IEEE P802.11
Wireless LANs

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| LB271 CR for subclause 35.3.1 |
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Abstract

This submission proposes resolutions of comments received from TGbe comment collection LB271 based on TGbe D3.0.

16369 16739 17164 17245 18188 17861 18112 16370 15675 16742 15224 15225 15724 15725 18279 17862 16743 15177 15178 16371 15811 15850 16372 16744 17246 17247 16746 17818 18113 17979 (30 CIDs)

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Minor update
* Rev 2: add green tags
* Rev 4: update the resolution for CID 16742, 18279 and 15177
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** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 16369 | 35.3.1 | 479.14 | If a non-AP EHT STA can set dot11MultiLinkActivated equal to false, it would only be able to connect to an EHT AP is a legacy BSS. An non-AP MLD can have a single AP MLD, so this requirement just complicates behaviour. | Remove the cited sentence and underlying requirement. | Rejected-The comment fails to identify the technical issue. If a non-AP EHT STA sets dot11MultiLinkActivated to false, it still forms an EHT BSS when it connects to an EHT AP. Note that BSS is at link level. |
| 16739 | 35.3.1 | 479.14 | "A non-AP EHT STA with dot11MultiLinkActivated equal to false shall not be affiliated with any non-APMLD." -- also true for AP | Change to "A STA with dot11MultiLinkActivated equal to false shall not be affiliated with anyMLD." | Rejected-It is not true for an AP. Otherwise it will conflict with the first sentence in this subclause: “An EHT AP shall set dot11MultiLinkActivated to true”. Note that the suggested sentence allows for an EHT AP, which does not implement MLO features. |
| 17164 | 35.3.1 | 479.14 | Similar statement for EHT AP should be added. | Add "An EHT AP with dot11MultiLinkActivated equal to false shall not be affiliated with any AP MLD." | Rejected-It is not true for an AP. Otherwise it will conflict with the first sentence in this subclause: “An EHT AP shall set dot11MultiLinkActivated to true”. The cited paragraph allows for an EHT AP, which does not implement MLO features. |
| 17245 | 35.3.1 | 479.15 | It is specified how a non-AP STA should behave if dot11MultiLinkActivated equals to false. However. It is not clear how an EHT AP with dot11MultiLinkActivated set to false should behave in terms of affiliation with an AP MLD. | Specify the behavior of the AP if dot11MultiLinkActivated equals to false | Rejected-The comment fails to identify the technical issue. According to the first sentence in this subclause, an EHT AP shall set dot11MultiLinkActivated to true. |
| 18188 | 35.3.1 | 479.15 | "A non-AP EHT STA with dot11MultiLinkActivated equal to false shall not be affiliated with any non-AP MLD." Replace the "non-AP MLD" to "MLD" to make the normative text more robust. | As in comment | Rejected-It is not true for an AP. Otherwise it will conflict with the first sentence in this subclause: “An EHT AP shall set dot11MultiLinkActivated to true”. Note that the suggested sentence allows for an EHT AP, which does not implement MLO features. |
| 17861 | 35.3.1 | 479.18 | This paragraph makes sense to be the first paragraph in the subclause. Move this paragraph as the first paragraph in the subclause. | As in comment | Revised-agree with the comment in principle. Apply the changes marked as #17861 in this document. |
| 18112 | 35.3.1 | 479.18 | 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'. | Accepted- |
| 16370 | 35.3.1 | 479.20 | The cited sentence has to do with TDLS and is disconnected from the previous sentences. Make it a separate paragraph. | At the cited location, insert a paragraph break before the beginning of the last sentence. | Revised-agree with the comment in principle. Apply the changes marked as #16370 in this document. |
