IEEE P802.11
Wireless LANs

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| **Ack related CRs**  |
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Abstract

Resolved the following **3 CIDs**

20996, 21174, 21186

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** |

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| 20996 | Mark RISON | 314.54 | Re CID 16374: "The recipient determines that all the MPDUs carried in the eliciting A-MPDU arereceived if all the MPDUs that precede the first MPDU delimiter with EOF equal to 1 and MPDULength field equal to 0 are received." is not tight enough. If an MPDU delimiter with a non-zero Length field is corrupted to one that has a zero Length field, this could cause false positives. The only safe option is to be very conservat0996ive | Change the cited text to "The recipient determines that all the MPDUs carried in the eliciting A-MPDU were received if there were no MPDU delimiter CRC errors and no MPDU FCS errors in that A-MPDU." | Accepted |
| 21174 | Pooya Monajemi | 235.36 | The AP can also include multiple Multi-STA BlockAck frames in HE MU PPDU. This might be to cover Multi-TID, or some STA in a Broadcast RU and others in single User RU with more DL Data. | "may send either multiple BlockAck frames (or Ack frames, or a Multi-STA BlockAck frames) in an HE MU PPDU, or a Multi-STA BlockAck frame (see 26.4 (HE acknowledgment procedure))." | Revised.Agree in principle. Made the text more generalTGax editor shall incorporate changes in 11-19-1306-01-00ax |
| 21186 | Pooya Monajemi | 317.18 | There is one missing case for a PS-Poll | Add that to case (1) text. | Revised.Agree in principle. Made the requested change.TGax editor shall incorporate changes in 11-19-1306-01-00ax |

* Acknowledgment procedure for an UL MU transmission

An AP that receives frames from more than one STA that are part of an UL MU transmission (see 9.42.2) and that require an immediate acknowledgment (i.e., the ack policy of the eliciting QoS Data frame is Normal Ack or Implicit BAR(#20545)), shall send an immediate acknowledgment in either an SU PPDU (see 26.4.4.5 (Responding to an HE TB PPDU with an SU PPDU)) or an HE MU PPDU (see 26.4.4.6 (Responding to an HE TB PPDU with an HE MU PPDU)) (#21174). The Multi-STA BlockAck frame may be transmitted in a non-HT PPDU, non-HT duplicate PPDU, HT PPDU, VHT PPDU, HE SU PPDU, HE ER SU PPDU or (#21175, #21455)HE MU PPDU. After a successful reception of an UL frame requiring acknowledgment, transmission of the DL acknowledgment shall commence after a SIFS, without regard to the busy/idle state of the medium. When an AP transmits an immediate acknowledgment in an HE MU PPDU in response to an A-MPDU sent in an HE TB PPDU, the AP should send it within the 20 MHz channel(s) where the pre-HE modulated fields of the HE TB PPDU sent by the STA are located. The immediate acknowledgment is an Ack frame, Compressed BlockAck frame or Multi-STA BlockAck frame.

[…]

* HE acknowledgment procedure
* Overview

The HE acknowledgment procedure builds on the features defined for HT-immediate block ack (see 10.24.7 (HT-immediate block ack extensions)), with the following extensions:

* Support for a Multi-STA BlockAck frame
* Support for a MU-BAR Trigger frame
* Support for a Multi-TID BlockAckReq frame
* Support for BlockAck Bitmap field lengths of 32, 64, 128 and 256
* Acknowledging QoS Data frames with two or more TIDs using a Multi-STA BlockAck frame
* Acknowledging QoS Data frames with one or more TIDs, and a Management frame using a Multi-STA BlockAck frame
* Acknowledging all MPDUs in a PPDU using a variant of the Multi-STA BlockAck frame
* Acknowledging MPDUs from multiple associated STAs using a single Multi-STA BlockAck frame(#21299)
* Acknowledging MPDUs from multiple unassociated STAs with a single Multi-STA BlockAck frame(#21299)

An HE STA shall be able to respond with Compressed BlockAck frames if HT-immediate block ack is supported in the role of recipient (see 10.24.7.1 (Introduction)). An HE STA shall be able to respond with a Multi-STA BlockAck frame if multi-TID A-MPDU operation (26.6.3 (Multi-TID A-MPDU and ack-enabled A-MPDU)) is supported in the role of recipient.

