IEEE P802.11
Wireless LANs

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| D1 Comment Resolution, brianh, part 6 |
| Date: 2011-10-10 |
| Author(s): |
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##### Baseline is 11ac D1.1 except it is 11ac D1.2 as noted (e.g. 3398, 3429). Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Latex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb

R2

MU CIDs addressed: 3398, 3429

PHY CIDs open: 2464

R1

MU CIDs addressed: 2124, 3796, 3797, 3396, 3325, 3179, 3180, 3557, 3299,

PHY CIDs addressed: 2466

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| 2124 | Chambelin, Philippe |  |  | How dynamically the assignment of number of AP's streams to a STA can change ? For instance if the load Element reports a stream under utilized or a bad SNR woulf it be possible to assign the under utilized stream to another STA |  | **Disagree. In the absence of a specific section#/page#/line# to help us understand the concern, we can provide the following general comments. The AP can dynamically assign the number of streams assigned to individual STAs on a PPDU-by-PPDU basis, since the number of space time streams is provided in the TXVECTOR and then advertised in the NSTS field of the PLCP header. This dynamism does not depend on the Load element (which is likely to vary more slowly)** | MU |

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| 3796 | Reuss, Edward |  | 33.20 | For the phrase ", the field is set to all ones", shouldn't the field be set to "Reserved"? Do we have a standard assignment for Reserved fields? Why does this clause explicitly specify this reserved field is set set to all ones? | Change this field to follow the standard behaviour for a reserved field. | **Agree in principle: See 11/1216r0** | MU |

***Discussion:***

The language is changed in D1.1 under CID 3285, and no longer contains the offending text



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| 3797 | Reuss, Edward |  | 33.34 | For the phrase "Sounding Sequence are reserved and set to 0", shouldn't the field be set to "Reserved"? Do we have a standard assignment for Reserved fields? Why does this clause explicitly specify this reserved field is set to all zeros? | Change this field to follow the standard behaviour for a reserved field. | **Agree in principle. See 11/1216r0** | MU |

***Discussion:***

The language is changed in D1.1 under CID 3285, and no longer contains the offending text



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| 3396 | Seok, Yongho | 8.4.11.38 | 42.30 | The phases "feedback with BW=20MHz", "feedback with BW=40MHz", and "feedback with BW=80MHz" are not clear. | Rewrite the sentences with the defined term "Channel Width" in VHT MIMO Control field. | **Agree in principle. See changes implemented under CIDs 2160 and 3171 in 11/1206r1** | MU |

For reference, thse changes are:

***When the BSS operates ~~operating~~ with a 40 MHz, 80 MHz, ~~and~~ or 160 MHz channel width, the subcarriers for which Compressed Feedback Beamforming Matrix subfield is sent in the* *Beamforming feedback ~~with~~ when the Channel Width subfield of the VHT MIMO Control field is equal to*** ***~~BW=~~20MHz correspond~~s~~ to the ~~tones~~subcarriers in the primary 20 MHz channel.***

***When the BSS operates ~~operating~~ with an 80 MHz, ~~and~~ or 160 MHz channel width, the subcarriers for which Compressed Feedback Beamforming Matrix subfield is sent in the* *Beamforming feedback ~~with~~ when the Channel Width subfield of the VHT MIMO Control field is equal to*** ***~~BW=4~~0MHz correspond~~s~~ to the ~~tones~~subcarriers in the primary 40 MHz channel.***

***When the BSS operates ~~operating~~ with an 80+80 MHz, ~~and~~ or 160 MHz channel width, the subcarriers for which Compressed Feedback Beamforming Matrix subfield is sent in the* *Beamforming feedback ~~with~~ when the Channel Width subfield of the VHT MIMO Control field is equal to*** ***~~BW=8~~0MHz correspond~~s~~ to the ~~tones~~subcarriers in the primary 80 MHz channel***

