IEEE P802.11
Wireless LANs

|  |
| --- |
| LB266 – CR for CIDs related to 35.3.7 |
| Date: 2022-08-15 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou |  |  |  | laurent.cariou@intel.com |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 12442 | 35.3.7 | 427.04 | For Multi-link load balancing, information of other links such as link utilization, number of STAs, link availability should be indicated in somewhere such as A-Control field, ML element, etc. | as in the comment |    |
| 10013 | 35.3.7 | 427.05 | if one of the affilicated AP operating on CAC state, the link should be disable and enabled again once it's out of CAC mode. | 11be SPEC should have a solution to indicate the CAC mode and the remaing time, so that the non-AP MLD can decide whether to associated with such AP MLD. |  Revised – Not sure what CAC mean but D2.1 now has a mode to advertise in beacons that a link is disabled with a duration field, which seems to be the mode of operation that the commenter is looking for.No further actions needed. |
| 14055 | 35.3.7.1 | 427.05 | There are situations in which performing load balancing between links by an AP becomes vital to the operation of an 802.11 network. The spec needs an enforceable and flexible mechanism to perform load balancing between links | Introduce a load balancing mechanism, preferably by extending TID to Link Mapping |   |
| 10488 | 35.3.7.1 | 427.07 | TID-to-link mapping as defined is useless for Enterprise. For 802.11be to support Enterprise use cases, it is required to have the following enhancements:- Introduce a priority level in TID-to-link mapping negotiations- Define "enhanced TID to link subset" mapping capability- Introduce a method for both non-AP STAs and APs to identify reasons for TID mapping changes- Add scalable TID-to-link mapping mechanisms (broadcast advertisement and group-negotiation) | as in comment |   |
| 12860 | 35.3.7.1 | 427.07 | Lack of rules for an efficient operation of Basic TF regarding uplink TID-To-Link Mapping. Especially, a Basic TF may indicate a preferred AC not in line with the uplink TID-To-Link mapping in use. | Specify rules for Basic TF regarding uplink TID-To-Link mapping |  Revised – the rules regarding the non-AP STA behavior are clear in the spec and can be found in subclause 35.6 (A-MPDU operation in an EHT PPDU): *A STA affiliated with an MLD, which transmits a multi-TID A-MPDU on a link, shall follow the proceduresdescribed in 26.6.3 (Multi-TID A-MPDU and ack-enabled single-TID A-MPDU) for constructing the multiTID A-MPDU with the exception that the A-MPDU shall not include an MPDU corresponding to a TID thatis not mapped to the link (see 35.3.7.1 (TID-to-link mapping)).*A statement can be added so that the Preferred AC is not set to an AC to which TIDs are not mapped.Apply the changes marked as #12860 in this document |
| 13287 | 35.3.7.1 | 427.07 | The TID-to-link mapping feature negotiates mapping of TIDs to links for UL and/or DL between MLDs, which negotiates a set of links to be used for carrying traffic for specific TIDs. This feature can also be enhanced and used to provide link recommendations (optional to follow for non-AP MLD, not binding) to non-AP MLDs for UL and/or DL for all TIDs or at the TID granularity level. | Consider extending T2L mapping to provide generic link recommendations to non-AP STAs for UL and/or DL traffic transmissions. |  Revised – agree with the commenter. There is a need for a link recommendation mechanism. Document 1026r10 has discussed this and proposed modifications to the existing link recommendation tool. This addresses the comment.No further changes needed for this CID. |
| 11759 | 35.3.7.1 | 427.09 | For efficient functioning of a large scale deployment as well as some specific use cases, a non-default TID-to-link negotiation is required. A non-AP MLD does not know whether the AP MLD requires a non-default TID-to-Link mapping. The AP MLD needs to be able to signal that a negotiation is required. | Add signaling to indicate the need to perform such a negotiation. |  Revised – an AP MLD can initiate a TID-mapping negotiation. If an AP MLD wants to impose a TID-mapping on all non-AP MLDs, it can now advertise that in beacons with the mechanism defined in 35.3.7.1.7, as discussed in document 22/1023r5..No further actions are needed for this CID. |
| 11764 | 35.3.7.1 | 427.09 | Important use cases benefit greatly if the TID-to-link mapping negotiation for a non-default mapping does not start from scratch but from a non-default preferred mapping the AP broadcasts/advertises in its Beacon. In that case it gives the non-AP MLD a starting point to negotiate a different mapping. In most cases the non-default preferred mapping broadcasted/advertised will be use case specific and the non-AP MLD will benefit from this knowledge when setting up TID-to-Link mapping. | Add signalling to address the comment |  Revised – an AP MLD can now advertise a TID-mapping to all non-AP MLDs in beacons with the mechanism defined in 35.3.7.1.7, as discussed in document 22/1023r5.Further clarify the power state for a STA on a link that is enabled at the end of this advertised TID-to-link mapping. Apply the changes marked as #11764 in this document. |
| 11903 | 35.3.7.1.1 | 427.12 | Sentence is long and can actually be simplified and clarified. | Replace "The TID-to-link mapping mechanism allows an AP MLD and a non-AP MLD that performed or are performing multi-link setup to determine how UL and DL Qos traffic corresponding to TID values between 0 and 7 will be assigned to the setup links for the non-AP MLD." with "The TID-to-link mapping mechanism enables peer MLDs to determine how UL and DL Qos traffic, which are identified by their respective TIDs, will be assigned to the setup links that are in use between the two MLDs. |  Revised – agree with the commenter. Modify the sentence, especially regarding the TID. Apply the changes marked as #11903 in this document. |
| 12753 | 35.3.7.1 | 427.12 | The TID-to-Link mapping mechanism considers only UL and DL traffics. A TID may be related to a peer-to-peer link. | Add a mechanism to include the peer-to-peer communication in the TID-to-link mapping |  Reject – peer-to-peer communication with more than one link has not been defined yet. If it is this change will be considered. For now, this is not the case. |
| 12907 | 35.3.7.1.1 | 427.12 | (1) There is no such thing as "Qos [sic] traffic"; we have QoS frames. In this case no need to mention QoS, (2) Use "have performed" instead of "performed", (3) meaning of "assigned" is not clear, "determine" is not the right choice,.. (4) Use conventions in 1.4 (Word usage) in baseline (2nd paragraph in this case) to shorten the text. | Change the first paragraph to "The TID-to-link mapping mechanism allows an AP MLD and a non-AP MLD that have performed or are performing multi-link setup to establish a mapping between DL and/or UL transmissions of Data frames with TIDs 0-7, and the setup links. |  Revised – agree with the commenter. Replace QoS traffic with Data frame and management frames. Apply the changes marked as #12907 in this document. |
| 11775 | 35.3.7.1.1 | 427.13 | the use of the term "QoS traffic" is not exact. I suggest change to UL and DL frames corresponding to TID..... | As in comment |  Revised – agree with the commenter. Replace QoS traffic with Data frame and management frames. Apply the changes marked as #11775 in this document. |
| 13986 | 35.3.7.1.1 | 427.13 | Change "Qos" to "QoS". | As in comment |  Revised – agree with the commenter in principle. Following other CID’s requests, replace QoS traffic with Data frame and management frames. Apply the changes marked as #13986 in this document. |
| 11776 | 35.3.7.1.1 | 427.24 | This TID-to-link mapping doesn't seem to be efficient. A TID value may be mapped to a congested link while another link where the same value is not mapped to may not be busy. | Delete the TID-to-link mapping and keep the default mapping only. |  Reject – non default TID-to-link mapping function needs to be used with caution and properly. If done so, this will provide benefits that have been identified and discussed in this group. |
| 11904 | 35.3.7.1.1 | 427.24 | These two paragraphs have either a mix of normative behaviors and motivations as to why that normative behavior or are simply too long, which makes it difficult to follow. Suggest to simplify the sentences, eventually splitting them. | As in comment. |  Revised – the sentence is modified based on other CIDs and this helps the ndersanding. Apply the changes marked as #11904 in this document. |
