IEEE P802.11
Wireless LANs

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| LB 266 CR for Capability Update Notification |
| Date: 2022-08-05 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Frank Hsu | Mediatek Inc.  |  |  | frank.hsu@mediatek.com |
| Jame Yee |  |  |  |

Abstract

This submission proposes resolutions for following 1 CID received for TGbe LB266

: 10773

Revision History:

* Rev 0: Initial version of the document
* Rev 1: Capability changed to be indicated in MLD capabilities and added another status code
* Rev 2: Editorial update and wrong text fix
* Rev 3: Editorial update and wrong text fix

***TGbe editor: The baseline for this document is 11be D2.0***

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).***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| 10773 | Chien-Fang Hsu | 9.4.2.313 | 228.46 | In an MLD, some resources may be shared by affiliated STAs or APs, e.g. memory. When the number of enabled links changes, the shared resources can also be re-allocated so that the efficiency can be improved. For example, the max MPDU length can be increased when enabled links are less. There is no such protocol to update capabilities dynamically now. It is necessary to have a new protocol to allow capability change in the MLO. | Add a unified protocol to allow a device to update its capabilities after association when the number of enabled links changes or some other reasons apply. Capabilties such as max MPDU length, A-MSDU max length, max A-MPDU Length Exponent are candidates to be changed when the MLD has less or more enabled links to increase the efficiency. | **Revised**Agree in principle with the commentor. Add corresponding procedures to allow a STA affiliated with non-AP MLD to update its capabilities.**TGbe editor, please apply the changes tagged as 10773 in this document.** |

***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.***

**Discussion:**

Consider a scenario, in the non-AP MLD, total 26K memory is available and the memory is shared by STAs affiliated to the non-AP MLD. After association, all 3 links are enabled, and the max MPDU length is set up to 8K for each link. For some reason, link 3 is disabled, and if the non-AP MLD can re-allocate link 1 and link 2 with 11k memory, respectively, and changes the capabilities of link 1 and link 2 accordingly, efficiency of link 1 and link 2 can be improved. However, in the current specs. there is no such mechanism that the non-AP MLD can update its capabilities while the number of enabled links changes or other usage scenarios apply. The document addresses the topic and provides protocols so that the non-AP MLD can update its capabilities dynamically.



**9.4.1.9 Status Code field**

TGbe editor: ***Add a new row in Table 9-78 (Status codes) as follows(#10773):***

|  |  |  |
| --- | --- | --- |
| **Status code** | **Name** | **Meaning** |
| … | … | … |
| <ANA> | NEED\_MORE\_TIME | Capability update denied at this time and a later request suggested. |
| <ANA> | DENIED\_CAPABILITY\_UPDATE | Capability update denied because the requested capability update is not acceptable. |

**9.4.2.312.2.2 Common Info field of the Basic Multi-Link element**

TGbe editor: M***ake the following changes in Figure 9-1002l and Table 9-401i***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 |  | B3 | B4 | B5 |  | B6 B7 |  | B11 | B12 | B13  | B14 B15 |
| Ma | ximu | m |  | TID-To-Li | nk | Fr | equen | cy |  |  |  |
| Number Of Simultaneous Links | SRSSupport | Mapping Negotiation Supported | Separation For STR/AP MLDType Indication | AARSupport | CapabilityUpdate Support | Reserved |
| Bits: |  | 4 |  | 1 |  | 2 |  | 5 |  | 1 | 1 | 2 |

**Figure 9-1002l—MLD Capabilities and Operations subfield format (#10773)**

###  Table 9-401i—Subfields of the MLD Capabilities and Operations field

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| … | … | … |
| Capability Update Support (#10773) | Indicates support of capability update negotiation. | Set to 1 if dot11CapabilityUpdateImplemented is true.Set to 0 otherwise.See 35.3.x (Non-AP MLD Capability Update) |

TGbe editor: ***Insert the following new subclause at the end of subclause 9.4.2*** (#10773)***:***

**9.4.2.xxx Capability Update element (#10773)**

The Capability Update element defined in Figure 9-xxx (Capability Update element format) contains capability to be updated and is present in Capability Update Request frame (see 9.6.35.x).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Control | Capability Update  |
| Octets: | 1 | 1 | 1 | 1 | 2 |

**Figure 9-xxx — Capability Update element format**

The Element ID, Length, and Element ID Extension fields are defined in [9.4.2.1 (General)](file:///C%3A%5CUsers%5Cpmonajem%5CDocuments%5CDocs%5CIEEE%20802.11%5C11be%5CSource%5CTGbe_Cl_09.doc#bookmark85).

The Control field is defined in Figure 9.xxy (Control field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 | B2 B7 |
|  | Maximum MPDU Length Present | A-MSDULengthPresent | Reserved  |
| bits: | 1 | 1 | 6 |

**Figure 9-xxy — Control field format**

The Maximum MPDU Length Present subfield is set to 1 if the Maximum MPDU Length subfield is present in the Capability Update field. Otherwise, the Maximum MPDU Length Present subfield is set to 0.

The A-MSDU Length Present subfield is set to 1 if the A-MSDU Length subfield is present in the Capability Update field. Otherwise, the A-MSDU Length Present subfield is set to 0.

