IEEE P802.11
Wireless LANs

|  |
| --- |
| LB275 Comment Resolution – Multi-Link Traffic Indication (MLTI) |
| Date: 2023-9-20 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Minyoung Park | Intel Corporation |  |  | Minyoung.park@intel.com |
|  |  |  |  |  |
|  |  |  |  |  |

Abstract

This submission proposes comment resolution(s) for the following 21 CID(s) received in LB275 on TGbe D4.0 related to the Multi-link Traffic Indication in subclause 9.3.3.2, 9.4.2.315, 35.3.12.4:

CIDs:

19669 19755 19852 19867 19784 19717 19718 19719 19785 19786

19206 19212 19720 19721 19787 19788 20122 19722 19723 19851

19213

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: added a missing CID tag.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause Number** | **Page.****Line** | **Comment** | **Proposed Change** | **Resolution** |
| 19669 | Arik Klein | 9.4.2.315 | 290.25 | The following sentnece is grammarly unclear since singular/ plural tense is mixed (too many s are wrapped in brackets - Please revise as suggested. | The sentence should be revised as follows: "The \*subsequent\* N Per-Link Traffic Indication Bitmap n subfields correspond to the AIDs of the non-AP MLDs or a non-MLD non-AP STAs that are identified by the corresponding bits that are equal to 1, where N is the number of bit(s) that are equal to 1..." | Rejected.There could be only one Per-Link Traffic Indication Bitmap n subfield, so ‘(s)’ is necessary to include one or more Per-Link Traffic Indication Bitmap n subfields. |
| 19755 | Abhishek Patil | 9.4.2.315 | 291.23 | A non-AP MLD can retrieve DL BUs for any TID if all the TIDs are mapped to at least one link. Therefore, the AP MLD does not need to include Multi-Link Traffic Indication element in a Beacon frame of its affiliated APs. | Replace "all the enabled links" with "at least one enabled link". Same change on line 29. | Rejected.The suggested change assumes that a non-AP MLD always first uses a link on which all TIDs are mapped to retrieve buffered data without knowing whether it can use other enabled links on which not all TIDs are mapped. This could limit the performance of the non-AP MLD.  |
| 19852 | Vishnu Ratnam | 35.3.12.4 | 541.53 | The size of the multi-link traffic indication element can be unnecessarily too large, since the AP may not have a specific link recommendation for many AIDs. A mechanism to reduce size of the MLTI element is needed. | Introduce an AID bitmap element as an optional subfield of the MLTI element that indicates the AIDs for which traffic is pending and the AP MLD has a link recommendation. The per link traffic indication list only inludes indication for the AIDs indicated in this AID bitmap. | Rejected.The same comment CID17993 was discussed in the group in the previous LB but the group couldn’t reach consensus. |
| 19867 | Ming Gan | 35.3.12.4 | 541.59 | pending buffered traffic is not clear | change it to "the status ofbuffered, individually addressed MSDUs/MMPDUs" | Revised.TGbe editor to make the following changes in TGbe D4.0 with the CID tag (#19867):P541L54 and P54158: change ‘pending buffered’ to ‘the status of buffered, individually addressed MSDUs/MMPDUs’ |
| 19784 | Abhishek Patil | 35.3.12.4 | 542.25 | This is a duplication of the first bullet in the last paragraph of this subclause. Duplication leads to inconsistent spec text. | Delete this paragraph to remove the duplication. | Revised.Agree in principle. Combined the two paragraphs to one and deleted the last paragraph.TGbe editor to make the changes with the CID tag (#19784) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19717 | Arik Klein | 35.3.12.4 | 542.37 | The first part of the following sentnece is grammarly unclear since singular/ plural tense is mixed (too many s are unecessarily wrapped in brackets): "The Per-Link Traffic Indication Bitmap n subfield(s) corresponds to the AID(s) of the non-AP MLD(s) or non-MLD non-AP STA(s), .... " - Please revise as suggested. | Please revise the sentnece as follows: "The Per-Link Traffic Indication Bitmap n subfield corresponds to the AID of the non-AP MLD or non-MLD non-AP STA,..." | Rejected.Since there could be one or more Per-Link Traffic Indication Bitmap n subfields, using ‘(s)’ is accurate. |
| 19718 | Arik Klein | 35.3.12.4 | 542.39 | The first Per-Link Traffic Indication Bitmap n subfield corresponds to a non-AP MLD, not to an AID. Please rephrase the sentence as suggested. | Please rephrase the sentence as follows: ".... and the first Per-Link Traffic Indication Bitmap n subfield corresponds to \*the non-AP MLD whose AID value is indicated\* in the AID Offset subfield of the Multi-Link Traffic Indication Control field \*that is contained in\* the Multi-Link Traffic Indication element. " | Revised.Agree in principle.TGbe editor to make the changes with the CID tag (#19718) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19719 | Arik Klein | 35.3.12.4 | 542.42 | Remove the unnecessary "(s)" and avoid using "that" after "that" in the following sentnece: " The order of the Per-Link Traffic Indication Bitmap n subfield(s) follows the order of the bit(s) that are set to 1 in the Partial Virtual Bitmap subfield of the TIM element that correspond(s) to the AID(s) of the non-AP MLD(s) or nonMLD non-AP STA(s) ".Please revise the sentnece as suggested. | The sentence shall be revised as follows: " The order of the Per-Link Traffic Indication Bitmap n subfields follows the order of the bits that are set to 1 in the Partial Virtual Bitmap subfield of the TIM element \*and\* correspond to the AIDs of the non-AP MLDs or non-MLD non-AP STAs" | Revised.Agree in principle.TGbe editor to make the changes with the CID tag (#19719) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19785 | Abhishek Patil | 35.3.12.4 | 542.47 | Nondefault mapping includes the case when all TIDs are mapped to a subset of link. However, this paragraph would not apply when all TIDs are mapped to a subset of links. Therefore, "nondefault mapping" is not accurate. Please update the sentence to accurately reflect this. | As in comment | Revised.Agree in principle.TGbe editor to make the changes with the CID tag (#19785) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19786 | Abhishek Patil | 35.3.12.4 | 542.50 | Needs to be set to 1 only when there isn't at least one link where all TIDs are mapped to and the non-AP STA(s) operating on the link(s) where the TID is mapped to are in power-save mode. | Please update the sentence to clarify this. | Rejected.The suggested change assumes that a non-AP MLD always first uses a link on which all TIDs are mapped to retrieve buffered data without knowing whether it can use other enabled links on which not all TIDs are mapped. This could limit the performance of the non-AP MLD.  |
| 19206 | Minyoung Park | 35.3.12.4 | 542.63 | It is not clear how the Bitmap Size subfield is set since the paragraph is using "should" and lack of information about the "smallest link ID value". | Change "should" to "shall" and delete "minus the smallest link ID value" from the paragraph. | Accepted. |
| 19212 | Sanghyun Kim | 35.3.12.4 | 542.62 | Because the Bitmap Size subfield can be set to the difference between the largest and smallest link ID value amongst the bits that are set to 1 in the Per-Link Traffic Indication Bitmap subfield(s), interpretation of the Per-Link Traffic Indication Bitmap subfield needs to be corrected. For example, if the Bitmap size subfield is determined to be 3-1 = 2 (the largest link ID set to 1 is 3, and the smallest is 1), then B0 in the Per-Link Traffic Indication Bitmap subfield should correspond to Link ID 1, and B2 should correspond to Link ID 3. | Link ID offset information should be provided along with