A non-AP HE STA that is associated with an AP and that sends a Multi-STA BlockAck frame shall set the AID11 subfield in the Per AID TID Info field of the Multi-STA BlockAck frame to 0 and the RA field to the MAC address of the intended recipient. A non-AP HE STA that is not associated with an AP shall not send a Multi-STA BlockAck frame.

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. 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 and that is sent in response to an HE TB PPDU may set the RA field of the Multi-STA BlockAck frame to either the address of the recipient STA or to the broadcast address. 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 and that is not sent in response to an HE TB PPDU shall set the RA field of the Multi-STA BlockAck frame to the address of the recipient STA.

An HE AP that sends a Multi-STA BlockAck frame to an associated STA shall set 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 Multi-STA BlockAck frame to an unassociated STA shall set the AID11 subfield in the Per AID TID Info field of the Multi-STA BlockAck frame to 2045.

An HE STA that transmits a Multi-STA BlockAck frame shall use a rate, HT‑MCS(#20972), <VHT-MCS, NSS> tuple or <HE-MCS, NSS> tuple that is supported by all recipient STAs.

An HE STA that receives a Multi-STA BlockAck frame that is a response to frames requiring acknowledgment(#20943) shall examine Per AID TID Info field received in the Multi-STA BlockAck frame, and shall process each Per AID TID Info field using the procedure defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).

A non-AP HE STA that receives a Multi-STA BlockAck frame that is a response to frames requiring acknowledgment but that do not belong to an established a block ack agreement shall examine each Per AID TID Info field received in the Multi-STA BlockAck frame as follows:

* If the Ack Type field is 1 and the TID field is less than 8, then the Per AID TID Info field indicates the acknowledgment of an EOF MPDU(#20925) that is a QoS Data frame with the indicated TID. The BA Information field is addressed 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 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).
* If the Ack Type field is 1 and the TID field is 15, then the Per AID TID Info field indicates the acknowledgment of an EOF MPDU(#20925) that is a Management frame that solicits acknowledgment or a PS-Poll frame. The BA Information field is addressed 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 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).
* If the Ack Type field is 0, and the AID field is 2045, and the TID field is 15, then Per AID TID Info field indicates the acknowledgment of an EOF MPDU(#20925) that is a Management frame soliciting immediate acknowledgment. The RA field in the Per AID TID Info field is the MAC address of an unassociated STA for which the Per AID TID Info subfield is intended. The BA Information field is addressed 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 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).

An HE AP with dot11MultiBSSIDImplemented equal to true shall not send to a non-AP STA that is associated with a nontransmitted BSSID in the multiple BSSID set a Multi-STA BlockAck frame with the TA field set to the transmitted BSSID unless the HE AP has received from the non-AP STA an HE Capabilities element with the Rx Control Frame To MultiBSS subfield in HE MAC Capabilities Information field equal to 1.(#20582, #20315)

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 unless dot11MultiBSSIDImplemented 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.

An HE STA that transmits a Multi-TID BlockAckReq frame in a PPDU that is not an HE TB PPDU shall set the TID subfields in the AID TID Info fields in the Per TID Info subfields of the BAR Information field of the Multi-TID BlockAckReq frame to TIDs that correspond to ACs that have the same or higher priority as the primary AC. An HE STA that transmits a Multi-TID BlockAckReq frame in an HE TB PPDU may set the TID subfields in the AID TID Info fields in the Per TID Info subfields of the BAR Information field of the Multi-TID BlockAckReq frame to a TID that corresponds to any AC.

An HE STA that transmits a BlockAckReq frame in an HE TB PPDU may set the TID subfield in the AID TID Info field in the BAR Information field of the BlockAckReq frame to a TID that corresponds to any AC.

