IEEE P802.11
Wireless LANs

|  |
| --- |
| LB 271 CR for 4.9.6 Reference model for MLO |
| Date: April 1, 2023 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Duncan Ho | Qualcomm Inc |  |  | dho@qti.qualcomm.com |
| Abhishek Patil |  |  |  |
| Gaurang Naik |  |  |  |
| George Cherian |  |  |  |
| Alfred Asterjadhi |  |  |  |
| Yanjun Sun |  |  |  |
| Abdel Karim Ajami |  |  |  |

 Abstract

This submission proposes resolutions for following CIDs received for TGbe LB271:

15160, 15355, 15494, 16121, 16387, 16690, 18051, 18068, 18069, 18070, 18071, 18072

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Clarified some of the proposed resolutions.
* Rev 2: revised per Mark Hamilton’s offline comments

***TGbe editor: The baseline for this document is 11be D3.0***

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.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 15160 | Po-Kai Huang | 4.9.6 | 70.38 | Use non-AP STAs for STAs affiliated with a non-AP MLD in this clasue. | Use non-AP STAs for STAs affiliated with a non-AP MLD in this clasue. | Revised.**TGbe editor, please make the changes in this doc as shown below in this document.** |
| 15355 | John Wullert | 4.9.6 | 73.53 | The sentence mentions "association to an AP MLD" when it should say "association to an AP" | Replace "using only one set of lower MAC and PHY pairs for association to an AP MLD (which may or may not be affiliated with an AP MLD)." with "using only one set of lower MAC and PHY pairs for association to an AP (which may or may not be affiliated with an AP MLD)." | Accepted. |
| 15494 | Chaoming Luo | 4.9.6 | 72.44 | it sounds like there is only one MLD lower MAC sublayer, whilst P73L50 says "The non-AP MLD reference model includes the MLD upper MAC sublayer and MLD lower MAC sublayers (one for each link)" | Change to:The MAC Sublayer is further divided into an MLD upper MAC sublayer and multiple MLD lower MAC sublayers (one for each link). The MLD upper MAC sublayer performs functionalities that are common across all links, and each MLD lower MAC sublayer (corresponding to an AP or STA affiliated with the MLD) performs functionalities that are local to each link. | Revised.**TGbe editor, please make the changes in this doc as shown below in this document.** |
| 16121 | Jian Yu | 4.9.6 | 72.58 | The tracked change of the deleted bracket should be removed | As in comment | Accepted. |
| 16387 | Massinissa Lalam | 4.9.6 | 71.48 | The part ", while in general, an MLD can support more than two links." could be deleted from the NOTE 1. | As in comment | Revised –**TGbe editor: Please delete cited text.** |
| 16690 | Yonggang Fang | 4.9.6 | 74.08 | It should be Supplincant, not Authenticator in the Figure 4-30d High level architecture for non-AP MLD with affiliated non-AP STAs. | Change "Authenticator" to "Supplicant" | Accepted. |
| 18051 | Albert Petrick | 4.9.6 | 72.27 | Figure 4-30b Reference model for an MLD for two links: As examples, Link1 uses 2.4 GHz and Link2 uses 5 GHz. There is no reference to 6 GHz in the example. | In the figure, add a reference to Link 2 (e.g., in 5 GHz or 6GHz) or add a NOTE While Link 1 is referenced as 2.4 GHz, Link 2 may be either 5 GHz or 6 GHz in this example. | Revised.**TGbe editor: please add 6GHz as an example to the description under link 2 i.e., “(e.g., in 5 GHz or 6GHz)”** |
| 18068 | Abhishek Patil | 4.9.6 | 70.42 | An MLO association can be for one or more links (see 35.3.5). This can be because the two MLDs happened to have only 1 link in comment (e.g., MLD 1 can operate only on 2.4 & 5 while MLD 2 can opreate only on 5 & 6). Alternatively, an ML association may reduce to a single link if an AP is removed via the ML reconfiguration procedure. | Replace 'multiple' with 'one or more links'. Please check other such instances in the draft and apply this change. | Revised.**TGbe editor: on pg 70 lines 40 and 41, change “multiple links’ to “one or more links”.** |
| 18069 | Abhishek Patil | 4.9.6 | 70.53 | The two cases can be consolidated as: "Each STA affiliated with an MLD has a MAC address different from any other STA affiliated with the same MLD." | As in comment | Revised.**TGbe editor, please make the changes in this doc as shown below in this document.** |
| 18070 | Abhishek Patil | 4.9.6 | 72.59 | Delete the extra ')' | As in comment | Accepted. |
| 18071 | Abhishek Patil | 4.9.6 | 73.44 | Please use consistent terminology (and harmonize different variant to one). | Since the term non-MLO is defined, replace non-MLD with non-MLO throughout the draft | Accepted.**TGbe editor, please make the changes on page 73/line 43 (2 occurrences) and page 524/line 29 (one occurrence).** |
| 18072 | Abhishek Patil | 4.9.6 | 73.53 | A non-MLO STA will associate with an AP which may or may not be affiliated with an AP MLD. Therefore, AP MLD is incorrect (possibly got added as a typo). | Delete 'MLD' from 'AP MLD' | Accepted. |

