IEEE P802.11  
Wireless LANs

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| **CIDs for: Section 25.4/25.4.1**  **Selection of BlockAck and BlockAckReq variants** |
| Date: 2016-04-17 |

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Abstract

This submission proposes resolutions for multiple comments related to TGax D0.1 with the following CIDs (**13 CIDs**):

* 1218, 31, 168, 752, 1495, 1498, 1499, 1500, 1664, 1795, 1900, 2319, 813

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Incorporated suggestion by Mark. Fixed document number and adjusted instructions to the editor and comment resolution tabs. Changes to the spec text w.r.t. Rev 0 are highlighted in green. Note:
* Rev 3: Made 32bit bitmap optional.

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** | | | | | **PP.LL** | | | | | | **Comment** | | | | **Proposed Change** | | | | | **Resolution** | | |
| 1218 | | | | Liwen Chu | | | | | 55.45 | | | | | M-BA can be used in acknowledging DL MU transmission also. The RA can be unicast/broadcast MAC address. | | | | | | As in comment. | | | | | | REVISED. Agree in principle. See CID 2212  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1218. |
| 31 | | | | Ahmadreza Hedayat | | | | | 55.57 | | | | | It is expected that a multi-STA BA would contain at most one BA Info field with a given AID. Hence, this statement "On receiving such a Multi-STA BlockAck frame a STA performs the following for each BA Information field with its AID ..." should be "On receiving such a Multi-STA BlockAck frame a STA performs the following for the BA Information field with its AID". | | | | | As in the comment. | | | | | | REVISED. See below  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 31. | |
| 168 | | | | Alfred Asterjadhi | | | | 73.48 | | | | | These subclause needs to specify the following cases:when multi-TID A-MPDUs can be sent, multi-STA BA sent by non-AP STA, as a response to MGMT frames, as a response to multi-TID A-MPDUs, the selection of the blockack bitmap size of the BA frame that is transmitted, the selection of the BA frame itself, and the clear determination of when all-ack indication is possible. Same considerations for BARs. Also an HE STA has to mandatory support M-BA otherwise none of these cases can be enabled. | | | | | | As in comment. | | REVISED. Agree in principle. See changes below  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 168. | | | | | |
| 752 | | | | Jarkko Kneckt | | | | 56.01 | | | | | The receiver of the ACK needs to know is a single MPDU or all MPDUs being acknowledged. This cannot be either or. | | | | | | Add rules how the receiver of the ACK knows if a single MPDU or all MPDUs have been acknowledged. | | | | | | REJECT. The originator has the context of what is sent – single MPDU or multiple MPDUs. This is devined as VHT Single MPDU (for Ack) and A-MPDU for BA. | |
| 1495 | | | | Mark RISON | | | | 55.55 | | | | | What is "Multi-STA BA" and how is support signalled? | | | | | | Indicate how support is signalled | | | | | | REVISED. Agree in principle. See changes below  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1495. | |
| 1498 | | | | Mark RISON | | | | 55.60 | | | | | "If the ACK type field is 1 then the BA Start Sequence Control, TID and BA Bitmap of the BA information field are processed according the procedure given in 10.24.7 (HT-immediate block ack extensions)." -- err, except if the ack was for something involving a dynamic fragment, in which case 25.3 applies instead/in addition, no? | | | | | | Clarify | | | | | | REVISED. Agree in principle. See changes below. Also added Editor’s note.  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1498. | |
