

**Supplement to IEEE Standard for Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements**

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

High-speed Physical Layer in the 5 GHz Band

<p>Adopted by the ISO/IEC and redesignated as ISO/IEC 8802-11:1999/Amd 1:2000(E)</p>

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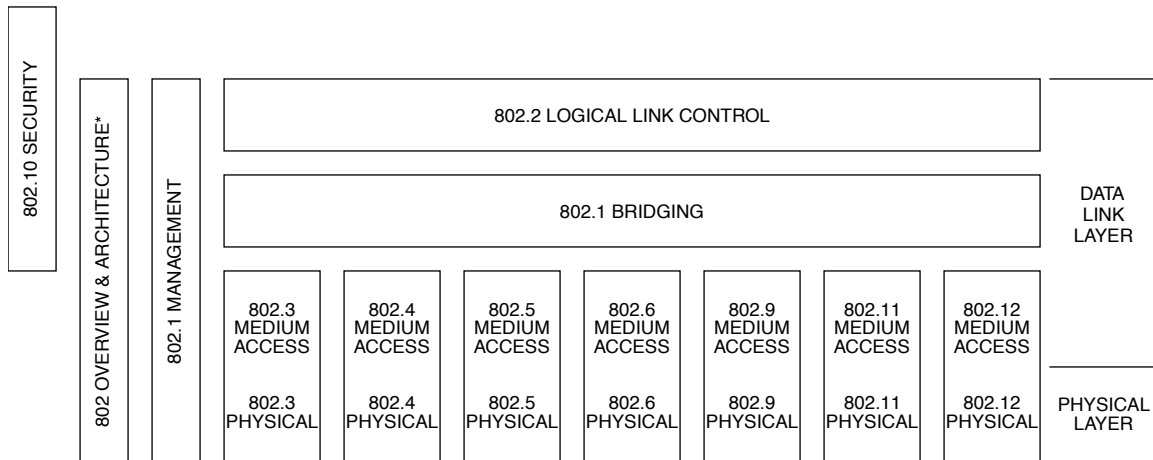
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Introduction

(This introduction is not part of IEEE Std 802.11a-1999, Supplement to IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific Requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band.)

This standard is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1:1994). The access standards define seven types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The standards defining the access technologies are as follows:

- IEEE Std 802 *Overview and Architecture.* This standard provides an overview to the family of IEEE 802 Standards.
- ANSI/IEEE Std 802.1B and 802.1k [ISO/IEC 15802-2] *LAN/MAN Management.* Defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ANSI/IEEE Std 802.1D [ISO/IEC 15802-3] *Media Access Control (MAC) Bridges.* Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- ANSI/IEEE Std 802.1E [ISO/IEC 15802-4] *System Load Protocol.* Specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.
- IEEE Std 802.1F *Common Definitions and Procedures for IEEE 802 Management Information*
- ANSI/IEEE Std 802.1G [ISO/IEC 15802-5] *Remote Media Access Control Bridging .* Specifies extensions for the interconnection, using non-LAN communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.

- ANSI/IEEE Std 802.2 [ISO/IEC 8802-2] *Logical Link Control*
- ANSI/IEEE Std 802.3 [ISO/IEC 8802-3] *CSMA/CD Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.4 [ISO/IEC 8802-4] *Token Passing Bus Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.5 [ISO/IEC 8802-5] *Token Ring Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.6 [ISO/IEC 8802-6] *Distributed Queue Dual Bus Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.9 [ISO/IEC 8802-9] *Integrated Services (IS) LAN Interface at the Medium Access Control and Physical Layers*
- ANSI/IEEE Std 802.10 *Interoperable LAN/MAN Security*
- IEEE Std 802.11 [ISO/IEC DIS 8802-11] *Wireless LAN Medium Access Control and Physical Layer Specifications*
- ANSI/IEEE Std 802.12 [ISO/IEC DIS 8802-12] *Demand Priority Access Method, Physical Layer and Repeater Specifications*

