IEEE P802.11  
Wireless LANs

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| --- | --- | --- | --- | --- |
| TGaf Clause 8 proposal | | | | |
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Abstract

Submission for candidate P802.11af clause 8 ammendment

## Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGaf Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGaf Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGaf Editor: Editing instructions preceded by “TGaf Editor” are instructions to the TGaf editor to modify existing material in the TGaf draft. As a result of adopting the changes, the TGaf editor will execute the instructions rather than copy them to the TGaf Draft.***

The editing instructions are shown in ***bold italic***. Four editing instructions are used: ***change, delete, insert, and replace***. Change is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~strikethrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editorial notes will not be carried over into future editions because the changes will be incorporated into the base standard.

This amendment’s baseline is IEEE Std 802.11™–2012, as amended by

* Amendment 1 802.11ae-2012
* Amendment 2 802.11aa-2012
* Amendment 3 P802.11ad Draft 8.0
* Amendment 4 P802.11ac Draft 3.0
* Frame formats
* MAC frame formats
* General frame format

Change the second paragraph as follows:(#4473)

The Frame Body field is of variable size, but constrained or affected by:

* the maximum MMPDU, MSDU, A-MSDU and MPDU sizes supported by the recipient(s) for the PPDU format in use, as specified in Table 8-0a (Maximum DU sizes (in octets) and durations (in microseconds) per PPDU format)
* the maximum PPDU duration (e.g. HT\_MF L SIG L\_LENGTH, HT\_GF or VHT aPPDUMaxTime, or DMG aDMGPPDUMaxTime (see Table 8-0a (Maximum DU sizes (in octets) and durations (in microseconds) per PPDU format)); any non-zero TXOP Limit; any regulatory constraints (e.g. CS4-msBehavior))
* the fields present in the MAC header (e.g. QoS Control, Address 4, HT Control)
* any security encapsulation (e.g. TKIP/CCMP/GCMP Header and MIC) or Mesh Control fields

~~The maximum frame body size is determined by the maximum MSDU size, plus the length of the Mesh Control field (6, 12 or 18 octets) if present, the maximum unenerypted MMPDU size (see Table 8-0a), plus any overhead from security encapsulation.~~ The maximum MPDU length transmitted by a DMG STA is 7995 octets.(11ad)

Replace Figure 8-1 with the following (changing the frame body length range):

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octets: 2 | 2 | 6 | 6 | 6 | 2 | 6 | 2 | 4 | 0-11424 | 4 |
| Frame  Control | Duration  /ID | Address  1 | Address  2 | Address  3 | Sequence  Control | Address  4 | QoS  Control | HT  Control | Frame  Body | FCS |
| MAC Header | | | | | | | | |  |  |
| * MAC frame format(#4473) | | | | | | | | | | |

Replace Table 8-0a with the following:(#4473)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * Maximum DU sizes (in octets) and durations (in microseconds) per PPDU format | | | | |
|  | Non-HT non-VHT non-DMG PPDU and non-HT duplicate PPDU | HT PPDU other than non-HT duplicate PPDU | VHT PPDU other than non-HT duplicate PPDU | DMG PPDU |
| MMPDU size | 2304 | 2304 | See NOTE 1 | 2304 |
| MSDU size | 2304 | 2304 | 2304 | 7920 |
| A-MSDU size | 3839 or 4065 (HT STA) or N/A (non-HT STA) | 3839 or 7935 (see also Table 8-124) | See NOTE 3 | 7935 |
| MPDU size | See NOTE 4 | See NOTE 5 | 3895 or 7991 or 11 454 (see also Table 8-183u (Subfields of the VHT Capabilities Info field)) | See NOTE 5 |
| PSDU size (see NOTE 7) | 213-1 (Clause 16, Table 16-2)  212-1 (others, see Table 17-5, Table 18-7, Table 19-8) | 216-1 (see Table 20-25) | 4 692 480 (~222.16) (see Table 22-29 (VHT PHY characteristics)) | 218-1 (see Table 21-17) |
| PPDU duration (see NOTE 7) | See NOTE 6 | 5484 (HT\_MF; see 9.23.4) or 10000 (HT\_GF; see Table 20-25) | 5484 (see Table 22-29 (VHT PHY characteristics)) | 2000 (see Table 10-18) |
| NOTE 1—No direct constraint on the maximum MMPDU size; indirectly constrained by the maximum MPDU size (see 8.3.3.1 (Format of management frames  ))  NOTE 2—Indirect constraint from the maximum PSDU size: 212-1 octets minus the minimum QoS Data MPDU overhead (26 octets for the MAC header and 4 octets for the FCS)  NOTE 3—No direct constraint on the maximum A-MSDU size; indirectly constrained by the maximum MPDU size  NOTE 4—No direct constraint on the maximum MPDU size; indirectly constrained by the maximum MSDU/MMPDU or (for HT STAs only) A-MSDU size  NOTE 5—No direct constraint on the maximum MPDU size; indirectly constrained by the maximum A MSDU size  NOTE 6—No direct constraint on the maximum duration, but a PLCP header LENGTH value above 2332 might not be supported by some receivers (see last NOTE in 9.23.4)  NOTE 7—The information given here on maximum PSDU sizes and on maximum PPDU durations is informative only; see the normative references given | | | | |

* Frame fields
* Frame Control field
* Type and subtype fields

Change Table 8-1 as follows, inserting rows for the VHT NDP Announcement and Beamforming Report Poll control frames and updating the reserved subtype range appropriately:

|  |  |  |  |
| --- | --- | --- | --- |
| * Valid type and subtype combinations | | | |
| Type value  b3 b2 | Type description | Subtype value  b7 b6 b5 b4 | Subtype description |
| 01 | Control | 0000-~~0101~~ 0011 | Reserved |
| 01 | Control | 0100 | Beamforming Report Poll |
| 01 | Control | 0101 | VHT NDP Announcement(#4921) |

* More Data field

Insert the following after the 5th paragraph:

In a VHT BSS, if(#4021) the TXOP power save feature is supported at both the AP and an individual STA (as determined from its VHT Capabilities(#5237) element), the More Data field indicates that more BUs are buffered for that STA at the AP (see 10.2.1.4a (Power management during VHT transmissions) for the operation of TXOP power save). A value of 1 in individually addressed frames transmitted by the VHT AP to a VHT STA in TXOP PS mode indicates that at least one additional buffered BU is present for the same STA.

* Order field

Change the second bullet in the first paragraph as follows:

* It is set to 1 in a QoS data or management frame transmitted with a value of HT\_GF ~~or~~, HT\_MF or VHT for the FORMAT parameter of the TXVECTOR to indicate that the frame contains an HT Control field.
* Duration/ID field

Change the fourth paragraph as follows:

The Duration/ID fields in the MAC headers of MPDUs in an A-MPDU all carry the same value. The Duration/ID fields in the MAC headers of MPDUs in A-MPDUs carried in the same MU PPDU all carry the same value.

* Address fields
* TA field

Change the paragraph in this section as follows:

The TA field contains an IEEE MAC ~~individual~~ address that identifies the STA that has transmitted, onto the WM, the MPDU contained in the frame body field. If the Individual/Group bit is 0, then the TA field is the individual address of the STA; otherwise the TA field is a bandwidth signaling TA(#5029), indicating that the frame caries additional information in the scrambling sequence (see 8.3.1.2 (RTS frame format

))(#4485). ~~The Individual/Group bit is always transmitted as a zero in the transmitter address.~~

* QoS Control field
* Ack Policy subfield

Change Table 8-6 as follows:

|  |  |  |
| --- | --- | --- |
| * Ack Policy subfield in QoS Control field of QoS data frames | | |
| Bits in QoS Control field | | Meaning |
| Bit 5 | Bit 6 |
| 0 | 0 | Normal Ack or Implicit Block Ack Request.  In a frame that is a ~~non-A-MPDU~~ single MPDU frame(#4817)(#4780)(#4524):  The addressed recipient returns an ACK or QoS +CF-Ack frame after a short interframe space (SIFS) period, according to the procedures defined in 9.3.2.8 (ACK procedure) and 9.19.3.5 (HCCA transfer rules). For a non-DMG STA, this(11ad) is the only permissible value for the Ack Policy subfield for individually addressed QoS Null (no data) frames.  ~~In a frame that is part of an A-MPDU~~Otherwise:  The addressed recipient returns a BlockAck MPDU, either individually or as part of an A-MPDU starting a SIFS after the PPDU carrying the frame, according to the procedures defined in 9.3.2.9 (BlockAck procedure), 9.21.7.5 (Generation and transmission of BlockAck by an HT STA), 9.21.8.3 (Operation of HT-delayed Block Ack), 9.25.3 (Rules for RD initiator), 9.25.4 (Rules for RD responder) and 9.29.3 (Explicit feedback beamforming). |

* HT Control field

Insert a subsection heading 8.2.4.6.1 before the first paragraph:

* General

Replace Figure 8-5 with the following:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 B29 | B30 | B31 |
|  | VHT | HT Control Middle | AC  Constraint | RDG/More PPDU |
| Bits | 1 | 29 | 1 | 1 |
| * HT Control field | | | | |

Insert the following after the 3rd paragraph:

The HT Control field has two forms, the HT variant and the VHT variant. The two forms differ in the format of the HT Control Middle subfield, described in 8.2.4.6.2 (HT variant)f or the HT variant and in 8.2.4.6.3 (VHT variant) for the VHT variant.(#4909)

The AC Constraint subfield of the HT Control field indicates whether the mapped AC of an RD data frame is constrained to a single AC, as defined in Table 8-12 (AC Constraint subfield values).

The RDG/More PPDU subfield of the HT Control field is interpreted differently depending on whether it is transmitted by an RD initiator or an RD responder, as defined in Table 8-13 (RDG/More PPDU subfield values).

Insert a new subsection heading 8.2.4.6.2 after these new paragraphs:

* HT variant

Insert a new paragraph at the head of the new subsection:

The format of the HT Control Middle subfield of the HT variant HT Control field is(#4909) shown in Figure 8-5a.

Insert a new figure:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B1 B15 | B16 B17 | B18 B19 | B20 B21 | B22 B23 | B24 | B25 B28 | B29 |
|  | Link  Adaptation  Control | Calibration  Position | Calibration  Sequence | Reserved | CSI/Steering | NDP  Announcement | Reserved | DEI(11aa) |
| Bits: | 15 | 2 | 2 | 2 | 2 | 1 | 4 | 1 |
| * HT Control Middle subfield of the HT variant HT Control field(#4909) | | | | | | | | |

The format of the Link Adaptation Control subfield of the HT variant HT Control field is defined in Figure 8-6 (Link Adaptation Control subfield).

Replace Figure 8-6 with the following (removing the ‘Reserved’ field):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B1 | B2 B5 | B6 B8 | B9 B15 |
|  | TRQ | MAI | MFSI | MFB/ASELC |
| Bits: | 1 | 4 | 3 | 7 |
| * Link Adaptation Control subfield | | | | |

Change the following paragraphs in the remainder of this section:

The Calibration Position and Calibration Sequence subfields of the HT variant HT Control field are defined in Table 8-10 (Calibration control subfields).

The CSI/Steering subfield of the HT variant HT Control field indicates the type of feedback, as shown in Table 8-11 (CSI/Steering subfield values).

The NDP Announcement subfield of the HT variant HT Control field indicates that an NDP will be transmitted after the frame (according to the rules described in 9.31 (Null data packet (NDP) sounding)). It is set to 1 to indicate that an NDP will follow; otherwise, it is set to 0.

~~The AC Constraint subfield of the HT Control field indicates whether the mapped AC of an RD data frame is constrained to a single AC, as defined in Table 8-12 (AC Constraint subfield values).~~

~~The RDG/More PPDU subfield of the HT Control field is interpreted differently depending on whether it is transmitted by an RD initiator or an RD responder, as defined in Table 8-13 (RDG/More PPDU subfield values).~~

Insert the following as a new subclause 8.2.4.6.3:

* VHT variant

The format of the HT Control Middle subfield of the VHT variant HT Control field is(#4909) shown in Figure 8-8a.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B1 | B2 | B3 B5 | B6 B8 | B9 B23 | B24 B26 | B27 | B28 | B29 |
| Reserved | MRQ | MSI/STBC | MFSI/  GID-L | MFB | GID-H | Coding Type | FB Tx Type | Unsolicited MFB |
| Bits: 1 | 1 | 3 | 3 | 15 | 3 | 1 | 1 | 1 |
| * HT Control Middle subfield of the VHT variant HT Control field(#4909) | | | | | | | | |

The subfields of VHT variant HT Control field are defined in Table 8-13a (VHT variant HT Control field subfields).

|  |  |  |
| --- | --- | --- |
| * VHT variant HT Control field subfields | | |
| Subfield | Meaning | Definition |
| MRQ | VHT MCS feedback request | Set to 1 to request VHT MCS feedback (solicited MFB), otherwise set to 0. |
| MSI/STBC | MRQ sequence identifier/STBC indication | If the Unsolicited MFB subfield is 0 and the MRQ subfield is 1, the MSI/STBC subfield contains a sequence number in the range 0 to 6 that identifies the specific request.  If the Unsolicited MFB subfield is 0 and the MRQ subfield is 0, the MSI/STBC subfield is reserved.  If the Unsolicited MFB subfield is 1, the MSI/STBC field contains the Compressed MSI and STBC Indication subfields as shown in Figure 8-8b.  The STBC Indication subfield(#4023) indicates whether or not the estimate in the MFB subfield is computed based on a PPDU using STBC encoding:  Set to 0 if the PPDU was not STBC encoded  Set to 1 if the PPDU was STBC encoded(#4964)  The Compressed MSI contains a sequence number that identifies the specific request. It is in the range 0 to 3 if STBC Indication equals 0 or in the range 0 to 2 if STBC Indication equals 1. |
| MFSI/GID-L | MFB sequence identifier/LSB of group ID(#4829) | If the Unsolicited MFB subfield is 0, the MFSI/GID-L subfield contains the received value of MSI contained in the frame to which the MFB information refers.  If the Unsolicited MFB subfield is 1 and the MFB is estimated from an MU PPDU, the MFSI/GID-L subfield contains the lowest 3 bits of group ID(#4829) of that PPDU from which the MFB was estimated (bit 0 of the group ID(#4829) appears in the lowest numbered bit of the field MFSI/GID-L). If the unsolicited MFB is estimated from an SU PPDU, the MFSI/GID-L subfield is set to all ones. |
| MFB | N\_STS, MCS, BW and SNR feedback | MFB subfield is interpreted as defined in Table 8-13b (MFB subfield in the VHT variant HT Control field). This subfield contains the recommended MFB. The combination(#4282) of MCS=15 and N\_STS=7 indicates that no feedback is present. |
| GID-H | MSB of group ID(#4829) | If the Unsolicited MFB subfield is 1 and the unsolicited MFB is estimated from an MU PPDU, the GID-H subfield contains the highest 3 bits of group ID(#4829) of the PPDU from which the unsolicited MFB was estimated (bit 3 of the group ID(#4829) appears in the lowest numbered bit of the field GID-H). If the unsolicited MFB is estimated from an SU PPDU, the GID-H subfield is set to all ones.  Otherwise this subfield is reserved. |
| Coding Type | Coding type of the measured PPDU(#4853) | If the Unsolicited MFB subfield is 1, the Coding Type subfield contains the Coding information (0 for BCC and 1 for LDPC) of the frame(#5241) from which the unsolicited MFB was estimated.  Otherwise this subfield is reserved. |
| FB Tx Type | Transmission type of the measured PPDU(#4853) | If the Unsolicited MFB subfield is 1 and  FB Tx Type subfield is 0, the unsolicited MFB is estimated from a VHT PPDU with RXVECTOR parameter BEAMFORMED equal to 0(#4284).  If the Unsolicited MFB subfield is 1 and the FB Tx Type subfield is 1, the unsolicited MFB is estimated from a VHT PPDU with RXVECTOR parameter BEAMFORMED equal to 1(#4284).  Otherwise this subfield is reserved. |
| Unsolicited MFB | Unsolicited MCS feedback indicator | Set to 1 if the MFB is not a response to an MRQ.  Set to 0 if the MFB is a response to an MRQ. |

The format of the MSI/STBC subfield when the Unsolicited subfield is 1 is shown in Figure 8-8b.

|  |  |  |
| --- | --- | --- |
|  | B3 B4 | B5 |
|  | Compressed MSI | STBC Indication |
| Bits: | 2 | 1 |
| * MSI/STBC subfield when the Unsolicited MFB subfield is 1 | | |

The format of the MFB subfield in the VHT variant HT Control field is shown in Figure 8-8c.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B9 B11 | B12 B15 | B16 B17 | B18 B23 |
|  | N\_STS | MCS | BW | SNR |
| Bits: | 3 | 4 | 2 | 6 |
| * MFB subfield in the VHT variant HT Control field | | | | |

The MFB subfields in the VHT variant HT Control field are defined in Table 8-13b (MFB subfield in the VHT variant HT Control field).

|  |  |  |
| --- | --- | --- |
| * MFB subfield in the VHT variant HT Control field | | |
| Subfield | Meaning | Definition |
| N\_STS | Recommended *NSTS* | Indicates the recommended *NSTS* as defined in 9.28.3 (Link adaptation using the VHT variant HT Control field). |
| MCS | Recommended MCS | Indicates the recommended VHT MCS as defined in 9.28.3 (Link adaptation using the VHT variant HT Control field). |
| BW | Bandwidth of the recommended MCS | If the Unsolicited MFB subfield is 1, the BW subfield indicates the bandwidth for which the recommended MCS is intended, as defined in 9.28.3 (Link adaptation using the VHT variant HT Control field):  Set to 0 for 20 MHz  Set to 1 for 40 MHz  Set to 2 for 80 MHz  Set to 3 for 160 MHz and 80+80 MHz.(Ed)  If the Unsolicited MFB subfield is 0, the(#4744) BW subfield is reserved. |
| SNR | Average SNR | Indicates the average SNR, which is an SNR averaged over data subcarriers and space-time streams as defined in 9.28.3 (Link adaptation using the VHT variant HT Control field). |

TGaf Editor: Insert a new Clause 8.2.4.6.3a after 8.2.4.6.3:

* a VHT variant

See 8.2.4.6.3 with 20MHz replaced with ‘reserved’, 40MHz replaced with TVHT\_W, 80MHz with TVHT\_2W and TVHT\_W+W, 160MHz with TVHT\_4W and TVHT\_2W+2W

* Duration/ID field
* Setting for single and multiple protection under enhanced distributed channel access (EDCA)

Change the first paragraph as follows:

Within a frame (excluding data frames containing QoS CF-Poll, PSMP frames, and frames that have the RDG/More PPDU subfield equal to 1) transmitted under EDCA by a STA that initiates a TXOP, there are two classes of duration settings: single protection and multiple protection. In single protection, the value of the Duration/ID field of the frame can set a NAV value at receiving STAs that protects up to the end of any following data, management, or response frame plus any additional overhead frames as described below. In multiple protection, the value of the Duration/ID field of the frame can set a NAV that protects up to the estimated end of a sequence of multiple frames. Frames that have the RDG/More PPDU subfield equal to 1 always use multiple protection. PSMP frames always use multiple protection. The STA selects between single and multiple protection when it transmits the first frame of a TXOP. All subsequent frames transmitted by the STA in the same TXOP use the same class of duration settings. VHT NDP Announcement frames and Beamforming Report Poll frames always use multiple protection settings.(#4527)

NOTE—Any TXOP involving transmission of VHT NDP Announcement frames and Beamforming Report Poll frames therefore uses multiple protection settings.(#4527)

Change the TSINGLE-MSDU and TPENDING description in “Multiple protection settings” as follows:

* *TSINGLE-MSDU* is the estimated time required for the transmission of the allowed frame exchange sequence defined in ~~8.4.2.31~~9.19.2.2 (EDCA TXOPs) (for a TXOP limit value of 0), including applicable IFS durations
* *TPENDING* is the estimated time required for the transmission of
* Pending MPDUs of the same AC
* Any associated immediate response frames
* Any NDP or Beamforming Report Poll frame transmissions and explicit feedback response frames(#4528)
* Applicable IFS durations
* Any RDG

Insert as the last paragraph of this subclause:

The estimated duration for a VHT Compressed Beamforming frame response is determined by assuming that:

* All segments (see 9.31.5 (VHT sounding protocol)) are transmitted, even if a Beamforming Report Poll frame is used and not all the bits in the Segment Retransmission Bitmap therein are equal to 1.
* They are transmitted at a rate no lower than that which would be used if they were control response frames (see 9.7.5.6 (Rate selection for other data and management frames)).
* The VHT MIMO Control field subfield values are as follows:
* The Feedback Type, Nr Index and Channel Width are as specified in 9.31.5 (VHT sounding protocol).
* The Nc Index is as specified in 9.31.5 (VHT sounding protocol) if the Feedback Type is MU, or to the greatest value allowed by 9.31.5 (VHT sounding protocol) if the Feedback Type is SU.
* The Grouping indicates no grouping.
* The Codebook Information has the value 1.(#4787)

NOTE—For a TXOP that includes the transmission of a VHT Compressed Beamforming frame by the TXOP responder, the TXOP holder can, if the duration estimates prove excessive, indicate truncation of the TXOP by using a CF-End frame, provided that the remaining duration of the TXOP after the transmission of the last frame can accommodate the CF-End frame (see 9.19.2.7 (Truncation of a TXOP)).(#4787)

* Format of individual frame types
* Control frames
* RTS frame format

Change the third paragraph as follows:

The TA field is the address of the STA transmitting the RTS frame or a bandwidth signaling TA(#5029). The TA field is set to a bandwidth signaling TA(#5029) in an RTS frame transmitted by a VHT STA in a non-HT or non-HT duplicate format to indicate that the scrambling sequence carries the TXVECTOR parameters CH\_BANDWIDTH\_IN\_NON\_HT and DYN\_BANDWIDTH\_IN\_NON\_HT (see 9.3.2.5a (VHT RTS procedure

)).(#4173)

* CTS frame format

Change the second paragraph as follows:

When the CTS frame follows an RTS frame, the RA field of the CTS frame is set to a non-bandwidth signaling TA obtained ~~copied~~ from the TA field of the immediately previous RTS frame to which the CTS is a response(#4884). When the CTS is the first frame in a frame exchange, the RA field is set to the MAC address of the transmitter.

