IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Resolution for CIDs related to UHR Critical Updates Procedure | | | | |
| Date: July 4, 2025 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Abhishek Patil | Qualcomm Technologies Inc. |  |  | appatil@qti.qualcomm.com |
| Gaurang Naik |  |  |  |
| Alfred Asterjadhi |  |  |  |
| George Cherian |  |  |  |
| Sanket Kalamkar |  |  |  |
| Duncan Ho |  |  |  |
| Giovanni Chisci |  |  |  |
| Sherief Helwa |  |  |  |

Abstract

This submission proposes resolutions for the following CIDs received for TGbn D0.1 CC: 2542, 3340

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Updates based on offline feedback.

***TGbn editor: Baseline for this document is 802.11-2024, TGbe D7.0, TGbn D0.3, 11-25/0882r0 and 11-25/0551r4***

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 TGbn Draft. This introduction is not part of the adopted material.

***TGbn Editor: Editing instructions preceded by “TGbn Editor” are instructions to the TGbn editor to modify existing material in the TGbn draft. As a result of adopting the changes, the TGbn editor will execute the instructions rather than copy them to the TGbn Draft.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Clause** | **Page.line** | **Comment** | **Proposed Change** | **Resolution** |
| 2542 | Jarkko Kneckt | 9.3.3.2 | 55.46 | The Beacon frames critical update field does not signal reliably the cirtical parameter updates of an AP MLD, because the critical update field is set to 1 only for a limited duration. If a STA receives Beacons more seldomly, the STA needds to receive almost complete Beacon frame to detect update in BPCC. The RNR element carries BPCC values for specific affiliated APs. RNR is at the very end of the Beacon frame so in this case, the STA needs to receive the complete Beacon frame. | Please add to early of the Beacon a one octet or 6 bits long field that signals the sum of all affiliated APs BPCC values. This field is more reliable and criticial update field to signal update in any affilaited APs parameters. This field enables also effcient Beacon early termination. | ToDo |
| 3340 | Ahmadreza Hedayat | 37 | 67.05 | When a critical update happens in a UHR BSS, it's more efficient that the updated UHR IEs to be included in Beacon frame, so that associated STAs avoid probibg the AP to get the updated IEs. Define rules for such operation. | As in comment | ToDo |
|  |  |  |  |  |  |  |

**Discussion:** ToDo

**Proposed changes:**

***TGbn editor: please add the following subclause after 37.28.2 as shown below.***

**37.28.3 Indication of enhanced critical updates**

This subclause describes the enhanced critical updates procedures defined for UHR STAs. The enhancements aim to help non-AP STAs save power while providing an efficient, low overhead mechanism for APs to advertise the updates.

A UHR AP affiliated with an AP MLD initiates the advanced notification procedure (as described in 37.28.2 (Advance notification of updates to operation modes and parameters)) when there is an update to a UHR defined mode of operation for:

* The AP's AP MLD, or
* Any affiliated link of the AP’s AP MLD, or
* If the AP corresponds to the transmitted BSSID of a multiple BSSID set:
  + the AP MLD of any of the non-transmitted BSSIDs of that set, or
  + any affiliated link of any of the AP MLDs of the non-transmitted BSSIDs of that set.

When the advanced notification procedure is initiated by an AP affiliated with an AP MLD, the AP shall, in the Beacon frame it transmits:

* Set to 1 the Enhanced Critical Updates Flag of the Capability Information field.
* Include the Critical Updates Indicator field within the Partial Virtual Bitmap field of the TIM element and:
  + Carry a value of 1 in the Update Type field of the Critical Updates Indicator field to indicate an update to a UHR defined mode of operation.
  + Increment by 1 the value carried in the Update Counter field of the Critical Updates Indicator field.
* Increment by 1 the value carried in the Enhanced BSS Parameter Change Count subfield in the Enhanced Critical Updates Information field corresponding to each affected AP.
* Carry a value of 1 in the Critical Update Type subfield in the Enhanced Critical Updates Information field corresponding to each affected AP to indicate an update to a UHR defined mode of operation.
* Set to 1 the Enhanced All Updates Included subfield in the Enhanced Critical Updates Information field corresponding to an affected AP if both conditions are satisfied:
  + The affected is another AP is affiliated with the AP MLD of the transmitting AP, or the affected AP is another AP affiliated with the AP MLD of a nontransmitted BSSID if the AP is a transmitted BSSID in the same multiple BSSID set
  + The frame includes the UHR Parameters Update element for the affected AP.

