IEEE P802.11
Wireless LANs

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| LB 266 - CR for ML Reconfiguration clause 35.3.6 part 2 |
| Date: October 12, 2022 |
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 Abstract

This submission proposes resolutions for following 18 CIDs received for TGbe LB266:

10021 11640 13067 13987 10022 13068 10073 10095 10633 10634

11103 11636 13281 13282 13900

11433 12806 12807

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Added CID 13282, updates to resolution of CIDs 11433 and 11636.

***TGbe editor: The baseline for this document is* 11be D2.2 + 22/1487r7 + 22/1765r0*.***

Interpretation of a Motion to Adopt

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

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

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

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| --- | --- | --- | --- | --- | --- | --- |
| ***CID*** | ***Commenter*** | ***Clause*** | ***Page*** | ***Comment*** | ***Proposed Change*** | ***Resolution*** |
| 10021 | Morteza Mehrnoush | 35.3.6.2.2 | 426.07 | In AP removel case, if a TID is only mapped to a link where the AP will be removed, it's not clear what is the mapping for this TID after AP removal. Is default TID-to-link mapping will be in effect after AP removal (all TID to all link mapping) and the AP or non-AP MLD have to renegotiate the TID-to-Link mapping? | as in comment | RevisedAgree in principle. Text has been added to specify the behavior for TID-to-link mapping when one or more TIDs are not mapped to any links after an AP removal.**TGbe editor, please make the changes tagged by CID #10021 in 22/1838r0.** |
| 11640 | Morteza Mehrnoush | 35.3.6.2.2 | 426.07 | In AP removal case, if a TID is only mapped to a link where the AP will be removed, it's not clear what is the mapping for this TID after AP removal. Is default TID-to-link mapping will be in effect after AP removal (all TID to all link mapping) and the AP or non-AP MLD have to renegotiate the TID-to-Link mapping? | as in comment | RevisedSame resolution as CID #10021.**TGbe editor, please make the changes tagged by CID #10021 in 22/1838r0.** |
| 13067 | Chittabrata Ghosh | 35.3.6.2.2 | 426.07 | In AP removel case, if a TID is only mapped to a link where the AP will be removed, it's not clear what is the mapping for this TID after AP removal. Is default TID-to-link mapping will be in effect after AP removal (all TID to all link mapping) and the AP or non-AP MLD have to renegotiate the TID-to-Link mapping? | as in comment | RevisedSame resolution as CID #10021.**TGbe editor, please make the changes tagged by CID #10021 in 22/1838r0.** |
| 13987 | Geonjung Ko | 35.3.6.2.2 | 426.01 | TID-to-link mapping is unclear after removing affiliated APs. | Clarify TID-to-link mapping after a removal of affiliated APs | RevisedSame resolution as CID #10021.**TGbe editor, please make the changes tagged by CID #10021 in 22/1838r0.** |
| 10022 | Morteza Mehrnoush | 35.3.6.2.2 | 426.54 | It's not clear after AP removal, PM state of the STAs affiliated with non-AP MLD, and TWT negotiation over the removed link etc. Please add text to clarify the corresponding behaviors. | as in comment | RevisedAgree in principle. Text has been added to specify the behavior for PM state and negotiated TWT schedules after an AP removal.**TGbe editor, please make the changes tagged by CID #10022 in 22/1838r0.** |
| 13068 | Chittabrata Ghosh | 35.3.6.2.2 | 426.54 | It's not clear after AP removal, PM state of the STAs affiliated with non-AP MLD, and TWT negotiation over the removed link etc. Please add text to clarify the corresponding behaviors. | as in comment | RevisedAgree in principle. Text has been added to specify the behavior for PM state and negotiated TWT schedules after an AP removal.**TGbe editor, please make the changes tagged by CID #10022 in 22/1838r0.** |
| 10073 | Thomas Derham | 35.3.6.2.2 | 426.40 | There is no need to disallow inclusion of all other optional fields in BSS Transition Management Request frame when used for link removal. In particular, it may be useful to include one or more BSS Transition Candidate List entries to recommend other candidate APs or MLDs that the STA might prefer to roam to while the link of the currently associated MLD is down. | Allow BSS Transition Candidate List Entries field to be included (also consider if there are use cases for other optional fields) | RevisedAgree in principle. Text has been added to support optionally sending BSS Transition Candidate List entries in the BTM.**TGbe editor, please make the changes tagged by CID #10073 in 22/1838r0.** |