Insert new subclauses 8.3.1.19 and 8.3.1.20:

* VHT NDP Announcement(#4921)
* frame format

The frame format of the VHT NDP Announcement(#4921) frame is shown in Figure 8-29i.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Frame Control | Duration | RA | TA | Sounding Sequence | STA Info 1 | … | STA Info *n* | FCS |
| Octets: | 2 | 2 | 6 | 6 | 1 | 2 |  | 2 | 4 |
| * VHT NDP Announcement(#4921) | | | | | | | | | |

The Duration field is set as defined in 8.2.5 (

Duration/ID field

).

The VHT NDP Announcement(#4921) frame contains at least one STA Info field. If the VHT NDP Announcement(#4921) frame contains only one STA Info field, then the RA field is set to the address of the STA identified by the AID in the STA Info field. If the VHT NDP Announcement(#4921) frame contains more than one STA Info field, then the RA field is set to the broadcast address.

The TA field is set to the address of the STA transmitting the VHT NDP Announcement(#4921) frame.

The format of the Sounding Sequence field is shown in Figure 8-29j.

|  |  |  |
| --- | --- | --- |
|  | B0 B1 | B2 B7 |
|  | Reserved | Sequence Number |
| Bits: | 2 | 6 |
| * Sounding Sequence field | | |

The Sequence Number subfield in the Sounding Sequence field contains a value selected by the beamformer to identify the VHT NDP Announcement frame(#4286).

The format of the STA Info field is shown in Figure 8-29k.

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B11 | B12 | B13 B15 |
|  | AID12(#4342) | Feedback Type | Nc Index |
| Bits: | 12 | 1 | 3 |
| * STA Info field | | | |

The subfields in the STA Info field are described in Table 8-18a (STA Info subfields).

|  |  |
| --- | --- |
| * STA Info subfields | |
| Field | Description |
| AID12(#4342) | Contains the 12 least significant bits of the(#4342) AID of a(#4287) STA expected to process the following VHT NDP(#4923) and prepare the sounding feedback. Equal to 0 if the STA is an AP, mesh STA or STA that is a member of an IBSS.(#4287) |
| Feedback Type | Indicates the type of feedback requested.  Set to 0 for SU.  Set to 1 for MU. |
| Nc Index | If the Feedback Type field indicates MU(#4289), then Nc Index indicates the number of columns, *Nc*, in the Compressed Beamforming Feedback Matrix subfield(#4723) minus one:(#4655)  Set to 0 to request *Nc* = 1  Set to 1 to request *Nc* = 2  …  Set to 7 to request *Nc* = 8  Reserved if the Feedback Type field indicates SU(#4289). |

* Beamforming Report Poll
* frame format

The Beamforming Report Poll frame is shown in Figure 8-29l.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Frame Control | Duration | RA | TA | Feedback(#4293) Segment Retransmission Bitmap | FCS |
| Octets: | 2 | 2 | 6 | 6 | 1 | 4 |
| * Beamforming Report Poll | | | | | | |

The Duration field is set as defined in 8.2.5 (

Duration/ID field

)

.

The RA field is the address of the intended recipient

.

The TA field is the address of the STA transmitting the Beamforming Report Poll.

The Feedback(#4293) Segment Retransmission Bitmap field indicates the feedback(#4293) segments to be polled in a VHT Compressed Beamforming report, which is contained in one or more VHT Compressed Beamforming frames (see 9.31.5 (VHT sounding protocol

))(#4667). The bit in position *n* (*n=0* for LSB and *n=7* for MSB) is set to 1 when the segment with the Remaining Feedback Segments(#4293) subfield in VHT MIMO Control field set to *n* is requested. The bit in position *n* is set to 0 when the segment with the Remaining Feedback Segments(#4293) subfield in VHT MIMO Control field set to *n* is not requested.

* Data frames
* Data frame format

Change Figure 8-30 as shown (changing Frame Body field size range to 0-11424 and inserting the notes that follow):

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octets:  2 | 2 | 6 | 6 | 6 | 2 | 6 | 2 | 4 | ~~0-7599~~  0-11424 | 4 |
| Frame  Control | Duration/  ID | Address  1 | Address  2 | Address  3 | Sequence  Control | Address  4 | QoS  Control | HT  Control | Frame  Body | FCS |
| MAC Header | | | | | | | | |  |  |
| * Data frame | | | | | | | | | | |

NOTE 1—The maximum Frame Body size (11 424 octets) is arrived at by subtracting the length of the shortest QoS Data frame MAC header (26 octets) and FCS from the maximum MPDU length of 11 454 octets.

NOTE 2—The maximum Frame Body size for a data frame carried in a non-VHT PPDU is 7951 octets for CCMP encryption of a maximum-size A-MSDU (note that TKIP encryption is not allowed in this case and any Mesh Control fields are part of the A-MSDU subframes). The maximum frame body size if A-MSDUs are not used is 2338 octets for CCMP encryption of a maximum-size MSDU and 2342 octets for TKIP encryption of a maximum-size MSDU, including in both cases an 18-octet Mesh Control field. The frame body size might in all these cases be greater if a vendor-specific cipher suite is used.(#4793)

* Management frames
* Format of management frames

Change the 1st paragraph as follows:

The format of a management frame is defined in Figure 8-34. The Frame Control, Duration, Address 1, Address 2, Address 3, and Sequence Control fields are present in all management frame subtypes. ~~The~~ In an MMPDU carried in one or more non-VHT PPDU(s)(#4529) the maximum unencrypted MMPDU size~~, excluding the MAC header and FCS, is 2304 octets~~ is specified in Table 8-0a (Maximum DU sizes (in octets) and durations (in microseconds) per PPDU format)(#4473). In an MMPDU carried in one or more PPDU(s),(#4529) all of which are VHT PPDU(s), the maximum unencrypted MMPDU size is the maximum MPDU size supported by the recipient(s) less the shortest management frame MAC header and FCS. In an MMPDU carried in one or more PPDU(s), none of which are VHT PPDU(s), the maximum unencrypted MMPDU size is 2304 octets.(#4699)

Change Figure 8-34 as follows (Changing the Frame Body field size range and inserting the associated note):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Octets: | 2 | 2 | 6 | 6 | 6 | 2 | 4 | ~~0-2320~~  0-11426 | 4 |
|  | Frame Control | Duration | Address 1 | Address 2 | Address 3 | Sequence Control | HT  Control | Frame Body | FCS |
| * Management frame format | | | | | | | | | |

NOTE 1—The maximum frame body size shown in Figure 8-34 is arrived at by subtracting the length of the shortest management frame MAC header and FCS from the maximum MPDU length of 11 454 octets.

Change the existing note as follows:

NOTE ~~1~~2—The maximum frame body size ~~shown in Figure 8-34 is~~ for a management frame carried in a non-VHT PPDU is 2320 octets for CCMP encryption with a maximum-size MMPDU (note TKIP encryption is not allowed and any Mesh Control field is held within the MMPDU, not as a separate header). The frame body size might be greater if a vendor-specific cipher suite is used.

Insert the following as the second paragraph (after the notes):

If a management MPDU is sent using a VHT PPDU, the size of the MPDU is constrained by the maximum MPDU size supported by the recipient. Otherwise, the maximum management MPDU size is 2356 octets.

* Beacon frame format

Insert new rows for Order 60 through 66 after Order 59 in Table 8-20 as follows:

* Order 1 to 55 in 802.11-2012, +1 in P80211ae, +2 in P802.11aa
* , +1 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Beacon frame body | | |
| Order | Information | Notes |
| 60 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 61 | VHT Operation | The VHT Operation element is present when the dot11VHTOptionImplemented (#4028)is true; otherwise it is not present(#4880). |
| 62 | VHT Transmit Power Envelope element | (#4748)One VHT Transmit Power Envelope element is present for each distinct value of the Local Maximum Transmit Power Units Interpretation subfield that is supported for the BSS(#4259) if both the following conditions are met:   * dot11VHTOptionImplemented is true; * Either dot11SpectrumManagementRequired is true or (#4748)dot11RadioMeasurementActivated is true.   Otherwise, this parameter is not present. |
| 63 | Channel Switch Wrapper element(#4259) | The Channel Switch Wrapper element is optionally present if dot11VHTOptionImplemented is true and at least one of a Channel Switch Announcement element or an Extended Channel Switch Announcement element is also present in the Beacon frame and the Channel Switch Wrapper element contains at least one subelement. |
| 64 | Extended BSS Load element | The Extended BSS Load element is optionally(#4291) present if dot11QosOptionImplemented,(#4531) dot11QBSSLoadImplemented and dot11VHTOptionImplemented are true. |
| 65 | Quiet Channel | The Quiet Channel element is optionally present if dot11VHTOptionImplemented is true, and either dot11SpectrumManagementRequired or dot11RadioMeasurementActivated is true. |
| 66 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Association Request frame format

Insert a row for Order 22 after Order 21 in Table 8-22 as follows:

* Order 1 to 18 in 802.11-2012, none in P80211ae, none in P802.11aa
* , +3 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Association Request frame body | | |
| Order | Information | Notes |
| 22 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 23 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Association Response frame format

Insert rows for Order 27 and 28 after Order 26 in Table 8-23 as follows:

* Order 1 to 21 in 802.11-2012, +1 in P80211ae, none in P802.11aa
* , +4 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Association Response frame body | | |
| Order | Information | Notes |
| 27 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 28 | VHT Operation | The VHT Operation element is present when the dot11VHTOptionImplemented (#4028)is true; otherwise it is not present(#4880). |
| 29 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Reassociation Request frame format

Insert a row for Order 28 after Order 27 in Table 8-24 as follows:

* Order 1 to 23 in 802.11-2012, +1 in P80211ae, none in P802.11aa
* , +3 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Reassociation Request frame body | | |
| Order | Information | Notes |
| 28 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 29 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Reassociation Response frame format

Insert rows for Order 31 and 32 after Order 30 in Table 8-25 as follows:

* Order 1 to 25 in 802.11-2012, +1 in P80211ae, none in P802.11aa
* , +4 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Reassociation Response frame body | | |
| Order | Information | Notes |
| 31 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 32 | VHT Operation | The VHT Operation element is present when the dot11VHTOptionImplemented (#4028)is true; otherwise it is not present(#4880). |
| 33 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Probe Request frame format

Insert a row for Order 17 after Order 16 in Table 8-26 as follows:

* Order 1 to 13 in 802.11-2012, none in P80211ae, none in P802.11aa
* , +3 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Probe Request frame body | | |
| Order | Information | Notes |
| 17 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |

* Probe Response frame format

Insert new rows for Order 61 through 66 after Order 60 in Table 8-27 as follows:

* Order 1 to 54 in 802.11-2012, +1 in P80211ae, +1 in P802.11aa
* , +4 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Probe Response frame body | | |
| Order | Information | Notes |
| 61 | VHT Capabilities | The VHT Capabilities element is present when the dot11VHTOptionImplemented (#4028)is true |
| 62 | VHT Operation | The VHT Operation element is present when the dot11VHTOptionImplemented (#4028)is true; otherwise it is not present(#4880). |
| 63 | VHT Transmit Power Envelope element | (#4748)One VHT Transmit Power Envelope element is present for each distinct value of the Local Maximum Transmit Power Units Interpretation subfield that is supported for the BSS(#4259) if both the following conditions are met:   * dot11VHTOptionImplemented is true; * Either dot11SpectrumManagementRequired is true or (#4748)dot11RadioMeasurementActivated is true.   Otherwise, this parameter is not present. |
| 63 | Channel Switch Wrapper element(#4259) | The Channel Switch Wrapper element is optionally present if dot11VHTOptionImplemented is true and at least one of a Channel Switch Announcement element or an Extended Channel Switch Announcement element is also present in the Beacon frame and the Channel Switch Wrapper element contains at least one subelement. |
| 65 | Extended BSS Load element | The Extended BSS Load element is optionally(#4291) present if dot11QosOptionImplemented,(#4531) dot11QBSSLoadImplemented and dot11VHTOptionImplemented are true. |
| 66 | Quiet Channel | The Quiet Channel element is optionally present if dot11VHTOptionImplemented is true, and either dot11SpectrumManagementRequired or dot11RadioMeasurementActivated is true. |
| 67 | Operating Mode Notification | The Operating Mode Notification element is optionally present if dot11OperatingModeNotificationImplemented is true.(#5096) |

* Management and Extension frames(11ad) body components
* Fields that are not information elements
* Action field

Insert the following row into Table 8-38:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * Category values | | | | |
| Code | Meaning | See subclause | Robust | Group addressed privacy |
| 21 | VHT | 8.5.23 (VHT Action frame details  ) | No | No(#5349) |

* CSI Report field

Change the 1st paragraph as follows:(#4432)

The CSI Report field is used by the CSI frame (see 8.5.12.6) to carry explicit channel state information to a transmit HT beamformer, as described in 9.29.3.

* Noncompressed Beamforming Report field

Change the 1st paragraph as follows:(#4432)

The Noncompressed Beamforming Report field is used by the Noncompressed Beamforming frame to carry explicit feedback in the form of noncompressed beamforming feedback matrices V for use by a transmit HT beamformer to determine steering matrices Q, as described in 9.29.3 and 20.3.12.3.

Change the 4th paragraph as follows:

The SNR values in Table 8-46 and Table 8-47 are encoded as an 8-bit twos complement value of 4 × (SNR\_average – 22), where SNR\_average is the sum of the values of SNR per tone (in decibels) divided by the number of tones represented. This encoding covers the SNR range from –10 dB to 53.75 dB in 0.25 dB steps. The SNR in space-time stream i corresponds to the SNR associated with the column i of the beamforming feedback matrix V. Each SNR corresponds to the predicted SNR at HT beamformee when the HT beamformer applies the matrix V.

* Compressed Beamforming Report field

Change the 1st paragraph as follows:(#4432)

The Compressed Beamforming Report field is used by the Compressed Beamforming frame (see 8.5.12.8) to carry explicit feedback information in the form of angles representing compressed beamforming feedback matrices V for use by a transmit HT beamformer to determine steering matrices Q, as described in 9.29.3 and 20.3.12.3.

Change the 6th paragraph as follows:(#4432)

The SNR values in Table 8-50 and Table 8-51 are encoded as an 8-bit twos complement value of 4 × (SNR\_average – 22), where SNR\_average is the sum of the values of SNR per tone (in decibels) divided by the number of tones represented. This encoding covers the SNR range from –10 dB to 53.75 dB in 0.25 dB steps. Each SNR value per tone in stream i (before being averaged) corresponds to the SNR associated with the column i of the beamforming feedback matrix *V* determined at the HT beamformee. Each SNR corresponds to the predicted SNR at the HT beamformee when the HT beamformer applies the matrix *V*.

* Rate Identification field

Change the 3rd and subsequent paragraphs and insert new figure as follows:

The MCS Selector field set to 0 indicates the MCS Index field is reserved. The MCS Selector field set to 1 indicates the MCS Index field specifies an index value that is taken from Table 20-30 (MCS parameters for mandatory 20 MHz, NSS = 1, NES = 1) through Table 20-33 (MCS parameters for optional 20 MHz, NSS = 4, NES = 1, EQM) and Table 20-39 (MCS parameters for optional 20 MHz, NSS = 2, NES = 1, UEQM) through Table 20-41 (MCS parameters for optional 20 MHz, NSS = 4, NES = 1, UEQM) in 20.6 (Parameters for HT MCSs). The MCS Selector field set to 2 indicates the MCS Index field specifies an index value that is taken from Table 20-34 (MCS parameters for optional 40 MHz, NSS = 1, NES = 1) through Table 20-38 (MCS parameters for optional 40 MHz MCS 32 format, NSS = 1, NES = 1) and Table 20-43 (MCS parameters for optional 40 MHz, NSS = 3, UEQM) through Table 20-44 (MCS parameters for optional 40 MHz, NSS = 4, UEQM) in 20.6 (Parameters for HT MCSs).

The MCS Selector field set to 3 indicates that the MCS Index field specifies values that are taken from Table 22-30 (VHT MCSs for mandatory 20 MHz, NSS = 1) through Table 22-37 (VHT MCSs for optional 20 MHz, NSS = 8), indicating a VHT MCS for a 20 MHz channel width.

The MCS Selector field set to 4 indicates that the MCS Index field specifies values that are taken from Table 22-38 (VHT MCSs for mandatory 40 MHz, NSS = 1) through Table 22-45 (VHT MCSs for optional 40 MHz, NSS = 8), indicating a VHT MCS for a 40 MHz channel width.

The MCS Selector field set to 5 indicates that the MCS Index field specifies values that are taken from Table 22-46 (VHT MCSs for mandatory 80 MHz, NSS = 1) through Table 22-53 (VHT MCSs for optional 80 MHz, NSS = 8), indicating a VHT MCS for an 80 MHz channel width.

The MCS Selector field set to 6 indicates that the MCS Index field specifies values that are taken from Table 22-54 (VHT MCSs for optional 160 MHz and 80+80 MHz, NSS = 1) through Table 22-61 (VHT MCSs for optional 160 MHz and 80+80 MHz, NSS = 8), indicating a VHT MCS for a 160 MHz or 80+80 MHz channel width.

The MCS Selector field value~~s 3 to~~ of 7 ~~are~~ is reserved.

The Rate Type field set to 0 indicates the Rate field is reserved. The Rate Type field set to 1 indicates the Rate field specifies a data rate that is in the basic rate set. The Rate Type field set to 2 indicates the Rate field specifies a data rate that is not in the basic rate set.

If MCS Selector(#4532) is (#4533)1 or 2, t~~T~~he MCS Index field is a 1 octet unsigned integer that specifies the row index for one of the MCS parameter tables in 20.6 (Parameters for HT MCSs)(#4953).

If MCS Selector(#4532) is (#4533)3, 4, 5 or 6, the MCS Index field format is as shown in Figure 8-70a. The Nss subfield indicates the number of spatial streams and the MCS Index Row subfield indicates a value from the MCS Index column of the MCS table in 22.5 (Parameters for VHT MCSs) that corresponds to the channel width and *NSS* values.

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B2 | B3 B6 | B7 |
|  | Nss | MCS Index Row | Reserved |
| Bits | 3 | 4 | 1 |
| * MCS Index field format when the MCS Selector field is (#4533)3, 4, 5 or 6 | | | |

The Rate field contains a 2-octet unsigned integer that specifies the PHY rate in 0.5 Mb/s units.

Insert new subclauses 8.4.1.47 through 8.4.1.52 following the last subclause of 8.4.1:

* VHT MIMO Control field

The VHT MIMO Control field is defined in Figure 8-80d.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B0 B2 | B3 B5 | B6 B7 | B8 B9 | B10 | B11 | B12 B14 | B15 | B16 B17 | B18 B23 |
| Nc Index | Nr Index | Channel Width | Grouping | Codebook Information | Feedback Type | Remaining Feedback(#4293) Segments | First Feedback(#4293) Segment | Reserved | Sounding Sequence Number |
| Bits: 3 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 2 | 6 |
| * VHT MIMO Control field | | | | | | | | | |

The subfields of the VHT MIMO Control field are defined in Table 8-53c (Subfields of the VHT MIMO Control field).

|  |  |
| --- | --- |
| * Subfields of the VHT MIMO Control field | |
| Subfield | Description |
| Nc Index | Indicates the number of columns, *Nc*, in the compressed beamforming feedback matrix(#4723) minus one:  Set to 0 for *Nc* = 1  Set to 1 for *Nc* = 2  …  Set to 7 for *Nc* = 8 |
| Nr Index | Indicates the number of rows, *Nr*, in the compressed beamforming feedback matrix(#4723) minus one:  Set to 0 for *Nr* = 1  Set to 1 for *Nr* = 2  …  Set to 7 for *Nr* = 8 |
| Channel Width | Indicates the width of the channel in which the measurement to create the compressed beamforming feedback matrix(#4723) was made:  Set to 0 for 20 MHz  Set to 1 for 40 MHz  Set to 2 for 80 MHz  Set to 3 for 160 MHz or 80+80 MHz |
| Grouping | Indicates the subcarrier grouping, *Ng*, used for the compressed beamforming feedback matrix(#4720):  Set to 0 for *Ng* = 1 (No grouping)  Set to 1 for *Ng* = 2  Set to 2 for *Ng* = 4  The value 3 is reserved |
| Codebook Information | Indicates the size of codebook entries:  If Feedback Type is SU:(Ed)  Set to 0 for 2 bits for ψ, 4 bits for   Set to 1 for 4 bits for ψ, 6 bits for   If Feedback Type is MU:(Ed)  Set to 0 for 5 bits for ψ, 7 bits for   Set to 1 for 7 bits for ψ, 9 bits for  |
| Feedback Type | Indicates the feedback type:  Set to 0 for SU  Set to 1 for MU |
| Remaining Feedback(#4293) Segments | Indicates the number of remaining feedback segments for the associated VHT Compressed Beamforming frame:  Set to 0 for the last feedback segment of a segmented report or the only segment of an unsegmented report.  Set to a value between 1 and 6 for a feedback segment that is neither the first nor the last of a segmented report.  Set to a value between 1 and 7(#4656) for a feedback segment that is not the last segment of a segmented report.(#4667)  In a retransmitted feedback segment, the field is set to the same value associated with the segment in the original transmission. |
| First Feedback(#4293) Segment | Set to 1 for the first feedback segment of a segmented report or the only feedback segment of an unsegmented report(#4667); set to 0 if it is not the first feedback segment or if the VHT Compressed Beamforming Report field and MU Exclusive Beamforming Report field are not present in the frame.(#4656)  In a retransmitted segment, the field is set to the same value associated with the feedback segment in the original transmission. |
| Sounding Sequence Number | Sequence number from the VHT NDP Announcement frame(#4921) soliciting feedback |

In a VHT Compressed Beamforming frame not carrying all or part of (#4667)a VHT(#4713) Compressed Beamforming Report field, the fields Nc Index, Nr Index, Channel Width, Grouping, Codebook Information, Feedback Type(#4656) and Sounding Sequence Number are reserved, the First Segment field is(#4667) set to 0 and the Remaining Feedback(#4293) Segments field is set to 7.