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| 3325 | Rosdahl, Jon | 8.4.2.100.2 | 52.44 | Is a non-AP STA required to set "MU Beamformer Capable" to 0? | Clarify | **Agree in principle. See 11/1216r0** | MU |
| 3179 | Perahia, Eldad | 8.4.2.100.2 | 52.45 | I thought only AP could be DL MUMIMO beamformer | if so, change "Indicates whether or not the STA supports operation as an MU beamformer" to "Indicates whether or not the AP STA supports operation as an MU beamformer" or combine two capabilities into one conditioned on whether devices is AP or non-AP | **Agree in principle. See 11/1216r0** | MU |
| 3180 | Perahia, Eldad | 8.4.2.100.2 | 52.50 | I thought only non-AP could be DL MUMIMO beamformee | if so, change "Indicates whether or not the STA supports operation as an MU beamformee" to "Indicates whether or not the non-AP STA supports operation as an MU beamformee" or combine two capabilities into one conditioned on whether devices is AP or non-AP | **Agree in principle. See 11/1216r0** | MU |

***Change:***

**Table 8-ac13—Subfields of the VHT Capabilities Info field *(continued)***

|  |  |  |
| --- | --- | --- |
| MU Beamformer Capable | Indicates support for(#3298) operation as an MU beamformer (see 9.30.5 (VHT sounding protocol)) | Set to 0 if not supported or if sent by a non-AP STASet to 1 if supported |
| MU Beamformee Capable | Indicates support for(#3298) operation as an MU beamformee (see 9.30.5 (VHT sounding protocol)) | Set to 0 if not supported or if sent by an AP Set to 1 if supported |

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| 3557 | Stephens, Adrian | 8.4.2.100.1 | 53.38 | "NOTE 1—A STA that sets MU Beamformee Capable to 0 is not able to demodulate an MU VHT PPDU with only onenon-zero NSTS subfield."This may or may not be true. | Replace with: "...is not required to be able to demodulate..." | **Agree. See 11/1216r0** | MU |

***Change:***

**8.4.2.140.2 VHT Capabilities Info field**

NOTE 1—A STA that sets MU Beamformee Capable to 0 is not required to be able to demodulate an MU VHT PPDU with only one non-zero NSTS subfield.

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| 3299 | Rosdahl, Jon | 8.4.2.100.2 | 85.39 | what are Compressed Steering Number of Beamformer Antennas Supported and Number of Sounding Dimensions set to if a device does not support BF? | Say something like "Set to 0 if operation as a beamformee/beamformer [respectively] is not supported" | **Agree in principle. See 11/1216r0** | MU |

***Change:***

**Table 8-ac13—Subfields of the VHT Capabilities Info field *(continued)***

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| --- | --- | --- |
| Compressed Steering Number of Beamformer Antennas Supported | Indicates the maximum number of beamformer antennas the beamformee can support when sending compressed beamforming feedback | If SU Beamformeecapable, set to maximum value minus 1.Otherwise reserved. |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 3398 | Seok, Yongho | 8.4.2.100.2 | 86.40[should be 52.40] | The number of antennas is not necessarily the same with the number of space-time streams depending on the implementation. Focusing the number of space-time streams seems more reasonable. | Use the number of space-time streams instead of the number of antennas. | **Accept in principle. See 11/1216r2.** | MU |
| 3429 | Shapira, Nir | 8.4.2.100.2 | 52.40 | Should indicate maximum number of antennas used by beamformer. Beamformer can always choose to use less than its maximum number of antennas, e.g. to serve beamformees that support less antennas | replace "indicates the number of antennas…" by "Indicates the maximum number of antennas…" | **Accept in principle. See 11/1216r2.** | MU |

***Discussion:*** Agree that it should me “max” and refer to NSTS (in the VHT NDP) not antennas. Change MIB variable appropriately also.

Also, the Spatial Stream Underutilization formula in the Extended BSS Load element invalidly co-mingles NSS and NSTS parameters. Which is right?

