IEEE P802.11
Wireless LANs

|  |
| --- |
| Comment resolution for Enterprise-Grade TID Mapping |
| Date: 2022-02-07 |
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Abstract

Proposed draft text for enhancements to TID mapping.

The submission proposes text changes to resolve CIDs 5030, 5759, 6347, 6643, 6766, 6767, 6895, 7671,8179 from CC36. All proposed changes are based on 802.11be Draft 1.4.

Please see discussion notes below for a review of introduced changes.

# Revision History

|  |  |  |
| --- | --- | --- |
| **Date** | **Revision** | **Changes** |
| 2021-11-6 | 0 | Initial draft |
| 2022-01-18 | 1 | Added countdown timer and reason code |

# CC36 Comments and discussion [against Draft 1.0]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 6643 | 258.8 | 35.3.6.1.1 | TID to link negotiation can be mandatory in certain cases, however not in all. AP needs to be able to signal that a negotiation is required. | Add signaling in operation element indicating the need to perform negotiation. | Resolution: Revised, please implement the changes as shown in this document marked #6643. |
| 6766 | 9.4.2.295e | 154.15 | The text suggests that the recommendation for a link is only for default mapping mode. I do not understand why is it excluded negociated TID-link mapping which may have several links (not all links) for one TID | as in comment | Revised – Add an additional signaling that will apply to all modes and for both UL and DL. Apply the changes marked as #6766 in this document.  |
| 6767 | 35.3 | 246.15 | The link recommendation addressed in 35.3.10.4 is for the downlink traffic, it may be necessary to have a mechanism of link recommendation for uplink traffic. | Propose an equivalent mechanism of link recommendation for uplink traffic to help AP for the scheduling. For instance, add the link id information in the buffer status report | Revised – Add an additional signaling that will apply to all modes and for both UL and DL. Apply the changes marked as #6766 in this document. |
| 6895 | 35.3.10.4 | 267.17 | The sentence says "An AP MLD may recommend a non-AP MLD to use one or more enabled links to retrieve individually addressed buffered BU(s)". Through what signaling mechanism this recommendation is done? Is the recommendation made by using the Multi-Link Traffic element? Specifically, by using the Per-Link Traffic Indication Bitmap subfield in Multi-Link Traffic element? | The spec needs to provide clarification on how (signaling mechanism) the recommendation is made | Revised – Clarify the signaling and add an additional signaling that will apply to all modes and for both UL and DL. Apply the changes marked as #6766 in this document. |
| 7671 | 35.3.10.4 | 267.17 | It says "An AP MLD may recommend a non-AP MLD to use one or more enabled links to retrieve individually addressed buffered BU(s)" But how to recommend is missing. Please clarify. | See comment. | Revised – Clarify the signaling and add an additional signaling that will apply to all modes and for both UL and DL. Apply the changes marked as #6766 in this document. |
| 8179 | 35.3.10.4 | 267.17 | "An AP MLD may recommend a non-AP MLD to use one or more enabled links to retrieve individually addressed buffered BU(s)" It only happens under default mapping, please clarify. | as in comment | Revised – Provide clarification for this signaling and add an additional signaling that will apply to all modes and for both UL and DL. Apply the changes marked as #6766 in this document. |
| 5030 | 35.3.10.4 | 267.18 | It is not clear from the spec, how to recommend to use specific links to retrieve BUs between the beacons | Add a special control field | Revised – agree with the commenter. Reformulate to better capture how the recommendation is made. Apply the changes marked as #5030 in this document. |
| 5759 | 35.3.10.4 | 267.18 | "The AP's indication may be carried in a broadcast or a unicast frame". Current spec has specified the broadcast version, but we still miss the unicast version of it, which will be useful to recommend a link when the STA is awake/active or for UL. | define signaling for a link recommendation that would be sent in a unicast manner (A-ctrl, management frame, ...) | Revised – agree with the commenter. Define a new Link Recommendation frame that can include recommendation in a broader way for DL and UL and also for active STAs. Apply the changes marked as #5759 in this document. |
| 6347 | 35.3.10.4 | 267.18 | The detail of how an AP MLD recommends one or more enabled links to a non-AP MLD in an individually addressed frame is missing. | Define a signaling that an AP MLD can recommend one or more enabled links to a non-AP MLD. One way is to use the A-Control field of a frame from the AP MLD to include the recommended links. | Revised – agree with the commenter. Define a new Link Recommendation frame that can include recommendation in a broader way for DL and UL and also for active STAs. Apply the changes marked as #6347 in this document. |

**Discussion:**

This document addresses two general topics:

* TID to link mapping enhancements
* Link recommendation

The first part of the document presents TID to link mapping enhancements. Please refer to contribution 802.11-21/1611 for discussion on this topic.

The enhancements are meant to help clients maintain maximum connectivity on the maximum number of links that are most preferred by the non-AP STA as the AP performs either of

* Load balancing to mitigate excess collisions in high scale environments
* Temporary disablement of one AP in an AP MLD during operations, maintenance, and the like

The proposed draft text for these enhancements:

* Introduces a priority level in TID-to-link mapping negotiations
* Defines TID-to-link-subset mapping requirements
* Introduces a method for non-AP STAs (and APs) to identify reasons for TID mapping
* Adds scalable TID-to-link mapping mechanisms (broadcast advertisement and group-negotiation)
* Adds a countdown timer (required when a mandatory priority is set), in order to allow time for the recipient to change its mapping

For load balancing an approach is introduced where an AP MLD can send unicast or “multicast” (ie. broadcast with an AID list) TID-to-Link mapping requests with a priority level. When the priority level is set to recommendation the recipient STA may or may not follow the request. To address cases where the collective responses to the recommendation does not meet the load balancing need then a mandatory option is included. Even when the priority is set to mandatory, during the countdown timer, the recipient is allowed to respond with alternate requests indicating link preference and limitations on its side which the AP should take into consideration before completing the TID-to-Link negotiation**.**

For temporary disablement of an AP a broadcast method is defined where an AP MLD announces that a link will be temporarily disabled for all STAs using a TID-to-link-mapping element included in a Beacon. For this scheme no responses are defined.

The second part of the document presents enhancements to the link recommendation scheme.

### 9.3.3.2 Beacon frame format

TGbe editor: Add two rows to table 9-32 as follows (#6643):

**Table 9-32—Beacon frame body(#1004)(#2246)(#3352) *(continued)***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 2> | EHT Capabilities | The EHT Capabilities element is present if dot11EHTOptionIm- plemented is true; otherwise it is not present. |
| <Last assigned + 3> | EHT Operation | The EHT Operation element is present if dot11EHTOptionImple- mented is true; otherwise it is not present. |
| <Last assigned + 4> | TID-To-Link Map- ping | One or two TID-To-Link Map ping elements are optionally present if dot11MultiLinkActivated and dot11TIDtoLinkMappingActivated are true; otherwise, none are present. - If two TID-To-Link Mapping elements are present, the Mapping Switch Count subfield in one of the TID-To-Link Mapping elements is set to 0 and the Mapping Switch Count subfield in the other TID- To-Link Mapping element is set to a nonzero value. |
| <Last assigned + 5> | ML Load  | The ML Load element is optionally present if dot11MultiLinkActivated is true and dot11TIDtoLinkMappingActivated is true; otherwise it is not present.  |

### 9.3.3.10 Probe Response frame format

TGbe editor: Add two rows to table 9-39 as follows (#6643):

