IEEE P802.11
Wireless LANs

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| Comment Resolutions on Clause 26.3.12.4 |
| Date: 2016-05-27 |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D0.1 as follows:

* 340, 341, 342, 343, 1023, 2734, and 2889.

Revisions:

* Rev 0: Initial version of the document.
* Rev 2: Editorial updates (change Accepted 🡪 Revised); propose carrying UL Power Headroom in the A-Control field, which location is currently TBD.

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.***

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| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause Number** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 340 | 26.2.12.4.4 | 157.5 | Details of the power control mechanism in MU motions #49, 50, 52, 53 were approved but corresponding text has been added | Describe the details of the power control mechanism | Revised: Proposed resolution accounts for the suggested change. The motions for 11-16/0617r0 from May 2016 IEEE F2F included as well.TGax Editor to make the changes shown in IEEE 802.11-16/0775r2 under all headings that include CID 340. |
| 341 | 26.3.12.4.6 | 157.31 | In Table 26-35, the range of transmit power levels for which the accuracy applies is not specified. | Specify that the transmit power accuracy is applicable for the entire range of transmit powers that the STA is capable of. | Revised: Proposed resolution accounts for the suggested change.TGax Editor to make the changes shown in IEEE 802.11-16/0775r2 under all headings that include CID 341. |
| 342 | 26.3.12.4.6 | 157.31 | In Table 26-35, the specific range of RSSI values for which the RSSI measurement accuracy should apply is not specified. | The min and max Rx input power levels are defined for 2.4 and 5GHz in accordance with IEEE specifications | Revised: Proposed resolution accounts for the suggested change. The motions for 11-16/0617r0 from May 2016 IEEE F2F included as well.TGax Editor to make the changes shown in IEEE 802.11-16/0775r0 under all headings that include CID 342. |
| 343 | 36.2.12.4.6 | 157.31 | Table 26-35 does not include the relative Tx power accuracy which was approved in MU Motion #54 | The relative Tx power accuracy requirements as per the MU motion should be included in Table 26-35 | Revised: Proposed resolution accounts for the suggested change.TGax Editor to make the changes shown in IEEE 802.11-16/0775r2 under all headings that include CID 343. |
| 1023 | 26.3.12.4.6 | 157.16 | Subclause 26.3.12.4.6 (Requirements for STAs transmitting HE trigger-based PPDUs) talks about the accuracy requirements for RSSI and transmission power. It seems that the rules are applicable both to OFDMA and MU-MIMO cases. However, this subclause is placed under 26.3.12.4 (UL MU-MIMO) subclase, which sounds like it is only valid for MU-MIMO case. | Please clarify if the rule is valid both for OFDMA and MU-MIMO. If yes, relocate the subclause to somewhere generally talks about the requirements to MU transmissions for non-AP STAs. Otherwise, create a subclause specifying requirements to UL OFDMA transmissions. | Revised: Proposed resolution accounts for the suggested change.TGax Editor to make the changes shown in IEEE 802.11-16/0775r2 under all headings that include CID 1023. |
| 2734 | 26.3.12.4.6 | 157.25 | Required accuracy should be defined with dynamic range. | Define multiple values corresponding to multiple dynamic ranges | Rejected:The STA is capable to meet the absolute transmit power accuracy requirement for the entire range of transmit power that the STA is capable of.On the other hand, a single value for absolute transmit power accuracy is used for simplicity. |
| 2889 | 26.3.12.4.6 | 157.25 | Required accuracy should be defined with dynamic range. | Define multiple values corresponding to multiple dynamic ranges | Rejected:The STA is capable to meet the RSSI measurement accuracy requirement from minimum Rx to maximum Rx input power. The minimum Rx and maximum Rx input power is defined for 2.4 and 5 GHz. On the other hand, a single value for RSSI measurement accuracy is used for simplicity. |

*Changes to D0.1 related to CID 340, CID 341, CID 342, CID 343, and CID1023*

**9.2.4.6.4.1 General**

**TGax Editor: *Insert a new row toTable 9-18a (Control ID subfield values):***

**Table 9‑18a - Control ID subfield values**

|  |  |  |  |
| --- | --- | --- | --- |
| **Control ID value** | **Meaning** | **Length, in bits, of the****Control Information subfield** | **Contents of the****Control Information subfield** |
| … |  |  |  |
| 4 | UL Power Headroom | 8 | See 9.2.4.6.4.6 (UL Power Headroom) |
| 5-15 | Reserved |  |  |

**TGax Editor: *Insert a new subclause (UL Power Headroom) below as follows***

**9.2.4.6.4.6 UL Power Headroom**

The Control Information subfield, when the Control ID subfield is 4, contains the UL power headroom used for power pre-correction (see 26.3.13.2 (Power pre-correction).

|  |  |  |
| --- | --- | --- |
|  | B0 B5 | B6 B7 |
|  | UL Power Headroom | Reserved |
| Bits: | 6 | 2 |

**Figure 9‑14c--Control Information subfield format when Control ID subfield is 4**

The 5 LSBs (B0:B4) of the UL Power Headroom subfield indicate the available power headroom in units of dB, for the current MCS. The resolution for the UL power headroom reported in UL Power Headroom subfield is 1 dB. The UL Power Headroom subfield encoding is defined in Table XX-1.

