### IEEE P802.11 Wireless LANs

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| 11be D2.0 CR for indicating to operate in EML mode via PS-Poll or QoS Null frame | | | | |
| Date: 2022-07-21 | | | | |
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Abstract

This submission proposes resolutions for the following CIDs:

10125

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Add TWT case

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 D2.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe D2.0 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** | **Clause** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 10125 | Xiangxin Gu | 35.3.17 | 462.56 | It's useful to have a mechanism for an EMLSR/EMLMR supporting non-AP MLD to enable EMLSR/EMLMR mode by PS-Poll or QoS Null frame after awaking from doze. | Define the mechanism to enable EMLSR/EMLMR mode by PS-Poll or QoS Null frame | **Revised:**  Agree with the commenter in principle.  Propose the non-AP MLD to piggyback the intention to operate in EML mode during this awake period on the Reserved B14 of Frame Control Subfield of PS-Poll frame or QoS Null frame.  Tgbe editor: please implement changes as shown in this doc tagged as 10125 |

**Discussion:**

**Scenario:**

A single radio non-AP MLD with 2 affiliated STA1 and STA 2 setups link 1 and 2 respectively with an AP MLD. Both STA 1 and STA 2 support 2x2 MIMO and SMPS. The non-AP MLD supports EMLSR and has enabled EMLSR mode mode on link 1 and link 2.

There are 2 services running over the links. Service 1 has aperiodic small data. Service 2 has periodic traffic with large amount of data.

At one time after awaking from doze to retrieve BUs, the STA affiliated with the non-AP MLD will have data transmission for service 1. The non-AP MLD expects not to work in EMLSR mode to save power with SMPS.

At another time after awaking from doze to retrieve BUs, the STA affiliated with the non-AP MLD will have data transmission for service 2. The non-AP MLD expects to work in EMLSR mode to have data transferred ASAP.

Actually the behaviour of the STAs affiliated with the non-AP MLD operating in EMLSR mode after awake from doze is not clear in the standard. If the non-AP MLD operates in EMLSR mode and the both 2 STA are awake and both 2 RF chains of the single radio are working during the awake time, it is power consuming because. If only the other STA keeps in doze, the non-AP will lose EMLSR gains.

In order to have the non-AP MLD select to operate in EMLSR mode or not while a STA affiliated with the non-AP MLD awakes from doze based on the service going to happen, a light way is needed other than using EML Operating Mode Notification frame.

Similar need is there for EMLMR mode. The difference from EMLSR mode is that, if a STA affiliated with the non-AP MLD awakes for data transmission of service 1, the non-AP MLD may not turn on other eMLMR STAs affiliated with it to save power.

**Proposed Solution:**

After awaking from doze to retrieve BUs, the STA affiliated with the non-AP MLD will transmit a PS-Poll or QoS Null frame to the associated AP. So it is a good choice to piggback the intention to operate in EML mode on PS-Poll or QoS Null frame. Specifically, if the non-AP MLD intends to operate in EMLSR mode, the STA affiliated with the non-AP MLD indicates the intension by setting B14 of the Frame Control field of the PS-Poll or QoS Null frame to 1. Transition Delay after receiption of ACK corresponding to the PS-Poll or QoS Null, the non-AP MLD operates in EMLSR mode. Otherwise, B14 of the Frame Control field of the PS-Poll or QoS Null frame is set to 0 and the non-AP MLD will not operate in EMLSR mode.

After awaking from doze for UL transmission or unannounced TWT SP initally, the non-AP MLD operates in EMLSR mode and do CCA on both link 1 and link 2 by default. If the non-AP MLD intends not to operate in EMLSR mode during this awake period, the STA affiliated with the non-AP MLD shall send a QoS Null frame with EML Mode subfield of the Frame Control field set to 0.

Similar mechanism for EMLMR.

**End of discussion**

**Propose:**

*TGbe editor: Change 9.2.4.1.1 General as follows (track changes on):*

* **General**

The first three subfields of the Frame Control field of a PV0 frame are Protocol Version, Type, and Subtype. The remaining subfields of the Frame Control field depend on the setting of the Type and Subtype subfields.

