**Abstract**: This amendment defines modifications to both the IEEE 802.11 physical layer (PHY) and the medium access control (MAC) sublayer for high efficiency operation in frequency bands between 1 GHz and 6 GHz.

**Keywords:** high efficiency, PHY, physical layer, MAC, medium access control, OFDMA, orthogonal frequency division multiple access, wireless local area network, WLAN

# Introduction

This introduction is not part of IEEE P802.11ax /D0.1, March 2016, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area network—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications—Amendment 6: Enhancements for high efficiency in frequency bands between 1 GHz and 6 GHz.

This amendment defines modifications to both the IEEE 802.11 physical layer (PHY) and the medium access control (MAC) sublayer for high efficiency operation in frequency bands between 1 GHz and 6 GHz.

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## Draft STANDARD for Information Technology— Telecommunications and information exchange between systems— Local and metropolitan area networks— Specific requirements

## Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

## Amendment 6: Enhancements for high efficiency in frequency bands between 1 GHz and 6 GHz

[This amendment is based on IEEE P802.11REVmc D5.0 amended by IEEE P802.11ai/D4.0, IEEE P802.11ah/D5.0, IEEE P802.11aq/D3.0, IEEE P802.11ak/D1.0 and IEEE P802.11aj/D1.0]

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

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 instructions, change markings and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

### Editorial Notes

***Editor's Note: Editorial Notes in the body of the standard appear like this. They will be removed before publication. They may highlight some issue that the editor has had to address during the implementation of a change. Where there may be any technical impact from an editing issue, the editor will raise a technical letter ballot comment. There is no need for voters to comment on such issues unless they have a specific resolution they wish to present.***

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***Editor's Note: Line numbering is only approximate. This is a limitation of the FrameMaker tool. Whitespace between paragraphs is part of the IEEE-SA style, as defined in their templates. The combination of these two facts leads to the appearance of blank lines in the draft between every paragraph. Please do not report this as an editorial defect as it is the unavoidable behavior.***

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Otherwise, when a whole paragraph is new, the paragraph is tagged. Otherwise tags are placed after a section of changes within a paragraph or at the end of the paragraph if the changes are substantial.

New tables are tagged in the table caption (if there is one), or in the introductory paragraph. Otherwise, new rows in existing tables are tagged only in the first column, to avoid distraction. Otherwise, a modified cell is tagged.

Finally, any other changes made by the editor (e.g., for grammar, language, style & consistency with other comment resolutions, baseline, etc.) are tagged (#Ed).

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**Table 1—Draft Status**

| Draft | Date | Status |
|---|---|---|
| D0.1 | 2016-03-03 | Converted to FrameMaker from 16/0024r1 Proposed draft specification |

# 3. Definitions, acronyms, and abbreviations

## 3.2 Definitions specific to IEEE 802.11

***Change the following definition:***

***Insert the following definitions:***

## 3.4 Abbreviations and acronyms

***Insert the following acronym definitions (maintaining alphabetical order):***

| | |
|---|---|
| DL | Dowlink |
| DL MU | Downlink multi-user |
| HE | High efficiency |
| OFDMA | Orthogonal frequency-division multiple access |
| MU-RTS | Multi-user request to send |
| UL | Uplink |

# 4. General description

## 4.3 Components of the IEEE Std 802.11 architecture

***Insert a new subclause after subclause 4.3.12 as follows:***

### 4.3.12a High efficiency (HE) STA

The IEEE 802.11 HE STA operates in frequency bands between 1 GHz and 6 GHz.

An HE STA is VHT STA that, in addition to the features supported as a VHT STA, supports the MAC features defined in Clause 25 and the PHY features defined in Clause 26.

# 6. Layer management

## 6.1 Overview of management model

## 6.2 Generic management primitives

## 6.3 MLME SAP interface

### 6.3.7 Associate

#### 6.3.7.2 MLME-ASSOCIATE.request

##### 6.3.7.2.2 Semantics of the service primitive

***Change the primitive parameters as follows (note that not all existing parameters in the baseline are shown):***

The primitive parameters are as follows:

MLME-ASSOCIATE.request(

...

HE Capabilities,

VendorSpecificInfo

)

***Insert the following entry to the unnumbered table in this subclause:***

| Name | Type | Valid range | Description |
|---|---|---|---|
| HE Capabilities | As defined in frame format HE Capabilities element. | As defined in 9.4.2.213 (HE Capabilities element) | Specifies the parameters within the HE Capabilities element that are supported by the MAC entity. The parameter is optionally present if dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |

#### 6.3.7.3 MLME-ASSOCIATE.confirm

##### 6.3.7.3.2 Semantics of the service primitive

***Change the primitive parameters as follows (note that not all existing parameters in the baseline are shown):***

The primitive parameters are as follows:

MLME-ASSOCIATE.confirm(

...,

HE Capabilities,

VendorSpecificInfo

)

***Insert the following entry to the unnumbered table in this subclause:***

| Name | Type | Valid range | Description |
|---|---|---|---|
| HE Capabilities | As defined in frame format HE Capabilities element. | As defined in 9.4.2.213 (HE Capabilities element) | Specifies the parameters within the HE Capabilities element that are supported by the MAC entity. The parameter is optionally present if dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |

### 6.3.8 Reassociate

### 6.3.8.2 MLME-REASSOCIATE.request

#### 6.3.8.2.2 Semantics of the service primitive

***Change the primitive parameters as follows (note that not all existing parameters in the baseline are shown):***

The primitive parameters are as follows:

MLME-REASSOCIATE.request(

...
HE Capabilities,
VendorSpecificInfo
)

***Insert the following entry to the unnumbered table in this subclause:***

| Name | Type | Valid range | Description |
|---|---|---|---|
| HE Capabilities | As defined in frame format HE Capabilities element. | As defined in 9.4.2.213 (HE Capabilities element) | Specifies the parameters within the HE Capabilities element that are supported by the MAC entity. The parameter is optionally present if dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |

### 6.3.8.3 MLME-REASSOCIATE.confirm

#### 6.3.8.3.2 Semantics of the service primitive

***Change the primitive parameters as follows (note that not all existing parameters in the baseline are shown):***

The primitive parameters are as follows:

MLME-REASSOCIATE.confirm(

...
HE Capabilities,

VendorSpecificInfo
)

***Insert the following entry to the unnumbered table in this subclause:***

| Name | Type | Valid range | Description |
|---|---|---|---|
| HE Capabilities | As defined in frame format HE Capabilities element. | As defined in 9.4.2.213 (HE Capabilities element) | Specifies the parameters within the HE Capabilities element that are supported by the MAC entity. The parameter is optionally present if dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |

### 6.3.11 Start

### 6.3.11.2 MLME-START.request

#### 6.3.11.2.2 Semantics of the service primitive

***Change the primitive parameters as follows (note that not all existing parameters in the baseline are shown):***

MLME-START.request(

...,
HE Capabilities,
HE Operation,
VendorSpecificInfo
)

***Insert the following entry to the unnumbered table in this subclause:***

| Name | Type | Valid range | Description |
|---|---|---|---|
| HE Capabilities | As defined in frame format HE Capabilities element. | As defined in 9.4.2.213 (HE Capabilities element) | Specifies the parameters within the HE Capabilities element that are supported by the MAC entity. The parameter is optionally present if dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |
| HE Operation | As defined in frame format HE Operation element. | As defined in 9.4.2.214 (HE Operation element) | The additional HE capabilities to be advertised for the BSS. The parameter is present if BSSType = INFRASTRUCTURE and dot11HighEfficiencyOptionImplemented is true; otherwise, this parameter is not present. |

# 9. Frame formats

## 9.2 MAC frame formats

### 9.2.4 Frame fields

#### 9.2.4.1 Frame Control field

#### 9.2.4.1.3 Type and Subtype fields

***Change the row below and insert a new row immediately after it in Table 9-1 (Valid type and subtype combinations) as follows:***

**Table 9-1—Valid type and subtype combinations**

| Type value B3 B2 | Type description | Subtype value B7 B6 B5 B4 | Subtype description |
|---|---|---|---|
| 01 | Control | 0000–~~0011~~<ANA> | Reserved |
| 01 | Control | <ANA> | Trigger |

#### 9.2.4.1.10 Order field

***Change this subclause as follows:***

The Order field is 1 bit in length. The setting of the Order field is as follows:

— It is set to 1 in a non-QoS Data frame transmitted by a non-QoS STA to indicate that the frame contains an MSDU, or fragment thereof, that is being transferred using the StrictlyOrdered service class.

— It is set to 1 in a QoS Data or Management frame transmitted with a value of HT_GF, HT_MF, VHT, HE or S1G for the FORMAT parameter of the TXVECTOR to indicate that the frame contains an HT Control field.

— It is set to 1 in an S1G RTS frame to indicate that the intended recipient of the frame has permission to extend the TXOP as described in 10.51.5.4 (Relay-shared TXOP protection mechanisms).

Otherwise, the Order field is set to 0.

NOTE—The Order field is always set to 0 for frames transmitted by a DMG STA.

#### 9.2.4.6 HT Control field

#### 9.2.4.6.1 General

***Remove Figure 9-7 (HT Control field).***

***Insert Table 9-1 as follows:***

**Table 9-9a—HT Control field**

| Variant | Bit 0 (value) | Bit 1 (value) | Bit 2-29 | Bit 30 | Bit 31 |
|---|---|---|---|---|---|
| HT variant | VHT (0) | HT Control Middle | | AC Constraint | RDG/More PPDU |
| VHT variant | VHT (1) | HE (0) | VHT Middle | AC Constraint | RDG/More PPDU |
| HE variant | VHT (1) | HE (1) | Aggregated Control | | |

***Change the paragraphs below of 9.2.4.6.1 as follows:***

The HT Control field has ~~two~~ different forms, the HT variant, and the VHT variant, and the HE variant. These forms differ in the values of the VHT and/or HE subfields and in their formats, which are shown in Table 9-9a (HT Control field). ~~The two forms differ in the format of the HT Control Middle subfield, described in 9.2.4.6.2 (HT variant) for the HT variant and in 9.2.4.6.3 (VHT variant) for the VHT variant and in the value of the VHT subfield.~~

The VHT subfield is set to 0 to indicate a HT variant HT Control field. The VHT subfield is set to 1 and the HE subfield is set to 0 to indicate a VHT variant HT Control field. The VHT subfield is set to 1 and the HE subfield is set to 1 to indicate a HE variant HE Control field.

The HT Control Middle subfield is defined in 8.2.4.6.2 (HT variant) and the VHT Control Middle subfield is defined in 8.2.4.6.3 (VHT variant).

The Aggregated Control subfield is defined in 8.2.4.6.4 (HE variant).

~~The VHT subfield of the HT Control field indicates whether the HT Control Middle subfield is the VHT Variant or the HT Variant. The VHT subfield is set to 1 to indicate that the HT Control Middle subfield is the VHT Variant and is set to 0 to indicate that the HT Control Middle subfield is the HT Variant.~~

### 9.2.4.6.3 VHT variant

***Change the paragraph below as follows:***

The format of the VHT Control Middle subfield of the VHT variant HT Control field is shown in Figure 9-12 (VHT Control Middle subfield of the VHT variant HT Control field).Insert the following after Figure 14 (MFB subfield in the VHT variant HT control field):

***Change Figure 9-12 as follows (remove Reserved field and change title):***

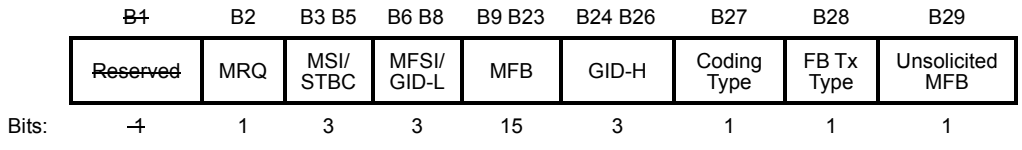


**Figure 9-12—VHT Control Middle subfield of the VHT variant HT Control field**

*Insert a new subclause 9.2.4.6.4 following 9.2.4.6.3:*

### 9.2.4.6.4 HE variant

#### 9.2.4.6.4.1 General

The format of the Aggregated Control (A-Control) subfield of the HE variant HT Control is shown in Figure 9-14a (A-Control subfield of the HE variant HT Control field).

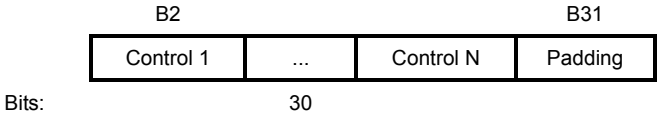


**Figure 9-14a—A-Control subfield of the HE variant HT Control field**

The A-Control subfield contains a sequence of one or more Control subfields. The format of each Control subfield is defined in Figure 9-14b (Control subfield format). The Control subfield with Control ID subfield equal to 0, if present, is the first subfield of the sequence.

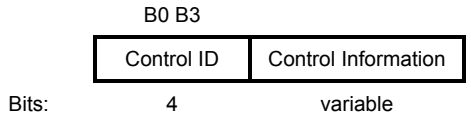


**Figure 9-14b—Control subfield format**

The Control ID subfield indicates the type of information carried in the Control Information subfield, and the length of the Control Information subfield, which is fixed and that corresponds to each value of the Control ID subfield. The values of the Control ID subfield and the associated length of the Control Information subfield are defined in Table 9-18a (Control ID subfield values).

**Table 9-18a—Control ID subfield values**

| Control ID value | Meaning | Length of the Control Information subfield (bits) | Content of the Control Information subfield |
|---|---|---|---|
| 0 | UL MU response scheduling | TBD | |
| 1 | Receive operation mode indication | TBD | |
| 2 | HE link adaptation | TBD | |
| TBD | ... | | |
| 8-15 | Reserved | | |

The Control Information subfield carries control information that depends on the Control ID value, as defined in Table 9-18a (Control ID subfield values).

The Padding subfield follows the last Control subfield and is set to a sequence of zeros so that the length of the A-Control subfield is 30 bits.

#### 9.2.4.6.4.2 UL MU response scheduling

The Control Information subfield, when the Control ID subfield is 0, contains scheduling information for an HE trigger-based PPDU that carries an immediate acknowledgment, which is sent as a response to the soliciting A-MPDU (see 25.5.2 (UL MU operation)).

The format of the Control Information subfield is defined in Figure 9-14c (Control Information subfield format when Control ID subfield is 0).

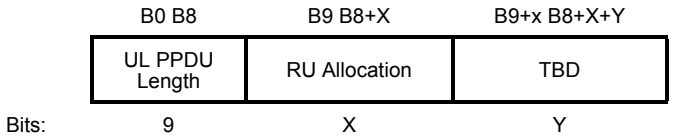


**Figure 9-14c—Control Information subfield format when Control ID subfield is 0**

The UL PPDU Length subfield indicates the length of the HE trigger-based PPDU response and is set to a nonzero value that is TBD.

The RU Allocation subfield indicates the resource unit (RU) assigned for transmitting the HE trigger-based PPDU response and is set to TBD.

#### 9.2.4.6.4.3 Receive operation mode indication

The Control Information subfield, when the Control ID subfield is 1, contains information related to the receive operation mode of the STA transmitting the frame containing this information (see 25.8 (Receive operating mode)).

The format of the Control Information subfield is defined in Figure 9-14d (Control Information subfield format when Control ID subfield is 1).

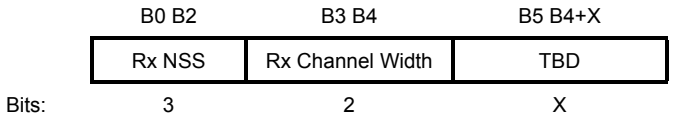


**Figure 9-14d—Control Information subfield format when Control ID subfield is 1**

The RX NSS subfield indicates the maximum number of spatial streams, $N_{SS}$, supported by the STA in reception, and is set to $N_{SS} - 1$.

The RX Channel Width subfield indicates the operating channel width supported by the STA in reception, and is set to 0 for 20 MHz, 1 for 40 MHz, 2 for 80 MHz, and 3 for 160 MHz.

#### 9.2.4.6.4.4 HE link adaptation

The Control Information subfield, when the Control ID subfield is 2, contains information related to the HE link adaptation procedure (see 9.31.4 (Link adaptation using the HE variant HT Control field)).

The format of the Control Information subfield is defined in Figure 9-14e (Control Information subfield format when Control ID subfield is 2).

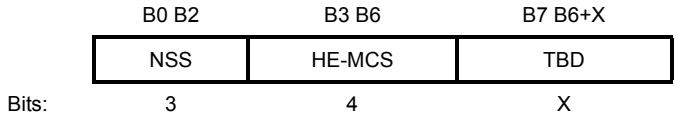


**Figure 9-14e—Control Information subfield format when Control ID subfield is 2**

The NSS subfield indicates the recommended number of spatial streams, $N_{SS}$, and is set to $N_{SS} - 1$.

The HE-MCS subfield indicates the recommended HE-MCS, and is set to the HE-MCS Index value (defined in 26.5 (Parameters for HE-MCSs)).

### 9.2.5 Duration/ID field (QoS STA)

#### 9.2.5.1 Setting for single and multiple protection under enhanced distributed channel access (EDCA)

***Change item a) of the 2nd paragraph in this subclause as follows:***

The Duration/ID field is determined as follows:

a) Single protection settings.

1) For an RTS frame that is not part of a dual clear-to-send (CTS) exchange and is not part of a BDT exchange(11ah), the Duration/ID field is set to the estimated time, in microseconds, required to transmit the pending frame, plus one CTS frame, plus one Ack or BlockAck frame if required, plus any NDPs required, plus explicit feedback if required, plus applicable IFSs.

1a) In an MU-RTS frame, the Duration/ID field is set to the estimated time, in microseconds, required for the pending transmission.

***Insert the two sentences as below under $T_{pending}$ of item 4) of item b):***

b) Multiple protection settings. The Duration/ID field is set to a value D as follows:

4) Else $T_{END-NAV} - T_{PPDU} \le D \le T_{TXOP-REMAINING} - T_{PPDU}$

where

$T_{SINGLE\text{-}MSDU}$ is the estimated time required for the transmission of the allowed frame exchange sequence defined in 10.22.2.8 (TXOP limits) (for a TXOP limit of 0), including applicable IFS durations

$T_{PENDING}$ is the estimated time required for the transmission of

—Pending MPDUs of the same AC

—Any associated immediate response frames

—Any HT NDP, VHT NDP, or Beamforming Report Poll frame transmissions and explicit feedback response frames

—Applicable IFSs

—Any RDG

—Any pending QoS Null frame exchanges by paged STAs(11ah)

—Any pending PS-Poll or NDP PS-Poll frame exchanges by paged STAs(11ah)

—Any DL MU PPDUs

—Any HE trigger-based PPDUs

—Any Trigger frames to solicit HE trigger-based PPDUs

$T_{TXOP}$ is the duration given by dot11EDCATableTXOPLimit (dot11QAPEDCATableTXOPLimit for the AP) for that AC

$T_{TXOP-REMAINING}$ is $T_{TXOP}$ less the time already used time within the TXOP

$T_{END-NAV}$ is the remaining duration of any NAV set by the TXOP holder, or 0 if no NAV has been established

$T_{PPDU}$ is the time required for transmission of the current PPDU

#### 9.2.5.7 Setting for control response frames

***Insert a new paragraph after the 2nd paragraph of this subclause:***

In a CTS frame that is transmitted in response to an MU-RTS frame, the Duration/ID field is set to the value obtained from the Duration/ID field of the MU-RTS frame that elicited the CTS frame minus the time, in microseconds, between the end of the PPDU carrying the MU-RTS frame and the end of the PPDU carrying the CTS frame.

## 9.3 Format of individual frame types

### 9.3.1 Control frames

#### 9.3.1.3 CTS frame format

***Change the 2nd paragraph of this subclause as follows:***

When the CTS frame is a response to an RTS frame, the value of the RA field of the CTS frame is set to the address from the TA field of the RTS frame with the Individual/Group bit forced to the value 0. When the CTS frame is a response to an MU-RTS frame, the value of the RA field of the CTS frame is set to the address from the TA field of the MU-RTS frame with the Individual/Group bit forced to the value 0.

