IEEE P802.11
Wireless LANs

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| LB 266 - CR for ML Reconfiguration critical update evets |
| Date: October 12, 2022 (original proposal date) |
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 Abstract

This submission proposes resolutions for following 3 CIDs received for TGbe LB266:

11433 12806 12807

**Revisions:**

* Rev 0: Initial version of the document. Moved resolution for these 3 CIDs from 11-22/1838r2 to this doc for a separate discussion
* Rev 1: Updates to option 1 during MAC Ad-hoc call

***TGbe editor: The baseline for this document is* 11be D2.3*.***

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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| --- | --- | --- | --- | --- | --- | --- |
| 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 | RevisedAgree in principle. Text is added to set the All Updates Included flag to 1 for AP Removal and AP addition events. **TGbe editor, please make the changes tagged by CID #11433 in 22/1838r1.** |

**Discussion for CIDs 11433, 12806 and 12807:**

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 AP Removal or AP Addition resulting in updates to Reconfiguration ML element, Basic ML element or RNR element, it cannot determine that there is an update for AP Removal or AP Addition 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 and acquires subsequent beacons which does not have CUF set (but includes BPCCs), it won’t determine that Reconfiguration ML element, Basic ML element or RNR element were updated, since CUF is not set and BPCC is not updated.
* If AP removal and AP addition result in only CUF update and no BPCC update, then non-AP STAs will need to keep processing Reconfig ML elements, Basic ML element and RNR element on the current link anytime CUF is set, which may be for critical update events on other links (indicated by BPCC for those links) and not for AP removal or AP Addition, which is inefficient. Considering AP removal and AP addition as critical update events and incrementing BPCC avoids such inefficiency.
* Just setting the CUF and not setting BPCC for AP removal and AP addition events requires non-AP MLDs to support two separate logic for update events– one based only on CUF updates (as in current draft spec for AP Removal/AP Addition) and other based on CUF+BPCC updates or only BPCC updates (as for other critical events in draft spec). Incrementing BPCC for these events simplifies the behavior for non-AP MLD.
* Also, current draft spec only captures non-AP MLD behavior related to BPCC and no behavior is captured related to CUF in clause 35.3.10 (assume this is left to implementation). Updating BPCC ensures that retrieval of AP Removal and AP Addition updates is not left to the STA implementation and is specified clearly per the BPCC update logic defined in the spec.

These issues can be easily addressed by including AP removal and AP addition as critical update events which result in updating BPCC. Both these events cause updates to BSS parameters by updating specific elements in the Beacon and these updates are critical to indicate to the non-AP STAs and hence it makes sense to classify these updates as BSS parameters critical updates. This doc proposes following:

BPCC update:

**AP Removal:** BPCC should be incremented for all affiliated APs since all APs will include Reconfig ML element.

**AP Addition:** BPCC should be incremented for all affiliated APs, except for the new added AP for which BPCC should be initialized to 0.

All Updates Included subfield:

**AP Removal:** Since Reconfig ML element transmitted by every AP provides information on all affiliated APs being removed, the All Updates Included subfield should be set to 1 for all APs in the RNR for AP Removal event.

**AP Addition:** Since the information for the AP addition event is reflected in Basic ML element Common Info field and in RNR for all APs, the All Updates Included subfield should be set to 1 for all affiliated APs in RNR, including the added AP. For the added AP the non-AP MLD has not acquired the Beacon yet, so it will acquire the Beacon for that AP independent of All Updates Included flag. Once it has acquired the Beacon, it does not need to acquire the Beacon again because All Updates Included flag will be set to 1 for the new AP.

One concern raised was that it may not be desirable to update Check Beacon field in the TIM broadcast frame (clause 11.2.3.15) for 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 doc also proposes an option 2 where AP removal and AP addition are listed as ML critical update events under clause 35.3.10, without any updates to TIM broadcast. If group decides to 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 in that option.

**Text is proposed for two options:**

Option 1: AP Removal and AP Addition events added under clause 11.2.3.15 (TIM broadcast) as critical update events

Option 2: AP Removal and AP Addition events are indicated as ML critical update events under 35.3.10 (BSS parameter critical update procedure), without impacting TIM broadcast clause.

**Proposed text for Option 1:**

**11.2.3.15 TIM Broadcast**

***TGbe editor: Please add following two additional events in list as shown below:***

The following events about the (#13131)BSS parameters of the AP shall classify as a critical update:

a) Inclusion of a Channel Switch Announcement element
b) Inclusion of an Extended Channel Switch Announcement element
c) Modification of the EDCA parameters element
d) Inclusion of a Quiet element
e) Modification of the DSSS Parameter Set
f) Modification of the HT Operation element
g) Inclusion of a Wide Bandwidth Channel Switch element
h) Inclusion of a Channel Switch Wrapper element
i) Inclusion of an Operating Mode Notification element
j) Inclusion of a Quiet Channel element
k) Modification of the VHT Operation element
l) Modification of the HE Operation element
m) Insertion of a Broadcast TWT element
m1) Insertion of a Broadcast TWT Parameter Set field in an existing Broadcast TWT element
n) Inclusion of the BSS Color Change Announcement element
o) Modification of the MU EDCA Parameter Set element

p) Modification of the Spatial Reuse Parameter Set element
q) Modification of the UORA Parameter Set element
r) Modification of the EHT Operation element

s) (#11433)Inclusion or modification of a Reconfiguration Multi-Link element as per procedure defined in 35.3.6.2.2 (Removing affiliated APs)

t) (#11433)Announcement of addition of an affiliated AP through the Basic Multi-Link element or the Reduced Neighbor Report element as per procedure defined in 35.3.6.2.1 (Adding affiliated APs)

**35.3.10 BSS parameter critical update procedure**

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

— For each reported AP affiliated with the same AP MLD as the AP, set the All Updates Included
subfield to 1 in the MLD Parameters subfield in the TBTT Information field of the Reduced
Neighbor Report element corresponding to the reported AP if the updated elements that correspond
to the latest critical update that generated a change to the value carried in the BSS Parameters
Change Count subfield for the reported AP are included in the frame carrying the Reduced Neighbor
Report element(#10556)(#10730), with the updated elements selected from the elements as
described in 35.3.11 (Multi-link procedures for channel switching, extended channel switching, and
channel quieting) (#12807)and from the elements as described in 35.3.6.2 (Adding or removing affiliated APs), and until the updated elements are no longer included or until the BSS Parameters
Change Count subfield is incremented(#10415), and set to 0 otherwise.

— For each reported AP affiliated with the same AP MLD as the AP corresponding to the
nontransmitted BSSID, set the All Updates Included subfield to 1 in the MLD Parameters subfield in
the TBTT Information field of the Reduced Neighbor Report element corresponding to the reported
AP if all the updated elements that correspond to the latest critical update that generated a change to
the value carried in the BSS Parameters Change Count subfield for the reported AP are included in
the frame carrying the Reduced Neighbor Report element(#11385)(#10730), with the updated
elements selected from the five elements described in 35.3.11 (Multi-link procedures for channel
switching, extended channel switching, and channel quieting) (#12807)and from the elements as described in 35.3.6.2 (Adding or removing affiliated APs), and until the updated elements are no longer included or until the BSS Parameters Change Count subfield is incremented, and set to 0 otherwise.

**9.4.1.4 Capability Information field**

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

An AP affiliated with an AP MLD sets the Critical Update Flag subfield to 1 if any of the following conditions are met:
— There is a change to a value carried in the BSS Parameters Change Count subfield of the MLD
Parameters field in the Reduced Neighbor Report element for any reported AP affiliated with the
same AP MLD as the AP.

— There is a change to a value carried in the BSS Parameters Change Count subfield in the Common
Info field of the Basic Multi-Link element corresponding to the AP.(#11433) .(#11433)

**Proposed text for Option 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).

— For each reported AP affiliated with the same AP MLD as the AP, set the All Updates Included
subfield to 1 in the MLD Parameters subfield in the TBTT Information field of the Reduced
Neighbor Report element corresponding to the reported AP if the updated elements that correspond
to the latest critical update that generated a change to the value carried in the BSS Parameters
Change Count subfield for the reported AP are included in the frame carrying the Reduced Neighbor
Report element(#10556)(#10730), with the updated elements selected from the elements as
described in 35.3.11 (Multi-link procedures for channel switching, extended channel switching, and
channel quieting) (#12807)and from the elements as described in 35.3.6.2 (Adding or removing affiliated APs), and until the updated elements are no longer included or until the BSS Parameters
Change Count subfield is incremented(#10415), and set to 0 otherwise.

***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).

— For each reported AP affiliated with the same AP MLD as the AP corresponding to the
nontransmitted BSSID, set the All Updates Included subfield to 1 in the MLD Parameters subfield in
the TBTT Information field of the Reduced Neighbor Report element corresponding to the reported
AP if all the updated elements that correspond to the latest critical update that generated a change to
the value carried in the BSS Parameters Change Count subfield for the reported AP are included in
the frame carrying the Reduced Neighbor Report element(#11385)(#10730), with the updated
elements selected from the five elements described in 35.3.11 (Multi-link procedures for channel
switching, extended channel switching, and channel quieting) (#12807)and from the elements as described in 35.3.6.2 (Adding or removing affiliated APs), and until the updated elements are no longer included or until the BSS Parameters Change Count subfield is incremented, and set to 0
otherwise.

***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)

**9.4.1.4 Capability Information field**

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

An AP affiliated with an AP MLD sets the Critical Update Flag subfield to 1 if any of the following conditions are met:
— There is a change to a value carried in the BSS Parameters Change Count subfield of the MLD
Parameters field in the Reduced Neighbor Report element for any reported AP affiliated with the
same AP MLD as the AP.

— There is a change to a value carried in the BSS Parameters Change Count subfield in the Common
Info field of the Basic Multi-Link element corresponding to the AP.(#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: