IEEE P802.11

Wireless Access Method and Physical Layer Specification

Changes to all clauses except Annex C Between D5.3 and D6.1

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This document lists the changes made to the draft standard 5.3, except the annex c, in the resolution of the LMSC recirculation ballot. For detailed information refer to Draft 5.4 for change bars and to doc. 97/43 for the annex c changes. The annex c does not have a version with change bars because the tools do not provide such feature.

1. Definitions have been isolated from the body and moved to the definitions clause

2. The name PLCP-PDU used for a subfield of the PLCP-PDU itself in clause 14 has been changed into PSDU

Changed PLCPPDU into PSDU in clauses 14.2.2.2, 14.3.2.2, 14.3.2.2.1 (1 in title and 1 in text), 14.3.2.3 (2nd occurrence in text), 14.3.3.1.2 (2 times), Figure 74, Figure 75 (3 times).

Changed PLCPPDU into PPDU in clauses 14.3.3.3.1 (5 times), Figure 80, 14.3.3.3.2 (2nd and 3rd occurrence)

Changed MPDU into PSDU in clauses 14.2.3.1, 14.3.2, 14.3.2.2.1, Figure 75 (3 times), Figure 80 (2 times).

Changed MPDU into PPDU in clauses 14.2.3.2.

Changed PLCPPDU into whitened PSDU in Table 30, Figure 76 and clause 14.3.3.3.2 (1st occurrence).

Changed PLCPDU into PLCP in clauses 14.3.2.3 (in title and 1st occurrence in text), caption of Figure 72.

Changed packet PLCPDU into PPDU in clause 14.3.3.3.1

Clause 14.3.2 and Figure 70 changed into:

14.3.2 Physical Layer Convergence Procedure Frame Format

The PPDU~~PLCP~~ Frame Format provides for the asynchronous transfer of MAC sublayer MPDUs from any transmitting station to all receiving stations within the wireless LAN's BSS. The PPDU~~LCP frame format~~ illustrated in Figure 1 consists of three parts: a PLCP Preamble, a PLCP Header, and a PSDU~~PLCPPDU~~. The PLCP Preamble provides a period of time for several receiver functions. These functions include antenna diversity, clock and data recovery, and field delineation of the PLCP Header and the PSDU~~PLCPPDU~~. The PLCP Header is used to specify the length of the whitened PSDU~~MPDU~~ field and support any PLCP management information. The PPDU~~PLCPPDU~~ contains the PLCP Preamble, the PLCP Header, and the PSDU~~MPDU data~~ modified by the P~~LCP~~PDU data whitener.

PLCP Preamble		PLCP Header			Whitened PSDU
Sync	Start Frame Delimiter	PLW	PSF	Header Error Check	
80 bits	16 bits	12 bits	4 bits	16 bits	Variable number of octets

~~PLCP Preamble~~		~~PLCP Header~~			~~PLCP_PDU~~
~~Sync~~	~~Start Frame Delimiter~~	~~PLW~~	~~PSF~~	~~Header Error Check~~	
~~80 bits~~	~~16 bits~~	~~12 bits~~	~~4 bits~~	~~16 bits~~	~~Variable number of octets~~

Figure 1, PLCP Frame Format

Changed clause 14.3.3.1.1 as follows:

14.3.3.1.1 Transmit State Machine

The PLCP transmit state machine illustrated in **Error! Reference source not found.** includes functions that must be performed prior to, during, and after PPDU~~MPDU~~ data transmission. Upon entering the transmit procedure in response to a *PHY-TXSTART.request (TXVECTOR)* from the MAC, the PLCP shall switch the PHY PMD circuitry from receive to transmit state; ramp on the transmit power amplifier in the manner prescribed in 14.6 (PMD specification); and transmit the preamble sync pattern and start frame delimiter. The PLCP shall generate the PLCP header as defined in 14.3.2.2 (PLCP Header) in sufficient time to send the bits at their designated bit slot time. The PLCP shall add the PLCP header to the start of the PSDU~~PLCPPDU~~ data.

Prior to transmitting the first PSDU~~MPDU~~ data bit, the PLCP shall send a *PHY-TXSTART.confirm* message to the MAC indicating that the PLCP is ready to receive an MPDU data octet. The MAC will pass an MPDU data octet to the PHY with a *PHY-DATA.request(DATA)* which the PHY will respond to with a *PHY-DATA.confirm*. This sequence of *PHY-DATA.request(DATA)* and *PHY-DATA.confirm* shall be executed until the last data octet is passed to the PLCP. During transmission of the PSDU~~PLCPPDU~~ data, each bit of the PSDU~~MPDU passed from the MAC~~ shall be processed by the data whitener algorithm defined in Figure 75 and described in 14.3.2.3 (PLCP~~PDU~~ Data Whitener). Each PSDU~~MPDU~~ data octet is processed and transmitted lsb first and msb last.

After the last MPDU octet is passed to the PLCP, the MAC will indicate the end of the frame with a *PHY-TXEND.request*. After the last bit of the PSDU~~PLCPPDU~~ data has completed propagation through the radio and been transmitted into the air, the PLCP shall complete the transmit procedure by sending a *PHY-TXEND.confirm* to the MAC sublayer, ramp off the power amplifier in the manner prescribed in subclause 14.6 (PMD), and switch the PHY PMD circuitry from transmit to receive state. The execution shall then return to the CS/CCA procedure.

3. Removed a redundant requirement for this description from clause 5.7.1

The following text has been removed from the 1st paragraph:

. ~~In an ESS the message shall be handled by the Distribution Service if the To DS bit is set, otherwise the Data message is sent directly. In an Independent BSS, the Data message is sent directly. The ESS and IBSS cases are controlled by the To DS and From DS bits (refer to clause 7).~~

4. Removed a sentence about reordering from clause 5.7.2

The following has been removed:

~~In addition, since MSDUs may transit a DS, and certain DS implementations may reorder MSDUs, it is not possible for the MAC to guarantee MSDU ordering when the source and destination of an MSDU are in different BSSs of an ESS, even when no reordering is performed by the MAC entities themselves. However,~~

5. Made the conventions in clause 7.1.1 of Frame formats more clear

Clause 7.1.1 now reads:

7.1.1 Conventions

The MAC protocol data units (MPDUs) or frames in the MAC sublayer are described as a sequence of fields in specific order. Each figure in clause 7 depicts the fields/subfields as they appear in the MAC frame and in the order in which they are passed to PLCP, from left to right. ~~transferred, leftmost field first.~~

In figures, all bits within fields are numbered, from 0 to k, where the length of the field is k+1 bits. The octet boundaries within a field can be obtained by taking the bit-numbers of the field modulo 8. Octets within numeric fields that are longer than a single octet are depicted in increasing order of significance, from lowest numbered bit to highest numbered bit. The octets in fields longer than a single octet are sent to the PLCP in order from the octet containing the lowest numbered bits to the octet containing the highest numbered bits.

~~The sequence of octets in the fields of the MAC frame forms an octet stream at the MAC/PLCP sublayer boundary. The leftmost octet in each field of the MAC frame is passed across the MAC/PLCP boundary first.~~

~~Fields that are longer than a single octet are depicted with the least significant octet on the left. In figures, the least significant bit of each octet is defined as the leftmost bit of that octet.~~ Any field containing a Cyclic Redundancy Code (CRC) is an exception to this convention and is transmitted commencing with the coefficient of the highest order term. ~~Fields that are less than one octet in length are ordered with the least significant bit to the left.~~

MAC addresses are assigned as ordered sequences of bits. The Individual/Group bit is always transferred first and is ~~the least significant~~ bit 0 of the first octet.

Values specified in decimal are coded in natural binary unless otherwise stated. The values in Table 1 are in binary, with the bit assignments shown in the table. Values in other tables are shown in decimal notation.

Reserved fields and subfields are set to 0 upon transmission and are ignored on reception.

6. Made authentication mandatory in infra-structure BSS and optional in IBSS

The second paragraph of clause 8.1 now reads:

A mutual authentication relationship shall exist between two stations following a successful authentication exchange as described below. ~~An a~~Authentication shall be used between stations and the AP~~exchange shall only be initiated by an STA~~ in an infrastructure BSS. ~~Although not mandatory, a~~Authentication may be used between two stations in an IBSS.

7. Removed two requirements to build a method “on top of “ a function.

First 2 paragraphs of clause 9.1.2 now read:

Point Coordination Function (PCF)

The 802.11 MAC may also incorporate an optional access method called a point coordination function, which is only usable on infrastructure network configurations. ~~This optional access method shall be implemented on top of the distributed coordination function.~~ This access method uses a point coordinator, which shall operate at the access point of the BSS, to determine which station currently has the right to transmit. The operation is essentially that of polling with the point coordinator performing the role of the polling master. The operation of the point coordination function may require additional coordination, not specified in this standard, to permit efficient operation in cases where multiple Point-Coordinated BSSs are operating on the same channel, in overlapping physical space.

The point coordination function ~~shall be built up from the distributed coordination function through the~~ uses ~~of~~ a virtual carrier sense mechanism aided by an access priority mechanism. The point coordination function shall distribute information within Beacon Management frames to gain control of the medium by setting the NAV in stations. In addition, all frame transmissions under the point coordination function may use an IFS that is smaller than the IFS for frames transmitted via the distributed coordination function. The use of a smaller IFS implies that point-coordinated traffic shall have priority access to the medium over stations in overlapping BSSs operating under the DCF access method.

8. Made in clause 9.2.5.6 unambiguous that an RTS/CTS frames defines the time of the following frame and acknowledgement in stead of the first one of all fragments in an MSDU and removed the redundant remark that sequences have to be separated by a SIFS

The 1st paragraph of clause 9.2.5.6 now reads:

9.2.5.6 RTS/CTS Usage with Fragmentation

The following is a description of using RTS/CTS for ~~the first fragment of~~ a fragmented MSDU or MMPDU. The RTS/CTS frames define the duration of the following~~first~~ frame and acknowledgment. The Duration/ID field in the Data and Acknowledgment frames specifies the total duration of the next fragment and acknowledgment. This is illustrated in Figure 55.

9. Included ProbeDelay in MLME-Join.request (10.3.3.1)

Clause 10.3.3.1 now reads as follows:

10.3.3.1 MLME-JOIN.request

Function

This primitive requests synchronization with a BSS.

Semantics of the Service Primitive

The primitive parameters are as follows:

MLME-JOIN.request (
BSSDescription,
JoinFailureTimeout,
ProbeDelay.
OperationalRateSet
)

Name	Type	Valid Range	Description
BSSDescription	BSSDescription	N/A	The BSSDescription of the BSS to join. The

			BSSDescription is a member of the set of descriptions that was returned as a result of a MLME-SCAN.request.
JoinFailureTimeout	integer	greater than or equal to 1	The time limit, in units of beacon intervals, after which the join procedure will be terminated
ProbeDelay	integer	N/A	Delay (in µs) to be used prior to transmitting a Probe frame during active scanning
OperationalRateSet	set of integers	1 through 127 inclusive (for each integer in the set)	The set of data rates (in units of 500kbit/s) that the STA desires to use for communication within the BSS. The STA must be able to receive at each of the data rates listed in the set. The OperationalRateSet is a superset of the BSSBasicRateSet advertised by the BSS.

When Generated

This primitive is generated by the SME when a STA wishes to establish synchronization with a BSS.

Effect of Receipt

This primitive initiates a synchronization procedure once the current frame exchange sequence is complete. The MLME synchronizes its timing with the specified BSS based on the elements provided in the BSSDescription parameter. The MLME subsequently issues a MLME-JOIN.confirm that reflects the results.

10. Changed in clause 13.1.4.16 and 17 aPreambleLength and aPLCPHeaderLength in microseconds in stead of bits

The clauses now read as follows:

13.1.4.16 aPreambleLength

PreambleLength ATTRIBUTE
WITH APPROPRIATE SYNTAX
integer;
BEHAVIOR DEFINED AS
"The current PHY's Preamble Length in microseconds~~bits~~. If the actual value of the length of the modulated preamble is not an integral number of microseconds~~bits~~, the value shall be rounded up to the next higher value. ";
REGISTERED AS
{ iso(1) member-body(2) us(840) ieee802dot11(10036) phy(3) attribute(7) PreambleLength (16) };

13.1.4.17 aPLCPHeaderLength

PLCPHeaderLength ATTRIBUTE
WITH APPROPRIATE SYNTAX
 integer;
BEHAVIOR DEFINED AS
 "The current PHY's PLCP Header Length in microseconds~~bits~~. If the actual value of the length of the modulated header is not an integral number of microseconds~~bits~~, the value shall be rounded up to the next higher value. ";
REGISTERED AS
 { iso(1) member-body(2) us(840) ieee802dot11(10036) phy(3) attribute(7) PLCPHdrLength (17) };

11. Changed in clause 13.1.4.23 and 24 kb/s into kbit/s and 6.4 Mb/s in 63.54 Mb/s to reflect correct mathematics

12. Changed in clause 13.1.4.41 nano into micro to make consistent with clause 14

Clause now reads as follows:

13.1.4.41 aHopTime

HopTime ATTRIBUTE
WITH APPROPRIATE SYNTAX
 integer;
BEHAVIOR DEFINED AS
 "The time in micro~~nano~~seconds for the PMD to change from channel 2 to channel 80";
REGISTERED AS
 { iso(1) member-body(2) us(840) ieee802dot11(10036) phy(3) attribute(7) HopTime (41) };