IEEE P802.11
Wireless LANs

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| LB 266 Resolution for CIDs related to MLO Architecture Section 5 (Part 2) |
| Date: August, 2022 |
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 Abstract

This submission proposes resolutions for following 13 CIDs received for TGbe LB266:

10279, 10342, 10343, 10344, 10446, 10447, 10528, 10898, 12087, 12282, 12364, 12950, 13045

These are all related to the description of Block Ack scoreboard at the MLD upper MAC sublayer and MLD lower MAC sublayer.

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: corrected the references and added more info about the latest BA scoreboard requirements captured in 22/1336r4 (see CIDs 11074 and 11075) (passed motion)
* Rev 2: removed CID 10448 and modified resolution of CID 10342 per discussion on the TGbe MAC meeting on 11/16/2022

***TGbe editor: The baseline for this document is 11be D2.1***

Interpretation of a Motion to Adopt

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

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

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

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| **CID** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 10279 | Michael Montemurro | 5.1.5.1 | 70.08 | Not sure what this note means. Please re-word to make clearer or delete the note. | Delete the cited note. | **Accepted** |
| 10342 | Tomoko Adachi | 5.1.5.1 | 70.27 | "Optionally, the MLD upper MAC sublayer delivers the Block Ack record on one link to the MLD lower MAC sublayer of other links"To be accurate, the Block Ack record should be the successful status records of MPDUs in the block acknowledgement record at the "Block Ack Scoreboarding" in the MLD lower MAC sublayer.Moreover, the windows of the "Block Ack Scoreboarding" in the MLD lower MAC sublayers need to be adjusted. This is to solve a problem to transmit an outdated BlockAck frame at a link when it doesn't receive MPDUs at all for some period and the recorded SNs become older than 2^11 while the other links receive MPDUs. The window at the scoreboard context control at that link needs to be updated at an appropriate time to catch up with those in other links. | Change it to "Optionally, the MLD upper MAC sublayer delivers successful status records of MPDUs and/or scoreboard context control information on Block Ack scoreboarding at one of the setup links to other setup links." | **Revised**Agreed in principle. Also added clarification to the MLD lower MAC sublayer section.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10342** |
| 10343 | Tomoko Adachi | 5.1.5.1 | 70.53 | "Optionally, the MLD lower MAC sublayer receives the Block Ack record on the other links from the MLD upper MAC sublayer)"Similar to comment in line 27.Furthermore, the reception of the scoreboard context control information should be mandatory. | Change it to "The MLD lower MAC sublayer receives scoreboard context control information on Block Ack scoreboarding from other setup links. Optionally, the MLD lower MAC sublayer receives successful status records of MPDUs on Block Ack scoreboarding on other setup links. The scoreboard context control information on other setup links or the successful status records of MPDUs on other setup links may be received through the MLD upper MAC sublayer or directly from the other setup links."Add "NOTE 6--The reception of scoreboard context control information from other setup links is to prevent transmitting an outdated BlockAck frame with acknowledged SNs older than 2^11 compared to the other links." after NOTE 5 in pp.ll 70.59. | **Rejected**An MLD lower MAC sublayer should not be mandated to receive BA info from another setup links. |
| 10344 | Tomoko Adachi | 5.1.5.1 | 70.63 | "When MLO is being used, the "Block Ack Scoreboarding" block in the MLD upper MAC sublayer manages the overall Block Ack status of the MPDUs (of Block Ack session established between two MLDs) that are received on any (all) setup links."The important part is not to manage the reception statuses of the setup links but to manage the window at the scoreboard context control at the setup links so that the recorded SNs at one of the links are not older than 2^11 compared to the most advancing recorded SNs at another link. This is to prevent transmitting an outdated BlockAck frame in MLO.And Block Ack status is not a correct term. It should be reception status (or acknowledgment bitmap). | Change it to "When MLO is being used, the "Block Ack Scoreboarding" block in the MLD upper MAC sublayer manages the scoreboard context control and may manage the reception statuses in the setup links where Block Ack session are established between two MLDs." | **Revised**Agreed in principle.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10344** |