* Acknowledgment context in a Multi-STA BlockAck frame

A recipient of an A-MPDU shall set the Ack Type subfield and TID subfield in the Per AID TID Info field of the Multi-STA BlockAck frame sent as a response depending on the acknowledgment context as follows:

* An HE AP that receives an A-MPDU that includes one MPDU, and the MPDU is an EOF MPDU(#20925) that is a Management frame that solicits an acknowledgment prior to association may generate a Multi-STA BlockAck frame using the procedure described in the pre-association ack context defined below.
* An HE STA that receives an A-MPDU that does not include an EOF MPDU(#20925) but does include one or more non-EOF MPDUs(#20925) that are QoS Data frames with Normal Ack or Implicit BAR ack policy(#20545) belonging to the same block ack agreement may generate a Multi-STA BlockAck frame as follows:
* If all MPDUs in the A-MPDU are received successfully, then the recipient may follow the procedure described in the all ack context as defined below.
* Otherwise, the recipient shall follow the procedure described in the BlockAck context defined below.
* If an HE STA supports ack-enabled aggregation by setting the Ack-Enabled Aggregation Support subfield in the HE MAC Capabilities Information field to 1 and the A-MPDU includes(#20982) an EOF MPDU(#20925) that is a Management frame that solicits acknowledgment, and one or more MPDUs (either EOF MPDUs or non-EOF MPDUs(#20925)) that are QoS Data frames with Normal Ack or Implicit BAR ack policy(#20545), then the recipient shall generate Multi-STA BlockAck frame as follows:
* If all the MPDUs in the A-MPDU are received successfully, then the recipient may follow the procedure described in the all ack context.
* Otherwise:
* For the MPDU that is a Management frame, the recipient shall create a Per AID TID info field using the procedure described below in Ack context with the TID value set to 15.
* For the EOF MPDUs(#20925) that are QoS Data frames, the recipient shall create a Per AID TID info field using the procedure described below in Ack context with the TID set to the TID of the QoS Data frame
* For the non-EOF MPDUs(#20925) that are QoS Data frames, the recipient shall create a Per AID TID info field using the procedure described below in BlockAck context with the TID set to the TID of the QoS Data frame
* If an HE STA supports multi-TID aggregation and the A-MPDU does not include(#20982) an EOF MPDU but does include non-EOF MPDUs(#20925) that are QoS Data frames with Implicit BAR ack policy(#20545) and are belonging to more than one block ack agreement, then the recipient shall generate a Multi-STA BlockAck frame as follows:
* If all MPDUs in the A-MPDU are received successfully, then the recipient may follow the procedure described in the all ack context
* Otherwise, for each TID included the received A-MPDU, the recipient shall create a per AID TID info field using the procedure described in BlockAck context with the TID set to the TID of the QoS Data frame

NOTE—A STA indicates the maximum number of Per AID TID Info fields with the same AID excluding the one for a(#20213) Management frame that it can include in the Multi-STA BlockAck frame in the Multi-TID Aggregation Rx Support field in the HE Capabilities element it transmits.

The procedure for different acknowledgment contexts 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, then the recipient may set the Ack Type field to 1 and the TID subfield to 14 to indicate the reception of all the MPDUs carried in the eliciting A-MPDU or multi-TID A-MPDU. 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 addressed to an originator in the Multi-STA BlockAck frame. The recipient determines that all the MPDUs carried in the eliciting A-MPDU are received if all the MPDUs that precede the first MPDU delimiter with EOF equal to 1 and MPDU Length field equal to 0 are received.
* Pre-association ack context: A recipient receiving a Management frame from an unassociated STA, that requires an acknowledgment, shall set the Ack Type field to 0, AID subfield to 2045, and the TID field to 15 in the Per AID TID Info field, and the RA field of the Per AID TID Info field to the intended recipient's MAC address to indicate the successful reception of that Management frame.
* Ack context: A recipient that sets the Ack-Enabled Aggregation Support subfield in the HE Capabilities element to 1 and that receives an EOF MPDU(#20925) soliciting acknowledgment shall set the Ack Type field to 1 and, if the EOF MPDU(#20925) is a QoS Data frame, set the TID field to the TID of the QoS Data frame, or, if the EOF MPDU(#20925) is a Management frame or PS-Poll frame, set the TID field to 15.