In addition to the family of standards, the following is a recommended practice for a common Physical Layer technology:

- IEEE Std 802.7 *IEEE Recommended Practice for Broadband Local Area Networks*

The following additional working groups have authorized standards projects under development:

- IEEE 802.14 *Standard Protocol for Cable-TV Based Broadband Communication Network*
- IEEE 802.15 *Wireless Personal Area Networks Access Method and Physical Layer Specifications*
- IEEE 802.16 *Broadband Wireless Access Method and Physical Layer Specifications*

Editor's Notes

Clause 4, subclause 9.1, and Clause 17 in this supplement will be inserted into the base standard as an additional PHY specification for the 5 GHz unlicensed national information infrastructure (U-NII) band.

There are three annexes included in this supplement. Following are instructions to merge the information in these annexes into the base document.

Annex A: This annex shows a change to the table in A.4.3 of the base standard (IUT configuration) and the addition of a new subclause. Item *CF6 should be added to the table in A.4.3 of the base standard. The entire subclause A.4.8 (Orthogonal frequency division multiplex PHY functions) should be added to the end of Annex A in the base standard (i.e., after A.4.7).

Annex D: This annex contains additions to be made to Annex D (ASN.1 encoding of the MAC and PHY MIB) of the base standard. There are five sections that provide instructions to merge the information contained herein into the appropriate locations in Annex D of the base standard.

Annex G: This annex is new to the base standard. The purpose of Annex G is to provide an example of encoding a frame for the OFDM PHY, described in Clause 17, including all intermediate stages.

Participants

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Control (MAC) and Physical Layer
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5 GHz Band**

[These additions are based on IEEE Std 802.11, 1999 Edition.]

EDITORIAL NOTE—The editing instructions contained in this supplement define how to merge the material contained herein into IEEE Std 802.11, 1999 Edition, to form the new comprehensive standard as created by the addition of IEEE Std 802.11a-1999.

The editing instructions are shown in ***bold italic***. Three editing instructions are used: change, delete, and insert. ***Change*** is used to make small corrections to existing text or tables. The editing instruction specifies the location of the change and describes what is being changed either by using ~~striketrough~~ (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instructions. Editorial notes will not be carried over into future editions.

4. Abbreviations and acronyms

Insert the following acronyms alphabetically in the list in Clause 4:

BPSK	binary phase shift keying
C-MPDU	coded MPDU
FFT	Fast Fourier Transform
GI	guard interval
IFFT	inverse Fast Fourier Transform
OFDM	orthogonal frequency division multiplexing
PER	packet error rate
QAM	quadrature amplitude modulation
QPSK	quadrature phase shift keying
U-NII	unlicensed national information infrastructure

9.1 Multirate support

Add the following text to the end of 9.6:

For the 5 GHz PHY, the time required to transmit a frame for use in the Duration/ID field is determined using the PLME-TXTIME.request primitive and the PLME-TXTIME.confirm primitive. The calculation method of TXTIME duration is defined in 17.4.3.

10.4 PLME SAP interface

Add the following text to the end of 10.4:

Remove the references to aMPDUDurationFactor from 10.4.3.1.

Add the following subclauses at the end of 10.4:

10.4.6 PLME-TXTIME.request

10.4.6.1 Function

This primitive is a request for the PHY to calculate the time that will be required to transmit onto the wireless medium a PPDU containing a specified length MPDU, and using a specified format, data rate, and signalling.

10.4.6.2 Semantics of the service primitive

This primitive provides the following parameters:

PLME-TXTIME.request(TXVECTOR)

The TXVECTOR represents a list of parameters that the MAC sublayer provides to the local PHY entity in order to transmit a MPDU, as further described in 12.3.4.4 and 17.4 (which defines the local PHY entity).

10.4.6.3 When generated

This primitive is issued by the MAC sublayer to the PHY entity whenever the MAC sublayer needs to determine the time required to transmit a particular MPDU.

10.4.6.4 Effect of receipt

The effect of receipt of this primitive by the PHY entity shall be to generate a PHY-TXTIME.confirm primitive that conveys the required transmission time.