| 1499 | | | | Mark RISON | | | | 56.01 | | | | | "If the ACK type field is 0, the field indicates an ACK of either a single MPDU or all MPDUs carried in the eliciting PPDU that was transmitted by the STA." -- well, which is it? | | | | | | Change to "If the ACK type field is 0, the field indicates acknowldegement the MPDU(s) carried in the eliciting PPDU that was transmitted by the STA." | | | | | | REJECT. Need to handle the case of VHT single MPDU | |
| 1500 | | | | Mark RISON | | | | 56.01 | | | | | "If the ACK type field is 0, the field indicates an ACK of either a single MPDU or all MPDUs carried in the eliciting PPDU that was transmitted by the STA." -- err, but the MPDU(s) for the TID specified in the BA Information field in question, in the case of a multi-TID A-MPDU, no? | | | | | | Restrict the statement to have per-TID scope | | | | | | REJECTED. MPDUs may be in the mixed order of TIDs. So, missing one MPDU in a TID cannot be distinguished from another. So, this can work only if it across all TIDs | |
| 1664 | | | NARENDAR MADHAVAN | | | | 55.53 | | | | | What is the RA field of a Multi-STA BlockAck frame with BA information for a single AID? | | | | | | A Multi-STA BlockAck frame with BA information for single AID and multiple AIDs shall have RA field set to the unicast address and broadcast address respectively. | | | | | | REVISED. Agree in principle. See CID 2212.  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1664. | | |
| 1795 | | Robert Stacey | | | | 55.47 | | | | | The block acknowledgement rules for level 2 fragmented MSDUs are not clear. Under the current block ack rules (which assume an MPDU carries a complete MSDU) the recipient puts 1 in the bitmap index that corresponds to the SN received. The 1 can remain in each future transmision of the bitmap. WIth level 2 fragmentation, this is no longer the case. The recipient must only send a 1 for a particular SN if it received an MPDU with that SN in the immediately preceding A-MPDU and must send 0 otherwise. | | | | | | Add a subclause to 25.4 for HE modifications to HT immediate block ack. Add statements about what applies and what does not apply (e.g., full state operation). Explicitly state that the bitmap only acknowledges MPDUs received in the A-MPDU to which it is a response. | | | | | | Revised –  Please refer to resolutions to CID2629, CID1794.  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1795. | | | |
| 1900 | | Sigurd Schelstraete | | | | 55.56 | | | | | Missing word? | | | | | | Replace "An HE STA that supports Multi-STA BA shall examine each received Multi-STA sent by an STA ..." with "An HE STA that supports Multi-STA BA shall examine each received Multi-STA BA sent by an STA ..." | | | | | | REVISED. Agree in principle. See changes below. Also added Editor’s note.  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 1900. | | | |
| 2319 | Yasuhiko Inoue | | | | 55.56 | | | | | "An HE STA that supports Multi-STA BA shall examine each received Multi-STA sent by an STA with which it has a BA agreement."  "Received Multi-STA" is not clear enough. Is it Multi-STA BA frame or Multi-STA field in the Block Ack? | | | | | | Clarify, please. | | | | | | REVISED. See below  TGax editor to make the changes shown in 11-16/1028r1r0 under all headings that include CID 2319. | | | | |
| 813 | Jinsoo Ahn | | | | 55.55 | | | | | Selection of BlockACK variants needs to be considered under consideration of EIFS duration | | | | | | Insert the following "AP should choose a valid BlockAck method that BA transmission time does not exceed (EIFS - SIFS) duration. If BA transmission time of all the possible methods exceeds (EIFS - SIFS) duration, AP shall choose the most short air time BlockAck method." | | | | | | REJECT. A "shall" requirement for AP is too restrictive | | | | |

