IEEE P802.11
Wireless LANs

|  |
| --- |
| CR on Beacon frame and Group frames type information |
| Date: 2021-10-31 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Jarkko KnecktYong Liu,Tianyu Wu,Qi Wang,Jinjing Jiang | Apple Inc | Cupertino, CA |  | jkneckt@apple.com |
| Pooya Monajemi | Cisco |  |  |  |
| Srinivas Kandala,Ravi Gidvani | Samsung |  |  |  |
| Rojan ChitrakarRajat Pushkarna | Panasonic |  |  |  |
| Mark HamiltonPeter Khoury | Ruckus / CommScope |  |  |  |

Abstract

This submission provides comment resolution for the following 10 CIDs: 5324, 5325, 5327, 5332, 5334, 5335, 5337, 5338, 5340, and 5341.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution**  |
| 5324 | 35.3.4.1 | 251.33 | The RNR element should signal whether a reported AP sends beacon on high transmission rates, lets say higher than 12 Mbit/s or 24 mbit/s. This helps STA to optimize scanning of the AP and helps to determine the reported BSS range. | Please add a bit to the RNR to signal whether the reported AP sends Beacons in transmission rate that is smaller or equal to 24 Mbit/s. | Revised. Agree in principle with the comment. RNR needs a subfield that characterizes transmitted Beacon type for passive scanning non-associated STAs. The submission 11-21-1737r1 explains this in more details. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5324 from 11-21-1756r2. |
| 5325 | 9.4.2.170 | 123.21 | The RNR element should signal whether AP sends beacon in non-HT PPDU format. This helps STA to optimize scanning of the AP and helps to determine whether AP optimizes its range. | Please add a bit to signal whether AP sends Beacons on non-HT PPDU or Non-HT Duplicate PPDU. | Revised. Agree in principle with the comment. RNR should have a subfield that characterizes transmitted Beacon type for passive scanning non-associated STAs. The submission 11-21-1737r1 explains this in more details. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5325 from 11-21-1756r2. |
| 5327 | 9.4.2.170 | 123.21 | Low Power Indoor (LPI) AP in the 6 GHz band may transmit Beacons on larger than 20 MHz BW. To maximize the range from which the scanning STA is able to receive these Beacon frames, the scanning STA should have out-of-band infromation to use wider than 20MHz RX BW. | Please add a bit to the RNR to signal whether the reported AP transmits Beacons on wider than 20 MHz BW. | Revised.Agree in principle with the comment. RNR should have a to signal whether Beacon is transmitted on larger than 20 MHz BW. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5325 from 11-21-1756r2. |
| 5332 | 9.4.2.295a | 126.42 | An AP MLD should provide information of the affiliated APs Beacon and other discovery frame types and transmission parameters (MCS, BW and Primary 20 MHz channel) that the affiliated APs transmit. This information helps the STAs to determine the range of the affilaited APs and allows the scaning STAs to optimize their scanning/link maintenance with the affiliated APs. The Beacon BW and P20 information are needed especially for the 6 GHz band where the non-HT Duplicate PPDU may transmit a Beacon to other than primary 20 MHz channels. | Please add to the EHT Operation element, or create a new element to signal the P20 of the BSS, Beacon frame type and its transmission parameters. Please ensure that AP MLD transmits the information of all affiliated APs. | Revised. Agree in principle of the comment. Target is to provide affiliated APs Beacon frame type information to help STA to discover affiliated APs and estimate whether the scanning STA may receive a frame from the affiliated AP. The signaling is done through Per-STA Profile of the ML element and the RNR element. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5332 from 11-21-1756r2.  |
| 5334 | 9.3.3.2 | 105.07 | All associated non-AP MLDs should detect, if an affiliated AP changes its Beacon frame transmission parameters. | Please add beacon frame transmission parameter modification as a criterion to add AP specific Change Sequence Counter to let all associated non-AP MLDs to detect the link specific beacon frame parameters change. | Revised. Agree in principle with the comment. A change in Beacon frame transmission parameters will modify the range of the BSS. In some cases, this may cause some STAs to lose BSS connectivity. Associated STAs should notify such a change and obtain connectivity through other link. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5334 from 11-21-1756r2. |
| 5335 | 9.4.2.295a | 133.43 | The Per-STA Profile of the multi-link element should provide detailed parameters of the transmitted Beacon frame type and transmission mode of the reported AP | Please add detailed information of the Beacon frame type and its transmission parameters to Per-STA Profile of the reported AP. | Revised. Agree in principle with the comment. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5335 from 11-21-1756r2. |
| 5337 | 9.4.2.36 | 120.30 | The group addressed frames transmission rate and PPDU type is currently not signaled to the scanning STAs or associated STAs. This information may help select an AP from which the STA receives group frames. | Please add information of the group addressed frames transnmission rate and PPDU type to the candidate AP/affiliated APs of the AP MLDs. | Revised. Agree in principle with the comment. Signaling of the high-level description of the group frames transmission parameters is added. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5337 from 11-21-1756r2. |
| 5338 | 9.4.2.295a | 126.42 | An AP MLD should provide information of the affiliated APs group addressed frames transmission rate and PPDU type. This information helps the STAs to selet the AP from which they receive group addressed frames. | Please add to EHT Operation element, or create a new element to signal the group addressed frames type and their transmission parameters. Please ensure that AP MLD transmits the information to all affiliated APs. | Revised. Agree in principle with the comment. The signaling is included to the Per-STA Profile of the ML element. Revised. Agree in principle with the comment. Signaling of the high-level description of the group frames transmission parameters is added. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5338 from 11-21-1756r2.  |
| 5340 | 35.3.13 | 273.21 | All associated non-AP MLDs should detect, if an affiliated AP changes its group addressed frames transmission parameters in otfer to receive the frames from a link that transmits the frames reliably and in short duration. | Please add group frame transmission parameter modification as a criteria to add AP specific Change Sequence Counter to let all associated non-AP MLDs to detect the link specific group addressed frames parameters change. | Revised. Agree in principle with the comment. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5340 from 11-21-1756r2. |
| 5341 | 9.4.2.295a | 133.43 | The Per-STA Profile of the multi-link element should provide detailed parameters of the transmitted group frames type and transmission mode of the reported AP | Please add detailed information of the Group frames type and its transmission parameters to Per-STA Profile of the reported AP. | Revised. Agree in principle with the comment. The submission 1737r1 explains the group frames transmission parameters. TGbe Editor, as a resolution of the comment, please incorporate to the 802.11be draft the normative text identified by the CID #5341 from 11-21-1756r2. |

