IEEE P802.11
Wireless LANs

|  |
| --- |
| OM Control Comment Resolutions |
| Date: 2018-09-05 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Jarkko Kneckt | Apple Inc. | Cupertino, CA |  | jkneckt@apple.com |
|  |  |  |  |  |

Abstract

The submission contains commetn resolution for the OM Control related comment

The following 23 CIDs are solved: 15010, 15011, 15105, 15173, 15372, 15734, 15735, 15736, 15737, 15766, 15864, 15865, 15990, 16615, 16188, 16362, 16488, 16489, ~~16602,~~ 17016, 17017, 17031, 17033 and 17034.

Main changes in R2:

* The UL MU Disallow and Data in UL MU Disallow subfield names are changed and the description is updated to use the new names.
* Updates on various comment resolutions based on the feedback from the July IEEE meeting.
* CID 16602 is already solved in July IEEE meeting.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 15010 | 73.06 | The field names [UL MU (Data) Disable)] and the description text in the table is misleading. The intention is to inform the AP that the transmitting non-AP STA doesn't want to be triggered (for UL data or any form of UL) - it doesn't matter if the TF is soliciting response just from this STA or from multiple STAs (which includes this STA). The description in table 9-18b suggest that it is applicable to only the MU case. E.g., "All UL MU transmissions are suspended...". | Generalize the description (and perhaps the field names) to indicate that the STA is disabling TB Response or TB Data Transmissions. |  Revised. Agree in principle with the comment. The UL MU Disable includes also MU-RTS, so denying HE TB PPDUs is not correct, it could have allowed responses to MU-RTS. Change throughout the ax spec the following term: the following terms:1 UL MU Disable to Trigger Response Disabled. 2 Change the UL MU Data Disabled to Data In HE TB PPDU Disabled3 Change the OM Control UL MU Data Disable RX Support subfield to HE TB PPDU Data Disable Support subfield.- TGax editor to make changes as shown in 11-18/1246r2that are marked with CID 15010. |
| 15011 | 73.06 | The combination of 1,1 in Table 9-18b should be reserved. The 3 other combinations cover all possible TB Response scenarios. | Mark the 3rd and 4th column for 1,1 combination as Reserved |  Revised. The Table 9-18b is deleted by #15010. - TGax editor to make changes as shown in 11-18/1246r2that are marked with CID 15011. |
| 15105 | 332.12 | Can an AP know if an associated STA is able to close the link only using narrow band RUs? | Please clarify |  Rejected. The logic how AP uses the field is outside of the 802.11ax standard.  |
| 15173 | 73.38 | Copy paste error for the last row. | Remove the text in the last row. This value is reserved. |  Revised. The Table is 9-8b is deleted. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15173. |
| 15372 | 337.02 | Conditional and it is not indicated whether the value is set or equal to. | Change "When" to "if", and add "are set to 0s". |  Accepted |
| 15734 | 334.64 | The transition time from the higher BW or NSS to the lower values should be specified in the standard. It is important for the reliable data exchange. This mechanism is needed to operate between all devices. | Add a field and description to signal the transition time from larger BW and NSS to the lower values in the 802.11ax as suggested bythe note. Or alternatively specify a predefined time value that is used in the transitions. Also correct the descriptions in 27.8.2 and 27.8.3 to use this transition time. | Rejected. The Note provides instructions how to protect against issues due to slow transition.  |
| 15735 | 334.48 | UL MU Disallow field has a possibility to disallow only data or both the data and acknowledgements. All alternatives are not described here. | Please describe also the UL MU Disallow data mode. | Revised. The NSS and BW setting rules are added to include the HE TB Data Disabled. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15735. |
| 15736 | 335.41 | The lines 41 -42 make no sense. Acknowledgement is transmitted as commanded and the ack is transmitted typically a SIFS after the soliciting frame, so there is no time to send other frames. | Delete the lines 41 - 46. | Revised. The ACK rule specifies when the AP may send the next frame. The note specifies more details on the subsequent PPDU. The next PPDU is clarified not to be the next PPDU following the ACK. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15736.  |
| 15737 | 336.10 | The UL MU suspend is described in two separate paragraphs and they are hard to read and understand. | Please combine the paragraphs and clarify the message. |  Rejected. The bullet below is related to AP capability and the upper text is not related to the capability. The current wording maintains the capability visible in the text.  |
| 15766 | 310.42 | Delete the whole prargraph of the NOTE, there is no need to mention this | As in comment |  Rejected. The note specifies the subsequent PPDU in more details.  |
| 15864 | 72.51 | if the BW is 20MHz, it can be non-primary 20MHz channel. | Change to "...for 20MHz, 1 for parimary 40MHz, 2 for primary 80MHz..." | Revised. Agree in principle of the comment. A STA that operates in 20 MHz BW may be configured to operate in other than its primary 20 MHz. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15864. |
| 15865 | 72.55 | "The subfield is set to 0 to indicate that the STA has no recommendation on AP's DL MU-MIMO operation."Baed on the name of the subfield, the subfield is set to 0 in order to indicate that the STA has no recommendation on AP's resound for L MU-MIMO operation. If the original text is correct, the field name should be changed to | As in the comment |  Revised, agree in principle with the comment. The subfield indicates whether a STA requests resounding or does not provide instruction for the sounding frequency. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15865. |
| 15990 | 336.23 | "UL MU data transmission is suspended" is not clear because it is not clear whether the special case of a Trigger frame that solicits from a single STA is "UL MU" | At the referenced location change "only UL MU data transmission is suspended but UL MU control response transmissions in response to a Basic Trigger frame or a frame with TRS Control subfield present is not suspended" to "only transmission of QoS Data frames in HE TB PPDUs is suspended but transmission of Control frames in HE TB PPDUs in response to a Basic Trigger frame or a frame with TRS Control subfield present is not suspended" |  Revised. D 3.0 lists that only Acknowledgements are allowed to be transmit when “UL MU data” is suspended. The QoS NULL is allowed to be delivered information on Power Management field and HE A-Control field (OM, Buffer Status, etc) information to UL. . - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 15990. |
