IEEE P802.11  
Wireless LANs

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Abstract

This submission proposes resolutions for multiple comments related to TGbe D1.0 with the following CIDs:

16303 16304 16946 15922 16429 16947 16562 15452 15917 16948

17858 17859 16949 16563 16951 17866 17884 15155 16952 16953

16954 15921 16428 15129

Revisions:

* Rev 0: Initial version of the document.

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** | **PP** | **LL** | **Comment** | **Proposed Change** | Resolution |
| 16303 | 572 | 4 | The current EMLMR operation consumes more power when non-AP STAs affiliated with a non-AP MLD are in power management mode. When a non-AP STA transmits a PS-poll frame to the AP MLD to receive BU, it must use multiple RF chains of the MLD after receiving the initial frame. To improve power efficiency in the non-AP MLD, a method that allows the MLD to choose its NSS for power management is needed. For example, the non-AP MLD can preset its NSS and MCS for power management, or the non-AP MLD can include signaling in its response frame that contains information about its preferred NSS and MCS. | As in comment. | Rejected  eMLMR procedure already allows the non-AP MLD to modify the eMLMR NSSs by exchanging an additional EML Operation mode change. On a side note, the use of a particular MCS set as opposed to another MCS set has very limited (if any) impact to power consumption. But yet also this is allowed to be updated. |
| 16304 | 572 | 4 | EMLMR non-AP MLD can suffer from delay including MediumSyncDelay, if it uses all RF chains for DL/UL transmission. For example, some low-latency TIDs can be mapped to a specific link. If transmissions of other link are performed, low-latency TID will be delayed due to EMLMR transmission and MediumSyncDelay. To address this issue, non-AP MLD may choose not to move all RF chains for Rx/Tx and leave some RF chains in the specific link(s). | As in comment. | Rejected –  The comment fails to identify a technical issue. The non-AP MLD can move back to MLMR mode, which provides the functionality mentioned by the commenter. |
| 16946 | 572 | 4 | "after the initial frame exchange subject to its per-link" missing comma before "subject" | As it says in the comment | Accepted |
| 15922 | 572 | 5 | Per current text it's not clear when a non-AP MLD is in a TXOP (as the initiator or responder) over a link, is it able to do frame exchange over the other link? The non-AP MLD may not use all its TX/RX chains during the EMLMR TXOP over one link and may be able to do concurrent frame exchange over the other link with the remaining TX/RX chains. Please add the necessary rules to allow the aforementioned case. | As in comment | Rejected --  The comment fails to identify a technical issue. The spec clarifies what the behavior is on the eMLMR links which is required to provide the desired functionality. Defining functionality for the other links adds to the complexity while not providing much gains. Please note that if the non-AP MLD intends to use the multiple links it can always move to operate as an MLMR MLD. |
| 16429 | 572 | 5 | Per current text it's not clear when a non-AP MLD is in a TXOP (as the initiator or responder) over a link, is it able to do frame exchange over the other link? The non-AP MLD may not use all its TX/RX chains during the EMLMR TXOP over one link and may be able to do concurrent frame exchange over the other link with the remaining TX/RX chains. Please add the necessary rules to allow the aforementioned case. | As in comment | Rejected --  The comment fails to identify a technical issue. The spec clarifies what the behavior is on the eMLMR links which is required to provide the desired functionality. Defining functionality for the other links adds to the complexity while not providing much gains. Please note that if the non-AP MLD intends to use the multiple links it can always move to operate as an MLMR MLD. |
| 16947 | 572 | 18 | "After the end of the frame exchange sequence, each non-AP STA affiliated with 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 defined by EHT Capabilities element, the exchanged Operating Mode Notification frame, (EHT) OM control and subject to any switching delay indicated by the non-AP MLD." -- obviously after the frame exchange you still are able to tx/rx PPDUs (missing plural), subject to your capabilities | Delete the cited text | Rejected  Discussion: this sentence describes the rule that after the frame exchanges in the first EMLMR link with the RF chains of the other EMLMR links switching to the first EMLMR link, the RF chains switch back to the other links. |
| 16562 | 572 | 19 | The following 2 sentences seems repetitive and only one of them shall be remained: Sentence 1 (P572 L19 ):" After the end of the frame exchange sequence, each non-AP STA affiliated with 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 defined by EHT Capabilities element, the exchanged Operating Mode Notification frame, (EHT) OM control and subject to any switching delay indicated by the non-AP MLD." Sentence 2 (P572 L30 ): " The non-AP MLD shall switch to its per-link spatial stream capabilities defined by EHT Capabilities element or the latest OM (if exists) on the EMLMR links after the time duration indicated in the EMLMR Delay subfield after the end of the TXOP." | 1. If both sentences are required - please locate them together and explain the distinction between them 2. Otherwise - please remove the redundant sentence. | Revised  Discussion: generally agree with the commenter. P572L30 will be removed from the draft.  TGbe editor to make changes in THIS DOCUMENT with CID tag 16562 |
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| 15452 | 572 | 28 | When a non-AP MLD operates in EMLMR mode, it is not specified for untriggered UL transmissions how it selects its EMLMR STA which initiates the frame exchange | Specify how the affiliated non-AP STA which initiates the frame exchange is selected | Rejected  Discussion: the selection of the EMLMR STA for initiating the TXOP is the implementation choice. |