### Table 9-39—Probe Response frame body(#1004)(#2246)(#3359)

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| 11 | Quiet | The Quiet element is optionally present if dot11SpectrumManage- mentRequired is true or if dot11RadioMeasurementActivated is true or dot11RestrictedTWTOptionImplemented is true(#2215). |
| <Last assigned + 1> | Multi-Link | (#3016)(#1005)(#1896)(#1007)(#2861)(#1898)(#2860)(#1155)(# 1414)(#2581)(#3367)(#3359)(#2859)(#6700)The Basic Multi-Link element is present if the AP is affiliated with an AP MLD. Otherwise it is not present. |
| <Last assigned + 2> | EHT Capabilities | The EHT Capabilities element is present if dot11EHTOptionIm- plemented is true; otherwise it is not present. |
| <Last assigned + 3> | EHT Operation | The EHT Operation element is present if dot11EHTOptionImple- mented is true; otherwise it is not present. |
| <Last assigned + 4> | TID-To-Link Map- ping | The TID-To-Link Map ping element is optionally present if dot11MultiLinkActivated is true, and dot11TIDtoLinkMappingActivated is true; otherwise it is not present.- If two TID-To-Link Mapping elements are present, the Mapping Switch Count subfield in one of the TID-To-Link Mapping elements is set to 0 and the Mapping Switch Count subfield in the other TID- To-Link Mapping element is set to a nonzero value. |
| <Last assigned + 5> | ML Load  | The ML Load element is optionally present if dot11MultiLinkActivated is true and dot11TIDtoLinkMappingActivated is true; otherwise it is not present.  |

### **9.4.2 Elements**

### **9.4.2.1 General**

TGbe editor: ***Insert two new rows to*** [***Table 9-128 (Element IDs(#1009)(#1121))***](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark86)(#6643)***:***

**Table 9-128—Element IDs(#1009)(#1121)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| EHT Operation (see [9.4.2.311 (EHT](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark113) [Operation element)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark113)) | 255 | 106 | Yes | No |
| Multi-Link (see [9.4.2.312 (Multi-Link](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark116) [element)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark116)) | 255 | 107 | Yes | Yes |
| EHT Capabilities (see [9.4.2.313 (EHT](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark142) [Capabilities element(#4819))](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark142)) | 255 | 108 | Yes | No |
| TID-To-Link Mapping (see [9.4.2.314](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159) [(TID-To-Link Mapping element)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159)) | 255 | 109 | Yes | Yes |
| Multi-Link Traffic (see [9.4.2.315 (Multi-](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark162) [Link Traffic element(#2341))](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark162)) | 255 | 110 |  |  |
| (#4918)QoS Characteristics (see [9.4.2.316](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark167) [(QoS Characteristics element(#4918))](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark167) | 255 | <ANA> | Yes | Yes |
| AID List element (see 9.4.2.317 AID List element) | 255 | <ANA> | Yes | Yes |
| ML-Load element (see 9.4.2.318 ML Load element) | 255 | <ANA> | Yes | Yes |

**9.4.2.27** **BSS Load element**

***TGbe editor: Modify the following paragraph in section 9.4.2.27 as follows*** (#6643)***:***

The STA Count field is interpreted as an unsigned integer that indicates the sum of the total number of STAs currently associated with this BSS that are not part of an MLD and the total number of the enabled links with this BSS.

* MU EDCA Parameter Set element(11ax)

***TGbe editor: Update the following paragraph in section 9.4.2.251 as follows*** (#6643)***:***

* The MU EDCA Timer field indicates the duration of time, in units of 8 TUs, during which the HE STA uses the MU EDCA parameters for the corresponding AC, as defined in 26.2.7 (EDCA operation using MU EDCA parameters), with the following exceptions:the value 0 is reservedthe field is reserved when conditions described in 35.3.7.1.1 (General) are met

### **9.4.2.312.2.2 Multi-Link Control field of the Basic Multi-Link element**

TGbe editor: Modify section 9.4.2.312.2.2 as shown below (#6643):

**Table 9-401h—Subfields of the MLD Capabilities field(#1078)(#1475)(#2981) *(continued)***

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| TID-To-Link Map- ping Negotiation Sup- ported | Indicates support for TID-to-link mapping negotiation. | Set to 0 if dot11TIDtoLinkMappingActivated is false (#4267)and TID-to-link mapping is not supported by the MLD.Set to 1 if dot11TIDtoLinkMappingActivated is true and the MLD (#4267)only supports the mapping of all TIDs to the same link set, both for DL and UL.Set to 2 if dot11TIDtoLinkMappingActivated is true and the MLD supports the mapping, for both UL and DL, of all TIDs to a subset of links while optionally mapping, for both UL and DL, some TIDs to a single link, with TIDs corresponding to the same AC mapped to the same set of links.Set to 3 if dot11TIDtoLinkMappingActivated is true and the MLD supports the mapping of each TID to the same or different link set.(See 35.3.7.1.3 (Negotiation of TID-to-link mapping)) |

TGbe editor: Modify section 9.4.2.314 as shown below (#6643):

### **9.4.2.314 TID-To-Link Mapping element**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | TID-To-Link Mapping Control | Mapping Switch Count | Duration | Link Mapping Of TID 0(Optional) | … | Link Mapping Of TID 7(Optional) | Link Reason Code List(Optional)) |

Octets: 1 1 1 2 0 or 1 0 or 3 0 or 2 0 or 2 Variable

**Figure 9-1002z—TID-To-Link Mapping element format**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 | B5 | B6 B7 | B8 |  | B15 |
| Direction | Default Link Mapping | Priority | Mapping Switch Count Present | Duration Present | Reserved |  | Link Mapping Presence Indicator |
| Bits: | 2 | 1 | 1 | 1 | 1 | 2 |  | 8 |  |

**Figure 9-1002aa—TID-To-Link Control field format**

The Default Link Mapping subfield is set to 1 if the TID-To-Link Mapping element represents the default TID-to-link mapping. Otherwise, it is set to 0.

The Priority subfield indicates the priority level for the proposed Link Mapping according to Table 9-xx2 when the TID-To-Link Mapping element is sent in a TID-To-Link Mapping Response frame or an Association Response frame, and according to Table 9-xx1 otherwise.

**Table 9-xx1 —Priority subfield in a frame other than a TID-To-Link Mapping Response frame or an Association Response frame**

|  |  |  |
| --- | --- | --- |
| **Priority Subfield** | **Request by AP MLD** | **Request by non-AP MLD** |
| 0 | Prefer to change | Prefer to change |
| 1 | Mandatory | Strongly prefer to change |

**Table 9-xx2 —Priority subfield in a TID-To-Link Mapping Response frame or an Association Response frame**

|  |  |  |
| --- | --- | --- |
| **Priority Subfield** | **Response by AP MLD** | **Response by non-AP MLD** |
| 0 | Prefer not to change | Prefer not to change |
| 1 | Cannot accept change | Strongly prefer not to change |

The Mapping Switch Count Present subfield is set to 1 if the Mapping Switch Count field is present and 0 otherwise.

The Duration Present subfield is set to 1 if the Duration field is present and 0 otherwise.

The Link Mapping Presence Indicator subfield indicates whether the Link Mapping Of TID n field is present in the TID-To-Link Mapping element (#4023)(i.e., it identifies the TID(s) for which the mapping is pro- vided in the element). A value of 1 in bit position n of the Link Mapping Presence Indicator subfield indicates that the Link Mapping Of TID n field is present in the TID-To-Link Mapping element. Otherwise, the Link Mapping Of TID n field is not present in the TID-To-Link Mapping element. When the Default Link Mapping subfield is set to 1, this subfield is (#7707)not present.

The Mapping Switch Count field is present when the TID-To-Link Mapping element is transmitted by an AP MLD and the Priority subfield of the TID-To-Link Control field is 1;otherwise it is not present. The Mapping Switch Count field is set to the number of TBTTs until the AP sending the TID-To-Link Mapping element switches to the new mapping.