NOTE 1 – The Update Counter subfield of the Critical Updates Indicator field is incremented only once if there are updates occurring simultaneously to more than one mode of operation at an AP and/or at more than one AP and/or at more than one AP MLD in a multiple BSSID set.

NOTE 2 – The Enhanced Critical Updates Information field is carried in the Reduced Neighbor Report element if the affected AP is a reported AP. The Enhanced Critical Updates Information field is carried in the Common Info field of the Basic Multi-Link element if the affected AP is the transmitting AP or AP corresponding to the nontransmitted BSSID in the same multiple BSSID set as the transmitting AP. The Enhanced Critical Updates Information field in the Common Info field, or the STA Info field of the Basic Multi-Link element does not include Enhanced All Updates Included subfield. The Enhanced Critical Updates Information field in the STA Info field of the Basic Multi-Link element does not include the Critical Update Type subfield.

NOTE 3 – The Enhanced BSS Parameter Change Count subfield for all the APs affiliated with the AP MLD are incremented when there is an update to the parameters for a UHR defined mode of the AP MLD.

While the advanced notification procedure is in progress (for a period indicated in the Parameter Update Adv Notification Interval field of the UHR Capabilities element) at an AP affiliated with an AP MLD and until and including the DTIM beacon transmitted by that AP after the TBTT when the update has taken effect, the AP, in the Beacon frame it transmits shall:

* Set to 1 the Enhanced Critical Updates Flag of the Capability Information field.
* Carry a value of 1 in the Update Type subfield of the Critical Updates Indicator field of the TIM element to indicate an update to a UHR defined mode of operation.
* Carry the latest counter in the Update Counter subfield of the Critical Updates Indicator field of the TIM element.
* Carry a value of 1 in the Critical Update Type subfield in the Enhanced Critical Updates Information field corresponding to each affected AP to indicate an update to a UHR defined mode of operation.
* Set to 1 the Enhanced All Updates Included subfield in the Enhanced Critical Updates Information field corresponding to an affected AP if both conditions are satisfied:
  + The affected is another AP is affiliated with the AP MLD of the transmitting AP, or the affected AP is another AP affiliated with the AP MLD of a nontransmitted BSSID if the AP is a transmitted BSSID in the same multiple BSSID set
  + The frame includes the UHR Parameters Update element for the affected AP.

The AP, in the Beacon frames it transmits following the DTIM beacon immediately after the critical update has taken effect and until the next initiation of an advanced notification procedure, shall:

* Set to 0 the Enhanced Critical Updates Flag of the Capability Information field.
* Carry a value of 1 in the Critical Update Type subfield in the Enhanced Critical Updates Information field corresponding to each affected AP to indicate an update to a UHR defined mode of operation.
* Set to 0 the Enhanced All Updates Included subfield in the Enhanced Critical Updates Information field corresponding to all other affiliated APs of its AP MLD and all other affiliated APs affiliated with the AP MLD of a nontransmitted BSSID if the AP is a transmitted BSSID in the same multiple BSSID set.

The AP, in the Beacon frame it transmits after a period indicated in the Update Indication In TIM Interval field of the UHR Capabilities element has passed after the critical update has taken effect and until the next initiation of an advanced notification procedure, shall not include the Critical Updates Indicator field of the TIM element unless the first octet carried in the TIM element is before the Critical Update Indicators field.

NOTE 4 – When the Critical Updates Indicators field is absent in the PVB, the value carried in the Update Counter field is preserved.

Figure 37-xx (Enhanced Critical Updates Mechanism) summarizes the operation outlined in this subclause.



**Figure 37-xx – Enhanced Critical Updates Mechanism**

A non-AP STA affiliated with a non-AP MLD that has performed ML setup with an AP MLD, and that has ReceiveDTIMBeacons equal to false wakes up on a link, the non-AP STA shall attempt to receive the Beacon frame from the AP affiliated with the AP MLD and operating on that link to determine the value of enhanced BSS parameter change count and the type of the most recent update for that link before performing frame exchanges with that AP.

If a non-AP STA determines that the enhanced BSS parameter change count of its associated AP is higher, by a value greater than one, compared to the enhanced BSS parameter change count for the link stored at the non-AP STA, then the non-AP STA shall acquire the updated parameters for that link by following the probing procedures described in 11.1.4.3 (Active scanning and probing procedures) before exchanging frames with the AP.

If a non-AP STA determines that the enhanced BSS parameter change count of its associated AP is higher, by a value of exactly one, compared to the enhanced BSS parameter change count for the link stored at the non-AP STA, then the non-AP STA

* Shall acquire the updated parameters for that link by following the probing procedures before exchanging frames with the AP if either condition is satisfied:
  + The type of update indicates UHR, and the UHR Parameter Update element is not present in the Beacon frame.
  + The conditions specified in 35.3.10 are satisfied.
* May, subject to conditions specified in 35.3.10, acquire the updated parameters for that link by following the probing procedures before exchanging frames with the AP if the type of update does not indicate UHR.

**9.4.1.4 Capability Information field**

***TGbn editor: Please change Figure 9-140 as follows:***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | ESS | IBSS | Enhanced Critical Update Flag | Reserved | Privacy | Short Preamble | Critical Update Flag | Nontransmitted BSSIDs Critical Update Flag |
| Bits | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | B8 | B9 | B10 | B11 | B12 | B13 | B14 | B15 |
|  | Spectrum Management | QoS | Short Slot Time | APSD | Radio Measurement | EPD | Reserved | Reserved |
| Bits | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Figure 9-140—Capability Information field format (non-DMG STA)**

***TGbn editor: Please add the following paragraph before the paragraph starting “An AP sets the Privacy subfield” as shown below:***

The Enhanced Critical Updates Flag field is set to 1 in Beacon and Probe Response frames transmitted by a UHR AP when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met. Otherwise, the field is set to 0. The field is reserved in frames transmitted by a non-AP STA.

**9.4.1.4 TIM element**

**9.4.2.5.1 General**

***TGbn editor: Please add the following paragraphs before the paragraph starting “When the TIM with a nonzero Partial Virtual Bitmap field is carried in an S1G PPDU …” in this subclause as shown below***

The TIM element carried in a Beacon frame transmitted by a non-S1G non-DMG PPDU AP includes the Critical Updates Indicator field subject to the conditions specified in 37.28.3 (Indication of enhanced critical updates). <Exact location (i.e., B16) to be discussed>

The format of the Critical Updates Indicator subfield is as shown in 9-215a (Critical Updates Indicator subfield format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B2 | B3 B6 | B7 |
|  | Update Type | Update Counter | Reserved |
| Bits: | 3 | 4 | 1 |
| **Figure 9-215a – Critical Updates Indicator subfield format** | | | |

The Update Type subfield indicates the type of critical update, and the value is set as shown in Table 9-131a (Update Type field encoding).

**Table 9-131a – Encoding of Update Type subfield**

|  |  |
| --- | --- |
| **Value** | **Type** |
| 0 | No update or non-UHR update |
| 1 | Update to at least one UHR mode of operation |
| 2-7 | Reserved |

The Update Counter subfield carries a counter which is incremented when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met.

**9.4.2.44 Multiple BSSID element**

***TGbn editor: please update the following paragraph as shown below***

The MaxBSSID Indicator field contains a value assigned to n, where 2n is the maximum number of BSSIDs in the multiple BSSID set, including the reference BSSID (see 11.10.14 (Multiple BSSID set)). The maximum value of n is 8 for a non-UHR AP and 4 for a UHR AP.

* **Neighbor AP Information field**

***TGbn editor: please update the following paragraph as shown below***

The UHR Parameters subfield is present

* and carries the SMD ID of the reported UHR AP when the following conditions are met:
* The Collocated AP subfield in the BSS Parameters field is set to 0,
* The Member Of SMD subfield in the BSS Parameters field is set to 1,
* The Same SSID subfield in the BSS Parameters field is set to 0,
* The reported AP does not belong to the same SMD as the reporting AP.
* and carries the Enhanced Critical Updates Information subfield of the reported UHR AP when the following condition is met:
* The Collocated AP subfield in the BSS Parameters field is set to 1.

Otherwise, the UHR Parameters subfield is not present.

***TGbn editor: please add the following paragraphs, figure and table at the end of this subclause as shown below:***

The format of the Enhanced Critical Updates Information field is as shown in Figure 9-734d (Enhanced Critical Updates Information field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B3 | B4 B6 | B7 |
|  | Enhanced BSS Parameter Change Count | Critical Update Type | Enhanced All Updates Included |
| Bits: | 4 | 3 | 1 |
| **Figure 9-734d – Enhanced Critical Updates Information field format** | | | |

The Enhanced BSS Parameter Change Count subfield carries an unsigned integer, initialized to 0. The value carried in the subfield is incremented by 1 (modulo 16) when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met for the reported AP.

The Critical Update Type subfield indicates the type of critical update, and the value is set as shown in Table 9-131a (Update Type field encoding).

**Table 9-328a – Encoding of Critical Update Type subfield**

|  |  |
| --- | --- |
| **Value** | **Type** |
| 0 | No update or non-UHR update |
| 1 | Update to at least one UHR mode of operation |
| 2-7 | Reserved |

The Enhanced All Updates Included set to 1 when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met. Otherwise, the subfield is set to 0.

