IEEE P802.11
Wireless LANs

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| D1.0 Comment Resolution  |
| Date: September 19, 2011 |
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Abstract

This document provides resolution for the following CIDs:

2609, 2624, 3699, 3322, 3697, 3719.

The comments are based on D1.0.

Edits for the proposed resolutions are based on D1.0.

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| **CommentID** | **Subclause** | **Page** | **Line** | **CommentType** | **Comment** | **SuggestedRemedy** |
| 2609 | 8.4.2.102 | 56 | 45 | T | It is not clear how it is possible to detect that 40MHz operating BSS Channel Width was busy, i.e. clarify how the busy\_bandwidth\_40 parameter value is obtained or calculated. In many instances when the AP transmits or recieves with 20 MHz and cannot monitor larger bandwidth. during these times the larger bandwidths are not monitored and thus the load information is not maintained. | Should there be other conditions to monitor the busy times of the channels and the durations that the BSS reserves the channels? Please clarify  |
| 2624 | 8.4.2.102 | 56 | 45 | T | Please clarify the condition to detect that 40MHz operating BSS Channel Width was busy, i.e. clarify how the busy\_bandwidth\_40 parameter value is obtained or calculated. There are many times when the AP transmits or recieves with 20 MHz and cannot monitor larger bandwidth. during these times the larger bandwidths are not monitored and thus the load information is not maintained. Should there be other conditions to monitor the busy times of the channels and the durations that the BSS reserves the channels. | Please clarify. |
| 3699 | 8.4.2.102 | 56 | 45 | T | Please clarify the condition to detect that 40MHz operating BSS Channel Width was busy, i.e. clarify how the busy\_bandwidth\_40 parameter value is obtained or calculated. There are many times when the AP transmits or recieves with 20 MHz and cannot monitor larger bandwidth. during these times the larger bandwidths are not monitored and thus the load information is not maintained. | Should there be other conditions to monitor the busy times of the channels and the durations that the BSS reserves the channels.  |

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| 3322 | 8.4.2.102 | 56 | 36 | T | The CS mechanism doesn’t distinguish the cause of busy, especially not whether a transmission is MU-MIMO, does it? | Clarify |
| 3697 | 8.4.2.102 | 56 |  | T | The Extended BSS Load Element does not provide guidance for spatial streams use for SU MIMO transmissions. Currently only the spatial stream inefficiency for MU MIMO tranamissions is provided | Add information element to provide information of the SU-MIMO spatial stream under utilisation.  |
| 3719 | 8.4.2.102 | 56 | 36 | T | As an example, supposed the AP indicated maximum number ss supported is 4 (for both MU-MIMO) and the AP is transmitting 4 SU spatial stream all the time. The Spatial Stream Under-Utility would indicate 255 (100%) under-tulitized when in fact all supported spatial streams are utilized during measuring period. For this reason, I suggest to change the above text to MU-MIMO or SU-MIMO. | change the text "MU-MIMO" to "MU-MIMO or SU-MIMO" |

**Discussion:**

There are six CIDs addressing issues pertinent to secion 8.4.2.102.

Comments 2609, 2624, and 3699 are asking how to determine that “40MHz operating BSS Channel Width was busy”.

Comments 3322, 3697, and 3719 are suggesting the extended load element should include SU-MIMO.

(1) The definition of busy\_bandwidth\_40

In the current definition, the busy\_bandwidth\_40 field does not differentiate the reason why only 40MHz channel is used by an 11ac AP.

The 40MHz channel busy indication could be either because the receiver is an 11n device and can only operating in 40MHz channel or the receiver is an 11ac device but only 40MHz channel is available. A proposed resolution is to add another 40MHz channel utilization field (an octet) in Figure 8-ac16. One of the 40MHz channel utilization field is reserved for 11n STA and another 40MHz channel utilization field is reserved for 11ac STA.

(2) The Extended Load Element and CS

The current text includes the following statement about channel busy, “the CS mechanism, as defined in 9.3.2.2 (CS mechanism) has indicated that the channel is busy”. The description leads to confusion about what the 11ac extended BSS load element is addressing.

The BSS load element defined in 802.11 (IEEE Std 802.11 - 2007) and 11n (7.3.2.28, 802.11n-2008) specify channel busy according to the following statement, “the AP sensed the medium was busy, as indicated by either the physical or virtual carrier sense (CS) mechanism.”

The definition of channel busy in BSS load element includes the uplink and downlink traffic. Since the extended BSS load element complements the BSS load elemenet by computing the utilization of MU and SU-MIMO operations only, the definition only applies to downlink traffic transmiited by the AP. As a result, there is no need for sensing.

