IEEE P802.11  
Wireless LANs

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| 11ax Comment Resolutions for Clause 28.3.9 | | | | |
| Date: 2017-03-01 | | | | |
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Abstract: This document contains proposed resolutions for comments in *Clause 28.3.9* from 11ax D1.0 with the CIDs below.

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| ***Clause 28.3.9*** | | | | |  | | |
| * 8880 * 8881,5255 * 8883,8884 * 7515 * 8885 * 8887 * 4866,8888 * 4867 * 8889 * 4868,4994,9484 * 4990 * 4993 | | | | | | |  |
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| 8880 | Sigurd Schelstraete | | 28.3.9 | 261.30 | Wrong reference: 22.3.7 is TVHT | Probably 21.3.7 | | **Revised.**  Change to as in the resolution of CID8880 in doc IEEE802.11-17/0305r1. | | | |

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P261L30 (CID #8880):

For a description on subcarrier indices over which the signal is transmitted for non-HT, HT and VHT PPDUs, see21.3.7 (Mathematical description of signals).

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| 8881 | Sigurd Schelstraete | 28.3.9 | 261.37 | "The signal is transmitted on subcarriers -122 to -4 and 4 to 122". Not all subcarriers are necessarily used. Change to "The signal is transmitted on all or a subset of subcarriers -122 to -4 and 4 to 122" | See comment.  Similar for lines 41, 44, 48 | **Revised.**  Change to as in the resolution of CID8881 in doc IEEE802.11-17/0305r1. |
| 5255 | Dorothy Stanley | 28.3.9 | 261.40 | Do we have definitions for non-OFDMA HE PPDU and OFDMA HE PPDU? | define | **Revised.**  Change to as in the resolution of CID8881 in doc IEEE802.11-17/0305r1. |

**Discussions:**

In this context, non-OFDMA and OFDMA refer to the type of multiple access used for transmission. They are not used to define PPDU type. To eliminate confusion, we can rephrase “non-OFDMA HE PPDU transmission” to “HE PPDU using non-OFDMA transmission”, and rephrase “OFDMA HE PPDU transmission” to “HE PPDU using OFDMA transmission”.

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P261L32 (CID #8881, CID #5255):

For a 20 MHz HE PPDU using non-OFDMA transmission, the 20 MHz is divided into 256 subcarriers. The signal is transmitted on subcarriers –122 to –2 and 2 to 122, with 0 being the center (DC) subcarrier.

For a 20 MHz HE PPDU using OFDMA transmission, the 20 MHz is divided into 256 subcarriers. The signal is transmitted on all or a subset of subcarriers –122 to –4 and 4 to 122, with 0 being the center (DC) subcarrier.

For a 40 MHz HE PPDU using non-OFDMA transmission, the 40 MHz is divided into 512 subcarriers. The signal is transmitted on subcarriers –244 to –3 and 3 to 244, with 0 being the center (DC) subcarrier.

For a 40 MHz HE PPDU using OFDMA transmission, the 40 MHz is divided into 512 subcarriers. The signal is transmitted on all or a subset of subcarriers –244 to –3 and 3 to 244, with 0 being the center (DC) subcarrier.

For an 80 MHz HE PPDU using non-OFDMA transmission, the 80 MHz is divided into 1024 subcarriers. The signal is transmitted on subcarriers –500 to –3 and 3 to 500, with 0 being the center (DC) subcarrier.

For an 80 MHz HE PPDU OFDMA transmission, the 80 MHz is divided into 1024 subcarriers. The signal is transmitted on all or a subset of subcarriers –500 to –4 and 4 to 500, with 0 being the center (DC) subcarrier.

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| 8883 | Sigurd Schelstraete | 28.3.9 | 262.28 | Instead of a single figure 28-18, have one figure for HE MU and one figure for formats that do not contain HE-SIG-B | See comment  Also duplicate (28-2) for the two cases. | **Revised.**  Change to as in the resolution of CID8883 in doc IEEE802.11-17/0305r1. |

**Discussions:**

It is not necessary to draw another figure for HE PPDU formats other than HE MU PPDU. But it can be emphasized that HE-SIG-B field is only present in HE MU PPDU. It is also not necessary to duplicate equation (28-2) for non HE MU PPDU formats since the text already states that  only applies to HE MU PPDU.

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P262L10 (CID #8883):

The transmitted RF signal is derived by up-converting the complex baseband signal, which consists of several fields. The timing boundaries for the various fields are shown in Figure 28-18 (Timing boundaries for HE PPDU fields), where  is the number of HE-LTF symbols and is defined in Table 28-12 (Frequently used parameters),  is the number of symbols in the HE-SIG-B field present in HE MU PPDU, and  is the number of symbols in the Data field.

