IEEE P802.11
Wireless LANs

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| LB271 CR for Listen Interval |
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Abstract

This submission proposes resolutions of comments received from TGbe comment collection LB271 based on TGbe D3.1.

17963 16829 15872 16537 16538 16539 16540 16436 16046 16830 16541 16542 15102 16437 17294 (15 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** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 17963 | 35.3.12.6 | 542.01 | Is the WNM Sleep interval included in operation of MLD listen interval ? It may be applied as listen interval,but we need more specific clarification.If it is involved in WNM sleep mode in multi-link operation,i don't find relevant sentences specifying the unit of it(e.g., the maximum DTIM beacon interval of all links) | as the comment | Rejected-The comment asks to clarify the relationship between WNM Sleep and Listen Interval behavior. The Listen Interval is independent of WNM Sleep behavior, which is described in 11.2.3.1 (General). |
| 16829 | 35.3.12.6 | 542.05 | "The value of the Listen Interval field shall be in units of the maximum value of beacon intervalscorresponding to the links that the non-AP MLD intends to setup in the (Re)Association Request frame (see9.4.1.6 (Listen Interval field))." is very confusing. The LI field is defined in Clause 9 as being in units of beacon intervals, and I don't think it makes sense to redefine it here as being in units of a number of beacon intervals, especially with such a vague definition ("maximum ... intends") as the receiver doesn't know the sender's intentions | Delete (leave units as in Clause 9) | Revised-Rephrase this sentence based on offline discussion. Apply the changes marked as #16537 in this document. |
| 15872 | 35.3.12.6 | 542.06 | How this MLD listen interval gets interpreted or updated after a link removal via ML Reconfiguration? Missing info for handling this situation causes mis-interpretation and wrong behavior. | Add necessary description on how this value should be re-interpretated or need to be updated after a link removal. | Revised-The note after the first paragraph clarifies that the Listen Interval is not changed after the multi-link setup, even if there is link removal/addition. To make it clear, the note is rephrased. Apply the changes marked as #15872 in this document. |
| 16537 | 35.3.12.6 | 542.08 | The AP MLD is the entity that may reject the multi-link setup due to large value that is requested for the Listen Interval, not the affiliated AP - since the Listen Interval is applied in the MLD level.Please revise the sentence, as suggested. | Please revise the sentence as follows: "The AP MLD may reject the multi-link (re)setup because the listen interval requested by the non-AP MLD is too large. After successful multi-link (re)setup,.." | Revised-Apply the changes marked as #16537 in this document. |
| 16538 | 35.3.12.6 | 542.23 | A non-AP STA that is in power save mode does not "wake up" for receiving Beacon frames - please revise the terminology to "transit its power state from doze state to awake state", as suggested | Please revise the sentence as follows: " at least one of these non-AP STAs shall \*transit its power state from doze state to awake state\* 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,..." | Rejected-The original sentence is grammatically correct. “wake up” is also commonly used in 802.11REVme D2.0. The suggested change is not needed. |
| T16539 | 35.3.12.6 | 543.12 | The requirement to change the power state to awake state in order to receive Beacon frame applies to any of the non-AP STAs affiliated with the non-AP MLD. Please revise the sentence as suggested. | The sentence should be revised as follows:"...then \*any of the non-AP STAs\* affiliated with the non-AP MLD is required to wake up .." | Rejected-The original sentence is grammatically correct. The suggested change is not needed. |
| 16540 | 35.3.12.6 | 543.13 | A non-AP STA that is in power save mode does not "wake up" for receiving Beacon frames - please revise the terminology to "transit its power state from doze state to awake state", as suggested | Please revise the sentence as follows: " ...then a non-AP STA affiliated with the non-AP MLD is required to \*transit its power state from doze state to awake state\* to receive at least one Beacon frame before T2 where T2 = T1 + 250 ms,..." | Rejected-The original sentence is grammatically correct. “wake up” is also commonly used in 802.11REVme D2.0.The suggested change is not needed. |
| 16436 | 35.3.12.6 | 543.16 | In the sentence "...the fourth beacon frame on link 3 (at T1 + 280ms)", the value 280ms is not correct. | The sentence should be corrected with the correct value, i.e. 210ms (i.e. 3\*70ms) | Accepted- |
| 16046 | 35.3.12.6 | 543.17 | On link 3, the non-AP STA3 needs to receive third beacon at T1+210 ms, so that it wakes up before T2 (T1+250 ms). Same issue needs to be fixed on pg544 ln10. | Update text as in comment | Accepted- |
| 16830 | 35.3.12.6 | 543.18 | "may" should be "might" | As it says in the comment. Also at 544.10 | Accepted- |
| 16541 | 35.3.12.6 | 543.62 | The AP MLD is the entity that accepts or rejects the ML Association Request frame that is sent by the non-AP STA affiliated with the non-AP MLD, not the affiliated AP2.Please revise the sentence as suggested | The sentence should be revised as follows:" \*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, ...." | Revised-Apply the changes marked as #16541 in this document. |
| 16542 | 35.3.12.6 | 544.06 | A non-AP STA that is in power save mode does not "wake up" for receiving Beacon frames - please revise the terminology to "transit its power state from doze state to awake state", as suggested | Please revise the sentence as follows: " then either non-AP STA 2 or non-AP STA 3 is required to \*transit its power state from doze state to awake state\* to receive at least one Beacon frame before T2 where T2 = T1 + 250 ms, ..." | Rejected-The original sentence is grammatically correct. “wake up” is also commonly used in 802.11REVme D2.0.The suggested change is not needed. |
| 15102 | 35.3.12.6 | 544.07 | "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 + 250 ms" Then there is an example "or the non-AP STA 3 receives the fourth Beacon frameon link 3 (which occurs at T1 + 280 ms)" T1+280 exceeds listening interval so AP may discard the BU | Clarify for the example of non-AP STA 3 receivers the fourth Beacon frame on lin 3, the AP may discard the BU | Revised-It is typo, it should be T1+210 ms on link 3. Apply the changes marked as #15102 in this document. |
| 16437 | 35.3.12.6 | 544.09 | In the sentence "...the fourth beacon frame on link 3 (at T1 + 280ms)", the value 280ms is not correct. | The sentence should be corrected with the correct value, i.e. 210ms (i.e. 3\*70ms) | Accepted- |
| 17294 | 35.3.12.6 | 544.10 | "which occurs at T1+280 mms" seems not right | Change to T1+210 mms | Accepted- |