**9.4.2.321.2 Basic Multi-Link element**

**9.4.2.321.2.2 Presence Bitmap subfield of the Multi-Link Control field in a Basic Multi-Link element**

***TGbn editor: please update Figure 9-1072g in this subclause as shown below:***

B0 B1 B2 B3

|  |  |  |  |
| --- | --- | --- | --- |
| Link ID Info Present | BSS Parameters Change Count Present | Medium Synchronization Delay Information Present | EML Capabilities Present |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bits: | | 1 | 1 | | 1 | |  | | 1 |  |
|  | | B4 | B5 | | B6 | | B7 | |  | B11 |
| MLD Capabilities And Operations Present | | | AP MLD ID Present | | Extended MLD Capabilities And Operations Present | | Enhanced Critical Updates Information Present | | | | Reserved |

Bits: 1 1 1 1 4

**Figure 9-1072g—Presence Bitmap subfield of the Basic Multi-Link element format**

***TGbn editor: please add the following at the end of 9.4.2.321.2.2:***

The Enhanced Critical Updates Information Present subfield is set to 1 if the Enhanced Critical Updates Information subfield is present in the Common Info field of the Basic Multi-Link element. Otherwise, the Enhanced Critical Updates Information Present subfield is set to 0. A non-AP STA sets this subfield to 0 in the Basic Multi-Link element that it transmits. This subfield is set to 1 in the Basic Multi-Link element transmitted by an AP except when the element is carried in an Authentication frame or FT Action frame.

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

***TGbn editor: please update Figure 9-1072h in this subclause as shown below:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Common Info Length | MLD MAC  Address | Link ID Info | BSS  Parameters Change Count | Medium Synchronization Delay Information |

Octets: 1 6 0 or 1 0 or 1 0 or 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EML  Capabilities | MLD  Capabilities And Operations | AP MLD ID | Extended MLD Capabilities And Operations | Enhanced Critical Updates Information |

Octets: 0 or 2 0 or 2 0 or 1 0 or 2 0 or 1

**Figure 9-1072h—Common Info field of the Basic Multi-Link element format**

***TGbn editor: please add the following at the end of 9.4.2.321.2.3:***

The format of the Enhanced Critical Updates Information field is as shown in Figure 9-1072la (Enhanced Critical Updates Information field format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B3 | B4 B6 | B7 |
|  | Enhanced BSS Parameter Change Count | Critical Update Type | Enhanced All Updates Included |
| Bits: | 4 | 3 | 1 |
| **Figure 9-1072la – Enhanced Critical Updates Information field format** | | | |

The subfields carried in the Enhanced Critical Updates Information field apply to the AP that is affiliated with an AP MLD described in the Basic Multi-Link element and matches one of the following:

* It is the AP that transmitted the Basic Multi-Link element.
* It is the AP that corresponds to a nontransmitted BSSID that is a member of the same multiple BSSID set as the AP that transmitted the Multiple BSSID element containing the profile for the non- transmitted BSSID that includes the Basic Multi-Link element.

The Enhanced BSS Parameter Change Count subfield carries an unsigned integer, initialized to 0. The value carried in the subfield is incremented by 1 (modulo 16) when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met for the AP.

The Critical Update Type subfield indicates the type of critical update, and the value is set as shown in Table 9-131a (Update Type field encoding).

The Enhanced All Updates Included set to 1 when conditions specified in 37.28.3 (Indication of enhanced critical updates) are met. Otherwise, the subfield is set to 0.

**9.4.2.321.2.4 Link Info field of the Basic Multi-Link element**

***TGbn editor: please update Figure 9-1072n in this subclause as shown below:***

B0 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B15

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Link ID | Complete Profile | STA MAC  Address Present | Beacon Interval Present | TSF  Offset Present | DTIM  Info Present | NSTR  Link Pair Present | NSTR  Bitmap Size | BSS  Parameters Change Count Present | Enhanced Critical Updates Information Present | Reserved |

Bits: 4 1 1 1 1 1 1 1 1 1 3

**Figure 9-1072n—STA Control field format of the Basic Multi-Link element**

***TGbn editor: please add the following before the paragraph starting “The format of the STA Info field is … ”:***

The Enhanced Critical Updates Information Present subfield is set to 1 if the Enhanced Critical Updates Information subfield is present in the STA Info field of the Basic Multi-Link element. Otherwise, the Enhanced Critical Updates Information Present subfield is set to 0. A non-AP STA sets this subfield to 0 in the Basic Multi-Link element that it transmits. An AP sets this subfield to 1 in the Basic Multi-Link element carried in a (Re)Association Response or Link Reconfiguration Response frames and sets it to 0 in other frames.

