IEEE P802.11
Wireless LANs

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| Proposed resolution for comments related to CID 9153, 8810, 8811(HE STA) |
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Abstract

This submission proposes resolutions for CID 9153, 8810 8811

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

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

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

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| --- | --- | --- | --- | --- |
| **CID** | **Line** | **Comment** | **Proposed Change** | **Resolution** |
| 9153 | 28.3.3.6 | It is not clear on the possibility of the operation in secondary channels from 'primary 20 MHz channel as a mandatory mode' description. | Clarify the operation capability on secondary 20 MHz channels of 20 MHz-only STA, e.g., only primary 20 MHz support or else, and if it is required to operate, define the procedure and signaling. | Revised.Propose to allow 20 MHz-operating STA to operate on any 20 MHz. Please see the text for details.  |
| 8810 | 28.3.3.6  | "A 20 MHz only HE STA operates in the primary 20 MHz channel as a mandatory mode." is not correct language for a standard. | Change to "A 20 MHz only HE STA shall only operate in the primary 20 MHz channel." | Revised. Propose that 20MHz only STA shall support operating on primary channel and may optionally operate on non-primary channels. Please see the proposed text for details |
| 8811 | 28.3.3.6 | "A 20 MHz only HE STA operates in the primary 20 MHz channel as a mandatory mode."Having 20 MHz-only systems operate in only the primary channel is suboptimal. There should be an option for 20-MHz only devices to operate in any 20 MHz channels. | See comment | Agreed in principlePropose to allow 20 MHz-operating STA to operate on any 20 MHz. Please see the text for details. |
|  |  |  |  |  |

TGax Editor: Please modify this section as follows:

TGax Editor: Please modify the following subsection after 9.4.2.225

**9.4.2.218** **HE Capabilities element**

**9.4.2.218.1 General**

An HE STA declares that it is an HE STA by transmitting the HE Capabilities element.

The HE Capabilities element contains a number of fields that are used to advertise the HE capabilities of an HE STA. The HE Capabilities element is defined in Figure 9-589cj (HE Capabilities element format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  | Element ID | Length | HE MAC Capabilities Information | HE PHY Capabilities Information | Tx Rx HE MCS NSS Support | PPE Thresholds (optional) | STA Channel Switch Outage Time (optional) |
| Octets: | 1 | 1 | 5 | 9 | 2 or more | variable | 1 |
| **HE Capabilities element format** |

The Element ID and Length fields are defined in 9.4.2.1 (General).

The HE MAC Capabilities Information, HE PHY Capabilities Information, Tx Rx HE MCS NSS Support, ~~and~~ PPE Thresholds and STA Channel Switch Outage Time fields are defined in the subclauses below.

**9.4.2.218.2 HE MAC Capabilities Information field**

The format of the HE MAC Capabilities Information field is defined in Figure 9-589ck (HE MAC Capabilities Information field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B33 | B34 | B35  | B36~~B35~~  B39 |
|  | QTP Support | A-BQR Support | Non-Primary Channel Operation | Reserved |
| Bits: | 1 | 1 | 1 | 4~~5~~ |
| **HE MAC Capabilities Information field format (**B1-B32 are omitted here**)** |

TGax Editor: Please insert a row below to Table 9-262z (Subfields of the HE MAC Capabilities Information field).

|  |
| --- |
| **Subfields of the HE MAC Capabilities Information field** |
| **Subfield** | **Definition** | **Encoding** |
| Non-Primary Channel Operation | Indicates support for non-AP STA’s operation on non-primary channels | Set to 1 if dot11NonPrimaryChannelOptionallyImplemented is set to true.Set to 0 otherwise. |

TGax Editor: Please insert the following subsection after 9.4.2.218.5

**9.4.2.218.6 STA Channel Switch Outage Time**

The STA Channel Switch Outage Time field is present if Non-Primary Channel Operation field is set to 1. STA Channel Switch Outage Time field defines the outage time when the STA switches operating channel, in unit of 50 µs. A value 255 indicates that the channel switch outage time is unknown.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |
|  |

TGax Editor: Please insert the following subsection after 9.4.2.225

**9.4.2.226 STA Channel Switch Request Element**

The STA Channel Switch Request element defines the request sent by an HE non-AP STA to an HE AP to switch its operating channel or sent by an AP STA to request a non-AP STA to switch its operating channel. The format of STA Channel Switch Request element is shown in Figure xx (STA Channel Switch Request Element).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | Channel Index | Primary Channel Period | Non-Primary Channel Operation Timeout |  |
| Octets: | 1 | 1 | 1 | 1 | 1 | 1 |  |
| STA Channel Switch Request element |

The Element ID and Length fields are defined in 9.4.2.1 (General).

