IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CC36 Comment Resolution for EMLSR – Part 1 | | | | |
| Date: 2021-8-19 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Minyoung Park | Intel Corporation |  |  | Minyoung.park@intel.com |
|  |  |  |  |  |
|  |  |  |  |  |

Abstract

This submission proposes comment resolutions for the following CIDs related to EMLSR mode enable/disable and power management received in CC36:

* 4759, 5766, 6342, 5845, 6340, 6341, ~~6776~~, 7834, 8353, 6350

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Deleted CC34 comments and added CC36 comments related to the EMLSR mode enable/disable signalling and power management; updated proposed spec text based on feedbacks from the members
* Rev 2: Added clarification for a bit of the EMLSR Link Bitmap subfield set to 0 for a single-radio non-AP MLD. Fixed typo. Moved the changes related to ‘EMLSR Links’ from doc 287 (part 2) to this document.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause Number** | **Page.**  **Line** | **Comment** | **Proposed Change** | **Resolution** |
|  |  |  |  |  |  |  |
| 4759 | Chunyu Hu | 35.3.15 | 281.19 | A non-AP MLD may want to limit the EMLSR operation over a subset of enabled links instead of all links. The EML capability only specifies # of sim links but there is no field specifying which links. | As commented: add signaling to allow the non-AP MLD specify which links to enable EMLSR. | Revised.  Agree with the commenter. Added a link bitmap that indicates which enabled links are used for the EMLSR mode.  TGbe editor to make the changes with the CID tag (#5766) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 5766 | Laurent Cariou | 35.3.15 | 281.32 | "The non-AP MLD shall be able to listen on the enabled links". My recollection is that we want to allow that a non-AP MLD can have 3 enabled links, but performs eMLSR on only 2 links. The current text is a bit ambiguous on this point. | either clarify that in the normative text or define a link bitmap in the setup of eMLSR so that we define the links on which eMLSR will apply | Revised.  Agree with the commenter. Added a link bitmap that indicates which enabled links are used for the EMLSR mode.  TGbe editor to make the changes with the CID tag (#5766) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 6342 | Minyoung Park | 35.3.15 | 281.19 | For a single-radio non-AP MLD that enabled 3 links (2.4/5/6 GHz), the non-AP MLD could choose only 2 links out of the three enabled links for the EMLSR operation. The current spec is missing which enabled links are used for the EMLSR operation. | Defined the EMLSR links, which is a subset of the enabled links, and define "EMLSR Link Bitmap" in the EML Control field. The EMLSR Link Bitmap is defined as follows: "The EMLSR Link Bitmap subfield indicates the subset of the enabled links that is used by the non-AP MLD in the EMLSR mode. The bit position i of the EMLSR 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."  Update the spec so that the EMLSR operation applies to the EMLSR links. | Revised.  Agree with the commenter. Added a link bitmap that indicates which enabled links are used for the EMLSR mode.  TGbe editor to make the changes with the CID tag (#6342) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
|  |  |  |  |  |  |  |
| 5845 | Lei Wang | 35.3.15 | 281.23 | Section 35.3.15 only specifies how to signal the capability of EMLSR in the paragraph in line 23 page 281, but has no text about how to signal a Multi-Link Single-Radio non-AP MLD is operating in the EMLSR mode. The description in line 29 to line 61 on page 281 indicates that the AP MLD side needs to know if the Multi-Link Single-Radio non-AP MLD is in EMLSR mode, in order to make the EMLSR work. | Provide the description how to signal that an Multi-Link Single-Radio non-AP MLD operates in the EMLSR mode. For example, using some text similar to EMLMR operation mode notification description in Section 35.3.16, by using the EML Operating Mode Notification frame. | Revised.  A signalling for enabling and disabling the EMLSR mode is defined.  TGbe editor to make the changes with the CID tag (#5845) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 6340 | Minyoung Park | 35.3.15 | 281.19 | A signaling mechanism that enables and disables the EMLSR mode is missing. | Add a signaling that enables and disables the EMLSR mode. Define a procedure that uses the EML Operating Mode Notification frame as the Action frame that enables/disables the EMLSR mode. | Revised.  A signalling for enabling and disabling the EMLSR mode is defined.  