IEEE P802.11
Wireless LANs

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| --- |
| AP Disablement Advertisement  |
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Abstract

Proposed draft text for enhancements to TID mapping.

The submission proposes text changes to resolve CIDs 10013, 10383, 11105, 11760, 12623, 12911 and 14054 from LB266. All proposed changes are based on 802.11be Draft 2.0.

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

# Revision History

|  |  |  |
| --- | --- | --- |
| **Date** | **Revision** | **Changes** |
| 2021-07-10 | 0 | Initial draft |

# LB266 Comments and discussion [against Draft 2.0]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| 10013 | 427.05 | 35.3.7 | if one of the affilicated AP operating on CAC state, the link should be disable and enabled again once it's out of CAC mode. | 11be SPEC should have a solution to indicate the CAC mode and the remaing time, so that the non-AP MLD can decide whether to associated with such AP MLD. | Resolution: Revised, please implement the changes as shown in this document marked #14054. |
| 10383 |  | 4.3.16a | Add mandatory support for TID2Link mapping for non-AP MLD devices, for at least one mode where all the TIDs can be mapped to a subset of links that are set up | As in the comment | Resolution: Revised, please implement the changes as shown in this document marked #10383. |
| 11105 | 428.27 | 35.3.7.1.3 | There are many circumstances whereby an AP in an MLD setup might need to stop serving clients then resume, with all the BA and TWT agreements retained. This is not possible in D2.0, and is a major oversight, since the coupling introduced by MLO causes \*all\* APs in the MLD to be disrupted in these circumstances instead of just one, and there is no clean way for the client to continue seamless connectivity on the surviving links then resume operation on all links when the AP returns. The solution is a natural extension to the T2LM negotiation except it is an mandatory T2LM advertised by the AP | Add a variant of the T2LM neg whereby an AP can advertise a new T2LM, with all TIDs on the affected link unmapped, in the Beacon etc, and all clients maintain connectivity on the surviving links; then later the AP can advertise a new T2LM, with all TIDs on all links mapped, in the Beacon etc, and all clients gain connectivity on all the links without needing to reneg keys, TWT agreements etc | Resolution: Revised, please implement the changes as shown in this document marked #14054. |
| 11760 | 427.09 | 35.3.7 | Procedure for AP MLD to signal a disabled a link (an affiliated AP) with appropriate reason codes is missing. | Add the signaling and relevant reason codes as per the comment. | Resolution: Revised, please implement the changes as shown in this document marked #14054. |
| 12623 | 427.24 | 35.3.7.1.1 | The current definition for enable or disabled link for a non-AP MLD applies only for a specific non-AP MLD (through the individual negotiation of a TID-To-Link mapping). Need to extend the disabled/ enabled link definitions for the entire BSS - in which the AP can disable a link that is used by subset or all associated non-AP MLDs. | Add an element to the Beacon or Probe Response frames where the affiliated AP indicates which of the Links is disabled or enabled.The indication need to be also in the RNR so unassociated non-AP MLDs will not send any Probe Request frames or Association frames to an affiliated AP that is operating on a disabled link | Resolution: Revised, please implement the changes as shown in this document marked #14054. |
| 12911 | 428.27 | 35.3.7.1.3 | It's more organized to number the TID-to-link mapping capability levels from simplest (no support) to most flexible (any TID on any link); capability levels 1 and 2 can be swapped if we go with that assumption. Also introduce the capabilities in order (0 first, then 1, then 2...) | Swap level 1 and level 2 definitions | Resolution: Revised, please implement the changes as shown in this document marked #12911. |
| 14054 | 427.05 | 35.3.7.1 | An AP affiliated with an AP MLD may need to temporarily be unavailable and return after a period of time while preserving client state. This feature is missing from spec. | Introdue a temporary AP disablement feature, preferably by extending TID to Link Mapping | Resolution: Revised, please implement the changes as shown in this document marked #14054. |

**Discussion:**

**TID to Link Mapping Use Cases**

This document addresses the AP link unavailability use case using the existing TID to Link Mapping feature. An AP MLD needs a notification-based mechanism that will allow it to temporarily prohibit frame exchange on one or more of the links it operates. The reasons for the unavailability may include operations or maintenance by the AP administrator among other reasons.