**Discussion:** None.

**35.3.12.6 Operation for MLD listen interval**

During multi-link (re)setup, the value carried in the (16828) Listen Interval field in the (Re)Association Request frame sent by a non-AP STA affiliated with a non-AP MLD to an AP affiliated with an AP MLD is requested at the MLD level. The Listen Interval value included by the non-AP MLD in a (Re)Association Request frame shall be in units of the maximum beacon interval of the requested setup links (see 9.4.1.6 (Listen Interval field)).(#16829) The AP MLD, via the affiliated AP, (#16537) may reject the multi-link (re)setup 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.

NOTE— The value of the listen interval negotiated during successful multi-link (re)setup remains unchanged for the duration of the association. (#15872)

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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 250 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 in units of 250 ms. Therefore, the listen interval requested by the non-AP MLD is 250 ms. The AP MLD, via the affiliated AP 1, (#16541) 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 multi-link setup, non-AP STA 2 and non-AP STA 3 enter (#16603) power save mode. A little later, non-AP STA 1 enters power save mode (i.e., signals PM = 1). In this case, the AP MLD shall buffer the DL BUs to the non-AP MLD at least for 250 ms. At T1, the non-AP STA 1 receives a Beacon frame on link 1, then a non-AP STA affiliated with the non-AP MLD is required to wake up to receive at least one Beacon frame before T2 where T2 = T1 + 250 ms, for example, the non-AP STA 1 receives the second Beacon frame on link 1 (at T1 + 250 ms), or the non-AP STA 2 receives the second Beacon frame on link 2 (at T1 + 200 ms), or the non-AP STA 3 receives the fourth Beacon frame on link 3 (at T1 + 210 ms). (#16436, 16046) The figure is simplified to show the first Beacon frames on all links as aligned. In a real deployment, the first TBTTs on all links might (#16830) not be aligned.

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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 250 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 in units of 250 ms. The AP MLD, via the affiliated AP 2,(#16541) 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, the listen interval requested by the non-AP MLD is still 250 ms and it is not changed along with the accepted links in the multi-link setup procedure. After the successful multi-link setup, non-AP STA 3 enters (#16605) power save mode. A little later, non-AP STA 2 enters power save mode (i.e., signal PM = 1). In this case, the AP MLD shall buffer the DL BUs to the non-AP MLD at least for 250 ms. At T1, the non-AP STA 2 receives 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 + 250 ms, for example, the non-AP STA 2 receives the second Beacon frame on link 2 (which occurs at T1 + 200 ms in this example) or the non-AP STA 3 receives the fourth Beacon frame on link 3 (which occurs at T1 + 210 ms) (#16046, 15102, 16437, 17294). The figure is simplified to show the first Beacon frames on all links as aligned. In a real deployment, the first TBTTs on all links might(#16830) not be aligned.