TGaf Editor: Insert a new Clause 8.4.1.47a after 8.4.1.47:

* a TVHT MIMO Control field

See 8.4.1.47 with 20MHz replaced with ‘reserved’, 40MHz replaced with TVHT\_W, 80MHz with TVHT\_2W and TVHT\_W+W, 160MHz with TVHT\_4W and TVHT\_2W+2W

* VHT Compressed Beamforming Report field

The VHT Compressed Beamforming Report field is used by the VHT Compressed Beamforming frame (see 8.5.23.2 (VHT Compressed Beamforming frame format

)) to carry explicit feedback information in the form of angles representing compressed beamforming feedback matrices *V* for use by a transmit beamformer to determine steering matrices *Q*, as described in 9.29.3 (Explicit feedback beamforming)(#4954) and 20.3.12.3 (Explicit feedback beamforming).

The size of the VHT Compressed Beamforming Report field depends on the values in the VHT MIMO Control field.

The VHT Compressed Beamforming Report field contains VHT Compressed Beamforming Report information or successive (possibly zero-length) portions of this in the case of a segmented VHT Compressed Beamforming report (see 9.31.5 (VHT sounding protocol)). VHT Compressed Beamforming Report information is always included in the VHT Compressed Beamforming report.(#4667)

The VHT Compressed Beamforming Report information(#4667) contains the channel matrix elements indexed, first, by matrix angles in the order shown in Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield) and, second, by data subcarrier index from lowest frequency to highest frequency. The explanation on how these angles are generated from the beamforming feedback matrix *V* is given in 20.3.12.3.6 (Compressed beamforming feedback matrix). In Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield),

*Nc* is the number of columns in a compressed beamforming feedback matrix determined by the Nc Index field of the VHT MIMO Control field,

*Nr* is the number of rows in a compressed beamforming feedback matrix determined by the Nr Index field of the VHT MIMO Control field.

|  |  |  |
| --- | --- | --- |
| * Order of angles in the Compressed Beamforming Feedback Matrix subfield | | |
| Size of *V* (*Nr × Nc*) | Number of angles (*Na*) | The order of angles in the Compressed Beamforming Feedback Matrix subfield |
| 2×1 | 2 | 11, 21 |
| 2×2 | 2 | 11, 21 |
| 3×1 | 4 | 11, 21, 21, 31 |
| 3×2 | 6 | 11, 21, 21, 31, 22, 32 |
| 3×3 | 6 | 11, 21, 21, 31, 22, 32 |
| 4×1 | 6 | 11, 21, 31, 21, 31, 41 |
| 4×2 | 10 | 11, 21, 31, 21, 31, 41, 22, 32, 32, 42 |
| 4×3 | 12 | 11, 21, 31, 21, 31, 41, 22, 32, 32, 42, 33, 43 |
| 4×4 | 12 | 11, 21, 31, 21, 31, 41, 22, 32, 32, 42, 33, 43 |
| 5×1 | 8 | 11, 21, 31, 41, ψ21, ψ31, ψ41, ψ51 |
| 5×2 | 14 | 11, 21, 31, 41, ψ21, ψ31, ψ41, ψ51, 22, 32, 42, ψ32, ψ42, ψ52 |
| 5×3 | 18 | 11, 21, 31, 41, ψ21, ψ31, ψ41, ψ51, 22, 32, 42, ψ32, ψ42, ψ52, 33, 43, ψ43, ψ53 |
| 5×4 | 20 | 11, 21, 31, 41, ψ21, ψ31, ψ41, ψ51, 22, 32, 42, ψ32, ψ42, ψ52, 33, 43, ψ43, ψ53, 44, ψ54 |
| 5×5 | 20 | 11, 21, 31, 41, ψ21, ψ31, ψ41, ψ51, 22, 32, 42, ψ32, ψ42, ψ52, 33, 43, ψ43, ψ53, 44, ψ54 |
| 6×1 | 10 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61 |
| 6×2 | 18 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61, 22, 32, 42, 52, ψ32, ψ42, ψ52, ψ62 |
| 6×3 | 24 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61, 22, 32, 42, 52, ψ32, ψ42, ψ52, ψ62, 33, 43, 53, ψ43, ψ53, ψ63 |
| 6×4 | 28 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61, 22, 32, 42, 52, ψ32, ψ42, ψ52, ψ62, 33, 43, 53, ψ43, ψ53, ψ63, 44, 54, ψ54, ψ64 |
| 6×5 | 30 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61, 22, 32, 42, 52, ψ32, ψ42, ψ52, ψ62, 33, 43, 53, ψ43, ψ53, ψ63, 44, 54, ψ54, ψ64, 55, ψ65 |
| 6×6 | 30 | 11, 21, 31, 41, 51, ψ21, ψ31, ψ41, ψ51, ψ61, 22, 32, 42, 52, ψ32, ψ42, ψ52, ψ62, 33, 43, 53, ψ43, ψ53, ψ63, 44, 54, ψ54, ψ64, 55, ψ65 |
| 7×1 | 12 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71 |
| 7×2 | 22 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72 |
| 7×3 | 30 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72, 33, 43, 53, 63, ψ43, ψ53, ψ63, ψ73 |
| 7×4 | 36 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72, 33, 43, 53, 63, ψ43, ψ53, ψ63, ψ73, 44, 54, 64, ψ54, ψ64, ψ74 |
| 7×5 | 40 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72, 33, 43, 53, 63, ψ43, ψ53, ψ63, ψ73, 44, 54, 64, ψ54, ψ64, ψ74, 55, 65, ψ65, ψ75 |
| 7×6 | 42 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72, 33, 43, 53, 63, ψ43, ψ53, ψ63, ψ73, 44, 54, 64, ψ54, ψ64, ψ74, 55, 65, ψ65, ψ75, 66, ψ76 |
| 7×7 | 42 | 11, 21, 31, 41, 51, 61, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, 22, 32, 42, 52, 62, ψ32, ψ42, ψ52, ψ62, ψ72, 33, 43, 53, 63, ψ43, ψ53, ψ63, ψ73, 44, 54, 64, ψ54, ψ64, ψ74, 55, 65, ψ65, ψ75, 66, ψ76 |
| 8×1 | 14 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81 |
| 8×2 | 26 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82 |
| 8×3 | 36 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, φ63, 73, ψ43, ψ53, ψ63, ψ73, ψ83 |
| 8×4 | 44 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, 63, 73, ψ43, ψ53, ψ63, ψ73, ψ83,44, 54, 64, 74, ψ54, ψ64, ψ74, ψ84 |
| 8×5 | 50 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, 63, 73, ψ43, ψ53, ψ63, ψ73, ψ83,44, 54, 64, 74, ψ54, ψ64, ψ74, ψ84, 55, 65, 75, ψ65, ψ75, ψ85 |
| 8×6 | 54 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, 63, 73, ψ43, ψ53, ψ63, ψ73, ψ83,44, 54, 64, 74, ψ54, ψ64, ψ74, ψ84, 55, 65, 75, ψ65, ψ75, ψ85, 66, 76, ψ76, ψ86 |
| 8×7 | 56 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, 63, 73, ψ43, ψ53, ψ63, ψ73, ψ83,44, 54, 64, 74, ψ54, ψ64, ψ74, ψ84, 55, 65, 75, ψ65, ψ75, ψ85, 66, 76, ψ76, ψ86, 77, ψ87 |
| 8×8 | 56 | 11, 21, 31, 41, 51, 61, 71, ψ21, ψ31, ψ41, ψ51, ψ61, ψ71, ψ81, 22, 32, 42, 52, 62, 72, ψ32, ψ42, ψ52, ψ62, ψ72, ψ82, 33, 43, 53, 63, 73, ψ43, ψ53, ψ63, ψ73, ψ83,44, 54, 64, 74, ψ54, ψ64, ψ74, ψ84, 55, 65, 75, ψ65, ψ75, ψ85, 66, 76, ψ76, ψ86, 77, ψ87 |

A relative relationship between *Nc* and *Nr* and antenna numbers on the beamformee and beamformer sides is shown in Equation (8-1), where ***H***, with size *NBFEE,RX×NBFER,TX*, is represented by an arbitrary diagonalizing decomposition via ***H****=****A****×****B****×****C****H*, and ***V****Nr×Nc* is a sub-matrix of ***C***.



where

(#4294)

The angles are quantized as defined in Table 8-53e (Quantization of angles). The value of k for each angle is(#4576) transmitted LSB to MSB.

|  |  |
| --- | --- |
| * Quantization of angles | |
| Quantized | Quantized |
| radians  where    is the number of bits used to quantize (defined by the Codebook Information field of the VHT MIMO Control field (see 8.4.1.47 (VHT MIMO Control field  )) | radians  where    is the number of bits used to quantize (defined by the Codebook Information field of the VHT MIMO Control field (see 8.4.1.47 (VHT MIMO Control field  )) |

The VHT Compressed Beamforming Report information(#4667) has the structure defined in Table 8-53f (VHT Compressed Beamforming Report information), where *Na* is the number of angles used for the compressed beamforming feedback matrix subfield (see Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield)).

|  |  |  |
| --- | --- | --- |
| * VHT Compressed Beamforming Report information(#4667) | | |
| Field | Size  (bits) | Meaning |
| Average SNR of Space-Time Stream 1 | 8 | Signal-to-noise ratio at the beamformee for space-time stream 1 averaged over all data subcarriers. See Table 8-53h (Average SNR of Space-Time Stream i subfield). |
| ... | … | … |
| Average SNR of Space-Time Stream *Nc* | 8 | Signal-to-noise ratio at the beamformee for space-time stream *Nc* averaged over all datasubcarriers. See Table 8-53h (Average SNR of Space-Time Stream i subfield). |
| Compressed(#4295) Beamforming Feedback Matrix *V* for subcarrier | *Na×*(*b +b*)/2 | Compressed beamforming feedback matrix as defined in Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield) |
| Compressed(#4295) Beamforming Feedback Matrix *V* for subcarrier | *Na×*(*b +b*)/2 | Compressed beamforming feedback matrix as defined in Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield) |
| Compressed(#4295) Beamforming Feedback Matrix *V* for subcarrier | *Na×*(*b +b*)/2 | Compressed beamforming feedback matrix as defined in Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield) |
| ... | … | … |
| Compressed(#4295) Beamforming Feedback Matrix *V* for subcarrier | *Na*×( *b +b*)/2 | Compressed beamforming feedback matrix as defined in Table 8-53d (Order of angles in the Compressed Beamforming Feedback Matrix subfield) |
| NOTE—*scidx(.)* is defined in Table 8-53g (Subcarriers for which a Compressed Beamforming Feedback Matrix subfield is sent back) | | |

*Ns* is the number of subcarriers for which the Compressed Beamforming Feedback Matrix subfield is sent back to the beamformer. Beamformee may choose to reduce *Ns* by using a method referred to as grouping, in which only a single Compressed Beamforming Feedback Matrix is reported for each group of *Ng* adjacent subcarriers. *Ns* is a function of the Channel Width and Grouping subfields in VHT MIMO Control Field (see 8.4.1.47 (VHT MIMO Control field

)). Table 8-53g (Subcarriers for which a Compressed Beamforming Feedback Matrix subfield is sent back) lists *Ns*, the exact subcarrier indices and their order for which the Compressed Beamforming Feedback Matrix(#4723) subfield is sent back. No padding is present between angles (#4712)in the VHT Compressed Beamforming Report information(#4667), even if they correspond to different subcarriers. If the size of the VHT(#4714) Compressed Beamforming Report information(#4667) is not an integral multiple of 8 bits, up to 7 zeros are appended to the end of the field to make its size an integral multiple of 8 bits.

