IEEE P802.11
Wireless LANs

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| Comment Resolutions on Clause 28.3.14.3 (Transmit Requirements for an HE trigger-based PPDU)  |
| Date: 2017-01-16 |
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Abstract

This submission proposes resolutions for the following 26 comments on 28.3.14.3 (Transmit Requirements for an HE trigger-based PPDU) of TGax D1.0:

5784, 5785, 5953, 5954, 7442,

6869, 6870, 6871, 3606, 3609,

3359, 5282, 5281, 9028, 9027,

9090, 9078, 10125, 10314, 7678,

7832, 8575, 8581, 8582, 8583,

8578

Revisions:

* Rev 0: Initial version of the document.

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** |
| 5784 | 28.3.14.3 | 342.58 | "A STA that transmits an HE trigger-based PPDU shall have timing accuracy of +/-0.4 ++s relative to the actualending time of the PPDU carrying the Trigger frame. This requirement does not include round trip delay."--the word "actual ending time" needs to be clarified. Same applies to 17.3.9.10 for PPDUs carrying MU-RTS. | Use better word, for example "the last sample of the PPDU as indicated by the preamble" | Revised— Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 5784. |
| 5785 | 28.3.14.3 | 342.58 | For VHT packets with short GI carrying trigger frame, the RXTIME is computed based on (21-106), which rounds to the next 4us boundary, therefore it is contradictory with the statement of "actual ending time". | Disallow SGI for HT/VHT PPDUs carrying a HE Trigger frame | Revised— The contribution 11-17-0114r0, which resolves CID 9773 is applicable to this CID.Short guard interval shall not be used for Trigger frame transmission if the Trigger Frame is transmitted using HT or VHT PPDU format. DSSS or HR/DSSS PPDU format shall not be used for Trigger frame transmission.  |
| 5953 | 28.3.14.3 | 342.20 | Table 28-40 currently specifies two classes of devices based on TX power and RSSI measurement accuracy, with +/- 3dB as the smallest minimum requirement. However, based on current technologies, we believe 3 dB is too large for devices targetting high performance. | Suggest to add a new A+ device category whose tranmit power and RSSI measurment accuracy minimum requirement is +/- 2 dB. Accordingly, the 'Device Class' field in the HE PHY Capabilities IE in 9.4.2.218.3 will require 1 more bit to express the new device class. | Reject—+/-2 dB RSSI measurement accuracy may be tight considering* RSSI measurement variations over different temperature and frequency channels,
* Platform-level inaccuracy matters as well (front-end insertion loss variation),
* Potential error in test equipment