| 15675 | 35.3.1 | 479.28 | The D3.0 allows each AP with the same AP MLD selects BSS color independently, which means different APs can select the same BSS Color.Assume an AP MLD with two links and each AP with the same AP MLD select the same BSS Color, and two STAs (MLDs) are both working on link0 and establish a TDLS over single link on the same channel as link0, of which the frames on TDLS link use the same BSS Color as AP0 on link0. According to current BSS Color Collision rule, the TDLS frames won't cause the BSS Color Collision on link0.If later the TDLS peers negotiate to switch channel to the link1's working channel, the TDLS frames (with MLD mac address) on link1 will falsely make the BSS1 (e.g. AP1) on link1 think there is a BSS Color Collsion. | The proposed changes may be:1. change the BSS Color Collision rule (to not treat the frames with same MLD mac address and BSS Color as the case of BSS Color Collision) , or2. not allow the TDLS over single link to negotiate channel switch to the same channel on other links.But the simplest proposed change is to not allow the APs with the same AP MLD to select same BSS Color. So at least a note can be added in the same paragraph to illustrate that "it recommends the APs affilicated with the same AP MLD do not select the same BSS Color" | Rejected-The probability of this case is quite low. If it does happen, the BSS Color Collison recovery procedure can address it. |
| 16742 | 35.3.1 | 479.35 | "Each STA affiliated with an MLD shall follow the procedures in 11.1.3 (Maintaining synchronization). AnAP MLD shall correct the clock drift to be within +/-30 Âµs between TSF timers of any two APs affiliated withit." is not clear. What kind of correction is this? If it's just the usual 0.01% drift thing then it should be moved to Clause 11. If it's some more fancy cross-adjustment thing it needs to be specified in more detail (e.g. you don't want to be correcting towards the STA that's running slow/fast) | As it says in the comment | Revised-Rephrase this sentence to make it clear. The objective should be the clock drift difference between the TSF timers of two APs. Apply the changes marked as #16742 in this document. |
| 15224 | 35.3.1 | 479.36 | AP MLD may have common information on the TSF timer because affiliated APs should refer not only to each TSF timer corresponding to each affiliated TSF timer indicated as 35.3.1 but also to the common TSF timer. | Proposed to add the text as "An AP MLD may have a TSF timer to provide common TSF to affiliated APs."Section 35.3.19 seems this architecture is already adopted to NSTR mobile AP MLD. 35.3.19"NOTE 4--All APs affiliated with an NSTR mobile AP MLD have the same TSF timer (see 35.3.19 (NSTR mobile AP MLD operation))." | Rejected-The proposed change belongs to implementation, out of the scope of standard. |
| 15225 | 35.3.1 | 479.36 | The complete profile of a reported AP may be inherited using the Beacon frame if multiple affiliated APs utilize common of the TSF timer. | Proposed to add the text as "An AP affiliated with an AP MLD may provide common TSF information and inherit it to the reported STAs according to the inheritance rule (see 35.3.3.6.)." | Rejected-Common TSF is one possible option for the implementation. According to 35.3.3.4 (Fields and elements not carried in a per-STA profile), each per-STA profile doesn't carry a Timestamp field and this field is link specific. it is not necessary to add a new inheritance rule just for this minor overhead. |
| 15724 | 35.3.1 | 479.36 | "An AP MLD shall correct the clock drift to be within +/-30 Î¼s between TSF timers of any two APs affiliated with it." can be as read each AP affiliated with an AP MLD shall have an independent TSF timer respectively. However, an AP MLD might has a common TSF timer for all APs affiliated with it or there might be a common TSF timer which provides all All APs with a common TSF information. | If an implementation of a common TSF timer is not excluded, please add the following language in 35.3.1:"A TSF information may be provided to all AP affiliated with an AP MLD from a common TSF timer." | Rejected-The proposed change belongs to implementation, out of the scope of standard. |
