IEEE P802.11
Wireless LANs

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| CR for TID to Link Mapping Advertisement |
| Date: Jan 2023 |
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Abstract

Proposed draft text for enhancements to TID mapping.

The submission proposes text changes to resolve CIDs 10535, 11761, and 12632 from LB266. All proposed changes are based on 802.11be Draft 2.2.

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

# Revision History

|  |  |  |
| --- | --- | --- |
| **Date** | **Revision** | **Changes** |
| 2022-11-12 | 0 | Initial draft |
| 2022-11-12 | 1 | Added example of TID-to-link mapping exchanges and clarifications regarding advertised default mapping in 35.3.7.1.7. Minor fixes to editor notes. |
| 2023-01-11 | 2 | Reviewer feedback integrated through text, RNR updates omitted  |

# LB266 Comments and discussion [against Draft 2.0]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 10535 | 172.59 | 9.3.3.5 | Keep the description short. Consider deleting the description related to setting of the Direction subfield. | Cover the setting of specific subfield values in the normative clause (35.3.7.1). | Resolution: Revised, please implement the changes as shown in document 22/1966r[motioned revision] marked #10535. |
| 11761 | 220.8 | 9.4.2.312.2.2 | Multiple use cases require traffic for all TIDs to traverse the same subset of links in a multi-link setup. Add an encoding for TID-To-Link Mapping Negotiation Supported subfield in the MLD Capabilities and Operations field to support such a TID-to-link subset mapping as well as relevant normative text in clause 35. | as in comment | Resolution: Revised. No changes are required because the comment has been addressed by doc 22/1023r5 |
| 12632 | 430.25 | 35.3.7.1.5 | 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. | Resolution: Revised, please implement the changes as shown in document 22/1966r [motioned revision] marked #12632. |

**9.3.3.2 Beacon frame format**

TGbe editor: Modify the last row of Table 9-60 in 9.3.3.2 as shown below (#10535):

**Table 9-60—Beacon frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| (#14054)<Last assigned+ 5> | TID-To-Link Mapping | One or two TID-To-Link Mapping elements are optionally present if dot11MultiLinkActivated and dot11TIDtoLinkMappingActi- vated are true; otherwise, none are present.  |

**9.3.3.5 Association Request frame format**

TGbe editor: Modify the last row of Table 9-62 in 9.3.3.5 as shown below (#10535):

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 3> | TID-To-Link Map- ping | One or two TID-To-Link Mapping elements are present if dot11- MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and a non-AP STA affiliated with a non-AP MLD initiates (#10270)both an association with an AP MLD and a TID-to-link mapping negotiation. Otherwise it is not present.. |

**9.3.3.6 Association Response frame format**

TGbe editor: Modify the last row of Table 9-63 in 9.3.3.6 as shown below (#10535):

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 4> | TID-To-Link Map- ping | One or two TID-To-Link Mapping elements are present if dot11- MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and the AP sends an Association Response frame in response to a received Association Request frame that is initiating both a multi-link setup and a TID-to-link mapping negotiation. Other- wise it is not present.  |

**9.3.3.7 Reassociation Request frame format**

TGbe editor: Modify the last row of Table 9-64 in 9.3.3.7 as shown below (#10535):

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 3> | TID-To-Link Map- ping | One or two TID-To-Link Mapping elements are present if dot11- MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and a non-AP STA affiliated with a non-AP MLD initiates both a multi-link resetup and a TID-to-link mapping negotiation. Otherwise it is not present. |

**9.3.3.8 Reassociation Response frame format**

TGbe editor: Modify the last row of Table 9-65 in 9.3.3.8 as shown below (#10535):

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 4> | TID-To-Link Map- ping | One or two TID-To-Link Mapping elements are present if dot11- MultiLinkActivated is true, dot11TIDtoLinkMappingActivated is true, and the AP sends a Reassociation Response frame in response to a received Reassociation Request frame that is initiat- ing both a multi-link resetup and a TID-to-link mapping negotia- tion. Otherwise it is not present.  |

**9.3.3.10 Probe Response frame format**

TGbe editor: Modify the last row of Table 9-67 in 9.3.3.10 as shown below (#10535):

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| (#14054)<Last assigned+ 4> | TID-To-Link Mapping | One or two TID-To-Link Mapping elements are optionally present if dot11MultiLinkActivated and dot11TIDtoLinkMappingActi- vated are true; otherwise, none are present.  |

**9.6.13.9 BSS Transition Management Request frame format**

TGbe editor: Modify section 9.6.13.9 as shown below (#10535):

— (#10575)For an AP MLD that operates with more than one affiliated AP, it sets the Link Removal Imminent field (bit 5) to 1 to limit the scope of the BSS termination to the link on which the request is being transmitted if the BSS Termination Included field (bit 3) is set to 1, and otherwise, it sets the field to 0. If a receiving STA is not affiliated with a non-AP MLD, it will ignore the Link Removal Imminent (bit 5) field. When the Link Removal Imminent (bit 5) field is set to 1,

• If a receiving STA is affiliated with a non-AP MLD that has set up only this link, then the nonAP MLD will be disassociated.