#### 9.3.1.9 BlockAck frame format

***Change Figure 9-32 as follows:***

| | B0 | B1 | B2 | B3 | B4 | ~~B4~~B5 B11 | B12 B15 |
|---|---|---|---|---|---|---|---|
| | BA Ack Policy | Multi-TID | Compressed Bitmap | GCR | Multi STA | Reserved | TID_INFO |
| Bits: | 1 | 1 | 1 | 1 | 1 | ~~8~~7 | 4 |

**Figure 9-32—BA Control field**

***Change the 6th paragraph of this subclause as follows:***

For BlockAck frames sent under Delayed and HT-delayed agreements, the BA Ack Policy subfield of the BA Control field has the meaning shown in Table 9-23 (BA Ack Policy subfield). For BlockAck frames sent under other types of agreement, the BA Ack Policy subfield is reserved. A BlockAck frame with the Multi-STA subfield equal to 1 is not sent under Delayed and HT-delayed agreements.

***Change Table 9-24 as follows:***

**Table 9-24—BlockAck frame variant encoding**

| Multi-TID subfield value | Compressed Bitmap subfield value | GCR subfield value | Multi-STA subfield value | BlockAck frame variant |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Basic BlockAck |
| 0 | 1 | 0 | 0 | Compressed BlockAck |
| 1 | 0 | 0 | 0 | Extended Compressed BlockAck |
| 1 | 1 | 0 | 0 | Multi-TID BlockAck |
| 0 | 0 | 1 | 0 | Reserved |
| 0 | 1 | 1 | 0 | GCR BlockAck |
| 1 | 0 | 1 | 0 | Reserved |
| 1 | 1 | 1 | 0 | Reserved |
| 0 | 0 | 0 | 1 | Reserved |
| 1 | 0 | 0 | 1 | Reserved |
| 1 | 1 | 0 | 1 | Multi-STA BlockAck |
| 0 | 0 | 1 | 1 | Reserved |
| 0 | 1 | 1 | 1 | Reserved |
| 1 | 0 | 1 | 1 | Reserved |
| 1 | 1 | 1 | 1 | Reserved |

***Change the 7th paragraph of this subclause as follows:***

The values of the Multi-TID, Compressed Bitmap, ~~and~~ GCR and Multi-STA subfields of the BA Control field determine which of the BlockAck frame variants is represented, as indicated in the Table 9-24 (Block-Ack frame variant encoding).

### 9.3.1.9.3 Compressed BlockAck variant

***Change subclause 9.3.1.9.3 as follows:***

The TID_INFO subfield of the BA Control field of the Compressed BlockAck frame contains the TID for which this BlockAck frame is sent.

The BA Information field of the Compressed BlockAck frame comprises the Block Ack Starting Sequence Control subfield and the Block Ack Bitmap subfield, as shown in Figure 9-34 (BA Information field (Compressed BlockAck)). The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield contains the sequence number of the first MSDU or A-MSDU for which this BlockAck frame is sent. The value of this subfield is defined in 10.24.7.5 (Generation and transmission of BlockAck frames by an HT STA or DMG STA). ~~The Fragment Number subfield of the Block Ack Starting Sequence Control subfield is set to 0.~~

When the Fragment Number subfield is 0, the ~~The~~ Block Ack Bitmap subfield of the BA Information field of the Compressed BlockAck frame is 8 octets in length and is used to indicate the received status of up to 64 MSDUs and A-MSDUs. Each bit that is equal to 1 in the compressed Block Ack Bitmap field acknowledges the successful reception of a single MSDU or A-MSDU in the order of sequence number, with the first bit of the Block Ack Bitmap field corresponding to the MSDU or A-MSDU with the sequence number that matches the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield.

When the Fragment Number subfield is 1, the Block Ack Bitmap subfield of the BA Information field of the Compressed BlockAck frame is used to indicate the receive status of up to 16 MSDUs and A-MSDUs. Bit position n of the Block Ack Bitmap field, if equal to 1, acknowledges receipt of an MPDU with sequence number value, SN and fragment number value, FN with n equal to 4 × (SN – SSN) + FN, where SSN is the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield and the operations on the sequence numbers are performed modulo 4096. When bit position n of the Block Ack Bitmap field is equal to 0 it indicates that the MPDU has not been received.

NOTE—When the Fragment Number subfield is equal to 1 then the BlockAck Bitmap field is split into 16 subbitmaps, each of which indicates receive status for 4 fragments of each of the 16 MSDUs.

***Insert a new subclause after 9.3.1.9.6:***

### 9.3.1.9.7 Multi-STA BlockAck variant

The TID_INFO subfield of the BA Control field of the Multi-STA BlockAck frame is reserved.

The BA Information field of the Multi-STA BlockAck frame comprises one or more instances of the Per STA Info subfields. The Per STA Info subfield is shown in Figure 9-37a (Per STA Info subfield format).

| | Per AID TID Info | Block Ack Starting Sequence Control | Block Ack Bitmap |
|---|---|---|---|
| Octets | 2 | 0 or 2 | 0 or 8 |

**Figure 9-37a—Per STA Info subfield format**

The Per AID TID Info subfield is shown in Figure 9-37b (Per AID TID Info subfield format).

| | B0 B10 | B11 | B12 B15 |
|---|---|---|---|
| | AID | ACK Type | TID |
| Bits: | 11 | 1 | 4 |

**Figure 9-37b—Per AID TID Info subfield format**

The AID field carries the AID of the STA for which the Per STA Info field is intended.

The TID field contains the TID for which the acknowledgement or block acknowledgement applies.

If the ACK Type field is 0, then the Block Ack Starting Sequence Control and Block Ack Bitmap are not present and the Per STA Info field indicates the acknowledgement of successful reception of either a single MPDU or of all the MPDUs carried in the eliciting (A-) MPDU. If the ACK Type subfield is 1, then the Block Ack Starting Sequence Control and Block Ack Bitmap fields are present.

When the Fragment Number subfield is 1, the Block Ack Starting Sequence Control subfield is as shown in Figure 9-27. The Block Ack Bitmap subfield of the BA Information field of the Multi-STA BlockAck frame contains an 8-octet block ack bitmap. Each bit that is equal to 1 in the Block Ack Bitmap subfield acknowledges the successful reception of a single MSDU or A-MSDU in the order of sequence number with the first bit of the Block Ack Bitmap subfield corresponding to the MSDU or A-MSDU with the sequence number that matches the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield.

When the Fragment Number subfield is 1, the Block Ack Bitmap subfield of the BA Information field of the Multi-STA Block Ack frame is used to indicate the receive status of up to 16 MSDUs and A-MSDUs. Bit position n of the Block Ack Bitmap field, if equal to 1, acknowledges receipt of an MPDU with sequence number value, *SN* and fragment number value, *FN* with *n* equal to $4 \times (SN - SSN) + FN$, where SSN is the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield and the operations on the sequence numbers are performed modulo 4096. When bit position n of the Block Ack Bitmap field is equal to 0 it indicates that the MPDU has not been received.