| 16188 | 332.48 | "When a first STA transmit both OM Control field and Operating Mode fieldin different PPDUs to a second STA, the second STA shall use the most recently received one to decide theopering mode of the first STA. [...] An HE STA should not transmit an OM Control subfield and an Operating Mode field in the same PPDU." -- not clear what happens if send in same MPDU. The resolution to CID 12839 claimed that "The standard denies the use of OM Control and OMI fields in the same MPDU to avoid STAs to indicate contradicting parameters" but I cannot find this in D3.0 | Add to the end of the para "When a first STA transmits both an OM Control field and an Operating Mode fieldin the same PPDU to a second STA, the second STA shall use the most recently received one to decide theopering mode of the first STA. NOTE---An OM Control field is received before an Operating Mode field in the same MPDU." Change "transmit" to "transmits" at 286.57 of D2.0, add a space at the start of the sentence, delete "An HE STA should not transmit an OM Control subfield and an Operating Mode field in the same PPDU. " at 287.16 of D2.0 |  Revised. OM Control and operating mode field contain different parameters and if these fields are present in the same MPDU, the information from both fields should be updated. The Bandwidth and the NSS fields control the same parameters. A Note is added to further clarify which field should be used if they are in the same MPDU. The spec discusses on transmission order of the field, not the reception order of the field. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 16188.  |
| 16362 | 335.26 | "An OMI initiator that is an HE AP should be capable of receiving within an operating channel width andwith NSS that are up to the values of the most recently transmitted Channel Width subfield and Rx NSS sub-field that the OMI initiator has successfully indicated in the OM Control subfield or in the Operating Modefield sent to any associated STA." -- should honour promises made | Change "should" to "shall" in the cited text | Rejected. The 802.11ax has discussed and agreed long time that should provide enough support for the feature.  |
| 16488 | 332.00 | Table 27-9 is intended to determine the Nss to be used when a HE STA is signaling specific Nss for 20/40/80/160MHz. However, for 160MHz there is no specific signaing for Nss signaling in OMI. The Nss to be used for 160MHz is based on the Nss that was signaled for 80MHz and this applicable to HE as well (not limited to VHT). | Make the following change the text in 13 - 16:A HE STA transmitting an OM Control Subfield will use the Supported Channel Width, and Extended Nss BW Support fields as signaled in VHT Capabilities and as defined in Table 27-9 to determine:- the allowed Nss when operating in HE mode using channel bandwidth of 160MHz or 80+80- the allowed VHT Channel Width and VHT Nss when operating in VHT mode | Revised. Agree in principle with the comment. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 16488. |
| 16489 | 335.00 | The following is true only if the Channel Width is <= 80MHz: "The OMI responder shall update the operating channel width and the maximum NSS values as obtained fromthe Channel Width and Rx NSS subfields, respectively, of the most recently received OM Control subfield " add text to clarify the allowed Nss to be used when Channel Width is 160MHz. | Add the following text after line 39:If the received OM Control subfield has channel width subfield signaling 160MHz or 80\_80MHz, then the OMI responder shall update the maximum Nss values based on the value determined by using the value of Rx Nss subfield and Table 27-9. | Revised. Agree in principle with the comment. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 16489. |
| 16615 | 336.10 | Value "1 1" assigned to a bit is incorrect and per table 9-18b UL MU Data Disable must be set to 1 to indicate suspension of UL MU operation | Change values assigned to both UL MU Disable and UL MU Data Disable subfields to 1 to indicate UL operation suspension |  Revised. Agree that the value of the field is incorrect. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 16615. |
| 17016 | 335.57 | "An OMI responder that receives a frame that carries an OM Control field with the DL MU-MIMO Resound Recommendation field equal to 1 from an OMI initiator may resound the channel or increase the frequency of the channel sounding with the OMI initiator."If the OMI responder thinks that the DL MU-MIMO is not appropriate for the OMI Initiator through the DL MU-MIMO Resound Recommendation field, it can change to the SU transmissions for the OMI Initiator.Please change the sentence as the following:"... may resound the channel or increase the frequency of the channel sounding with the OMI initiator if the OMI responder sends the DL MU-MIMO PPDU to the OMI initiator." | As in comment. | Revised. Agree in principle with the comment. The more frequent resounding is needed only if the AP sends DL MU-MIMO PPDUs addressed to the OMI initiator. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 17016. |
| 17017 | 335.50 | "A OMI initiator that is a non-AP STA and that has no recommendation on the AP's DL MU-MIMO operation shall set DL MU-MIMO Resound Recommendation subfield to 0."Also add the following sentence:"An OMI initiator that is an AP shall set the DL MU-MIMO Resound Recommendation subfield to 0." | As in comment. | Revised. Agree in principle with the comment. - TGax editor to make changes as shown in 11-18/1219r2 that are marked with CID 16602. |
| 17031 | 73.21 | "Trigger based UL MU Control response transmission triggered by a Basic Trigger frame or a frame with TRS Control subfield present soliciting only Ack, or Multi-STA BlockAck frames are enabled by the STA (see 27.8.3 (Transmit operating mode (TOM) indication))."How about is other Trigger frames? Is a response triggered by a BFRP, MU-BAR, MU-RTS, BSRP, GCR MU-BAR, BQRP, or NFRP enabled? Please clarify it. | As in comment. |   Revised. Agree in principle with the comment. The Data In HE TB PPDU Disallow subfield controls only basic Trigger frame types and other Trigger types use is not controlled. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 17031. |
| 17033 | 336.23 | "...indicate that only UL MU data transmission is suspended but UL MU control response transmissions in response to a Basic Trigger frame or a frame with TRS Control subfield present is not suspended (see 27.5.3 (UL MU operation) except only Ack or BlockAck frame transmission is allowed)."Is only data transmission is suspended? Does it means that an UL MU mangement frame is not suspended? Pleasse clarify it.Also please clarify whether a response triggered by a BFRP, MU-BAR, MU-RTS, BSRP, GCR MU-BAR, BQRP, or NFRP is not suspedned. (refer the comment that I submitted in 9.2.4.6a.2.) | As in comment. |  Revised. No other Trigger frame except basic type Trigger frame is controlled by the UL MU Data transmission suspend field. QoS Null frame transmission is allowed as a response to enable STA to signal information through MAC Header. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 17033.  |
| 17034 | 336.49 | "The TOM parameters UL MU Disable and UL MU Data Disable changes from higher to lower when its value changes from 0 to 1."Based on Table 9-18b, what is happened if UL MU Disable value changes from 1 to 0 and UL MU Data Disable value changes from 0 to 1?Probably, it should be changed depending on the AP supports the OM Control UL MU Data Disable RX. | As in comment. |  Revised. Agree in principle with the comment. Clarified that this change is from lower values to the higher OMI values. - TGax editor to make changes as shown in 11-18/1246r2 that are marked with CID 17034. |