| 10446 | Yonggang Fang | 5.1.5.1 | 70.26 | Block Ack scoreboarding at LMAC is for individually addressed frames. Whether it collaborate with the MLD upper MAC sublayer depends on single link or T2L mapping in MLO, or others. | Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD upper MAC sublayer). It may collabrate with the MLD upper MAC sublayer. | **Rejected**It’s obvious if non-default T2L mapping is in effect, the collaboration will be limited by the T2L mapping. If a TID is not mapped to a link, there will be no BA scoreboarding collaboration between the MLD upper MAC sublayer and the link for that TID. |
| 10447 | Yonggang Fang | 5.1.5.1 | 70.52 | Block Ack scoreboarding at LMAC is for individually addressed frames. Whether it collaborate with the MLD upper MAC sublayer depends on single link or T2L mapping in MLO, or others. | Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD upper MAC sublayer). It may collabrate with the MLD upper MAC sublayer. Optionally, the MLD lower MAC sublayer receives the Block Ack record on the other links from the MLD upper MAC sublayer) | **Revised**Same resolution as 10342.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10342** |
| 10528 | Abhishek Patil | 5.1.5.1 | 71.05 | Clarify that lower MAC on one link can provide status of successful receiption (to be consistent with 35.3.8) | Replace "of the MPDUs received" with "of successfully received MPDUs". | **Accepted** |
| 10898 | Akira Kishida | 5.1.5.1 | 70.26 | The Block ACK scoreboarding are included in both MLD Upper MAC and MLD Lower MAC, and they work in collaboration. Also, 35.3.16.9 describes "the MLD may attempt retransmissions of the frame on any link to which the TID is mapped". It looks that the originator MLD transmts a Block Ack Request, and either (1) a receiver MLD Lower MAC or (2) a receiver MLD Upper MAC responses Block Ack. However, if so, this is difficult to understand. At least, it should be clearly describes that the originator MLD transmits a Block Ack Request, and idealy an example of Block Ack Response and Block Ack exchange sequence between an originator MLD and either a receiver MLD Lower MAC or a receiver MLD Upper MAC should be added. | As in the comment. | **Revised**Same resolution as 10342.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10342** |
| 12087 | Chaoming Luo | 5.1.5.1 | 70.44 | Non-AP MLD should also has upper MAC sublayer functions (only on non-AP) including link specific encryption/decryption/integrity protection and PN assignment using GTK, since non-AP MLD could also transmit group addressed Data frames. | As commented | **Rejected**Out of scope of this section because Non-AP MLD transmitting group addressed frames is not discussed in this section. |
| 12282 | KENGO NAGATA | 5.1.5.1 | 70.26 | The Block ACK scoreboarding are included in both MLD Upper MAC and MLD Lower MAC, and they work in collaboration. Also, 35.3.16.9 describes "the MLD may attempt retransmissions of the frame on any link to which the TID is mapped". It looks that the originator MLD transmts a Block Ack Request, and either (1) a receiver MLD Lower MAC or (2) a receiver MLD Upper MAC responses Block Ack. However, if so, this is difficult to understand. At least, it should be clearly describes that the originator MLD transmits a Block Ack Request, and idealy an example of Block Ack Response and Block Ack exchange sequence between an originator MLD and either a receiver MLD Lower MAC or a receiver MLD Upper MAC should be added. | As in the comment. | **Revised**Same resolution as 10342.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10342** |
| 12364 | Rojan Chitrakar | 5.1.5.1 | 69.32 | In Figure 5-2b since the "Block Ack Scoreboarding" is already implemented by the MLD lower MAC sublayer, it is not required in the upper MAC sublayer for the affiliated APs. | Delete the "Block Ack Scoreboarding" boxes in the upper MAC sublayer for the affiliated APs. | **Revised**Added clarification in Note 5.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 12364** |
| 12950 | Chunyu Hu | 5.1.5.1 | 70.09 | Not clear what context/scenario NOTE 3 is for. It says "is still transmitted", and "otherwise", but not sure which case it is describing. Need clarification. | Add necessary clarification, or change wording. See comment. | **Revised**Agreed in principle. Same resolution as in 10279.**TGbe editor, same resolution as in CID 10279** |
| 13045 | Huizhao Wang | 5.1.5.1 | 70.28 | Not sure what is the purpose of MLD deliver BA record from one link to another link. MLD is the owner of BA, it will be make sense to say that MLD can share its BA record with the underline links optionally. | As suggested in the comment | **Revised**Same resolution as 10342.**TGbe editor, please make changes as shown in 11-22/1260r1 tagged 10342** |

* + - 1. **General**

[…]

(#10279)

The MLD upper MAC sublayer functions include:

* Authentication, association, and reassociation (between an AP MLD and a non-AP MLD)
* Security association (e.g., PMKSA, PTKSA) and distribution of GTK/IGTK/BIGTK
* SN/PN assignment for frames to be encrypted by PTK for unicast frames
* SN assignment for group addressed MSDUs
* Power save buffering of individually addressed frames (only on AP MLD)
* Encryption/decryption using PTK for unicast frames
* Selection of the MLD lower MAC sublayer for transmission (TID-to-link mapping (see 35.3.7.1 (TID-to-link mapping)))
* Merging reception of MPDUs from two or more links
* Reordering of packets to ensure in-order delivery per each Block Ack session
* Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD lower MAC sublayer). Optionally, the MLD upper MAC sublayer (#10342)delivers successful status records of MPDUs and/or scoreboard context control information on Block Ack scoreboarding at one of the setup links to other setup links.
* MLD level management information exchange/indication via the MLD lower MAC sublayer
* Coordination of distribution and management of EDCA parameters across the MLD lower MAC sublayers of the links

The affiliated (non-MLO) upper MAC sublayer functions (only on AP) include:

* Non-MLO peer operations, above the MLD lower MAC sublayer
* Maintenance of link specific GTK/IGTK/BIGTK (between an AP affiliated with the AP MLD and a non-AP STA affiliated with the non-AP MLD)
* Link specific encryption/decryption/integrity protection and PN assignment using GTK/IGTK/ BIGTK (between an AP affiliated with the AP MLD and a non-AP STA affiliated with the non-AP MLD)
* Link-specific management info exchange/indication (e.g., Beacon)
* Power save buffering of group addressed frames

The MLD lower MAC sublayer functions include:

* Link specific control information exchange/indication (e.g., RTS/CTS, acknowledgements, NDP, etc.)
* Power save state and mode
* MAC address filtering for frame reception
* Block Ack scoreboarding for individually addressed frames (in collaboration with the MLD upper MAC sublayer). Optionally, the MLD lower MAC sublayer receives the (#10342)successful status records of the MPDUs and/or scoreboard context control information of the Block Ack agreement from the MLD upper MAC sublayer)

NOTE 4—The above functionality partitioning is meant for modeling the functionalities of each MAC sublayer and is not meant for describing the MAC sublayer for which the actual implementation of each function should reside.

NOTE 5—The Block Ack scoreboarding maintenance (#12364)might be either at the MLD upper MAC sublayer or the MLD lower MAC sublayer, or both. The maintenance might involve collaboration between the MLD upper MAC sublayer and MLD lower MAC sublayer.

When MLO is being used, the “Block Ack Scoreboarding” block in the MLD upper MAC sublayer manages the (#10344)scoreboard context control and may manage the reception status in the setup links where the Block Ack session is established between the two MLDs. (#10448) The “Block Ack Scoreboarding” block in the MLD lower MAC sublayer manages at least the Block Ack status of the MPDUs (of this Block Ack session) that are received on this link. The MLD lower MAC sublayer may convey Block Ack status of the MPDUs received on another link if it obtained such info from the other link. The “Block Ack Scoreboarding” block in the affiliated AP upper MAC sublayer manages the Block Ack status of the (#10528)successfully received MPDUs over corresponding non-MLO links. In an implementation, this function may be distributed into the MLD lower MAC sublayer.

Do you agree to the resolution provided in doc 11-22/1260r1 for the following CIDs?

10279, 10342, 10343, 10344, 10446, 10447, 10528, 10898, 12087, 12282, 12364, 12950, 13045