|  |  |  |  |
| --- | --- | --- | --- |
| * Subcarriers for which a Compressed Beamforming Feedback Matrix subfield is sent back | | | |
| Channel Width | *Ng* | *Ns* | Subcarriers for which Compressed Feedback Beamforming Matrix subfield is sent: *scidx*(0), *scidx*(1), …, *scidx*(*Ns*-1) |
| 20 MHz | 1 | 52 | -28, -27, -26, -25, -24, -23, -22, -20, -19, -18, -17, -16, -15, -14, -13, -12, -11, -10, -9, -8, -6, -5, -4, -3, -2, -1, 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28  NOTE—Pilot subcarriers (±21, ±7) and DC subcarrier (0) are skipped |
| 2 | 30 | -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, -4, -2, -1, 1, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 |
| 4 | 16 | -28, -24, -20, -16, -12, -8, -4, -1, 1, 4, 8, 12, 16, 20, 24, 28 |
| 40 MHz | 1 | 108 | -58, -57, -56, -55, -54, -52, -51, -50, -49, -48, -47, -46, -45, -44, -43, -42, -41, -40, -39, -38, -37, -36, -35, -34, -33, -32, -31, -30, -29, -28, -27, -26, -24, -23, -22, -21, -20, -19, -18, -17, -16, -15, -14, -13, -12, -10, -9, -8, -7, -6, -5, -4, -3, -2, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 54, 55, 56, 57, 58  NOTE—Pilot subcarriers (±53, ±25, ±11) and DC subcarriers (0, ±1) are skipped. |
| 2 | 58 | -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, ‑22, -20, -18, -16, -14, -12, -10, -8, -6, -4,-2, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58 |
| 4 | 30 | -58, -54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6,-2, 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58 |
| 80 MHz | 1 | 234 | -122, -121, -120, -119, -118, -117, -116, -115, -114, -113, -112, -111, -110, -109, ‑108, -107, -106, -105, -104, -102, -101, -100, -99, -98, -97, -96, -95, -94, -93, ‑92, -91, -90, -89, -88, -87, -86, -85, -84, -83, -82, -81, -80, -79, -78, -77, -76, -74, ‑73, -72, -71, -70, -69, -68, -67, -66, -65, -64, -63, -62, -61, -60, -59, -58, -57, -56, ‑55, -54, -53, -52, -51, -50, -49, -48, -47, -46, -45, -44, -43, -42, -41, -40, -38, -37, ‑36, -35, -34, -33, -32, -31, -30, -29, -28, -27, -26, -25, -24, -23, -22, -21, -20, -19, ‑18, -17, -16, -15, -14, -13, -12, -10, -9, -8, -7, -6, -5, -4, -3, -2, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122  NOTE—Pilot subcarriers (±103, ±75, ±39, ±11) and DC subcarriers (0, ±1) are skipped. |
| 2 | 122 | -122, -120, -118, -116, -114, -112, -110, -108, -106, -104, -102, -100, -98, -96,  -94, -92, -90, -88, -86, -84, -82, -80, -78, -76, -74, -72, -70, -68, -66, -64, -62, -60, -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, -4, -2, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122 |
| 4 | 62 | -122, -118, -114, -110, -106, -102, -98, -94, -90, -86, -82, -78, -74, -70, -66, -62,  -58, -54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6, -2, 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78, 82, 86, 90, 94, 98, 102, 106, 110, 114, 118, 122 |
| 160 MHz | 1 | 468 | -250, -249, -248, -247, -246, -245, -244, -243, -242, -241, -240, -239, -238, -237, -236, -235, -234, -233, -232, -230, -229, -228, -227, -226, -225, -224, -223, -222, -221, -220, -219, -218, -217, -216, -215, -214, -213, -212, -211, -210, -209, -208, -207, -206, -205, -204, -202, -201, -200, -199, -198, -197, -196, -195, -194, -193, -192, -191, -190, -189, -188, -187, -186, -185, -184, -183, -182, -181, -180, -179, -178, -177, -176, -175, -174, -173, -172, -171, -170, -169, -168, -166, -165, -164, -163, -162, -161, -160, -159, -158, -157, -156, -155, -154, -153, -152, -151, -150, -149, -148, -147, -146, -145, -144, -143, -142, -141, -140, -138, -137, -136, -135, -134, -133, -132, -131, -130, -126, -125, -124, -123, -122, -121, -120, -119, -118, ‑116, -115, -114, -113, -112, -111, -110, -109, -108, -107, -106, -105, -104, ‑103, ‑102, -101, -100, -99, -98, -97, -96, -95, -94, -93, -92, -91, -90, -88, -87, -86, -85, -84, -83, -82, -81, -80, -79, -78, -77, -76, -75, -74, -73, -72, -71, -70, -69, -68, -67, -66, -65, -64, -63, -62, -61, -60, -59, -58, -57, -56, -55, -54, -52, -51, -50, -49, -48, -47, -46, -45, -44, -43, -42, -41, -40, -39, -38, -37, -36, -35, -34, -33, -32, -31, -30, -29, -28, -27, -26, -24, -23, -22, -21, -20, -19, -18, -17, -16, -15, -14, -13, -12, -11, -10, -9, -8, -7, -6, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 118, 119, 120, 121, 122, 123, 124, 125, 126, 130, 131, 132, 133, 134, 135, 136, 137, 138, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250(#4871)  NOTE—Pilot subcarriers (±231, ±203, ±167, ±139, ±117, ±89, ±53, ±25), DC subcarriers (0, ±1, ±2, ±3, ±4, ±5) and subcarriers ±127, ±128, ±129 are skipped. |
| 2 | 244 | -250, -248, -246, -244, -242, -240, -238, -236, -234, -232, -230, -228, -226, -224, -222, -220, -218, -216, -214, -212, -210, -208, -206, -204, -202, -200, -198, -196, -194, -192, -190, -188, -186, -184, -182, -180, -178, -176, -174, -172, -170, -168, -166, -164, -162, -160, -158, -156, -154, -152, -150, -148, -146, -144, -142, -140, -138, -136, -134, -132, -130, -126, -124, -122, -120, -118, -116, -114, -112, -110, ‑108, -106, -104, -102, -100, -98, -96, -94, -92, -90, -88, -86, -84, -82, -80, -78, ‑76, -74, -72, -70, -68, -66, -64, -62, -60, -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250  NOTE—Subcarriers 0, ±2, ±4 and ±128 are skipped. |
| 160 MHz | 4 | 124 | -250, -246, -242, -238, -234, -230, -226, -222, -218, -214, -210, -206, -202, -198, -194, -190, -186, -182, -178, -174, -170, -166, -162, -158, -154, -150, -146, -142, -138, -134, -130, -126, -122, -118, -114, -110, -106, -102, -98, -94, -90, -86, -82, ‑78, -74, -70, -66, -62, -58, -54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78, 82, 86, 90, 94, 98, 102, 106, 110, 114, 118, 122, 126, 130, 134, 138, 142, 146, 150, 154, 158, 162, 166, 170, 174, 178, 182, 186, 190, 194, 198, 202, 206, 210, 214, 218, 222, 226, 230, 234, 238, 242, 246, 250  NOTE—Subcarriers ±2 are skipped. |
| 80+80 MHz | 1 | 468 | -122(L), -121(L), -120(L), -119(L), -118(L), -117(L), -116(L), -115(L), -114(L), ‑113(L), -112(L), -111(L), -110(L), -109(L), -108(L), -107(L), -106(L), -105(L), ‑104(L), -102(L), -101(L), -100(L), -99(L), -98(L), -97(L), -96(L), -95(L), ‑94(L), -93(L), -92(L), -91(L), -90(L), -89(L), -88(L), -87(L), -86(L), -85(L), ‑84(L), -83(L), -82(L), -81(L), -80(L), -79(L), -78(L), -77(L), -76(L), -74(L), ‑73(L), -72(L), -71(L), -70(L), -69(L), -68(L), -67(L), -66(L), -65(L), -64(L), ‑63(L), -62(L), -61(L), -60(L), -59(L), -58(L), -57(L), -56(L), -55(L), ‑54(L), ‑53(L), -52(L), -51(L), -50(L), -49(L), -48(L), -47(L), -46(L), -45(L), ‑44(L), ‑43(L), -42(L), -41(L), -40(L), -38(L), -37(L), -36(L), -35(L), -34(L), ‑33(L), ‑32(L), -31(L), -30(L), -29(L), -28(L), -27(L), -26(L), -25(L), -24(L), ‑23(L), ‑22(L), -21(L), -20(L), -19(L), -18(L), -17(L), -16(L), -15(L), -14(L), ‑13(L), ‑12(L), -10(L), -9(L), -8(L), -7(L), -6(L), -5(L), -4(L), -3(L), -2(L), 2(L), 3(L), 4(L), 5(L), 6(L), 7(L), 8(L), 9(L), 10(L), 12(L), 13(L), 14(L), 15(L), 16(L), 17(L), 18(L), 19(L), 20(L), 21(L), 22(L), 23(L), 24(L), 25(L), 26(L), 27(L), 28(L), 29(L), 30(L), 31(L), 32(L), 33(L), 34(L), 35(L), 36(L), 37(L), 38(L), 40(L), 41(L), 42(L), 43(L), 44(L), 45(L), 46(L), 47(L), 48(L), 49(L), 50(L), 51(L), 52(L), 53(L), 54(L), 55(L), 56(L), 57(L), 58(L), 59(L), 60(L), 61(L), 62(L), 63(L), 64(L), 65(L), 66(L), 67(L), 68(L), 69(L), 70(L), 71(L), 72(L), 73(L), 74(L), 76(L), 77(L), 78(L), 79(L), 80(L), 81(L), 82(L), 83(L), 84(L), 85(L), 86(L), 87(L), 88(L), 89(L), 90(L), 91(L), 92(L), 93(L), 94(L), 95(L), 96(L), 97(L), 98(L), 99(L), 100(L), 101(L), 102(L), 104(L), 105(L), 106(L), 107(L), 108(L), 109(L), 110(L), 111(L), 112(L), 113(L), 114(L), 115(L), 116(L), 117(L), 118(L), 119(L), 120(L), 121(L), 122(L), -122(H), -121(H), -120(H), ‑119(H), ‑118(H), -117(H), -116(H), -115(H), -114(H), -113(H), -112(H), ‑111(H), ‑110(H), -109(H), -108(H), -107(H), -106(H), -105(H), -104(H), ‑102(H), ‑101(H), -100(H), -99(H), -98(H), -97(H), -96(H), -95(H), -94(H), ‑93(H), ‑92(H), -91(H), -90(H), -89(H), -88(H), -87(H), -86(H), -85(H), -84(H), ‑83(H), ‑82(H), -81(H), -80(H), -79(H), -78(H), -77(H), -76(H), -74(H), -73(H), ‑72(H), ‑71(H), -70(H), -69(H), -68(H), -67(H), -66(H), -65(H), -64(H), -63(H), ‑62(H), ‑61(H), -60(H), -59(H), -58(H), -57(H), -56(H), -55(H), -54(H), -53(H), ‑52(H), ‑51(H), -50(H), -49(H), -48(H), -47(H), -46(H), -45(H), -44(H), -43(H), ‑42(H), ‑41(H), -40(H), -38(H), -37(H), -36(H), -35(H), -34(H), -33(H), -32(H), ‑31(H), ‑30(H), -29(H), -28(H), -27(H), -26(H), -25(H), -24(H), -23(H), -22(H), ‑21(H), ‑20(H), -19(H), -18(H), -17(H), -16(H), -15(H), -14(H), -13(H), -12(H), ‑10(H), ‑9(H), -8(H), -7(H), -6(H), -5(H), -4(H), -3(H), -2(H), 2(H), 3(H), 4(H), 5(H), 6(H), 7(H), 8(H), 9(H), 10(H), 12(H), 13(H), 14(H), 15(H), 16(H), 17(H), 18(H), 19(H), 20(H), 21(H), 22(H), 23(H), 24(H), 25(H), 26(H), 27(H), 28(H), 29(H), 30(H), 31(H), 32(H), 33(H), 34(H), 35(H), 36(H), 37(H), 38(H), 40(H), 41(H), 42(H), 43(H), 44(H), 45(H), 46(H), 47(H), 48(H), 49(H), 50(H), 51(H), 52(H), 53(H), 54(H), 55(H), 56(H), 57(H), 58(H), 59(H), 60(H), 61(H), 62(H), 63(H), 64(H), 65(H), 66(H), 67(H), 68(H), 69(H), 70(H), 71(H), 72(H), 73(H), 74(H), 76(H), 77(H), 78(H), 79(H), 80(H), 81(H), 82(H), 83(H), 84(H), 85(H), 86(H), 87(H), 88(H), 89(H), 90(H), 91(H), 92(H), 93(H), 94(H), 95(H), 96(H), 97(H), 98(H), 99(H), 100(H), 101(H), 102(H), 104(H), 105(H), 106(H), 107(H), 108(H), 109(H), 110(H), 111(H), 112(H), 113(H), 114(H), 115(H), 116(H), 117(H), 118(H), 119(H), 120(H), 121(H), 122(H)  NOTE 1—Subcarrier *x*(L) denotes subcarrier index x in the frequency segment lower in frequency, and subcarrier *x*(H) denotes subcarrier index *x* in the frequency segment higher in frequency.  NOTE 2—Pilot subcarriers (±103, ±75, ±39, ±11) and DC subcarriers (0, ±1) are skipped in each frequency segment. |
| 80+80 MHz | 2 | 244 | -122(L), -120(L), -118(L), -116(L), -114(L), -112(L), -110(L), -108(L), -106(L), ‑104(L), -102(L), -100(L), -98(L), -96(L), -94(L), -92(L), -90(L), -88(L), -86(L), ‑84(L), -82(L), -80(L), -78(L), -76(L), -74(L), -72(L), -70(L), -68(L), -66(L), ‑64(L), -62(L), -60(L), -58(L), -56(L), -54(L), -52(L), -50(L), -48(L), -46(L), ‑44(L), -42(L), -40(L), -38(L), -36(L), -34(L), -32(L), -30(L), -28(L), -26(L), ‑24(L), -22(L), -20(L), -18(L), -16(L), -14(L), -12(L), -10(L), -8(L), -6(L), -4(L), -2(L), 2(L), 4(L), 6(L), 8(L), 10(L), 12(L), 14(L), 16(L), 18(L), 20(L), 22(L), 24(L), 26(L), 28(L), 30(L), 32(L), 34(L), 36(L), 38(L), 40(L), 42(L), 44(L), 46(L), 48(L), 50(L), 52(L), 54(L), 56(L), 58(L), 60(L), 62(L), 64(L), 66(L), 68(L), 70(L), 72(L), 74(L), 76(L), 78(L), 80(L), 82(L), 84(L), 86(L), 88(L), 90(L), 92(L), 94(L), 96(L), 98(L), 100(L), 102(L), 104(L), 106(L), 108(L), 110(L), 112(L), 114(L), 116(L), 118(L), 120(L), 122(L), -122(H), -120(H), ‑118(H), -116(H), -114(H), -112(H), -110(H), -108(H), -106(H), -104(H), ‑102(H), -100(H), -98(H), -96(H), -94(H), -92(H), -90(H), -88(H), -86(H), ‑84(H), -82(H), -80(H), -78(H), -76(H), -74(H), -72(H), -70(H), -68(H), -66(H), ‑64(H), -62(H), -60(H), -58(H), -56(H), -54(H), -52(H), -50(H), -48(H), -46(H), ‑44(H), -42(H), -40(H), -38(H), -36(H), -34(H), -32(H), -30(H), -28(H), -26(H), ‑24(H), -22(H), -20(H), -18(H), -16(H), -14(H), -12(H), -10(H), -8(H), -6(H), ‑4(H), -2(H), 2(H), 4(H), 6(H), 8(H), 10(H), 12(H), 14(H), 16(H), 18(H), 20(H), 22(H), 24(H), 26(H), 28(H), 30(H), 32(H), 34(H), 36(H), 38(H), 40(H), 42(H), 44(H), 46(H), 48(H), 50(H), 52(H), 54(H), 56(H), 58(H), 60(H), 62(H), 64(H), 66(H), 68(H), 70(H), 72(H), 74(H), 76(H), 78(H), 80(H), 82(H), 84(H), 86(H), 88(H), 90(H), 92(H), 94(H), 96(H), 98(H), 100(H), 102(H), 104(H), 106(H), 108(H), 110(H), 112(H), 114(H), 116(H), 118(H), 120(H), 122(H) |
| 4 | 124 | -122(L), -118(L), -114(L), -110(L), -106(L), -102(L), -98(L), -94(L), -90(L), ‑86(L), -82(L), -78(L), -74(L), -70(L), -66(L), -62(L), -58(L), -54(L), -50(L), ‑46(L), -42(L), -38(L), -34(L), -30(L), -26(L), -22(L), -18(L), -14(L), -10(L), ‑6(L), -2(L), 2(L), 6(L), 10(L), 14(L), 18(L), 22(L), 26(L), 30(L), 34(L), 38(L), 42(L), 46(L), 50(L), 54(L), 58(L), 62(L), 66(L), 70(L), 74(L), 78(L), 82(L), 86(L), 90(L), 94(L), 98(L), 102(L), 106(L), 110(L), 114(L), 118(L), 122(L), ‑122(H), -118(H), -114(H), -110(H), -106(H), -102(H), -98(H), -94(H), -90(H), ‑86(H), -82(H), -78(H), -74(H), -70(H), -66(H), -62(H), -58(H), -54(H), -50(H), ‑46(H), -42(H), -38(H), -34(H), -30(H), -26(H), -22(H), -18(H), -14(H), -10(H), ‑6(H), -2(H), 2(H), 6(H), 10(H), 14(H), 18(H), 22(H), 26(H), 30(H), 34(H), 38(H), 42(H), 46(H), 50(H), 54(H), 58(H), 62(H), 66(H), 70(H), 74(H), 78(H), 82(H), 86(H), 90(H), 94(H), 98(H), 102(H), 106(H), 110(H), 114(H), 118(H), 122(H) |

The Average SNR of Space-Time Stream *i* subfield in the Table 8-53f (VHT Compressed Beamforming Report information) is an 8-bit two's complement integer whose definition is shown in Table 8-53h (Average SNR of Space-Time Stream i subfield).

|  |  |
| --- | --- |
| * Average SNR of Space-Time Stream *i* subfield | |
| Average SNR of Space-Time Stream *i* subfield | *AvgSNRi* |
| -128 | -10 dB(#4794) |
| -127 | -9.75 dB |
| -126 | -9.5 dB |
| … | … |
| +126 | 53.5 dB |
| +127 | 53.75 dB(#4794) |

The *AvgSNRi* in Table 8-53h (Average SNR of Space-Time Stream i subfield) is the sum of the values of SNR per tone (in decibels) divided by the number of tones represented. Each SNR value per tone in stream *i* (before being averaged) corresponds to the SNR associated with the column *i* of the beamforming feedback matrix *V* determined at the beamformee. Each SNR corresponds to the predicted SNR at the beamformee when the beamformer applies the matrix *V*.

A STA with a 40 MHz, 80 MHz or 160 MHz operating channel width and sending feedback for a 20 MHz channel width(#4297) includes subcarriers corresponding to the primary 20 MHz channel in the Compressed Feedback Beamforming Matrix subfield.

A STA with an 80 MHz or 160 MHz operating channel width and sending feedback for a 40 MHz channel width(#4297) includes subcarriers corresponding to the primary 40 MHz channel in the Compressed Feedback Beamforming Matrix subfield.

A STA with a 160 MHz or 80+80 MHz(#4795) operating channel width and sending feedback for an 80 MHz channel width(#4297) includes subcarriers corresponding to the primary 80 MHz channel in the Compressed Feedback Beamforming Matrix subfield.

TGaf Editor: Insert a new Clause 8.4.1.48a after 8.4.1.48:

* a TVHT Compressed Beamforming Report field

See 8.4.1.48 with the following modifications.

The subcarriers for which Compressed Feedback Beamforming Matrix subfield is sent in Table 8-53g for 40MHz are used for each frequency segment in TVHT\_MODE\_1 and TVHT\_MODE\_2N. See tone location description in table 23-5b clause 23.

For TVHT\_MODE\_2C with 6MHz and 8MHz channelization the subcarriers for which Compressed Feedback Beamforming Matrix subfield are sent in the Lower frequency segment are based on subtracting 72 from the values shown in table 8-53g and for the Upper frequency segment by adding 72.

For TVHT\_MODE\_2C with 7MHz channelization the subcarriers for which Compressed Feedback Beamforming Matrix subfield are sent in the Lower frequency segment are based on subtracting 84 from the values shown in table 8-53g and for the Upper frequency segment by adding 84.

For TVHT\_MODE\_4C with 6MHz and 8MHz channelization the subcarriers for which Compressed Feedback Beamforming Matrix subfield are sent in the lowest, second to lowest, second to highest and highest frequency segments are based on subtracting 216, subtracting 72, adding 72 and adding 216 from the values shown in table 8-53g respectively

For TVHT\_MODE\_4C with 7MHz channelization the subcarriers for which Compressed Feedback Beamforming Matrix subfield are sent in the lowest, second to lowest, second to highest and highest frequency segments are based on subtracting 252, subtracting 84, adding 84 and adding 252 from the values shown in table 8-53g respectively

For TVHT\_MODE\_4N channelization the subcarriers for which Compressed Feedback Beamforming Matrix subfield are sent in each of the two non-contiguous frequency sections are as described for TVHT\_MODE\_2C

A STA with a TVHT\_2W MHz, TVHT\_4W MHz, TVHT\_W+W MHz or TVHT\_2W+2W MHz operating channel width and sending feedback for a TVHT\_W MHz channel width(#4297) includes subcarriers corresponding to the primary TVHT\_W MHz channel in the Compressed Feedback Beamforming Matrix subfield.

A STA with an TVHT\_4W MHz or TVHT\_2W+2W MHz operating channel width and sending feedback for a TVHT\_2W MHz channel width(#4297) includes subcarriers corresponding to the primary TVHT\_2W MHz channel in the Compressed Feedback Beamforming Matrix subfield.

* MU Exclusive Beamforming Report field

The MU Exclusive Beamforming Report field is used by the VHT Compressed Beamforming report (see VHT Compressed Beamforming frame format) to carry explicit feedback information in the form of delta SNRs for use by a transmit MU beamformer to determine steering matrices *Q*, as described in 9.29.3 (Explicit feedback beamforming) and 20.3.12.3 (Explicit feedback beamforming).(#4667)

The size of the MU Exclusive Beamforming Report field depends on the values in the VHT MIMO Control field. The MU Exclusive Beamforming Report field contains MU Exclusive Beamforming Report information or successive (possibly zero-length) portions of this in the case of a segmented VHT Compressed Beamforming report (see 9.31.5 (VHT sounding protocol)). The MU Exclusive Beamforming Report information is included in the VHT Compressed Beamforming report if the Feedback Type subfield in the VHT MIMO Control field indicates MU (see 8.4.1.47 (VHT MIMO Control field

)).(#4667)

The MU Exclusive Beamforming Report information(#4667) consists of Delta SNR subfields for each space-time stream (1 to *Nc*) of a subset of the subcarriers spaced  apart, where  is signaled in the Grouping subfield of the VHT MIMO Control field, starting from the lowest frequency subcarrier and continuing to the highest frequency subcarrier. No padding is present between  in the MU Exclusive Beamforming Report field, even if they correspond to different subcarriers.(#4299) The subset of subcarriers included is determined by the values of the Channel Width and Grouping subfields of the VHT MIMO Control field as listed in Table 8-53j (Number of subcarriers and subcarrier mapping). For each subcarrier included, the deviation in dB of the SNR of that subcarrier for each column of *V* relative to the average SNR of the corresponding space-time stream is computed using Equation (8-2).

* (#4299)

(#4194)where

*k* is the subcarrier index in the range of *scidx*(0), …, *scidx*(*Ns*'-1)(#4299)

*i* is the space-time stream index in the range of 1, …, *Nc*(#4299)

 is the estimated MIMO channel for subcarrier *k*

 is column *i* of the beamforming matrix *V* for subcarrier *k*

 is the average noise plus interference power, measured at the beamformee,(#4301) that was used to calculate



 is the average SNR of space-time stream *i* reported in the VHT Compressed Beamforming Report information(#4667) (Average SNR in Space-Time Stream *i* field)

Each Delta SNR subfield contains the  computed using Equation (8-2) and quantized to 4 bits in the range -8 dB to 7 dB (#4300)with 1 dB granularity. The structure of the MU Exclusive Beamforming Report field is shown in Table 8-53i (MU Exclusive Beamforming Report information).

|  |  |  |
| --- | --- | --- |
| * MU Exclusive Beamforming Report information(#4667) | | |
| Field | Size (Bits) | Meaning |
| Delta SNR for space-time stream 1 for subcarrier *k = scidx(0)* | 4 | as defined in Equation (8-2) |
| … | … | … |
| Delta SNR for space-time stream  for subcarrier *k = scidx(0)* | 4 | as defined in Equation (8-2) |
| Delta SNR for space-time stream 1 for subcarrier *k = scidx(1)* | 4 | as defined in Equation (8-2) |
| … | … | … |
| Delta SNR for space-time stream  for subcarrier *k = scidx(1)* | 4 | as defined in Equation (8-2) |
| … | … | … |
| Delta SNR for space-time stream 1 for subcarrier *k = scidx(Ns’-1)* | 4 | as defined in Equation (8-2) |
| … | … | … |
| Delta SNR for space-time stream  for subcarrier *k = scidx(Ns’-1)* | 4 | as defined in Equation (8-2) |

In Table 8-53i (MU Exclusive Beamforming Report information),

*Ns'* is the number of subcarriers for which the Delta SNR subfield is sent back to the beamformer. Table 8-53j (Number of subcarriers and subcarrier mapping) shows *Ns'*, the exact subcarrier indices and their order for which the Delta SNR is sent back.

