### **IEEE P802.11 Wireless LANs**

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| LB271 CR for preamble puncturing | | | | |
| Date: 2023-05-31 | | | | |
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**Abstract**

This submission proposes resolutions for the following CIDs for TGbe LB271:

* 17893,16666,17998,18183,18184

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: updated the text based on inputs during the May meeting
* Rev 2: removed the resolutions that have passed the motion; in the resolution to CID 17893, changed Bandwidth Indication element with Channel Switch Wrapper element to based on CID 16666. Revised text in the resolution for CID 17998 to use *shall* instead of *may* because EHT Operation element and Channel Switch Wrapper element are the only two possible elements for an EHT AP to indicate puncturing pattern update; editorial updates in the resolution of 18184.

***TGbe editor: Please note Baseline is REVme\_D3.0 and 11be D3.1***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CID | Commenter | Clause | Page | Comment | Proposed Change | Resolution |
| 17893 | Gaurang Naik | 35.15.2 | 643.58 | When the channel switch is to a channel that has at least one punctured subchannel, the affected AP will include a Bandwidth Indication element. The reporting AP will include the corresponding (E)CSA element in the per-STA profile corresponding to the affected AP but the Bandwidth Indication element is not included. Without the bandwidth indication element, the receiving STA will not be aware of the punctured subchannel. | Please add Bandwidth Indication element to the direct inclusion element list in clause 35.3.11 | Revised  Agree with the commenter in principle. As other information such as transmit power envelop is also needed, we propose to insert Channel Switch Wrapper element (as it contains the Bandwidth Indication element suggested in the comment and TPE) to the list right after the Extended Channel Switch Announcement element in 35.3.11  Tgbe editor please implement changes as shown in doc 11-23/0728r2 tagged as #17893 |
| 16666 | Liwen Chu | 35.15.2 | 645.07 | The Tx power information shoud be updated when the channel BW is more than 160MHz. | fix the issue mentioned in the comment | Revised  Agree with the commenter in principle. We propose to insert Channel Switch Wrapper element (as it contains the Bandwidth Indication element and TPE) to the list right after the Extended Channel Switch Announcement element in 35.3.11.  Tgbe editor please implement changes as shown in doc 11-23/0728r2 tagged as #17893, same as above |
| 17998 | Yanjun Sun | 35.15.2 | 643.59 | Clarification is needed on the 2 methods an EHT AP can use to indicate an updated puncturing pattern in D3.0: 1) indicated via the the Disabled Subchannel Bitmap subfield in the EHT Operation element in the Beacon frame, 2) indicated via the Disabled Subchannel Bitmap subfield in the Bandwidth Indication element of (e)CSA. The key difference between the two methods is that method 2) allows for a more graceful transition based on the channel switch acount. Please clarify the difference to avoid interop issue and add a should requirement for method 2) if a graceful transition is needed. | As in comment | Revised  Agree with the commenter in principle  Tgbe editor please implement changes as shown in doc 11-23/0728r2 tagged as #17998 |
| 18183 | Abhishek Patil | 35.15.2 | 643.58 | TPE with EIRP for 320MHz/puncturing is missing. | Please add it for completeness of the spec | Revised  Agree with the commenter in principle  Tgbe editor please implement changes as shown in doc 11-23/0728r2 tagged as #18183 |
| 18184 | Abhishek Patil | 35.15.2 | 643.58 | TPE with PSD for 320MHz/puncturing is missing. | Please add it for completeness of the spec | Revised  Agree with the commenter in principle  Tgbe editor please implement changes as shown in doc 11-23/0728r2 tagged as #18184 |

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.***

***Tgbe editor: Please update subclause 35.3.11 as follows (track change enabled):***

**35.3.11 Multi-link procedures for channel switching, extended channel switching, and**

**channel quieting**

… …

If an AP (affected AP) affiliated with an AP MLD includes any of the following applicable elements outside

the Basic Multi-Link element in the Beacon frame, Probe Response frame or (Extended) Channel Switch

Announcement frame it transmits:

— Channel Switch Announcement element

— Extended Channel Switch Announcement element

(#17893)-- Channel Switch Wrapper element

… …

If an AP corresponding to the transmitted BSSID in a multiple BSSID set includes any of the following

elements in the Beacon frame or Probe Response frame it transmits so that any of these elements is inherited

for the affected AP in these frames:

— Channel Switch Announcement element

— Extended Channel Switch Announcement element

(#17893)-- Channel Switch Wrapper element

… …

If an AP affiliated with an AP MLD is switching channel, the Channel Switch Announcement element, or

the Extended Channel Switch Announcement element with the Channel Switch Count field of the