The proposed draft text makes the following enhancements:

* Defines TID-to-link-subset mapping requirements
* Adds a broadcast advertisement of TID-to-link mapping mechanism in Beacons in order to announce that a link is temporarily unavailable for all non-AP STAs associated with the unavailable AP
* Adds a countdown timer in order to allow time for the recipient to change its mapping

TGbe editor: Modify section in 4.3.16a as follows (#10383,14054 ):

### 4.3.16a Extremely high throughput (EHT) STA

— In an AP MLD, mandatory support for multi-link group addressed frame delivery

— In a non-AP MLD, mandatory support for TID-To-Link Mapping Negotiation with value 1 as described in Table 9-401i

— In a non-AP MLD operating on a STR link pair, mandatory support for STR operation

TGbe editor: Add two new sections in 6.3 as follows (#14054):

6.3.134 Link Disable

6.3.134.1 Introduction

This mechanism supports the process of advertising that a link on which an AP affiliated with an AP MLD is operating is disabled for all associated non-AP MLDs that have an affiliated non-AP STA operating on that link. An affiliatd AP, while operating on a disabled link, does not transmit or receive any frames.

6.3.134.2 MLME-BSS-DISABLE.request

6.3.134.2.1 Function

This primitive requests the MAC entity associated with an affiliatd AP to disable links for all associated non-AP MLDs.

6.3.134.2.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-BSS-DISABLE.request(

 BSSID,

 DisableTimer,

 ExpectedDuration,

 DisassociateNonMLDSTAs

)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| BSSID | MAC address | Any valid individual MAC address | The BSSSID of the AP operating on the link to be disabled. |
| DisableTimer | Integer | 0–65 535 | Specifies the number of TUs until the link on which the AP is operating becomes disabled. |
| ExpectedDuration | Integer | 0- 16,777,215 | Indicates the expected duration in TUs for which the requested disablement is expected to be effective  |
| DisassociateNonMLDSTAs | Boolean | true, false | Specifies whether associated STAs not affiliated with any MLDs need to be disasociated. |

6.3.134.2.3 When generated

This primitive is generated by the SME when it decides to disable a link on which an affiliated AP is operating.

6.3.134.2.4 Effect of receipt

The primitive starts the affiliated AP link disablement process in 35.3.7.3.1 (Affiliated AP link disablement). All services provided by the AP to an infrastructure BSS, including Beacon and Probe Response frame transmissions and access to the DS, are stopped during the disablement. If DisassociateNonMLDSTAs is true, then all the associated non-MLD STAs in an infrastructure BSS are disassociated before the occurence of the disablement.

6.3.134.3 MLME-BSS-DISABLE.confirm

6.3.134.3.1 Function

This primitive reports the results of an affiliated AP link disablement procedure.

6.3.134.3.2 Semantics of the service primitive

The primitive parameter is as follows:

MLME-BSS-DISABLE.confirm(

 BSSID

)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| BSSID | MAC address | Any valid individual MAC address | The BSSID of the AP operating on the link that was disabled. |

6.3.134.3.3 When generated

This primitive is generated by the MLME as a result of an MLME-BSS-DISABLE.request primitive to disable a link on which an affiliated AP is operating.

6.3.134.3.4 Effect of receipt

The SME is notified of the results of the affiliated AP link disablement procedure.

6.3.135 Link Enable

6.3.135.1 Introduction

This mechanism supports the process of enabling a link on which an AP affiliated with an AP MLD, i.e., allowing transmission and reception of frames in the BSS on which the affiliated AP was operating before the link was disabled.

6.3.135.2 MLME-BSS-ENABLE.request

6.3.135.2.1 Function

This primitive requests the AP MLD to re-initiate the operation of the BSS corresponding to the affiliated AP operation on the link that becomes enabled and to indicate the enabling of the link.

6.3.135.2.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-BSS-ENABLE.request(

 BSSID,

 EnableTimer

)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| BSSID | MAC address | Any valid individual MAC address | The BSSID of the AP operating on the link to be enabled. |
| EnableTimer | Integer | 0–65 535 | Specifies the number of TUs until the link on which the affiliated AP is operating becomes enabled.  |

6.3.135.2.3 When generated

This primitive is generated by the SME when a current AP link disablement is to expire and the BSS corresponding to the AP affiliated with the AP MLD which is operating on that link is to be re-initialized.

