IEEE P802.11
Wireless LANs

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| D2.0 Comment Resolution for MU-MIMO PHY |
| Date: 2022-08-15 |
| Author(s): |
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Abstract

This submission proposes resolutions for the following comments on P802.11be D2.0: Comments in 36.3.3

NOTE – Set the Track Changes Viewing Option in the MS Word to “All Markup” to clearly see the proposed text edits.

**Revision History:**

R0: Initial version. Resolve CIDs 11344, 11345, 11346, 11347, 11348, 12186, 12187, 12580, 12581, 12582, 12870, 13209

# CID 11344

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 11344 | 36.3.3.1.2 | 603.32 | Variable name "NssmaxrxSUtx" can be improved to, for example, max(Nss,su). Make the same change in 36.3.3.2.4 P605L36 | As in the comment. | Revised.Agree to the comment that we need to make the variable name better. We define a simpler name as given below. Also, we make similar changes to the variable name in P605L36 for consistency.Instruction to editor:*Please make changes for CID 11344 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P603L32 as shown below for CID 11344:**

An EHT STA shall support the reception of non-OFDMA DL MU-MIMO transmissions with a maximum number of spatial streams (per user) that is where is the maximum number of spatial streams supported for reception of an EHT SU transmission.

***Instructions to the editor:***

**Please make the changes to P605L36 as shown below for CID 11344:**

The number of spatial streams allocated to the non-AP STA ranges from 1 to *N*, where *N* is where is the maximum number of spatial streams supported by the non-AP STA for EHT SU transmissions.

# CID 11345, 12186, 12870, 13209

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 11345 | 36.3.3.1.2 | 603.36 | "reception of an EHT MU PPDU when sent to a STA as part of an SU transmission" can be simplifed as "reception of EHT MU PPDU for single user transmission". Make the similar changes to other places too | As in the comment. | Revised.Agreed to the comment that the term “SU transmission” needs to be replaced with something less confusing and consistent throughout the spec. We propose replacing this term with “EHT SU transmission” wherever it appears in the spec. The term “EHT SU transmission” is introduced and defined in proposed text updates for CID 13113.Instruction to editor:*Please make changes for CID 11345 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |
| 12186 | 36.3.3.1.2 | 603.35 | Replace "SU transmission" with "transmission to single user" to be consistent with the rest part of the spec. There are mulitple occurance in this paragragh, L35, L37, L44 | As in the comment. | Revised.Instruction to editor:This CID 12186 is resolved in the resolution to CID 11345. No further changes needed. |
| 12870 | 36.3.3.1.2 | 603.35 | Consistent use of "SU transmission" with "transmission to single user" | As in the comment. | Revised.Instruction to editor:This CID 12870 is resolved in the resolution to CID 11345. No further changes needed. |
| 13209 | 36.3.3.1.2 | 603.35 | To make it consistence, replace one to another between n "SU transmission" and "transmission to single user" | As in the comment. | Revised.Instruction to editor:This CID 13209 is resolved in the resolution to CID 11345. No further changes needed. |

***Instructions to the editor:***

**Please make the changes to P603L31 – P603L45 as shown below for CID 11345, CID 12186, CID 12870, and CID 13209:**

is the maximum number of spatial streams supported for reception of an an EHT SU transmission. The maximum number of spatial streams supported for reception of an EHT SU transmission is indicated for various bandwidths in the Supported EHT-MCS And NSS Set field in the EHT Capabilities element, where, as defined in 35.12.3 (Contents of the EHT PHY Capabilities Information field and Supported EHT-MCS And NSS Set field), this field is determined in turn by dot11EHTSupportedEhtMcsAndNssSet20MhzOnlyStaImplemented for a 20 MHz-only non-AP STA and by dot11EHTSupportedEhtMcsAndNssSetImplemented for other STAs. The maximum number of spatial streams supported for reception of an EHT SU transmission can also be limited by either an operating mode notification, or the operating mode indication (OMI) procedure.

***Instructions to the editor:***

**Please make the changes to P605L37 as shown below for CID 11345, CID 12186, CID 12870, and CID 13209:**

is the maximum number of spatial streams supported by the non-AP STA for EHT SU transmissions.

