IEEE P802.11
Wireless LANs

|  |
| --- |
| Resolution for comments received for CC on D0.1 for subclause 37.9.2 |
| Date: 2025-07-23 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou | Intel |  |  | laurent.cariou@intel.com |

Abstract

This document contains proposed resolutions to comments received on 802.11bn D0.1:

267 542 769 770 1256 1257 1258 1259 1260 1314 1530 1597 1926 2135 2136 2137 2477 3030 3031 3032 3033 3034 3184 3655 3688 3689 3896 3950 3961

R1: comments received from Brian

R2: comments received from Mark

R3-R4: changes in green: ensure consistent indications across links and across fields in the frame, clarify that an indication of PM1 on a link is not considered as an APSD Trigger.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CID** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 267 | 77.47 | The current section only mentions the cross-link behavior of MLPM non-AP MLD. It should be supplemented with the behavior of MLPM AP MLD to indicate changes in its power management mode through MLPM signaling. | As in comment. Add the cross-link indication behavior and rules of the AP MLD regarding the PM mode of its affiliated APs. |  Reject – this mechanism is for non-AP STAs. APs shall always be in active mode. |
| 542 | 77.58 | may transmit ... 'only if it is associated with an MLMP AP MLD' | please add the precondition 'only if it is associated with an MLMP AP MLD' |  Revised – agree with the commenter. Apply the changes marked as #542 in this document. |
| 769 | 77.50 | ' shall set to 1 the Multi-Link Power Management Supportfield in the UHR MAC Capabilities Information field in Management frames that it transmits' => shall set the Multi-Link Power Management Supportfield in the UHR MAC Capabilities Information field in Management frames that it transmits to 1 | as in comment | Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 770 | 77.55 | ' shall set to 1 the Multi-Link Power Management Supportfield in the UHR MAC Capabilities Information field in Management frames that it transmits' => shall set the Multi-Link Power Management Supportfield in the UHR MAC Capabilities Information field in Management frames that it transmits to 1 | as in comment |  Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 1256 | 77.61 | define the signaling by having the encoding for the MLPM A-Control in 9.2.4.7.12. It should contains the link bitmap indication of the links that PM change takes effect and a time that this multi-link PM change takes effect | As in comment |  Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 1257 | 78.01 | define the behavior of non-AP STA affiliated with non-AP MLD to indicate that it will be in new PM mode at the indicated time | As in comment |  Reject – this is already covered by referring to 11.2.3.2 operation |
| 1258 | 78.03 | It needs to be clarified how the PM mode indication in MLPM Control field works with the PM bit in the Frame Control field to prevent the race condition. To clarify: 1) PM bit in Frame Control field and the PM bit in MLPM Control field corresponding to the link that the frame carrying the MLPM control is send shall be the same, 2) if STA1 sends a cross link PM indication for another link on which STA2 affiliated with the same non-AP MLD is operating, and if STA2 sends a frame carrying PM bit in Frame Control field, STA2 shall set the PM bit in Frame Control field to the same value in MLPM Control field sent by STA1 over the first link. Please define the behavior for the above cases. | As in comment |  Revised – agree with the commenter. Make the corresponding bit reserved. Apply the changes marked as #1258 in this document. |
| 1259 | 78.06 | There is non-zero delay for exchanging information among APs of AP MLD which is known as cross link processing delay (CLPD). If AP MLD announces its expected CLPD, non-AP MLD can determine when the AP affiliated with same AP takes PM mode change in effect on another link. This helps the non-AP MLD to build its power save behavior based on this information. Please define the CLPD as explained | As in comment | Reject – current spec assumes that the AP MLD accounts for the change as soon as the frame is acknowledged. |
