IEEE P802.11
Wireless LANs

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| LB233 CR Transmit Power Control  |
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Abstract

This submission proposes resolutions of comments received from TGax LB233.

(The proposed change is based on TGax Draft 3.0.)

* CIDs: 15835, 16441, 16448 (3 CIDs)

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

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

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

| **CID** | **Page** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| --- | --- | --- | --- | --- | --- |
| 15835 | 138.60 | 9.4.2.162 | Local max transmit power can be defined by the transmit power envelope element, which defines power limits for 20MHz, 40MHz, 80MHz, 160MHz. These limits are for single user transmissions using these bandwidth. 11ax defines operation with UL MU where a STA can transmit on 20MHz or less but not on the primary channel. Clarification should be added to 11ax spec on how to derive the max transmit power if the AP uses transmit power envelope element. | Define the rules to derive max TxPower when operating with UL MU and when the Transmit Power Envelope element is used by the AP. | Revised- Agree in principle. Please refer the discussion part in 11-18/1779r1.TGax editor makes changes as shown in the as specified in 11-18/1779r1. |

**Discussion:**

In the Transmit Power Envelope element, the 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.

In 802.11ax, the X MHz PPDUs’s definition includes all HE PPDUs with the TXVECTOR parameter CH\_BANDWIDTH equal to CBWX.

As of now, for an HE TB PPDU, the local maximum transmit power is constrained by the TXVECTOR parameter CH\_BANDWIDTH and the Local Maximum Transmit Power value associated with the CH\_BANDWIDTH parameter. But, it can cause to exceed the regulatory requirement about the EIRP limit.

In the proposed changes, the local maximum transmit power for an X MHz HE TB PPDU is constrained by the Local Maximum Transmit Power For X MHz field value – 10 log (X / (the bandwidth of the pre-HE modulated of the HE TB PPDU)).

***TGax Editor: Change the subclause 9.4.2.161 as follows:***

* Transmit Power Envelope element

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 when the X MHz PPDU is an HE TB PPDU. In which case, the local maximum transmit power of the X MHz HE TB PPDU, where the bandwidth of the pre-HE modulated fields of the X MHz HE TB PPDU is Y MHz, is defined by the Local Maximum Transmit Power For X MHz field value minus 10 log (X/Y). 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. The value of 63.5 dBm indicates 63.5 dBm or higher (i.e., no local maximum transmit power constraint).

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| --- | --- | --- | --- | --- | --- |
| 16441 | 78.25 | 9.2.4.6a.5 | It would be useful to have a way to signal that the recipient of DATA MPDUs is experiencing eithe resource constraints or local interference that might cause a complete lack of an acknowledgement transmission and that the failure of an AMPDU originator to receive an acknowledgement when thus indicated should not be a reason to adjust the MCS for the link. | Add a signaling indication to the UPH Control to indicate that the recipient is currently resource constrained and that missing acknowledgement frames should not be construed as indicative of a poor MCS choice for the link. | Rejected- The HLA Control can already provide the correct MCS choice to the originator.  |

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| 16448 | 78.44 | 9.2.4.6a.5 | The draft needs a mechanism that provides per MCS link transmit power information so that closed loop transmit power adjustments can be made which reduce the excess margin introduced by the use of conservative estimates for various, unknown link components and allow higher throughputs to be achieved. Also note that UPH value is not useful without knowledge of the UPH sender's TX PA settings per MCS. If a value of 3 is given for UPH at MCS7, does this mean that the transmitted TX Power is 3 dB from the maximum that the PA can output, or does it mean that the power is 3 dB from where the transmitter thinks that TXEVM will be exceeded for this MCS? And how does this 3 dB relate to any other MCS? Probably need to refine the meaning of the UPH value to answer some of these questions. Note that by providing a complete list of TX power values per MCS, a single UPH response can indicate to the AP what values of MCS and Target RSSI are appropriate for each non-AP STA. | At a minimum, refine the meaning of "available power headroom" - with reference to what? To max PA power? To the point when TX EVM is expected to be exceeded? Or to what? Best to also include a link transmit power signaling mechanism to provide a reference value for the UPH parameter. | Revised- Agree in principle. Please refer the discussion part in 11-18/1779r1.TGax editor makes changes as shown in the as specified in 11-18/1779r1. |

**Discussion:**

The Power Capability element in IEEE 802.11 REVmd 1.4 specifies the minimum and maximum transmit powers with which a STA is capable of transmitting in the current channel. The usage of the the minimum and maximum transmit power capability is the beyond of this standard.

