IEEE P802.11
Wireless LANs

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| Comment resolutions for definitions |
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Abstract

This document proposes comment resolutions for the transmit block diagrams in sections “3.1 Definitions” and “3.2 Definitions specific to IEEE802.11.” The corresponding CIDs are 2308, 2018, 2742, 3122, 2082, 2083, 2084, 2019, 2743, and 3123.

Revision History

R2: Revise the resolutions for 20/40 MHz mask PPDU and 80+80 MHz mask PPDU.

R1: Revise the resolution for CID 2308.

R0: Iinitial version.

Notes on this document:

* Comments are from: 11-11-0907-04-00ac-lb178-comments-tgac-d1-0.xls
* Comments refer to: Draft P802.11ac\_D1.0. pdf
* In providing instruction for spec editing, the following conventions are used.
	+ Red text indicates changes to be applied to existing text in Draft P802.11ac\_D1.0.pdf.
	+ Text in blue is text copied from the Draft P802.11REVmb\_D8.0.pdf that was not shown in the 11ac draft and that need be added to the draft, with the modifications shown in green.
	+ Text in black is unmodified text from Draft P802.11ac\_D1.0.pdf.
	+ Italic light gray text indicates instruction to the editor.

Proposed Resolutions

* **A comment related to the term of MU-MUMO (CID 2308)**

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| 2308 | Grigat, Michael | 3.1 | 2 | 11 | T | "same channel bandwidth" can also mean transmission over two separate channels with same bandwidth | Delete "bandwidth" or change expression, e.g. "same RF channel" or "same physical transmission channel" | Agree in principle. See resolution in 11/1192. | PHY |

**Discussion:**

The original sentence of the definition of MU-MIMO is as follows:

**multi-user multiple input, multiple output (MU-MIMO):** A technique where multiple STAs, each with one or more antennas, transmit or receive independent data streams simultaneously over the same channel bandwidth; typically to or from a common STA with two or more antennas, respectively.

The comment points out that the phrase “same channel bandwidth” can be regarded as two configurations as illustrated in the following Figure.



**Figure I: Channel configuration for current definition of MU-MIMO.**

The typical channel configuration for MU-MIMO is Fig. 1 (a). Fig. 1 (b) is not MU-MIMO but OFDMA transmission. The phrase “same channel bandwidth” should be revised not to include the configuration of (b).

**Proposed response to CIDs 2308**:

***Change section 3.1 as follows: (P2L9):***

**multi-user multiple input, multiple output (MU-MIMO):** A technique where multiple STAs, each with one or more antennas, transmit or receive independent data streams simultaneously over the same frequency channel ~~bandwidth~~ ; typically to or from a common STA with two or more antennas, respectively.

* **Comment related to 20 or 40MHz mask PPDUs. (CID 2018, 2742, and 3122)**

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| 2018 | Asai, Yusuke | 3.2 | 2 | 46 | T | In TGac Draft, 20 MHz and 40MHz VHT PPDUs are newly defined; therefore, the definitions of 20 MHz and 40 MHz mask PPDUs shall be modified accordingly. | Change the definitions of 20 MHz and 40 MHz mask PPDUs to include "a Clause 22 20MHz VHT PPDU with TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW20" and "a clause 22 20MHz VHT PPDU with TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW20 and a clause 22 40MHz VHT PPDU with TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW40", respectively. | Agree in principle. See resolution in 11/1192r2.  | PHY |
| 2742 | Kudo, Riichi | 3.2 | 2 | 46 | T | The definitions of 20 MHz and 40 MHz mask PPDUs shall be reconsidered. | 20 MHz mask PPDU shall include a 20 MHz VHT PPDU. 40 MHz mask PPDU shall include a 40 MHz VHT PPDU. | Agree in principle. See resolution in 11/1192r2. | PHY |
| 3122 | Okada, Kazuyasu | 3.2 | 2 | 46 | T | 20 MHz and 40MHz VHT PPDUs are newly defined in TGac Draft; however, 20 MHz and 40 MHz mask PPDUs are not modified at all. This means that 20 MHz and 40 MHz PPDUs cannot be transmitted in the condition when 40 MHz mask PPDU can be transmitted. | The definitions of 20 MHz and 40 MHz PPDUs shall be changed to include 20 MHz and 40 MHz mask PPDUs. | Agree in principle. See resolution in 11/1192r2.  | PHY |

