IEEE P802.11
Wireless LANs

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| --- |
| LB 187 PICS Related Comments |
| Date: 2012-03-28 |
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|  |  |  |  |  |

Abstract

This submission includes proposed resolutions to CIDs, 4125, 4126, 4127, 4128, 4129, 4131, 4187, 4188, 4706, 4853, 4854, 4864, 4870, 5395, 5458, 5460, 5462, 5463, 5464, 5465, 5468, 5469, and 5421.

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| --- | --- | --- | --- | --- |
| 4125 | 300.51 | B.4.3 | The reference from CFac is to a structure that describes the optional features, but none of the mandatory features. | Add reference to 4.3.10a to CFac row. |

Proposed Resolution: Reject

Context: (B.4.3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| \*CF16(11n)(#4000) | High-throughput (HT) features | 8.4.2.58 (HT Capabilities element (11n)) | OCFac:M  | Yes  No  |
| CFac | Very High Throughput (VHT) Features | 8.4.2.160 (VHT Capabilities element) | O | Yes  No  N/A  |

Proposed Resolution: Reject.

For consistency, the reference for CFac follows what is used for CF16 (HT).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4126 | 301.37 | B.4.14 | Why is support for MultiTID Block Ack mandatory?See: 9.21.6: "The Multi-TID subfield of the BA Control field shall be set to 1 in all BlockAck frames related to an HTimmediate agreement transmitted inside a PSMP sequence and shall be set to 0 otherwise. The Multi-TID subfield of the BAR Control field shall be set to 1 in all BlockAckReq frames related to an HT-immediate agreement transmitted inside a PSMP sequence and shall be set to 0 otherwise."It should be optional for an HT STA,that is an error in REVmb. However, by making it mandatory for HT, it is also mandatory for VHT, regardless of any reference to CF16. So we do need to fix this up. | Change QB4.4 Status to"CF12:OCF16 & PC37:M"(i.e. removing the CFac: M insert and modifying the .11n condition)Also remove "CFac: M" at 303.23. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| QB4.4 (11n) | MultiTID Block Ack | 8.3.1.8.4 (Multi-TID BlockAckReq variant(11n)) | CF12:O CF16:MCFac:M | Yes  No  N/A  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4127 | 301.35 | B.4.14 | In Annex B, any insertion of "CFac:X" to accompany a "CF16:X" is superfluous.As 300.47 shows, if CFac is true, then so is CF16. | Remove superfluous CFac:M statements at:301.35, 301.55, 302.04, 302. 07, 302.11, 302.27, 302.31, 302.38, 302.46, 303.05, 303.13, 303.40, 303.44 |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| QB4.1 (11n) | Immediate Block Ack | 8.3.1.8.1 (Overview(11n)), 8.3.1.8.2 (Basic BlockAckReq variant(11n)), 8.3.1.9.1 (Overview(11n)), 8.3.1.9.2 (Basic BlockAck variant(11n)),8.5.5 (Block Ack Action frame details), 9.20 (Block Acknowledgment (Block Ack)) (except 9.20.7 (HT-immediate Block Ack extensions) and 9.20.8 (HT-delayed Block Ack extensions)), 10.5 (Block Ack operation) | CF12:OCF16:MCFac:M | Yes  No  N/A  |
| QB4.3 (11n) | Compressed Block Ack | 8.3.1.8.3 (Compressed BlockAckReq variant(11n)) | CF12:O CF16:MCFac:M | Yes  No  N/A  |
| QB4.4 (11n) | MultiTID Block Ack | 8.3.1.8.4 (Multi-TID BlockAckReq variant(11n)) | CF12:O CF16:MCFac:M | Yes  No  N/A  |