First, using STBC with MU would be odd: if you can create tight nulls then you can certainly beamform, and BFing would outperform STBC. So we don't have to care much whether it is NSTS or NSS.

Second, what if an AP did use STBC regardless? Well, a 4x4 AP that supports NSS=4 that is sending 2x1 STBC to two clients because it only has two clients is underutilized yet is using NSTS=4. It would be more utilized if there were 4 associated clients and the AP MU-ed to them all via 4\*1SS. So I think we can make an argument that NSS is better than NSTS.

Given that, Number of Sounding Dimensions shouldn’t be used and the terms in the equations should apply to SS not STS. So let’s do the clean-up at the same time.

***Change:***

**8.4.2.140.2 VHT Capabilities Info field**

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| Number of Sounding Dimensions | Beamformer’s capability indicating(#2671) the maximum value of the NUM\_STS parameter in the TXVECTOR of a VHT NDP that can be sent by the STA as a beamformer | If SU beamformer capable or MU beamformercapable, set to value minus 1.Otherwise reserved.(#2671) |

**8.4.2.142 Extended BSS Load element**

The Spatial Stream Underutilization(#2187) field is defined as the percentage of time, linearly scaled with

255 representing 100%(#2726), that the AP has underutilized(#2187) spatial domain resources for given busy

time of the medium. When more than one channel is in use for the BSS, the spatial stream underutilization(#

2188) is calculated only for the primary channel. This percentage is computed using the formula,



where

*Nmax\_SS* is defined to be the maximum number of spatial streams, summed across all users in a MU PPDU, that the AP is capable of transmitting.

Tbusy 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.

Tutiliized is defined to be sum\_{i=1}^{N} Ti.NSS,i, where Ti is the time interval during which the CS mechanism has

indicated channel busy (Ed)due to transmission of MU PPDU(#3494) by the AP, *NSS,i* is the

number of spatial streams(#3801) transmitted during(#3323) the time interval , *N* is the number

of time intervals.

Annex C

dot11VHTNumberSoundingDimensions OBJECT-TYPE

SYNTAX Unsigned32 (1..8)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute indicates the maximum value of the NUM\_STS parameter in the TXVECTOR of a VHT NDP sent by the STA as a beamformer."

DEFVAL { 1 }

::= { dot11TransmitBeamformingConfigEntry 19

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| 2464 | Hart, Brian | 22.3.12 | 176.45 | "NDP shall be the only VHT sounding format" is not aligned with the language in 22.3.11.2 | Change to "NDP shall be the only clause 22 sounding mechanism defined." | **Agree in principle. See 11/1216r1** | PHY |

***Discussion:***

Consider the case of an HT STA that supports HT sounding modes (e.g. implicit or explicit sounding). The HT STA associates to a VHT AP. If the VHT AP, which appears as an HT AP to the HT STA, chooses to support HT sounding modes, then the link benefits from this choice. There is no additional complexity on the HT STA, nor on third party STAs (i.e. no coexistence impact, etc). For this reason, there is no technical reason to forbid a VHT AP that chooses to support HT sounding modes from using HT BFing modes with HT STAs.

Accordingly a) we don’t have “shall”s on the spec, we have only have “definitions” – e.g. “NDP is the only clause 22 sounding mechanism defined”, b) the quoted text is redundant since it is true by inspection, and c) the quoted text is misleading since it hints that VHT STAs can’t use HT sounding mechanisms with HT STAs

Having said that, we still need equivalent shall’s on the MAC to prohibit HT sounding between VHT STAs. Now, Sounding PPDUs are HT PPDUs with TXVECTOR SOUNDING =0 aka HT PLCP NOT\_SOUNDING set to 0. From the following quotes, this prohibition prevents HT NDPs and extension LTFs within a sounding PPDU.

XXXX Search “sounding PPDU” including baseline and add HT or VHT modifier

**3.2 Definitions specific to IEEE 802.11**

**sounding physical layer convergence procedure (PLCP) protocol data unit (PPDU):** A PPDU that is

intended by the transmitting station (STA) to enable the receiving STA to estimate the channel between the

transmitting STA and the receiving STA. There are HT sounding PPDUs and VHT sounding PPDUs. The Not Sounding field in the High-Throughput SIGNAL field (HT-SIG) is (#10128)equal to 0 in HT sounding PPDUs.(11n) The VHT NDP is the only VHT sounding PPDU.

XXXX

HT has TRQ that can solicit staggered/NDP; VHT has no TRQ – not allowed / must use HT Control field?

ASEL, TXASSI, TXASSR, …

Calibration

Ch Est Cap

9.27 Sounding PPDUs – just exclude from VHT-to-VHT?

A STA transmits sounding PPDUs when it operates in the following roles:

— MFB requester (see 9.28.2 (Link adaptation using the HT Control field(11n)))

— Beamformee responding to a training request, calibration initiator, or responder involved in implicit

transmit beamforming (see 9.29.2.2 (Unidirectional implicit transmit beamforming(11n)), 9.29.2.3

(Bidirectional implicit transmit beamforming(11n)), and 9.29.2.4 (Calibration(11n)))

— Beamformer involved in explicit transmit beamforming (see 9.29.3 (Explicit feedback

beamforming(11n)))

— ASEL transmitter and ASEL sounding-capable transmitter involved in ASEL (see 9.30.2

(Procedure(11n)))

**19.3.13 HT Preamble format for sounding PPDUs**

**19.3.13.1 General(#2119)**

A sounding PPDU is identified by setting the Not Sounding field in the

HT-SIG to 0. A sounding PPDU may have any allowed number of HT-LTFs satisfying NLTF>=NSTS. In

general, if the Not Sounding field in the HT-SIG is (#10128)equal to 0 and , HT-ELTFs are

used, except where NSS=3 and NLTF=4 or in an NDP.

**9.30.2 Transmission of an HT NDP(11n)**

A STA that transmits an HT NDP shall set the LENGTH, SOUNDING, STBC, MCS, and NUM\_EXTEN\_SS

parameters of the TXVECTOR as specified in this subclause.

— LENGTH shall be set to 0.

— SOUNDING shall be set to SOUNDING.

— STBC shall be set to 0.

— MCS shall indicate two or more spatial streams.

***Change:***

**22.3.12 VHT preamble format for sounding PPDUs**

**9.26 Sounding PPDUs(11n)**

A sounding PPDU is an HT PPDU for which the SOUNDING parameter of the corresponding RXVECTOR or

TXVECTOR has the value SOUNDING. Sounding PPDUs are transmitted by STAs to enable the receiving

STAs to estimate the channel between the transmitting STA and the receiving STA.

A VHT STA shall not transmit a sounding PPDU to another VHT STA; otherwise, a STA transmits sounding PPDUs when it operates in the following roles:

— MFB requester (see 9.27.2 (Link adaptation using the HT Control field(11n)))

— Beamformee responding to a training request, calibration initiator, or responder involved in implicit

transmit beamforming (see 9.28.2.2 (Unidirectional implicit transmit beamforming(11n)), 9.28.2.3

(Bidirectional implicit transmit beamforming(11n)), and 9.28.2.4 (Calibration(11n)))

— Beamformer involved in explicit transmit beamforming (see 9.28.3 (Explicit feedback

beamforming(11n)))

— ASEL transmitter and ASEL sounding-capable transmitter involved in ASEL (see 9.29.2

(Procedure(11n)))

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| 2466 | Hart, Brian | 22.3.14 | 177.19 | Actuially, from the MIB, the values defined are cbw20, cbw40 … | Align with MIB | Agree. See 11/1216r0 | PHY |

**Table 22-18—Fields to specify VHT channels**

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| **Field** | **Meaning** |
| dot11CurrentChannelBandwidth | Channel bandwidth. Possible values are cbw20, cbw40, cbw80, cbw160 and cbw80p80. |