Please refer to 11-16-0617r1. |
| 5954 | 28.3.14.3 | 342.53 | The carrier sense requirement is -82 dBm and -82 dBm is also the receiver minimum input level sensitivity of lowest MCS in the draft spec. The CFO/SFO requirements shown here are only defined at receive power of -60 dBm, which is not enough to help receivers usually decoding packets with power much lower than -60 dBm. | Suggest to add more CFO/SFO constraints for power below -60 dBm, such as -72 dBm, -82 dBm and even lower power. | Reject—UL MU performance is a function of CFO correction performance. In lieu of defining multiple curves for CFO requirements (e.g., for -82 dBm, -72 dBm, -60 dBm) and increasing complexity for testing, the spec. describes a one value (-60 dBm) for simplicity. CFO constraints for other power levels can be derived from the described rule, if needed. |
| 7442 | 28.3.14.3 | 341.48 | Due to STA's minimum/maximum transmit power limit, the actual received signal power at AP for an HE trigger-based PPDU may be higher or lower than the target RSSI. For example, for one STA which is located very closed to AP, the received signal power at AP may be much higher than the target RSSI due to the STA's minimum transmit power limit. For one STA which is located far away from the AP, the received signal power at AP may be much lower than the target RSSI due to the STA's maximum transmit power limit. As a result, the received signal power at AP could differ significantly among STAs, which results in severe MUI (multi-user interference). This problem becomes even more severe in case of OFDMA based random access, since AP has no knowledge about which STA will be transmitting at a random access RU. | Insert the following statement after L48 of P341:"An STA should not transmit its HE trigger-based PPDU when the estimated received signal power at AP is much larger than the target RSSI." | Reject—AP may leverage the UL Power Headroom information as well as its scheduling algorithms to overcome situation described in comment. |
| 6869 | 28.3.14.1 | 340.57 | "An AP can schedule" ... should this really be "can", or is "may" meant? | If the intended meaning is that the AP is permitted to take the action described, then change to "may". | Revised— Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0xxxr1 under all headings that include CID 6869. |
| 6870 | 28.3.14.1 | 340.58 | Imprecise specification of mandatory requirement: "A STA ... shall support power correction described in 28.3.14.2". As worded, this would be satisfied by a STA that satisfied some (any) of the requirements in 28.3.14.2, even if it did not support all of them. The draft should make it clear exactly what is required. | Add "as" before "described". | Revised— Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0xxxr1 under all headings that include CID 6870. |
| 6871 | 28.3.14.1 | 340.59 | Imprecise specification of mandatory requirement: "... and shall meet pre-correction accuracy requirements described in 28.3.14.3". As worded, this would be satisfied by a STA that satisfied some (any) of the pre-correction accuracy requirements in 28.3.14.3, even if it did not support all of them. The draft should make it clear exactly what is required. | Add "the" before "pre-correction accuracy requirements". | Revised— Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0xxxr1 under all headings that include CID 6871. |
| 3606 | 28.3.14.3 | 342.45 | In clause 28.3.14.3 transmit power requirements and RSSI measurement accuracy requirements are defined for signal level ranges in dBm operating in the 2.4 GHz and 5GHz bands. The requirements are defined for nominal (room) temperature conditions. Specifying transmit power measurements and RSSI accuracy measurements over temperature is implementation dependent and could be regulatory dependent. Specifying a specific operation temperature drives an implementation and is out-of-scope of the standard. | Delete sentence: "The requirements are fornominal (room) temperature conditions." | Reject—The statement adds value. The RSSI measurement accuracy is influenced by temperature. Hence, it is recommended that test equipments conduct RSSI measurement accuracy tests at room temperature. |
| 3609 | 28.3.14.3 | 342.46 | In clause 28.3.14.3 the RSSI is measured during the "PHY legacy preamble". The RSSI\_LEGACY is defined, but the PHY legacy preamble is not. It's not define or referenced in the IEEE 802.11-2016 baseline. This should be defined and referenced back to the IEEE 802.11-2016 baseline standard. | Add definition for PHY legacy preamble in clause 3.4 Definitions, acronyms, and abbreviations with reference back to IEEE 802.11-2016 figures, text or subclause | Revised—Define PHY Legacy Preamble.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 3609. |
| 3359 | 28.3.14.3 | 342.53 | CCDF not defined | Change "CCDF" to "complementary cumulative distribution function (CCDF)".Add definition for CCDF in clause 3.4 Definitions, acronyms, and abbreviations | Revised— Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 3359. |
| 5282 | 28.3.14.3 | 342.09 | "with P the maximum power the STA can transmit at the antenna connector", specify the units for P. | as in comment | Revised—P is in dBm.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 5282. |
| 5281 | 28.3.14.3 | 341.1 | We need to specify in the subclause whether Tx Power is conducted or EIRP so there is no confusion. | as in comment | Revised—Tx power is referenced to the antenna connector.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 5281. |
| 9028 | 28.3.14.3 | 342.49 | Start new subsection starting at line 49 (28.3.14.4 CFO pre-compensation) | See comment | Reject—Clause 28.3.14.3 is inclusive of power and CFO correction requirements. |
| 9027 | 28.3.14.3 | 341.34 | Don't use term "legacy preamble" | Replace with e.g. pre-HE modulated fields | Revised—Pre-HE modulated fields includes RL-SIG, HE-SIG-A and HE-SIG-B. The RSSI\_LEGACY is measured over L-STF, L-LTF, and L-SIG.Define PHY Legacy Preamble.Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 9027. |