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| 8884 | Sigurd Schelstraete | 28.3.9 | 262.28 | Looks like (28-3) defines a subfield, rather than a field | Change subscript to "SubField". Similarly for equation (28-4). | **Revised.**  Change to as in the resolution of CID8884 in doc IEEE802.11-17/0305r1. |
| 8885 | Sigurd Schelstraete | 28.3.9 | 263.41 | The dimensions of Q in (28-4) don't look correct. A STA transmitting N\_STS,r,u streams on N\_TX antennas needs a spatial mapping matrix of dimensions N\_TX x N\_STS,r,u. Instead, the subscript (M\_r,u + m) implies that the matrix is larger. | Correct. No need for M\_r,u in spatial mapping matrix (it is needed in T\_CS,HE). Maybe the matrix Q needs a label depending on r,u. | **Revised.**  Change to as in the resolution of CID8885 in doc IEEE802.11-17/0305r1. |

**Discussions:**

The commentor is right the equations (28-3) and (28-4) are mathematical descriptions for each subfield. The commentor is right that for each STA in trigger-based PPDU, the dimension of the spatial mapping matrix Q is . Hence  should be removed from column index of Q. To make it clear that an individual spatial mapping matrix Q is applied to each STA,  should be defined as the spatial mapping matrix for user u on subcarrier k, and used in trigger-based PPDU. In addition, equations (28-35), (28-59) and (28-112) need to be modified accordingly.

 definition for pre-HE modulated fields is not accurate for HE trigger-based PPDU since pre-HE modulated fields are only sent the 20MHz channels where STA HE modulated fields are allocated.  indices depends on which 20MHz channels are occupied and total bandwidth assigned to HE trigger-based PPDU.

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P262L22 (CID #8884, CDI #8885): please replace equation (28-3) and (28-4) with the equations below.

Each subfield,  is defined to be an inverse discrete Fourier transform.

(28-3)

In an HE trigger-based PPDU, transmitted by user-u in the r-th RU, each subfield, , is defined in Equation (28-4).

 (28-4)

* On P263L62 (CID #8884, CID #8885): please replace  with 

 is a windowing function. An example function, , is given in 18.3.2.5 (Mathematical conventions in the signal descriptions).

 For pre-HE modulated fields,  is the set of subcarriers indices in the allocated 20MHz channelsFor HE modulated fields in a non-OFDMA HE PPDU, is the set of subcarriers indices from  to  as defined in Table 28-10 (Tone allocation related constants for Data field in a non-OFDMA HE PPDU) excluding DC subcarriers.

* On P26473 (CID #8884, CID #8885): please remove Table 28-13.
* On P266L39 (CID #8884, CID #8885): Add following text on P266L39.

 is the spatial mapping matrix for user u on subcarrier k in frequency segment . For HE modulated fields,  is a matrix with  rows and  columns. For pre-HE modulated fields,  is a column vector with elements with element  being, where  represents the cyclic shift for the transmitter chain whose values are defined in 28.3.10.2.1 (Cyclic shift for pre-HE modulated fields).

* On P336L44 (CID #8884, CID #8885): please move the definition of  before equation (28-112).

 is defined in 28.3.9 (Mathematical description of signals).

 (28-112)

where  is defined in 28.3.9 (Mathematical description of signals).

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| 7515 | Lei Huang | 28.3.9 | 263.7 | "where N\_HE-SIG-B is the number of OFDM symbols in the HE-SIG-B field" is redundant since N\_HE-SIG-B has been defined in the previous page (see L15 of P262) | remove "where N\_HE-SIG-B is the number of OFDM symbols in the HE-SIG-B field" | **Revised.**  Change to as in the resolution of CID7515 in doc IEEE802.11-17/0305r1. |

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P263L7 (CID #7515):

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| 8887 | Sigurd Schelstraete | 28.3.9 | 264.45 | It is not clear what "and 1 otherwise" refers to. | Change to "It is 1 for all other fields" | **Revised.**  Change to as in the resolution of CID8887 in doc IEEE802.11-17/0305r1. |

**Discussions:**

is set to 1 for HE-SIG-A and Data fields in an HE extended range SU PPDU, and all fields for other HE PPDU formats.

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P264L45 (CID #8887):

and 1for HE-SIG-A and Data fields in an HE extended-range SU PPDU, and all fields in other HE PPDU formats.