|  |  |  |  |
| --- | --- | --- | --- |
| * Number of subcarriers and subcarrier mapping | | | |
| Channel Width | *Ng* | *Ns'* | Subcarriers for which the Delta SNR subfield is sent: *scidx*(0), *scidx*(1), … *scidx*(*Ns'*-1) |
| 20 MHz | 1 | 30 | -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, -4, -2, -1, 1, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 |
| 2 | 16 | -28, -24, -20, -16, -12, -8, -4, -1, 1, 4, 8, 12, 16, 20, 24, 28 |
| 4 | 10 | -28, -20, -12, -4, -1, 1, 4, 12, 20, 28 |
| 40 MHz | 1 | 58 | -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, -4,-2, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58 |
| 2 | 30 | -58, -54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6,-2, 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58 |
| 4 | 16 | -58, -50, -42, -34, -26, -18, -10, -2, 2, 10, 18, 26, 34, 42, 50, 58 |
| 80 MHz | 1 | 122 | -122, -120, -118, -116, -114, -112, -110, -108, -106, -104, -102, -100, -98, -96, -94, ‑92, -90, -88, -86, -84, -82, -80, -78, -76, -74, -72, -70, -68, -66, -64, -62, -60, -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, -4, -2, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122 |
| 2 | 62 | -122, -118, -114, -110, -106, -102, -98, -94, -90, -86, -82, -78, -74, -70, -66, -62, -58, ‑54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6, -2, 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78, 82, 86, 90, 94, 98, 102, 106, 110, 114, 118, 122 |
| 4 | 32 | -122, -114, -106, -98, -90, -82, -74, -66, -58, -50, -42, -34, -26, -18, -10, -2, 2, 10, 18, 26, 34, 42, 50, 58, 66, 74, 82, 90, 98, 106, 114, 122 |
| 160 MHz | 1 | 244 | -250, -248, -246, -244, -242, -240, -238, -236, -234, -232, -230, -228, -226, -224, ‑222, -220, -218, -216, -214, -212, -210, -208, -206, -204, -202, -200, -198, -196, ‑194, -192, -190, -188, -186, -184, -182, -180, -178, -176, -174, -172, -170, -168, ‑166, -164, -162, -160, -158, -156, -154, -152, -150, -148, -146, -144, -142, -140, ‑138, -136, -134, -132, -130, -126, -124, -122, -120, -118, -116, -114, -112, -110, ‑108, -106, -104, -102, -100, -98, -96, -94, -92, -90, -88, -86, -84, -82, -80, -78, -76, ‑74, -72, -70, -68, -66, -64, -62, -60, -58, -56, -54, -52, -50, -48, -46, -44, -42, -40, -38, -36, -34, -32, -30, -28, -26, -24, -22, -20, -18, -16, -14, -12, -10, -8, -6, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250  NOTE—Subcarriers 0, ±2, ±4 and ±128 are skipped. |
| 2 | 124 | -250, -246, -242, -238, -234, -230, -226, -222, -218, -214, -210, -206, -202, -198, ‑194, -190, -186, -182, -178, -174, -170, -166, -162, -158, -154, -150, -146, -142, ‑138, -134, -130, -126, -122, -118, -114, -110, -106, -102, -98, -94, -90, -86, -82, -78, ‑74, -70, -66, -62, -58, -54, -50, -46, -42, -38, -34, -30, -26, -22, -18, -14, -10, -6, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66, 70, 74, 78, 82, 86, 90, 94, 98, 102, 106, 110, 114, 118, 122, 126, 130, 134, 138, 142, 146, 150, 154, 158, 162, 166, 170, 174, 178, 182, 186, 190, 194, 198, 202, 206, 210, 214, 218, 222, 226, 230, 234, 238, 242, 246, 250  NOTE—Subcarriers ±2 are skipped. |
| 4 | 64 | -250, -242, -234, -226, -218, -210, -202, -194, -186, -178, -170, -162, -154, -146, ‑138, -130, -126, -118, -110, -102, -94, -86, -78, -70, -62, -54, -46, -38, -30, -22, -14, ‑6, 6, 14, 22, 30, 38, 46, 54, 62, 70, 78, 86, 94, 102, 110, 118, 126, 130, 138, 146, 154, 162, 170, 178, 186, 194, 202, 210, 218, 226, 234, 242, 250 |
| 80+80 MHz | 1 | 244 | -122(L), -120(L), -118(L), -116(L), -114(L), -112(L), -110(L), -108(L), -106(L), ‑104(L), -102(L), -100(L), -98(L), -96(L), -94(L), -92(L), -90(L), -88(L), -86(L), ‑84(L), -82(L), -80(L), -78(L), -76(L), -74(L), -72(L), -70(L), -68(L), -66(L), -64(L), ‑62(L), -60(L), -58(L), -56(L), -54(L), -52(L), -50(L), -48(L), -46(L), -44(L), -42(L), ‑40(L), -38(L), -36(L), -34(L), -32(L), -30(L), -28(L), -26(L), -24(L), -22(L), -20(L), ‑18(L), -16(L), -14(L), -12(L), -10(L), -8(L), -6(L), -4(L), -2(L), 2(L), 4(L), 6(L), 8(L), 10(L), 12(L), 14(L), 16(L), 18(L), 20(L), 22(L), 24(L), 26(L), 28(L), 30(L), 32(L), 34(L), 36(L), 38(L), 40(L), 42(L), 44(L), 46(L), 48(L), 50(L), 52(L), 54(L), 56(L), 58(L), 60(L), 62(L), 64(L), 66(L), 68(L), 70(L), 72(L), 74(L), 76(L), 78(L), 80(L), 82(L), 84(L), 86(L), 88(L), 90(L), 92(L), 94(L), 96(L), 98(L), 100(L), 102(L), 104(L), 106(L), 108(L), 110(L), 112(L), 114(L), 116(L), 118(L), 120(L), 122(L), ‑122(H), -120(H), -118(H), -116(H), -114(H), -112(H), -110(H), -108(H), -106(H), ‑104(H), -102(H), -100(H), -98(H), -96(H), -94(H), -92(H), -90(H), -88(H), -86(H), ‑84(H), -82(H), -80(H), -78(H), -76(H), -74(H), -72(H), -70(H), -68(H), -66(H), ‑64(H), -62(H), -60(H), -58(H), -56(H), -54(H), -52(H), -50(H), -48(H), -46(H), ‑44(H), -42(H), -40(H), -38(H), -36(H), -34(H), -32(H), -30(H), -28(H), -26(H), ‑24(H), -22(H), -20(H), -18(H), -16(H), -14(H), -12(H), -10(H), -8(H), -6(H), -4(H), ‑2(H), 2(H), 4(H), 6(H), 8(H), 10(H), 12(H), 14(H), 16(H), 18(H), 20(H), 22(H), 24(H), 26(H), 28(H), 30(H), 32(H), 34(H), 36(H), 38(H), 40(H), 42(H), 44(H), 46(H), 48(H), 50(H), 52(H), 54(H), 56(H), 58(H), 60(H), 62(H), 64(H), 66(H), 68(H), 70(H), 72(H), 74(H), 76(H), 78(H), 80(H), 82(H), 84(H), 86(H), 88(H), 90(H), 92(H), 94(H), 96(H), 98(H), 100(H), 102(H), 104(H), 106(H), 108(H), 110(H), 112(H), 114(H), 116(H), 118(H), 120(H), 122(H)  NOTE—Subcarrier *x*(L) denotes subcarrier index *x* in the frequency segment lower in frequency, and subcarrier *x*(H) denotes subcarrier index *x* in the frequency segment higher in frequency.(#4577) |
| 2 | 124 | -122(L), -118(L), -114(L), -110(L), -106(L), -102(L), -98(L), -94(L), -90(L), -86(L), ‑82(L), -78(L), -74(L), -70(L), -66(L), -62(L), -58(L), -54(L), -50(L), -46(L), -42(L), ‑38(L), -34(L), -30(L), -26(L), -22(L), -18(L), -14(L), -10(L), -6(L), -2(L), 2(L), 6(L), 10(L), 14(L), 18(L), 22(L), 26(L), 30(L), 34(L), 38(L), 42(L), 46(L), 50(L), 54(L), 58(L), 62(L), 66(L), 70(L), 74(L), 78(L), 82(L), 86(L), 90(L), 94(L), 98(L), 102(L), 106(L), 110(L), 114(L), 118(L), 122(L), -122(H), -118(H), -114(H), -110(H), ‑106(H), -102(H), -98(H), -94(H), -90(H), -86(H), -82(H), -78(H), -74(H), -70(H), ‑66(H), -62(H), -58(H), -54(H), -50(H), -46(H), -42(H), -38(H), -34(H), -30(H), ‑26(H), -22(H), -18(H), -14(H), -10(H), -6(H), -2(H), 2(H), 6(H), 10(H), 14(H), 18(H), 22(H), 26(H), 30(H), 34(H), 38(H), 42(H), 46(H), 50(H), 54(H), 58(H), 62(H), 66(H), 70(H), 74(H), 78(H), 82(H), 86(H), 90(H), 94(H), 98(H), 102(H), 106(H), 110(H), 114(H), 118(H), 122(H) |
| 4 | 64 | -122(L), -114(L), -106(L), -98(L), -90(L), -82(L), -74(L), -66(L), -58(L), -50(L), ‑42(L), -34(L), -26(L), -18(L), -10(L), -2(L), 2(L), 10(L), 18(L), 26(L), 34(L), 42(L), 50(L), 58(L), 66(L), 74(L), 82(L), 90(L), 98(L), 106(L), 114(L), 122(L), -122(H), ‑114(H), -106(H), -98(H), -90(H), -82(H), -74(H), -66(H), -58(H), -50(H), -42(H), ‑34(H), -26(H), -18(H), -10(H), -2(H), 2(H), 10(H), 18(H), 26(H), 34(H), 42(H), 50(H), 58(H), 66(H), 74(H), 82(H), 90(H), 98(H), 106(H), 114(H), 122(H) |

TGaf Editor: Insert a new Clause 8.4.1.49a after 8.4.1.49:

* a TVHT MU Exclusive Beamforming Report field

See 8.4.1.49 with the following modifications.

The subcarriers for which the Delta SNR subfield is sent in Table 8-53j for 40MHz are used for each frequency segment in TVHT\_MODE\_1 and TVHT\_MODE\_2N. See tone location description in table 23-5b clause 23.

For TVHT\_MODE\_2C with 6MHz and 8MHz channelization the subcarriers for which Delta SNR subfield are sent in the Lower frequency segment are based on subtracting 72 from the values shown in table 8-53j and for the Upper frequency segment by adding 72.

For TVHT\_MODE\_2C with 7MHz channelization the subcarriers for which Delta SNR subfield are sent in the Lower frequency segment are based on subtracting 84 from the values shown in table 8-53j and for the Upper frequency segment by adding 84.

For TVHT\_MODE\_4C with 6MHz and 8MHz channelization the subcarriers for which Delta SNR subfield are sent in the lowest, second to lowest, second to highest and highest frequency segments are based on subtracting 216, subtracting 72, adding 72 and adding 216 from the values shown in table 8-53j respectively

For TVHT\_MODE\_4C with 7MHz channelization the subcarriers for which Delta SNR subfield are sent in the lowest, second to lowest, second to highest and highest frequency segments are based on subtracting 252, subtracting 84, adding 84 and adding 252 from the values shown in table 8-53j respectively

For TVHT\_MODE\_4N channelization the subcarriers for which Delta SNR subfield are sent in each of the two non-contiguous frequency sections are as described for TVHT\_MODE\_2C

* (#5096)Operating Mode field

The (#5096)Operating Mode field is used in the (#5096)Operating Mode Notification frame (see 8.5.23.4 (Operating Mode Notification

frame format)) to indicate the number of spatial streams and optionally the operating channel width(#4306) on which the sending STA is able to receive. When Rx Nss Type subfield(#4911) is 1, only the Rx Nss(#4696) subfield has a non-reserved value(#5062). The length of the field is 1 octet.

The (#5096)Operating Mode field is shown in Figure 8-80e.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B1 | B2 B3 | B4 B6 | B7 |
|  | Channel Width | Reserved | Rx Nss | Rx Nss Type |
| Bits: | 2 | 2 | 3 | 1 |
| * (#5096)Operating Mode field(#4911) | | | | |

The STA transmitting this field indicates its current operating channel width and the number of spatial streams it can receive using the settings defined in Table 8-53k (Subfield values of the Operating Mode field).

|  |  |
| --- | --- |
| * Subfield values of the (#5096)Operating Mode field | |
| Subfield | Description |
| Channel Width | If the Rx Nss Type subfield(#4911) is 0, indicates the supported channel width:  Set to 0 for 20 MHz  Set to 1 for 40 MHz  Set to 2 for 80 MHz  Set to 3 for 160 MHz or 80+80 MHz  Reserved if the Rx Nss subfield(#4911) is 1. |
| Rx Nss | If the Rx Nss Type subfield(#4911) is 0, indicates the maximum number of spatial streams that(#4308) the STA can receive.  If the Rx Nss Type subfield(#4911) is 1, indicates the maximum number of spatial streams that(#4308) the STA can receive as a beamformee in an SU PPDU using a beamforming steering matrix derived from a VHT Compressed Beamforming report(#4667) with Feedback Type subfield indicating MU in the VHT Compressed Beamforming frame(s).(#4911)(#4667)  Set to 0 for *NSS* = 1  Set to 1 for *NSS* = 2  …  Set to 7 for *NSS* = 8 |
| Rx Nss Type | Set to 0 to indicate that the Rx Nss subfield carries the maximum number of spatial streams that(#4308) the STA can receive.  Set to 1 to indicate that the Rx Nss subfield carries the maximum number of spatial streams that(#4308) the STA can receive as an SU PPDU using a beamforming steering matrix derived(#4911) from a VHT Compressed Beamforming frame with the Feedback Type subfield indicating MU in the VHT Compressed Beamforming frame(s).(#4029)(#4667) |

TGaf Editor: Insert a new Clause 8.4.1.50a after 8.4.1.50:

* a TVHT Operating Mode field

See 8.4.1.50 with 20MHz replaced with ‘reserved’, 40MHz replaced with TVHT\_W, 80MHz with TVHT\_2W and TVHT\_W+W, 160MHz with TVHT\_4W and TVHT\_2W+2W

(#4030)

* Membership Status Array field

The Membership Status Array field is used in the Group ID Management frame (see 8.5.23.3 (Group ID Management

frame format)). The length of the field is 8 octets. An 8 octet Membership Status Array field (indexed by the group ID(#4829)) consists of a 1-bit(#4756) Membership Status subfield for each of the 64 group IDs(#4829), as shown in Figure 8-80f.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 |  | B63 |
|  | Membership Status In Group ID 0 | Membership Status In Group ID 1 | … | Membership Status In Group ID 63 |
| Bits: | 1 | 1 |  | 1 |
| * Membership Status Array field | | | | |

Within the 8 octet Membership Status Array field, the 1-bit(#4756) Membership Status subfield for each group ID(#4829) is set as follows:

* Set to 0 if the STA is not a member of the group
* Set to 1 if STA is a member of the group

The Membership Status subfields for group ID(#4829) 0 (transmissions to AP) and group ID(#4829) 63 (downlink SU transmissions) are reserved.

* User Position Array field

The User Position Array field is used in the Group ID Management frame (see 8.5.23.3 (Group ID Management

frame format)). The length of the field is 16 octets. A 16 octet User Position Array field (indexed by the Group ID) consists of a 2-bit(#4757) User Position subfield for each of the 64 group IDs(#4829), as shown in Figure 8-80g.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B1 | B2 B3 |  | B126 B127 |
|  | User Position In Group ID 0 | User Position In Group ID 1 | … | User Position In Group ID 63 |
| Bits: | 2 | 2 |  | 2 |
| * User Position Array field | | | | |

If the Membership Status subfield for a particular group ID(#4829) is 1, then the corresponding User Position subfield is encoded as shown in Table 8-53l (Encoding of User Position subfield).

|  |  |
| --- | --- |
| * Encoding of User Position subfield | |
| User Position subfield value | User position |
| 00 | 0 |
| 01 | 1 |
| 10 | 2 |
| 11 | 3 |

If the Membership Status subfield for a group ID(#4829) is 0 (meaning the STA is not a member of that group), then the corresponding User Position subfield in the User Position Array field is reserved.

The User Position subfields for group ID(#4829) 0 (transmissions to AP) and group ID(#4829) 63 (downlink SU transmissions) are reserved.

* Information elements
* General

Insert the new elements shown below into Table 8-54:

|  |  |  |  |
| --- | --- | --- | --- |
| * Element IDs | | | |
| Element | Element ID | Length of indicated element (in octets) | Extensible |
| VHT Capabilities (see 8.4.2.160 (VHT Capabilities element  )) | 191 | 14 | Yes(#4311) |
| VHT Operation (see 8.4.2.161 (VHT Operation element  )) | 192 | 7 | Yes(#4311) |
| Extended BSS Load (see 8.4.2.162 (Extended BSS Load element)) | 193 | 8(#4324) | Yes |
| Wide Bandwidth Channel Switch (see 8.4.2.163 (Wide Bandwidth Channel Switch element)) | 194 | 5 | Yes |
| VHT Transmit Power Envelope (see 8.4.2.164 (VHT Transmit Power Envelope element)) | 195 | 5 or 7 | Yes |
| Channel Switch Wrapper (see 8.4.2.165 (Control Switch Wrapper element))(#4252) | 196 | 7 to 257 | Subelements |
| AID (see 8.4.2.166 (AID element)) | 197 | 4 |  |
| Quiet Channel | 198 | 3 or 9 | Yes |
| Operating Mode Notification(#5096) | 199 | 3 | Yes |

* Support Rates element

Change Table 8-55 as follows (inserting a new row for the VHT PHY):

|  |  |  |
| --- | --- | --- |
| * BSS membership selector value encoding | | |
| Value | Feature | Interpretation |
| 127 | HT PHY | Support for the mandatory features of Clause 20 is required in order to join the BSS that was the source of the Supported Rates element or Extended Supported Rates element containing this value. |
| 126 | VHT PHY | Support for the mandatory features of Clause 22(#5011) is required in order to join the BSS that was the source of the Supported Rates element or Extended Supported Rates element containing this value. |

* Country element

Replace Figure 8-90 with the following:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Country String | Triplet | Pad (if needed) |
| Octets: | 1 | 1 | 3 | *Q×*3 | 0 or 1 |
| * Country element format | | | | | |

(#4252)

Change the 2nd through 7th paragraphs as follows and insert new figures as shown:(#4252)

~~The element ID for this element is set to the value for Country, specified in Table 8-54. The length of the element is variable, as the element may contain more than one triplet comprising the First Channel Number, Number of Channels, and Maximum Transmit Power Level fields and referred to as subband triplets. Alternatively, where dot11OperatingClassesRequired is true and the First Channel Number/Operating Extension Identifier octet has a positive integer value of 201 or greater, then that triplet comprises the Operating Extension Identifier, Operating Class, and Coverage Class fields. Together they are referred to as an operating triplet. The minimum length of the element is 8 octets.~~

The element ID for this element is set to the value for Country, specified in Table 8-54. The length of the element is variable, as the element contains the variable length Triplet field.

If dot11OperatingClassesRequired is false, then the Triplet field is a single Subband Triplet Sequence field, as shown in Figure 8-90a, that is composed of *Q* Subband Triplet fields, where *Q* is one or more. The format of the Subband Triplet field is shown in Figure 8-90b.

|  |  |
| --- | --- |
|  | One or more |
|  | Subband Triplet |
| Octets: | 3 |
| * Subband Triplet Sequence format | |

|  |  |  |  |
| --- | --- | --- | --- |
|  | First Channel Number | Number of Channels | Maximum Transmit Power Level |
| Octets: | 1 | 1 | 1 |
| * Subband Triplet field | | | |

If dot11OperatingClassesRequired is true, then the Triplet field is composed of one or more Operating/Subband Sequences, as shown in Figure 8-90c. Each Operating/Subband Sequence is composed of one Operating Triplet field followed by one Subband Triplet Sequence field, as shown in Figure 8-90d. Each Subband Triplet Sequence field is composed of zero or more Subband Triplets fields. If dot11OperatingClassesRequired is true, the number of triplets in the Triplet field is .

|  |  |
| --- | --- |
|  | One or more indexed by |
|  | Operating/Subband Sequence |
| Octets: | 3 |
| * Triplet field if dot11OperaratingClassRequired is true | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Operating Triplet | | | Subband Triplet Sequence made up of P(m) Subband Triplet fields, where |
|  | Operating Extension Identifier | Operating Class | Coverage Class |
| Octets: | 1 | 1 | 1 | 3*P(m)* |
| * Format of *m*-th Operating/Subband Sequence field | | | | |

The number *Q* of Subband or Operating triplets in the element is determined by the Length field.

An operating class for an 80+80 MHz channel bandwidth is expressed by two consecutive Operating/Subband Sequences, where the first Operating/Subband Sequence field contains an Operating Triplet for an 80 MHz Channel Spacing with an 80+ Behavior Limit and the second Operating/Subband Sequence field contains an Operating Triplet for an 80 MHz Channel Spacing without an 80+ Behavior Limit.

Operating/Subband Sequence fields for 80, 160 or 80+ MHz operating classes contain zero Subband Triplet fields.

NOTE—The VHT Transmit Power Envelope element is always used for TPC for 80 MHz, 160 MHz or 80+80 MHz operating classes instead of subband triplets (see 10.39.1 (Basic VHT BSS functionality)).

The first octet in each Subband or Operating Triplet field contains an unsigned integer and identifies the type of triplet. If the integer has a value less than or equal to 200, then the triplet is a Subband Triplet field. If the integer has a value of 201 or greater, then the triplet is an Operating Triplet field.

The minimum length of the element is 8 octets.

The Country String field of the element is 3 octets in length. The AP and mesh STA set this field to the value contained in the dot11CountryString attribute before transmission in a Beacon or Probe Response frame. Upon reception of this element, a STA sets the value of the dot11CountryString to the value contained in this field.

NOTE—The three octets of the Country String have additional structure as defined by dot11CountryString (see Annex C).

The First Channel Number~~/Operating Extension Identifier~~ field ~~is 1 octet in length. If the field has a positive integer value less than 201, then it contains a positive integer value that~~ indicates the lowest channel number in the Subband triplet ~~subband described in this element~~. The group of channels described by each pair of the First Channel Number and the Number of Channels fields within a Subband Triplet Sequence field do not have overlapping channel identifiers. [For example, the pairs (2,4) and (5,2) overlap and are not used within the same Subband Triplet Sequence field ~~together~~.]

The First Channel Numbers are monotonically increasing within a Subband Triplet Sequence field ~~where dot11OperatingClassesRequired is not true.Where dot11OperatingClassesRequired is true, consecutive subband triplets following an operating triplet have monotonically increasing First Channel Number fields~~.

The Number of Channels field of the subelement is 1 octet in length.

The Maximum Transmit Power Level field is a signed number and is 1 octet in length. ~~It~~ The Maximum Transmit Power Level field indicates the maximum power, in dBm, allowed to be transmitted. As the method of measurement for maximum transmit power level differs by regulatory domain, the value in this field is interpreted according to the regulations applicable for the domain identified by the Country String.

An operating class is an index into a set of values for radio equipment sets of rules. The Operating Class field is 1 octet in length.

A coverage class is an index into a set of values for aAirPropagationTime. The Coverage Class field is 1octet in length.

~~These three fields are repeated, as determined by the Length field.~~

The Coverage Class field of the operating triplet specifies the aAirPropagationTime characteristic used in BSS operation, as shown in Table 8-56. The characteristic aAirPropagationTime describes variations in actual propagation time that are accounted for in a BSS and, together with maximum transmit power level, allow control of BSS diameter.

The Pad field is 0 or 1 octet in length. The length of the Country element is evenly divisible by 2. The Pad is used to add a single octet to the element if the length is not evenly divisible by 2. The value of the Pad field is 0.

* Power Capability element

Change the 3rd and 4th paragraphs as follows:

The Minimum Transmit Power Capability field is set to the nominal minimum transmit power with which the STA is capable of transmitting in the current channel, with a tolerance ± 5 dB. The field is coded as a signed integer in units of decibels relative to 1 mW. Further interpretation of this field is defined in 10.8.2 (Association based on transmit power capability).(#4252)

The Maximum Transmit Power Capability field is set to the nominal maximum transmit power with which the STA is capable of transmitting in the current channel, with a tolerance ± 5 dB. The field is coded as a signed integer in units of decibels relative to 1 mW. Further interpretation of this field is defined in 10.8.2 (Association based on transmit power capability).(#4252)

* Secondary Channel Offset element

Change the first paragraph as follows:

The Secondary Channel Offset element is used by an AP in a BSS, a STA in an IBSS, or a mesh STA in an MBSS ~~together with the Channel Switch Announcement element~~ when changing to a new 40 MHz or wider channel. The format of the Secondary Channel Offset element is shown in Figure 8-103.

