IEEE P802.11
Wireless LANs

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| LB1000 CID5960 NSS support partitioning |
| Date: 2015-05-12 |
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Abstract

This document proposes a resolution for CID 5960 of LB1000 (first sponsor ballot), a comment on TGm Draft 4.0 suggesting the creation of additional partitioning of support indication for NSS values.

**REVISION NOTES:**

***Revisions to 11-14-0793:***

R0: initial

R1: R2: change table 8-251 references to 8-250, remove the word non-contiguous wherever it appeared

R3: changes to describe interaction between new 80+80 and 160 max nss subfields and basic VHT-MCS fields, modifications to indicate VHT-MCS supported set determination per operational bandwidth

R4: no conceptual changes - fix incorrect value indicated for determinant in the RX section of the determinant=1 case for both 80+80 and 160, and fix the phrase “one less than” to “two less than” in the description of the encoding for the value 2 in the Max NSS for 80+80 Adjustment and Max NSS for 160 Adjustment

R5: correct the value of Max VHT-MCS for n SS that is used to determine the maximum NSS for 80 MHz operation from a value of 0 to a value of 3

R6: Limited NSS reduction to half only. Changed MCS support to same or twice the supported NSS.

R8: added more CIDs

R9: add MIB variable

 Add modifications to subclauses affected by the Extended NSS BW Support indication – e.g. Rx Supported VHT-MCS and NSS Set

 Add VHT capability bit, do not modify existing VHT Cap definitions, but only add new functionality, replacing previously reserved bits

Update baseline text to Draft P802.11REVmc\_D4.0

Remove CID information referring to old WG letter balloting process

***Revisions to 11-15-0654:***

R0: initial – beginning with 11-14-0793r9, including the following changes:

 In Rx Supported VHT-MCS and NSS Set and Tx Supported VHT-MCS and NSS Set, change the language to only require interpretation of the half NSS bit if the recipient of the bit is capable of interpreting the bit and in the new subclause Half Maximum NSS Support Signaling, remove the text that restricted the transmission of the half NSS signalling bits only to STA that have indicated support for interpretation of the bits. This change is needed because an AP for example, can broadcast capability in a beacon to all STA, both supporters and non-supporters and the interpretation of the half NSS bits are then left to the recipients of the bits. Those recipients that have the capability are required to interpret the value of 1 and those that do not have the capability are allowed to ignore the bits.

R1: providing the alternative, recipient determined setting of the capability bits

R2: yet another alternative, that allows both BW and NSS modifications to deal with the broadcast capability information problem that is created by previous alternatives – that is – if an AP sends VHT Capability information in a broadcast Beacon, then it is unclear whether the association response information will override the Beacon information at a non-AP STA that associates with the AP, so a different signalling method is proposed which allows the creation of a “secret” extended NSS and BW operational set which is only understood by STA that have the optional capability to understand these bits.

R3: remove some inserted text that mentioned basic channel width set

 Extended NSS BW Support bit description in the table – changed TVHT case to reserved and removed change marks, as this section is new text for insertion.

R4: reorder the entries in the tables, add another entry to cover a missing case

 Some simple capitalization issues repaired

R5: Remove paragraph that said that computation of Max VHT NSS field is computed assuming that the MIB variable is false – this is not necessary when the entire set of instructions for these fields is read together

R6: editorial fixes

R7: add an explicit definition of Max VHT NSS.

R8: split table for recipient in clause 9 based on MIB variable and include Operating Mode field’s Channel Width field in the column header

 Add explicit description of what is done for NSS value and Max VHT MCS for n SS values when Max VHT NSS is doubled

 Answer the question of whether the baseline allows BSS BW to exceed AP BW? (yes)

Add changes to Operating Mode field Rx NSS value

Add changes to 9.34.5.2 Rules for VHT sounding protocol sequences where NSS is referenced

Add changes to 10.4.2 TSPEC construction which references NSS

Add new field Dynamic Extended NSS BW field to Operating Mode field and associated table

Simplify language in 9.34.5.2 and 10.42

R9: Add a capability bit and language on behaviour of a STA that is capable of the new signalling and that associates with a STA that is not capable – such a STA may advertise the new capability but shall not use the new capability. This deals with the problem of a STA that understands the new capability but does not use an encoding that is distinguishable from a legacy encoding. An associating STA cannot distinguish such a NSS BW capable STA from a non NSS BW capable STA and therefore, is unable to determine whether the associated STA is capable of interpreting the new signalling bits that it uses. If the associated STA is not capable, then the associating STA should not use those NSS BW combinations of which it is capable, but that the associated STA is unaware. The changes add a bit to indicate support for the mechanism and adds behavioural rules in 10.40.8 Extended NSS BW Support Signaling and a note in the RX Supported VHT MCS and NSS and TX Supported VHT MCS and NSS subclauses.

R10: Add ¾ mode

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 TGmc Draft. This introduction is not part of the adopted material.