| 10095 | Yiqing Li | 35.3.6 | 425.38 | Add AID reassignment procedure after ML reconfiguration | As commented | RejectedIt is not clear from CID description why AID reassignment is needed after ML reconfiguration and what issue need to be addressed. |
| 10633 | Abhishek Patil | 35.3.6.2.1 | 425.56 | In order to keep the link IDs continuous, an AP MLD must assign the same Link ID to an AP that is being added, to the same channel as before if that AP was previously affiliated with the AP MLD and was removed as part of the ML reconfiguration procedure. This will also conform to the definition of link ID (tuple consisting of BSSID, Channel, Op Class). | As in comment | RevisedIt may not be possible to reassign the same Link ID when an AP is added back, because the AP MLD could have reassigned that Link ID to another added affiliated AP. It is possible for the AP MLD to assign smallest available Link ID when an AP is added so that the largest assigned Link ID is kept as small as possible. Added a note for this.**TGbe editor, please make the changes tagged by CID #10633 in 22/1838r0.** |
| 10634 | Abhishek Patil | 35.3.6.2.2 | 426.03 | Typically on the client side, there can be a lag between discovery and association. During ML (re)setup is possible that a non-AP MLD, in its (re)association request frame, requests an affiliated AP that will be removed as part of ML Reconfiguration procedure. | Provide a Status Code value for rejecting the inclusion of such an AP in the ML setup | RevisedAgree in principle. Added a failure Status Code to indicate that the AP is removed or being removed for (re)association response.**TGbe editor, please make the changes tagged by CID #10634 in 22/1838r0.** |
| 11103 | Brian Hart | 35.3.6.2.1 | 425.53 | Consider an AP MLD that removes an affiliated AP, then advertises its addition (with the same MAC address) according to this procedure. Then assume there is a STA in a deep sleep that misses the removal + re-add. Now the non-AP STA thinks it has the AP in its MLD setup but the AP MLD does not agree. Of course the non-AP STA should have received an indication from the AP during the AP removal procedure, but perhaps the non-AP STA was in a very deep sleep and/or there was a sequence of unlucky collisions such that the information got lost. | Add a note as to how the non-AP MLD might detect this scenario and/or any mitigations that the non-AP MLD should perform. If extra AP signaling is unavoidable, then add that too. | RevisedA note is added to indicate that if non-AP MLD believes that it has a link to an AP which is removed, the frame transmission on that link will fail and then non-AP MLD can take implementation specific action (e.g. remove the link from its ML setup) to rectify the condition. **TGbe editor, please make the changes tagged by CID #11103 in 22/1838r0.** |
| 11636 | Morteza Mehrnoush | 35.3.6.2.2 | 427.01 | In addition to STR and NSTR link pair relationship, the EMLSR and EMLMR non-AP MLD behavior upon AP removal should be defined. In AP MLD with two affiliated APs, if one affiliated AP is removed, the non-AP MLD can only do frame exchange over one link so no EML(SR/MR) operation is needed at AP and non-AP MLD. Please add clarification in the text. | as in comment | RevisedAgree in principle. There is a proposal in 22/1860r2 to optimize EMLSR operation when only a single EMLSR non-AP STA is in awake state. The single EMLSR link after AP removal case should be addressed as part of that proposal. For AP Removal clause added notes to clarify that after AP removal if only a single EMLSR or EMLMR link is left, then AP MLD and non-AP MLD continue to operate per EMLSR or EMLMR procedures defined. **TGbe editor, please make the changes tagged by CID #11636 in 22/1838r0.** |
| 13281 | Binita Gupta | 35.3.6.2.1 | 425.57 | Which MLME primitive triggers addition of a new affiliated AP? Provide reference to the MLME primitive from clause 6.3 for adding a new affiliated AP to an AP MLD. | As in comment | RevisedReference is added to existing MLME-START.request for adding an affiliated AP.**TGbe editor, please make the changes tagged by CID #13281 in 22/1838r0.** |
| 13282 | Binita Gupta | 35.3.6.2.2 | 426.08 | Which MLME primitive triggers removal of an affiliated AP? Provide reference to the MLME primitive from clause 6.3 for removing an affiliated AP from an AP MLD. | As in comment | Revised Added reference to the new MLME-BSS-AP-REMOVAL.request defined in CR doc 22/ 1765r0 for the removal of an AP.**TGbe editor, please make the changes tagged by CID #13282 in 22/xxxxr0.** |
| 13900 | Ming Gan | 35.3.6.2.2 | 426.14 | this requirement is too strong, please change it to "should" | change shall to should | RevisedThis shall requirement is already rephrased to a should requirement as part of CID 12082 resolution in 22/1487r7. No further changes needed. |