6.3.135.2.4 Effect of receipt

The primitive starts the affiliated AP link enablement process in 35.3.7.3.2 (Affiliated AP link enablement). All services provided by the AP to an infrastructure BSS, including Beacon and Probe Response frame transmissions and access to the DS, are resumed.

6.3.135.3 MLME-BSS-ENABLE.confirm

6.3.135.3.1 Function

This primitive reports the results of an affiliated AP link enablement procedure.

6.3.135.3.2 Semantics of the service primitive

The primitive parameter is as follows:

MLME-BSS-ENABLE.confirm(

 BSSID

)

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Type | Valid range | Description |
| BSSID | MAC address | Any valid individual MAC address | The BSSID of the AP operating on the link that was enabled. |

6.3.135.3.3 When generated

This primitive is generated by the MLME as a result of an MLME-BSS-ENABLE.request primitive to enable a link on which an affiliated AP is to operate.

6.3.135.3.4 Effect of receipt

The SME is notified of the results of the affiliated AP link enablement procedure.

### 9.3.3.2 Beacon frame format

TGbe editor: Add one row to table 9-60 as follows (#14054):

**Table 9-60—Beacon frame body *(continued)***

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <Last assigned + 1> | Multi-Link | The Basic Multi-Link element is present if dot11MultiLinkActivated is true; 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> | Multi-Link Traffic Indication | The Multi-Link Traffic Indication element is present ifdot11MultiLinkTIMActivated is true; otherwise it is not present |
| <Last assigned + 5> | 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 Time subfield is present in one of the TID-To-Link Mapping elements and not present in the other TID- To-Link Mapping element. |

### 9.3.3.10 Probe Response frame format

TGbe editor: Add one row to table 9-67 as follows (#14054):

### Table 9-67—Probe Response frame body

|  |  |  |
| --- | --- | --- |
| **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. |
| 96 | TWT | The TWT element is optionally present within broadcast ProbeResponse frames if dot11TWTOptionActivated, dot11HEOptionImplemented and dot11FILSOmitReplicateProbeResponses aretrue; otherwise, it is not present.The TWT element is present if the dot11RestrictedTWTOptionImplemented is true and the AP has at least one r-TWT scheduleas described in 35.9.3 (r-TWT service periods announcement).Otherwise, the TWT element is not present.If the TWT element is present, then the Negotiation Type subfieldof the TWT element is 2. |
| <Last assigned + 1> | Multi-Link | 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 | 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 Time subfield is present in one of the TID-To-Link Mapping elements and not present in the other TID- To-Link Mapping element. |

**9.4.2.170 Reduced Neighbor Report element**

**9.4.2.170.2 Neighbor AP Information field**

***TGbe editor: Update the following Figure 9-709c (MLD Parameters subfield format) as follows***(#14054)***:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B7 | B8 B11 | B12 B19 | B20 | B21 | B22 B23 |
|  | MLD ID | Link ID | BSS Parameters Change Count | All UpdatesIncluded | Disabled Link Indication | Reserved |
| Bits: | 8 | 4 | 8 | 1 | 1 | 3 |

**Figure 9-709c—MLD Parameters subfield format**

***TGbe editor: Add the following at the end of this subclause as follows***(#14054)***:***

The Disabled Link Indication subfield is set to 1 if the reported AP is operating on a link that is advertised as disabled for all associated non-AP MLDs and the Co-Located AP bit of the BSS Parameters subfield of the TBTT Information field of the Neighbor AP Information field is set to 1. Otherwise, the Disabled Link Indication subfield is set to 0. Additional rules for associated and unassociated STAs when a link is advertised as disabled for all associated non-AP MLDs are defined in 35.3.7.1.7(Advertised TID-to-link mapping in Beacon and Probe Response frames).

### **9.4.2.312.2.2** Common Info field of the Basic Multi-Link element

TGbe editor: Modify one row in Table 9-401i in section 9.4.2.312.2.2 as shown below (#12911, #14054):

**Table 9-401i— Subfields of the MLD Capabilities and Operations field *(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 and TID-to-link mapping is not supported by the MLD.  Set to 1 if dot11TIDtoLinkMappingActivated is true and the MLD only supports the mapping of all TIDs to the same link set, both for DL and UL.The value 2 is reservedSet to 3 if dot11TIDtoLinkMappingActivated is true and the MLD supports the mapping of each TID to the same or different link set.See NOTE 1(See 35.3.7.1.3 (Negotiation of TID-to-link mapping)) |
| NOTE 1—Indicating support for TID-to-link mapping negotiation using any value also indicates support for negotiations applicable to all smaller values. |

TGbe editor: Modify section 9.4.2.314 as shown below (#14054):

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element ID | Length | Element ID Extension | TID-To-Link Mapping Control | Mapping Switch Time | Expected Duration |

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

|  |  |  |
| --- | --- | --- |
| Link Mapping Of TID 0(Optional) | … | Link Mapping Of TID 7(Optional) |

 Octets: 0 or 2 0 or 2

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B1 | B2 | B3 | B4 | B5 B7 | B8 |  | B15 |
| Direction | Default Link Mapping | Mapping Switch Time Present | Expected Duration Present | Reserved | Link Mapping Presence Indicator (Optional)  |
| Bits: | 2 | 1 | 1 | 1 | 3 |  | 0 or 8 |  |

**Figure 9-1002an—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 Mapping Switch Time Present subfield is set to 1 if the Mapping Switch Time field is present and 0 otherwise.

The Expected Duration Present subfield is set to 1 if the Expected 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 (i.e., it identifies the TID(s) for which the mapping is provided 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 not present.

The Mapping Switch Time field is present when the TID-To-Link Mapping element is transmitted by an AP affiliated with an AP MLD in a Beacon or Probe Response frame and the indicated TID-to-Link mapping is not yet established; otherwise it is not present. The absence of Mapping Switch Time field in the TID-To-Link Mapping element in a Beacon or Probe Response frame transmitted by an AP affiliated with an AP MLD indicates that the indicated TID-to-Link mapping is already established. The 2 octet Mapping Switch Time field has units of TUs and is set to the time at which the the new mapping is established using as a timebase the value of the TSF corresponding to the BSS identified by the BSSID of the frame containing the TID-To-Link Mapping element: i.e., bits 10 to 25 of the TSF or rem(floor(TSF / 1024), 65536)) of that time.

The Expected Duration field indicates the duration for which the proposed TID-to-link Mapping is expected to be effective in units of TUs when the Mapping Switch Time field is present, and the remaining duration for which the proposed TID-to-link Mapping is expected to be effective in units of TUs when the Mapping Switch Time field is not present. The duration indicated by Expected Duration field is exact when the duration is smaller than two DTIM periods of the AP transmitting the frame carrying the field, and is considered an estimate otherwise. The Expected Duration field is present if the frame carrying the TID-To-Link Mapping element is carried in a Beacon or a Probe Response frame transmitted by an AP affiliated with an AP MLD, 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 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 (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. 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.

### 11.2.3.15 TIM Broadcast

***TGbe editor: Please update the subclause as follows*** (#14054)***:***

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, except for modification of the Mapping Switch Time or the Expected Duration fields

## 35.3.4 Discovery of an AP MLD

* + - 1. **AP behavior**

***TGbe editor: Please update the following 6th paragraph as follows***(#14054)***:***

The TBTT offset between two APs affiliated with the same AP MLD shall never be larger than 254 TUs. An AP affiliated with an AP MLD shall not set the Neighbor AP TBTT Offset subfield to 255 for an AP affiliated with the same AP MLD, except under the rules defined in [35.3.11 (Multi-link procedures for](file:///C%3A%5CUsers%5Cpmonajem%5CDownloads%5C11-21-1327-06-00be-cc36-resolution-for-cid-5154.docx#bookmark30) [channel switching, extended channel switching, and channel quieting](file:///C%3A%5CUsers%5Cpmonajem%5CDownloads%5C11-21-1327-06-00be-cc36-resolution-for-cid-5154.docx#bookmark30) and except if the link on which the reported AP is operating is disabled as advertised according to the procedures in 35.3.7.1.7(Advertised TID-to-link mapping in Beacon and Probe Response frames).