the Bitmap size subfield, and the link ID corresponding to B0 in the Per-Link Traffic Indication Bitmap subfield should be determined based on the information. | Revised.TGbe editor to make the changes with the CID tag (#19206) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19720 | Arik Klein | 35.3.12.4 | 542.62 | The Bitmap Size subfield of the Multi-Link Traffic Indication Control field should be set to (m-1) and not to m (as currently stated in the sentnece). Otherwise - it is in conflict with P290L14 :" The Bitmap Size subfield is set to the size of each Per-Link Traffic Indication Bitmap n subfield minus 1, in bits." | The sentence should be revised as follows: " The Bitmap Size subfield of the Multi-Link Traffic Indication Control field should be set to (m-1), where m is ...." | Rejected.‘m’ is correct since m is the largest Link ID value and the link ID value starts from 0. |
| 19721 | Arik Klein | 35.3.12.4 | 542.62 | The difference between the largest link ID value and the smallest link ID value is measured among the Per-Link Traffic Indication Bitmap n subfields, not among the bits. Please rephrase the sentence as suggested. | The sentence should be revised as follows: "... where m is equal to the largest link ID value minus the smallest link ID value amongst the Per-Link Traffic Indication Bitmap n subfield(s) whose bits that are set to 1"Per-Link Traffic Indication Bitmap n subfield(s)." | Revised.TGbe editor to make the changes with the CID tag (#19206) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |
| 19787 | Abhishek Patil | 35.3.12.4 | 543.02 | When a non-AP MLD has all TIDs mapped to at least one enabled link, then it can receive DL BU(s) for any TID on that link. Based on the TID(s) of the retrieved BU(s), the non-AP MLD can then decide to wake-up on additional link(s). | Replace the 'all enabled links' with 'at least one link' | Rejected.The method described in the comment forces a non-AP MLD to first retrieve data on a link on which all TIDs are mapped and then use other enabled link, which could limit the performance of the non-AP MLD. |
| 19788 | Abhishek Patil | 35.3.12.4 | 544.25 | When a non-AP MLD has all TIDs mapped to at least one enabled link, then it can receive DL BU(s) for any TID on that link. Based on the TID(s) of the retrieved BU(s), the non-AP MLD can then decide to wake-up on additional link(s). Replace the 'all enabled links' condition with 'at least one link' | Replace the 'all enabled links' with 'at least one link' - 2 instances in this bullet. | Rejected.The method described in the comment forces a non-AP MLD to first retrieve data on a link on which all TIDs are mapped and then use other enabled link, which could limit the performance of the non-AP MLD. |
| 20122 | Gaurang Naik | 25 | 544.35 | If all TIDs are mapped to one link, non-AP MLDs can receive Beacons on that link. This condition does not seem correct.  | Change "mapped to all the enabled links" to "mapped to at least one enabled link" on L25 and change "that are not mapped to all enabled links" to "that are not mapped to at least one enabled link" on L26.  | Rejected.The method described in the comment forces a non-AP MLD to first retrieve data on a link on which all TIDs are mapped and then use other enabled link, which could limit the performance of the non-AP MLD. |
| 19722 | Arik Klein | 35.3.12.4 | 543.41 | The non-AP STA affiliated with the non-AP MLD has to be in awake state (in PS mode) in order to issue a PS-Poll frame or a U-APSD trigger frame. Please add this condition to the sentence, as suggested. | The sentence should be revised as follows: "... any non-AP STA affiliated with the non-AP MLD \*which is in awake state (operating under PS mode)\* may issue a PS-Poll frame, or a U-APSD trigger frame ..." | Rejected.When a STA transmits a frame, it is in the awake state and this condition doesn’t need to be added in every place in the spec where a STA is transmitting a frame. |