| 1260 | 78.12 | When a non-AP STA of non-AP MLD indicates PM mode change by setting PM bit to 1 for another link, i.e. another STA of non-AP MLD enters PS mode, AP of AP MLD that operates on another link shall consider that STA in PS mode after the indicated time; AP of AP MLD that operates on that link shall stop transmitting to the STAs in PS mode. Also after non-AP STA enters PS mode, AP of AP MLD that operates on that link shall not expect a response in DL or UL TB from the non-AP STA and it shall not degrade the rate because of no response from the non-AP STA. Please define the behavior of the AP as explained | As in comment |  Revised – this is no different than baseline behavior when receiving PM change information on the ongoing link, so current spec text refers the baseline behaviors. Apply the changes marked as #1260 in this document |
| 1314 | 77.49 | If an AP STA affiliated with a MLPM AP MLD, which is associated with a legacy non-AP STA, goes to the power save mode, the legacy non-AP STA cannot receive frames such as beacon frames transmitted by the AP STA. | Please clarify the condition so that a legacy non-AP STA operates well when an AP STA affiliated with a MLPM AP MLD is in the power save mode. |  Reject – this is a mechanism for non-AP MLD, not for AP MLDs. |
| 1530 | 0.00 | It is unclear what the combinations of valid PM and MLMP Control are for the link which is used to transmit the (M)MPDU. Are they allowed to have different values, and if yes which takes effect? | Specify any restrictions. |  Revised – agree with the commenter. Make the corresponding bit reserved. Apply the changes marked as #1258 in this document. |
| 1597 | 77.47 | In Multi-Link power save, the idea of dynamic PS can also be used. In the High capability mode, the non-AP MLD can operate on multiple links, and in low capability mode, the non-AP MLD only listen on one link using the most energy efficient parameters | as in the comment |  Reject – DPS is defined for a non-AP STA and MLPM is defined for an MLD. |
| 1926 | 78.06 | This sentence is with too many unnecessary commas, suggest to reorganize the sentence. | As in comment. |  Revised – apply the changes marked as #1926 |
| 2135 | 77.50 | The need for support indication of MLPM by a non-AP MLD (i.e., that the indication of the capability of transmitting MLPM) is not clear. Please clarify how this support indication impacts operation of an AP. | As in comment. |  Reject – the subclause defines what are the requirements on the AP MLD side and non-AP MLD side. |
| 2136 | 78.04 | It has to be clarified if the rules in 11.2.3.2 are to be followed immediately upon successfully transmitting the MLPM signaling or there is any applicable delay. | As in comment. |  Revised – current spec text mentions that the AP follows the rules as in 11.2.3.2 as if it had received a frame with PM change directly, this means the change is in effect immediately. Apply the changes marked as #2136 in this document. |
| 2137 | 78.12 | It has to be clarified if the rules in 11.2.3.6 and 35.3.12 are to be followed immediately upon sending an aknowledgement to the MLPM signaling or there is any applicable delay. | As in comment. |  Revised – current spec text mentions that the AP follows the rules as in 11.2.3.2 as if it had received a frame with PM change directly, this means the change is in effect immediately. Apply the changes marked as #2136 in this document. |
| 2477 | 77.61 | Need to define signaling of the new A-control for cross link power save variant. A good design would be to include a field indicating the power mode and a linkID bitmap to indicate which link will see the power mode change. | as in comment |   Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 3030 | 0.00 | "Multi-Link power management" should be lowercase if not at the start of a sentence etc., and should probably be "Multi-link power management" if at the start of a sentence etc. | As it says in the comment |  Accept |
