IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Disallowed Sub channels | | | | | | Date: 2018-04-16 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Matthew Fischer | Broadcom |  |  | [Matthew.fischer@broadcom.com](mailto:Matthew.fischer@broadcom.com) | | Yongho Seok | MediaTek |  |  | [yongho.seok@mediatek.com](mailto:yongho.seok@mediatek.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Proposed language to address the issue of disallowed subchannels.

The proposed change is to add a new field to the end of the HE Operation IE called Operational Subchannel Information field.

One additional bit called Punctured Operation is added inside of the HE Operation Information field to signal the presence/absence of the new field

The new field is a combination of a length and a bit map, where the length is a 3 bit value and the bit map is the length of octets indicated in the length field. Each bit of the bitmap corresponds to a subchannel of resolution 242-tones. The lowest numbered bit corresponds to the subchannel with the lowest frequency of the BSS operating channel, etc.

A bit set to 1 indicates transmissions are allowed on that subchannel.

A bit set to 0 indicates transmission is not allowed on that subchannel.

The absence of the field indicates no puncturing, i.e. transmission is allowed on all subchannels of the BSS channel width.

Corresponding behavioral language is added to subclause 27.

A change to the HE NDP Announcement is included to signal the puncturing of the sounding sequence by adding a disallowed subchannel bitmap field which is present when the AID11 value is 2047, instead of a normal STA Info field.

Also included are proposed HE MIMO Control field changes to indicate a punctured set of feedback information, basically, adding the same disallowed subchannels bitmap to the HE MIMO Control field.

The proposed changes on this document are based on TGax Draft 2.3.

**REVISION NOTES:**

**R0**:

initial

**R1**:

Removed resolution field

Updated document revision number references

**R2**:

The supported channel width indicated in the HT and VHT Capabilities elements is not the same as the value represented in the HE Capabilities element when some subchannels are disallowed.

**R3**:

Added a modified STA Info subfield in the 9.3.1.20 VHT/HE NDP Announcement frame format subclause to carry punctured subchannel information using a newly reserved AID11 value.

Added punctured operation behavioural description within 27.6.2 Sounding sequences and support, where the bandwidth of the HE feedback is determined, first by applying the tone index values and then by applying the disallowed subchannel indication within the HE NDP Announcement frame. Similar language added to 27.6.3 Rules for HE sounding protocol sequences where the bandwidth of the HE NDP Announcement frame is determined.

Change resolution of Operational Subchannel Information in the HE Op IE from 20 MHz to 242-tone.

Added Disallowed Subchannel Bitmap subfield to the HE MIMO Control field in 9.4.1.62 and some behavioural language to 27.6.2 and 27.6.3 to describe its use.

Changed MIB variable name (shortened it)

**R4**:

Add a rule that when a STA Info field in the HE NDPA frame has the AID11 field value of 2047, then that STA Info field shall be the first in the frame.

In 9.4.1.62 HE MIMO Control field changes, modified the disallowed subchannel bitmap length to be 0 or 8 and add a reserved field of 0 or 8. The intent was to add 16 bits to allow word alignment of the remainder of the frame contents and the disallowed subchannel bitmap is only 8 bits in length, not 16, so a reserved field is needed to reach a total of 16 bits

**R5**:

Update text to D3.0

Update CID – remove LB230 CID, replace with LB233 CID

Add Disambiguation field to STA Info subfield of HE NDPA frame when AID11 == 2047

27.6.3 – redefined MU sounding vs SU sounding (i.e. based on number of STA Info fields present in the NDPA frame, i.e. now excluding AID11==2047 from the count)

27.16.1 – BSS BW indication and interpretation – added sentences to describe how a puncturing capable AP sets BW and bitmap values (BW set to the set of contiguous subchannels indicated in the operational subchannel bitmap that includes the primary channel) and how a non-AP STA combines the two fields to determine the actual available punctured set of subchannels/tones for transmission

**END OF REVISION NOTES**

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.***

**CIDs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 16723 | Ron Porat | 28.3.16 | 547.53 | preamble puncturing as currently defined in D3.0 is lacking several features needed to make it useful especially in Radar channels when some subchannels are blocked for very long durations | Please consider adding the following enhancements: 1. Broadcast message to declare punctured subchannels 2. Punctured NDP to enable BF and DL MU-MIMO 3. NDPA signaling of punctured subbands in the NDP 4. Punctured Non-HT Dup to carry NDPA 5. New PHY modes to enable single user transmission across the entire available punctured BW with at least 60MHz support and one mode for >80MHz (e.g. 120MHz) | Revise - TGax editor to make changes as shown in 11-18/0496r5 that are marked with CID 16723 |

