IEEE P802.11
Wireless LANs

|  |
| --- |
| Proposed Resolutions to PICS-Related Comments |
| Date: 2011-10-05 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Osama Aboul-Magd | Huawei Technologies | 303 Terry Fox DriveOttawa, ONT. CanadaK2K-3J1 | 613-287-1405 | Osama.aboulmagd@huawei.com  |
|  |  |  |  |  |

Abstract

This submission contains proposed resolutions to PICS related comments; CIDs 2179, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2520, 3614, 2615, 3616, 3617, 3618, and 3735.

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| --- | --- | --- | --- | --- | --- |
| 2179 | 239. | B.4.4.2 | According to 8.3.1, new control frames are being added to the draft. | Update (B.4.4.2 MAC frames) reflecting the new frames. | Accepted: Two new control frames are added by the IEEE 802.11ac, The NDPA frame and the Beamforming Report Poll frame. Bothe frames are specified for the use in Beamforming which is an optional procedure for IEEE 802.11ac. *For discussion: It doesn’t seem that all the MAC frames are included in this table. For example the BlockAckRequest and BlockAck frames are not included. Is there any role for deciding to add a frame to this table?* |
| 2508 | 220.38 | B.4.19.1 | Rogue "and"? "Xxx:M and XXX:O" is non-standard; should be "XXX:M <linefeed> XXX:O" OR "CFac and QB4.2:M". Equivalent problem at P221L9, P225L18 | As in comment | Accepted. |
| 2509 | 223.53 | B.4.23.2 | I don't see entries for short GI (and maybe other things? - audit TXVECTOR to ensure all options are covered) | As in comment | Accepted. Rows for Short\_GI are added to the table. |
| 2510 | 222.5 | B.4.23.1 | "CF2" but beacons etc - seems more like an AP function - i.e. CF1 | As in comment | Accepted. |
| 2511 | 222.48 | B.4.23.1 | This allows devices to support MU BFee/BFer roles without supporting SU BFer/BFee roles. I would suggest (here and in the body of the spec) that if you support MU BFee/BFer then you shall also support SU BFee/BFer. Here VHTM4.2 would depend on VHTM4.1. | As in comment | Accept in principleMake sure that the body of the spec includes a provision to support SU beamforming of MU beamforming is supported. |
| 2512 | 223.16 | B.4.23.1 | "Secondary" means "Secondary20" so need to list secondary40 and (conditioned on 160/80+80) secondary80 too. Ditto P223L20 | As in comment | Accepted. |
| 2513 | 223.23 | B.4.23.1 | Group ID is a heading - not sure it can have Y/N/A. Create a new line VHTM9.05 for GroupID or delete ref & Y/N/A | As in comment | Accepted |
| 2514 | 223.31 | B.4.23.1 | STAs must be either dynamic or static - at least one is mandatory. Also, if a STA receives an RTS, there are mandatory behaviors required, according to static or dynamic operation. So, not sure that this can be O | As in comment | Accepted. Operating in Static or dynamic mode is now TGac mandatory.*Shouldn’t there be a default mode of operation that is mandatory?* |