| 15917 | 572 | 28 | "If an EMLMR STA of a non-AP MLD obtains the TXOP and transmits frames, the PPDUs that carries the frames are subject to the MCS and Nss in EMLMR Supported MCS and Nss Set announced by the non-AP MLD. The non-AP MLD shall switch to its per-link spatial stream capabilities defined by EHT Capabilities element or the latest OM (if exists) on the EMLMR links after the time duration indicated in the EMLMR Delay subfield after the end of the TXOP." this operation conflicts with the base line rule that a STA can only use the antennas that passed CCA for TX operation. If this new rule is added, please provide justification this new rule will not generate unfairness to legacy STAs. | Please clarify | Reject  Discussion: the EMLMR operation is like the dynamic SM power save where the single RF chain is used for CCA to decide whether the CTS can be transmitted after receiving the soliciting MU-RTS, RTS or the other soliciting frame. |
| 16948 | 572 | 28 | "If an EMLMR STA of a non-AP MLD obtains the TXOP and transmits frames, the PPDUs that carries the frames" -- grammar all over the place | Change to "If an EMLMR STA of a non-AP MLD obtains a TXOP and transmits frames, the PPDUs that carry the frames" | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 16948. |
| 17858 | 572 | 28 | Replace 'STA of a non-AP MLD' with 'STA affiliated with non-AP MLD'. | As in comment | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 17858 |
| 17859 | 572 | 28 | the PPDUs that carries the frames' needs to be fixed. | Either change to 'each PPDU that carries the frames' or 'PPDUs that carry frames'. | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 17859 |
| 16949 | 572 | 29 | "subject to the MCS and Nss in EMLMR Supported MCS and Nss Set announced" -- not clear what this means | Change to "are transmitted at an EHT-MCS and NSS indicated as supported in the EMLMR Supported MCS and Nss Set field advertised" | Accepted |
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| 16563 | 572 | 35 | Replace the "of" with a "affiliated with" term in the following sentence:" When an AP affiliated with the AP MLD as the TXOP holder does the frame exchanges with an EMLMR STA of a non-AP MLD and the frame exchanges with the EMLMR STA are not finished..." | The sentence should be revised as follows: "When an AP affiliated with the AP MLD as the TXOP holder does the frame exchanges with an EMLMR STA \*affiliated with\* a non-AP MLD and the frame exchanges with the EMLMR STA are not finished.." | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 16563 |
| 16951 | 572 | 35 | "does the frame exchanges" is too casual | Change to "performs frame exchanges". Ditto line 38 "shall not do the frame exchange" -> "shall not initiate a frame exchange" and line 37 "shall not initiate the frame exchanges" -> "shall not initiate a frame exchange" | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 16951 |
| 17866 | 572 | 35 | Change the following: 'does the' --> 'performs'; 'of the' --> 'affiliated with the' throughout the paragraph; 'not finished' --> 'ongoing' | As in comment | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 17866 |
| 17884 | 572 | 35 | "When an AP affiliated with the AP MLD as the TXOP holder does the frame exchanges with an EMLMR STA of a non-AP MLD and the frame exchanges with the EMLMR STA are not finished, another AP affiliated with the AP MLD \*shall not\* initiate the frame exchanges with another EMLMR STA of the non-AP MLD, and another EMLMR STA of the non-AP MLD shall not do the frame exchange with its associated AP." What if the AP MLD wants to send initial frame on both links and let the non-AP MLD decide which link to respond on? The cited rule limits the performance of the EMLMR mode. | Change "shall not" to "should not". | Rejected  Discussion: what the comment asked makes the implementation complicated with very limited benefits. |
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| 15155 | 572 | 42 | Clarify that it is EMLMR non-AP STA affiliated with a non-AP MLD in the description and the figure. Also fix other instances in the same clause. | Use "EMLMR non-AP STA affiliated with a non-AP MLD" in description and the figure. Also fix other instances in the same clause. | Rejected  Discussion: in the paragraph and figure, “EMLMR STA affiliated with a non-AP MLD” is used. |
| 16952 | 572 | 44 | "the QoS Null frame" wrong article | Change to "a QoS Null frame" | Accepted |
| 16953 | 572 | 46 | "the QoS Null" should be "the QoS Null frame" | As it says in the comment | Accepted |
| 16954 | 572 | 48 | "no more than the MCS, Nss in EHT Capabilities element" -- there is no "MCS, Nss in EHT Capabilities element". Also "no more" is not clear | Refer to specific subfields of the EHT Capabilities element and clarify the "no more than" test (ditto at line 47) | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 16954 |
| 15921 | 572 | 54 | Please clarify in the figure how/when the switching from per-link MCS/NSS to EMLMR MCS/NSS happens after receiving the initial frame; also please clarity the switching back to per-link MCS/NSS at the end of frame exchange. | As in comment | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 15921 |
| 16428 | 572 | 54 | Please clarify in the figure how/when the switching from per-link MCS/NSS to EMLMR MCS/NSS happens after receiving the initial frame; also please clarity the switching back to per-link MCS/NSS at the end of frame exchange. | As in comment | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 16428 |
| 15129 | 572 |  | Figure 35-36 does not show anything special to EMLMR but just showing two frames, QoS Null and A-MPDU, exchanged between an AP and a STA. By the figure itself, it does not give new information to the readers. Maybe you can add conditions on NSS and MCS from the body text to the figure. | As in comment. | Revised  Generally agree with the commenter.  TGbe editor to make the changes in THIS DOCUMENT with CID tag 15129 |