**Discussion:**

Operation within some bands in some regulatory jurisdictions requires monitoring and/or other means of determining whether a primary operator is using channels in the band (e.g. database information). If primary devices are detected or otherwise indicated as operating within a channel, then regulations might require that secondary users, e.g. WLAN devices, are required to cease transmissions in the channel. Because some regulations allow operation on an aggregation of multiple disjoint channels in some of these “shared” bands, and might add additional similar regulations for various bands in the future, and provided that it is in the interest of 802.11 devices to be able to take advantage of disjoint aggregation, then it is necessary to include signalling for 802.11 devices to communicate which disjoint channel combinations are allowed to be used at any given time.

Within various existing regulations, the concept exists, wherein, a device operating as a non-primary user in the band may be a master device which determines which channels are available and which are not available and through some means communicates this information, often implicitly, to non-master devices (aka dependent devices). Existing 802.11 TGax signalling to support the master device concept is both implicit and positive and therefore does not adequately address the case of discontiguous channel aggregation.

For example, a master device acting as an AP might determine that a primary user has begun operating in a channel N that is currently being used by the master device and the master device may then choose to inform any non-master device of its intent to change to a new channel without explicitly indicating the reason for doing so. E.g. the Channel Switch Announcement element can be used.

Non-master devices wishing to operate on a specific channel must first identify the presence of a master device operating on the channel and the presence of such a master device transmitting on the channel is an implicit indication of the availability of the channel for use by the non-primary user. That is, the presence or absence of a master device transmission on a channel is an implicit indication of the availability of the channel for use by non-primary devices. This is implicit signalling as there is no specific field in for example, a beacon that indicates that the channel is available for use.

For discontiguous operation, a master device could operate on an aggregation of channels while intentionally avoiding transmissions on an interior channel based on its knowledge of primary user use of that interior channel. A non-master device currently has no way to determine whether some portion of an aggregated set of channels is not actually available for use by non-primary devices. For example, an 802.11 TGax AP could indicate operation on an 80 MHz channel as a non-primary user, but then discover that a primary user is operating on one of the 20 MHz channels within the 80 MHz. The AP can avoid transmitting on the protected sub-channel, but there is no signalling to indicate to other devices, e.g. non-AP STAs, that that sub-channel is not available. The text in this document offers a proposal for communicating this explicit information.

Summary of the proposed change:

The proposed change is to add a new field to the end of the HE Operation IE called Operational Subchannel Information field.

One additional bit called Punctured Operation is added inside of the HE Operation Information field to signal the presence/absence of the new field

The new field is a combination of a length and a bit map, where the length is a 3 bit value and the bit map is the length of octets indicated in the length field. Each bit of the bitmap corresponds to a specific subchannel. The lowest numbered bit corresponds to the subchannel with the lowest frequency of the BSS operating channel, etc. Note that a length field is needed in order to maintain extensibility of the HE Operation element.

A bit set to 1 indicates transmissions are allowed on that subchannel.

A bit set to 0 indicates transmission is not allowed on that subchannel.

The absence of the field indicates no puncturing, i.e. transmission is allowed on all subchannels of the BSS channel width.

Corresponding behavioral language is added to subclause 27.

**Proposed Changes to Draft Text of TGax D3.0:**

**9.3.1.20 VHT/HE NDP Announcement frame format**

***TGax editor: change the caption of Figure 9-51b – STA Info subfield format in an HE NDP Announcement frame to “STA Info subfield format in an HE NDP Announcement frame when the value in the AID11 subfield is not equal to 2047”***

***TGax editor: add a new figure with the caption “Figure 9-51bx – STA Info subfield format in an HE NDP Announcement frame when the value in the AID11 subfield is equal to 2047” with the figure appearing as shown:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B10 | B11 B18 | B19 B26 | B27 | B28 B31 |
|  | AID11 | Disallowed Subchannel Bitmap | Reserved | Disambiguation | Reserved |
| Bits: | 11 | 8 | 8 | 1 | 4 |

**Figure 9-51bx – STA Info subfield format in an HE NDP Announcement frame when the value in the AID11 subfield is equal to 2047**

***TGax editor: modify the text as shown:***

The AID11 subfield contains the 11 least significant bits of the AID of a STA expected to process the following HE NDP and prepare sounding feedback, except that if the AID11 field contains the value 2047, then the remaining bits of the STA Info subfield have the meaning indicated in Figure 9-51bx – STA Info subfield format in an HE NDP Announcement frame when the value in the AID11 subfield is equal to 2047.