### 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 (#14054):

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 AP MLD may support TID to link mapping negotiation. A non-AP MLD that performs multi-link (re)setup on at least two links with an AP MLD that sets the TID-To-Link Mapping Negotiation Supported subfield of the MLD Capabilities field of the Basic Multi-Link element to a nonzero value shall support TID-to-link mapping negotiation with the TID-To-Link Mapping Negotiation Supported subfield of the MLD Capabilities field of the Basic Multi-Link element to at least 1. An MLD with dot11EHTBaseLineFeaturesImplementedOnly equal to true shall not set the TID-To-Link Mapping Negotiation Supported subfield of MLD Capabilities field of the Basic Multi-Link element to 3.By default, all TIDs shall be mapped to all setup links for both DL and UL (see 35.3.7.1.2 (Default mapping mode)). When a negotiated aTID-to-link mapping is in effect according to the procedures defined in 35.3.7.1.3 (Negotiation of TID-to-link mapping), 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames), and 35.3.7.1.8 (Association Procedures for TID-to-link mapping) then a TID can be mapped to a link set, which is a subset of setup links, spanning from only one setup link to all the setup links.

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 a single TID for which the link set is made of zero setup links. By default, all setup links shall be enabled (see 35.3.7.1.2 (Default mapping mode)).

* 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 and only MSDUs or A- MSDUs with TIDs mapped to that link may be transmitted on that link between the corresponding STA and AP of the non-AP MLD and AP MLD in the direction (DL/UL) corresponding to the TID-to-link mapping.

* 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 affiliated with the non-AP MLD and AP MLD, respectively, in the direction (DL/UL) corresponding to the TID-to-link mapping.
* Individually addressed Management frames and Control frames may be sent on any enabled links between the corresponding STA affiliated with the non-AP MLD and AP affiliated with the associated AP MLD both in DL and UL.

If a link is disabled for a non-AP MLD, it shall not be used for individually addressed frame exchange between the corresponding STA affiliated with the non-AP MLD and AP affiliated with the associated AP MLD, including Management frames.

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 2— 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).

If a TID is mapped in UL to a set of enabled links for a non-AP MLD, then the non-AP MLD may use any link within this set of enabled links to transmit individually addressed MSDUs or A-MSDUs corresponding to that TID.

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

— The non-AP MLD may retrieve individually addressed buffered BUs 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 individually addressed MSDUs or A-MSDUs corresponding to that TID, subject to the power state of the non-AP STA on each of these links.

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 not all TIDs are 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 on that link.

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 that are not a TPC Request frame or a Link Measurement Request frame, subject to the power state of the non-AP STA on each of the links.

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 corresponding to that set of negotiated TIDs for the non-AP MLD, and

— MMPDUs that are not a TPC Request frame or a Link Measurement Request frame 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.

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 (#14054):

Under this mode, all TIDs are mapped to all setup links for DL and UL, and all setup links are enabled. A non-AP MLD associated with an AP MLD shall operate under this mode if a TID-to-link mapping is not advertised by the AP MLD (see 35.3.7.1.7(Advertised TID-to-link mapping in Beacon and Probe Response frames)), and 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 (#14054):

An MLD that supports TID-to-link mapping

negotiation has dot11TIDtoLinkMappingActivated equal to true and shall set to a nonzero value the TID-tolink Mapping Negotiation Supported subfield in the MLD Capabilities and Operations field of the Basic

Multi-Link element that it transmits. An MLD that does not support TID-to-link mapping negotiation has

dot11TIDtoLinkMappingActivated equal to false and 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 2, the MLD that initiates a TID-to-link mapping negotiation to the peer MLD shall

send only the TID-to-link Mapping element where all TIDs are mapped to the same link set. If the TID-tolink Mapping Negotiation Supported subfield value received from a peer MLD is equal to 2 or 3, the MLD that

initiates a TID-to-link mapping negotiation to the peer MLD shall send the TID-to-link Mapping element

where each TID is mapped to the same or different link set.

After the multi-link (re)setup is successful and 4-way handshake is complete (if RSNA is required), 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.

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

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

- Advertise a TID-to-link Mapping by including a TID-To-Link Mapping element in Beacon and Probe Response frames as defined in 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames).

After receiving the individually addressed TID-to-link Mapping Request frame, the responding MLD 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.

— 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. When the Status Code in the TID-to-link Mapping Response frame is

134 (PREFERRED\_TID\_TO\_LINK\_MAPPING\_SUGGESTED), the responding MLD is

suggesting a preferred mapping as indicated in the TID-to-link Mapping element included in the

frame

An MLD may suggest a preferred TID-to-link mapping to a peer MLD by sending an unsolicited TID-tolink 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 either 0 (SUCCESS) or 133 (DENIED\_TID\_TO\_LINK\_MAPPING).

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.

A multi-radio non-AP MLD should accept a TID-to-link mapping initiated by its associated AP MLD.

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 an advertisement of TID-to-link mapping. After teardown, if a mapping scheme is advertised by the AP MLD as described in 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames)), the MLDs shall operate in the established mode as described in 35.3.7.1.7 (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 uplink and/or downlink TID-to-link mapping information according to the negotiated TID-to-link mapping. In case a TID-to-link mapping of a specific TID is missing in the negotiation, the most recent TID-to-link mapping of this TID remains unchanged and valid. If an MLD has failed to negotiate the TID-to-link mapping with a peer MLD, the most recent TID-to-link mapping of all TID remains unchanged and valid.

NOTE2—If there is no successfully negotiated TID-to-link mapping for a TID, and that TID is not included in an AP advertised mapping according to 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames), then the TID is mapped to all setup links for DL and UL.

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

in the (Re)Association Request frame, TID-To-Link Mapping Request frame, Beacon frame, or Probe Response frame 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 in the (Re)Association Request frame, TID-To-Link Mapping Request frame, Beacon frame, or Probe Response frame 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.

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

TGbe editor: Add a new section 35.3.7.1.7 as shown below and renumber sections accordingly (#14054):

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 set 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.

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

NOTE 2— Since the Link IDs can be different for MLDs affiliated with each BSSID in a multiple BSSID set, inheritance will not apply to advertised TID-To-Link mapping for 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 non-default 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.

NOTE 3— If the newly advertised TID-to-link mapping is the default mapping, the AP MLD sets the Expected Duration field of the currently advertised TID-to-link mapping to the remaining time until the default mapping is established as described in 9.4.2.314 (TID-To-Link Mapping element). After the establishment of the default mapping, no TID-To-Link Mapping elements are included in the Beacon or Probe Response frames transmitted by the APs affiliated with the AP MLD.

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.

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 STA affiliated with a non-AP MLD from an AP affiliated with its associated AP MLD, 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 beginning at the time indicated by the Mapping Switch Time field in a newly changed TID-To-Link Mapping element received by a non-AP MLD in a Beacon or a Probe Response frame from its associated AP MLD is derived as follows:

- 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 4—An individually negotiated TID-to-link mapping whose negotiation was completed prior to the establishment of 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 STA’s MLD setup procedure. For example, if the AP MLD operates 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 not established as described in this section. 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.

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

TGbe editor: Add a new section 35.3.7.1.8 as shown below and renumber sections accordingly (#14054):

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.

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:

— Where the AP MLD advertises a TID-To-Link Mapping that is already established according to 35.3.7.1.7(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 Time Present subfield equal to 0 and indicating the TID-to-link mapping that is advertised in Beacons 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, if the AP MLD does not accept an individually requested TID-to-link mapping in an Association Request frame, 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 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.

— 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. The AP MLD that accepts the requested TID-tolink mapping shall not include in the (Re)Association Response frame the TID-to-link Mapping element.

NOTE 1—Whether the multi-link (re)setup is successful or not is independent from whether the TID-to-link mapping negotiation that is done jointly with the multi-link setup is successful or not. A multi-link (re)setup can be successful even if the TID-to-link mapping negotiation is not successful.

TGbe editor: Add a new section 35.3.7.3 as shown below and renumber sections accordingly (#14054):

**35.3.7.3 Affiliated AP link disablement and enablement**

An AP MLD shall use the procedures described in 35.3.7.1.7 (Advertised TID-to-link mapping in Beacon and Probe Response frames) in order to disable or enable a link for all associated non-AP MLDs. Further rules pertaining to the disablement and enablement are described in the sections below 35.3.7.3.1 Affiliated AP link disablement and 35.3.7.3.2 Affiliated AP link enablement.

**35.3.7.3.1 Affiliated AP link disablement**

Upon receiving an MLME-BSS-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-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-DISABLE.request primitive.

