IEEE P802.11
Wireless LANs

|  |
| --- |
| Resolution for CIDs related to Multi-Link element (CC 34) – Part 2 |
| Date: March 20, 2021 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Abhishek Patil | Qualcomm Inc. |  |  | appatil@qti.qualcomm.com |
| Gaurang Naik |  |  | gnaik@qti.qualcomm.com |
| George Cherian |  |  | gcherian@qti.qualcomm.com |
| Alfred Asterjadhi |  |  | aasterja@qti.qualcomm.com |
| Duncan Ho |  |  | dho@qti.qualcomm.com |
| Yanjun Sun |  |  | yanjuns@qti.qualcomm.com |
| Xiaofei Wang | Interdigital |  |  |  |
| Tomo Adachi | Toshiba |  |  |  |
| Ryuichi | Sony |  |  |  |
| Insun | LGE |  |  |  |
| Namyeong |  |  |  |
| Laurent | Intel |  |  |  |
| Greg | Wilus |  |  |  |
| Rojan | Panasonic |  |  |  |

 Abstract

This submission proposes resolutions for following 40 CIDs received for TGbe CC34:

2294, 1858, 1859, 1034, 2149, 1861, 2831, 1833, 1863, 1860, 2586, 2183, 1799, 1035, 2451, 1036, 1050, 1778, 2165, 2489, 1864, 1919, 3315, 1184, 1185, 2866, 3335, 2309, 2964, 2472, 2296, 2868, 2167, 3021, 3212, 3369, 3370, 1005, 1896, 3016

***TGbe editor: Please note Baseline is 11be D0.4.***

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Revised based on feedback from several members – added as co-authors
	+ Added CID 3016 to the list of resolved comments based on discussion with Xiaofei
* Rev 2: Revised based on further feedback from Insun
	+ The following CIDs are transferred from Insun since they are resolved in this contribution
		- 1799, 1050, 1778, 2165, 2489
* Rev 3:
	+ Minor updates based on comment in doc 11-21/0218 (Mark Rison) – tagged as [#1]
	+ Additional updates based on feedback from Laurent, Rojan and Greg

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.***

**PART A** [9 CIDs: 2294 1858 1859 1034 2149 1861 2831 1833 1863]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 2294 | Michael Montemurro | 126.01 | 35.3.2 | This title makes no sense. How is it a container? | Rename to "Requirements for multi-link operation" | **Revised**Based on offline discussion with the commenter, the title of the subclause was changed to “Advertisement of multi-link information”.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2294 and revise the title in all references to the subclause throughout the draft.**  |
| 1858 | Jarkko Kneckt | 126.37 | 35.3.2.1 | The lines 37 - 40 seem to discuss on the content of the per-STA profile. These details are not needed in general introduction clause. | Please move lines 37 - 40 to clause 35.3.2.2 | **Revised**Agree with the comment. Moved the cited paragraphs to clause 35.3.2.2 at appropriate locations**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1858** |
| 1859 | Jarkko Kneckt | 126.37 | 35.3.2.1 | Per-STA profile does not have good introduction in the general paragraph. | Please add introduction for the Per-STA profile. | **Revised**Agree with the comment. Moved the 1st paragraph of clause 35.3.2.2 to clause 35.3.2.1 as the last paragraph with the text updated to clarify that clause 35.3.2.2 provides details on advertisement of per-link information. The title of 35.3.2.2 is updated as “Advertisement of complete or partial per-link information”**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1859 including updating the title of clause 35.3.2.2 throughout the draft.** |
| 1034 | Abhishek Patil | 126/47 | 35.3.2.2 | Remove the TBD. When the element is included in an ML Probe Response frame or (Re)Association Response frame, it carries complete profile. Complete profile includes all the capabilities and operational IEs with inheritance applied. For non-AP MLD, (Re)Association Request frame carries complete profile which includes the reported STA's capabilities. When the element is include in an ML Probe Response frame, it carries partial profile, the content depends on the content of soliciting ML Probe Request frame. For example, non-AP MLD can request specific element via the (Extended) Request element or non-AP MLD may request critical updates information. ML IE when included in the Beacon frame includes only MLD level information. | As in comment | **Revised**The TBD was addressed. The 3rd paragraph in clause 35.3.2.2 which was added by doc 11-21/242r4 (and incorporated in D0.4) covers when the profile carries complete information. The subclause 35.3.2.2 was updated to clarify the case of partial information or the case when link information is not carried in the frame:1. Basic variant ML IE when included in Authentication frame or Neighbor Report IE does not include Link Information field.2. Beacon frame doesn’t carry complete profile (to prevent bloating). Beacon may carry partial profile in case of critical updates such as channel switch announcement or quiet element3. Provided reference to clause 35.3.4.2 which provides rules for when probe response frame carries complete or partial profile.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1034.** |
| 2149 | Laurent Cariou | 0.00 | 35.3.2.2 | Fix: "exact set of elements/fields that constitute partial information is TBD", to refer to the Request element which specifies the requested partial information | as in comment | **Revised**The TBD was addressed. The 3rd paragraph in clause 35.3.2.2 which was added by doc 11-21/242r4 (and incorporated in D0.4) covers when the profile carries complete information. The subclause 35.3.2.2 was updated to clarify the case of partial information or the case when link information is not carried in the frame:1. Basic variant ML IE when included in Authentication frame or Neighbor Report IE does not include Link Information field.2. Beacon frame doesn’t carry complete profile (to prevent bloating). Beacon may carry partial profile in case of critical updates such as channel switch announcement or quiet element3. Provided reference to clause 35.3.4.2 which provides rules for when probe response frame carries complete or partial profile.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2149.** |
| 1861 | Jarkko Kneckt | 126/47 | 35.3.2.1 | Please list the elements that are mandatory to be present in a partial per-STA profile. | Please list the elements that are mandatory to include to the partial per-STA profile. | **Revised**The TBD was addressed. The 3rd paragraph in clause 35.3.2.2 which was added by doc 11-21/242r4 (and incorporated in D0.4) covers when the profile carries complete information. The subclause 35.3.2.2 was updated to clarify the case of partial information or the case when link information is not carried in the frame:1. Basic variant ML IE when included in Authentication frame or Neighbor Report IE does not include Link Information field.2. Beacon frame doesn’t carry complete profile (to prevent bloating). Beacon may carry partial profile in case of critical updates such as channel switch announcement or quiet element3. Provided reference to clause 35.3.4.2 which provides rules for when probe response frame carries complete or partial profile.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1861.** |
| 2831 | Srinivas Kandala |  | 0.00 | STA profile elements need to be expanded substantially | As in the Comment | **Revised**The comment is not clear about the clause where the changes are expected. There are several contributions in the queue that are adding text to clause 9 to describe new sub-fields that are being added to the STA Control and STA Info fields. The contents of the STA Profile field depend based on whether the profile is complete or partial. Text in clause 35.3.2.2 was updated to provide rules for when the profile is complete or partial. **TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2831.** |
| 1833 | Jarkko Kneckt | 75/35 | 9.4.2.295b.2 | The partial Per-STA Profile is not well defined. Does partial profile contain some mandatory fields that are always present in the non-copmplete profile? | Please clarify the fields that are always present and list the fields that may be optionally present in the non-complete profile. | **Revised**Agree with the commenter. A paragraph was added to clause 35.3.2.1 to clarify that the Multi-Link Control field is always carried in the element and signals the presence of other fields in the Common Info field of the element. A paragraph was added to clause 35.3.2.2 to clarify that the Per-STA Control field is always present and signals the presence of other field in the Per-STA Profile subelement.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1833.** |
| 1863 | Jarkko Kneckt | 127.15 | 35.3.2.3 | The basic variant multi-link element may be added to the authenticate req/resp frames, but there is no description of the content of the multi-link element in this case. | Please clarify how basic variant of the multi-link element is used in the authentication req/resp frames. Alternatively, please create new ML element for authentication req/resp frames. | **Revised**Agree with the commenter. Clause 35.3.5.4 was updated to clarify that per-STA profile is not carried in Basic variant ML IE that is included in an Authentication frame. Further, Table 9-40 was updated to indicate that Basic variant ML IE is present (not optionally present) in Authentication frame transmitted by a AP/STA affiliated with an MLD. **TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1863.** |

