IEEE P802.11
Wireless LANs

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| **CIDs: Acknowledgment related comments** |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D1.0s with the following CIDs (**21 CIDs**):

3059, 4852, 7084, 7529, 7538, 8432, 8460, 8467, 8469, 9429

8479, 8481, 8483, 8484, 8487, 8488, 8489, 8492, 8493,

9394, 9395,

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

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

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

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| **CID** | **Commenter** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 3059 | Abhishek Patil | 157.63 | Procedure for GCR MU BAR reception is missing | Add procedure upon reception of GCR MU BAR | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax  |
| 7084 | Junichi Iwatani | 162.07 | Regarding the format of a response in HE MU PPDU, especially for Multi-STA BA, this should be specified as OFDMA HE MU PPDU for clarification. (as described in 10.3.2.10.3, Page 120, Line 5) | as in comment | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 7529 | Li-Hsiang Sun | 121.01 | 10.7.6.1 in 802.11-2016 states"The following rules determine whether a Control frame is carried in a non-HT, HT or VHT PPDU:...Otherwise, the Control frame shall be carried in a non-HT PPDU ..."However, the case of MBA in Fig. 10-12c transmitted in HT, VHT, or HE PPDU are not covered | Add 10.7.6.1 in 802.11-2016 to ax draft, and revise the condition to avoid contradiction with baseline text. | Rejected - Section 27.15 defines the rules for HE STAs, which refers to section 10.7.6 |
| 7538 | Li-Hsiang Sun | 113.22 | 10.2.7 of 802.11-2016 specifies that 'anMSDU is transmitted using an HT-immediate or HT-delayed block ack agreement or when the MSDU or MMPDU is carried in an A-MPDU that does not contain a VHT single MPDU, in which case the MSDU or MMPDU is transmitted without fragmentation.'.The block ack agreement used in 11ax is considered HT-immediate BA agreement. This clause in baseline contradicts with dynamic fragementation | add 10.2.7 of 802.11-2016 to the ax draft and revise the condition in comment to allow dynamic fragmentation | Rejected - Per new editorial guidelines, all HE related spec is captured in Section 27. So, fragmentation for HE devices follow rules in Section 27.3 |
| 8432 | Robert Stacey | 157.16 | The Block Acknowledgement subclause is poorly written. The overview section should provide an overview and define the relationship to HT-immediate block ack. | Introduce the block ack extensions in the overview (or intro) subclause. Give the new procedure a name (e.g., HE-immendiate block ack). Ennumerate the extnesions (e.g., An HE extension to the block ack feature, called HE-immeidate block ack, is defined in 27.4.2, 27.4.3 and 27.4.4. HE-immeidate block ack builds on the features defined for HT-immediate block ack, with the following extensiosn: 1) Support for a Multi-STA BlockAck frame, 2) Support for a Multi-STA BlockAckReq (MU-BAR), 3) Additional options for the block ack scoreboard size, ...". Move the requirements into the subsequent subclauses. | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8460 | Robert Stacey | 157.22 | "An HE STA shall support generation...if HT-immediate BA is supported...": An HE STA is an HT STA. HT-immediate block ack support is mandatory for an HT STA hence it is mandatory for an HE STA thus the "if HT-immediate..." condition is unecessary. Making the "generation" of a particular frame type mandatory is meanlingless. Frame types are "generated" to meet protocol requirements, for example, a Compressed BlockAck frame is sent in response to Compressed BlockAckReq frame so there is no need for a standalone statement on the generation of such frames. If a STA supports a protocol (such as HT-immediate block ack) it supports the generation of the frames required to implement that procotol. SImilarly, statements regarding the generation of Multi-STA BlockAck frame is unnecessary. | Delete 2nd and 3rd sentence of the first paragraph. | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8467 | Robert Stacey | 157.56 | The introductory sentence says that "a STA performs the following", but this (second) bullet does not descibe an action. | The meaning of the fields in a frame are defined in the frame formats section. This is a behavioral clause and should define an action. Fix. | Rejected - Procedure part already captured in pp-217, line 12 onwards in D1.4) |
| 8469 | Robert Stacey | 157.61 | The rules for responding to a BlockAckReq frame are defined in 10.24.7 (more accurately 10.24.7.5) but the rules for responding to an MU-BAR frame are not defined there. It seem that the sentence needs to be two sentences: how to respond to a BlockAckReq frame and another on how to respond to an MU-BAR frame. Also this sentence references itself: if the repsonse is defined in this subclause there should be no need to reference it. References statements should not contain shall statements; references are informative and help the reader find the normative text. A statement like "shall respond with a BlockAck frame as defined in" does not account for the full suite of options in 10.24.7 (10.24.7.5 only requires a reponse if Address 1 matches). The reference should be to 10.24.7.5 not 10.24.7 since it is only 10.24.7.5 that deals with responding to a BlockAckReq frame. | Change to read "An HE STA responds to a BlockAckReq frame as defined in 10.24.7.5 (Generation and transmission of BlockAck frames by an HT STA or DMG STA)." | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8479 | Robert Stacey | 36.20 | Only 4 values of the 16 available values of the Fragment Number subfield have any meaning, the other 12 values are reserved. The table can be simplified. Also, the meaning of Fragmentation Level 3 ON/OFF is not clear since it doesn't relate to any other text in this subclause. | The table is better presented in 3 columns (Fragment Number subfield, Block Ack Bitmap subfield length, Block Ack Bitmap subfield interpretation). The rows would be {0, 8 octets, <interpretation>}, {4, 32 octets, <interpretation>}, {1, 8 octets, <interpretation>}, {5, 32 octets, <interpretation>}, {Otherwise, -, Reserved} and <interpretation> is substituted by the text in paragraphs below. For example, the <interpretation> for Fragment Number = 0 is "Indicates the receive status of 64 MSDUs and A-MSDUs. Each bit that is 1 indicates successful reception of a single MSDU or A-MSDU or fragment of an MSDU or A-MSDU with the first bit corresponding to...". | Rejected – Currently, the table is clear, and is in the same format for representing Multi-STA BlockAck variant (Table 9-24c). So, prefer to keep the current format. |
| 8481 | Robert Stacey | 158.37 | "TID value of that MPDU": Not all MPDUs have a TID field. "that requires acknowledgement": needs to be more specific. "receiving a single MPDU": this appers to refer to S-MPDU (i.e., MPDU in an A-MPDU subframe wth EOF = 1). "A single MPDU" is grammetically equivalent to "an MPDU". | Fix | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8483 | Robert Stacey | 160.34 | The EOF field is not what solicits an immediate response. It is also inaccurate (The EOF field is set in the padding delimiters at the end of an A-MPDU). EOF=1 with Lengh > 0 is the equivalent of not setting the Aggregation field in an HT PPDU. | Delete "and the EOF field setting" | Rejected – EOF field setting is used to differentiate S-MPDU with other regular MPDUs in A-MPDU, which is used by the responder to determine how the acknowledgement is formatted. |