10.4.7 PLME-TXTIME.confirm

10.4.7.1 Function

This primitive provides the time that will be required to transmit the PPDU described in the corresponding PLME-TXTIME.request.

10.4.7.2 Semantics of the service primitive

This primitive provides the following parameters:

PLME-TXTIME.confirm(TXTIME)

The TXTIME represents the time in microseconds required to transmit the PPDU described in the corresponding PLME-TXTIME.request. If the calculated time includes a fractional microsecond, the TXTIME value is rounded up to the next higher integer.

10.4.7.3 When generated

This primitive is issued by the local PHY entity in response to a PLME-TXTIME.request.

10.4.7.4 Effect of receipt

The receipt of this primitive provides the MAC sublayer with the PPDU transmission time.

Add the entire Clause 17 to the base standard:

17. OFDM PHY specification for the 5 GHz band

17.1 Introduction

This clause specifies the PHY entity for an orthogonal frequency division multiplexing (OFDM) system and the additions that have to be made to the base standard to accommodate the OFDM PHY. The radio frequency LAN system is initially aimed for the 5.15–5.25, 5.25–5.35 and 5.725–5.825 GHz unlicensed national information structure (U-NII) bands, as regulated in the United States by the Code of Federal Regulations, Title 47, Section 15.407. The OFDM system provides a wireless LAN with data payload communication capabilities of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s. The support of transmitting and receiving at data rates of 6, 12, and 24 Mbit/s is mandatory. The system uses 52 subcarriers that are modulated using binary or quadrature phase shift keying (BPSK/QPSK), 16-quadrature amplitude modulation (QAM), or 64-QAM. Forward error correction coding (convolutional coding) is used with a coding rate of 1/2, 2/3, or 3/4.

17.1.1 Scope

This subclause describes the PHY services provided to the IEEE 802.11 wireless LAN MAC by the 5 GHz (bands) OFDM system. The OFDM PHY layer consists of two protocol functions, as follows:

- a) A PHY convergence function, which adapts the capabilities of the physical medium dependent (PMD) system to the PHY service. This function is supported by the physical layer convergence procedure (PLCP), which defines a method of mapping the IEEE 802.11 PHY sublayer service data units (PSDU) into a framing format suitable for sending and receiving user data and management information between two or more stations using the associated PMD system.
- b) A PMD system whose function defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more stations, each using the OFDM system.

17.1.2 OFDM PHY functions

The 5 GHz OFDM PHY architecture is depicted in the reference model shown in Figure 11 of IEEE Std 802.11, 1999 Edition (5.8). The OFDM PHY contains three functional entities: the PMD function, the PHY convergence function, and the layer management function. Each of these functions is described in detail in 17.1.2.1 through 17.1.2.4.

The OFDM PHY service is provided to the MAC through the PHY service primitives described in Clause 12 of IEEE Std 802.11, 1999 Edition.

17.1.2.1 PLCP sublayer

In order to allow the IEEE 802.11 MAC to operate with minimum dependence on the PMD sublayer, a PHY convergence sublayer is defined. This function simplifies the PHY service interface to the IEEE 802.11 MAC services.

17.1.2.2 PMD sublayer

The PMD sublayer provides a means to send and receive data between two or more stations. This clause is concerned with the 5 GHz band using OFDM modulation.

17.1.2.3 PHY management entity (PLME)

The PLME performs management of the local PHY functions in conjunction with the MAC management entity.

17.1.2.4 Service specification method

The models represented by figures and state diagrams are intended to be illustrations of the functions provided. It is important to distinguish between a model and a real implementation. The models are optimized for simplicity and clarity of presentation; the actual method of implementation is left to the discretion of the IEEE 802.11 OFDM PHY compliant developer.

The service of a layer or sublayer is the set of capabilities that it offers to a user in the next higher layer (or sublayer). Abstract services are specified here by describing the service primitives and parameters that characterize each service. This definition is independent of any particular implementation.