IEEE P802.11
Wireless LANs

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| LB271  |
| Date: 2023-01-11 |
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Abstract

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

 16940 16941 16559 16560 16942 16561 15649 15925 16432 15032

16106 16943 16944 15915 15916 16618 16945

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 |
|  |  |  |  |  |  |
| 16940 | 571 | 5 | "The EMLMR link switching" -- excess article, for once! | Delete "The" | Accepted |
| 16941 | 571 | 6 | "the duration ofinitial response frame" missing article | Add "the" after "of" | Accepted |
| 16559 | 571 | 10 | As opposed to EMLSR mode (see P565L16), there is no requirement for the EMLMR STA to be in awake state till the reception of the initial frame. Please add such a requirement, as proposed. | Consider adding the following requirement: "When a non-AP MLD is operating in the EMLMR mode with an AP MLD supporting the EMLMR mode, the non-AP MLD shall be able to listen on the EMLMR link(s), by having its affiliated non-AP STA(s) corresponding to those links in awake state. The listening operation includes CCA and receiving the initial frame of frame exchanges that is initiated by the AP MLD." | Revised.Discussion: generally agree with the commenter. TGbe editor to make changes in THIS DOCUMENT under CID tag 16559 |
| 16560 | 571 | 14 | As opposed to EMLSR mode (see P565L32), there is no requirement for the frame type in which the EMLMR Delay field is received. Please add such a requirement, as proposed. | Please revise the sentence as follows:"...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 Multi-Link element \*carried in a (Re)Association Request frame that the non-AP STA affiliated with the non-AP MLD transmits\*". | RevisedTGbe editor to make changes in THIS DOCUMENT with CID tag 16560 |
| 16942 | 571 | 16 | “The initial frame exchange can be any frame exchange with the requirement the soliciting frame needs tosatisfy the padding requirement, e.g., through Trigger frame padding if the soliciting frame is Trigger frame, throughMPDU Delimiter padding if the soliciting frame is carried in A-MPDU. “ – grammar all over the place | Change to “The initial frame exchange can be any frame exchange as long as the soliciting framesatisfies the padding requirement, e.g., through Trigger frame padding if the soliciting frame is a Trigger frame, or throughMPDU delimiter padding if the soliciting frame is carried in an A-MPDU. “ | Accepted |
| 16561 | 571 | 17 | According to note 2, in EMLMR mode, the initial frame can be any frame. Specifically it can be MU-RTS or Trigger frame which can apply for multiple non-AP STAs (affiliated with non-AP MLDs).Need to explain what are the MCS and Nss values that are used in the frame exchange that is done in MU case (since each STA has its own set of values). | 1. If the EMLMR mode can be done for MU case – please clarify what are the MCS and Nss values that are used for the frame exchange that is done in the EMLMR mode of operation (as well as an illustrative figure to show such an example).2. If the EMLMR mode can’t be applied for the MU case – please add a specific note to explicitly clarify this point. | RejectedDiscussion: the initial frame can be in SU or MU PPDU, the only restriction is that the Nss, MCS of the initial PPDU needs to satisfy the Rx requirement of the recipient as defined in P570L1. |
| 15649 | 571 | 21 | There will be an issue in the Trigger Based sounding sequence when the non-AP STA affiliated with a non-AP MLD in EMLSR mode operating on one of EMLSR links is not the only beamformee and is not triggered for the feedback by the first BFRP TF. It may switch back to listening state during the first BFRP round. | Fix the issue | RejectedDiscussion: when soliciting the beamformees that are EMLMR STSs for a trigger-based sounding, the AP needs to guarantee that all the beamformees need to be trigger by its first BFRP Trigger. |
| 15925 | 571 | 23 | There is no EMLMR Transition delay subfield; please fix this by either adding a new subfield or just use the EMLMR Delay subfield for the switch back delay as well. | As in comment | RevisedDiscussion: in EMLSR mode, EMLSR Padding Delay and EMLSR Transition Delay are defined. The reason is that in EMLSR non-AP MLD the time of the radio switch to a link for receiving the following frames (that can’t be 0us) and the time of the radio switch for listening in multiple links ( that could be 0us, i.e. no radio switch in some implementation) are different. In EMLMR mode, the similar case may happen.TGbe editor to make change in THIS DOCUMENNT with tag 15925 |
| 16432 | 571 | 23 | There is no EMLMR Transition delay subfield; please fix this by either adding a new subfield or just use the EMLMR Delay subfield for the switch back delay as well. | As in comment | RevisedDiscussion: in EMLSR mode, EMLSR Padding Delay and EMLSR Transition Delay are defined. The reason is that in EMLSR non-AP MLD the time of the radio switch to a link for receiving the following frames (that can’t be 0us) and the time of the radio switch for listening in multiple links ( that could be 0us, i.e. no radio switch in some implementation) are different. In EMLMR mode, the similar case may happen.TGbe editor to make change in THIS DOCUMENNT with tag 16432 |
| 15032 | 571 | 24 | No EMLMR Transition Delay is defined in EML capability | Please add it in EML capability | RevisedDiscussion: in EMLSR mode, EMLSR Padding Delay and EMLSR Transition Delay are defined. The reason is that in EMLSR non-AP MLD the time of the radio switch to a link for receiving the following frames (that can’t be 0us) and the time of the radio switch for listening in multiple links ( that could be 0us, i.e. no radio switch in some implementation) are different. In EMLMR mode, the similar case may happen.TGbe editor to make change in THIS DOCUMENNT with tag 15032 |
| 16106 | 571 | 24 | Need to change "EMLMR Transition Delay subfield" to "EMLMR Delay subfield" | As in the comment | RevisedDiscussion: in EMLSR mode, EMLSR Padding Delay and EMLSR Transition Delay are defined. The reason is that in EMLSR non-AP MLD the time of the radio switch to a link for receiving the following frames (that can’t be 0us) and the time of the radio switch for listening in multiple links ( that could be 0us, i.e. no radio switch in some implementation) are different. In EMLMR mode, the similar case may happen.TGbe editor to make change in THIS DOCUMENNT with tag 16016 |
| 16943 | 571 | 23 | "by EHT Capabilities element" missing article | Add "the" after "by" | Accepted |
| 16944 | 571 | 23 | "the latest OM (if exists)" -- OM not defined, and exists not clear either | Change to "the current operating mode (if different)". Ditto at 572.31 | RevisedDiscussion: generally agree with the commenter. TGbe editor to make change in THIS DOCUMENNT with CID tag 16944 |
| 15915 | 571 | 36 | "The MAC of the STA affiliated with the non-AP MLD that received the initial frame receives a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay starting at the end of the PPDU transmitted by the STA affiliated with the non- AP MLD as a response to the most recently received frame from the AP affiliated with the AP MLD or starting at the end of the reception of the PPDU containing a frame for the STA from the AP affiliated with the AP MLD that does not require immediate acknowledgement and the STA affiliated with the non-AP MLD does not detect, within the PPDU corresponding to the PHY- RXSTART.indication any of the following frames: ". Same as eMLSR case, the EMLMR protocol should be revised to optimize the waiting time for the EMLMR STAs | Add extra conditions to optimize the waitin time of eMLMR STAs | RejectedDiscusison: the commenter didn’t give enough information to address the comment. |
| 15916 | 571 | 55 | "a NDP Announcement frame that has one of the STA Info fields addressed to the non-AP STA affiliated with the non-AP MLD and a sounding NDP" is not sufficient to cover the sounding sequence for eMLSR STAs. | Add extra rules that mandating AP to solicte sounding feedback from eMLSR STAs in the first BFRP trigger frame if TB based sounding sequence is used. | RevisedDiscussion: generally agree with the commenter.TGbe editor to make change in THIS DOCUMENNT with CID tag 15916 |
| 16618 | 571 | 56 | Replace "a" with "an" in the following sentence: "a NDP Announcement frame that has one of the STA Info fields addressed to the STA affiliated with the non-AP MLD and a sounding NDP" | Revise the sentence as follows: "an NDP Announcement frame that has one of the STA Info fields addressed to the STA affiliated with the non-AP MLD and a sounding NDP" | Accepted |
| 16945 | 571 | 62 | "The AP affiliated with the AP MLD should transmit before the TXNAV timer expires" -- it has to do so, else it will need to re-contend | Change "should" to "shall" | RejectedDiscussion: the AP can do the other things, e.g. ending the TXOP without transmiting anything. |