TGbe editor to make the changes with the CID tag (#6340) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| 6341 | Minyoung Park | 35.3.15 | 281.19 | It is unclear how the power states of the STAs of the enabled links of the non-AP MLD are set after the EMLSR mode is enabled or disabled. A non-AP MLD that opreates in the EMLSR mode is a single-radio MLD which can be in awake state on one link at a time. Before operating in the EMLSR mode, the non-AP MLD is awake on one of the enabled links. When the non-AP MLD enables the EMLSR mode, the other enabled links have to be in awake state for the listening operation. However, since the non-AP MLD is a single-radio MLD, it cannot set each enabled link's power state to awake by transmitting a frame with the PM bit set to 0 on each enabled link sequentially. Also when the non-AP MLD wants to enter PS mode and doze state on all the enabled links, setting each STA's power management mode and power state to PS mode/doze state by transmitting a frame with PM bit =1 on each link sequentially could take a long delay esp. for a busy network environment, which could cause an issue to the overall operation of the non-AP MLD. | Add the following paragraphes after the second paragraph of 35.3.15:  "A non-AP MLD with dot11EHTEMLSROptionImplemented equal to true operates in the EMLSR mode on the EMLSR links after successful transmission of an EML Operating Mode Notification frame with the EMLSR Mode subfield of the EML Control field of the frame set to 1. The EMLSR links shall be indicated in the EMLSR Link Bitmap subfield of the EML Control field of the EML Operating Mode Notification frame by setting the bit positions of the EMLSR Link Bitmap to 1. After the successful transmission of the EML Operating Mode Notification frame on one of the EMLSR links, the STAs on the other links of the EMLSR links shall transition to active mode.  A non-AP MLD with dot11EHTEMLSROptionImplemented equal to true disables the EMLSR mode after successful transmission of an EML Operating Mode Notification frame with the EMLSR Mode subfield of the EML Control field of the frame set to 0. After the successful transmission of the EML Operating Mode Notification frame on one of the EMLSR links, the STAs on the other links of the EMLSR links shall transition to power save mode after the transition delay indicated in the Transition Timeout subfield after the end of the frame transmission. Each of the STAs on the other links of the EMLSR links may transmit a frame with the Power Management subfield set to 1 and shall transition to power save mode immediately after successful transmission of the frame."  Also add 200 usec, 400 usec, and 800 usec values to the Transition Timeout subfield values of the EML Capabilities subfield. | Revised.  The EMLSR operation with the power management is added.  TGbe editor to make the changes with the CID tag (#6341) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| ~~6776~~ | Romain GUIGNARD | 35.3.15 | 281.17 | What is the state of the EMLSR mode after the (re)setup? | Please indicate EMLSR mode state after the (re)setup | Revised.  Added a sentence that defines the state of the EMLSR mode after the (re)setup.  TGbe editor to make the changes with the CID tag (#6776) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 7834 | Yong Liu | 35.3.15 | 281.23 | It is important to allow an EMLSR device to enable and disable the EMLSR mode dynamically. | Add signaling, protocol, and corresponding rules to allow a EMLSR device to enable and disable the EMLSR mode dynamically. | Revised.  A signalling for enabling and disabling the EMLSR mode is defined.  TGbe editor to make the changes with the CID tag (#7834) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 8353 | Zhiqiang Han | 35.3.15 | 281.29 | This paragraph describes the operation when a non-AP MLD is operating in the EMLSR mode, but it's better to add a paragraph to describe how to enter the EMLSR mode before this paragraph. | Please clarify it | Revised.  A signalling for enabling and disabling the EMLSR mode is defined.  TGbe editor to make the changes with the CID tag (#8353) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |
| 6350 | Minyoung Park | 35.3.15 | 281.47 | Inappropriate shall: the requirement is not to initiate a frame exchange sequence, the requirement is that a frame exchange sequence begin with an initial Control frame. | Change to "An AP MLD that initiates a frame exchange sequence with an EMLSR non-AP STA, shall begin the frame exhange with an initial Control frame." | Revised.  Agree in principle.  TGbe editor to make the changes with the CID tag (#6350) in doc.: IEEE 802.11-21/283r2  [https://mentor.ieee.org/802.11/dcn/21/11-21-0283-02-00be-cc34-cr-emlsr-part1.docx] |

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

***TGbe Editor to make the following changes in Subclause 35.3.16 (# 4759, 5766, 6342, 5845, 6340, 6341, 7834, 8353, 6350)***

(#4759, 5766, 6342) A non-AP MLD may operate in the EMLSR mode on a specified set of the enabled links between the non-AP MLD and its associated AP MLD(#2332). The specified set of the enabled links in which the EMLSR mode is applied is called EMLSR links. The EMLSR links shall be indicated in the EMLSR Link Bitmap subfield of the EML Control field of the EML Operating Mode Notification frame by setting the bit positions of the EMLSR Link Bitmap to 1.When the EMLSR mode is enabled in a single-radio non-AP MLD, the STA(s) affiliated with the non-AP MLD that operates on the link(s) that corresponds to the bit position(s) of the EMLSR Link Bitmap set to 0 shall be in doze state if a STA affiliated with the non-AP MLD that operates on one of the EMLSR links is in awake state.

