IEEE P802.11
Wireless LANs

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| LB225 CR for CID5917 and CID8165 |
| Date: 2017-03-08 |
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Abstract

This submission proposes resolutions of comments received from TGax LB225. (The proposed change is based on TGax Draft 1.0.)

* CIDs: 5917, 8165 (2 CIDs)

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.***

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- |
| 5917 | 67.01 | 9.4.2 | With the introduction of new features such as OFDMA and UL MU MIMO, the existing BSS load elements (9.4.2.160 & 9.4.2.28), which address STA numbers, primary/secondary channel busy condition and DL MU-MIMO underutilization (11ac) are not sufficient for addressing the BSS load status in a 11ax BSS. A further enhanced BSS Load element needs to be defined.  | Add a new information element to define 11ax BSS Load. The new IE shall address utilization status of OFDMA as well as UL/DL MU MIMO, as well as provisions to allow future extensions.  | Revised- Agree in principal. The proposed resolution is to provide a spatial/frequency underutilization to solve load unbalancing problem in 802.11axTGax editor makes changes as shown in the as specified in 11-17/360 r0. |
| 8165 | 67.01 | 9.4.2 | BSS load element provides the channel utilization such that the unassociated STA can choose the proper AP┤+ε and extended BSS load element further provides the the spatial stream underutilization given the busy channel such that unassociated STA with MU-MIMO capability can choose the proper AP. Now 11ax introduce a OFDMA, there is the probability of frequence underutilization given the busy channel.  | Define a HE BSS load element considering frequency utilization such to help unassociated STA to choose a best AP  | Revised- Agree in principal. The proposed resolution is to provide a spatial/frequency underutilization to solve load unbalancing problem in 802.11axTGax editor makes changes as shown in the as specified in 11-17/360 r0. |

**Discussion: *…***

**9.4.2 Elements**

**TGax Editor: *Add the following subsection***

**9.4.2.226 HE BSS load element**

The HE BSS Load element reported by the AP contains information on frequency and spatial stream underutilization. The element format is defined in Figure 9-xxx (HE BSS Load element format). A STA receiving the element might use the information it conveys in an implementation-specific AP selection algorithm.

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

The HE STA Count field indicates the total number of STAs currently associated with this BSS that declare that they are HE STAs by transmitting their HE Capabilities elements. The frequency and spatial stream underutilization field is defined as the percentage of time, linearly scaled with 255 representing 100%, that the AP has underutilized frequency and spatial domain resources for given busy time of the medium. The spatial stream underutilization is calculated for each 20MHz channel. This percentage is computed using the formula

$$\left⌊\frac{\_{}\_{}\sum\_{}^{}\left\{\left(\sum\_{}^{\_{}}\_{}\_{}\right)\_{}\right\}}{\_{}\_{}}\right⌋$$

Where

 $\_{}$ is is the maximum number of spatial streams supported by the AP.

 $T\_{busy}$ is the number of microseconds during which CCA indicated the channel was busy during the measurement duration. The resolution of the CCA busy measurement is in microseconds.

 $T\_{i}$ is the time interval, in units of microseconds, during which the measured 20 MHz channel is busy due to the OFDMA transmission of one or more spatial streams by the AP to HE STAs; $\_{}$ is the number of RU which is allocated within the measured 20MHz channel during time interval $\_{}$; $N\_{SS,j,i}$ is the number of spatial streams transmitted over the j-th RU during time interval $T\_{i}$; and N is the number of busy events that occurred during the total measurement time which is less than or equal to dot11ChannelUtilizationBeaconIntervals consecutive beacon intervals.

 $\_{}$ is a normalizing factor depending on the RU size. If the j-th RU is 26-tone RU, then $\_{}{}/{}$; If the j-th RU is 52-tone RU, then $RU\_{j}=$${}/{}$; If the j-th RU is 106-tone RU, then $RU\_{j}=$${}/{}$; If the j-th RU is 242-tone RU or lager, then $RU\_{j}=$$$.

If $\_{}$is 0, the frequency and spatial stream underutilization fields are reserved.

The first 20 MHz channel to the 8th 20 MHz channel correspond to the 20 MHz sub-channel with the lowest frequency to the 20 MHz sub-channel with the highest frequency, respectively.

The measurement of the observable loading on each 20 MHz subband of secondary 40 MHz channel, and secondary 80 MHz channel in conjunction with the measurement on the primary 20 MHz channel and the secondary 20 MHz channel provides a STA with the loading on the 40 MHz, 80 MHz, 160 MHz, and 80+80 MHz channels.

The Observable Utilization fields for each 20 MHz subband of secondary 40 MHz channel, and secondary 80 MHz channel are defined using Equation (xxxx)

$$$$

$$\left⌊\frac{\_{}}{}\right⌋$$

Where

dot11ChannelUtilizationBeaconIntervals represents the number of consecutive beacon intervals during which the secondary channel busy time is measured.

$\_{}$is computed as the sum of the times from PHY-CCA.indication(BUSY,{ per20MHz bitmap }) where the n-th (n=1,…,8) bit corresponding to the w1-th 20 MHz channel of the secondary W2 is set 1 to the next issue of a PHY-CCA.indication primitive and that overlap the measurement interval, for W1 = 1, or 2, and where W2 equals to secondary40 , for W1 = 1, 2, 3, or 4, and where W2 equals to secondary80.



**Figure 9-xxx—HE BSS Load element format**

If the AP indicates a channel width of 20 MHz, 40 MHz, or 80 MHz in the STA Channel Width field in the HT Operation element and in the Channel Width field in the VHT Operation element, then the Frequency and Spatial Stream Underutilization for nth ($1\leq n\leq 8$) 20MHz channel within secondary 80 MHz fields are reserved, and the Observable from 1st to 4th 20 MHz of Secondary 80 MHz Utilization fields are reserved. If the AP indicates a channel width of 20 MHz or 40 MHz in the STA Channel Width field in the HT Operation element, then the Frequency and Spatial Stream Underutilization for nth ($1\leq n\leq 8$) 20MHz channel within secondary 40 MHz fields are reserved and the Observable from 1st to 2nd 20 MHz of Secondary 40 MHz Utilization fields are reserved. If the AP indicates a channel width of 20 MHz in the STA Channel Width field in the HT Operation element, then the Frequency and Spatial Stream Underutilization for nth ($1\leq n\leq 8$) 20MHz channel corresponding to second 20 MHz field is reserved.