IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Resolutions for CC34 CIDs for channel switching quieting | | | | |
| Date: 2021-02-08 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Laurent Cariou |  |  |  | laurent.cariou@intel.com |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause Number(C)** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 2324 | Ming Gan | 35.3.9 | 138.01 | The tile is vague, what is content for this subclause. It seems it is related to channel switch and so on | As in comment | Revised – agree with the commenter. As suggested by commenter in CID2600, change title to mutli-link general procedures. Apply the changes marked as #2324 in this document. |
| 2600 | Rojan Chitrakar | 35.3.9 | 138.01 | Ambigious title: General procedures for what? | Clarify what the clause is for. Use a more descriptive title: Multi-link general procedure? | Revised – agree with the commenter. Change title to mutli-link general procedures. Apply the changes marked as #2600 in this document. |
| 1693 | GEORGE CHERIAN | 35.3.9.1 | 138.11 | "NOTE--Management frames that would carry such information include Beacon, Probe Response, and (Re)Association Response frames."  Update the NOTE to say 'NOTE - The Mgmt frames are the ones that carry Basic variant of ML IE'" | As in the comment | Revised – agree with the commenter. Apply the changes marked as #1693 in this document. |
| 3254 | Yuchen Guo | 35.3.9.1 | 138.06 | Not only "field", but also "information elements" shall be regarded as if been received from the reported AP | add " or information element" after "field" | Revised – the term fields have been used to be as general as possible, as elements also contains fields. Add a note to clarify. Apply the changes marked as #3254 in this document. |
| 1073 | Abhishek Patil | 35.3.9.2 | 138.15 | There are several long sentences describing different cases and conditions under which certain rules apply. The long sentences are harder to follow and are error prone. | Split the long sentences into smaller ones to address each condition and case separately. It will also help to separately address the MBSSID cases. Provide figures to show the sequence of events. | Revised – for multiple BSSID case, there would already be 4 cases and we would need to repeat the 20 lines 4 times. Not sure if that would really improve readability. On the contrary, adding a figure that illustrates how the fields are set in different cases would help improve the readability. Apply the changes marked as #1073 in this document. |
| 1074 | Abhishek Patil | 35.3.9.2 | 138.15 | The proposed mechanism needs to be extended to handle new association (ML setup) case where the associating non-AP MLD needs to be made aware of the quiet intervals on another link of the AP MLD or duration for which the AP on another link that performed channel change operation won't resume beaconing operation. See doc 11-20/1140 for details. | The commenter will provide a contribution | Revised – agree with the commenter. Information should be provided in (re)association response frames in some specific cases. Explicitly define rules for those specific cases. Apply the changes marked as #1074 in this document. |
| 1203 | Arik Klein | 35.3.9.2 | 138.14 | In case that Beacon frame or Probe Response frame is transmitted by the transmitted BSSID in the same multiple BSSID set as the first AP if the first AP corresponds to a nontransmitted BSSID, need to add a note that the location of any of the transmitted elements can be either in non-transmitted BSSID profile corresponding to the first AP (if the element is not inherited from the same element in the Beacon or the Probe Response) or is utilized from the same element that resides in the Beacon or Probe response of the transmitted BSSID (if this element is inherited). | Add the following note: "In case that Beacon frame or Probe Response frame is transmitted by the transmitted BSSID in the same multiple BSSID set as the first AP if the first AP corresponds to a nontransmitted BSSID, the location of any of the transmitted elements can be either in: - non-transmitted BSSID profile corresponding to the first AP, if the element is not inherited from the same element in the Beacon or the Probe Response - or is utilized from the same element that resides in the Beacon or Probe response of the transmitted BSSID, if this element is inherited. | Revised – agree with the commenter. Modify the normative text to mention that the element is included explicitly or through inheritance. Apply the changes marked as #1203 in this document. |
| 1428 | Chien-Fang Hsu | 35.3.9.2 | 138.29 | it is not clear another AP is affiliated to the same AL MLD with which AP. | Clarify it | Revised – modify the sentence to improve reasability.  Apply the changes marked as #1428 in this document. |
| 1429 | Chien-Fang Hsu | 35.3.9.2 | 138.17 | The "or" here introduces a condition when multiple BSSID applies, but it is not clear if the first AP is affliated to an AP MLD | Clarify it | Revised – modify the sentence to improve reasability.  Apply the changes marked as #1429 in this document. |
| 1430 | Chien-Fang Hsu | 35.3.9.2 | 138.55 | it is not defined to set which fields to the initial operating class/channel | Clarify it | Revised – modify the sentence to improve reasability.  Apply the changes marked as #1430 in this document. |
| 1431 | Chien-Fang Hsu | 35.3.9.2 | 138.62 | it is not defined to set which fields to the target operating class/channel | Clarify it | Revised – modify the sentence to improve reasability.  Apply the changes marked as #1431 in this document. |
| 1658 | Geonjung Ko | 35.3.9.2 | 138.17 | It is unclear which AP corresponds to "a first AP" | Clarify "a first AP" | Revised – modify the sentence to improve reasability.  Apply the changes marked as #1658 in this document. |
| 1694 | GEORGE CHERIAN | 35.3.9.2 | 138.17 | "If the Beacon frame or Probe Response frame transmitted by a first AP affiliated to an AP MLD, or transmitted by the transmitted BSSID in the same multiple BSSID set as the first AP if the first AP corresponds to a nontransmitted BSSID, any of the following elements is included for the first AP"  Sentence does not read right. Please fix | As in the comment | Revised – modify the sentence by adding “in” at the beginning of the sentence to improve reasability.  Apply the changes marked as #1694 in this document. |
| 1754 | Hanseul Hong | 35.3.9.2 | 138.17 | What does it mean by 'first AP'? | Define the 'first AP' | Revised – propose to add a note to clarify why we use the term First AP in this paragraph. Apply the changes marked as #1754 in this document. |
| 2132 | Laurent Cariou | 35.3.9.2 | 0.00 | what happens if the beacon is scheduled on link 2 during a quiet period on link1 (how is it signaled?) | as in comment | Revised – propose to modify the encoding of the quiet count subfield to point to a TBTT in the past on other links. Apply the changes marked as #2132 in this document. |
| 2166 | Laurent Cariou | 35.3.9.2 | 0.00 | We need to specify how to signal a quiet period that is ongoing in a quiet element that is sent on another link per this procedure. | as in comment | Revised – propose to modify the encoding of the quiet count subfield to point to a TBTT in the past on other links. Apply the changes marked as #2166 in this document. |
| 2191 | Li-Hsiang Sun | 35.3.9.2 | 138.38 | Not clear what "the most recent TBTT" is. Is it 1) the last TBTT of the reported AP that is <= last/next TBTT of the reporting AP? Or 2) the TBTT of the reported AP indicated in the TBTT info of RNR element sent by reporting AP? | Clarify "the most recent TBTT" is the TBTT indicated in the TBTT info of RNR element sent by the reporting AP |  |
| 2197 | Li-Hsiang Sun | 35.3.9.2 | 139.03 | After changing channel, the NSTR capability may be different and needs to be signaled The spec should also say what happens to the MLD association if the new channel on 1 link is not supported by a non-AP MLD | allow ML element to be included in SA query request frame to signal the new NSTR constraint  Clarify that the changed links is removed from the setup links in the ML association if the non-AP MLD does not support the new channel. |  |
| 2749 | Sanghyun Kim | 35.3.9.2 | 138.53 | Typo "extended channel switch announcement" Extended? Enhanced? | Change "enhanced channel switch announcement" to "extended channel switch announcement" | Revised – agree with the commenter. Apply the changes marked as #2749 in this document. |
| 2874 | Stephen McCann | 35.3.9.2 | 138.17 | What is a "first AP"? Does it matter that these procedures are applied to the first AP? | Change all occurances of "first AP" to "AP". | Revised – first AP is just used here to make the sentence clearer and to differentiate that AP from the other APs of the AP MLD. Add a note to help that understanding. Apply the changes marked as #2874 in this document |
| 2875 | Stephen McCann | 35.3.9.2 | 138.30 | The text "the other AP" implies that there are only 2 APs affiliated to the MLD. | Change "the other AP" to "another AP" | Revised – change the sentence to clarify that the following applies to each of the other APs. Apply the changes marked as #2875 in this document. |
| 2911 | SunHee Baek | 35.3.9.2 | 138.29 | "the same AP MLD" is needed to be specified with the first AP mentioned above. | change "Then, if another AP is affiliated to the same AP MLD:" to "Then, if another AP is affiliated to the same AP MLD with the first AP:" | Revised – agree with the commenter. Apply the changes marked as #2911 in this document. |
| 2912 | SunHee Baek | 35.3.9.2 | 138.34 | A citation is needed to explain about the Basic variant Multi-Link element (9.4.2.295b.2). | change "to the first AP in the Basic variant Multi-Link element corresponding to the AP MLD." to "to the first AP in the Basic variant Multi-Link element(see 9.4.2.295b.2 (Basic variant Multi-Link element)) corresponding to the AP MLD." | Revised – agree with the commenter. Apply the changes marked as #2912 in this document. |
| 3320 | Yunbo Li | 35.3.9.2 | 138.55 | "another affiliated AP of the AP MLD shall set the fields corresponding to the first AP that is reported in the Reduced Neighbor Report element in Beacon and Probe Response frames it transmits (or that the transmitted BSSID in the same multiple BSSID set as the other AP transmits if the other AP corresponds to a nontransmitted BSSID) before the target switch time to the initial operatingﾠclass/channel," This and following subbullet covers the case before and after the target switch time respectively. How to set the operating class/channel when Beacon trasmit time overlapped with target switch time? | as in comment. | Revised – Agree with the commenter. Modify the condition so that the AP includes the target operating class/channel at or after the target switch time. Apply the changes marked as #3320 in this document. |

**Discussion for CID2132 and CID2166**

With current agreement: If a quiet interval is happening on one link of an AP MLD, then the AP on another link of the AP MLD shall include a Quiet element to describe the ongoing Quiet interval. But current signaling doesn’t allow that.

Define everything with one Quiet element by defining a way to indicate a TBTT reference that is not in the future but in the past. One way to do this is to use values above 127 in the Quiet count field to indicate negative values: -128 is -1 TBTT, -129 is -2 TBTT, …

This would force quiet elements to never use absolute values above 128, which means TBTT periods that can not be higher than 128 BIs.

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 802.11 editor on how to merge the text with the baseline documents).***

1. **Proposed spec text**

TGbe editor: modify the following subclause (35.3.9 General procedures) as shown below

**35.3.9 Multi-link general procedures (#2324, #2600)**

**35.3.9.1 General**

If a STA of a non-AP MLD receives a Management frame with a field corresponding to a reported AP of the AP MLD, then an affiliated STA (if any) of the non-AP MLD that operates on the link of the reported AP shall follow the procedure (if any) corresponding to receiving such field from the reported AP, as if that field was received by the affiliated STA from the reported AP.

NOTE 1—Management frames that would carry such information are the ones that carry Basic variant Multi-link element. (#1693)

NOTE 2—The fields can be included in elements in the management frame. (#3254)

**35.3.9.2 Channel switching, extended channel switching, and channel quieting** (#2749)

If a first AP is affiliated to an AP MLD and in the Beacon frame or Probe Response frame either transmitted by the first AP (# 1429, 1658, 1694, 1754 and 2874), or transmitted by the transmitted BSSID in the same multiple BSSID set as the first AP if the first AP corresponds to a nontransmitted BSSID, any of the following elements is included for the first AP:

* Channel Switch Announcement element
* Extended Channel Switch Announcement element (#2749)
* Max Channel Switch Time element
* Quiet element
* Quiet Channel element

Then, for each of the other APs affiliated to the same AP MLD as the first AP, the following applies (#2875, #2911, #1428):

* in the Beacon frames and Probe Response frames transmitted by the other AP, or transmitted by the transmitted BSSID in the same multiple BSSID set as the other AP if the other AP corresponds to a nontransmitted BSSID, the same element(s) shall be included explicitly or through inheritance (35.3.2.3 Inheritance in a per-STA profile) (#1203) in the per-STA profile corresponding to the first AP in the Basic variant Multi-Link element (see 9.4.2.295b.2 (Basic variant Multi-Link element)) (#2912) corresponding to the AP MLD,
* the timing fields in the Channel Switch Announcement element, the Extended (#2749) Channel Switch Announcement element, the Quiet element, and the Quiet Channel element shall be applied in reference to the most recent TBTT and BI indicated in the corresponding element(s) of the first AP and not to the TBTT and BI of the other AP of the AP MLD.

NOTE 1—If the other AP corresponds to a nontransmitted BSSID, the same element(s) for the first AP is included in the per-STA profile corresponding to the first AP in the Basic variant Multi-Link element corresponding to the AP MLD in the nontransmitted BSSID profile corresponding to the other AP in the Multiple BSSID element in the Beacon and Probe Response frames transmitted by the transmitted BSSID.

NOTE 2—If an AP affiliated to an AP MLD is switching channel, the Channel Switch Announcement element, the Extended (#2749) Channel Switch Announcement element, and the Max Channel Switch Time elements will be included in every Beacon and Probe Response frames on all links of the AP MLD from right after the time the AP includes the elements in the Beacon frame it transmits until the intended channel switch time.