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

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

**CID LIST:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 5960 | Matthew Fischer | 1306.9 | 9.7.12.1 | Some implementations could have a maximum VHT NSS value that is dependent on the bandwidth of operation. Signaling to support this behavior is desired. Specifically, there is likely to be a difference between maximum NSS support for the 80+80 and 160 MHz bandwidths vs the 20, 40 and 80 MHz bandwidths. | Provide the necessary signaling to allow bandwidth dependent maximum VHT NSS values to be indicated. A presentation will be provided with specific details as to how to accomplish this. Propagate the changes to TVHT. | Revise - generally agree with commenter, TGmc editor to execute proposed changes from 11-15-0654r10 found under all headings which include CID5960 |

**Discussion:**

Implementations can benefit from subsets of functionality that have a finer resolution than the current capabilities fields allow.

With respect to the question of whether a VHT AP can signal a BSS BW that is greater than the AP BW capability, nowhere in the baseline is there a restriction against doing this:

**10.40 VHT BSS operation**

**10.40.1 Basic VHT BSS functionality**

A VHT STA has dot11VHTOptionImplemented equal to true.

A STA that is starting a VHT BSS shall be able to receive and transmit at each of the <VHT-MCS, NSS> tuple values indicated by the **Basic** VHT-MCS and NSS Set field of the VHT Operation parameter of the MLME-START.request primitive and shall be able to receive at each of the <VHT-MCS, NSS> tuple values indicated by the Supported VHT-MCS and NSS Set field of the VHT Capabilities parameter of the MLMESTART.request primitive.

…

A STA that is a VHT AP or a VHT mesh STA declares its channel width capability in the Supported Channel Width Set subfield of the VHT Capabilities element VHT Capabilities Info field as described in Table 8-240 (Subfields of the VHT Capabilities Info field).

A STA that is a VHT AP or a VHT mesh STA shall set the STA Channel Width subfield in the HT Operation element HT Operation Information field and the Channel Width subfield in the VHT Operation element VHT Operation Information field to indicate the BSS operating channel width as defined in Table 10-25 (VHT BSS operating channel width).



**Proposed changes**

The proposed changes add a few new subfields to describe the partitioning of NSS support over a broader range of BW and MU/SU values than is currently describable.

**CID 5960**

**4.3.13 Television very high throughput (TVHT) STA**

***TGmc editor: add a new item to the list of TVHT replacments within subclause 4.3.13 Television very high throughput (TVHT) STA:***

* “dot11TVHTExtendedNSSBWSignalingOptionImpelemented” replaces “dot11VHTExtendedNSSBWSignalingOptionImplemented”.

***TGmc editor: modify Table 8-72 – Subfield values of the Operating Mode field by changing the contents of the row that has the value “Rx NSS” in the Subfield column, as shown:***

**8.4.1.52 Operating Mode field**

|  |  |
| --- | --- |
| **Subfield** | **Description** |
| Rx NSS | If the Rx NSS Type subfield is 0, the value of this field, combined with other information described in 8.4.2.157.3, indicates the maximum number of spatial streams that the STA can receive.If the Rx NSS Type subfield is 1, the value of this field, combined with other information described in 8.4.2.157.3, indicates the maximum number of spatial streams that the STA can receive as a beamformee in an SU PPDU using a beamforming steering matrix derived from a VHT Compressed Beamforming report with Feedback Type subfield indicating MU in the corresponding VHT Compressed Beamforming frame sent by the STA.Set to 0 for NSS = 1Set to 1 for NSS = 2…Set to 7 for NSS = 8 |

***TGmc editor: modify Figure 8-115 – Operating Mode field by changing the two reserved bits to be a new field “Dynamic Extended NSS BW”, and add the following row to Table 8-72 – Subfield values of the Operating Mode field.***

|  |  |
| --- | --- |
| **Subfield** | **Description** |
| Dynamic Extended NSS BW field | The Dynamic Extended NSS BW field, combined with the Supported Channel Width Set field and the Supported VHT-MCS and NSS Set field indicates whether 80+80 MHz and 160 MHz operation is supported. In addition, the Dynamic Extended NSS BW Support field, combined with the Supported VHT-MCS and NSS Set field indicates extensions to the maximum NSS supported for each bandwidth of operation. The use of these fields is described in 9.7.12.1 (Rx Supported VHT-MCS and NSS Set) and 9.7.12.2 (Tx Supported VHT-MCS and NSS Set) and 10.40.8 (Extended NSS BW Support Support Signaling). See Table 8-240fff. |

***TGmc editor: insert the new Table 8-240fff Setting of the Channel Width subfield and Dynamic Extended NSS BW subfield at a STA transmitting the Operating Mode field within subclause 8.4.1.52 Operating Mode field, as shown:***

