IEEE P802.11
Wireless LANs

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| **TGbe D1.0 Comment Resolutions****for A-MPDU in EHT PPDU** |
| **Date:** 2021-11-30 |

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Abstract

This submission proposes resolutions for a comment on TGbe D1.0 regarding A-MPDU with the following CID (1 **CID**):

* 4295

Revisions:

- Rev 0: Initial version of the document.

- Rev 1: Add CID number in the proposed texts and make correct some typos.

- Rev 2: modified some typos and editor notes.

- Rev 3: Update resolutions based on comments of Liwen Chu, Jeongki Kim, and Yongho Seok.

 + Update a resolution in 10.12.7 Setting the EOF/Tag field of the MPDU delimiter

 + Edit the texts based on 11be D1.4 and REVme D1.0

 + Remove a paragraph on the case of 2.4 GHz in 35.X.1

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 TGbe Draft. This introduction is not part of the adopted material.

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

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 4295 | 9.7 | Add EHT classifiers in the appropriate locations for the PPDU carrying A-MPDUs (references relative to TGax 8.0). Same consideration for clause 10.12. | As in comment. | **Revised**Agree with the comment.The rules of baseline can be applied to EHT PPDU.And a new field is added as follows; since the maximum length of A-MPDU pre-EOF padding in an EHT PPDU is larger than the maximum length of A-MPDU pre-EOF padding in an HE PPDU, a new field named Maximum A-MPDU Length Exponent Extension is suggested in the EHT MAC Capabilities element. The specific value is described in new section 35.x (A-MPDU operation in an EHT PPDU).**TGbe editor, please make changes as shown in doc 11-21/1761r3 tagged as CID 4295** |

**Discussion:**

|  |  |  |
| --- | --- | --- |
|  | **HE PPDU** | **EHT PPDU** |
| **The maximum length of an A-MPDU pre-EOF padding** | **6 500 631 octets** | **15 523 200 octets** |
| **The Maximum A-MPDU Length Exponent Extension subfield** | **2 bits**(In case of sending VHT and HE capabilities elements, the value sets to)* 0: 1 048 573 octets
* 1: 2 097 151 octets
* 2: 4 194 303 octets
* 3: 6 500 631 octets (based on the below function, but originally 8 388 607)

$$min\left(2^{\left(20+α\right)}-1, 6 500 631\right)$$$α: Maximum A-MPDU Length Exponent Extension$ in HE Capabilities element.\*The Maximum A-MPDU Length Exponent subfield in VHT Capabilites element sets to 7 | **(suggestion) 1 bit**(In case of sending VHT, HE, and EHT capabilities elements, the value sets to)* 0: 8 388 607 octets
* 1: 15 523 200 octets (based on the below function, but originally 16 777 215)

$$min\left(2^{\left(23+α\right)}-1, 15 523 200\right)$$$α: Maximum A-MPDU Length Exponent Extension$ in EHT Capabilities element.\*The Maximum A-MPDU Length Exponent Exponent subfield in HE Capabilites element sets to 3 |

**Propose:**

***TGbe editor: Please note that the baseline is 11be D1.4.***

**9.4.2.313.2 EHT MAC Capabilities Information field**

***TGbe editor: Please add the below new field in the Figure 9-1002s as follows:***

 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 B15

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EPCS Priority Access Supported | EHT OM Control Support | Triggered TXOP Sharing Mode 1 Support | Triggered TXOP Sharing Mode 2 Support | Restricted TWT Support | SCS Traffic Description Support | Maximum MPDU Length | Maximum A-MPDU Length Exponent Extension | Reserved |

Bits: 1 1 1 1 1 1 2 1 7

**Figure 9-1002x – EHT MAC Capabilities Information field format(#4295)**

***TGbe editor: Please add a row in the Table 9-401i as follows:***

**Table 9-401j – Subfields of the EHT MAC Capabilities Information field**

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| (#4295)Maximum A-MPDU Length Exponent Extension | Indicates the exponent extension for the maximum A-MPDU length supported in reception (see 35.x (A-MPDU operation in an EHT PPDU)). | Set to the value of the maximum A-MPDU exponent extension value. |

***TGbe editor: Please add a new section under 35(Extremely high throughout (EHT) MAC specification) as follows:***

**35.X A-MPDU Operation in an EHT PPDU(#4295)**

**35.X.1 General**

A-MPDU operation for an EHT PPDU follows the procedures defined in 10.12(A-MPDU operation) and the additional rules in this subclause.

An EHT STA that sends a Class 1 frame or a Class 2 frame in an EHT PPDU shall send the frame as an S-MPDU (see Table 9-534).

An EHT STA shall not transmit an A-MPDU in an EHT PPDU to a STA that exceeds the maximum A-MPDU length capability indicated in the EHT Capabilities element, HE Capabilities element, VHT Capabilities element, and HT Capabilities element received from the recipient STA. If a VHT Capabilities element is received from the recipient STA, then the maximum A-MPDU length capability is derived from the Maximum A-MPDU Length Exponent Extension subfield in the HE Capabilities element and EHT Capabilities element, and the Maximum A-MPDU Length Exponent subfield in the VHT Capabilities element. Otherwise, the maximum A-MPDU length capability is derived from the Maximum A-MPDU Length Exponent Extension subfield in the HE Capabilities element and EHT Capabilities element, and the Maximum A-MPDU Length Exponent subfield in the HT Capabilities element or in the HE 6GHz Band Capabilities element.