Table XX-1: Encoding of UL Power Headroom subfield in Control Information subfield, when the Control ID subfield is 4.

|  |  |
| --- | --- |
| UL Power Headroom | Description |
| 0 to 31 | Values 0 to 31 maps to 0 dB to 31 dB |

The MSB (B5) of the UL Power Headroom subfield is set to 1 to indicate that the minimum transmit power for the current MCS is reached by the STA; otherwise it is set to 0.

## 10.9 HT Control field operation

**TGax Editor: *Change the paragraph below as follows:***

An HE variant HT Control field shall not be present in a frame addressed to a STA unless that STA declares support for +HTC-HE in the HE Capabilities Information field of its HE Capabilities element. The HE variant HT Control field carried in the frame may contain a Control subfield supported by the intended receiver that has:

* A value of 0 in the Control ID subfield when the transmitting STA expects an UL MU PPDU that carries an immediate acknowledgement, as described in 9.42.2 (UL MU operation).
* A value of 1 in the Control ID subfield when the transmitting STA changes the receive operation mode, as described in 10.45.2 (Receive operating mode indication).
* A value of 2 in the Control ID subfield when the transmitting STA follows the HE link adaptation procedure, as described in 10.31.4 (Link adaptation using the HE variant HT Control field).
* A value of 4 in the Control ID subfield when the transmitting STA follows the UL MU operation procedure, as described in 26.3.13.2 (Power pre-correction).

***TGax Editor: Change the paragraph below as follows (#340, #341; #342; #343, #1023):***

**~~26.3.12.4.3 Pre-correcitions in UL MU-MIMO~~**

~~Since multiple transmitters take part in an UL MU-MIMO transmission, it requires transmission time, frequency, sampling symbol clock, and power pre-correction by the participating STAs to mitigate the synchronization related issues at the AP. Frequency and sampling clock pre-corrections are needed to prevent inter-carrier interference. Power pre-correction is required to control interference among participating STAs in UL MU-MIMO transmission and is described in 26.3.13.2. The Trigger frame serves as a reference DL frame for the STAs to do the aforementions pre-corrections to the UL PPDUs. The accuracy requirements on these pre-corrections are specified in 26.3.13.3.~~

**26.3.13 Transmit requirements for HE trigger-based PPDU**

**26.3.13.1 Introduction**

HE trigger-based PPDU transmissions are preceded by a Trigger frame from the AP. Since multiple transmitters take part in an HE trigger-based PPDU transmission, it requires transmission time, frequency, ~~sampling~~ symbol clock, and power pre-correction by the participating STAs to mitigate the synchronization related issues at the AP. Frequency and sampling clock pre-corrections are needed to prevent inter-carrier interference. Power pre-correction is required to control interference among participating STAs HE trigger-based PPDU transmission. An AP can schedule in the same HE trigger-based PPDU transmission both Class A and Class B devices. A STA participating in HE trigger-based PPDU transmissions shall support power pre-correction described in 26.3.13.2 and shall meet pre-correction accuracy requirements decribed in 26.3.13.3.

**26.3.13.2 Power pre-correction**

An AP indicates in the AP Tx Power subfield of the Common Info field in Trigger frame the combined transmit power of all the transmit antennas used to transmit the Trigger frame normalized to 20 MHz bandwidth. An AP indicates in the Target RSSI subfield of the Per User Info field in Trigger frame the target receive signal power averaged over the AP’s antennas for the HE trigger-based PPDU.

Each STA that is scheduled in the Trigger frame calculates UL transmit power $Tx\_{pwr}^{STA}$ of HE trigger-based PPDU for the assigned MCS using Equation 1.

$Tx\_{pwr}^{STA}=PL\_{DL}+Target\_{RSSI}$, (1)

where

$PL\_{DL}$ represents DL pathloss and $Target\_{RSSI}$ represents target receive signal power averaged over the AP’s antennas for the HE trigger-based PPDU.$ Target\_{RSSI}$ is dBm value of Target RSSI subfield of Per User Info field in Trigger frame, the encoding of which is specified in Table X-XXX, section 9.3.1.23. Note that an encoded value of 127 in Target RSSI subfield indicates to the STA to transmit an HE trigger-based PPDU at its maximum transmit power for the assigned MCS.

