IEEE P802.11
Wireless LANs

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| Resolution for CIDs related to BSS Color |
| Date: July 10, 2018 |
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 Abstract

This submission proposes resolutions for comments received for TGax LB233 (10):

15107, 16769, 17122, 15108, 16183, 16467, 15123, 15124, 16617, 16618

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Minor changes based on feedback received when the contribution was presented (7/10/18 AM2)

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** | **Commenter** | **Pg / Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 15107 | Abhishek Patil | 353.56 | 27.11.4 | An HE STA associated with an AP does not transmit HE Op or BSS Color Change Announcement. No need to add the exception clause | Delete the text "except when the HE STA is a non-AP STA associated with an HE AP" | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 15107** |
| 16769 | Sigurd Schelstraete | 354.04 | 27.11.4 | The notation "HE (ER) SU" is used here in two places as shorthand for "HE SU PPDU or HE ER SU PPDU". This notation is not used anywhere else in the document. | Replace "HE (ER) SU" with "HE SU PPDU or HE ER SU PPDU" (two occurences) | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 16769** |
| 17122 | yujin noh | 354.12 | 27.11.4 | what is the definition of "active BSS color"? Maybe the case HE STA shall set the BSS Color Disabled subfield in the HE Operation element to 0. |  | **Revised**Active color does not dependent on the value of BSS Color Disabled subfield. After BSS Color change TBTT, BSS Color Disabled subfield can be 1 while the active color is the new color. To further clarify active color, the text was revised to separate setting of TXVECTOR BSS\_COLOR and the definition of active color.**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 17122** |
| 15108 | Abhishek Patil | 354.33 | 27.11.4 | The key point here is the PPDU is an HE PPDU and it is sent to an HE mesh STA. Why tie the actions to receiption of HE Op element from neighboring mesh peer? There could be other means by which a STA determines that a peer STA is an HE STA. | Change the note to: "An HE mesh STA sets the TXVECTOR parameter BSS\_COLOR of an HE PPDU that it transmits to a peer HE mesh STA to the value in the BSS Color subfield of its transmitted HE Operation element" | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 15108** |
| 16183 | Mark RISON | 355.18 | 27.11.4 | "PARTIAL\_AID [5:8] for VHT PPDUs transmitted by an HE APwith the TXVECTOR parameter GROUP\_ID equal to 63 is not the same as the partial BSS color announcedby the HE AP" -- partial BSS colour is not announced, the full colour is, with an extra info that partial BSS colour bits are in use for AIDs | Reword as "PARTIAL\_AID [5:8] for VHT PPDUs transmitted by an HE APwith the TXVECTOR parameter GROUP\_ID equal to 63 is not compatible with the partial BSS color announcedby the HE AP" | **Revised**Agree with the comment. Changed text to say ‘consistent with’ instead of same as.**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 16183** |
| 16467 | Ming Gan | 372.54 | 27.16.2.1 | Delete"NOTE1" and change this note to be nomative. In P373L48, the last paragraph has the similar meaning as NOTE1, harmonize them. | As in comment | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 16467** |
| 15123 | Abhishek Patil | 372.58 | 27.16.2.1 | Note 2 is not needed as the topic is covered in 27.16.2.2.1 (page 373 line 63) | Delete note 2 | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 15123** |
| 15124 | Abhishek Patil | 372.65 | 27.16.2.1 | Clarify that a STA should receive at least one announcement before the color change occurs | Update the last sentence of the paragraph as: "... to have an opportunity to receive at least one frame carrying a BSS Color Change Announcement element before the BSS color change occurs." | **Revised**Agree with the comment. Text updated as suggested by the comment**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 15124** |
| 16617 | Pooya Monajemi | 374.15 | 27.16.2.2 | Language does not address the channels on which OBSS colors are detected. If STA is reporting non-co-channel OBSS colors (found possibly during scans) then channel information must accompany the report. | Indicate that only co-channel OBSSs shall be reported. Alternatively, revise 9.4.2.68.7 to add channel information | **Revised**Agree in principle. The section is updated to say the collision occurred on the channels where the AP’s BSS is operating.**TGax editor, please make changes as shown in doc 11-18/1244r1 for CID 16617** |
| 16618 | Pooya Monajemi | 374.15 | 27.16.2.2 | RSSI information about the color-colliding OBSSs is vital for optimizing BSS Color selection | HE STAs should include RSSI information along with BSS Color reports. Revise this subclause and 9.4.2.68.7 accordingly. Alternatively, enable AP to announce RSSI thresholds below which STAs shall ignore BSS Color collisions. | **Reject**This would be implementation dependent and most likely be the ED threshold. A client would report a collision when it impacts it decision to classify a frame as inter or intra. Since each client has an opportunity to detect and report a collision as it sees, the spec doesn’t need to define rules or a threshold value.  |

* **BSS\_COLOR**

***TGax Editor: Please update this section as shown below:***

The BSS color is an identifier of the BSS and is used to assist a receiving STA in identifying the BSS from which a PPDU originates so that the STA can use the channel access rules as described in 27.9 (Spatial reuse operation) or reduce power consumption as described in 27.14.1 (Intra-PPDU power save for non-AP HE STAs) or update the NAV as described in 27.2.4 (Updating two NAVs).

An HE STA transmitting an HE Operation element or a BSS Color Change Announcement element [#15107]shall select a value in the range 1 to 63 to include in either the BSS Color subfield of the HE Operation element or the New BSS Color subfield of the BSS Color Change Announcement element respectively that it transmits. The HE STA shall maintain that single value of the BSS Color subfield for the lifetime of the BSS or until the BSS color changes as described in 27.16.2.1 (Selecting and advertising a new BSS color). A non-AP HE STA associated with an HE AP that is transmitting an HE PPDU in a direct path to a TDLS peer STA shall set the BSS Color subfield of the HE Operation element it transmits to the peer STA to the value indicated in the BSS Color subfield of the HE Operation element received from the HE AP.

An HE STA that transmitted an HE Operation element shall set the TXVECTOR parameter BSS\_COLOR of an HE SU PPDU, HE ER SU PPDU or DL HE MU PPDU to the value indicated in the BSS Color subfield of its HE Operation element, except when the HE STA transmits an HE SU PPDU or HE ER SU PPDU for which one or more of the intended recipient STAs is not a member of the transmitting STA's HE BSS. In this case, the HE STA shall set the TXVECTOR parameter BSS\_COLOR of the HE SU PPDU or HE ER SU PPDU to 0.[#16769]

A non-AP HE STA that transmits an HE SU PPDU or HE ER SU PPDU to a STA that is not a member of the transmitting STA's HE BSS, shall set the TXVECTOR parameter BSS\_COLOR to 0.

[#17122]The active BSS color is one of the following:

* The value of the BSS Color field in the most recently received HE Operation element when an HE STA receives an HE Operation element from a peer HE STA.
* The value of the New BSS Color field in the most recently received BSS Color Change Announcement element when an HE STA receives a BSS Color Change Announcement element from a peer HE STA and the BSS color change TBTT has passed (see 27.16.2.1 (Selecting and advertising a new BSS color)).

An HE STA shall set the TXVECTOR parameter BSS\_COLOR for an HE SU PPDU, HE ER SU PPDU or UL HE MU PPDU that is addressed to a peer STA to the active BSS color value, if the HE STA has established any of the following:

* An association with the peer STA
* A TDLS link with the peer STA
* An IBSS membership with the peer STA

NOTE 1 – A non-AP HE STA sets the TXVECTOR parameter BSS\_COLOR for an HE TB PPDU to the active color (see 27.5.3.3).[#17122]

NOTE 2— An HE mesh STA sets the TXVECTOR parameter BSS\_COLOR of an HE PPDU that it transmits to a peer HE mesh STA to the value in the BSS Color subfield of its transmitted HE Operation element.[#15108]

An HE STA that receives an HE PPDU with RXVECTOR parameter BSS\_COLOR with a value between 1 and 63 follows the spatial reuse rule described in 27.9 (Spatial reuse operation).

NOTE—An HE STA that received an HE PPDU with the RXVECTOR parameter BSS\_COLOR equal to 0 does not follow the spatial reuse rule described in 27.9 (Spatial reuse operation).

An HE STA that received an HE SU PPDU or an HE ER SU PPDU with the RXVECTOR parameter BSS\_COLOR equal to 0 shall not discard the HE PPDU.

All APs that are members of a multiple BSSID set or co-located BSSID set shall use the same BSS color.

An HE STA that transmits an HE Operation element and that decides to temporarily disable the use of BSS color in the BSS to which it belongs, for example, after detecting a BSS color collision with an OBSS (see 27.16.2.2 (Detecting and reporting BSS color collision)), shall set the value of BSS Color Disabled subfield in the HE Operation element to 1 to inform its associated peer HE STAs that the BSS color is disabled; otherwise the HE STA shall set the BSS Color Disabled subfield to 0.

While the BSS Color Disabled subfield is 1, an HE STA shall continue to advertise a nonzero value (same as before the color was disabled) in the BSS Color subfield of HE Operation element and in the TXVECTOR parameter BSS\_COLOR of an HE PPDU that it transmits.

NOTE—A non-AP HE STA sets the TXVECTOR parameter BSS\_COLOR of an HE PPDU that it transmits to the value advertised by the AP it intends to communicate with even if the AP has temporarily disabled BSS color.

If the most recently received HE Operation element from the AP to which it is associated contained a value of 1 in the BSS Color Disabled subfield then:

* A non-AP HE STA should use the A1, A2 and Duration/ID fields of the MPDUs contained in the received HE PPDUs instead of the RXVECTOR parameters BSS\_COLOR and TXOP\_DURATION to determine whether the STA should update the intra-BSS NAV.
* A non-AP HE STA should use the A1, A2 fields of the MPDUs contained in the received HE PPDUs instead of the RXVECTOR parameters BSS\_COLOR and STA\_ID\_LIST to determine whether the STA may go to doze state for the duration of that PPDU (see 27.14.1 (Intra-PPDU power save for non-AP HE STAs)).

A non-AP HE STA may use the RXVECTOR parameter BSS\_COLOR of an HE PPDU to determine whether it should update the intra-BSS NAV (see 27.2.4 (Updating two NAVs)) and/or the STA may go to doze state for the duration of the PPDU (see 27.14.1 (Intra-PPDU power save for non-AP HE STAs)) if the most recently received HE Operation element from the AP to which it is associated contained a value of 0 in the BSS Color Disabled subfield.

When the value of TXVECTOR parameter PARTIAL\_AID [5:8] for VHT PPDUs transmitted by an HE AP with the TXVECTOR parameter GROUP\_ID equal to 63 is not [#16183]consistent with the partial BSS color (i.e., *BCB*(0:3) described in 27.16.3 (AID assignment)) announced by the HE AP, then the HE AP shall set the Partial BSS Color field in the HE Operation element to 0. Otherwise, the HE AP may set the Partial BSS Color subfield in the HE Operation element to 1 (see 27.16.3 (AID assignment)).

* **BSS color**
* **Selecting and advertising a new BSS color**

***TGax Editor: Please update this section as shown below:***

An HE STA that transmits an HE Operation element shall select a BSS color as defined in 27.11.4 (BSS\_COLOR) for its BSS. An HE AP may change the color of its BSS under certain conditions such as when it detects an OBSS using the same color (see 27.16.2.2). The criteria for changing the BSS color and the method for selecting a new BSS color are beyond the scope of this standard.

[#16467][#15123]An HE AP shall announce a pending BSS color change using the BSS Color Change Announcement element, which may be carried in the Beacon, Probe Response and (Re)Association Response frames transmitted by the AP. The HE AP may announce the pending BSS color change using the HE BSS Color Change Announcement frame. An HE AP should announce the pending BSS color change for a period of time that is sufficiently long for all STAs in the BSS, including STAs in PS mode, to have an opportunity to receive at least one frame carrying a[#15124] BSS Color Change Announcement element before the BSS color change.

If the Color Switch Countdown field in BSS Color Change Announcement element has a value greater than 0, then at the next TBTT the AP shall decrement the Color Switch Countdown field value by 1 until it reaches 0. BSS color change TBTT is the one at which the Color Switch Countdown field value has decremented to 0. An HE AP shall not alter the BSS color change TBTT after it has announced a pending BSS color change. An AP belonging to a co-located BSSID set (see 27.16.6 (Co-located BSSID set)) should select the value of Color Switch Countdown field such that the BSS color change TBTT interval between the BSSs in the set shall not be greater one beacon interval of the BSS with largest beacon interval in the set.

During the time leading up to the BSS color change TBTT:

* An HE AP shall set the BSS Color Disabled subfield to 1 and shall continue to advertise the existing BSS color via the BSS Color subfield in the HE Operation element.
* An HE AP shall not change the value it advertises in the New BSS Color subfield of the BSS Color Change Announcement element.
* An HE AP shall set the TXVECTOR parameter BSS\_COLOR of an HE PPDU to the existing BSS Color.

At the BSS color change TBTT, an HE AP shall:

* Set the BSS Color Disabled subfield in the HE Operation element that it transmits to 0 unless the HE AP belongs to a co-located BSSID set, in which case it shall continue to set the BSS Color Disabled subfield to 1 until all the BSSs in the co-located BSSID set have passed their respective BSS color change TBTT
* Start advertising the new BSS color in the BSS Color subfield in the HE Operation element
* Start using the new BSS color for all frames that it transmits after the TBTT

A co-located AP should not transmit an HE PPDU during the transition period until all the BSSs in the co-located set have completed their switch to the new color.

A non-AP HE STA that receives a BSS Color Change Announcement element from an AP shall use the value specified in the New BSS Color field of the element as the BSS color when communicating with that AP following the BSS Color change TBTT.

A non-AP HE STA in an infrastructure BSS shall not transmit the BSS Color Change Announcement element. [#16467]HE STAs belonging to an IBSS or a mesh BSS shall not transmit a BSS Color Change Announcement element. HE STAs participating in such BSS may temporarily disable the color if they determine that a color collision has occurred (see 27.11.4 (BSS\_COLOR)).

[#16467]an described in this subclause

* **Detecting and reporting BSS color collision**
* **General**

***TGax Editor: Please update this section as shown below:***

An HE AP may determine that a BSS color collision has occurred if it receives frames, on its primary channel, [#16617]from an OBSS STA containing the same BSS color as the one it has selected for its BSS or if it receives autonomous BSS color collision report(s) from its associated STA(s). The HE AP shall set the BSS Color Disabled subfield to 1 in the HE Operation element that it transmits if the BSS color collision persists for a duration of at least dot11BSSColorCollisionAPPeriod. An HE AP that decides to change its BSS color may consider BSS color information of OBSS APs that it has gathered by itself and via the autonomous collision report(s) from associated STA(s) when selecting the value of its BSS color.

* **Autonomous reporting of BSS color collision**

A STA that supports autonomous reporting of BSS color collision shall set dot11AutonomousBSSColorCollisionReportingImplemented to true.

A non-AP HE STA that supports autonomous reporting of BSS color collision may send a color collision report to its associated AP when it detects that color collision has occurred. The STA shall declare that a color collision has occurred if it receives, on its associated AP’s primary channel,[#16617] an MPDU with at least three Address fields in the MAC header and with the same color as its associated BSS in which none of the Address fields match the BSSID of the BSS that the STA is associated with, or any of the other BSSs in the same multiple BSSID set or co-located BSSID set to which its BSS belongs.

The HE STA's autonomous report shall include BSS color information of all OBSSs that the STA is able to detect frames from in order to help its associated AP select a new non-overlapping BSS color when the AP decides to switch to a different BSS color.

A non-AP HE STA that is autonomously reporting a BSS color collision, shall transmit an Event Report frame (see 9.6.14.3 (Event Report frame format)) containing a single Event Report element (see 9.4.2.68 (Event Report element)). The Event Report element shall carry Event Token field value set to 0 (autonomous report) and Event Type field value set to 4 (BSS Color Collision). The Event Report Status field shall be set to 0 (Successful) and the Event Report field shall carry information about the BSS color used by OBSSs that the reporting STA is able to detect.

A non-AP HE STA that intends to autonomously report a BSS color collision to its associated HE AP, shall do so by scheduling for transmission a BSS color collision Event Report frame every dot11BSSColorCollisionSTAPeriod unless the BSS color collision no longer exists or if the associated HE AP has set the BSS Color Disabled bit to 1 in HE Operation element that it transmits or if the non-AP STA has transmitted several such reports to its associated HE AP.

NOTE—The maximum number of BSS color collision reports a non-AP STA transmits is out of scope of this standard.