**Discussion:**

TGac D1.0 does not include any additional definitions of 20 and 40 MHz mask PPDUs, which means that current definition of 20 or 40 MHz mask PPDU does not include any VHT PPDUs. This is a critical problem. Beacuse a STA cannot transmit 20 or 40 MHz VHT PPDU in the case when it can transmit 20 or 40 MHz mask PPDU.

**Proposed response to CID 2018, 2742 and 3122**:

***Add the following sentences in Section 3.2 of TGac Draft D1.0 (P2L45):***

**20 MHz mask physical layer convergence procedure (PLCP) protocol data unit (PPDU):** A Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) PPDU, a Clause 18 (Extended Rate PHY (ERP) specification) orthogonal frequency division multiplexing (OFDM) PPDU, ~~or~~ a Clause 19 (High Throughput (HT) PHY specification) 20 MHz high-throughput (HT) PPDU with the TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW20 and the CH\_OFFSET parameter equal to CH\_OFF\_20~~.~~, or a Clause 22 (Very High Throughput VHT) PHY specification (11ac)) 20 MHz very high-throughput (VHT) PPDU with the TXVECTOR parameter CH\_BANDWIDTH equal to CBW20. The PPDU is transmitted using a 20 MHz transmit spectral mask defined in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification), Clause 18 (Extended Rate PHY (ERP) specification), ~~or~~ Clause 19 (High Throughput (HT) PHY specification), or Clause 22 (Very High Throughput (VHT) PHY specification (11ac)), respectively.

**40 MHz mask physical layer convergence procedure (PLCP) protocol data unit (PPDU):** One of the following PPDUs:

1) a 40 MHz high-throughput (HT) PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW40);

2) a 40 MHz non-HT duplicate PPDU (TXVECTOR parameter CH\_BANDWIDTH equal to NON\_HT\_CBW40); ~~or~~

3) a Clause 19 (High Throughput (HT) PHY specification(11n)) 20 MHz HT PPDU with the TXVECTOR parameter CH\_BANDWIDTH equal to HT\_CBW20 and the CH\_OFFSET parameter equal to either CH\_OFF\_20U or CH\_OFF\_20L~~.~~ ;

4) a Clause 22 (Very High Throughput (VHT) PHY specification (11ac)) 20MHz VHT PPDU with the TXVECTOR parameter CH\_BANDWIDTH equal to CBW20;

5) a 40 MHz very high throughput (VHT) PPDU with the TXVECTOR parameter CH\_BANDWIDTH equal to CBW40.

The PPDU is transmitted using a 40 MHz transmit spectral mask defined in Clause 19 (High Throughput (HT) PHY specification (11n)).

* **Comments related to 80, 160, 80+80 MHz mask PPDU (CIDs 2082, 2083, and 2084)**

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| 2082 | Ashley, Alex | 3.2 | 3 | 31 | T | To quote the style guide "Each definition should be a brief, self-contained description of the term in question and shall not containany other information, such as requirements and elaborative text." | Suggest changing to "A PPDU transmitted using the 80 MHz transmit spectral mask defined in Clause 22." | Disagree: See discussion in 11/1192r2. | PHY |
| 2083 | Ashley, Alex | 3.2 | 3 | 46 | T | To quote the style guide "Each definition should be a brief, self-contained description of the term in question and shall not containany other information, such as requirements and elaborative text." | Suggest changing to "A PPDU transmitted using the 160 MHz transmit spectral mask defined in Clause 22." | Disagree: See discussion in 11/1192r2. | PHY |
| 2084 | Ashley, Alex | 3.2 | 3 | 64 | T | To quote the style guide "Each definition should be a brief, self-contained description of the term in question and shall not containany other information, such as requirements and elaborative text." | Suggest changing to "A PPDU transmitted using the 80+80 MHz transmit spectral mask defined in Clause 22." | Disagree: See discussion in 11/1192r2. | PHY |

**Discussion:**

The commentor suggests that all bullet items in the definition of 80 MHz should be deleted; however, the following parameters are indispensable for the definition of “x MHz mask PPDU”:

* Transmit spectrum mask
* CH\_BANDWIDTH
* FORMAT

For example, if 80 MHz mask PPDU is defined as the sentence, “A PPDU transmitted using the 80 MHz tramsmit spectral mask defined in Clause 22,” TGac D1.0 will not specify the essential information for 80 MHz mask PPDU, the variations of CH\_BANDWIDTH (20, 40, or 80 MHz) and FORMAT (non-HT, non-HT duplicate, HT, or VHT).

In addition, 20 and 40 MHz mask PPDUs in section 3A of 11n standard are also defined as the same manner. Regarding consistency to the existing definitions, current definitions are appropriate.

**Proposed response to CID 2082, 2083 and 2084**:

Disagree.

* **Comment for the definition of 80+80 mask PPDU (CID 2019, 2743 and 3123)**

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| 2019 | Asai, Yusuke | 3.2 | 3 | 63 | T | As Figure 22-7 suggests, it is natural implementation for a transmitter to equip two RF chains which corresponds to two frequency segment per spatial stream in 80+80 MHz transmission. Based on this implementation, when a STA checks CCA idle on entire of 80+80 MHz channel and transmits a PPDU which bandwidth is equal to or less than 80 MHz, it is quite easy to transmit the frame with 80 MHz mask because the RF block of secondary segment is not used at all. Therefore, it is regarded that current definition of 80+80MHz mask PPDU allows unnecessary out-of-band emission at secondary segment when a STA transmits a 20, 40, or 80 MHz PPDU. | Delete 3) to 5) conditions from 80+80 MHz mask PPDU and replace "80+80 MHz mask PPDU" to "80+80 MHz or 80 MHz mask PPDU" on P98L62. | Agree in principle: See resolution in 11/1192r2.  | PHY |
| 2743 | Kudo, Riichi | 3.2 | 3 | 63 | T | 80+80 MHz mask PPDU should not include PPDUs which bandwidth is equal to or less than 80 MHz. A STA which supports 80+80 MHz transmission, it will probably have a couple of RF chains per 80+80 MHz spatial stream. Therefore, when CCA is idle on 80+80 MHz channel and a STA would like to transmit a PPDU which bandwidth is equal to or less than 80 MHz, it will use only one RF chain and another RF chain which corresponds to secondary segment will be turned off. This means it is quite easy to generate 80 MHz mask PPDU. Therefore, it is regarded that current definition of 80+80MHz mask PPDU allows unnecessary out-of-band emission at secondary segment when a STA transmits a 20, 40, or 80 MHz PPDU. | Exclude conditions 3), 4), and 5) from the definition of 80+80 MHz mask PPDU. In addition, replace "80+80 MHz mask PPDU" to "80+80 MHz or 80 MHz mask PPDU" on P98/L62. | Agree in principle: See resolution in 11/1192r2. | PHY |
| 3123 | Okada, Kazuyasu | 3.2 | 3 | 63 | T | 80+80 MHz mask PPDU is defined a group of PPDUs which are allowed to transmit when CCA for 80+80 MHz channel is idle state. Regarding implementation of a STA which support 80+80 MHz transmission, it is natural to equip two RF chains per spatial stream in 80+80 MHz transmission, which correspond to two segments. If such a STA transmit a PPDU which bandwidth is 80 MHz or less, it will simply turn the RF block which corresponds to secondary segment off. This means it is easy to not to radiate out-of-band emission on secondary segment. However, current definition of 80+80 MHz mask PPDU allows large out-of-band emission. | Delete the conditions for PPDUs which bandwidth is 20, 40, or 80 MHz from 80+80 MHz mask PPDU. Then add "80 MHz mask PPDU" in addition to "80+80 MHz mask PPDU" on line 62 of page 98.  | Agree in principle: See resolution in 11/1192r2. | PHY |

**Discussion**

The three comments commonly point out the problem of the 80+80 MHz mask PPDU. The definition of 80+80 MHz mask PPDU in TGac D1.0 is a straightforward extension from 80 or 160 MHz mask PPDU. The all of PPDUs included in 80+80 MHz mask PPDU are illustrated in Figure II.