**[TGbe editor: for CID 15160, please make the following changes]**

1. **In Figure 4-30a, replace “STA1” with “non-AP STA1” and “STA2” with “non-AP STA2”**
2. **Modify 4.9.6 as follows:**

**4.9.6 Reference model for multi-link operation (MLO)**

[…]

An example of an AP MLD with two affiliated APs (Link 1 and Link 2) is shown in Figure 4-30a (Example MLD and the affiliated STA communication system). The figure shows an AP MLD with MLD MAC address *M* and the MLD lower MAC sublayers of two affiliated APs (AP1 with MAC address *w* and AP2 with MAC address *x*). The AP MLD is associated with a non-AP MLD with MLD MAC address *P* and the MLD lower MAC sublayers of two affiliated non-AP STAs (non-AP STA1 with MAC address *y* and non-AP STA2 with MAC address *z*) are shown. Link 1 is established between AP1 and non-AP STA1 and link 2 is established between AP2 and non-AP STA2. In general, the MAC address of an MLD and the MAC addresses of the STAs affiliated with the MLD are all different (e.g., M, P, w, x, y, and z have different values). However, the architecture supports an implementation where M could equal either w or x, and where P could equal y or z.

==============================================================================================

**[TGbe editor: for CIDs 15494 and 15355, please make the following changes in section 4.9.6]**

The non-AP MLD reference model includes the MLD upper MAC sublayer and one or more (#15494)MLD lower MAC sublayers (one for each link). The MLD upper MAC sublayer performs functionalities that are common across all links, and each MLD lower MAC sublayer (corresponding to a STA affiliated with the MLD) performs functionalities that are local to each link (#15494). The single upper MAC within a non-AP MLD can operate at any given time in either MLO over one or more lower MAC and PHY pairs for association to an AP MLD, or as a (non-MLO) non-AP STA using only one (#15494)lower MAC and PHY pair (#15494)for association to an AP (#15355)(which may or may not be affiliated with an AP MLD). A single Supplicant on the non-AP MLD manages the PTKSA, and multiple group key security associations (one set per link). The reference architecture when operating in MLO is shown in Figure 4-30d (High level architecture for non-AP MLD with affiliated non-AP STAs).

==============================================================================================

**[TGbe editor: for CIDs 18069, please make the following changes in section 4.9.6]**

Each MLD has a single MAC-SAP. Each STA affiliated with an MLD has a MAC address different from any other STA affiliated with the same MLD (#18069).

Do you agree to the resolution provided in doc 11-23/xxxxr0 for the following CIDs?

15160, 15355, 15494, 16121, 16387, 16690, 18051, 18068, 18069, 18070, 18071, 18072