| 8484 | Robert Stacey | 160.31 | The fact that a STA can send a PPDU and get a variety of responses dependent on the frame carried in the PPDU is a truism and does not need stating. The statement specifically related to QoS Data frames and QoS Null frames is incomplete. No response is also a possibility. | Delete sentence. | Rejected – The point of this statement is that different responses are possible based on: the Ack Policy field of QoS Data or QoS Null frames, the type of the frame (e.g., Action, (multi-TID) BAR, MU-BAR Trigger frame, GCR MU-BAR Trigger frame, etc.) and the EOF field setting |
| 8487 | Robert Stacey | 160.53 | This convention of prefixing MPDU with a (A-) adds ambiguity. Presumably the intent is to apply the requirement to both MPDUs and A-MPDUs. However, MPDUs and A-MPDUs are very different beasts. An A-MPDU is a framing structure that encapsulates MPDUs. The "at most one of the MPDUs" is a very different statement from "at most one of the A-MPDUs". Also, an A-MPDU does not have an Ack Policy subfield. Nor do most MPDUs for that matter. | Change the statement so that it refers to frames that have an Ack Policy subfield. | RevisedAgree in principle. Some aspects of the comment were already addressed. Remaining part (that at most one MPDU) is fixed through this CIDTGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8488 | Robert Stacey | 160.52 | SU PPDU is not a defined | Create a definition in 3.2 | Rejected – SU PPDU definition already exists in 28.1.4 PPDU formats |
| 8489 | Robert Stacey | 160.27 | We don't need shall rules to prevent implementors from doing stupid things at the initiator side (like a rule to not solicit an immediate response from more than one STA). What we need are rules at the responder side that prevent bad things happening. | Add a statement that clarifies when an HE trigger-based PPDU is used as a response to HE MU PPDU and when an SU PPDU is is used "An HE STA transmits an HE trigger-based PPDU in response to an HE MU PPDU (provided the conditions in xxx [CCA, NAV, etc.] are met) when the A-MPDU in the HE MU PPDU that is received by the STA includes a Trigger frame or a QoS Data frame or QoS Null frame with a UL MU Scheduling Response A-Control field. An HE STA transmits an SU PPDU in response to an HE MU PPDU if the A-MPDU in the HE MU PPDU that is received by the STA iincludes an MPDU that solicits an immediate response and the A-MPDU does not include any of the following: 1) a Trigger frame 2) a QoS Data frame or QoS Null frame with a DL MU Scheduling Response A-Control field 3) A QoS Data frame or QoS Null frame where the Ack Policy subfield in the QoS Control field is MU Ack 4) an Action frame." | Rejected – The rules for responding STA is already clearly spelled out. See pp220LL50; pp221LL28 etc. |
| 8492 | Robert Stacey | 160.58 | A DL MU PPDU (= HE MU PPDU?) does not solicit an immediate response; the frames it carries do the soliciting. The list is not all inclusive, other responses might be possible. Item 1: an S-MPDU does not necessarily have an Ack Policy field; only an S-MPDU that is a QoS Data or QoS Null frame has such a field. Item 2: An A-MPDU does not have an Ack Policy. Item 3: An A-MPDU does not have an Ack Policy. How does the recipient know the A-MPDU is a multi-TID A-MPDU? | "A STA that receives an HE MU PPDU with an A-MPDU that contains QoS Data or QoS Null frames addressed to it, responds as follows: 1) If there is only one QoS Data or QoS Null frame, it is an S-MPDU and the ack policy is Normal Ack, then the STA responds with an Ack frame carried in an SU PPDU. 2) If the QoS Data or QoS Null frames have ack policy Implicit BAR and all the QoS Data and QoS Null frames are associated with the same block ack agreement, then the STA responds with a Compressed BlockAck frame carried in an SU PPDU 3) If the QoS Data and QoS Null frames have ack policy Implicit BAR and are associated with two or more block ack agreements, then the STA responds with a Multi-STA BlockAck frame carried in an SU PPDU." | RevisedAgree in principle. TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 8493 | Robert Stacey | 161.33 | Poorly titled subclause. An HE trigger-based PPDU does not solicit anything. It is the AP that decides what follows the HE trigger-based PPDUs (there can be more than one). It even says so in the subclause: "If the AP intends..." | The text in 27.4.4.4 and 27.4.4.5 should be in the MU operation subclauses | Rejected – True, it could be moved to MU operation subclause also. But this section contains ack related rules also. So, one could debate which is the right place. Keeping at where it is now until there is a strong reason to move it.  |
| 9394 | Woojin Ahn | 160.27 | If an askedforack MPDU was aggregated with another askedforack MPDU in an A-MPDU and one of the askedforack MPDU was the only MPDU successfully received by the intended recipient, than the recipient may respond with an Ack frame in which case the originator cannot process the acknowledgement | The recipient should respond with an M-BA frame unless it received the whole A-MPDU successfully | Rejected -A clarification is made in AMPDU section that the transmitter will consider this as a failure unless it receives Ack from all the single MPDUs..  |
| 9395 | Woojin Ahn | 160.27 | If an MPDU with EOF 1 and non-zero length is aggregated with Action No Ack in an A-MPDU, then the A-MPDU is neither an S-MPDU nor a multi-TID A-MPDU, in which case, the A-MPDU must be responded by compressed BA that doesn't have Ack type field. | If there is only one MPDU that solicits an immediate response in an A-MPDU, the recipient should respond with an Ack frame even if the MPDU was not the only MPDU in the A-MPDU | Revised – In this case, responder responds with Ack frame. Clarified in the text.TGax editor shall incorporate changes in 11-17-1330-01-00ax |
| 9429 | Xiaofei Wang | 121.55 | The sentence "A STA may use a BlockAckReq frame to solicit the acknowledgment frame(s), to whom the STA sent the QoS Data frame(s) with Ack Policy subfield equal to Block Ack or from whom the STA did not receive the immediate acknowledgement frames after sending QoS Data frame(s) in a HE trigger-based PPDU with Ack Policy subfield equal to Normal Ack or Impilcit BAR." is confusing and not clear. It should be rewritten. Also "impilcit" is spelled wrong. | change the sentence "A STA may use a BlockAckReq frame to solicit the acknowledgment frame(s), to whom the STA sent the QoS Data frame(s) with Ack Policy subfield equal to Block Ack or from whom the STA did not receive the immediate acknowledgement frames after sending QoS Data frame(s) in a HE trigger-based PPDU with Ack Policy subfield equal to Normal Ack or Impilcit BAR." into " A STA may send a BlockAckReq frame to solicit the acknowledgment frame(s) from a STA, to whom it sent the QoS Data frame(s) with Ack Policy subfield equal to Block Ack. A STA may send a BlockAckReq frame to solicit the acknowledgement frame(s) from a STA if it did not receive the immediate acknowledgement frames after sending QoS Data frame(s) in a HE trigger-based PPDU with Ack Policy subfield equal to Normal Ack or Implicit BAR." | Rejected – The modified text doesn’t capture the concept well. The idea is indeed to have BAR sent to a STA from whom BA was not received |

