IEEE P802.11
Wireless LANs

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| Resolution for CIDs related to UHR Critical Updates Procedure |
| Date: July 31, 2025 |
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 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.
* Rev 2: Updated based on offline feedback from various members.
* Rev 3: Further updates based on offline feedback from various members.

***TGbn editor: Baseline for this document is 802.11-2024, TGbe D7.0, TGbn D0.3, and 11-25/1091r6***

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. | **Revised**Agree in principle. The resolution proposes an enhanced critical updates mechanism that supports a range of client devices (from always-on to light sleepers to STAs that wake once in a long while). The scheme introduces early indicators in the beacon frame to notify awake or lightly sleeping clients of upcoming or recent updates and their types. For deep sleepers, these indicators offer a quick way to detect whether an update occurred while they were in doze state. Additional fields later in the beacon convey BPCC, AUI, and update type details, helping clients identify the affected link, the type (e.g., UHR) of the update, and whether the updated parameters are currently included in the beacon (if the update is upcoming or on-going).**TGbn editor: Please implement the changes shown in this doc.** |
| 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 | **Revised**Agree in principle. The resolution proposes an enhanced critical updates mechanism that supports a range of client devices (from always-on to light sleepers to STAs that wake once in a long while). The scheme introduces early indicators in the beacon frame to notify awake or lightly sleeping clients of upcoming or recent updates and their types. For deep sleepers, these indicators offer a quick way to detect whether an update occurred while they were in doze state. Additional fields later in the beacon convey BPCC, AUI, and update type details, helping clients identify the affected link, the type (e.g., UHR) of the update, and whether the updated parameters are currently included in the beacon (if the update is upcoming or on-going).**TGbn editor: Please implement the changes shown in this doc.** |

***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.

A UHR AP affiliated with an AP MLD shall initiate 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 either of the two cases:

* The update pertains to the AP MLD with which the AP is affiliated, or to any AP affiliated with the same AP MLD as the AP.
* The AP corresponds to the transmitted BSSID in a multiple BSSID set, and the update pertains to:
	+ The AP MLD with which any of the nontransmitted BSSIDs in that set is affiliated, or
	+ Any AP affiliated with the same AP MLD as one of the nontransmitted BSSIDs in that set.

At the TBTT when an AP affiliated with an AP MLD initiates the advanced notification procedure for the cases described above, 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.
	+ Increment by 1 (modulo 16) the value carried in the Update Counter field of the Critical Updates Indicator field.
* Increment by 1 (modulo 16) the value carried in the Enhanced BSS Parameter Change Count field corresponding to each affected AP, carry a value of 1 in the Critical Update Type field corresponding to each affected AP and set to 1 the Enhanced All Updates Included field.
	+ The Enhanced BSS Parameter Change Count, Critical Update Type and the Enhanced All Updates Included fields are carried in the Enhanced Critical Updates Information field which is present in the TBTT Information field of the Reduced Neighbor Report element if the affected AP is a collocated UHR AP.
	+ The Enhanced BSS Parameter Change Count, Critical Update Type and the Enhanced All Updates Included fields are carried in the Enhanced Critical Updates Information field contained in the Common Info field of the Basic Multi-Link element if the affected AP is the transmitting AP or if the affected AP is the AP corresponding to the nontransmitted BSSID in the same multiple BSSID set as the transmitting AP.
	+ The Enhanced BSS Parameter Change Count is carried in the Enhanced Critical Updates Information field contained in the STA Info field of the Basic Multi-Link element carried in a (Re)Association Response frame or a Link Reconfiguration Response frame.
* Includes the UHR Parameter Update element in the Beacon frame as described in 37.28.2.2 (Procedure for advance notification).

NOTE 1 – The Enhanced BSS Parameter Change Count field corresponding to all the APs affiliated with an AP MLD are incremented when there is an update to the parameters for a UHR defined mode of that AP MLD.

NOTE 2 – The Update Counter field of the Critical Updates Indicator field of the TIM element 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.

Upon initiation, an AP shall perform the advanced notification procedure for a duration specified in the Parameter Update Adv Notification Interval field of the UHR Capabilities element.

While the advanced notification procedure is in progress at an AP affiliated with an AP MLD, and until the DTIM Beacon transmitted by that AP following the TBTT at which the update takes effect (inclusive), the AP shall, in the Beacon frame it transmits:

* Set to 1 the Enhanced Critical Updates Flag of the Capability Information field.
* Carry a value of 1 in the Update Type field of the Critical Updates Indicator field of the TIM element to indicate an update to a UHR defined mode of operation.
* Carry the latest updated value in the Update Counter field of the Critical Updates Indicator field of the TIM element.
* Carry a value of 1 in the Critical Update Type field in the corresponding to each affected.
* Carry the last updated value for the corresponding AP in the corresponding Enhanced BSS Parameter Change Count field.
* Set to 1 the Enhanced All Updates Included field for the corresponding AP and includes the UHR Parameter Update element in the Beacon frame as described in 37.28.2.2 (Procedure for advance notification).

