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Wireless LANs

ETRI proposal specification for IEEE 802.11 TGn

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Abstract

The following is an IEEE 802.11 TGn physical layer specification proposed by ETRI. This document describes the physical layer specification of high data rate wireless LAN system targeting the maximum speed of 144Mbps in 20MHz bandwidth and 288Mbps in 40MHz bandwidth to achieve at least 100Mbps maximum throughput at the top of the MAC SAP (Service Access Point). Additionally, this specification has compatibility with IEEE 802.11a legacy-OFDM systems. For more cost effective implementation, 2 transmit chains and dual band (two 20MHz bandwidth channels) scheme are utilized.

Features of this high throughput wireless LAN specification include the followings:

- Compatible with the IEEE802.11a system
- Data rate in 20MHz bandwidth
  - 6,9,12,18,24,36,48,54 (IEEE 802.11a Legacy OFDM and optional STBC-OFDM modes)
  - 72,96,108, 128, 144Mbps (SDM-OFDM mode with 2 independent data streams, 128 and 144Mbps are optional)
  - The above data rates are doubled in 40MHz bandwidth
- Bandwidth: 20 and 40MHz
- Multiple antennas: 2 transmit antennas (3 receive antennas are recommended. To utilized all antennas, implementer can use transmit antenna selection (2 out of 3 antennas).)
- Modulation: Legacy-OFDM, MIMO-OFDM including SDM-OFDM and STBC-OFDM
- Forward error correction: Rate variable punctured convolutional code

Contents

4. Abbreviations and acronyms

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

MIMO	Multiple Input Multiple Output
SDM	Spatial Division Multiplexing
STBC	Space-Time Block Code

20. MIMO-OFDM specification

20.1 Introduction

This clause specifies rate extension of OFDM PHY systems of Clause 17. The target of this PHY specification is to achieve at least 100Mbps maximum throughput at the top of the MAC SAP. For this purpose, this specification provides maximum of 144Mbps and 288Mbps in 20 and 40MHz bandwidth, respectively.

The legacy OFDM PHY modes with single transmit antenna and 20MHz bandwidth in Clause 17 provides a wireless LAN data pay load communication capabilities of 6, 9, 12, 18, 24, 36, 48 and 54Mbps. As the demands for high-speed data transmission in home, enterprise and hot-spot environments have increased, the new technology capable of hundreds Mbps data transmission is required. As a solution for this target, the new PHY modes are suggested using 2 transmit antennas and dual band modes, which can offer maximum of 288Mbps. In 20MHz bandwidth case, data rates of 72, 96, 108, 128 and 144 Mbps are added. If dual band (40MHz bandwidth) is employed, the PHY supports 12, 18, 24, 36, 48, 72, 96 and 108 Mbps which transmit single data stream through 1 transmit antenna and 144, 192, 216, 256 and 288Mbps which transmit two data streams simultaneously through 2 transmit antennas.

In addition to these high data rate SDM-OFDM mode, further reliability improvement can be achieved by using the well-known Alamouti space-time block code in the transmitter in STBC-OFDM mode.

20.1.1 Scope

This subclause describes the PHY services provided to the IEEE 802.11 wireless LAN using MIMO-OFDM technologies, which is compatible with legacy IEEE 802.11a system. The 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 services. 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.

20.1.2 MIMO-OFDM PHY functions

The MIMO-OFDM PHY architecture is depicted in the reference model shown in Figure 11 of IEEE Std 802.11. 1999 Edition (5.8). The MIMO-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 20.1.2.1 through 20.1.2.4.

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

20.1.2.1 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.

20.1.2.2 PMD sublayer

The PMD sublayer provides a means to send and receive data between two or more stations. This clause is concerned with the legacy OFDM and MIMO-OFDM modulation.

20.1.2.3 PHY management entity (PLME)

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

20.1.2.4 Service specification method

The models represented by figures and state diagram 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 MIMO-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 high 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.

20.2 MIMO-OFDM PHY specific service parameter list

20.2.1 Introduction

The architecture of the IEEE 802.11 MAC is intended to be PHY independent. Some PHY implementations require medium management state machines running in the MAC sublayer in order to meet certain PMD requirements. These PHY-dependent MAC state machines reside in a sublayer defined as the MAC sublayer management entity (MLME). In certain PMD implementations, the MLME may need to interact with the PLME as part of the normal PHY SAP primitives. These interactions are defined by the PLME parameter list currently defined in the PHY service primitives as TXVECTOR and RXVECTOR. The list of these parameters, and the values they may represent, are defined in the specific PHY specifications for each PMD. This subclause addresses the TXVECTOR and RXVECTOR for the legacy OFDM and MIMO-OFDM PHY.

20.2.2 TXVECTOR parameters

The parameters in Table 124A are defined as a part of the TXVECTOR parameter list in the PHY-TXSTART.request service primitive.

Table 124A – TXVECTOR parameters

Parameter	Associate primitive	Value
LENGTH	PHY_TXSTART.request (TXVECTOR)	1-4095. This parameter means the length per 20MHz band. In dual band case, a real data length shall be 2×LENGTH.
DATARATE	PHY_TXSTART.request	Data rate corresponding to one 20MHz bandwidth.

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