(#2143)(#3206)An MLD with dot11EHTEMLSROptionImplemented equal to true shall set the EML Capabilities Present subfield to 1 and shall set the EMLSR Support subfield of Basic variant Multi-Link element (9.4.2.295b.2 (Basic variant Multi-Link element)) to 1(#2915); otherwise, the MLD shall set the EMLSR Support subfield to 0.

~~(#6776) When a non-AP MLD with dot11EHTEMLSROptionImplemented equal to true (re)associates with an AP MLD, the EMLSR mode is disabled by default.~~

(#5845, 6340, 6341, 7834, 8353) When a non-AP MLD with dot11EHTEMLSROptionImplemented equal to true intends to operate in the EMLSR mode on the EMLSR links, a STA affiliated with the non-AP MLD shall transmit an EML Operating Mode Notification frame with the EMLSR Mode subfield of the EML Control field of the frame set to 1 to an AP affiliated with an AP MLD with dot11EHTEMLSROptionImplemented equal to true. An AP affiliated with the AP MLD that received the EML Operating Mode Notification frame from the STA affiliated with the non-AP MLD should transmit an EML Operating Mode Notification frame to one of the STAs affiliated with the non-AP MLD operating on the EMLSR links within the timeout interval indicated in the Transition Timeout subfield in the EML Capabilities subfield of the Basic variant Multi-Link element starting at the end of the PPDU transmitted by the AP affiliated with the AP MLD as an acknowledgement to the EML Operating Mode Notification frame transmitted by the STA affiliated with the non-AP MLD. After the successful transmission of the EML Operating Mode Notification frame on one of the EMLSR links by the STA affiliated with the non-AP MLD, the non-AP MLD shall operate in the EMLSR mode and the STAs on the other links of the EMLSR links shall transition to active mode after the transition delay indicated in the Transition Timeout subfield in the EML Capabilities subfield of the Basic variant Multi-Link element or immediately after receiving an EML Operating Mode Notification frame from one of the APs operating on the EMLSR links and affiliated with the AP MLD. A STA on one of the other links of the EMLSR links shall not transmit a frame with the Power Management subfield set to 1 before receiving the EML Operating Mode Notification frame from the AP affiliated with the AP MLD or before the end of the timeout interval.

(#5845, 6340, 6341, 7834, 8353) When a non-AP MLD with dot11EHTEMLSROptionImplemented equal to true intends to disable the EMLSR mode, a STA affiliated with the non-AP MLD shall transmit an EML Operating Mode Notification frame with the EMLSR Mode subfield of the EML Control field of the frame set to 0 to an AP affiliated with an AP MLD with dot11EHTEMLSROptionImplemented equal to true. An AP affiliated with the AP MLD that received the EML Operating Mode Notification frame from the STA affiliated with the non-AP MLD should transmit an EML Operating Mode Notification frame to one of the STAs affiliated with the non-AP MLD operating on the EMLSR links within the timeout interval indicated in the Transition Timeout subfield in the EML Capabilities subfield of the Basic variant Multi-Link element starting at the end of the PPDU transmitted by the AP affiliated with the AP MLD as an acknowledgement to the EML Operating Mode Notification frame transmitted by the STA affiliated with the non-AP MLD. After the successful transmission of the EML Operating Mode Notification frame on one of the EMLSR links by the STA affiliated with the non-AP MLD, the non-AP MLD shall disable the EMLSR mode and the STAs on the other links of the EMLSR links shall transition to power save mode after the transition delay indicated in the Transition Timeout subfield in the EML Capabilities subfield of the Basic variant Multi-Link element or immediately after receiving an EML Operating Mode Notification frame from one of the APs operating on the EMLSR links and affiliated with the AP MLD. A STA on one of the other links of the EMLSR links shall not transmit a frame with the Power Management subfield set to 0 before receiving the EML Operating Mode Notification frame from the AP affiliated with the AP MLD or before the end of the timeout interval.