| 19723 | Arik Klein | 35.3.12.4 | 543.49 | The non-AP STA affiliated with the non-AP MLD has to be in PS mode / awake state in order to issue a PS-Poll frame or a U-APSD trigger frame. Please add this condition to the sentence, as suggested. | The sentence should be revised as follows: "... any non-AP STA affiliated with the non-AP MLD that operates on the link(s) indicated as 1 in the Per-Link Traffic Indication Bitmap subfield \*and which is in awake state (under PS mode)\* may issue a PS-Poll frame, or a U-APSD trigger frame ..." | Rejected.When a STA transmits a frame, it is in the awake state and this condition doesn’t need to be added in every place in the spec where a STA is transmitting a frame. |
| 19851 | Vishnu Ratnam | 35.3.12.4 | 543.46 | A mechanism should be provided in the traffic indication procedure, for an AP affiliated with an AP MLD to recommend one or more non-AP MLD(s) with default TTLM to wake up STAs operating on all links to receive BUs when the traffic buffer at AP MLD is large. | When a non-AP MLD that is in the default mapping mode detects that the bit corresponding to its AID is equal to 1 in the TIM element and the Multi-Link Traffic Indication element is present in a Beacon frame and the Multi-Link Traffic Indication element includes a Per-Link Traffic Indication Bitmap n subfield that corresponds to the non-AP MLD, the non-AP MLD shall operate as follows: (i) if all bits of the Per-Link Traffic Indication Bitmap n subfield are set to 0, all non-AP STAs affiliated with the non-AP MLD should issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all ACs are delivery enabled, to retrieve buffered BU(s) from the AP MLD. (ii) if not all bits of the Per-Link Traffic Indication Bitmap n subfield are set to 0, any non-AP STA affiliated with the non-AP MLD that operates on the link(s) indicated as 1 in the Per-Link Traffic Indication Bitmap n subfield may issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all ACs are delivery enabled, to retrieve buffered BU(s) from the AP MLD. | Rejected.The control of the power management of a non-AP MLD should be left to the non-AP MLD and not controlled by an AP MLD as there could be cases in which the non-AP MLD cannot follow what the AP MLD is asking due to its constraints on power consumption.  |
| 19213 | Sanghyun Kim | 35.3.12.4 | 543.55 | Even if a non-AP MLD has successfully negotiated TID-to-Link mapping, the Per-Link Traffic Indication subfield might not be indicated depending on the TID of the BU for that non-AP MLD.It is neccessary adding a rule for the non-AP MLD that has successfully negotiated TID-to-link mapping and does not receive ML-TIM element. | Please add the following rule:When a non-AP MLD that has successfully negotiated TID-to-link mapping and not all TIDs are mapped to all the enabled links detects that the bit corresponding to its AID is equal to 1 in the TIM element and does not receive the corresponding Per-Link Traffic Indication Bitmap subfield, any non-AP STA affiliated with the non-AP MLD may issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all ACs are delivery enabled, to retrieve buffered BU(s) from the AP MLD. | Revised.Agree in principle. Deleted ‘that is in the default mapping mode’ in the paragraph in P543L36 so that this paragraph can apply to any non-AP MLD that detects its corresponding TIM bit is set to 1 in TIM element and there is no MLTI element or the corresponding Per-Link Traffic Indication Bitmap n subfield. Also added the ‘all TIDs mapped to all enabled links’ in the paragraph (P543L46) for the link recommendation case.TGbe editor to make the changes with the CID tag (#19213) in doc.: IEEE 802.11-23/1660r1[https://mentor.ieee.org/802.11/dcn/23/11-23-1660-01-00be-lb275-cr-mlti.docx] |

