IEEE P802.11  
Wireless LANs

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| CRs on 28.3.3.8. | | | | |
| Date: 2017-07-10 | | | | |
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Abstract

This submission shows

* Resolution for a comment received from TGax comment collection (TGax Draft D1.0)
* The proposed changes are based on 11ax D1.3.

The submission provides resolutions to comment related to DL MU-MIMO.

* The submission provides resolutions to 15 CIDs:

8815, 8816, 8817, 9320, 4976, 8819, 7423, 10384, 10386, 8821,   
7509, 7510, 10104, 10387, 8822

Revisions:

* Rev 0: Initial version of the document.

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 8815 | 238.27 | Change title to "Supported RU sizes for DL MU-MIMO" | See comment | Revised.  Agreed in priciple.  This subclause describes on the suppored RU sizes for DL MU-MIMO. And with D1.3 having “Supported RU sizes for UL MU-MIMO” approved last meeting, in order to keep consistent titles between DL MU-MIMO and UL MU-MIMO, "Minimum RU size in DL MU-MIMO" is replaced with "Supported RU sizes in DL MU-MIMO".  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 8816 | 238.30 | There should be a similar requirement for transmit side (MU-MIMO only on RU sizes >= 106 tones) | Add requirement | Rejected.  Given the capability of the STA supporting Partial Bandwidth DL MU-MIMO, AP can determine whether to transmit the partial bandwidth DL MU-MIMO or not.  However, the similar requirement for AP does not call for different behavier of the STA regardless of AP’s capability. Looking at the Partial Bandwidth DL MU-MIMO subfield of the HE PHY Capabilities Information field in the HE Capabilities element, it is reserved for an AP based on the same rationale. |
| 8817 | 238.30 | Add reference to HE Capabilities field "DL MUMIMO On Partial Bandwidth" | See comment | Revised.  Agreed in principle.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |

**Discussion**

* Modification improves the wording of the specficification for better understanding.
* Refer to the 28.3.3.10.2 Supported RU sizes in UL MU-MIMO in D1.3 below

“A STA that sets the Partial Bandwidth UL MU-MIMO subfield of the HE PHY Capabilities Information field in the HE Capabilities element that it transmits to 1 shall support transmission and reception of an HE TB PPDU with RU sizes greater than or equal to 106 subcarriers”

***To TGax editor:*** ***P319L54*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

* Supported RU sizes in DL MU-MIMO (#8815)

A STA that sets the Partial Bandwidth DL MU-MIMO subfield of the HE PHY Capabilities Information field in the HE Capabilities element that it transmits to 1 shall support reception of HE MU PPDUwith RU sizes greater than or equal to 106-subcarriers. (#8817)

***------------- End Text Changes ---------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 9320 | 238.35 | In the SFD, there was the following requirement: "For an 11ax AP, support for DL MU-MIMO transmission, where MU-MIMO is being done on the entire PPDU BW, shall be mandatory if the AP supports TxNss >= 4." This is mentioned in subclause 4.3.14a but should be also mentioned in subclause 28.3.3.8.2, as other similar requirements are mentioned here. | As in comment. | Revised.  Agreed in principle.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 4976 | 238.51 | Para is improperly introduced | Why have this para is it is the same ... just generalize the above para's! Well, because this feature is optional. So then need to start with that constraint, for clarity ... or just dup the content with the new rider that it its for MU-MIMO+DL-OFDMA. BUT, cleaner is probably to define what PPDUs are possible, then define what STAs have to support and may support ... i.e. rewrite for clarity. Finally, "Aforementioned" ... where does the "fore" stop? Need to define (add "in this sub-section") | Revised.  In 28.1.1 Introduce to the HE PHY, since what STA shall support or may support has been already described, not necessary to rewrite it for clarity. The purpose of this subclause is to specify the maximum number of spatial streams regardless whether the specific feature is mandatory or not.  When it comes to “Aforementioned “, to make it clear the original text is modified with "All of the aforementioned restrictions in this subclause on the per-user and total number of space-time-streams...."  The same modification is applied to 28.3.3.10.4 Maximum number of spatial streams in UL MU-MIMO to be consistent.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |

**Discussion**

* Modification improve the wording of the specficification for better understanding.

***To TGax editor:*** ***P319L61*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

* Maximum number of spatial streams in an HE MU PPDU

An HE STA shall support reception of DL MU-MIMO transmissions on full bandwidth with maximum number of space-time streams (per user) equal to minimum of 4 and the maximum number of space-time streams supported for reception of HE SU PPDUs. The maximum number of space-time streams supported for reception of HE SU PPDUs is indicated for various bandwidths in Supported HE-MCS and NSS Set field(#5518) in the HE Capabilities element.

An HE STA shall support reception of DL MU-MIMO transmissions on full bandwidth with the total number of space-time streams (across NUM\_USERS) less than or equal to a maximum value indicated by the Nsts\_Total support for BW <= 80 MHz and Nsts\_Total support for BW > 80 MHz fields in the HE Capabilities element.