The Capability Update field contains capability information to be updated and is shown in Figure 9.xxz (Capability Update field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B1 | B2 |  |
|  | Maximum MPDU Length  | A-MSDULength | Pad |
| bits: | 0 or 2 | 0 or 1 | variable |

**Figure 9-xxz — Capability Update field format**

The Maximum MPDU Length subfield is in defined in Table 9-310 (Subfields of the VHT Capabilities Information field).

The A-MSDU Length subfield is in defined in Table 9-221 (Subfields of the HT Capabilities Information field).

The Pad subfield contains all 0s. The number of bits in the Pad subfield is the number of bits required to make the length of the Capability Update field to 2 octets.

### 9.6.35.1 Protected EHT Action field

TGbe editor: Add rows to table 9-623c as follows (#10773)

**Table 9-623c—Protected EHT Action field values**

|  |  |  |
| --- | --- | --- |
| 7 |  Capability Update Request |  No |
| 8 |  Capability Update Response |  No |
| 9-255 |  |  |

TGbe editor: ***Insert the following new subclause at the end of subclause 9.6.35*** (#10773)

**9.6.35.x Capability Update Request frame format**

The Capability Update Request frame is sent by a STA affiliated with a non-AP MLD to indicate that the STA is updating its capabilities. The Action field of the Capabilty Request frame contains the information is shown in Table 9-xxx (Capability Update Request frame Action field format).

**Table 9-xxx—Capability Update Request frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Capability Update (see [9.4.2.xxx (Capability](#bookmark191) Update [element)](#bookmark191)) |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

The Dialog Token field is a set to a nonzero value chosen by the STA sending the Capability Update Request frame to identify the request/response transaction.

**9.6.35.x Capability Update Response frame format**

The Capability Update Request frame is sent by an AP affiliated with an AP MLD in response to a Capability Request frame to accept or to reject the request of capability update in the Capability Update Request frame. The Action field of the Capability Update Response frame contains the information shown in Table 9-xxy (Capability Update Response frame Action field format).

**Table 9-xxy—Capability Update Response frame Action field format**

|  |  |
| --- | --- |
| **Order** | **Information** |
| 1 | Category |
| 2 | Protected EHT Action |
| 3 | Dialog Token |
| 4 | Status Code |

The Category field is defined in 9.4.1.11 (Action field).

The Protected EHT Action field is defined in 9.6.35.1 (Protected EHT Action field).

When the Capability Response frame is transmitted as a response to a Capability Request frame, the Dialog Token field is the value in the corresponding Capability Request frame.

The Status Code is defined in 9.4.1.9 (Status Code field) and is set to the value 0 (SUCCESS) or <ANA> (NEED\_MORE\_TIME) or <ANA> (DENIED\_CAPABILITY\_UPDATE).

TGbe editor: ***Insert the following new subclause at the end of subclause 35.3*** (#10773)

**35.3.x Non-AP MLD Capability Update**

An MLD shall set the Capability Update Support subfield in the Common Info field of the Basic Multi-Link element it transmits to 1 if its dot11CapabilityUpdateImplemented is true; otherwise the MLD shall set it to 0. An EHT STA affiliated with an MLD in which dot11CapabilityUpdateImplemented is true is referred to as *capability update capable*.

A capability udate capable non-AP STA affiliated with a non-AP MLD should notify a capability udate capable AP affiliated with the associated AP MLD of change in its capability by transmitting a Capability Update Request frame including a Capability Update element.

An AP affiliated with an AP MLD shall not transmit a Capability Update Request frame.

A capability update capable AP affiliated with an AP MLD received a Capability Update Request frame shall respond with a Capability Update Response frame. Before the AP affiliated with the AP MLD transmits the corresponding Capability Update Response frame, the AP affiliated with the AP MLD shall not apply the capabilities of the non-AP STA affiliated with the non-AP MLD indicated in the Capability Update element of the Capability Update Request frame.

Before receiving of the Capability Update Response frame, the non-AP STA affiliated with the non-AP MLD shall not apply the capabilities in the Capability Update element of the corresponded Capability Update Request frame.

After receiving of the Capability Update Response frame in which the Status Code is set to the value 0 (SUCCESS), the non-AP STA affiliated with the non-AP MLD shall apply the capabilities in the Capability Update element of the corresponded Capability Update Request frame.

After receiving of the Capability Update Response frame in which a Status Code is set to the value <ANA> (NEED\_MORE\_TIME) or <ANA> (DENIED\_CAPABILITY\_UPDATE), the non-AP STA affiliated with the non-AP MLD shall not apply the capabilities in the Capability Update element of the corresponded Capability Update Request frame.

A non-AP STA affiliated with a non-AP MLD intends to update capabilities of other non-AP STA(s) affiliated with the same non-AP MLD shall send a Capability Update Request frame including a MLO Link Information element and follow the rules in 35.3.14.2 (Identification of the Intended STA).

The value of the maximum MPDU Length subfiled carried in the Capability Update element of the Capability Update Request frame indicates the value to update the maximum MPDU Length subfiled in VHT Capabilities element (if applicable) or in HE 6 GHz Band Capabilities element (if applicable) or in EHT Capabilities element (if appliable).

The value of the A-MSDU Length subfiled carried in the Capability Update element of the Capability Update Request frame indicates the value to update the A-MSDU Length subfiled in HT Capabilities element.