IEEE P802.11
Wireless LANs

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| CC36 CR for EMLMR Links Sets |
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Abstract

This submission proposes resolutions of comments received from TGbe comment collection CC36 based on TGbe D1.3.

* 6217

Revisions:

* Rev 0: Initial version of the document.
1. **Introduction**

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. The introduction and the explanation of the proposed changes are 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 802.11be 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** | **Clause**  | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 6217 | Mickael Lorgeoux | 35.3.16 | 282.61 | The current text considers only one set of EMLMR links, it is restrictive. | The signaling added for EMLMR links must support the non-AP MLD implementations with several sets of radios supporting the EMLMR mode independtly. | Revised.Agree with the commenter. Proposed resolution addresses the suggested change TGbe editor to make the changes shown in 21/xxxxr0 under all headings that include CID 6217. |

**Discussion:**

This document proposes a solution for a multi radio non-AP MLD to signal its sets of EMLMR links to an AP MLD. The signaling is performed in two steps:

1. During multi link setup, a first step signaling is performed in EML Capabilities:
	* The non-AP MLD signals all the links eligible to any EMLMR mode operation, called eligible EMLMR links. This is done through the subfield called “EMLMR Links Bitmap” which is based on Link IDs.

This first step signaling helps the AP MLD during multi link setup :

* + All the eligible EMLMR Links able to aggregate the Tx/Rx NSS signalled in EML capabilities are identified (based on Link IDs).

Once the multi link setup is completed, it is not mandatory for the AP MLD to store the content of this subfield (i.e. “EMLMR Links Bitmap”).

1. Once multi link setup is completed, the second step signaling is performed in EML Control Field carried in the EML notification frame used to activate/deactivate the EMLSR and EMLMR modes:
	* It is proposed to modify the EML Control field. The EML Control field is as follows:
	* As the support of EMLSR mode and EMLMR mode is mutualy exclusive for a non-AP MLD, the conventional “EMLSR mode” bit and “EMLMR mode” bit are replaced by a single bit called “EML mode”.
	* The conventional “EMLSR Link Bitmap” subfield is renamed “EML Link Bitmap”:
		+ When used by a single radio non-AP MLD, there is no change, the behaviour remains the one described in the D1.3 standard draft. The only impact is the name of this subfield.
		+ When used by a multi radio non-AP MLD, this subfield signals (based on Link IDs) a set of EMLMR links (part of all eligible EMLMR links signalled in EML capabilities) involved in the activated/deactivated EMLMR mode. A set of EMLMR links is called an EMLMR links set.

Assumptions:

* + To enable/disable EMLMR mode independently and simultaneously on several EMLMR links sets, the EML Link Bitmap of these sets shall be disjoint.

Optimizations:

* + For the deactivation of the EMLMR mode on a set of EMLMR links, the “EML Link Bitmap” is not included in the EML Control field carried in the EML notification frame. In such a case, the non-AP MLD sends the EML notification frame on one of the link belonging to this set.

**9.4.1.74 EML Control field**

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***TGbe Editor to make the following changes in Figure 9-144i and related description – EML Control field (#6217):***

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 B16 | B17 B22 |
|  | EML Mode | EML Link Bitmap | Reserved |
| Bits: | 1 | 16 | 6 |

**Figure 9-144i – EML Control field format (#6217)**

(#6217)The single one-bit subfield, namely EML Mode subfield, inherits from the declared supported mode (either EMLSR or EMLMR) in the EML Capabilities subfield (see 9.4.2.312.2.2, Figure 9-1002h): EML Mode subfield indicates the activation or deactivation of the sole EML OM supported as declared during the association procedure.

(#6217)A non-AP MLD that supports enhanced multi-link single radio operation (see 35.3.16 (Enhanced multi-link single radio operation)) sets the EML Mode subfield to 1 to implicitly indicate an activation of the EMLSR mode and thus that the non-AP MLD operates in EMLSR mode and to 0 to indicate a deactivation of the current EMLSR mode, and thus that the non-AP MLD does not operate in EMLSR mode. (#6217)(#7699)An AP MLD with dot11EHTEMLSROptionImplemented equal to true that receives an EML Operating Mode Notification frame from a STA affiliated with a non-AP MLD sets the EML Mode subfield of the EML Operating Mode Notification frame that is sent in response to the value obtained from the received EML Operating Mode Notification frame.

(#6217)A non-AP MLD that supports enhanced multi-link multi-radio operation (see 35.3.17 (Enhanced multi-link multi-radio operation)) sets the EML Mode subfield to 1 to implicitly indicate an activation of the EMLMR mode and thus that the non-AP MLD operates in EMLMR mode and to 0 to indicate a deactivation of the current EMLMR mode, and thus that the non-AP MLD does not operate in EMLMR mode. (#6217)(#7699)An AP MLD with dot11EHTEMLMROp-tionImplemented equal to true that receives an EML Operating Mode Notification frame from a STA affiliated with a non-AP MLD sets the EML Mode subfield of the EML Operating Mode Notification frame that is sent in response to the value obtained from the received EML Operating Mode Notification frame.

(#6217)(#6664)NOTE 1—The EML Mode subfield is used to implicitly enable or disable either the EMLSR, or the EMLMR mode. A non-AP MLD indicates which mode it supports in the EML Capabilities field of the Basic Multi-Link element that it transmits (see 9.4.2.312.2 (Basic Multi-Link element(#6700))).

(#6217)The EML Control field includes an EML Link Bitmap subfield signaling a set of links for activating the EMLSR or EMLMR OM.