**Table 8-240fff—Setting of the Channel Width subfield and Dynamic Extended NSS BW subfield at a STA transmitting the Operating Mode field**

|  |  |  |
| --- | --- | --- |
| **Channel Width**  | **Dynamic Extended NSS BW**  | **Meaning** |
| 0 | 0 | Transmitting STA (See NOTE 1) supports 20, 40, and 80 MHz PPDUs at Max VHT NSS – See NOTE 2. Transmitting STA does not support 160 MHz PPDUs and transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 1 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz PPDUs at **half** Max VHT NSS. See NOTE 3. Transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 2 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at **half** Max VHT NSS. |
| 0 | 3 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 0 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 1 | Transmitting STA supports 20, 40, 80 and 160 MHz PPDUs at max VHT NSS, Transmitting STA supports 80+80MHz PPDUs at **half** Max VHT NSS. |
| 1 | 2 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 3 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at 2xMax VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 0 | Transmitting STA supports 20, 40, 80, 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 1 | Reserved |
| 2 | 2 | Reserved |
| 2 | 3 | Transmitting STA supports 20, 40, and 80 PPDUs at 2xMax VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at Max VHT NSS. |
| 3 | 0 | Reserved |
| 3 | 1 | Reserved |
| 3 | 2 | Reserved |
| 3 | 3 | Reserved |
| NOTE 1 – A transmitting STA refers to the STA transmitting the Channel Width and Dynamic Extended NSS BW bits of the Operating Mode field.NOTE 2 – Max VHT NSS is defined per MCS in 8.4.2.157.3 (Supported VHT-MCS and NSS Set field)NOTE 3 – Half Max VHT NSS is equal to one half of Max VHT NSS rounded down to the nearest integer.NOTE 4 – Three fourths Max VHT NSS is equal to three fourths of Max VHT NSS rounded down to the nearest integer. |

**8.4.2.157.2 VHT Capabilities Info field**

***TGmc editor: modify the VHT Capabilities Info field of the VHT Capabilities element by changing the reserved bits B30 and B31 of Figure 8-554 – VHT Capabilities Info field within subclause 8.4.2.157.2 VHT Capabilities Info field to become “Extended NSS BW Support”***

***TGmc editor: add the following paragraph in an appropriate location within subclause 8.4.2.157.2 VHT Capabilities Info field to describe the new bit “Extended NSS BW Support”of the VHT Capabilities Info field:***

The Extended NSS BW Support field, combined with the Supported Channel Width Set field and the Supported VHT-MCS and NSS Set field indicates whether 80+80 MHz and 160 MHz operation is supported. In addition, the Extended NSS BW Support field, combined with the Supported VHT-MCS and NSS Set field indicates extensions to the maximum NSS supported for each bandwidth of operation. The use of these fields is described in 9.7.12.1 (Rx Supported VHT-MCS and NSS Set) and 9.7.12.2 (Tx Supported VHT-MCS and NSS Set) and 10.40.8 (Extended NSS BW Support Support Signaling).

***TGmc editor: modify the “Supported Channel Width Set” row of Table 8-240 Subfields of the VHT Capabilities Info field within subclause 8.4.2.157.2 VHT Capbilities Info field, as shown:***

**Table 8-240—Subfields of the VHT Capabilities Info field**

|  |  |  |
| --- | --- | --- |
| Supported ChannelWidth Set | Together with the Extended NSS BW Support subfield, indicates the channel widths supported by the STA. See 10.40 (VHT BSS operation). | For a non-TVHT STA:See Table 8-240bb (Setting of the Supported Channel Width Set subfield and Extended NSS BW Support subfield at a STA transmitting the VHT Capabilities Info field).For a TVHT STA, the field isstructured into subfields as defined in Figure 8-553a.For a TVHT STA, set the TVHT\_MODE\_2C Support subfield to 1 if it supports TVHT\_MODE\_2C; otherwise set the subfield to 0.For a TVHT STA, set the TVHT\_MODE\_2N Support subfield to 1 if it supports TVHT\_MODE\_2N; otherwise set the subfield to 0. |

***TGmc editor: modify Table 8-240 Subfields of the VHT Capabilities Info field within subclause 8.4.2.157.2 VHT Capbilities Info field, by adding a row as shown:***

**Table 8-240—Subfields of the VHT Capabilities Info field**

|  |  |  |
| --- | --- | --- |
| Extended NSS BW Support | Together with the Supported Channel Width Set subfield and Supported VHT-MCS and NSS Set field, indicates the channel widths and maximum NSS values per width supported by the STA. See 10.40 (VHT BSS operation). | For a non-TVHT STA:See Table 8-240bb. For a TVHT STA, the field is reserved. |

***TGmc editor: insert the new Table 8-240bb Setting of the Supported Channel Width Set and Extended NSS BW Support subfield at a STA transmitting the VHT Capabilities Info field within subclause 8.4.2.157.2 VHT Capbilities Info field, as shown:***

**Table 8-240bb—Setting of the Supported Channel Width Set subfield and Extended NSS BW Support subfield at a STA transmitting the VHT Capabilities Info field**