\**9.4.1.9 Status Code field**

***TGbe editor: Please add the following new row in the Table as shown below:***

**Table 9-78—Status codes**

|  |  |  |
| --- | --- | --- |
| **Status code**  | **Name**  | **Meaning** |
| …  | …  | … |
| <ANA>(#10634) | DENIED\_INCLUDED\_AP\_IS\_REMOVED\_OR\_BEING\_REMOVED\_ | Association is denied because an AP included in the request in either removed or is being removed from the AP MLD. |

**35.3.6.2.1 Adding affiliated APs(#13678)**

***TGbe editor: Please update following paragraph in this subclause as shown below:***

An AP MLD may add (#13678)one or more affiliated APs (#13679)to the AP MLD (#13281)(see 6.3.11.2 (MLME-START.request)). Each added affiliated AP(#10237) shall be announced through the Basic Multi-Link element (by changing the Maximum Number
Of Simultaneous Links (#12619)subfield of the MLD Capabilities and Operations subfield), and through the
Reduced Neighbor Report element (by including a TBTT Information field (#13276)with MLD Parameter
field for the added AP), in the Beacon and Probe Response frames (#12618)transmitted by other APs
affiliated with the same AP MLD.

***TGbe editor: Please add following note in this subclause:***

(#10633)Note:For each added affiliated AP it is recommended that the AP MLD assigns the lowest link ID available at the time the AP is added to the AP MLD, so that the largest assigned link ID is kept as small as possible.

**35.3.6.2.2 Removing affiliated APs**

***TGbe editor: Please update following paragraph in this subclause as shown below:***

An AP MLD may remove one or more of its affiliated APs (#13282)(see 6.3.xxx.2 (MLME-BSS-AP-REMOVAL.request)). (#14015)An AP MLD that is an NSTR mobile AP MLD shall not remove the affiliated AP operating on the primary link (see 35.3.19 (NSTR mobile AP MLD operation)). The AP MLD shall announce the removal of any affiliated AP through a Reconfiguration
Multi-Link element (see 9.4.2.312.4 (Reconfiguration Multi-Link element)) (#14015)in all Beacon frames
transmitted by its affiliated APs, as well as all Probe Response frames it transmits, until the affiliated AP has
been removed.

***TGbe editor: Please update following paragraph in this subclause as shown below:***

(#13279) If the affiliated AP being removed transmits BSS Transition Management Request frame(s) to notify termination of the BSS (#11565)corresponding to the affiliated AP, the SME of that affiliated AP shall perform the following procedure to terminate the BSS

(#13279) It shall follow the procedure in 11.21.7.3 (BSS transition management request) and 35.3.23 (BSS transition management for MLDs) to transmit BSS Transition Management Request frame(s). It shall set the fields in the BSS Transition Management Request frame(s) as follows:

The Disassociation Imminent, BSS Termination Included, and Link Removal Imminent sub- fields of the Request Mode field are set to 1; other subfields of the Request Mode field are reserved (#10073)except the Preferred Candidate List Included field which can be set as per the rules described in this subclause.