NOTE - Each of the STAs on the other links of the EMLSR links can transmit a frame with the Power Management subfield set to 1 and transition to power save mode immediately after successful transmission of the frame. (see 11.2.3.2 (Non-AP STA power management modes))

When a non-AP MLD is operating in the EMLSR mode with an AP MLD supporting the EMLSR mode the following applies:

— The non-AP MLD shall be able to listen on the EMLSR links, by having its affiliated STA(s) corresponding to those links in awake state. The listening operation includes CCA and receiving the initial Control frame of a frame exchange sequence that is initiated by an AP MLD. (#4759, 5766, 6342)

…

— An AP affiliated with the AP MLD that initiates frame exchanges with the non-AP MLD on one of the EMLSR links shall begin the frame exchanges by transmitting the initial Control frame to the non-AP MLD with the limitations specified above. (#4759, 5766, 6342, 6350)

— After receiving the initial Control frame of a frame exchange sequence, the non-AP MLD shall be able to transmit or receive frames on the link in which the initial Control frame was received and shall not transmit or receive on the other EMLSR link(s) until the end of the frame exchange sequence, and subject to its spatial stream capabilities, operation mode, and link switch delay, the non-AP MLD shall be capable of receiving a PPDU that is sent using more than one spatial stream a SIFS after the end of its response frame transmission solicited by the initial Control frame. During the frame exchange sequence, the AP MLD shall not transmit frames to the non-AP MLD on the other EMLSR link(s).(#4759, 5766, 6342)

…

9.4.1.67e EML Control field

***TGbe Editor to change the EML Control field format as shown below (#4759, 5766, 6342):***

The Enhanced Multi-Link (EML) Control field is defined in Figure 9-144c (EML Control field format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | | B1 | B2 B17 | B18 B23 |
|  | EMLSR Mode | | EMLMR Mode | EMLSR Link Bitmap | Reserved |
| Bits: | 1 | | 1 | 16 | 6 |
|  | | **Figure 9-144c – EML Control field** | | |  |

A non-AP MLD that supports Enhanced multi-link single-radio operation (see 35.3.16 (Enhanced multi-link single-radio operation)) sets the EMLSR Mode subfield to 1 to indicate that the non-AP MLD operates in EMLSR mode and to 0 to indicate that the non-AP MLD does not operate in EMLSR mode. The EMLSR Mode subfield is set to 0 for all non-AP MLDs that don’t support Enhanced multi-link single-radio operation, for all non-AP MLDs that have set the EMLMR Mode subfield to 1. An AP MLD sets the EMLSR Mode subfield to the value obtained from the corresponding received EML Operating Mode Notification frame.

…

***TGbe Editor to insert the EMLSR Link Bitmap definition after the definition of the EMLSR Mode subfield as shown below (#4759, 5766, 6342):***

The EMLSR Link Bitmap subfield indicates the subset of the enabled links that is used by the non-AP MLD in the EMLSR mode. The bit position *i* of the EMLSR 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.

NOTE – 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 operation, the two bit positions, the second bit and the third bit positions, of the EMLSR Link Bitmap subfield are set to 1 and other bit positions are set to 0.

***TGbe Editor to make the following changes in* 9.4.2.295b.2 Basic variant Multi-Link element *(#5845, 6340, 6341, 7834, 8353):***

**9.4.2.295b.2 Basic variant Multi-Link element**

**…**

The Transition Timeout subfield indicates the timeout value for EML Operating Mode Notification frame exchange in EMLMR mode (see 35.3.17 (Enhanced multi-link multi-radio operation)) and EMLSR mode.

When the Transition Timeout subfield is included in a frame sent by an AP affiliated with an AP MLD, the Transition Timeout subfield is set to 0 for 0 TU, set to 1 for 128 µs, set to 2 for 256 µs, set to 3 for 512 µs, set to 4 for 1 TU, set to 5 for 2 TUs, set to 6 for 4 TUs, set to 7 for 8 TUs, set to 8 for 16 TUs, set to 9 for 32 TUs, set to 10 for 64 TUs, set to 11 for 128 TUs, and the values 12 to 15 are reserved. When the Transition Timeout subfield is included in a frame sent by a non-AP STA affiliated with a non-AP MLD, the Transition Timeout subfield is set to 0.