IEEE P802.11  
Wireless LANs

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| Resolution to CIDs related to TPC | | | | |
| Date: 2019-January-14 | | | | |
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Abstract

This submission proposes resolution to CID 3094, 3095, 3098, 3521, 3522, 3588, 3571, 3572, 3574 and 3634

The resolutions are in reference to Draft IEEE P802.11ay/D2.2 and IEEE 802.11REVmd\_D2.0.

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| CID | Clause | Comment | Proposed change |
| 3094 |  | There should be a MIB defined to enable transmit power control (TPC) | Define a MIB defined to enable transmit power control (TPC) |
| 3095 |  | The TPC MIB should be made mandatory for TDD networks | Make TPC MIB mandatory for TDD networks |
| 3098 |  | Several contributions in 11ay discussed the impact of TDD network on SRD operation, which cannot be ignored for proper operation of the SRD. We cannot simply rely on edeployment to take care of the co-existence. Rather analysis has shown that TPC is very helpful for TDD netwrok to protect not only STAs in the TDD network but also to SRDs in the its vicinity. Straw poll results (see IEEE 802.11-18/0877r0.) also indicated strong support to mandate TPC for TDD network. | Add the relevent text to mandate the TPC support for TDD devices. |
| 3588 |  | It is not clear how to run the transmit power control (TPC) when both transmit side and receive side are capable and intend to run TPC. | Point to or provide a band-independent solution, such that one takes prority based on some metric or network roe (AP, non-AP..) |
| 3571 |  | dot11SpectrumManagementRequired operation for DMG is underspecified | Under this MIB,  - Add TPC Report IE to DMG Beacon frame  - Add Country, Power Constraint, Channel Switch Announcement, Quiet and TPC Report IEs to Announce frame |

**Discussion:**

REVmd already had a DMG TPC procedure, however it is not based on the periodic link measurement.

TPC in general can implemented in two ways: computation is on the Tx side or on the Rx side.

TPC based on link measurements from the responder requires only the reception of the Link Measurements reports from the responder. All spec components for this mode already exist in the current spec. The resolution below adds the dot11ExtendedTPCActivated MIB element to activate the functionality.

It should be noted that in this mode, the Initiator (the transmitter) may receive the results of the responder power commands and it may use it as part of its TPC algorithm.

TPC based on responder power commands is more complex. The Initiator is the transmit side of the link and it needs to know that the Responder can generate power control commands. Therefore, we added a capability bit to the DMG Capabilities. The responder sends the results of the TPC-Rx computation via existing fields in the Link Measurement Report. The Initiator shall use these values to adjust the transmit power as long as they don’t exceed the min and max supported transmit power.

There is a need to define a new TPC based on periodic link measurements report and clearly define how the TPC based on power commands and TPC based on link measurements operate.

The DMG Periodic TPC is different than the existing DMG TPC by:

(a) it is based on the Periodic Link Measurements

(b) no additional unsolicited Link Measurement Report is required to acknowledge the reception and execution of the transmit power change received from the Responder

(c) The Extended TPC is separate from the dot11SpectrumManagementRequired MIB.

The solution includes:

* A new MIB to define the Extended TPC mode {None, Rx, Tx}, named dot11ExtendedTPCActivated [CID#3094].  
  The new MIB can be made mandatory for STA in TDD mode [CID#3095]
* A new DMG capability for the responder to signal that it can perform his part of the DMG Periodic TPC-Rx [needed for CID#3588]
* A new section to define the MAC functionality for the DMG Extended TPC [CID#3588]
* Rename the new TPC to be Extended TPC

All above are related to CID#3098, CID#3588

The dot11SpectrumManagementRequired can be also made mandatory for STA in TDD mode [CID#3571]

The DMG TPC supports MCS and transmit power changes request via the Activity subfield.

For the Enhanced TPC we had a straw poll:

“Should we remove MCS from the Extended TPC text?”

Results: Yes:4, No:1, Abstain:12

Hence the MCS part was removed

**Proposed resolution:** Revise.

**Changes to section 6.3.32 Link Measure Request**

***TGay Editor: Edit the following paragraph of subclause 6.3.32.1 (REVmd P456L43-44)***

The following primitives support the measurement of link path loss, ~~and~~ the estimation of link margin

between peer entities and Extended TPC at the Responder.

***TGay Editor: Edit the following paragraph of subclause 6.3.32.2.1 (REVmd P456L51-52)***

This primitive supports the measurement of link path loss, ~~and~~ the estimation of link margin between peer

Entities and Extended TPC at the Responder.