| 12908 | 35.3.7.1.1 | 427.24 | Enabled/disabled state of a link has been tied to whether it carries Data MPDUs (TIDs) or not: "A setup link is defined as enabled for a non-AP MLD if at least one TID is mapped to that link either in DL or in UL and is defined as disabled if no TIDs are mapped to that link both in DL and UL."This view is wrong and unnecessary: A multi-link device has valid reasons to want to exchnage mangement frames on a given link for a variety of applications (ranging, sounding, sensing, calibration, reguatory, device or service discovery ...) and yet want to divert Data MPDUs to other links for traffic engineering, perhaps even as preperatory steps before runnnig non-data applications. Not sending Data frames has never been and should not be synonyous with a disabled link. In fact, TGbe ran into this topic in previous Letter Ballot when some mebers argued some management frames need to be allowed in this state (for a variety of rasons unrelate dto this comment), without consensus.The issue is simply a result of bad formulation: There is need in teh architeture for a disabled link concept (client side and AP side) in the sense of not allowing any frames to go out, and there is also room to manage/move any number of TIDs, includng all, to other links without disrupting other management functions. The coupling between these two is unnecessary.We end by noting that current definitions (on client side at least) seem to have come out of a poor formulation to try to optimize/protect single radio operation, whereas that objective can still be met without mixing these topics. With single radio concept established, there is no reason to be paranoid about this design clean up jeopordizing such implementations, and instead single radio case can be looked at independently to ensure implementation constraints are protected -- something that I think would come naturally after cleanups. | Decouple the link enable/disable state definition - client side and AP (broadcast) side - from TID-to-link mapping. Enabling/disabling a link is an administrative/management decision. A reasonable implementation may want to divert TIDs from a link that is to be disabled for example. Eliminating non-Data frames would need teh separate step of disabling/enabling link. |  Reject – Link enable/disable and TID-mapping are by conception coupled and the group agreed on that from the first step. The commenter is really asking to be able to map management frames on disabled links, which so far has not reached sufficient consensus in the group. |
| 12999 | 35.3.7.1.1. | 427.24 | The "disabled" and "enabled" link definitions are confusing as strictly speaking, it's really only QoS data being disabled/enabled over a link. Changing to more intuitive/sensible definitions, e.g. TID-enabled or QD-enabled (QD for QoS-Data) link. | As in comment |  Revised – document 22/1023r5 rephrased the definition of enable and disable, which makes it clearer. The name change would complicate things here as this is now widely used. |
| 13093 | 35.3.7.1.1 | 427.24 | Enabled/disabled state of a link has been tied to whether it carries Data MPDUs (TIDs) or not: "A setup link is defined as enabled for a non-AP MLD if at least one TID is mapped to that link either in DL or in UL and is defined as disabled if no TIDs are mapped to that link both in DL and UL."This view is wrong and unnecessary: A multi-link device has valid reasons to want to exchnage mangement frames on a given link for a variety of applications (ranging, sounding, sensing, calibration, reguatory, device or service discovery ...) and yet want to divert Data MPDUs to other links for traffic engineering, perhaps even as preperatory steps before runnnig non-data applications. Not sending Data frames has never been and should not be synonyous with a disabled link. In fact, TGbe ran into this topic in previous Letter Ballot when some mebers argued some management frames need to be allowed in this state (for a variety of rasons unrelate dto this comment), without consensus.The issue is simply a result of bad formulation: There is need in teh architeture for a disabled link concept (client side and AP side) in the sense of not allowing any frames to go out, and there is also room to manage/move any number of TIDs, includng all, to other links without disrupting other management functions. The coupling between these two is unnecessary.We end by noting that current definitions (on client side at least) seem to have come out of a poor formulation to try to optimize/protect single radio operation, whereas that objective can still be met without mixing these topics. With single radio concept established, there is no reason to be paranoid about this design clean up jeopordizing such implementations, and instead single radio case can be looked at independently to ensure implementation constraints are protected -- something that I think would come naturally after cleanups. | Decouple the link enable/disable state definition - client side and AP (broadcast) side - from TID-to-link mapping. Enabling/disabling a link is an administrative/management decision. A reasonable implementation may want to divert TIDs from a link that is to be disabled for example. Eliminating non-Data frames would need teh separate step of disabling/enabling link. |  Reject – Link enable/disable and TID-mapping are by conception coupled and the group agreed on that from the first step. The commenter is really asking to be able to map management frames on disabled links, which so far has not reached sufficient consensus in the group. |
| 10848 | 35.3.7.1.1 | 427.25 | Regarding the text "At any point in time, a TID shall always be mapped to at least one setup link both in DL and UL, which means that a TID-to-link mapping change is only valid and successful if it will not result in having a single TID for which the link set is made of zero setup links.", what if the AP removal (by MLD reconfiguration) happens and some TIDs miss the mapping of links, i.e., should we clarify if this wouldn't happen at all (e.g. AP removal is only allowed without this kind of issues) or add some text for such exception? | As in comment |  Revised – add a note that this rule is always true and needs to be respected also for link removal. Apply the changes marked as #10848 in this document. |
| 13864 | 35.3.7.1.1 | 427.29 | The last sentence is redundant because the paragraph avobe already specified the default state. 'By default, all TIDs shall be mapped to all setup links'. | As in comment. |  Revised – remove the normative text as it is redundant and make it informative. Apply the changes marked as #13864 in this document. |
| 12624 | 35.3.7.1.1 | 427.32 | Need to use a unified terminology along the TGbe spec, and replace "of" with "affiliated with" in the following sentence: "If a link is enabled for a non-AP MLD, it may be used for individually addressed frame exchange, subject to the power state of the non-AP STA operating on that link and only MSDUs or A-MSDUs with TIDs mapped to that link may be transmitted on that link between the corresponding STA and AP \*of\* the non-AP MLD and AP MLD in the direction (DL/UL) ..." | Please revise the sentence as follows: "If a link is enabled for a non-AP MLD, it may be used for individually addressed frame exchange, subject to the power state of the non-AP STA operating on that link and only MSDUs or A-MSDUs with TIDs mapped to that link may be transmitted on that link between the corresponding STA and AP \*affiliated with\* the non-AP MLD and AP MLD in the direction (DL/UL) ..." |  Revised – agree with the commenter. Modify all occurrence to affiliated with. Apply the changes marked as #12624 in this document. |
| 11104 | 35.3.7.1.1 | 427.33 | Various simulations (e.g., 11-20/1841r2) show that MLO in congested scenarios on all links just increases collisions and degrades performance. Changing EDCA parameters has limited value due to implementations in the field. Therefore a known-good, field-proven technique is to spread clients across all links via BTM, selected assoc rej etc. However, with MLO, the client can perform MLD setup with all links then go into PS mode on all but one link. In order to achieve Wi-Fi6 levels of performance in a congested environment, the AP must disassoc clients and only let them back in with a single link. Ditto, when hte congestion eases and MLO is possible again, the AP has to disassoc such clients again. | Provide the AP with an enforceable (i.e., mandatory) way to load balance clients: to signal to individual STAs or a group of STAs to limit what links their traffic are sent on, for both UL and DL. Since clients have constraints that are hard to express and time varying , provide both a way for the AP to express a requested preferred link (e.g., Link Recommendation) or a request a new agreed T2LM agreement before the AP needs to use the mandatory mechanism. |  Revised – agree with the commenter. Document 1026r10 has proposed the link recommendation tool. This addresses the comment.No further changes needed for this CID. |
| 10459 | 35.3.7.1.1 | 427.36 | Not all individually addressed Management and Control frames can be sent on any enabled link. For example, the immediate response frame should be sent on the same link which the request frame or data frame is received. | Please clarify and add the exception for this rule for Ack or BA, for example. |  Reject – there are specific rules regarding sending on one link management frames that target a STA on another link. This is already clarified on other part of the spec. Control frames are also regulated per spec, especially for Ack and BA and don’t need to be recalled there.  |
| 12625 | 35.3.7.1.1 | 427.36 | The term "enabled links" refer to the non-AP MLD and the AP MLD, and not to the non-AP STA / AP affiliated with the non-AP MLD / AP MLD. Please revise the sentence as proposed | Please revise the sentence as follows: "Individually addressed Management frames and Control frames may be sent on any \*of the\* enabled links between the \*non-AP MLD and AP MLD\* both in DL and UL" |  Reject – the STA and AP are sending the frame for the non-AP and AP MLD. |