* HE Block acknowledgement procedure (#8432)
* Overview

(#8432) HE-immediate block acknowledge procedure builds on the features defined for HT-immediate block ack, with the following extensions:

1. Support for a Multi-STA BlockAck frame,
2. Support for a Multi-STA BlockAckReq (MU-BAR),
3. Support for a Multi-TID BlockAckReq frame.

Additionally, HE-immediate block acknowledgment procedure also added features such as:

1. Acknowledging multiple STAs using a single Multi-STA BlockAck frame
2. All-Ack, which uses a variant of Multi-STA BlockAck frame to acknowledge all MPDUs in the eliciting PPDU,
3. Pre-Association acknowledgment, which acknoowldeges pre-association management frames for multiple STAs using a single Multi-STA BlockAck frame,
4. Acknowledgment for single MPDUs (i.e., MPDU in an A-MPDU subframe wth EOF = 1) of certain TIDs with multiple-MPDUs from other TIDs in a multi-TID A-MPDU using a single Multi-STA BlockAck frame

(#8460) (#6608, #8459)An HE STA shall support generation of Compressed BlockAck frames if HT-immediate block ack(#Ed) is supported in the role of recipient (see 10.24.7.1 (Introduction))(#9875). An HE STA shall support generation of Multi-STA BlockAck frame if multi-TID A-MPDU operation (27.10.4 (A-MPDU with multiple TIDs)) is supported in the role of recipient. An non-AP HE STA shall support reception of a Multi-STA BlockAck frame.(#9286, #10329)

A non-AP HE STA(#6256) that is associated with the AP, that sends a Multi-STA BlockAck frame shall set the AID11 subfield(#Ed) in the Per AID TID Info field(#7734) of the Multi-STA BlockAck frame to 0 and the RA field to the MAC address of the intended recipient.(#8051). A non-AP HE STA that is not associated with the AP shall not send Multi-STA BlockAck frame. (#8432)(#9120)

 [Editor’s Note: This paragraph moved down for readability purpose](#8461, #8462)An HE AP that sends a Multi-STA BlockAck frame where the Per AID TID Info fields are addressed to more than one STA shall set the RA field to the broadcast address(#8463). An HE AP that sends a Multi-STA BlockAck frame where the Per AID TID Info fields are all addressed to a single recipient STA may set the RA field to either the address of the recipient STA or the broadcast address(#8464). An HE AP that sends a a Multi-STA BlockAck frame to an associated STA shall set the the AID11 subfield in the Per AID TID Info field of the Multi-STA BlockAck frame to the 11 LSBs of the AID of the intended STA. An HE AP that sends a a Multi-STA BlockAck frame to an un-associated STA shall set the the AID11 subfield in the Per AID TID Info field of the Multi-STA BlockAck frame to 2045(#8432).