NOTE—When the Fragment Number subfield is equal to 1 then the BlockAck Bitmap field is split into 16 subbitmaps, each of which indicates receive status for 4 fragments of each of the 16 MSDUs.

***Insert a new subclause after 9.3.1.22:***

### 9.3.1.23 Trigger frame format

The Trigger frame is used to allocate resource for UL MU transmission and to solicit an UL MU transmission at [TBD IFS] after the PPDU that carries the Trigger frame. The Trigger frame also carries other information required by the responding STA to send UL MU.

The frame format for the Trigger frame is as defined in Figure 9-51a (Trigger frame).

| | Frame Control | Duration | (RA) | TA | Common Info | Per User Info | ... | Per User Info | Padding | FCS |
|---|---|---|---|---|---|---|---|---|---|---|
| Octets: | 2 | 2 | 6 | 6 | TBD | TBD | | TBD | | 4 |

**Figure 9-51a—Trigger frame**

The Duration/ID field is set as defined in 9.2.5 (Duration/ID field (QoS STA)).

The RA field of the Trigger frame is the address of the recipient STA. Whether RA is not part of Trigger frame is TBD.

The TA field value is the address of the STA transmitting the Trigger frame.

The Common Info field is defined in Figure 9-51b (Common Info field).

| | Length | Cascade Indication | CS Required | HE-SIG-A Info | CP and LTF Type | Trigger Type | Trigger Dependent Common Info |
|---|---|---|---|---|---|---|---|
| Bits: | 12 | 1 | 1 | TBD | TBD | TBD | variable |

**Figure 9-51b—Common Info field**

The Length subfield of the Common Info field indicates the value of the L-SIG Length field of the HE trigger-based PPDU that is the response to the Trigger frame.

If the Cascade Indication subfield is 1, then a subsequent Trigger frame follows the current Trigger frame. Otherwise the Cascade Indication subfield is 0.

The CS Required subfield is set to 1 to indicate that the STAs identified in the Per User Info fields are required to use ED to sense the medium and to consider the medium state and the NAV in determining whether or not to repond. The CS Requred subfield is set to 0 to indicate that the STAs identified in the Per User Info fields are not required consider the medium state or the NAV in determining whether or not to respond.

The HE-SIG-A Info subfield of the Common Info field indicates the content of the HE-SIG-A field of the HE trigger-based PPDU response. The TBD bits in HE-SIG-A of the HE trigger-based PPDU that may be implicitly known by all responding STAs can be excluded.

The CP and LTF Type subfield of the Common Info field indicates the CP and HE-LTF type of the HE trigger-based PPDU response. The CP and LTF field encoding is defined in Table 9-ax1 (CP and LTF field encoding).

**Table 9-ax1—CP and LTF field encoding**

| CP and LTF field value | Description |
|---|---|
| 0 | 2x LTF + 0.8 μs CP |
| 1 | 2x LTF + 1.6 μs CP |
| 2 | 4x LTF + 3.2μs CP |
| 3-TBD | Reserved |

The Trigger Type subfield indicates the type of the Trigger frame. The Trigger frame can include an optional type-specific Common Info and optional type-specific Per User Info. Table 9-ax2 (Trigger Type field encoding) defines the valid Trigger Type.

**Table 9-ax2—Trigger Type field encoding**

| Trigger Type field value | Description |
|---|---|
| 0 | Basic Trigger |
| 1 | Beamforming Report Poll Trigger |
| 2 | MU-BAR |
| 3 | MU-RTS |
| 4-TBD | Reserved |

The Per User Info field is defined in Figure 9-51c (Per User Info field).

| | User Identifier | RU Allocation | Coding Type | MCS | DCM | SS Allocation | Trigger Dependent Per User Info |
|---|---|---|---|---|---|---|---|
| Bits: | 12 | TBD | TBD | TBD | TBD | TBD | variable |

**Figure 9-51c—Per User Info field**

The User Identifier subfield of the Per User Info field indicates the AID of the STA allocated the RU to transmit the MPDU(s) in the HE trigger-based PPDU.

The RU Allocation subfield of the Per User Info field indicates the RU used by the HE trigger-based PPDU of the STA identified by User Identifier subfield. The length and coding of RU Allocation subfield are TBD.

The Coding Type subfield of the Per User Info field indicates the code type of the HE trigger-based PPDU response of the STA identified by User Identifier subfield. Set to 0 for BCC and set to 1 for LDPC.

The MCS subfield of the Per User Info field indicates the MCS of the HE trigger-based PPDU response of the STA identified by User Identifier field. The encoding of the MCS field is as defined in Section XXX.

The DCM subfield of the Per User Info field indicates dual carrier modulation of the HE trigger-based PPDU response of the STA identified by User Identifier subfield. A value of 1 indicates that the HE trigger-based PPDU response shall use DCM as defined in section XXX. Set to 0 to indicate that DCM shall not be used.

The SS Allocation subfield of the Per User Info field indicates the spatial streams of the HE trigger-based PPDU response of the STA identified by User Identifier field.

The Padding field extends the frame length to give the recipient STAs more time to prepare a response. The length and the content of Padding field are TBD.

#### 9.3.1.23.1 MU-BAR variant

If the Trigger frame is an MU-BAR variant, then the Trigger Dependent Common Info field is define in Figure 9-51d (Trigger Dependent Common Info field for MU-BAR variant).

| | User Identifier | RU Allocation | Coding Type | MCS | DCM | SS Allocation | Trigger Dependent Per User Info |
|---|---|---|---|---|---|---|---|
| Bits: | 12 | TBD | TBD | TBD | TBD | TBD | variable |

**Figure 9-51d—Trigger Dependent Common Info field for MU-BAR variant**

If the Trigger frame is an MU-BAR variant, then the Trigger-dependent Per User Info field is define in Figure 9-14e (Control Information subfield format when Control ID subfield is 2).

| | BAR Control | BAR Information |
|---|---|---|
| Bits: | | |

**Figure 9-51e—Trigger Dependent Common Info field for MU-BAR variant**

The BAR Control subfield is defined in 9.3.1.8 (BlockAckReq frame format).

The BAR Information subfield is defined in 9.3.1.8 (BlockAckReq frame format).

#### 9.3.1.23.2 MU-RTS variant

The MU-RTS frame format is a variant of Trigger frame format as shown in Figure 9-51a (Trigger frame).

If an MU-RTS frame requests a STA to respond with a CTS frame carried in a non-HT or non-HT duplicate PPDU, the RU Allocation subfield in the Per-User Info field addressed to the STA indicates whether the CTS frame is transmitted on the primary 20 MHz channel, primary 40 MHz channel, primary 80 MHz channel, 160 MHz channel, or 80+80 MHz channel.

