IEEE P802.11  
Wireless LANs

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| Comment resolutions for subclause 26.15 | | | | |
| Date: 2019-11-01 | | | | |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D5.0 with the following CIDs (12 CIDs):

* 22049, 22050, 22051, 22052, 22145, 22146, 22149, 22245, 22246, 22247,
* 22403, 22444

Revisions:

* Rev 0: Initial version of the document.

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

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

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

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| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 22049 | Jarkko Kneckt | 443.22 | The clause 26.15.4.3 defines HE rate restrictions that allow the network operator to configure the HE MCSs, BW and NSS tuple that the AP supports. Unfortunately these configurations cannot be used in 6 GHz, because the signaling is done through the HT-MCS support field. | Add to 6 GHz HE configuration signaling a mechanism that allows the AP to configure the unsoppurted MCS , BW and NSS tuple for the BSS. This allows all bands and HT, VHT and HE STAs to use similar mechanism to configure the supported bands. | Rejected –  There is a plethora of rules that are band specific since every band has its own properties, requirements and regulatory rules. In this case the behavior is not really band specific because the STA will receive a frame that contains this field that instructs the STA to follow this encoding. Currently the AP provides the STA with one value for the minimum rate field, which is a simple rule, while the proposed modification from the comment would add several more combinations (per BW, MCS, NSS), which is more complex and can create configuration problems. |
| 22050 | Jarkko Kneckt | 444.33 | The Minimum Rate field is only used in 6 GHz band. STAs should avoid implementing band specific rules and use the existing operating principles when ever possible. | Please change the Minimum Rate field to possibility to configure the MCS, NSS and BW tuples that are not in use in the BSS. | Rejected –  There is a plethora of rules that are band specific since every band has its own properties, requirements and regulatory rules. In this case the behavior is not really band specific because the STA will receive a frame that contains this field that instructs the STA to follow this encoding. Currently the AP provides the STA with one value for the minimum rate field, which is a simple rule, while the proposed modification from the comment would add several more combinations (per BW, MCS, NSS), which is more complex and can create configuration problems. |
| 22051 | Jarkko Kneckt | 444.14 | If Minimum Rate field controls both the non-associated STA TX rate and the associated STAs transmission rate, it may happen that non-assocaited STAs are not able to transmit an association request frame or probe response frame with 54 Mbit/s, but the same STA in isassociated state is able to send data that meets the minimum rate requirement by using larger BW and lower MCS. This leads to situations that a STA cannot associate to a BSS, even if it could transmit data in associated state with the AP. This is not desirable operation. | Please delete:" or in the Minimum Rate field of the HE Operation element sent by the AP" from the third and fourth bullets in lines 13 and 19. | Rejected –  The comment points out an issue, which seems to derive from a misinterpretation of the text.  The STA is free to chose whichever <BW, NSS, MCS> triple it wishes to use for HE PPDUs, prior to and after association, provided that the data rate obtained from that combination is greater than or equal to the minimum rate required by the AP and the triple being used is supported in RX by the AP. Please refer to the bulleted list of rules for pre-association exchanges in this same subclause. |
| 22052 | Jarkko Kneckt | 444.26 | The benefit of controlling the transmission rate of a non-HT (duplicate) PPDU is small and easily wasted by retransmissions needed for the non-HT PPDUs. Please allow non-AP STA to transmit non-HT PPDUs without minimum rate restriction. | Please delete the bullet:" - if the PPDU is a non-HT (duplicate)..." | Rejected –  The comment is speculative in its claim that the benefit of controlling the transmission rate of a non-HT (dup) PPDU is small and easily wasted … Allowing a STA to transmit non-HT PPDUs without following minimum rate restrictions defeats the purpose of having minimum rate restrictions. |
| 22145 | Mark RISON | 441.51 | "a Beacon frame or group addressed frames" is weird because a Beacon frame is a group addressed frame | Change the cited text to "one or more group addressed frames" in 26.15.5 Additional rules for ER beacons and group addressed frames and 26.15.6 Additional rules for HE SU beacons and group addressed frames. In each of these two subclauses also change "A Beacon frame or a group addressed frame" to "A group addressed frame" | Rejected –  The comment fails to identify a technical issue. While agree that a Beacon frame is a group addressed frame it is also true that the Beacon frame is a frame of interest due to its role in the BSS. To keep consistency between the title and the subclause contents proposal is to keep the current terminologies even though they might be redundant. |
| 22146 | Mark RISON | 441.51 | "except for group addressed Data frames, which may also be sent as an A-MPDU" is wrong, because "sent as an A-MPDU" is meaningless given that everything in HE is sent in an A-MPDU | Change the cited text to "except for group addressed Data frames, which are not required to be sent as an S-MPDU" in 26.15.5 Additional rules for ER beacons and group addressed frames and 26.15.6 Additional rules for HE SU beacons and group addressed frames | Revised –  Agree in principle with the comment. Proposed resolution deviates somewhat from the proposed change in the sense that we do keep the subclause reference to which the allowance of these A-MPDU generation is specified.  TGax editor to make the changes shown in 11-19/1833r0 under all headings that include CID 22146. |
| 22149 | Mark RISON | 443.30 | "SST STAs" need to be HE SST STAs | Add "HE " before "SST STA" in 26.15.7 Additional rules for group addressed frames in an HE MU PPDU (3x) | Accepted  Note: Although technically all subclause 26 applies to HE STAs by default. |
| 22245 | Mark RISON | 438.46 | "an HE SU PPDU, HE MU PPDU" -- this was the subject of a comment about ER SU, I think | Change the cited text to "an HE SU PPDU, HE ER SU PPDU or HE MU PPDU" | Rejected –  BW, MCS, and NSS rules for ER SU PPDUs are defined in this same subclasuse. E.g., ER SU PPDUs are only 20 MHz wide, hence the channel width is no more than 20 MHz by default, and the MCS selection rule is listed in this same subclause:  “A STA that transmits a Control frame that is an S-MPDU carried in an HE ER SU PPDU and that is a response to a frame received in an HE ER SU PPDU shall use the <HE-MCS, NSS> tuple <HE-MCS 0, 1>.”  Hence, no further changes are necessary. |
| 22246 | Mark RISON | 443.07 | "The RU allocation complies" should be "The RU allocation shall comply" | As it says in the comment | Accepted |
| 22247 | Mark RISON | 443.13 | "if the group addressed frame is a FILS Discovery or a broadcast Probe Response frame" -- repetition | Delete "broadcast " in the cited text | Accepted |
| 22403 | Mark RISON | 436.31 | "if the most recently received HE Capa- bilities element from that peer STA" -- capabilities are static, so it doesn't have to be the most recent one | Delete "most recently received " in the cited text | Revised –  Agree in principle with the comment. We do need to specify that is received though. Proposed resolution removes “most recently”.  TGax editor to make the changes shown in 11-19/1833r0 under all headings that include CID 22403. |
| 22444 | ron porat | 437.01 | "A Trigger frame that is not an MU-RTS Trigger frame may be carried in any PPDU format that is supported by the intended receivers.". Trigger frame should not be carried in STBC or 11n/ac SGI or BPHY frames. | Update PPDU restrictions based on details in Draft 5.0, section 26.5.2.2.1, page 339, "An AP shall not use the short guard interval for an HT or VHT PPDU that carries a Trigger frame. A Trigger frame shall not be carried in a DSSS or HR/DSSS PPDU. An AP shall not use STBC encoding for a PPDU that carries a triggering frame" | Revised –  Agree in principle with the comment. Proposed resolution adds that the allowance is subject to the restrictions defined in 26.5.2.  TGax editor to make the changes shown in 11-19/1833r0 under all headings that include CID 22444. |