An HE AP that transmits a Multi-STA BlockAck frame shall use a rate, HT MCS, <VHT-MCS, NSS> tuple or <HE-MCS, NSS> tuple that is supported by all recipient STAs.(#6609) [Editor’s Note: This paragraph added from above for readability purpose]

(#9877, #8565)A non-AP HE STA(#10333) that has established a block ack agreement with an HE STA(#8466) shall examine each BA Information field received in the Multi-STA BlockAck frame from the HE STA(#9878) and shall process each BA information according to the procedure defined in 27.4.2(#8432).

 (#8432)A non-AP HE STA that has not established a block ack agreement with an HE STA shall examine each BA Information field received in the Multi-STA BlockAck frame as follows:

* If the Ack Type field is 1, then the Per AID TID Info field indicates either the acknowledgement of a single MPDU (i.e., MPDU in an A-MPDU subframe wth EOF = 1) identified by the value of the TID, or a single MPDU(i.e., MPDU in an A-MPDU subframe wth EOF = 1) that is an Action frame or a PS-Poll frame when the TID field is set to 15. The BA Information field is intended to the STA if the AID of the BA Information field contains the STA's AID, and is processed according to the procedure defined in 27.4.2.
* If the Ack Type field is 0, the AID field is set to 2045, and the TID field is 15, then the RA field is the MAC address of an unassociated STA for which the Per AID TID Info subfield is intended. The BA Information field is intended to the STA if the RA field of the BA Information field contains the STA's MAC address, and is processed according to the procedure defined in 27.4.2.(#10328)

 [Editor’s Note: This paragraph moved to 27.4.5 for readability purpose] (#8432) [Editor’s Note: This paragraph moved to 27.4.5 for readability purpose] (#3059)An HE AP shall not send to the STA a Multi-STA BlockAck frame that has Per STA Info fields for STAs associated with more than one BSS in a multiple BSSID set unless the HE AP has received from the STA an HE Capabilities element with the Rx Control Frame To MultiBSS subfield in HE MAC Capabilities Information field set to 1(#3060, #9444, #Ed).

An AP that transmits a Multi-STA BlockAck frame addressed to HE STAs shall set the TA field of the frame to the MAC address of the AP, except when dot11MultiBSSIDActivated is true and the Multi-STA BlockAck frame is directed to STAs from at least two different BSSs of the multiple BSSID set, in which case, the AP shall set the TA field of the frame to the transmitted BSSID.(#3060, #9444)

A non-AP HE STA(#6256) that is associated with a BSS corresponding to(#5175) a nontransmitted BSSID and has indicated support for receiving Control frames with TA set to the Transmitted BSSID (via the Rx Control Frame To MultiBSS subfield set to 1 in HE Capabilities element that it transmits) shall, upon receiving an MU BAR Control frame with TA set to the transmitted BSSID,(#3062) respond to an MU-BAR Trigger frame with RA(#) set either to the (nontransmitted) BSSID of the BSS(#5175) it is associated with or the transmitted BSSID (i.e., the TA of the soliciting MU-BAR Trigger frame(#10252, #7077)).

* Acknowledgement context in a Multi-STA BlockAck frame(#8482)

A recipient of an S-MPDU, or A-MPDU, or a multi-TID A-MPDU(#9446) sets the Ack Type and TID subfields in the AID TID Info field(#7734) of the Multi-STA BlockAck frame sent as a response depending on the acknowledgement context as follows: (#8432)

* An HE AP that receives an S-MPDU prior to association may generate a Multi-STA BlockAck frame using the procedure described in Pre-association ack context.
* The recipient of single-TID A-MPDU may generate a Multi-STA BlockAck frame as follows:
	+ If all MPDUs in the AMPDU are received successfully, then the recipient may follow the procedure described in the All Ack context. Otherwise, the recipient may follow the procedure described in the BlockAck context.
* The recipient of multi-TID A-MPDU shall generate a Multi-STA BlockAck frame as follows:
	+ If all MPDUs in the multi-TID AMPDU are received successfully, then the recipient may follow the procedure described in the All Ack context
	+ Otherwise, for each TID included the received multi-TID A-MPDU,
		- If the EOF delimiter field of the non-zero length MPDU is set to 1, the recipient shall create a per AID TID info field using the procedure described in Ack context
		- If the EOF delimiter field of the non-zero length MPDU is set to 0, the recipient shall create a per AID TID info field using the procedure described in BlockAck context

The procedure for different acknowledgment context for generating Multi-STA BlockAck frame is defined below:

* All Ack context: if the originator had set the All Ack Support subfield in the HE Capabilities element to 1(#Ed), then the recipient may set the Ack Type field to 1 and the TID subfield to 14 to indicate the successful reception of all the MPDUs (#6619)carried in the eliciting A-MPDU or multi-TID A-MPDU(#5979). Otherwise the recipient shall not set the Ack Type field to 1 and the TID subfield to 14. The Multi-STA BlockAck frame shall contain only one Per AID TID Info field(#7734) addressed to an originator in the Multi-STA BlockAck frame.
* Pre-association ack context: A recipient receiving a single MMPDU from the unassociated STA, that requires an acknowledgment, shall set the Ack Type field to 0, AID11 subfield to 2045, and the TID field to 15 in the Per AID TID Info field, and the BA information set to the intended recepient’s MAC address to indicate the successful reception of that MMPDU.(#9120)
* Ack context: If the recipient had set the ACK-enabled A-MPDU Support subfield in the HE Capabilities element to 1, then the recipient receiving a single MPDU (#8481)(i.e., MPDU in an A-MPDU subframe wth EOF = 1), that requires an acknowledgment, shall set the Ack Type field to 1 and the TID field to the TID value of that MPDU(#3203) to indicate the successful reception of that MPDU or to the TID value of 15 to indicate the successful reception of the MPDU that is an Action frame or PS-Poll frame(#5652, #5651, #5065).