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| 4866 | Bin Tian | 28.3.9 | 265.17 | The sentence "cardinality of the set of subcarriers modulated with data within Kr" may lead to confusion that only data subcarrier are counted. Change to "cardinality of the set of modulated subcarriers modulated within Kr" | as in comment | **Revised.**  Change to as in the resolution of CID4866 in doc IEEE802.11-17/0305r1. |
| 8888 | Sigurd Schelstraete | 28.3.9 | 265.17 | "is the cardinality of the set of subcarriers modulated with data within K\_r for the HE-STF and Data fields". Is this correct? In e.g. (28-109), the sum over K\_r includes pilot tones. | Correct | **Revised.**  Change to as in the resolution of CID4866 in doc IEEE802.11-17/0305r1. |

ax editor: please make the following changes in D1.0 *Clause 28.3.9*:

* On P265L17 (CID #4866, CID #8888):

 is the cardinality of the set of modulated subcarriers within  for HE-STF and Data fields.

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| CID | Commenter | Section | Page | Comment | Proposed Change | Resolution |
| 4867 | Bin Tian | 28.3.9 | 265.35 | The capation of table 28-14 needs to be reviese. This table doesn't directly provide Tone scaling factor. May change to Occupied subcarrier number for each field of HE PPDU | as in comment | **Revised.**  Change to as in the resolution of CID4867 in doc IEEE802.11-17/0305r1. |

**Discussions:**

The commentor is right that  defined in Table 28-14 is not exactly Tone scaling factor for HE-LTF field, which depends on HELTF modes and number of modulated subcarriers in Data field.  defined in Table 28-14 is indeed the number of modulated subcarriers for each HE PPDU field. It is more appropriate to change the title of Table 28-14 to “Number of modulated subcarriers and guard interval duration values for HE PPDU fields”.

ax editor: please make the following changes in D1.0 *Clause 26.3.9*:

* On P265L35 (CID #4867):

Table 28-14 - Number of modulated subcarriers and guard interval duration values for HE PPDU fields

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| Field | as a function of bandwidth, and RU size per frequency segment | | | | Guard interval duration |
| 20 MHz | 40 MHz | 80 MHz | 160 MHz |
| L-STF | 12 | 24 | 48 | 96 | - |
| L-LTF | 52 | 104 | 208 | 416 | TGI,L-LTF |
| L-SIG | 56 | 112 | 224 | 448 | TGI,LegacyPreamble |
| RL-SIG | 56 | 112 | 224 | 448 | TGI,LegacyPreamble |
| HE-SIG-A | 56 | 112 | 224 | 448 | TGI,LegacyPreamble |
| HE-SIG-B | 56 | 112 | 224 | 448 | TGI,LegacyPreamble |
| HE-STF not in HE\_TRIG | 14 | 30 | 62 | 126 | - |
| HE-STF in HE\_TRIG | 30 | 60 | 124 | 248 | - |
| HE-LTF 1x Duration | 60 | 122 | 250 | 500 | TGI,HE-LTF1 |
| HE-LTF 2x Duration | 122 | 242 | 498 | 996 | TGI,HE-LTF2 |
| HE-LTF 4x Duration | 242 | 484 | 996 | 1992 | TGI,HE-LTF4 |
| HE-Data | 242 | 484 | 996 | 1992 | TGI,Data |
| NON\_HT\_DUP\_OFDM-Data | 56 | 112 | 224 | 448 | TGI,LegacyPreamble |
| NOTE--in the case of an HE OFDMA PPDU, the value of HE-STF, HE-LTF and HE-Data fields is variable, and is determined by which RUs of the current full bandwidth are transmitted in the PPDU. | | | | | |

ax editor: please change “Table 28-14 Tone scaling factor and guard interval duration values for HE PPDU fields” to “Table 28-14 Number of modulated subcarriers and guard interval duration values for HE PPDU fields” throughout the draft.

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| CID | Commenter | Section | Page | Comment | Proposed Change | Resolution |
| 8889 | Sigurd Schelstraete | 28.3.9 | 265.38 | Why do we need a column "Guard interval duration in Table 28-14? | Remove column | **Rejected.**  Guard interval duration in Table 28-14 clearly listed guard interval for each field, which is also included in Table 21-8 in mathematical description of transmitted signal for VHT PPDU. To keep the spec consistent, it is better to keep guard interval duration in Table 28-14. |