| 15725 | 35.3.1 | 479.36 | "NOTE 3--An AP affiliated with an AP MLD provides TSF offset in the complete profile of a reported AP (see 9.4.2.312.2.4 (Link Info field of the Basic Multi-Link element)). A non-AP MLD can determine the TSF information of all the APs affiliated with an AP MLD when it receives a frame carrying TSF of any one AP affiliated with that AP MLD (also see 35.3.12.2 (Basic BSS operation)) and use that information to maintain TSF timer for each non-AP STA per 11.1.3 (Maintaining synchronization)." If both a reported AP and a reporting AP use a common TSF timer, the TSF offset would be the same. In that case the complete profile of a reported AP can be inherited. | If an implementation of a common TSF timer is not excluded, please add the following language in 35.3.1:"If a TSF information is common between a reporting AP and a reported AP, the TSF information may be inherited in Basic Multi-Link element by inheritance rule (see 35.3.3.6.)" | Rejected-Common TSF is one possible option for the implementation. According to 35.3.3.4 (Fields and elements not carried in a per-STA profile), each per-STA profile doesn't carry a Timestamp field and this field is link specific. It is not necessary to add a new inheritance rule just for this minor overhead. |
| 18279 | 35.3.1 | 479.36 | "An AP MLD shall correct the clock drift to be within +/-30 Î¼s between TSF timers of any two APs affiliated with it." This is at best ambiguous, more likely is missing information. Specifically, is this really saying the clock \_drift\_ must be corrected to be within tolerance, or is it trying to say that the TSFs must be within 30 us? From discussion, I think it is the former, but the sentence is unclear. Assuming it is the former (the TSFs do not have to agree/align, just the clock rates ("drift") must be locked), then this needs to be specified as "within 30 us" per some period. 30 us per TBTT? 30us per minute? 30 us per year? | Correct/clarify this sentence. | Revised-Rephrase this sentence to make it clear. The objective should be the clock drift difference between the TSF timers of two APs. Apply the changes marked as #18729 in this document. |
| 17862 | 35.3.1 | 479.49 | Can't the two statements on L49 and L51 be combined as 'An MLD shall operate with one or more affiliated STAs'? For logical flow, it makes sense to have the combined statement after the paragraph 'A non-AP EHT STA with dot11MultiLinkActivated equal to false shall not be affiliated with any non-APMLD.' | As in comment | Revised-Agree with the comment in principle. Apply the changes marked as #17862 in this document. |
| 16743 | 35.3.1 | 479.53 | Both of the examples are where links were dropped, leaving just one | At the end of the NOTE add "Or an MLD might associate with only one link." | Rejected-The comment fails to identify the technical issue. The proposed new added text is redundant. |
| 15177 | 35.3.1 | 479.57 | When dot11MultiLinkActivated is false, the multiple non-AP STAs may be active on different ESS. But then the multiple non-AP STAs would \*all\* use the same MAC address. | Delete the paragraph. | Revised-This paragraph takes BSS transition between an AP MLD and a legacy AP into account. In this way, it can do fast BSS transition. Note that when dot11MultiLinkActivated is set to false, it operates with only one STA. A clarification for this case is added. Apply the changes marked as #15177 in this document. |
| 15178 | 35.3.1 | 479.57 | This paragraph conflicts with the requirement that a STA has its own MAC address (clause 4.9.6, pg 70, line 54), and STAs affiliated with an MLD shall use different mac addresses (clause 35.3.2, pg 480, line 17). | Delete the paragraph. | Rejected-When dot11MultiLinkActivated is set to false, it operates with only one STA. There is no conflict with that requirement on page 480, line 17 of clause 35.3.2. |
| 16371 | 35.3.1 | 479.57 | Not sure what the requirement is here. Also the cross reference doesn't seem to line up. Is it trying to say that if a non-AP MLD performs a BSS Transition between an AP MLD and AP, it sets an affiliated STA address to the non-AP MLD address? | Replace the cited paragraph with "When a nin-AP MLD performs BSS transition (see 4.5.3.2 (Mobility types) between an AP MLD and an AP, dot11MultiLinkActivated shall be set to false and the MAC address of a non-AP EHT STA shall be set to the MLD MAC address of the non-AP MLD . | Rejected-Partially agree with the comment that these values that are set are good for BSS transition. However, BSS transition is a future behavior and can't be predicted. These values should be set for the association before BSS transition. Otherwise it is too late if BSS transition happens in the future. |
