IEEE P802.11
Wireless LANs

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| Disallowed Sub channels |
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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 the resolution 20 MHz. 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.

The proposed changes on this document are based on TGax Draft 2.1.

**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.

**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**

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| --- | --- | --- | --- | --- | --- | --- |
| 14334 | Zhou Lan | 10.22.2.5 | 195.56 | per20MHzbitmap is too restrictive. In many case the interference appear as a narrow band signal. Small granularity is more useful for the AP to make correct decision on DL/UL OFDMA operation.Enhance CCA capability to smaller granularity. | as in the comment | Revise - TGax editor to make changes as shown in 11-18/0496r1 that are marked with CID 14334 |

**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 D2.1:**

**9.4.2.238 HE Operation element**

***TGax editor: change one of the reseved 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 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 20 MHz subchannels of the BSS width transmissions are allowed. The lowest numbered bit of the Operational Subchannel Bitmap subfield corresponds to the 20 MHz 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)**

***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 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. **(#14323)**

An HE STA 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. **(#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.

**End of proposed changes.**