The Duration/ID field is defined in 9.2.5.2 Duration/ID field (QoS STA).

### 9.3.2 Data frames

### 9.3.3 Management frames

#### 9.3.3.1 Beacon frame format

***Insert the following new rows (header row shown for convenience) into Table 9-27 (Beacon frame body):***

**Table 9-27—Beacon frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | TWT | The TWT element is optionally present when the dot11TWTOptionActivated is true; otherwise it is not present. |

#### 9.3.3.5 Association Request frame format

***Insert the following new rows (header row shown for convenience) into Table 9-29 (Association Request frame body):***

**Table 9-29—Association Request frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

### 9.3.3.6 Association Response frame format

***Insert the following new rows (header row shown for convenience) into Table 9-30 (Association Response frame body):***

**Table 9-30—Association Response frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

### 9.3.3.7 Reassociation Request frame format

***Insert the following new rows (header row shown for convenience) into Table 9-31 (Reassociation Request frame body):***

**Table 9-31—Reassociation Request frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

### 9.3.3.8 Reassociation Response frame format

***Insert the following new rows (header row shown for convenience) into Table 9-32 (Reassociation Response frame body):***

**Table 9-32—Reassociation Response frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

#### 9.3.3.9 Probe Request frame format

***Insert the following new rows (header row shown for convenience) into Table 9-33 (Probe Request frame body):***

**Table 9-33—Probe Request frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

#### 9.3.3.10 Probe Response frame format

***Insert the following new rows (header row shown for convenience) into Table 9-34 (Probe Response frame body):***

**Table 9-34—Probe Response frame body**

| Order | Information | Notes |
|---|---|---|
| TBD | HE Capabilities | The HE Capabilities element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when the dot11HEOptionImplemented is true; otherwise it is not present. |

## 9.4 Management and Extension frame body components

### 9.4.1 Fields that are not elements

***Insert the following two subclauses:***

#### 9.4.1.62 HE Compressed Beamforming Report field

The format of the HE Compressed Beamforming Report field is based on the VHT Compressed Beamforming Report field in 9.4.1.48 (VHT Compressed Beamforming Report field) except for the following modifications.

The supported values for the tone grouping factor *Ng* shall be *Ng* = 4 and *Ng* = 16 for SU-MIMO, MU-MIMO and OFDMA. Here, the tone grouping factor *Ng* is defined with respect to data tones of the HE PPDU.

Other modification are TBD.

### 9.4.1.63 HE MU Exclusive Beamforming Report field

The HE MU Exclusive Beamforming Report Field is based on the VHT Exclusive Beamforming Report Field in 9.4.1.50, except for the following modifications.

The MU Exclusive Beamforming Report information consists of Delta SNR subfields for each space-time stream (1 to *Nc*) of a subset of the subcarriers spaced *Ng* apart (where *Ng* is the tone grouping factor). Specifically, the locations of the feedback tones for delta SNR subfields shall be identical to the tone locations of the compressed V matrices fed back.

Other modification are TBD.

## 9.4.2 Elements

### 9.4.2.1 General

***Insert the following new rows into Table 9-75 Element IDs (header row shown for convenience)::***

**Table 9-74—Element IDs**

| Element | Element ID | Element ID Extension | Extensible |
|---|---|---|---|
| HE Capabilities (see 9.4.2.213 (HE Capabilities element)) | <ANA> | N/A | Yes |
| HE Operation (see 9.4.2.214 (HE Operation element)) | <ANA> | N/A | Yes |

### 9.4.2.196 TWT element

***Change as Figure 9-577ax (Control field format) follows.***

| | B1 | B2 | B3 | ~~B3~~B4 B8 |
|---|---|---|---|---|
| | NDP Paging Indicator | Responder PM Mode | Broadcast | Reserved |
| Bits: | 1 | 1 | 1 | ~~6~~5 |

**Figure 9-577ax—Control field format**

***Insert the following paragraph after Table 9-248l (TWT Setup Command field values):***

The Broadcast field indicates if the TWT SP indicated by the TWT element is a broadcast TWT as defined in 9.44.3 (Broadcast TWT Operation). The Broadcast field is set to 1 to indicate that the TWT(s) defined by the TWT element are broadcast TWT(s); otherwise, it is set to 0.

***Change Figure 9-577ay (Request Type field format) as follows (B4 from "Reserved" to "Trigger").***

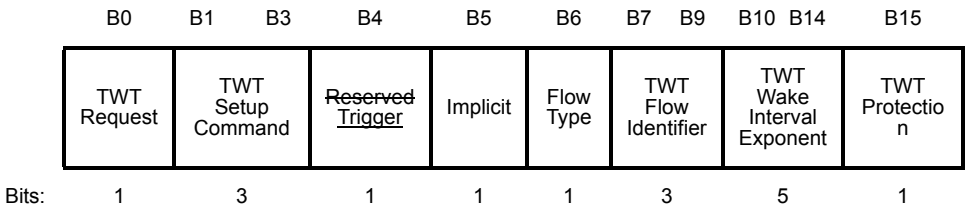


**Figure 9-577ay—Request Type field format**

***Insert the following paragraph after Table 9-248l (TWT Setup Command field values):***

The Trigger field indicates if the TWT SP indicated by the TWT element includes Trigger frames as defined in 10.44 (Target wake time (TWT)). The Trigger field is set to 1 to indicate that at least one Trigger frame is transmitted during the TWT SP. The Trigger field is set to 0 otherwise.

***Change the text as shown in subclause 9.4.2.196 TWT element:***

For a TWT SP that is not a broadcast TWT SP, the ~~The~~ TWT Flow Identifier subfield contains a 3-bit value which identifies the specific information for this TWT request uniquely from other requests made between the same TWT requesting STA and TWT responding STA pair. For a TWT SP that is a broadcast TWT SP, the TWT Flow Identifier subfield contains a value that indicates recommendations on the types of frames that are transmitted during the broadcast TWT SP, encoded according to Table 9-248l1 (TWT Flow Identifier field for a broadcast TWT element).