| 15811 | 35.3.1 | 479.58 | The sentence "The MAC address of a non-AP EHT STA..." is inconsistent as it mentions address rule for a non-AP EHT STA with dot11MultiLinkActivated set to false and later true, but a single rule is stated. So which scenario does it apply to? | Please clarify and amend the sentence if needed | Rejected-The comment fails to identity the technical issue. There is no inconsistency. This paragraph takes BSS transition between an AP MLD and a legacy AP into account. In this way, it can do fast BSS transition.  |
| 15850 | 35.3.1 | 479.61 | NOTE 6 is unnecessary as the sentence at line 14 already states the case where the dot11MultiLinkActivated equal to false. | Remove NOTE 6. | Accepted- |
| 16372 | 35.3.1 | 479.61 | Not sure what this note means or how it is relevant. It seems as if lines 57-65 cover BSS Transition but the description is not clear | Delete the note. | Accepted- |
| 16744 | 35.3.1 | 479.61 | "NOTE 6 --A non-AP EHT STA might set dot11MultiLinkActivated to true or false. " -- well, of course. Otherwise the previous sentence wouldn't say "with dot11MultiLinkActivated set to false" | Delete | Accepted- |
| 17246 | 35.3.1 | 479.62 | NOTE-6 is stating the obvious! If there is a binary MIB variable defined for a feature the STA implementing this feature shall be able to set it to either true or false. In what scenarios the STA is able only to set it to one value (true or false). | Remove NOTE-6 | Accepted- |
| 17247 | 35.3.1 | 479.62 | What about the AP with regard to the setting of dot11MultiLinkActivated? May an AP set dot11MultiLinkActivated to false? | Remove NOTE-6 or specify the allowed setting of dot11MultiLinkActivated for APs | Revised-Remove the note-6 since it is redundant. Apply the changes marked as #17247 in this document. |
| 16746 | 35.3.1 | 480.06 | "As a result, all APs affiliated with the same AP MLD shall advertise the same SSID." -- since this is a consquence not an intrinsic requirement, better to delete the "shall" | As it says in the comment | Revised-Apply the changes marked as #16746 in this document. |
| 17818 | 35.3.1 | 480.09 | "shall not support TIM Broadcast" has same meaning as "shall set to 0 the TIM Broadcast field of the Extended Capabilities elements that it transmits". | remove "shall not support TIM Broadcast and" from this sentence. | Revised-Agree with the comment in principle. Apply the changes marked as #17818 in this document. |
| 18113 | 35.3.1 | 480.09 | TIM broadcast is disallowed for a non-AP MLD. Therefore, changes to any MLO related features (such as including to Reconfiguration ML IE or T2LM advertisement) must not be added to 11.2.3.15 and instead must be listed in clause 35.3.10 (and cause the BPCC to increment). In other words, BPCC is incremented based on criteria listed in 11.2.3.15 & 35.3.10. Check Beacon field in TIM frame will be incremented only based on criteria listed in 11.2.3.15. The benefit here is that a non-MLO STA will not be affected by any MLO update (which it doesn't care about). | As in comment | Rejected-This comment was discussed in the previous Working Group letter ballot on Draft 2.0. The TGbe group could not reach consensus since the current critical update flag can achieve the same function. AP removal is carried in an ML element that also carries the information of other links, belonging to a self-contained element. That is to say, all information could be obtained from the same frame. It doesn't need an additional procedure to retrieve an update of the other link. |
| 17979 | 35.3.1 | 480.64 | Note 7 seems to be out of place and should be moved to the section of discovery | as in comment | Revised-Partially agree with the comment.This part is about association for an EHT STA that is not affiliated with an MLD, using the same association request/response frame (without ML element) as a legacy STA. However, the discovery section is not a suitable place for this text. Move this note to the subclause of the multi-link setup procedure. Apply the changes marked as #17979 in this document. |