The Disallowed Subchannel Bitmap subfield indicates which 242-tone groups are disallowed for operation and which 242-tone groups are to be included in the requested feedback. The lowest numbered bit of the Disallowed Subchannel Bitmap subfield corresponds to the 242-tone group that lies within the BSS width and that has the lowest frequency of the set of all 242-tone groups within the BSS width. Each successive bit in the bitmap corresponds to the next higher frequency 242-tone group. A bit in the bitmap is set to 1 to indicate that for the corresponding punctured 242-tone group, no energy is present in the NDP frames associated with this NDP Announcement frame and STAs addressed by the NDP Announcement frame do not include the group when determining the average SNR of space time streams 1 to Nc when generating the requested feedback. Otherwise, the bit is set to 0.

**9.4.1.62 HE MIMO Control field**

***TGax editor: change one of the reserved bits of the HE MIMO Control field to be “Disallowed Subchannel Bitmap Present” in Figure 9-121d – HE MIMO Control field and add two new fields called “Disallowed Subchannel Bitmap” with a number of bits indicated as “0 or 8” and a reserved field with a number of bits indicated as “0 or 8” and add the following descriptive text:***

The Disallowed Subchannel Bitmap Present subfield indicates whether a Disallowed Subchannel Bitmap subfield and a reserved field of 8 bits are present in the HE MIMO Control field. These subfields are present if the Disallowed Subchannel Bitmap Present subfield is equal to 1. These subfields are not present if the Disallowed Subchannel Bitmap Present subfield is equal to 0.

The Disallowed Subchannel Bitmap subfield is defined in 9.3.1.20 (VHT/HE NDP Announcement frame format).

**9.4.2.237.2 HE MAC Capabilities Information field**

***TGax editor: change one of the reserved bits of the HE Capability element MAC Capabilities subfield to be “Punctured Operation Support” and add the following row to Table 9-262z – Subfields of the HE MAC Capabilities Information field, noting that the column headings are shown for editing convenience:***

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| Punctured Operation Support | Indicates support for punctured operation as described in 27.6 (HE Sounding protocol)). | Set to 1 if dot11PuncturedOperationActivated is true (see 27.6 (HE Sounding protocol)).  Set to 0 otherwise. |

**9.4.2.238 HE Operation element**

***TGax editor: change one of the reserved bits of the HE Operation Parameters field to be a new one-bit subfield called “Punctured Operation” and add the following paragraph as a description of the new subfield:***

The Punctured Operation subfield indicates whether the BSS channel width includes disallowed subchannels. The Punctured Operation subfield is set to 1 if dot11PuncturedOperationActivated is true to indicate that the BSS channel width includes disallowed subchannels and is set to 0 otherwise. The Punctured Operation subfield is set to 0 when transmitted by a STA operating in the 2.4 GHz band. **(#14323)**

***TGax editor: add one new subfield called “Operational Subchannel Information” to the MSbit side of Figure 9-589cq – HE operation element format, label the width of the new subfield as “variable” and add the following paragraphs and figures as descriptions of the new subfield and its sub-subfields:***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | HE Operation Parameters | Basic HE MCS And NSS Set | VHT Operation Information | MaxBSSID Indicator | Operational Subchannel Information |
| Bits: | 1 | 1 | 1 | 4 | 3 | 0 or 3 | 0 or 1 | variable**(#14323)** |

**Figure 9-589cq – HE Operation element format**

The Operational Subchannel Information subfield indicates on which subchannels of the BSS width, transmission is allowed and on which subchannels, transmission is disallowed. The Operational Subchannel Information subfield contains three subfields as shown in Figure 9-589xx Operational Subchannel Information subfield format. The Operational Subchannel Information field is present if the Punctured Operation subfield is equal to 1 and is not present otherwise. **(#14323)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reserved | Operational Subchannel Bitmap Length | Operational Subchannel Bitmap |
| Bits: | 5 | 3 | variable |