An EHT STA that sends an EHT Capabilities element with Maximum A-MPDU Length Exponent Extension subfield of 0 shall support in reception of an EHT PPDU with an A-MPDU pre-EOF padding with maximum length as defined in 10.12.2(A-MPDU length limit rules).

An EHT STA that sends a VHT Capabilities element, HE Capabilities element, and EHT Capabilities element with Maximum A-MPDU Length Exponent Extension subfield greater than 0 shall support in reception of an EHT PPDU with an A-MPDU pre-EOF padding with maximum length as defined in 10.12.2(A-MPDU length limit rules), except that the maximum length for the A-MPDU pre-EOF padding shall be equal to *min*(2(23 + Maximum A-MPDU Length Exponent Extension) – 1, 15 523 200). An EHT STA that sets the Maximum A-MPDU Length Exponent Extension subfield in the EHT Capabilities element to a value greater than 0 shall set the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities element to 7 and the Maximum A-MPDU Length Exponent Extension subfield of the HE Capabilities element to 3.

NOTE 1 – The value 15 523 200 is defined in Table 9-34(Maximum data unit sizes (in octets) and durations (in micorseconds)) as the upper bound of PSDU size of EHT PPDU.

~~An EHT STA that does not send a VHT Capabilities element but sends an HT Capabilities element, an HE Capabilities element and an EHT Capabilities element with Maximum A-MPDU Length Exponent Extension subfield greater than 0 shall support in reception of an EHT PPDU with an A-MPDU pre-EOF padding with maximum length as defined in 10.12.2(A-MPDU length limit rules), except that the maximum length for the A-MPDU pre-EOF padding shall be equal 2~~~~(19 + Maximum A-MPDU Length Exponent Extension)~~ ~~– 1. An EHT STA that sets the Maximum A-MPDU Length Exponent Extension subfield in the EHT Capabilities element to a value greater than 0 shall set the Maximum A-MPDU Length Exponent subfield of the HT Capabilities element to 3 and the Maximum A-MPDU Length Exponent Extension subfield of the HE Capabilities element to 3.~~

~~NOTE 2 – An EHT STA that is a VHT STA sends a VHT Capabilities element. An EHT STA that is not a VHT STA does not send a VHT Capabilities element.~~

An EHT STA that sends an HE 6 GHz Band Capabilities element, an HE Capabilities element, and an EHT Capabilities element with Maximum A-MPDU Length Exponent Extension subfield greater than 0 shall support in reception of an EHT PPDU with an A-MPDU pre-EOF padding with maximum length as defined in 10.12.2(A-MPDU length limit rules), except that maximum length for the A-MPDU pre-EOF padding shall be equal to *min*(2(23 + Maximum A-MPDU Length Exponent Extension) – 1, 15 523 200). An EHT STA that sets the Maximum A-MPDU Length Exponent Extension subfield in the EHT Capabilities element to a value greater than 0 shall set the Maximum A-MPDU Length Exponent subfield of the HE 6 GHz Band Capabilities element to 7 and the Maximum A-MPDU Length Exponent Extension subfield of HE Capabilities element to 3.

***TGbe editor: Please note that the baseline is REVme D1.0.***

**9.7 Aggregate MPDU (A-MPDU)**

**9.7.1 A-MPDU format**

***TGbe editor: Please change the 4th paragraph as follows:***

The EOF Padding field is shown in Figure 9-1204 (EOF Padding field format). This is present only in a VHT, (11ay)EDMG, S1G,(#4295) (11ax)HE, or EHT PPDU.

***TGbe editor: Please change the 6th and subsequent paragraphs as follows:***

(#4295)In a VHT, EDMG(11ay), S1G, HE(11ax), or EHT PPDU, the following padding is present, as determined by the rules in 10.12.6 (A-MPDU padding for VHT, HE(11ax), EHT or S1G PPDU):

* 0–3 octets in the Padding subfield of the final A-MPDU subframe (see Figure 9-1205 (A-MPDU subframe format)) before any EOF padding subframes. The content of these octets is unspecified.
* Zero or more EOF padding subframes in the EOF Padding Subframes subfield.
* 0–3 octets in the EOF Padding Octets subfield. The content of these octets is unspecified.

An A-MPDU pre-EOF padding refers to the contents of the A-MPDU up to, but not including, the EOF Padding field.

NOTE 1—A-MPDU pre-EOF padding includes any A-MPDU subframes with 0 in the MPDU Length field and 0 in the

EOF/Tag field inserted in order to meet the minimum MPDU start spacing requirement.(11ax)

The maximum length of an A-MPDU in an HT PPDU is 65 535 octets. The maximum length of an

A-MPDU in a DMG PPDU is 262 143 octets. The maximum length of an A-MPDU pre-EOF padding in a

VHT PPDU is 1 048 575 octets. (11ax)The maximum length of an A-MPDU pre-EOF padding in an HE PPDU is

6 500 631 octets. (11ay)TThe maximum length of an A-MPDU in an EDMG PPDU is 4 194 303 octets. (#4295)The maximum length of an A-MPDU pre-EOF padding in an EHT PPDU is 15 523 200 octets. The length of an A-MPDU addressed to a particular STA can be further constrained as described in 10.12.2 (A-MPDU length limit rules).