**Discussion:** None.

TGbe Editor: please modify the following paragraphs

35.3 Multi-link operation

**35.3.1 General**

MLO enables a non-AP MLD to discover, authenticate, associate, and set up one or more links with an AP MLD. Each link enables channel access and frame exchanges between the non-AP MLD and the AP MLD based on the supported capabilities exchanged during association. (#17861, 18112)

An EHT AP shall set dot11MultiLinkActivated to true and shall be affiliated with an AP MLD. An AP MLD and all of its affiliated AP(s) shall follow the rules defined in 35.3 (Multi-link operation).

A non-AP EHT STA with dot11MultiLinkActivated equal to true shall be affiliated with a non-AP MLD. A non-AP MLD and all of its affiliated non-AP STA(s) shall follow the rules defined in 35.3 (Multi-link operation).

A non-AP EHT STA with dot11MultiLinkActivated equal to false shall not be affiliated with any non-AP MLD and shall operate with only one non-AP STA. (#15177)

A non-AP MLD may establish a single link TDLS direct link with another non-AP MLD or a non-AP STA as defined in 35.3.21 (TDLS procedure in multi-link operation). (#17861, 16370)

Each STA affiliated with an MLD may select and manage its capabilities and operating parameters independently from the other STA(s) affiliated with the same MLD, unless specified otherwise.

NOTE 1—For example, each AP affiliated with an AP MLD can independently select, disable, and update its BSS color (see 26.17.3 (BSS color)) for its BSS.

NOTE 2—Examples of operating parameters that are selected at the MLD level (i.e., not independently selected by affiliated STAs) are the listen interval (see 35.3.12.6 (Operation for MLD listen interval)) and the WNM sleep interval (see 11.2.3.1 (General)).

Each STA affiliated with an MLD shall follow the procedures in 11.1.3 (Maintaining synchronization). (#16742, 18729) In addition, an AP MLD shall correct the clock drift within all the affiliated APs to continuously comply with the following constraint for each pair of affiliated APs:

| (T1AP1– T2AP1) – (T1AP2 – T2AP2) | <= 30us

where AP 1 and AP 2 are any two affiliated APs, and T1 and T2 are the TSFs of respective APs at any two instances in time.

NOTE 3—An AP affiliated with an AP MLD provides TSF offset in the complete profile of a reported AP (see 9.4.2.312.2.4 (Link Info field of the Basic Multi-Link element)). A non-AP MLD can determine the TSF information of all the APs affiliated with an AP MLD when it receives a frame carrying TSF of any one AP affiliated with that AP MLD (also see 35.3.12.2 (Basic BSS operation)) and use that information to maintain TSF timer for each non-AP STA per 11.1.3 (Maintaining synchronization).

NOTE 4—All APs affiliated with an NSTR mobile AP MLD have the same TSF timer (see 35.3.19 (NSTR mobile AP MLD operation)).

An MLD shall operate with one or more affiliated STAs. (#17862)

NOTE 5—An AP MLD might operate with a single affiliated AP, for example, after removing some of its affiliated APs. Similarly, a non-AP MLD might operate with a single affiliated non-AP STA, for example, after the associated AP MLD has removed some of its affiliated APs. See 35.3.6.2.2 (Removing affiliated APs).

The MAC address of a non-AP EHT STA with dot11MultiLinkActivated set to false shall be set to the MLD MAC address of the non-AP MLD that the non-AP EHT STA is affiliated with when the non-AP EHT STA has dot11MultiLinkActivated set to true.

(#15850, 16372, 16744, 17246, 17247)

All APs affiliated with the same AP MLD are members of the same ESS and are connected to the same DS. (16746)All APs affiliated with the same AP MLD shall advertise the same SSID.

A non-AP STA affiliated with a non-AP MLD shall not support the TIM Broadcast procedure defined in 11.2.3.15 (TIM Broadcast) (#17818).

**35.3.5.1 Multi-link (re)setup procedure**

The multi-link (re)setup procedure sets up link(s) between a non-AP MLD and an AP MLD and is completed through the exchange of (Re)Association Request and (Re)Association Response frames. The non-AP MLD and AP MLD shall follow the (re)association procedure between MLDs as described in 11.3 (STA authenticationAuthentication and association).

NOTE 1—Prior to utilizing (Re)Association Request/Response frame exchange to perform multi-link (re)setup with an AP MLD, the non-AP MLD and AP MLD follow the authentication procedure between MLDs as described in 11.3 (STA authenticationAuthentication and association).

A non-AP MLD may initiate a multi-link setup with an AP MLD to (re)set up one or more links with AP(s) affiliated with the AP MLD. When a non-AP MLD initiates a multi-link (re)setup with an AP MLD, a STA that is affiliated with the non-AP MLD shall transmit an (Re)Association Request frame on the link that it desires to use as part of the multi-link (re)setup.

A (Re)Association Request/Response frame exchange is for a multi-link setup only if both the (Re)Association Request frame and the (Re)Association Response frame include a Basic Multi-Link element.

 (#17979)