* OM Control

If the Control ID subfield in a Control subfield of an A-Control subfield is 1, the Control Information subfield of the Control subfield contains information related to the operating mode (OM) change of the STA transmitting the frame containing this information (see 27.8 (Operating mode indication)).(#12027) The format of the subfield is shown in Figure 9-15d (Control Information subfield for OM Control).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0        B2 | B3        B4 | B5 | B6          B8 | B9 | B10 | B11 |
|  | Rx NSS |  Channel Width | Trigger Response (#15010)Disable | Tx NSTS | ER SU Disable(#11261) | DL MU-MIMO Resound Recommendation(18/906r7) | HE TB PPDU Data (#15010) Disable(#14331) |
| Bits: | 3 | 2 | 1 | 3 | 1 | 1 | 1 |
| * Control Information subfield for OM Control(#11971)
 |

The Rx NSS subfield indicates the maximum number of spatial streams, *NSS*, that the STA supports in reception for PPDU(#Ed) bandwidths less than or equal to 80 MHz and is set to *NSS* – 1. The RX NSS support for PPDU bandwidths(#Ed) greater than 80 MHz is defined in 27.8 (Operating mode indication).(#11683)

The Channel Width subfield indicates the operating channel width supported by the STA for both reception and transmission. It is set to 0 for 20 MHz,(#15864) 1 for primary 40 MHz, 2 for primary 80 MHz, and 3 for 160 MHz and 80+80 MHz.