**9.4.2.170 Reduced Neighbor Report element**

**9.4.2.170.2 Neighbor AP Information field**

***TGbe Editor: Please update the Figure 9-632b as shown below and add the new paragraph at the end of the clause.***



**Figure 9-632b—MLD Parameters subfield format**

The Beacon Type subfield is set to 1, if the reported AP transmits Beacon frames in non-HT PPDU or non-HT Duplicate PPDU and the transmission rate of the PPDU containing the Beacon frame is less or equal to 24 Mb/s and is set to 0 otherwise. (#5324, #5325)

The Duplicate Beacon subfield is set to 1 if the reported AP transmits Beacon frames in non-HT Duplicate PPDU with a TXVECTOR parameter CH\_BANDWIDTH value that is up to BSS bandwidth and is set to 0. (#5327)

**9.4.2.295b.2.3 Link Info field of the Basic Multi-Link element(#7567)**

***TGbe Editor: Please update the figure Figure 9-788ej as shown below and add the new paragraph as the new eighth paragraph after the Figure 9-788ej.***



The Beacon Frame Info Present subfield indicates the presence of the Beacon Type Information subfield in the STA Info field and is set to 1 if the Beacon Type Information subfield is present in the STA Info field; otherwise set to 0. A non-AP STA sets the Beacon Frame Info Present subfield to 0 in the transmitted Basic Multi-Link element. An AP sets this subfield to 1 when the element carries complete profile. (#5332, #5335)

***TGbe Editor: Please update the figure Figure 9-788ep as shown below.***



***TGbe Editor: Please add the new figure and new paragraphs before the last paragraph of the clause. Please renumber the captions accordingly.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Group Frames Tx Mode | Beacon Tx Power Difference | Beacon Rate | Reserved |
| Bits: | 2 | 6 | 4 | 4 |

**Figure 9-788xx—Beacon Type Information field format**

TheGroup Frames Tx Mode subfield indicates the group frames transmission mode. The endocing is defined in Table XX(Group Frames Tx Mode subfield encoding). (#5337, #5338, #5341)

**Table XX – Group Frames Tx Mode subfield encoding.**

|  |  |
| --- | --- |
| Value | Meaning  |
| 0 | The AP transmits group frames at the same rate, BW and PPDU Type as the Beacon frames. |
| 1 | The condition of the value 0 is not met and the AP transmits all group frames as non-HT or non-HT Duplicate PPDU with ≤ 24 Mb/s rate.  |
| 2 | The condition of the value 1 is not met. The AP might use any mandatory rate for group frames transmission. |
| 3 | Reserved |

The Beacon Tx Power Difference subfield of the STA Info field is six bits in length and represents a 2s complement signed integer in dB. It carries the beacon transmit power (expressed in EIRP) normalized to 20 MHz of the AP reported in the Per-STA Profile subelement minus the beacon transmit power of the transmitting AP (expressed in EIRP) normalized to 20 MHz. The value 32 indicates a transmission power difference that is higher or equal to the 32 dB. The value -31 indicates a transmission power difference that is lower or equal to the -31 dB. (#5332, #5335)

NOTE – For example, if the beacon transmit power (in EIRP) normalized to 20 MHz of the AP that transmitted the ML probe response is 23 dBm and the beacon transmit power (in EIRP) normalized to 20 MHz of an AP that is reported is 20 dBm then the Beacon TxPower Difference subfield carries the binary value 111101. (#5332, #5335)

The Beacon Rate subfield specifies the rate of the Beacon PPDU. The encoding is defined in Table XX+1(Beacon Rate subfield encoding). (#5332, #5335)

**Table XX+1 – Beacon Rate subfield encoding.**

|  |  |  |  |
| --- | --- | --- | --- |
| Beacon Rate subfield value | DSSS PPDU rate | Non-HT OFDM rate | HE MCS |
| 0 | 1 Mb/s | 6 Mb/s | 0 |
| 1 | 2 Mb/s | 9 Mb/s | 1 |
| 2 | 5.5 Mb/s | 12 Mb/s | 2 |
| 3 | 11 Mb/s | 18 Mb/s | 3 |
| 4 | Reserved | 24 Mb/s | 4 |
| 5 | Reserved | 36 Mb/s | 5 |
| 6 | Reserved | 48 Mb/s | 6 |
| 7 | Reserved | 54Mb/s  | 7 |
| 8 – 15  | Reserved | Reserved | Reserved |

**11.2.3.15 TIM Broadcast**

***TGbe Editor: Please add the row to the end of the list.***

s) Modification of the Beacon Type Information field. (#5334, #5340)

**35.3.4 Discovery of AP MLD**

***TGbe editor: Please insert the following (new) subclause as shown below:***

**35.3.4.x Estimating Link Reachability** (#5332, #5335)

An AP affiliated with an AP MLD might independently select the rate and transmit power for the Beacon frames that it transmits based on deployment scenario or to satisfy regulatory requirements. In addition, the pathloss characteristics for each band are different. Therefore, it is possible that there will be a situation in which a STA of a non-AP MLD is able to receive Beacon frames transmitted by an AP affiliated with an AP MLD while the STA affiliated with the non-AP MLD is unable to receive Beacon frames from another AP affiliated with the same AP MLD. This subclause defines mechanisms by which an AP affiliated with an AP MLD advertises information that can help a non-AP MLD determine reachability and Beacon detectability for requested links.