The Channel Index field is a bitmap field that is used to indicate the 20 MHz channels within the BSS operating bandwidth with least significant bit indicating the lowest 20 MHz of the BSS bandwidth and most significant bit indicating the highest 20 MHz channel in a 160/80+80 MHz BSS.

Notes: When transmitted by an HE AP, only one bit is allowed to be set to 1, i.e., the non-AP STA is allowed by the AP to switch to a single 20 MHz channel. When transmitted by an HE non-AP STA, one or more more one bit are allowed to be set to 1 to report the candidate 20 MHz channels that the non-AP STA is willing to operate on (27.7.16).

If sent by an HE AP, the Primary Channel Period indicates the period, in unit of 1TU, starting from each DTIM that the AP will not transmit any traffic to STAs operating on non-primary channels. If sent by non-AP STA, this field is reserved.

If sent by non-AP STA, t If sent by an HE AP, this field is reserved.

**9.4.2.227 STA Channel Switch Response Element**

The HE STA Channel Switch Response element defines the response sent by an HE non-AP STA in response to a STA Channel Switch Request sent by an HE AP or sent by an HE AP STA in response to a STA Channel Switch Request sent by a non-AP STA. The format of STA Channel Switch Response Request element is shown in Figure xx (STA Channel Switch Response Element).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | Channel Index | Primary Channel Period  | Non-Primary Channel Operation Timeout |
| Octets: | 1 | 1 | 1 | 1 | 1 | 1 |
| **STA Channel Switch Response element** |

The Element ID and Length fields are defined in 9.4.2.1 (General).

If the Status Code in the frame that contains this STA Channel Switch Response element is SUCCESS and if the STA Channel Switch Response frame that contains this STA Channel Switch Response element is from an HE AP, then the Channel Index field is specified in 9.4.2.226. Otherwise, the Channel Index field is reserved.

Note: The non-primary channel that the non-AP STA will operate on is decided by the AP. The non-AP STA sending the STA Channel Switch Response does not include Channel Index since it is decided by the AP.

The Primary Channel Period subfield is specified in 9.4.2.226.

The Non-Primary Channel Operation Timeout subfield is specified in 9.4.2.226.

**9.3.3.5 Association Request frame format**

***Order: 11ai adds 24-28, 11ah adds 29-38, 11ak adds 24 (appears to be out of date), 11aj adds two (numbers unassigned)***

***Insert the following new row (header row shown for convenience) into Table 9-29 (Association Request frame body):***

|  |  |  |
| --- | --- | --- |
| **Association Request frame body** |  |  |
| **Order** | **Information** | **Notes** |
| 43 | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 44 | STA Channel Switch Request | The STA Channel Switch Request element contains the candidate 20 MHz channels that the non-AP STA is willing to operate on. |

**9.3.3.6 Association Response frame format**

***Order: 11ai adds 31-36, 11ah adds 37-49, 11aq adds none, 11ak adds 30-31 (appears to be out of date), 11aj adds three (numbers unassigned)***

***Change Table 9-30 (Association Response frame body) as follows maintaining numeric order (only rows with changes are shown):***

|  |  |  |
| --- | --- | --- |
| **Association Response frame body** |  |  |
| **Order** | **Information** | **Notes** |
| 29 | TWT | ~~The TWT element is optionally present if dot11TWTOptionActivated~~~~is true; otherwise not present.~~The TWT element is present if dot11TWTOptionActivated is true and the TWT element is present in the Association Request frame that elicited this Association Response frame.The TWT element is optionally present if dot11TWTOptionActivated is true and the TWT Requester Supported field in the HE Capabilities in the Association Request frame that elicited this Association Response frame is one. |
| 54 | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 55 | HE Operation | The HE Operation element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 56 | BSS Color Change Announcement | The BSS Color Change Announcement element is optionally present when dot11HEOptionImplemented is true; otherwise it is not pre-sent. |
| 57 | Spatial Reuse Parameter Set | The Spatial Reuse Parameter Set element is optionally present if dot11HighEfficiencyOptionImplemented is true.(#8111) |
| 58 | STA Channel Switch Response | The STA Channel Switch Response element contains the 20 MHz channel that the non-AP STA is assigned to operate on. |