## 25.4 Block acknowledgement

**TGax Editor: *Change this subclause as follows (#CID 1218, 31, 168, 1495, 1498, 1664, 1795, 1900, 2319):***

### 25.4.1 Overview

[CID168] An HE STA can use Compressed BlockAck frame (C-BA) or Multi-STA BlockAck frame (M-BA) after setting up a blockack agreement. An HE STA shall support generation of Compressed BlockAck frames if HT-immediate BA is supported in the role of recipient (see 10.24.7.1 (Introduction). An HE STA shall support generation of Multi STA BlockAck frame if either UL MU operation (see 25.5.2 (UL MU operation)) or multi-TID A-MPDU operation (25.10.3 (A-MPDU with multiple TIDs)) is supported in the role of recipient [CID1495].

An that sends a Multi-STA BlockAck frame

### 25.4.2 Acknowledgement, block acknowledgment or all acknowledgement selection in a Multi-STA BlockAck frame

A recipient sets the Ack Type and TID subfields in a Per AID TID Info field of the Multi-STA BlockAck frame sent as a response depending on the acknowledgement context:

1. All Ack context: if the originator had set the the All Ack Supported subfield to 1 in the HE Capabilities element, 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 intended to it carried in the eliciting A-MPDU or multi-TID A-MPDU only. 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 STA Info field intended to an originator in the Multi-STA BlockAck frame.
2. Ack context: A recipient receiving a single MPDU, that requires an acknowledgment, shall set the Ack Type field to 1 and the TID field to the TID value of that MPDUs to indicate the successful reception of that that MPDU.
   * If multiple single MPDUs in a Multi-TID A-MPDUs are received by a recipient that supports its reception, the Multi-STA BlockAck frame may contain multiple occurrences of these Per STA Info fields that are intended to an originator, one for each successfully received single MPDU requesting an acknowlegment,
   * 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 Ack frame).
3. BlockAck context: The recipient shall set the Ack Type field to 0 and the TID field of a Per STA Info field 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 STA Info fields intended 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 blockack session, and according to 25.3 (Fragmentation) for each blockack 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 STA Info field when the originator and recipient negotiate their use as defined in 25.4.3 (Negotiation of blockack bitmap lengths).

An originator [CID168] shall examine each received Multi-STA BA [CID1900, CID2319] sent by an STA as a response to a soliciting PPDU.

Upon reception of the Multi-STA BlockAck frame the originator performs the following for each [CID31] Per STA Info field that has an AID field intended to the originator (i.e., the AID subfield is an AID if the originator is a non-AP STA and is 0 when the originator is an AP):

* If the ACK Type field is 0 [CID2185] then the BlockAck Starting Sequence Control, TID and BA Bitmap fields of the Per STA Info field are processed according to 10.24.7 (HT-immediate block ack mechanism), [CID1498] 25.3 (Fragmentation), and as defined below.
* If the ACK Type field is 1 [CID2185] then the Per STA Info field indicates either the acknowledgement of a single MPDU identified by the value of the TID or of all MPDUs [CID1500] carried in the eliciting PPDU as defined by the acknowledgement context.

### 25.4.3 Negotiation of blockack bitmap lengths

Both Compressed BlockAck frame and Multi-STA BlockAck frame allow different Block Ack Bitmap 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 length of BlockAck frames used during a BA session depends on the negotiated buffer size between the originator and the recipient as indicated below:

* When Compressed BlockAck frame is used:

1. If the negotiated buffer size is within [1, 64] then a BlockAck Bitmap length of 64 shall be used during the BA session;
2. If the negotiated buffer size is within [1, 256] then a BlockAck Bitmap length of either 64 or 256 shall be used during the BA session.

* When Multi-STA BlockAck frame is used:

1. 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;
2. If the negotiated buffer size is within [1, 128] then a BlockAck Bitmap length of 32, 64, or 128 shall be used during the BA session;
3. If the negotiated buffer size is within [1, 256] then a BlockAck Bitmap length of 32, 64, 128, or 256 shall be used during the BA session.

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 blockack responses to exceed the BlockAck Bitmap length that is derived by the Buffer Size field of the ADDBA Request frame sent by the originator.

A recipient shall not include in a transmitted Multi-STA BlockAck frame a BlockAck Bitmap field of size 32 bits that is intended to a STA that has not declared support of its reception in the HE Capabilities element it transmits.

NOTE—The recipient can include in the Multi-STA BlockAck frame BlockAck Bitmap fields of 32 bits for other intended recipients that declare reception support and the nonsupporting recipient needs to parse these fields to be able to locate the block ack information that is intended to it.

