IEEE P802.11  
Wireless LANs

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| Proposed changes to P802.11ah D4.0 regarding the S1G Operation element | | | | |
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Abstract

This submission proposes resolutions to following CIDs of P802.11ah D4.0 LB207 regarding to the S1G Operation element.

* CID: 6069, 6070, 6071, and 6072.

Also this submission provides commenters proposed change for CID 6068 (Not a resolution).

R0: Initial

## 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 TGah Draft. This introduction is not part of the adopted material.

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

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

## Proposed Changes

| **CID** | **Clause** | **Page** | **Line** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
| 6069 | 8.4.2.209 | 180 | 29 | The S1G Operation Information is specified as field in Figure 8-575a52 and as subfield in Table 8-258a16. | Change the title of Table 8-258a16 to "S1G Operation Information field".- P132L44- P180L29 and L33- P181L1- P365L48 and L50  - P366L33 | Accept. |
| 6070 | 8.4.2.209 | 180 | 24 | In 8.4.1.36 (Operating Class) of the P802.11mc D4.0, size of Operating Class field is 1 octet. | Change the size of the Operating Class subfield of Figure 8-575a52 to 1 octet, and reduce the size of the S1G Operation Information field by 1 octet. | Revise.  TGah editor to make the changes shown in 11-15/0252r0 under all headings that include CID 6070. |
| 6071 | 8.4.2.209 | 180 | 20 | Both a Channel Center Frequency subfield and a Primary Channel Number subfield are necessary to specify the position of the primary channel in the S1G non-SST BSS channels.  For example, a VHT STA gets the primary channel information from the HT Operation element, and has the Channel Center Frequency Segment 0/1 subfields in the VHT Operation element (See 8.4.2.158 of P802.11mc D4.0). | Add the Channel Center Frequency subfield to the S1G Operation Information field as proposed in 11-15/252. | Revise.  TGah editor to make the changes shown in 11-15/0252r0 under all headings that include CID 6071. |
| 6072 | 8.4.2.160 | 132 | 43 | As specified in 10.48.3, the primary channel after the switch is announced in the New Channel Number field in the Extended Channel Switch Announcement element or Extended Channel Switch Announcement frame. The New Channel Center Frequency Segment 0 subfield of the Wide Bandwidth Channel Switch element shall indicate the Channel Center Frequency after the switch. | Replace "Primary Channel Number" with "Channel Center Frequency" in the last paragraph. See 11-15/252 also. | Revise.  TGah editor to make the changes shown in 11-15/0252r0 under all headings that include CID 6072. |

### Discussion

In P802.11mc D4.0, the length of Operating Class field is one octet as specified in 8.4.1.36 (Operating Class) and 8.4.2.53 (Supported Operating Classes element). Also, ANA database (11-11/270r27) specifies the maximum value of Operating Class as 255. Hence, the length of the Operation Class subfield of the S1G Operation Information field should be one (1) to reduce size of element.

The subclause 10.48.1 (Basic S1G BSS functionality) specifies the channelization as follows:

An S1G STA shall determine the channelization based on the Channel Width and Primary Channel Number subfields of the S1G Operation Information field (see 24.3.13 (Channelization)).

The subclause 24.3.13 (Channelization) specifies the channel center frequency as follows:

*Channel center frequency = Channel starting frequency + 0.5[MHz] × ChannelCenterFrequencyIndex*

where Channel center frequency, Channel starting frequency and ChannelCenterFrequencyIndex are given by the operating class (Annex E). Channel spacing in Annex E denotes the corresponding bandwidth for S1G operation.

To calcurate the channel center frequency, the value of ChannelCenterFrequencyIndex is necessary. However, the current S1G Operation element does not contain the corresponding subfield. Also, it is necessary to specify the value of primacy channel center frequency in the subclause 24.3.13 as shown in the the following figure.

1. 4 MHz operating channel with 1 MHz primary channel

Primary channel center frequency

Channel center frequency

primary1

Secondary2

Primary channel center frequency

Channel center frequency

primary2

Secondary2

1. 8 MHz operating channel with 2 MHz primary channel

Secondary4

primary1

The simlar discussion applies to the Wide Bandwidth Channel Switch element. The subclause 10.48.3 (Channel Switching methods for an S1G BSS) specifies that the New Channel Number field in the Extended Channel Switch Announcement element or Extended Channel Switch Announcement frame identifies the primary channel after the switch. To set channel center frequency, the Wide Bandwidth Channel Switch element shall indicate the value of ChannelCenterFrequencyIndex after switch.

### Suggested Remedy (CID 6070, 6071 and 6072)

### 8.4.2.160 Wide Bandwidth Channel Switch element

*TGah Editor: replace "Primary Channel Number" with "Channel Center Frequency" in the last paragraph of 8.4.2.160 as shown in red text bellow:*

If the value of the New Operating Class field in the frame that contains this element does not indicate an S1G band, ~~T~~the subfields New Channel Width, New Channel Center Frequency Segment 0 and New Channel Center Frequency Segment 1 have the same definition, respectively, as Channel Width, Channel Center Frequency Segment 0 and Channel Center Frequency Segment 1 in the VHT Operation Information field, described in Table 8-252 (VHT Operation Information subfields). Otherwise, the subfields New Channel Width, and New Channel Center Frequency Segment 0 have the same definition, respectively, as the Channel Width, and the ~~Primary Channel Number~~Channel Center Frequency in the S1G Operation Information field, described in Table 8-258a16 (S1G Operation Information subfields). The New Channel Center Frequency Segment 1 subfield is reserved.