(Extended) Channel Switch Announcement element set to a nonzero value, (#17893)the Channel Switch Wrapper element and the Max Channel Switch

Time element shall be included in every Beacon and Probe Response frames on all links of the AP MLD

from right after the time the AP includes the elements in the Beacon frame it transmits until the estimated

channel switch time. After the estimated channel switch time, the Channel Switch Announcement element,

the Extended Channel Switch Announcement element and the Channel Switch Wrapper element(#17893) shall not be included in the per-STA profile

(#16597)corresponding to the affected AP in the Beacon and Probe Response frames and the Max Channel

Switch Time element shall be included in the per-STA profile of the affected AP in every Beacon and Probe

Response frames on all links of the AP MLD until the affected AP resumes BSS operation on the new

channel. The value carried in the Switch Time field indicates the adjusted estimated time of the first Beacon

frame in the new channel.

***Tgbe editor: Please insert a new paragraph to the end of subclause 35.15.2 as follows (track change enabled):***

* + 1. **Preamble puncturing operation**

(#17998)To indicate a puncturing pattern change for the current BSS operating channel, an EHT AP shall use an EHT Operation element or a Channel Switch Wrapper element (see 35.15.3 (Channel switching methods for an EHT BSS)).

NOTE—The Channel Switch Count field in a Channel Switch Announcement element or an Extended Channel Switch Announcement element sent together with the Channel Switch Wrapper element allows the AP to notify the associated non-AP STAs in advance about the upcoming puncturing pattern, so it is recommended to use the Channel Switch Wrapper element to indicate the puncturing pattern change.

***Discussion for CID 18183:***

*Issue: for TPE indicating an EIRP, there is no normative text on how to interpret reserved values for the Maximum Transmit Power Count subfield, so the behavior of a legacy STA is unknown if any value between 4-7 is used*

A picture containing text, screenshot, font, number

Description automatically generated

*To avoid interop issues with the legacy STAs deployed in the field, the group has discussed two options in the past:*

* *Option1: Append a new subfield to the existing TPE, which is an extensible element* 
  + *Pros: lowest overhead (1 octet only), proposed text in* [*22/1482r7*](https://mentor.ieee.org/802.11/dcn/22/11-22-1482-07-00be-lb266-cr-for-preamble-puncturing.docx) *has been discussed*
* *Option2: Carry an EHT TPE together with the legacy TPE in a Beacon frame*
  + *Pros: more flexibility for future expansion, not getting enough support due to larger overhead*
* *Option3: any other proposal?*

*The text below is copied from* [*22/1482r7*](https://mentor.ieee.org/802.11/dcn/22/11-22-1482-07-00be-lb266-cr-for-preamble-puncturing.docx) *based on option1.*

Tgbe Editor: modify the following paragraph (P1234L50 in 11meD2.0) in 9.4.2.161 Transmit Power Envelope element as follows (track change enabled)

~~Local~~ Maximum Transmit Power For *X* MHz fields (where *X* = 20, 40, 80, or 160/80+80) define the local maximum transmit power limit of *X* MHz PPDUs, except for an HE TB PPDU and for an EHT TB PPDU where *X* MHz is the bandwidth of the pre-HE and pre-EHT modulated fields of the HE TB PPDU and EHT TB PPDU transmitted by a STA. Each ~~Local~~ Maximum Transmit Power For *X* MHz field is encoded as an 8-bit 2s complement signed integer in the range –64 dBm to 63 dBm with a 0.5 dB step. Setting this field to 63.5 dBm indicates 63.5 dBm or higher (i.e., no local maximum transmit power constraint).(#18183)

Tgbe Editor: modify Table 9-691 Transmit Power Envelope element format as follows (track change enabled)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Transmit Power Information | Maximum Transmit Power | Extension Maximum Transmit Power |
| Octets: | 1 | 1 | 1 | variable | variable(#18183) |
| * **Transmit Power Envelope element format(11ax)** | | | | |  |

Tgbe Editor: add a new Figure 9-xxx-Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 0 or 2 as follows

|  |  |
| --- | --- |
|  | Maximum Transmit Power For 320 MHz |
| Octets: | 1 |

**Figure 9-xxx-Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 0 or 2**(#18183)

Tgbe Editor: add the following paragraph after the Figure 9-xxx-Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 0 or 2

(#18183)The maximum Transmit Power For 320 MHz fields define the local maximum transmit power limit of 320 MHz PPDUs, except for an EHT TB PPDU where 320 MHz is the bandwidth of the pre-EHT modulated fields of the EHT TB PPDU transmitted by a STA. The Maximum Transmit Power For 320 MHz field is encoded as an 8-bit 2s complement signed integer in the range –64 dBm to 63 dBm with a 0.5 dB step. Setting this field to 63.5 dBm indicates 63.5 dBm or higher (i.e., no local maximum transmit power constraint).

