IEEE P802.11
Wireless LANs

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| CR on dot11HECCAIndicationMode |
| Date: 2019-09-18 |
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Abstract

Proposed resolution for #21023.

# Comment

| **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

The commenter points out that, according to the MIB description, the SME control 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 a 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.

The conditions that trigger PHY-CCA.indication() are defined in 27.3.19.6.3 (CCA sensitivity for the primary 20 MHz channel) and 27.3.19.6.4 (CCA sensitivity for signals not occupying the primary 20 MHz channel), i.e., the usual conditions for detecting occupancy on the primary and secondary channels. The per20bitmap then just provides finer granularity on occupancy of each 20 MHz subchannel.

It would not be possible PHY-CCA.indication() to report a 20 MHz subchannel as busy in the per20bitmap without also reporting one of {primary|secondary|secondary40|secondary80} – such condition could not exist.

Possible indications:

PHY-CCA.incation(IDLE) – the primary 20 MHz channel and secondary channels are idle. Each 20 MHz subcahnnel is idle.

PHY-CCA.indication(BUSY) – operating channel width = 20 MHz and the channel is busy

PHY-CCA.indication(BUSY, {primary| secondary|secondary40|secondary80}, per20bitmap) – operating channel width > 20 MHz and the primary or one of the secondaries is busy. per20bitmap provides detail on each 20 MHz subchannel

# Proposed Resolution

 REVISED.

TGax editor to apply the changes in <this document> under “Editing instructions” to D4.3. 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:***

* 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 elements) as follows:

|  |
| --- |
| * The channel-list parameter elements
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| 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 PHY is not an HE PHY or the operating channel width is 20 MHz, then the per20bitmap parameter is absent. Otherwise, it carries the busy/idle status of each 20 MHz subchannel in the operating channel according to the rules in 27.3.19.6.5 (Per 20 MHz CCA sensitivity).

The per20bitmap is a bitmap where each bit represents the busy/idle status of a 20 MHz subchannel in the operating channel width, with the LSB indicating the status of the 20 MHz subchannel that is lowest in frequency and the MSB indicating the status of the 20 MHz subchannel that is highest frequency. If a 20 MHz subchannel is busy, then the corresponding bit is set to 1, otherwise it is set to 0.

* 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 elements of the channel-list parameter change. For Clause 21 ~~and~~, Clause 22 and 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 or when the elements of the channel-list parameter change. 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 20MHz 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.

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

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

If the MAC receives a PHY-CCA.indication primitive with the channel-list parameter present, the channels
considered idle are defined in Table 10-16 (Channels indicated idle by the channel-list parameter).

Change Table 10-16 (Channels indicated idle by the channel-list parameter) as follows:

|  |
| --- |
| * Channels indicated idle by the channel-list parameter
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| PHY-CCA.indication primitive channel-list element | Idle channels |
| primary | None |
| secondary | Primary 20 MHz channel |
| secondary40 | Primary 20 MHz channel and secondary 20 MHz channel |
| secondary80 | Primary 20 MHz channel, secondary 20 MHz channel, and secondary 40 MHz channel |
|  |  |

Insert the following after the 1st paragraph:

If the per20bitmap parameter is present, it 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(BUSY, {primary}, per20bitmap) primitive 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. 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 (PHY-CCA.indication(BUSY, channel-list) primitive) 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).

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| * Conditions for CCA BUSY on the primary 20 MHz
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| 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 PPDU 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 PPDU 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 PPDU or HE PPDU at or above –73 dBm. |

The receiver shall issue a PHY-CCA.indication(BUSY, {primary}, per20bitmap) primitive 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); then the receiver shall not issue a PHY-CCA.indication(BUSY,{secondary}, per20bitmap), PHY-CCA.indication(BUSY,{secondary40}, per20bitmap), PHY-CCA.indication(BUSY,{secondary80}, per20bitmap), or PHY-CCA.indication(IDLE) primitive while the threshold continues to be exceeded.

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

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

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary}, per20bitmap) primitive if the conditions for issuing PHY-CCA.indication(BUSY, {primary}, per20bitmap) primitive are not present and one of the following conditions are 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); then the PHY shall not issue a PHY-CCA.indication(BUSY, {secondary40}, per20bitmap), PHY-CCA.indication(BUSY, {secondary80}, per20bitmap), or PHY-CCA.indication(IDLE) primitive while the threshold continues to be exceeded.
* A 20 MHz NON\_HT, HT\_MF, HT\_GF, VHT PPDU or HE PPDU detected in the secondary 20 MHz channel at or above max(–72 dBm, *OBSS\_PDlevel*) with >90% probability within a period aCCAMidTime (see 27.4.4 (HE PHY)).

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary40}, per20bitmap) primitive if the conditions for issuing a PHY-CCA.indication(BUSY, {primary}, per20bitmap) and PHY-CCA.indication(BUSY, {secondary}, per20bitmap) primitive are not present and one of the following conditions are 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); then the PHY shall not issue a PHY-CCA.indication(BUSY, {secondary80}, per20bitmap) primitive or PHY-CCA.indication(IDLE) primitive while the threshold continues to be exceeded.
* A 40 MHz non-HT duplicate, HT\_MF, HT\_GF, VHT PPDU or HE PPDU detected in the secondary 40 MHz channel at or above 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 PPDU or HE PPDU detected in any 20 MHz sub-channel of the secondary 40 MHz channel at or above max(–72 dBm, *OBSS\_PDlevel*) with >90% probability within a period aCCAMidTime.

The PHY shall issue a PHY-CCA.indication(BUSY, {secondary80}, per20bitmap) primitive if the conditions for PHY-CCA.indication(BUSY, {primary}, per20bitmap), PHY-CCA.indication(BUSY, {secondary}, per20bitmap), and PHY-CCA.indication(BUSY, {secondary40}, per20bitmap) primitive are not present and one of the following conditions are 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 PPDU 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 PHY issues a PHY-CCA.indication(BUSY, channel-list, per20bitmap) 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 one of the following conditions apply:

* A signal is present on the 20 MHz subchannel at or above a threshold of -62 dBm at the receive 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 threshold continues to be exceeded.
* The 20 MHz subchannel is in an 80 MHz channel on which an 80 MHz non-HT duplicate, VHT PPDU or HE PPDU at or above max(–69 dBm, *OBSS\_PDlevel* + 6 dB) at the receive 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 40 MHz 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 receive 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 receive 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)).