If a received A-MPDU contains more than one EOF MPDU(#20925) that solicits an immediate acknowledgment, then the Multi-STA BlockAck frame shall contain multiple Per AID TID Info fields, with Ack Type field equal to 1, one for each such received(#20724) EOF MPDU(#20925) requesting an acknowledgment.

The TID field is set to the TID of the QoS Data or QoS Null frame that is being acknowledged and set to 15 for a PS Poll frame or Management frame that is being acknowledged.
* BlockAck context: The recipient shall set the Ack Type field to 0 and the TID field of a Per AID TID Info field to the TID value of MPDUs requesting block acknowledgment 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 addressed to an originator, one for each MPDU that is requesting block acknowledgment, 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 26.3 (Fragmentation and defragmentation) 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 acknowledgment of QoS Data frames).

Variable bitmap lengths may be included in the Per AID TID Info field when the originator and recipient negotiate their use as defined in 26.4.3 (Negotiation of block ack bitmap lengths).

The Ack Type subfield(s) in a Multi-STA BlockAck frame shall be set to 0 if the Multi-STA BlockAck frame is sent in response to an MU-BAR Trigger frame.(#20105)

Upon receipt of a Multi-STA BlockAck frame the originator shall examine each Per AID TID Info field and shall perform the following operations:

* If the AID subfield is 0 for an AP originator or the non-AP STA's AID for a non-AP STA originator, the Ack Type field is 0 and the TID field is less than 8 then the BlockAck Starting Sequence Control, TID and Block Ack Bitmap fields of the Per AID TID Info field are processed according to 10.24.7 (HT-immediate block ack mechanism), 26.3 (Fragmentation and defragmentation), and as defined below.
* If the AID subfield is 2045, the Ack Type field is 0 and the TID field is 15, then the Per AID TID Info field indicates the acknowledgment of a single Management frame sent by the unassociated STA as defined by the acknowledgment context.
* If the AID subfield is 0 for an AP originator or the non-AP STA's AID for a non-AP STA originator, 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 indicates the acknowledgment of an EOF MPDU(#20925) that is a QoS Data frame identified by the value of the TID, a Management frame or a PS-Poll frame.
* If the AID subfield is 0 for an AP originator or the non-AP STA's AID for a non-AP STA originator, the Ack Type field is 1 and the TID subfield of AID TID Info field is 14, then the Per AID TID Info field indicates the acknowledgment of all MPDUs carried in the eliciting A-MPDU as defined by the acknowledgment 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 9.3.1.8 (BlockAck frame format). The allowed Block Ack Bitmap lengths for each of the negotiated buffer sizes are defined in Table 26-1 (Negotiated buffer size and Block Ack Bitmap subfield length).

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| * Negotiated buffer size and Block Ack Bitmap subfield length
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| Negotiated buffer size | Block Ack Bitmap subfield length (bits) in a Compressed BlockAck frame | Block Ack Bitmap subfield length (bits) in a Multi-STA BlockAck frame |
| 1–64 | 64 | 32 or 64 |
| 65–128 | 64 or 256 | 32, 64 or 128 |
| 129–256 | 64 or 256 | 32, 64, 128 or 256 |
| NOTE—A 32-bit Block Ack Bitmap subfield length is not allowed unless the originator has set the 32-bit BA Bitmap Support field in the HE MAC Capabilities Information field in the HE Capabilities element to 1.(#20608) |

An HE STA that transmits a Compressed BlockAck frame or a Multi-STA BlockAck frame shall use a Block Ack Bitmap subfield length identified in Table 26-1 (Negotiated buffer size and Block Ack Bitmap subfield length) for the negotiated buffer size of the block ack agreement to which the BA Information field corresponds.

The recipient is allowed to(#20607) respond with a Block Ack Bitmap subfield in the BA Information field that is less than the maximum allowed Block Ack Bitmap for the negotiated buffer size. The length of the Block Ack Bitmap subfield in a Compressed BlockAck frame or a Multi-STA BlockAck frame may be less than the negotiated buffer size but shall be sufficient to include the recipient's scoreboard state for MPDUs beginning with the MPDU for which the Sequence Number subfield value is *WinStartR* and ending with the MPDU for which the Sequence Number subfield is *WinEndR*.