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

*TGbe editor: Please change 9.4.2.312.2.3 as follows:* (#15925, 16432, 15032, 16016)

......

B0 B1 B3 B4 B6 B7 B8 B10 B11 B14 B15

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| EMLSRSupport | EMLSRPadding Delay/EMLMR Padding Delay | EMLSRTransition Delay/EMLMR Transition Delay | EMLMRSupport |  Reserved | Transition Timeout | Reserved |

Bits: 1 3 3 1 3 4 1

**Figure 9-1002j—EML Capabilities subfield format**

**……**

The EMLSR Padding Delay subfield indicates the minimum MAC padding duration of the Padding field of the initial Control frame requested by the non-AP MLD as defined in 35.3.17 (Enhanced multi-link single radio operation). The EMLMR Padding Delay subfield indicates the minimum MAC padding duration of the Padding field of the initial frame requested by the non-AP MLD as defined in 35.3.18 (Enhanced multi-link multiple radio operation). When the EMLSR Padding Delay/EMLMR Padding Delay subfield is included in a frame sent by an AP affiliated with an AP MLD, the EMLSR Padding Delay/EMLMR Padding Delay subfield is reserved. The EMLSR Padding Delay/EMLMR Padding Delay subfield includes 3 bits and is set as defined in [Table 9-401e (Encoding of the EMLSR Padding Delay/EMLMR Padding Delay subfield)](#bookmark177).

**Table 9-401e—Encoding of the EMLSR Padding Delay**/EMLMR Padding Delay **subfield**

|  |  |
| --- | --- |
| **EMLSR Padding Delay subfield value** | **EMLSR****padding delay** |
| 0 | 0 µs |
| 1 | 32 µs |
| 2 | 64 µs |
| 3 | 128 µs |
| 4 | 256 µs |
| 5–7 | Reserved |

The EMLSR Transition Delay subfield indicates the transition delay time needed by a non-AP MLD to switch from exchanging frames on one of the enabled links to the listening operation on the enabled links (see 35.3.17 (Enhanced multi-link single radio operation)). The EMLMR Transition Delay subfield indicates the transition delay time needed by a non-AP MLD to switch from exchanging frames on one of the enabled links to the listening operation on the enabled links (see 35.3.18 (Enhanced multi-link single radio operation)). When the EMLSR Transition Delay/EMLSR Transition Delay subfield is included in a frame sent by an AP affiliated with an AP MLD, the EMLSR Transition Delay subfield is reserved. The EMLSR Transition Delay/EMLSR Transition Delay subfield includes 3 bits and is set as defined in [Table 9-401f](#bookmark178) [(Encoding of the EMLSR Transition Delay subfield)](#bookmark178).

**Table 9-401f—Encoding of the EMLSR Transition Delay**/EMLSR Transition Delay **subfield**

|  |  |
| --- | --- |
| **EMLSR Transition Delay subfield value** | **EMLSR****transition delay** |
| 0 | 0 µs |
| 1 | 16 µs |
| 2 | 32 µs |
| 3 | 64 µs |
| 4 | 128 µs |
| 5 | 256 µs |
| 6–7 | Reserved |

The EMLMR Support subfield indicates support of the EMLMR operation for an MLD. The EMLMR Sup- port subfield is set to 1 if the MLD supports the EMLMR operation; otherwise it is set to 0. For a non-AP MLD, the EMLMR Support subfield is set to 0 if the EMLSR Support subfield is set to 1.

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**35.5.2.2.3 Padding for a triggering frame**

*TGbe editor: Please change 35.8.5.1 as follows:* (#15925, 16432, 15032, 16016)

……

When an EHT AP of an AP MLD transmits a triggering frame using a non-HT or non-HT duplicate PPDU as an initial frame to initiate a frame exchange with a non-AP MLD operating in EMLMR mode, the AP shall ensure that the number of bits in the PSDU following the last bit of the User Info field addressed to the non-AP MLD is at least *LPAD* *MAC* defined in [Equation (35-1)](#bookmark122) together with the padding requirement defined in 26.5.2.2.3 (Padding for a triggering frame)

*LPAD* *MAC*

= *NDBPSmPAD*

(35-1)

where

0

if *EMLMR*\_ *PADDING*\_*DELAY* is 0

*mPAD* =



2*EMLSR*\_ *PADDING*\_*DELAY* + 2

Otherwise

*EMLMR*\_*Padding*\_*DELAY* is the value of the EMLMR Padding Delay subfield in the EML Capabilities subfield in the Multi-Link element.

*NDBPS* is defined in Table 17-4 (Modulation-dependent parameters).

NOTE—The initial frame of a frame exchange sequence to initiate a frame exchange with a non-AP MLD operating in EMLMR mode can be sent using the non-HT PPDU, non-HT duplicate PPDU, HT PPDU, VHT PPDU, HE PPDU, or EHT PPDU. However, for HT PPDU, VHT PPDU, HE PPDU, or EHT PPDU, there are other methods to do the padding for the initial frame, so the above padding method only applies to the case where the initial frame is sent using non-HT or non-HT duplicate PPDU.**35.8.5 Channel access rules for R-TWT SPs**

**35.8.5.1 TXOP and backoff procedures rules for R-TWT SPs**

*TGbe editor: Please change 35.8.5.1 as follows:* (#15925, 16432, 15032, 16016)

**……**

When a non-AP STA, which is affiliated with a non-AP MLD and operates on one of a pair of NSTR or EMLSR or EMLMR links, is a member of a R-TWT SP on the first link; if the second non-AP STA affiliated with the same MLD is not a member of any other R-TWT SPs on the second link that overlap with the first SP, then the second non-AP STA and its associated AP (referred as the second AP), if their respective dot11RestrictedTWTOptionImplemented equal to true, should follow the rules below:

—The second AP as a TXOP holder on the second link should ensure its TXOP ends no later than *T*amount of time before the start time of the R-TWT SP on the first link,

—The second non-AP STA as a TXOP holder on the second link should ensure its TXOP ends no later than *T* amount of time before the start time of the R-TWT SP on the first link,

where *T* equals to one of the following values:

—0 if the two non-AP STAs operate on a pair of NSTR links,

—the EMLSR transition delay, indicated in the EMLSR Transition Delay subfield, as specified for the pair of EMLSR links if the two non-AP STAs belong to a pair of EMLSR links,

—the EMLMR transition delay, indicated in the EMLMR Transition Delay subfield, as specified for the pair of EMLMR links if the two non-AP STAs belong to a pair of EMLMR links.

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

*TGbe editor: Please change 35.3.18 as follows:*

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(#15925, 16432, 15032, 16016) A non-AP MLD with dot11EHTEMLMROptionActivated equal to true shall indicate the minimum padding duration required for the non-AP MLD for EMLMR link switch in the EMLMR Padding Delay subfield in the Common Info field of transmitted Basic Multi-Link elements.

NOTE 1—The EMLMR link switching, which is the action of switching transmit chains and receive chains from one link to another link, 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).

(#16559) When a non-AP MLD is operating in the EMLMR mode, the non-AP MLD shall be able to listen on the EMLMR link(s), by having its affiliated non-AP STA(s) corresponding to those link(s) in awake state. The listening operation includes CCA and receiving the initial frame of frame exchanges that is initiated by the AP MLD.

When an AP affiliated with 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 Padding (#15925, 16432, 15032, 16016) Delay field of the Basic Multi-Link element in the (Re)Association Request frame (#16560) received from the non-AP MLD.

(#15916)When an AP affiliated with an AP MLD does the TB sounding that includes the EMLMR STA(s) as the beamformee(s), the AP shall schedule all the EMLMR STA(s) to transmit its sounding feedback in the first BRFP Trigger frame of the TB sounding.

NOTE 2—The initial frame exchange can be any frame exchange with the requirement the soliciting frame needs to satisfy the padding requirement, e.g., through Trigger frame padding if the soliciting frame is Trigger frame, through MPDU Delimiter padding if the soliciting frame is carried in A-MPDU.

Within a TXOP initiated by an AP affiliated with AP MLD with an EMLMR STA affiliated with a non-AP MLD as the TXOP responder, the non-AP MLD shall switch to its per-link spatial stream capabilities defined by EHT Capabilities element or the (#16944)current operating mode (if different) per (EHT) OM Control or Operaitng Mode Notification element after the time indicated in the EMLMR Transition Delay subfield of the EML Capabilities subfield in the Common Info field of the Basic Multi-Link element if any of the following conditions is met and this is defined as the end of the frame exchange sequence:

—The MAC of the STA affiliated with the non-AP MLD that received the initial frame does not receive a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay starting at the end of the PPDU transmitted by the STA affiliated with the non-AP MLD as a response to the most recently received frame from the AP affiliated with the AP MLD or starting at the end of the reception of the PPDU containing a frame for the STA from the AP affiliated with the AP MLD that does not require immediate acknowledgement.

—The MAC of the STA affiliated with the non-AP MLD that received the initial frame receives a PHY-RXSTART.indication primitive during a timeout interval of aSIFSTime + aSlotTime + aRxPHYStartDelay starting at the end of the PPDU transmitted by the STA affiliated with the non-AP MLD as a response to the most recently received frame from the AP affiliated with the AP MLD or starting at the end of the reception of the PPDU containing a frame for the STA from the AP affiliated with the AP MLD that does not require immediate acknowledgement and the STA affiliated with the non-AP MLD does not detect, within the PPDU corresponding to the PHY- RXSTART.indication any of the following frames:

•an individually addressed frame with the RA equal to the MAC address of the STA affiliated with the non-AP MLD

•a Trigger frame that has one of the User Info fields addressed to the STA affiliated with the non-AP MLD

•a CTS-to-self frame with the RA equal to the MAC address of the AP affiliated with the AP MLD

•a Multi-STA BlockAck frame that has one of the Per AID TID Info fields addressed to the STA affiliated with the non-AP MLD

•a NDP Announcement frame that has one of the STA Info fields addressed to the STA affiliated with the non-AP MLD and a sounding NDP

—The STA affiliated with the non-AP MLD that received the initial frame does not respond to the most recently received frame from the AP affiliated with the AP MLD that requires immediate response after a SIFS.

The AP affiliated with the AP MLD should transmit before the TXNAV timer expires another initial frame addressed to the non-AP STA affiliated with the non-AP MLD if the AP intends to continue the frame exchanges with the STA and did not receive the response frame from this STA for the most recently transmitted frame that requires an immediate response after a SIFS.

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