***Insert a new table as follows:***

**Table 9-248l1—TWT Flow Identifier field for a broadcast TWT element**

| TWT Flow Identifier field value | Description when transmitted in a broadcast TWT element |
|---|---|
| 0 | No constraints on the frames transmitted during a broadcast TWT SP. |
| 1 | Frames transmitted during a broadcast TWT SP are recommended to be limited to: PS-Poll, CQI, QoS Null with buffer status, Sounding Feedback, Management Action<br>Trigger frames transmitted by the AP during the broadcast TWT SP do not contain RUs for random access. |
| 2 | Frames transmitted during a broadcast TWT SP are recommended to be limited to: PS-Poll, CQI, QoS Null with buffer status, Sounding Feedback, Management Action, (Re)Association Request<br>Trigger frames transmitted by the AP during the broadcast TWT SP contain at least one RU for random access. |
| 3-7 | Reserved |

***Change the paragraph below as follows:***

In a TWT element transmitted by a TWT requesting STA, the TWT wake interval is equal to the average time that the TWT requesting STA expects to elapse between successive TWT SPs. In a TWT element transmitted by a TWT responding STA, the TWT wake interval is equal to the average time that the TWT-responding STA expects to elapse between successive TWT SPs. In a TWT element contained in a TWT request/response that is sent to negotiate the wake intervals for beacon frames containing broadcast TWT, the TWT wake interval indicates the value of the listen interval (see 10.44.3.4 (Negotiation of TBTT and listen interval).

The TWT Wake Interval Exponent subfield is set to the value of the exponent of the TWT wake interval value in microseconds, base 2. The TWT wake interval of the requesting STA is equal to (TWT Wake Interval Mantissa) × 2^(TWT Wake Interval Exponent).

***Change the paragraph below as follows:***

When transmitted by a TWT requesting STA or a TWT scheduled STA, the Target Wake Time field contains a positive integer which corresponds to a TSF time at which the STA requests to wake, or a value of zero when the TWT Setup Command subfield contains the value corresponding to the command "Request TWT". When a TWT responding STA or a TWT scheduling STA with dot11TWTGroupingSupport equal to 0 transmits a TWT element to the TWT requesting STA, the TWT element contains a value in the Target Wake Time field which corresponds to a TSF time at which the TWT responding STA requests the TWT requesting STA or TWT scheduled STA to wake and it does not contain the TWT Group Assignment field.

*Change Table 9-248l - TWT Setup Command field values by adding two new columns as shown:*

**Table 9-248l—TWT Setup Command field values**

| TWT Setup Command field value | Command name | Description when transmitted by a TWT requesting STA | Description when transmitted by a TWT responding STA | Description when transmitted by a TWT scheduled STA | Description when transmitted by a TWT scheduling STA |
|---|---|---|---|---|---|
| 0 | Request TWT | The Target Wake Time field of the TWT element contains 0s as the TWT responding STA specifies the target wake time value for this case, other TWT parameters* are suggested by the TWT requesting STA in the TWT request. | N/A | The Target Wake Time field of the TWT element contains 0s as the TWT scheduling STA specifies the target wake time value for this case, other TWT parameters* are suggested by the TWT scheduled STA in the TWT request. | N/A |
| 1 | Suggest TWT | TWT requesting STA includes a set of TWT parameters such that if the requested target wake time value and/or other TWT parameters cannot be accommodated, then the TWT setup might still be accepted. | N/A | | N/A |
| 2 | Demand TWT | TWT requesting STA includes a set of TWT parameters such that if the requested target wake time value and/or other TWT parameters cannot be accommodated, then the TWT setup will be rejected. | N/A | | N/A |
| 3 | TWT Grouping | N/A | TWT responding STA suggests TWT group parameters that are different from the suggested or demanded TWT parameters of the TWT requesting STA | N/A | N/A |

**Table 9-248l—TWT Setup Command field values *(continued)***

| | | | | | |
|---|---|---|---|---|---|
| 4 | Accept TWT | N/A | TWT responding STA accepts the TWT request with the TWT parameters (See NOTE) indicated in the TWT element transmitted by the responding STA | N/A | TWT scheduling STA accepts the TWT request with the TWT parameters* indicated in the TWT element transmtted by the TWT scheduled STA. |
| 5 | Alternate TWT | N/A | TWT responding STA suggests TWT parameters that are different from TWT requesting STA suggested or demanded TWT parameters | N/A | N/A |
| 6 | Dictate TWT | N/A | TWT responding STA demands TWT parameters that are different from TWT requesting STA TWT suggested or demanded parameters | N/A | |
| 7 | Reject TWT | N/A | TWT responding STA rejects TWT setup | N/A | TWT scheduling STA rejects TWT setup |

NOTE—TWT Parameters are: TWT, Nominal Minimum Wake Duration, TWT Wake Interval and TWT Channel sub-field values indicated in the element.

***Insert the following new subclauses after the last subclause in 9.4.2:***

### 9.4.2.213 HE Capabilities element

An HE STA declares that it is an HE STA by transmitting the HE Capabilities element.

The HE Capabilities element contains a number of fields that are used to advertise the HE capabilities of an HE STA. The HE Capabilities element is defined in Figure 9-ax1 (HE Capabilities element format)..

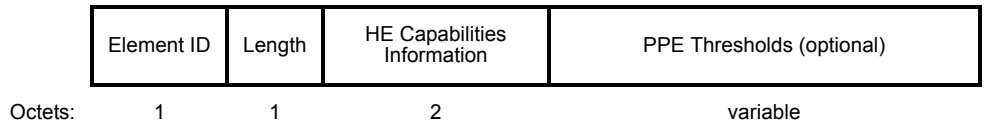


**Figure 9-ax1—HE Capabilities element format**

The Element ID and Length fields are defined in 9.4.2.1 (General).

The format of the HE Capabilities Information field is defined in Figure 9-554ab (HE Capabilities field format).

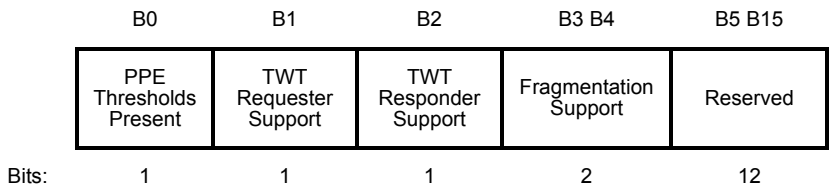


**Figure 9-ax2—HE Capabilities Information field format**

The PPE Thresholds Present field indicates if the HE PPE Thresholds field is present or not. A value of 1 in this field means that the PPE Thresholds field is present. A value of 0 in this field means that the HE PPE Thresholds field is not present because no packet extension is ever required for the STA transmitting this field.

The TWT Requester Support field indicates support by an HE STA for the role of TWT requesting STA as described in 10.44 (Target wake time (TWT)). The field is set to 1 if dot11TWTOptionActivated is true, the STA is an HE STA and the STA supports TWT requester STA functionality (see 10.44 (Target wake time (TWT))). Set to 0 otherwise.

The TWT Responder Support field indicates support by an HE STA for the role of TWT responder STA as described in 10.44 (Target wake time (TWT)). The field is set to 1 if dot11TWTOptionActivated is true, the STA is an HE STA and the STA supports TWT responder STA functionality (see 10.44 (Target wake time (TWT))). Set to 0 otherwise.

The Fragmentation Support field indicates the level of HE fragmentation that is supported by a STA. The encoding of this field is described in Table 9-ax13 (Fragmentation Support field encoding).

