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**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)**

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*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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Published in Switzerland

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- *Part 15-4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs).*

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**Part 15.4: Wireless Medium Access Control  
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8 September 2006

**IEEE Std 802.15.4™-2006**  
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Approved 7 June 2006

**IEEE-SA Standards Board**

**Abstract:** IEEE Std 802.15.4-2003 defined 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). This revision extends the market applicability of IEEE Std 802.15.4, removes ambiguities in the standard, and makes improvements revealed by implementations of IEEE Std 802.15.4-2003.

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

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Print: ISBN 0-7381-4996-9 SH95552  
PDF: ISBN 0-7381-4997-7 SS95552

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## Introduction

This introduction is not part of IEEE Std 802.15.4-2006, IEEE Standard for 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).

This standard defines the protocol and interconnection of devices via radio communication in a personal area network (PAN). The standard uses carrier sense multiple access with collision avoidance (CSMA-CA) medium access mechanism and supports star as well as peer-to-peer topologies. The media access is contention based; however, using the optional superframe structure, time slots can be allocated by the PAN coordinator to devices with time critical data. Connectivity to higher performance networks is provided through a PAN coordinator.

This revision was initiated to incorporate additional features and enhancements as well as some simplifications to the 2003 edition of this standard. The standard now includes two optional physical layers (PHYs) yielding higher data rates in the lower frequency bands and, therefore, specifies the following four PHYs:

- An 868/915 MHz direct sequence spread spectrum (DSSS) PHY employing binary phase-shift keying (BPSK) modulation
- An 868/915 MHz DSSS PHY employing offset quadrature phase-shift keying (O-QPSK) modulation
- An 868/915 MHz parallel sequence spread spectrum (PSSS) PHY employing BPSK and amplitude shift keying (ASK) modulation
- A 2450 MHz DSSS PHY employing O-QPSK modulation

The 868/915 MHz PHYs support over-the-air data rates of 20 kb/s, 40 kb/s, and optionally 100kb/s and 250kb/s. The 2450 MHz PHY supports an over-the-air data rate of 250 kb/s. The PHY chosen depends on local regulations and user preference.

This revision also incorporates the following additions and enhancements to the 2003 edition:

- Adds support for a shared time base through the addition of a data time stamping mechanism
- Adds extensions of the 2.4GHz derivative modulation yielding higher data rates at the lower frequency bands
- Incorporates a mechanism for communicating the revision level on a frame-by-frame basis
- Adds support for beacon scheduling
- Allows synchronization of broadcast messages in beacon-enabled PANs
- Improves usage of security suite

Also, this revision incorporates the following changes and simplifications:

- Makes GTS support optional
- Removes restrictions for manually enabling the receiver
- Simplifies passive and active scan procedures
- Allows for more flexibility in the CSMA-CA algorithm
- Reduces association time in nonbeacon networks

This revision is backward-compatible to the 2003 edition; in other words, devices conforming to this standard are capable of joining and functioning in a PAN composed of devices conforming to IEEE Std 802.15.4-2003.

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