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 TBTT pointed to by the value of the Delete Timer field of the Reconfiguration Multi-Link element in transmitted beacons.

The BSS Termination Duration field shall be present and contain a BSS Termination Duration subelement (see 9.4.2.36 (Neighbor Report element)), with the BSS Termination TSF field of the subelement set to the value of the TSF timer when the BSS the affiliated AP belongs to will be terminated. The BSS Termination TSF field value shall indicate a time that is later than the TBTT the Disassociation Timer field value points to.

(#10073)The BSS Transition Candidate List Entries field may be included specifying one or more Neighbor Report elements to provide BSS transition candidate list. If the BSS Transition Candidate List Entries field is included, the Preferred Candidate List Included field shall be set to 1 if the included candidate list is a preferred candidate list, else the Preferred Candidate List Included field shall be set to 0.

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

***TGbe editor: Please add following three paragraphs after existing NOTE 3 in this subclause:***

(#10021)If a non-AP MLD removes a setup link from its multi-link setup as a result of the removal of an AP affiliated with its associated AP MLD, and that results in one or more TIDs not being mapped to remaining enabled links for that non-AP MLD, then the non-AP MLD and the AP MLD shall operate with all TIDs mapped to all remaining enabled links in both UL and DL for that non-AP MLD after the link removal until a new TID-to-link mapping is negotiated; Otherwise both the AP MLD and the non-AP MLD shall continue to operate based on the currently established TID-to-Link mapping on the remaining enabled links for that non-AP MLD after the link removal.

(#10022)If a non-AP MLD removes a setup link from its multi-link setup as a result of the removal of an AP affiliated with its associated AP MLD:

* The non-AP STA affiliated with the non-AP MLD which was operating on the removed link may cease maintaining a power state and power management mode.
* The TWT agreements and TWT memberships setup on the removed link shall be deleted.

(#11103)Note: If a non-AP MLD missed an AP removal indication from the associated AP MLD for some reason and incorrectly believes that it has a link with an affiliated AP which has been removed, the transmission of frames on that link will fail for the non-AP MLD since the AP MLD does not have that link as part of the ML setup for that non-AP MLD. The non-AP MLD can then take appropriate implementation specific action (e.g. remove the link from its ML setup) to correct the state mismatch with the AP MLD.

***TGbe editor: Please add following two notes after the last paragraph in this subclause:***

(#11636) Note: If an AP affiliated with an AP MLD is removed and if the link associated with the removed AP was one of the EMLSR links for a non-AP MLD and if there is only one remaining EMLSR link for that non-AP MLD after the AP removal, the AP MLD and the non-AP MLD continue to operate as per the EMLSR procedure in 35.3.17 (Enhanced multi-link single radio operation) on the remaining EMLSR link.

(#11636) Note: If an AP affiliated with an AP MLD is removed and if the link associated with the removed AP was one of the EMLMR links for a non-AP MLD and if there is only one remaining EMLMR link for that non-AP MLD after the AP removal, the AP MLD and the non-AP MLD continue to operate as per the EMLMR procedures in 35.3.18 (Enhanced multi-link multi-radio operation) on the remaining EMLMR link.