**Figure II: Spectrum allocation of all of 80+80 MHz mask PPDUs defined in TGac D1.0.**

In Figure II, primary channel locates at the third 20 MHz channel from the left as well as Figure 7-ac1.



From Figure II, there are no signals on secondary frequency segment when PPDUs with 80 MHz or less bandwidth; however, maximum transmit power spectrum density is the same as that of main spectrum. Unlike other contiguous transmissions (20/40/80/160 MHz mask PPDUs), as illustrated in Figure 22-7, one of typical implementation of 80+80 MHz non-contiguous transmission there is one RF chain per frequency segment. It is reasonable to generate 80+80 MHz non-contiguous spectrum by using a couple of RF chains in terms of requirement of filters and flexibility of two center frequencies.

Based on the configuration, it is quite easy to apply 80 MHz spectrum mask to the 80+80 MHz mask PPDUs which bandwidth is equal to or less than 80 MHz. When a STA transmit a PPDU which bandwidth is 80 MHz or less, it is possible to follow 80 MHz spectrum mask without filter swithing by just switching RF circuit on secondary frequency segment off.



**Figure 22-7 – Transmitter block digram 7 (Data field in an SU packet for non-contiguous 80+80 MHz)**

Based on the considerations, it can be regarded that current definition of 80+80 MHz mask PPDU allows radiating quite large interference on secondary 80 MHz channel. For example of the most extreme case, when a STA transmit 20 MHz PPDU, it allows to radiate up to four times interference as much as the power of the PPDU. Therefore, the current definition of 80+80 MHz mask PPDU should be reconsidered for efficient spectrum usage and TGac Draft.

The basic ideas for revisions are as follows:

1. 80+80 MHz spectrum mask is applied only 80+80 MHz VHT PPDU and 80+80 MHz non-HT duplicate PPDU.
2. When a STA finds entire 80+80 MHz channel, which comprises primary, secondary, secondary40 and secondary 80 channels, is idle and it would like to transmit a frame which bandwidth is equal to or less than 80 MHz, it should use the 80 MHz spectrum mask.

**Proposed response to CID 2019, 2743, and 3123**:

***Change section 3.2 as follows: (P3L63)***

**80+80 MHz mask physical layer convergence procedure (PLCP) protocol data unit (PPDU):** One of the following PPDUs:

1. an 80+80 MHz VHT PPDU (TXVECTOR parameter CH\_BANDWIDTH set to CBW80+80);
2. an 80+80 MHz non-HT duplicate PPDU (TXVECTOR parameter CH\_BANDWIDTH set toCBW80+80);
3. ~~a 20 MHz non-HT, HT or VHT PPDU (TXVECTOR parameter CH\_BANDWIDTH set toCBW20);~~
4. ~~a 40 MHz non-HT duplicate, HT or VHT PPDU (TXVECTOR parameter CH\_BANDWIDTH set to CBW40);~~
5. ~~an 80 MHz non-HT duplicate or VHT PPDU (TXVECTOR parameter CH\_BANDWIDTH setto CBW80).~~

The PPDU is transmitted using the 80+80 MHz transmit spectral mask defined in Clause 22.

***Change section 10.25.2 (STA CCA sensing in a VHT BSS) as follos: (P99L17)***

If the primary channel has not been idle during an interval of PIFS immediately preceding the time at whicha STA is permitted to begin a TXOP, the STA may begin a TXOP by transmitting:

* a 160 MHz or 80+80 MHz or 80 MHz or 40 MHz or 20 MHz mask PPDU if the immediately preceding frame was a 160 MHz mask PPDU or 80+80 MHz mask PPDU,