***TGbn editor: please update Figure 9-1072o in this subclause as shown below:***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| STA Info Length | STA MAC  Address | Beacon Interval | TSF Offset | DTIM Info | NSTR  Indication Bitmap | BSS  Parameters Change Count | Enhanced Critical Updates Information Present |

Octets: 1 0 or 6 0 or 2 0 or 8 0 or 2 0 or 1 or 2 0 or 1 0 or 1

**Figure 9-1072o—STA Info field format of the Basic Multi-Link element**

***TGbn editor: please add the following at the end of 9.4.2.321.2.3:***

The format of the Enhanced Critical Updates Information field is as shown in Figure 9-734d (Enhanced Critical Updates Information field format).

|  |  |  |
| --- | --- | --- |
|  | B0 B3 | B4 B7 |
|  | Enhanced BSS Parameter Change Count | Reserved |
| Bits: | 4 | 4 |
| **Figure 9-1072pa – Enhanced Critical Updates Information field format** | | | |

The Enhanced BSS Parameter Change Count subfield of the STA Info field is as defined in 9.4.2.169.2 (Neighbor AP Information field) and carries the most recent Enhanced BSS parameters change count corresponding to the reported AP.

**9.4.2.aa2 UHR Capabilities element**

***TGbn editor: please update the following figure in this subclause as shown below***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B4 | B5 | B6 | B7 |
|  | DPS Support | DPS Assisting Support | Multi-Link Power Management | NPCA Supported | Enhanced BSR Support | Additional Mapped TID Support | EOTSP Support |
| Bits: | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  | B8 | B9 | B10 | B11 | B12 | ... | B10 Bz |
|  | DSO Support | P-EDCA Support | DBE Support | Parameter Update Adv Notification Interval | Update Indication In TIM Interval | ... | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | ... | x |
| **Figure 9-aa5 – UHR MAC Capabilities Information field format** | | | | | | | |

***TGbn editor: please add the following two rows at the end of table 9-349c in this subclause as shown below***

|  |  |  |
| --- | --- | --- |
| **Table – 9-349c – Subfields of the UHR MAC Capabilities Information field** | | |
| **Subfield** | **Definition** | **Encoding** |
| Parameter Update Adv Notification Interval | Specifies how far in advance the AP initiates the advanced notification procedure (as described in 37.28.2) for an upcoming critical update | At an AP, set to the value of dot11UHRParamUpdateAdvNotificationInterval  Reserved for non-AP STA |
| Update Indication In TIM Interval | Specifies the duration for which the AP includes the Critical Updates Indicator subfield within the Partial Virtual Bitmap field of the TIM element after a critical update has taken effect. | At an AP, set to the value of dot11UpdateIndicationInPVBInterval  Reserved for non-AP STA |

**11.49 Reduced neighbor report**

***TGbn editor: please update the following paragraph and table in this subclause as shown below:***

Table 11-33a (Determining SMD ID and Critical Updates Information of a reported AP in a Reduced Neighbor Report element) shows the different scenarios and corresponding the mechanism to determine the SMD ID and critical updates information for a reported UHR AP for which the Member Of SMD subfield is set to 1 in its TBTT Information field.

**Table -11-33a – Determining SMD ID and Critical Updates Information of a reported AP in a Reduced Neighbor Report element**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reported AP** | **Collocated AP subfield** | **Same SSID subfield** | **SMD ID present in UHR Parameters field** | **Enhanced Critical Updates Information present in UHR Parameters field** | **Remark** |
| AP affiliated with the AP MLD of the reporting AP | 1 | 1 | No | Yes | SMD ID is 0 (same as AP MLD ID) |
| AP affiliated with the AP MLD of an AP corresponding to a nontransmitted BSSID | 1 | 0 | No | Yes | SMD ID is BSSID index (same as AP MLD ID) |
| Non-collocated AP belonging to the same SMD as the reporting AP | 0 | 1 | No | No | SMD ID is 0; critical updates information is not provided |
| Non-collocated AP belonging to the same SMD as an AP corresponding to a nontransmitted BSSID | 0 | 0 | Yes | No | SMD ID is BSSID index of the nontransmitted BSSID; critical updates information is not provided |
| Non-collocated AP not belonging to the same SMD as the reporting AP or the nontransmitted BSSID | 0 | 0 | Yes | No | SMD ID is greater than 2^n - 1; critical updates information is not provided |