(#14331)The Trigger Response Disable subfield indicates whether the non-AP STA has suspended responding to Trigger frames and to frames containing TRS Control fields. The Trigger Response Disable subfield is set to 1 if the non-AP STA has suspended responding to Trigger frames and frames with TSR Control field; otherwise the STA sets the UL MU Disable subfield to 0. (#15010)

The HE TB PPDU Data Disable subfield indicates whether the non-AP STA has suspended responding to Basic Trigger frames with all frame types except Ack, BA and QoS Null frames. The HE TB PPDU Data Disable subfield is set to 1 if the STA has suspended responding to Trigger frames with all frame types except Ack, BA and QoS Null frames(#15099). Otherwise, the subfield is set to 0. The HE TB PPDU Data Disable subfield is reserved if any of the following conditions is satisfied: *(#15010,#15011)*

* The STA has set the Trigger Response Disable subfield to 1
* The STA has set the HE TB PPDU Data Disable Support subfield to 0 in HE Capabilities elements it transmits
* The AP has set the HE TB PPDU Data Disable Support subfield to 0 in HE Capabilities elements it transmits
* The STA is AP. *(#15010,#15011)*

***Note to ax Editor. Please delete the Table 9-18b****. (#15010,#15011)*

|  |
| --- |
| * ~~UL MU Disable and UL MU Data Disable subfields encoding~~
 |
| ~~UL MU Disable subfield~~ | ~~UL MU Data Disable subfield~~ | ~~Interpretation by an AP that transmits a value of 0 in the OM Control UL MU Data Disable RX Support~~ | ~~Interpretation by an AP that transmits a value of 1 in the OM Control UL MU Data Disable RX Support~~ |
| ~~0~~ | ~~0~~ | ~~All triggered UL MU operations are enabled by the STA as defined in 27.5.3 (UL MU operation).~~ | ~~All trigger based UL MU operations are enabled by the STA as defined in 27.5.3 (UL MU operation).~~ |
| ~~0~~ | ~~1~~ | ~~All triggered UL MU operations are enabled by the STA as defined in 27.5.3 (UL MU operation).~~ | ~~Trigger based UL MU Data transmission triggered by a Basic Trigger frame is suspended(#15010).~~~~Trigger based UL MU Control response transmission triggered by a Basic Trigger frame or a frame with TRS Control subfield present soliciting only Ack, or Multi-STA BlockAck frames are enabled by the STA (see 27.8.3 (Transmit operating mode (TOM) indication)).~~ |
| ~~1~~ | ~~0~~ | ~~All triggered UL MU transmissions are suspended by the STA.~~ ~~The STA will not respond to a received Trigger frame or TRS Control subfield.~~ | ~~All triggered UL MU transmissions are suspended by the STA.~~ ~~The STA will not respond to a received Trigger frame or TRS Control subfield.~~ |
| ~~1~~ | ~~1~~ | ~~All triggered UL MU transmissions are suspended by the STA.~~~~The STA will not respond to a received Trigger frame or TRS Control subfield.~~ | ~~Reserved~~ |

The Tx NSTS subfield indicates the maximum number of space-time streams, *NSTS*, that the STA supports in transmission and is set to *NSTS* – 1.

The ER SU Disable subfield is set to 1 to indicate that 242-tone HE ER SU PPDU reception is disabled and set to 0 to indicate that 242-tone HE ER SU PPDU reception is enabled.(#11261)

The DL MU-MIMO Resound Recommendation subfield is set to 1 to indicate that the STA suggests that the AP either resounds the channel or increases the channel sounding frequency with the STA. The subfield is set to 0 to indicate that the STA has no recommendation on the AP channel resounding frequency (#15865). The DL MU-MIMO Resound Recommendation subfield is reserved for an HE AP.

* HE MAC Capabilities Information field

### *Note to ax Editor. Please change the B44 subfield to OM Control Data In Trigger Based PPDU Disable RX Support in Figure 9-589ck–HE MAC Capabilities Information field format (#15010)*

### *Note to ax Editor. Please change the last element of the Table 9-262z. (#15010)*

|  |  |  |
| --- | --- | --- |
| HE TB PPDU Data Disable Support (#15010) | Indicates whether an AP supports interpretation of the Data In Trigger Based PPDU Disable subfield of the OM Control subfield as described in 27.5.3 (UL MU operation). *(#15010)* | Set to 1 if supported. Set to 0 otherwise. |

* Operating mode indication
* General

OMI is a procedure used between an OMI initiator and an OMI responder. An HE STA that transmits a frame including an OM Control subfield is defined as an OMI initiator. An HE STA with dot11OMIOptionImplemented equal to true(#12838) that receives a frame including an OM Control subfield is defined as an OMI responder.