**Figure 9-589xx – Operational Subchannel Information subfield format(#14323)**

The Operational Subchannel Bitmap Length subfield is 3 bits in length and contains an unsigned integer which indicates the length of the Operational Subchannel Bitmap subfield. The length of the Operational Subchannel Bitmap subfield is equal to one plus the numerical value of the Operation Subchannel Bitmap Length subfield octets. **(#14323)**

The Operational Subchannel Bitmap subfield indicates on which 242-tone subchannels of the BSS width transmissions are allowed. The lowest numbered bit of the Operational Subchannel Bitmap subfield corresponds to the 242-tone subchannel that has the lowest frequency of all of the similarly-sized, equally-spaced, contiguous subchannels included within the BSS channel width and that has its left edge at the same frequency as the left edge of the operating channel corresponding to the BSS width. Each successively higher bit in the bitmap corresponds to the next contiguous, higher subchannel contained within the BSS channel width. A bit in the bitmap is set to 1 to indicate that transmission is allowed on the corresponding subchannel and is set to 0 to indicate that transmission is disallowed on the corresponding subchannel. The number of subchannels in the BSS width might not be a multiple of eight. Bits of the bitmap corresponding to subchannels that are not contained within the BSS width are reserved. If the Operational Subchannel Bitmap subfield is not present, then transmission is allowed on all subchannels of the BSS channel width. **(#14323)**

**27.6.2 Sounding sequences and support**

***TGax editor: modify the text as shown:***

The bandwidth (partial or full) of the feedback solicited by an HE beamformer from an HE beamformee depends on the Partial BW subfield in the STA Info field addressed to the HE beamformee in the HE NDP Announcement frame, the bandwidth of the HE NDP Announcement frame and the value of the Disallowed Subchannel Bitmap subfield, if present. Full bandwidth feedback is solicited if the RU Start Index subfield in the Partial BW subfield is 0; the Disallowed Subchannel Bitmap subfield is absent, or contains all zeroes; and the following conditions apply:

* The RU End Index subfield in the Partial BW subfield is 8 and the bandwidth of the HE NDP Announcement frame is 20 MHz
* The RU End Index subfield is 17 and the bandwidth of the HE NDP Announcement frame is 40 MHz
* The RU End Index subfield is 36 and the bandwidth of the HE NDP Announcement frame is 80 MHz
* The RU End Index subfield is 73 and the bandwidth of the HE NDP Announcement frame is 80+80 MHz or 160 MHz

Other settings of the Partial BW subfield solicit partial bandwidth feedback. Punctured operation is indicated by the inclusion of a non-zero Disallowed Subchannel Bitmap subfield in the NDP Announcement frame and in such a case, the disallowed subchannels are applied to the tone information to be included in the feedback after selecting tones for feedback based on the RU Start Index and RU End Index subfield values and HE NDP Announcement frame bandwidth as described above. See Table 27-4 (Settings for BW, RU Start Index, and RU End Index fields in HE NDP Announcement frame).

An SU beamformer may solicit full bandwidth SU feedback from an SU beamformee in an HE non-TB sounding sequence. An SU beamformer shall not solicit partial bandwidth SU feedback in an HE non-TB sounding sequence. An SU beamformer may solicit partial bandwidth or full bandwidth SU feedback from an SU beamformee in an HE TB sounding sequence if the SU beamformee indicates support by setting the Triggered SU Beamforming Feedback subfield in the HE PHY Capabilities Information field in the HE Capabilities element it transmits to 1.

An MU beamformer may solicit full bandwidth MU feedback from an MU beamformee in an HE TB sounding sequence. An MU beamformer may solicit partial bandwidth MU feedback from an MU beamformee in an HE TB sounding sequence if the MU beamformee indicates support by setting the Triggered MU Beamforming Partial BW Feedback subfield to 1.

An MU beamformer may solicit full bandwidth or partial bandwidth CQI feedback from an MU beamformee in an HE TB sounding sequence if the MU beamformee indicates support by setting the Triggered CQI Beamforming Feedback subfield to 1.

An MU beamformer may solicit full bandwidth CQI feedback from an MU beamformee in an HE non-TB sounding sequence if the MU beamformee indicates support by setting the Non-Triggered CQI Beamforming Feedback subfield to 1.