**Discussion: *None***

* PPDU format, BW, MCS, NSS, and DCM selection rules
* General

An HE STA can transmit different PPDUs formats, with different transmit parameters, such as channel width, MCS, NSS, DCM. This subclause defines the rules followed by an HE STA for selecting these parameters depending on the capabilities of the intended receiver(s) and other considerations.

* PPDU format selection

An HE STA that transmits non-HT, HT, or VHT PPDUs shall follow the rules in 10.6 (Multirate support). An HE STA may transmit an HE SU PPDU to a peer HE STA subject to the restrictions defined below.(#21523)

An HE AP may transmit an HE MU PPDU as defined in 26.5.1 (HE DL MU operation). A non-AP HE STA transmits HE TB PPDUs as defined in 26.5.2 (UL MU operation).

A STA shall not transmit a 242-tone HE ER SU PPDU to a peer non-AP STA if the most recently received OM Control field from that peer non-AP STA, if any, has the ER SU Disable subfield equal to 1.(#20909)

A STA shall not transmit a 242-tone HE ER SU PPDU to an AP if the most recently received HE Operation element from that AP has the ER SU Disable subfield equal to 1.(#20909)

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 22403):***

A STA shall not transmit a 106-tone HE ER SU PPDU to a peer STA if the HE Capabilities element received from that peer STA has the Partial Bandwidth Extended Range field equal to 0. *(#22403)* (#20909)

A STA shall not transmit a 20 MHz HE MU PPDU with just a 106-tone RU to a peer STA unless it has received from the peer STA(#20934) an HE Capabilities element with the Rx Partial BW SU In 20 MHz HE MU PPDU(#20934) subfield in the HE PHY Capabilities Information field equal to 1.

NOTE—A non-AP STA transmitting an HE MU PPDU sets the TXVECTOR parameter UPLINK\_FLAG to 1 if the PPDU is sent to the AP and to 0 if the PPDU is sent to a TDLS STA (see 26.11.2 (UPLINK\_FLAG)). The HE MU PPDU format enables the non-AP STA to include its AID (i.e., transmitter's AID if the UPLINK\_FLAG is 1 and the receiver's AID if the UPLINK\_FLAG is 0) in the PHY header of the PPDU and its use is out of scope of the standard.