| 2515 | 224.52 | B.4.23.2 | This should be dependent on VHTP3.5 | As in comment | Accepted. |
| 2516 | 225.29 | B.4.23.2 | VHTP3.4 -> (VHTP3.4 OR VHTP3.5) | As in comment | Accepted. |
| 2517 | 225.33 | B.4.23.2 | If I don't support 80+80, what do I fill in? Maybe remove the BWs in the "proto cap" column for 9.3 onwards, so then this is purely a MCS8 question, and implicitly the available BWs are filtered by other PICS entries.  | As in comment | Revised- see proposed resolution. |
| 2520 | 231.47 | C.3 | PICS lumps BFer and BFee. If these are separate capabilities, should have separate PICS entries for BFer/BFee | As in comment |  |
| 3614 | 219.15 | B.4.19.1 | There's a whole bunch of dependencies on CFac added to "parallel" dependencies on HT.One way to avoid this is to make pics item CF16 mandatory if you support CFac (which is the operational semantics anyway). This then results in CF16:M being equivalent to (CF16:M, CFac:M) because CFac ==> CF16. | Make change to CF16 status to read: "O<newline> CFac:M" | Accepted. |
| 3615 | 221.8 | B.4.19.2 | "CF16:O and CFac:O" there is no "and" needed, just newline. | replace "and" by newline. | Accepted. See resolution of CID 2508. |
| 3616 | 220.37 | B.4.19.1 | "CF16 andQB4.2:MCFac:M andQB4.2:M" - this is a marvelous abuse of syntax | Replace delete second "and". | Accepted. See resolution of CID 2508 |
| 3617 | 220.43 | B.4.23.1 | The PIC syntax requires an item that is referenced in a status column to have an asterisk before its name. So VHTM4.1, which is referenced by VHTM4.3, should have one. | Review all terms to determine which are referenced in other PICS entries and ensure they are appropriately flagged with an asterisk (or gaul, if you must). | Accepted. |
| 3618 | 223.39 | B.4.23.1 | In what sense is VHT operating mode notification mandatory for all STA? The reference here is to an element. The PICS really should relate to behaviour. There are two distinct roles related to use of this element, and they should be called out separately. | Add VHTM12.1 and .2 being VHT Operating Mode Notification (as transmitter) and … (as receiver). Reference the appropriate Clause 10 subclause. Make (as transmitter) CFac:O, and (as receiver) CFac:M.This work needs to be repeated for those entries where the PICS currently cites a frame format, and where there are distinct behavioural roles. This includes:222.21, 222.28, 222.43, 222.48, 223.26, 223.48 | Accepted. |
| 3735 | 242.12 | B.4.19.2 | Support of the short guard interval is not mentioned for 11ac. It is indicated as optional for 11n in the HT PHY Features table for Item HTP 2.3.3. Suggest to add Cfac: O in the status column for that row (Item HTP 2.3.3) to indicate optional support for short GI | Modify status column corresponding to Item HTP2.3.3 so that it reads CF16:O and CFac:O | Revised: see proposed resolution. |