An MU beamformer may solicit punctured MU feedback from an MU beamformee in an HE TB sounding sequence if the MU beamformee indicates support for punctured operation by setting the Punctured Operation Support subfield to 1. An MU beamformer shall indicate punctured subchannels in the NDP frames of an HE NDP sounding sequence by setting the appropriate bits of the Disallowed Subchannel Bitmap subfield of the STA Info field that includes the value of 2047 in the AID11 subfield within an HE NDP Announcement frame. An MU beamformer that includes a value of 2047 for AID11 in a STA Info field of an HE NDP Announcement frame shall place that STA Info field as the first STA Info field of the frame.

An MU beamformee that supports punctured operation shall generate feedback corresponding to the tones indicated in the STA Info field with an AID11 value matching the twelve least significant bits of its AID value from within a received HE NDP Announcement frame, but excluding tones that are disallowed according to the value of the Disallowed Subchannel Bitmap subfield of the same HE NDP Announcement frame.

**27.6.3 Rules for HE sounding protocol sequences**

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

An HE non-TB sounding sequence is a sounding sequence initiated by an HE beamformer with a burst of two frames comprising an individually addressed HE NDP Announcement frame with a single STA Info field with a value in the AID11 field other than 2047 followed after SIFS by an HE NDP. An HE beamformer that initiates an HE non-TB sounding sequence shall transmit an HE NDP Announcement frame with one and only one STA Info field and the RA field set to the address of the HE beamformee addressed in the STA Info field as the initial frame of the sequence.

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

An HE beamformer that transmits an HE NDP Announcement frame to an HE beamformee that is an AP, mesh STA or STA that is a member of an IBSS, shall include one STA Info field in the HE NDP Announcement frame and shall set the AID11 field in the STA Info field of the frame to 0. An HE beamformer that transmits an HE NDP Announcement frame to one or more HE beamformees that are non- AP STAs shall set the AID11 field in each STA Info field to the 11 LSBs of the AID of the non-AP STA to which the STA Info field is addressed. An HE NDP Announcement frame shall not include more than one STA Info fields that have the same value in the AID11 subfield. An HE beamformer that transmits an HE NDP Announcement frame may include a STA Info field with an AID11 subfield value of 2047 to indicate disallowed subchannels during punctured channel operation. When present, the STA Info field with AID11 value of 2047 shall be the first STA Info field in the frame.

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

An HE beamformer that transmits an HE NDP Announcement frame shall set the RU Start Index and RU End Index subfields in a STA Info field to indicate the starting 26-tone RU and the ending 26-tone RU, respectively, of the solicited HE compressed beamforming and CQI report (see 9.3.1.20 (VHT/HE NDP Announcement frame format)). For punctured channel operation, the RU Start Index and RU End Index correspond to the bandwidth before puncturing and the Disallowed Subchannel Bitmap subfield is used to indicate which tones are punctured in the HE NDP frames and in the solicited feedback.

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

The HE beamformer shall solicit feedback over full bandwidth when the HE NDP Announcement frame has only one STA Info field or when the STA Info field is addressed to an HE beamformee that has indicated no support for partial bandwidth feedback. The HE beamformer may solicit feedback over full bandwidth or partial bandwidth when the STA Info field is addressed to an HE beamformee that has indicated support for partial bandwidth feedback and the sequence is an HE TB sounding sequence (see 27.6.2 (Sounding sequences and support)).

For 80+80 MHz, feedback is not requested for the gap between the 80 MHz segments.

The HE beamformer shall set the TXVECTOR parameter CH\_BANDWIDTH or CH\_BANDWIDTH\_ IN\_NON\_HT, the RU Start Index field, and the RU End Index field of the HE NDP Announcement frame, depending on the operating channel width and partial BW support of the HE beamformee, as defined in Table 27-4 (Settings for BW, RU Start Index, and RU End Index fields in HE NDP Announcement frame) and the Bandwidth of the HE NDP Announcement frame is determined before applying puncturing based on disallowed subchannels.