An HE STA with dot11OMIOptionImplemented equal to true shall set the OM Control Support subfield in the HE MAC Capabilities Information field of the HE Capabilities element it transmits to 1; otherwise the HE STA shall set the OM Control Support subfield to 0.(#18/627r1) An HE AP shall set dot11OMIOptionImplemented to true and the HE AP shall implement the reception of the OM Control subfield.(#11378)

An OMI initiator may send to an OMI responder an individually addressed QoS Data, QoS Null or Class 3 Management frame after association that contains the OM Control subfield and that solicits an immediate acknowledgment to indicate a change in its receive operating mode (ROM) as defined in 27.8.2 (Receive operating mode (ROM) indication) and/or transmit operating parameters (TOM) as defined in 27.8.3 (Transmit operating mode (TOM) indication). An OMI responder implements the reception of an individually addressed QoS Data, QoS Null or Class 3 Management frame that contains the OM Control subfield that indicates a change in ROM and/or TOM parameters.(#11378, #12839)

The OMI initiator shall indicate a change in its ROM parameters by including the OM Control subfield in a QoS Data, QoS Null or Class 3 Management frame that solicits acknowledgment(#11208) and is addressed to the OMI responder as defined in 27.8.2 (Receive operating mode (ROM) indication).

NOTE 1—Frames that solicit an immediate acknowledgment(#11208) are, for example, QoS Null frames and QoS Data frames with ack policy Normal Ack or Implicit Block Ack Request and Action frames.

An HE STA can change its operating mode setting using either operating mode notification (#14275)as described in 11.42 (Notification of operating mode changes), or the operating mode indication (OMI) procedure described in this subclause. An HE STA should not transmit an OM Control subfield and an Operating Mode field in the same PPDU. When a STA transmits both an OM Control subfield(#14137) and Operating Mode field in the same PPDU, then the OMI responder shall use the channel width and the maximum number of spatial streams indicated by(#14134) the most recently OM Control subfield(#14137) or Operating Mode field from the OMI initiator.

(#12840, #11997)

NOTE—An OM Control field is transmitted before an Operating Mode field in the same MPDU. (#16188)

The OMI initiator supports receiving PPDUs with a bandwidth up to the value indicated by the Channel Width subfield and with a number of spatial streams, *Nss*, as indicated in the Rx NSS subfield of the OM Control subfield and calculated in the Equation (27-3).(#11683)

(#13812, #13170)The Rx NSS support for a given HE-MCS as a function of the received HE PPDU bandwidth *BW* at an HE STA transmitting an OM Control subfield is defined in Equation (27-3).(#11232)

* floor (*Rx-NSS-from-OMI* × (*Max-HE-NSS-at-BW* / *Max-HE-NSS-at-80*))

where

*Rx-NSS-from-OMI* is Rx NSS from the OM Control subfield transmitted by the STA

*Max-HE-NSS-at-BW* is the maximum HE NSS among all HE-MCS at *BW* MHz from the Supported HE-MCS and NSS Set field transmitted by the STA as described in 27.15.4 (Rate selection constraints for HE STAs)(#12981)

*Max-HE-NSS-at-80* is the maximum HE NSS among all HE-MCS at 80 MHz from the Supported HE-MCS and NSS Set field transmitted by the STA

NOTE—The Rx NSS subfield indicates the maximum number of spatial streams for PPDU(#Ed) bandwidths that are equal to or less than 80 MHz.(#13757)

The VHT channel width and the VHT NSS allowed at an HE STA transmitting an OM Control subfield are defined in Table 27-9 (Setting of the VHT Channel Width and VHT NSS at an HE STA transmitting the OM Control subfield) to determine:

* The allowed NSS when operating as HE STA using channel bandwidth of 160MHz or 80+80
* The allowed VHT Channel Width and VHT NSS when operating as VHT STA. (#16488)