### 8.4.2.209 S1G Operation element

*TGah Editor: replace Figure 8-575a52 with following figure:*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel Width | Operating Class | Primary Channel Number | Channel Center Frequency |
| Octets: | 1 | 1 | 1 | 1 |

**Figure 8-575a52 - S1G Operation Information field**

*TGah Editor: Insert a following row to Table 8-258a16, excluding the heading row:*

|  |  |  |
| --- | --- | --- |
| Fields | Definition | Encoding |
| … |  |  |
| Channel Center Frequency | Defines the channel center frequency. | Indicates the channel index of the BSS operating channel (see 24.3.13 (Channelization)) |

### 10.48.1 Basic S1G BSS functionality

*TGah Editor: Change the fifth paragraph of 10.48.1 as follows:*

An S1G STA shall determine the channelization based on the Channel Width ~~and~~, Primary Channel Number, and Channel Center Frequency subfields of the S1G Operation Information field (see 24.3.13 (Channelization)).

### 24.3.13 Channelization

*TGah Editor: Insert a following text at the end of 24.3.13:*

The center frequency of the primary 1 MHz or primary 2 MHz channel is defined as:

*Primary channel center frequency = Channel starting frequency + 0.5[MHz] × Primary Channel Number*

## Commenters proposed change for CID 6068 (Informational).

| **CID** | **Clause** | **Page** | **Line** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
| 6068 | 8.4.2.197.2 | 154 | 4 | The COLOR subfield shall be located in the S1G Operation element, not in the S1G Capabilities element as the COLOR is a parameter signaled by an AP.  If the COLOR subfield is located in the S1G Capabilities element, the value of COLOR is fixed when the AP starts the BSS. The AP cannot notice associated STAs a change of the value of COLOR (See. 10.47). If the AP performs channel switching, the current value of COLOR may be already used by OBSSs in the new channel, and the merit of COLOR may be lost. | 1) Remove the COLOR subfield from the S1G Capabilities info field by:  - Delete the COLOR subfield from Figure 8-575a26 and Table 8-258a5.  - Reassign the Link Adaptation per Normal Control Response Capable subfield and change the size of the S1G Capabilities info field to 9 octets (Figure 8-575a25).  2) Add the COLOR subfield to the S1G Operation Information field as proposed in 11-15/252.  3) Modify the last paragraph of clause 9.20a (P269L14) as follows:  "An AP shall include the value within the range 0 to 7 that it is using for the TXVECTOR parameter COLOR in non-1MHz, non-NDP frames in the COLOR subfield of the S1G Operation Information field of the S1G Operation element in all frames that contain that element." | **TBD** |

### Discussion

COLOR was introduced to assist in identifying OBSS traffic [2]. The subclause 9.20a (Group ID, partial AID, Uplink Indication and COLOR in S1G PPDUs) of the IEEE P802.11ah D4.0 specifies that an S1G AP shall maintain the value of COLOR for the duration of the existence of the BSS (See P269L9). A procedure to notice change of COLOR from an AP to its associated STAs is not provided.

However, if the AP switches the operating channel, the current value of COLOR may be already used by OBSSs that is using the same operating channel after switch. There are no restrictions on channel selection regarding COLOR (See 10.48.2 (Channel selection methods for an S1G BSS)).

Furthermore, it looks odd to assign COLOR in the S1G Capabilities element as the COLOR is an operating parameter which is assigned by an AP. The COLOR should be assigned to the S1G Operation element. One problem to assign COLOR to the S1G Operation element is lack of reserved bits. There is only one reserved bit, but COLOR filed needs 3 bits.

To make enough free bits for COLOR, encodings of the Channel Width subfield should be changed. There are 13 possible cases of channel width and primary channel width as follows:

* 1 MHz primary channel and 1 MHz operating channel width (1 case)
* 1 MHz primary channel and 2 MHz or wider operating channel width (4 cases)
* 2 MHz primary channel and 2 MHz or wider operating channel width (8 cases)

So, encoding of channel width needs only 4 bits (current encoding uses 6 bits). By using 4 bits for channel width, there remains 3 free bits for COLOR.

### Suggested Remedy (CID 6068)

### 8.4.2.197 S1G Capabilities element

### 8.4.2.197.1 S1G Capabilities element structure

*TGah Editor: Change the size of the S1G Capabilities Info field to 9 in Figure 8-575a25:*

### 8.4.2.197.2 S1G Capabilities Info field

*TGah Editor: Remove “COLOR” subfield from the S1G Capabilities Info field, move “Link Adaptation per Normal Control Response Capable” subfield to B66, delete B72 to B79 “Reserved” subfield and change the size of the S1G Capabilites Info field to 9 in Figure 8-575a26 (S1G Capabilities Info field):*

*TGah Editor: Remove “COLOR” row from Table 8-258a5:*

### 8.4.2.209 S1G Operation element

*TGah Editor: Change the “Channel Width” row of Table 8-258a16 as follows:*

|  |  |  |
| --- | --- | --- |
| Fields | Definition | Encoding |
| Channel Width | This field defines the BSS operating channel width (see Table 10-27 (S1G BSS operating channel width) in 10.48.1 (Basic S1G BSS functionality) also)~~.~~ and the value that is used for the TXVECTOR parameter COLOR in frames transmitted by members of this BSS, as described in 9.20a (Group ID, partial AID, Uplink Indication and COLOR in S1G PPDUs). | Bitmap of B0-B4 indicates the operating channel widths, the primary channel widths, and the location of 1MHz primary channel within the 2 MHz primary channel, ~~1/2/4/8/16 MHz~~.  Encodings of B0 to B4 are defined in Table 10-27 (S1G BSS operating channel width).  ~~B5 bits indicates the location of 1MHz primary~~  ~~channel within the 2 MHz primary channel~~  ~~—B5 is set to 0 to indicate that is located at the lower side of 2MHz primary channel.~~  ~~—B5 is set to 1 to indicate that is located at the upper side of 2MHz primary channel.~~  ~~B6 is reserved.~~  B4 to B6 indicates an unsigned integer in the range 0 to 7 that is used for the TXVECTOR parameter COLOR.  B7 is set to 1 to indicate MCS10 is permitted but not recommended. |
| … |  |  |

### 9.20a Group ID, partial AID, Uplink Indication and COLOR in S1G PPDUs

*TGah Editor: Change the following text in the second last paragraph of 9.20a as follows:*

…

An AP transmitting an S1G PPDU that is not a 1 MHz PPDU and is not an NDP frame shall set the TXVECTOR parameter COLOR to a value of its choosing within the range 0 to 7 and shall maintain that value ~~for the duration of the existence of the BSS~~ as long as the same primary channel is used. …

*TGah Editor: Change the last paragraph of 9.20a as follows:*

An AP shall include the value within the range 0 to 7 that it is using for the TXVECTOR parameter COLOR in non-1MHz, non-NDP frames in the ~~COLOR~~Channel Width subfield of the S1G ~~Capabilities Info~~Operation Information field of the S1G ~~Capabilities~~Operation element in all frames that contain that element. ~~The COLOR field of the S1G Capabilities Info field of the S1G Capabilities element in all frames transmitted from a non-AP STA is reserved.~~

### 10.48.1 Basic S1G BSS functionality

*TGah Editor: Change the fourth paragraph of 10.48.1 as follows:*

An S1G STA that is an S1G AP shall set the Channel Width subfield in the S1G Operation Information field of the S1G Operation element to indicate the BSS operating channel width and the location of 1 MHz primary channel as defined in Table 10-27 (S1G BSS operating channel width), ~~the location of 1 MHz primary channel as defined in Table 8-258a16 (S1G Operation Information subfields)~~ and whether MCS10 is permitted but not recommended as defined in Table 8-258a16 (S1G Operation Information subfields). Table 10-27 (S1G BSS operating channel width) is the only combination allowed in an S1G BSS operation. The Channel Width field in the S1G Operation element not listed in Table 10-27 (S1G BSS operating channel width) shall not be declared by an S1G STA that is an S1G AP.

*TGah Editor: replace Table 10-27 (S1G BSS operating channel width) with following table:*

**Table 10-27—S1G BSS operating channel width**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S1G Operation element Channel Width field**  **(B0-B1)** | **S1G Operation element Channel Width field**  **(B2-B3)** | **BSS primary channel width** | **BSS operating channel width** | **Location of the 1 MHz primary channel within the 2 MHz primary channel** |
| 0 | 0 | 2 MHz | 2 MHz | Lower side |
| 1 | 2 MHz | 4 MHz | Lower side |
| 2 | 2 MHz | 8 MHz | Lower side |
| 3 | 2 MHz | 16 MHz | Lower side |
| 1 | 0 | 1 MHz | 1 MHz | - |
| 1 | Reserved | Reserved | - |
| 2 | Reserved | Reserved | - |
| 3 | Reserved | Reserved | - |
| 2 | 0 | 2 MHz | 2 MHz | Upper side |
| 1 | 2 MHz | 4 MHz | Upper side |
| 2 | 2 MHz | 8 MHz | Upper side |
| 3 | 2 MHz | 16 MHz | Upper side |
| 3 | 0 | 1 MHz | 2 MHz | - |
| 1 | 1 MHz | 4 MHz | - |
| 2 | 1 MHz | 8 MHz | - |
| 3 | 1 MHz | 16 MHz | - |

**References:**

[1] 11-11/270r27 “ANA database”

[2] 11-13/1207r1 “CID 205 BSSID Color Bits”

[3] 11-15/0261r2 “TGah LB207 comments on D4.0”