| 12626 | 35.3.7.1.1 | 427.36 | In case of a link is disabled by the AP MLD for the entire BSS, need to define the following topics:1. No frame exchange is allowed on the disabled link (to Include Beacon frames)2. What is the status of individually negotiated TID-To-Link mappings.3. what is the status of individual TWT agreements corresponding to the disabled link?4. What happens to associated non-MLD STAs in case the link becomes disabled? | Add clarification in the text to the points raised in the comment |  Revised – this has been discussed in document 22/1023r5 and the mechanism is now captured in draft 2.1.No further actions are needed for this CID. |
| 12379 | 35.3.7.1.1 | 427.40 | "If a link is disabled for a non-AP MLD, it shall not be used for individually addressed frame exchange between the corresponding STA and AP of the non-AP MLD and AP MLD, including Management frames."I guess this statement is more for non-APs, I assume APs will continue to transmit beacon frames on a disabled link if the link is enabled for at least one non-AP STA.This is excessively restrictive; there may be cases where for any reasons the sole enabled link may be down; at least class 1, 2 frames should be allowed to be transmitted on disabled links (for example to transmit keepalive frames within Max Idle Period). | Clarify that this sentence applies only to non-AP STAs. Allow at least class 1, 2 frames and may be certain class 3 frames (e.g. TID-to-link mapping request/response) to be transmitted on disabled links by non-AP STAs. |  Revised – agree with the commenter. Apply the changes marked as #12379 in this document. |
| 12078 | 35.3.7.1.1 | 427.41 | This sentence "If a link is disabled for a non-AP MLD, it shall not be used for individually addressed frame exchange between the corresponding STA and AP of the non-AP MLD and AP MLD, including Management frames." is redundant with the previous sentence: "Individually addressed Management frames and Control frames may be sent on any enabled links between the corresponding STA and AP of the non-AP MLD and AP MLD both in DL and UL." | Expand the sentence on L37 to "Individually addressed frames, including Management frames and Control frames, may be sent on any enabled links between the corresponding STA and AP of the non-AP MLD and AP MLD both in DL and UL." and delete the sentence on L41. |  Revised – the fact that transmission is allowed on enabled links doesn’t necessarily mean that it is not allowed in disabled link, so based on the request in previous rounds of comment collections, it was preferred to clarify the rules both for enable and disable. Document 22/1023r5 modified the sentence to further clarify the rules and the changes are captured in Draft 2.1.No further action are needed for this CID. |
| 10023 | 35.3.7.1.1 | 427.42 | In "including the management frame", please add the control frames too. | as in comment |  Revised – agree with the commenter in principle. Apply the changes marked as #10023 in this document |
| 10635 | 35.3.7.1.1 | 427.42 | It is possible that a non-AP MLD is unable to close the link with the AP MLD on any of the enabled links. How can a non-AP MLD send T2LM Teardown or T2LM Request or Disassociation frame to the AP MLD? | Standard needs to provide a mechanism to address this issue. | Revised – agree in principle. Following suggestion from CID12379, allowing some management frames in disabled links  |
| 10024 | 35.3.7.1.1 | 427.44 | From the current text it's not clear if there is any exception of frame delivary on the disabled link; the text covers some of the cases where the frame delivery is not possible but it's not all the cases. Please add text to disallow any frame transmission over the disabled link for clean disablement of the link. This is helpful for the scenarios where the AP is turned off temporarily (due to maintanance) and if the AP could disable the link completely the AP removal is not needed. | as in comment |  Revised – based on suggestion from other CIDs there are exceptions, but the commenter is correct that these exceptions should not happen when the AP advertises the link as disabled in beacon. Apply the changes marked as #10024 in this document. |
| 11641 | 35.3.7.1.1 | 427.44 | From the current text it's not clear if there is any exception of frame delivery on the disabled link; the text covers some of the cases where the frame delivery is not possible but it's not all the cases. Please add text to disallow any frame transmission over the disabled link for clean disablement of the link. This is helpful for the scenarios where the AP is turned off temporarily (due to maintenance) and if the AP could disable the link completely the AP removal is not needed. | as in comment |  Revised – based on suggestion from other CIDs there are exceptions, but the commenter is correct that these exceptions should not happen when the AP advertises the link as disabled in beacon. Apply the changes marked as #11641 in this document. |
| 13069 | 35.3.7.1.1 | 427.44 | From the current text it's not clear if there is any exception of frame delivary on the disabled link; the text covers some of the cases where the frame delivery is not possible but it's not all the cases. Please add text to disallow any frame transmission over the disabled link for clean disablement of the link. This is helpful for the scenarios where the AP is turned off temporarily (due to maintanance) and if the AP could disable the link completely the AP removal is not needed. | as in comment |   Revised – based on suggestion from other CIDs there are exceptions, but the commenter is correct that these exceptions should not happen when the AP advertises the link as disabled in beacon. Apply the changes marked as #13069 in this document. |
| 10460 | 35.3.7.1.1 | 427.53 | Please remove one "buffered" as it is redundant. Also BU means bufferable. unit. | in the comment |  Revised – agree with the commenter. According to baseline the correct wording would be Buffered BUs available at the…Apply the changes marked as #10460 in this document. |
| 12408 | 35.3.7.1.1 | 427.53 | The word "buffered" is unnecessarily used twice. | Remove the word "buffered" before BUs, such that the sentence becomes "The non-AP MLD may retrieve individually addressed BUs buffered at the AP MLD ..." |  Revised – agree with the commenter. According to baseline the correct wording would be Buffered BUs available at the…Apply the changes marked as #12408 in this document. |
| 12627 | 35.3.7.1.1 | 427.53 | The following sentence is practically meaningless: "If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then: The non-AP MLD may retrieve individually addressed buffered BUs buffered at the AP MLD that are MSDUs or A-MSDUs corresponding to that TID on any link within this set of enabled links." since the non-AP MLD does not know what is the TID of each of the BUs. Besides, according to 35.3.12.4, the retrieval of the BUs is done using the Multi-Link Traffic Indication element, where the link that corresponds to the BUs is indicated.Additionally, the following condition is missing: the non-AP MLD has one or more affiliated non-AP STAs in PS mode (thus the retrieval of the BUs can be only on the link on which these affiliated non-AP STAs are operating)Please revise or remove as proposed | Option 1: Rephrase the sentence as follows: "If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then: The non-AP MLD \*which one or more of its affiliated non-AP STAs are in PS mode\* may retrieve individually addressed buffered BUs buffered at the AP MLD that are MSDUs or A-MSDUs corresponding to that TID using the TIM element and the Multi-Link Traffic Indication element included in the Beacon, as defined in 35.3.12.4"Option 2: Remove the sentence |  Revised – the commenter is asking to clarify how the non-AP MLD will determine that it can retrieve a buffered BU on a particular link. Add a note to clarify that. Apply the changes marked as #12627 in this document. |
| 13902 | 35.3.7.1.1 | 427.53 | How does non-AP MLD know whether its buffered BUs are MSDUs or MMPDUs? Please clarify it | please clarify this and update the text |  Revised – add a note clarifying how the non-AP MLD will determine if it can retrieve a buffered BU on a link. Apply the changes marked as #13902 in this document. |
| 12628 | 35.3.7.1.1 | 427.56 | According to following sentence: "If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then: The AP MLD may use any link within this set of enabled links to transmit individually addressed MSDUs or A-MSDUs corresponding to that TID, subject to the power state of the non-AP STA on each of these links".Need to add the following condition: the transmitted MSDUs or A-MSDUs are destined to the non-AP MLD. Please rephrase the sentence as proposed | Please rephrase the sentence as follows: "If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then: The AP MLD may use any link within this set of enabled links to transmit individually addressed MSDUs or A-MSDUs \*that are destined to the non-AP MLD and correspond\* to that TID, subject to the power state of the non-AP STA on each of these links". |  Revised – agree with the commenter. Apply the changes marked as #12628 in this document. |
| 11905 | 35.3.7.1.1 | 427.57 | "of the non-AP STA that is affiliated with the non-AP MLD" | As in comment. |  Revised – agree with the commenter. Apply the changes marked as #11905 in this document. |
| 12629 | 35.3.7.1.1 | 427.60 | Please replace the "default mode" term with "default mapping mode" term ,as this is the correct terminology defined in 35.3.7.1.2 | As in comment |  Revised - agree with the commenter. Apply the changes marked as #12629 in this document. |
| 10461 | 35.3.7.1.1 | 427.63 | Please clarify whether the BUs that are MMPDUs buffered at the AP MLD is individually addressed or not. | in the comment |  Revised – in this subclause the MMPDUs are individually addressed. For group address retrieval, all setup links can be used, and another subclause cover that part.Apply the changes marked as #10461 in this document. |
| 12630 | 35.3.7.1.1 | 427.63 | The following sentence is practically meaningless: "A non-AP MLD may retrieve buffered BUs that are MMPDUs buffered at the AP MLD on any enabled link" since the non-AP MLD does not know which of the BUs is MMPDU. Besides, according to 35.3.12.4, the retrieval of the BUs is done using the Multi-Link Traffic Indication element, where the link that corresponds to the BUs is indicated.Additionally, the following condition is missing: the non-AP MLD has affiliated non-AP STAs that are all in PS mode (thus the retrieval of the BUs can be only on the link on which these affiliated non-AP STAs are operating)Please revise or remove as proposed | Option 1: Rephrase the sentence as follows: "A non-AP MLD \*which all of its affiliated non-AP STAs are in PS mode\*may retrieve buffered BUs that are MMPDUs buffered at the AP MLD on any enabled link using the TIM element and the Multi-Link Traffic Indication element included in the Beacon, as defined in 35.3.12.4"Option 2: Remove the sentence |   Revised – the commenter is asking to clarify how the non-AP MLD will determine that it can retrieve a buffered BU on a particular link. Add a note to clarify that. Apply the changes marked as #12630 in this document. |
| 11906 | 35.3.7.1.1 | 427.64 | The AP may transmit any ind. Addr mgmt frames, not only bufferable, since there is a condition that subjects it to the power save state of the STA. Remove "bufferable" in P427L64. | As in comment. |  Revised – remove bufferable and refer to the correct subclause where the rules are defined. Apply the changes marked as #11906 in this document. |
| 11907 | 35.3.7.1.1 | 428.01 | What is special for TPC Request and Link Measurement frames to be called out in this sentence? Also does it mean that these frames cannot be sent on any of the enabled links? Please re-phrase the sentence to clairfy the intent. Similar consideration for the next paragraph. Alternatively specify this rule in one single place and refer to that in other parts of the draft. | As in comment. |  Revised – agree with the commenter. Refer to the correct subclause where the rules are defined. Apply the changes marked as #11907 in this document. |
| 11908 | 35.3.7.1.1 | 428.05 | Too strong of a requirement. It is possible that the AP has nothing to transmit to the STA. Suggest to replace "transmit" with "only transmit". Also replace "MSDUs/A-MSDUs with that set of negotiated TIDs for the" with "MSDUs or A-MSDUs that correspond to the negotiated TIDs with the".And lastly replace "unless it is transmitted to another STA affiliated with the same non-AP MD and in active mode" with " unless the MSDUs or MSDUs are transmitted to another STA in active mode that is affiliated with the same non-AP MLD. | As in comment. |  Revised – add “if any” for both bullets. Modify the rest of the sentence as suggested by commenter. Apply the changes marked as #11908 in this document. |
| 12912 | 35.3.7 | 428.05 | The TID-to-link mapping (TLM) interpretation as excluding a set of TIDs from a set of links is draconian and unnecessary. For example, sending one TIDx MPDU together with hundreds of TIDy MPDUs in response to a trigger frame does not break any traffic policing framework; on teh other hand, client having to switch link to transmit that singe TIDy MPDU is inconvenient and inefficient to client. We propose an aternative (softer) imterpretation of TLM: A TID unmapped to a link means there can be no contention for airtime for MPDUs with that TID, but planned channel access (routinely triggered access or access through restricted TWTs), which is assumed to undersatnd the link traffic pattern, can allow unmapped TIDs. The plannning behind the triggered/scheduled access will not be disrupted by these unmapped TIDs as they will be transmitted only if solicited - the unpredictable part (client starting a TXOP to transmit TIDx uplink for example) is still eliminated for unmapped TIDs. | Change the TLM meaning to mapped TID allowed to contend for airtime using the link, as opposed to mapped TIDs being the only TIDs transmitted over the link. |  Reject – we could have defined TID-mapping based on channel access as suggested by the commenter, but that would first have likely interop issues or complications for non-AP MLDs not knowing exactly if some frames will be delivered. And some actors wanted to have a clear separation of traffic per link, for load balancing or QoS differentiation reasons. The group decided to go with TID mapping. |
| 13903 | 35.3.7.1.1 | 428.13 | is this "singular", it should be "they are" | change it "they are" |  Revised – agree with the commenter. Apply the changes marked as #13903 in this document. |
| 12896 | 35.3.7.1 | 428.15 | Add a mechanism to temporarily change the TID-to-link mapping of a STA for a given time interval. After the end of the time interval, the STA should use the previously established TID-to-link mapping. | as in comment |  Revised – document 22/1023r5 added a mechanism to advertise a TID-mapping with a specific duration. That seems to satisfy the comment and that is now included in Draft 2.1.No further actions needed for this CID. |
| 12909 | 35.3.7.1.2 | 428.18 | (1) There is no need for "mode" to describe default TID-to-link mapping; "mode is normally used to describe broader operation aspects (e.g., power save mode), (2) "... if negotiation for different mapping did not occur ..." implies negotiation was supposed to happen, use "in the absence of negotiation"..., (3) language is unintentially including the case where negotiation to change an existing mapping A to a new mapping B fails, and says default mapping will need to be assumed, which is not the case. (4) Define "default mapping) as all-to-all, independent of whether negotiation is performed or not; this is to allow the rest of te text to simply use "default mapping" and not have extra words over abnd over about whether negotiation happens or not. | (1) Change the subclause title to "Default TID-to-link mapping", (2) Change the paragraph to "In the absence of a TID-to-link mapping agreement, an associated non-AP MLD shall assume all TIDs can be transmitted on any setup link, for DL and UL. A TID-to-link mapping agreement is not present if no negotiation was made during multi-link (re)setup, the negotiation was made during multi-link (re)setup but failed, or if an established agreement is torn down."(3) P429L42: Change the sentence to: "Once a TID-to-link mapping agreemnt between two MLDs is torn down, the two MLDs shall assume default TID-to-link mapping (see 35.3.7.1.2)." (4) Update other refernces to "default mapping mode" accordingly. |  Reject – doesn’t see value in the editorial changes suggested by the commenter. |
| 10918 | 35.3.7.1.2 | 428.22 | If the TID-to-link mapping is unsuccessful and there was a successfully negotiated TID-to-link mapping, then the most recent TID-to-link mapping of all TID remains unchanged and valid rather than operating in default mapping mode. | Replace "A non-AP MLD associated with an AP MLD shall operate under this mode if a TID-to-link mapping negotiation for a different mapping did not occur, was unsuccessful or was torn down." with "A non-AP MLD associated with an AP MLD shall operate under this mode if a TID-to-link mapping negotiation for a different mapping did not occur, was unsuccessful while having no succefully negotiated TID-to-link mapping before or was torn down." |  Accept |
| 12926 | 35.3.7.1.4 | 430.05 | 35.3.7.1.4 is titled "Power state after enablement" but talks about association. Both paragraphs in 35.3.7.1.4 start with "When a link becomes enabled for a STA that is affiliated with a nono-AP MLD after successful MLD asscociation with (Re)Association Request/Response frames ..", which seems unrelated to what the paragraphs are meant to specify. Title suggests power state after after enablement, it's not clear what association refernces mean. | Remove references to association if this subclause is about enablement (or change title). |  Reject – the subclause is about enablement. There are different conditions for a link to become enabled, one of them being association, reason why there is a mention of association in this subclause. |
| 13094 | 35.3.7.1.4 | 430.05 | 35.3.7.1.4 is titled "Power state after enablement" but talks about association. Both paragraphs in 35.3.7.1.4 start with "When a link becomes enabled for a STA that is affiliated with a nono-AP MLD after successful MLD asscociation with (Re)Association Request/Response frames ..", which seems unrelated to what the paragraphs are meant to specify. Title suggests power state after after enablement, it's not clear what association refernces mean. | Remove references to association if this subclause is about enablement (or change title). |  Reject – the subclause is about enablement. There are different conditions for a link to become enabled, one of them being association, reason why there is a mention of association in this subclause. |
| 11909 | 35.3.7.1.4 | 430.09 | I don't think there are other options for MLD association. So no need to call this part out here. Remove "with (Re)Association Request/Response frames". Technically you can get away also by replacing ", immediately after the acknowledgement of the (Re) Association Response frame" with "in the link where the MLD association is performed". Suggest similar simplifications in the next paragraph as well. | As in comment. |  Reject – the important aspect here is to mention that the association exchange happens on the link or on another link of the MLD.  |
| 11910 | 35.3.7.1.4 | 430.18 | What about the case of the link where the TID to Link mapping is performed in the current link. What is the PM of the STA in that link? I take it is the PM that is signaled in the soliciting frame? Please clarify. | As in comment. |  Revised – following other CIDs, propose to allow TID-mapping negotiation on a disabled link. In that case, we need to specify the power mode of the STA on that link. Propose to follow the same procedure as for association, as during the enabled phase, no power mode/power states need to be maintained by the STA and AP for the STA on the disabled link.Apply the changes marked as #11910 in this document. |
| 12927 | 35.3.7.1.5 | 430.21 | 35.3.7.1.5 is titled "Power state after disablement" but includes text about TWT agreemnts being deleted. Better organization needed. It is not clear why TWT agreements need to be deleted? | Consider not deleting TWT agreements for disabled links (notre -- there are other comments about meaning of a disabled link in general). |  Revised – modify the title to capture TWT. Apply the changes marked as #12927 in this document. |
| 13095 | 35.3.7.1.5 | 430.21 | 35.3.7.1.5 is titled "Power state after disablement" but includes text about TWT agreemnts being deleted. Better organization needed. It is not clear why TWT agreements need to be deleted? | Consider not deleting TWT agreements for disabled links (note -- there are other comments about meaning of a disabled link in general). |  Revised – modify the title to capture TWT. Apply the changes marked as #13095 in this document. |
| 12631 | 35.3.7.1.5 | 430.25 | In case of disabled link for a specific non-AP MLD, the TWT agreement must be referred to only the individual TWT agreement setup for the disabled link. Please revise the sentence accordingly, as proposed | The sentence should be revised as follows: "When a link becomes disabled for a non-AP MLD, the \*individual\* TWT agreements and APSD scheduled SPs of the STA affiliated with the non-AP MLD and operating on the link shall be deleted" |  Rejected – what is deleted is the TWT agreement of the STA, so that means individual TWT agreements and being also a member of a broadcast TWT |
| 12632 | 35.3.7.1.5 | 430.25 | It is not clear why in case of disabled link for non-AP MLD, the individual TWT agreements are automatically deleted? This is opposed to REVme D1.0 section 26.8.4.2 which enables to suspend the individual TWT agreement under some circumstances. Please add the option to suspend the individual TWT agreement for a disabled link | Following the method used in REVme D1.0 section 26.8.4.2, if the non-AP STA affiliated with non-AP MLD, need to add indication in the TWT Information frames that should indicate the suspension of TWT agreement during the disablement link periodThis indication is applicable for EHT non-AP STA affiliated with non-AP MLD. |  Reject – TID-mapping changes are supposed to be infrequent, and it’s always better if these changes are stateless so that the STA doesn’t need to keep memory of many previous agreements, especially if those will not longer be well fitted to the load status of the link and traffic status of the STA when the link will be enabled again. The group therefore judged simpler to delete it. |
| 10242 | 35.3.7.1.5 | 430.28 | The phrase "may not maintain a power state" could be interpretted as "is not allowed to maintain a power state" or "is allowed to not maintain a power state". Given normative langauge, I believe the former is intended, but it would be helpful to revise the language to remove the ambiguity | Revise to "The STA affiliated with the non-AP MLD and operating on the link may cease maintaining its power state and power management mode." |  Revised – agree with the commenter. Apply the changes marked as #10242 in this document. |
| 11567 | 35.3.7.1.5 | 430.28 | "may not" is ambiguous and should be replaced according to the style guide. | change the two instances of "may not" to "shall not" |  Revised – propose to follow the suggestion from COD10242. Apply the changes marked as #11567 in this document. |
| 10243 | 35.3.7.1.5 | 430.31 | The phrase "may not maintain a power state" could be interpretted as "is not allowed to maintain a power state" or "is allowed to not maintain a power state". Given normative langauge, I believe the former is intended, but it would be helpful to revise the language to remove the ambiguity | Revise to "The AP associated to the STA affiliated with the non-AP MLD and operating on the link may cease maintaining a power management status that indicates in which power management mode the STA is currently operating." |  Revised – agree with the commenter. Apply the changes marked as #12243 in this document. |
| 11911 | 35.3.7.1.5 | 430.31 | What about other PM related functionalities? E.g., keep alive frames, wake to receive a beacon every listen interval etc? Do those still apply? | As in comment. |  Reject – keep alive frames are defined at the MLD level for an MLD and defined in another subclause. Wake to receive beacon is also at the MLD level and handled in another subclause. So at least for the examples that the commenter gives, the spec already explicits the behavior.  |
| 10462 | 35.3.7.1.6 | 430.35 | This sentence is not related to power state and should be moved to 35.3.7.1.1 | in the comment |  Reject – this is actually related to power state. |
| 13905 | 35.3.7.1.5 | 430.35 | change "of" to "affiliated with" | change "of" to "affiliated with" |  Revised – accept |
| 13906 | 35.3.7.1.5 | 430.35 | which frame is allowed to be transmitted on disabled link, please clarify it | please clarify the frame type |  Revised – as suggested by CID 12379, clarify the frames that are allowed. Apply the changes marked as #13906 in this document. |
| 10109 | 35.3.7.1.5 | 430.36 | don't find any rule to allowe the frame transmit on the disabled link, if so, need remove the whole sentence"A STA of a non-AP MLD..." | remove this paragragh if there is no allowed ruled defined in 35.3.7.1.1 |  Revised – as suggested by CID 12379, clarify the frames that are allowed. Apply the changes marked as #10109 in this document. |
| 11610 | 35.3.7.1.5 | 430.36 | Suggest using the terminilogy consistently in the spec, i.e., changing "A STA of a non-AP MLD" to "A STA affiliated with a non-AP MLD" | changing "A STA of a non-AP MLD" to "A STA affiliated with a non-AP MLD" |  Accept |
| 13365 | 35.3.7.1.5 | 430.36 | It is not clear in which condition this will happen. | The disablement of a link can be disallowed when the response is expected from the link only. |  Revised - as suggested by CID 12379, clarify the frames that are allowed. Apply the changes marked as #13365 in this document. |
| 10637 | 35.3.7.1.5 | 430.37 | Line 41 on pg 427 in clause 35.3.7.1.1 is very clear that no frames are allowed on a disabled link. Therefore, the paragraph starting line 34 on pg 430 is incorrect. There is no such case allowed by 35.3.7.1.1. | Delete the cited paragraph |  Revised - as suggested by CID 12379, clarify the frames that are allowed. Apply the changes marked as #10637 in this document. |
| 11912 | 35.3.7.1.5 | 430.38 | What types of frames are allowed when the link is disabled (could not find anything in the cited subclause 35.3.7.1.1)? Also what procedure has timed out? | As in comment. |  Revised - as suggested by CID 12379, clarify the frames that are allowed. Apply the changes marked as #11912 in this document. |
| 10317 | 35.3.7.1.6 | 430.42 | Sure, the affiliated AP sets the more data field, but isn't this managed by the MLD? Re-word the requirement to state that the MLD manages the use of more data with respect to buffered BUs and the more data field is set in frames transmitted through an affiliated AP. | Commenter is willing to collaborate on a submission with a set of changes. |  Revised – rephrase so that the more data field is managed by the MLDs. Apply the changes marked as #10317 in this document. |
| 11914 | 35.3.7.1.6 | 430.43 | The first paragraph of this subclause contains declarative statements that should be in clause 9 rather than here. Propose that these descriptions are converted as normative behaviors and added as an exception (with a complete list) to the execptions that are mentioned (as above) in the paragraph that follows. | As in comment. |  Revised – the first sentences are informative as they explain the behavior. The normative statements suggested by the commenter are included in the next paragraph. Clarify the meaning so that the more data is handled by the MLD. Apply the changes marked as #11914 in this document. |
| 12928 | 35.3.7.1.6 | 430.43 | (1) Redunt word "more" in second line pf paragraph, (2) Meningless: "(not including the BU currently being transmitted) -- it means the BU being transmitted does not satisfy the rest of the sentence. (3) Many repetitive sentences -- in particular "most recent" TID-to-link mapping or default mapping... We define all mapping details once in 35.3.7.1 and after that meaning of TIDs mapped to a link is clear. | Change paragraph to: "An AP affiliated with an AP MLD uses the More Data subfield as defined in9.2.4.1.8 (More Data subfield) to indicate to a non-AP STA in PS mode and affiliated with the non-AP MLD that individually addressed BUs are buffered for that non-AP MLD. The indicated buffered BUs include only Data frames with TIDs that are mapped to this link (see 35.3.7.1 (TID-to-link mapping)) or Management frames other than TPC Request and Link Measureent Request (see 35.3.12.4 (Traffic indication))." |  Revised – simplify the sentence and add the word only as suggested by the commenter. Apply the changes marked as #12928 in this document. |
| 10026 | 35.3.7.1.6 | 430.49 | How about buffering control frames like BAR? Do we need to set the More data? Please clarify | as in comment |  Reject – control frames are not buffered. |
| 13070 | 35.3.7.1.6 | 430.49 | How about buffering control frames like BAR? Do we need to set the More data? Please clarify | as in comment |  Reject – control frames are not buffered. |
| 10463 | 35.3.7.1.6 | 430.52 | Please clarify whether an individually addressed means individually addressed STA affiliated with MLD or MLD? | in the comment |  Revised – Clarify the addressing for data frames and for management frames. Also remove the mention of TPC Request and Link Measurement Requst frame and refer to the relevant subclause 35.3.14 to determine the management frames that can be retrieved on this link. Apply the changes marked as #10463 in this document. |
| 12929 | 35.3.7.1.6 | 430.52 | NOTE is repetitive and stating the obvious. | Delete NOTE |  Revised – agree with the commenter. Remove the note. Apply the changes marked as #12929 in this document. |
| 11962 | 35.3.7.1.6 | 430.57 | TWT SP early termination should not be done based on More data bit value. The More data may be set to 1 only for STAs that are in power save mode. If a non-AP MLD has a link in active mode, then more data field may not be set to value 1. This makes More data field unreliable for TWT SP early termination. | Please, define that more data field is not used to early terminate TWT SPs of non-AP MLDs, because AP may only be capable to transmit value 0 to the STAs that belong to non-AP MLD that has one STA in active mode. Such indication would terminate immediately the TWT SP, which makes TWT SP a broken feature. |  Revised – There is indeed an inherent issue that if a STA of a non-AP MLD is in active mode, the frames are not buffered, while they can be in the queue of the AP/AP MLD and could be transmitted on another link where the STA is in PS mode and awake during a TWT SP. Propose to allow the more data bit to be set to 1 in that very specific case to preserve the possibility to use the TWT SP. This is only needed for the transmission of non-QoS frames, otherwise the EOSP is used.Apply the changes marked as #11962 in this document. |
| 10025 | 35.3.7.1.6 | 430.61 | Please fix this "When a STA is affiliated ..." to "When a STA that is affiliated ..." | as in comment |  AcceptChanges are marked as #10025 in this document. |
| 11915 | 35.3.7.1.6 | 430.61 | This sentence is a bit ambiguous. If a STA receives an MPDU with MD bit equal to 1 and continues to be awake then no other STAs need to send PS-Poll frames and such to retrieve BUs. Clarify that this rule applies only if none of the STAs are in the awake state following the MD bit =1 receipt since if any of the STAs is in the awake state then they dont send anything but rather just wait for the delivery of such frames. Similar consideration for the next paragraph. | As in comment. |  Revised – agree with the commenter. There can be cases where the STA doesn’t need to send anything to retrieve buffered BUs. Add “if needed” in the sentence. Apply the changes marked as #11915 in this document. |
| 10638 | 35.3.7.1.6 | 430.64 | If a STA affiliated with a non-AP MLD that received the MD=1 is in active mode or any other STA affiliated with the same non-AP MLD is in active mode, then the AP can send DL to one of the STAs that is in active state without waiting for a PS-Poll frame. The condition would apply only if all the STAs of the non-AP MLD are in PS mode. Update the paragraph to capture this condition. Same conditions apply to the next paragraph. | As in comment |  Revised – agree with the commenter. Clarify the sentence to qualify the condition that the STA has to be in PS mode. Apply the changes marked as #10638 in this document. |
| 13000 | 35.3.7.1.6 | 431.08 | Is "a link that is mapped to any of the TIDs" referring to "a link with at least one TID mapped"? If so, use the applicable definition which I believe is "an enabled link". | As in comment |  Revised – Agree with the commenter. Rephrase the sentence to improve clarify. Use term affected Link to refer to the link on which the frame with the MD bit is sent. Apply the changes marked as #13000 in this document. |
| 11916 | 35.3.7.1.6 | 431.09 | Replace "more data bit" with "More Data subfield equal to 1" and move "as specified by the most recent DL TID-to-link mapping)" immediately after "is also mapped to the link". | As in comment. |  Revised – Agree with the commenter. Rephrase the sentence to improve clarify. Use term affected Link to refer to the link on which the frame with the MD bit is sent to simplify the sentence. Apply the changes marked as #11916 in this document. |
| 13907 | 35.3.7.1.6 | 431.13 | what does "with any TID that is mapped to this operating link " mean, please clarify it | clarify it and update the text |  Revised – Agree with the commenter. Rephrase the sentence to improve clarify. Use term affected Link to refer to the link on which the frame with the MD bit is sent to simplify the sentence. Apply the changes marked as #13907 in this document |
| 12482 | 35.3.7.2 | 431.16 | The multi link power management procedure is described partially in chapter 35.3.7 and in chapter 35.3.12. This looks strange to me to have a chapter called "Dynamic link transitions" in chapter 35.3.7.2 that is indeed a direct application of the chapter 35.3.12.1 without even a reference to this chapter | Move the chapter 35.3.7.2 in the multi link power management (35.3.12), or at least add a reference to the chapter 35.3.12 in chapter 35.3.7.2. |  Revised – as suggested by the commenter, add reference to subclause 35.3.12. Apply the changes marked as #12482 in this document. |
| 12931 | 35.3.7.2 | 431.16 | Delete Section 35.3.7.2. The entire section is an example, and an obvious/trivial one. Behavior described is not even limited to single radio, so it can be misleading too. The first sentece with the word "may" (which people may want to refer to to argue section defines something) is trivial and redundant. | Delete 35.3.7.2, and renumber (move up) 35.3.7.1 as 35.3.7 TID-to-link mapping. |  Reject – several subclauses have been defined in 11be to describe and explain expected behavior or possible use of the defined functionalities without providing any normative text. This is the case for 35.3.4.6 for instance. This help improve the understanding of what can be achieved with the different tools available. |
| 13097 | 35.3.7.2 | 431.16 | Delete Section 35.3.7.2. The entire section is an example, and an obvious/trivial one. Behavior described is not even limited to single radio, so it can be misleading too. The first sentece with the word "may" (which people may want to refer to to argue section defines something) is trivial and redundant. | Delete 35.3.7.2, and renumber (move up) 35.3.7.1 as 35.3.7 TID-to-link mapping. |  Reject – several subclauses have been defined in 11be to describe and explain expected behavior or possible use of the defined functionalities without providing any normative text. This is the case for 35.3.4.6 for instance. This help improve the understanding of what can be achieved with the different tools available. |
| 11430 | 35.3.7.2 | 431.19 | Replace 'of its non-AP STAs' with 'of its affiliated non-AP STAs' | As in comment |  Accept – changes are marked as #11430 in this document. |
| 11913 | 35.3.7.2 | 431.42 | This example can be described better by calling out the frames that enable the transition from awake to doze (in link 1) and from doze to awake i(in link 2). Also since this is an example please avoid using normative behavior, and replace "stay" with "remain". Finally i suggest removing the "to save power" in these two paragraphs because for the single radio case the MLD needs to perform these functionalities for link transition and not neccessarily for power save. | As in comment. |  Revised – agree with the commenter. Add a sentence to clarify the transition. Change ‘may’ to ‘might’, remove ‘to save power’.Apply the changes marked as #11913 in this document. |
| 10318 | 35.3.7.2 | 431.44 | STA 1 and STA 2 are affiliated with the non-AP MLD. | At 431.44, change "STA 1 of the" to "STA 1 affiliated with the"At 431.50, change "STA 2 of the" to "STA 2 afilliated with the" |  Revised – agree with the commenter.Apply the changes marked as #10318 in this document. |
| 11431 | 35.3.7.2 | 431.44 | Replace 'STA1 of the non-AP MLD' with 'STA1 affiliated with the non-AP MLD'. Do the same on L51. | As in comment |   Revised – agree with the commenter.Apply the changes marked as #11431 in this document. |

1. **Introduction**
2. **Proposed spec text**
	* 1. **Link management**
			1. **TID-to-link mapping**
				1. **General**

(#11903, #12907, #11775, #13986, #11904) The TID-to-link mapping mechanism allows an AP MLD and a non-AP MLD that performed or are performing multi-link setup to determine how Data frames belonging to TIDs 0-7 and management frames will be assigned for transmission, on the setup links between the two MLDs in DL and UL.

(#14054)An AP MLD may support TID-to-link mapping negotiation. A non-AP MLD that performs multi- link (re)setup on at least two links with an AP MLD that sets the (#14054)TID-To-Link Mapping Negotiation Support subfield of the MLD Capabilities field of the Basic Multi-Link element to a nonzero value shall support TID-to-link mapping negotiation with the (#14054)TID-To-Link Mapping Negotiation Support subfield of the MLD Capabilities field of the Basic Multi-Link element it transmits to at least 1. An MLD with dot11EHTBaseLineFeaturesImplementedOnly equal to true shall not set the (#14054)TID-To- Link Mapping Negotiation Support subfield of MLD Capabilities field of the Basic Multi-Link element to 3.

By default, all TIDs shall be mapped to all setup links for both DL and UL (see [35.3.7.1.2 (Default mapping](#bookmark37) [mode)](#bookmark37)). (#14054)When a negotiated TID-to-link mapping is in effect according to the procedure defined in

[35.3.7.1.3 (Negotiation of TID-to-link mapping)](#bookmark38), [35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and](#bookmark39) [Probe Response frames(#14054))](#bookmark39), and [35.3.7.1.8 (Association procedures for TID-to-link](#bookmark40) [mapping(#14054))](#bookmark40), then a TID can be mapped to a link set, which is a subset of setup links, spanning from only one setup link to all the setup links, with restrictions defined in [35.3.7.1.3 (Negotiation of TID-to-link](#bookmark38) [mapping)](#bookmark38).

A setup link is defined as enabled for a non-AP MLD if at least one TID is mapped to that link either in DL or in UL and is defined as disabled if no TIDs are mapped to that link both in DL and UL. At any point in time, a TID shall always be mapped to at least one setup link both in DL and UL, which means that a TID- to-link mapping change is only valid and successful if it will not result in having (#14054)any TID for which the link set for DL or UL is made of zero setup links. By default, all setup links (#13864) are enabled (see [(Default mapping mode)](#bookmark37)).

(#10848) NOTE – Before removing an affiliated AP following the procedure described in 35.3.6.2.2 (Removing affiliated APs), an AP MLD must ensure that all TIDs will be mapped to at least one link for all associated non-AP MLDs after the AP is removed.

(#12624)If a link is enabled for a non-AP MLD, (#14054)then:

* it may be used for individually addressed frame exchange, subject to the power state of the non-AP STA operating on that link and only MSDUs or A-MSDUs with TIDs mapped to that link may be transmitted on that link between the corresponding non-AP STA and AP affiliated with the non-AP MLD and AP MLD, respectively, in the direction (DL/UL) corresponding to the TID-to-link mapping.
* MSDUs or AMSDUs as defined in 10.23.2 (HCF contention based channel access (EDCA)) with TIDs mapped to that link may be transmitted on that link between the corresponding non-AP STA and AP affiliated with the non-AP MLD and AP MLD, respectively, in the direction (DL/UL) corresponding to the TID-to-link mapping.
* Individually addressed Management frames and Control frames may be sent on any enabled links between the corresponding non-AP STA (#14054)affiliated with the non-AP MLD and AP affiliated with the associated AP MLD both in DL and UL.

If a link is disabled for a non-AP MLD, it shall not be used for individually addressed frame exchange between the corresponding non-AP STA (#14054)affiliated with the non-AP MLD and AP affiliated with the associated AP MLD, including Management (#10023) and Control frames, (#12379, #10024, #13069, #13906, #10109, #13365, #10637, #11912) except that if the link is disabled for a non-AP MLD but is not advertised as disabled by the AP MLD (see 35.3.7.1.7 Advertised TID-to-link mapping in Beacon and Probe Response frames), then the link may be used for class 1 and 2 Management frames, class 1 Control frames and TID-to-link Mapping Request, TID-to-link Mapping Response and TID-to-link Mapping Teardown frames.

(#14054)A STA affiliated with an MLD that operates on a disabled link shall suspend all wireless functionalities on that link until the link is enabled.

(#14054)NOTE 1— Suspension of wireless functionalities refers to functionalities such as frame generation, schedules, scoreboard maintenances, etc., while still preserving previously negotiated parameters with the peer EHT STA(s).

NOTE 2—Group addressed frames delivery procedure is defined in [35.3.15 (Multi-link group addressed frame delivery](#bookmark62) [and reception)](#bookmark62).

If a TID is mapped in UL to a set of enabled links for a non-AP MLD, then the non-AP MLD may use any link within this set of enabled links to transmit individually addressed MSDUs or A-MSDUs (#12628)that are destined to the AP MLD and that correspond to that TID.

If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then:

* The non-AP MLD may retrieve individually addressed buffered BUs (#12460, #12408)available at the AP MLD that are MSDUs or A-MSDUs corresponding to that TID on any link within this set of enabled links.
* The AP MLD may use any link within this set of enabled links to transmit individually addressed MSDUs or A-MSDUs (#12628) that are destined to the non-AP MLD and that correspond to that TID, subject to the power state of the non-AP STA (#11905) affiliated with the non-AP MLD on each of these links.

(#12627, #13902, #12630) NOTE 2—If the default (#12629)mapping mode is used, the non-AP MLD can retrieve BUs buffered by the AP MLD on any setup link. If non-default mapping is used, a non-AP MLD can determine that it can retrieve a buffered BU on a link based on its TID-to-link mapping alone or based on its TID-to-link mapping and on traffic indications in Multi-Link Traffic Indication element in the Beacon frames of an AP affiliated with its associated AP MLD. In addition, the AP MLD can recommend link(s) in Beacon frames and in Link Recommendation frames as defined in [35.3.12.4 (Traffic indication)](#bookmark53).

A non-AP MLD may retrieve buffered BUs that are (#10461)individually addressed MMPDUs (#12460, #12408)available at the AP MLD on any enabled link. An AP MLD may use any enabled links to transmit individually addressed (#10906)management frames(#11907, #10906), subject to the rules defined in 35.3.14 (Multi-link device individually addressed Management frame delivery) and subject to the power state of the non-AP STA on each of the links (see 35.3.12 (Multi-link power management)).

If a non-AP STA affiliated with a non-AP MLD is in active mode on a link with a set of TIDs mapped for DL transmission, its associated AP affiliated with the AP MLD shall transmit to the non-AP STA:

* MSDUs/A-MSDUs(#10908), if any, (#14054)corresponding to that set of negotiated TIDs for the non-AP MLD, and
* (#11907)MMPDUs(#10908), if any, for the non-AP MLD or its affiliated non-AP STAs, subject to the rules defined in 35.3.14 (Multi-link device individually addressed Management frame delivery),

(#10908, #13903)unless the MSDUs/A-MSDUs and/or MMPDUs are transmitted to another non-AP STA that is affiliated with the same non-AP MLD and that is in active mode or in PS mode and in the awake state.

NOTE 3—Operation with STAs affiliated with a non-AP MLD in power save mode are defined in [35.3.12.4 (Traffic](#bookmark53) [indication)](#bookmark53).

* + - * 1. **Default mapping mode**

Under this mode, all TIDs are mapped to all setup links for DL and UL, and all setup links are enabled. A non-AP MLD associated with an AP MLD shall operate under this mode (#14054)if (#10918) the following two conditions are true:

* a TID-to-link mapping is not advertised by the AP MLD (see [35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe](#bookmark39) [Response frames(#14054))](#bookmark39)),
* a TID-to-link mapping negotiation for a different mapping did not occur, was unsuccessful (#10918) while having no successfully negotiated TID-to-link mapping before or was torn down.