• If a receiving STA is affiliated with a non-AP MLD that has set up more than this link, and the AP MLD is announcing that the AP will be removed according to procedures defined in 35.3.6.2.2 (Removing affiliated APs), then the non-AP MLD is still associated to the AP MLD with the remaining setup link(s).

• If a receiving STA is affiliated with a non-AP MLD that has set up more than this link, and the AP MLD is advertising that the AP link will be disabled for all associated non-AP MLDs according to procedures defined in 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames), then the non-AP MLD may ignore the BTM request and remains associated to the AP MLD on all currently setup link(s) while the link is disabled and re-enabled in a future time.

The Link Removal Imminent (bit 5) field is reserved (#10575)if one of the following conditions is met: • when theThe transmitting AP is not affiliated with an AP MLD. • The transmitting AP is affiliated with an AP MLD that operates with only one affiliated AP.or when the BSS Termination Included field is zero, and is ignored by a receiving STA that is not affiliated with a non-AP MLD or when the BSS Termination Included field is zero. The field is set to 1 to limit the scope of the BSS termination to the link on which the request is being transmitted, and is set to 0 otherwise.

### 35.3.7.1 TID-to-link mapping

TGbe editor: Modify section 35.3.7.1.1 as shown below (#12632 and #10535):

### 35.3.7.1.1 General

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 35.3.7.1.2 (Default mapping mode)).

If a link his 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 (#12624)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.

 (#10535)— Individually addressed Management frames and Control frames may be sent on any enabled links between the corresponding (#12625)(#12624)non-AP MLD (#14054)and 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 (#12624)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)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(#14054))), 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, if initiated by the non-AP MLD.

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.

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 and reception).

(#12632)When a link becomes disabled for a non-AP MLD, if the expected duration of the disablement is indicated in the Expected Duration field of the TID-To-Link mapping element that initiated the link disablement, and if the non-AP STA affiliated with the non-AP MLD corresponding to the disabled link has set the TWT Information Frame Disabled field to 0 in the TWT element sent during a TWT setup, then the non-AP STA shall consider all TWT Individual and Broadcast agreements suspended until the link is enabled, unless the TWT agreements are already suspended with a resumption time after the Expected Duration expires. Otherwise, if the non-AP STA has not set the TWT Information Frame Disabled field to 0, or if the expected duration of the disablement is not specified, then all TWT Individual agreements and broadcast TWT memberships shall be torn down.

**35.3.7.1.5 Power state and TWT schedules after disablement(#12927)**

TGbe editor: Modify section 35.3.7.1.5 as shown below (#12632):

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

— The APSD scheduled SPs of the (#12242)non- AP STA affiliated with the non-AP MLD and operating on the link shall be deleted.

— If the link has been disabled using an individual TID-to-link mapping negotiation, then the TWT agreements and (#12631)TWT memberships of the (#12242)non- AP STA affiliated with the non-AP MLD and operating on the link shall be torn down

— The (#12242)non-AP STA affiliated with the non-AP MLD and operating on the link may (#11567)cease maintaining a power state and power management mode.

— The AP associated to the (#12242)non-AP STA affiliated with the non-AP MLD and operating on the link may (#11567)cease maintaining a power management status that indicates in which power management mode the STA is currently operating.

A STA (#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) 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.

**35.3.7.1.7 Advertised TID-to-link mapping in Beacon and Probe Response frames(#14054)**

TGbe editor: Modify section 35.3.7.1.7 as shown below (#10535):

An AP MLD may advertise a mandatory TID-to-link mapping by including a TID-To-Link Mapping element in the Beacon and Probe Response frames that the APs affiliated with the AP MLD transmit.

An AP that advertises a TID-to-link mapping shall include the Mapping Switch Time field and sets it to the time, in units of TUs, of a DTIM Beacon of one of the APs affiliated with the AP MLD. Beginning at the indicated time, the indicated TID-to-link mapping is established and the Mapping Switch Time field is no longer included.

An AP MLD shall not advertise a TID-to-link mapping that does not map all TIDs to the same link set, both for DL and UL. The Direction field of an advertised TID-To-Link Mapping element shall be set to 2.

NOTE 1—An advertised TID-to-link mapping will include a mapping for all TIDs.

NOTE 2— if the Link ID of each AP in a multiple BSSID set and affiliated with different MLDs is different, then inheritance will not apply to an advertised TID-to-link mapping for the APs that are part of a multiple BSSID 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 affiliated with the AP MLD transmit, if there is already an established advertised TID-to-link mapping and a new nondefault advertised TID-to-link mapping will replace it. In this case, the AP MLD shall not include the Mapping Switch Time field in the currently established advertised TID-To-Link Mapping element, and shall include the Mapping Switch Time field in the new TID-To-Link Mapping element, in order to indicate an advertised TID-to-link mapping that will be established in the future. The value of the Expected Duration field of the existing TID-To-Link Mapping element shall indicate a remaining duration that ends at the same time as indicated by the Mapping Switch Time field of the new TID-To-Link Mapping element.

….

All APs affiliated with an AP MLD that advertises a TID-to-link mapping shall include the same mapping in all Beacon and Probe Response frames from the time at which the TID-to-link mapping is first advertised until the time at which the TID-to-link mapping is no longer advertised, and shall include the Expected Duration field in all TID-to-link mapping elements in Beacons. From when a new TID-to-link mapping is advertised in a Beacon frame until the advertised TID-to-link mapping is established, the Mapping Switch Time field shall be included in the TID-To-Link Mapping element and set to the time, in units of TUs, at which the TID-to-link mapping will be established, then not included thereafter. The time indicated by the Mapping Switch Time field shall be the TBTT of the DTIM Beacon of one of the APs affiliated with the AP MLD. The Mapping Switch Time field should initially be set to a sufficiently large value. After an advertised TID-to-link mapping is established, the duration indicated by Expected Duration field shall indicate the time when the advertised TID-to-link mapping is expected to end. During the advertisement of the TID-to-link mapping the time indicated may be updated to indicate an earlier time than initially indicated, but shall not be updated to indicate a later time than initially indicated. The duration indicated by Expected Duration field shall be exact when the duration is smaller than two DTIM periods of the AP transmitting the frame carrying the field.

At the time indicated by the Mapping Switch Time field of a TID-To-Link Mapping element in a Beacon or a Probe Response frame received by a (#12242)non-AP STA affiliated with a non-AP MLD from an AP affiliated with its associated AP MLD, or at the time indicated by the Expected Duration field of an existing advertised TID-to-link mapping which will be replaced by an advertised default mapping, the non-AP MLD shall update its TID-to-link mapping according to the rules that establish a TID-to-link mapping in this subclause and with the consequences of the updated mapping defined in 35.3.7.1.1 (General).

The TID-to-link mapping that is established in a non-AP MLD following an advertised TID-to-link mapping from its associated AP MLD is derived as follows:

— The set of mapped links for each TID and direction for a non-AP MLD are the set of links that are included in the non-AP MLD multi-link setup with the associated AP MLD and have been mapped to that TID for that direction in the advertised TID-to-link mapping.

NOTE 4—An individually negotiated TID-to-link mapping whose negotiation was completed prior to the establishment of an advertised TID-to-link mapping is discarded at the time of the establishment of the advertised TID-to-link mapping.

NOTE 5—A non-AP MLD ignores links that are included in the link mappings of an advertised TID-to-link mapping that are not part of the non-AP MLD multi-link setup procedure. For example, if the AP MLD operates on links 1, 2, and 3, and it advertises that link 3 is disabled and all TIDs are mapped to links 1 and 2, then for a non-AP MLD that is associated with the AP MLD using links 1 and 2 the default mapping will apply. In this case, for a non-AP MLD that is associated with the AP MLD using links 1 and 3, link 3 will be disabled.

NOTE 6—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 successfully negotiated.

NOTE 7—No TID-To-Link Mapping Request nor TID-To-Link Mapping Response frames are transmitted by non-AP STAs affiliated with the associated non-AP MLDs in response to an advertised TID-to-link mapping.

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 different from the TID-to-link mapping established from the advertisement as described in this subclause. Any MLD shall not initiate a negotiation for a TID-to-link mapping that maps a TID to a link if the requested TID is not already mapped to the link in the advertised TID-to-link mapping.

Figure 35.zzz shows an example sequence of TID-to-link mapping frame exchanges. The non-AP MLD operates in default mapping mode in the beginning of the sequence. The non-AP MLD then initiates a negotiation of a TID-to-link mapping A. The AP MLD accepts the request, after which TID-to-link mapping A is active for the non-AP MLD. Next the AP MLD starts to advertise a TID-to-link mapping B. At the time indicated by the Mapping Switch field of the advertised TID-to-Link Mapping element, TID-to-link mapping B is established on the non-AP MLD. Note that we assume that the non-AP MLD includes all the AP MLD link in its ML setup, so the same mapping B is established for the non-AP MLD. In the next step the non-AP MLD requests another TID-to-link mapping C. Note that any mapping between TIDs and links that is enabled in C must be already enabled in the advertised TID-to-link mapping B. The AP MLD accepts the request for TID-to-link mapping C, after which TID-to-link mapping C is active for the non-AP MLD. In the next step, the advertised TID-to-link mapping B ends (by Expected Duration reaching 0). At this point the non-AP MLD also reverts to a default mapping. Note that the ending of the former advertised TID-to-link mapping is treated as an advertisement of a new default mapping, hence the formerly established individually negotiated TID-to-link mapping is discarded.

