IEEE P802.11
Wireless LANs

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| CC36 CR for listen interval |
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Abstract

This submission proposes resolutions of comments received from TGbe comment collection CC36 based on TGbe D1.01.

* 5195 5265 8038 8199 8343 5263 5264 5693 5921 5991 6304 6374 6886 6375 6768 7420 7421 8198 8240 8241 (20 CIDs)

Revisions:

* Rev 0: Initial version of the document.
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** | **Commenter** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 5195 | Guogang Huang | 35.3.10.6 | 271.13 | Update this figure 35-10 and the corresponding text because the assocaition is successful only when the transmitting link is accepted | As in comment. | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5195. |
| 5265 | Insun Jang | 35.3.10.6 | 271.01 | In Figure 35-10, the example for ML setup is not proper because if link 1 is not accpeted, the ML setup fails. Please modify the example, e.g., Association Request frame is trasnmitted on link 2 | As in the comment, we need to modify the example to be consistent with ML setup procedure | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5265. |
| 8038 | Yuchen Guo | 35.3.10.6 | 271.36 | In this example, link 1 (the transmitting link) is not accepted for multi-link setup. Suggest changing the example to be the case that non-AP STA 2 sends the association response | as in comment | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 8038. |
| 8199 | Yunbo Li | 35.3.10.6 | 271.01 | The group didn't get a conclusion whether AP can reject the link that Association Request frame in transmitted on for a successful association. It is better to modify the example in Figure 35-10 that the Association Request frame is transmitted on link 2. | as in comment | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 8199. |
| 8343 | Zhiqiang Han | 35.3.10.6 | 271.42 | Non-AP STA 1 sends the Association Request frame to AP2 on link1, so the information of link1 is not included in multi-link element. AP MLD cannot reject link1 between AP1 and non-AP STA1 | as in comment. | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 8343. |
| 5264 | Insun Jang | 35.3.10.6 | 270.45 | This is not consistent with the subclause 35.3.6.1.4 Power state after enablement. It says "the initial power management mode of the STA, immediately after the acknowledgement of the (Re)Association Response frame, is active mode". Please clarify it | As in the comment | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5264. |
| 5693 | kaiying Lu | 35.3.10.6 | 269.30 | Clarify that the MLD level listen interval is based on the Beacon interval of the link on which an association request frame is received. | Please clairify it | Revised-In 9.4.1.6 Listen Interval field, it says its value is in units of the maximum value of beacon intervals corresponding to the links that the non-AP MLD intends to setup in the (Re)Association Request frame. A clearification is added in this subclauseTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5693. |
| 5921 | Li-Hsiang Sun | 35.3.10.6 | 269.34 | The duration of Listen Interval signaled on link 1 should be at least greater than the largest BI of all other requested setup links, otherwise the non-AP may miss BU if monitor beacon on other links | add a non-AP requirement as in comment | RevisedIn the subclause 9.4.1.6 Listen Interval field, it says its value is in units of the maximum value of beacon intervals corresponding to the links that the non-AP MLD intends to setup in the (Re)Association Request frame, so the duration of Listen Interval signaled on link 1 should be at least greater than the largest BI of all other requested setup links. A clearification about the unit is added in this subclause.TGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5921. |
| 5263 | Insun Jang | 35.3.10.6 | 270.40 | Please add the sublcuase 9.4.1.6 Listen Interval field as a reference for understanding. Likewise, for the next example | As in the comment | Revised-Agree with the comment. Proposed resolution accounts for the suggested changeTGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 5263. |
| 5991 | Liwen Chu | 35.3.10.6 | 269.26 | The frame should be sent by MLD through its affiliated STA to its peer MLD. | As in comment | RejectedIt is correct that the frame is sent by a non-AP STA affiliated a non-AP MLD. In the draft, there are a few similar sentence like this. |
| 6304 | Ming Gan | 35.3.10.6 | 269.01 | The motion " the WNM sleep interval of a non-AP MLD is applied at the MLD level and not at the link level" is not reflected in this subclause | as in the comment | RejectedThe corresponding text was added into the subclause 11.2.3.1 General. So there is no any change more. |
| 6374 | Morteza Mehrnoush | 35.3.10.6 | 269.31 | Please add "with" to "The AP affiliated AP MLD...". | as in comment | Accepted- |
| 6886 | Rubayet Shafin | 35.3.10.6 | 269.31 | It says "AP affiliated AP MLD". There should be a "with" in the middle. | Please change it to "AP affiliated with AP MLD" | Accepted- |
| 6375 | Morteza Mehrnoush | 35.3.10.6 | 270.48 | Please add "with" to "affiliated the non-AP MLD is required...". | as in comment | Accepted- |
| 6768 | Romain GUIGNARD | 35.3.10.6 | 269.31 | Please change multi-link setup in multi-link (re)setup | as in comment | Accepted- |
| 7420 | SunHee Baek | 35.3.10.6 | 269.32 | The listen interval can be presented as 300 ms. In this case, the adjective "large" in the sentence is needed to be changed as "long". | Please change to "the listen interval requested by the non-AP MLD is too long." | Rejected-“large” here is for value of this field. It is correct based on the text in the Spec. |
| 7421 | SunHee Baek | 35.3.10.6 | 271.44 | Is the listen interval requested by the non-AP MLD the value of the most longest the becon interval among of links between MLDs regardless of whether the links are accepted or not? Is it mandatory? | Please clarify it. | Rejected-There is no any change which is needed for the comment.Note to the commenter: AP MLD needs to know the exact value of the linsten interval such that it can manage its buffered BUs to the corresponding non-AP MLD where all the affiliated non-AP STAs are in power save mode. The existing text just makes sure the AP MLD knows the requested listen interval from the non-AP MLD. Otherwise, it will bring the interoperability issue. |
| 8198 | Yunbo Li | 35.3.10.6 | 269.42 | "all STAs operating on enabled links and affiliated with the non-AP MLD that is associated with the multi-link (re)setup are in power save mode", it is redundant to say "that is associated with the multi-link (re)setup", because enabled links already imply that the non-AP MLD finished the multi-link setup. | remove "that is associated with the multi-link (re)setup" | Accepted- |
| 8240 | Yuxin LU | 35.3.10.6 Operation for MLD listen interval | 269.42 | Change "associated with the multi-link (re)setup" to "associated with the AP MLD" | As in comment | Revised-This part is redundant based on the CID 8198, so it is removed.TGbe editor to make the changes shown in 21/1587r0 under all headings that include CID 8240. |
| 8241 | Yuxin LU | 35.3.10.6 Operation for MLD listen interval | 269.47 | Change "STA affiliated with the MLD" to "STA affiliated with the non-AP MLD", in alignment with line 41, which says "affiliated with the non-AP MLD" | As in comment | Accepted- |

