IEEE P802.11  
Wireless LANs

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| 802.11 TGac WG Letter Ballot LB187  Proposed resolutions on VHT Operating Mode Field | | | | |
| Date: 2012-03-13 | | | | |
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##### Comments are based on 11ac D2.0. Proposed resolutions are based on 11ac D2.0. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

Following CIDs are covered in this document (total 8):

MAC: 4911, 4029, 4309, 4310, 4030, 4306, 5062, 4307

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4911 | 59.43 | 8.4.1.49 | The name of the field "Max Nss For SU Present" is bothering me. And the explanation in the description box is incredibly difficult to interpret. I think that the name could be improved. | Throughout the draft, change the name "Max Nss For SU Present" to "Max Nss for SU calculated from MU sounding" - change the description from "Set to 0 to indicate that the Rx Nss field carries the maximum number of spatial streams the STA can receive. Set to 1 to indicate that the Rx Nss field carries the maximum number of spatial streams the STA can receive as a beamformee in a single user transmission beamformed using feedback from a VHT Compressed Beamforming frame with the Feedback Type subfield in the VHT MIMO Control field equal to MU. A beamformer may ignore this limit, defined by Rx Nss, if SU type feedback is used to form a single user beamformed transmission." to "Set to 0 when the value in the Rx Nss field was generated from SU sounding. Set to 1 to indicate that the value in the Rx Nss field was generated from MU sounding." Any restrictions on the use of this information by a beamformer should appear in the text of the document and not within this box. |
| 4029 | 59.50 | 8.4.1.49 | "A beamformer may ignore this limit, defined by Rx Nss, if SU type feedback is used to form a single user beamformed transmission."  this has nothing to do with the coding of the frame structure. | Move cited sentence to Clause 9 or 10. |
| 4309 | 59.51 | 8.4.1.49 | "may" | Belongs in clause 9/10. Ditto last para on P59 |
| 4310 | 59.51 | 8.4.1.49 | "SU type feedback ... single user BFed transmission" | Better to refer to fields / TXVECTOR / RXVECTOR parameters |
| 4030 | 59.55 | 8.4.1.49 | "If a STA has not received any VHT Operating Mode Notification frame with Max ..." This has a couple of problems: 1. Clause 8 is for explaining structure / encoding, not behaviour. 2. "shall assume" is untestable. | 1. Move to Clause 9 /10. 2. Reword to avoid "shall assume" - i.e., related to observable behaviour. |

**Discussion:**

Context:



When ‘Max Nss For SU Present’ = 0:

* Channel Bandwidth
  + **Indicates the supported channel width (P59L26).**
  + This provides an additional restriction on the supported RX bandwidth from what was initially defined by the VHT Operation element
* Rx Nss
  + **Indicates the maximum number of spatial streams the STA can receive (P59L35).**
  + This provides an additional restriction on the number of spatial streams the STA can receive on top of what is defined by the VHT Supported MCS.
  + Note that when some of the RX chains are turned off for power save, then it impacts the max. Rx Nss for both HT and VHT PPDUs. Thus, the VHT Operating Mode field puts additional restriction on the Rx Nss defined by (HT) Supported MCS as well.

When ‘Max Nss for SU Present’ = 1:

(Only Rx Nss subfield is defined)

* Rx Nss
  + **Indicates the maximum number of spatial streams the STA can receive as a beamformee in a single user transmission (P59L36) using feedback from a VHT Compressed Beamforming frame with the Feedback Type subfield in the VHT MIMO Control field equal to MU (P59L46).**
  + This provides an additional restriction on the number of spatial streams the STA can receive on top of what is defined by the VHT Supported MCS.

Note that the existing rule on the allowed Nss and BW in a PPDU is given in clause 9.7.5.6 (REVmb D12.0).



Part of the problem seems to be that the rules are not specified in a single place, causing confusion to readers (see CID 4911). Furthermore, Clause 8 is for specifying frame formats, and is not the appropriate place to specify ‘rules’ as indicated in CIDs 4029, 4309 and 4030. Hence, the proposed resolution is to move the ‘rules’ in to Clause 9.7.5.6 (Rate selection).

Furthermore, CID 4911 highlights a potential confusion in the name “Max Nss for SU Present” as this applies only to SU **beamformed** PPDU using **MU feedback**, not for all SU PPDUs. Also, the field name is too long. Hence, changing the name to ‘Rx Nss Type’ would be better.

Note that the sentence “A beamformer may ignore this limit, defined by Rx Nss, if SU type feedback is used to form a single user beamformed transmission” (P59L50) provides no additional information as the cited situation (‘Max Nss For SU Present = 1) is explicitly limited to the case of using MU type feedback. Hence this sentence can be deleted.

**Proposed Resolution:**

**CID 4911:**

REVISE. Make changes as specified under “consolidated text changes” at the end of 11-12/0380r0. These changes update the name of the subfield “Max Nss For SU Present”, as well as providing clearer explanation on the usage of the VHT Operating Mode field.

**CID 4029, 4309, 4310:**

REVISE. Make changes as specified under “consolidated text changes” at the end of 11-12/0380r0. These changes remove the cited sentence as it provides no additional information.