An HE STA shall not transmit an HE MU PPDU with a single user being allocated an RU occupying the entire PPDU bandwidth and a compressed HE-SIG-B to a peer STA unless the HE STA has received from the peer STA an HE Capabilities element with the Rx Full BW SU Using HE MU PPDU With Compressed HE-SIG-B subfield in the HE PHY Capabilities Information field equal to 1.

An HE STA shall not transmit an HE MU PPDU with a single user being allocated an RU occupying the entire PPDU bandwidth and a noncompressed(#mdr) HE-SIG-B to a peer STA unless the PPDU bandwidth is less than or equal to 80 MHz and the HE STA has received from the peer STA an HE Capabilities element with the Rx Full BW SU Using HE MU PPDU With Non-Compressed HE-SIG-B subfield in the HE PHY Capabilities Information field equal to 1.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 22444):***

An HE STA shall send Control frames following the rules defined in 10.6.6 (Rate selection for Control frames) with the following exceptions:

* A Control frame shall be carried in an HT PPDU, VHT PPDU, HE ER SU PPDU or HE SU PPDU when the Control frame is sent using an STBC frame.
* A Control frame sent by the AP as a response to an HE TB PPDU may be carried in any PPDU format that is supported by the intended receivers.
* A Trigger frame that is not an MU-RTS Trigger frame may be carried in any PPDU format that is supported by the intended receivers subject to the restrictions defined in 26.5.2 (UL MU operation).*(#22444)*
* A Control frame is carried in an HE TB PPDU if it is sent as a response to a PPDU that contains a Trigger frame that is not an MU-RTS Trigger frame or if it is sent as a response to a PPDU that contains a frame containing a TRS Control subfield (see 26.5.2 (UL MU operation)).
* A Control frame sent by an HE STA as a response to an HE ER SU PPDU that does not contain a Trigger frame or frame carrying a TRS Control field should be carried in an HE ER SU PPDU unless the most recently received PPDU sent by a recipient of the HE ER SU PPDU to the HE STA after association was not an HE ER SU PPDU in which case the Control frame should be carried in non-HT PPDU.(#20237)
* A Control frame sent by an HE STA as a response to an HE SU PPDU or a non-HT PPDU(#21513) that does not contain a Trigger frame or frame carrying a TRS Control field should be carried in a non-HT PPDU unless the most recent received PPDU sent by a recipient of the HE SU PPDU to the HE STA after association was an HE ER SU PPDU in which case the Control frame should be carried in an HE ER SU PPDU.(#20237)
* A Control frame shall not be sent in an HE ER SU PPDU if the channel bandwidth of the soliciting PPDU is greater than 20 MHz.
* (#21362)A Control frame that is not solicited by another frame and is not a Trigger frame may be carried in an HE ER SU PPDU.
* A Control frame sent in the 6 GHz band as a response to an HE SU PPDU, HE MU PPDU, and that is not carried in HE TB PPDU, may be carried in an HE SU PPDU if the transmit time of HE SU PPDU is less than or equal to the PPDU duration of a non-HT PPDU containing the Control frame sent at the primary rate (see 10.6.6.5.2 (Selection of a rate or MCS)).

NOTE 1—A change in the format of the PPDU containing the control response frame (between non-HT and HE ER SU PPDU) occurs in subsequent TXOPs. A STA that solicits a control response frame from a responding STA accounts for the PPDU format of the control response frame to calculate the expected duration of the TXOP. The responding STA determines that the most recent PPDU sent to the soliciting STA is received(#20724) if it receives an immediate acknowledgment by the soliciting STA in response to the PPDU.(#20913)

NOTE 2—A STA does not transmit a Control frame in an HE ER SU PPDU to a receiving STA unless the receiving STA indicates that HE ER SU PPDU reception is enabled.

An HE STA should send an Ack frame in the same PPDU format as the soliciting PPDU if the soliciting PPDU is a VHT PPDU or HT PPDU containing an Fine Timing Measurement frame(#20606).

* MCS, NSS, BW and DCM selection

An HE STA shall follow the rules defined in 10.7 (Multirate support) and 26.15.4 (Rate selection constraints for HE STAs) for selecting the rate, MCS, NSS, and the rules defined in 10.3.2.6 (VHT RTS procedure), 10.3.2.7 (CTS and DMG CTS procedure), 10.7.6.6 (Channel Width selection for Control frames) and 10.7.11 (Channel Width in non-HT and non-HT duplicate PPDUs) for selecting the channel width (BW) of transmitted PPDUs with the following exceptions:

* HE-MCS(#20991), NSS, and BW selection for an HE TB PPDU are defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation).
* Rate and BW selection for a CTS sent in response to an MU-RTS Trigger frame are defined in 26.2.6 (MU-RTS Trigger/CTS frame exchange procedure).
* A STA that transmits a Control frame carried in a non-HT PPDU that is a response to a frame received in an HE ER SU PPDU shall set the rate of the non-HT PPDU to 6 Mb/s.
* A STA that transmits a Control frame that is an S-MPDU carried in an HE ER SU PPDU and that is a response to a frame received in an HE ER SU PPDU shall use the <HE-MCS, NSS> tuple <HE-MCS 0, 1>.(#20991)
* NSS and BW selection is further constrained as defined in 26.9 (Operating mode indication), 11.42 (Notification of operating mode changes), 26.15.2 (PPDU format selection), 26.17 (HE BSS operation) and in the remaining subclauses of 26.15 (PPDU format, BW, MCS, NSS, and DCM selection rules).(#21275)

An HE STA that transmits an HE PPDU to a receiving STA shall use an <HE-MCS, NSS> tuple that is supported by the receiving STA as indicated by the Supported HE-MCS And NSS Set field in the HE Capabilities element that the receiving STA transmits. If the Supported HE-MCS and NSS set of the receiving STA or STAs is not known, the transmitting STA shall transmit using a <HE-MCS, NSS> tuple in the basic HE-MCS and NSS set if the basic HE-MCS and NSS set is not empty, otherwise the transmitting STA shall transmit using a <HE-MCS, NSS> tuple in the mandatory HE-MCS and NSS Set. An HE STA is subject to all of the rules for HT STAs and VHT STAs that apply to its operating band (see 10.27 (Protection mechanisms)).

An HE STA may transmit an HE PPDU with 1024-QAM on a 26-, 52-, and 106-tone RU to a recipient STA if it has received from the recipient STA an HE Capabilities element with the Rx 1024-QAM < 242-tone RU Support subfield in the HE PHY Capabilities Information field equal to 1; otherwise the HE STA shall not transmit an HE PPDU with 1024-QAM on a 26-, 52-, and 106-tone RU.

An HE AP shall not set the UL HE-MCS subfield(#20991) of a(#20713) User Info field in a Trigger frame to 10 or 11 for a 26-, 52-, or 106-tone RU allocation unless the User Info field is addressed to a non-AP HE STA from which the HE AP has received an HE Capabilities element with the Tx 1024-QAM < 242-tone RU Support subfield in the HE PHY Capabilities Information field equal to 1.

An HE STA that sends a Control frame in response to a frame carried in an HE SU PPDU or an HE ER SU PPDU or an HE MU PPDU that carries a frame(#mdr) with the Normal Ack or Implicit BAR ack policy(#20545) shall set the TXVECTOR parameter CH\_BANDWIDTH to indicate a channel width that is the same as the channel width indicated by the RXVECTOR parameter CH\_BANDWIDTH of the frame eliciting the response. If the most recently received(#20724) PPDU sent by the responding STA to the soliciting STA after association was an HE ER SU PPDU, the soliciting STA shall set the TXVECTOR parameter CH\_BANDWIDTH to CBW20 for an HE SU PPDU and to ER-RU-242 or ER-RU-H-106 for an HE ER SU PPDU(#20762).

NOTE—A preamble punctured HE MU PPDU cannot(#Ed) carry a frame(#mdr) with Normal Ack or Implicit BAR ack policy(#20545) if the solicited PPDU containing a control response occupies one ore more punctured 20 MHz channels of the preamble punctured HE MU PPDU (see 26.4.4.3 (Responding to an HE MU PPDU with an SU PPDU)).

If a control response frame is to be transmitted within an HE SU PPDU, HE MU PPDU, the channel width (CH\_BANDWIDTH parameter of the TXVECTOR) shall be selected first according to 10.6.6.6 (Channel Width selection for Control frames), and then the <HE-MCS, NSS> tuple shall be selected from a set of <HE-MCS, NSS> tuples called the *CandidateMCSSet*. The *CandidateMCSSet* is defined in 10.6.6.5.3 (Control response frame MCS computation) except that the set additionally contains the <HE-MCS, NSS> tuples for an HE STA.

An HE STA may transmit an HE PPDU with DCM to a recipient STA if it has received from the recipient STA an HE Capabilities element with the DCM Max Constellation Rx subfield in the HE PHY Capabilities Information field greater than 0; otherwise the HE STA shall not transmit an HE PPDU with DCM to the recipient STA.

An HE STA transmits an HE TB PPDU with DCM as defined in 26.5.2.3 (Non-AP STA behavior for UL MU operation). An HE AP shall not set the DCM subfield of a User Info field in a Trigger frame to 1 if it has not received from the recipient STA an HE Capabilities element with the DCM Max Constellation Tx subfield in the HE PHY Capabilities Information field greater than 0.

An HE STA that transmits an HE PPDU with DCM to a recipient STA shall use an RU size that is less than or equal to the maximum RU size(#20939) indicated in the DCM Max RU subfield in the HE PHY Capabilities Information field in the HE Capabilities element received from the recipient STA.

An HE AP that transmits a Trigger frame addressed to a recipient STA that solicits an HE TB PPDU with DCM(#20943) shall set the RU Allocation subfield in the Trigger frame to indicate an RU size that is less than or equal to the maximum RU size(#20939, #20940) indicated in the DCM Max RU subfield in HE PHY Capabilities Information field in the HE Capabilities element received from the recipient STA.