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

The HE beamformer shall use a lowest 26-tone RU, which is the lower bound of the starting 26-tone in the RU Start Index subfield of a STA Info field that is equal to the maximum of:

— The minimum 26-tone RU located within the channel width in the VHT Operation Information field of either the HE Operation element or the VHT Operation element, whichever is present, and within the channel width in the HT Operation element

— The minimum 26-tone RU located within the channel width in the most recently received Operating Mode Notification frame, Operating Mode Notification element with the Rx NSS Type subfield equal to 0, or OM Control subfield sent by the corresponding HE beamformee (see 27.8 (Operating mode indication))

The HE beamformer shall use a highest 26-tone RU, which is the upper bound of the ending 26-tone RU in the RU End Index subfield of a STA Info field that is equal to the minimum of:

— The maximum 26-tone RU located within the channel width in the VHT Operation Information field of either the HE Operation element or the VHT Operation element, whichever is present, and within the channel width in the HT Operation element

— The maximum 26-tone RU located within the channel width in the most recently received Operating Mode Notification frame, Operating Mode Notification element with the Rx NSS Type subfield equal to 0, or OMI Control field sent by the corresponding HE beamformee (see 27.8 (Operating mode indication))

***TGax editor: modify the following text in 27.6.3 Rules for HE sounding protocol sequences, as shown:***

A non-AP HE beamformee that transmits an HE Compressed Beamforming and CQI Report shall set the RU Start Index and RU End Index subfields of the HE MIMO Control field to indicate the range of tones for which compressed beamforming and CQI information is provided. If the HE NDP Announcement frame that solicited the feedback includes a Disallowed Subchannel Bitmap field with a non-zero value, then a beamformee that indicates support for Punctured Operation shall include a Disallowed Subchannel Bitmap subfield in the solicited feedback with the same value as the Disallowed Subchannel Bitmap subfield of the HE NDP Announcement frame that solicited the feedback to indicate tones for which feedback information is not provided from within the range of tones indicated by the RU Start Index and RU End Index subfields.

The value of the Sounding Dialog Token Number in the HE MIMO Control field shall be set to the same value as the Sounding Dialog Token Number field in the corresponding HE NDP Announcement frame.

***TGax editor: modify the text shown:***

**27.16.1 Basic HE BSS functionality**

A STA transmitting a frame containing both an HT Capabilities element and an HE Capabilities element shall set the Supported Channel Width Set subfield of the HT Capabilities element to 1 when either B0 or B1 of the Channel Width Set subfield of the HE Capabilities element is 1 with the following exceptions:

—If the STA is a 20 MHz-only non-AP HE STA, the STA shall set the Supported Channel Width Set subfield of the HT Capabilities element to 0.

— If the frame, or the STA’s most recently transmitted HE Operation element’s Operational Subchannel Information subfield of the HE Operation Parameters field indicates a disallowed subchannel within the primary 40 MHz channel, the STA shall set the Supported Channel Width Set subfield of the HT Capabilities element to 0.

A STA transmitting a frame containing both a VHT Capabilities element and an HE Capabilities element shall set the Supported Channel Width Set subfield of the VHT Capabilities element to a value that indicates the same channel width capability as the channel width capability indicated in the HE Capabilities element with the following exceptions:

—If the STA is a 20 MHz-only non-AP HE STA, the Supported Channel Width Set subfield of the VHT Capabilities element is reserved.

— If the frame, or the STA’s most recently transmitted HE Operation element’s Operational Subchannel Information subfield of the HE Operation Parameters field indicates at least one disallowed subchannel, the STA shall set the Supported Channel Width Set and the Extended NSS BW Support subfields of the VHT Capabilities element to 0 and include the Operating Mode Notification element in the frame with one of the following settings:

—the Operating Mode field’s Rx NSS Type subfield set to 0, Channel Width subfield set to 2, and 160/80+80 BW subfield set to 0, if none of the disallowed subchannels is within the primary 80 MHz channel and the STA indicates support for 80+80 or 160 MHz operation.

—the Operating Mode field’s Rx NSS Type subfield set to 0, Channel Width subfield set to 1, and 160/80+80 BW subfield set to 0, if none of the disallowed subchannels is within the primary 40 MHz channel.

—the Operating Mode field’s Rx NSS Type subfield set to 0, Channel Width subfield set to 0, and 160/80+80 BW subfield set to 0, if none of the disallowed subchannels is the primary channel.

A STA that is an HE AP or an HE mesh STA that transmits an HE Operation element that has the VHT Operation Information Present field set to 1 shall set the STA Channel Width subfield in the HT Operation element HT Operation Information field, the Channel Width, Channel Center Frequency Segment 0 and Channel Center Frequency Segment 1 subfields in the HE Operation element VHT Operation Information field to indicate the BSS bandwidth as defined in Table 11-24 (VHT BSS bandwidth).