***TGbe editor: Please change Table 9-627 (MPDU delimiter fields (11ay)) as follows:***

**Table 9-627 – MPDU delimiter fields (11ay)**

|  |  |  |
| --- | --- | --- |
| Field | Size (bits) | Descriptions |
| EOF/Tag(11ax) | 1 | End of frame indication if the MPDU Length field is 0. Set to 1 in an A-MPDU subframe that has 0 in the MPDU Length field and that is used to pad the A-MPDU in a VHT(#4295), HE, or EHT PPDU as described in 10.12.6 (A-MPDU padding for VHT, HE(11ax), EHT or S1G PPDU). Set to 1 in the MPDU delimiter of an S-MPDU as described in 10.12.7 (Setting the EOF/Tag(11ax) field of the MPDU delimiter).(11ax)(11ax)Tagged/untagged indication if the MPDU Length field is nonzero. Set to 1 in an MPDU delimiter preceding a QoS Data frame or Management frame soliciting an Ack frame or Per AID TID Info field with the Ack Type field set to 1 in a Multi-STA BlockAck frame in a response that is contained in an ack-enabled multi-TID A-MPDU as described in 26.6.3.4 (Ack-enabled multi-TID A-MPDU operation)and ack-enabled single-TID A-MPDU as described in 26.6.3.2 (Ack-enabled single-TID A-MPDU operation). Set to 0 otherwise.(11ay) In a DMG PPDU, this field is reserved. In an EDMG PPDU, it is set to 1 in EOF padding subframes and set to 0 otherwise (see 10.12.7 (Setting the EOF/Tag(11ax) field of the MPDU delimiter)). |
| Reserved | 1 |  |
| MPDU Length | 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 10.12.3 (Minimum MPDU start spacing rules) to meet the minimum MPDU start spacing requirement and also to pad the A-MPDU to fill the available octets in a VHT(#4295), (11ax)HE, or EHT PPDU as defined in 10.12.6 (A-MPDU padding for VHT, HE(11ax), EHT, or S1G PPDU). |
| CRC | 8 | 8-bit CRC of the preceding 16 bits. |
| Delimiter Signature | 8 | Pattern that can be used to detect an MPDU delimiter when scanning for an MPDU delimiter. The unique pattern is 0x4E, which is the ASCII value of the character 'N'.(11ax) |

***TGbe editor: Please change the below paragraph as follows:***

The format of the MPDU Length field when transmitted by a non-DMG STA is shown in Figure 9-1207 (MPDU Length field format (non-DMG)). The MPDU Length Low subfield contains the 12 low order bits of the MPDU length. In a VHT(#4295), (11ax)HE, or EHT 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.

***TGbe editor: Please replace (9-13) with the following equation and the variable list remains unchanged as follows:***

The MPDU length value is derived from the MPDU Length field subfields as follows:(11ax)(11ay)

 $L\_{low}+ L\_{high} ×4096, for a VHT, HE, PPDU$

$L\_{MPDU}=$ $L\_{low}, for an HT PPDU $ (9-13)

$L, for a DMG and EDMG PPDU$

where

$L\_{low}$ is the value of the MPDU Length Low subfield

$L\_{high}$ is the value of the MPDU Length High subfield

$L$ is the value of the MPDU Length field

***TGbe editor: Please change NOTE 2 as follows:***

NOTE 2—The format of the MPDU Length field maintains a common encoding structure for (#4295)EHT, HE, VHT, and HT PPDUs(11ax). For HT PPDUs, only the MPDU Length Low subfield is used, while for VHT(#4295), HE(11ax), and EHT PPDUs, both subfields are used.

**9.7.2 A-MPDU contents**

***TGbe editor: Please add the last bullet of the 1st paragraph 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.
* The FORMAT parameter set to HE\_SU, HE\_MU, HE\_TB, or HE\_ER\_SU.(11ax)
* (#4295)The FORMAT parameter set to EHT\_MU, or EHT\_TB.

***TGbe editor: Please change the below paragraph as follows:***

The Duration/ID fields in the MAC headers of all MPDUs in an A-MPDU carry the same value. The Duration/ID fields in the MAC headers of the MPDUs in the A-MPDUs carried in a VHT MU PPDU(#4295), an HE MU PPDU, and an EHT MU PPDU carry the same value.(11ax)

***TGbe editor: Please change the below paragraphs as follows:***

A VHT MU PPDU, S1G MU PPDU(#4295), HE MU PPDU, and EHT MU PPDU do not carry more than one A-MPDU that contains one or more MPDUs soliciting an immediate response if the immediate response is carried in a PPDU that is not an HE TB PPDU (#4295)and is not an EHT TB PPDU. An HE MU PPDU (#4295)and an EHT MU PPDU can carry more than one A-MPDU each of which contains one or more MPDUs soliciting an immediate response if the immediate response is carried in an HE TB PPDU (#4295)or an EHT TB PPDU.(11ax)

NOTE 3—The TIDs present in a data enabled A-MPDU context are also constrained by the channel access rules (for a TXOP holder; see 10.23.2 (HCF contention based channel access (EDCA)) and 10.23.3 (HCF controlled channel access (HCCA))), (11ax)the TXOP responder rules (see 26.6 (A-MPDU operation in an HE PPDU), and 26.5.2 (UL MU operation)) and the RD response rules (for an RD responder, see 10.29.4 (Rules for RD responder)). This is not shown in these tables.

