IEEE P802.11
Wireless LANs

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| CC36-Resolution-for-CID-5154 |
| Date: 2021-10-03 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Arik Klein | Huawei | Huawei TLV Research Center |  | arik.klein@Huawei.com  |
| Stephen McCann | Huawei |  |  | stephen.mccann@huawei.com |
| John Wullert | Peraton Labs |  |  | jwullert@peratonlabs.com |
| Vishnu Ratnam | Samsung USA |  |  | vishnu.r@samsung.com |
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Abstract

This submission proposes CR for CIDs 5154.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: adding modification based on offline discussions
* Rev 2: Align the doc with 802.11be D1.2 baseline,
Modifying the Enabled Link / Disabled Link definition due to John’s comment,
Adding Link disablement Parameters field in the EHT Operation element due to Vishnu’s comments,
Adding distinction between link disablement (between AP MLD and associated non-AP MLD) and BSS Link disablement (between AP MLD and all associated non-AP MLDs operating on that link) both in Description part and text part – due to Vishnu’s comments.

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.***

| **CID** | **Commenter** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- | --- |
| 5154 | George Cherian |  |  | The procedure, if an AP MLD chooses to disable a link (for any reason) is missing. Please specify. | As in comment | **Revised**Agree in principle with the comment. Following the discussion below, need to add a notification-based mechanism to allow the AP MLD to temporarily prohibit the frame exchange on one or more setup links (as the normative behavior defined for a disabled link).**TGbe Editor, please implement changes as shown in doc 11-21/1237r1 tagged as 5154.** |

## Discussion

According to 802.11be D1.1 section 35.3.6.1.1 the definition of a disabled link is “A setup link to which no TIDs are mapped”. Moreover, the expected behavior of a disabled link is defined as follows:” If a link is disabled, it shall not be used for frame exchange, including Management frames both for DL and UL”.

Formally, the only way for AP MLD and non-AP MLD to disable a link is to use the non-default TID-to-Link Mapping negotiation procedure (as defined in section 35.3.6.1.3 (Negotiation of TID-to-link mapping)), which is very slow (and complicated) process that requires mutual agreement of both sides (i.e. non-AP MLD and AP MLD) on any change DL/UL TID-To-Link mapping before taking effect.

On the other hand, the non-AP MLD has an exception that “de-facto” allows it to turn any enabled link into a “disabled link” from the AP behavior aspect (i.e. it simply prohibits the AP from any frame exchange on that link), by a simple notification manner: utilizing the Power Save mechanism on each of the affiliated non-AP STA. In this way, the non-AP STA does not need any approval of the associated AP to get into Power Save mode and effectively to “disable” the link on which its peer AP is operating on.

The AP MLD also needs a similar notification-based mechanism (as clearly specified in CID5154) that will allow it to temporarily prohibit the non-AP MLD (and the AP MLD) from any frame exchange within the BSS on that link for any reason it has (Reducing AP Power consumption, especially when the AP MLD handles multiple TX/RX chains on different bands).

This proposal covers the above issues (from the AP MLD perspective) and includes a mechanism to notify the disablement of a link operation within the BSS (i.e. BSS link disablement) by the AP using Beacon and Probe Response frames.

It should be noted that Disablement of the link is a **different** operation than Deleting a link (which is discussed in the 11-21/534r7): When the link is disabled by the AP MLD, all the non-AP MLDs operating on that link are kept associated with all the link parameters, so once the link is enabled the frame exchange can be immediately initiated on this link, where in case the link is deleted/removed all the related link parameters are erased and this link can’t be used anymore from this point onwards.

In addition, the proposed mechanism suggests an alternative to the “known” CSA mechanism in case of associated non-AP MLDs only (that may be lengthy due to sending the same notification several times ahead so all the STAs will receive it prior to the actual channel switching).

Actually, it takes advantage that there is more than a single setup link between the AP MLD and the non-AP MLD, so the indication does not necessarily have to be sent only on the link that is intended to be disabled.

Therefore, the switching time between the notification (for disabling a link) and the actual disablement of the link is significantly decreased.

The proposed solution is based on the following guidelines:

* The link(s) can be disabled from operating / enabled to operate within the BSS in a resolution of TBTTs.
* Adding an indication in the RNR element (which includes the information corresponding to the link that becomes disabled for that BSS) – to avoid any Probe Request / Association Request frames transmission by non-AP MLDs on the disabled link(s).
Please note that these RNRs are included in the Beacon / Probe response frames of the APs affiliated with the same AP MLD (as the affiliated AP operating on the link that becomes disabled), as shown in the example illustrated in the following diagram:


In this example, AP MLD is associated with non-AP MLD1 and non-AP MLD2 and on each enabled link, it includes the RNR elements for the affiliated APs (of the same AP MLD). An indication of BSS link disablement of 5 GHz Link will be included in the RNR elements corresponding to AP2, which are included in the Beacon and Probe response frames transmitted on the 2.4GHz and 6GHz links. In this way, an unassociated non-AP MLD 3 will avoid initiating the transmission of any Probe Request / Authentication / Association Request frame during the period of the BSS disablement of Link 2.

* Adding an indication in the EHT Operation element – to announce that the current link becomes disabled within the BSS for the associated MLDs operating on the link to be disabled. It is much needed if the associated non-AP MLD has only one enabled link with the AP MLD.
* The indication for the BSS Disabled link should be included in the BSS parameters subfield of the RNR. This will enable future extensions for the link disablement for co-located HE AP STA that is operating on 6GHz band (possibly through updates in REVme).
* The BSS link disable / enable indication in the RNR will be defined as a Critical Update, so the non-AP MLD will be notified promptly for any change on the link status.

\*\*\*\* End of discussion part \*\*\*\*\*

*TGbe editor: Please note baseline is 11be D1.2 and REVme D0.1*

**9.4.2.170 Reduced Neighbor Report element**

**9.4.2.170.2 Neighbor AP Information field**

[CID 5154]

***TGbe editor: Update the following Figure 9-664a (BSS Parameters subfield format) as follows:***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | OCT Recommended | Same SSID | Multiple BSSID | Transmitted BSSID | Member Of ESS With 2.4/5 GHz Co-Located AP | Unsolicited Probe Responses Active | Co-Located AP | BSSLink Disabled |
| Bits:  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| * BSS Parameters subfield format
 |

***TGbe editor: Add the following after the 24th paragraph of this subclause (“The Co-Located AP subfield is set to 1..”) as follows:***

The BSS Link Disabled subfield is set to 1 if the operating link of the AP described in this Neighbor AP Information field is disabled. Otherwise – it is set to 0.

Note: when a link is indicated as disabled, no frame exchange is allowed on this link, as defined in section 35.3.6.1.1

**9.4.2.295aEHT Operation element**

[CID 5154]

***TGbe editor: Update the following Figure 9-788ee (EHT Operation element format) as follows:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | EHT Operation Information | Disabled Subchannel Bitmap | BSS Link Disablement Parameters |
| Octets: | 1 | 1 | 1 |  | 0 or 2 | 0 or 4 |

### Figure 9-788ee—EHT Operation element format

***TGbe editor: Add the following subfields in Table 9-322al as follows:***

**Table 9-322al—EHT Operation Information subfields**

| **Subfield** | **Definition** | **Encoding** |
| --- | --- | --- |
| Channel Width | This subfield defines the EHT BSS bandwidth. | Set to 0 for 20 MHz EHT BSS band- width.Set to 1 for 40 MHz EHT BSS band- width.Set to 2 for 80 MHz EHT BSS band- width.Set to 3 for 160 MHz EHT BSS band- width.Set to 4 for 320 MHz EHT BSS band- width.Other values are reserved. |
| CCFS | This subfield provides channel center frequency segment information for a 20, 40, 80, 160, or 320 MHz EHT BBS. |  |
| Disabled Subchannel Bitmap Present | This subfield indicates whether the Disabled Subchannel Bitmap field is present or not. | Set to 1 if the Disabled Subchannel Bitmap field is present; set to 0 other- wise. |
| BSS Link Disablement indication | This subfield indicates whether the current link is going to be disabled or is (already) disabled or is enabled within the BSS | Set to 1 if the current operating link is going to be disabled or is disabled within the BSS (based on the value in BSS Link disablement count subfield).Set to 0 if the current oprating link is enabled. |

***TGbe editor: Add the following paragraphs before the last paragraph of this subclause as follows:***

The BSS Link Disablemt Parameters field is present only if the BSS Link disablement indication subfield is set to 1.

The format of the BSS Link Disablement Parameters field is shown in Figure 9-788ef (BSS Link Disablement Parmeters field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | BSS Link Disablement Count | BSS Link Disablement Period | BSS Link Disablement Duration |
| Octets: | 1 | 1 | 2 |

### Figure 9-788ef— BSS Link Disablement Parmeters field format

The subfields of the BSS Link Disablement Parameters are defined in Table 9-322am (BSS Link Disablement Parameters subfields).

**Table 9-322am—** BSS **Link Disablement Parameters subfields**

| **Subfield** | **Definition** | **Encoding** |
| --- | --- | --- |
| BSS Link Disablement Count | This subfield indicates the number of TBTTs (in the range of [0,255]) until the link is disabled within the BSS | A non-zero value indicates that the link becomes disabled within the BSS after an amount of TBTTs indicated by this value.The value 0 indicates that the BSS link disablement occurs at any time after the Beacon frame is transmitted or that the link is already disabled within the BSS. |
| BSS Link disablement Period | This subfield indicates the number of beacon intervals between the start of regularly scheduled disablements for this link within the BSS | The value 0 indicates that no periodic disablement for this link within the BSS is defined |
| BSS Link disablement Duration | This subfield indicates the duration in which the link will be disabled within the BSS. | The value is expressed in TUsA value of 65535 indicates unkown duration |

Note: when a link is indicated as disabled, no frame exchange is allowed on this link, as defined in section 35.3.6.1.1

* + - 1. **TIM Broadcast**

[CID 5154]

***TGbe editor: Please update the subclause as follows:***

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. Modification of the Reduced Neighbor Report element

**35.3.6.1.1 General**

[CID 5154]

***TGbe editor: Please replace the third paragraph of this subclause, as follows:***

*

A setup link is defined as disabled if any of the following conditions occur and is defined as enabled if none of the following conditions occur:

* No TIDs are mapped to that link.

The non-AP STA affiliated with non-AP MLD associated with the AP MLD and is operating on this setup link is in Power Save mode

A setup link is defined as BSS disabled link if any of the following conditions occur and is defined as enabled if none of the following conditions occur:

* The BSS Link Disablement indication subfield is set to 1 and the BSS Link Disablement Count subfield is set to 0 in the BSS Link Disablement Parameters field of the EHT Operation Element included in the Beacon, Probe Response, (Re)Association Response frames transmitted by the AP affiliated with AP MLD on this setup link.
* The BSS Link Disabled subfield is set to 1 in the Neighbor AP Information field of the RNR element included in the Beacon or Probe Response frames transmitted by the APs affiliated with the same AP MLD as the AP operating on this setup link.

At any point in time, a TID shall always be mapped to at least one setup link, unless admission control is used. By default, as TIDs are mapped to all setup links, all setup links shall be enabled (see [35.3.6.1.2 (Default mapping mode)](#bookmark21)).

[CID 5154]

***TGbe editor: Please add the following new subclause to section 35.3.6***

35.3.6.3 AP Notification of BSS Link Disablement / Enablement

An AP MLD may disable one or more setup links it is operating within the BSS. When the link is defined as BSS disabled link by the AP MLD, it shall not be used for any frame exchange within this BSS by any non-AP MLD (associated or unassociated).

During the BSS link disablement duration, the setup link maintains state (with all the link parameters defined before the BSS link disablement preocedure) but is prohibited for any frame exchange within that BSS.

An AP MLD shall notify that a link is a BSS disabled link, as follows:

* The AP affiliated with the AP MLD that is operating on the setup link to be disabled shall set the BSS Link Disablement indication subfield to 1 and the BSS Link Disablement Count subfield to 0 in BSS Link Disablement Parameters field of the EHT Operation Element included in the Beacon, Probe Response and (Re)Association Response frames that it transmits.
* The AP affiliated with the same AP MLD as the affiliated AP that is operating on the setup link to be disabled within the BSS shall set the BSS Link Disabled subfield to 1 in the Neighbor AP Information field of the RNR element included in either the Beacon or Probe Response frames that it transmits.

Notes:

* Unassociated non-AP MLDs use only the BSS Link Disabled subfield indication in the RNR to avoid sending any Probe Request / Association Requst frames on the disabled link.
* Associated non-AP MLDs may use either the BSS Link Disablement indication subfield in EHT Operation element or the BSS Link disabled subfield indication in the RNR to avoid exchanging any frame with the AP MLD on the disabled link.

An AP MLD shall notify that a link is a BSS enabled link, as follows:

* The AP affiliated with the AP MLD that is operating on the enabled setup link shall set the the BSS Link Disablement indication subfield to 0 in the EHT Operation Element included in the Beacon, Probe Response, (Re)Association Response frames it transmits.
* The AP affiliated with the same AP MLD as the affiliated AP which is operating on the enabled setup link shall set the BSS Link Disabled subfield to 0 in the Neighbor AP Information field of the RNR element included either in the Beacon or Probe Response frames that it transmits.

Note: When a setup link becomes a BSS enabled link (after it is disabled within the BSS), it can be immediately used for frame exchange by any non-AP MLD, using the parameters set for this link before it has been disabled.

When the BSS Link disablement indication subfield is set to 1, the AP MLD shall include the BSS Link Disablement Parameters field in the EHT Operation element.

The AP MLD may announce to its associated non-AP MLDs ahead of the BSS link disablement by setting the BSS Link Disablement Count subfield in the BSS Link Disablement Parameters field of the EHT Operation element to a non-zero value. The BSS Link disablement initiated by an AP MLD should be scheduled so that all non-AP STAs operating on the link that are affiliated with the non-AP MLD associated with that AP MLD have the opportunity to receive at least one Beacon frame indicating when the BSS link disablement will take effect. The AP MLD may announce a periodic BSS link disablement by additionally setting the BSS Link Disablement Period subfield in the BSS Link Disablement Parameters field of the EHT Operation element to a non-zero value. A link that is set as a BSS disabled link which is announced with the BSS Link Disablement Duration subfield in the BSS Link Disablement Parameters field of the EHT Operation element not set to 65535, shall be enabled by the AP MLD before the expiry of the time indicated in the BSS Link Disablement Duration field.

Note: The link is disabled only if both Link Disablement indication subfield is equal to 1 and the Link Disablement Count subfield is equal to 0 in the EHT Operation element.

Straw Poll:

Do you support to incorporate the proposed draft text in this document 11-21/1237r2 to the next revision of TGbe Draft 1.1, for addressing the CID 5154?

Result: Yes/No/Abstain