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| CID | Commenter | Section | Page | Comment | Proposed Change | Resolution |
| 4868 | Bin Tian | 28.3.9 | 266.53 | Remove the sentence " Note that the mulitiplication matrices Ak\_HE-LT ..." and the next one "when the TXVECTOR ...". The matix Ak\_HE-LTF is not introduced here and carries the next level of details of how to generate HE-LTF, which is not needed here. | as in comment | **Revised.**  Change to as in the resolution of CID4868 in doc IEEE802.11-17/0305r1. |
| 4994 | Brian Hart | 28.3.9 | 266.51 | "Note that ..." ... need a reference to a normative stmt to make this note trustworthy | Add xref | **Revised.**  Change to as in the resolution of CID4990 in doc IEEE802.11-17/0305r1. |
| 9484 | Yan Zhang | 28.3.9 | 266.53 | Sentence "Note that the multiplication matrices Ak\_HE-LTF are included in the calculation of X(iseg,m)\_k,r,u for the HE-STF and HE-LTF fields" is not completely accurate. The multiplication matrices Ak\_HE-LTF should not included in the calculation of X(iseg,m)\_k,r,u for HE-STF. | Change to "Note that the multiplication matrices Ak\_HE-LTF are included in the calculation of X(iseg,m)\_k,r,u for HE-LTF field". | **Revised.**  Change to as in the resolution of CID4990 in doc IEEE802.11-17/0305r01 |

**Discussions:**

The commentors are right that introducing the multiplication matrices  without definition is not meaningful in this paragraph. It is better to remove the sentence “Note that the multiplication matrices  are included in the calculation of  for the HE-STF and HE-LTF fields. When the TXVECTOR parameter BEAM\_CHANGE is 0, the first column of the multiplication matrices  are included in the calculation of  for the pre-HE modulated fields.” In the following sub-clauses, there are detailed equations show how to include multiplication matrices  inside  for HE-LTF field, and some pre-HE modulated fields when BEAM\_CHANGE=0.

ax editor: please make the following changes in D1.0 *Clause 26.3.9*:

* On P266L51 (CID #4990, CID #4990, CID #9484): Remove the sentence “Note that the multiplication matrices  are included in the calculation of  for the HE-STF and HE-LTF fields. When the TXVECTOR parameter BEAM\_CHANGE is 0, the first column of the multiplication matrices  are included in the calculation of  for the pre-HE modulated fields.”

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| CID | Commenter | Section | Page | Comment | Proposed Change | Resolution |
| 4990 | Brian Hart | 28.3.9 | 263.52 | "Total power should not exceed ..." ... this flexilibty is OK if BEAM\_CHANGE=1, but this flexiblity should be prohibitied (same power before and after) if BEAM\_CHANGE=0 | "Total power should not exceed ..." ... this flexilibty is OK if BEAM\_CHANGE=1, but this flexiblity should be prohibitied (same power before and after) if BEAM\_CHANGE=0 | **Revised.**  Change to as in the resolution of CID4990 in doc IEEE802.11-17/0305r1. |

**Discussions:**

The total power of the time domain HE-LTF field signal summed over all transmit chains cannot be exactly the same as the total power of the time domain L-LTF field signal summed over all transmit chain when BEAM\_CHANGE=0, since HE-LTF per tone power is required to be the same as DATA per tone power, and L-LTF has different tone assignments than DATA. Based on tone assignments for L-LTF and HE-LTF, receiver can scale the received powers from L-LTF and HE-LTF to estimate channel. Hence the statement on power contraint does not apply to BEAM\_CHANGE=0.

In addition, the statement “Total power of the time domain HE modulated field signals summed over all transmit chains should not exceed the total power of the time domain pre-HE modulated field signals summed over all transmit chains” is not true for HE extended range SU PPDU since HE-STF and HE-LTF fields have 3dB power boost.

ax editor: please make the following changes in D1.0 *Clause 26.3.9*:

* On P263L52 (CID #4990):

The total power of the time domain HE modulated field signals summed over all transmit chains should not exceed the total power of the time domain pre-HE modulated field signals summed over all transmit chains when BEAM\_CHANGE=1 and power boost in HE modulated fields is not present.

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| CID | Commenter | Section | Page | Comment | Proposed Change | Resolution |
| 4993 | Brain Hart | 28.3.9 | 264.50 | Signalling for this optional mode is unclear | Add a xref to Power Boost Factor +ªr Support in HE Cap. And when that is advertised as true hten the STA \*shall\* support [0.5;2] | **Revised.**  Change to as in the resolution of CID4993 in doc IEEE802.11-17/0305r1. |

ax editor: please make the following changes in D1.0 *Clause 26.3.9*:

* On P264L50 (CID #4993):

 is the power boost factor for the r-th RU in an HE PPDU. For a DL HE MU PPDU, an AP can support the ratio between maximum value of  and the minimum value of  up to 2. In addition, an AP can support the ratio between the maiximum value of and the minimum value of up to 4 if all recipient STAs set Power Boost Factor  bit to 1 in HE PHY Capabilities Information field format (Figure 9-589cl)