IEEE P802.11
Wireless LANs

|  |
| --- |
| CC36 Resolution for CIDs related to Multiple BSSID (Part 1) |
| Date: December 2, 2021 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Abhishek Patil | Qualcomm Inc |  |  | appatil@qti.qualcomm.com |
| Gaurang Naik |  |  |  |
| George Cherian |  |  |  |
| Alfred Asterjadhi |  |  |  |
| Duncan Ho |  |  |  |
| Yanjun Sun |  |  |  |
| Abdel Karim |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

 Abstract

This submission proposes resolutions for following 10 CID received for TGbe CC36:

4203 4205 4678 5071 4087 6645 5074 5075 8252 8253

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Revised based on offline feedback from various members (Po-Kai, Minyoung, Chunyu, Arik, Tomo)
	+ Includes 6 more CIDs: 4678 5071 4087 6645 5074 5075
	+ Removed CIDs 4010 and 4083

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** |
| 4203 | Alfred Asterjadhi | 35.3.18.1 | 284.48 | Use neither nor, reads better. | As in comment. | **Revised**Agree with the commenter. The cited text was revised as suggested by the commenter. Similar change was made to the 1st paragraph in AA.3**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 4203** |
| 4205 | Alfred Asterjadhi | 35.3.18.1 | 284.60 | Since this is optional (may include) is there some other way for a non-AP STA to understand whether that nonTx BSSID is part of an AP MLD? Please clarify | As in comment. | **Revised**The cited sentence was updated as a resolution to CID 3212 (in doc 11-21/254 during CC34). However, there was an error in incorporating the change and did not appear in D1.0. The issue was fixed in subsequent releases of the draft (D1.01 and later). The resolution to CID 3212 address this comment.**TGbe editor, no changes are needed to address this CID.** |
| 4678 | Brian Hart | 9.3.3.2 | 105.07 | Beacons are getting longer, and approaching the limits of what legacy STAs can receive. Consider 11n+11ac+11ax+11be capabilities + operation elements + WFA-related elements + MBSSID-related parameters | We need solutions to this, and which are palatable to the industry and will get WFA-certified. EMA seems a natural starting point; but it is likely that adaptations for MLO are needed, and potentially simplifications / profiles. | **Revised**Agree in principle. IEEE 802.11ax defines, in clause 11.1.3.8, the conditions when an HE AP operates as EMA AP and the procedure for operating as an EMA AP. All EHT APs are HE APs (see 4.3.16a). Therefore, TGbe doesn’t need to define a new procedure. The proposed change adds a paragraph referring to baseline spec pointing to the clause describing the procedure for multiple BSSID set, co-hosted BSSID set and PPDU classification.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 4678****Same resolution for CIDs 5071 and 4087** |
| 5071 | Gaurav Patwardhan | 11.1.3.8 | 183.10 | With ever increasing Beacon sizes because of newer PHYs and now MLO added to it, 802.11be needs to support EMA for EHT APs and AP MLDs. | Extend EMA AP support from 802.11ax\_D8.0 to include EHT APs and AP MLDs for multiple BSSID procedure. | **Revised**Agree in principle. IEEE 802.11ax defines, in clause 11.1.3.8, the conditions when an HE AP operates as EMA AP and the procedure for operating as an EMA AP. All EHT APs are HE APs (see 4.3.16a). Therefore, TGbe doesn’t need to define a new procedure. The proposed change adds a paragraph referring to baseline spec pointing to the clause describing the procedure for multiple BSSID set, co-hosted BSSID set and PPDU classification.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 4678****Same resolution as CID 4678** |
| 4087 | Abhishek Patil | 35.3.18 | 284.40 | During scanning, a non-AP MLD is looking to gather information of multiple links. Therefore, an EHT AP must provide adequate information for scanning a non-AP MLD to determine the configuration and membership of the set (such as number of active BSSIDs in the set). In addition, an EHT AP must respond with the information of BSSID not known to the requesting STA if the soliciting Probe Request frame includes Known BSSID element. Provide corresponding guidance for non-AP MLD - e.g., make use of MBSSID configuration and the tools such as Known BSSID element to quickly gather information of the intended BSSID in the Multiple BSSID set. | Commenter will provide a contribution | **Revised**Agree in principle. IEEE 802.11ax defines, in clause 11.1.3.8, the conditions when an HE AP operates as EMA AP and the procedure for operating as an EMA AP. All EHT APs are HE APs (see 4.3.16a). Therefore, TGbe doesn’t need to define a new procedure. The proposed change adds a paragraph referring to baseline spec pointing to the clause describing the procedure for multiple BSSID set, co-hosted BSSID set and PPDU classification.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 4678****Same resolution as CID 4678** |
| 6645 | Pooya Monajemi | 35.3.18 | 284.40 | With inclusion of MLO, beacon sizes are expected to increase beyond today's already large numbers. EMA was designed in 11ax in order to reduce the beacon sizes in multi-BSSID cases, although not widely adopted. We need to ensure proper handing of large beacon sizes is mandatory by all non-AP STAs. | Make EMA support mandatory for EHT non-AP STAs. | **Revised**Agree in principle. The proposed change adds a paragraph in clause 35.14.1 recommending that an EHT non-AP STA follows the EMA procedure described in clause 11.1.3.8.3 for efficient discovery during scanning and saving power after association.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 6645** |
| 5074 | Gaurav Patwardhan | 35.3.9.2 | 264.56 | There is support missing for Channel Switch Announcement (CSA)/ Extended Channel Switch Announcement (eCSA) when an AP affilied with an AP MLD intends to switch its link to a new channel and another AP operating on a different link and affilied with the same AP MLD is an EMA AP and cannot broadcast the annoucement in a timely fashion. | Fix the subclause 35.3.9.2 to support the case where one of the APs in an AP MLD is an EMA AP as referenced by the comment. | **Revised**Agree in principle. The proposed change requires an AP affiliated with an AP MLD to advertise an upcoming event (channel change or quiet periods) early enough such that it is included (advertised) in a DTIM Beacon of the other APs affiliated with the same AP MLD. The text provides an exception for channel switch scenario in case the affected AP is required to change channel immediately to meet DFS conditions. In addition, per clause 11.1.3.8.3 (baseline), an EMA AP is required to include a nontransmitted BSSID profile in its DTIM Beacon frame. Therefore, no additional changes are needed to support EMA operation. Explanatory NOTEs are added for further clarification.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 5074** |
| 5075 | Gaurav Patwardhan | 35.6.4.2 | 298.47 | There is support missing for Quiet element when an AP affilied with an AP MLD signals Quiet element on one link and another AP operating on a different link and affilied with the same AP MLD is an EMA AP and cannot signal the Quiet element in a timely fashion. | Fix the subclause 35.6.4.2 to support the case where one of the APs in an AP MLD is an EMA AP as referenced by the comment. | **Rejected**Per clause 35.3.10, a Quiet element advertised by an AP affiliated with an AP MLD, to facilitate rTWT operation on its link, is not advertised (i.e., included in the Per-STA profile carried in an ML IE) by another AP affiliated with the same AP MLD. Therefore, no additional considerations are needed when the other AP is operating as an EMA AP. |
| 8252 | Yuxin LU | Annex AA.2 | 633.48 | Suggest to add "in power save mode" following "when it wakes" for completeness | Change this sentence to "The links shown in the figures are operating on different channels." | **Revised**The cited sentence and the paragraph containing the sentence was revised to clarify the operation at the AP side and how it can aid power-save operation at an associated non-AP STA.**TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 8252** |
| 8253 | Yuxin LU | Annex AA.3 | 633.65 | "operating on different channels" is more of a requirement rather than assumption, since MLD1 operates on all the three links as shown in Figure AA-6 | Change this sentence to "The links shown in the figures are operating on different channels." | **Revised**Agree with the comment. The contents and the figure under AA.3 are updated to clarify that the multiple BSSID set operate on a particular channel and that each AP affiliated with an AP MLD operating on the same channel has its own link. **TGbe editor, please incorporate changes as shown in doc 11-21/1184r1 tagged as CID 8253** |

***TGbe editor: The baseline for this document is 11be D1.31.***

* + 1. **Multi-link operation in a multiple BSSID set or co-hosted BSSID set**

**35.3.19.1 General**

***TGbe editor: Please update the 3rd paragraph in this subclause as shown below:***

Each AP affiliated with an AP MLD shall be independently configured to operate as a transmitted or as a nontransmitted BSSID in a multiple BSSID set, or as an AP belonging to a co-hosted BSSID set, or as an AP that is neither a member of a multiple BSSID set nor a member of a co-hosted BSSID set. Annex AA provides example configurations.[4203]

***TGbe editor: Please add the following paragraph after the 3rd paragraph in this subclause as shown below:***

[4678]An AP affiliated with an AP MLD that is a member of a multiple BSSID set shall follow the procedures described in clause 11.1.3.8 (Multiple BSSID Procedure). A non-AP STA affiliated with a non-AP MLD shall follow the procedure described in clause 11.1.3.8 (Multiple BSSID Procedure) during discovery and after association when the peer AP is a member of a multiple BSSID set. An AP affiliated with an AP MLD that is a member of a co-hosted BSSID set shall follow the rules described in clause 26.17.7 (Co-hosted BSSID set). A non-AP STA affiliated with a non-AP MLD shall follow the procedure described in clause 26.17.7 (Co-hosted BSSID set) when the peer AP is a member of a co-hosted BSSID set.

NOTE – A STA affiliated with an MLD classifies a received PPDU as inter- or intra-BSS based on the rules defined in 26.2.2 (Intra-BSS and inter-BSS PPDU classification).

**35.14.1 Basic EHT BSS operation**

***TGbe editor: Please add the following paragraph in this subclause as shown below:***

[6645]If the peer AP is operating as an EMA AP, an EHT non-AP STA should follow the procedure described in 11.1.3.8.3 (Discovery of a nontransmitted BSSID profile) for efficient discovery during scanning and to save power after association.

**35.3.10 Multi-link procedures for channel switching, extended channel switching, and channel quieting**

***TGbe editor: Please add the following paragraph and NOTEs at the end of this subclause as shown below:***

[5074]An AP affiliated with an AP MLD that intends to setup quiet period(s) for its BSS shall start advertising the corresponding element(s) for a duration that is greater than or equal to the maximum value of the DTIM interval corresponding to each of the other AP(s) affiliated with the same AP MLD. An AP affiliated with an AP MLD that intends to switch the operating channel for its BSS shall start advertising the corresponding element(s) for a duration that is greater than or equal to the maximum value of the DTIM interval corresponding to each of the other AP(s) affiliated with the same AP MLD unless the AP is required to move out of its current operating channel within a short duration to meet regulatory rules.

NOTE 1 – Advertising the pertinent element(s) for a duration that includes the DTIM beacon on another link makes it possible for a non-AP MLD that is monitoring only the other link and is in doze state to wake-up only to receive the DTIM beacon on that link to get the notification (by receiving the element(s) in the per-STA profile, corresponding to the affected AP, of the Basic Multi-Link element).

NOTE 2 – The other AP affiliated with the AP MLD can correspond to either the transmitted BSSID or a nontransmitted BSSID if it belongs to a multiple BSSID set (see 35.3.19.1 (General)).

NOTE 3 – When the other AP affiliated with the same AP MLD operates as an EMA AP, the DTIM interval selected for a nontransmitted BSSID is a multiple of the value carried in the Full Set Rx Periodicity field of the Multiple BSSID Configuration element (as described in 11.1.3.8.3 (Discovery of a nontransmitted BSSID profile) and Annex AA). With this mechanism, a non-AP STA, that is associated with an AP corresponding to the nontransmitted BSSID, can receive the profile (and any updates carried within the profile) in a DTIM beacon without having to wake up for additional beacons and thus saving power in the process.

### AA.2 Examples illustrating the relationship between profile periodicity and DTIM interval

***TGbe editor: Please update the contents of this subclause as shown below:***

[8252]***Move the following content from subclause AA.1 as the first paragraph of this (AA.2) subclause and apply changes as shown below:***

[8252]The examples provide guidance on how an AP might organize the inclusion of nontransmitted BSSID profiles in its Beacon frames if it cannot fit all the profiles in a single Beacon frame (i.e., the AP advertises partial list of profiles). By having the DTIM interval for a nontransmitted BSSID be a multiple of the profile periodicity, the profile for that BSSID would always appear in its DTIM beacon. This helps an associated non-AP STA save power by not having to wake-up, from doze state, for listening to beacons other than the DTIM beacon to receive any updates to its associated profile.

