IEEE P802.11
Wireless LANs

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| Comment Resolutions on PHY Sounding Part 1 |
| Date: 2018-04-19 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Lochan Verma | Qualcomm Inc. | 5775 Morehouse Dr, San Diego, CA 92121 | +1-858-845-7832 | lverma@qti.qualcomm.com |
| Youhan Kim |  |  | youhank@qca.qualcomm.com |
| Bin Tian |  |  | btian@qti.qualcomm.com |
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Abstract

This submission proposes resolutions for the following comments on TGax D2.0:

11444, 12580, 12066, 12762, 12763,

12766, 12780, 12786, 12787, 12812,

12813, 14007, 12848, 13764, 13969,

13987, 13996, 13998, 14001, 14004,

14008

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** |
| 11444 | 3.2 | 32 | definition has bad/confusing grammar | Original: A non-AP HE STA that indicates in the Channel Width Set subfield in the HE PHY Capabilities Information field of the HE Capabilities element that it transmits, support for only 20 MHz channel width for the frequency band in which it is operating. Updated: A non-AP HE STA that indicates in the Channel Width Set subfield in the HE PHY Capabilities Information field of the HE Capabilities element support for only a 20 MHz channel width in its current operating frequency band. | Reject –The current text as if is both technically and grammatically sound. The comment appears to be a personal preference of commenter. |
| 12580 | 28.3.10.8.3 | 424.54 | It should be made clear that when preamble puncturing is used no RU is allocated in "punctured" subchannels so that the data is also "punctured" too | At the end of the referenced subclause add a para "When preamble puncturing is present, no RU shall be allocated that overlaps with any 20 MHz sub-channel that is punctured." | Accept— |
| 12066 | 9.4.1.65 | 116 | Note that CQI calculation is according to 26-tone RU index, but the BF feedback for 26-Tone RU has different index. For example, the index for 26-tone RU is from -121:-96, but for BF feedback, the index for 26-tone RU is from -122:-96. | Clarify the 26-tone index for CQI only report is according the tone plan shown in table 28-6, table 28-7 and table 28-8 | Revised—Three changes are made1. The subcarrier indices for 26-tone RU in 20/40/80 MHz are defined in Tables 28-6/-7/-8, respectively.
2. The SNR computation for CQI-only is unclear. It is clarified that “Each SNR value per subcarrier in stream i (before being averaged) corresponds to the SNR associated with column i of the beamforming feedback matrix V determined at the beamformee. Each SNR corresponds to the predicted SNR at the beamformee when the beamformer applies all columns of the matric V.”
3. Current text is unclear if beamformee can use any spacing (e.g., Ng = 16) between subcarriers when computing feedback SNR per 26-tone RU. The text is updated with a recommendation.

TGax Editor to make the changes for CID12066 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 12762 | 9.4.1.65 | 116.55 | " The RU indicesruidx(0) and ruidx(Ncqi - 1) correspond to the RU Start Index and RU End Index subfields, respectively. " -- "correspond" is too vague | Change "correspond" to "are equal" in the cited text | Accept— |
| 12763 | 9.4.1.65 | 116.57 | "The RU index ruidx(i) = ruidx(i - 1) + 1, where 1 <= i <= Ncqi - 2." -- the case i = Ncqi - 1 is missing | Change "2" to "1" in the cited text | Reject—The RU indices *ruidx*(0) and *ruidx*(*Ncqi* - 1) are equal to the RU Start Index and RU End Index subfields, respectively. The RU index *ruidx*(*i*) = *ruidx*(*i* - 1) + 1, where 1 ≤ *i* ≤ *Ncqi* - 2.As seen above, the values for ruidx(0) and ruidx(Ncqi-1) are explicitly mapped while other values are derived from the equation. |
| 12766 | 9.4.1.65 | 116.54 | "Ncqi is afunction of the RU Start Index and RU End Index subfields in the HE MIMO Control field." -- the function needs to be specified | State that Ncqi = RU End - RU Start + 1 | Revised—Agree with the comment. Necessary text changes are made.TGax Editor to make the changes for CID12766 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 12780 | 9.4.1.65 | 116.53 | The rules for Ncqi do not cover the 80+80/160 case (unlike the rules for Ns for non-CQI-only feedback) | Give the rules for Ncqi for 80+80 and 160 | Reject—RU Start Index and RU End Index subfield values for 160/80+80 MHz are defined (see Partial BW Info subfield in NDP Announcement frame). The ruidx(i) = ruidx(i-1) +1, where $1\leq i\leq Ncqi-2$, generates the 26-tone RU indices.  |
| 12786 | 9.4.1.63 | 110.21 | "(S, E) for 80 MHz" is unclear, especially when the RU index is different (e.g. at 110.62) | Just give the value directly | Reject—Formulation rather than exact values was used to reduce chances of error while writing the specification and while implementing.  |
| 12787 | 9.4.1.63 | 112.1 | "(S, E) for 80 MHz" is unclear, especially when the RU index is different (e.g. at 112.41) | Just give the value directly | Reject—Formulation rather than exact values was used to reduce chances of error while writing the specification and while implementing. |
| 12812 | 9.4.2.237.3 | 144.37 | There are several issues with the "20 MHz In 40 MHz HE PPDU In 2.4 GHz Band" subfield: "Band" is missing in the 2 instances on p. 140; NOTE 2 on p. 140 duplicates the cell to the left and the information on p. 144 and should be deleted; it is not specified that B4 of the Channel Width Set is reserved when transmitted by an AP; a statement is missing in 28.3.3.5 (or elsewhere) that an AP shall not tx or request tx of a 20 in 40 if the non-AP STA set this field to 0 (cf. last para of 28.3.3.7) | As it says in the comment | Revised—The following is the breakdown of multiple comments in this CID.1. Missing “Band” word on Pg.140🡪Added
2. NOTE 2 on Pg. 140 to be deleted 🡪 It is not an exact duplicate of the cell to the lest on Pg.144. Furthermore, it is useful information regarding B4 bit setting.
3. Not specified that B4 is reserved for AP🡪 Please note that B4 is described for a non-AP STA and also states “Otherwise, B4 is reserved”.
4. Statement about normative text 🡪 Added