When the TID-To-Link Mapping element is carried in a Beacon frame on a link that is enabled or disabled after the TID-to-link mapping is applied, the value 0 indicates that the switch occurs after the groupcast frames following the frame containing the element is transmitted. Otherwise, the value 0 indicates that the switch has already occurred.

The Duration field indicates the duration for which the proposed TID Mapping is expected to be effective in units of TUs. The Duration field is present if the frame carrying the TID-To-Link Mapping element is a Beacon or a Probe Response frame transmitted by an AP of an AP MLD and the Priority subfield of the TID-To-Link Control field is set to 1, and is not present otherwise.

The Link Mapping Of TID n field (where n= 0, 1… 7 ) indicates the link(s) on which frames belonging to the TID n are allowed to (#4024)be sent (i.e., carries a bitmap of the links to which the TID n is mapped to). A value of 1 in bit position i (#6668)(where i = 0, 1…14 ) of the Link Mapping Of TID n field indicates that TID n is mapped to the link associated with the link ID i for the direction as specified in the Direc- tion subfield. (#5134)A value of 0 in bit position i indicates that the TID n is not mapped to the link associated with the link ID i. When the Default Link Mapping subfield is set to 1, this field is not present.

The Link Reason Code List field is present in all TID-To-Link Mappingelements transmitted by an AP MLD and in all TID-To-Link Mapping elements with Priority subfield set to1 transmitted by a non-AP MLD. The field indicates a Reason Code associated with a link in a TID-to-link mapping negotiation. The format of the Link Reason Code List field is defined in Figure 9-1002ab (Link Reason Code List field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Link Reason Code Presence Indicator | Link 1 Reason Code  | Link 2 Reason Code  | … | Link m Reason Code  | Padding |
| Bits: | 16 | 4 | 4 |  | 4 | 0 or 4 |

**Figure 9-1002ab—** **Link Reason Code List field format**

The Link Reason Code Presence Indicator subfield indicates the links for which a Link Reason Code subfield is present. In bit position n of the Link Reason Code Presence Indicator subfield, a value of 1indicates that the Link Reason Code subfield is present for the link associated with the link ID n. Otherwise, the Link Reason Code subfield for the link associated with link ID n is not present.

Each Link x Reason Code subfield indicates the Reason Code for a link that has a corresponding bit set to 1 in the Link Reason Code Presence Indicator subfield, in increasing order of link ID.

Table 9-xx3 lists the Reason Codes transmitted by AP MLDs. Table 9-xx4 lists the Reason Codes transmitted by non-AP MLDs.

The Padding subfield contains either 0 or 4 bits so that the length of the Link Reason Code List field is a multiple of 8 bits. The padding bits, if present, are set to 0.

**Table 9-xx3 — Encoding of the Link x Reason Code field when transmitted by an AP MLD**

|  |  |  |
| --- | --- | --- |
| Value  | Reason Code | Description  |
| 0 | OPERATIONS ADMIN\_MAINTENANCE | The BSS is paused due to operations, administration, and maintenance.  |
| 1 | MOBILE AP POWER SAVING  | The BSS is paused to save power.   |
| 2 | REGULATORY RELATED  | The BSS is paused due to regulatory related measurements and restrictions on the link. For instance, during the BSS pause, the AP may check whether it is allowed to operate as a DFS owner. |
| 3 | LOW RATE  | The recipient STA affiliated with a non-AP MLD has a poor transmission rate. The STA consumes too much medium time on the link. |
| 4 | QOS RELATED | The link is exclusively intended for traffic with QoS requirements.   |
| 5 | CHANNEL LOAD  | The BSS load is too high.  |
| 6 | COEXISTENCE, INTERNAL | The BSS operation is impacted due to internal coexistence. |
| 7 | COEXISTENCE, EXTERNAL | The BSS operation is impacted due to external coexistence. |
| 8 | NO REASON | An AP has no reason for the TID-to-link mapping. The use of this Reason Code in a TID-To-Link-Mapping element with the Priority subfield set to 1 is described in 35.3.7.1.4 (Mandatory TID-to-link mapping procedure).  |
| 9-15 | Reserved  |  |

**Table 9-xx4 — Encoding of the Link Reason Code field when transmitted by a non-AP MLD**

|  |  |  |
| --- | --- | --- |
| Value  | Reason code | Description |
| 0 | POWER SAVING  | The STA intends to save power and disable the link.  |
| 1 | POOR RSSI | The STA has transmission range issues and cannot operate the link efficiently. |
| 2 | HIGH QOS REQUIREMENT | The STA prefers the link to meet traffic QoS requirements. |
| 3 | TRAFFIC THROUGHPUT | The STA prefers the link for higher throughput. |
| 4 | PREFERRED LINK  | The STA prefers to operate on the link. |
| 5 | COEXISTENCE, INTERNAL | The STA is experiencing an unacceptable level of interference on the link due to internal coexistence issues  |
| 6 | COEXISTENCE EXTERNAL | The STA is experiencing an unacceptable level of interference on the link due to external co-existence issues. |
| 7-15 | Reserved  |  |

TGbe editor: ***Insert the following new subclause at the end of subclause 9.4.2*** (#6643)***:***

### **9.4.2.317 AID List element**

The AID List element is used to signal a list of AIDs in a frame transmitted by an AP. The format of this element is shown in Figure 9-1002ah (AID List element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Bitmap Control | Partial AID Bitmap |
| Octets: | 1 | 1 | 1 | 1 | 0 –251 |

**Figure 9-1002ah—AID List element format**

The Element ID, Length, and Element ID Extension fields are defined in [9.4.2.1 (General)](file:///C%3A%5C%5CUsers%5C%5Cpmonajem%5C%5CDocuments%5C%5CDocs%5C%5CIEEE%20802.11%5C%5C11be%5C%5CSource%5C%5CTGbe_Cl_09.doc%22%20%5Cl%20%22bookmark85).

The Bitmap Control field is a single octet. Bit 0 of the field is reserved. The remaining 7 bits of the field form the Bitmap Offset as shown in Figure 9-1002ai Bitmap Control field format.

An AID bitmap is a bitmap consisting of 2008 bits where a bit position K is set to 1 if AID K is a member of the signaled list of AIDs and otherwise is set to 0. The AID bitmap is organized into 251 octets such that bit number *N* (0 £ *N* £ 2007) in the bitmap corresponds to bit number (*N* mod 8) in octet number ë*N* / 8û where the low order bit of each octet is bit number 0, and the high order bit is bit number 7.

The Partial AID Bitmap field consists of octets numbered *N*1 to *N*2 of the AID bitmap, where *N*1 is the largest even number such that bits numbered 1 to (*N*1 ´ 8) – 1 in the AID bitmap are all 0 and *N*2 is the smallest number such that bits numbered (*N*2 + 1) ´ 8 to 2007 in the AID bitmap are all 0. The Bitmap Offset subfield value contains the number *N*1/2, and the Length field is set to (*N*2 – *N*1) + 3.

### **9.4.2.318 ML Load element**

TGbe editor: ***Insert the following new subclause at the end of subclause 9.4.2*** (#6643)***:***

The ML Load element contains load information of APs affiliated with an AP MLD. The element is transmitted by an AP MLD in Beacon, Probe Response, TID-To-Link MappingRequest, and TID-To-Link MappingResponse frames. The format of this element is shown in Figure 9-1002ai (ML Load element format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Link ID Bitmap  | Link 1 Load | … | Link N Load |
| Octets: | 1 | 1 | 1 | 2 | 5 |  | 5 |

**Figure 9-1002ai—ML Load element format**

The Element ID, Length, and Element ID Extension fields are defined in [9.4.2.1 (General)](file:///C%3A%5C%5CUsers%5C%5Cpmonajem%5C%5CDocuments%5C%5CDocs%5C%5CIEEE%20802.11%5C%5C11be%5C%5CSource%5C%5CTGbe_Cl_09.doc%22%20%5Cl%20%22bookmark85).