**Table 9-ax13—Fragmentation Support field encoding**

| Fragmentation Support field value | Meaning |
|---|---|
| 0 | No support for HE Fragmentation |
| 1 | Support for fragments that are contained within a VHT single MPDU, no support for fragments within an A-MPDU |
| 2 | Support for up to one fragment per MSDU within a single A-MPDU |
| 3 | Support for multiple fragments per MSDU within an A-MPDU |

The format of the PPE Thresholds field is defined in Table 9-ax3 (PPE Thresholds field format).

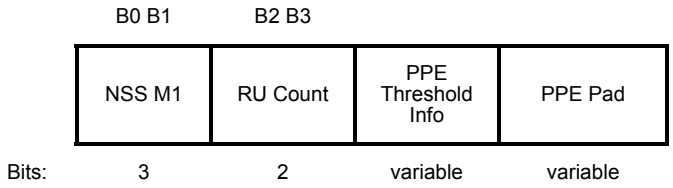


**Figure 9-ax3—PPE Thresholds field format**

The NSS M1 subfield contains an unsigned integer that is equal to the number of NSS values minus one for which PPE threshold information is included in the PPE Thresholds field. For example, if the number of NSS values represented is 4, then the NSS M1 subfield contains the value 3.

The RU Count subfield contains an unsigned integer that is equal to the number of RU allocation values for which HE PPE threshold information is included in the PPE Thresholds field. The value of zero for this field is reserved. The value of three for this field is reserved.

The PPE Threshold Info field is (NSS M1 + 1) x RU Count x 6 bits in length. The format of the PPE Threshold Info field is defined in Table 9-ax4 (PPE Thresholds Info field format).

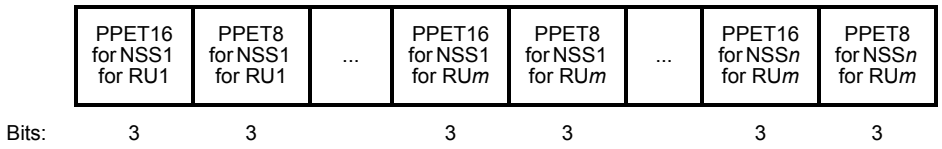


**Figure 9-ax4—PPE Thresholds Info field format**

Each PPET8 for NSS*n* for RU*m* subfield contains a Constellation Index value.

Each PPET16 for NSS*n* for RU*m* subfield contains a Constellation Index value.

All the PPET8 for NSS*n* for RU*m* subfield and PPET16 for NSS*n* for RU*m* subfield values are combined to encode the minimum duration of the post-FEC padding and packet extension for HE PPDUs that are transmitted to the STA sending this field, for each value of NSS and RU specified by the field and implicitly, for

values of NSS and RU not explicitly indicated in the field. The encoding is described in Table 9-ax14 (PPET8 and PPET16 encoding).

**Table 9-ax14—PPET8 and PPET16 encoding**

| Result of comparison of the constellation index x of an HE PPDU with NSS value n and RU value m to the value in the PPET8 for NSS*n* for RU*m* subfield | Result of comparison of the constellation index of an HE PPDU with NSS value n and RU value m to the value in the PPET16 for NSS*n* for RU*m* subfield | Combined minimum total duration of the post-FEC padding and packet extension requirement for an HE PPDU transmitted to this STA using the constellation index = x, NSS = *n* and RU = *m* |
|---|---|---|
| X < PPET8 or PPET8 == NONE | X < PPET16 or PPET16 == NONE | 0 μs |
| X > PPET8 | X < PPET16 or PPET16 == NONE | 8 μs |
| X > PPET8 or PPET8 == NONE | X > PPET16 | 16 μs |
| PPET8 == NONE | PPET16 == NONE | 0 |
| PPET8 not present | PPET16 not present | 0 |

The RU Allocation Index encoding is indicated in Table 9-ax15 (RU Allocation Index encoding).

**Table 9-ax15—RU Allocation Index encoding**

| RU Allocation Index value | RU allocation value |
|---|---|
| 0 | 2x996 |
| 1 | 996 |
| 2 | 484 |
| 3 | 242 |

The Constellation Index encoding is indicated in Table 9-554ah (Constellation Index encoding).

**Table 9-ax16—Constellation Index encoding**

| Constellation Index value | Corresponding Transmission Constellation |
|---|---|
| 0 | BPSK |
| 1 | QPSK |
| 2 | 16-QAM |
| 3 | 64-QAM |
| 4 | 256-QAM |
| 5 | 1024-QAM |
| 6 | Reserved |
| 7 | None |

The PPE Pad field contains all zeros. The number of bits in the PPE Pad field is the number of bits required to round the length of the PPE Thresholds field up to the next integer quantity of octets.

STA that declare support for HE trigger-based PPDU shall also declare whether they belong to class A or class B. Class A STAs that are high capability devices and Class B STAs are low capability devices.

### 9.4.2.214 HE Operation element

The operation of HE STAs in an HE BSS is controlled by the HT Operation element, the VHT Operation element and the HE Operation element. The format of the HE Operation element is defined in Figure 9-ax5 (HE Operation element format).

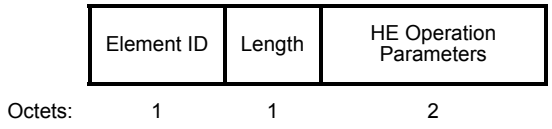


**Figure 9-ax5—HE Operation element format**

The Element ID and Length fields are defined in 9.4.2.1 (General).

The format of the HE Operation Parameters field is defined in Figure 9-ax6 (HE Operation Parameter field format).

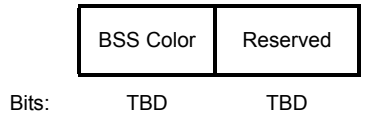


**Figure 9-ax6—HE Operation Parameter field format**

The BSS Color field is an unsigned integer whose value is the BSS Color of the BSS corresponding to the AP which transmitted this element, except that a value of 0 in this field indicates that there is no BSS Color for this BSS.

## 9.7 Aggregate MPDU (A-MPDU)

### 9.7.3 A-MPDU contents

***Change the 1st paragraph of this subclause as follows:***

In a non-DMG PPDU, an A-MPDU is a sequence of A-MPDU subframes carried in a single PPDU with one of the following combinations of RXVECTOR or TXVECTOR parameter values:

- The FORMAT parameter set to VHT
- The FORMAT parameter set to HT_MF or HT_GF and the AGGREGATION parameter set to 1
- The FORMAT parameter set to S1G, S1G_DUP_1M, or S1G_DUP_2M and the AGGREGATION parameter set to 1(11ah)
- The FORMAT parameter set to HE_SU, HE_MU, HE_TRIG or HE_EXT

***Insert the following paragraph:***

An A-MPDU carried in a HE MU PPDU may include MPDUs with different values of the TID field. Additional rules are TBD.