The AP MLD shall signal in the Beacon Type subfield and Beacon BW subfield of the Reduced Neighbor Report element whether its affiliated APs transmit a Beacon frame in a Non-HT Duplicate PPDU or Non-HT PPDU at a rate that is less or equal to 24 Mb/s. This information helps a passive scanning STA to estimate whether it can receive Beacon frames from the reported APs affiliated with the same AP MLD. (#5324, #5325, #5327)

An AP affiliated with an AP MLD shall, when responding to an ML probe request that is requesting the complete profile of another AP affiliated with the same AP MLD, include Beacon Type Information field in the STA Profile field of the Per-STA Profile subelement of the Multi-link element corresponding to the reported AP. The AP shall transmit an ML probe response frame that carries the complete profile for one or more reported APs with the same TXVECTOR parameters as its Beacon frames.

A non-AP MLD can estimate whether it is able to receive a Beacon on a requested link of the AP MLD by using the values carried in the Reduced Neighbor Report element, HE Operation Parameters element and the Beacon Type Information field. A non-AP MLD can estimate the difference in the receive power and the required receive power to receive a Beacon frame for the requested link of the AP MLD. A non-AP MLD can, based on this estimate, make decisions on selecting a suitable AP MLD for performing multi-link setup. For example, if the non-AP MLD estimates that it would not be able to receive Beacon frames from one or more reported AP(s) affiliated with the AP MLD, it might decide to select a different AP MLD for performing multi-link setup.

An example of reachability estimation is shown in Figure 35-xxx (Example of reachability estimation).



**Figure 35-xxx – Example of reachability estimation**

In the example shown in Figure 35-xxx (Example of reachability estimation), STA1 affiliated with a non-AP MLD (N) sends an ML probe request to AP1 affiliated with an AP MLD (A), requesting the complete information of AP2 and AP3, which are also affiliated with the AP MLD (A). AP1 responds with an ML probe response, sent at the same transmit power as its Beacon frames, that provides:

* The AP2 Beacon frame transmission rate and difference between the beacon transmit power between AP1 and AP2 (carried in the Per-STA Profile subelement of the Basic Multi-Link element corresponding to AP2);
* The AP3 Beacon frame transmission rate and and difference between the beacon transmit power between AP1 and AP3 (carried in the Per-STA Profile subelement of the Basic Multi-Link element corresponding to AP3).

Using this information, the non-AP MLD (N) can estimate the required receive power to receive a Beacon frame and compute an estimate of the received power for the Beacon frames transmitted on L2 by AP2 and on L3 by AP3, respectively.

The computation of difference in the received power on links L1 and L2 is shown in Equation (35-x1).

 (35-x1)

where,

 is the difference in receive power between link L2 and link L1

 is the difference in transmit power between link L2 and link L1

 is the estimated difference in the path loss between link L2 and link L1

NOTE – The estimated difference in the path loss between the reporting link and the reported link depends on the device implementation and is outside the scope of this standard.

The computation of the estimated received power on link L2 is shown in Equation (35-x2).

= (35-x2)

where,

 is the estimated receive power on link L2

 is the actual received power on link L1

**35.3.15 Multi-link group addressed frame delivery and reception**

**35.3.15.2 Group addressed frame reception** (#5337, #5338, #5341)

***TGbe editor: Please insert the following (new) paragraph at the end of the clause:***

A non-AP MLD might use the Beacon Type Information field of the STA Profile field of the Per-STA Profile subelement to select the AP affiliated with the associated AP MLD from which the non-AP MLD receives the group addressed frames. The Beacon Type Information subfield signals the transmission rates of the group frames enabling the non-AP MLD to estimate whether it can receive group frames from the affiliated AP.