NOTE 4—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 TA within an A-MPDU carried in a PPDU with FORMAT HT\_MF or HT\_GF or within an MPDU carried in a non-HT PPDU are constrained so that the length of the QoS Data frame 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, HE(#4295), EHT or DMG PPDUs. The use of A-MSDU within A-MPDU might be further constrained as described in 9.4.1.13 (Block Ack Parameter Set field) through the operation of the A-MSDU Supported field.

***TGbe editor: Please change the Table 9-628(A-MPDU contexts) as follows:***

**Table 9-628 – A-MPDU contexts**

|  |  |  |
| --- | --- | --- |
| **Name of context** | **Definition of context** | **Table defining permitted contents** |
| (11ax)Non-HE Data Enabled Immediate Response | The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder or an RD responder includeing potential immediated response | Table 9-629 (A-MPDU contents in the non-HE(11ax) data enabled immediate response context) |
| Data Enabled No Immediate Response | The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder. (11ax)TXOP responder when transmitted by an HE STA to another HE STA, and the A-MPDU does not include or solicit an immediate response. See NOTE | Table 9-630 (A-MPDU contents in the data enabled no immediate response context) |
| PSMP | The A-MPDU is transmitted within a PSMP sequence. | Table 9-631 (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, (11ax)or the A-MPDU is transmitted by an HE AP in reponse to an HE TB PPDU(#4295), or an EHT AP in response to an EHT TB PPDU, and the transmitter also needs to transmit one of the following immediate response frames:* Ack frame
* BlockAck frame with a TID for which an HT-immediate block ack agreement exists
* Multi-STA BlockAck frame for acknowledging multi-TID A-MPDU(11ax)
 | Table 9-632 (A-MPDU contents in the control response context) |
| S-MPDU context | The A-MPDU is transmitted within a VHT PPDU(#4295), an HE PPDU(11ax), or an EHT PPDU and contains an S-MPDU | Table 9-633 (A-MPDU contents in the S-MPDU context) |
| (11ax)HE Non-Ack-Enabled Single-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an HE PPDU and solicits block acknowledgment for a single TID. | Table 9-634 (A-MPDU contents in the HE non-ack-enabled single-TID immediate response context(11ax) or in the EHT non-ack-enabled single-TID immediate response context) |
| (11ax)HE Ack-Enabled Single-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an HE PPDU and solicits single acknowledgment. | Table 9-635 (A-MPDU contents in the HE ack-enabled single-TID immediate response context(11ax) or in the EHT ack-enabled single-TID immediate response context) |
| (11ax)HE Non-Ack Enabled Multi-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an HE PPDU, and solicits block acknowledgments for multiple TIDs. | Table 9-636 (A-MPDU contents in the HE non-ack-enabled multi-TID immediate response context(11ax) or in the EHT non-ack-enabled multi-TID immediate response context) |
| (11ax)HE Ack-Enabled Multi-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an HE PPDU, and solicits at least one acknowledgment and zero or more block acknowledgments. | Table 9-637 (A-MPDU contents in the HE ack-enabled multi-TID immediate response context(11ax) or in the EHT ack-enabled multi-TID immediate response context) |
| (#4295)EHT Non-Ack-Enabled Single-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an EHT PPDU and solicits block acknowledgment for a single TID. | Table 9-634 (A-MPDU contents in the HE non-ack-enabled single-TID immediate response context(11ax) or in the EHT non-ack-enabled single-TID immediate response context) |
| (#4295)EHT Ack-Enabled Single-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an EHT PPDU and solicits single acknowledgment. | Table 9-635 (A-MPDU contents in the HE ack-enabled single-TID immediate response context(11ax) or in the EHT ack-enabled single-TID immediate response context) |
| (#4295)EHT Non-Ack Enabled Multi-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an EHT PPDU, and solicits block acknowledgments for multiple TIDs. | Table 9-636 (A-MPDU contents in the HE non-ack-enabled multi-TID immediate response context(11ax) or in the EHT non-ack-enabled multi-TID immediate response context) |
| (#4295)EHT Ack-Enabled Multi-TID Immediate Response | The A-MPDU is transmitted by a TXOP holder or TXOP responder in an EHT PPDU, and solicits at least one acknowledgment and zero or more block acknowledgments. | Table 9-637 (A-MPDU contents in the HE ack-enabled multi-TID immediate response context(11ax) or in the EHT ack-enabled multi-TID immediate response context) |
| NOTE – This context includes cases when no reponse is generated. |

