IEEE P802.11
Wireless LANs

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| Resolution for CIDs related to MLO BA Procedure (CC 34) – Part 1 |
| Date: April 12, 2021 |
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 Abstract

This submission proposes resolutions for following 26 CIDs received for TGbe CC34:

1751, 1684, 2445, 3029, 2871, 2870, 1930, 1931, 1199, 1932, 1686, 1446, 1427, 1065, 3339, 2353, 3340, 2837, 1689, 2713, 2756, 2838, 3383, 1752, 3341, 2485

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Updated based on offline feedback from several members (added co-authors to this doc)

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbe Draft. This introduction is not part of the adopted material.

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

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

#1: indicates changes based on comments/suggestions in doc 11-21/0218r0 (Mark Rison)

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| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Section** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 1751 | Hanseul Hong | 35.3.7.1.1 | 135.20 | This subclause seems to be based on operation described in 11.5 (Block Ack operation), except the superseding functions in this subcluase. Add the reference of 11.5 (Block Ack operation) in the beginning of the subcluase | As in the comment | **Revised**Agree with the comment. Added a paragraph to make reference to clause 10.25 and clause 11.5 stating that BA procedure follows rules from these clause with additional rules/exceptions defined in clause 35.3.7.1**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1751** |
| 1684 | GEORGE CHERIAN |   | 0.00 | "A block ack agreement between two MLDs shall apply to all links to which the TID corresponding to the block ack agreement, is mapped (i.e., there are no independent block ack agreements on a per-link basis)."The above text is not accurate. Please rephrase as follows:"A block acknowledgement agreement between two MLDs for a TID ishall be applicable to all the links to which the TID is mapped to" | As in the comment | **Revised**Clarified the sentence to state that the BA agreement for each TID is at the MLD level and applies to all the links to which the TID is mapped to.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1684** |
| 2445 | Pascal VIGER | 35.3.7.1.1 | 135.20 | A block ack agreement between two MLDs shall apply to all links currently supporting the TID, and there is no independent block ack agreement on per-link basis. Nevertheless, it is generally admitted than acknowlegments provide deficiencies in low latency delivery (e.g. unuseful retransmissions for aging-elapsed data, head-of-line blocking if missing packets at destination, double acknowlegment protocols: TCP over 802.11, etc).Therefore, there is a need of a low latency link among other links, where a STA can transmit faster and without reliability. | Provide a latency sensitive link where conveyed data are not acknowledged, while keeping the global block ack agreement enabled for the TID. This results in that the transmitting STA selects part of a given TID traffic to be faster transmitted with no reliability. STA is free to select the convenient low latency traffic compared to usual traffic of same TID. | **Reject**The mechanism requested by the comment is already possible in the current standard. A transmitter of an MPDU can set the ACK policy for an MPDU to be No Ack in the Ack Policy subfield carried in the QoS Control field (see Table 9-13 and clause 10.26). |
| 1710 | GEORGE CHERIAN | 35.3.7.1 | 135.20 | Rules are defined for implicit BAR protocol in MLD. But they are missing for BAR. Specify what rules from baseline are applicable to BAR in MLD and what are not. | As in the comment | **Revised**Agree with the comment. Added a sentence to clarify that the rules for providing receive status as described in 35.3.7.1.1 apply for both implicit and explicit BAR.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1710** |
| 3029 | Xiaofei Wang | 35.3.7.1.1 | 135.23 | The note seems to contain normative behavior and should either be formulated differently or become regular spec text. | as in comment | **Revised**The cited NOTE was deleted. The (shifted) 4th paragraph in this clause provides the same rules (as normative text)**TGbe editor please make changes as shown in 11-21/0285r1 tagged 3029** |
| 2871 | Stephen McCann | 35.3.7.1.1 | 135.27 | What is an "originator MLD"? | The term "originator MLD needs to be defined. | **Revised**Added a sentence, similar to the one found in 10.25 to describe originator MLD and recipient MLD. **TGbe editor please make changes as shown in 11-21/0285r1 tagged 2871** |
| 2870 | Stephen McCann | 35.3.7.1.1 | 135.30 | What is a "recipient MLD"? | The term "recipient MLD" needs to be defined. | **Revised**Added a sentence, similar to the one found in 10.25 to describe originator MLD and recipient MLD.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2870** |
| 1930 | Jeongki Kim | 35.3.7.1.1 | 135.27 | "a STA of the originator MLD sends" text should have normative behavior? shall send or may send? | Make the normative text.Change sends to shall send | **Revised****TGbe editor please make changes as shown in 11-21/0285r1 tagged 2838** |