**CID 4030:**

REVISE. Make changes as specified under “consolidated text changes” at the end of 11-12/0380r0. These changes move the sited rule to Clause 9.7.5.6 and reword the rule to an observable behavior.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4304 | 58.57 | 8.4.1.49 | the operating channel width and NSS | NSS and optionally the operating channel width |

**Discussion:**

Context:



The ‘Channel Width’ subfield is not present when ‘Max Nss For SU Present’ subfield is 1.

**Proposed Resolution:**

ACCEPT. See the changes as specified under “consolidated text changes” at the end of 11-12/0380r0 for detailed editing instructions.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4306 | 58.57 | 8.4.1.49 | What is this NSS of which you speak ? Ditto P143L53 | Refer to a TXVECTOR / RXVECTOR parameter or a frame/element/field name |

(From 11-12/0344r0)

**Discussion:**

Context: 58.52

**8.4.1.49 VHT Operating Mode field**

The VHT Operating Mode field is used in the VHT Operating Mode Notification frame (see 8.5.23.4 (VHT Operating Mode Notification frame format)) to indicate the operating channel width and *NSS* on which the sending STA is able to receive. When Max Nss For SU Present is 1, the VHT Operating Mode field is used for sending RX Nss only. The length of the field is 1 octet.

143.46:

**10.38.5 VHT STA notification of operating mode changes**

A STA may use the VHT Operating Mode Notification Action frame to notify one or more VHT STAs that it is capable of receiving frames with a bandwidth up to and including the indicated Channel Width and with a *NSS* up to and including the indicated Rx Nss. The VHT Operating Mode Notification frame is either sent as a group addressed frame or as one or more individually addressed frames.

This is a generic introduction. Details come later, so it would be better not to clobber the text with ‘Max Nss SU Present = X’ here. Instead, let’s change ‘Nss’ to ‘number of spatial streams’ to make it more generic.

**Proposed Resolution:**

REVISE. Make changes as specified under “consolidated text changes” at the end of 11-12/0380r0. These changes update ‘Nss’ to ‘number of spatial streams’ to highlight that this is a generic introduction.

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 5062 | 58.58 | 8.4.1.49 | Clarify sentence | Replace sentence "When Max Nss For SU Present is 1, the VHT Operating Mode field is used for sending RX Nss only" with "When the subfield 'Max Nss For SU Present' has the value 1, only the subfield 'Rx Nss' has a non-reserved value" |

(From 11-12/0344r0)

**Context:**

When Max Nss For SU Present is 1, the VHT Operating Mode field is used for sending RX Nss only. The length of the field is 1 octet.

Change proposed by commenter:

When subfield ‘Max Nss For SU Present’ has the value 1, only the subfield ‘Rx Nss’ as a non-reserved value.. The length of the field is 1 octet.

**Discussion:**

Much of the changes contravene 802.11style.

**Proposed change:**

When the Max Nss For SU Present subfield is 1, only the RX Nss subfield has a non-reserved value. The length of the field is 1 octet.

**Proposed Resolution:**

REVISE. Make changes as specified under “consolidated text changes” at the end of 11-12/0380r0. These changes update the cited sentence to read: “When the Max Nss For SU Present subfield is 1, only the RX Nss subfield has a non-reserved value”

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| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| 4307 | 58.60 | 8.4.1.49 | What happens if Max Nss For SU Present is 0? | Define |

(From 11-12/0344r0)

**Discussion:**

Context:

When Max Nss For SU Present is 1, the VHT Operating Mode field is used for sending RX Nss only.

There is no point repeating the contents of Table 8-53j in the text. Table 8-53j is describes the encodings of the various fields when Max Nss For SU Present is 0.

**Proposed Resolution:**

REJECT. When Max Nss for SU Present is 0, the contents of the field are defined in Table 8-53j. It is not necessary to repeat that in the text.

**Consolidated Text Change:**

**8.4.1.49 VHT Operating Mode field**

The VHT Operating Mode field is used in the VHT Operating Mode Notification frame (see 8.5.23.4 (VHT Operating Mode Notification frame format)) to indicate the (#4304) number of spatial streams (#4306) and optionally the operating channel width (#4304) on which the sending STA is able to receive. When the Rx Nss Type subfield (#4911) is 1, only the RX Nss subfield has a non-reserved value (#5062). The length of the field is 1 octet.

The VHT Operating Mode field is shown in Figure 8-80d.

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|  | B0 B1 | B2 B3 | B4 B6 | B7 |
|  | Channel Width | Reserved | Rx Nss | Rx Nss Type (#4911) |
| Bits | 2 | 2 | 3 | 1 |

**Figure 8-80d – VHT Operating Mode field**

The STA transmitting this field indicates its current operating channel width and the number of spatial streams it can receive using the settings defined in Table 8-53j (Subfield values of the VHT Operating Mode field).