The proposed resolution is to eliminate the confusion by revising the text to make it clear that the channel busy is defined for downlink only and there is no need for channel sensing.

**Proposed Response:**

**AGREE in principle.**

**Proposed Resolution Text:**

*Revise the clause 8.4.2.102 as proposed below.*

**8.4.2.102 Extended BSS Load element**

The Extended BSS Load element contains information on bandwidth utilization and MU-MIMO spatial stream under utilization. The element information format is defined in Figure 8-ac16. The element may be used by the STA for vendor-specific AP selection algorithm.

 The MU-MIMO Capable STA Count field indicates the total number of STAs with MU Rx capability currently associated with this BSS.

The Spatial Stream Under-Utilization field is defined as the fraction of time, linearly scaled with 255, that the AP has under utilized spatial domain resources for given busy time of the medium. When more than one channel is in use for the BSS, the spatial stream under-utility value is calculated only for the primary channel. This percentage is computed using the formula,

Spatial Stream Under-Utilization = floor((max\_supported\_ss\* channel\_busy\_time - utilized\_ss\_time)/(channel\_busy\_time\* max\_supported\_Nss)) x 255),

where

channel\_busy\_time is defined to be the number of microseconds during which the ~~CS mechanism, as defined in 9.3.2.2 (CS mechanism) has indicated that the channel is busy~~ AP is transmitting DL-MIMO, US or MU data streams.

utilized\_ss\_time is defined to be , where is the time interval during which the ~~CS mechanism has indicated~~ channel is busy ~~indication~~ due to transmission of MU-MIMO or SU-MIMO PPDU by the AP, **NSTS,i**  is the number of spatial stream transmitted at the time interval , **N**  is the number of time intervals.

max\_supported\_Nss is defined to be the maximum number of spatial streams indicated by the Number of Sounding Dimensions subfield of the VHT Capabilities Info field of the AP.

The Forty MHz Utilization\_n field is defined as the fraction of time, linearly scaled with 255, that the 40 MHz of the operating BSS Channel ~~Width~~ was busy. This percentage is computed using the formula,

Forty MHz Utilization = floor((busy\_bandwidth\_40/channel\_busy\_time) x 255),

The Forty MHz Utilization\_ac field is defined as the fraction of time, linearly scaled with 255, that the 40 MHz of the operating BSS Channel ~~Width~~ was busy. This percentage is computed using the formula,

Forty MHz Utilization = floor((busy\_bandwidth\_40/channel\_busy\_time) x 255),

The Eighty MHz Utilization field is defined as the fraction of time, linearly scaled with 255, that the 80 MHz of the operating BSS Channel ~~Width~~ was busy. This percentage is computed using the formula,

Eighty MHz Utilization = floor((busy\_bandwidth\_80/channel\_busy\_time) x 255),

The Hundred Sixty MHz Utilization field is defined as the fraction of time, linearly scaled with 255, that the 160 MHz or 80+80 MHz of the operating BSS Channel ~~Width~~ was busy. This percentage is computed using the formula,

Hundred Sixty MHz Utilization = floor((busy\_bandwidth\_160/channel\_busy\_time) x 255),

where

channel\_busy\_time is defined to be the number of microseconds during which the ~~CS mechanism, as defined in 9.3.2.2 (CS mechanism) has indicated a channel busy indication~~ AP was transmitting MU-MIMO or SU-MIMO PPDU.

busy\_bandwidth\_40\_n, busy\_bandwidth\_40\_ac, busy\_bandwidth\_80, and busy\_bandwidth\_160 are defined to be the number of microseconds during which the ~~CS mechanism has indicated channel busy~~ AP was transmitting into ~~for the valid~~ 40 MHz to 11n STA, 40 MHz to 11ac STA, 80MHz, 160MHz channel respectively. 80+80 MHz transmission shall be considered 160 MHz during utility computation context. The busy\_bandwidth\_80, and busy\_bandwidth\_160 are useful for 11ac STA only.

~~The 40 MHz channel was detected to be busy by the CS mechanism when any of the primary or the secondary parameter of the channel-list indicates busy.~~

~~The 80MHz channel was detected to be busy by the CS mechanism when any of the primary, the secondary, or the secondary40 parameter of the channel-list indicates busy. The 160 MHz channel was detected to be busy by the CS mechanism when any of the primary, the secondary, the secondary 40, or secondary 80 parameter of the channel-list indicates busy.~~