**35.3.2 Advertisement of multi-link information in Multi-Link element**[CID 2294]

**35.3.2.1 General**

***TGbe editor: Please move the following two paragraphs to clause 35.3.2.2 as shown below:***

[CID 1858]

[CID 1858]

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

[CID 1833]A STA affiliated with an MLD shall provide an indication of the presence of fields carried in the Common Info field of the Multi-Link element via the subfields in the Multi-Link Control field.

***TGbe editor: Please moved the following to clause 35.3.2.1 from 35.3.2.2 as the last paragraph with changes as shown below:***

[CID 1859]include Link Info field in the Basic variant Multi-link element that it transmits to affiliated with as defined in 35.3.2.2 (Advertisement of per-link information) [CID 1034, 2149, 1861, 1833, 2831]

**35.3.2.2 Advertisement of complete or partial per-link information**[CID 1859]

***TGbe editor: Please move the 1st paragraph of this subclause to clause 35.3.2.1 as shown below:***

[CID 1034, 2149, 1861, 1833, 1859]

***TGbe editor: Please add the following two paragraphs after the paragraph starting “A reporting STA affiliated with an MLD shall set the Complete Profile subfield…” in this subclause as shown below:***

[CID 1833] The subfields of the STA Control field in the Per-STA Profile subelement corresponding to a reported STA shall provide an indication of the presence of optional fields carried in the STA Info field.

[CID 1858],

***TGbe editor: Please add the following paragraphs after the paragraph starting “The complete information of a reported STA …” as shown below:***

[CID 1034, 2149, 1861, 2831]An AP affiliated with an AP MLD shall not include a complete profile of a reported AP affiliated with the same AP MLD in the transmitted Beacon frame or a Probe Response frame that is not an ML probe response as defined in 35.3.4.4 (Multi-link element usage rules in the context of discovery) and 35.3.9 (General procedures).

[CID 1858] a

[CID 1034, 1833, 2149, 1861, 2831]An AP affiliated with an AP MLD may include either the complete profile or the partial profile of a reported AP affiliated with the same AP MLD in a transmitted Probe Response frame, that is an ML probe response frame, as defined in 35.3.4.2 (Use of ML probe request and response).

**35.3.4.2 Use of ML probe request and response**

***TGbe: Please update the following paragraph as shown below***

[CID 1034, 2149, 1861, 2831]The partial information of a requested AP sent by a reporting AP consists of one or more elements that are requested in the (Extended) Request element carried in the ML probe request.

**35.3.5.4 Usage and rules of Basic variant Multi-link element in the context of multi-link setup**

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

An STA affiliated with an MLD shall include a Basic variant Multi-Link element containing the MLD MAC address of the MLD with which the STA is affiliated in the Authentication frame that it transmits. [CID 1863] A STA affiliated with an MLD shall not include a Link Info field of the Basic variant Multi-Link element in the Authentication frame that it transmits.

**9.3.3.11 Authentication frame format**

***TGbe editor: Please update the following entry in Table 9-40 as shown below:***

 **Table 9-40—Authentication frame body**[CID 1863]

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | Multi-Link | The Basic variant Multi-Link element is present if the STA is affiliated with an MLD and the frame exchange is with a peer STA that is affiliated with an MLD. Otherwise it is not present. |

**PART B** [20 CID: 1860 2586 2183 1799 1035 2451 1050 1778 2165 2489 1036 1864 1919 3315 1184 1185 2866 3335 2309 2964]

#1: indicates changes based on comments/suggestions in doc 11-21/0218r0 (Mark Rison)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 1860 | Jarkko Kneckt | 126/47 | 35.3.2.1 | The order of the information is not logical. The fields that are included in complete profile should be listed in clause that discusses on complete per-STA profile. | Please list the elements that are part of the complete per-STA profile in complete per-sta profile clause. | **Revised**Agree with the commenter. The list of elements and fields that are part of the complete per-STA profile and Figure 35-1 are moved to 35.3.2.2.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1860.** |
| 2586 | Rojan Chitrakar | 127/25 | 35.3.2.3 | "...each Per-STA Profile subelement in a Basic variant Multi-Link element that is a complete profile shall contain a list of elements as follows:"the bullets do not only talk about elements, it also talks about fields. | rephrase as:"...each Per-STA Profile subelement in a Basic variant Multi-Link element that is a complete profile shall contain a list of fields and elements as follows:" | **Revised**Agree with the comment. The cited sentence was updated to include fields.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2586.** |
| 2183 | Li-Hsiang Sun | 9.4.2.1 | 68.58 | DTIM count/period is currently in TIM or Multiple BSSID-index elements, but these elements (and their DTIM related fields) are unlikely to be included in the per-STA profile in some cases | define a new element for DTIM information of reported APs | **Revised**Agree with the comment. DTIM Info field and Beacon Interval fields were added to per-STA profile with corresponding presence indicator bits in the control field.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2964.** |
| 1799 | Insun Jang | 75.59 | 9.4.2.295b.2 | Based on current SFD, in order for a non-AP MLD to set its listen Interval, it shall obatin beacon intervals (BIs) of other APs of AP MLD with which it intends to setup. The non-AP MLD can obtain them based on currently defined procedure, e.g., ML Probe Request or scanning for all links. However, to reduce such overhead on the side of non-AP MLD, an AP MLD also needs to indicate BIs of affilaited APs in ML IE (Please see Doc. 20/1738 (with the latest version)) | Based on the comment, each Per-STA Profile subelement in Basic-varaint ML IE needs to include beacon interval (BI) corresponding to the AP. Moreover, to avoid mandoatry inclusion on the AP MLD side, it includes BI present field in Per-STA Control field. Please add those proposed parts in Basic-varint ML IE format | **Revised**Agree with the comment. Beacon Interval fields is added to per-STA profile subelement with corresponding presence indicator subfield in the STA control field.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1799.** |
| 1035 | Abhishek Patil | 127.29 | 35.3.2.3 | Fix the TBDs. One of the first field or element must be the Capabilities Information field for the reported STA. Also need to provide the BI, DTIM interval etc for each link. | As in comment | **Revised**Agree with the comment.The cited paragraph (now moved to clause 35.3.2.2) was updated to address the TBDs.1. Each per-STA profile consists of an unknown set of fields whose presence is signaled via the subfields in the Control field and a variable number of fields and elements based on the frame that carries the ML IE and inheritance. The format of the Per-STA Profile sublement is updated to have 3 parts – STA Control, STA Info and STA Profile. This will make it easy to describe the contents of each portion of the subelement. Clause 9 was updated accordingly.2. The text in the cited paragraph was extensively updated to provide details on the presence and order in which the elements and field appear when per-STA profile carries complete information.3. Added a list of elements that are not carried in the per-STA profile. Since BSS Max Idle Period element is common to all the APs, the NOTE in 35.3.2.2 related to BSS Max Idle Period is removed. The IE is listed as one of the elements that will not be carried in the per-STA profile4. Included rules on inheritance.Figure 35-1 was revised to demonstrate the contents of the Per-STA Profile subelement when the Basic variant Multi-Link element is carried by a STA affiliated with a non-AP MLD in an Association Request frame. **TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1035.****TGbe editor please replace all occurrences of *Per-STA Control* field (of Per-STA Profile subfield) to *STA Control* field.** |
| 2451 | Patrice Nezou | 127/30 | 35.3.2.3 | The wording "fixing order" does not define any order. Please clarify. | Define an order to the list of element contained in a Basic variant Multi-Link element | **Revised**Agree with the comment.The cited paragraph (now moved to clause 35.3.2.2) was updated to address the TBDs.1. Each per-STA profile consists of an unknown set of fields whose presence is signaled via the subfields in the Control field and a variable number of fields and elements based on the frame that carries the ML IE and inheritance. The format of the Per-STA Profile sublement is updated to have 3 parts – STA Control, STA Info and STA Profile. This will make it easy to describe the contents of each portion of the subelement. Clause 9 was updated accordingly.2. The text in the cited paragraph was extensively updated to provide details on the presence and order in which the elements and field appear when per-STA profile carries complete information.3. Added a list of elements that are not carried in the per-STA profile. Since BSS Max Idle Period element is common to all the APs, the NOTE in 35.3.2.2 related to BSS Max Idle Period is removed. The IE is listed as one of the elements that will not be carried in the per-STA profile4. Included rules on inheritance.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2451.****TGbe editor please replace all occurrences of *Per-STA Control* field (of Per-STA Profile subfield) to *STA Control* field.** |
| 1050 | Abhishek Patil | 130.59 | 35.3.5.1 | When and how does the AP MLD know the MAC address of the STAs of the non-AP MLD operating on other link? | (Re)Association Request frame carries the MAC address of the STA(s) operating on other links in the per-STA profile of the ML IE. | **Revised**Agree with the comment. A subfield called ‘STA MAC Address’ is added to the STA Info field of the Per-STA Profile subelement to carry the MAC address of the STA transmitting the frame. A corresponding presence bit is added the STA Control field of the Per-STA Profile subelement**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1050.** |