**Table 8-53j – Subfield values of the VHT Operating Mode field**

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| **Subfield** | **Description** |
| Channel Width | If Rx Nss Type subfield (#4911) is 0, indicates the supported channel width:  Set to 0 for 20 MHz  Set to 1 for 40 MHz  Set to 2 for 80 MHz  Set to 3 for 160 MHz or 80+80 MHz  Reserved if Rx Nss Type subfield (#4911) is 1. |
| Rx Nss | If Rx Nss Type subfield (#4911) is 0, indicates the maximum number of spatial streams the STA can receive.  If Rx Nss Type subfield (#4911) is 1, indicates the maximum number of spatial streams the STA can receive as a beamformee in an SU PPDU using a beamforming steering matrix derived from a VHT Compressed Beamforming frame with Feedback Type subfield in the VHT MIMO Control field equal to MU (#4911).  Set to 0 for *NSS* = 1  Set to 1 for *NSS* = 2  …  Set to 7 for *NSS* = 8 |
| Rx Nss Type (#4911) | Set to 0 to indicate that the Rx Nss subfield carries the maximum number of spatial streams the STA can receive.  Set to 1 to indicate that the Rx Nss subfield carries the maximum number of spatial streams the STA can receive as a beamformee in an SU PPDU using a beamforming steering matrix derived (#4911) from a VHT Compressed Beamforming frame with the Feedback Type subfield in the VHT MIMO Control field equal to MU.(#4029) |

(#4030)

**9.7.5.6 Rate selection for other data and management frames**

Copy the following paragraph from REVmb 12.0 into TGac D2.0 P95L8, with the following modifications:

***Change the first paragraph as follows:***

A data or management frame not identified in 9.7.5.1 through 9.7.5.5 shall be sent using any data rate or MCS subject to the following constraints:

* A STA shall not transmit a frame using a rate, MCS or (MCS, number spatial streams) combination that is not supported by the receiver STA or STAs, as reported in any Supported Rates element, Extended Supported Rates element, Supported MCS Set or VHT Supported MCS Set (#4911, #4309, #4030) field in management frames transmitted by the receiver STA.
* If at least one VHT Operating Mode field with the Rx Nss Type subfield equal to 0 was received from the receiver STA:
  + A STA shall not transmit a frame with the number of spatial streams greater than that indicated in the Rx Nss subfield in the most recently received VHT Operating Mode field with the Rx Nss Type subfield equal to 0 from the receiver STA.
* If at least one VHT Operating Mode field with the Rx Nss Type subfield equal to 1 was received from the receiver STA:
* A STA shall not transmit an SU PPDU frame using a beamforming steering matrix with the number of spatial streams greater than that indicated in the Rx Nss subfield in the most recently received VHT Operating Mode field with the Rx Nss Type subfield equal to 1 from the receiver STA if the beamforming steering matrix was derived from a VHT Compressed Beamforming frame with Feedback Type subfield equal to MU. (#4911, #4309, #4030)A STA shall not transmit a frame using a value for the CH\_BANDWIDTH parameter of the TXVECTOR that is not supported by the receiver STA, as reported in any HT Operation element or VHT Operation element (#4911, #4309, #4030).
* If at least one VHT Operating Mode field with the Rx Nss Type subfield equal to 0 was received from the receiver STA:
* A STA shall not transmit a frame using a value for the CH\_BANDWIDTH parameter of the TXVECTOR that is not supported by the receiver STA as reported in the most recently received VHT Operating Mode field with the Rx Nss Type subfield equal to 0 from the receiver STA. (#4911, #4309, #4030)A STA shall not initiate transmission of a frame at a data rate higher than the greatest rate in the OperationalRateSet, the HTOperationalMCSSet or the VHTOperationalMCSSet (#4911, #4309, #4030), which are parameters of the MLMEJOIN.request primitive.

**9.31.5 VHT sounding protocol**

Change P130L59 as follows:

A beamformer that sets the Feedback Type subfield of a STA Info field to 1 shall set the Nc Index subfield of the same STA Info field to a value equal or less than the minimum of the following:

* The maximum number of supported spatial streams according to the corresponding beamformee's Rx MCS map in the VHT Supported MCS set field.
* The maximum number of supported spatial streams according to the Rx Nss field value in the VHT Operation Mode field of the most recently received VHT Operating Mode Notification frame with the Rx Nss Type subfield equal to 0 from the corresponding beamformee.

**10.38.5 VHT STA notification of operating mode changes**

Change P143L52 as follows:

A STA may use the VHT Operating Mode Notification Action frame to notify one or more VHT STAs that it is capable of receiving frames with a bandwidth up to and including the indicated Channel Width and with a number of spatial streams (#4306) up to and including the indicated Rx Nss. The VHT Operating Mode Notification frame is either sent as a group addressed frame or as one or more individually addressed frames.

A STA shall not transmit a VHT Operating Mode Notification Action frame with the value of the Rx Nss field indicating a number of spatial streams not supported by the STA, as reported in any Supported Rates element, Extended Supported Rates element, Supported MCS Set or VHT Supported MCS Set field in management frames transmitted by the STA.

A STA shall not transmit a VHT Operating Mode Notification Action frame with the value of the Channel Width field indicating a bandwidth not supported by the STA, as reported in the Supported Channel Width Set subfield in the HT Capabilitites Info field or the VHT Capabilities Info field in management frames transmitted by the STA.