NOTE 3—The term First AP is used in this paragraph to differentiate this AP with the other APs that are part of the same AP MLD. (#1754, #2874)

When a first AP of an AP MLD is switching from an initial operating class/channel to a target operating class/channel at a target switch time using channel switch announcement procedure or extended channel switch announcement procedure, then:

* another affiliated AP of the AP MLD shall set the Operating Class and Channel Number (#1430) fields corresponding to the first AP that is reported in the Reduced Neighbor Report element in Beacon and Probe Response frames it transmits (or that the transmitted BSSID in the same multiple BSSID set as the other AP transmits if the other AP corresponds to a nontransmitted BSSID) before the target switch time to the initial operating‌ﾠclass/channel,
* another affiliated AP of the AP MLD shall set the Operating Class and Channel Number (#1431) fields corresponding to the first AP that is reported in the Reduced Neighbor Report element in Beacon and Probe Response frames it transmits (or that the transmitted BSSID in the same multiple BSSID set as the other AP transmits if the other AP corresponds to a nontransmitted BSSID) at or (#3320) after the target switch time to the target operating class/channel.

end of changes

TGbe editor: add the following paragraphs at the end of subclause 35.3.9.2 Channel switching, extended channel switching, and channel quieting (#1074)

If an AP (affected/reported AP) of an AP MLD is switching from an initial operating class/channel to a target operating class/channel at a target switch time using channel switch announcement or extended channel switch announcement procedure and includes a Max Channel Switch Time element in the Beacon and Probe Response frames it sends, and another AP (reporting AP) of the AP MLD receives a (Re)Association Request frame to perform multi-link setup with the AP MLD with the AP (affected/reported AP) as a requested link, then the other AP (reporting AP) shall include a Max Channel Switch Time element in the per-STA profile corresponding to the AP (affected/reported AP) in the Basic variant Multi-link element included in the (Re)Association Response frame it sends in response to indicate the time at which the AP (affected/reported AP) will start beaconing, if the (Re)Association Response frame is sent between the last beacon on the initial operating class/channel and the first beacon on the target operating class/channel. Otherwise, the other AP (reporting AP) shall not include a Max Channel Switch Time element or (Extended) Channel Switch Announcement element in (re)association response frames.

When an AP (affected/reported AP) of an AP MLD has announced quiet intervals using Quiet element and optionally Quiet Channel element, and another AP (reporting AP) of the same AP MLD receives a (Re)Association Request frame to perform multi-link setup with the AP MLD with the AP (affected/reported AP) as a requested link, then the other AP (reporting AP) shall include the corresponding Quiet element and Quiet Channel element (if present) in the per-STA profile corresponding to the AP (affected/reported AP) in the Basic variant Multi-link element included in the (Re)Association Response frame it sends in response. Otherwise, the other AP (reporting AP) shall not include a Quiet element and Quiet Channel element in (re)association response frames.

end of changes

TGbe editor: add the following paragraphs at the end of subclause 35.3.9.2 Channel switching, extended channel switching, and channel quieting (#1073)



Figure 35-x – Example of an AP carrying a Quiet element to signal channel quieting on another link

For the example shown in Figure 35-x (Example of an AP carrying a Quiet element to signal channel quieting on another link), AP1 and AP2 are two APs affiliated with an AP MLD that operate on Link 1 and Link 2, respectively. The Beacon frame transmitted by AP1 includes a Quiet element to indicate a scheduled quiet interval on Link 1 (the affected link). From this point onward and until the quiet interval begins on Link 1, AP2, which operates on Link 2 (the reporting link), includes a Quiet element in the Per-STA Profile subelement corresponding to AP1 in the Basic variant Multi-Link element carried in its Beacon frames. Although not shown in the figure, Quiet element will also be included in the Per-STA Profile subelement of the Basic variant Multi-Link element corresponding to AP1 carried in the Probe Response frames transmitted by AP2. The values of the Quiet Count field, Quiet Offset field, and the Quiet Duration field of the Quiet element carried on Link 2 are set by AP2 with reference to Link 1. As the value of the Beacon Interval for AP2 is greater than the value of Beacon Interval for AP1, the Quiet Count field of the Quiet element is decremented at a faster rate (i.e., 2 in this example) in every subsequent Beacon transmitted by AP1. In Figure 35-x (Example of an AP carrying a Quiet element to signal channel quieting on another link), a STA affiliated with a non-AP MLD, that is capable of operating on Link 2, transmits a (Re-)Association Request frame to AP2, in order to perform multi-link setup. The multi-link setup includes Link 1 as one of the links. Since the (Re-)Association Response frame is transmitted by AP2 after the quiet interval has started on Link 1, AP2 includes the Quiet element in the Per-STA Profile corresponding to AP1 in the (Re-)Association Response frame it transmits. The value of the Quiet Count field of the Quiet element carried in the (Re-)Association Response frame is set to 129 to indicate that the quiet interval on Link 1 started in the Beacon Interval that occurred 2 TBTTs in the past on Link 1.



Figure 35-y – Example of an AP carrying a Channel Switch Announcement element to signal channel switching on another link

For the example shown in Figure 35-y (Example of an AP carrying a Channel Switch Announcement element to signal channel switching on another link), AP1 and AP2 are two APs affiliated with an AP MLD that operate on Link 1 and Link 2, respectively. The Beacon frame transmitted by AP1 includes a Channel Switch Announcement element to indicate that the channel on Link 1 (the affected link) will be switched. From this point onward and until the channel on Link 1 switches, AP2, which operates on Link 2 (the reporting link), includes a Channel Switch Announcement element in the Per-STA Profile corresponding to AP1 in the Basic variant Multi-Link element carried in the Beacon frame it transmits. When AP1 begins to include the Channel Switch Announcement element in its Beacon frames, the Change Sequence subfield in the TBTT Information field corresponding to AP1 in the Reduced Neighbor Report element carried in AP2’s Beacon frames is incremented by 1. The values of the Channel Switch Count field of the Channel Switch Announcement element carried on Link 2 are set by AP2 with reference to Link 1. As the value of the Beacon Interval for AP2 is twice the value of Beacon Interval for AP1, the Channel Switch Count field of the Channel Switch Announcement element is decremented by 2 in every subsequent Beacon transmitted by AP1. If AP1 carries the Extended Channel Switch Announcement element and the Max Channel Switch Time element in the Beacon frame its transmits, AP2 also includes the Extended Channel Switch Announcement element and the Max Channel Switch Time element in the Per-STA Profile corresponding to AP1 in the Basic variant Multi-Link element in the Beacon frames it transmits. Although not shown in the figure, the Channel Switch Announcement element, Extended Channel Switch Announcement element (if included by AP1) and Max Channel Switch Time element (if included by AP1) will also be included in the Per-STA Profile subelement of the Basic variant Multi-Link element corresponding to AP1 carried in the Probe Response frames transmitted by AP2. In Figure 35-y (Example of an AP carrying a Quiet element to signal channel switching on another link), a STA affiliated with a non-AP MLD, that operates on Link 2, transmits a (Re-)Association Request frame to AP2 requesting Link 1 as one of the links for ML setup. Since the (Re-)Association Response frame is transmitted by AP2 after the last beacon frame on the initial operating class/channel on Link 1 and before the first beacon on the initial operating class/channel is transmitted, AP2 includes the Max Channel Switch Time element in the Per-STA Profile corresponding to AP1 in the (Re-)Association Response frame it transmits. The value carried in Max Channel Switch Time element provides an estimate of time until the first TBTT on the new channel on Link 1. The STA affiliated with the non-AP MLD operating on link 1 does not transmit a frame until it hears the first Beacon frame from AP1 on link 1.

end of changes

**9.4.2.22 Quiet element**

TGbe editor: Modify the 3rd paragraph of subclause 9.4.2.22 Quiet element as follows (#2132, #2166)

For a non-EHT AP, the Quiet Count field is set to the number of TBTTs until the beacon interval during which the next quiet interval starts. (#2472)The value of 0 is reserved. For an EHT AP:

* the Quiet Count field is equal to the number of TBTTs until the beacon interval during which the next quiet interval starts if the field is set to a value lower or equal to 127.
* the Quiet Count field minus 127 is equal to the number of TBTTs in the past to reach the beacon interval during which the ongoing quiet interval started if the field is set to a value higher than 127.

end of changes

**11.8.3 Quieting channels for testing**

TGbe editor: Add the following paragraph at the end of subclause 11.8.3 Quieting channels for testing (#2132, #2166)

An EHT AP shall follow the rules defined in 9.4.2.22 (Quiet element) to set the fields in the Quiet element and shall not schedule quiet intervals that would require a value higher than 127 in the Quiet Count field. (#2132, #2166)

NOTE – Quiet element carried in a Per-STA Profile of Basic variant Multi-Link element corresponding to a reported AP can have the Quiet Count field set to a value greater than 127 to indicate a quiet interval that the reported AP has started in the past on the link on which the reported AP operates. The number of TBTTs in the past is computed as defined in 9.4.2.22 (Quiet element).

end of changes