| 3031 | 77.48 | "A non-AP MLD that has dot11UHRMLPMImplemented set to 1 supports Multi-Link power management signaling, is called an MLPM non-AP MLD and shall set to 1 the Multi-Link Power Management Support field in the UHR MAC Capabilities Information field in Management frames that it transmits.An AP MLD that has dot11UHRMLPMImplemented set to 1 supports Multi-Link power management sig-naling, is called an MLPM AP MLD and shall set to 1 the Multi-Link Power Management Support field in the UHR MAC Capabilities Information field in Management frames that it transmits." -- everything except the AP v non-AP STA is the same, so express the common stuff once and only the AP v non-AP STA stuff separately | As it says in the comment |  Accept |
| 3032 | 78.01 | "A non-AP STA affiliated with the MLPM non-AP MLD, for which a power management mode change has been indicated through the MLPM signaling," should be "with an" and should not have commas | As it says in the comment |  Accept |
| 3033 | 78.05 | "If an MLPM AP MLD receives, via an affiliated AP, a power management mode change for a non-AP STA affiliated with an associated MLPM non-AP MLD and operating on an enabled link, then the AP affiliated with the MLPM AP MLD and operating on the corresponding enabled link follows the rules defined in 11.2.3.6 (AP operation) and 35.3.12 (ML power management) for the changed power management mode of the non-AP STA, as if it had received, on the link, a frame, from the non-AP STA, that indicates the same power management change." -- previous para said it better (simpler): "follows the rules defined in xxx for that changed power management mode" | As it says in the comment |  Revised – apply the changes marked as #1926 in this document |
| 3034 | 78.05 | "If an MLPM AP MLD receives, via an affiliated AP, a power management mode change for a non-AP STA affiliated with an associated MLPM non-AP MLD and operating on an enabled link, then the AP affiliated with the MLPM AP MLD and operating on the corresponding enabled link" too waffly | Change to "If an MLPM AP MLD receives a power management mode change for a non-AP STA affiliated with an associated MLPM non-AP MLD and operating on an enabled link, then the AP operating on the corresponding enabled link" |  Revised – agree with the commenter. Apply the changes marked as #3034 in this document |
| 3184 | 77.48 | consider to conbime the first two paragraphes, and clarify that an MLPM MLD can be an MLPM non-AP MLD or an MLPM AP MLD. | as in comment. |  Revised – agree with the commenter. Apply the changes marked as #3031 in this document |
| 3655 | 77.61 | Finalize MLPS Control signaling, and also add a figure that exemplifies the operation. Also technical description in this subclause can be improved a little bit. | As in comment. |   Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 3688 | 77.50 | I propose the following edit:"and shall set the Multi-Link Power Management Support field to 1 in the UHR MAC Capabilities Information field in Management frames that it transmits." | Explained in the comment |  Revised – agree with the commenter. Apply the changes marked as #3688 in this document |
| 3689 | 77.55 | I suggest the following edit:"and shall set the Multi-Link Power Management Support field to 1 in the UHR MAC Capabilities Information field in Management frames that it transmits." | Explained in the comment |  Revised – agree with the commenter. Apply the changes marked as #3688 in this document |
| 3896 | 77.49 | Add MIB to Annex C | As in comment |  Revised – agree with the commenter. Apply the changes marked as #3896 in this document |
| 3950 | 77.61 | For MLPM signaling, a client should be able to signal both PM=0 and PM=1 power save mode for other links of the non-AP MLD in the A-Control. This is desirable because client may want to indicate PM=0 for certain links and PM=1 for other links and it is more efficient and faster to signal both in one A-control. | Define an A-Control for MLPM signaling that allows indicating both PM=0 and PM=1 for different links. The signaling can be optimized to use 8 bits for MLPM Link Bitmap (instead of 16 bits) since APs won't have more than 8 links. |   Revised – agree with the commenter. Apply the changes marked as #1256 in this document |
| 3961 | 77.46 | The detailed parameters for the multi-Link power management signaling and behaviors of non-AP MLD need to be specified. | As in comment |   Revised – agree with the commenter. Apply the changes marked as #1256 in this document |