**B.4.19 High-throughput (HT) features**

**B.4.19.1 HT MAC features**

*Change table as follows (only modified rows are shown):*(11n)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Protocol Capabilities** | **References** | **Status** | **Support** |
|  | Are the following MAC protocol features supported? |  |  |  |
| HTM3 | MPDU aggregation |  |  |  |
| HTM3.1 | Reception of A-MPDU | 8.4.2.58.3 (A-MPDU Parameters field), 11.3 (RSNA confidentiality and integrity(11w) protocols), 9.12.2 (A-MPDU length limit rules(11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM3.2 | A-MPDU format | 8.6.1 (A-MPDU format(11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM3.3 | A-MPDU contents | 8.6.3 (A-MPDU contents (11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM3.4 | A-MPDU frame exchange sequences | 9.19.2.4 (Multiple frame transmission in an EDCA TXOP)  | CF16:MCFac:M | Yes  No  N/A  |
| HTM3.5 | Transmission of A-MPDU  | 8.4.2.58.3 (A-MPDU Parameters field), 11.3 (RSNA confidentiality and integrity(11w) protocols) | CF16:OCFac:M | Yes  No  N/A  |
| HTM4 | MSDU aggregation |  |  |  |
| HTM4.1 | Reception of A-MSDUs | 8.2.4.5 (QoS Control field), 8.3.2.2 (A-MSDU format(11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM4.2 | A-MSDU format | 8.3.2.2 (A-MSDU format(11n)) | CF16:MCFac :M | Yes  No  N/A  |
| HTM4.3 | A-MSDU content | 8.3.2.2 (A-MSDU format(11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM4.4 | Transmission of A-MSDUs | 8.3.2.2 (A-MSDU format(11n)), 8.2.4.5 (QoS Control field) | CF16:OCFac:O | Yes  No  N/A  |
| HTM5 | Block Ack |  |  |  |
| HTM5.1 | Block Ack mechanism | 8.3.1.8 (BlockAckReq(11n) frame format), 8.3.1.9 (BlockAck(11n) frame format), 8.4.1.14 (Block Ack Parameter Set field), 9.20 (Block Acknowledgment (Block Ack)), 10.15 (20/40 MHz BSS operation(11n)) | CF16:MCFac:M | Yes  No  N/A  |
| HTM5.2 | Use of compressed bitmap between HT STAs | 8.3.1.9.3 (Compressed BlockAck variant(11n)), 9.20.6 (Selection of BlockAck and BlockAckReq variants(11n)), | CF16:MCFac:M | Yes  No  N/A  |
| HTM5.3 | HT-immediate Block Ack extensions | 9.20.7 (HT-immediate Block Ack extensions) | CF16:MCFac:M | Yes  No  N/A  |
| HTM5.4 | HT-delayed Block Ack extensions | 9.20.8 (HT-delayed Block Ack extensions) | CF16 and QB4.2:M (3616) | Yes  No  N/A  |
| HTM5.5 | Multiple TID Block Ack | 8.3.1.8.4 (Multi-TID BlockAckReq variant(11n)), 8.3.1.9.4 (Multi-TID BlockAck variant(11n)), 9.25.1.7 (PSMP acknowledgment rules(11n)) | HTM12:MCFac:M | Yes  No  N/A  |
| HTM8 | Duration/ID rules for A-MPDU and TXOP | 8.2.4.2 (Duration/ID field) | CF16:OCFac:M | Yes  No  N/A  |
| HTM9 | Truncation of TXOP as TXOP holder | 9.19.2.7 (Truncation of TXOP(11n)) | CF16:OCFac:O | Yes  No  N/A  |
| \*HTM11 | Reverse direction (RD) aggregation exchanges | 9.24 (Reverse Direction Protocol(11n)) | CF16:OCFac:O | Yes  No  N/A  |

Proposed Resolution: Accept

Since a VHT STA is also an HT STA, the commenter is right in observing that adding a CFac:X is redundant.

