IEEE P802.11
Wireless LANs

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| CR on dot11HECCAIndicationMode |
| Date: 2019-11-14 |
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Abstract

Proposed resolution for CIDs 22348 and 22416.

r0 presented in Thu AM1 at September 2019 session

r1 reinstated OBSS\_PD\_level paragraph in 27.3.19.6.5; various editorial fixes.

r2 updated to reference D5.1

r3 accommodate Mark Rison’s comments. Need to allow per20bitmap along with IDLE indication since some of the conditions for 20 MHz subchannel being busy would not trigger secondary 40 channel or secondary 80 channel busy.

r4 additional fixes with feedback from Mark

r5 editorial correction and new resolution for 22348 following group discussion.

# Comments

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| --- | --- | --- | --- | --- |
| 22348 | 657.04 | 27.3.19.6.5 | 27.3.19.6.5 Per 20 MHz CCA sensitivity does not fully address the 160/80+80 case (e.g. last para only covers "For 80 MHz operation") | As it says in the comment |

### Discussion

The commenter is referring to the second of these two paragraphs:

The per20bitmap is 8 bits in length. For 160 MHz or 80+80 MHz operation, the first bit to the 8th bit correspond to the 20 MHz subchannel with the lowest frequency to the 20 MHz subchannel with the highest frequency respectively. When a 20 MHz subchannel is BUSY, the corresponding bit is set to 1, otherwise it is set to 0. If dot11HECCAIndicationMode is equal to 1 (per20bitmap), the bit corresponding to the primary 20 MHz is set to 0.

For 80 MHz operation, the first bit to the 4th bit corresponds to the 20 MHz subchannel with the lowest frequency to the 20 MHz subchannel with the highest frequency respectively. When a 20 MHz subchannel is BUSY, the corresponding bit is set to 1, otherwise it is set to 0. If dot11HECCAIndicationMode is equal to 1 (per20bitmap), the bit corresponding to the primary 20 MHz is set to 0 and the last 4 bits are reserved and set to 1s.

### Proposed Resolution

REVISED.

The last paragraph does indeed not address the 160/80+80 case, but this is addressed in the immediately preceding paragraph.

However, both paragarphs deal with the format of the per20bitmap parameter and, since this is an abstract interface, this detail is unnecessary. In the MAC text we could simply say “if the per20bitmap parameter indicates that channel x is busy, then…”. We do not need a format description.

TGax editor to delete the last two paragaraphs of 27.3.19.6.5.

## Comments

On D5.0:

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| --- | --- | --- | --- | --- |
| 22416 |  |  | Re CID 21023, 16306, 13230: dot11HECCAIndicationMode apparently indicates the SME controls what the PHY-CCA.ind contains. This makes no sense | Make the changes indicated in 19/1684 |

On D4.0:

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** |
| --- | --- | --- | --- | --- |
| 21023 | 714.28 | C.3 | Re CID 16306, 13230: dot11HECCAIndicationMode apparently indicates the SME controls what the PHY-CCA.ind contains | It seems to me that that MIB variable needs to be deleted completely, and the behaviour should be specified as "use per-20 MHz bitmap if doing preamble puncturing, TB or BQR, otherwise use single-element form" |

# Discussion

With CID 22416 and 21023, the commenter points out that, according to the MIB description, the SME controls how the PHY reports CCA. This would be OK if the STA had different modes of operation and the SME placed it in one of those modes for longish periods of time. However, it seems that the intent is to report CCA based on frame sequencing (e.g., report CCA with a channel-list={per20bitmap} during the SIFS that follows receipt of a Trigger frame but report CCA with channel-list={secondary|secondary40|secondary80} otherwise). The SME is not aware of the frame sequencing, so this would be impossible.

The proposal here is to have the HE PHY always provide the per20bitmap in PHY-CCA.indication() when the operating channel width is greater than 20 MHz.

Possible indications:

If the operating channel width is 20 MHz, then channel-list and per20bitmap parameters are not present

PHY-CCA.indication(BUSY)

PHY-CCA.indication(IDLE)

If the operating channel width is greater than 20 MHz and the primary and secondary channels are idle. Individual 20 MHz subcahnnels in the secondary 40 MHz or secondary 80 MHz channel could be busy without triggering the condition for secondary 40 MHz or secondary 80 MHz channel busy.

PHY-CCA.indication(IDLE, per20bitmap)

If the operating channel width is greater than 20 MHz and the primary 20 MHz channel, secondary 20 MHz channel, secondary 40 MHz channel or secondary 80 MHz channel is busy. One or more of the 20 MHz subchannels is busy.

PHY-CCA.indication(BUSY, channel-list, per20bitmap)

# Proposed Resolution

REVISED.

TGax editor to apply the changes under “Editing instructions” in <this document> to D5.1. The changes remove the MIB object and add a parameter to the PHY-CCA.indication() so that the busy/idle status of the 20 MHz subchannels is always reported.

# Editing instructions

***TGax editor: delete the dot11HECCAIndicationMode MIB object:***

***TGax editor: delete the dot11HECCAIndicationMode entry in dot11PhyHEEntry***

**8.3.4.3 PHY SAP service primitives parameters**

***TGax editor: change the cell in the last column of Table 8-3 correspondng to the row STATE as follows:***

(BUSY, [channel-list, per20bitmap])
(IDLE, [per20bitmap])

* PHY-CCA.indication
* Semantics of the service primitive

***TGax editor: change as follows:***

The primitive provides the following parameters:

PHY-CCA.indication(

 STATE,

 IPI-REPORT,

 channel-list,

 per20bitmap

)

***TGax editor: Change Table 8-5 as follows:***

Change Table 8-5 (The channel-list parameter entries) as follows:

|  |
| --- |
| * The channel-list parameter entires
 |
| channel-list element | Meaning |
| primary | In an HT STA that is ~~not~~ neither a VHT STA nor an HE STA, indicates that the primary 20 MHz channel is busy.In a VHT STA that is not an HE STA, indicates that the primary 20 MHz channel is busy according to the rules specified in 21.3.18.5.3 (CCA sensitivity for signals occupying the primary 20 MHz channel).In a TVHT STA, indicates that the primary channel is busy according to the rules specified in 22.3.18.6.3 (CCA sensitivity for signals occupying the primary channel).In an HE STA, indicates that the primary 20 MHz channel is busy according to the rules specified in 27.3.19.6.3 (CCA sensitivity for the primary 20 MHz channel). |
| secondary | In an HT STA that is ~~not~~ neither a VHT STA nor an HE STA, indicates that the secondary channel is busy.In a VHT STA that is not an HE STA, indicates that the secondary 20 MHz channel is busy according to the rules specified in 21.3.18.5.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel).In a TVHT STA, indicates that the secondary channel is busy according to the rules specified in 22.3.18.6.4 (CCA sensitivity for signals not occupying the primary channel).In an HE STA, indicates that the secondary 20 MHz channel is busy according to the rules specified in 27.3.19.6.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel). |
| secondary40 | In a VHT STA that is not an HE STA, indicates ~~Indicates~~ that the secondary 40 MHz channel is busy according to the rules specified in 21.3.18.5.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel).In a TVHT STA, indicates that the secondary TVHT\_2W channel is busy according to the rules specified in 22.3.18.6.4 (CCA sensitivity for signals not occupying the primary channel).In an HE STA, indicates that the secondary 40 MHz channel is busy according to the rules specified in 27.3.19.6.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel). |
| secondary80 | In a VHT STA that is not an HE STA, indicates ~~Indicates~~ that the secondary 80 MHz channel is busy according to the rules specified in 21.3.18.5.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel).In an HE STA, indicates that the secondary 80 MHz channel is busy according to the rules specified in 27.3.19.6.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel). |
|  |  |

TGax editor: Insert a new paragraph at the end of the subclause:

If the STA is an HE STA with an operating channel width greater than 20 MHz, then the per20bitmap parameter is present; ortherwise it is absent. If present, the per20bitmap parameter is a bitmap where each bit represents the busy/idle status of a 20 MHz subchannel in the operating channel width as defined in 27.3.19.6.5 (Per 20 MHz CCA sensitivity).

* When generated

Change the first paragraph and remove the note as follows:

For Clause 15 (DSSS PHY specification for the 2.4 GHz band designated for ISM -applications) to Clause 20 (Directional multi-gigabit (DMG) PHY specification) PHYs, this primitive is generated within aCCATime of the occurrence of a change in the status of the primary channel from channel idle to channel busy or from channel busy to channel idle or when the entries of the channel-list parameter change. For Clause 21and Clause 22 PHYs, this primitive is generated when the status of the channel(s) changes from channel idle to channel busy or from channel busy to channel idle or when the entries of the channel-list parameter change. For Clause 27 PHYs, this primitive is generated when the status of the channel(s) changes from channel idle to channel busy or from channel busy to channel idle, when the entries of the channel-list parameter change, or when the per20bitmap parameter changes. This includes the period of time when the PHY is receiving data. The timing of PHY-CCA.indication primitives related to transitions on secondary channel(s) is PHY specific. Refer to specific PHY clauses for details about CCA behavior for a given PHY.

~~NOTE—For the VHT PHY, the timing information is omitted here and is defined in 21.3.18.5.~~

* Extended BSS Load element

TGax editor: change as follows:

Change the description of the Tbusy,W1 parameter in 7th paragraph as follows:

Tbusy,W1 is computed as the sum of the times from PHY-CCA.indication(BUSY,{W2},per20bitmap) to the next issue of a PHY-CCA.indication primitive and that overlap the measurement interval, for W1 = 20, 40, or 80~~, and where W2 equals secondary, secondary40, or secondary80 for W1 = 20, 40, or 80, respectively~~. For a VHT AP, for W1 = 20, 40, 80, W2 equals secondary, secondary40, or secondary80, respectively. For an HE AP, for W1= 20, W2 equals secondary or per20bitmap has the bit corresponding to the primary 20 MHz channel t equal to 0 and the bit corresponding to the secondary 20 MHz channel equal to 1; for W1= 40, W2 equals secondary40 or per20bitmap has the bits corresponding to the primary 20 MHz and secondary 20 MHz channels equal to 0, and at least one bit corresponding to any 20 MHz subchannel in the secondary 40 MHz channel equal to 1; for W1 = 80, W2 equals secondary80 or per20bitmap has the bits corresponding to the primary 20 MHz, secondary 20 MHz and secondary 40 MHz channels equal to 0, and at least one bit corresponding to any 20 MHz subchannel in the secondary 80 MHz channel equal to 1.

10.23.2.5 EDCA channel access in a VHT, HE or TVHT BSS

TGax editor: Undo the edits to Table 10-16 (Channels indicated idle by the channel-list parameter):

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***TGax editor: Undo the following edits:***

TGax editor: Insert the following:

Insert the following after the 1st paragraph:

If the MAC receives a PHY-CCA.indication primitive with the per20bitmap parameter present, the parameter indicates the busy/idle status of each of the 20 MHz subchannels that comprise the operating channel width.

* CCA sensitivity for the primary 20 MHz channel

***TGax editor: change as follows:***

The PHY shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY if one of the conditions listed in Table 27-53 (Conditions for CCA BUSY on the primary 20 MHz) is met in an otherwise idle 20 MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz operating channel width. The channel-width parameter is present and set to {primary} if the operating channel width is greater than 20 MHz. With >90% probability, the PHY shall detect the start of a PPDU that occupies at least the primary 20 MHz channel under the conditions listed in Table 27-53 (Conditions for CCA BUSY on the primary 20 MHz) within a period of aCCATime (see 21.4.4 (VHT PHY)) and hold the CCA signal busy ( not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE) for the duration of the PPDU, unless it receives a CCARESET.request primitive before the end of the PPDU for instance during spatial reuse operation as described in 26.10 (Spatial reuse operation).

|  |
| --- |
| * Conditions for CCA BUSY on the primary 20 MHz
 |
| Operating Channel Width | Conditions |
| 20 MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz | The start of a 20 MHz Non-HT PPDU in the primary 20 MHz channel as defined in 17.3.10.6 (CCA requirements).The start of an HT PPDU under the conditions defined in 19.3.19.5 (CCA sensitivity).The start of a 20 MHz VHT PPDU in the primary 20 MHz channel at or above –82 dBm.The start of a 20 MHz HE PPDU in the primary 20 MHz channel at or above –82 dBm. |
| 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz | The start of a 40 MHz non-HT duplicate, VHT or HE PPDU in the primary 40 MHz channel at or above –79 dBm.The start of an HT PPDU under the conditions defined in 19.3.19.5 (CCA sensitivity). |
| 80 MHz, 160 MHz, or 80+80 MHz | The start of an 80 MHz non-HT duplicate, VHT or HE PPDU in the primary 80 MHz channel at or above –76 dBm. |
| 160 MHz or 80+80 MHz | The start of a 160 MHz or 80+80 MHz non-HT duplicate, VHT or HE PPDU at or above –73 dBm. |

The receiver shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY for any signal that exceeds a threshold equal to 20 dB above the minimum modulation and coding rate sensitivity (82 + 20 = 62 dBm) in the primary 20 MHz channel within a period of aCCATime after the signal arrives at the receiver's antenna(s). If the operating channel width is greater than 20 MHz, then the channel-list parameter is present and shall be set to {primary}. Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE or with a change in the channel-list parameter.

* CCA sensitivity for signals not occupying the primary 20 MHz channel

***TGax editor: change as follows:***

The PHY shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY and with the channel-list parameter set to {secondary}if the conditions for issuing a PHY-CCA.indication primitive with the STATUS parameter BUSY as defined in 27.3.19.6.3 (CCA sensitivity for the primary 20 MHz channel) are not present and at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz operating channel width:

* Any signal within the secondary 20 MHz channel at or above a threshold of –62 dBm within a period of aCCATime after the signal arrives at the receiver’s antenna(s)
* A 20 MHz Non-HT, HT\_MF, HT\_GF, VHT or HE PPDU detected in the secondary 20 MHz channel at or above a threshold of max(–72 dBm, *OBSS\_PDlevel*) with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).

Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE, or with the STATUS parameter set to BUSY and the channel-list parameter set to {secondary40} or {secondary80}.

The PHY shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY and the channel-list parameter set to {secondary40} if the conditions for issuing a PHY-CCA.indication with the STATUS parameter set to BUSY as defined in 27.3.19.6.3 (CCA sensitivity for the primary 20 MHz channel) and above are not present and at least one of the following conditions is present in an otherwise idle 80 MHz, 160 MHz, or 80+80 MHz operating channel width:

* Any signal within the secondary 40 MHz channel at or above a threshold of –59 dBm within a period of aCCATime after the signal arrives at the receiver’s antenna(s)
* A 40 MHz non-HT duplicate, HT\_MF, HT\_GF, VHT or HE PPDU detected in the secondary 40 MHz channel at or above a threshold of max(–72 dBm, *OBSS\_PDlevel +* 3 dB) with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).
* A 20 MHz non-HT, HT\_MF, HT\_GF, VHT or HE PPDU detected in any 20 MHz sub-channel of the secondary 40 MHz channel at or above a threshold of max(–72 dBm, *OBSS\_PDlevel*) with >90% probability within a period aCCAMidTime.

Following the indication and while the threshold continues to be exceeded, the receiver shall not issue a PHY-CCA.indication primitive with the STATUS parameter set to IDLE, or with the STATUS parameter set to BUSY and the channel-list parameter set to {secondary80}.

The PHY shall issue a PHY-CCA.indication primitive with the STATUS parameter set to BUSY and the channel-list parameter set to {secondary80} if the conditions for issuing a PHY-CCA.indication primitive with the STATUS parameter set BUSY as defined 27.3.19.6.3 (CCA sensitivity for the primary 20 MHz channel) and above are not present and at least one of the following conditions is present in an otherwise idle 160 MHz or 80+80 MHz operating channel width:

* Any signal within the secondary 80 MHz channel at or above –56 dBm.
* An 80 MHz non-HT duplicate, VHT or HE PPDU detected in the secondary 80 MHz channel at or above max(–69 dBm, *OBSS\_PDlevel +*6 dB) with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).
* A 40 MHz non-HT duplicate, HT\_MF, HT\_GF, VHT or HE PPDU detected in any 40 MHz sub-channel of the secondary 80 MHz channel at or above max(–72 dBm, *OBSS\_PDlevel +*3 dB) with >90% probability within a period aCCAMidTime.
* A 20 MHz NON\_HT, HT\_MF, HT\_GF, VHT or HE PPDU detected in any 20 MHz sub-channel of the secondary 80 MHz channel at or above max(–72 dBm, *OBSS\_PDlevel*) with >90% probability within a period aCCAMidTime.

*OBSS\_PDlevel* is defined in 26.10.2.4 (Adjustment of OBSS PD and transmit power) and applied in the equations to define the detection level in this subclause if an HE STA has ignored a 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz inter-BSS PPDU following the procedure in 26.10.2.2 (General operation with non-SRG OBSS PD level) or 26.10.2.3 (General operation with SRG OBSS PD level). It is applied to any secondary channels within the PPDU bandwidth of the inter-BSS PPDU and during the RXTIME of the inter-BSS PPDU. Otherwise, *OBSS\_PDlevel* is not applied in the equations to define the detection level in this subclause.

* Per 20 MHz CCA sensitivity

***TGax editor: change as follows:***

If the operating channel width is greater than 20 MHz and the PHY issues a PHY-CCA.indication primitive, the PHY shall set the per20bitmap to indicate the busy/idle status of each 20 MHz subchannel. A 20 MHz subchannel is busy if at least one of the following conditions is present in an otherwise idle 40 MHz, 80 MHz, 80+80 MHz or 160 MHz channel:

* A signal is present on the 20 MHz subchannel at or above a threshold of -62 dBm at the receiver’s antenna(s). The PHY shall indicate that the 20 MHz subchannel is busy a period aCCATime after the signal starts and shall continue to indicate the 20 MHz subchannel is busy while the threshold continues to be exceeded.
* The 20 MHz subchannel is in a channel on which an 80 MHz non-HT duplicate, VHT or HE PPDU at or above max(–69 dBm, *OBSS\_PDlevel* + 6 dB) at the receiver’s antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).
* The 20 MHz subchannel is in a channel on which a 40 MHz non-HT duplicate, HT\_MF, HT\_GF, VHT or HE PPDU at or above max(–72 dBm, *OBSS\_PDlevel +*3 dB) at the receiver’s antenna(s) is present. The PHY shall indicate that the 20 MHz subchannel is busy with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).
* A 20 MHz Non-HT, HT\_MF, HT\_GF, VHT, or HE PPDU at or above max(–72 dBm, *OBSS\_PDlevel*) at the receiver’s antenna(s) is present on the 20 MHz subchannel. The PHY shall indicate that the 20 MHz subchannel is busy with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).

NOTE—Following the receipt of a Trigger frame with the CS Required subfield in the Common Info field set to 1, the HE PHY is only required to detect a signal at the -62 dBm threshold since the other conditions require more time than is available before the response is expect.

*OBSS\_PDlevel* is defined in 26.10.2.4 (Adjustment of OBSS PD and transmit power) and applied in the equations to define the detection level in this subclause if an HE STA has ignored a 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz inter-BSS PPDU following the procedure in 26.10.2.2 (General operation with non-SRG OBSS PD level) or 26.10.2.3 (General operation with SRG OBSS PD level). It is applied to any secondary channels within the PPDU bandwidth of the inter-BSS PPDU and during the RXTIME of the inter-BSS PPDU. Otherwise, *OBSS\_PDlevel* is not applied in the equations to define the detection level in this subclause.