**AA.3 Example illustrating the relationship between multi-link operation and multiple BSSID set or co-hosted BSSID set**

***TGbe editor: Please update the contents of this subclause (including the Figures) as shown below:***

[4203]Each AP affiliated with an AP MLD can correspond to a transmitted or a nontransmitted BSSID in a multiple BSSID set, or to an AP belonging to a co-hosted BSSID set, or to an AP that is neither a member of a multiple BSSID set nor a member of a co-hosted BSSID set.

[8253][8253]The first example illustrates the case where APs on each channel belong to a multiple BSSID set. APs affiliated with the same AP MLD have the same properties (such as security credentials, SSID etc) while APs within the same multiple BSSID set have different properties (e.g., security credentials, SSID etc). Therefore, APs belonging to the same multiple BSSID set on a channel are not affiliated with the same AP MLD. Figure AA-6 (Example of affiliated APs from different multiple BSSID sets) shows an example where APs affiliated with an AP MLD belong to a multiple BSSID set on their respective channel. Further, APs within the same AP MLD may correspond to a transmitted or nontransmitted BSSID.



[8253]**Figure AA-6—Example of affiliated APs from different multiple BSSID sets**

[8253]Figure AA-6 (Example of affiliated APs from different multiple BSSID sets) illustrates that APs corresponding to BSSID-x and BSSID-y are part of a multiple BSSID set on channel 1 and are affiliated with different AP MLDs (MLD 1 and MLD 3, respectively). On channel 1, AP-y, affiliated with MLD 3, corresponds to the transmitted BSSID (depicted as BSSID-y [T]) for the multiple BSSID set on channel 1. On channel 2, there are three APs that are part of the same multiple BSSID set and each is affiliated with a different AP MLD. AP-q, affiliated with MLD 2, corresponds to the transmitted BSSID (depicted as BSSID-q [T]) for the multiple BSSID set on channel 2. On channel 3, there are three APs which are part of the same multiple BSSID set and two of the APs are affiliated with two different MLDs. AP-a, affiliated with MLD 1, corresponds to the transmitted BSSID (depicted as BSSID-a [T]) for the multiple BSSID set on channel 3. AP-c is a not affiliated with any AP MLD. Each AP MLD independently assigns a Link ID to its affiliated APs (shown as “(Link n)” in the example).

[8253]The second example illustrates the case where APs affiliated with an AP MLD belong to a mix of a multiple BSSID set, a co-hosted BSSID set and an AP that is neither a member of multiple BSSID set nor a member of a co-hosted BSSID set. APs affiliated with the same AP MLD have same properties (such as security credentials, SSID etc) while APs within the same multiple BSSID set or within the same co-hosted BSSID set have different properties (e.g., security credentials, SSID etc). Therefore, APs belonging to the same co-hosted BSSID set on a channel are not part of the same AP MLD and APs belonging to the same multiple BSSID set on a channel are not affiliated with the same AP MLD. Figure AA-7 (Example of affiliated APs belonging to a multiple BSSID set, a co-hosted BSSID set and neither of these two cases) shows an example where APs affiliated with an AP MLD belong to a mix of multiple BSSID set, co-hosted set and neither a member of multiple BSSID set nor a member of a co-hosted BSSID set.



[8253]**Figure AA-7—Example of affiliated APs belonging to a multiple BSSID set, a co-hosted BSSID set and neither of these two cases**

[8253]As seen from [Figure AA-7 (Example of affiliated APs belonging to a multiple BSSID set, a co-hosted BSSID set](#bookmark1) [neither of these two cases)](#bookmark1), APs corresponding to BSSID-x, BSSID-z, and BSSID-y are part of the multiple BSSID set on channel 1 and are affiliated with different AP MLDs (MLD 1, MLD 2, and MLD 3, respectively). On channel 1, AP-y, affiliated with MLD 3, corresponds to the transmitted BSSID (depicted as BSSID-y [T]) for the multiple BSSID set on channel 1. The three APs on channel 2, AP-p, AP-q, and AP-r, belong to the same co-hosted BSSID set and each is affiliated with a different MLD, MLD 1, MLD 2, and MLD 3, respectively. On channel 3, there is a single AP (AP-b) that is affiliated with AP MLD 2. Each AP MLD independently assigns a Link ID to its affiliated APs (shown as “(Link n)” in the example).