***Instructions to the editor:***

**Please make the changes to P605L46 as shown below for CID 11345, CID 12186, CID 12870, and CID 13209:**

The maximum number of spatial streams supported by a STA for EHT SU transmissions is indicated in the

Supported EHT-MCS And NSS Set field in the EHT Capabilities element, where, as defined in 35.12.3

(Contents of the EHT PHY Capabilities Information field and Supported EHT-MCS And NSS Set field), this

field is determined in turn by the maximum number of spatial streams supported among the transmit-related

subfields of dot11EHTSupportedEhtMcsAndNssSet20MhzOnlyImplemented for a 20 MHz-only non-AP

STA and by the maximum number of spatial streams supported among the transmit-related subfields of

dot11EHTSupportedEhtMcsAndNssSetmplemented for other STAs.

***Instructions to the editor:***

**Please make the changes to P706L1 as shown below for CID 11345, CID 12186, CID 12870, and CID 13209:**

EHT 40/80/160/320 MHz PPDU bandwidths for EHT SU transmission,

# CID 11346

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 11346 | 36.3.3.1.2 | 603.59 | Dl MU MIMO support is mandatory for non-AP STA. Change "If dot11EHTSUBeamformeeImplemented is true," to "For non-AP EHT STA" to be consistent with the paragraph above. | As in the comment. | Revised.Agree to the comment. As pointed out by the commentor, since DL MU MIMO support is mandatory for non-AP STAs, the phrase “If dot11EHTSUBeamformeeImplemented is true” is redundant and can be replaced by "For a non-AP EHT STA" as the discussion in 36.3.3.1.2 pertains to non-OFDMA DL MU MIMO for non-AP STAs.Instruction to editor:*Please make changes for CID 11346 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P603L59 as shown below for CID 11346:**

For a non-AP EHT STA, the minimum value for each of the Beamformee SS (≤ 80 MHz), Beamformee SS (= 160 MHz), and Beamformee SS (= 320 MHz) subfields is 3, because the minimum value of each of dot11EHTBeamformeeSSLessThanOrEqualTo80, dot11EHTBeamformeeSSEqualTo160, and dot11EHTBeamformeeSSEqualTo320 is 4.

# CID 11347

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 11347 | 36.3.3.2.4 | 605.41 | Add "non-OFDMA" before "MU-MIMO" | As in the comment. | Revised.We propose modifying the contents of 36.3.3.2.4 as given below for improved readability.Instruction to editor:*Please make changes for CID 11347 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P605L40 – P605L53 as shown below for CID 11347:**

EHT SU transmissions

The total number of spatial streams, summed across all users for UL MU-MIMO in an EHT TB PPDU is less than or equal to 8.

# CID 11348

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 11348 | 36.3.3.2.4 | 605.42 | Add "an" before "RU or MRU" | As in the comment. | AcceptedInstruction to editor:*Please make changes for CID 11348 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P605L42 as shown below for CID 11348:**

For the non-AP STA that supports the partial bandwidth based UL MU-MIMO, the total number of spatial streams (summed over all users) for an RU or MRU of an EHT TB PPDU across all scheduled users using MU-MIMO is less than or equal to 8.

# CID 12187

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 12187 | 36.3.3.1.2 | 604.11 | "an EHT AP supports for transmission from a single sTA", it is confusing for the phrase "from a single STA". Suggest to remove or further clarify. | As in the comment. | Revised.Agree to the comment that this sentence is confusing and misleading. We suggest changing the phrase “transmission from a single STA” to “EHT SU transmission” to avoid the ambiguity. The term “EHT SU transmission” is introduced and defined in proposed text updates for CID 13113.Also, we found the other sentences in this paragraph confusing and suggest modifying the same as given in the instructions to the editor. Particularly, since MU beamformer (BW ≤ 80 MHz), MU beamformer (BW = 160 MHz) and MU beamformer (BW = 320 MHz) are three different subfields, we propose having their names in entirety in the spec as opposed to the currently employed consolidated notation MU beamformer (BW ≤ 80 MHz), (BW = 160 MHz) and (BW = 320 MHz). Instruction to editor:*Please make changes for CID 12187 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P604L1- P604L23 as shown below for CID 12187:**