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| --- | --- | --- | --- | --- |
| 4128 | 305.37 | B.4.23.1 | "VHTM4.1 andVHTM4.2: M"I suspect that support for NDP is required if you are either a beamformee or a beamformer, not only if you are both. | Change "and" to "or". |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| \*VHTM4.1 | SU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.2 | SU Beamformee Capable(2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.3 | MU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | VHTM4.1:O | Yes  No  N/A  |
| \*VHTM4.4 | MU Beamformee Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | VHTM4.2:O | Yes  No  N/A  |
| VHTM4.3 | Null Data Packet | 9.31 (Null data packet (NDP) sounding) | VHTM4.1 and VHTM4.2: M | Yes  No  N/A  |

Proposed Resolution: Revised

The commenter is correct on the need to change the “and” to an “or”. Also the Item number need to be fixed.

Proposed Changes:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM4.5 | Null Data Packet | 9.31 (Null data packet (NDP) sounding) | VHTM4.1 OR VHTM4.2: M | Yes  No  N/A  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4129 | 306.39 | B.4.23.1 | "CF: M" - incomplete | Replace with "CFac :M" |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM9.2 | Reception of Group ID Management Frame  | 8.15.6.3 (Group ID Management Frame Format) | CF:M |  |

Proposed Resolution: Accept.

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| --- | --- | --- | --- | --- |
| 4131 | 311.23 | B.4.23.2 | "CFac: O" - This should be a conditional option | Initially "CFac and VHTP3.4: O" seems right. But this allows us to express an invalid combination where we support MCS 0-9 (VHTP8.2.3), but do not support MCS 0-8.So, I think you need to state:"CFac and VHTP3.4: OCFac and VHTP8.2.3: M"Likewise VHTP8.2.3 needs to be changed to: "CFac and VHTP3.4: O".A similar change needs to be made throughout VHTP8 as follows:1. Where the MCS is dependent on 80, 160 or 80+80, it should reference VHTP3.3, VHTP3.4 and VHTP3.5 respectively. (Also add "\*" in front of these 3 labels to signify depencies).2. Where the MCS is a subset of another PICS entry, it should be "<that-entry>: M" |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTP8.2.2 | MCS with Index 0-8 and Nss = 1 | 22.5 (Parameters fr VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP8.2.3 | MCS with Index 0-9 and Nss = 1 | 22.5 (Parameters fr VHT MCSs) | CFac:O | Yes  No  N/A  |

Proposed Resolution: Reject

MCS with index 0-8 and index 0-9 are VHT optional features regardless of the CBW, Nss, or any other parameter.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4187 | 307.32 | B.4.23.1 | Does "Quiet Channel element sent by AP" mean support for transmission of the element, or reception of the element? Given PICS entry VHTM5.3, I am guessing it means transmission. | Change to "Transmission of Quiet Channel element by AP or mesh STA" |
| 4188 | 308.03 | B.4.23.1 | Does "Quiet Channel element sent by an independent STA" mean support for transmission of the element, or reception of the element? Given PICS entry VHTM5.3, I am guessing it means transmission. | Change to "Transmission of Quiet Channel element by an independent STA" |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM5.1 | Quiet Channel element sent by AP or mehs STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:O | Yes  No  N/A  |
| VHTM5.2 | Quiet Channel element sent by an independent STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:O | Yes  No  N/A  |
| VHTM5.3 | Quiet Channel element received by an independent STA or mesh STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:M | Yes  No  N/A  |

Proposed Resolution: Revise

For consistency with the other elements in the PICS table, the wprds “transmission” and “reception” are used. The revised resolution is to use the same words for the Quiet element. In addition to that the numbering of the feature needs to be changes from 5 to 15.

Proposed Changes:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM15.1 | Transmission of Quiet Channel element by AP or mehs STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:O | Yes  No  N/A  |
| VHTM15.2 | Transmission of Quiet Channel element by an independent STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:O | Yes  No  N/A  |
| VHTM15.3 | Reception of Quiet Channel element by an independent STA or mesh STA | 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.4.2.167 (Quiet Channel element), 10.9.3 (Quieting channels for testing) | (CF1 OR CH21) AND CF10 AND CFac:M | Yes  No  N/A  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4706 | 303.18 | B.4.19.1 | HT-delayed BA is not an option worth keeping support for | Replace "CF16 and QB4.2:M" with "CF16 and QB4.2 and not CFac:M" |

Context: see CID 4127

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4853 | 303.23 | B.4.19.1 | Why is MTBA required? | Delete the CFac:M |

Context: see CID 4127

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4854 | 303.36 | B.4.19.1 | Why isn't obeying the Duration/ID rules mandatory for non-VHT HT? | Change to CF16:M and delete the CFac:M |

Context: See CID 4127

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4864 | 306.00 | B.4.23.1 | What exactly is the requirement on receiving Extended BSS Load? | Delete this row |

The commenter may have quoted the worng page number and line number. The reference to Extended BSS Load element is p307L19.

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM14 | Extended BSS Load Element |  |  |  |
| VHTM14.1 | Transmission of Extended BSS Load Element  | 8.4.2.96(Extended BSS Load Element) | CFac:O | Yes  No  N/A  |
| VHTM14.2  | Reception of Extended BSS Load Element | 8.4.2.96(Extended BSS Load Element) | CFac:M | Yes  No  N/A  |

Proposed Resolution: Reject

PICS table do not define requirements for sending or receiving a certain element. It is concerened with the support of a certin feature that is included in the spec. Therefore it is appropriate not to delete the entry related to reception of the Extended BSS Load element.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4870 | 308.31 | B.4.23.2 | Support for the MCS ranges, apart from the mandatory ones, needs to be qualified by Highest Supported Data Rate | Add something like "where within the highest supported data rate" to the "Protocol capability" cells |

Context:

MCS related entries

Proposed Resolution: Reject

PICS table are concerned with the support (or no support) of certain features. Supported data rates are given in Cluase 22.5.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5395 | 308.32 | B.4.23.2 | STBC is missing from VHT PHY features | Add STBC to the list of VHT PHY features. |

Context:

**B.4.19.2 HT PHY features**

*Change table as follows (only modified rows are shown):* (11n)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Protocol Capability** | **Reference** | **Status** | **Support** |
| \*HTP2.11 | Space-time block coding (STBC) | 19.3.11.9.2 (Space-time block coding (STBC))  | CF16:O  | Yes  No  N/A  |

Proposed Resolution: Accept

The only reference in the PICS is to HT STBC. There is a need to add a PICS entry for VHT STBC operation.

Proposed changes:

Add to the end of the PICs table on p314

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTP9 | Space-time block coding (STBC) | 22.3.10.9.4 (Space-time block coding) | CFac:O | Yes  No  N/A  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5458 | 303.17 | B.4.19.1 | There is no change for Item HTM5.4. | Add CFac:M on Status column. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HTM5.4 | HT-delayed Block Ack extensions | 9.20.8 (HT-delayed Block Ack extensions) | CF16 and QB4.2:M (3616) | Yes  No  N/A  |

Proposed Resolution: Reject. CID

Since a VHT STA is also an HT STA, adding CFac:X is redundant as indicated by CID 4127.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5460 | 304.22 | B.4.23.1 | Parentheses are needed for "CFac and CF1." | As in comment. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM1.2 | Signaling of STA capabilities in Probe Request, (Re)Association Request frames | 8.4.2.94 (VHT Capabilities element (11ac)), 8.3.3.9 (Probe Request frame format), 8.3.3.5 (Association Request frame format), 8.3.3.7 (Reassociation Request frame format) | CFac and CF2:M | Yes  No  N/A  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5462 | 305.46 | B.4.23.1 | Erroneous Status number for VHTM5.2. (VHT4.1:M -> VHTM4.2:M) | As in comment. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM5.2 | VHT sounding protocol as SU beamformee  | 9.31.5 (VHT Sounding Protocol) Sounding) | VHTM4.1: M | Yes  No  N/A  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5463 | 305.53 | B.4.23.1 | Erroneous Status number for VHTM5.4. (VHT5.1:M -> VHTM5.2:M) | As in comment. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM5.4 | VHT sounding protocol as MU beamformee | 9.31.5 (VHT Sounding Protocol) Sounding) | VHTM5.1: M | Yes  No  N/A  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5464 | 306.34 | B.4.23.1 | In VHT MAC, transmission of Group ID management frame is supported only by an AP and a non-AP STA does not need to support this function. | Change the status to "(CFac and CF1):O." |