(#6217)(#4759)(#5766)(#6342)The EML Link Bitmap subfield indicates the set or subset of the enabled links that is used by the non-AP MLD in the EMLSR mode. These are the EMLSR links in which the EMLSR mode to activate will apply. The bit position *i* of the EML Link Bitmap subfield corresponds to the link with the Link ID equal to *i* and is set to 1 to indicate that the link is used by the non-AP MLD for the EMLSR mode and is a member of the EMLSR links; otherwise the bit position is set to 0.

(#6217)The EML Link Bitmap subfield indicates the set or subset of the enabled links (named EMLMR links set) that is used by non-AP MLD in the EMLMR mode. These are the EMLMR links in which the EMLMR mode to activate will apply. In such a case, the bit at position i of EML Link Bitmap subfield corresponds to the link with the Link ID equal to i and is set to 1 to indicate that the link is used by non-AP MLD for the EMLMR mode and is a member of the EMLMR links set; otherwise the bit is set to 0.

(#6217)When EML Mode subfield is set to 0, i.e. to deactivate an activated EML Mode, EML Link Bitmap subfield may not be included in the EML Control field.

(#6217)(#4759)(#5766)(#6342)NOTE 2—As an example, when a non-AP MLD enables three links and the first link has Link ID equal to 0, the second link has Link ID equal to 1, and the third link has Link ID equal to 2, and the two links with Link ID equal to 1 and Link ID equal to 2 are used for the EMLSR or EMLMR operation, the two bit positions, the second bit and the third bit positions, of the EML Link Bitmap subfield are set to 1 and other bit positions are set to 0.

**9.4.2.312.2.2 Multi-Link Control field of the Basic Multi-Link element**

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***TGbe Editor to make the following changes in Figure 9-1002h – EML Capabilities subfield format (#6217):***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 B3 | B4 | B5 B7 | B8 B11 | B12 B15 | B16 B31 | B32 B35 | B36 B39 |
|  | EMLSR Support | EMLSR Delay | EMLMR Support | EMLMR Delay | Transition Timeout | Reserved | EMLMR Link Bitmap | EMLMR Rx NSS | EMLMR Tx NSS |
| Bits: | 1 | 3 | 1 | 3 | 4 | 4 | 16 | 4 | 4 |

**Figure 9-1002h—EML Capabilities subfield format (#6217)**

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***TGbe Editor to add the following texts at the end of paragraphs describing subfields of EML Capabilities subfield (#6217):***

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(#6217)EMLMR Link Bitmap indicates the eligible EMLMR links. The eligible EMLMR links are all the links eligible to any EMLMR mode operation

(#6217)When the EMLMR Link Bitmap subfield is included in a frame sent by a STA affiliated with a non-AP MLD, the i-th bit in the EMLMR Link Bitmap subfield is set to 1 if a link with Link ID equal to i is a member of the eligible EMLMR links; otherwise it is set to 0. When the EMLMR Link Bitmap subfield is included in a frame sent by an AP affiliated with an AP MLD, the EMLMR Links Bitmap subfield is set to all 0s. When the EMLMR Support subfield is set to 0, the EMLMR Link Bitmap subfield is reserved.

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*TGbe editor: Change 35.3.17 Enhanced multi-link multi-radio operation as follows (#6217):*

**35.3.17 Enhanced multi-link multi-radio operation**

(#6217)A non-AP MLD may operate in the EMLMR mode on at least one specified set of the enabled links between the non-AP MLD and its associated AP MLD. (#6217)A specified set of the enabled links in which the EMLMR mode is applied is called an EMLMR links set. (#6217)An EMLMR links set shall be indicated in the EML Link Bitmap subfield of the EML Control field of the EML Operating Mode Notification frame by setting the bit positions of the EML Link Bitmap to 1.

(#6217)An EMLMR links set indicated in the EML Link Bitmap subfield is composed of EMLMR links that were part of the eligible EMLMR links indicated in the EMLMR Link Bitmap subfield of the Common Info field of the Basic Multi-Link element.

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 (#6700)Basic Multi-Link 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 the Common Info field of transmitted (#6700)Basic Multi-Link element to dot11SupportedEMLMRRxNSS and the EMLMR Tx NSS subfield of the Common Info field of transmitted (#6700)Basic Multi-Link element to dot11SupportedEMLMRTxNSS, which indicate MLD level capabilities.

(#6217)If a non-AP MLD with dot11EHTEMLMROptionImplemented equal to true intends to switch EMLMR mode on an EMLMR links set after multi-link setup, then a non-AP STA affiliated with the non-AP MLD shall transmit an EML Operating Mode Notification frame with EML Mode subfield equal to 1 or 0 to respectively enable or disable EMLMR mode for the EMLMR links set indicated in the EML Link Bitmap subfield.

(#6217)If a non-AP MLD with dot11EHTEMLMROptionImplemented equal to true intends to deactivate a current EMLMR mode applying in an EMLMR links set after multi-link setup, then a non-AP STA affiliated with the non-AP MLD shall transmit, on a link belonging to the EMLMR link set, an EML Operating Mode Notification frame with EML Mode subfield equal to 0 to disable the EMLMR mode for this EMLMR links set.

(#6217)A non-AP MLD may enable/disable EMLMR mode independently and simultaneously on several EMLMR links sets by transmitting several EML Operating Mode Notification frames to the AP MLD. To enable/disable EMLMR mode independently and simultaneously on several EMLMR links sets, the EML Link Bitmap of these sets shall be disjoint.

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 (#6700)Basic 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.

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 (#6700)Basic Multi-Link 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 (#6700)Basic Multi-Link element received from the non-AP MLD.

(#6217)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 links of the EMLMR links set, 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 the Common Info field of transmitted (#6700)Basic Multi-Link element 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 Tx NSS subfield of the Common Info field of transmitted (#6700)Basic Multi-Link element at a time on the link for which the initial frame exchange was made.

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.