| 1931 | Jeongki Kim | 35.3.7.1.1 | 135.28 | For clarification, add the receiver in the indicate text. E.g., STA of the originator MLD sends an ADDBA Request frame "to a STA of the recipient MLD", on any enabled link, indicating the TID... | change the indicated text as follows:STA of the originator MLD sends an ADDBA Request frame to a STA of the recipient MLD, on any enabled link, indicating the TID... | **Revised**Agree with the comment. Added “to the corresponding STA affiliated with the recipient MLD” to the sentence to clarify that the ADDBA frame is directed to the STA of the recipient MLD operating on the link**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1931** |
| 1199 | Arik Klein | 35.3.7.1.1 | 135.29 | Add the Extended Buffer Size field to the following sentence (as an additional advisory parameter) : "The Buffer Size and Block Ack Timeout fields in the ADDBA Request frame are advisory" | The revised sentence shall be: "The Buffer Size, \*Extended buffer Size\* and Block Ack Timeout fields in the ADDBA Request frame are advisory" | **Revised**Agree with the comment. Added Extended Buffer size to the list.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1199** |
| 1932 | Jeongki Kim | 35.3.7.1.1 | 135.31 | The "A STA of the recipient MLD shall respond with an ADDBA Response frame." text needs to be clarified. e.g., When does the STA respond?Change the indicated text to one of the following option.Option 1: Upon receiving an ADDBA Request frame, a STA of the recipient MLD shall respond with an ADDBA Response frame.Option 2: A STA of the recipient MLD shall send an ADDBA Response frame in response to the received ADDBA Request frame. | Change the indicated text to one of the following option.Option 1: Upon receiving an ADDBA Request frame, a STA of the recipient MLD shall respond with an ADDBA Response frame.Option 2: A STA of the recipient MLD shall send an ADDBA Response frame in response to the received ADDBA Request frame. | **Revised**Agree with the comment. The sentence was updated to clarify that the ADDBA Response frame is sent in response to (i.e., upon receiving) an ADDBA Request frame.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2838** |
| 1686 | GEORGE CHERIAN | 35.3.7.1.1 | 135.20 | Does the ADDBA signaling need to take place on one of the links on which the TID is mapped to? Or the ADDBA can be sent on any links irrespective of whether the TID is mapped to the link on which the signaling is taking place or not? Please clarify | As in the comment | **Revised**Agree with the comment. The BA session is established at the MLD level and Mgmt. frames can be exchanged on any enabled link. The sentence was updated to clarify to say the response frame can be sent on any enabled link. **TGbe editor please make changes as shown in 11-21/0285r1 tagged 1686** |
| 1446 | Chunyu Hu | 35.3.7.1.1 | 135.28 | The BlockAck agreement should be established over any of the link(s) where the corresponding TID is mapped to. But here the sentence states "on any enabled link". If link 1 has only TID 1 mapped to, then the BlockAck agreement intended for TID 2 should not use link 1 for the establishment procedure. | Modify the sentence to capture the comment as follows: "To setup a block ack agreement between two MLDs for a TID, a STA of the originator MLD sends an ADDBA Request frame on any of the link(s) to which the TID is mapped." | **Revised**The BA session is established at the MLD level and Mgmt. frames can be exchanged on any enabled link. Therefore, the sentence was updated to clarify to say the response frame can be sent on any enabled link. **TGbe editor please make changes as shown in 11-21/0285r1 tagged 1446** |
| 1427 | Chien-Fang Hsu | 35.3.7.1.1 | 135.30 | The ADDBA response frame needs to be sent on the same enabled link which the ADDBA request frame was sent? | Clarify it | **Revised**The BA session is established at the MLD level and Mgmt. frames can be exchanged on any enabled link. Therefore, the sentence was updated to clarify to say the response frame can be sent on any enabled link. **TGbe editor please make changes as shown in 11-21/0285r1 tagged 1427** |
| 1065 | Abhishek Patil | 35.3.7.1.1 | 135.40 | Incorrect section reference. Update reference to point to the clause on TID mapping. | Change the reference to 35.3.6.1. | **Revised**The sentence was simplified and updated to point to clause 35.3.6.1 and 35.3.10**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1065** |
| 3339 | Yusuke Tanaka | 35.3.7.1.1 | 135.45 | Please clarify the destination that "a STA of a recipient MLD shall provide" to. It is unclear whether the destination is the originator or other STA in the same MLD. | Add "to a STA of an originator MLD" if it is the intention of this sentence. | **Revised**Agree with the comment. The sentence was updated to clarify that the receive status is sent to the STA affiliated with the originator MLD.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 3339** |
| 2353 | Morteza Mehrnoush | 35.3.7.1.1 | 135.50 | Do we need to consider the tid-to-link mapping of the STAs here? i.e. should the TID of the received MPDU be mapped to both STAs (the STA that MPDU is received successfully and another STA that the status information will be provided)? | If the answer is yes, add the tid-to-link mapping condition to the paragraph. | **Revised**Agree with the comment. The sentence was updated to clarify that the rules related to providing status of successful reception on another link applies only when a TID is mapped to more than one link.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2353** |