***TGay Editor: Add to subclause C.3 (REVmd D2.0) – at the end of Dot11StationConfigEntry ::= SEQUENCE***

dot11ExtendedTPCActivated Integer

**Changes to MIB section – add new element dot11ExtendedTPCActivated**

***TGay Editor: Add to subclause C.3 (REVmd D2.0) – before “End of dot11StationConfig TABLE”***

dot11ExtendedTPCActivated OBJECT-TYPE

SYNTAX INTEGER { none(0), Tx(1), Rx(2) }

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This is a control variable.

It is written by the SME or external management entity.

Changes take effect for the next MLME-LINKMEASURE.request primitive.

A STA uses the defined TPC procedure according to this attribute if attribute is > 0;

otherwise it does not use the defined TPC procedures."

DEFVAL { 0 }

::= { dot11StationConfigEntry 193 }

**Changes to DMG STA Capability Information field**

***TGay Editor: Replace Figure 9-543 (in REVmd\_D2.0) with the following:***



***TGay Editor: Insert the following paragraph after paragraph starting with “The Code Rate 13/16 subfield specifies whether the STA supports rate 13/16. It is set”(REVmd2.0 P1275L43)***

The Extended TPC Rx Supported subfield is set to 1 to indicate that the STA supports Extended TPC Rx on the receiver side described in 10.44.6. The subfield is set to 0 otherwise.

**New section - DMG Extended TPC**

***TGay Editor: Add the following subclause***

**10.44.6 DMG Extended TPC**

A STA that initiates DMG Extended TPC shall support TDD Link maintenance as defined in10.44.5 TDD Link maintenance and the periodic Link Measurement as defined in 10.44.1.

A STA that sets to one the Extended TPC Rx Supported subfield in the DMG STA Capability Information field of the last transmitted DMG Capabilities element shall support TDD Link maintenance as defined in 10.44.5 TDD Link maintenance and the periodic Link Measurement as defined in 10.44.1 General.

A STA that has dot11ExtendedTPCActivated set to Rx and receives Link Measurement Report shall adjust its transmit power according to the values of the Extended TPC field (defined in 9.4.2.142.8) in the received Link Measurement Report frame. A STA may not implement the signaled transmit power change if the value exceeds the device limits.

NOTE - A STA that has dot11ExtendedTPCActivated set to Rx, sends Link Measurement Request with Indication for Periodic Report Request set to 1. The STA will receive periodically Link Measurement Report including Extended TPC sub-field, including transmit power update. The STA uses the received values to update its transmitter power. The peer device, which responds with Link Measurement Report, continuously performs evaluation of the link based on the information it has from its receiver and computes the update for the transmit power of the initiator.

A STA that has dot11ExtendedTPCActivated set to Tx and receives Link Measurement Report shall adjust its transmit power. The STA algorithm to determine the transmit power is beyond the scope of this standard. It may use any part of the received measurements and any additional information the STA has.

NOTE - A STA that has dot11ExtendedTPCActivated set to Tx, sends Link Measurement Request with Indication for Periodic Report Request set to 1. The STA will receive periodically Link Measurement Report including Parameters Across RX Chains and/or Parameters Across PPDUs and/or Parameters Across LDPC Codewords and/or Parameters Across SC Blocks Or OFDM Symbols. The STA uses the received values to update its transmitter power. The STA may also receive Extended TPC sub-field, including transmit power update. When dot11ExtendedTPCActivated is set to Tx, the STA is not required to follow the values in Extended TPC sub-field. It may use them as additional information used to update its transmitter power. The STA may use any additional information it has, like BACK.

An AP or PCP that has dot11ExtendedTPCActivated, set to Tx or Rx, shall have Extended TPC Rx Supported capability set to 1 and support the computation and report of the Extended TPC field defined in 9.4.2.142.8.

**Additional text in TPC procedures section**

***TGay Editor: Add the following paragraph to the end of subclause 11.7.1 (REVmd2.0 P2240L57)***

If dot11ExtendedTPCActivated is defined and is different than None, a DMG STA shall support DMG Extended TPC as defined in section 10.44.6

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| CID | Clause | Comment | Proposed change |
| 3572 |  | TPC Report elementcan be present in more frames than listed here | Change to "A TPC Report element is included in a Beacon, DMG Beacon or Announce frame, and also in a Probe Response frame without a corresponding request. Additionally, TPC Report element is present as a fixed part of the Link Measurement Report frame."  Note unorthodox use of TPC Report IE as a filed in Link Measurement Report needs to be spelled separately to highlight its diferent nature. |

**Discussion:**

The TPC in TDD mode is based on DMG Extended TPC and not the DMG TPC.