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:

* the Disabled Link Indication subfield shall be set to 1 in the MLD Parameters subfield corresponding to the AP affiliated with the AP MLD and operating on the link which is included in the Neighbor AP Information field in the Reduced Neighbor Report element carried in the Beacon or Probe Response frames transmitted by any of the APs affiliated with the AP MLD when the Co-Located AP bit of the BSS Parameters subfield of the TBTT Information field of the Neighbor AP Information field is set to 1, and shall be set to 0 otherwise. If the Disabled AP Link Indication subfield corresponding to a reported AP is set to 1, then the Neighbor AP TBTT Offset subfield included in the same TBTT Information field of the Reduced Neighbor Report element shall be set to 255.
* an EHT STA affiliated with a non-AP MLD that is associated with the AP MLD shall not use the link to transmit individually addressed frames to the AP affiliated with the AP MLD which is operating on a link that is disabled
* an EHT STA affiliated with a non-AP MLD that is not associated with the AP MLD shall not transmit ML Probe Request, Authentication and (Re)association Request frames to the AP affiliated with the AP MLD while the link is disabled (as indicated in the Expected Duration field in the advertised TID-to-link Mapping element which does not include Mapping Switch time field, or as indicated in the Disabled Link Indication subfield in the RNR element).
* an EHT STA affiliated with a non-AP MLD that is not associated with the AP MLD should not use the link to transmit other individually addressed management frames to the AP affiliated with the AP MLD which is operating on a link that is disabled
* A non-AP STA affiliated with the non-AP MLD shall not delete the GTK/IGTK/BIGTK values

NOTE 1—When an AP MLD advertises that a link is disabled for all associated non-AP MLDs, a non-AP MLD remains associated with the AP MLD.

NOTE 2––The AP affiliated with an AP MLD which is operating on the link to become disabled may disassociate or use BTM in advance for non-MLD non-AP STAs.

NOTE 3–– The non-AP MLD uses the GTK/IGTK/BIGTK for the reception of protected broadcast/groupcast management frames when the link becomes enabled again.

An AP affiliated with an AP MLD that intends to turn its operating link into a disabled link should verify that it is not associated with any non-MLD non-AP STA on the link to become disabled.

**35.3.7.3.2 Affiliated AP link enablement**

Upon receiving the MLME-BSS-ENABLE.request primitive, the affiliated AP shall advertise a TID-to-link mapping in Beacon and Probe Response frames that maps at least one TID to the link on which the AP is operating or stop advertising a TID-to-link mapping. If included in the frames advertising the TID-to-link-mapping, the Mapping Switch Time field for the advertised TID-to-link mapping shall point to the same time as indicated in the EnableTimer parameter of the MLME-BSS-ENABLE.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-ENABLE.request primitive.

When an AP MLD stops advertising that a link is disabled for all associated non-AP MLDs:

* the Disabled AP Link Indication subfield shall be set to 0 in the MLD Parameters subfield corresponding to the AP affiliated with the AP MLD and operating on the link which is included in the Neighbor AP Information field in the Reduced Neighbor Report element carried in the Beacon or Probe Response frames transmitted by any of the APs affiliated with the AP MLD
* the AP operating on this link shall retain unchanged keys as before this link was advertised as disabled for all associated non-AP MLDs
* the AP operating on this link shall transmit a TSF that is equivalent to the expected TSF if this link was never advertised as disabled
* frame exchange operation on this link between the affiliated AP and non-AP STAs affiliated with the associated non-AP MLD can be initiated by any member of the BSS that is affiliated with an MLD following CCA performance until a frame is detected by which it can set its NAV, or a period equal to NAVSyncDelay has transpired, whichever is earlier. The frame exchange is initiated using all the link parameters that were defined before the link has been defined as an unavailable link subject to power state (see 35.3.11) and enablement status (see 35.3.6.1) of the affiliated non-AP EHT STA.

NOTE—An equivalent TSF is desirable for maintaining TWT agreements. An equivalent TSF might be implemented at the AP MLD by determining the difference between the TSF of the disabled AP minus the TSF of another affiliated AP when the link is disabled and then initializing the TSF of the AP when later enabled to the TSF of the other affiliated AP plus the difference.