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. When the Buffer Size field in the ADDBA Request frame is set to 0, the Buffer Size field of an ADDBA Response frame is in the range 1 to 64.

NOTE—Refer to Block Ack Bitmap subfield length identified in Table 26-1 (Negotiated buffer size and Block Ack Bitmap subfield length) for the negotiated buffer size of the block ack agreement.

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.

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.

The originator of a BlockAckReq frame, MU-BAR Trigger frame, GCR MU-BAR Trigger frame or a A-MPDU that includes QoS Data frames that solicits an immediate BlockAck frame response or Mangement frame that solicits acknowledgment(#20890) shall set the Duration field value accounting for the largest BlockAck Bitmap length based on negotiated buffer size.

A recipient shall not transmit a Compressed BlockAck frame or a Multi-STA BlockAck frame with the LSB of the Fragment Number subfield set to 1 unless the recipient has received from the originator an HE Capabilities element with the Dynamic Fragmentation Support subfield equal to 3. If the LSB of the Fragment Number subfield of the BlockAck frame is set to 1, then the Block Ack Bitmap fields are set as defined in 26.3.2.4 (Level 3 dynamic fragmentation)(#21307).

* Per-PPDU acknowledgment selection rules
* General

A STA that transmits a PPDU can solicit different immediate responses for frames contained in the PPDU by using the Ack Policy Indication subfield(#20545) of QoS Data or QoS Null frames, the type of the frame, PPDU format, number of TIDs in the A-MPDU and the EOF field setting of the A-MPDU delimiter.

* Responding to an HE SU PPDU or HE ER SU PPDU with an SU PPDU

An HE STA that receives an HE SU PPDU or HE ER SU PPDU carrying an A-MPDU that includes MPDUs that solicits acknowledgment and that does not include a triggering frame(#21348)(#20943) shall respond using an SU PPDU as follows:

* If the A-MPDU includes only one MPDU and the MPDU is an EOF MPDU(#20925) that is either a QoS Data frame or QoS Null frame with Normal Ack ack policy(#20545), or a Management frame that solicits acknowledgment, then the STA shall respond with an Ack frame.
* If the A-MPDU includes only one MPDU and the MPDU is an EOF MPDU(#20925) that is a PS-Poll frame the STA shall respond with an Ack frame or a QoS Data frame. [#21186]
* If the HE STA supports ack-enabled aggregation by setting the Ack-Enabled Aggregation Support subfield in the HE MAC Capabilities Information field to 1, and if the A-MPDU includes more than one MPDU, only one of which solicits acknowledgment and the MPDU that solicits acknowledgment is an EOF MPDU that is a QoS Data frame or a QoS Null frame with Normal Ack ack policy(#20545), or a Management frame that solicits acknowledgment, then the HE STA shall respond with an Ack frame.
* If the A-MPDU does not include an EOF MPDU but does include one or more non-EOF MPDUs(#20925) that are QoS Data frames belonging to the same block ack agreement and with the Ack Policy Indication subfield equal to Implicit BAR(#20545) for at least one MPDU, then the STA shall either respond with a Compressed BlockAck frame as defined in 10.26.6.5 (Generation and transmission of BlockAck frames by an HT STA, DMG STA, or S1G STA) or a Multi-STA BlockAck frame with Ack Type field set to 1 and the TID field set to 14 as defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame) if the recipient has indicated support for the all ack context(#20893) by setting the All Ack Support subfield in the HE MAC Capabilities Information field to 1.
* If the HE STA supports ack-enabled aggregation by setting the Ack-Enabled Aggregation Support subfield in the HE MAC Capabilities Information field to 1, and if the A-MPDU includes a Management frame that solicits an acknowledgment, and one or more QoS Data frames with ack policy Normal Ack or Implicit BAR(#20317), then the STA shall respond with a Multi-STA BlockAck frame as defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).
* If the HE STA supports multi-TID aggregation and if the A-MPDU includes two or more QoS Data frames with ack policy Implicit BAR(#20317) and belonging to more than one block ack agreement, then the STA shall respond with a Multi-STA BlockAck frame as defined in 26.4.2 (Acknowledgment context in a Multi-STA BlockAck frame).