|  |
| --- |
| * Setting of the VHT Channel Width and VHT NSS at an HE STA transmitting the OM Control subfield
 |
| OM Control subfield | VHT capabilities of STA transmitting OM Control subfield | VHT NSS Support of STA transmitting the OM Control subfield as a function of the PPDU bandwidth (× Max VHT NSS) (see requirements R1 and R2) | Location of 160 MHz center frequency if BSS bandwidth is 160 MHz | Location of secondary 80 MHz center frequency if BSS bandwidth is 80+80 MHz |
| Channel Width | Supported Channel Width | Extended NSS BW Support | 20 MHz | 40 MHz | 80 MHz | 160 MHz | 80+80 MHz |
| 0 | 0-2 | 0-3 | 1 |  |  |  |  |  |  |
| 1 | 0-2 | 0-3 | 1 | 1 |  |  |  |  |  |
| 2 | 0-2 | 0-3 | 1 | 1 | 1 |  |  |  |  |
| 3 | 0 | 1 | 1 | 1 | 1 | 1/2 |  | CCFS2 |  |
| 3 | 0 | 2 | 1 | 1 | 1 | 1/2 | 1/2 | CCFS2 | CCFS2 |
| 3 | 0 | 3 | 1 | 1 | 1 | 3/4 | 3/4 | CCFS2 | CCFS2 |
| 3 | 1 | 0 | 1 | 1 | 1 | 1 |  | CCFS1 |  |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1/2 | CCFS1 | CCFS2 |
| 3 | 1 | 2 | 1 | 1 | 1 | 1 | 3/4 | CCFS1 | CCFS2 |
| 3 | 1 | 3 | 2 | 2 | 2 | 2 | 1 | CCFS1 | CCFS1 |
| 3 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | CCFS1 | CCFS1 |
| 3 | 2 | 3 | 2 | 2 | 2 | 1 | 1 | CCFS1 | CCFS1 |
| R1: NSS support shall be rounded down to the nearest integer.R2: The maximum NSS support shall be 8.NOTE 1—Max VHT NSS as indicated by the value of the Rx NSS field. The Rx NSS field indicates the same Max HE NSS and Max VHT NSS. Max VHT NSS is at the bandwidth indicated in the VHT Capabilities element. For all allowed MCS values, the Max VHT NSS values are same, but the supported NSS can be different.(#11455)NOTE 2—1/2 × or 3/4 × Max VHT NSS support might end up being 0, indicating no support.NOTE 3—Any other combination than the ones listed in this table is reserved.NOTE 4—CCFS1 refers to the value of the Channel Center Frequency Segment 1 field of the most recently transmitted VHT Operation element.NOTE 5—CCFS2 refers to the value of the Channel Center Frequency Segment 2 field of the most recently transmitted HT Operation element.NOTE 6—CCFS1 is nonzero when the current BSS bandwidth is 160 MHz or 80+80 MHz and the NSS support is at least Max VHT NSS. CCFS2 is zero in this case.NOTE 7—CCFS2 is nonzero when the current BSS bandwidth is 160 MHz or 80+80 MHz and the NSS support is less than Max VHT NSS. CCFS1 is zero in this case.NOTE 8—At most one of CCFS1 and CCFS2 is nonzero.NOTE 9—A supported multiple of Max VHT NSS applies to both transmit and receive. A supported multiple of Max HE NSS applies to receiveNOTE 10—Some combinations of Supported Channel Width Set and Extended NSS BW support might not occur in practice. |

The OMI initiator shall indicate a change in its TOM parameters by including the OM Control subfield in a QoS Data, QoS Null or Class 3 Management frame that solicits an immediate acknowledgment(#11208) frame and is addressed to the OMI responder as defined in 27.8.3 (Transmit operating mode (TOM) indication).

A non-AP STA OMI initiator that sends an OM Control subfield(#14137) with Trigger Response (#15010) Disable subfield equal to 0 or OM Control subfield(#14137) with an OM Control subfield with Trigger Response Disable subfield equal to 0 and HE TB PPDU Data Tx Disable subfield equal to 1 (#15735), supports transmitting an HE TB PPDU with an RU allocation that is within the operating channel width indicated in the Channel Width subfield and with a number of space-time streams, *NSTS*, that is up to the value indicated by the Tx NSTS subfield of the OM Control subfield as defined in 27.8.3 (Transmit operating mode (TOM) indication).

NOTE 2—To avoid possible frame loss, an OMI initiator can continue with its current operating channel width and active receive chains and active transmission chains in HE TB PPDUs and not suspend HE TB PPDUs or Data frames in HE TB PPDUs (#15010) until it infers that the OMI responder (#Ed) has processed an OM Control subfield from the OMI initiator (#Ed) indicating any of the following OM Control value changes:

* Reduced operating channel width
* Reduction in the number of active receive chains
* Reduction in the number of active transmission chains in HE TB PPDUs
* Suspension of Trigger responses
* Suspension of Data frames transmission in HE TB PPDUs

The OMI initiator (#Ed) might make this inference from any combination of the following:(#12437)

* By receiving a frame addressed to itself from the second HE STA in a PPDU with a bandwidth and NSS that are less than or equal to the channel width and NSS, respectively, indicated in the OM Control subfield
* Based on the passage of time in some implementation dependent way, which is outside the scope of this Standard

NOTE 3—It might take a long time for a STA to change its operating mode following the transmission of the OM Control subfield and during that time the STA might not be able to receive frames resulting in frame loss. If a non-AP STA cannot tolerate frame loss during that period it can set the Power Management subfield of the Frame Control field of the frame which carries OM Control subfield to 1 to indicate that the STA has entered power save. When the non-AP STA has completed its operating mode change, it can send another frame (such as a QoS Null) with the Frame Control Power Management subfield set to 0 to indicate that the STA has exited power save.