Tgbe Editor: Add the following paragraphs at the end of 9.4.2.161 Transmit Power Envelope element

(#18183)The format of the Extension Maximum Transmit Power field is defined in Figure 9-xxx (Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 0 or 2) if the Maximum Transmit Power Interpretation subfield is 0 or 2.

(#18183)The Extension Maximum Transmit Power field is included only following conditions defined in 35.16.3 (EHT operation with the Transmit Power Envelope element).

TGbe Editor: Add the following subclause 35.15.4 EHT operation with the Transmit Power Envelope element

(#18183)**35.15.4 EHT operation with the Transmit Power Envelope element**

An EHT STA follows the rules defined in 10.22.4 (Operation with the Transmit Power Envelope element) and the rules defined in this subclause.

The Extension Maximum Transmit Power field shall be included in the Transmit Power Envelope element by an AP only if the following condition is met:

* the AP is operating in the 6 GHz band, the Maximum Transmit Power Interpretation subfield is 0 or 2, and the EHT BSS operating channel width is 320 MHz.

If the Extension Maximum Transmit Power field is included and if the Maximum Transmit Power Interpretation subfield is 0 or 2, then the Maximum Transmit Power Count field shall be set to 3.

In a Transmit Power Envelope element transmitted by an EHT AP with the Maximum Transmit Power Interpretation subfield set to 0 or 2, the Maximum Transmit Power For X MHz subfield shall be included (where X = 20, 40, 80, 160/80+80, or 320) if X is less than or equal to the operating channel width of the corresponding EHT BSS.

**Discussion on CID 18184**

There were 3 candidates solutions discussed:

* Option1: use the reserved values in the Maximum Transmit Power Count subfield in TPE defined in 11ax to indicate 320 MHz TPE
* Option2: proposal in this CR, inherited from [*22/1482r7*](https://mentor.ieee.org/802.11/dcn/22/11-22-1482-07-00be-lb266-cr-for-preamble-puncturing.docx)
* Option3: define a new EHT TPE and send it together with HE TPE in the same frame
* Option4: any alternative?

**Issue with option1: unknown behavior for HE STAs already in the field (i.e. backward compatibility risk)**

TPE in HE has two flavors: EIRP and PSD. For EIRP, there is no rule defined on how an HE STA interprets a reserved value (e.g. 4-7) in the Maximum Transmit Power Count subfield. For PSD, the HE rules were defined without knowing static puncturing rules in EHT, so HE STA behavior is unknown if we try to use the reserved value in some cases. Please see an example below.

HE BSS: 40 MHz operating bandwidth

EHT BSS: 320 MHz operating bandwidth with S40 punctured



In this case, two HE rules would result into two possible conflicting settings on the first 2 PSD values in TPE.

1) Max Transmit Power field for P160 based on the following 11ax rule: “If the BSS bandwidth is 20, 40, 80 or 160 MHz, then the Maximum Transmit PSD 1-N subfields correspond to 20 MHz channels from lowest to highest frequency, respectively, within the indicated bandwidth”



2) Max Transmit Power field for P160 based on the 11ax text: “If N is greater than 8, the Maximum Transmit PSD 1-8 subfields correspond to the 20 MHz channels from lowest to highest frequency, respectively, within the 160 MHz channel containing the primary 20 MHz channel”



In summary, option1 not only requires amendment in 11me but also faces the risk of backward compatibility for HE STAs already in the field.

Both option2 (proposal in this CR, inherited from [*22/1482r7*](https://mentor.ieee.org/802.11/dcn/22/11-22-1482-07-00be-lb266-cr-for-preamble-puncturing.docx)) and option3 (define a new EHT TPE and send it together with HE TPE in the same frame) can handle 320 MHz without concerns on backward compatibility. As TPE is an extensible element, both solutions can be expanded later for future amendement. The main difference between option2 and option3 is that option3 has larger overhead in Beacon frames (e.g. at least 4 octets extra overhead for each co-hosted BSS).

Tgbe Editor: Add the following paragraphs at the end of 9.4.2.161 Transmit Power Envelope element

(#18184)The format of the Extension Maximum Transmit Power field is defined in Figure 9-xx2 (Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 1 or 3) the same as the Maximum Transmit Power field if the Maximum Transmit Power Interpretation subfield is 1 or 3, as defined in Figure 9-617b (Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 1 or 3).

|  |  |  |
| --- | --- | --- |
|  | Extension Transmit PSD Information | Maximum Transmit PSD Values |
| Octets: | 1 | variable |

**Figure 9-xx2-Extension Maximum Transmit Power field format if the Maximum Transmit Power Interpretation subfield is 1 or 3**(#18184)

The format of the Extension Transmit PSD Information subfield is defined in Figure 9-xx3 (Extension Transmit PSD Information subfield format). The Extension Count subfield determines the value of an integer *K*, which indicates the number of 20 MHz channels for which a maximum transmit PSD is included in the Maximum Transmit PSD Values subfield of the Extension Maximum Transmit Power field.