|  |  |  |
| --- | --- | --- |
| **Supported Channel Width Set** | **Extended NSS BW Support** | **Meaning** |
| 0 | 0 | Transmitting STA (See NOTE 1) supports 20, 40, and 80 MHz PPDUs at Max VHT NSS – See NOTE 2. Transmitting STA does not support 160 MHz PPDUs and transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 1 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz PPDUs at **half** Max VHT NSS. See NOTE 3. Transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 2 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at **half** Max VHT NSS. |
| 0 | 3 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 0 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 1 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at **half** Max VHT NSS. |
| 1 | 2 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 3 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at 2xMax VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 0 | Transmitting STA supports 20, 40, 80, 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 1 | Reserved |
| 2 | 2 | Reserved |
| 2 | 3 | Transmitting STA supports 20, 40, and 80 PPDUs at 2xMax VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at Max VHT NSS. |
| 3 | 0 | Reserved |
| 3 | 1 | Reserved |
| 3 | 2 | Reserved |
| 3 | 3 | Reserved |
| NOTE 1 – A transmitting STA refers to the STA transmitting the Supported Channel Width Set and Extended NSS BW Support bits of the VHT Capabilities Info field.NOTE 2 – Max VHT NSS is defined per MCS in 8.4.2.157.3 (Supported VHT-MCS and NSS Set field)NOTE 3 – Half Max VHT NSS is equal to one half of Max VHT NSS rounded down to the nearest integer.NOTE 4 – Three fourths Max VHT NSS is equal to three fourths of Max VHT NSS rounded down to the nearest integer. |

**8.4.2.157.3 Supported VHT-MCS and NSS Set field**

***TGmc editor: change the reserved bit B61 of Figure 8-557 Supported VHT-MCS and NSS Set field to “VHT Extended NSS BW Capable”.***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B15 | B16 B28 | B29 B31 | B32 B47 | B48 B60 |  B61 | B62 B63 |
|  | Rx VHT-MCS Map | Rx Highest Supported Long GI Data Rate | Reserved | Tx VHT-MCS Map | Tx Highest Supported Long GI Data Rate | VHT Extended BW NSS Capable | Reserved |
| Bits: | 16 | 13 | 3 | 16 | 13 | 1 | 2 |

***TGmc editor: modify some of the text in subclause 8.4.2.157.3 Supported VHT-MCS and NSS Set field, as shown, including the addition of a new row in Table 8-241 – Supported VHT-MCS and NSS Set subfields:***

The Supported VHT-MCS and NSS Set field’s subfields are defined in Table 8-241 (Supported VHT-MCS and NSS Set subfields).

**Table 8-241—Supported VHT-MCS and NSS Set subfields**

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| Rx VHT-MCSMap | Indicates the maximum value of the RXVECTOR parameter MCS of a PPDU that can be received at all channel widths supported by this STA for each number of spatial streams. The maximum value of the RXVECTOR parameter MCS of a PPDU is further modified by the Extended NSS BW Support subfield as described in 8.4.2.157.2 (VHT Capabilities Info field) and the Dynamic Extended NSS BW Support field of the Operating Mode field in 8.4.1.52. | The format and encoding of this subfield are defined in Figure 8-556 (Rx VHT-MCS Map and Tx VHT-MCS Map subfields and Basic VHT-MCS and NSS Set field(11ac)) and the associated description. |
| Rx Highest Supported Long GI Data Rate | Indicates the highest long GI VHT PPDU data rate that the STA is able to receive. | The largest integer value less than or equal to the highest long GI VHT PPDU data rate in Mb/s the STA is able to receive (see 9.7.12.1 (Rx Supported VHT-MCS and NSS Set(11ac))).The value 0 indicates that this subfield does not specify the highest long GI VHT PPDU data rate that the STA is able to receive. |
| Tx VHT-MCSMap | Indicates the maximum value of the TXVECTOR parameter MCS of a PPDU that can be transmitted at all channel widths supported by this STA for each number of spatial streams. The maximum value of the TXVECTOR parameter MCS of a PPDU is further modified by the Extended NSS BW Support subfield, as described in 8.4.2.157.2 (VHT Capabilities Info field) and the Dynamic Extended NSS BW Support field of the Operating Mode field in 8.4.1.52. | The format and encoding of this subfield are defined in Figure 8-556 (Rx VHT-MCS Map and Tx VHT-MCS Map subfields and Basic VHT-MCS and NSS Set field(11ac)) and the associated description. |
| Tx Highest Supported Long GI Data Rate | Indicates the highest long GI VHT PPDU data rate that the STA is able to transmit at. | The largest integer value less than or equal to the highest long GI VHT PPDU data rate in Mb/s that the STA is able to transmit (see 9.7.12.2 (Tx Supported VHT-MCS and NSS Set(11ac))).The value 0 indicates that this subfield does not specify the highest long GI VHT PPDU data rate that the STA is able to transmit. |
| VHT Extended NSS BW Capable | Indicates if the STA is capable of interpreting the Extended NSS BW Support bits. | Set to 1 to indicate that the STA is capable of interpreting the Extended NSS BW bits.Set to 0 otherwise. |

The Rx VHT-MCS Map subfield and the Tx VHT-MCS Map subfield have the structure shown in Figure 8-557 (Rx VHT-MCS Map and Tx VHT-MCS Map subfields and Basic VHT-MCS and NSS Set field).



The Max VHT-MCS For *n* SS subfield (where *n* = 1, ..., 8) is encoded as follows:

— 0 indicates support for VHT-MCS 0-7 for *n* spatial streams

— 1 indicates support for VHT-MCS 0-8 for *n* spatial streams

— 2 indicates support for VHT-MCS 0-9 for *n* spatial streams

— 3 indicates that *n* spatial streams is not supported

The value of Max VHT NSS is equal to the smaller of:

* the maximum value of *n* for which the Max VHT-MCS for *n* SS has a value that is not equal to 3
* the maximum supported NSS as indicated by the value of the Rx NSS field of the Operation Mode Notification frame

NOTE—A VHT-MCS indicated as supported in the VHT-MCS Map fields for a particular number of spatial streams might not be valid at all bandwidths (see 22.5 (Parameters for VHT-MCSs)) and might be limited by the declaration of Tx Highest Supported Long GI Data Rates and Rx Highest Supported Long GI Data Rates and might be affected by 9.7.12.3 (Additional rate selection constraints for VHT PPDUs) and the value of the Extended NSS BW Support field of the VHT Capabilities Info field in 8.4.2.157.2 and the Dynamic Extended NSS BW Support field of the Operating Mode field in 8.4.1.52.

***TGmc editor: modify subclause 9.7.12.1 Rx Supported VHT-MCS and NSS Set and 9.7.12.2 Tx Supported VHT-MCS and NSS Set as shown:***

**9.7.12.1 Rx Supported VHT-MCS and NSS Set**

The Rx Supported VHT-MCS and NSS Set of a first VHT STA is determined by a second VHT STA for each <VHT-MCS, NSS> tuple NSS = 1,…, 8 and bandwidth (20 MHz, 40 MHz, 80 MHz, and 160 MHz or 80+80 MHz) from the Supported VHT-MCS and NSS Set field received from the first STA as follows:

— If support for the VHT-MCS for NSS spatial streams for a bandwidth is mandatory (see 22.5 (Parameters for VHT-MCSs)), then the <VHT-MCS, NSS> tuple at that bandwidth is supported by the STA on receive.

— Otherwise, if the Max VHT-MCS For *n* SS subfield (*n* = NSS) in the Rx VHT-MCS Map subfield indicates support and the Rx Highest Supported Long GI Data Rate subfield is equal to 0, then the <VHT-MCS, NSS*>* tuple at that bandwidth is supported by the STA on receive, except that if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is false, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa1 and if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is true, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa2.

— Otherwise, if the Max VHT-MCS For *n* SS subfield (*n* = NSS) in the Rx VHT-MCS Map subfield indicates support and the data rate for long GI of the MCS for NSS spatial streams at that bandwidth (expressed as the largest integer in Mb/s that is less than or equal to the data rate) is less than or equal to the rate represented by the Rx Highest Supported Long GI Data Rate subfield, then the <VHT-MCS, NSS> tuple at that bandwidth is supported by the STA on receive, except that if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is false, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa1 and if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is true, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa2.

— Otherwise, the <VHT-MCS, NSS> tuple at that bandwidth is not supported by the STA on receive.

The <VHT-MCS, NSS> tuples excluded by 9.7.12.3 (Additional rate selection constraints for VHT PPDUs) are also eliminated from the Rx Supported VHT-MCS and NSS Set.

A VHT STA shall not, unless explicitly stated otherwise, transmit a VHT PPDU unless the <VHT-MCS, NSS> tuple and bandwidth used are in the Rx Supported VHT-MCS and NSS Set of the receiving STA(s).

NOTE—Support for a <VHT-MCS, NSS> tuple at a given bandwidth implies support for both long GI and short GI on receive, if short GI is supported at that bandwidth.

NOTE – A STA can determine the expected interpretation of its Supported Channel Width Set and Channel Width and Dynamic Extended NSS BW and Extended NSS BW Support fields at a recipient by examining the VHT Extended NSS BW Capable field value in the Supportred VHT-MCS and NSS Set field of the recipient.

**Table 9-aaa1—Interpretation of the Supported Channel Width Set and Extended NSS BW Support bits of the VHT Capabilities Info field and the Channel Width field of the Operating Mode field at a receiving STA with a value of false for dot11VHTExtendedNSSBWSignalingOptionImplemented**

|  |  |  |
| --- | --- | --- |
| **Smaller of the Supported Channel Width Set and the Channel Width** | **Most recently received value of the Dynamic Extended NSS BW field or the value of the received Extended NSS BW Support field if no Dynamic Extended NSS BW Support field has been received** | **Meaning if dot11VHTExtendedNSSBWSignalingOptionImplemented of the STA receiving the VHT Capability field is False** |
| 0 | 0 | Transmitting STA (See NOTE 1) supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. (See NOTE 2) Transmitting STA does not support 160 MHz PPDUs and transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 1 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 160 MHz PPDUs and Transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 2 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 160 MHz PPDUs and Transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 3 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 160 MHz PPDUs and Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 0 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 1 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 2 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 3 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 2 | 0 | Transmitting STA supports 20, 40, 80, and 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 1 | Transmitting STA supports 20, 40, 80, and 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 2 | Transmitting STA supports 20, 40, 80, and 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 3 | Transmitting STA supports 20, 40, 80, and 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 3 | 0 | Reserved |
| 3 | 1 | Reserved |
| 3 | 2 | Reserved |
| 3 | 3 | Reserved |
| NOTE 1 – A transmitting STA refers to the STA transmitting the Supported Channel Width Set and Extended NSS BW Support bits of the VHT Capabilities Info field.NOTE 2 – Max VHT NSS is defined per MCS in 8.4.2.157.3NOTE 2 – Half Max VHT NSS is equal to one half of Max VHT NSS rounded down to the nearest integer. |