Each STA computes $PL\_{DL}$ using Equation 2.

$PL\_{DL}=Tx\_{pwr}^{AP}-DL\_{RSSI}$, (2)

where

$Tx\_{pwr}^{AP}$ represents AP’s combined transmit power of all the transmit antennas used to transmit the Trigger frame normalized to 20 MHz bandwidth and $DL\_{RSSI}$ represents measured received power from the legacy preamble portion of the Trigger frame at the STA, also normalized to 20 MHz bandwidth. $Tx\_{pwr}^{AP}$ is dBm value of AP Tx Power subfield of the Common Info field in Trigger frame, the encoding of which is specified in Table X-XX, section 9.3.1.23. $DL\_{RSSI}$ is an average of the received power over the antennas on which the average $PL\_{DL}$ is being computed.

The UL transmit power of HE trigger-based PPDU is further subject to a STA’s minimum and maximum transmit power limit due to hardware capability, regulatory requirements as well as non-802.11 in-device coexistence requirements.

Each STA that is scheduled in the Trigger frame transmits UL Power headroom $HR\_{STA}$ in the HE trigger-based PPDU to assist in the AP’s MCS selection. The UL power headroom for the assigned MCS is defined in Equation 2.

$HR\_{STA}=Tx\_{pwr}^{Max}-Tx\_{pwr}^{STA}$, (3)

where

$Tx\_{pwr}^{Max}$ and $Tx\_{pwr}^{STA}$ represent maximum UL transmit power of HE trigger-based PPDU for the assigned MCS and current UL transmit power of HE trigger-based PPDU for the assigned MCS, respectively. $HR\_{STA}$ is dB value of UL Headroom in HE trigger-based PPDU, the encoding of which is specified in Table XX-1, section 9.2.4.6.4.6. Note that the MSB bit of the UL Headroom subfield being set to 1 indicates that the STA is transmitting the HE trigger-based PPDU at its minimum $Tx\_{pwr}^{STA}$ for the assigned MCS.

**26.3.13.3 Pre-correction accuracy Requirements**

A STA that transmits an HE trigger-based PPDU shall support per chain max(P-32, -10 dBm) as the minimum transmit power, with P the maximum power the STA can transmit at the antenna conntector of that chain using MCS0 while meeting the TX EVM and spectral mask requirements. A STA transmitting at and above the minimum power shall support the EVM requirements for MCS7 (TBD whether support for higher MCS).

A STA that transmits an HE trigger-based PPDU shall support the absolute transmit power accuracy requirements and the RSSI measurement accuracy requirements defined in Table 26-35 (Transmit power and RSSI measurement accuracy). The absolute transmit power accuracy is applicable for the entire range of transmit power that the STA is capable of. The RSSI accuracy requirements shall be applied to receive signal level range from -82 dBm to -20 dBm in 2.4 GHz and – 82 dBm to – 30 dBm in 5 GHz. The requirements are stated for nominal (room) temperature conditions. The RSSI shall be measured during the reception of PHY legacy preamble.

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Minimum Requirement** | **Comments** |
| **Class A** | **Class B** |
| Absolute transmit power accuracy | +/- 3 dB | +/- 9 dB | Accuracy of achieving a specified transmit power |
| RSSI measurement accuracy | +/- ~~2~~ 3 dB | +/- 5 dB | The ~~D~~difference between the ~~actual~~ RSSI and the ~~measured RSSI~~ received powerRequirements are valid from minimum Rx to maximum Rx input power |
| Relative transmit power accuracy | - | +/- 3 dB | Accuracy of achieving a change in transmit power for consecutive HE trigger-based PPDUThe relative transmit power accuracy is applicable only to Class B devices. |

A STA that transmits an HE trigger-based PPDU shall pre-compensate for carrier frequency offset (CFO) error and ~~timing drift~~ symbol clock error. After compensation, the absolute value of residual CFO error with respect to the PPDU carrying the associated Trigger frame shall not exceed 350 Hz for data subcarriers when measured as the 10% point of CCDF of CFO errors in AWGN at a received power of -60 dBm in the primary 20 MHz. The residual CFO error measurement shall be made on the HE trigger-based PPDU following the HE-SIG-A field. The symbol clock error shall be pre-compensated by the same ppm amount as CFO error.

A STA that transmits an HE trigger-based PPDU shall have timing accuracy of +/- 0.4 us relative to the PPDU carrying the Trggier frame. This requirement does not include round trip delay.

**26.3.~~13~~14 Transmit specification**

**26.3.~~14~~15 HE transmit procedure**

**26.3.~~15~~16 HE receive procedure**

**References:**

1. **IEEE P802.11axTM/D0.1, March 2016.**