An HE STA that transmits an HE PPDU with DCM to a recipient STA shall use an NSS that is less than or equal to the value indicated in the DCM Max NSS Rx subfield in the HE PHY Capabilities Information field in the HE Capabilities element received from the recipient STA.

An HE AP that transmits a Trigger frame with a User Info field addressed to a recipient STA and with the UL DCM subfield in the User Info field set to 1(#20943) shall set the Number Of Spatial Streams subfield in the SS Allocation subfield in the User Info field to less than or equal to the DCM Max NSS Tx subfield(#20938) in HE PHY Capabilities Information field in the HE Capabilities element received from the recipient STA.

An HE AP shall not transmit a Trigger frame with the UL STBC subfield set to 1 and the UL BW subfield set to indicate a bandwidth less than or equal to 80 MHz if at least one User Info field is addressed to a non-AP HE STA from which the HE AP has received an HE Capabilities element with the STBC Tx ≤ 80 MHz subfield in HE PHY Capabilities Information field equal to 0.

An HE AP shall not transmit a Trigger frame with the UL STBC subfield set to 1 and the UL BW subfield set to indicate 80+80 MHz or 160 MHz if at least one User Info field is addressed to a non-AP HE STA from which the HE AP has received an HE Capabilities element with the STBC Tx > 80 MHz subfield in HE PHY Capabilities Information field equal to 0.

An HE STA that sends a Control frame in an HE ER SU PPDU format should use:

* DCM encoding if the most recently received(#20724) PPDU sent by the HE STA, after association, to the STA soliciting the Control frame used DCM; otherwise the STA should not use DCM for the Control frame.
* 106-tone HE ER SU PPDU if the most recently received(#20724) PPDU sent by the HE STA, after association, to the STA soliciting the Control frame was a 106-tone HE ER SU PPDU; otherwise the STA should not use a 106-tone HE ER SU PPDU for the Control frame.

NOTE—Transmit(#20525) parameter switching occurs in subsequent TXOPs. A STA that solicits a Control frame from a peer STA accounts for the transmit(#20525) parameter of the Control frame to calculate the expected duration of the TXOP. The responding STA determines that the most recent PPDU sent to the soliciting STA is received(#20724) if it receives an immediate acknowledgment by the soliciting STA in response to the PPDU.

* Rate selection constraints for HE STAs
* Receive(#20526) HE-MCS and NSS Set

The receive HE-MCS and NSS set is the set of <HE-MCS, NSS> tuples for PPDU bandwidths less than or equal to 80 MHz, 160 MHz PPDUs or 80+80 MHz PPDUs that a STA is capable of receiving. The receive HE-MCS and NSS set for a first STA is determined(#20526) by a second HE STA for each <HE-MCS, NSS> tuple NSS = 1, …, 8 and PPDU bandwidth (less than or equal to 80 MHz, and 160 MHz or 80+80 MHz)(#20690) from the Supported HE-MCS And NSS Set field of the HE Capabilities element received from the first STA as follows:

* If support for the HE-MCS for NSS spatial streams at that PPDU bandwidth(#20690) is mandatory (see 27.1.1 (Introduction to the HE PHY)), then the <HE-MCS, NSS> tuple at that bandwidth is supported by the first STA on receive.
* Otherwise, if the Max HE-MCS For *n* SS subfield (*n* = NSS) in each Rx HE-MCS Map *b* subfield(#20563) for *b*  {≤ 80 MHz, 160 MHz, 80+80 MHz} indicates support and neither the Operating Mode field nor the OM Control subfield is received from the first HE STA, then the <HE-MCS, NSS> tuple at PPDU bandwidth *b* for a given operating channel width(#20690) is supported by the first STA on receive as defined in 9.4.2.247.4 (Supported HE-MCS And NSS Set field).
* Otherwise,
* If the Operating Mode field is received from the first HE STA, the <HE-MCS, NSS> tuple at that PPDU bandwidth for a given operating channel width(#20690) is supported by the first STA on receive as defined in 9.4.2.247.4 (Supported HE-MCS And NSS Set field) and by Equation (9-2a).
* If the OM Control subfield is received from the first HE STA, the <HE-MCS, NSS> tuple at that PPDU bandwidth for a given operating channel width(#20690) is supported by the first STA on receive as defined in 9.4.2.247.4 (Supported HE-MCS And NSS Set field) and by Equation (26-4)(#Ed).
* Otherwise, the <HE-MCS, NSS> tuple at that PPDU bandwidth(#20690) is not supported by the first STA on receive.

The <HE-MCS, NSS> tuples excluded by 26.15.4.3 (Additional rate selection constraints for HE PPDUs) can also be eliminated from the receive HE-MCS and NSS set(#20526).