| 3340 | Yusuke Tanaka | 35.3.7.1.1 | 135.50 | Please clarify the destination that "a STA of a recipient MLD shall provide" to. It is unclear whether the destination is the originator or other STA in the same MLD. | Add "to a STA of an originator MLD" if it is the intention of this sentence. | **Revised**Agree with the comment. The sentence was updated to clarify that the receive status is sent to the STA affiliated with the originator MLD operating on the same link as the transmitting STA of the recipient MLD.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 3340** |
| 2837 | Srinivas Kandala | 35.3.7.1.1 | 135.51 | It is not clear if the STA is on the same link or a different link | Rephrase, "by another STA" with " on another link by the corresponding STA" or words to that effect | **Revised**Agree with the comment. The sentence was clarified to state that the receive status (indicating successful reception) applies to a STA of the recipient MLD that is operating on a different link than the STA transmitting the receive status.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2837** |
| 3341 | Yusuke Tanaka | 35.3.7.1.1 | 135.60 | This section may refer the baseline, 802.11REVmd D5.0 10.25.6.2, but no description about full-state or partial-state operation. Does the recipient choose either of them? | Please clarify. | **Revised**Agree with the comment that the spec needs to provide guidance on this topic. Added a sentence to clarify that the recipient MLD can maintain a partial state for each link that is part of the same BA setup.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 3341** |
| 2485 | Po-Kai Huang | 35.3.7.1.1 | 136.03 | It should be clarified that independent scoreboard context control (partial state) can be used in any link. Dynamically coordinate the Block ack received status across links is difficult, and certainly can not be mandated. | add "an recipient MLD may have independent scoreboard context control during partial-state operation for each <peer MLD, TID>tuple under a block ack agreement in each setup link." | **Revised**Agree with the comment that the spec needs to provide guidance on this topic. Added a sentence to clarify that the recipient MLD can maintain a partial state for each link that is part of the same BA setup.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2485** |
| 1689 | GEORGE CHERIAN | 35.3.7.1.1 | 135.61 | "A recipient MLD shall maintain a single common receive reordering buffer for each <peer MLD, TID> tuple under a block ack agreement, independently of the number of links that are setup."Define what the peer-MLD is identified by. I assume it is MLD MAC address | As in the comment | **Revised**Agree with the comment. Added a NOTE to clarify that the peer MLD is identified based on its MLD MAC address. **TGbe editor please make changes as shown in 11-21/0285r1 tagged 1689** |
| 2713 | Ryuichi Hirata | 35.3.7.1.1 | 136.06 | It is not clear whether recipient maintains a single common scoreboard for each <peer MLD, TID> or per-link scoreboards. If recipient maintains a single common scoreboard, how to control scoreboard context for Data frames simultaneously received on multiple links should be defined. | Clarify how received MPDUs are analyzed by the scoreboard control. | **Reject**The originator MLD maintains a single common scoreboard and the receive status for the MPDU is updated based on status indicating successful reception. In addition, the scoreboard at the originator is not updated if the receive status for an MPDU already indicates success. Please see 11be D0.4 P202L61 and P203L1. As a result, the scoreboard context at the recipient MLD can be either at the MLD-level or per-link level. |
| 2756 | Sanghyun Kim | 35.3.7.1.1 | 136.11 | We have no EHT SU PPDU.Change "EHT SU PPDU" to "EHT MU PPDU to a single STA" | As in the comment. | **Revised**Agree with the comment. The cited text is replaced with ‘EHT MU PPDU directed to a single STA’**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2756** |
| 2838 | Srinivas Kandala | 35.3.7.1.1 | 136.11 | I think EHT SU PPDU is not going to be defined (the only reference I could find was for NDP) | Delete "or EHT SU PPDU" and "or EHT SU PPDU (respectively)" in the cited paragraph | **Revised**Agree with the comment. The cited text is replaced with ‘EHT MU PPDU directed to a single STA’**TGbe editor please make changes as shown in 11-21/0285r1 tagged 2838** |
| 3383 | Zhou Lan | 35.3.7.1.1 | 136.11 | primary rate is in the BSSBasicRateSet and it is possible for the responding STA to choose a rate that is higher than the primary rate. So if the respoinding STA choose a HE rate, how can the STA know the the HE/EHT SU PPDU is actually shorter than the non HT PPDU? Please | As stated in the comment | **Reject**Baseline rules (see 10.6.6.5) mandate that the BA is sent at primary rates, ehnce the duration of the PPDU sent at the primary rate will be used for comparison purpose. |
| 1752 | Hanseul Hong | 35.3.7.1.1 | 136.14 | There are mixing terms of Control frame and Blockack frame. 1) If it is only for BlockAck frame, change 'Control frame' to 'BlockAck frame'. 2) If this description is not only for BlockAck frame, this should be described in another clause 3) If the recipient is non-EHT STA, the EHT SU PPDU cannot be used. | As in the comment | **Revised**Agree with the comment. To address items 1) and 2), a new subclause was added under clause 35 to cover the PPDU format and various transmit parameters for the PPDU. A subclause on PPDU format section was created and the cited paragraph was moved under this clause. To address item 3), the text was clarified to say the rules apply when the frame is directed to an EHT STA.**TGbe editor please make changes as shown in 11-21/0285r1 tagged 1752** |