**9.8 MAC frame format for PV1 frames**

**9.8.2 General PV1 frame format**

***TGbe editor: Please change Table 9-632 (A-MPDU contents in the control response context) as follows:***

**Table 9-632 – A-MPDU contents in the control response context**

|  |  |
| --- | --- |
| MPDU | Conditions |
| Ack | Ack frame transmitted in response to an MPDU that requires an Ack frame. | (11ax)One of Ack and compressed BlockAck frame is present at the start of the A-MPDU between two STAs that are not both HE STAs; these are not present other than at the start of the A-MPDU.(11ax)One of Ack, Compressed BlockAck, and Multi-STA BlockAck frame is present at the start of the A-MPDU between two HE STAs; these are not present other than at the start of the A-MPDU. |
| BlockAck | (11ax)Compressed BlockAck frame with a TID that corresponds to an HT-immediate block ack agreement. See NOTE.(11ay)(11ax)Multi-STA BlockAck frame if the preceding PPDU is either an HE (#4295)or EHT TB PPDU that solicits an immediate response (see 26.4.4.5(Responding to an HE TB PPDU with an SU PPDU)) or an HE (#4295)or EHT PPDU that carries a multi-TID A-MPDU or ack-enabled multi-TID A-MPDU (see 26.6.3 (Multi-TID A-MPDU and ack-enabled single-TID A-MPDU)). |
| EDMG Multi-TID BlockAck(11ay) | If the preceding PPDU that carried a multi-TID A-MPDU contains an implicit or explicit block ack requests for multiple TIDs for which an HT-immediate block ack agreement exists, one or several copies of the same EDMG Multi-TID BlockAck frame.(11ay) |
| Action No Ack | (11ax)In an A-MPDU between two STAs that are not both HE STAs:BRP +HTC frames.Action No Ack +HTC frames containing an explicit feedback response.Action No Ack frames that are Flow Suspension frames or Flow Resumption frames.(11ax)In an A-MPDU between two HE STAs: Action No Ack frames. |
| (11ax)QoS Null frame with No Ack ack policy | If sent to an HE STA. QoS Null frames with No Ack ack policy. |
| NOTE—This condition is applicable for BlockAck variants established by block ack agreements and is not applicable for the EDMG Multi-TID BlockAck where the condition depends on a preceding PPDU. (11ay) |

**9.8.3.1 Frame Control field**

***TGbe editor: Please replace the title of Table 9-634 (A-MPDU contents in the HE non-ack-enabled single-TID immediate response context(11ax)) with “A-MPDU contents in the HE non-ack-enabled single-TID immediate response context(11ax) or in the EHT non-ack-enabled single-TID immediate response context” as follows:***

**Table 9-634 – A-MPDU contents in the HE non-ack-enabled single-TID immediate response context(11ax) (#4295)or in the EHT non-ack-enabled single-TID immediate response context**

***TGbe editor: Please replace the title of Table 9-635 (A-MPDU contents in the HE ack-enabled single-TID immediate response context(11ax)) with “A-MPDU contents in the HE ack-enabled single-TID immediate response context(11ax) or in the EHT ack-enabled single-TID immediate response context” as follows:***

**Table 9-635 – A-MPDU contents in the HE ack-enabled single-TID immediate response context(11ax) (#4295)or in the EHT ack-enabled single-TID immediate response context**

***TGbe editor: Please replace the title of Table 9-636 (A-MPDU contents in the HE non-ack-enabled multi-TID immediate response context(11ax)) with “A-MPDU contents in the HE non-ack-enabled multi-TID immediate response context(11ax) or in the EHT non-ack-enabled multi-TID immediate response context” as follows:***

**Table 9-636 – A-MPDU contents in the HE non-ack-enabled multi-TID immediate response context(11ax) (#4295)or in the EHT non-ack-enabled multi-TID immediate response context**

***TGbe editor: Please replace the title of Table 9-637 (A-MPDU contents in the HE ack-enabled multi-TID immediate response context(11ax)) with “A-MPDU contents in the HE ack-enabled multi-TID immediate response context(11ax) or in the EHT ack-enabled multi-TID immediate response context” as follows:***

**Table 9-637 – A-MPDU contents in the HE ack-enabled multi-TID immediate response context(11ax) (#4295)or in the EHT ack-enabled multi-TID immediate response context**