| 1778 | Insun Jang | 127.31 | 35.3.2.3 | An element of the list of elements in fixed order should be MAC address (sub)element because it can enable frame exchanges between an AP and a non-AP STA on link(s) where Association frames are not exchanged during multi-link setup and it is not included in body of Beacon or Probe Response frames (Please see Doc. 21/134r0) | As in the comment, an element of the list of elements in fixed order should be MAC address (sub)element. MAC address element can be the existing MAC address subelement or a newly defined element (could be field) | **Revised**Agree with the comment. A subfield called ‘STA MAC Address’ is added to the STA Info field of the Per-STA Profile subelement to carry the MAC address of the STA transmitting the frame. A corresponding presence bit is added the STA Control field of the Per-STA Profile subelement**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1778.** |
| 2165 | Laurent Cariou | 0.00 | 9.4.2.295b.2 | For multi-link setup, the STA shall include all capabilities for all links in the ML element in the association request frame. The Per STA profile shall therefore have a field or element to be able to include the link MAC address of a STA of the same non-AP MLD as the STA sending the frame | as in comment | **Revised**Agree with the comment. A subfield called ‘STA MAC Address’ is added to the STA Info field of the Per-STA Profile subelement to carry the MAC address of the STA transmitting the frame. A corresponding presence bit is added the STA Control field of the Per-STA Profile subelement**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2165.** |
| 2489 | Po-Kai Huang | 75.44 | 9.4.2.295b.2 | Each Per-STA Profile subelement shall have MAC address of the STA. Otherwise, link can not be identified after multi-link setup. | Add MAC address of the STA to each Per-STA Profile subelement. | **Revised**Agree with the comment. A subfield called ‘STA MAC Address’ is added to the STA Info field of the Per-STA Profile subelement to carry the MAC address of the STA transmitting the frame. A corresponding presence bit is added the STA Control field of the Per-STA Profile subelement**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2489.** |
| 1036 | Abhishek Patil | 127/33 | 36.3.2.3 | The order and list of elements should depend on the type of frame carrying the element - e.g., if the element is carried in a Beacon frame, then follow 9-32, for ML Probe Response follow 9-32 and so on for (Re)assoc resp. Also update the text in figure 35-1 | As in comment | **Revised**Agree with the comment. The text was updated to identify the Tables in clause 9.3.3 for the order in which the fields and element will be carried for each frame that carries the Basic variant ML IE.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1036.** |
| 1864 | Jarkko Kneckt | 128/06 | 35.3.2.3 | Per-STA profile is not optional in the association request/response frame. | Please change to optional/conditional subelements in figure 35-1. | **Revised**Agree with the commenter. Text in clause 35.3.5.4 already specifies that (Re)Assoc Req/Resp frames carry complete profile. In addition, text in clause 35.3.2.2 was updated in doc 11-21/242r4 (and appears in D0.4) to suggest that these frames carry complete profile. The bulleted text was updated to indicate that order of the fields and elements in the per-STA profile is same as that for each of the frames. In addition, figure 35-1 was updated to show Association Request frame as an example carrying complete profile.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1864.** |
| 1919 | Jeongki Kim | 127/35 | 35.3.2.3 | Regarding the non-AP STA case, don't we need to consider the Probe Reqeust frame as well as Association Request frame? If yes, add the text related to Probe Request frame. | Add the text of Probe Request frame | **Rejected**Probe Request frame doesn’t carry Basic variant ML IE as specified in clause 35.3.4.4 |
| 3315 | Yunbo Li | 127.40 | 35.3.2.3 | The descriptions of Non-Inheritance element are conflict. Non-Inheritance element is optioinal to included, but it is in the list of elements that shall be contained. | clarify that Non-Inheritance element shall be contained only when it is necessary. | **Revised**The bullet is revised to say “Optionally, a Non-Inheritance element appears as …”**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1919.** |
| 1184 | Arik Klein | 128.07 | 35.3.2.3 | Figure 35-1 does not include "elements specific to the reported STA or with content that is not inherited from the reporting STA" that should precede the Last element (Non-Inheritance element) - not aligned with the requirements of the Basic variant Multi-Link element that is a complete profile as defined in P127L25 | Correct Figure 35 to align with the the requirements of the Basic variant Multi-Link element that is a complete profile as defined in P127L25 | **Revised**Agree with the commenter. The bullets in preceding paragraph were updated to clarify that the fields and elements included in the STA profile are subject to inheritance as defined in clause 35.3.2.3. In addition the figure was updated to provide this clarification.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1184.** |
| 1185 | Arik Klein | 128.07 | 35.3.2.3 | Figure 35-1 includes several fields (designated as: Field1..Field K) following the Multi-link control field and followed by the Optional Subelements part. This is not aligned with the Basic Variant format, as described in section 9.4.295b where the Multi-link Control field is followed by Common Info field of the Basic variant Multi-Link element (see Figure 9-788eh) | Please correct the example in Figure 35-1 so it will be aligned with the Basic Variant format as described in section 9.4.295b | **Revised**Agree with the commenter. The figure was simplified to provide a specific example – i.e., that of Association Request frame. In addition, a descriptive text was added after the figure for describing the contents of the element.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1185.** |
| 2866 | Stephen McCann | 128.20 | 35.3.2.3 | What do Element L and Element Y refer to within Figure 35-1 | Some text needs to be written to explain what these Elements are referring to. | **Revised**Agree with the commenter. The figure was simplified to provide a specific example – i.e., that of Association Request frame. In addition, a descriptive text was added after the figure for describing the contents of the element.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2866.** |
| 3335 | Yusuke Tanaka | 128.26 | 35.3.2.3 | Please clarify what k, x, y, L and Y mean in figure 35-1. | As commented. | **Revised**Agree with the commenter. The figure was simplified to provide a specific example – i.e., that of Association Request frame. In addition, a descriptive text was added after the figure for describing the contents of the element.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3335.** |
| 2309 | Ming Gan | 128.06 | 35.3.2.3 | In Fig 35-1, some fields except for Per STA Control field in Per-STA Profile are missing | As in comment | **Revised**Agree with the commenter. The figure was simplified to provide a specific example – i.e., that of Association Request frame. In addition, a descriptive text was added after the figure for describing the contents of the element.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2309.** |
| 2964 | Tomoko Adachi | 0.00 | 9.4.2.295b.2 | Information of additional requested links needs to be provided when used in (Re)Association Request frames. | As in comment. | **Revised**Agree with the commenter. Approved text from 11-21/242r4 (incorporated in D0.4) already mentions that (Re)Association Request and Response frames carry complete profile in the per-sta profile. In addition, text in clause 35.3.2.2 and an example figure were added to clarify this aspect.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2964.** |

**35.3.2.2 Complete or partial per-STA profile**

***TGbe: Please delete the following NOTE after the paragraph starting “An AP affiliated with an AP MLD shall include, in (Re)Association Response frame” as shown below***

***TGbe: Please move the following paragraph and figure from clause 35.3.2.3 to this clause after the paragraph starting “An AP affiliated with an AP MLD shall include, in (Re)Association Response frame” and apply additional changes to the text and the figure as shown below:***

[CID 1860]When carried in a Management frame transmitted by an STA affiliated with an MLD, each Per-STA Profile subelement, that is a complete profile, shall comprise of the following:

* [CID 1035, 2451]the STA Control field (see Figure 9-788ej (STA Control field format)),
* [CID 2451][CID 2451]
* [CID 1035, 2451]the STA Info field (presence of subfields within this field are signaled in the STA Control field),
* [CID 2451]and the STA Profile field, with the following rules:
	+ [CID 1036, 1864, 2451, 2964]If the reporting STA is an AP, the STA Profile field corresponding to the reported AP carries [CID 2586]fields and elements [CID 1184](subject to inheritance rules defined in 35.3.2.3) in the order defined in Table 9-39, if the frame is a Probe Response frame, that is an ML probe response, Table 9-35, if the frame is an Association Response frame, or Table 9-37, if the frame is a Reassociation Response frame.
	+ [CID 1036, 2451]If the reporting STA is a non-AP [#1]STA, the STA Profile field corresponding to the reported non-AP STA carries [CID 2586]fields and elements [CID 1184](subject to inheritance rules defined in 35.3.2.3) in the order defined in Table 9-34 (Association Request frame body) if the frame is an Association Request frame, or Table 9-36 if the frame is a Reassociation Request frame.
	+ [CID 1035]If the reporting STA is an AP, the Timestamp field, AID field, SSID element and BSS Max Idle Period element are not included in the STA Profile field.
	+ [CID 1035]If the reporting STA is a non-AP STA, Listen Interval field and Current AP Address field are not included in the STA Profile field.
	+ [#1, CID 1919]Optionally, a Non-Inheritance element appears as the last element in the profile and carries a list of elements that are not inherited by the reported STA from the reporting STA (see 35.3.2.3 (Inheritance in a per-STA profile)).

[CID 1860, 1184, 1185, 2866, 3335, 2309, 2964]An example of a Basic variant Multi-Link element, carried in an Association Request frame, containing a complete per-STA profile is shown in Figure 35-1 (Example of Basic variant Multi-Link element in an Association Request Frame).



**Figure 35-1 – Example of Basic variant Multi-Link element in an Association Request frame**[#1, CID 1860, 1035, 1864, 1184, 1185, 2866, 3335, 2309, 2964, 1050, 1778, 2165, 2489]

***TGbe editor: Please insert the paragraph below Figure 35-1 as shown below:***

[CID 1184, 1185, 2866, 3335, 2309, 2964]In Figure 35-1 (Example of Basic variant Multi-Link element in an Association Request Frame), a STA affiliated with a non-AP MLD transmits an Association Request frame which includes Basic variant Multi-Link element that carries the complete profile of two other STAs affiliated with its non-AP MLD (STA x and STA y). The figure expands the Per-STA profile for one of the reported STA. The Type subfield of the Multi-Link Control field is set to 0 to indicate that the Multi-Link element is a Basic variant Multi-Link element. The Common Info field carries information that applies to the MLD level as described in 9.4.2.295b.2 (Basic variant Multi-Link element). In this example, only the MLD MAC Address field is shown. However, there can be other fields present in the Common Info portion whose presence is signaled via the subfields in the Multi-Link Control field. Each Per-STA Profile subelement in the Link Info field carries the complete profile, with inheritance applied, of a reported STA affiliated with the non-AP MLD. Each Per-STA Profile subelement carries the STA Control field as the first field, followed by the STA Info field and the STA Profile field. In this example, only the STA MAC Address field is shown. However, there can be other fields present in the STA Info portion whose presence is signaled via the subfields in the STA Control field. The STA Profile field carries variable number of fields and elements in the order defined in Table 9-34 with inheritance applied (see 35.3.2.3 (Inheritance in a per-STA profile)).

**9.4.2.295b.2 Basic variant Multi-Link element**[CID 1035, 2183, 2451, 1799, 1050, 1778, 2165, 2489]

***TGbe editor: Please update the text after Table 9-322an as follows:***

***TGbe editor: The TBDs shown in figures 9-788xx and 9-788ej are not new or added by this document (i.e., they are inherited from D0.4). Document 11-21/506 is providing a resolution to remove the TBDs:***

The format of a Per-STA Profile subelement is defined in Figure 9-788xx (Per-STA Profile subelement format)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Subelement ID | Length | STA Control | STA Info | STA Profile |
| Octet: |  | 1 |  | 1 | TBD | variable | variable |

**Figure 9-788xx—Per-STA Profile subelement format**

The format of the STA Control field is defined in [Figure 9-788ej (STA Control field format)](#bookmark46).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 B3 | B4 | B5 | B6 | B7 | B8 TBD |
| Link ID | Complete Profile | MAC Address Present | Beacon Interval Present | DTIM Info Present | Reserved |
| Bits: |  | 4 |  | 1 | 1 | 1 | 1 | TBD |

### Figure 9-788ej—STA Control field format

***TGbe editor: Please insert the following paragraphs after the paragraph starting: “The Complete Profile subfield is…” as follows:***

The MAC Address Present subfield indicates the presence of the STA MAC Address subfield in the STA Info field and is set to 1 if the STA MAC Address subfield is present in the STA Info field; otherwise set to 0.

The Beacon Interval Present subfield indicates the presence of the Beacon Interval subfield in the STA Info field and is set to 1 if the Beacon Interval subfield is present in the STA Info field; otherwise set to 0. A non-AP STA sets the Beacon Interval Present subfield to 0 in transmitted Basic variant Multi-Link element.

The DTIM Info Present subfield indicates the presence of the DTIM Info subfield in the STA Info field and is set to 1 if the DTIM Info subfield is present in the STA Info field; otherwise set to 0. A non-AP STA sets the DTIM Info Present subfield to 0 in transmitted Basic variant Multi-Link element.

***TGbe editor: Please delete “Other subfields are TBD.” and insert the following paragraphs as shown below:***

The STA Info field consists of zero or more fields whose presence is indicated by the subfields of the STA Control field. The subfields in the STA Info field appear in the same order as their corresponding presence subfield in the STA Control field.

The STA MAC Address subfield of the STA Info field carries the MAC address of the (AP or non-AP) STA that can operate on the link identified by the Link ID subfield and is affiliated with the same MLD as the STA that transmitted the Basic variant Multi-Link element. The format of the STA MAC Address field is defined in Figure 9-788xx (STA MAC Address subfield format).

|  |  |
| --- | --- |
|  | STA MAC Address |
| Octet: | 6 |

**Figure 9-788xx—STA MAC Address subfield format**

The Beacon Interval subfield of the STA Info field is defined in 9.4.1.3 (Beacon Interval field).

The DTIM Info subfield of the STA Info field has the format as defined in Figure 9-788xx (DTIM Info subfield format).

|  |  |  |
| --- | --- | --- |
|  | DTIM Count | DTIM Period |
| Octet: |  | 1 |  | 1 |

**Figure 9-788xx—DTIM Info subfield format**

The DTIM Count field and the DTIM Period field are defined in 9.4.2.5 (TIM element).

The contents of the STA Profile field when a STA affiliated with an MLD transmits the Basic variant Multi-Link element are defined in clause 35.3.2.2 (Complete or partial per-STA profile).

**35.3.2.3 Inheritance in a per-STA profile**[CID 1860]

***TGbe editor: Please move the following text and Figure 35-1 to clause 35.3.2.2 as shown below***

**PART C** [8 CIDs: 2472 2296 2868 2167 3021 3212 3369 3370]

#1: indicates changes based on comments/suggestions in doc 11-21/0218r0 (Mark Rison)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 2472 | Payam Torab Jahromi | 127/08 | 35.3.2.3 | STAs of an MLD may not have similar capabilities, so suggest to change the justification for inheritance. Inheritance is a tool that opportunistically reduces the frame size. Also "would inherit" -> inherits. | Change the first paragraph to "It is possible for STAs of an MLD to have similar capabilities and operational parameters on different links. As a result some elements carried in the per-STA profile for a reported STA can be identical to same elements for the reporting STA. To reduce the frame size, when a per-STA profile carries complete information for a reported STA, it inherits the elements from the reporting STA." | **Revised****TGbe editor, please apply the change as suggested by the comment while adding a comma “,” after the “As a result” in the second sentence. NOTE, this change is not shown in document 11-21/0254r3.** |
| 2296 | Michael Montemurro | 127/10 | 35.3.2.3 | This information is neither useful or relevant to any requirements in the specification. | At cited location, delete "In order to reduce frame bloating," | **Revised**Agree with the commenter. The cited part of the sentence was removed as a resolution to CID 2472.**TGbe editor, no changes are needed to address this comment.** |
| 2868 | Stephen McCann | 127/12 | 35.3.2.3 | The term "complete information" needs to be defined in this clause, or a forward reference needs to be added. | Move the paragraph at P130L13, to the cited clause. | **Revised**The description of complete information was added to clause 35.3.2.2 by 11-21/242r4 (and appears in D0.4). Please see D0.4 pg 191 ln 38**TGbe editor: no further action is required as a resolution to this CID.** |
| 2167 | Laurent Cariou | 0.00 | 35.3.2.3 | Clarify that the inheritence only applies when the complete information is provided | as in comment | **Revised**Agree with the commenter. A note was added to clarify.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 2167.** |
| 3021 | Xiaofei Wang | 127/19 | 35.5.2.3 | It is unclear to which frame "the frame" refers. Please rewrite and clarify | as in comment | **Revised**The statement was clarified to state that the frame refers to the one that is carrying the Basic variant Multi-Link element. A figure was added to clause 35.3.2.3 along with description to explain inheritance when the profile carries complete information.A figure was also added to clause 35.3.17 along with description to explain inheritance in a multiple BSSID scenario.**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3021.** |
| 3212 | Young Hoon Kwon | 127.18 | 35.3.2.3 | In case the reported STA is affiliated with the same MLD as an MLD that an AP of a nontransmitted BSSID is affiliated with, it is not clear if the reporting STA implies the AP of the nontransmitted BSSID or the reporting STA implies another AP corresponding to the transmitted BSSID. Further clarification is needed. | As shown in the comment. | **Revised**Agree with the comment. For the scenario described in the comment, the reporting STA is the AP corresponding to the transmitting BSSID. In addition, an example figure and description text was added to clause 35.3.17 to explain the inheritance in a multiple BSSID set. The last paragraph of 35.3.2.3 was deleted and the 1st sentence was moved to 35.3.17 and the 2nd paragraph was added as a NOTE at the end of 2nd paragraph of 35.3.2.3**TGbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3212.** |
| 3369 | Zhiqiang Han | 127.17 | 35.3.2.3 | No any condition is specified in the Table 9-32,please clarify it | Please clarify it. | **Revised**The identified statement was clarified to state that the condition for the existence of a certain element in a Management frame is given by the table corresponding to that frame in Clause 9.3.3.**Tgbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3369.** |
| 3370 | Zhiqiang Han | 127.19 | 35.3.2.3 | which condition? where is the corresponding condition? | Please clarify it. | **Revised**The identified statement was clarified to state that the condition for the existence of a certain element in a Management frame is given by the table corresponding to that frame in Clause 9.3.3.**Tgbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3370.** |

**35.3.2.3 Inheritance in a per-STA profile**

***TGbe editor: Please add NOTE after the first paragraph as shown below:***

[CID 2167]NOTE – The inheritance mechanism described in this subclause is not applicable when the Per-STA Profile subelement of the Basic variant Multi-Link element carries the partial information of the reported STA.

***TGbe editor: Please split the second paragraph as shown along with additional changes shown below:***

[CID 3021, 3212, 3369, 3370]A STA that transmits a Management frame carrying the Basic variant Multi-Link element shall include an element that is specific to the reported STA in the complete profile of the reported STA carried in the Basic variant Multi-Link element. An element is specific to a reported STA if any one of the following conditions is satisfied:

* its value is different from the element, if advertised by the reporting STA that has the same Element ID and Extended Element ID (if present)
* the reported STA satisfies the condition for that element to be included in the frame that carries the Basic variant Multi-Link element while the reporting STA does not satisfy the corresponding condition.

NOTE 1 – The above rules do not apply for the case when the Basic variant Multi-Link element is carried in a Nontransmitted BSSID Profile.

NOTE 2 – The conditions to include an element in a particular Management frame are as specified in clause 9.3.3 (for example, Table 9-35 specifies the conditions for an element to be included in an Association Response frame).

When an element that is carried in a Management frame transmitted by the reporting STA is not present in a complete profile of a reported STA, then the element is considered to be part of the reported STA’s profile and the value to use is the same as that of the corresponding element carried in the reporting STA’s frame unless the complete profile carries the Non-Inheritance element (see 9.4.2.240 (Non-Inheritance element)) and the element is listed in the Non-Inheritance element.

NOTE – When multiple elements carried in the Management frame transmitted by the reporting STA, have the same Element ID and Extended Element ID (if present), and at least one such element is not applicable to the reported STA, then the per-STA profile corresponding to the reported STA includes all the elements that have a value specific to the reported STA and have the same Element ID and Extended Element ID (if present) as that in the reporting STA’s frame. In this case, inheritance is not applied for the such elements.

***TGbe editor: Please add the following description text and figure before the last paragraph as shown below:***

[CID 3021, 3212]Figure 35-xx (Example of inheritance in a complete per-STA profile) illustrates inheritance when a per-STA profile carries complete information. The example shows a Management frame transmitted by a reporting STA that is affiliated with an MLD. The Management frame carries several elements with their corresponding element IDs shown in parenthesis. The frame also carries a Basic variant Multi-Link element which is carrying a complete profile for a reported STA x. The per-STA profile for STA x includes elements with ID B and D since the elements have value different from the corresponding elements carried in the frame. The profile also includes element with ID Y which is specific to STA x. In addition, elements with ID C and ID F are inherited and are not carried in the profile for STA x. The values for these two elements are the same as that carried in the frame. Furthermore, elements with ID A and ID E are not applicable to STA x as their corresponding (Extended) Element IDs are listed in the Non-Inheritance element.



**Figure 35-xx: Example of inheritance in a complete per-STA profile**[CID 3021]

***TGbe editor: Please move the first sentence to clause 35.3.17 and the second sentence as a NOTE 1 after the now modified 2nd paragraph:***

[CID 3212]

**35.3.17 Multi-BSSID**

***TGbe editor: Please move the following text from the last paragraph of 35.3.2.3 to this clause as the new 2nd paragraph:***

[#1, 3212]shall notunless

***TGbe editor: Please add the following description text and figure at the end of this subclause as shown below:***

[CID 3021, 3212]Figure 35-yy (Example of inheritance in a complete per-STA profile for a Multiple BSSID scenario) illustrates inheritance when a per-STA profile carries complete information in a Basic variant Multi-Link element that is contained in a Nontransmitted BSSID Profile of a Multiple BSSID element. The example shows a Management frame transmitted by a transmitted BSSID. The Management frame carries several elements with their corresponding element IDs shown in parenthesis. The frame also carries a Multiple BSSID element which includes profile for nontransmitted BSSID N. The Nontransmitted BSSID Profile contains a Basic variant Multi-Link element carrying complete profile for AP x. The BSSID N is inheriting elements with ID B, C and E. It does not inherit element with ID A and is listed in the Non-Inheritance element. Since the value of element F for BSSID N is not the same as that advertised by the transmitted BSSID, the element is carried in the profile for BSSID N. An element with ID Y is specific to the BSSID N and is included in its profile. AP x inherits elements with ID D and F directly from the BSSID N and element with ID C indirectly from the transmitted BSSID (via the BSSID N’s inheritance). AP x does not inherit element A (same as nontransmitted BSSID). The elements with ID B and Y are specific to AP x and appear in its profile. Furthermore, AP x does not inherit element E from the transmitted BSSID and is listed in the Non-Inheritance element present in its profile.



**Figure 35-yy: Example of inheritance in a complete per-STA profile for a Multiple BSSID scenario**

**PART D** [3 CID: 3016 1005 1896]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Pg/Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 3016 | Xiaofei Wang | 73.55 | 9.4.2.295b.1 | A MLD MAC Address should always be part of the ML element, given that the MLD should have an identifier for MLD descriptions. | will submit a contribution for resolution | **Revised**Agree in principle with the comment. This topic was discussed with several members and the conclusion was that the MLD MAC address is required in Beacon and Probe Response frames for any security method supported by IEEE 802.11. But most importantly, SAE, FILS and FT. Text has been revised that an AP MLD shall always include MLD MAC address in the Basic variant ML element in Beacon and Probe Response.**Tgbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 3016.** |
| 1005 | Abhishek Patil | 57.50 | 9.3.3.2 | Fix the TBD - the Basic variant of ML IE is optionally present in the beacon (for example when the AP support SAE authentication) | As in comment | **Revised**During discovery, an AP affiliated with an AP MLD needs to identify that it supports multi-link operation and that it is affiliated with an AP MLD. Therefore, the AP’s Beacon frame or a Probe Response frame (that is not a ML probe response) needs to carry Basic variant Multi-Link element carrying the MAC Address of the AP MLD. At the same time, such frames should not be bloated and must limit the amount of information they carry. Therefore, these frames must only carry the Common Info field unless certain conditions, that require the per-STA profile to be present are satisfied.Resolves two TBDs**Tgbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1005.** |
| 1896 | Jeongki Kim | 57.52 | 9.3.3.2 | The Basic variant Multi-Link element will be present in the Beacon frame if the AP is affiliated with an AP MLD. So remve the TBD in the related text. If there is the case that does not include ML element, change TBD to optionally. | Either Remove the TBD or change TBD to optionally | **Revised**During discovery, an AP affiliated with an AP MLD needs to identify that it supports multi-link operation and that it is affiliated with an AP MLD. Therefore, the AP’s Beacon frame or a Probe Response frame (that is not a ML probe response) needs to carry Basic variant Multi-Link element carrying the MAC Address of the AP MLD. At the same time, such frames should not be bloated and must limit the amount of information they carry. Therefore, these frames must only carry the Common Info field unless certain conditions, that require the per-STA profile to be present are satisfied.Resolves two TBDs**Tgbe editor please implement changes as shown in doc 11-21/0254r3 tagged as 1896.** |

***TGbe editor: Please update the add the following Tables as shown below:***

 **Table 9-32—Beacon frame body**[CID 3016, 1005, 1896]

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | Multi-Link | The Basic variant Multi-Link element is present if the AP is affiliated with an AP MLD. Otherwise it is not present. |

**Table 9-39—Probe Response frame body**[CID 3016, 1005, 1896]

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| <ANA> | Multi-Link | The Basic variant Multi-Link element is present if the AP is affiliated with an AP MLD. Otherwise it is not present. |

**35.3.4.4 Multi-link element usage rules in the context of discovery**[CID 3016, 1005, 1896]

***TGbe editor: Please update the following paragraphs in this subclause as shown below:***

An AP affiliated with an AP MLD shall include, in a Beacon frame or a Probe Response frame, which is not an ML probe response, only the Common Info field of the Basic variant Multi-Link element as defined in 9.4.2.295b (Multi-Link element) unless conditions in 35.3.9 are satisfied.

An AP affiliated with an AP MLD shall include the MLD MAC address of that AP MLD in the Beacon and Probe Response frames it transmits in the Common Info field of the Basic variant Multi-Link element.