*9.4.2.14 Power Capability element*

*The Power Capability element specifies the minimum and maximum transmit powers with which a STA is capable of transmitting in the current channel. The format of the Power Capability element is shown in Figure 9-172 (Power Capability element format).*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Element ID* | *Length* | *Minimum Transmit Power Capability* | *Maximum Transmit Power Capability* |
| *Octets:* | *1* | *1* | *1* | *1* |

***Figure 9-172—Power Capability element format***

*The Element ID and Length fields are defined in 9.4.2.1 (General).*

*The Minimum Transmit Power Capability field is set to the nominal minimum transmit power with which the STA is capable of transmitting in the current channel, with a tolerance ± 5 dB. The field is coded as a 2s complement(#124) signed integer in units of decibels relative to 1 mW. Further interpretation of this field is defined in 11.7.4 (Interpretation of transmit power capability).*

*The Maximum Transmit Power Capability field is set to the nominal maximum transmit power with which the STA is capable of transmitting in the current channel, with a tolerance ± 5 dB. The field is coded as a 2s complement(#125) signed integer in units of decibels relative to 1 mW. Further interpretation of this field is defined in 11.7.4 (Interpretation of transmit power capability).*

*The Power Capability element is included in Association Request frames, as described in 9.3.3.6 (Association Request frame format); Reassociation Request frames, as described in 9.3.3.8 (Reassociation Request frame format); and Mesh Peering Open frame, as described in 9.6.15.2.2 (Mesh Peering Open frame details). The use of Power Capability elements is described in 11.7.2 (Association based on transmit power capability).*

But, the maximum transmit power can be varied depending on the MCS, as mentioned by CID 16448. Providing the more exact power capability information of the STA can be helpful to improve the performance (e.g., the uplink power control for the HE TB PPDU). Please also refer the following submissions, 11-17/112r5 and 11-17/123r2.

***TGax Editor: Insert the following new subclause after 9.4.2.14 (Power Capability element):***

**9.4.2.14a Extended Power Capability element**

The Extended Power Capability element specifies the maximum transmit powers with which a STA is capable of transmitting per MCS in the current channel. The format of the Extended Power Capability element is shown in Figure 9-172a (Extended Power Capability element format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | MCI Bitmap | Maximum Transmit Power Capability List |
| Octets: | 1 | 1 | 1 | 2 | variable |

**Figure 9-172a—** **Extended Power Capability element format**

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1 (General).

The MCI Bitmap indicates which maximum transmit power capability values are present in the element. A value of 1 in bit position B0 of the MCI Bitmap field means that the Maximum Transmit Power Capability valuefor the constellation and encoding corresponding to the MCI Value 0 in Table 9-bbb (MCI Encoding) is present in the Maximum Transmit Power Capability List field of the element. A value of 1 in bit position B1 of the MCI Bitmap field means that the Maximum Transmit Power Capability value for the constellation and encoding corresponding to the MCI Value 1 in Table 9-bbb (MCI Encoding) is present in the Maximum Transmit Power Capability List field of the element. Bit positions B12 through B15 are reserved.

**Table 9-bbb—MCI Encoding**

|  |  |
| --- | --- |
| **MCI Value** | **Constellation, Encoding** |
| 0 | BPSK, ½ |
| 1 | QPSK, ½ |
| 2 | QPSK, ¾ |
| 3 | 16QAM, ½ |
| 4 | 16QAM, ¾ |
| 5 | 64QAM, 2/3 |
| 6 | 64 QAM, ¾ |
| 7 | 64QAM, 5/6 |
| 8 | 256QAM, ¾ |
| 9 | 256QAM, 5/6 |
| 10 | 1024QAM, ¾ |
| 11 | 1024QAM, 5/6 |
| 12-15 | Reserved |

The Maximum Transmit Power Capability List field contains N octets, each of which is Maximum Transmit Power Capability field as defined in 9.4.2.14 (Power Capability element). The value of N is equal to the number of bits that are set to 1 in the MCI Bitmap. The first Maximum Transmit Power field in the Maximum Transmit Power Capability List field corresponds to the MCS represented by the lowest numbered bit that is set to 1 in the MCI bitmap subfield and indicates the nominal maximum transmit power for the MCS that employs the constellation and encoding values that correspond to the MCI corresponding to the position of the bit in the MCI bitmap as indicated in Table 9-bbb (MCI Encoding).

The Exnted Power Capability element is included in (Re)-Association Request frames.

**9.3.3.6 Association Request frame format**

***TGax Editor: Insert the following new row into Table 9-29 (Association Request frame body):***

**Table 9-29—Association Request frame body**

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| 44 | Extended Power Capability | The HE Capabilities element is optionally present if dot11HEOptionImplemented is true; otherwise it is not present. |

**9.3.3.8 Reassociation Request frame format**

***TGax Editor: Insert the following rows in Table 9-31 (Reassociation Request frame body):***

**Table 9-31—Reassociation Request frame body**

|  |  |  |
| --- | --- | --- |
| Order | Information | Notes |
| 49 | Extended Power Capability | The HE Capabilities element is optionally present if dot11HEOptionImplemented is true; otherwise it is not present. |