Change Table 8-57 as follows:

|  |  |  |
| --- | --- | --- |
| * Values of the Secondary Channel Offset field | | |
| Value | Name | Description |
| 0 | SCN - no secondary channel | Indicates that no secondary channel is present. |
| 1 | SCA - secondary channel above | Indicates that the secondary 20 MHz channel is above the primary channel.(#4707) |
| 2 |  | Reserved |
| 3 | SCB - secondary channel below | Indicates that the secondary 20 MHz channel is below the primary channel.(#4707) |
| 4-255 |  | Reserved |

* RSN element
* Cipher suites

Insert the following paragraph after the 3rd paragraph:

The use(Ed) of GCMP as a group cipher suite with a pairwise cipher suite other than GCMP is not supported.

* Extended Capabilities element

Insert a new row for bits 61 and 62 as shown below in Table 8-103 and change the range of the reserved bits in the last row to exclude this bit:

|  |  |  |
| --- | --- | --- |
| * Capabilities field | | |
| Bit | Information | Description |
| 61 | TDLS Wider Bandwidth | The TDLS Wider Bandwidth subfield indicates whether the STA supports a wider bandwidth than the BSS bandwidth for a TDLS direct link on the base channel. The field is set to 1 to indicate that the STA supports a wider bandwidth on the base channel and to 0 to indicate that the STA does not support a wider bandwidth on the base channel. |
| 62 | Operating Mode Notification | If dot11OperatingModeNotificationImplemented is true, the Operating Mode Notification field is set to 1 to indicate support for reception of the Operating Mode Notification element and the Operating Mode Notification frame.  If dot11OperatingModeNotificationImplemented is false or not present, the Operating Mode Notification field is set to 0 to indicate lack of support for reception of the Operating Mode Notification element and the Operating Mode Notification frame.(#5096) |

(#4799)

Change Table 8-105 as shown (PHYs listed in TXOP limit heading row):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| * Default EDCA Parameter Set element parameter values if dot11OCBActivated is false | | | | | | |
| AC | CWmin | CWmax | AIFSN | TXOP limit | | |
| For PHYs defined in Clause 15 (DSSS PHY specification for the 2.4 GHz band designated for ISM -applications) and Clause 16 (High Rate direct sequence spread spectrum (HR/DSSS) PHY -specification) | For PHYs defined in Clause 17 (Orthogonal frequency division multiplexing (OFDM) PHY specification), Clause 18 (Extended Rate PHY (ERP) specification), ~~and~~ Clause 19 (High Throughput (HT) PHY specification) and Clause 22 (Very High Throughput (VHT) PHY specification) | Other PHYs |
| AC\_BK | aCWmin | aCWmax | 7 | 0 | 0 | 0 |
| AC\_BE | aCWmin | aCWmax | 3 | 0 | 0 | 0 |
| AC\_VI | (aCWmin+1)/2 – 1 | aCWmin | 2 | 6.016 ms | 3.008 ms | 0 |
| AC\_VO | (aCWmin+1)/4 – 1 | (aCWmin+1)/2 – 1 | 2 | 3.264 ms | 1.504 ms | 0 |

* Neighbor Report element

Replace Figure 8-216 with the following (adding the Very High Throughput field):

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 B9 | B10 | B11 | B12 | B13 B31 |
|  | AP Reachability | Security | Key Scope | Capabilities | Mobility Domain | High Throughput | Very High Throughput | Reserved |
| Bits: | 2 | 1 | 1 | 6 | 1 | 1 | 1 | 19 |
| * BSSID Information field | | | | | | | | |

Insert the following paragraph after the paragraph that(#4490) starts “The High Throughput bit...”:

The Very High Throughput bit is set to 1 to indicate that the AP represented by this BSSID is a VHT AP and that the VHT Capabilities element, if included as a subelement in the report, is identical in content to the VHT Capabilities element included in the AP’s Beacon.

Change the subsequent paragraph as follows:

Bits ~~12~~13-31 are reserved.

Change Table 8-115 as follows (adding Subelement 46 following 45 and Subelement 63 following 62):

|  |  |  |  |
| --- | --- | --- | --- |
| * Optional Subelement IDs for Neighbor Report | | | |
| Subelement ID | Name | Length field (octets) | Extensible |
| 46 | VHT Capabilities subelement | 12 | Yes |
| ~~46~~47-60 | Reserved |  |  |
| 63 | VHT Operation subelement | 5 | Yes |
| ~~63~~64-65 | Reserved |  |  |

Insert the following after the paragraph beginning “The Secondary Channel Offset subelement...”:

The VHT Capabilities subelement is the same as the VHT Capabilities element as defined in 8.4.2.160 (VHT Capabilities element

).

The VHT Operation subelement is the same as the VHT Operation element as defined in 8.4.2.161 (VHT Operation element

).

* RCPI element

Change the last paragraph of 8.4.2.40 as follows:

The RCPI field contains an RCPI value as specified for certain PHYs in Clause 15 (DSSS PHY specification(#5012) for the 2.4 GHz band designated for ISM applications), Clause 18 (Orthogonal frequency division multiplexing (OFDM) PHY specification), Clause 17 (High Rate direct sequence spread spectrum (HR/DSSS) PHY specification), Clause 19 (Extended Rate PHY (ERP) specification), ~~and~~ Clause 20 (High Throughput (HT) PHY specification) and Clause 22 (Very High Throughput (VHT) PHY specification).

* Multiple BSSID element

Change the 8th paragraph as follows:

The Non-Transmitted BSSID Profile subelement contains a list of elements for one or more APs or DMG STAs(11ad) that have non-transmitted BSSIDs, and is defined as follows:

* The Timestamp and Beacon Interval fields, DS Parameter Set, FH Parameter Set, IBSS Parameter Set, Country, FH Parameters, FH Pattern Table, Channel Switch Assignment, Extended Channel Switch Announcement, Wide Bandwidth Channel Switch, VHT Transmit Power Envelope, Supported Operating Classes, IBSS DFS, ERP Information, HT Capabilities, ~~and~~ HT Operation, VHT Capabilities and VHT Operation elements are not included in the Non-Transmitted BSSID Profile field; the values of these elements for each non-transmitted BSSID are always the same as the corresponding transmitted BSSID element values.
* HT Capabilities element
* Supported MCS Set field

Change the 1st paragraph as follows:

The Supported MCS Set field of the HT Capabilities element indicates which HT MCSs a STA supports.(#4707)

Change the 5th paragraph as follows:

The Rx Highest Supported Data Rate subfield of the Supported MCS Set field defines the highest HT PPDU data rate that the STA is able to receive, in units of 1 Mb/s, where 1 represents 1 Mb/s, and incrementing by 1 Mb/s steps to the value 1023, which represents 1023 Mb/s. If the maximum data rate expressed in Mb/s is not an integer, then the value is rounded ~~up~~ down to the next integer. The value 0 indicates that this subfield does not specify the highest HT PPDU data rate that the STA is able to receive; see 9.7.6.5.3.

* HT Extended Capabilities field

Change the name of the “+HTC Support” field to “+HTC-HT Support” in Figure 8-252.(#4156)

Change the row for “+HTC Support” in Table 8-127 as follows:

|  |  |  |
| --- | --- | --- |
| * Subfields of the HT Extended Capabilities field | | |
| Subfield | Definition | Encoding |
| +HTC-HT Support | Indicates support of the HT variant HT Control field. See 9.9 (HT Control field operation) | Set to 0 if not supported  Set to 1 if supported |

* Transmit Beamforming Capabilities

Change Table 8-128 as follows (“beamformee/r” to “HT beamformee/r”).(#4432)

|  |  |  |
| --- | --- | --- |
| * Subfields of the Transmit Beamforming Capabilities field | | |
| Subfield | Definition | Encoding |
| CSI Number of  Beamformer  Antennas Supported | Indicates the maximum number of beamformer antennas the HT beamformee can support when CSI feedback is required | Set to 0 for single Tx antenna sounding  Set to 1 for 2 Tx antenna sounding  Set to 2 for 3 Tx antenna sounding  Set to 3 for 4 Tx antenna sounding |
| Noncompressed  Steering Number of  Beamformer  Antennas Supported | Indicates the maximum number of beamformer antennas the HT beamformee can support when noncompressed beamforming feedback matrix is required | Set to 0 for single Tx antenna sounding  Set to 1 for 2 Tx antenna sounding  Set to 2 for 3 Tx antenna sounding  Set to 3 for 4 Tx antenna sounding |
| Compressed  Steering Number of  Beamformer  Antennas Supported | Indicates the maximum number of beamformer antennas the HT beamformee can support when compressed beamforming feedback matrix is required | Set to 0 for single Tx antenna sounding  Set to 1 for 2 Tx antenna sounding  Set to 2 for 3 Tx antenna sounding  Set to 3 for 4 Tx antenna sounding |
| CSI Max Number of  Rows Beamformer  Supported | Indicates the maximum number of rows of CSI explicit feedback from the HT beamformee or calibration responder or transmit ASEL responder that an HT beamformer or calibration initiator or transmit ASEL initiator can support when CSI feedback is required. | Set to 0 for a single row of CSI  Set to 1 for 2 rows of CSI  Set to 2 for 3 rows of CSI  Set to 3 for 4 rows of CSI |

* HT Operation element

Change the Basic MCS Set row in Table 8-130 as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * HT Operation element fields and subfields | | | | |
| Subfield | Definition | Encoding | Reserved in IBSS? | Reserved in MBSS? |
| Basic MCS Set | Indicates the HT MCS(#4707) values that are supported by all HT STAs in the BSS.  Present in Beacon, Probe Response, Mesh Peering Open and Mesh Peering Confirm frames. Otherwise reserved. | The Basic MCS Set is a bitmap of size 128 bits. Bit 0 corresponds to MCS 0. A bit is set to 1 to indicate support for that MCS and 0 otherwise.  MCS values are defined in 8.4.2.58.4. | N | N |

* Event Report element
* Peer-to-Peer Link event report

Change the 5th paragraph follows:

The STA Tx Power field indicates the target transmit power at the antenna (i.e., EIRP) in dBm with a tolerance of ± 5 dB of the lowest basic rate of the reporting STA.(#4252)

* Diagnostic Request element
* Diagnostic Information subelement descriptions

Change the paragraph describing the Tx Power field as follows:

The Tx Power field indicates the target transmit power level(s) at the antenna(s) (i.e., EIRP), where the actual power is within ±5 dB to the target. Each transmit power level is encoded in a single octet as a 2's complement value in dBm, rounded to the nearest integer. If the Tx Power Mode field is 0 then the Tx Power field contains one or more transmit power levels in increasing numerical order. If the Tx Power Mode field is 1, the Tx Power field contains the STA's minimum and nonzero maximum transmit power levels, in that order.(#4252)

* Location Parameters element
* Radio Information subelement

Change the 4th paragraph follows:

The Transmit Power field is the transmit power used to transmit the current Location Track Notification frame containing the Location Parameters element with the Radio Information subelement and is a signed integer, one octet in length, reported as an EIRP in dBm. A value of -128 indicates that the transmit power is unknown. The tolerance for the transmit power value reported in the Radio Information subelement is ± 5 dB. This tolerance is defined as the maximum possible difference, in decibels, between the reported power value and the total transmitted power across all antennas of the STA, which are measured when transmitting Location Request frames.(#4252)

Insert new subclauses 8.4.2.160 through 8.4.2.168 following the last subclause in 8.4.2:

* VHT Capabilities element
* VHT Capabilities element structure

A VHT STA declares that it is a VHT STA by transmitting the VHT Capabilities element.

The VHT Capabilities element contains a number of fields that are used to advertise VHT capabilities of a VHT STA. The VHT Capabilities element is defined in Figure 8-401br.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | VHT Capabilities  Info | VHT Supported MCS Set |
| Octets: | 1 | 1 | 4 | 8 |
| * VHT Capabilities element format | | | | |

The Element ID field is set to the value for VHT Capabilities element defined in Table 8-54 (Element IDs).

The Length field of the VHT Capabilities element is set to 12.(#4312)

* VHT Capabilities Info field

The structure of the VHT Capabilities Info field is defined in Figure 8-401bs.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 B3 | B4 | B5 | B6 | B7 | B8 B10 | B11 | B12 | B13 B15 |
|  | Maximum MPDU Length | Supported Channel Width Set | Rx LDPC | Short GI for 80 MHz | Short GI for 160 and 80+80 MHz | Tx STBC | Rx STBC | SU Beamformer Capable | SU Beamformee Capable | Compressed Steering  Number  of Beamformer  Antennas  Supported |
| Bits: | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 3 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| B16 B18 | B19 | B20 | B21 | B22 | B23 B25 | B26 B27 | B28 | B29 | B30 B31 |
| Number Of Sounding Dimensions | MU Beamformer Capable | MU Beamformee Capable | VHT TXOP PS | +HTC-VHT Capable | Maximum A-MPDU Length Exponent | VHT Link Adaptation Capable | Rx Antenna Pattern  Consistency | Tx Antenna Pattern  Consistency | Reserved |
| 3 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 2 |
| * VHT Capabilities Info field | | | | | | | | | |

The subfields of the VHT Capabilities Info field are defined in Table 8-183u (Subfields of the VHT Capabilities Info field).

|  |  |  |
| --- | --- | --- |
| * Subfields of the VHT Capabilities Info field | | |
| Subfield | Definition | Encoding |
| Maximum MPDU Length | Indicates the maximum MPDU length (see 9.11 (A-MSDU operation)). | Set to 0 for 3895 octets.  Set to 1 for 7991 octets  .  Set to 2 for 11 454 octets  .  The value 3 is reserved.(#4033) |
| Supported Channel Width Set | Indicates the channel widths supported by the STA. See 10.39 (VHT BSS operation) | Set to 0 if the STA does not support either 160 or 80+80 MHz  .  Set to 1 if the STA supports 160 MHz  .  Set to 2 if the STA supports 160 MHz and 80+80 MHz  .  The value 3 is reserved. |
| Rx LDPC | Indicates support for receiving LDPC encoded(#4313) packets | Set to 0 if not supported  .  Set to 1 if supported. |
| Short GI for 80 MHz | Indicates short GI support for the reception of packets transmitted with TXVECTOR parameters FORMAT equal to VHT and CH\_BANDWIDTH equal to CBW80 | Set to 0 if not supported.  Set to 1 if supported  . |
| Short GI for 160 and 80+80 MHz | Indicates short GI support for the reception of packets transmitted with TXVECTOR parameters FORMAT equal to VHT and CH\_BANDWIDTH equal to CBW160 or(#4707) CBW80+80 | Set to 0 if not supported.  Set to 1 if supported  . |
| Tx STBC | Indicates support for the transmission of at least 2x1 STBC | Set to 0 if not supported  .  Set to 1 if supported. |
| Rx STBC | Indicates support for the reception of PPDUs using STBC | Set to 0 for no support.  Set to 1 for support of one spatial stream.  Set to 2 for support of one and two spatial streams.  Set to 3 for support of one, two and three spatial streams.  Set to 4 for support of one, two, three and four spatial streams.  The values 5, 6, 7 are reserved. |
| SU Beamformer Capable | Indicates support for operation as an SU(#4721) beamformer (see 9.31.5 (VHT sounding protocol)) | Set to 0 if not supported  .  Set to 1 if supported. |
| SU Beamformee Capable | Indicates support for operation as an SU(#4721) beamformee (see 9.31.5 (VHT sounding protocol)) | Set to 0 if not supported  .  Set to 1 if supported. |
| Compressed Steering Number of Beamformer Antennas Supported | The maximum number of space-time streams that the STA can receive in a VHT NDP, the maximum value for *NSTS,total* that can be sent to the STA in an MU PPDU if the STA is MU beamformee capable and the maximum value of *Nr* that the STA transmits in a VHT Compressed Beamforming frame.(#4315) | If SU beamformee capable, set to the maximum number of supported beamformer antennas minus 1.(#5066)  Otherwise reserved. |
| Number of Sounding Dimensions | Beamformer’s capability indicating the maximum value of the TXVECTOR parameter NUM\_STS for(Ed) a VHT NDP | If SU beamformer capable, set to the maximum(#4657) supported value of the TXVECTOR parameter NUM\_STS minus 1.(#4491)  Otherwise reserved. |
| MU Beamformer Capable | Indicates support for operation as an MU beamformer (see 9.31.5 (VHT sounding protocol)) | Set to 0 if not supported  or if SU Beamformer Capable is set to 0 or if sent by a non-AP STA.  Set to 1 if supported and SU Beamformer Capable is set to 1.(#4977) |
| MU Beamformee Capable | Indicates support for operation as an MU beamformee (see 9.31.5 (VHT sounding protocol)) | Set to 0 if not supported  or if SU Beamformee Capable is set to 0 or if sent by an AP.  Set to 1 if supported and SU Beamformee Capable is set to 1.(#4977) |
| VHT TXOP PS | Indicates whether or not the AP supports VHT TXOP Power Save Mode or whether or not the non-AP STA has enabled(#4034) VHT TXOP Power Save mode. | When transmitted by a VHT AP in the VHT Capabilities element included in Beacon, Probe Response, Association Response and Reassociation Response frames:  Set to 0 if the VHT AP does not support VHT TXOP Power Save in the BSS.  Set to 1 if the VHT AP supports TXOP Power Save in the BSS  .  When transmitted by a non-AP VHT STA(#4219) in the VHT Capabilities element included in Association Request, Reassociation Request and Probe Request frames:  Set to 0 when the VHT STA has not enabled in TXOP Power Save Mode.  Set to 1 when the VHT STA has enabled TXOP Power Save Mode.(#4034) |
| +HTC-VHT Capable | Indicates whether or not the STA supports receiving a VHT variant HT Control field | Set to 0 if not supported  Set to 1 if supported |
| Maximum A-MPDU Length Exponent | Indicates the maximum length of A-MPDU that the STA can receive. EOF padding is not included in this limit.(#4035) | This field is an integer in the range of 0 to 7.  The length defined by this field is equal to  octets. |
| VHT Link Adaptation Capable | Indicates whether or not the STA supports link adaptation using VHT variant HT Control field.(#4036) | If +HTC-VHT Capable is 1(#4036):  Set to 0 (No Feedback) if the STA does not provide VHT MFB.  Set to 2 (Unsolicited) if the STA provides only unsolicited VHT MFB.  Set to 3 (Both) if the STA can provide VHT MFB in response to VHT MRQ and if the STA provides unsolicited VHT MFB.  The value 1 is reserved.  Reserved if +HTC-VHT Capable is 0.(#4036) |
| Rx Antenna Pattern Consistency | Indicates the possibility of Rx antenna pattern change | Set to 0 if Rx antenna pattern might change during the lifetime of the current association.  Set to 1 if Rx antenna pattern does not change during the lifetime of the current association.  See 10.39.6 (VHT STA antenna indication).(#5268)(#5243) |
| Tx Antenna Pattern Consistency | Indicates the possibility of Tx antenna pattern change | Set to 0 if Tx antenna pattern might change during the lifetime of the current association.  Set to 1 if Tx antenna pattern does not change during the lifetime of the current association.  See 10.39.6 (VHT STA antenna indication).(#5269)(#5243) |

NOTE 1—An AP that sets MU Beamformer Capable to 1 can transmit a VHT MU PPDU(#5399) with only one non-zero TXVECTOR parameter NUM\_STS[*p*], for . However, a STA that sets MU Beamformee Capable to 0 is not required to be able to demodulate a VHT MU PPDU(#5399) with only one non-zero RXVECTOR parameter NUM\_STS[*p*], for .(#4315)

NOTE 2—The value for the Maximum MPDU Length in the VHT Capabilities Info field imposes a constraint on the allowed value of the Maximum MPDU Length in the HT Capabilities Info field of the HT Capabilities element carried in the same frame (see 9.11 (A-MSDU operation

)).(#4033)

Support for short GI for the reception of packets with TXVECTOR parameter CH\_BANDWIDTH equal to CBW20 and CBW40 is indicated in the HT Capabilities Info field of the HT Capabilities element(#4707).

TGaf Editor: Insert a new Clause 8.4.2.160.2a after 8.4.2.160.2:

* a TVHT Capabilities Info field

See 8.4.2.160.2 with the fields Supported Channel Width Set, Short GI for 80 MHz and Short GI for 160 and 80+80 MHz in table 8-183u redefined as follows:

Set the value of B2 to 1 if the TVHT device support TVHT\_MODE\_2C

Set the value of B3 to 1 if the TVHT device support TVHT\_ MODE\_2N

Set the value of B5 to 1 if the TVHT device support TVHT\_ MODE\_4C

Set the value of B6 to 1 if the TVHT device support TVHT\_ MODE\_4N

Support for Short GI is mandatory.