***TGbe editor: Please note Baseline is 11be D1.0.***

* **Multi-link block ack**
* **Multi-link BlockAck procedure**
* **General**

***TGbe editor: Please update the paragraphs in this subclause as shown below:***

[1751]An MLD shall follow the mechanisms defined in clause 10.25 (Block acknowledgment (block ack)), 11.5 (Block ack operation), 26.4 (HE acknowledgment procedure), and 35.3.7.2 (EHT acknowledgment procedure) with additional rules as defined in this subclause for performing block ack operation after multi-link setup (MLD association).

[1684]For each TID, there shall not be more than one block ack agreement established between two MLDs and the agreement shall apply to all the links to which the TID is mapped to (i.e., there are no independent block ack agreements for each TID on a per-link basis).

[3029][2870, 2871]In this subclause, the MLD with data to send using the block ack mechanism is referred to as the *originator* MLD, and the receiver of that data as the *recipient* MLD. To [#1]set-up a block ack agreement between two MLDs, a STA affiliated with the originator MLD shall send an ADDBA Request frame [1931]to the corresponding STA affiliated with the recipient MLD, on any enabled link, indicating the TID for which the block ack agreement is being set up. The Buffer Size, [1199]Extended Buffer Size, and Block Ack Timeout fields in the ADDBA Request frame are advisory. [1932]Upon receiving an ADDBA Request frame, a STA affiliated with the recipient MLD shall respond, [1686, 1446, 1427, #1]on any enabled link, with an ADDBA Response frame. The recipient MLD has the option of accepting or rejecting the request. If the recipient MLD accepts the request, then a block ack agreement is established between the originator MLD and the recipient MLD for the TID specified in the ADDBA frames as defined in 10.25.2 (Setup and modification of the block ack parameters).