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| 11433 | Gaurang Naik | 35.3.10 | 434.22 | Removal of an AP must be a critical update, i.e., addition of the Reconfig ML element in the Beacon must be listed in 11.2.3.15 as a critical update. Directly setting the CUF to 1 can create problems if the non-AP MLD misses the Beacon frame(s) that had the CUF set to 1. Same comment for addition of the AP. Also, the same comment for nontransmitted BSSID case (P435L13). | As in comment | RevisedAgree in principle. Added text to indicate AP Removal and AP Addition events as critical updates.**TGbe editor, please make the changes tagged by CID #11433 in 22/1838r1.**  |
| 12806 | Laurent Cariou | 35.3.10 | 434.22 | There is an issue when an AP is removed. We currently use directly the critical update flag in this case, and not the BSS parameters update. If there is a change in BSS parameters update together with the inclusion of the ML reconfig element, the STA can miss it. Also, if the STA misses the beacon on which there was a critical update flag, it can not determine if there had been a critical update. Everything can be easily solved if we increment BSS parameters update in this case (link remove), as we do for any other update for a particular AP affiliated with an AP MLD. | Add a new condition for critical update in 11.2.3.15, which will be as follows: Inclusion of a Reconfiguration Multi-Link element by an AP affiliated with an AP MLD that will be removed following procedure defined in 35.3.6.2.2 (Removing affiliated APs) | RevisedAgree in principle. Added text to indicate AP Removal and AP Addition events as critical updates. Same resolution as CID 11433.**TGbe editor, please make the changes tagged by CID #11433 in 22/1838r1.** |
| 12807 | Laurent Cariou | 35.1.10 | 434.22 | For the case of AP removal, the ML reconfiguration element is present in beacon, so when the critical update flag is set to 1, the All Updates Included flag of the corresponding AP also has to be set to 1. | as in comment | RevisedPer clause 35.3.10, the All Updates Included flag is set to 1 if the latest critical updates that changed BPCC is included in the frame carrying RNR. Text is added to include AP Removal event as a critical update. Hence using the existing behavior, if only the AP Removal event happened then the All Updates Included flag will be set to 1. Same resolution as CID 11433.**TGbe editor, please make the changes tagged by CID #11433 in 22/1838r1.** |

**Discussion for CIDs 11433 and 12806:**

Currently AP Removal and AP Addition events are not classified as BSS critical updates in clause 11.2.3.15, for incrementing the BSS Parameters Change Count (BPCC) field. For these events, the Critical Update Flag (CUF) is directly set without updating BPCC. This can lead to undesirable outcome as below:

* If the STA misses the Beacon frames where the CUF was set for the Reconfiguration ML element, it cannot determine that there is an update for AP Removal in the Beacon. For example, if DTIM period is 2, then CUF is set for two Beacons including DTIM beacon. If STA misses those two beacons (say because of collisions) and acquires subsequent beacons which does not have CUF set (but does include BPCC), it won’t determine that Reconfiguration ML element is updated, since CUF is not set.
* Since AP Removal does not update BPCC, A non-AP STA may miss retrieving Reconfiguration ML element in the case when STA did a (Re)Association and got BPCC for all the APs from Reassociation Response frame and assuming BPCCs are not updated (no critical updates happened, but a Reconfiguration ML element got added in the Beacon), the non-AP STA may not retrieve the Beacon right away and hence won’t get the Reconfiguration ML element.
* If AP removal and AP addition result in only CUF update and no BPCC update, then non-AP STAs will need to support the logic of processing Reconfig ML elements anytime CUF is updated, which may be for other critical update events on other links and not AP removal, hence it results in inefficient behavior. Considering AP removal and AP addition as critical update events avoids such inefficiency.
* Just setting the CUF and not setting BPCC for AP removal and AP addition events requires non-AP MLDs to support separate logic to determine AP removal and AP addition events, as compared to other critical update events, which adds unnecessary complexity on the non-AP STA side.

All these issues can be easily addressed by including AP removal and AP addition as critical update events which results in updating BPCC. Both these events cause updates to BSS parameters and these updates are critical to indicate to the non-AP STAs and hence technically it makes sense to classify these updates as BSS parameters critical updates. This removes the need for having separate logic just for AP removal and AP addition events at the AP MLD and non-AP MLD as compared to other critical update events, simplifying spec text/behavior both for AP and non-AP sides.