**Discussion:** None.

***TGbe editor: Please modify the subclause 35.3.10.6 Operation for MLD listen Interval as follows***

**35.3.10.6 Operation for MLD listen Interval**

During multi-link (re)setup, the value carried in Listen Interval field in the (Re)Association Request frame sent by a non-AP STA affiliated with a non-AP MLD to an AP affliatated with an AP MLD is requested at the MLD level. The value of Listen Interval field shall be in units of the maximum value of beacon intervals corresponding to the links that the non-AP MLD intends to setup in the (Re)Association Request frame (see 9.4.1.6 (Listen Interval field) (#CID 5693, 5921 and 5263). The AP affliated with (#CID 6374, 6886) AP MLD may reject the multi-link (re)setup (#CID 6768) because the listen interval requested by the non-AP MLD is too large. After successful multi-link (re)setup, the AP MLD shall use the listen interval in determining the lifetime of frames that it buffers for the non-AP MLD.

The AP MLD may delete buffered BUs for the implementation dependent reasons (subject to 11.2.3.10 (AP and AP MLD aging function)), including the use of an aging function and availability of buffers where the aging function is based on the listen interval indicated by the non-AP MLD in its (Re)Association Request frame or the WNM sleep interval specified by the non-AP MLD in the WNM Sleep Mode Request frame.