**10.12 A-MPDU Operation**

**10.12.2 A-MPDU length limit rules**

***TGbe editor: Please change and add the below paragraphs as follows:***

A STA indicates in the Maximum A-MPDU Length Exponent field in its HT Capabilities element the maximum A-MPDU length that it can receive in an HT PPDU. A STA indicates in the Maximum A-MPDU Length Exponent field in its VHT Capabilities element the maximum length of the A-MPDU pre-EOF padding that it can receive in a VHT PPDU. A STA indicates in the Maximum A-MPDU Length Exponent field in its S1G Capabilities element the maximum length of the A-MPDU pre-EOF padding that it can receive in an S1G PPDU. A STA indicates in the Maximum A-MPDU Length Exponent field in its DMG Capabilities element the maximum A-MPDU length that it can receive in a DMG PPDU. A STA indicates the maximum length of the A-MPDU pre-EOF padding that it can receive in an HE PPDU in the Maximum A-MPDU Length Exponent field in its HT Capabilities, VHT Capabilities, and HE 6 GHz Band Capabilities elements (if present) and in the Maximum A-MPDU Length Exponent Extension field in its HE Capabilities element.(11ax) A STA indicates in the Maximum A-MPDU Length Exponent field in its EDMG Capabilities element the maximum length of the A-MPDU that it can receive in an EDMG PPDU.(11ay) (#4295)A STA indicates the maximum length of the A-MPDU pre-EOF padding that it can receive in an EHT PPDU in the Maximum A-MPDU Length Exponent field in its HT Capabilities, VHT Capabilities, and (if present) HE 6 GHz Band Capabilities elements, and in the Maximum A-MPDU Length Exponent Extension field in HE Capabilities and EHT Capabilities elements.

A VHT STA that sets the Maximum A-MPDU Length Exponent field in its VHT Capabilities element to a value in the range 0 to 3 shall set the Maximum A-MPDU Length Exponent in its HT Capabilities to the same value. A VHT STA that sets the Maximum A-MPDU Length Exponent field in the VHT Capabilities element to a value larger than 3 shall set the Maximum A-MPDU Length Exponent in its HT Capabilities element to 3.

Using the Maximum A-MPDU Length Exponent fields in the HT Capabilities, (11ax)VHT Capabilities and HE 6 GHz Band Capabilities elements (if present) and the Maximum A-MPDU Length Exponent Extension fields in the HE Capabilities and EHT Capabilities elements, the STA establishes at association the maximum length of an A-MPDU pre-EOF padding that can be sent to it. An HT STA shall support receiving A-MPDUs of length up to the value indicated by the Maximum A-MPDU Length Exponent field in its HT Capabilities element. A VHT STA shall support receiving A-MPDUs where the A-MPDU pre-EOF padding length is up to the value indicated by the Maximum A-MPDU Length Exponent field in its VHT Capabilities element. An S1G STA that sets the A-MPDU Supported subfield in the S1G Capabilities element to 1 shall support receiving A-MPDUs where the A-MPDU pre-EOF padding length is up to the value indicated by the Maximum A-MPDU Length Exponent field in its S1G Capabilities element.

(11ax)An HE STA shall support receiving A-MPDUs where the A-MPDU pre-EOF padding length is up to the value indicated by the Maximum A-MPDU Length Exponent field in its HT Capabilities and VHT Capabilities elements and the Maximum A-MPDU Length Exponent Extension field in its HE Capabilities element in the 2.4 GHz or 5 GHz bands. An HE STA shall support receiving A-MPDUs where the A-MPDU pre-EOF padding length is up to the value indicated by the Maximum A-MPDU Length Exponent Extension field in the HE Capabilities element and the Maximum A-MPDU Length Exponent field in HE 6 GHz Band Capabilities element in the 6 GHz band.

(#4295)An EHT STA shall support receiving A-MPDUs where A-MPDU pre-EOF padding length is up to the value indicated by the Maximum A-MPDU Length Exponent field in its HT Capabilities and VHT Capabilities elements and the Maximum A-MPDU Length Exponent Extension field in its HE Capabilities and EHT Capabilities elements in the 2.4 GHz or 5 GHz bands. An EHT STA shall support receving A-MPDUs where the A-MPDU pre-EOF padding length is up to value indicated by the Maximum A-MPDU Length Exponent field in HE 6 GHz Band Capabilities and the Maximum A-MPDU Length Exponent Extension field in the HE Capabilities and EHT Capabilities elements in the 6 GHz band.

A STA shall not transmit an A-MPDU in an HT PPDU that is longer than the value indicated by the Maximum A-MPDU Length Exponent field in the HT Capabilities element received from the intended receiver. MPDUs in an A-MPDU carried in an HT PPDU shall be limited to a maximum length of 4095 octets. A STA shall not transmit an A-MPDU in a VHT PPDU where the A-MPDU pre-EOF padding length is longer than the value indicated by the Maximum A-MPDU Length Exponent field in the VHT Capabilities element received from the intended receiver. An S1G STA shall not transmit an A-MPDU in an S1G PPDU where the AMPDU pre-EOF padding length field is longer than the value indicated by the Maximum A-MPDU Length Exponent field in the S1G Capabilities element received from the intended receiver. A STA shall not transmit an A-MPDU in a DMG PPDU that is longer than the value indicated by the Maximum A-MPDU Length Exponent field in the DMG Capabilities element received from the intended receiver. (11ay)A STA shall not transmit an A-MPDU in an EDMG PPDU that is longer than the value indicated by the Maximum A-MPDU Length Exponent field in the EDMG Capabilities element received from the intended receiver.