If a received multi-TID A-MPDU contains one or more MPDUs where each MPDU corresponds to a unique TID and has the EOF subfield set to 1 in the preceding nonzero length MPDU delimiter, solicits an immediate acknowledgment, then the Multi-STA BlockAck frame may contain multiple occurrences of unique AID TID Info fields(#7734), with Ack Type field equal to 1, one for each such successfully received MPDU requesting an acknowledgment.(#9446)

The allowed values for the TID field in this context are 0 to 7 (for indicating acknowledgement of QoS Data or QoS Null frames) or 15 (for indicating acknowledgement of an Action frame or a management frame sent by the unassociated HE STA, e.g., Association Request(#9120)).
* BlockAck context: The recipient shall set the Ack Type field to 0 and the TID field of a Per AID TID Info field(#7734) to the TID value of MPDUs requesting block acknowledgement that are carried in the eliciting A-MPDU or multi-TID A-MPDU.

The Multi-STA BlockAck frame may contain multiple occurrences of these Per AID TID Info fields(#7734) addressed to an originator, one for each MPDU that is requesting block acknowledgement, in which case the Block Ack Starting Sequence Control and Block Ack Bitmap fields shall be set according to 10.24.7 (HT-immediate block ack extensions) for each block ack session, and according to 27.3 (Fragmentation and defragmentation(#8457)) for each block ack session with dynamic fragmentation.

The allowed values for the TID field in this context are 0 to 7 (for indicating block acknowledgement of QoS Data frames).

Variable bitmap lengths can be included in the Per AID TID Info field(#7734) when the originator and recipient negotiate their use as defined in 27.4.3 (Negotiation of block ack bitmap lengths).

(#8467)Upon reception of the Multi-STA BlockAck frame the originator shall examine each Per AID TID Info field and shall perform the following operations for each Per AID TID Info field(#7734) that has an AID field addressed to the originator (i.e., the AID subfield is an AID if the originator is a non-AP STA, is 0 when the originator is an AP, and is 2045 when the originator is an unassociated HE STA(#9120)):

* If the Ack Type field is 0 and the TID field is less than 8(#9120) then the BlockAck Starting Sequence Control, TID and BA Bitmap fields of the Per AID TID Info field(#7734) are processed according to 10.24.7 (HT-immediate block ack mechanism), 27.3 (Fragmentation and defragmentation(#8457)), and as defined below.
* If the Ack Type field is 0 and the TID field is 15, then the Per AID TID Info field indicates the acknowledgement of a single MMPDU sent by the unassociated STA as defined by the acknowledgement context.(#9120)
* If the Ack Type field is 1 and the TID is less than or equal to 7 or is equal to 15, then the Per AID TID Info field(#7734) indicates the acknowledgement of a single MPDU(i.e., MPDU in an A-MPDU subframe wth EOF = 1) identified by the value of the TID, an Action frame or a PS-Poll frame(#3063, #6621)(#6096).
* If the Ack Type field is 1 and the TID subfield of AID TID Info field(#7734) is 14, then the Per AID TID Info field(#7734) indicates the acknowledgement of all MPDUs carried in the eliciting PPDU as defined by the acknowledgement context.
* Negotiation of block ack bitmap lengths

Both the Compressed BlockAck frame and Multi-STA BlockAck frame allow different Block Ack Bitmap subfield lengths. The length of the Block Ack Bitmap subfield is indicated in the Fragment Number subfield of the Block Ack Starting Sequence Control field as defined in 9.3.1.9 (BlockAck frame format). The Block Ack Bitmap subfield length in bits(#7801) of a BlockAck frame used during a BA session depends on the negotiated buffer size between the originator and the recipient as indicated below:

* When a Compressed BlockAck frame is used:
* If the negotiated buffer size is within [1, 64] then a BlockAck Bitmap length of 64 shall be used during the BA session
* If the negotiated buffer size is within [65, 256](#5654) then a BlockAck Bitmap length of either 64 or 256 shall be used during the BA session
* When a Multi-STA BlockAck frame is used:
* If the negotiated buffer size is within [1, 64] then a BlockAck Bitmap length of either 32 or 64 shall be used during the BA session
* If the negotiated buffer size is within [65, 128] then a BlockAck Bitmap length of 32, 64 or 128 shall be used during the BA session(#5655, #7534, #9882)
* If the negotiated buffer size is within [129, 256] then a BlockAck Bitmap length of 32, 64, 128 or 256 shall be used during the BA session(#5655, #7534, #9882)

The recipient shall not include in the Buffer Size field of an ADDBA Response frame a value that would cause the BlockAck Bitmap length of its block ack responses to exceed the BlockAck Bitmap length that is derived by the Buffer Size field of the ADDBA Request frame sent by the originator. The originator sets the Duration field value accounting for the largest BlockAck Bitmap length based on negotiated buffer size.(#8122)

A recipient shall not include in a Multi-STA BlockAck frame a Per AID TID Info field with a 32-bit BlockAck Bitmap field addressed to an originator if the 32-bit BA Bitmap Support field in the HE MAC Capabilities Information field in the HE Capabilities element received from that originator is 0.(#6622)