An HE AP that is capable of transmiting space-time streams equal to or larger 4 shall support DL MU-MIMO transmissions on full bandwidth.(#9320)

All of the aforementioned restrictions in this subclause on the per-user and total number of space-time-streams are also applicable to an MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth. (#4976)

***------------- End Text Changes ---------------***

***To TGax editor:*** ***P321L56*** *replace the current text with the proposed changes below.*

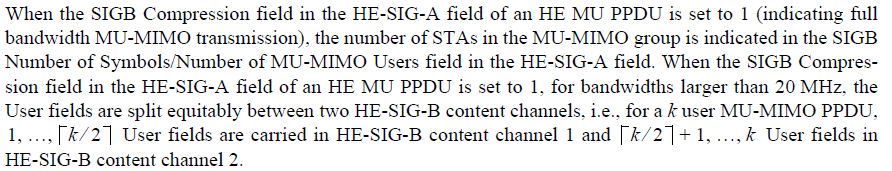
***------------- Begin Text Changes ---------------***

All of the aforementioned restrictions in this subclause on the per-user and total number of space-time-streams are also applicable to an MU-MIMO transmission on an RU in an HE MU PPDU where the RU does not span the entire PPDU bandwidth. (#4976)

***------------- End Text Changes ---------------***

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| **CID** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 8819 | 238.55 | Most of the text in 28.3.3.8.3 seems to belong in either HE-SIG-A or HE-SIG-B sections. Move the relevant text to the appropriate sections and describe resource allocation in more general terms for this section. | See comment | Revised.  Agreed in principle.  Some repeated/detail texts and descriptions shown in both this subclause and HE-SIG-A/HE-SIG-B subclauses are deleted.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 7423 | 239.02 | In case of full bandwidth MU-MIMO transmission, the number of HE-SIG-B symbols is not indicated in the HE-SIG-A. Instead the number of STAs in the MU-MIMO group is indicated in the HE-SIG-A. However, in this case, a STA still needs to know the number of HE-SIG-B symbols for decoding HE-SIG-B. Therefore, it is necessary to clarify how the number of HE-SIG-B symbols is determined in case of full bandwidth MU-MIMO transmission. | Insert the following statement after the sentence "The number of STAs in the MU-MIMO group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users field in HE-SIG-A."  "In this case, the number of HE-SIG-B symbols can be derived according to the values of the SIGB MCS field, the SIGB DCM field and the Number Of HE-SIG-B Symbols Or MU-MIMO Users field in the HE-SIG-A field. | Rejected.  Without the details specificed in the spec, it is intiutive to derive the number of HE-SIG-B OFDM symbols when implemented. |
| 10384 | 239.05 | "between two SIG-B channels," Define them explicitly as SIG-B content channels | between two SIG-B content channels ( 28.3.10.8.1) … | Revised.  Agreed in principle.  To use two HE-SIG-B content channels without the definition can make readers confused. Adding reference may help solving this issue. But if so, the same description seems to be shown here and in HE-SIG-B chapter.  To avoid duplication issues, the repeated texts are removed.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 10386 | 239.12 | "are indicated in spatial configuration field of user specific block containing the STA ID of designated MU-MIMO STA as" : missing article "the" | "are indicated in the spatial configuration field of the user specific block containing the STA ID of designated MU-MIMO STA as" | Accepted.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 8821 | 239.17 | Paragraph starting at line 17 describes receiver operation. Transmitter behavior should be described instead. | Describe contents of HE-SIG-B from transmitter point of view. | Revised.  One of purposes of this sub-clause is to describe on STA self-identification in an HE MU-PPDU. It is more reasonable and understandable to take this approach describing how to interpret the control information in HE-SIG-B as a STA's points of view.  But I agree that the spec shall not provide any restriction how receiver processes the signal. I added ‘may’ to corresponding description.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 7509 | 239.18 | Throughout the whole paragragh, it is better to change "beamformee group" to "MU-MIMO group" for keeping consistency. | As per comment | Revised.  Agreed in principle.  "beamformee group" is replaced with “MU-MIMO group” to be consistent through the spec.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 7510 | 239.22 | What does a multiplexing information lookup table means? Further clarification is required. | Replacing "From a multiplexing information lookup table for Nuser,r, the ordered number of spatial streams for all members in the beamformee group in RU r, NSS,r,u, u = 1, ..., Nuser,r, is obtained." by "From the spatial configuration fields of user specific blocks for RU r and Nuser,r, the ordered number of spatial streams for all members in the MU-MIMO group in RU r, NSS,r,u, u = 1, ..., Nuser,r, is obtained." | Revised.  Agreed in priciple.  Since it is not necessary to have additional terminology to indicate the Spatial Configuration field, a multiplexing information lookup table is deleted and replaced with the Spatial Configuration field with reference.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 10104 | 239.22 | clarify the meaning of block index in "The user position is indicated by the block index". There is no definition of block index in the spec. | As in the comment. | Revised.  How to obtain the user position is following in this sub-clause without using block index which is the new terminology. For example, it is depending on the position of the User field in the User Specific field. So removing the sentence "The user position is indicated by the block index" does not make any trouble for readers to understand it.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 10387 | 239.22 | "From a multiplexing information lookup table for Nuser,r," : this table is not defined or referred to anywhere | define what the Mux lookup table is? Or is this an implementation issue ? If it is then explicitly say so or remove the sentence. | Revised.  The same resolution of CID10104 is applied.  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |
| 8822 | 239.38 | "If a STA finds that it is a member of the beamformee group in RU r, its corresponding NSTS,r,u interpreted from the HE-SIG-B user specific blocks shall not be zero for the STA in the PPDU." There is no way the receiver can control the value of the HE-SIG-B user specific blocks, so this requirement as formulated for the receiver does not make sense. | Change to e.g. "If a STA is included as a a member of the beamformee group in RU r, its corresponding NSTS,r,u as contained in the HE-SIG-B user specific blocks shall not be zero." | Revised.  Agreed in principle.  The original text is replaced with "If a STA is included as a member of the MU-MIMO group in RU r, its corresponding NSTS,r,u as contained in the User field shall not be zero."  TGax Editor: make changes according to this document 11-17-0945-00-00ax CRs on 28.3.3.8. |