| 9090 | 28.3.14.3 | 341.00 | Each STA that is scheduled in the Trigger frame calculates UL transmit power, , of the HE trigger-based PPDU for the assigned MCS using Equation (28-118). | For Equation (28-118), need to specify the bandwidth over which UL transmit power is averaged. AP power is averaged over 20MHz but for UL Tx its not specified. | Reject—The TxPWRAP is normalized to 20 MHz bandwidth because in some cases the STA does not know the bandwidth of the PPDU transmission carrying the Trigger frame.In Equation 28-118, TargetRSSI is specified for the bandwidth of the RU allocated to the STA. PL\_DL does not require bandwidth normalization. Thus TXPWRSTA (LHS of equation) is calculated over the RU bandwidth allocated to the STA. |
| 9078 | 28.3.14.3 | 341.00 | Each STA that is scheduled in the Trigger frame calculates UL transmit power, , of the HE trigger-based PPDU for the assigned MCS using Equation (28-118). | For Equation (28-118), better to explicitly specify the bandwidth over which UL transmit power is averaged. AP power is averaged over 20MHz but for UL Tx its not specified. | Reject—The TxPWRAP is normalized to 20 MHz bandwidth because in some cases the STA does not know the bandwidth of the PPDU transmission carrying the Trigger frame.In Equation 28-118, TargetRSSI is specified for the bandwidth of the RU allocated to the STA. PL\_DL does not require bandwidth normalization. Thus TXPWRSTA (LHS of equation) is calculated over the RU bandwidth allocated to the STA. |
| 10125 | 28.3.14.3 | 342.37 | clarify the meaning of consecutive HE trigger-based PPDU. For example, is it the HE tirrger-based PPDU followed by another HE trigger-based PPDU without the Trigger frame? | As in the comment. | Reject—HE tirrger-based PPDU followed by another HE trigger-based PPDU without the Trigger frame is undefined mode in specification.According to D1.0, it is understandable consecutive HE trigger-based PPDU imply two instances of HE trigger-based transmissions that follow each other. |
| 10363 | 28.2.2 | 221.32 | "NOTE—The TXVECTOR parameter CH\_BANDWIDTHdoes not represent the channel width of the transmitted PPDU." Is there a parameter that does ? If so reference it. | Reference to parameter that represents channel width of transmitted PPDU | Reject—BW field in HE-SIG-A of HE trigger-based PPDU is set through Trigger frame. CH\_BANDWIDTH indicates BW field value in HE-SIG-A.The RU Allocation in per user field of Trigger frame indicates bandwidth allocated to each STA for transmission. |
| 10314 | 28.3.14.3 | 342.20 | Need to specify either number of packet or time duration for device to meet transmit power accuracy requirement. In subclause 28.3.14.2 it discuss how the device should adjust power. However, it does not specify either number of PPDU or time duration for the device to finish adjust transmitting power. In table 28-40, it also does not specify this requirement. 1 PPDU or 100 PPDU to achieve requirement will impact system performance/capacity differently. | add specific number of PPDU for the device to reach transmit power accuracy. If it was implied to reach accuracy requirement within 1 PPDU, it is better to explicitly define it in the 28.3.14.3. | Reject—The pre-correction accuracy requirements apply to each PPDU. There is no ‘warm-up’ time to meet the requirements. |
| 7678 | 28.3.14.2 | 341.63 | Reference to MSB bit of the UL Headroom subfield can be clarified further by referring to the exact bit location. | Replace "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^{STA}\_{pwr} for the assigned MCS" with "that the bit B5 of the UL Headroom subfield being set to 1 indicates that the STA is transmitting the HE trigger-based PPDU at its minimum Tx^{STA}\_{pwr} for the assigned MCS | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0261r0 under all headings that include CID 7678. |
| 7832 | 28.3.14.3 | 342.59 | Confusing sentence. Doesn't seem necessary. | Delete the sentence "This requirement does not include round trip delay." | Reject—This sentence is very important and provides guidance for testing.If two STAs are located at very different distances from the AP then the trigger frame and the immediately following HE Trigger-based PPDU are off in timing due to round trip delay. |
| 8575 | 28.3.14.3 | 342.55 | "The symbol clock error shall be pre-compensated by the same ppm amount as CFO error." The source/reference of the ppm value should be specified. | Either delete this sentence or provide the source to obtain the ppm amount and how to compensate the symbol clock error. | Reject—The spec. already has the following text.Transmit center frequency and the symbol clock frequency for all transmit antennas and frequency segments shall be derived from the same reference oscillator. (Clause 28.3.18.3) |
| 8581 | 28.3.14.3 | 341.41 | How to obtain BF gain, and how to apply the BF gain into the power pre-correction equation should be specified.It is not clear if the BF gain includes both Tx (@STA) and Rx (@AP) BF gain. | Provide the way(s) to obtain the BR gains and make it clear if it refers to Tx or/and Rx BF gain. | Reject—It is upto STA implementation to account for BF gain when calculating the transmit power needed to meet the target RSSI.For e.g., BF gain = 10.log10(Ntx), where Ntx is the number of transmit antennas. |
| 8582 | 28.3.14.2 | 341.44 | The formulation that considers max and min tx power should be explicitly given in Eq (28-118). | Update Equation (28-118) including min and max Tx powers. | Reject—AP Tx Power is advertised in Trigger frame. The Trigger frame section describes the max and min values of it.  |
| 8583 | 28.3.14.2 | 341.59 | Where to obtain "maximum UL transmit power of HE trigger-based PPDU for the assigned MCS" should be given. | Provide the source to obtain "maximum UL transmit power of HE trigger-based PPDU for the assigned MCS" | Reject—‘maximum UL transmit power for HE trigger-based PPDU’ is a STA hardware capability. In other words, it is dependent on implementation and defining values of it is beyond scope of spec. |
| 8578 | 28.3.14.2 | 341.07 | It is not clear if "the target receive signal power" is from each STA or the total received power. | Make it clear if "the target receive signal power" is from each STA or the total received power. | Reject—Target RSSI is from each STA.The user Info field of Trigger frame is referenced in description. |