* VHT Supported MCS Set field

The VHT Supported MCS Set field is used to convey the combinations of MCSs and spatial streams that(#4318) a STA supports for both reception and transmission. The structure of the field is shown in Figure 8-401bt.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B15 | B16 B28 | B29 B31 | B32 B47 | B48 B60 | B61 B63 |
|  | Rx MCS Map | Rx Highest Supported Data Rate | Reserved | Tx MCS Map | Tx Highest Supported Data Rate | Reserved |
| Bits: | 16 | 13 | 3 | 16 | 13 | 3 |
| * VHT Supported MCS Set field | | | | | | |

The Rx MCS Map subfield, the Tx MCS Map subfield and the VHT Basic MCS Set field(#4037) have the structure shown in Figure 8-401bu.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 B3 | B4 B5 | B6 B7 | B8 B9 | B10 B11 | B12 B13 | B14 B15 |
|  | Max MCS For 1 SS | Max MCS For 2 SS | Max MCS For 3 SS | Max MCS For 4 SS | Max MCS For 5 SS | Max MCS For 6 SS | Max MCS For 7 SS | Max MCS For 8 SS |
| Bits: | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| * Rx MCS Map and Tx MCS Map | | | | | | | | |

The VHT Supported MCS Set subfields are defined in Table 8-183v (VHT Supported MCS Set subfields).

|  |  |  |
| --- | --- | --- |
| * VHT Supported MCS Set subfields | | |
| Subfield | Definition | Encoding |
| Rx MCS Map | Indicates the maximum value of the RXVECTOR parameter MCS of a PPDU that can be received at all channel widths supported by this STA for each number of spatial streams.(#4534)(#5025) | The 2-bit Max MCS For *n* SS field for each number of spatial streams *n* = 1, ..., 8 is encoded as follows (see NOTE):  0 indicates support for MCS 0-7  1 indicates support for MCS 0-8  2 indicates support for MCS 0-9  3 indicates that *n* spatial streams is not supported |
| Rx Highest Supported Data Rate | Indicates the highest long GI VHT PPDU data rate that the STA is able to receive. | In units of 1 Mb/s (see 9.7.11.1 (VHT Rx Supported MCS Set))(#4967). The value 0 indicates that this subfield does not specify the highest long GI VHT PPDU data rate that the STA is able to receive. |
| Tx MCS Map | Indicates the maximum value of the TXVECTOR parameter MCS of a PPDU that can be transmitted at all channel widths supported by this STA for each number of spatial streams.(#4534)(#5025) | The 2-bit Max MCS For *n* SS field for each number of spatial streams *n* = 1, ..., 8 is encoded as follows (see NOTE)  :  0 indicates support for MCS 0-7  1 indicates support for MCS 0-8  2 indicates support for MCS 0-9  3 indicates that *n* spatial streams is not supported |
| Tx Highest Supported Data Rate | Indicates the highest long GI VHT PPDU data rate that the STA is able to transmit at. | In units of 1 Mb/s (see 9.7.11.2 (VHT Tx Supported MCS Set))(#4967).  The value 0 indicates that this subfield does not specify the highest long GI VHT PPDU data rate that the STA is able to transmit at. |
| NOTE—An MCS indicated as supported in the MCS Map fields for a particular number of spatial streams might not be valid at all bandwidths (see 22.5 (Parameters for VHT MCSs  )).(#4320)(#4038) | | |

* VHT Operation element

The operation of VHT STAs in the BSS is controlled by the HT Operation element and the VHT Operation element. The format of the VHT Operation element is defined in Figure 8-401bv.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | VHT Operation Information | VHT Basic MCS Set |
| Octets: | 1 | 1 | 3 | 2 |
| * VHT Operation element format | | | | |

The Element ID field is set to the value for VHT Operation element defined in Table 8-54 (Element IDs).

The structure of the VHT Operation Information field is defined in Figure 8-401bw.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Channel Width | Channel Center Frequency  Segment 0(#4322) | Channel Center Frequency  Segment 1(#4322) |
| Octets: | 1 | 1 | 1 |
| * VHT Operation Information field | | | |

The VHT STA gets the primary channel information from the HT Operation element. The subfields of the VHT Operation Information field are defined in Table 8-183w (VHT Operation Information subfields).

|  |  |  |
| --- | --- | --- |
| * VHT Operation Information subfields | | |
| Field | Definition | Encoding |
| Channel Width | This field, together with the HT Operation element STA Channel Width field, defines the BSS operating channel width (see 10.39.1 (Basic VHT BSS functionality)). | Set to 0 for 20 MHz or 40 MHz operating channel width.  Set to 1 for 80 MHz operating channel width.  Set to 2 for 160 MHz operating channel width.  Set to 3 for 80+80 MHz operating channel width  .  Values in the range 4 to 255 are reserved. |
| Channel Center Frequency Segment 0(#4322) | Defines the channel center frequency for an 80 and 160 MHz VHT BSS and the segment 0(#4322) channel center frequency for an 80+80 MHz VHT BSS. See 22.3.14 (Channelization). | For 80 MHz or 160 MHz operating channel width, indicates the channel center frequency index for the 80 MHz or 160 MHz channel on which the VHT BSS operates.  For 80+80 MHz operating channel width, indicates the channel center frequency index for the 80 MHz channel of frequency segment 0(#4322) on which the VHT BSS operates.  Reserved otherwise(#4801). |
| Channel Center Frequency Segment 1(#4322) | Defines the segment 1(#4322) channel center frequency for an 80+80 MHz VHT BSS. See 22.3.14 (Channelization). | For an 80+80 MHz operating channel width, indicates the channel center frequency index of the 80 MHz channel of frequency segment 1(#4322) on which the VHT BSS operates. Reserved otherwise. |

The VHT Basic MCS Set field indicates the MCSs(#4323) for each number of spatial streams in VHT PPDUs that are supported by all VHT STAs in the BSS (including IBSS and MBSS). The VHT Basic MCS Set field is a bitmap of size 16 bits; each 2 bits indicates the supported MCS set for Nss from 1 to 8. The VHT Basic MCS Set field is defined as Rx MCS Map subfield in 8.4.2.160.3 (VHT Supported MCS Set field

).

TGaf Editor: Insert a new Clause 8.4.2.161a after 8.4.2.161:

* a TVHT Operation element

See 8.4.2.161 with values in table 8-183w changed to:

|  |  |  |
| --- | --- | --- |
| * TVHT Operation Information subfields | | |
| Field | Definition | Encoding |
| Channel Width | This field, together with the HT Operation element STA Channel Width field, defines the BSS operating channel width (see 10.39.1 (Basic VHT BSS functionality)). | Set to 0 for TVHT\_W MHz operating channel width.  Set to 1 for TVHT\_2W MHz operating channel width.  Set to 2 for TVHT\_4W MHz operating channel width.  Set to 3 for TVHT\_W+W MHz operating channel width  Set to 4 for TVHT\_2W+2W MHz operating channel width  .  Values in the range 5 to 255 are reserved. |
| Channel Center Frequency Segment 0(#4322) | Defines the channel center frequency for an TVHT\_W, TVHT\_2W and TVHT\_4W MHz TVHT BSS and the segment 0(#4322) channel center frequency for an TVHT\_W+W MHz TVHT BSS and the section 0 channel center frequency for an TVHT\_2W+2W MHz TVHT BSS. See 22.3.14 (Channelization). | For TVHT\_W MHz , TVHT\_2W or TVHT\_4W MHz operating channel width, indicates the channel center frequency index for the TVHT\_W MHz, TVHT\_2W or TVHT\_4W MHz channel on which the TVHT BSS operates.  For TVHT\_W+W MHz operating channel width, indicates the channel center frequency index for the TVHT\_W MHz channel of frequency segment 0(#4322) on which the VHT BSS operates.  For TVHT\_2W+2W MHz operating channel width, indicates the channel center frequency index for the TVHT\_2W MHz channel of frequency section 0(#4322) on which the VHT BSS operates.  Reserved otherwise(#4801). |
| Channel Center Frequency Segment 1(#4322) | Defines the segment 1(#4322) channel center frequency for an TVHT\_W+W MHz TVHT BSS and the section 1 channel center frequency for an TVHT\_2W+2W MHz TVHT BSS. See 22.3.14 (Channelization). | For an TVHT\_W+W MHz operating channel width, indicates the channel center frequency index of the TVHT\_W MHz channel of frequency segment 1(#4322) on which the VHT BSS operates  For an TVHT\_ TVHT\_2W+2W MHz operating channel width, indicates the channel center frequency index of the TVHT\_2W MHz channel of frequency section 1(#4322) on which the VHT BSS operates  Reserved otherwise. |

Refer to section 23.3.14 for definitions.

* Extended BSS Load element

The Extended BSS Load element reported by the AP contains information on bandwidth utilization and MIMO spatial stream underutilization by MU capable STAs. The element format is defined in Figure 8-401bx. A STA receiving the element might use the information it conveys in an implementation specific AP selection algorithm.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | MU-MIMO Capable STA Count | Spatial Stream Underutilization | VHT 40 MHz Utilization | 80 MHz Utilization | 160 MHz Utilization |
| Octets: | 1 | 1 | 2(#4324) | 1 | 1 | 1 | 1 |
| * Extended BSS Load element format | | | | | | | |

The Element ID field is set to the value for the Extended BSS Load element in Table 8-54 (Element IDs).(#4324)

The Length field is set to 6.(#4324)

The MU-MIMO Capable STA Count field indicates the total number of STAs currently associated with this BSS that have a 1 in the MU Beamformee(#4326) Capable field of their VHT Capabilities element.

The Spatial Stream Underutilization field is defined as the percentage of time, linearly scaled with 255 representing 100%, that the AP has underutilized spatial domain resources for given busy time of the medium. The(#4327) spatial stream underutilization is calculated only for the primary channel. This percentage is computed using the formula,



where

 is (Ed)the maximum number of spatial streams indicated by the Number of Sounding Dimensions subfield of the VHT Capabilities Info field of the AP.

 is (Ed)the number of microseconds during which the AP is transmitting one or more spatial streams to MU capable STAs.

 is (Ed)(#4328), where  is the time interval, in units of microseconds,(#4492) during which the primary 20 MHz channel(#5069) is busy due to the transmission of one or more spatial streams by the AP to MU capable STAs, *NSS,i*(#4328) is the number of spatial streams transmitted during the time interval , and *N* is the number of busy events that occurred during the total measurement time which is less than or equal to dot11ChannelUtilizationBeaconIntervals consecutive beacon intervals(#5321).

If  is zero, the Spatial Stream Underutilization field is reserved(#4802).(Ed)

The VHT 40 MHz Utilization field is defined as the percentage of time, linearly scaled with 255 representing 100%, that the 40 MHz operating BSS Channel Width was busy. This percentage is computed using the formula,

(#5319)

The 80 MHz Utilization field is defined as the percentage of time, linearly scaled with 255 representing 100%, that the 80 MHz operating BSS Channel Width was busy. This percentage is computed using the formula,

(#5319)

The 160 MHz Utilization field is defined as the percentage of time, linearly scaled with 255 representing 100%, that the 160 MHz or 80+80 MHz operating BSS Channel Width was busy. This percentage is computed using the formula,

(#5319)

where

(#5319) is (Ed)the number of microseconds during which the CS mechanism, as defined in 9.3.2.2 (CS mechanism), has indicated a channel busy condition(Ed).

, , and  are defined to be the number of microseconds during which the AP was transmitting a 40 MHz PPDU to a VHT STA, 80 MHz PPDU, or a 160 MHz PPDU respectively.

If  is zero, the VHT 40 MHz Utilization, 80 MHz Utilization and 160 MHz Utilization fields are reserved(#5309).

The measurements for the Spatial Stream Underutilization field, VHT(#5072) 40 MHz Utilization field, 80 MHz Utilization field, and 160 MHz Utilization field values are performed over a period of dot11ChannelUtilizationBeaconIntervals consecutive beacon intervals as described in 8.4.2.30 (BSS Load element).(#5071)

If the AP indicates a channel width of 20 MHz, 40 MHz or 80 MHz in the Channel Width field in the VHT Operation element, then the 160 MHz Utilization field is reserved. If the AP indicates a channel width of 20 MHz(#4804) or 40 MHz in the Channel Width field in the VHT Operation element, then the 80 MHz Utilization field is reserved. If the AP indicates a channel width of 20 MHz in the Channel Width field in the VHT Operation element, then the 40 MHz Utilization field is reserved.

* Wide Bandwidth Channel Switch element

The Wide Bandwidth Channel Switch element is included in Channel Switch Announcement frames, as described in 8.5.2.6 (Channel Switch Announcement frame format), and TDLS Channel Switch Request frames, as described in 8.5.13.7 (TDLS Channel Switch Request frame format)(#5259). The format of the Wide Bandwidth Channel Switch element is shown in Figure 8-401by.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element ID | Length | New(#4333)  Channel Width | New  Channel Center Frequency  Segment 0(#4322) | New  Channel Center Frequency  Segment 1(#4322) |
| Octets: 1 | 1 | 1 | 1 | 1 |
| * Wide Bandwidth Channel Switch element format | | | | |

The Element ID field is set to the value for the Wide Bandwidth Channel Switch element in Table 8-54 (Element IDs).(#4331)

The Length field is set to 3.(#4331)

The subfields New (#4333)Channel Width, New Channel Center Frequency Segment 0 and New Channel Center Frequency Segment 1(#4322) have the same definition, respectively, as (#4333)Channel Width, Channel Center Frequency Segment 0(#4322) and Channel Center Frequency Segment 1(#4322) in the VHT Operation Information field(#4707), described in Table 8-183w (VHT Operation Information subfields).

* VHT Transmit Power Envelope element

The VHT Transmit Power Envelope element conveys the maximum transmit power for various transmission bandwidths. The format of the VHT Transmit Power Envelope element is shown in Figure 8-401bz.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Transmit Power Information | Local Maximum Transmit Power For 20 MHz | Local Maximum Transmit Power For 40 MHz | Local Maximum Transmit Power For 80 MHz | Local Maximum Transmit Power For 160/80+80 MHz |
| Octets: | 1 | 1 | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 1 |
| * VHT Transmit Power Envelope element format | | | | | | | |

The Element ID field is set to the value for the VHT Transmit Power Envelope element defined in Table 8-54 (Element IDs).

The format of the Transmit Power Information field is defined in Figure 8-401ca.

|  |  |  |  |
| --- | --- | --- | --- |
| Bits: | B0 B2 | B3 B5 | B6 B7 |
|  | Local Maximum Transmit Power Count | Local Maximum Transmit Power Units Interpretation | Reserved |
| * Transmit Power Information field | | | |

The Local Maximum Transmit Power Count subfield indicates the number of Local Maximum Transmit Power for *X* MHz fields (where *X* = 20, 40, 80 or 160/80+80) minus 1 in the VHT Transmit Power Envelope element, as shown in Table 8-183x (Meaning of Local Maximum Transmit Power Count subfield).

|  |  |
| --- | --- |
| * Meaning of Local Maximum Transmit Power Count subfield | |
| Value | Field(s) present |
| 0 | Local Maximum Transmit Power For 20 MHz. |
| 1 | Local Maximum Transmit Power For 20 MHz and Local Maximum Transmit Power For 40 MHz. |
| 2 | Local Maximum Transmit Power For 20 MHz, Local Maximum Transmit Power For 40 MHz and Local Maximum Transmit Power For 80 MHz. |
| 3 | Local Maximum Transmit Power For 20 MHz, Local Maximum Transmit Power For 40 MHz, Local Maximum Transmit Power For 80 MHz and Local Maximum Transmit Power For 160/80+80 MHz. |
| 4-7 | Reserved |

The Local Maximum Transmit Power Units Interpretation subfield provides additional interpretation for the units of the Local Maximum Transmit Power for *X* MHz fields (where *X* = 20, 40, 80 or 160/80+80) and is defined in Table 8-183y (Definition of Local Maximum Transmit Power Units Interpretation subfield). Allowed values are further constrained as defined in Annex E.

|  |  |
| --- | --- |
| * Definition of Local Maximum Transmit Power Units Interpretation subfield | |
| Value | Units Interpretation of the Local Maximum Transmit Power for *X* MHz fields |
| 0 | EIRP |
| 1-7 | Reserved |
| NOTE—This table is only expected to be updated if regulatory domains mandate the use of transmit power control with limits that cannot be converted into an EIRP value per PPDU bandwidth. | |

Local Maximum Transmit Power For *X* MHz fields (where *X* = 20, 40, 80 or 160/80+80) define the local maximum transmit power limit of the transmission bandwidth *X* MHz. Each Local Maximum Transmit Power For *X* MHz field is encoded as an 8-bit 2's complement signed integer in the range of -64 dBm to 63 dBm with a 0.5 dB step. The value of 63.5 dBm indicates 63.5 dBm or higher (i.e. no local maximum transmit power constraint).(#4252)

* Control Switch Wrapper element(#4252)

The Channel Switch Wrapper contains sub-elements that indicate characteristics of the BSS after a channel switch. The format of the Channel Switch Wrapper element is defined in Figure 8-401cb.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | Zero or one | Zero or one | Zero or more |
|  | Element ID | Length | New Country subelement | Wide Bandwidth Channel Switch subelement | New VHT Transmit Power Envelope subelement |
| Octets: | 1 | 1 | variable | variable | variable |
| * Channel Switch Wrapper element format | | | | | |

The Element ID field is set to the value for the Channel Switch Wrapper element in Table 8-54 (Element IDs).

The New Country subelement is present when an AP performs extended channel switching to a new Country, Operating Class Table or a changed set of Operating Classes relative to the contents of the Country element sent in the Beacon; otherwise this subelement is not present. The format of the New Country subelement is defined to be the same as the format of the Country element (see 8.4.2.10 (Country element)), except that no Subband Triplet fields are present in the New Country subelement. The Country string within the New Country subelement indicates the Country and Operating Class Table of the BSS after extended channel switching and Operating Triplet fields within the New Country subelement indicate the operating classes of the BSS after extended channel switching (see 10.39.1 (Basic VHT BSS functionality)).

The Wide Bandwidth Channel Switch subelement is present when channel switching to a BSS Operating Channel Width of 40 MHz or wider; if switching to a 20 MHz BSS Operating Channel Width then this subelement is not present. The format of the Wide Bandwidth Channel Switch subelement is defined to be the same as the Wide Bandwidth Channel Switch element (see 8.4.2.163 (Wide Bandwidth Channel Switch element)), except that when the New Channel Bandwidth field is set to zero, then it signifies a 40 MHz BSS Operating Channel Width only. The Wide Bandwidth Channel Switch subelement indicates the BSS operating bandwidth after channel switching (see 10.39.1 (Basic VHT BSS functionality)).

Each New VHT Transmit Power Envelope subelement that is present is defined to have the same format as the VHT Transmit Power Envelope element (see 8.4.2.164 (VHT Transmit Power Envelope element)) and includes a distinct value of the Local Maximum Transmit Power Units Interpretation. Each New VHT Transmit Power Envelope subelement indicates the local maximum transmit powers for the BSS for the indicated bandwidths with an indicated units interpretation after channel switching (see 10.39.1 (Basic VHT BSS functionality)).

* AID element

The AID element includes the AID assigned by an AP during association that represents the 16-bit ID of a STA. The format of the AID element is shown in Figure 8-401cc.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | AID |
| Octets: | 1 | 1 | 2 |
| * AID element format | | | |

The AID field is defined in 8.4.1.8 (AID field).

* Quiet Channel element

The Quiet Channel element is used to indicate that the secondary 80 MHz channel of a VHT BSS is to be quieted during a quiet interval indicated by either a Quiet element (see 8.4.2.25 (Quiet element)) or the Quiet Channel element if its AP Quiet Mode field is equal to 1. Furthermore, the Quiet Channel element indicates the conditions under which the primary 80 MHz channel of the VHT BSS may be used during the quiet interval. The format of the Quiet Channel element is shown in Figure 8-401cd.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | AP Quiet Mode | Quiet Count (optional) | Quiet Period (optional) | Quiet Duration (optional) | Quiet Offset (optional) |
| Octets: | 1 | 1 | 1 | 0 or 1 | 0 or 1 | 0 or 2 | 0 or 2 |
| * Quiet Channel element format | | | | | | | |

The Element ID field is defined in Table 8-54 (Element IDs).

The Length field specifies the number of octets in the element following the Length field.

The AP Quiet Mode field specifies STA behavior during the quiet intervals. When communications to the AP are allowed within the primary 80 MHz(#5361) channel of the BSS, then the AP Quiet Mode field is set to 1. Otherwise, the AP Quiet Mode field is set to 0.

If the AP Quiet Mode field is 1, then the Quiet Count field, Quiet Period field, Quiet Duration field and Quiet Offset field are present in the Quiet Channel element; otherwise these fields are not present in the Quiet Channel element.(#4806)

The Quiet Channel element may be included in Beacon frames, as described in 8.3.3.2 (Beacon frame format

), and Probe Response frames, as described in 8.3.3.10 (

Probe Response frame format

). The use of Quiet Channel elements is described in 10.9.3 (Quieting channels for testing).

The Quiet Count field, Quiet Period field, Quiet Duration field and Quiet Offset field have the same definition as described in 8.4.2.25 (Quiet element).(#4040)

* Operating Mode Notification element(#5096)

The Operating Mode Notification element is used to notify STAs that the transmitting STA is changing its operating channel width, the maximum number of spatial streams it can receive, or both. The format of the Operating Mode Notification element is defined in Figure 8-401ce.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Element ID | Length | Operating Mode |
| Octets: | 1 | 1 | 1 |
| * Operating Mode Notification element | | | |

The Operating Mode field is defined in 8.4.1.50 (Operating Mode field

).