An HE STA shall not, unless explicitly stated otherwise, transmit an HE PPDU unless the <HE-MCS, NSS> tuple and bandwidth used are in the receive HE-MCS and NSS set(#20526) of the receiving STA(s).

* Transmit(#20526) HE-MCS and NSS Set

The transmit HE-MCS and NSS set is the set of <HE-MCS, NSS> tuples for PPDU bandwidth less than or equal to 80 MHz, 106 MHz PPDUs or 80+80 MHz PPDUs that a STA is capable of transmitting. The transmit HE-MCS and NSS set of a first STA is determined(#20526) by a second STA for each <HE-MCS, NSS> tuple NSS = 1, …, 8 and PPDU bandwidth (less than or equal to 80 MHz, and 160 MHz or 80+80 MHz)(#20690) from the Supported HE-MCS And NSS Set field received from the first STA as follows:

* If support for the <HE-MCS, NSS> tuple at that bandwidth is mandatory (see 27.1.1 (Introduction to the HE PHY)), then the <HE-MCS, NSS> tuple at that PPDU bandwidth(#20690) is supported by the first STA on transmit.
* Otherwise, if the Max HE-MCS For *n* SS subfield (*n* = NSS) in each Tx HE-MCS Map *b* subfield(#20563) for *b*  {≤ 80 MHz, 160 MHz, 80+80 MHz} indicates support, then the <HE-MCS, NSS> tuple at PPDU bandwidth *b* for a given operating channel width(#20690) is supported by the first STA on transmit as defined in 9.4.2.247.4 (Supported HE-MCS And NSS Set field).
* Otherwise, the <HE-MCS, NSS> tuple at that PPDU bandwidth(#20690) is not supported by the first STA on transmit.

A non-AP STA may exclude certain numbers of space-time streams, *NSTS*, as defined in 26.9.3 (Transmit operating mode (TOM) indication) from its transmit HE-MCS and NSS set.(#20526)

* Additional rate selection constraints for HE PPDUs

A STA shall not transmit a 20 MHz or 40 MHz HE PPDU with an <HE-MCS, NSS> tuple that has HE-MCS 0, 1, 2 or 3 and NSS less than or equal to 4 to a receiver STA that has marked as unsupported the HT‑MCS(#20972) with value HE-MCS + 8 ×(NSS – 1) in the Rx MCS Bitmask subfield in the Supported MCS Set field in the HT Capabilities element it transmits. The transmission of a 20 MHz or 40 MHz HE PPDU with HE-MCS greater than 3 is not subject to this constraint.

A STA shall not transmit an 80 MHz, 160 MHz or 80+80 MHz HE PPDU with an <HE-MCS, NSS> tuple that has HE-MCS 0 or 1 and NSS less than or equal to 4 to a receiver STA that has marked as unsupported the HT‑MCS(#20972) values of both 2× HE-MCS + 8×(NSS – 1) and 2 ×HE-MCS + 1 + 8× (NSS – 1) in the Rx MCS Bitmask subfield in the Supported MCS Set field in the HT Capabilities element it transmits. The transmission of an 80 MHz, 160 MHz or 80+80 MHz HE PPDU with HE-MCS greater than 1 is not subject to this constraint.

An example tabulation of this behavior is given in Table 26-13 (Example of rate selection for HE PPDUs).

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| --- | --- | --- |
| * Example of rate selection for HE PPDUs | | |
| HT-MCSs(#20972) that are marked as unsupported | <HE-MCS, NSS> tuples that are not used for  CBW20 and CBW40 | <HE-MCS, NSS> tuples that are not used for CBW80, CBW160, and CBW80+80 |
| 0, 8, 16 | <0, 1>, <0, 2>, <0, 3> | - |
| 1, 9 | <1, 1>, <1, 2> | - |
| 10 | <2, 2> | - |
| 3 | <3, 1> | - |
| 0, 1 | <0, 1>, <1, 1> | <0, 1> |
| 2, 3 | <2, 1>, <3, 1> | <1, 1> |
| 0, 1, 8, 9 | <0, 1>, <1, 1>, <0, 2>, <1, 2> | <0, 1>, <0, 2> |

(#20128)

* Rx Supported VHT-MCS and NSS Set

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 a first STA, a second HE STA shall follow the rules in subclause 10.7.12.1 (Rx Supported VHT-MCS and NSS Set) to determine the Rx Supported VHT-MCS and NSS Set of the first HE STA with the following exception:

* If the second HE STA receives OM Control subfield from the first HE STA, the receive HE-MCS and NSS Set(#20526) of a first HE STA is determined by a second HE STA according to 9.4.2.158.3 (Supported VHT-MCS and NSS Set field) and Table 26-9 (Setting of the VHT Channel Width and VHT NSS at an HE STA transmitting the OM Control subfield).

NOTE—If the second STA receives both an Operating Mode field and an OM Control subfield from the first STA, the rules in 26.9.1 (General) apply.

* Additional rules for ER beacons and group addressed frames

An AP that transmits a Beacon frame or group addressed frames in an HE ER SU PPDU shall transmit the HE ER SU PPDU with an <HE-MCS, NSS> tuple where the HE-MCS is a mandatory HE-MCS and NSS = 1.(#21292, #21295)

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 22146):***

A Beacon frame or a group addressed frame transmitted in an HE ER SU PPDU shall be sent as an S-MPDU (see Table 9-532 (A-MPDU contents in the S-MPDU context)), except for group addressed Data frames, which are not required to be sent as an S-MPDU only, but are required to follow the rules in 10.12.4 (A-MPDU aggregation of group addressed Data frames).*(#22146)* (#20120, #21293)

The HE AP transmitting the HE ER SU PPDU shall set the TXVECTOR parameters as follows:

* CH\_BANDWIDTH to ER-RU-242
* HE\_LTF\_TYPE to 2xHE-LTF and GI\_TYPE to 0u8s\_GI or 1u6s\_GI, or HE\_LTF\_TYPE to 4xHE-LTF and GI\_TYPE to 3u2s\_GI
* FEC\_CODING to BCC\_CODING
* STBC to 0
* DCM to 0
* DOPPLER to 0
* BEAMFORMED to 0
* NUM\_STS to 1
* NOMINAL\_PACKET\_PADDING to 16 µs
* NO\_SIG\_EXTN to false in the 2.4 GHz band and true otherwise
* BEAM\_CHANGE as defined in 26.11.3 (BEAM\_CHANGE)(#21571, #21296, #21163, #21508)
* Additional rules for HE SU beacons(#21163) and group addressed frames(#21295, #20123)

An AP that transmits a Beacon frame or group addressed frames in an HE SU PPDU shall transmit the HE SU PPDU with an <HE-MCS, NSS> tuple where the HE-MCS is a mandatory HE-MCS and NSS = 1.(#21292, #21295)

NOTE—An AP might send a Beacon frame in an HE SU PPDU only when operating in the 6 GHz band (see 26.17.2.2 (Beacons in the 6 GHz band)).(#20123)

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 22146):***

A Beacon frame or a group addressed frame transmitted in an HE SU PPDU shall be sent as an S-MPDU (see Table 9-532 (A-MPDU contents in the S-MPDU context)), except for group addressed Data frames, which are not required to be sent as an S-MPDU only, but are required to followthe rules in 10.12.4 (A-MPDU aggregation of group addressed Data frames).*(#22146)* (#21293, #20120, #20123)

If the HE SU PPDU contains a group addressed frame intended for at least one STA that is not associated to the AP, then the HE AP shall set the TXVECTOR parameters for the HE PPDU as follows:

* CH\_BANDWIDTH to CBW20
* HE\_LTF\_TYPE to 2xHE-LTF and GI\_TYPE to 0u8s\_GI or 1u6s\_GI, or HE\_LTF\_TYPE to 4xHE-LTF and GI\_TYPE to 3u2s\_GI
* FEC\_CODING to BCC\_CODING
* STBC to 0
* DCM to 0
* DOPPLER to 0
* BEAMFORMED to 0
* NOMINAL\_PACKET\_PADDING to 16 µs
* NO\_SIG\_EXTN to false in the 2.4 GHz band and true otherwise(#20120, #20123)
* BEAM\_CHANGE as defined in 26.11.3 (BEAM\_CHANGE)(#21296)

Otherwise, if the HE SU PPDU contains group addressed frames intended only for associated STAs then the AP shall set the TXVECTOR parameters listed above to values that are indicated as supported by all the intended STAs, except that the CH\_BANDWIDTH shall be set to CBW20 if at least one of the intended STAs is currently not in the awake state.(#20120, #20123)

* Additional rules for group addressed frames in an HE MU PPDU

(#21522, #20072)An HE AP may include group addressed frames in an HE MU PPDU subject to the rules defined in this subclause.

An HE AP shall not include a Beacon frame in an HE MU PPDU.

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 22149, 22246, 22247):***

An HE AP that includes a group addressed frame in an HE MU PPDU shall ensure that the frame is included in a broadcast RU in the HE MU PPDU. The HE AP shall additionally ensure that the following conditions are satisfied for the broadcast RU:

* The RU allocation shall comply*(#22246)* with the rules in 26.5.1.3 (RU allocation in an HE MU PPDU) and 27.3.2.8 (RU restrictions for 20 MHz operation)
* The <HE-MCS, NSS> tuple shall have a mandatory HE-MCS and NSS = 1
* The broadcast RU shall be located within:
* The primary 20 MHz channel if the group addressed frame is a FILS Discovery or a Probe Response frame*(#22247)*, except when the primary 20 MHz channel does not coincide with a PSC and the AP is a 6 GHz-only AP, in which case the broadcast RU may be in a PSC that is within the BSS operating channel width (see 26.17.2.3 (Scanning in the 6 GHz band)). The broadcast RU size shall not exceed 106 subcarriers if the MU PPDU has a bandwidth that is greater than 20 MHz.
* The primary 20 MHz channel if the group addressed frame is addressed to at least one associated non-AP STA that has not declared to be in the awake state. The broadcast RU size shall not exceed 106 subcarriers if the MU PPDU has a bandwidth that is greater than 20 MHz.
* A bandwidth that is indicated as supported in reception by one or more associated non-AP STAs, if the group addressed frame is addressed only to those non-AP STAs and the STAs have declared to be in the awake state. The broadcast RU size shall not exceed the minimum common bandwidth that is supported in reception by all STAs in the HE Capabilities element they transmit or in the most recently sent OM Control or OMN frames.
* The SST subchannel if the group addressed frame is addressed to one or more HE SST STAs, the primary 20 MHz channel does not coincide with the subchannel assigned to the HE SST STAs and the frame is not addressed to any STAs other than the HE SST STAs in that subchannel (see 26.8.7.2 (SST operation)). The broadcast RU size shall not exceed 106 subcarriers if the SST subchannel is 20 MHz. *(#22149)*
* The TXVECTOR parameters listed below shall be set as follows:
* HE\_LTF\_TYPE to 2xHE-LTF and GI\_TYPE to 0u8s\_GI or 1u6s\_GI, or HE\_LTF\_TYPE to 4xHE-LTF and GI\_TYPE to 3u2s\_GI
* FEC\_CODING to BCC\_CODING
* STBC to 0
* DCM to 0
* DOPPLER to 0
* BEAMFORMED to 0
* NOMINAL\_PACKET\_PADDING to 16 µs
* NO\_SIG\_EXTN to false in the 2.4 GHz band and true otherwise
* BEAM\_CHANGE as defined in 26.11.3 (BEAM\_CHANGE)
* STA\_ID as defined in 26.11.1 (STA\_ID)

Group addressed frames transmitted in an HE MU PPDU shall be sent as an S-MPDU (see Table 9-532 (A-MPDU contents in the S-MPDU context)) except for group addressed Data frames, which may also be sent within an A-MPDU subject to the rules in 10.13.4 (A-MPDU aggregation of group addressed Data frames).

* Additional rules for PPDUs sent in the 6 GHz band(#21297)

(#21522, #20072)An HE STA that transmits a PPDU that is not sent in response to a Trigger frame in the 6 GHz band (#20128)and that contains a frame that is not a control response frame with the Address 1 field (#21522, #20072)set to the MAC address of an HE AP with which it is not associated and from which it has received a FILS Discovery frame or an HE Operation element shall ensure that the PPDU(#20128) meets the following conditions:

* The bandwidth of the PPDU(#20128) is less than or equal to the operating bandwidth of the HE BSS as indicated in the BSS Operating Channel Width subfield of the FILS Discovery frame or in the Channel Width subfield of the HE Operation element sent by the AP
* The PPDU(#20128) is transmitted with a number of spatial streams that is less than or equal to the maximum number of spatial streams of the HE BSS as indicated in the Maximum Number of Spatial Stream subfield of the FILS Discovery frame or in the Basic HE-MCS and NSS Set field of the HE Operation element sent by the AP
* If the PPDU is an HE PPDU, then the PPDU is transmitted with an <HE-MCS, NSS> tuple providing a data rate that is greater than or equal to the minimum rate indicated in the FILS Minimum Rate field (if present) of the FILS Discovery frame or in the Minimum Rate field of the HE Operation element sent by the AP.(#20128, #21300)
* If the PPDU is a non-HT PPDU then the PPDU is transmitted with a data rate that is greater than or equal to the minimum of <R, 54 Mb/s>, where R is the minimum rate indicated in the FILS Minimum Rate field (if present) of the FILS Discovery frame or in the Minimum Rate field of the HE Operation element sent by the AP(#20128, #21300)

An HE STA that transmits a PPDU that is not sent in response to a Trigger frame in the 6 GHz band and that contains a frame that is not a control response frame with Address 1 field (#21522, #20072)set to the MAC address of the AP to which it is associated shall ensure that the PPDU meets the following conditions:

* If the PPDU is a non-HT (duplicate) PPDU then the PPDU is transmitted with a data rate that is greater than or equal to the minimum of <R, 54 Mb/s>, where R is the minimum rate indicated in the Minimum Rate field of the HE Operation element sent by the AP.
* If the PPDU is an HE PPDU then the PPDU is transmitted with an <HE-MCS, NSS> tuple providing a data rate that is not less than the data rate indicated in the Minimum Rate field of the HE Operation element sent by the AP.(#20128)

An HE STA that transmits a(#21523, #20218) PPDU that is not an HE TB PPDU in the 6 GHz band and that contains a frame that is not a control response frame with Address 1 field (#21522, #20072)set to the MAC address of an AP with which it is not associated shall determine a local maximum transmit power for that transmission following the rules in 11.7.5 (Specification of regulatory and local maximum transmit power levels), if the local maximum transmit power is received in Transmit Power Envelope elements and combinations of Country elements and Power Constraint elements in the most recent Beacon or Probe Response frame, on the channel from that AP.