IEEE P802.11
Wireless LANs

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| Resolution for CIDs related to EMLMR (CC34) – Part 1 |
| Date: 2021-3-29 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Young Hoon Kwon | NXP |  |  | younghoon.kwon@nxp.com |
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Abstract

This submission proposes resolutions for following 11 CIDs received for TGbe (CC34):

1437, 2104, 2111, 2758, 2919, 2960, 3207, 3037, 3228, 3402, 3432

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Change the rev. number for referencing contribution (21/335r12) and the baseline document is updated to reflect D1.0 results.

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** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 1437 | Chien-Fang Hsu | 145/47 | 35.3.15 | Can a non-AP MLD support eMLSR and eMLMR at the same time? | Clarify it | Revised:Agree in principle with the comment. Based on draft 0.3, there’s no indication if a non-AP MLD supporting EMLSR can also support EMLMR. However, as a non-AP MLD supporting EMLSR has different hardware requirements from a non-AP MLD supporting EMLMR, it does not make sense to enable supporting of both EMLSR and EMLMR simultaneously. With this regards, PDT document 11-21/335r12 resolved this issue in a way that EMLSR Mode subfield and EMLMR Mode subfield are not allowed to be set to 1 simultaneously.TGbe editor does not need to make any change to the draft. |
| 2104 | Kaiying Lu | 145/65 | 35.3.15 | For EMLMR mode, please specify the per-link spatial stream capabilities for initial frame exchange. | as in comment | Revised:Agree in principle with the comment. Per-link spatial stream capabilities for initial frame exchange implies the spatial stream capabilities that are used for baseline operation. However, it is not clear enough in current draft 0.3. However, as this behavior is already defined in the draft 0.3 and no additional behavior needs to be defined, a note is added to clarify this.TGbe editor to make the changes shown in 11-21/0557r1 under all headings that include CID 2104. |
| 2111 | Kaiying Lu | 145/51 | 35.3.15 | For EMLMR mode, please specify the number of spatial stream is 0 on the other link when the initial Control frame was received on one link. | as in comment | Revised:Agree in principle with the comment. Currently it is not clear if the non-AP MLD can initiate another frame exchange while frame exchange is on going on a link of EMLMR links. However, if another frame exchange is allowed for other links, rules for the frame exchange on other links need to be defined further which makes the EMLMR operation to be quite complicated without expecting potential gain. Thus, the text is updated to clarify that no other frame exchange is allowed on other links during a frame exchange on a link.TGbe editor to make the changes shown in 11-21/0557r1 under all headings that include CID 2111. |
| 2758 | Sharan Naribole | 146/1 | 35.3.15 | Expected CCA, transmit and receive behavior and/or assumptions for other links part of EMLMR mode are not defined | Clarification required on operation of other links part of EMLMR link set during an ongoing frame exchange on a link part of this EMLMR link set | Revised:Agree in principle with the comment. Currently it is not clear if the non-AP MLD can initiate another frame exchange while frame exchange is on going on a link of EMLMR links. However, if another frame exchange is allowed for other links, rules for the frame exchange on other links need to be defined further which makes the EMLMR operation to be quite complicated without expecting potential gain. Thus, the text is updated to clarify that no other frame exchange is allowed on other links during a frame exchange on a link.TGbe editor to make the changes shown in 11-21/0557r1 under all headings that include CID 2758. |
| 3207 | Young Hoon Kwon | 145/37 | 35.3.15 | Requirements on the link for which the initial frame exchange was not made is needed | As shown in the comment. | Revised:Agree in principle with the comment. Currently it is not clear if the non-AP MLD can initiate another frame exchange while frame exchange is on going on a link of EMLMR links. However, if another frame exchange is allowed for other links, rules for the frame exchange on other links need to be defined further which makes the EMLMR operation to be quite complicated without expecting potential gain. Thus, the text is updated to clarify that no other frame exchange is allowed on other links during a frame exchange on a link.TGbe editor to make the changes shown in 11-21/0557r1 under all headings that include CID 3207. |
| 2919 | SunHee Baek | 145/48 | 35.3.15 | This is TBD about where the EMLMR mode subfield is located. The subfield is needed to be in same field with the EMLSR mode subfield which is the Common Info field of the Basic variant Multi-Link element. The reason is the EMLMR mode is operated between non-AP MLD and its associated AP MLD on the enabled links, which is the same precondition with EMLSR mode. | As in comment. | Revised:Agree in principle with the comment. Based on draft 0.3, it is still TBD how to indicate EMLMR mode. Also, we agree with the commenter that this subfield should be in the Common Info field of the Basic variant ML element as it is an MLD level capability. With this regards, PDT document 11-21/335r12 resolved this issue in a way that EMLMR Support subfield is defined in the Common Info field of the Basic variant ML element, which indicates if the MLD supports the EMLMR mode.TGbe editor does not need to make any change to the draft. |
| 2960 | Tomoki Adachi | 29/ | 3.2 | It seems that definition for EMLMR non-AP MLD is also needed. | Add such definition in 3.2. | Rejected:EMLMR is not a type of MLD but is a mode of operation. We may define a terminology EMLMR MLD for those MLDs that support EMLMR operation. However, because an MLD that supports EMLMR operation can switch between baseline operation and EMLMR operation, it is not quire clear in defining the EMLMR MLD. So, we better not define EMLMR MLD separately. |
| 3402 | Zhou Lan | 145/39 | 35.3.15 | Please clarify the initial power mode of the STAs under a EMLMR operation |  | Revised:Agree in principle with the comment. Based on draft 0.3, it is not clear if enabling/disabling EMLMR mode have any impact on power mode setting and it is not clear what will the initial power state will be. In EMLMR operation for a non-AP MLD, any AP affiliated with a peer AP MLD can send an initial frame on any link within the EMLMR links that a STA affiliated with the non-AP MLD is in awake state. Therefore, EMLMR operation does not need any additional power management requirement on top of baseline power management mechanism. The text is updated to clarify that EMLMR operation works on baseline power management mode. TGbe editor to make the changes shown in 11-21/0557r1 under all headings that include CID 3402. |
| 3037 | Xiaofei Wang | 145/37 | 35.3.15 | The name EMLMR is confusing; the term Multi-link Multi-radio can be easily confused with STR or NSTR MLO. Change to Enhanced Multi-Link Multi-Spatial streams may be more clear. |  | Revised:There has been similar discussion that the terminology of (enhanced) multi-link single radio is confusing, but the group agreed to keep using the name of (enhaced) multi-link single radio operation. As (enhanced) multi-link multi radio operation is an extension of the (enhanced) multi-link single radio operation to multiple radio situation, it is quite straightforward to use the name as the (enhanced) multi-link multi radio operation. With this regards, PDT document 11-21/335r12 resolved this issue in a way that deleting the editor’s note mentioning that the name of the EMLMR mode is TBD.TGbe editor does not need to make any change to the draft. |
| 3228 | Young Hoon Kwon | 145/42 | 35.3.15 | How to define and indicate the EMLMR links should be clearly mentioned. | As shown in the comment. | Revised:Agree in principle with the comment. Based on D0.3, nothing describes how to indicate EMLMR links. As the EMLMR links should be declared by a non-AP MLDs as an MLD level capability, it is reasonable that this is indicated in a Common Info field of Basic variant ML element. With this regards, PDT document 11-21/335r12 resolved this issue in a way that EMLMR Link Bitmap subfield is defined in the Common Info field of the Basic variant ML element, which indicates a set of links that are member of EMLMR links.TGbe editor does not need to make any change to the draft. |
| 3432 | Yonggang Fang |  | 35.3.15 | What is difference between STR operation and enhanced multi-link multi-radio operation? |  | Rejected:The comment fails to identify changes in sufficient detail so that the specific wording of the changes that will satisfy the commenter can be determined. However, the difference between STR operation and EMLMR operation is clear. In case of EMLMR operation, the non-AP MLD can switch its Tx/Rx radios to one link such that the non-AP MLD can transmit and/or receive frames with more number of spatial streams that it can support on the link. Therefore, after receiving the initial frame, the EMLMR operation happens on one link only, whicle STR operation happens on multiple links simultaneously. |
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**Discussion:** *None.*

**Propose:**

*TGbe editor: Change 35.3.16 Enhanced multi-link multi-radio operation as follows (track change on):*

**35.3.16 Enhanced multi-link multi-radio operation**

A non-AP MLD may operate in the enhanced multi-link multi-radio (EMLMR) mode on a specified set of the enabled links between the non-AP MLD and its associated AP MLD. The specified set of the enabled links in which the EMLMR mode is applied is called EMLMR links.

An MLD with dot11EHTEMLMROptionImplemented equal to true shall set the EML Capabilities Present subfield to 1 and shall set the EMLMR Support subfield of the Common Info field of transmitted Basic variant ML elements to 1; otherwise, the MLD shall set the EMLMR Support subfield to 0.

A non-AP MLD with dot11EHTEMLMROptionImplemented equal to true shall set the EMLMR Rx NSS subfield of TBD element to dot11SupportedEMLMRRxNSS and the EMLMR Tx NSS subfield of TBD element to dot11SupportedEMLMRTxNSS, which indicate MLD level capabilities.

If a non-AP MLD with dot11EHTEMLMROptionImplemented equal to true intends to switch EMLMR mode after multi-link setup, then a non-AP STA affiliated with the non-AP MLD shall transmit an EML Operating Mode Notification frame with EMLMR Mode subfield equal to 1 or 0 to enable or disable EMLMR mode, respectively.

After successful transmission of the EML Operating Mode Notification frame from the non-AP STA affiliated with the non-AP MLD to an AP affiliated with an AP MLD, the non-AP STA and the AP initialize the Transition Timeout timer with the Transition Timeout subfield value in the EML Capabilities subfield of the Basic variant Multi-Link element received from the AP. The Transition Timeout timer begins counting down from the end of the PPDU containing the immediate response to the EML Operating Mode Notification frame. The AP should send an EML Operating Mode Notification frame to the non-AP STA with EML Control field set to the same value as EML Control field in the received EML Operating Mode Notification frame from the non-AP STA before the Transition Timeout expires.

The non-AP MLD shall transition to the indicated mode immediately after successfully receiving the EML Operating Mode Notification frame from the AP or immediately after the Transition Timeout timer expires, whichever comes first.

When a non-AP MLD associates with an AP MLD, the initial state of EMLMR mode for the non-AP MLD immediately after the association is enabled state, and the initial power management mode of STAs affiliated with the non-AP MLD operating on EMLMR links follows rules defined in 35.3.6.1.4 (Power state after enablement). (#3402)

A non-AP MLD with dot11EHTEMLMROptionImplemented equal to true shall indicate the minimum padding duration required for the non-AP MLD for EMLMR link switch in the EMLMR Delay subfield in the Common Info field of transmitted Basic variant ML elements. .

NOTE — The link switching can happen during the transmission time of the initial response frame. However, the duration of initial response frame can be different depending on the initial frame. The non-AP MLD might determine the minimum padding duration such that it can be satisfied even when the shortest initial response frame is used on EMLMR links (E.g., a CTS frame in non-HT PPDU with the highest rate in the BSSBasicRateSet parameters).

When an AP of an AP MLD transmits a PPDU that initiates a frame exchange with a non-AP MLD operating in EMLMR mode, the AP shall ensure that the padding duration of the PPDU is longer than or equal to the minimum padding duration value indicated by the EMLMR Delay field of the Basic variant Multi-Link element received from the non-AP MLD.

When a non-AP MLD operates in the EMLMR mode, after initial frame exchange subject to its per-link spatial stream capabilities and operating mode on one of the EMLMR links, the non-AP MLD shall be able to support the following until the end of the frame exchange sequence initiated by the initial frame exchange:

* Receive PPDUs with the number of spatial streams up to the value as indicated in the EMLMR Rx NSS subfield of TBD element at a time on the link for which the initial frame exchange was made.
* Transmit PPDUs with the number of space-time streams up to the value as indicated in the EMLMR Tx NSS subfield of TBD element at a time on the link for which the initial frame exchange was made.

NOTE — Values of EMLMR Rx NSS subfield and EMLMR Tx NSS subfield are not applied to the initial frame exchange. Therefore, spatial stream capabilities and operating modes for each link that are used when EMLMR mode is disabled are applied to the initial frame exchange. (#2104)

When a non-AP MLD operates in the EMLMR mode, after initial frame exchange on a link of the EMLMR links with an AP MLD, the non-AP MLD and the AP MLD shall not initiate any frame exchange with each other on any other link of the EMLMR links until the frame exchange on the link is completed. (#2111, 2758, 3207)

After the end of the frame exchange sequence, each STA of the non-AP MLD in the EMLMR mode shall be able to transmit or receive PPDU, subject to its per-link spatial stream capabilities and operating mode and subject to any switching delay indicated by the non-AP MLD.