**35.3.18 Enhanced multi-link multi-radio operation**

*TGbe editor: Please change 9.4.2.312.2.3 as follows:*

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When a non-AP MLD operates in the EMLMR mode, after the initial frame exchange subject to its per-link spatial stream capabilities and operating mode defined by the exchanged Operating Mode Notification frame, (EHT) OM control 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 Supported MCS And NSS Set subfield of the EML Control field of the EML Operating Mode Notification frame at a time on the link for which the initial frame exchange was made.

—Transmit PPDUs with the number of spatial streams up to the value as indicated in the EMLMR Supported MCS And NSS Set subfield of the EML Control field of the EML Operating Mode Notification frame at a time on the link for which the initial frame exchange was made.

(#16562)After the end of the frame exchange sequences initiated by the AP, each non-AP STA affiliated with 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 defined by EHT Capabilities element, the exchanged Operating Mode Notification frame, (EHT) OM control and subject to any switching delay indicated by the non-AP MLD.

Each EMLMR STA independently maintains its own power management mode and (#16258)the awake/doze state in power save mode.

(#16948, 17858)If an EMLMR STA affiliated with a non-AP MLD obtains a TXOP and transmits frames, (#17859) the PPDUs that carry the frames are subject to the MCS and Nss in EMLMR Supported MCS and Nss Set announced by the non-AP MLD. (#16562)

(#16951, 17866)If an AP affiliated with the AP MLD is the TXOP holder and performs frame exchanges with an EMLMR STA (#16563)affiliated with a non-AP MLD and the frame exchanges with the EMLMR STA are not finished, then another AP affiliated with the AP MLD shall not initiate frame exchanges with another EMLMR STA affiliated with the non-AP MLD, and another EMLMR STA (#16563)affiliated with the non-AP MLD shall not (#16951)initiate frame exchanges with its associated AP.

(#15157)An example of frame exchanges during EMLMR operation is shown in AF.15 (Examples of enhanced multi-link multi-radio operation(#15157)).

**AF.15 Examples of enhanced multi-link multi-radio operation(#15157)**

*TGbe editor: Please change AF.15 as follows:*

Figure AF-46 (An example of a frame exchange sequence between an AP affiliated with an AP MLD and an EMLMR STA affiliated with a non-AP MLD(#15157)) gives an example of frame exchange sequences that starts with the QoS Null frame between an AP affiliated with an AP MLD and an EMLMR STA affiliated with a non-AP MLD. (#15921, 16428, 15129)The non-AP MLD switches its RF chain(s) from the other EMLMR link(s) to the the EMLMR link where the QoS Null is received after finishing the decoding of QoS Null frame. (#16954)The AP selects the NSS, MCS of the PPDU carrying the QoS Null that are supported in the Supproted EHT-MCS And Nss Set field of the EHT Capabilities element announced by the EMLMR STA. (#16954)The AP selects the NSS, MCS of the PPDU carrying the A-MPDU that are supported in the EMLMR Supported MCS And Nss Set field of the EML Control field announced by the EMLMR STA.

QoS Null

Ack

A-MPDU

BA

AP affiliated with AP MLD

EMLMR STA affiliated with

non-AP MLD

SIFS

(#15921, 16428, 15129)AP MLD does the RF chain switch from the EMLMR link where the QoS Null is received to the other EMLMR link(s).

(#15921, 16428, 15129) non-AP MLD does the RF chain switch from the other EMLMR link(s) to the EMLMR link where the QoS Null is received.

**Figure AF-46—An example of a frame exchange sequence between an AP affiliated with an AP MLD and an EMLMR STA affiliated with a non-AP MLD(#15157)**

SIFS

SIFS