**9.3.3.7 Reassociation Request frame format**

***Order: 11ai adds 29-33, 11ah adds 34-43, 11aq adds none, 11ak adds 29 (appears to be out of date), 11aj adds two (numbers unassigned)***

***Insert the following row in Table 9-31 (Reassociation Request frame body) (header shown for convenience):***

|  |  |  |
| --- | --- | --- |
| **Reassociation Request frame body** |  |  |
| **Order** | **Information** | **Notes** |
| 47 | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 48 | STA Channel Switch Request | The STA Channel Switch Request element contains the candidate 20 MHz channels that the non-AP STA is will to operate on. |

**9.3.3.8 Reassociation Response frame format**

***Order: 11ai adds 35-49, 11ah adds 41-52, 11aq adds none, 11ak adds 34 and 30 (appears to be an error), 11aj adds three (numbers unassigned)***

***Change Table 9-32 (Reassociation Response frame body) as follows maintaining numeric order (only rows with changes are shown):***

|  |  |  |
| --- | --- | --- |
| **Reassociation Response frame body** |  |  |
| **Order** | **Information** | **Notes** |
| 42 | TWT | ~~The TWT element is optionally present if dot11TWTOptionActivated~~~~is true; otherwise not present.~~The TWT element is present if dot11TWTOptionActivated is true and the TWT element is present in the Reassociation Request frame that elicited this Reassociation Response frame.The TWT element is optionally present if dot11TWTOptionActivated is true and the TWT Requester Supported field in the HE Capabilities in the Reassociation Request frame that elicited this Association Response frame is one. |
| 55 | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 56 | HE Operation | The HE Operation element is present when dot11HEOptionImplemented is true; otherwise it is not present. |
| 57 | BSS Color Change Announcement | The BSS Color Change Announcement element is optionally present when dot11HEOptionImplemented is true; otherwise it is not pre-sent. |
| 58 | Spatial Reuse Parameter Set | The Spatial Reuse Parameter Set element is optionally present if dot11HighEfficiencyOptionImplemented is true.(#8111) |
| 59 | STA Channel Switch Response | The STA Channel Switch Response element contains the channel index that the non-AP STA is assigned to operate on |

TGax Editor: Please modify the following section as follows

**9.6.28 HE Action frame details**

**9.6.28.1 HE Action field**

An HE Action field, in the octet immediately after the Category field, differentiates the HE Action frame formats. The HE Action field values associated with each frame format within the HE category are defined in Table 9-421z (HE Action field values).

|  |  |
| --- | --- |
| **HE Action field values** |  |
| **Value** | **Meaning** |
| 0 | HE Compressed Beamforming And CQI |
| 1 | HE BSS Color Change Announcement |
| 2 | STA Channel Switch |
| 2-255 | Reserved |

TGax Editor: Please insert the following subsection after 9.6.29

**9.6.30 STA Channel Switch Action Frame Details**

**9.6.30.1 STA Channel Switch Action Field**

An STA Channel Switch Action field, in the octet immediately after the Category field, differentiates the HE Channel Switch Action frame formats. The STA Channel Switch Action field values associated with each frame format within the STA Channel Switch category are defined in Table 9-xx (STA Channel Switch Action field values).

|  |  |
| --- | --- |
| **STA Channel Switch Action field values** |  |
| **Value** | **Meaning** |
| 0 | STA Channel Switch Request |
| 1 | STA Channel Switch Response |
| 2-255 | Reserved |