NOTE—A Multi-STA BlockAck frame might include Per AID TID Info fields with a 32-bit BlockAck Bitmap field addressed to other originators and the nonsupporting originator needs to able to parse these fields to locate a possible Per AID TID Info field addressed to it.(#6622)

A recipient that is the intended receiver of an (multi-TID) A-MPDU, (multi-TID) BlockAckReq frame, MU-BAR Trigger frame or GCR MU-BAR Trigger frame(#3202) that solicits an immediate BlockAck frame response for each TID shall follow the rules defined in 10.24.7 (HT-immediate block ack extensions) except that:

* *WinSizeR* is set to the smaller of *BitmapLength* and the value of the Buffer Size field of the associated ADDBA Response frame that established the block ack agreement, where the *BitmapLength* is the largest value for the BlockAckBitmap that is supported(#7803) by the recipient
* The Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield shall be set to any value in the range from (*WinEndR*  *BitmapLength* + 1) to *WinStartR*
* The values in the recipient's record of status of MPDUs beginning with the MPDU for which the Sequence Number subfield value is equal to *WinStartR* and ending with the MPDU for which the Sequence Number subfield value is equal to *WinEndR* shall be included in the BlockAck Bitmap, wherein the length of the BlockAck Bitmap field shall be greater than or equal to *WinEndR*  *WinStartR*(#5805, #6623)

(#7966)NOTE—An HE STA can generate a BlockAck frame with variable length Block Ack Bitmap field in which case the STA ensures that the BlockAck frame response fits within the remaining duration of the TXOP.

If a STA sets(#7804) the HE Fragmentation Support subfield in the HE Capabilities element to 3, then the LSB of the Fragment Number subfield of the BA frame may be set to 1. If the LSB of the Fragment Number subfield of the BA frame is set to 1, then the BA Bitmap fields are re-mapped as defined in 27.3 (Fragmentation and defragmentation(#8457)).

* Per-PPDU acknowledgment selection rules
* General

A STA that sends a PPDU to an intended recipient can solicit different immediate responses by using the Ack Policy field of QoS Data or QoS Null frames, the type of the frame (e.g., Action, (multi-TID) BAR, MU-BAR Trigger frame(#Ed), GCR MU-BAR Trigger frame,(#3204) etc.) and the EOF field setting(#7938, #7939).

(#8432) [Editor’s Note: This paragraph moved to 27.4.5 for readability purpose]

* Response to HE SU PPDU using an SU PPDU (#9351, #8432))

An HE STA that receives an HE SU PPDU with an A-MPDU that contains QoS Data or QoS Null frames addressed to it shall follow the following acknowledgment procedure:

* If the HE SU PPDU carries an S-MPDU that is a QoS Data frame or QoS Null frame with the Ack Policy field equal to Normal Ack, or an Action Ack frame, then the STA shall respond with an Ack frame carried in an SU PPDU. (#9395)
* If the HE SU PPDU carries a single-TID A-MPDU that includes one or more QoS Data frame or QoS Null frame wth EOF = 0, and with the Ack Policy field equal to Implicit Block Ack Request for at least one MPDU, then the STA shall respond with a Compressed BlockAck frame as defined in 10.24.7.5, carried in an SU PPDU.
* If the HE SU PPDU carries a multi-TID A-MPDU that includes more than one QoS Data frame or QoS Null frame with the Ack Policy field equal to Implicit Block Ack Request and with more than one TID, then the STA shall respond with a Multi-STA BlockAck frame as defined in 27.4.2, carried in an SU PPDU

27.4.4.3 Response to HE MU PPDU(#8391) using an SU PPDU(#8432)

If an AP intends to solicit an immediate response in an SU PPDU format (#8391):

* the AP shall set the Ack Policy field of the QoS Data and QoS Null frames to Normal Ack or Implicit Block Ack Request(#5566)(#10253) for the MPDUs of at most one user (#8487) (#8391) (see 10.3.2.10.1 (Acknowledgement procedure for DL MU PPDU in SU format)(#3066) for an example of this sequence).
* The A-MPDUs in the HE MU PPDU(#8391) shall not contain an Action frame or an MMPDU that solicits a response.(#6625)

A non-AP STA that receives an HE MU PPDU(#8391) with an A-MPDU that contains QoS Data or QoS Null frames addressed to it with with the Ack Policy field equal to Normal Ack or Implicit Block Ack Request (#8492) (#9883) shall follow the following acknowledgment procedure:

* If the HE MU PPDU(#8391) carries an(#6626) S-MPDU that is a QoS Data frame or QoS Null frame addressed to it and with the Ack Policy field equal to Normal Ack, then the STA shall respond with an Ack frame carried in an SU PPDU.(#6627). (#9395) .
* If the HE MU PPDU(#8391) carries an single TID A-MPDU that includes one or more (#9395) QoS Data frame or QoS Null frame wth EOF = 0, and with the Ack Policy field equal to Implicit Block Ack Request(#5566) for at least one MPDU,, then the STA shall respond with a Compressed BlockAck frame as defined in 10.24.7.5, carried in an SU PPDU.(#6628)
* If the HE MU PPDU(#8391) carries an multi-TID A-MPDU that includes more than one QoS Data frame or QoS Null frame addressed to it with the Ack Policy field equal to Implicit Block Ack Request(#5566) and with more than one TID, then the STA shall respond with a Multi-STA BlockAck frame as defined in 27.4.2, carried in an SU PPDU.(#6629)

NOTE—A control response frame carried in an SU PPDU that is an immediate response to an HE MU PPDU(#6630) follows the rules defined in 10.7.6.5 (Rate selection for control response frames).