* Action frame format details
* Spectrum management action frames
* Channel Switch Announcement frame format

Change Figure 8-436 as follows:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | Zero or one | Zero or more |
|  | Category | Spectrum Management Action | Channel Switch Announcement element | Secondary Channel Offset element | Mesh Channel Switch Parameters element | Wide Bandwidth Channel Switch element | New VHT Transmit Power Envelope element |
| Octets: | 1 | 1 | 5 | 3 | 6 | 0 or 5 | variable |
| * Channel Switch Announcement frame Action field format(#4252) | | | | | | | |

Change the last 2 paragraphs of this subclause and insert a subsequent paragraph as follows:

The Secondary Channel Offset element is defined in 8.4.2.22 (Secondary Channel Offset element). This element is present when switching to a 40 MHz or wider channel(#4707). It may be present when switching to a 20 MHz channel (in which case the Secondary Channel Offset field is set to SCN).

The Mesh Channel Switch Parameters element is defined in 8.4.2.105. This element is present when a mesh STA performs an MBSS channel switch. Otherwise, t~~T~~he Mesh Channel Switch Parameters element is not present ~~included for channel switch other than MBSS~~.

The Wide Bandwidth Channel Switch element is defined in 8.4.2.163 (Wide Bandwidth Channel Switch element). This information element is present when switching to a channel width wider than 40 MHz.

Each New VHT Transmit Power Envelope element that is present is defined to have the same format as the VHT Transmit Power Envelope element (see 8.4.2.164 (VHT Transmit Power Envelope element)) and includes a distinct value of the Local Maximum Transmit Power Units Interpretation. If present, the New VHT Transmit Power Envelope element indicates the local maximum transmit powers for the BSS for the indicated bandwidths with an indicated units interpretation after channel switching (see 10.39.1 (Basic VHT BSS functionality)).(#4252)

* DLS Action frame details
* DLS Request frame format

Insert rows for Order 10 and 11 in Table 8-199 as follows:

|  |  |  |
| --- | --- | --- |
| * DLS Request frame Action field format | | |
| Order | Information | Notes |
| 10 | AID | The AID element(#4342) of the STA sending the frame is present if dot11VHTOptionImplemented (#4028)is true. |
| 11 | VHT Capabilities | The VHT Capabilities element is present if the dot11VHTOptionImplemented (#4028)is true. |

* DLS Response frame format

Insert rows for Order 10 and 11 in Table 8-200 as follows:

|  |  |  |
| --- | --- | --- |
| * DLS Response frame Action field format | | |
| Order | Information | Notes |
| 10 | AID | The AID element(#4342) of the STA sending the frame is present if dot11VHTOptionImplemented (#4028)is true. |
| 11 | VHT Capabilities | The VHT Capabilities element is present if the dot11VHTOptionImplemented (#4028)is true. |

(#4347)

* Public Action details
* Extended Channel Switch Announcement frame format(#4252)

Change Figure 8-449 as shown:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | Zero or one | Zero or one | Zero or more |
|  | Category | Public Action | Channel Switch Mode | New Operating Class | New Channel Number | Channel Switch Count | Mesh Channel Switch Parameters element | New Country element | Wide Bandwidth Channel Switch element | New VHT Transmit Power Envelope element |
| Octets: | 1 | 1 | 1 | 1 | 1 | 1 | 6 | variable | variable | variable |
| * Extended Channel Switch Announcement frame Action field format | | | | | | | | | | |

Insert the following paragraphs at the end of this subclause:

The New Country element is present when an AP performs extended channel switching to a new Country, Operating Class Table or a changed set of Operating Classes relative to the contents of the Country element sent in the Beacon; otherwise this element is not present. The format of the New Country element is defined to be the same as the format of the Country element (see 8.4.2.10 (Country element)), except that no Subband Triplet fields are present in the New Country element. The Country string within the New Country element indicates the Country and Operating Class Table of the BSS after extended channel switching and Operating Triplet fields within the New Country element indicate the operating classes of the BSS after extended channel switching (see 10.39.1 (Basic VHT BSS functionality)).

This Wide Bandwidth Channel Switch element is present when extended channel switching to a channel width wider than 40 MHz; otherwise this element is not present. The Wide Bandwidth Channel Switch element is defined in 8.4.2.163 (Wide Bandwidth Channel Switch element). The Wide Bandwidth Channel Switch element indicates the BSS operating bandwidth after extended channel switching (see 10.39.1 (Basic VHT BSS functionality)).

Each New VHT Transmit Power Envelope element that is present is defined to have the same format as the VHT Transmit Power Envelope element (see 8.4.2.164 (VHT Transmit Power Envelope element)) and includes a distinct value of the Local Maximum Transmit Power Units Interpretation. If present, the New VHT Transmit Power Envelope element indicates the maximum transmit powers for the BSS for the indicated bandwidths with an indicated units interpretation after extended channel switching (see 10.39.1 (Basic VHT BSS functionality)).

* TDLS Discovery Response frame format

Insert a row for Order 16 in Table 8-220 as follows:

* Order 1 to 15 in 802.11-2012, none in P802.11ae, none in P802.11aa, none in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Information for TDLS Discovery Response frame | | |
| Order | Information | Notes |
| 16 | VHT Capabilities | VHT Capabilities element (optional). The VHT Capabilities element is present if the dot11VHTOptionImplemented (#4028)is true. The VHT Capabilities element is defined in 8.4.2.160 (VHT Capabilities element  ). |

* TDLS Action frame details
* TDLS Setup Request frame format

Insert rows for Order 19 and 20 in Table 8-239 as follows:

* Order 1 to 17 in 802.11-2012, none in P802.11ae, none in P802.11aa, +1 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Information for TDLS Setup Request frame | | |
| Order | Information | Notes |
| 19 | AID | The AID element(#4342) of the STA sending the frame is present if dot11VHTOptionImplemented (#4028)is true. |
| 20 | VHT Capabilities | The VHT Capabilities element is present if the dot11VHTOptionImplemented (#4028)is true. |

* TDLS Setup Response frame format

Insert rows for Order 19 and 20 in Table 8-240 as follows:

* Order 1 to 18 in 802.11-2012, none in P802.11ae, none in P802.11aa, +1 in P802.11ad

|  |  |  |
| --- | --- | --- |
| * Information for TDLS Setup Response frame | | |
| Order | Information | Notes |
| 20 | AID | The AID element(#4342) of the STA sending the frame is present if dot11VHTOptionImplemented (#4028)is true. |
| 21 | VHT Capabilities | The VHT Capabilities element is present if the dot11VHTOptionImplemented (#4028)is true. |

* TDLS Setup Confirm frame format

Insert a row for Order 11 in Table 8-241 as follows:

|  |  |  |
| --- | --- | --- |
| * Information for TDLS Setup Confirm frame | | |
| Order | Information | Notes |
| 11 | VHT Operation | VHT Operation element (optional). The VHT Operation element is present if the dot11VHTOptionImplemented (#4028)is true, the TDLS Setup Response frame contained a VHT Capabilities element, the status code is 0 (Successful), and the BSS does not support VHT. The VHT Operation element is defined in 8.4.2.160 (VHT Capabilities element  ). |

* TDLS Channel Switch Request frame format

Insert a rows for Orders 8, 9 and 10 in Table 8-244 as follows:

|  |  |  |
| --- | --- | --- |
| * Information for TDLS Channel Switch Request frame | | |
| Order | Information | Notes |
| 8 | Wide Bandwidth Channel Switch | Wide Bandwidth Channel Switch element (optional). The Wide Bandwidth Channel Switch element is included when a switch to an 80 MHz, 160 MHz or 80+80 MHz direct link is indicated. See 8.4.2.163 (Wide Bandwidth Channel Switch element). |
| 9 | Country | Country element (optional). The Country element is included to change operating classes when a switch to a direct link is indicated. The Country element indicates the same country as the BSS and includes zero Subband Triplet fields.(#4252) |
| 10 | VHT Transmit Power Envelope | VHT Transmit Power Envelope element (optional). The VHT Transmit Power Envelope element is included for TPC when a switch to a direct link is indicated.(#4252) |

* Self-protected Action frame details
* Mesh Peering Open frame format
* Mesh Peering Open frame details

Insert a row for Order 19 and 20 following the row for Order 18 in Table 8-262 as follows:

|  |  |  |
| --- | --- | --- |
| * Mesh Peering Open frame Action field format | | |
| Order | Information | Notes |
| 19 | VHT Capabilities | The VHT Capabilities element is present when dot11VHTOptionImplemented is true. |
| 20 | VHT Operation | The VHT Operation element is present when dot11VHTOptionImplemented is true. |

* Mesh Peering Confirm frame format
* Mesh Peering Confirm frame details

Insert a row for Order 15 and 16 following the row for Order 14 in Table 8-263 as follows:

|  |  |  |
| --- | --- | --- |
| * Mesh Peering Confirm frame Action field format | | |
| Order | Information | Notes |
| 15 | VHT Capabilities | The VHT Capabilities element is present when dot11VHTOptionImplemented is true. |
| 16 | VHT Operation | The VHT Operation element is present when dot11VHTOptionImplemented is true. |

Insert new section 8.5.23 following the last section in 8.5:

* VHT Action frame details
* VHT Action field

Several Action frame formats are defined to support VHT functionality(#4349). A VHT Action field, in the octet immediately after the Category field, differentiates the VHT Action frame formats. The VHT Action field values associated with each frame format within the VHT category are defined in Table 8-281ah (VHT Action field values).

|  |  |  |
| --- | --- | --- |
| * VHT Action field values | | |
| Value | Meaning | Time Priority |
| 0 | VHT Compressed Beamforming | Yes(#5317) |
| 1 | Group ID Management |  |
| 2 | (#5096)Operating Mode Notification |  |
| 3-255 | Reserved |  |

* VHT Compressed Beamforming frame format

The VHT Compressed Beamforming frame is an Action No Ack frame of category VHT. The Action field of a VHT Compressed Beamforming frame contains the information shown in Table 8-281ai (VHT Compressed Beamforming frame Action field format).

|  |  |
| --- | --- |
| * VHT Compressed Beamforming frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | VHT Action |
| 3 | VHT MIMO Control (see 8.4.1.47 (VHT MIMO Control field  )) |
| 4 | VHT Compressed Beamforming Report (see 8.4.1.48 (VHT Compressed Beamforming Report field  )) |
| 5 | MU Exclusive Beamforming Report (see 8.4.1.49 (MU Exclusive Beamforming Report field  )) |

The Category field is set to the value for VHT, specified in Table 8-38 (Category values).

The VHT Action field is set to the value for VHT Compressed Beamforming, specified in Table 8-281ah (VHT Action field values).

The VHT MIMO Control field is always present in the frame. The presence and contents(#4667) of the VHT Compressed Beamforming Report field and the MU Exclusive Beamforming Report field are(#4667) dependent on the values of the Feedback Type, Remaining Feedback(#4293) Segments and First Feedback(#4293) Segment(#4656) subfields of the VHT MIMO Control field (see 8.4.1.47 (VHT MIMO Control field

), 8.4.1.48 (VHT Compressed Beamforming Report field

), 8.4.1.49 (MU Exclusive Beamforming Report field

) and 9.31.5 (VHT sounding protocol

)).(#4667)

No vendor-specific elements are present in a VHT Compressed Beamforming frame.(#4783)

* Group ID Management
* frame format

The Group ID Management frame is an Action frame of category VHT. It is transmitted by the AP to assign or change the user position of a STA for one or more group IDs(#4829). The Action field of a Group ID Management frame contains the information shown in Table 8-281aj (Group ID Management frame Action field format).

|  |  |
| --- | --- |
| * Group ID Management frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | VHT Action |
| 3 | Membership Status Array (see 8.4.1.51 (Membership Status Array field)) |
| 4 | User Position Array (see 8.4.1.52 (User Position Array field)) |

The Category field is set to the value for VHT, specified in Table 8-38 (Category values).

The VHT Action field is set to the value for Group ID Management, specified in Table 8-281ah (VHT Action field values).

* (#5096)Operating Mode Notification
* frame format

The (#5096)Operating Mode Notification frame is an Action frame of category VHT. It is used to notify STAs that the transmitting STA is changing its operating channel width, the maximum number of spatial streams it can receive, or both.(#4355)

The Action field of the (#5096)Operating Mode Notification frame contains the information shown in Table 8-281ak (Operating Mode Notification frame Action field format).

|  |  |
| --- | --- |
| * (#5096)Operating Mode Notification frame Action field format | |
| Order | Information |
| 1 | Category |
| 2 | VHT Action |
| 3 | (#5096)Operating Mode (see 8.4.1.50 (Operating Mode field  )) |

The Category field is set to the value for VHT, specified in Table 8-38 (Category values).

The VHT Action field is set to the value for (#5096)Operating Mode Notification, specified in Table 8-281ah (VHT Action field values).

* Aggregate MPDU (A-MPDU)
* A-MPDU format

Change 8.6.1 as follows:

An A-MPDU consists of a sequence of one or more A-MPDU subframes and 0 to 3 octets of EOF Pad, as shown in Figure 8-503.

Change Figure 8-503 as follows (adding the EOF Pad field):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | A-MPDU subframe 1 | A-MPDU subframe 2 | … | A-MPDU subframe n | EOF Pad |
| Octets: | variable | variable |  | variable | 0-3 |
| * A-MPDU format | | | | | |

The structure of the A-MPDU subframe is shown in Figure 8-504. Each A-MPDU subframe consists of an MPDU delimiter optionally followed by an MPDU. Each A-MPDU subframe in an A-MPDU, except for the last, has ~~Except when an A-MPDU subframe is the last one in an A-MPDU,~~ padding octets ~~are~~ appended to make ~~each A-MPDU subframe~~ it a multiple of 4 octets in length. In a VHT PPDU, the last A-MPDU subframe is padded to the last octet of the PSDU or to a multiple of 4 octets in length, whichever comes first. In an HT PPDU, the last A-MPDU subframe is not padded.(#4356) The A-MPDU maximum length for an HT PPDU is 65 535 octets. The A-MPDU maximum length for a VHT PPDU excluding A-MPDU subframes with 0 in the MPDU Length field and 1 in the EOF field, and EOF Pad, is 1 048 575 octets. The length of an A-MPDU addressed to a particular STA may be further constrained as described in 9.12.2 (A-MPDU length limit rules).

|  |  |  |  |
| --- | --- | --- | --- |
|  | MPDU delimiter | MPDU | Pad |
| Octets: | 4 | variable | 0-3 |
| * A-MPDU subframe format | | | |

The MPDU delimiter is 4 octets in length. The structure of the MPDU delimiter is defined in Figure 8-505.

Replace Figure 8-505 with the following (adding the EOF field and extending the MPDU Length field):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| B0 | B1 | B2 B15 | B16 B23 | B24 B31 |
| EOF | Reserved | MPDU Length | CRC | Delimiter Signature |
| * MPDU delimiter (non-DMG) | | | | |

The fields of the MPDU delimiter are defined in Table 8-282 (MPDU delimiter fields).

|  |  |  |
| --- | --- | --- |
| * MPDU delimiter fields | | |
| Field | Size (bits) | Description |
| EOF | 1 | End of frame indication. Set to 1 in an A-MPDU subframe with 0 in the MPDU Length field that is used to pad the A-MPDU in a VHT PPDU as described in 9.12.6 (A-MPDU padding for VHT PPDU). Set to 1 in the MPDU delimiter(#4969) of a VHT single MPDU as described in 9.12.7 (Setting the EOF field of the MPDU delimiter). Set to 0 otherwise. |
| Reserved | ~~4~~1 |  |
| MPDU Length | ~~12~~14 | Length of the MPDU in octets. Set to 0 if no MPDU is present. An A-MPDU subframe with 0 in the MPDU Length field is used as defined in 9.12.3 (Minimum MPDU Start Spacing field) to meet the minimum MPDU start spacing requirement and also to pad the A-MPDU to fill the available octets in a VHT PPDU as defined in 9.12.6 (A-MPDU padding for VHT PPDU). |
| CRC | 8 | 8-bit CRC of the preceding 16 bits |
| Delimiter Signature | 8 | Pattern that may be used to detect an MPDU delimiter when scanning for an MPDU delimiter(#4969).  The unique pattern is set to the value 0x4E.  NOTE—As the Delimiter Signature field was created by the IEEE 802.11 Task Group n, it chose the ASCII value for the character ‘N’ as the unique pattern. |

The format of the MPDU Length field is shown in Figure 8-505a1. The MPDU Length Low subfield contains the 12 low order bits of the MPDU length. In a VHT PPDU, the MPDU Length High subfield contains the two high order bits of the MPDU length. In an HT PPDU, the MPDU Length High subfield is reserved.(#4357)

Insert the following figure:

|  |  |
| --- | --- |
| B2 B3 | B4 B15 |
| MPDU Length High | MPDU Length Low |
| * MPDU Length field | |

The MPDU length value is derived from the MPDU Length field subfields as follows:(#4358)

* 

where

*Llow* is the value of the MPDU Length Low subfield

*Lhigh* is the value of the MPDU Length High subfield

NOTE—The format of the MPDU Length field maintains a common encoding structure for both VHT and HT PPDUs. For HT PPDUs only the MPDU Length Low subfield(#4811) is used, while for VHT PPDUs both subfields are used.

The purpose of the MPDU delimiter is to locate the MPDUs within the A-MPDU so that the structure of the A-MPDU can usually be recovered when one or more MPDU delimiters are received with errors. See S.2 (A-MPDU deaggregation) for a description of a deaggregation algorithm.

~~A delimiter with MPDU length zero is valid. This value is used as defined in 9.12.3 (Minimum MPDU Start Spacing field) to meet the minimum MPDU start spacing requirement.~~

* A-MPDU contents

Change 8.6.3 as follows:

An A-MPDU is a sequence of ~~MPDUs~~ A-MPDU subframes carried in a single PPDU

* with the TXVECTOR/RXVECTOR FORMAT parameter set to VHT, or
* with the TXVECTOR/RXVECTOR FORMAT parameter set to HT\_MF or HT\_GF and with the TXVECTOR/RXVECTOR AGGREGATION parameter set to 1.

All the MPDUs within an A-MPDU are addressed to the same RA. All QoS data frames within an A-MPDU that have a TID for which an HT-immediate Block Ack agreement exists have the same value for the Ack Policy subfield of the QoS Control field.

All protected MPDUs within an A-MPDU have the same Key ID.

The Duration/ID fields in the MAC headers of all MPDUs in an A-MPDU carry the same value.

An A-MPDU (#4813)is transmitted in one of the contexts specified in Table 8-283 (A-MPDU Contexts) as defined by the description in the column labeled “Definition of Context”, independently of whether the A-MPDU (#4813)is contained in an MU PPDU or an SU PPDU. Ordering of MPDUs within an A-MPDU is not constrained, except where noted in these tables. See 9.12.1 (A-MPDU contents).(#4812)

An MU PPDU does(#4477) not carry more than one A-MPDU (#4813)that contains one or more MPDUs soliciting an immediate response.(#4812)

NOTE 1—The TIDs present in a data enabled A-MPDU context are also constrained by the channel access rules (for a TXOP holder, see 9.19.2 (HCF contention-based channel access (EDCA)) and 9.19.3 (HCCA)) and the RD response rules (for an RD responder, see 9.24.4 (Rules for RD responder)). This is not shown in these tables.

NOTE 2—~~MPDUs carried in an A-MPDU are limited to a maximum length of 4095 octets.~~ If a STA supports A-MSDUs of 7935 octets (indicated by the Maximum A-MSDU Length field in the HT Capabilities element), A-MSDUs transmitted by that STA within an A-MPDU carried in a PPDU with FORMAT HT\_MF or HT\_GF are constrained so that the length of the QoS data MPDU carrying the A-MSDU is no more than 4095 octets. The 4095 octet MPDU length limit does not apply to A-MPDUs carried in VHT PPDUs.(#4360) The use of A-MSDU within A-MPDU can be further constrained as described in 8.4.1.14 (Block Ack Parameter Set field) through the operation of the A-MSDU Supported field. Change Table 8-283 as follows:

|  |  |  |
| --- | --- | --- |
| * A-MPDU Contexts | | |
| Name of Context | Definition of Context | Table defining permitted contents |
| Data Enabled Immediate Response | The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder or an RD responder including potential immediate responses. | Table 8-284 (A-MPDU contents in the data enabled immediate response context) |
| Data Enabled No Immediate Response | The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder that does not include or solicit an immediate response.  See NOTE. | Table 8-285 (A-MPDU contents in the data enabled no immediate response context) |
| PSMP | The A-MPDU is transmitted within a PSMP sequence. | Table 8-286 (A-MPDU contents in the PSMP context) |
| Control Response | The A-MPDU is transmitted by a STA that is neither a TXOP holder nor an RD responder that also needs to transmit one of the following immediate response frames:  ~~Ack~~ACK(#5485)  BlockAck with a TID for which an HT-immediate Block Ack agreement exists | Table 8-287 (A-MPDU contents MPDUs in the control response context) |
| VHT single MPDU context | The A-MPDU is tranmitted within a VHT PPDU and contains a VHT single MPDU. | Table 8-288 (A-MPDU contents in the VHT single MPDU context) |
| NOTE—This context includes cases when no response is generated or when a response is generated later by the operation of the delayed Block Ack rules. | | |

Insert new table below:

|  |  |
| --- | --- |
| * A-MPDU contents in the VHT single MPDU context | |
| MPDU | Conditions |
| Any MPDU | A VHT single MPDU, which can be any single MPDU.(#4361)  [The A-MPDU is carried in a PPDU with the TXVECTOR FORMAT parameter set to VHT.]  The MPDU delimiter(#4969) of the subframe containing the MPDU has the EOF field set to 1. |