*Changes to D1.0 related to CIDS: 9773*

***TGax Editor: Please add the following text at the end of section 3.4 (Abbreviations and acronyms).***

CCDF Complementary cumulative distribution function (#3359)

***TGax Editor: Please change in D1.0 on Pg 342, ln 53 as follows.***

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 complementary cumulative distribution function (CCDF) (#3359) of CFO errors in AWGN at a received power of -60 dBm in the primary 20 MHz.

***TGax Editor: Please change in D1.0 on Pg 342, ln 58 as follows.***

A STA that transmits an HE trigger-based PPDU shall have timing accuracy of ±0.4 μs relative to the ~~actual ending time of the~~ the last sample of the (#5784) PPDU carrying the Trigger frame. This requirement does not include round trip delay.

***TGax Editor: Please change in D1.0 on Pg 340, ln 57 as follows.***

An AP ~~can~~ may (#6869) 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 the (#6871) power pre-correction as (#6870) described in 28.3.14.2 (Power pre-correction) and shall meet the (#6871) pre-correction accuracy requirements as (#6870) described in 28.3.14.3 (Pre-correction accuracy requirements).

***TGax Editor: Please change in D1.0 on Pg 342, ln 09 as follows.***

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 in dBm (#5282) the STA can transmit at the antenna connector of that chain using MCS 0 while meeting the TX EVM and spectral mask requirements.

***TGax Editor: Please change in D1.0 on Pg 341, ln 01 as follows.***

An AP indicates in the AP Tx Power subfield of the Common Info field in Trigger frame the combined transmit power, referenced to the antenna connector, (#5281) of all the transmit antennas used to transmit the Trigger frame normalized to 20 MHz bandwidth.

***TGax Editor: Please change in D1.0 on Pg 341, ln 31 as follows.***

where $Tx\_{pwr}^{AP}$ represents AP's combined transmit power, referenced to the antenna connector, (#5281) 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.

***TGax Editor: Please change in D1.0 on Pg 341, ln 01 as follows.***

An AP indicates in the AP Tx Power subfield of the Common Info field in Trigger frame the combined transmit power, referenced to the antenna connector, (#5281) of all the transmit antennas used to transmit the Trigger frame normalized to 20 MHz bandwidth.

***TGax Editor: Please add the following in D1.0 section 3.2 (Definitions specific to IEEE 802.11).***

PHY legacy preamble: L-STF, L-LTF, and L-SIG fields of an HE PPDU defined in Clause 28 (HE PHY Specification) are together referred to as the PHY legacy preamble. (#3609, #9027)

***TGax Editor: Please edit in D1.0 pg 341, ln 63 as follows.***

Note that the ~~MSB~~ bit B5 (#7678) of the UL Power Headroom subfield (see 9.2.4.6.4.6 (UL power headroom)) ~~being~~ is set to 1 to indicate~~indicates~~ that the STA is transmitting the HE trigger-based PPDU at its minimum for the assigned MCS.

**References:**

1. **IEEE P802.11axTM/D1.0, Nov 2016.**