**Discussion**

* Modification improve the wording of the specficification for better understanding.
* CID8819 to remove duplicated texts which show up in the corresponding chapter separately.
  + This chapter includes below  
    For bandwidths larger than 20 MHz, the User fields are split equitably between two SIG-B content channels, i.e., for a k user MU-MIMO PPDU, 1, …., ceil(k/2) User fields are carried in HE-SIG-B content channel 1 and ceil(k/2) + 1, …, k User fields in HE-SIG-B content channel 2 below
  + 28.3.10.8.5 contains  
    

***To TGax editor:*** ***P320L16*** *replace the current text with the proposed changes below.*

***------------- Begin Text Changes ---------------***

* Resource indication and STA self-identification in an HE MU PPDU

An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0. A full bandwidth MU-MIMO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression field in HE-SIG-A and the Common field in HE-SIG-B is not present. If the value of SIGB Compression field in HE-SIG-A is 0, the RU Allocation field in the Common field in HE-SIG-B indicates the combination of RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO transmission. The number of users in RU *r* for MU-MIMO transmission, *Nuser,r* is indicated together with the RU allocation as defined in Table 28-23 (RU allocation signaling: arrangement and number of MUMIMO allocations). If the value of the SIGB Compression field in HE-SIG-A is 1, there is no RU Allocation field in Common field in HE-SIG-B and HE-SIG-B contains only User Specific field. The number of STAs in the MU-MIMO group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users field in HE-SIG-A. (#8819),(#10384) The number of spatial streams, *NSS,r,u*, is indicated by the NSTS field in User field in HE-SIG-B as defined in Table 28-24 (Fields of the User field for a non-MU-MIMO allocation) and Table 28-25 (Fields of the User field for an MU-MIMO allocation). The allocated spatial streams for a designated MU-MIMO user and the total number of spatial streams on the RU are indicated in the Spatial Configuration field of User field in HE-SIG-B containing the STA-ID of designated MU-MIMO STA as defined in Table 28-26 (Spatial Configuration subfield encoding). (#10386)

When processing the HE-SIG-B, a STA may look at information of each RU to find out its membership status, i.e., if it belongs to a MU-MIMO group in a certain RU. If *Nuser,r* STAs are scheduled in RU *r*, there are *Nuser,r* User fields for RU *r*.(#8821) Each User field has an 11-bit field indicating the STA-ID. A STA may identify itself as a member in the MU-MIMO group in the RU, if its STA-ID matches one of the STA-IDs. (#10104) (#10387)(#8821) From a Spatial Configuration field (see Table 28-24 (Spatial Configuration subfield encoding)) for *Nuser,r*, the ordered number of spatial streams for all members in the MU-MIMO group in RU *r*, *NSS,r,u*, *u*= 1, …, *Nuser,r,* is obtained. The spatial streams of different users are ordered in accordance to the position of the User field in the User Specific field. (#8819) (#7510) The user position values, i.e., the spatial streams for the user in user position 0 come first, followed by the spatial streams for the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial streams for the user in position 3, and so on

A STA may be also able to identify the space-time streams intended for other STAs that act as interference.(#8821) HE-LTF symbols in the DL HE MU PPDU are used to measure the channel for the space-time streams intended for the STA and can also be used to measure the channel for the interfering space-time streams. To successfully demodulate the space-time streams intended for the STA, it is recommended that the STA uses the channel knowledge for all space-time streams to reduce the effect of interfering space-time streams.

If a STA is included as a member of the MU-MIMO group in RU r, its corresponding *NSTS,r,u* contained in the User field in HE-SIG-B shall not be zero. If a STA finds that it is not a member of the MU-MIMO group in RU *r*, then the STA may elect not to process RU *r* in the remainder of the PPDU. (#8822)

***------------- End Text Changes ---------------***