(11ax)A STA shall not transmit an A-MPDU in an HE PPDU where the A-MPDU pre-EOF padding length is greater than the value indicated by the Maximum A-MPDU Length Exponent field in the HT Capabilities and VHT Capabilities elements and the Maximum A-MPDU Length Exponent Extension field in its HE Capabilities elements received from the intended receiver in the 2.4 GHz or 5 GHz bands. A STA shall not transmit an A-MPDU in an HE PPDU where the A-MPDU pre-EOF padding length is greater than the value indicated by the Maximum A-MPDU Length Exponent Extension field in the HE Capabilities element and the Maximum A-MPDU Length Exponent field in the HE 6 GHz Band Capabilities element received from the intended receiver in the 6 GHz band.

(#4295)A STA shall not transmit an A-MPDU in an EHT PPDU where the A-MPDU pre-EOF padding length is greater than the value indicated by the Maximum A-MPDU Length Exponent field in the HT Capabilities and VHT Capabilities elements and the Maximum A-MPDU Length Exponent Extension field in its HE Capabilities and EHT Capabilities elements received from the intended receiver in the 2.4 GHz or 5 GHz bands. A STA shall not transmit an A-MPDU in EHT PPDU where the A-MPDU pre-EOF padding length is greater than the value indicated by the Maximum A-MPDU Length Exponent field in the HE 6 GHz Band Capabilities element and the Maximum A-MPDU Length Exponent Extension field in the HE Capabilities and EHT Capabilities elements received from the intended receiver in the 6 GHz band.

An S1G STA shall not transmit an A-MPDU, except for an S-MPDU, to an S1G STA from which it received a frame containing an S1G Capability element with the A-MPDU Supported subfield equal to 0.

**10.12.3 Minimum MPDU start spacing rules**

***TGbe editor: Please change the below paragraphs as follows:***

If the intended receiver is a non-HE STA, a A STA shall not start the transmission of more than one MPDU within the time limit described in the Minimum MPDU Start Spacing field declared by the intended receiver. If the intended receiver is an HE (#4295)or EHT STA, an HE or EHT STA shall not start the transmission of more than one QoS Data frame, QoS Null frame, or Management frame within the time limit described in the Minimum MPDU Start Spacing field declared by the intended receiver. To satisfy this requirement, the number of octets between the start of two consecutive MPDUs in an A-MPDU, *N*, measured at the PHY SAP, shall meet the condition defined by Equation (10-12).(11ax)

$N \geq \left\{\begin{array}{c}t\_{MMSS}×{r}/{8}, if the A-MPDU is not carried in an HE TB PPDU \\t\_{mmss} × 2^{MMSF} ×{r}/{8,} if the A-MPDU is carried in an HE TB PPDU\end{array}\right.$ (10-12)

|  |  |
| --- | --- |
| $$t\_{MMSS}$$ | is the time (in microseconds) defined in the Encoding column of Table 9-222 (Subfields of the A-MPDU Parameters field) for an HT STA, of Table 9-342 (Subfields of the S1G Capabilities Information field) for an S1G STA for the value of the Minimum MPDU Start Spacing field, and of Table 9-288 (Subfields of the A-MPDU Parameters subfield) for a DMG STA for the value of the Minimum MPDU Start Spacing field |
| *MMSF* | is the value of the MPDU MU Spacing Factor subfield of the User Info field addressed to the HE (#4295)or EHT STA in the Trigger frame soliciting the HE TB PPDU (#4295)or the EHT TB PPDU(see 9.3.1.22 (Trigger frame format(11ax))) (11ax) |
| $$r$$ | is the value of the PHY Data Rate (in megabits per second) defined in 19.5 (Parameters for HT-MCSs) for HT PPDUs, in 21.5 (Parameters for VHT-MCSs) for VHT PPDUs, in 23.5 (Paramters for S1G-MCSs) for S1G PPDUs, and in Clause 20 (Directional multi-gigabit (DMG) PHY specification) for a DMG STA |

**10.12.4 A-MPDU aggregation of group addressed Data frames**

***TGbe editor: Please change NOTE 2 as follows:***

(#4295)NOTE 2—As a VHT STA, an HE STA, and an EHT STA are HT STAs, NOTE 1 also applies to VHT APs, VHT mesh STAs, HE APs, HE mesh STAs, EHT APs and EHT mesh STAs .(11ax)

***TGbe editor: Please add the paragraphs as follows:***

When a STA transmits a PPDU containing at least one A-MPDU that contains MPDUs with an RA that is a group address, the following shall apply:

* If the PPDU is an HT PPDU(11ax), the maximum A-MPDU length exponent value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the A-MPDU Parameters field of the HT Capabilities elements across all HT STAs associated with the transmitting AP or (11ax)across all peer HT mesh STAs.(11ax)
* If the PPDU is a VHT PPDU, the maximum A-MPDU length exponent (11ax)value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities elements across all VHT STAs associated with the transmitting AP or across all peer VHT mesh STAs.
* (11ax)If the PPDU is an HE PPDU sent in the 2.4 GHz or 5 GHz band, the maximum A-MPDU length exponent value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities elements across all HE STAs associated with the transmitting AP or across all peer HE mesh STAs.
* (11ax)If the PPDU is an HE PPDU sent in the 6 GHz band, the maximum A-MPDU length exponent value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the HE 6 GHz Band Capabilities elements across all HE STAs associated with the transmitting AP or across all peer HE mesh STAs.
* (#4295)If the PPDU is an EHT PPDU sent in the 2.4 GHz or 5 GHz band, the maximum A-MPDU length exponent value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the VHT Capabilities elements across all EHT STAs associated with the transmitting AP or across all peer EHT mesh STAs.
* (#4295)If the PPDU is an EHT PPDU sent in the 6 GHz band, the maximum A-MPDU length exponent value is the minimum value in the Maximum A-MPDU Length Exponent subfield of the HE 6 GHz Band Capabilities elements across all EHT STAs associated with the transmitting AP or across all peer EHT mesh STAs.
* (#4295)If the PPDU is an EHT PPDU sent in the 2.4 GHz, 5 GHz or 6 GHz band, the maximum A-MPDU length exponent extension value is the minimum value in the Maximum A-MPDU Length Exponent Extension subfield of the HE Capabilities elements across all EHT STAs associated with the transmitting AP or across all peer EHT mesh STAs.
* If the PPDU is a VHT PPDU, the minimum MPDU start spacing (11ax)value is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the HT Capabilities elements across all VHT STAs associated with the transmitting AP or across all peer VHT mesh STAs.
* If the PPDU is an HT PPDU transmitted by an AP(11ax), the minimum MPDU start spacing value (11ax)is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the HT Capabilities elements across all HT STAs associated with the transmitting AP or across all peer HT mesh STAs.(11ax)
* (11ax)If the PPDU is an HE PPDU sent in the 2.4 GHz or 5 GHz band, the minimum MPDU start spacing value is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the HT Capabilities elements across all HE STAs associated with the transmitting AP or across all peer HE mesh STAs.
* (11ax)If the PPDU is an HE PPDU sent in the 6 GHz band, the minimum MPDU start spacing value is the maximum value in the Minimum MPDU Start Spacing subfield of the HE 6 GHz Band Capabilities elements across all HE STAs associated with the transmitting AP or across all peer HE mesh STAs.
* (#4295)If the PPDU is an EHT PPDU sent in the 2.4 GHz or 5 GHz band, the minimum MPDU start spacing value is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the HT Capabilities elements across all EHT STAs associated with the transmitting AP or across all peer EHT mesh STAs.
* (#4295)If the PPDU is an EHT PPDU sent in the 6 GHz band, the minimum MPDU start spacing value is the maximum value in the Minimum MPDU Start Spacing subfield of the HE 6 GHz Band Capabilities elements across all EHT STAs associated with the transmitting AP or across all peer EHT mesh STAs.
* If the PPDU is a DMG PPDU, the maximum A-MPDU length exponent value (11ax)is the minimum value in the Maximum A-MPDU Length Exponent subfield of the A-MPDU Parameters field of the DMG Capabilities element of all DMG STAs associated with the AP or PCP.
* If the PPDU is a DMG PPDU, the minimum MPDU start spacing value (11ax)is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the DMG Capabilities element of all DMG STAs associated with the AP or PCP.
* If the PPDU is an S1G PPDU, the maximum A-MPDU length exponent value (11ax)is the minimum value in the Maximum A-MPDU Length Exponent subfields of the S1G Capabilities Information field of the S1G Capabilities elements across all S1G STAs associated with the transmitting AP.
* If the PPDU is an S1G PPDU, the minimum MPDU start spacing value (11ax)is the maximum value in the Minimum MPDU Start Spacing subfields of the S1G Capabilities Information field of the S1G Capabilities elements across all S1G STAs associated with the transmitting AP.
* (11ay)If the PPDU is an EDMG PPDU, the maximum A-MPDU length exponent value that applies is the minimum value in the Maximum A-MPDU Length Exponent subfield of the A-MPDU Parameters field of the EDMG Capabilities element of all EDMG STAs associated with the AP or PCP.
* (11ay)If the PPDU is an EDMG PPDU, the minimum MPDU start spacing value that applies is the maximum value in the Minimum MPDU Start Spacing subfield of the A-MPDU Parameters field of the EDMG Capabilities element of all EDMG STAs associated with the AP or PCP.

***TGbe editor: Please change the title of 10.12.6(A-MPDU padding for VHT, HE(11ax), or S1G PPDU) only as follows:***

**10.12.6 A-MPDU padding for VHT, HE(11ax)(#4295), EHT or S1G PPDU**

**10.12.7 Setting the EOF/Tag(11ax) field of the MPDU delimiter**

***TGbe editor: Please change the paragraph as follows:***

The (11ax)EOF/Tag field may be set to 1 in an A-MPDU subframe carried in a VHT PPDU, HE PPDU, EHT PPDU or S1G PPDU if the subframe’s MPDU Length field is nonzero and the subframe is the only subframe that has a nonzero MPDU Length field. The (11ax)EOF/Tag field of each A-MPDU subframe with an MPDU Length field with a nonzero value that is not the only A-MPDU subframe with MPDU Length field with a nonzero value in the A-MPDU carried in a VHT PPDU or S1G PPDU shall be set to 0. The (11ax)EOF/Tag field shall be set to 0 in all A-MPDU subframes that are carried in an HT PPDU.