If all STAs operating on enabled links and affiliated with the non-AP MLD (#CID 8198, 8240) are in power save mode, at least one of these STAs shall wake up to receive at least one Beacon frame scheduled for transmission within the interval of duration equal to the listen interval indicated by the non-AP MLD in its (Re)Association Request frame, starting from the last TBTT for which another STA or the same STA affiliated with the non-AP MLD (#CID 8241) was awake.

An example of operation for MLD listen interval is shown in Figure 35-9 (Example of operation for MLD listen interval)



Figure 35-9—Example of operation for MLD listen interval

In this example, AP MLD has three affiliated APs: AP 1 operates on link 1, AP 2 operates on link 2, and AP 3 operates on link 3. The beacon intervals of link 1, link 2 and link 3 are 300 ms, 200 ms and 70 ms, respectively. Non-AP STA 1 affiliated with the non-AP MLD sends an Association Request frame to AP 1 affiliated with the AP MLD. The non-AP STA 1 requests three links to be setup (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3) and set the value of Listen Interval field carried in the Association Request frame to 1 and the value of Listen Interval field in units of 300 ms (#CID 5263). Therefore, the listen interval requested by the non-AP MLD is 300ms. AP 1 affiliated with the AP MLD accepts the three links for this multi-link setup (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3) by sending an Association Response frame to non-AP STA 1 affiliated with the non-AP MLD. After the successful mult-link setup, non-AP STA 2 and non-AP STA 3 enter in power save mode. A little later, non-AP STA 1 enters power save mode (i.e., signals PM = 1). (#CID 5264) In this case, the AP MLD shall buffer the DL BUs to the non-AP MLD at least for 300 ms. At T1, the non-AP STA 1 recevies a Beacon frame on link 1, then a non-AP STA affliated with (#CID 6375) the non-AP MLD is required to wake up to receive at least one Beacon frame before T2 where T2=T1+300ms, for example, the non-STA 1 receives the second Beacon frame on link1 (at T1+300ms), or the non-AP STA 2 receives the second Beacon frame on link 2 (at T1+200ms), or the non-AP STA 3 receives the fourth Beacon frame on link 3 (at T1+280ms). The figure was simplified to show the first Beacon frames on all links as aligned. In real deployment, the first TBTTs on all links may not be aligned.

Another example of operation for MLD listen interval is shown in Figure 35-10 (Another example of operation for MLD listen interval)



Figure 35-10—Another example of operation for MLD listen interval

In this example, AP MLD has three affiliated APs: AP 1 operates on link 1, AP 2 operates on link 2, and AP 3 operates on link 3. The beacon intervals of link 1, link 2 and link 3 are 300 ms, 200 ms and 70 ms, respectively. Non-AP STA 2 affiliated with the non-AP MLD sends an Association Request frame to AP 2 affiliated with the AP MLD. The non-AP STA 2 requests three links to be setup (link 1 between AP 1 and non-AP STA 1, link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3) and sets the value of Listen Interval field carried in the Association Request frame to 1 and the value of Listen Interval field in units of 300 ms (#CID 5263). AP 2 affiliated with the AP MLD accepts the two links for this multi-link setup (link 2 between AP 2 and non-AP STA 2, and link 3 between AP 3 and non-AP STA 3) by sending an Association Response frame to non-AP STA 2 affiliated with the non-AP MLD, then listen interval requested by the non-AP MLD is still 300 ms and it is not changed along with the accepted links in the multi-link setup procedure. After the successful mult-link setup, non-AP STA 3 enters in power save mode. A little later, non-AP STA 2 enters power save mode (i.e., signals PM = 1). (#CID5264) In this case, the AP MLD shall buffer the DL BUs to the non-AP MLD at least for 300 ms. At T1, the non-AP STA 2 recevies a Beacon frame on link 2, then either non-AP STA 2 or non-AP STA 3 is required to wake up to receive at least one Beacon frame before T2 where T2=T1+300ms, for example, the non-AP STA 2 receives the second Beacon frame on link 2 (which occurs at T1+200ms in this example) or the non-AP STA 3 receives the fourth Beacon frame on link 3 (which occurs at T1+280ms). The figure was simplified to show the first Beacon frames on all links as aligned. In real deployment, the first TBTTs on all links may not be aligned. (#CID 5195, 5265, 8038, 8199 and 8343)