* Receive operating mode (ROM) indication

(#12842)ROM indication allows the OMI initiator to adapt the maximum operating channel width and/or the maximum number of spatial streams, *Nss*, it can receive from the OMI responder.

An OMI initiator that sends a frame that includes an OM Control subfield should change its OMI parameters, Rx NSS and Channel Width, as follows:

* When the OMI initiator changes a ROM parameter from higher to lower, it should make the change for that parameter only after the TXOP in which it received the immediate acknowledgment(#11208) from the OMI responder.
* When the OMI initiator changes a ROM parameter from lower to higher, it should make the change for that parameter only(#11685) after the TXOP in which it expects to receive acknowledgment(#11208) from the OMI responder.

An OMI initiator that is an HE AP should be capable of receiving within an operating channel width and with *NSS* that are up to the values of the most recently transmitted Channel Width subfield and Rx NSS subfield that the OMI initiator has successfully indicated in the OM Control subfield or in the Operating Mode field sent to any associated STA.

NOTE—In the event of transmission failure of the frame containing the OM Control subfield, the OMI initiator attempts the recovery procedure defined in 10.22.2.7 (Multiple frame transmission in an EDCA TXOP).

The OMI responder shall update the operating channel width and the maximum *NSS* values as obtained from the Channel Width and Rx NSS subfields, respectively, of the most recently received OM Control subfield sent by the OMI initiator to send SU PPDUs and to assign an RU allocation in sent MU PPDUs, subject to restrictions defined in 28.3.1.2 (OFDMA), addressed to the OMI initiator in subsequent TXOPs. The OMI responder shall update the maximum *NSS* value to a value determined from the Rx NSS subfield and Table 27-9 when the Channel Width subfield of the OM Control field indicates 160 or 80+80MHz. (#16489)

After transmitting the acknowledgment(#11208) for the frame containing the OM Control subfield, the OMI responder may transmit subsequent SU PPDUs or MU PPDUs that are addressed to the OMI initiator.

NOTE—The acknowledgement can be transmitted a SIFS after the frame. (#15736)A subsequent PPDU is a PPDU that is intended for the OMI initiator and need not be the PPDU immediately following the acknowledgement. (#15736)

A OMI initiator that is a non-AP STA may set the DL MU-MIMO Resound Recommendation subfield to 1 in the OM Control field in frames addressed to an OMI responder that is an AP to indicate that the non-AP STA suggests that the AP resound the channel with the non-AP STA. A OMI initiator that is a non-AP STA and that has no recommendation on the AP's DL MU-MIMO operation shall set DL MU-MIMO Resound Recommendation subfield to 0.

An OMI responder that receives a frame that carries an OM Control field with the DL MU-MIMO Resound Recommendation field equal to 1 from an OMI initiator may resound the channel or increase the frequency of the channel sounding with the OMI initiator if the OMI responder sends DL MU-MIMO PPDU addressed to the OMI initiator. (#17016)(18/906r7, #Ed)

* Transmit operating mode (TOM) indication(#12841)

(#12842)TOM indication allows the OMI initiator to suspend and resume(#12220) responding to variants of the Trigger frame and TRS Control subfields(#13136) per the UL MU Disable and UL MU Data Disable subfields settings as indicated in Table 9-18b (UL MU Disable and UL MU Data Disable subfields encoding), or to adapt the maximum operating channel width and/or the maximum number of space-time streams, *NSTS*, that it can transmit in response to a Trigger frame and TRS Control subfield(#13136) sent by the OMI responder.(#14331)

NOTE—TOM indication does not relate to transmissions in PPDUs other than HE TB PPDUs. An AP does not perform TOM indication as an OMI initiator.(#12842)

An OMI initiator that is a non-AP STA may indicate changes in its transmit parameters by sending a frame that contains the OM Control subfield to the OMI responder. The OMI initiator shall set:

* The Trigger Response Disable subfield to 1 to indicate suspension to response to a Trigger frame or a frame carrying TRS Control subfield. (see 27.5.3 (UL MU operation).(#16615)(#14331)
* An AP that is an OMI initiator shall set the Trigger Response (#15010) Disable subfield to 0.
* The Tx NSTS subfield to the maximum *NSTS* that the STA will use for an HE TB PPDU sent in response to a Trigger frame(#12185) or frame carrying a TRS Control subfield(#13136).
* The Channel Width subfield to(#12186) the maximum operating channel width that the STA will use for an HE TB PPDU sent in response to a Trigger frame or frame carrying a TRS Control subfield(#13136).