NOTE – An originator MLD can attempt a retransmission of an ADDBA Request frame on any enabled link. A recipient MLD can attempt a retransmission of an ADDBA Response frame on any enabled link.

[1065, #1]If an MLD has established a block ack agreement with another MLD, then QoS Data frames for the TID associated with the block ack agreement may be exchanged between the two MLDs on any link to which the TID is mapped by following the procedure described in 35.3.6.1 (TID-to-link mapping) and 35.3.10 (Multi-link power management).

[1710]A STA affiliated with a recipient MLD that receives an implicit or an explicit BAR shall provide reception status of an MPDU as specified in this paragraph. [3339]A STA affiliated with a recipient MLD shall provide, to the STA affiliated with the originator MLD that is operating on the same link, the reception status for any MPDU, with ACK policy [#1]other than No Ack, that is received on the link [#1]on which the STA affiliated with the recipient MLD is operating on. [2353]When a TID is mapped to more than one links, a STA affiliated with a recipient MLD may provide (if available), [3340]to the STA affiliated with the originator MLD that is operating on the same link, reception status indicating successful reception of any MPDU, that belongs to that TID and has an ACK policy [#1]other than No Ack, that is received by [2837, #1]a STA affiliated with the recipient MLD that is operating on a different link.

An originator MLD shall update the reception status of an MPDU corresponding to a block ack agreement if the received status indicates successful reception.

An originator MLD shall not update the reception status of an MPDU corresponding to a block ack agreement that has already been acknowledged as successful.

A recipient MLD shall maintain a single common receive reordering buffer for each <peer MLD, TID> tuple under a block ack agreement, independent of the number of links that are setup. An originator MLD shall maintain a single common transmit buffer for each <peer MLD, TID> tuple under a block ack agreement, independent of the number of links that are setup. The receive reordering buffer shall be responsible for reordering MSDUs or A-MSDUs so that MSDUs or A-MSDUs are eventually passed up to the next MAC process in the order of received sequence number. It shall also be responsible for identifying and discarding duplicate frames (i.e., frames that have the same sequence number as a currently buffered frame) that are part of this block ack agreement. It shall maintain its own state independent of the scoreboard context control to perform this reordering as specified in 10.25.6.6 (Receive reordering buffer control operation). Each received MPDU shall be analyzed by the scoreboard context control as well as by the receive reordering buffer control. [3341, 2485]Each affiliated STA of the recipient MLD may maintain an independent local scoreboard context control, for each enabled link to which the TID is mapped, during partial-state operation for each <peer MLD, TID> tuple under a block ack agreement. The scoreboard maintained at the originator MLD shall be updated as a bitwise OR operation of the reception status of each MPDU obtained from its affiliated STAs.

[1689]NOTE – A peer MLD is identified based on its MLD MAC address.

***TGbe editor: Move the following paragraph to (newly created) clause 35.xx.2 as shown below***

[1752]

***TGbe editor: Please insert a new subclause as shown below:***

**35.xx PPDU format, BW, MCS, NSS, and DCM selection rules**[1752]

**35.xx.1 General**

An EHT STA can transmit different PPDUs formats, with different transmit parameters, such as channel width, MCS, NSS, DCM. This subclause defines the rules followed by an EHT STA for selecting these parameters depending on the capabilities of the intended receiver(s) and other considerations.

**35.xx.2 PPDU format selection**

***TGbe editor: The following paragraph is moved from clause 35.3.7.1.1 with additional changes as shown below***

* in an [2756, 2838]MU[2756, 2838]directed to a single [1752]EHT STA [#1]PPDU duration [#1]the [2756, 2838]MU