The Link ID Bitmap field indicates the links for which a Link Load field is present. In bit position n of the Link ID Bitmap field, a value of 1indicates that the Link Load field is present for the link associated with the link ID n. Otherwise, the Link Load subfield for the link associated with link ID n is not present.

Each Link x Load field indicates load information for a link that has a corresponding bit set to 1 in the Link ID Bitmap field, in increasing order of link ID.

The Link x Load field is shown in Figure9-1002aj (Link Load field format).

|  |  |  |  |
| --- | --- | --- | --- |
| STA Count | Channel Utilization | Link Count  | BSS Utilization  |
| 2 | 1 | 1 | 1 |

**Figure 9-1002aj—Link Load field format**

The STA Count field and Channel Utilization field are defined in 9.4.2.27 (BSS Load element).

The Link Count field is defined as the number of enabled links in the reported AP. Value 254 indicates 254 or more enabled links. Value 255 indicates an unknown number of links.

The BSS Utilization subfield is defined as the percentage of time, linearly scaled with 255 representing 100%, during which the AP or an associated STA is a TXOP holder transmitting UL or DL frames and related control frames. The BSS Utilization is calculated with the following formula:

BSS Utilization = (Intra-BSS UL and DL transmission durations \*255) / (dot11ChannelUtilizationBeaconIntervals × dot11BeaconPeriod × 1024)

where

UL and DL transmissions durations is defined to be the number of microseconds during which the AP or an associated STA is a TXOP owner transmitting PPDUs containing UL or DL frames and related control frames,

dot11ChannelUtilizationBeaconIntervals represents the number of consecutive Beacon intervals during which the channel busy time is measured.

### **9.6.35 Protected EHT Action frame details**

TGbe editor: Modify section 9.6.35.2 as shown below (#6643):

### **9.6.35.2 TID-To-Link Mapping Request frame format**

**Table 9-623e—TID-To-Link Mapping Request frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | (#5372)Protected EHT Action |
| 3 | Dialog Token |
| 4 | TID-To-Link Mapping (see [9.4.2.314 (TID-To-Link Mapping](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159) [element)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159)) |
| 5 | ML Load  |
| 6 | AID List element |

The Category field is defined in 9.4.1.11 (Action field).

(#5372)The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

The Dialog Token field (#6760)is set to a value greater than one chosen by the STA sending the TID-To-Link Mapping Request frame to identify the request/response transaction.

The TID-To-Link Mapping field contains one or two TID-To-Link Mapping elements as specified in

9.4.2.314 (TID-To-Link Mapping element). When it contains two TID-To-Link Mapping elements, the Direction subfield in one of the TID-To-Link Mapping elements is set to 0(#6760) and the Direction sub- field in the other of the TID-To-Link Mapping elements is set to 1(#6760).

If the frame is transmitted by an AP affiliated with an AP MLD, the ML Load field is optionally present. Otherwise, the ML Load field is not present.

The AID List element is always present in a frame with a broadcast RA to indicate a list of target MLDs for the request and is not present in an individually addressed frame. The TID-To-Link Mapping Request frame is an Action No Ack frame when the AID List element is present.

TGbe editor: Modify section 9.6.35.3 as shown below (#6643):

### **9.6.35.3 TID-To-Link Mapping Response frame format**

The TID-To-Link Mapping Response frame is sent by a STA affiliated to an MLD in response to a TID-To- Link Mapping Request frame to accept or reject a proposed TID-to-link mapping, or sent by a STA affiliated to an MLD to suggest a preferred TID-to-link mapping. The Action field of the TID-To-Link Mapping Response frame contains the information shown in [Table 9-623f (TID-To-Link Mapping Response frame](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark194) [Action field format)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark194).

**Table 9-623f—TID-To-Link Mapping Response frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | (#5372)Protected EHT Action |
| 3 | Dialog Token |
| 4 | Status Code |
| 5 | TID-To-Link Mapping (see [9.4.2.314 (TID-To-Link Mapping](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159) [element)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark159)) |
| 6 | ML Load |

The Category field is defined in [9.4.1.11 (Action field)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark71).

The EHT Action field is defined in [9.6.34.1 (EHT Action field)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark186).

When the TID-To-Link Mapping Response frame is transmitted as a response to a TID-To-Link Mapping Request frame, the Dialog Token field is the value in the corresponding TID-To-Link Mapping Request frame. When the TID-To-Link Mapping Response frame is transmitted as an unsolicited response, then the Dialog token is set to 0. When the TID-To-Link Mapping Response frame is transmitted as a response to an advertised TID-to-link mapping (see 35.3.6.1.5.1 Advertised TID-to-link mapping), then the Dialog Token is set to 1.

The Status Code is defined in [9.4.1.9 (Status Code field)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark69).

The TID-To-Link Mapping field contains zero, one, or two TID-To-Link Mapping elements as specified in

9.4.2.314 (TID-To-Link Mapping element) in order to suggest a preferred mapping. The field contains zero, one, or two TID-To-Link Mapping elements if the Status Code is set to SUCCESS or 133(DENIED\_TID\_TO\_LINK\_MAPPING). The field contains one or two TID-To-Link Mapping elements if the Status Code is set to 134 (PREFERRED\_TID\_TO\_LINK\_MAP- PING\_SUGGESTED). Otherwise, it does not contain a TID-To-Link Mapping element. When it contains two TID-To-Link Mapping elements, the Direction subfield in one of the TID-To-Link Mapping elements is set to 0 (Downlink) and the Direction subfield in the other of the TID-To-Link Mapping elements is set to 1 (Uplink).

If the frame is transmitted by an AP affiliated with an AP MLD, the ML Load field is optionally present. Otherwise, the ML Load field is not present.

### 11.2.3.15 TIM Broadcast

[CID 5154]

***TGbe editor: Please update the subclause as follows*** (#6643)***:***

The following events about the operational parameters of the AP shall classify as a critical update:

1. Inclusion of a Channel Switch Announcement element
2. Inclusion of an Extended Channel Switch Announcement element
3. Modification of the EDCA parameters element
4. Inclusion of a Quiet element
5. Modification of the DSSS Parameter Set
6. Modification of the HT Operation element
7. Inclusion of a Wide Bandwidth Channel Switch element
8. Inclusion of a Channel Switch Wrapper element
9. Inclusion of an Operating Mode Notification element
10. Inclusion of a Quiet Channel element
11. Modification of the VHT Operation element
12. Modification of the HE Operation element
13. Insertion of a Broadcast TWT element
14. Inclusion of the BSS Color Change Announcement element
15. Modification of the MU EDCA Parameter Set element
16. Modification of the Spatial Reuse Parameter Set element
17. Modification of the UORA Parameter Set element
18. Modification of the EHT Operation element
19. Inclusion, removal or modification of a TID-To-Link Mapping element with the Priority subfield of the TID-To-Link Control field equal to 1, except for modification of the Mapping Switch Count or the Duration fields

### 35.3.7.1 TID-to-link mapping

### 35.3.7.1.1 General

TGbe editor: Modify section 35.3.7.1.1 as shown below (#6643):

(#5244)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.

