IEEE P802.11  
Wireless LANs

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| LB178 CID 2321 | | | | |
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| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Youhan Kim | Qualcomm | 1700 Technology Drive  San Jose, CA 95110 |  | youhank@qca.qualcomm.com |
| Simone Merlin | Qualcomm | 5775 Morehouse Dr  San Diego, CA 92109 |  | smerlin@qualcomm.com |
| Yi Luo | Huawei Technologies | F1-17, Huawei Base, Bantian, Shenzhen | +86-18665891036 | Roy.Luoyi@huawei.com |

Abstract

This document proposes resolutions to CID 2321.

The resolutions are based on P802.11ac\_D1.2.

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| --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 2321 | 143.22 | 22.3.8.2.3 | Definition includes u=1, which means a single user | My understanding is, that at least 2 users are required for MU operation. Explain difference between Multi-User operation with 1 user and Single User operation, if supported. | AGREE IN PRINCIPLE.  See 11/xxxxr0. |

**Discussion:**

The definition of an MU PPDU indicates that an MU PPDU carries PSDUs for ‘one or more’ STAs.

(D1.2: P2L25)

**multi-user (MU) physical layer convergence procedure (PLCP) protocol data unit (PPDU)**: A PPDU that carries independent PSDUs for one or more STAs using the MU-MIMO technique.

22.3.11.3 (Group ID) also defines MU-MIMO packets as a function of Group ID only.

(D1.2: P217L35)

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 to 62 indicates an MU-MIMO packet.

Furthermore, while the draft has a restriction that a STA not capable of receiving MU PPDUs is not required to demodulate MU PPDUs with only one user (D1.2, P64L1 shown below), there is no such restriction for a STA capable of receiving MU PPDUs. In addition, there is no restriction in the draft that an MU capable AP cannot send MU PPDUs with only one user to a STA capable of receiving MU PPDUs.

(D1.2: P64L1)

NOTE 1—A STA that sets MU Beamformee Capable to 0 is not required to be able to demodulate an MU VHT PPDU with only one non-zero NSTS subfield.

Hence, MU PPDUs with only one user is allowed. When to use an SU PPDU vs. an MU PPDU with one user (provided that the receiving STA is capable of receiving MU PPDUs) is upto the AP implementation. For example, suppose that an AP had transmitted an MU PPDU with multiple users, but failed to get a ACK/BA from one of the users. When sending the retrasmission, the AP may choose to keep the PPDU format used in the original transmission, thus transmit an MU PPDU with only one user. Another situation is when an AP transmits MU PPDU within a TXOP with TXOP power save enabled. There may be cases where only one user is left near the end of the TXOP, and the AP may decide to keep the same transmission mode (MU PPDU) for simplicity.

However, several inconsistencies were found upon reviewing the spec. Changes to resolve these inconsistencies, as well as additional clarifications, are shown below.

**Proposed Text Change:**

**3.1 Definitions**

*Change P2L25 as follows:*

**multi-user (MU) physical layer convergence procedure (PLCP) protocol data unit (PPDU)**: A PPDU that carries one or more independent PSDU(s) for one or more STAs using the MU-MIMO technique.

**8.4.2.140.2 VHT Capabilities Info field**

*Change P64L1 as follows:*

NOTE 1—An AP that sets MU Beamformer Capable to 1 can transmit an MU VHT PPDU with only one non-zero NSTS subfield. However, a STA that sets MU Beamformee Capable to 0 is not required to be(#3557) able to demodulate an MU VHT PPDU with only one non-zero NSTS subfield.

**22.1.4 PPDU formats**

*Add the following paragraph at P142L18:*

A VHT PPDU can be further categorized into an SU PPDU and an MU PPDU. A VHT PPDU using Group ID value of 0 or 63 is an SU PPDU, and either carries only one PSDU or no PSDU. A VHT PPDU using Group ID value in the range of 1 to 62 is an MU PPDU, and carries independent PSDUs to one or more STAs.

**22.2.2 TXVECTOR and RXVECTOR parameters**

*Change P148L44 as follows:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| USER\_POSITION | FORMAT is VHT and  1 ≤ GROUP\_ID ≤ 62 | Index for user in MU transmission. Integer: range 0-3 | MU | O |
| Otherwise | Not present | N | N |

*Change P148L57 as follows:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GROUP\_ID | FORMAT is VHT | Indicates the Group ID.  Integer: range 0-63 (see Table 22-10 (Fields in the VHT-SIG-A field))  A value of 0 or 63 indicates an SU PPDU. Otherwise, indicates an MU PPDU. | Y | Y |
| Otherwise | Not present | N | N |

*Change P149L10 as follows:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PARTIAL\_AID | FORMAT is VHT and  GROUP\_ID is 0 or 63 | Provides an abbreviated indication of the intended recipient(s) of the frame (see 9.17a (Group ID and Partial AID in VHT PPDUs)).  Integer: range 0-511. | Y | Y |
| Otherwise | Not present | N | N |
| NUM\_USERS | FORMAT is VHT | Indicates the number of users in range 1 through 4. | Y | N |
| Otherwise | Not present | N | N |
| BEAMFORMED | FORMAT is VHT and GROUP\_ID is 0 or 63 | Set to 1 if a beamforming steering matrix is applied. Set to 0 otherwise. | Y | O |
| Otherwise | Not present | N | N |

**22.3.8.2.3 VHT-SIG-A definition**

*Change Table 22-10 (P183-184) as follows:*

* Change all instances of ‘For MU:’ to ‘For MU PPDU:’
* Change all instances of ‘For SU:’ to ‘For SU PPDU:’
* On P184L25: Change ‘(if SU)’ to ‘(if SU PPDU)’
* On P184L26: Change ‘(if MU)’ to ‘(if MU PPDU)’

**22.3.8.2.6 VHT-SIG-B definition**

*Change Table 22-12 as follows:*

* On P192L7: Change ‘MU Allocation (bits)’ to ‘MU PPDU Allocation (bits)’
* On P192L7: Change ‘SU Allocation (bits)’ to ‘SU PPDU Allocation (bits)’

**22.3.10 Data field**

**22.3.10.1 General**

*Change P197L62 as follows:*

The Data field of the VHT PPDU contains data for one or more users. For an MU PPDU, the encoding process shall happen on a per-user basis. In the following sections, we describe this process from a single user’s point of view.

*Change P201L1 as follows:*

**22.3.10.5.5 Encoding process for MU PPDUs**

*Change P202L4 as follows:*

Next, for MU PPDUs, step (d) in 20.3.11.7.5 (LDPC PPDU encoding process) is replaced with step (d) below.≤

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

**22.3.11.1 General**

*Change P216L10 as follows:*

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

*Change P216L45 as follows:*

*Nu* is the number of MU-MIMO packet recipients. (see 22.3.7 (Mathematical description of signals))

**22.3.21 PLCP receive procedure**

*Change 22.3.21 as follows:*

* Change all instances of ‘SU transmission’ to ‘SU PPDU’
* Change all instances of ‘MU transmission’ to ‘MU PPDU’