**TGbe Editor to make the following changes in Subclause 35.3.12.4 (Traffic indication) in TGbe D4.0: (#19867)**

**35.3.12.4 Traffic indication**

An AP affiliated with an AP MLD where the AP is not a member of a multiple BSSID set shall indicate (#19867)the status of buffered, individually addressed MSDUs/MMPDUs for a non-AP MLD associated with that AP MLD using the partial virtual bitmap of the TIM element as described in 9.4.2.5 (TIM element) and by following the rules described in this subclause.

An AP affiliated with an AP MLD where the AP corresponds to a transmitted BSSID in a multiple BSSID set shall indicate (#19867)the status of buffered, individually addressed MSDUs/MMPDUs for a non-AP MLD associated with any AP MLD that has an affiliated AP in the same multiple BSSID set as the AP using the partial virtual bitmap of the TIM element as described in 9.4.2.5 (TIM element), 11.1.3.8.5 (Traffic advertisement in a multiple BSSID set), and by following the rules described in this subclause.

**TGbe Editor to make the following changes in Subclause 35.3.12.4 (Traffic indication) in TGbe D4.0 by combining the two paragraphs in P542L25 and P544L22: (#19784)**

(Paragraph starting from P542L25)

and an AP affiliated with an AP MLD shall include the Multi-Link Traffic Indication element (see 9.4.2.315 (Multi-Link Traffic Indication element)) in a Beacon frame it transmits if any of the following conditions is met:

 and an AP affiliated with the AP MLD shall not include the Multi-Link Traffic Indication element in a Beacon frame

…

(Paragraph starting from P544L22)

**TGbe Editor to make the following changes in Subclause 35.3.12.4 (Traffic indication) in TGbe D4.0 P542L36:**

The Multi-Link Traffic Indication element includes Per-Link Traffic Indication Bitmap *n* subfield(s) in the Per-Link Traffic Indication List field. The Per-Link Traffic Indication Bitmap *n* subfield(s) corresponds to the AID(s) of the non-AP MLD(s) or non-MLD non-AP STA(s), and the first Per-Link Traffic Indication Bitmap *n* subfield corresponds to (#19718)the non-AP MLD whose AID value is contained in the AID Offset subfield of the Multi-Link Traffic Indication Control field of the Multi-Link Traffic Indication element. The order of the Per-Link Traffic Indication Bitmap *n* subfields follows the order of the bits that are set to 1 in the Partial Virtual Bitmap subfield of the TIM element and corresponds to the AIDs of the non-AP MLDs or non-MLD non-AP STAs.(#19719)

If a non-AP MLD has successfully negotiated a TTLM with an AP MLD (#19785)and not all TIDs are mapped to all enabled links, the bit position *i* of the Per-Link Traffic Indication Bitmap *n* subfield that corresponds to the link with the link ID that is equal to *i* on which a non-AP STA affiliated with the non-AP MLD is operating shall be set to 1 if the AP MLD has buffered BU(s) with TID(s) that are mapped to that link or MMPDU(s) for that non-AP MLD, otherwise, the bit shall be set to 0.

…

(Paragraph P542L62)

The Bitmap Size subfield of the Multi-Link Traffic Indication Control field shall be set to *m*, where *m* is equal to the largest link ID value amongst the bits that are set to 1 in the Per-Link Traffic Indication Bitmap *n* subfield(s).(#19206)

…

(Paragraph P543L36)

When a non-AP MLD (#19213)detects that the bit corresponding to its AID is equal to 1 in the TIM element and the Multi-Link Traffic Indication element is not present in a Beacon frame or the Multi-Link Traffic Indication element is present in a Beacon frame but the Multi-Link Traffic Indication element does not include a Per-Link Traffic Indication Bitmap *n* subfield that corresponds to the non-AP MLD, any non-AP STA affiliated with the non-AP MLD may issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all ACs are delivery enabled, to retrieve buffered BU(s) from the AP MLD.

When a non-AP MLD that is in the default mapping mode (see 35.3.7.2.2 (Default mapping mode)) (#19213)or has all TIDs mapped to all enabled links detects that the bit corresponding to its AID is equal to 1 in the TIM element and the Multi-Link Traffic Indication element is present in a Beacon frame and the Multi-Link Traffic Indication element includes a Per-Link Traffic Indication Bitmap *n* subfield that corresponds to the non-AP MLD, any non-AP STA affiliated with the non-AP MLD that operates on the link(s) indicated as 1 in the Per-Link Traffic Indication Bitmap *n* subfield may issue a PS-Poll frame, or a U-APSD trigger frame if the STA is using U-APSD and all ACs are delivery enabled, to retrieve buffered BU(s) from the AP MLD.