An MLD may support TID to link mapping negotiation, except that a non-AP MLD that performs multi-link (re)setup on at least two links with an AP MLD that has set to a nonzero value the TID-To-Link Mapping Negotiation Supported subfield of MLD Capabilities field of the Multi-Link element shall support TID-to-link mapping negotiation. An MLD with dot11EHTBaseLineFeaturesImplementedOnly equal to true shall not set the TID-To-Link Mapping Negotiation Supported subfield of MLD Capabilities field of the Multi-Link element

to 3.

By default, all TIDs shall be mapped to all setup links for (#2068)both DL and UL (see 35.3.7.1.2 (Default mapping mode)). When a negotiated TID-to-link mapping is in effect according to the procedures defined in 35.3.7.1.3 (Negotiation of TID-to-link mapping), 35.3.7.1.4 (Mandatory TID-to-link mapping procedure), 35.3.7.1.5 (Advertised TID-to-link mapping in Beacon and Probe Response frames), and 35.3.7.1.6 (Association Procedures for TID-to-link mapping) then (#7060)a TID can be mapped to a link set(#2908), which is a subset of setup links, spanning from only one setup link to all the setup links.

(#8237)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, (#4051)(#6577)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. (#4050)By default, all setup links shall be enabled (see 35.3.7.1.2 (Default mapping mode)).

(#1496)(#5365)If a link is enabled for a non-AP MLD, then:

* may be used for individually addressed frame exchange, subject to the power state of the non-AP STA operating on that link
* MSDUs or AMSDUs as defined in 10.23.2 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) corresponding to the TID-to-link mapping.
* The non-AP STA affiliated with the non-AP MLD and operating on the enabled link may transmit MSDUs or AMSDUs with a TID not mapped to that link to the AP operating on that link and affiliated with its associated AP MLD if the AP doesn’t include the MU EDCA Parameters Set element in the Beacon frames it transmits, or if the AP includes the MU EDCA Parameters Set element in the Beacon frames it transmits and the non-AP STA has updated its CWmin[AC], CWmax[AC], AIFSN[AC] and MUEDCATimer[AC] state variables to the values contained in the dot11MUEDCATable, for the AC of that TID and ignores operation defined in 26.2.7 (EDCA operation using MU EDCA parameters) for that TID.
* 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 (#8237)both in DL and UL.

(#5365)(#6281)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.

All the existing TWT Individual agreements between the AP MLD and any of the associated non-AP MLDs corresponding to a link shall be suspended when the link is disabled and shall be resumed when a link is enabled.

If an AP MLD advertises that a link is disabled as described in 35.3.7.1.5(Advertised TID-to-link mapping in Beacon and Probe Response frames), then:

* An unassociated non-AP MLD should not use the link for transmitting individually addressed management frames to the AP MLD
* An unassociated non-AP MLD that has received such TID-to-link-mapping advertisement in a Beacon or a Probe Response frame shall not use the link to transmit Authentication and (Re)association Request frames to the AP affiliated to the AP MLD and operating on that link while the link is disabled (as indicated in the Duration field in the advertised TID-to-link Mapping element).

(#5365)NOTE 1—Group addressed frames delivery procedure is defined in 35.3.15 (Multi-link group addressed frame delivery and reception).

(#4052)If a TID is mapped in DL to a set of enabled links for a non-AP MLD, then:

— (#1226)The non-AP MLD may retrieve (#5365)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.— The AP MLD may use any link within this set of enabled links to transmit (#5365)individually addressed MSDUs or A-MSDUs (#4451)corresponding to that TID, subject to the power state of the non-AP STA on each of these links.

(#1788)(#1680)(#4053)NOTE 2—If the default mode is used, the non-AP MLD can retrieve BUs buffered by the AP MLD on any setup link but the AP MLD can recommend a link as defined in 35.3.12.4 (Traffic indication).

A non-AP MLD shall not retrieve buffered BUs in DL on a link to which all TIDs are not mapped in DL unless the non-AP MLD has received a Multi-Link Traffic element indicating that there are buffered BU(s) for the non-AP MLD with TIDs mapped to that link.

(#4052)A non-AP MLD may retrieve buffered BUs that are MMPDUs buffered at the AP MLD on any enabled link. An AP MLD may use any enabled links to transmit individually addressed bufferable management frames that are not measurement MMPDUs, subject to the power state of the non-AP STA on each of the links.

(#5753)If a 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 STA:

— MSDUs/A-MSDUs with that set of negotiated TIDs for the non-AP MLD, and

— MMPDUs that are not measurement MMPDUs for the non-AP MLD or its affiliated STAs,

unless it is transmitted to another STA affiliated with the same non-AP MLD and in active mode.

(#5753)NOTE 3—Operation with STAs affiliated with a non-AP MLD in power save mode are defined in 35.3.12.4 (Traffic indication).

### 35.3.7.1.2 Default mapping mode

TGbe editor: Modify section 35.3.7.1.2 as shown below (#6643):

(#1790)(#2427)(#2907)(#3377)(#3027)(#2908)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 and an AP MLD that performed multi-link setup shall operate under this mode if a TID-to-link mapping is not advertised by the AP MLD (see 35.3.5.1.5(Advertised TID-to-link mapping in Beacon and Probe Response frames)), and if a TID-to-link mapping negotiation for a different mapping did not occur, was unsuccessful, or was torn down.

### 35.3.7.1.3 Negotiation of TID-to-link mapping

TGbe editor: Modify section 35.3.7.1.3 as shown below (#6643):

An MLD that supports TID-to-link mapping negotiation has dot11TIDtoLinkMappingActivated equal to true and shall set to a nonzero value the TID-to- link Mapping Negotiation Supported subfield in the MLD Capabilities field of the (#6700)Basic Multi-Link element that it transmits. Otherwise it shall set the TID-to-link Mapping Negotiation Supported subfield to

0. If the TID-to-link Mapping Negotiation Supported subfield value received from a peer MLD is equal to 1, the MLD shall send to the peer MLD only the TID-to-link Mapping element where all TIDs are mapped to the same link set.

After the multi-link (re)setup is successful, to negotiate a new TID-to-link mapping, an initiating non-AP MLD with dot11TIDtoLinkMappingActivated equal to true shall send an individually addressed TID-to-link Mapping Request frame to a responding MLD that has indicated support of TID-to-link mapping negotiation. The non-AP MLD may set value 1 to the Priority subfield of the TID-To-Link-Mapping element if the non-AP MLD includes a Reason Code to at least one link.

An AP MLD with dot11TIDtoLinkMappingActivated equal to true that initiates a TID-to-link mapping negotiation shall perform one of the following:

- Send an individually addressed TID-to-link Mapping Request frame to a non-AP MLD

- Send a broadcast addressed TID-to-link Mapping Request frame that includes an AID List element

- Advertise a TID-to-link Mapping as defined in 35.3.7.1.5 (Advertised TID-to-link mapping in Beacon and Probe Response frames)

The AP MLD shall include a Reason Code for each link which TID settings are requested to be changed to the TID-to-Link Mapping element of a TID-to-Link Mapping frame. The AP MLD should include to the TID-to-link Request fames a ML Load element if any link has a Reason Code equal to LOW RATE, QOS RELATED or CHANNEL LOAD in the TID-to-Link Mapping element.

Except if otherwise stated in 35.3.7.1.4 (Mandatory TID-to-link mapping procedure), an MLD that receives an individually addressed TID-to-Link Mapping Request frame or a broadcast addressed TID-to-Link Mapping Request frame that includes an AID List element which indicates the MLD’s AID shall send an individually addressed TID-to-link Mapping Response frame to the initiating MLD according to the following rules:

— If the responding MLD accepts the requested TID-to-link mapping in the TID-to-Link Mapping element in the received TID-to-link Mapping Request frame, it shall set to 0 (SUCCESS) the Status Code in the TID-to-link Mapping Response frame. The TID-to-link mapping indicated in the TID-to-link Mapping Request frame is defined to be established after the transmission of the TID-to-Link Mapping Response frame with the Status Code set to 0 (SUCCESS). TID-to-link Mapping Response frame may include TID-to-link Mapping element with link specific Reason Codes to all links to signal responding MLD preferences to use the mapped links.