The setting of the Channel Center Frequency Segment 0, Channel Center Frequency Segment 1 and Channel Center Frequency Segment 2 subfields is shown in Table 11-25 (Setting of Channel Center Frequency Segment 0, Channel Center Frequency Segment 1 and Channel Center Frequency Segment 2 subfields), except that the Max NSS support is provided by the HE STA in frames that contain an HE Capabilities element (see 9.4.2.237 (HE Capabilities element)) and an Operating Mode field (see 9.2.4.6.4.3 (Operating Mode) and 9.4.1.53 (Operating Mode field)), wherein in the table the Max NSS support refers to the HE Max NSS support instead of the VHT Max NSS support for an HE STA.

An HE STA shall determine the channelization using the information in the Primary Channel field of the HT Operation element when operating in 2.4 GHz and the combination of the information in the Primary Channel field in the HT Operation element, the Operational Subchannel Information subfield, if present, and the Channel Center Frequency Segment 0 and Channel Center Frequency Segment 1 subfields in the VHT Operation Information field in the VHT Operation element when operating in 5 GHz (see 21.3.14 (Channelization)). **(#14323)**

An HE AP or an HE mesh STA shall set the Secondary Channel Offset subfield in the HT Operation Information field in the HT Operation element to indicate the secondary 20 MHz channel as defined in Table 9- 168 (HT Operation element fields and subfields), if the BSS bandwidth is more than 20 MHz.

An HE AP or an HE mesh STA shall set the values of the Operational Subchannel Bitmap subfield to indicate on which subchannels transmissions are allowed within the BSS as specified in 9.4.2.238 (HE Operation element). The Operational Subchannel Bitmap Length field shall be set to the minimum value needed to indicate the status of all subchannels within the BSS width. If transmission is disallowed on at least one subchannel within the BSS width, then the Punctured Operation subfield shall be set to one. The Operational Subchannel Bitmap Information subfield may be omitted from the HE Operation element and the Punctured Operation subfield set to zero if transmissions are allowed on all subchannels that are in the BSS width. A STA that transmits an Operational Subchannel Bitmap shall not set the Channel Width Set subfield of the HE Capabilities element to a value that indicates a bandwidth of operation that is larger than the bandwidth indicated by the set of contiguously located operational subchannels that includes the primary channel as indicated in the Operation Subchannel Bitmap. **(#14323)**

An HE STA with dot11PuncturedOperationActivated equal to true shall not transmit on any subchannel of the BSS channel width for which it has received an Operational Subchannel Bitmap subfield with a value of 0 in the corresponding bit position for that subchannel in the most recently received HE Operation element from the AP with which it is associated. An HE STA with dot11PuncturedOperationActivated equal to true may transmit on the subchannels indicated in the Operational Subchannel Bitmap regardless of the BSS operational bandwidth that is indicated in the Channel Width Set subfield of the HE Capabilities element. **(#14323)**

An HE STA that is a member of an HE BSS shall follow the same rules that are defined in 11.40.1 (Basic VHT BSS functionality) when transmitting a 20 MHz, 40 MHz, 80 MHz, 160 MHz or 80+80 MHz HE PPDUs with the following exceptions:

— An HE TB PPDU sent in response to a Trigger frame or a frame with a UMRS Control field(#Ed) follows the rules defined in 27.5.2.3 (STA behavior for UL MU operation(#8151))

— An 80 MHz, 160 MHz or 80+80 MHz DL HE MU PPDU(#6253) with preamble puncture may be transmitted if either the primary 20 MHz or the primary 40 MHz, or both are occupied by the transmission (see Table 28-18 (HE-SIG-A field of an HE MU PPDU)).

An HE STA shall not transmit to a second HE STA using a bandwidth that is not indicated as supported in the Supported Channel Width Set subfield in the HE Capabilities element received from that HE STA.

**TGax Editor: *Add a new MIB variable in C.3 MIB Detail within the dot11StationConfigEntry group as shown:***

**C.3 MIB Detail**

dot11PuncturedOperationActivated 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 STA implementation is capable of operating in a mode where some 242-tone groups are not allowed to be used within a channel of width 80 MHz or 160 MHz. The capability is disabled, otherwise"

DEFVAL { false }

::= { dot11StationConfigEntry <XX>}

**End of proposed changes.**