For a frame carried in a non-S1G PPDU, when the Type subfield is not 1 or the Subtype subfield is not 6, the remaining subfields within the Frame Control field are To DS, From DS, More Fragments, Retry, Power Management, More Data, Protected Frame / EML Mode (10125), and +HTC. In this case, the format of the Frame Control field is shown in Figure 9-3 (Frame Control field format in non-S1G PPDUs when Type subfield is not equal to 1 or Subtype subfield is not equal to 6).

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|  | B0     B1 | B2   B3 | B4      B7 | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 |
|  | Protocol  Version | Type | Subtype | To DS | From DS | More  Fragments | Retry | Power  Management | More Data | Protected Frame / EML Mode | +HTC |
| Bits: | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| * **Frame Control field format in non-S1G PPDUs when Type subfield is not equal to 1 or Subtype subfield is not equal to 6 (10125)** | | | | | | | | | | | |

*TGbe editor: Change 9.2.4.1.9 Protected Frame subfield as follows (track changes on):*

* **Protected Frame / EML Mode subfield (10125)**

The Protected Frame subfield is set to 1 if the Frame Body field contains information that has been pro-cessed by a cryptographic encapsulation algorithm. The Protected Frame subfield is reserved in Control frames of subtype Control Frame Extension, except that the EML Mode subfield is set to 1 in PS-Poll frame if sent by a STA affiliated with an non-AP MLD which intends to operate in EML mode and set to 0 otherwise (10125). When the Protected Frame subfield is equal to 1, the Frame Body field is protected utilizing the cryptographic encapsulation algorithm and expanded as defined in Clause 12 (Security). The Protected Frame subfield is set to 0 in Data frames of subtype Null, QoS CF-Poll, and QoS CF-Ack +CF-Poll (see, for example, 12.3.4.2 (TKIP MPDU formats) and 12.5.2.1 (General) that show that the frame body needs to be 1 octet or longer to apply the encapsulation). The EML Mode subfield is set to 1 in Data frames of subtype QoS Null if sent by a STA affiliated with an non-AP MLD which intends to operate in EML mode and set to 0 otherwise (10125).

*TGbe editor: Insert the following paragraph between 8th and 9th paragraph of 35.3.17 as follows (track changes on):*

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

……

(10125) For the EMLSR mode enabled in a single-radio non-AP MLD, if the non-AP MLD intends to operate in EMLSR mode after awaking from doze to retrieve BUs during this awake period, the STA affiliated with the non-AP MLD indicates the intension by setting EML Mode subfield of the Frame Control field of the PS-Poll or QoS Null frame to 1. Transition Delay after receiption of ACK corresponding to the PS-Poll or QoS Null, the non-AP MLD operates in EMLSR mode. Otherwise, the EML Mode of the Frame Control field of the PS-Poll or QoS Null frame is set to 0 and the non-AP MLD does not operate in EMLSR mode during this awake period.

In case of a STA on a EMLSR affiliated with the non-AP MLD awaking for UL transmission or unannounced TWT SP initially, the non-AP MLD operates in EMLSR mode by default. If the non-AP MLD intends not to operate in EMLSR mode during this awake period, the STA affiliated with the non-AP MLD shall send a QoS Null frame with EML Mode subfield of the Frame Control field set to 0.

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*TGbe editor: Insert the following paragraph between 8th and 9th paragraph of 35.3.18 as follows (track changes on):*

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

……

(10125) For the EMLMR mode enabled in a multi-radio non-AP MLD, if the non-AP MLD intends to operate in EMLMR mode after awaking from doze to retrieve BUs during this awake period, the STA affiliated with the non-AP MLD indicates the intension by setting EML Mode subfield of the Frame Control field of the PS-Poll or QoS Null frame to 1. Transition Delay after receiption of ACK corresponding to the PS-Poll or QoS Null, the non-AP MLD operates in EMLMR mode. Otherwise, the EML Mode of the Frame Control field of the PS-Poll or QoS Null frame is set to 0 and the non-AP MLD does not operate in EMLMR mode during this awake period.

In case of a STA on a EMLMR affiliated with the non-AP MLD awaking for UL transmission or unannounced TWT SP initially, the non-AP MLD operates in EMLMR mode by default. If the non-AP MLD intends not to operate in EMLMR mode during this awake period, the STA affiliated with the non-AP MLD shall send a QoS Null frame with EML Mode subfield of the Frame Control field set to 0.

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