— Otherwise, the responding MLD shall indicate rejection of the proposed TID-to-link mapping by setting to either 133 (DENIED\_TID\_TO\_LINK\_MAPPING) or 134 (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED) the Status Code in the TID-to-link Mapping Response frame and including link specific Reason Codes to the TID-To-Link Mapping element. The responding MLD may suggest a preferred TID-to-link mapping by setting to 134 (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED) the Status Code in the TID-to-link Mapping Response frame and including the TID-to-link Mapping element in the TID-to- link Mapping Response frame.

If a TID-to-link mapping request is rejected as allowed by in 35.3.7.1.4 (Mandatory TID-to-link mapping procedure), the previously established TID-to-link mapping shall remain unchanged.

An MLD may suggest a preferred TID-to-link mapping to a peer MLD by sending an unsolicited TID-to- link Mapping Response frame with the Dialog Token field set to 0 that includes the TID-to-link Mapping element and sets the Status Code to 134 (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED). An MLD shall not send an unsolicited TID-to-link Mapping Response frame that includes the TID-to-link Mapping element and sets the Status Code to 0 (SUCCESS).

If indicated by a peer MLD, an MLD should take into account the preferred TID-to-link mapping when it initiates a new TID-to-link mapping. In addition, an AP MLD should take into account the traffic flow(s) affiliated with the non-AP MLD and the capabilities and constraints (if any) of the non-AP MLD.

NOTE 1—A non-AP MLD can indicate its constraints (such as single radio) during multi-link setup.

NOTE 2––A non-AP MLD can indicate its link preferences by using the link specific Reason Codes in the TID-To-Link Mapping element.

A multi-link multi-radio (MLMR) non-AP MLD should accept a TID-to-link mapping initiated by its associated AP MLD if the Priority subfield of the TID-To-Link Control field in the TID-To-Link Mapping Request frame is set to 0.

When two MLDs have negotiated a TID-to-link mapping, either MLD may teardown the negotiated TID-to- link mapping by sending an individually addressed TID-To-Link Mapping Teardown frame, except a non-AP MLD shall not tear down a negotiated TID-to-link mapping if the current TID-to-link mapping was established by a negotiation in which the AP requested a mandatory TID-to-link mapping. Instead, the non-AP MLD may initiate a new TID-to-link mapping negotiation. After teardown, if a mapping scheme is advertised by the AP MLD as described in 35.3.4.1.5 (Advertised TID-to-link mapping in Beacon and Probe Response frames)), the MLDs shall operate in the established mode as described in 35.3.4.1.5 (Advertised TID-to-link mapping in Beacon and Probe Response frames), otherwise they shall operate in the default mapping mode (see 35.3.7.1.2 (Default mapping mode)).

If an MLD has successfully negotiated the TID-to-link mapping with a peer MLD, both the MLD and the peer MLD shall update an uplink and/or downlink TID-to-link mapping information according to the negotiated the TID-to-link mapping. In case that a TID-to-link mapping of specific TID is missing in the negotiation, the most recent TID-to-link mapping of this TID remains unchanged and valid.

NOTE 3—If there is no successfully negotiated TID-to-link mapping for a TID after a tear down, and that TID is not included in an AP advertised mapping according to 35.3.7.1.5 (Advertised TID-to-link mapping in Beacon and Probe Response frames), then the default mapping is applied to this TID.

Each AP affiliated with an AP MLD may transmit an ML Load element in their Beacons and Probe Responses to avoid ML-Probe Requests that query BSS Load elements on different links.

When an MLD has successfully negotiated with a peer MLD an uplink and/or downlink TID-to-link mapping in which the bit position i of the Link Mapping Of TID field in the TID-to-link Mapping element is set to 0, the TID n shall not be mapped to the link associated with the link ID i in an uplink and/or downlink.

When an MLD has successfully negotiated with a peer MLD an uplink and/or downlink TID-to-link mapping in which the bit position i of the Link Mapping Of TID n field in the TID-to-link Mapping element is set to 1, the TID n shall be mapped to the link associated with the link ID i in an uplink and/or downlink.

### 35.3.7.1.4 Mandatory TID-to-link mapping procedure

TGbe editor: Add a new section 35.3.7.1.4 as shown below and renumber sections accordingly (#6643):

An AP MLD may set the Priority subfield of the TID-To-Link Control field in a TID-to-link Mapping element to 1 to indicate that the requested TID-to-link mapping is mandatory.

An AP should only send the Priority field subfield of the TID-To-Link Control field in a TID-to-link Mapping element to 1 (mandatory) when the alternative action by the AP MLD for the non-AP MLD is disassociation. An AP MLD should not use NO REASON Reason Code in a mandatory TID-to-link mapping, if the AP MLD requests to disable a link. An AP shall include ML Load element to a TID-To-Link Mapping Request frame, if the frame requests disabling over 50% of a non-AP MLD links.

An AP that sets the Priority subfield value to 1 shall set the Mapping Switch Count field to the number of TBTTs until a DTIM Beacon at which the indicated TID-to-link mapping is required. The new TID-To-Link Mapping will be activated after the groupcast frames following the DTIM Beacon.

The AP should allow enough time for the responding non-AP MLDs to repond to the request frame by setting the initial value of the Mapping Switch Count field to a sufficiently large value.

A non-AP MLD that receives from its associated AP MLD a TID-To-Link Mapping element with the Priority subfield value set to 1 may send a TID-to-link Mapping Request frame before the indicated TBTT to request an alternate preferred mapping, except if the frame carrying the TID-To-Link Mapping element is a Beacon frame. The non-AP STA shall include a link specific Reason Code in the TID-to-link Mapping element of the TID-to-link Mapping Request frame to request alternate preferred mapping. The non-AP MLD may justify the alternate preferred TID-to-link Mapping with the following Reason Codes:

* HIGH QOS REQUIREMENT requests the AP to allow the non-AP STA to transmit and receive frames to ensure the QoS performance of the non-AP STA’s traffic with high TIDs (4-7).
* TRAFFIC THROUGHPUT requests the AP to allow the non-AP STA to transmit and receive frames on as many links as possible to improve throughput.
* PREFERRED LINK requests the AP, while otherwise allowed, to send DL frames and trigger UL frames primarily on this link. The non-AP STA anticipates being most often awake on this link.

In addition, the non-AP MLD may include the following per link Reason Codes to indicate its constraints on the links:

* POOR RSSI requests the AP to deprioritize the link, because the the non-AP STA has poor RSSI on the link and might not be able to receive from the AP.
* COEXISTENCE INTERNAL or COEXISTENCE EXTERNAL requests the AP to disable the link, because the non-AP STA has internal or external co-existence and might not be able to receive or transmit on the link,

An AP MLD that receives a TID-to-Link Mapping Request frame before the indicated TBTT of a mandatory mapping request should take into account the input received from the non-AP MLD, including the link specific Reason Codes, as part of determining the response. If the alternate mapping requested by the non-AP MLD is not acceptable the AP may ignore the request frame sent by the non-AP MLD. If no alternate mapping has been successfully negotiated with the AP by the indicated TBTT then the originally announced mapping is used to establish a mapping for the non-AP MLD and the established mapping is effective after the indicated TBTT.