One concern indicated was that it may not be desirable to update Check Beacon field in the TIM broadcast frame (clause 11.2.3.15) as a result of AP removal and AP addition, because TIM broadcast frame is received by non-EHT STAs as well and there is a proposal to remove TIM broadcast for non-AP MLDs. Hence, the proposal here is to list AP removal and AP addition as ML critical update events under clause 35.3.10, to avoid any updates to TIM broadcast. This also provides flexibility to add any ML specific critical update events in future under 35.3.10, instead of under 11.2.3.15 (TIM broadcast). If group decides to still keep TIM broadcast for non-AP MLDs, then clause 11.2.3.15 can also refer to these additional ML critical update events captured in clause 35.3.10.2.

***TGbe editor: Please rename the title for the following clause as shown below:***

**35.3.10 BSS parameter critical update (#11433)**

***TGbe editor: Please add following new subclause and move all the text from clause 35.3.10 under this new subclause:***

**35.3.10.1 BSS parameter critical update procedure (#11433)**

***TGbe editor: Please modify following paragraph in this clause as shown below:***

— (#13788)include in Beacon and Probe Response frames it transmits a BSS Parameters Change Count
subfield for each of all APs affiliated with the same AP MLD as the AP; include in a (Re)Association
Response frame it transmits a BSS Parameters Change Count subfield for each of all APs that are
requested for (re)setup in the received (Re)Association Request frame.
• The BSS Parameters Change Count subfield value for each AP is initialized to 0, and shall be
incremented (modulo 256 (#10555)excluding the value 255) (#10122)by 1 when a critical update
occurs to the (#13131)BSS parameters of that AP as defined in(#11433) 35.3.10.2 (Multi-link critical update events).

***TGbe editor: Please modify following paragraph in this clause as shown below:***

If an AP affiliated with an AP MLD is a nontransmitted BSSID in a multiple BSSID set, then the AP that
corresponds to the transmitted BSSID in the same multiple BSSID set shall
— include in Beacon and Probe Response frames it transmits a BSS Parameters Change Count subfield
for each of all APs affiliated with the same AP MLD as the AP corresponding to the
(#11434)nontransmitted BSSID
• The BSS Parameters Change Count subfield value for each AP is initialized to 0, and shall be
incremented (modulo 256 (#10555)excluding the value 255) (#10122)by 1 when a critical update
occurs to the (#13131)operational parameters of that AP as defined in(#11433) 35.3.10.2 (Multi-link critical update events).

***TGbe editor: Please add following new subclause in clause 35.3.10***

**35.3.10.2 Multi-link critical update events** (#11433)

The multi-link critical update events include all the critical update events captured in 11.2.3.15 (TIM Broadcast) plus the additional events listed below:

* Inclusion or modification of a Reconfiguration Multi-Link element by an affiliated AP as per procedure defined in 35.3.6.2.2 (Removing affiliated APs)
* Announcement of addition of an affiliated AP through the Basic Multi-Link element and the Reduced Neighbor Report element as per procedure defined in 35.3.6.2.1 (Adding affiliated APs)

***TGbe editor: Please remove following two paragraphs from clause 35.3.10:***

(#11433) .

(#11433)

**9.4.2.170.2 Neighbor AP Information field**

***TGbe editor: Please modify following paragraph in this clause as shown below:***

The BSS Parameters Change Count subfield is an unsigned integer, initialized to 0, that increments when a
critical update to the BSS Parameters of the reported AP occurs. The critical updates are defined in (#11433) 35.3.10.2 (Multi-link critical update events). The BSS Parameters Change Count subfield is set to 255 if the reported AP is not part of an AP MLD, or if the reporting AP does not have that information.

**9.4.2.312.2.3 Common Info field of the Basic Multi-Link element**

***TGbe editor: Please modify following paragraph in this clause as shown below:***

The BSS Parameters Change Count subfield in the Common Info field (#11387)carries an unsigned integer,
initialized to 0. The value carried in the subfield is incremented (#10122)by 1 when a critical update (as
defined in (#11433)(#11388) 35.3.10 (BSS parameter critical update procedure))
occurs to the (#13131)BSS parameters of the AP that is affiliated with an AP MLD which is described in the
Basic Multi-Link element and satisfies one of the following: