IEEE P802.11  
Wireless LANs

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| D1.0 Comment Resolution – Miscellaneous PHY Comments | | | | |
| Date: 2011-09-14 | | | | |
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##### Comments are based on 11ac D1.0. Proposed resolutions are based on 11ac D1.1. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

Following CIDs are covered in this document:

2434, 2435, 2694, 3146, 3632, 2441, 2442, 3035, 3206, 2236, 2072, 2458, 2459

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2434 | 156.02 | 22.3.10.1 | "The MAC delivers … In the case of BCC … The number of pad bits added will always be between 0 and 7 …" is not ideal. Sentence 1 is BCC/LDPC, sentence 2 is BCC only, sentence 3 is LDPC/BCC (Arguably) | Rewrite: Change sentence 2 to "The PHY determines the number of pad bits to add and apppends them to the PSDU". Append new sentence 4 "In the case of BCC, the number of pad bits to append is calulated using eqn (22-44)" | AGREE. See11/1190r0 |
| 2435 | 156.24 | 22.3.10.1 | The SU LDPC eqn is missing. This was addressed during the internal LB in 11/511r4, so need to revisit that doc and check if only this was omitted, or more changes were not incorporated | As in comment | AGREE. See 11/1190r0 |
| 2694 | 156.24 | 22.3.10.1 | Padding for SU LDPC is not defined. Note that resolution for this was already accepted during D0.1 comment resolution (D0.1 CID 621, resolution in 511r4). | Add following paragraph before line 24 (see 511r4 for MS Word format of this): 'In the case of SU LDPC encoding, the PHY padding bits are calculated using Equation (22-44a). NPAD = NSYM,initNDBPS – 8•PSDU\_LENGTH – Nservice (22-44a) where NSYM,init is given by Equation (22-49).' | AGREE. See 11/1190r0  (DUPLICATE – 2435) |
| 2458 | 174.57 | 22.3.11.1 | "subsets" is insufficiently precise. This was addressed during the internal LB in 11/511r4, so need to revisit that doc and check if only this was omitted, or more changes were not incorporated | As in comment | AGREE IN PRINCIPLE. See 11/1190r0 |
| 2459 | 175.28 | 22.3.11.1 | "white complex Gaussian noise" is overly narrow. This was addressed during the internal LB in 11/511r4, so need to revisit that doc and check if only this was omitted, or more changes were not incorporated | As in comment | AGREE IN PRINCIPLE. See 11/1190r0 |
| 2072 | 175.28 | 22.3.11.1 | "n is white complex Gaussian noise vector." is better because n is vector form. | As in comment. | AGREE IN PRINCIPLE. See 11/1190r0 |

**Discussion:**

**CID 2434**

The proposed order of sentences is clearer to the reader as the commenter indicates. Furthermore, Equation (22-51) is immediately followed by equations for LDPC cases which start with the phrases ‘In the case of SU/MU LDPC, …’. Hence, the proposed order of sentences is more aligned with the paragraphs following it.

**CID 2435, 3694**

As the commenters suggest, the padding equation for the SU LDPC was accepted during TGac internal LB (11/0511r4) but did not make it into D1.0. Re-added below.

There also seems to be some other changes from 11/0511r4 which did not make it into the D1.0.

**CID 2072**

Agree that ‘n’ is a vector. Note that 11/0511r4 changed the wording of this phrase. Please see below for the exact change to accommodate CID 2072.

**Proposed Text Changes:**

**22.3.10.1 General**

Change P176L35 (D1.1) as follows:

The padding flow is as follows. The MAC delivers a PSDU that fills the available octets in the Data field of the PPDU for each user *u*. The PHY determines the number of pad bits to add and appends them to the PSDU (#2434). The number of pad bits added will always be 0 to 7 (#3609) per user. In the case of BCC, the number of pad bits to append is calculated using Equation (22-51) (#2434).

 (22-51)

where

 is defined in 22.4.3 (TXTIME and PSDU\_LENGTH calculation)(#3693)

 is the number of symbols in the Data field and is the same for all users

 is  for user *u*, where is defined in Table 22-5 (Frequently used

parameters)

 and  are defined in Table 22-5 (Timing-related constants)

 is the number of BCC encoders for user *u*

In the case of SU LDPC encoding, the PHY padding bits are calculated using Equation (22-51a).

 (22-51a)

where

 is defined in 22.4.3 (TXTIME and PSDU\_LENGTH calculation)

 is given by Equation (22-56)

 is defined in Table 22-5 (Frequently used parameters)

 is defined in Table 22-5 (Timing-related constants) (#2435)

In the case of MU LDPC encoding, the PHY padding bits are calculated using Equation (22-52).

**22.3.11 SU-MIMO and MU-MIMO Beamforming**

**22.3.11.1 General**

With MU-MIMO beamforming, the space-time streams are divided between multiple STAs.(#2458)

Change P195L21 (D1.1) as follows (11/0511r4 – D0.1 CID 455, 456):

For MU-MIMO beamforming, the receive signal vector in subcarrier *k* at beamformee *i*, , is shown in Equation (22-95), where  denotes the transmit signal vector in subcarrier *k* for all  beamformees, with …

Change P195L48 (D1.1) as follows (11/0511r4 – D0.1 CID 463):

***n*** is a vector of(#2072) additive noise and may include interference(#2459)

**22.3.11.3 Group ID**

Change P196L32 (D1.1) as follows (11/0511r4 – D0.1 CID 470, 476, 468, 284, 453):

A value in the Group ID field in VHT-SIG-A (see 22.3.8.2.3 (VHT-SIG-A definition)) in the range 1(#2461) to 62 indicates an(#2017) MU-MIMO packet(Ed). Prior to transmitting a MU-MIMO packet, group definitions have been established by the AP for MU-MIMO capable STAs using the Group ID Management frame as defined in 8.5.18.3 (Group ID Management frame format)(#3712). For Group IDs whose corresponding Membership Status subfield is set to 1 in the Group ID Management frame, the User Position subfield determines which of the four sets of 3 bits in the NSTS field in VHT-SIG-A corresponds to the user in an MU transmission. When an MU-MIMO data packet is received, each STA identifies whether it is a member of the group for this packet by detecting the Group ID field in VHT-SIG-A. If a STA finds that it is a member of the group for the MU-MIMO data packet, the STA reads the number of space-time streams from its corresponding 3 bits in the NSTS field in VHT-SIG-A as determined by the group definition of the corresponding Group ID. At this point, a STA is also able to identify which space-time streams correspond to its own data and which space-time streams correspond to interference. For an MU-MIMO transmission, VHT-LTF symbols(#2368) are used to measure not only the channel for a beamformee’s designated space-time streams but also to measure the channel for the interfering signals at the beamformee. While receiving an MU-MIMO transmission, it is recommended that the receiver use its channel knowledge to all spatial streams (including those that are interference) to do receive processing, in order to reduce potential interference from other users' space-time streams(#2701).

If a STA finds that it is not a member of the group, or the STA is a member of the group but the corresponding NSTS in VHT-SIG-A indicates that there are zero space-time streams for the STA in the packet, then the STA may elect to not process the remainder of the packet.

**8.5.18.3 Group ID Management frame format**

Change P68L36 (D1.1) as follows (11/0511r4 – D0.1 CID 476, 468, 284, 453):

The Group ID Management frame is an Action frame of category VHT. It(#3320) is transmitted by the AP to assign or change user positions corresponding to one or more Group IDs.

Change Figure 8-ac21 (P69L4 - D1.1) as follows (11/0511r4 – D0.1 CID 476, 468, 284, 453):





**22.3.8.1.4 L-SIG definition**

Change Equation (22-21) (P160L12 - D1.1) as follows (11/0511r4 – D0.1 CID 374, 417):

*Change  in Equation (22-21) to .*

**22.3.8.2.6 VHT-SIG-B definition**

Change Equation (22-42) (P173L56 - D1.1) as follows (11/0511r4 – D0.1 CID 374, 417):

*Change  in Equation (22-42) to .*

Change the 3rd row of Table 22-12 (P172L14 - D1.1) as follows (11/0511r4 – D0.1 CID 414):

**Table 22-11—VHT-SIG-B fields**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| VHT-SIG-B Length | B0-B15 (16) | B0-B16 (17) | B0-B18 (19) | B0-B16 (17) | B0-B18 (19) | B0-B20 (21) | Length of A-MPDU pre-EOF padding in PSDU in  units of 4 octets |

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 3146 | 158.16 | 22.3.11.4.1.1 | In Eq 22-47, I think "x" and "b" need to have a subscript for user "u". | As in comment | AGREE IN PRINCIPLE. See 11/1190r0. |
| 3632 | 158.16 | 22.3.10.5.1 | in equation 22-47,the subscript Nes of b should be Nes,u .and the last expression of Nes,u-i+j should be Nes,u\*i+j |  | AGREE IN PRINCIPLE. See 11/1190r0. |
| 3206 | 158.16 | 22.3.11.4.1.1 | The subscript of b should be NES, u ．i+j instead of NES ．i+j | as per comment | AGREE IN PRINCIPLE. See 11/1190r0.  (Duplicate – 3632) |
| 2441 | 158.17 | 22.3.11.4.1.1 | Eqn (22-47) has some problems: a) Nes,u-I should be NES,u\*I; b) the last inequality should be < not <= c) the upper limit on I and j is wrong since tail bits are appended post-parsing forming a new quantity, yet d) in 22.3.11.4.1 refers to the pre-appended quantity xi(j) | For c) and d), dlete the "appended" sentence and merge the appending into (22-47). Make a piecewise definition ("braces"): i.e. pre-appending (one piece) and tail bits (second piece). I believe that limits for the first piece can be simplified to 0<=i<NSYM\*NDBPS,u/NES,u-Ntail, 0<=j<=NES,u-1 | AGREE IN PRINCIPLE. See 11/1190r0. |
| 2236 | 158.17 | 22.3.11.4.1 | N\_ES should be N\_ES,u |  | AGREE IN PRINCIPLE. See 11/1190r0. |

**Discussion:**

Each user is encoded separately, thus each user has a separate encoder parser. Therefore, the encoder parser input and outputs should have the user index.

The comment of CID 2441 is correct that the upper limit of *i* and *j* should be adjusted to not include the BCC tail bits, as the tail bits are not added as part of the encoder parsing operation. (D1.1 P178L65: “Following the parsing operation, *Ntail* zero tail bits are appended in each FEC input sequence.”)

While the updated Equation (22-54) below contains the addition of the tail bits, it may be informative to explain this to the user in plain text as well.

**Proposed Text Changes:**

**22.3.10.5.1 Binary convolutional coding**

**22.3.10.5.1.1 Encoder parsing operation**

Change 22.3.10.5.1.1 (D1.1) as follows:

If multiple encoders are used, the scrambled SERVICE, PSDU and pad bits are divided between the encoders by sending bits to different encoders in a round robin manner. Bit *i* to(#2440) encoder *j* of user *u*(#3146), denoted (#3146), is as specified in Equation (22-54).(#3601)

(#2441)(22-54)

where

 is the *k*-th bit of the scrambled SERVICE, PSDU and pad bits of user *u*. .

 is the number of symbols in the Data field, and is given by Equation (22-105) in case of SU packets, and by Equation (22-61) in case of MU packets

 is the number of BCC encoders for user *u*

 is  for user *u*, where  is defined in Table 22-5 (Frequently used parameters)

 is defined in Table 22-5 (Timing-related constants)

NOTE –  zero tail bits are being appended to each FEC input sequence in Equation (22-54).

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| 2442 | 158.34 | 22.3.11.4.1.2 | Add limits for i | As in comment | AGREE IN PRINCIPLE. See 11/1190r0. |

**Discussion:**

On top of adding the limits for *i*, we should also add the user index *u*.

**Proposed Text Changes:**

**22.3.10.5.1.2 Binary convolutional coding and puncturing**

Change P179L4 (D1.1) as follows:

The encoder parser output sequences of user *u* , ,  will each be encoded by a rate R = ½ convolutional encoder defined in 17.3.5.6 (Convolutional encoder).

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 3035 | 200.48 | 22.4.4 | The VHT PHY characterisitcs for aPPDUMaxTime is inherited from Table 19-25 (MIMO PHY Characteristics) and has the value 10ms.  However, given that the LSIG LENGTH can hold only max value of 4095, the max duration of the PPDU is approximately 5.46milli seconds | Define aPPDUMaxTime for VHT PHY keeping in mind that the LSIG LENGTH field is used for TXTIME indication | AGREE IN PRINCIPLE. See 11/1190r0. |

**Discussion:**

Max. L-SIG length = 212 - 1 = 4095 bytes

Max. duration in time after L-SIG = (4095 + 3) bytes / 3 bytes/symbol \* 4 us/symbol = 5.464 ms

Max. PPDU duration = 20 us (L-STF + L-LTF + L-SIG) + 5.464 ms = 5.484 ms

Hence, aPPDUMaxTime for a VHT PHY should be set to 5.484 ms.

**Proposed Text Changes:**

Change 22.4.4 (D1.1) as follows:

**22.4.4 PHY characteristics**

The static VHT PHY characteristics, provided through the PLME-CHARACTERISTICS service primitive, shall be as shown in Table 19-25 (MIMO PHY characteristics) unless otherwise listed in Table 22-24 (VHT PHY characteristics). The definitions for these characteristics are given in 6.5 (PLME SAP interface).

Table 22-24 – VHT PHY characteristics

|  |  |
| --- | --- |
| **Characteristics** | **Value** |
| aCCAMidTime | < 25 us |
| aPPDUMaxTime | 5.484 ms |