An AP, in the Beacon frames it transmits after the DTIM Beacon immediately following the TBTT at which the critical update takes effect and continuing 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 field corresponding to each affected AP.
* Carry the last updated value for the corresponding AP in the corresponding Enhanced BSS Parameter Change Count field.
* Set to 0 the Enhanced All Updates Included field for the corresponding AP.

An AP, in the Beacon frame it transmits after the duration specified in the Update Indication In TIM Interval field of the UHR Capabilities element has elapsed following the TBTT when the critical update takes effect and continuing until the next initiation of an advanced notification procedure, shall not include the Critical Updates Indicator field in the TIM element unless the first octet carried in the TIM element precedes the Critical Updates Indicator field.

NOTE 3 – When the Critical Updates Indicators field is absent in the TIM element, 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 MLD, that has performed multi-link setup with an AP MLD shall maintain a record for the most recently received enhanced BSS parameters change count value for each associated UHR AP affiliated with the AP MLD and shall retrieve the most recent UHR operational parameters for an AP’s BSS when the value of the enhanced BSS parameters change count for that AP is different from the previously received value.

**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, starting bit 56, subject to the conditions specified in 37.28.3 (Indication of enhanced critical updates).

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 (Encoding of Update Type subfield).

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

|  |  |
| --- | --- |
| **Value** | **Type** |
| 0 | No 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 2^n 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 Table 9-328 as shown below:***

**Table 9-328—TBTT Information field contents if the TBTT Information Field Type subfield is equal to 0**

|  |  |
| --- | --- |
| **TBTT Information Length subfield value** | **TBTT Information field contents** |
| 16 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield and the MLD Parameters subfield |
| 17 | The Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield, the BSS Parameters subfield, the 20 MHz PSD subfield, the MLD Parameters subfield and the Enhanced Critical Updates Information subfield |
| 18–255 | The first 17 octets of the field contain the Neighbor AP TBTT Offset subfield, the BSSID subfield, the Short-SSID subfield the BSS Parameters subfield, the 20 MHz PSD subfield, the MLD Parameters subfield and the Enhanced Critical Updates Information subfield (i.e., same contents as when the length of the TBTT Information field is 17). The remaining octets are reserved. |

***TGbn editor: please update Figure 9-733 as shown below:***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Neighbor AP TBTT Offset | BSSID(optional) | Short SSID (optional) | BSS parameters | 20 MHz PSD | MLD Parameters | Enhanced Critical Updates Information |
| Octets: | 1 | 0 or 6 | 0 or 4 | 0 or 1 | 0 or 1 | 0 or 3 | 0 or 1 |

**Figure 9-733—TBTT Information field format**

***TGbn editor: please add the following paragraph after the paragraph starting “The Disabled Link Indication subfield …”***

The Enhanced Critical Updates Information field is present when the reported AP is a collocated UHR AP (i.e., the Collocated AP field is set to 1). Otherwise, the Enhanced Critical Updates Information field is not present.

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 field carries an unsigned integer, initialized to 0. The value carried in the field 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 9-328a (Encoding of Critical Update Type field).

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

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

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

**9.4.2.322.2 Basic Multi-Link element**

**9.4.2.322.2.2 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 |  B8 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.

**9.4.2.322.2.3 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 MACAddress | Link ID Info | BSSParameters Change Count | Medium Synchronization Delay Information |

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EMLCapabilities | MLDCapabilities 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 nontransmitted 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 9-328a (Encoding of Critical Update Type field).

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

**9.4.2.322.2.4 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 MACAddress Present | Beacon Interval Present | TSFOffset Present | DTIMInfo Present | NSTRLink Pair Present | NSTRBitmap Size | BSSParameters 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 MACAddress | Beacon Interval | TSF Offset | DTIM Info | NSTRIndication Bitmap | BSSParameters 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 B13 | B14 B18 | ... | B10 Bz |
|  | DSO Support | P-EDCA Support | DBE Support | Parameter Update Adv Notification Interval | Update Indication In TIM Interval | ... | Reserved |
| Bits: | 1 | 1 | 1 | 3 | 5 | ... | 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, expressed as number of TBTTs, 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, expressed as number of TBTTs, 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 dot11UpdateIndicationInPVBIntervalReserved for non-AP STA |

**11.49 Reduced neighbor report**

***TGbn editor: please move the following note from 37.14.2 to this subclause with the following changes as shown below:***

3 If a UHR AP reports a non-collocated AP in the Reduced Neighbor Report element it transmits, it does not include the Enhanced Critical Updates Information field in the TBTT Information field corresponding to the reported AP.

* **SMD BSS transition discovery procedure**

***TGbn editor: please move the following note to 11.49:***

**C.3 MIB detail**

***TGbn editor: please add the following MIB entry as shown below.***

*dot11UpdateIndicationInPVBInterval OBJECT-TYPE*

*SYNTAX Unsigned32 (10..31)*

*MAX-ACCESS read-write*

*STATUS current*

*DESCRIPTION*

*"This is a control variable.*

*It is written by an external management entity.*

*This attribute specifies the duration for which the AP includes the Critical Updates Indicator field within the Partial Virtual Bitmap field of the TIM element after a critical update has taken effect.*

*"*

*DEFVAL { 20 }*

*::= { dot11UHRStationConfigEntry 11 }*