**Table 9-aaa2—Interpretation of the Supported Channel Width Set and Extended NSS BW Support bits of the VHT Capabilities Info field and the Channel Width field of the Operating Mode field at a receiving STA with a value of true for dot11VHTExtendedNSSBWSignalingOptionImplemented**

|  |  |  |
| --- | --- | --- |
| **Smaller of the Supported Channel Width Set and the Channel Width** | **Most recently received value of the Dynamic Extended NSS BW field or the value of the received Extended NSS BW Support field if no Dynamic Extended NSS BW Support field has been received** | **Meaning if dot11VHTExtendedNSSBWSignalingOptionImplemented of the STA receiving the VHT Capability field is True** |
| 0 | 0 | Transmitting STA (See NOTE 1) supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. See NOTE 2. Transmitting STA does not support 160 MHz PPDUS and transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 1 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz PPDUs at **half** Max VHT NSS. See NOTE 3. Transmitting STA does not support 80+80 MHz PPDUs. |
| 0 | 2 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at **half** Max VHT NSS. |
| 0 | 3 | Transmitting STA supports 20, 40, and 80 MHz PPDUs at Max VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 0 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA does not support 80+80 MHz PPDUs. |
| 1 | 1 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at half Max VHT NSS. |
| 1 | 2 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at Max VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at three fourths Max VHT NSS. |
| 1 | 3 | Transmitting STA supports 20, 40, 80, and 160 MHz PPDUs at 2xMax VHT NSS. Transmitting STA supports 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 0 | Transmitting STA supports 20, 40, 80, and 160, and 80+80 MHz PPDUs at Max VHT NSS. |
| 2 | 1 | Reserved |
| 2 | 2 | Reserved |
| 2 | 3 | Transmitting STA supports 20, 40, and 80 PPDUs at 2xMax VHT NSS. Transmitting STA supports 160 MHz and 80+80 MHz PPDUs at Max VHT NSS. |
| 3 | 0 | Reserved |
| 3 | 1 | Reserved |
| 3 | 2 | Reserved |
| 3 | 3 | Reserved |
| NOTE 1 – A transmitting STA refers to the STA transmitting the Supported Channel Width Set and Extended NSS BW Support bits of the VHT Capabilities Info field.NOTE 2 – Max VHT NSS is defined per MCS in 8.4.2.157.3NOTE 3 – Half Max VHT NSS is equal to one half of Max VHT NSS rounded down to the nearest integer.NOTE 4 – Three fourths Max VHT NSS is equal to three fourths of Max VHT NSS rounded down to the nearest integer. |

**9.7.12.2 Tx Supported VHT-MCS and NSS Set**

The Tx Supported VHT-MCS and NSS Set of a first VHT STA is determined by a second STA for each <VHT-MCS, NSS> tuple NSS = 1,…, 8 and bandwidth (20 MHz, 40 MHz, 80 MHz, and 160 MHz or 80+80 MHz) from the Supported VHT-MCS and NSS Set field received from the first STA as follows:

— If support for the <VHT-MCS, NSS> tuple at for a bandwidth is mandatory (see 22.5 (Parameters for VHT-MCSs)), then the <VHT-MCS, NSS> tuple at that bandwidth is supported by the STA on transmit.

— Otherwise, if the Max VHT-MCS for n SS subfield (n = NSS) in the Tx VHT-MCS Map subfield indicates support and the Tx Highest Supported Long GI Data Rate subfield is equal to 0, then the <VHT-MCS, NSS> tuple at that bandwidth is supported by the STA on transmit, except that if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is false, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa1 and if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is true, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9-aaa2.

— Otherwise, if the Max VHT-MCS for n SS subfield (n = NSS) in the Tx VHT-MCS Map subfield indicates support and the data rate for long GI of the <VHT-MCS, NSS> tuple at that bandwidth (expressed as the largest integer in Mb/s that is less than or equal to the data rate) is less than or equal to the rate represented by the Tx Highest Supported Long GI Data Rate subfield, then the <VHT-MCS, NSS> tuple at that bandwidth is supported by the STA on transmit, except that if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is false, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9- aaa1 and if the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the second STA is true, the supported bandwidth values and NSS values of each <VHT-MCS, NSS> tuple are updated according to Table 9- aaa2.

— Otherwise, the <VHT-MCS, NSS> tuple at that bandwidth is not supported by the STA on transmit.

NOTE—In contrast to reception, support for short GI transmissions by a STA cannot be determined by other STAs.

NOTE – A STA can determine the expected interpretation of its Supported Channel Width Set and Channel Width and Dynamic Extended NSS BW and Extended NSS BW Support fields at a recipient by examining the VHT Extended NSS BW Capable field value in the Supportred VHT-MCS and NSS Set field of the recipient.

***TGmc editor: modify some of the text within subclause 9.34.5.2 Rules for VHT sounding protocol sequences as shown:***

**9.34.5.2 Rules for VHT sounding protocol sequences**

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

* The maximum number of supported spatial streams for receive operation according to the combination of the corresponding VHT beamformee’s Rx VHT-MCS Map subfield in the Supported VHT-MCS and NSS Set field and VHT Capabilities Info field
* The maximum number of supported spatial streams according to the Rx NSS subfield value and, when the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the VHT Beamformee is true, the Dynamic Extended NSS BW Support value in the Operating Mode field of the most recently received Operating Mode Notification frame or Operating Mode Notification element with the Rx NSS Type subfield equal to 0 from the corresponding VHT beamformee, as computed according to 9.7.12.1

A VHT beamformee that transmits a VHT Compressed Beamforming frame shall set the Feedback Type field in the VHT MIMO Control field to the same value as the Feedback Type field in the corresponding STA Info field in the VHT NDP Announcement frame. If the Feedback Type field indicates MU, the STA shall send a VHT Compressed Beamforming frame with the Nc Index field value in the VHT MIMO Control field equal to the minimum of all of the following:

* The Nc Index field value in the corresponding STA Info field in the VHT NDP Announcement Frame
* The maximum number of supported spatial streams for receive operation according to the combination of its Rx VHT-MCS Map subfield in the Supported VHT-MCS and NSS Set field, VHT Capabilities Info field and Operating Mode field (see 9.7.12.1)
* The maximum number of supported spatial streams according to the Rx NSS subfield value and, when the value of dot11VHTExtendedNSSBWSignalingOptionImplemented of the VHT Beamformee is true, the Dynamic Extended NSS BW Support value in the Operating Mode field of the most recently received Operating Mode Notification frame or Operating Mode Notification element from the corresponding VHT beamformee, as computed according to 9.7.12.1

***TGmc editor: modify some of the text from 10.4.2 TSPEC construction as shown:***

**10.4.2 TSPEC construction**

TSPECs and DMG TSPECs are constructed at the SME, from application requirements supplied via the SME, and with information specific to the MAC layer.

The value of the Minimum PHY Rate in a TSPEC shall satisfy the following constraints:

a) for an uplink TS, it

— is included in dot11SupportedDataRatesTxTable and in the AP's operational rate set, or

— corresponds to an HT MCS included in dot11HTSupportedMCSTxTable, if present, and in the AP's operational HT MCS set, if defined, at a bandwidth and guard interval supported by the non-AP STA on transmission and permitted in the BSS, or

— corresponds to a VHT-MCS and NSS for which support is indicated by the combination of the Tx VHT-MCS Map subfield in the VHT Operation parameter of the MLME-(RE)ASSOCIATE.request primitive, if present, and the AP's operational VHT-MCS and NSS set, if defined, and the VHT Capabilities Info field, at a bandwidth and guard interval supported by the non-AP STA on transmission and permitted in the BSS.

b) for a downlink TS, it

— is included in the OperationalRateSet parameter of the MLME-JOIN.request primitive and supported by the AP on transmission, or

— corresponds to an HT MCS included in dot11HTSupportedMCSRxTable, if present, and supported by the AP on transmission, at a bandwidth and guard interval supported by the non-AP STA on reception and permitted in the BSS,48 or

— corresponds to a VHT-MCS and NSS for which support is indicated by the Rx VHT-MCS Map subfield in the VHT Operation parameter of the MLME-(RE)ASSOCIATE.request primitive, if present, and the Tx VHT-MCS Map subfield of the VHT Operation element advertised by the AP, if present, and the VHT Capabilities Info field, at a bandwidth and guard interval supported by the non-AP STA on reception and permitted in the BSS.

c) for a bidirectional TS, it satisfies both a) and b) above.

***TGmc editor: add a new subclause 10.40.8 Extended NSS BW Support Support Signaling, to appear immediately following subclause 10.40.7 BSS basic VHT-MCS and NSS set operation as shown:***

**10.40.8 Extended NSS BW Support Signaling**

If the value of dot11VHTExtendedNSSBWSignalingOptionImplemented is false, a STA shall set the Extended NSS BW Support Signaling Support subfield of the VHT Capabilities Info field to 0 in VHT Capability elements that it transmits, otherwise, the subfield may be set to 1, 2 or 3 as indicated in 8.4.2.157.2 (VHT Capabilities Info field).

If the value of dot11VHTExtendedNSSBWSignalingOptionImplemented is false, a STA shall set the VHT Extended NSS BW Capable subfield of the Supported VHT-MCS and NSS Set field to 0 in VHT Capability elements that it transmits, otherwise, the subfield shall be set to 1.

***TGmc editor: modify the text from 10.23.6.4.1 General as shown:***

**10.23.6.4.1 General**

A wideband off-channel TDLS direct link may be started if both TDLS peer STAs indicated wideband support in the VHT Capabilities element VHT Capabilities Info field included in the TDLS Setup Request frame or the TDLS Setup Response frame.

***TGmc editor: modify the text from 10.40.1 Basic VHT BSS functionality as shown:***

**10.40.1 Basic VHT BSS functionality**

A STA that is a VHT AP or a VHT mesh STA declares its channel width capability in the the VHT Capabilities element VHT Capabilities Info field as described in Table 8-240 (Subfields of the VHT Capabilities Info field).

A VHT STA shall not transmit to a second VHT STA using a bandwidth that is not indicated as supported in the Supported Channel Width Set subfield in the HT Capabilities element or in the VHT Capabilities Info field of the VHT Capabilities element received from that VHT STA.

**10.40.1 Basic VHT BSS functionality**

At a minimum, a VHT STA sets the Rx MCS Bitmask of the Supported MCS Set field of its HT Capabilities

element according to the setting of the Rx VHT-MCS Map subfield of the Supported VHT-MCS and NSS

Set field of its VHT Capabilities element as follows: for each subfield Max VHT-MCS For *n* SS, ,

of the Rx VHT-MCS Map field with a value other than 3 (no support for that number of spatial streams), the

STA shall indicate support for MCSs 8(*n–*1) to 8(*n–*1)+7 in the Rx MCS Bitmask, where *n* is the number of

spatial streams, except for those MCSs marked as unsupported as described in 9.7.12.3 (Additional rate

selection constraints for VHT PPDUs).

***TGmc editor: modify the text from 10.42 Notification of operating mode changes as shown:***

**10.42 Notification of operating mode changes**

A STA shall not transmit an Operating Mode field with the value of the Channel Width subfield indicating a bandwidth not supported by the STA, as reported in the Supported Channel Width Set subfield in the HT Capability Information field or in the VHT Capabilities Info field in Management frames transmitted by the STA.

The Operating Mode field in the Operating Mode Notification frame or the Operating Mode Notification element together with the Supported Channel Width set field and the Extended NSS BW Support field of the VHT Capabilities element indicates the transmitting STA’s receive bandwidth and NSS capabilties. See 9.7.12.1

***TGmc editor: modify the text from 10.43 Basic TVHT BSS functionality as shown:***

**10.43 Basic TVHT BSS functionality**

The STA that is creating a TVHT BSS shall be able to receive and transmit at each of the <VHT-MCS, NSS> tuple values indicated by the Basic VHT-MCS and NSS Set field of the VHT Operation parameter of the MLME-START.request primitive and shall be able to receive at each of the <VHT-MCS, NSS> tuple values indicated by the Supported VHT-MCS and NSS Set field of the VHT Capabilities parameter of the MLME-START.request primitive. A STA for which dot11TVHTOptionImplemented is true shall set dot11VHTOptionImplemented to true.

A TVHT AP declares its channel width capability in the VHT Capabilities element VHT Capabilities Info field, as defined in 8.4.2.157 (VHT Capabilities element).

A TVHT STA shall not transmit to a TVHT STA using a bandwidth that is not indicated as supported in the VHT Capabilities element or Operating Mode Notification frame recently received from that TVHT STA.

***TGmc editor: add the following new MIB variable to the dot11StationConfig group and add a corresponding value in the group’s SEQUENCE definition and add an appropriate entry to the dot11VHTMACAdditions Object-group:***

**C.3 MIB Detail**

dot11VHTExtendedNSSBWSignalingOptionImplemented OBJECT-TYPE

SYNTAX Integer {0..3}

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates that the IEEE 802.11 VHT Extended NSS BW Support Signaling option is implemented. The value 0 means that the device support same NSS at all its supported bandwidths. When dot11VHTChannelWidthOptionImplemented is 0, the value 1 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80MHz at Max VHT NSS, 160MHz at the ceil of Max VHT NSS divided by 2, and no support of 80+80MHz. When dot11VHTChannelWidthOptionImplemented is 0, the value 2 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80MHz at Max VHT NSS, 160/80+80MHz at the ceil of Max VHT NSS divided by 2. When dot11VHTChannelWidthOptionImplemented is 0, the value 3 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80MHz at Max VHT NSS, 160/80+80MHz at the ceil of ¾\*Max VHT NSS.

When dot11VHTChannelWidthOptionImplemented is 1, the value 1 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80/160MHz at Max VHT NSS, 80+80MHz at the ceil of Max VHT NSS divided by 2. When dot11VHTChannelWidthOptionImplemented is 1, the value 2 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80/160MHz at Max VHT NSS, 80+80MHz at the ceil of three fourths of the Max VHT NSS. When dot11VHTChannelWidthOptionImplemented is 1, the value 3 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80MHz at 2\*Max VHT NSS, 160/80+80MHz at the Max VHT NSS.

When dot11VHTChannelWidthOptionImplemented is 2, the value 3 of dot11VHTExtendedNSSBWSignalingOptionImplemented means 20/40/80/160MHz at 2\*Max VHT NSS, 80+80MHz at the Max VHT NSS"

DEFVAL { false }

::= { dot11StationConfigEntry <ANA> }

dot11VHTExtendedNSSBWCapable OBJECT-TYPE

SYNTAX Truthvalue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute, when true, indicates that the IEEE 802.11 VHT Extended NSS BW Support Signaling option is implemented.

DEFVAL { false }

::= { dot11StationConfigEntry <ANA> }

**References:**