B0 B3 B4 B7

|  |  |  |
| --- | --- | --- |
|  | Extension Count | Reserved |
| Bits: | 4 | 4 |

**Figure 9-xx3—Extension Transmit PSD Information subfield format** (#18184)

The format of the Extension Maximum Transmit PSD Values subfield is the same as the Maximum Transmit Power field as defined in Figure 9-694 (Maximum Transmit Power field format if Maximum Transmit Power Interpretation subfield is 1 or 3).

TGbe Editor: Add the following sentence to 9.4.2.161 (Transmit Power Envelope element) , at 11meD2.0P1235L58, right after “If N is greater than 0 and less than 2, 4, or 8 for 40, 80, or 160 MHz BSS bandwidth, respectively, then the indicated bandwidth is the primary 20 MHz, primary 40 MHz, or primary 80 MHz channel for N equal to 1, 2, or 4, respectively.”

(#18184)If the Extension Maximum Transmit Power field is included and the Maximum Transmit Power Interpretation subfield is 1 or 3, then:

* If N+K is equal to 2, 4, 8 or 16 for 40, 80, 160 or 320 MHz EHT BSS bandwidth, respectively, then the indicated bandwidth is the EHT BSS bandwidth.
* If N+K is less than 4, 8 or 16 for 80, 160 or 320 MHz EHT BSS bandwidth, respectively, then the indicated bandwidth is the primary 40 MHz, primary 80 MHz or primary 160 MHz channel for N+K equal to 2, 4, 8 respectively.
* If N+K is greater than 2, 4, 8 or 16 for 40, 80,160 or 320 MHz EHT BSS bandwidth, respectively, then the indicated bandwidth is wider than the EHT BSS bandwidth.
  + The Maximum Transmit PSD 1-M subfields correspond to the 20 MHz channels within the EHT BSS bandwidth in the order as described in this subclause, where M is 4, 8, or 16 for 80, 160 or 320 MHz EHT BSS bandwidth, respectively.
  + The Maximum Transmit PSD (M+1)-(N+K) subfields are reserved for future use

(#18184)If the Extension Maximum Transmit Power field is **not** included, the Maximum Transmit Power Interpretation subfield is 1 or 3, and N is greater and 0, then:

* If N is less than 2, 4, 8 or 16 for 40, 80, 160 or 320 MHz BSS bandwidth, respectively, then the indicated bandwidth is the primary 20 MHz, 40 MHz, primary 80 MHz channel or primary 160 MHz channel for N equal to 1, 2, 4, 8 respectively.

TGbe Editor: Add the following text to the end of subclause 35.15.4 (EHT operation with the Transmit Power Envelope element)

(#18184)The Extension Maximum Transmit Power field shall be included in the Transmit Power Envelope element by an AP only if the following conditions is met:

* the AP is operating in the 5GHz or 6 GHz band, the AP is announcing a BSS operating channel width to EHT non-AP STAs in EHT Operation element that is different from a non-EHT BSS operating channel width that it announces to non-EHT non-AP STAs (see 35.165.1 Basic EHT BSS operation), the Maximum Transmit Power Interpretation subfield is 1 or 3, the value of *N* determined from the Maximum Transmit Power Count subfield is greater than 0, and the number of 20 MHz subchannels covered by Transmit Power Envelope element is greater than the number of 20 MHz subchannels contained within the HE BSS operating channel width.

(#18184)If the Extension Maximum Transmit Power field is included and if the Maximum Transmit Power Interpretation subfield is 1 or 3, then:

* the Transmit Power Information field and the Maximum Transmit Power field shall be computed with the non-EHT BSS operating channel width of the AP that is different from the EHT BSS operating channel width.
* the Extension Maximum Transmit Power field shall be computed as follows:
  + The Extension Count subfield of the Extension Transmit PSD Information subfield is set to the value of *K*, corresponding to the number of 20 MHz subchannels for each of which the Transmit Power Envelope element has included a maximum transmit PSD, minus the number of 20 MHz subchannels contained within the non-EHT BSS operating channel.
  + the Maximum Transmit PSD 1-*K* subfields correspond  
    to 20 MHz channels from lowest to highest frequency, respectively, within the EHT BSS operating channel, excluding the 20 MHz channels within the non-EHT BSS operating channel.