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**Figure 35-zzz—Example TID-to-link mapping frame exchange**

**35.3.7.1.8 Association procedures for TID-to-link mapping(#14054)**

TGbe editor: Modify section 35.3.7.1.8 as shown below (#10535):

During 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.

An MLD that includes two TID-To-Link Mapping elements in a (Re)Association Request frame or a (Re)Association Response frame shall set the Direction subfield in one of the TID-To-Link Mapping elements to 0 and the Direction subfield in the other TID-To- Link Mapping element to 1.

After receiving the (Re)Association Request frame, the AP MLD shall reply to the (Re)Association Request frame according to 11.3.5.3 (Authentication—destination STA or MLD), 11.3.5.5 (Deauthentication— destination STA or MLD), and 35.3.5 (Multi-link (re)setup), and perform the following TID-to-link mapping negotiation procedure:

**35.3.7.3.2 Affiliated AP link disablement(#14054)**

TGbe editor: Modify section 35.3.7.3.2 as shown below (#10535):

Upon receiving an MLME-BSS-LINK-DISABLE.request primitive, the affiliated AP shall advertise a TID- to-link mapping in Beacon and Probe Response frames that does not map any TIDs to the disabled link on which the AP is operating. The Mapping Switch Time field for the advertised TID-to-link mapping shall point to the same time as indicated in the DisableTimer parameter of the MLME-BSS-LINK- DISABLE.request primitive. The Expected Duration field of the advertised TID-to-link mapping shall indicate the same duration as the ExpectedDuration parameter of the MLME-BSS-LINK-DISABLE.request primitive.

Additionally, in order to advertise the link disablement, the SME of that affiliated AP shall perform the following:

1) It shall follow the procedure in 11.21.7.3 (BSS transition management request) to notify all associated STAs that support BTM, with the BSS Transition Management Request frame fields set as follows:

— The Disassociation Imminent, and Link Removal Imminent subfields of the Request Mode field are set to 1, the BSS Termination Included subfield is set to 0, and other subfields of the Request Mode field are reserved.

— The Disassociation Timer field is set to the number of TBTTs of the affiliated AP before it transmits a Disassociation frame to the STA(s) receiving the BSS Transition Management Request frame. The Disassociation Timer field value shall point to a TBTT at or later than the time pointed to by the value of the Mapping Switch Time field for the advertised TID-to-link mapping.

— No other optional fields shall be present in the BSS Transition Management Request frame.

2) It shall start a disassociation timer with the initial value set to the value of the Disassociation Timer field, and shall decrement the timer by one after transmitting each Beacon frame, until the timer has the value of 0. The Disassociation Timer field in all subsequent transmitted BSS Transition Management Request frames shall be set to the value of this timer.

3) Once the disassociation timer reaches a value of 0, it should follow the procedure in 11.3.6.8 (AP, AP MLD, or PCP disassociation initiation procedure) to transmit Disassociation frames to all associated STAs that are not affiliated with a non-AP MLD. The affiliated AP shall not transmit Disassociation frames until the disassociation timer has a value of 0.

When an AP MLD advertises that a link is disabled for all associated non-AP MLDs, after the time indicated by the Mapping Switch Time field is reached:

**35.3.15 Multi-link group addressed frame delivery and reception**

**35.3.15.1 Group addressed frame delivery**

TGbe editor: Modify section 35.3.15.1 as shown below (#10535):

Each AP affiliated with an AP MLD shall schedule for transmission buffered group addressed frames immediately after every DTIM beacon with the following exceptions:

* An AP that operates on a link that has been advertised as disabled for all associated non-AP MLDs according to procedures defined in 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames) is exempt from this rule
* a TWT scheduling AP affiliated with that AP MLD shall schedule for transmission the buffered group addressed frames during the broadcast TWT SPs located within the beacon interval during which the DTIM Beacon frame is transmitted (see 26.8.3.2 (Rules for TWT scheduling AP)).

An AP MLD that distributes a group addressed Data frame received from an associated non-AP MLD shall set the SA field of the broadcast group addressed Data frame equal to the MLD MAC address of the non-AP MLD.