A non-AP MLD that receives a mandatory TID-to-link mapping request from an AP MLD shall schedule the transmission of a TID-To-Link Mapping Response frame with status set to SUCCESS before the indicated TBTT with Dialog Token in the TID-To-Link Mapping Response frame equal to the Dialog Token in the mandatory AP request, if any of the following happens:

* The non-AP MLD that is permitted to send a TID-To-Link Mapping Request frame with an alternate mapping in response to a mandatory AP request does not send a TID-to-Link Mapping Request frame with an alternate mapping or
* The non-AP MLD sends a TID-To-Link Mapping Request frame with an alternate mapping and does not receive a TID-To-Link Mapping Response frame from the AP with the status SUCCESS

### 35.3.7.1.5 Advertised TID-to-link mapping in Beacon and Probe Response frames

TGbe editor: Add a new section 35.3.7.1.5 as shown below and renumber sections accordingly (#6643):

An AP MLD may advertise a mandatory BSS-wide TID-To-Link mapping by including a TID-To-Link Mapping element in the Beacon and Probe Response frames that the APs of the AP MLD transmit. The Priority subfield of the TID-To-Link Control field shall be set to 1 in the advertized TID-To-Link Mapping element.

NOTE 1— Since the Link IDs can be different for MLDs affiliated with each BSSID in a multiple BSSID set, inheritance will not apply to TID-To-Link mapping for APs that are part of an MBSSID set, and therefore the TID-To-Link Mapping element needs to be carried in each Nontransmitted BSSID Profile to which an advertised mapping applies.

An AP MLD shall include two TID-To-Link Mapping elements in the Beacon and Probe Response frames that the APs of the AP MLD transmit, if there is already an ongoing advertised TID-to-link mapping and a new TID-to-link mapping will replace it. In this case, the AP MLD shall set the Mapping Switch Count field of the existing TID-To-Link Mapping elements to zero to indicate the currently advertised TID-to-link mapping and shall set the Mapping Switch Count field of the new TID-To-Link Mapping element to a nonzero value to indicate a TID-to-link mapping that will be advertised in the future.

All APs of an AP MLD that advertises a TID-to-link mapping shall include the same TID-to-link mapping in their Beacon and Probe Response frames. When a new TID-to-link mapping is advertised in a Beacon frame, the Mapping Switch Count field shall be set to the number of TBTTs until a DTIM Beacon at which the indicated TID-to-link mapping is required and should initially be set to a sufficiently large value. The new TID-To-Link Mapping will be activated after the groupcast frames following the DTIM Beacon.

After the Mapping Switch Count field of an advertised TID-To-Link Mapping element reaches 0 in a Beacon or a Probe Response frame received by a non-AP MLD from its associated AP MLD, the non-AP MLD shall not map frames associated with a TID to a link unless that the mapping is allowed for that link and direction by the advertised TID-To-Link Mapping.

The following rules define the TID-to-link mapping that is established in a non-AP MLD after a newly changed TID-To-Link Mapping element is received by a non-AP MLD in a Beacon or a Probe Response frame from its associated AP MLD:

- If the advertised TID-to-link mapping maps all TIDs to a subset of links while mapping some TIDs to a different subset of links, then a non-AP MLD that does not have in its MLD setup any of the links which have all TIDs mapped in the advertised TID-to-link mapping shall map all TIDs to the link in its MLD setup that has the largest number of TIDs mapped in the advertised mapping. If more than one such links exist, the link with the smallest link ID is selected.

- Otherwise, the set of mapped links for each TID and direction for a non-AP STA are the set of links that are included in the non-AP STA’s MLD setup and have been mapped to that TID for that direction in the advertised TID-to-link mapping

NOTE 1—A non-AP STA ignores links included in an advertised TID-to-link mapping that are not part of the non-AP STA’s MLD setup.

NOTE 2—In absence of an advertised mapping by the AP a default TID-to-link mapping is assumed unless an individual TID-to-link mapping is negotiated.

A non-AP MLD that receives a TID-To-Link Mapping element in its most recently received Beacon or a Probe Response frame from its associated AP MLD shall not transmit a TID-To-Link Mapping Response frame containing TID-To-Link Mapping elements.

An AP MLD shall not advertise in the Beacon and Probe Response frames that its affiliated APs transmit a TID-to-link mapping that has more than one link to which only some TIDs are mapped.

An AP MLD shall not advertise in the Beacon and Probe Response frames that its affiliated APs transmit a TID-to-link mapping that has different mapping in DL and UL and that has different mapping for TIDs corresponding to the same AC.

An AP MLD shall not advertise a TID-to-link mapping that does not map all TIDs to at least one link.

An AP MLD shall include a Reacon Code for every disabled link. AP MLD is allowed to use Reason Codes OPERATION AND MAINTENANCE, REGULATORY RELATED, COEXISTENCE, INTERNAL or COEXISTENCE, EXTERNAL on a link that is advertised as disabled. NSTR Mobile AP is allowed to use the same Reason Codes and MOBILE AP POWER SAVING.

All APs affiliated with AP MLD shall transmit a BSS Load element for all links, if the AP MLD disabled over 50% links of the affiliated APs.

A non-AP MLD that is associated with an AP MLD that advertises a TID-to-link mapping may initiate a negotiation for a TID-to-link mapping that is not established as described in this section. Any MLD shall not initiate a negotiation for a TID-to-link mapping that maps TIDs to a link that does not have this TID mapped to it in the advertised TID-to-link mapping.

### 35.3.7.1.6 Association Procedures for TID-to-link mapping

TGbe editor: Add a new section 35.3.7.1.6 as shown below and renumber sections accordingly (#6643):

In a multi-link (re)setup procedure, a non-AP MLD may initiate a TID-to-link mapping negotiation by including the TID-to-link Mapping element in the (Re)Association Request frame if an AP MLD has indicated a support of TID-to-link mapping negotiation.

After receiving the (Re)Association Request frame, the AP MLD shall reply to the (Re)Association Request frame according to 11.3.5.3 (AP, AP MLD, or PCP association receipt procedures), 11.3.5.5 (AP, AP MLD, or PCP reassociation receipt procedures), and

35.3.5 (Multi-link (re)setup), with the following additional rules:

— Where the AP MLD advertises a TID-To-Link Mapping according to 35.3.7.1.5(Advertised TID-to-link mapping in Beacon and Probe Response frames), if the non-AP MLD does not include at least one TID-to-link Mapping Request element or requests a mapping that maps TIDs to a link in a direction that is not enabled in the advertised mapping, the AP shall include in the (Re)Association Response frame a TID-To-Link Mapping element with the Mapping Switch Count Present subfield equal to 0 and indicating the TID-to-link mapping that is advertised for each of the links accepted in the association procedure. After the transmission of the (Re)Association Response frame the TID-to-link mapping included in that frame is established and shall be used during the association unless and until a new TID to link mapping is advertised or negotiated.

— Otherwise, the AP MLD can accept the requested TID-to-link mapping in the TID-to-link Mapping element in the received (Re)Association Request frame only if it accepts the multi-link (re)setup for all links on which at least one TID is requested to be mapped. In this case, it shall not include in the (Re)Association Response frame the TID-to-link Mapping element.

— Otherwise, the AP MLD shall indicate rejection of the proposed TID-to-link mapping by including in the (Re)Association Response frame the TID-to-link Mapping element that suggests a preferred TID-to-link mapping, and the default TID-to-link mapping remains established until a new TID to link mapping is advertised or negotiated.

The AP MLD that rejects a (Re)Association Request may include a TID-to-link Mapping-related status code and link specific reason codes in the TID-To-Link Mapping element in the (Re)Association Response frame even if the non-AP MLD does not initiate a TID-to-link mapping negotiation. Status codes 133 (DENIED\_TID\_TO\_LINK\_MAPPING) or 134 (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED) may be used.