A recipient that is the intended receiver of an (multi-TID) A-MPDU, (multi-TID) BAR, or MU BAR variant Trigger frame that solicits an immediate blockack 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 can be used 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*, wherein the length of the BlockAck Bitmap field shall be greater than or equal to the smallest *BitmapLength* that is greater than *WinEndR* – *WinStartR*

NOTE 1—An HE STA follows the rules in 10.24.7 (HT-immediate block ack extensions) where the value 64 is replaced with *BitmapLength*, and the value 63 is replaced with *BitmapLength* minus 1.

NOTE 2—An HE STA can generate a blockack frame with variable blockack bitmap in which case the STA ensures that the blockack response fits within the remaining duration of the TXOP.

[CID1498]If the HE Fragmentation Support subfield in the HE Capabilities element it transmits is 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 section 25.3. [Editor’s Note: This can be removed if this is covered as part of Section 25.3]

### 25.4.4 Per-PPDU acknowledgment selection rules

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 Ack, (multi-TID) BAR, MU BAR variant Trigger frame, etc.) and the EOF field setting when these frames are carried in an A-MPDU or multi-TID A-MPDU.

An HE AP may solicit blockack responses from multiple HE STAs using a MU BAR variant Trigger frame. If an MU BAR variant Trigger frame is aggregated in an A-MPDU then no other BAR frames shall be present in the same A-MPDU. The MU BAR variant Trigger frame shall contain either Compressed BAR variant or Multi-TID BAR variant in each of the Per User Info fields. An HE AP shall not send a Multi TID BAR (neither as part of a Per User Info field intended to the STA in an MU BAR variant Trigger frame nor as a BAR frame) to a STA that has not indicated support for multi-TID A-MPDU. (Multi-TID) BAR, BAR, and MU BAR variant Trigger frames indicate the length of the soliciting blockack responses according to the FN settings defined in 9.3.1.9 (BlockAck frame format).

### 25.4.4.1 DL MU PPDU soliciting a SU PPDU response

An AP that sends a DL MU PPDU that intends to solicit an immediate response carried in an SU PPDU shall set the Ack Policy to Normal Ack (or Implicit BAR) for at most one of the (A-) MPDUs contained in the soliciting DL MU PPDU (see 10.3.2.11.2 (MU acknowledgement procedure for DL MU PPDU in SU format) for an example of this sequence). The AP shall not solicit an immediate response for any of the other (A-) MPDUs carried in the DL MU PPDU. The A-MPDUs carried in the soliciting DL MU PPDU shall not contain an Action Ack frame or a MMPDU that solicits a response. A non-AP STA that receives a DL MU PPDU that solicits an immediate response shall follow the following acknowledgment procedure:

1. If the DL MU PPDU carries a VHT Single MPDU intended to it with the Ack Policy equal to Normal Ack, then the STA shall respond with an Ack frame carried in an SU PPDU
2. If the DL MU PPDU carries an A-MPDU intended to it with the Ack Policy equal to Implicit BAR, then the STA shall respond with an Compressed BlockAck frame carried in an SU PPDU
3. If the DL MU PPDU carries a multi-TID A-MPDU intended to it with the Ack Policy equal to Implicit BAR, then the STA shall respond with a Multi-STA BlockAck frame carried in an SU PPDU

NOTE—The control response frame carried in SU PPDU format follows the rules defined in 10.7.6.5 (Rate selection for control response frames).