* + - * 1. **Power state after enablement**

(#11910) When a link becomes enabled for a STA that is affiliated with a non-AP MLD after successful MLD association with (Re)Association Request/Response frames transmitted on that link or after successful TID-to-link mapping negotiation with TID-To-Link Mapping Request/Response frames transmitted on that link, the power management mode of the STA, immediately after the acknowledgement of the (Re)Association Response frame or of the TID-To-Link Mapping Response frame, is active mode.

When a link becomes enabled for a STA that is affiliated with a non-AP MLD after successful MLD association with (Re)Association Request/Response frames transmitted on another link or after successful TID-to-link mapping negotiation with TID-To-Link Mapping Request/Response frames transmitted on another link, the power management mode of the STA, immediately after the acknowledgement of the (Re)Association Response frame or of the TID-To-Link Mapping Response frame, is power save mode, and its power state is doze.

(#11764) When a link becomes enabled for a STA that is affiliated with a non-AP MLD at the end of an advertised TID-to-link mapping (see 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames)), the power management mode of the STA, immediately after the end of the advertised TID-to-link mapping, is power save mode, and its power state is doze.

* + - * 1. **Power state and TWT agreements after disablement (#12927)**

When a link becomes disabled for a non-AP MLD:

The TWT agreements and APSD scheduled SPs of the STA affiliated with the non-AP MLD and operating on the link shall be deleted.

(#10242, #11567)The STA affiliated with the non-AP MLD and operating on the link may cease maintaining a power state and power management mode.

(#10243, #11567)The AP associated to the STA affiliated with the non-AP MLD and operating on the link may cease maintaining a power management status that indicates in which power management mode the STA is currently operating.

A STA (#13905, #11610)affiliated with a non-AP MLD that has transmitted a frame to the AP affiliated with its associated AP MLD on a disabled link, if allowed by the rules defined in [35.3.7.1.1 (General)](#bookmark36) and from which it expects a response, shall remain in the awake state until such a response is received or until the procedure has timed out.

* + - * 1. **Use of More Data subfield by an MLD**

(#10317)An AP MLD uses the More Data subfield as defined in 9.2.4.1.8 (More Data subfield) in frames transmitted by one of its affiliated AP to a non-AP STA in PS mode affiliated with the non-AP MLD to indicate to the non-AP MLD that more individually addressed BUs are buffered for that non-AP MLD. (#12928)The indicated buffered BUs are buffered at the AP MLD for the non-AP MLD and correspond only to Data frames (#10463) for the non-AP MLD and with TIDs that are mapped to this link by the most recent DL TID-to-link mapping (negotiated TID-to-link mapping or default mode mapping, see [35.3.7.1 (TID-to-link mapping)](#bookmark35)) or Management frames (#10463) for the non-AP MLD or for a non-AP STA affiliated with the non-AP MLD(see Table 11-3 and [35.3.12.4 (Traffic indication)](#bookmark53)).

(#10463, #12929)

An AP affiliated with an AP MLD shall follow the procedure defined in 11.2.3.6 (AP operation) for setting the More Data subfield and the EOSP subfield, except that in individually addressed frames the More Data subfield is used to indicate the presence of more BUs at the AP MLD for a non-AP MLD, as defined above.

(#11962) Additionally, an AP MLD may set the More Data subfield as defined in 9.2.4.1.8 (More Data subfield) to 1 in a frame that is neither a QoS Data frame nor a QoS Null frame transmitted by one of its affiliated AP to a non-AP STA in PS mode participating in a TWT SP and affiliated with the non-AP MLD to indicate to the non-AP MLD that more individually addressed frames are scheduled for delivery for that non-AP MLD during the ongoing TWT SP. (#12928)The indicated frames correspond only to Data frames (#10463) for the non-AP MLD and with TIDs that are mapped to this link by the most recent DL TID-to-link mapping (negotiated TID-to-link mapping or default mode mapping, see [35.3.7.1 (TID-to-link mapping)](#bookmark35)) or Management frames (see Table 11-3 and 35.3.12.4 (Traffic indication)) that are not buffered because another non-AP STA affiliated with the same non-AP MLD is in active mode (see conditions in 35.3.12.4 (Traffic indication)).

(#10025, #10638) When a non-AP STA that is in PS mode and that is affiliated with a non-AP MLD operating with default mapping (see [35.3.7.1.2 (Default](#bookmark37) [mapping mode)](#bookmark37)) receives an individually addressed MPDU from its associated AP affiliated with the associated AP MLD with the More Data subfield set to 1, then at least one of any non-AP STA affiliated with the non-AP MLD shall follow (#11915)or continue following the procedure defined in 11.2.3.7 (Receive operation for STAs in PS mode) and 11.2.3.8 (Receive operation using APSD) and may send PS-Poll frames or UAPSD trigger frames(#11915), if needed, to retrieve buffered BUs buffered at the AP MLD.

(#10638, #13000, #11916, #13907)When a non-AP STA that is in PS mode and that is affiliated with a non-AP MLD operating with a negotiated non-default TID-to-link mapping (see [35.3.7.1.3 (Negotiation of TID-to-link mapping)](#bookmark38)) receives an individually addressed MPDU from its associated AP with the More Data subfield set to 1 on a link (receiving link), then at least one of any STA affiliated with the non-AP MLD that is operating on the link (receiving link) or another link to which any of the TIDs that is mapped to the link (receiving link) is also mapped shall follow (#11915)or continue following the procedures defined in 11.2.3.7 (Receive operation for STAs in PS mode) and 11.2.3.8 (Receive operation using APSD) and may send PS-Poll frames or UAPSD trigger frames(#11915), if needed, with any TID that is mapped to this operating link to retrieve the buffered BUs buffered at the AP MLD.

**35.3.7.2 Dynamic link transitions**

A non-AP MLD may use the power states of its (#11430) affiliated non-AP STAs (#12482)(see 35.3.12 Multi-link power management) to dynamically change the link(s) on which it operates. [Figure 35-11 (Example of link transition operation by a single radio non-AP MLD using power](#bookmark41) [states)](#bookmark41) provides an illustration of operation of a single radio non-AP MLD with default mapping (all TIDs mapped to all setup links), where the non-AP MLD transitions from operating on link 1 with STA 1 to operating on link 2 with STA 2 (#10318, #11431), where both STA 1 and STA 2 being affiliated with the non-AP MLD.

PPDU transmission carrying BUs from the AP MLD to the non‐AP MLD

AP MLD

AP1

AP2

AP3

Non‐AP MLD

STA1

STA2

STA3

Link1

STA1 awake STA1 awake

STA1 awake

STA2 awake

STA2 awake

STA2 awake

Link2

Link3

**Figure 35-11—Example of link transition operation by a single radio non-AP MLD using power states**

(#11913)In this example, while operating on link 1:

* STA 1 of the non-AP MLD might use active mode or power save mode with the awake state to retrieve BUs from the AP MLD or to send frames to the AP MLD and might use doze state when there is no buffered BUs or no frames to send to the AP MLD.
* STA 2 and STA 3 stay in doze state.

(#11913)In this example, while operating on link 2:

* STA 2 of the non-AP MLD might use active mode or power save mode with the awake state to retrieve BUs from the AP MLD or to send frames to the AP MLD and might transition to doze state when there is no buffered BUs or no frames to send to the AP MLD.
* STA 1 and STA 3 stay in doze state.

(#11913)The link transition from link 1 to link 2 is achieved in this example by having STA 1 transition to doze state and STA 2 transition to active mode or awake state.

**35.5.2.2.4 Allowed settings of the Trigger frame fields and TRS Control subfield**

***TGbe editor: Please add the following paragraph at the end of this subclause as shown below (#12860):***

The AP affiliated with an AP MLD and operating on a link shall not set an ACI value in the Preferred AC subfield in the Trigger Dependent User Info field of the User Info field of a Basic Trigger frame for a non-AP STA that is affiliated with a non-AP MLD if no TID that corresponds to this ACI are mapped to the link for the non-AP MLD by the TID-to-link mapping (see 35.3.7 (Link Management)).

NOTE – If one of the two TIDs matching the indicated Preferred AC is not mapped to the link where the Trigger frame is sent, then data frames belonging to the unmapped TID can not be transmitted on that link, following 11.3.7 (Link management).