**35.3.11.4 Traffic indication**

***Tgbe editor: Please modify the 4th paragraph in subclause 35.3.11.4 Traffic indication as follows***) (#5030, #6743, #5759)

An AP MLD may recommend a non-AP MLD to use one or more enabled links to retrieve individually addressed buffered BU(s), if present, by advertising the recommended links in the Multi-Link Traffic element in the Beacon frames it transmits.(#3256)(#3322). An AP MLD may also recommend a non-AP MLD to use one or more enabled links for all exchanges both for DL and UL by advertising the recommended links in a Link Recommendation frame.

***Tgbe editor: Please modify the following paragraph in subclause 35.3.11.4 Traffic indication as follows (#***6766, #6767, #6895, #7671, #8179)

When a non-AP MLD in PS mode that is in the default mapping mode (see 35.3.6.1.2 (Default mapping mode)) detects that the bit corresponding to its AID is 1 in the TIM element and the Multi-Link Traffic element is present in a Beacon frame, any STA affiliated with the non-AP MLD that operates on the link(s) indicated as recommended for that non-AP MLD in the MultiLink Traffic element should issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all Acs are delivery enabled, to retrieve buffered BU(s) in the AP MLD.

***Tgbe editor: Please insert the following paragraphs after paragraph 11 in subclause 35.3.11.4 Traffic indication (#***6766, #6767, #6895, #7671, #8179, #6743, #5759)

The APs affiliated with an AP MLD may also schedule for transmission a group-addressed Link Recommendation frame to provide link recommendation for a set of non-AP MLDs as follows:

* The bit corresponding to the AID of a non-AP MLD shall be set to 1 in the Partial AID Bitmap subfield of the AID List element in the Link Recommendation frame if the AP wants to provide a link recommendation for this non-AP MLD.
* The Multi-Link Traffic element includes Per-Link Traffic Indication Bitmap subfield(s) that corresponds to the AID(s) of the non-AP MLD(s), starting from the bit number *k* of the traffic indication virtual bitmap, in the Per-Link Traffic Indication Bitmap List field. The AID Offset subfield of the Multi-Link Traffic Control field of the Multi-Link Traffic element contains the value *k*. The order of the Per-Link Traffic Indication Bitmap subfield(s) follows the order of the bits that are set to 1 in the Partial AID Bitmap subfield of the AID List element carried in the Link Recommendation frame that corresponds to the AID(s) of the non-AP MLD(s). The bit position *i* of the Per-Link Traffic Indication Bitmap subfield in the Multi-Link Traffic element that corresponds to the link with the link ID equal to *i* on which a STA affiliated with the non-AP MLD is operating shall be set to 1 to indicate to the non-AP MLD that it should exchange frames on this link both in DL and UL.
* A link shall not be recommended if it is disabled for the non-AP MLD.

If a non-AP MLD receives a Link Recommendation frame with the bit corresponding to its AID set to 1 in the Partial AID Bitmap subfield of the AID List element in the Link Recommendation frame, it should exchange frames both in DL and UL on enabled links identified as recommended in the Multi-Link Traffic element in the Link Recommendation frame.

* + 1. **EHT Action frame details(#1119)(#1488)**
			1. **EHT Action field**

***Tgbe editor: Please change the following Table 9-623a EHT Action field values as follows (#***6766, #6767, #6895, #7671, #8179, #6743, #5759)

**Table 9-623a—EHT Action field values**

|  |  |
| --- | --- |
| **Value** | **Meaning** |
| 0 | EHT Compressed Beamforming/CQI |
| 1 | EML Operating Mode Notification. |
| 2 | Link Recommendation |
| 3–255 | Reserved |

***Tgbe editor: Please add the following subclause 9.6.34.4 Link Recommendation frame format as follows (#***6766, #6767, #6895, #7671, #8179, #6743, #5759)

**9.6.34.4 Link Recommendation frame format**

The Link Recommendation frame is an Action No Ack frame of category EHT. The Action field of an Link Recommendation frame contains the information shown in [Table 9-xxx](#bookmark188) [(Link Recommendation frame Action field format(#6078))](#bookmark188).

**Table 9-xxx—Link Recommendation frame Action field format(#6078)**

|  |  |
| --- | --- |
| **Order(#6078)** | **Meaning** |
| 1 | Category |
| 2 | EHT Action |
| 3 | Reason Code |
| 4 | AID List element |
| 5 | Multi-Link Traffic element (see 9.4.2.315 (Multi-Link Traffic element)) |

The Category field is defined in Table 9-79 (Category values). The EHT Action field is defined in Table 9-623a (EHT Action field values). The Reason Code field is defined in 9.4.1.7 (Reason Code field) and provides the reason why the AP MLD is sending the link recommendation.

The AID List element is described in 9.4.2.317 (AID List element) and is used to identify the non-AP MLDs for which a link recommendation is provided.

The Multi-Link Traffic element is described in 9.4.2.315 (Multi-Link Traffic element) and is used to describe the link recommendations for all the non-AP MLDs that are identified in the AID List element.

* + - 1. **Multi-Link Traffic element(#2341)**

***TGbe editor: Please modify following paragraphs in subclause 9.4.2.311 Multi-Link Traffic element as follows (#***6766, #6767, #6895, #7671, #8179, #6743, #5759)

The Per-Link Traffic Indication List field is defined in [Figure 9-1002ad (Per-Link Traffic Indication List](#bookmark165) [field format)](#bookmark165). The Per-Link Traffic Indication List field contains Per-Link Traffic Indication Bitmap sub- fields that correspond to the AIDs of the non-AP MLDs starting from the bit numbered *k* of the traffic indi- cation virtual bitmap or the Partial AID bitmap. The Per-Link Traffic Indication List field contains *l* Per-Link Traffic Indication Bitmap subfields, where *l* is the number of the bits that correspond to the AIDs of the non-AP MLDs set to 1, counting from the bit numbered *k* of the traffic indication virtual bitmap:

* + in the Partial Virtual Bitmap sub- field of the TIM element that is included in a Beacon frame with the Multi-Link Traffic element
	+ or in the Partial AID Bitmap subfield of the AID List element that is included in a Link Recommendation frame with the Multi-Link Traffic element.

***TGbe editor: Please modify following paragraphs in subclause 9.4.2.311 Multi-Link Traffic element as follows (#***6766, #6767, #6895, #7671, #8179, #6743, #5759)

Each bit in the Per-Link Traffic Indication Bitmap subfield corresponds to a link on which a STA affiliated with a non-AP MLD is operating, with the bit position *i* of the bitmap, B*i*, corresponding to a link with link ID equal to *i*. In a Beacon frame, when the Per-Link Traffic Indication Bitmap subfield corresponds to a non-AP MLD that has successfully negotiated TID-to-link mapping, a value of 1 in the bit position *i* in the bitmap indicates that there is buffered BU(s) with TID(s) mapped to the link with the link ID equal to *i* or MMPDU(s); a value of 0 in a bit position in the bitmap indicates that there is no buffered BU(s) with TID(s) mapped to the corre- sponding link nor MMPDU(s). In a Beacon frame, when the Per-Link Traffic Indication Bitmap subfield corresponds to a non- AP MLD that is in the default mapping mode, a value of 1 in the bit position *i* in the bitmap indicates that the link with the link ID equal to *i* is recommended for retrieving buffered BU(s).

In a Link Recommendation frame, when the Per-Link Traffic Indication Bitmap subfield corresponds to a non- AP MLD, a value of 1 in the bit position *i* in the bitmap indicates that the link with the link ID equal to *i* is recommended for frame exchanges both in DL and in UL.