in 2011. Major corrigenda items included changes to the security text to correct errors and clarify the text, removal of the encrypt only mode, addition of security policy checks for the IEs, corrections regarding personal area network identifier (PAN ID) compression behavior to eliminate ambiguous specification, and changes to the IEs subclauses to include more information necessary for users of this standard.

The Project Authorization Request (PAR) for IEEE Std 802.15.4-2015 was first proposed in July 2013 and was approved in October 2013 by IEEE's New Standards Committee (NesCom). After three working group ballots and two sponsor ballots, the final standard was approved in December 2015, just over two years from start to finish.

Contents

IEEE Standard for Low-Rate Wireless Networks

1. Overview

1.1 Scope

This standard defines the physical layer (PHY) and medium access control (MAC) sublayer specifications for low-data-rate wireless connectivity with fixed, portable, and moving devices with no battery or very limited battery consumption requirements. In addition, the standard provides modes that allow for precision ranging. PHYs are defined for devices operating various license-free bands in a variety of geographic regions.

1.2 Purpose

The standard provides for ultra low complexity, ultra low cost, ultra low power consumption, and low data rate wireless connectivity among inexpensive devices. In addition, one of the alternate PHYs provides precision ranging capability that is accurate to one meter. Multiple PHYs are defined to support a variety of frequency bands.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI X3.66-1979, Advanced Data Communication Control Procedures.[1]

Code of Federal Regulations, Title 47: Telecommunication, Part 90—Private Land Mobile Radio Services, Subpart S—Regulations Governing Licensing and Use of Frequencies in the 806–824, 851–869, 896–901, and 935–940 MHz Bands (47 CFR, Part 90, Subpart S).[2]

Code of Federal Regulations, Title 47: Telecommunication, Part 90—Private Land Mobile Radio Services, Subpart Y—Regulations Governing Licensing and Use of Frequencies in the 4940–4990 MHz Band (47 CFR, Part 90, Subpart Y).

FIPS Pub 197, Advanced Encryption Standard (AES).[3]

IEEE Std 802®-2014, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.[4, 5]

IETF RFC 6225, Dynamic Host Configuration Protocol Options for Coordinate-Based Location Configuration Information, Internet Engineering Task Force.[6]

[1]ANSI publications are available from the American National Standards Institute (http://www.ansi.org/)
[2]CFR publications are available from the U.S. Government Printing Office (http://www.gpo.gov/).
[3]FIPS publications are available from the National Technical Information Service (NTIS) (http://www.ntis.org/).
[4]IEEE publications are available from The Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).
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[6]IETF RFCs are available from the Internet Engineering Task Force (http://www.ietf.org/).