**CID 2179**

Add editing instructions to insert new rows to the table in clause B.4.4.2 (MAC Frames), on page 1948 (REVmb\_D10.2), after line 41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FT27FT28 | NDPABeamforing Report Poll | Clause 8 (Frame formatsClause 8 (Frame formats | OO | Yes  No  N/A Yes  No  N/A  |

Add editing instructions to insert a new entry in the table in clause B.4.4.2 (MAC Frames), on page 1951 (REVmb\_D10.2), after line 38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FR27FR28 | NDPABeamforing Report Poll | Clause 8 (Frame formatsClause 8 (Frame formats | OO | Yes  No  N/A Yes  No  N/A  |

**B.2.2 General Abbreviations for Item and Support columns**

* **VHTM: Very Hight Throughput MAC**
* **VHTP: Very High Throughput PHY**

|  |
| --- |
| * IUT configuration
 |
| Item | IUT configuration | References | Status | Support |
|  | What is the configuration of the IUT? |  |  |  |
| \* CF1 | Access point (AP) | 4.3 (Components of the IEEE 802.11 architecture) | O.1 | Yes  No  |
| \* CF2 | Independent station (*not* an AP) | 4.3 (Components of the IEEE 802.11 architecture) | O.1 | Yes  No  |
| \*CF2.1 | Operation in an infrastructure BSS(#1558) | 4.3 (Components of the IEEE 802.11 architecture) | CF2:M | Yes  No  N/A  |
| \*CF2.2 | Operation in an IBSS(#1558) | 4.3 (Components of the IEEE 802.11 architecture) | CF2:O | Yes  No  N/A  |
| \*CF2.3 (11p) | Independent station operating outside the context of a BSS (dot11OCBActivated(#10538) is true)  | 10.20 (STAs communicating data frames outside the context of a BSS(11p)) | (not CF17):O, CF17:M  | Yes  No  |
| \* CF3 | Frequency-hopping spread spectrum (FHSS) PHY for the 2.4 GHz band | — | O.2 | Yes  No  |
| \* CF4 | Direct sequence spread spectrum (DSSS) PHY for the 2.4 GHz band | — | O.2 | Yes  No  |
| CF5 (#4031) | Infrared (IR) PHY | — | O.2 | Yes  No  |
| \* CF6 | Orthogonal frequency division multiplexing (OFDM) PHY(11y) | — | O.2 | Yes  No  |
| \* CF7 | High-speed PHY | — | O.2 | Yes  No  |
| \* CF8 | Is multidomain operation capability -implemented? | 8.4.2.11 (Hopping Pattern Parameters (#1684)element), 8.4.2.12 (Hopping Pattern Table (#1684)element), 9.18 (Operation across regulatory domains), 10.1.4.5 (Synchronizing with a BSS) | O.3 | Yes  No  |
| \* CF9 | Extended Rate PHY (ERP) | Clause 18 (Extended Rate PHY (ERP) specification(#1468)(#1729)) | O.2 | Yes  No  |
| \* CF10 | Is spectrum management operation -supported? | 8.4.1.4 (Capability Information field), 10.6 (Higher layer timer synchronization) | (CF6 OR CF16:(11n) OCFac: O | Yes  No  |
| \*CF11 | Is operating classes(#2113) capability -implemented? | 8.4.2.13 (Request (#1684)element), 17.3.8.4.2 (Channel numbering), 17.3.8.7 (Slot time), 17.4.2 (OFDM PHY MIB), Annex D, Annex E | (CF6 OR CF16)(11n) &CF8&CF10:O | Yes  No  N/A  |
| \* CF12 | Quality of service (QoS) supported | 9.19 (HCF), 9.20 (Block Acknowledgment (Block Ack)), 4.3.10 (High-throughput (HT) station (STA)(11n))(11n) | OCF16:MCFac :M(11n) | Yes  No  N/A  (11n) |
| \* CF13(11k) | Is Radio Measurement supported? (#1704) | 8.4.1.4 (Capability Information field), 10.11 (Radio measurement procedures(11k)) | (CF6 AND CF11):O | Yes  No  N/A  |
| \*CF14(11r) | Is infrastructure mode implemented? | 4.3.3 (STA membership in a BSS is dynamic) | O | Yes  No  |
| \*CF15(11y) | 3.65–3.70 GHz band in United States | 8.4.2.54 (DSE Registered Location element(11y)), 10.12 (DSE procedures(11y)), 17.3.6 (CCA), 17.3.10.6 (CCA requirements(11y)), Annex D, Annex E | CF6&CF8&CF10&CF11:O | Yes  No  N/A  |
| \*CF16(11n)(#4000) | High-throughput (HT) features | 8.4.2.58 (HT Capabilities element (11n)) | OCFac:M (3614) | Yes  No  |
| \*CF17(11p) | 5.9 GHz band  | Annex E | CF6:O | Yes  No  |
| \*CF18(11z) | Is tunneled direct-link setup supported? | 10.22 (Tunneled direct-link setup(11z)) | O | Yes  No  N/A  |
| CFac | Very High Throughput (VHT) Features | 8.4.2.94 (VHT Capabilities element) | O | Yes  No  N/A  |

QoS base functionality

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Protocol capability | References | Status | Support |
| QB1 | QoS frame format | 8.3.1.2 (RTS frame format)–8.3.1.4 (ACK frame format), 8.3.2.1 (Data frame format(11n)),(11n) 8.3.3.2 (Beacon frame format), 8.3.3.5 (Association Request frame format)–8.3.3.8 (Reassociation Response frame format), 8.3.3.10 (Probe Response frame format), 8.3.3.13 (Action frame format) | CF12:M | Yes  No  N/A  |
| QB2 | Per traffic identifier (TID) -duplicate detection | 8.2.4.4 (Sequence Control field), 8.2.4.5 (QoS Control field), 9.3.2.11 (Duplicate detection and recovery(#1606)) | CF12:M | Yes  No  N/A  |
| QB3 | Decode of no-acknowledgment policy in QoS data frames | 8.2.4.5.4 (Ack Policy subfield), 9.19.2.4 (Multiple frame transmission in an EDCA TXOP), 9.19.2.5 (EDCA backoff procedure), 9.19.4.2 (Contention-based admission control procedures), 9.19.4.3 (Controlled-access admission control) | CF12:M | Yes  No  N/A  |
| QB4 | Block Acknowledgments (Block Acks) | (11n) |  |  |
| 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  |
| \*QB4.2 (11n) | Delayed 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:O | 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  |
| QB5 | Automatic power-save delivery (APSD) | 8.5.3 (QoS Action frame details), 10.2.1 (Power management in an infrastructure network) | CF12:O | Yes  No  N/A  |
| QB6 | Direct-link setup (DLS) | 8.4.2.21 (Channel Switch Announcement element), 8.5.4 (DLS Action frame details), 6.3.14 (Measurement request), 10.7 (DLS operation) | (CF1 AND CF12):M(CF2.1 AND CF12):O (#1558) | 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:MCFac and QB4.2:M | 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  |

**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 CFac:O(2508, 3615) | Yes  No  N/A  |

***Insert B.4.23 bellow following B.4.22:***

**B.4.23 Very High Throughput (VHT) Features**

**B.4.23.1 VHT MAC features**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Are the following MAC protocol features supported? |  |  |  |
| VHTM1 | VHT capabilities signaling |  |  |  |
| VHTM1.1 | VHT Capabilities(#11223) element | 8.4.2.94.1 (VHT Capabilities element structure(11ac)) | CFac:M | Yes  No  N/A  |
| 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  |
| VHTM1.3 | Signaling of STA and BSS capabilities in Beacon, Probe Response, (Re)Association Response frames | 8.4.2.94 (VHT Capabilities element (11ac)), 8.3.3.2 (Beacon frame format), 8.3.3.10 (Probe Response frame format), 8.3.3.6 (Association Response frame format), 8.3.3.8 (Reassociation Response frame format) | CFac and CF1:M(2510) | Yes  No  N/A  |
| VHTM2 | Signaling of VHT operation | 8.4.2.95 (VHT Operation element) | (CFac and CF1):M | Yes  No  N/A  |
| VHTM3 | Link adaptation |  |  |  |
| VHTM3.1 | Use of the VHT Control field for link adaptation in immediate response exchange. | 8.2.4.6 (HT Control field(11ac)), 8.3.3.14 (Action No Ack frame format(11n)), 9.27.3 (Link adaptation using the VHT Control field(11ac))  | CFac:O | Yes  No  N/A  |
| VHTM4 | Transmit beamforming |  |  |  |
| \*VHTM4.1(3617) | SU Beamformer/Beamformee Capable(2511) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| \*VHTM4.2(3617) | MU Beamformer/Beamformee Capable(2511) | 8.4.2.94.2 (VHT Capabilities (11ac)) | CFac:O | Yes  No  N/A  |
| VHTM4.3 | Null Data packet | 9.30 (Null Data Packet (NDP) Sounding) | VHTM4.1 and VHTM4.2: M | Yes  No  N/A  |
| VHTM5 | VHT Sounding Protocol  | 9.30.5 (VHT Sounding Protocol) | VHTM4.1 and VHTM4.2: M | Yes  No  N/A  |
| VHTM6 | TXOP Sharing  |  |  |  |
| VHTM6.1 | Sharing of EDCA TXOP | 9:19.2.2a (Sharing of EDCA TXOP) | CFac: O | Yes  No  N/A  |
| VHTM6.2 | Use of Primary and Secondary ACs | 9:19.2.2a (Sharing of EDCA TXOP) | VHTM6.1: M | Yes  No  N/A  |
| VHTM7 | TXOP Power Saving | 10.2.1.4a(Power Management During VHT Transmission) | CFac:O | Yes  No  N/A  |
| VHTM8 | BSS Operation |  |  |  |
| VHTM8.1 | Use of Primary,Secondary, and Secondary40 channels (2512) | 10.24.1(Basic VHT Functionality) | CFac:M | Yes  No  N/A  |
| VHTM8.2 | Use of Primary and Secondary80 channels for 160 and 80+80 MHz (2512) | 10.24.1(Basic VHT Functionality) | (VHTP3.4 OR VHTP3.5):M | Yes  No  N/A  |
| VHTM8.3 | CCA on Primary and Secondary, and Secondary40 Channels (2512) | 10.24.2(CCA Sensing in a VHT BSS) | CFac:M | Yes  No  N/A  |
| VHTM8.4 | CCA on Primary and Secondary80 channels for 160 and 80+80 MHz (2512) | 10.24.2(CCA Sensing in a VHT BSS) | (VHTP3.4 OR VHTP3.5):M | Yes  No  N/A  |
| VHTM9 | Group ID | (2513) |  |  |
| VHTM9.1 | Group ID Management | 8.15.6.3 (Group ID Management Frame Format) | CFac:O | Yes  No  N/A  |
| VHTM10 | Dynamic/Static Bandwidth Operation | 10.24.2(CCA Sensing in a VHT BSS) | CFac:M | Yes  No  N/A  |
| VHTM11 | VHT Single MPDU Format | 9.12.7(Transport of VHT Single MPDUs) | CFac:M | Yes  No  N/A  |
| VHTM12 | VHT Operation Notification |  |  |  |
| VHTM12.1 | Transmission of VHT Operation Element(3618) | 8.4.2.95(VHT Operation Element) and 10.25.1 Basic VHT Functionality | CFac:O | Yes  No  N/A  |
| VHTM12.2 | Rception of VHT Operation Element(3618) | 8.4.2.95(VHT Operation Element) and 10.25.1 Basic VHT Functionality | CFac:M | Yes  No  N/A  |
| VHTM13 | Partial AID in VHT PPDU | 9.17a(Partial AID in VHT PPDU) | CFac:M | Yes  No  N/A  |
| VHTM14 | BSS Load Element |  |  |  |
| VHTM14.1 | Transmission of VHTBSS Load Element (3618) | 8.4.2.96(Extended BSS Load Element) | CFac:O |  |
| VHTM14.2  | Reception of VHT BSS Load Element (3618) | 8.4.2.96(Extended BSS Load Element) | CFac:M |  |

**B.4.23.2 VHT PHY Features**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item | Protocol capability | References | Status | Support |
|  | Are the following PHY protocol features supported? |  |  |  |
| VHTP1 | PHY operating modes |  |  |  |
| VHTP1.1 | Operation according to 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification) and/or Clause 19 (High Throughput)  | 22.1.4 (PPDU formats) | CFac:M | Yes  No  N/A  |
| VHTP2 | VHT format | 22.3.2 (VHT PPDU format) | CFac:M | Yes  No  N/A  |
| VHTP3 | BSS Bandwidth |  |  |  |
| VHTP3.1 | 20 MHz Operation | 10.24.1(Basic VHT BSS Functionality) | CFac:M | Yes  No  N/A  |
| VHTP3.2 | 40 MHz Operation | 10.24.1(Basic VHT BSS Functionality) | CFac:M | Yes  No  N/A  |
| VHTP3.3 | 80 MHz Operation | 10.24.1(Basic VHT BSS Functionality) | CFac:M | Yes  No  N/A  |
| \*VHTP3.4(3617) | 160 MHz Operation | 10.24.1(Basic VHT BSS Functionality) | CFac: O | Yes  No  N/A  |
| \*VHTP3.5(3617) | 80+80 MHz Operation | 10.24.1(Basic VHT BSS Functionality) | CFac: O | Yes  No  N/A  |
| VHTP4 | Bandwidth Indication | 17.3.5.5 (PLCP Data Scrambler and Descrambler) | CFac: M | Yes  No  N/A  |
| VHTP5 | PHY Timing Parameters |  |  |  |
| VHTP5.1 | Values in VHT\_CBW 20 MHz channel | 22.3.6 (Timing-related parameters)  | CFac:M | Yes  No  N/A  |
| VHTP5.2 | Values in VHT\_CBW 40 MHz channel | 22.3.6 (Timing-related parameters)  | CFac:M | Yes  No  N/A  |
| VHTP5.3 | Values in VHT\_CBW 80 MHz channel | 22.3.6 (Timing-related parameters)  | CFac:M | Yes  No  N/A  |
| VHTP5.5 | Values in VHT\_CBW 160 MHz channel | 22.3.6 (Timing-related parameters) | CFac:O | Yes  No  N/A  |
| VHTP5.4 | Values in VHT\_CBW 80+80 MHz channel | 22.3.6 (Timing-related parameters) | CFac:O | Yes  No  N/A  |
| VHTP6 | VHT Preamble | 22.3.9(VHT Preamble) | CFac:M | Yes  No  N/A  |
| VHTP7 | Use of LDPC Code | 22.3.11.4.2 | CFac: O | Yes  No  N/A  |
| VHTP8 | Beamforming |  |  |  |
| VHTP8.1 | SU Beamforming | 22.3.12(SU-MIMO and MU-MIMO Beamforming) | VHTM4.1: M | Yes  No  N/A  |
| VHTP8.2 | MU Beamforming | 22.3.12(SU-MIMO and MU-MIMO Beamforming) | VHTM4.2:M | Yes  No  N/A  |
| VHTP8.3 | Group ID | 22.3.12.3(Group ID) | GFac:M | Yes  No  N/A  |
| VHT8.4 | VHT Preamble for Sounding PPDU | 22.3.13 (VHT Preamble format for sounding PPDU) | (VHTM4.1 ORVHTM4.2):M(2508)  | Yes  No  N/A  |
| VHTP 9 | Modulation and coding schemes (MCS) |  |  |  |
| VHTP9.1(3735) | Transmit and receive support for 400 ns GI | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.2 | MCS 0 through MCS 7 in 20, 40, and 80 MHz with Long\_GI, Nss=1 | 22.5 (Parameters for VHT MCSs) | CFac:M | Yes  No  N/A  |
| VHTP 9.3 | MCS 0 through MCS 7 in 160 or 80+80 MHz with Long\_GI, Nss=1(2517) | 22.5 (Parameters for VHT MCSs) | (VHTP3.4 OR VHTP3.5):M(2516) | Yes  No  N/A  |
| VHTP 9.4 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=1(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.5 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=2(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.6 | MCS 8 in 20, 40, 80, 160 or 80+80 MHz with Long\_GI , Nss=3 (2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.7 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=4 (2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.8 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=5(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.9 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=6(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.10 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=7(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.11 | MCS 8 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=8(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.12 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=1(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.13 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=2(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.14 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=3(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.15 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=4(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.16 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=5(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.17 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=6(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.18 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=7(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.19 | MCS 9 in 20, 40, 80, 160, or 80+80 MHz with Long\_GI , Nss=8(2517) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.20 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=1(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.21 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=2(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.22 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=3(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.23 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=4(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.24 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=5(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.25 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=6(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.26 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=7(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |
| VHTP 9.27 | MCS 0 through MCS 9 in 20, 40, and 80 MHz with Short\_GI, Nss=8(2509) | 22.5 (Parameters for VHT MCSs) | CFac:O | Yes  No  N/A  |

**References:**