**9.6.30.2** **STA Channel Switch** **Request frame format**

The STA Channel Switch Request frame is an Action frame of category STA Channel Switch. It is sent by an HE non-AP STA to its associated AP to request switching the operating channel or sent by an HE AP to a non-AP STA to request the non-AP STA to switch its operating channel. The Action field of STA Channel Switch Request frame contains the information shown in Table 9-xx (STA Channel Switch Request frame Action field format).

|  |  |
| --- | --- |
| **STA Channel Switch Request frame Action field format** |  |
| **Order** | **Information** |
| 1 | Category |
| 2 | STA Channel Switch Action |
| 3 | Dialog Token |
| 4 | STA Channel Switch Request element (see 9.4.2.226 (STA Channel Switch Request element)) |

9.6.30.3 **STA Channel Switch Response frame format**

The STA Channel Switch Response frame is an Action frame of category STA Channel Switch. It is sent by an HE AP in response to a request from a non-AP STA to switch the non-AP STA’s operating channel or sent by the non-AP STA in response to STA Channel Switch Request frame sent by its associated AP. The Action field of a STA Channel Switch Response frame contains the information shown in Table 9-421af (STA Channel Switch Response frame Action field format).

|  |  |
| --- | --- |
| **STA Channel Switch Response frame Action field format** |  |
| **Order** | **Information** |
| 1 | Category |
| 2 | STA Channel Switch Action |
| 3 | Dialog Token |
| 4 | Status Code |
| 5 | STA Channel Switch Response element (see 9.4.2.227 (STA Channel Switch Response element)) |

The Dialog Token field is set to the value in the corresponding STA Channel Switch Request frame.

The Status Code field is used to indicate the result of the corresponding STA Channel Switch Request frame. Valid values for the Status Code field is defined in 9.4.1.9.

TGax Editor: Please insert the following section at the end of section 6.

TGax Editor: Please insert the following section after section 27.16.

**27.16 20 MHz Operating STA on Non-primary 20 MHz Channel**

**27.16.1 Overview**

Only a 20MHz-only HE STA may operate on a non-primary 20 MHz channel. The procedure for the STA to operate on non-primary 20 MHz channel is described in this subclause. The operation on non-primary 20 MHz channel is optional for HE non-AP STAs and HE APs.

A STA shall set the Non-Primary Channel Operation field in HE capability to 1 if dot11NonPrimaryChannelOptionallyImplemented is set to true.

**27.16.2 Operating Channel Switch Procedure**

STA operating channel switch may be initiated for an HE STA that set UL MU Disable subfield to 0 in its mostly recent operating mode indication (27.8). Either an HE AP or a non-AP STA may initiate the operating channel switch for the non-AP STA when both the AP and the non-AP STA have set 1 in the Non-Primary Channel Operation subfield in HE Capabilities.

An 20 MHz operating non-AP STA may include a STA Channel Switch Request Element in (Re)Association Request frame to inform an HE AP the candidate 20 MHz channel that the non-AP STA is willing to operate on. An AP may include a STA Channel Switch Response element in the corresponding (Re)Association Response frame.

How the non-AP STA chooses the candidate 20 MHz channels to include in the STA Channel Switch Request Element and how AP selects a particular 20 MHz channel indicated the STA Channel Switch Response frame for the STA to operate on is beyond the scope of this specification.

After the non-AP STA is associated with an HE AP, the non-AP STA that may use STA Channel Switch Request frame (9.6.30.2) to request switching its operating channel if the receiving STA has indicated support of Non-Primary Channel Operation in its HE Capabilities element. After receiving a STA Channel Switch Request frame from a non-AP STA, the HE AP shall respond with a STA Channel Switch Response frame if dot11NonPrimaryChannelOptionallyImplemented is set to true and the HE AP may assign the non-AP STA to any 20 MHz channel as the operating channel. After the non-AP STA has received a STA Channel Switch Response frame which is a response to a STA Channel Switch Request frame sent by the non-AP STA and whose Status Code field indicates SUCCESS, the non-AP STA shall start switching to the channel indicated in the Channel Index field (9.4.2.227) of the received STA channel Switch Response frame if the Channel Index field indicates a different operating channel from the one that the non-AP STA is currently operating on.

An HE AP may use STA Channel Switch Request frame (9.6.30.2) to request a non-AP STA to switch its operating channel if the receiving STA has indicated support of Non-Primary Channel Operation in its HE Capabilities element. After receiving a STA Channel Switch Request frame from the associated AP, the non-AP STA shall respond with a STA Channel Switch Response frame if dot11NonPrimaryChannelOptionallyImplemented is set to true. If the Status Code is SUCCESS, then the STA shall set the Channel Index subfield to be the same value indicated in the STA Channel Switch Request received from the HE AP. Otherwise, the Channel Index is set to 0. After transmitting the STA Channel Switch Response frame which is a response to a STA Channel Switch Request frame received by the non-AP STA and whose Status Code field indicates SUCCESS, the non-AP STA shall start switching to the channel indicated in the Channel Index field (9.4.2.227) of the received STA channel Switch Request frame if the Channel Index field indicates a different operating channel from the one that the non-AP STA is currently operating on.

It is possible that the non-AP STA may experience some channel switch outage delay during which time the STA cannot transmit or receive any frames. The STA may report its channel switch outage delay in STA Channel Switch Outage Time field (9.4.2.218.6**)** in its HE Capabilities element. How the HE AP considers the channel switch outage delay experienced at the non-AP STA is beyond the scope of this specification.

**27.16.2 Channel Access for STAs operating on non-primary 20 MHz Channel**

When operating on a non-primary 20 MHz channel, the non-AP STA shall not use EDCA to gain medium access. The non-AP STA shall transmit only in response to a received trigger frame that allocates RUs within the non-AP STA’s operating channel. The non-AP STA operating on non-primary channel follows the carrier sensing requirements for UL MU operation (27.5.2.4).

Note: since non-AP STA operating on non-primary channel is not required to perform carrier sensing on primary 20 MHz channel, it cannot set NAV based on frames transmitted on primary channel. Therefore, the non-AP STAs operating on non-primary channel mainly rely on AP for protection of its transmissions. However, the STA’s NAV may be set based on frames received on its operating channel.

When an HE AP transmits frames to a non-AP STA on non-primary channel, it shall use either non-HT duplicate PPDU or HE MU PPDU. When transmitting in HE MU PPDU format to a non-AP STAs on non-primary 20 MHz, the AP shall always transmit the preamble on the primary 20 MHz even if there is no STA allocated on the primary 20 MHz channel. The AP may transmit dummy bits in the data field in the RU that corresponds to the primary 20 MHz using an unallocated AID.

**27.16.3 Non-primary Channel Operation Timeout**

A non-AP STA operating on non-primary channel may switch to primary channel only if it has not received a trigger frame that allocates an RU to the non-AP STA for a duration that is larger than the value indicated in Non-Primary Channel Operation Timeout field in HE operation element sent by the associated AP. After switching back to the primary channel the non-AP STA shall send a frame that requires an acknowledge from the HE AP to notify its operation on primary channel. An HE AP shall consider the non-AP’s operating channel as primary channel after receiving a frame that solicits an immediate acknowledgment from a non-AP STA.

**27.16.4 Broadcast and Multicast Frame Reception for non-AP STAs Operating on Non-primary 20 MHz Channel**

During the STA Channel Switch Request and Response negotiation, an HE AP shall include a Primary Channel period subfield which is used to indicate that the AP will not transmit any traffic on non-primary channel starting from DTIM to the end of this period. This period may be used by STA operating on non-primary channel to switch back to primary channel to receive Beacon and multicast frames. The non-AP STA shall switch back to primary channel to receive Beacon and multicast frames at DTIM interval and may switch back to its operating non-primary channel after the period specified in Primary Channel Period subfield.

When operating on primary channel, the non-AP STA shall suspend its timer that corresponds to the Non-Primary Channel Operation Timeout subfield specified in 27.2.226.

**27.16.4 Recommended operation for non-AP STAs operating on non-primary channels**

It is recommended that the non-AP STA operating on non-primary channel set up individual TWT agreement. It is recommended that the non-AP STA operate in power save mode before starting to operate on non-primary channel. This is to allows the non-AP STA to go to doze state on non-primary channel to conserve power and only wake up during the TWT SP.