The support by an EHT AP of EHT non-OFDMA DL MU-MIMO transmission on an RU or MRU size greater than or equal to 242 tones in a bandwidth up to 80 MHz, 160 MHz or 320 MHz is indicated in the respective MU beamformer (BW ≤ 80 MHz), MU beamformer (BW = 160 MHz) or MU beamformer (BW = 320 MHz) subfields in the EHT PHY Capabilities Information field in the EHT Capabilities element, where each of these subfields is determined in turn by dot11EHTMUBeamformerLessThanOrEqualTo80Implemented, dot11EHTMUBeamformerEqualTo160Implemented, or dot11EHTMUBeamformerEqualTo320Implemented, respectively (see 35.12.3 (Contents of the EHT PHY Capabilities Information field and Supported EHT-MCS And NSS Set field)). The number of spatial streams that an EHT AP supports for EHT SU transmission with bandwidth up to 80 MHz, 160 MHz or 320 MHz is determined from the transmit-related subfields for the respective bandwidth in the Supported EHT-MCS And NSS Set field in the EHT Capabilities element sent by the AP, where this field is determined in turn by dot11EHTSupportedEhtMcsAndNssSetmplemented. An EHT AP shall set dot11EHTMUBeamformerLessThanOrEqualTo80Implemented, dot11EHTMUBeamformerEqualTo160Implemented or dot11EHTMUBeamformerEqualTo320Implemented to true if the AP supports at least four spatial streams for EHT SU transmission in a bandwidth of up to 80 MHz, 160 MHz or 320 MHz, respectively; and accordingly the MU beamformer (BW ≤ 80 MHz), MU beamformer (BW = 160 MHz) or MU beamformer (BW = 320 MHz) subfield is set to 1 to indicate support for EHT non-OFDMA DL MU-MIMO transmission in the respective bandwidths.

# CID 12580

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 12580 | 36.3.3.1.2 | 603.51 | Value of the Beamformee SS (<=xx MHz) subfield is the number of maximal spatial streams minus 1. And in the next paragraph, it's confusing to say the minimum value of the Beamformee SS (<=xx MHz) is 3 without mentioning the value is maximal Nss - 1. | Add normative to mention the value of the Beamformee SS (<= xx MHz) is the number of maximal spatial streams minus 1. | Revised.Agree to the comment that the relationship between these two quantities must be made explicit in this paragraph. We modify the sentence to that effect here.Instruction to editor:*Please make changes for CID 12580 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P603L47 – P603L57 as shown below for CID 12580:**

For EHT MU PPDUs using a bandwidth less than or equal to 80 MHz, equal to 160 MHz, or equal to 320 MHz, a non-AP EHT STA shall support the reception of non-OFDMA DL MU-MIMO transmissions with the total number of spatial streams (across all users) that is supported for the reception of an EHT MU PPDU up to the value indicated by the Beamformee SS (≤ 80 MHz), Beamformee SS (= 160 MHz), or Beamformee SS (= 320 MHz) subfield, respectively, in the EHT PHY Capabilities Information field in the EHT Capabilities element, where, as defined in 35.12.3 (Contents of the EHT PHY Capabilities Information field and Supported EHT-MCS And NSS Set field), this subfield is set to dot11EHTBeamformeeSSLessThanOrEqualTo80 – 1, dot11EHTBeamformeeSSLessThanOrEqualTo160 – 1, or dot11EHTBeamformeeSSLessThanOrEqualTo320 – 1, respectively.

# CID 12581

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 12581 | 36.3.3.1.2 | 603.51 | The Beamformee SS (<=xx MHz) is present for 3 times, which is not necessary and redundant. We can just make it clean as the first paragraph of page 604, keep a single Beamformee SS, and 3 brackets for (<=xx MHz) after it. | As in the comment. | Rejected.Since Beamformee SS (≤ 80 MHz), Beamformee SS (= 160 MHz) and Beamformee SS (= 320 MHz) are three different subfields, we propose having their names in entirety in the spec as opposed to the notation Beamformee SS (≤ 80 MHz), (= 160 MHz) and (= 320 MHz) suggested by the commentor. This also makes the names consistent throughout the document. Also, we propose to modify the first paragraph in page 604 accordingly (see resolution to CID 12187). |

# CID 12582

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| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 12582 | 36.3.3.2.1 | 604.35 | The STAs should be non-AP STAs. | As in the comment. | AcceptedInstruction to editor:*Please make changes for CID 12582 as shown in the following document*[*https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo*](https://mentor.ieee.org/802.11/dcn/22/11-22-1370-00-00be-d2.0-comment-resolution-for-mu-mimo)*-phy* |

***Instructions to the editor:***

**Please make the changes to P604L35 as shown below for CID 12582:**

UL MU-MIMO is a technique to allow multiple non-AP STAs to transmit simultaneously over the same frequency resource to the receiver. The concept is very similar to SU-MIMO where multiple spatial streams are transmitted simultaneously over the same frequency resource utilizing spatial multiplexing through multiple antennas at the transmitter and receiver. The key difference from SU-MIMO is that in UL MU-MIMO, the transmitted streams originate from multiple non-AP STAs.