Introduction

* Multi-link power management [#3030]

[#3031]An MLD that has dot11UHRMLPMOptionImplemented set to 1 supports multi-link power management signaling, is called an MLPM MLD and shall set the Multi-Link Power Management Support field to 1 [#3688] in the UHR MAC Capabilities Information field in Management frames that it transmits, otherwise it shall set the Multi-Link Power Management Support field to 0.

[#3031]

An MLPM non-AP MLD may transmit a frame to an associated AP MLD [#542], via an affiliated non-AP STA, that carries an MLPM Control subfield to indicate in the MLPM Link Bitmap field the power management mode of the other non-AP STA(s) affiliated with the non-AP MLD and operating on enabled link(s), except that it shall not transmit such a frame if the AP MLD is not an MLPM AP MLD[#542] The Power Management field of the Frame Control field of the frame shall be set to the same value as the bit corresponding to the non-AP STA affiliated with the non-AP MLD that transmits the frame in the MLPM Link Bitmap field.

NOTE – The Power Management field of the Frame Control field of the frame is used to control the power management mode of the STA transmitting the frame.

[#3032]A non-AP STA affiliated with an MLPM non-AP MLD for which a power management mode change has been indicated through MLPM Control subfield follows the rules defined in 11.2.3.2 (non-AP STA power management modes) for that changed power management mode and changes its power management mode after the frame carrying the MLPM Control subfield is acknowledged by the AP that received the frame, as if the non-AP STA had received an acknowledgement from its associated AP.

NOTE: The non-AP MLD is expected to ensure that the power management indications that are transmitted across the links are consistent.

[#1926, #3034] If an MLPM AP MLD receives and acknowledges, via an affiliated AP, a frame carrying an MLPM Control subfield that includes a power management mode change for a non-AP STA that is affiliated with an associated MLPM non-AP MLD and that is operating on an enabled link, then the affiliated AP that is operating on the corresponding enabled link follows the rules defined in 11.2.3.6 (AP operation) and 35.3.12 (ML power management) for the changed power management mode of the non-AP STA, as if the affiliated AP had received on the link a frame from the non-AP STA that indicates the same power management change and had sent an acknowledgement frame in response [#1960], except that:

* If the power management mode of an affected non-AP STA that is affiliated with a non-AP MLD is set to 1 in the MLPM Control field in a frame transmitted on another link by a non-AP STA affiliated with the same non-AP MLD, while the affected non-AP STA is in power save mode and in doze state at the time at which the frame is transmitted, the AP operating on the same link as the affected non-AP STA shall ignore the indication for the affected non-AP STA in the MLPM Control field and still consider the STA in power save mode and in doze state.

***TGbn editor: Please modify the following subclause 9.2.4.6.4 HE variant [#1256]***

**9.2.4.6.4 HE variant**

 ***Change Table 9-25 (Control ID subfield values) as follows:***

**Table 9-25—Control ID subfield values**

|  |  |  |  |
| --- | --- | --- | --- |
| **ControlID value**  | **Meaning** | **Length of theControlInformationsubfield (bits)** | **Content of the Control Informationsubfield** |
| **…** |  |  |  |
| 10 | Multi-link power management (MLPM) | 20 | See 9.2.4.7.12 (MLPM Control) |
| 11–14~~7–14~~ | Reserved |  |  |
| 15  | Ones need expansion surely (ONES)  | 26  | Set to all 1s |

***TGbn editor: Please add the following subclause 9.2.4.7.12 MLPM Control after 9.2.4.7.11 ELA Control in D2.3 [#1256]***

**9.2.4.7.12 MLPM Control**

The Control Information subfield in an MLPM Control subfield contains the power management mode of non-AP STA(s) affiliated with a non-AP MLD.

The format of this subfield is shown in Figure 9-abc (Control Information subfield format in an MLPM Control subfield).

|  |  |  |
| --- | --- | --- |
|  | B0 B15 | B16 B19 |
|  | MLPM Link Bitmap | Reserved |
| Bits: | 16 | 4 |

**Figure 9-abc—Control Information subfield format in an MLPM Control subfield**

The MLPM Link Bitmap field indicates the power management mode of the non-AP STA(s) affiliated with a non-AP MLD on each of the link(s) of the non-AP MLD. The bit position *i* of the MLPM Link Bitmap field corresponds to non-AP STA operating on the link with link ID equal to *i* and set to 1 to indicate that the non-AP STA is in power save mode and is set to 0 to indicate that the non-AP STA is in active mode~~, except that the bit corresponding to the non-AP STA affiliated with the non-AP MLD that transmits the frame is reserved~~.

**C.3 MIB Detail**

***TGbn editor: Modify following paragraph as follows(#3896)***

Dot11UHRStationConfigEntry ::=

SEQUENCE {

dot11CoRTWTOptionImplemented TruthValue,

dot11NPCAOptionImplemented TruthValue,

dot11DUOOptionImplemented TruthValue,

dot11UHRBSROptionImplemented TruthValue,

dot11UHRMLPMOptionImplemented TruthValue,

}

***TGbn editor: add following paragraph as follows: (#3896)***

dot11UHRMLPMOptionImplemented OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a capability variable.

Its value is determined by device capabilities.

This attribute, when true, indicates that the STA implementation is affiliated with an MLD that supports

MLPM operation (see 37.9.2 (Multi-link power management signaling)).”

::= { dot11UHRStationConfigEntry 5 }