Context

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM9.1 | Transmission of Group ID Management frame | 8.15.6.3 (Group ID Management Frame Format) | CFac:O | Yes  No  N/A  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5465 | 306.39 | B.4.23.1 | The status for Item VHTM9.2 is not correct. | Change status as "CFac:M." |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM9.2 | Reception of Group ID Management Frame  | 8.15.6.3 (Group ID Management Frame Format) | CF:M |  |

Proposed Resolution: Accept

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5468 | 309.53 | B.4.23.2 | VHTP8.1.3 is defined for CBW = 20 MHz, 40 MHz and 80 MHz; however, MCS index 9 for CBW = 20 MHz is not valid and this item is only for CBW = 40 MHz and 80 MHz. Ditto VHTP8.1.6, VHTP8.1.12, VHTP8.1.15, VHTP8.1.18, VHTP8.1.21 and VHTP8.1.24. | Add some notes to exclude bandwidth which does not have MCS index 9. |

Context:

MCS entries in PICS table

Proposed Resolution: Reject

PICS table is concerned with support or lack of support of certain feature. It doesn’t specify what valid and invalid combination of a set of parameters. The validity of a certain set of parameters is indicated in the MCS tables, Clause 22.5.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5469 | 311.49 | B.4.23.2 | From Table 22-55, MCS Index 9 is not valid; therefore, VHTP8.2.9 shall not be defined. Ditto VHTP8.3.8 (P313/L23) | Delete the corresponding rows. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTP8.2.9 | MCS with Index 0-9 and Nss = 3 | 22.5 (Parameters fr VHT MCSs) | CFac:O | Yes  No  N/A  |

and;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTP8.3.9 | MCS with Index 0-9 and Nss = 3 | 22.5 (Parameters fr VHT MCSs) | CFac:O | Yes  No  N/A  |

Proposed Resolution: Reject

PICS table is concerned with support or lack of support of certain feature. It doesn’t specify what valid and invalid combination of a set of parameters. The validity of a certain set of parameters is indicated in the MCS tables, Clause 22.5.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 5421 | 129.09 | 9 | 9.31.5 |  | This paragraph suggests that a STA which has MU Beamformer capability also shall support SU Beamformer capability. It means that SU Beamformer capability should be specified as mandatory feature for MU Beamformer capable STAs. The relation between SU and MU Beamformee capabilities is similar condition. | Change Status for VHTM4.1 in P305/L17 to VHTM4.3:M. Change Status for VHTM4.2 in P305/L22 to VHTM4.4:M. |

Context:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM4 | Transmit beamforming |  |  |  |
| \*VHTM4.1(3617) | SU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.2 | SU Beamformee Capable(2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.3(3617) | MU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.4 | MU Beamformee Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |

Proposed Resolution: Revise

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VHTM4 | Transmit beamforming |  |  |  |
| \*VHTM4.1(3617) | SU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.2 | SU Beamformee Capable(2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.3(3617) | MU Beamformer Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | VHTM4.1: O | Yes  No  N/A  |
| \*VHTM4.4 | MU Beamformee Capable(2511, 2520) | 8.4.2.94.2 (VHT Capabilities (11ac)) | VHTM4.2:O | Yes  No  N/A  |

**References:**