27.4.4.4 Response to HE MU PPDU(#8391) or HE SU PPDU using an HE TB PPDU (#8432)

An AP that sends an HE MU PPDU(#8391) or HE SU PPDU that solicits(#6631) an immediate response carried in an HE TB PPDU shall set the Ack Policy to HTP Ack(#4723)(#Ed) for each of the MPDUs for which it intends to solicit an immediate response (see 10.3.2.11.3 (MU acknowledgement procedure for HE MU PPDU in MU format) for an example of this sequence). If an Action frame or an MMPDU that solicits an immediate acknowledgement is carried in an HE MU PPDU, then the response is carried in an HE TB PPDU.(#9719) A non-AP STA that receives an HE MU PPDU or HE SU PPDU (#8492)with an A-MPDU that contains QoS Data or QoS Null frames addressed to it with Ack Policy field equal to HTP Ack, or an Action-Ack frame shall not respond if it has not received the UL resource allocation information either through UMRS Control field or a Trigger frame in the soliciting PPDU.

A non-AP STA that receives an HE MU PPDU(#8391) or HE SU PPDU (#8492)with an A-MPDU that contains QoS Data or QoS Null frames addressed to it with Ack Policy field equal to HTP Ack, or an Action-Ack frame shall follow the following acknowledgment procedure if it has received the UL resource allocation information through either a UMRS Control field or a Trigger frame in the soliciting PPDU:(#9886, #9884)

* If the HE MU PPDU(#8391) or HE SU PPDU carries an S-MPDU(#9331) (#8492)that is a QoS Data frame or QoS Null frame with the Ack Policy field equal to HTP Ack,or an Action Ack frame and if a UMRS Control field(#Ed) is present(#9885), then the STA shall respond with an Ack frame carried in the HE TB PPDU sent as a response. (#9395).
* If the HE MU PPDU(#8391) or HE SU PPDU carries an single TID A-MPDU (#8492)that includes one or more QoS Data frame(s) or QoS Null frame(s) wth EOF = 0, with the Ack Policy field equal to HTP Ack for at least one MPDU, and either a Trigger frame or a frame with a UMRS Control field(#Ed) is present, then the STA shall respond with a Compressed BlockAck frame as defined in 10.24.7.5, carried in the HE TB PPDU sent as a response.
* If the HE MU PPDU(#8391) or HE SU PPDU carries a multi-TID A-MPDU (#8492)that includes a QoS Data frame(s) or QoS Null frame(s) with the Ack Policy field equal to HTP Ack, and an Action Ack frame, and either a Trigger frame or a frame with a UMRS Control field(#Ed) is present, then the STA shall respond with a Multi-STA BlockAck frame as defined in 27.4.2, carried in the HE TB PPDU(#6637) sent as a response.

27.4.4.5 Response to HE TB PPDU using a DL SU PPDU(#8432)

A non-AP STA that sends an HE TB PPDU as a response to a Basic Trigger frame(#8485) that solicits(#9287) an immediate response shall set the Ack Policy to Normal Ack/Implicit Block Ack Request(#5566) (see 10.3.2.10.3 (Acknowledgement procedure for an UL MU transmission)(#9288) for an example of this sequence). If the HE AP intends to send the response in a DL SU PPDU format, then the HE AP shall follow the following acknowledgment procedure:

* If the HE TB PPDU carries an S-MPDU(#10255) from a single STA that solicits an immediate response, then the HE AP shall respond with either an Ack frame or a Multi-STA BlockAck frame with the Ack Type field set to 1 carried in a DL SU PPDU format.
* If the HE TB PPDU carries an single TID A-MPDU from a single STA that solicits an immediate response, then the HE AP shall respond with a Compressed BlockAck frame, a Multi-STA BlockAck with the Ack Type field set to 1 and the TID field set to 14 or a Multi-STA BlockAck frame with the Ack Type field set to 0 carried in a DL SU PPDU format.
* If the HE TB PPDU carries a multi-TID A-MPDU(#3298) that solicits an immediate response from a single STA then the HE AP shall respond with a Multi-STA BlockAck frame with the Ack Type field set to 0(#9887) carried in a DL SU PPDU format.

If the HE TB PPDU carries S-MPDUs(#Ed), A-MPDUs, or multi-TID A-MPDUs from more than one STA, or a combination of S-MPDUs(#Ed) from a subset of STAs, A-MPDUs from another subset of STAs, or multi-TID A-MPDUs from another subset of STAs then the AP shall respond with a Multi-STA BlockAck frame carried in a DL SU PPDU format that contains the appropriate settings in each Per AID TID Info field(#7734) intended to each STA as defined in the previous subclauses.

27.4.4.6 Response to HE TB PPDU using an HE MU PPDU(#8391)(#8432)

A non-AP STA that sends an HE TB PPDU as a response to a Basic Trigger frame(#8385) that solicits(#6643) an immediate response shall set the Ack Policy to Normal Ack/Implicit Block Ack Request(#5566) for each of the MPDUs carried in the A-MPDU. (see 10.3.2.10.3 (Acknowledgement procedure for an UL MU transmission)(#7083) for an example of this sequence). If the HE AP intends to send the response in an (#7084) OFDMA HE MU PPDU format, then the HE AP shall follow the following acknowledgment procedure:

