IEEE P802.11
Wireless LANs

|  |
| --- |
| HE BSS Load Information Element |
| Date: 2017 – 09 - 10  |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Frank Hsu | MediaTek Inc. |  |  | frank.hsu@mediatek.com |
| Gabor Bajko | MediaTek Inc. |  |  | gabor.bajko@mediatek.com |
| James Yee | MediaTek Inc. |  |  | james.yee@mediatek.com |
| Bo Sun | ZTE |  |  | sun.bo1@zte.com.cn |
| Sigurd Schelstraete | Quantenna |  |  | sschelstraete@quantenna.com |

Abstract

This submission proposes resolutions for comments of TGax Draft 1.0 with the following CIDs:

**5917, 8165**

Revisions:

- Rev 0: Initial version of the document.

***Insert the following paragraph at the end of x.x.x.x:***

***Instruction to Editor: Add the following section in the next version of 11ax specification***

The HE BSS Load element contains information reported from AP on MU DL and UL PPDU utilization, SU DL PPDU utilization, and load reports by mean available RU sizes in the BSS. The element format is defined in Figure x-xx0 (HE BSS Load element). This element might be used by the roaming STA to select an appropriate AP to associate with based on implementation specific AP selection algorithm.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  | Subelement ID | Length | Element ID Extension | HESTA count | ObservationPeriod  | MU UL PPDU Utilization Percentage | MU DL PPDU Utilization Percentage | SU DL PPDU Utilization Percentage |
| Octets: | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mean ULAvailable RU | Mean DL Available RU | OptionalSubelements |
| Octets: | 3 | 3 | Variant |

Figure x.xx0 HE BSS load element format

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

The Element ID Extension field is defined in 9.4.2.1.

The HE STA count indicates the total number of STAs currently associated with this BSS which have transmitted the HE Capabilities element.

The Observation Period indicates the number of consecutive beacon intervals which the measurement is made.

The *W1* DL PPDU Utilization defines the time percentage, linearly scaled with 255 representing 100%, that the medium is acquired by AP to transmit W1 DL PPDUs over a measurement interval. This percentage is computed using the formula,

$$W1 DL PPDU Utilization=\left⌊\frac{T\_{W1DL}}{observationBeaconIntervals ×dot11BeaconPeriod ×1024}×255\right⌋$$

where

observationBeaconIntervals represents the number of consecutive beacon intervals indicated in the Observation Period field during which the *W1* DL PPDU utilization is measured.

*TW1DL* is computed as the sum of the periods which are used for *W1* DL PPDUs over the measurement interval.

The formula above is applied for both DL PPDU Utilization of SU and MU by applying *W1* to be SU or MU.

The MU UL PPDU Utilization defines the time percentage, linearly scaled with 255 representing 100%, that the medium is used for MU UL PPDU transmission from STAs over a measurement interval. This percentage is computed using the formula,

$$MU UL TXOP Utilization=\left⌊\frac{T\_{MUUL}}{observationBeaconIntervals ×dot11BeaconPeriod ×1024}×255\right⌋$$

where

observationBeaconIntervals is the same as defined in MU DL PPDU utilization.

*TMUUL* is computed as the sum of the periods which are used for MU UL PPDU transmission over the measurement interval.

The Mean UL and DL Available RU fields indicated the average quantized available RU size of OFDMA only transmission and of up to 7 spatial streams. The structure of Mean UL and DL Available RU fields are defined in Figure x.xx1.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean RU for OFDMA only | Mean RU for 1SS | Mean RU for 2SS | Mean RU for 3SS | Mean RU for 4SS | Mean RU for 5SS | Mean RU for 6SS | Mean RU for 7SS |
| bits: | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Figure x.xx1 Mean UL or DL Available RU field

The mean *W2* Available RU size for *W3* is calculated using the formula below.

where

*Kavail,i* is the number of tones of the maximum available RU inside the PPDU for *W3* and the *i*th *W2* transmission (The maximum available RU is the unused RU with most tones that can be allocated within the PPDU for *W3* transmission. For example, a 20 MHz MU MIMO and OFDMA capable HE AP with 2 spatial streams transmits a PPDU having one 106-tone single stream RU. For this PPDU, if there is no other interference, the number of tones of the maximum available RU for OFDMA only is 106 and the number of tones of the maximum available RU for 1SS is 106 as well.)

*T W2* is , the sum of periods used for *W2* PPDU transmission, *N* is the number of *W2* PPDU transmission during the measurement interval.

$\left⌊﹒\right⌋$ is to truncate the average tone size to the closest legal RU size. For the Mean Available for OFDMA only, if the average is less than 26, then there is no available RU for this case. For the other cases, if the average is less than 106, then there is no available RU for these cases.

The formula above is applied for both mean Available RU size of UL and DL by applying *W2* to be *DL* or *UL* and for different spatial streams by applying *W3* to be OFDMA only and *n* SS where *n* = 1, ..., 8.

The Mean Available RU for OFMDA only and for *n* SS subfield is (where *n* = 1, ..., 8) is encoded as follows:

— 0 indicates no available RU for this case

— 1 indicates 26-tone RU

— 2 indicates 52-tone RU

— 3 indicates 106-tone RU

— 4 indicates 242-tone RU

— 5 indicates 484-tone RU

— 6 indicates 996-tone RU

— 7 indicates 2×996-tone RU

The element is allowed to carry optional subelements defined in Table x.xx2.

Table x-xx2 — Optional subelement IDs for MU BSS Load subelement

|  |  |  |
| --- | --- | --- |
| Subelement ID | Subelment name | Extensible |
| 0 | Reserved |  |
| 1 | Active STA count | Yes |
| 2 | Active HE STA count | Yes |
| 3 | BSS Load |  |
| 4 | Extended BSS Load |  |
| 5-255 | Reserved |  |

The Active STA count subelement format is defined in Figure x.xx2.

The Active MU capable STA count subelement format is defined in Figure x.xx3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Subelement ID | Length | ObservationPeriod | Active STA count |
| Octets: | 1 | 1 | 1 | 2 |

Figure x.xx2 Active STA count subelement format

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | Subelement ID | Length | ObservationPeriod | Active HE STA count |
| Octets: | 1 | 1 | 1 | 2 |

Figure x.xx3 Active MU capable STA count subelement format

The Subelement ID field is 1 to uniquely identify this subelement as the Active STA counts subelement.

The Length field is defined in 9.4.3 (Subelements).

An active STA is defined as during the observation period, the AP has successfully received at least one MPDU from that STA to the AP.

For both subelements of ID 1and 2, the Observation Period indicates the number of consecutive beacon intervals which the measurement is made.

The Active STA count field indicates the number of active STAs among all STAs associated to the AP.

The Active HE STA count field indicates the number of active STAs among all HE STAs associated to the AP.

The BSS Load subelement is the same as the BSS Load element as defined in 9.4.2.28 (BSS Load element)..

The Extended BSS Load subelement is the same as the Extended BSS Load element as defined in 9.4.2.160 (Extended BSS Load element).