If a HE non-AP STA has received the HE TB PPDU Data Disable Support (#15010) field in the HE Capabilities element set to 1, then the HE non-AP STA, acting as an OMI initiator, may set the Trigger Response Disable subfield to 0 and the Data In HE TB PPDU(#15010) Disable subfield to 1 to indicate that transmission of all frame types, except Acknowledgement, BA and QoS Null frames are suspended in response to a Basic Trigger frame or a frame with TRS Control subfield present. (#15990, #17031, #17033)

NOTE – The Data In HE TB PPDU Disable subfield does not control the use of other than Basic Trigger frame types, i.e. BFRP, MU-BAR, MU-RTS, BSRP, GCR MU-BAR, BQRP, and NFRP Trigger frames. (#17031, #17033)

An OMI initiator shall set the Trigger Response (#15010) Disable subfield to 0 and the Data In HE TB PPDU Disable subfield to 0 to indicate resumption or continuation to transmit HE TB PPDUs with any frame types.

If an HE AP has set the HE TB PPDU Data Disable Support field in the HE Capabilities element it transmits to 0, an associated STA shall not set the Data In HE TB PPDU (#15010) Disable subfield in the OM Control field to 1.

An OMI initiator that sent a frame including the OM Control subfield should change its TOM parameters, Tx NSTS(#11686), Trigger Response (#15010) Disable(#12187), Data In HE TB PPDU (#15010) Disable(#14331) and Channel Width, as follows:

* When the OMI initiator changes a TOM parameter from higher to lower, it should make the change for that parameter only after the TXOP in which it received the immediate acknowledgment(#11208) from the OMI responder.
* When the OMI initiator changes a TOM parameter from lower to higher, it should make the change for that parameter only after the TXOP in which it expects to receive acknowledgment(#11208) from the OMI responder.

The TOM parameters Trigger Response Disable and Data In HE TB PPDU Disable changes from higher to lower when its value changes from 0 to 1. The change of Trigger Response Disable from value 1 to 0 and Data In HE TB PPDU Disable from value 0 to 1 is a change from lower to higher. (# from 0 to 1 is a change from lower to higher value. (#17034)

An OMI responder that successfully receives a frame containing an OM Control subfield from an OMI initiator performs the following operations.

An AP OMI responder shall not send any Trigger frames or frames carrying a TRS Control subfield(#13136)(#14137) to a non-AP STA OMI initiator for subsequent TXOPs (see 27.5.3 (UL MU operation)) if the Trigger Response (#15010) Disable subfield is 1 in the most recently received OM Control subfield sent by the STA.(#12808)(#11260)

NOTE—A device might have multiple radios that can create difficult in-device coexistence challenges. The device might set Trigger Response Disable subfield to 1 and the Data in HE TB PPDU (#15010) Disable subfield to 0 if it has trouble responding to a Trigger frame or a frame carrying a TRS Control subfield(#13136)(#14137) because the timing or high transmit power would cause interference with another radio in the device.

An OMI responder shall consider the OMI initiator not responding to any received Trigger frames for subsequent TXOPs if the Trigger Response Disable subfield is set to 0 (#15372) in the most recently received OM Control subfield with the following restrictions:

* The maximum *NSTS* that the OMI initiator can transmit in response to a Trigger frame or frame carrying a TRS Control subfield(#13136)(#14137) is indicated in the Tx NSTS subfield of the OM Control subfield
* The maximum operating channel width over which the OMI initiator can transmit in response to a Trigger frame or frame carrying a TRS Control subfield(#13136)(#14137) is indicated in the Channel Width subfield of the OM Control subfield

An OMI responder that has transmitted the HE TB PPDU Data Disable Support (#15010) subfield set to 1 shall regard an OMI initiator as capable of only transmitting QoS Null, Ack and Block Ack frames (#15990) in HE TB PPDUs when the Trigger Response Disable subfield is equal to 0 and the Data In HE TB PPDU (#15010) Disable subfield is equal to 1 in the most recently received OM Control subfield from that OMI initiator.(#14331)

The OMI responder shall indicate a number of spatial streams, *NSS*, in the Per User Info field of a Trigger frame, which contains the AID of the OMI initiator, that is less than or equal to the *NSTS* that is calculated from the Tx NSTS subfield of the OM Control subfield received from the OMI initiator.

The OMI responder shall indicate an RU allocation in the RU Allocation subfield of the Per User Info field of a Trigger frame or TRS Control subfield(#13136)(#14137) addressed to the OMI initiator, that is within the operating channel width specified in the Channel Width subfield of the OM Control subfield received from the OMI initiator and subject to the restrictions defined in 28.3.1.2 (OFDMA).

**References:**