* If the HE TB PPDU carries an S-MPDU from more than one STA, or (multi-TID) A-MPDU from more than one STA, or a combination of an S-MPDU from some STAs and (multi-TID) A-MPDU from other STAs, then the HE AP shall do one of the following:
* The AP shall respond with an(#6647) Ack frame (#3069)to each of the STAs from which an S-MPDU(#9331) that solicited an immediate response was received, and with a Compressed BlockAck frame (#3069)to each of the STAs from which an A-MPDU that solicited an immediate response was received, or a Multi-STA BlockAck frame to each of the STAs(#6649) from which a multi-TID A-MPDU that solicited an immediate response was received. The control response frame(#3214) for each STA shall be sent in the allocated RU that is identified by the AID of each STA.
* The AP may respond with group addressed Multi-STA BlockAck frame(s) in an HE MU PPDU if the receivers of group-addressed Multi-STA BlockAck frame support the(#6650) reception of MU Multi-STA BlockAck frame by Group Addressed Multi-STA BlockAck In DL MU Support in DL MU Support subfield in the HE MAC Capabilities Information field(#9330, #8551) The Ack Type field shall be set according to the acknowledgement context. An HE AP should only transmit a group addressed Multi-STA BlockAck frame in an HE MU PPDU(#8391) to a non-AP HE STA *n* on the broadcast RU (26/52/106/242/484/996) (see 28.3.10.8.6 (HE-SIG-B per-user content))(#6098, #5807, #7087, #9525) that includes the RU used for receiving the immediately(#6655) preceding HE TB PPDU from STA *n*. There shall be no more than one group addressed Multi-STA BlockAck frame (#Ed)carried in a broadcast RU of the HE MU PPDU(#8391).

27.4.5 HE Block acknowledgment request and response rules (#8469, #3059)

 [Editor’s Note: This paragraph is moved from section 27.4.4] (#8432, #3059)

An HE STA that receives a BlockAckReq frame or an(#6613) MU-BAR Trigger frame(#10252) that contains a Compressed BlockAckReq variant in the User Info field addressed to the STA, or a GCR MU-BAR Trigger frame that contains a Compressed BlockAckReq variant in the Common Info field(#3201) shall respond with a Compressed BlockAck frame(#Ed) or a Multi-STA BlockAck frame. The response that is sent using a Compressed BlockAck frame shall follow the procedure defined in 10.24.7.5. The response that is sent in a Multi-STA BlockAck frame contains a single Per AID TID Info field with a Block Ack Bitmap subfield, with Starting Sequence Number subfield set to the Starting Sequence Number subfield of the Block Ack Request Starting Sequence Control subfield and the length of the Block Ack Bitmap subfield calculated as defined in 27.4.3 (Negotiation of block ack bitmap lengths)(#9737). [Editor’s Note: This paragraph is moved from section 27.4.1] (#8432, #3059)

An HE STA that receives a Multi-TID BlockAckReq frame or an(#6614) MU-BAR Trigger frame(#10252) that contains a Multi-TID BlockAckReq variant in the User Info field addressed to the STA or a GCR MU-BAR Trigger frame that contains a Multi-TID BlockAckReq variant in the Common Info field(#3201) shall respond with a Multi-STA BlockAck frame that contains a Per AID TID Info field with a Block Ack Bitmap subfield for each of the TIDs (with values less than 8) contained in the BlockAckReq frame, with Starting Sequence Number subfield set to the Starting Sequence Number subfield of the Block Ack Request Starting Sequence Control subfield and the length of the Block Ack Bitmap subfield calculated as defined in 27.4.3 (Negotiation of block ack bitmap lengths)(#9737). [Editor’s Note: This paragraph is moved from section 27.4.1] (#8432, #3059)

* Ack Policy subfield

Change Table 9-9 (Ack Policy subfield in QoS Control field of QoS Data frames) as follows (only relevant row shown):

|  |
| --- |
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| --- |
| * Ack Policy subfield in QoS Control field of QoS Data frames
 |
| Bits in QoS Control field | Meaning |
| Bit 5 | Bit 6 |
| 0 | 1 | No explicit acknowledgment, ~~or~~ PSMP Ack or HE TB PPDU (HTP) Ack(#4723).When the frame is not carried in a DL HE MU PPDU(#6253) or HE SU PPDU (#9395) that solicits an HE TB PPDU:(#7709)When bit 6 of the Frame Control field (see 9.2.4.1.3 (Type and Subtype subfields)) is set to 1:There might be a response frame to the frame that is received, but it is neither the Ack frame nor any Data frame of subtype +CF-Ack.The Ack Policy subfield for QoS CF-Poll and QoS CF-Ack +CF-Poll Data frames is set to this value.When bit 6 of the Frame Control field (see 9.2.4.1.3 (Type and Subtype subfields)) is set to 0:The acknowledgment for a frame indicating PSMP Ack when it appears in a PSMP downlink transmission time (PSMP-DTT) is to be received in a later PSMP uplink transmission time (PSMP-UTT).The acknowledgment for a frame indicating PSMP Ack when it appears in a PSMP-UTT is to be received in a later PSMP-DTT.When the frame is carried in a DL HE MU PPDU that solicits an HE TB PPDU the addressed recipient returns an Ack, BlockAck, or Multi-STA BlockAck frame carried in an HE TB PPDU a SIFS after the DL HE MU PPDU as defined in 10.3.2.10.2 (Acknowledgement procedure for DL MU PPDU in MU format)(#8387) and 27.5.2 (UL MU operation).(#4724)(#8590)(#7709)NOTE—Bit 6 of the Frame Control field (see 9.2.4.1.3 (Type and Subtype subfields)) indicates the absence of a data Frame Body field. When equal to 1, the QoS Data frame contains no Frame Body field, and any response is generated in response to a QoS CF-Poll or QoS CF-Ack +CF-Poll frame, but does not signify an acknowledgment of data. When set to 0, the QoS Data frame contains a Frame Body field, which is acknowledged as described in 10.29.2.7 (PSMP acknowledgment rules). |