### 25.4.4.2 DL MU PPDU soliciting a Trigger-based PPDU response

An AP that sends a DL MU PPDU that intends to solicit an immediate response carried in an HE Trigger-based PPDU shall set the Ack Policy to MU Ack (‘01’) for each of the (A-) 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). An Action Ack frame in the DL MU PPDU is always responded with an HE Trigger-based PPDU. A non-AP STA that receives a DL MU PPDU that solicits an immediate response shall follow the following acknowledgment procedure:

1. If the DL MU PPDU carries a VHT Single MPDU intended to it that solicits an immediate response, and either an UL MU Response Scheduling A-Control field or a Trigger frame is present, then the STA shall respond with an Ack frame carried in the Trigger-based PPDU sent as a response.
2. If the DL MU PPDU carries an A-MPDU intended to it that solicits an immediate response, and either a Trigger frame or UL MU Response Scheduling A-Control field is present, then the STA shall respond with a Compressed BlockAck frame carried in the Trigger-based PPDU sent as a response.
3. If the DL MU PPDU carries a multi-TID A-MPDU intended to it that solicits an immediate response, and either a Trigger frame or an UL MU Response Scheduling A-Control field is present, then the STA shall respond with a Multi-STA BlockAck frame carried in the Trigger-based PPDU sent as a response.

### 25.4.4.3 Trigger-based PPDU soliciting a DL SU PPDU response

A non-AP STA that sends a Trigger-based PPDU as a response to a Basic variant Trigger frame that intends to solicit an immediate response shall set the Ack Policy to Normal Ack/Implicit BAR (see 10.3.2.11.4 (MU acknowledgement procedure for an UL MU transmission) 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:

1. If the HE Trigger-based PPDU carries a VHT Single MPDU from a single STA that solicits an immediate response, then the HE-AP shall respond with an Ack frame or a Multi-STA Block Ack frame with ACK Type set to 1 carried in a DL SU PPDU format.
2. If the HE Trigger-based PPDU carries an A-MPDU from a single STA that solicits an immediate response, then the HE-AP shall respond with Compressed BlockAck frame or a Multi-STA Block Ack frame with Ack Type set to 0 carried in a DL SU PPDU format.
3. If the HE Trigger-based PPDU carries a Multi-TID A-MPDU that solicits an immediate response from a single STA then the HE-AP shall send a Multi-STA BlockAck frame carried in a DL SU PPDU format.

If the HE Trigger-based PPDU carries VHT Single MPDUs, A-MPDUs, or multi-TID A-MPDUs from more than one STA, or a combination of VHT Single MPDU 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 STA Info field intended to each STA as defined in the previous subclauses.

### 25.4.4.4 Trigger-based PPDU soliciting a DL MU PPDU response

A non-AP STA that sends a HE Trigger-based PPDU as a response to a Basic variant Trigger frame that intends to solicit an immediate response shall set the Ack Policy to Normal Ack/Implicit BAR (see 10.3.2.11.4 (MU acknowledgement procedure for an UL MU transmission) for an example of this sequence). If the HE AP intends to send the response in a HE MU PPDU format, then the HE AP shall follow the following acknowledgment procedure:

1. If the HE Trigger-based PPDU carries VHT Single MPDU from more than one STAs, or (multi-TID) A-MPDU from more than one STAs, or a combination of VHT Single 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 Ack frame or an individually addressed Multi-STA BlockAck frame to each of the STAs from which a VHT Single MPDU that solicited an immediate response was received, and with a Compressed BlockAck frame or a Multi-STA BlockAck frame 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 STA from which a multi-TID A-MPDU that solicited an immediate response was received
   * The control response frames for each STA shall be sent in the allocated RU that is identified by the AID of each STAThe AP may respond with group addressed Multi-STA BlockAck frame(s) using TBD mechanism in an HE MU PPDU if the receivers of group-addressed Multi-STA BlockAck frame announce the support the reception of MU Multi-STA BlockAck frame. The Ack Type field shall be set according to the acknowledgement context. [CID1218].

**TGax Editor:** Insert a “32 Bit BA Bitmap Capable” in the HE Capabilities element.

**TGax Editor: Add the following sentence in HE Capabilities subclause:** “A STA sets the 32 Bit BA Bitmap Capable subfield to 1 to indicate that it supports receiving a Multi-STA BlockAck frame that contains a BlockAck Bitmap subfield of 32 bits that is intended to it; otherwise set to 0.”