**Proposed resolution:** Reject.

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| CID | Clause | Comment | Proposed change |
| 3521 | 9.4.2.142.8 | How do you identify which transmit chain it belong to ? | It should have multiple transmit chains identified like figure 38. up to NTx. |

**Proposed resolution:** Revise.

**Discussion:**

The commenter is correct. There is a need to have the 2 bytes per transmit stream.

The above is already stated in section 9.4.2.142.1 (Draft 2.2):

*The Extended TPC field is optionally present. If present, as defined in 9.4.2.142.8, it contains the activity and link margin of each transmit chain reported.*

It should be “link margin of each space-time streams reported”

But one can see that Figure 9-564 presents this field as “0 or 2xNRX”.

***TGay Editor: Edit Figure 9-564***



*Note to the editor that EDMG TPC filed is changed to Extended TPC.*

***TGay Editor: Edit the following paragraph of subclause 9.4.2.142.3 (P111L30-31)***

The Indication of ~~EDMG~~ Extended TPC subfield is set to 1 if the DMG Link Margin element contains the ~~EDMG~~ Extended TPC field (see 9.4.2.142.8). It is set to 0 otherwise.

***TGay Editor: Edit the following subclause 9.4.2.142.8***

The ~~EDMG~~ Extended TPC field is defined in Figure 36.





**Figure 38 — ~~EDMG TPPC~~ Extended TPC field format**

The Activityi subfield, 1≤*i*≤NSTS, is set to a preferred action that the STA sending this element recommends that the peer STA indicated in the RA field of the Link Measurement Report frame execute for the space-time stream *i*. The method by which the sending STA determines a suitable action for the peer STA is implementation specific. The Activity field is defined in 9.4.2.142.2.

The Link Margini subfield, 1≤*i*≤NSTS, contains the measured link margin of the transmit chain received from the peer STA indicated in the RA field of the Link Measurement Report frame for the space-time stream *i* and is coded as a 2s complement signed integer in units of decibels. A value of –128 indicates that no link margin is provided. The method used to measure the link margin is beyond the scope of this standard.

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| CID | Clause | Comment | Proposed change |
| 3522 | 9.4.2.142.8 | If there is a change in Tx antenna configuration, Tx power control has to be done for each new configuration if there is a change in configuration. | Index to tie Tx Power Control to antenna configuration. |

**Proposed resolution:** Reject.

**Discussion:**

The commenter refers to a case where an AP is communicating via MU-MIMO with several sets of STAs and some STAs belong to more than one group.

In this case the use of Tx based TPC is the only reasonable option, since the STAs don’t have information about the other STAs link status.

In this case the AP can keep track of the different MU-MIMO groups and the TPC adjustments for each without the need to converge the TPC from start every time the MU-MIMO group is switched. This is an implementation issue without any need to change the spec.

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| CID | Clause | Comment | Proposed change |
| 3574 | 9.4.2.14 | Power Constraint element can be present in more frames than listed here | Change the last sentence in this section to "The Power Constraint element is optionally included in Beacon frames, as described in 9.3.3.3, DMG Beacon frames, as described in 9.3.4.2, Announce frames, as dscribed in 9.6.22.2, and Probe Response frames, as described in 9.3.3.11" |

**Proposed resolution:** Reject.

**Discussion:**

Assume that the comment refers to REVmd section 9.4.2.14 P994L26-30.

The comment is correct that indeed Power Constraint element is included in more frames.

However, this is a general issue not DMG/EDMG related and therefore it should be submitted to REVmd comments.

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| CID | Clause | Comment | Proposed change |
| 3634 | 9.4.2.127.7 | A TDD Link Maintenance Statistics capability is presented in the TDD Capability Information field, however use of the TDD Link Maintenance Statistics is not limited to TDD Channel Access. There is no reason to keep the feature TDD specific. | Remove "TDD" from the name of the feature. Move the Link Maintenance Statistics capability subfield to one of the reserved subfields in DMG STA Capability Information field format. |

**Proposed resolution:** Reject.

**Reason:**

The values in the TDD Link Maintenance Statistics are specific to TDD operation mode.

**Discussion**: DMG Link Margin element includes EDMG TPC field which generates an issue since DMG is required to support EDMG field. Renamed as Entended TPC.

***TGay Editor: Replace in all places:***

EDMG TPC -- > Extended TPC