TGax Editor to make the changes for CID12812 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 12813 | 9.4.2.237.3 | 144.45 | There are several issues with the "20 MHz In 160/80+80 MHz HE PPDU" subfield: 366.56 is missing "/80+80"; NOTE 3 on p. 140 duplicates the cell to the left and the information on p. 144 and should be deleted; it is not specified that B5 of the Channel Width Set is reserved when transmitted by an AP; a statement is missing in 28.3.3.5 (or elsewhere) that an AP shall not tx or request tx of a 20 in 160/80+80 if the non-AP STA set this field to 0 (cf. last para of 28.3.3.7) | As it says in the comment | Revised—The following is the breakdown of multiple comments in this CID.1. Missing ‘/80+80’🡪 resolved in D2.3.
2. NOTE 3 on Pg. 140 to be deleted 🡪 It is not an exact duplicate of the cell to the lest on Pg.144. Furthermore, it is useful information regarding B5 bit setting.
3. Not specified that B5 is reserved for AP🡪 Please note that B4 is described for a non-AP STA and also states “Otherwise, B5 is reserved”.
4. Statement about normative text 🡪 Added

TGax Editor to make the changes for CID12813 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 14007 | 28,1,1 | 330.44 | "total of up to 8 space-time streams" could be mistaken to mean that a non-AP STA need to transmit 8SS. | Change "If it is supported ... are supported" to "If supported, then the non-AP STA shall support transmitting UL MU-MIMO in which the total space-time streams summed across all users are up to 8." at both P330 L44 and L47. | Accept— |
| 12848 | 9.4.1.63 | 109.62 | The rules for which subcarriers are in HE CBR is grotesquely complex (e.g. different rules for 20M and 40M+, outside subcarriers not necessarily Ng-separated from adjacent subcarrier, hand-waving for 160/80+80). Needs to be simplified both technically and editorially, especially for partial-BW's sake, otherwise there is essentially zero chance of interoperability | As it says in the comment | Reject—Partial BW Info field in NDPA indicates the Start 26-tone RU Index and End 26-tone RU Index. Tables 28-6, 28-7, and 28-8 provide 26-tone RU Indices for various bandwidths.Tables 9-76c, 9-76d, and 9-76e provide feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for various Ng values.The 11ax specification clearly defines the feedback tones and hence risk to interoperability is mitigated. |
| 13764 | 28.3.10.7 | 412.33 | Since 20MHz channel is not aligned with 242 tone RU in 80MHz,the 20MHz channel cannot be fully punctured because some RU in adjacent 20MHz may overlap with the punctured 20MHz.Currently, the spec doesn't specify how to handle this case. | Add the following clarifications after P.L. 412.33"If an AP indicate preamble puncture in a HE MU PPDU by setting the Bandwidth field in HE-SIG-A in the range 4 to 7,the AP is recommended to avoid allocate resources on the tones that could interfere the punctured channel." | Reject—CIDs 13200, 11358 resolved this CID. Please refer to Section 28.3.18.1 in D2.3.For preamble puncture, the signal leakage to the preamble punctured channel from the occupied subchannels shall be less than or equal to -20 dBr (db relative to the maximum spectral density of the signal) starting 0.5 MHz from the boundary of the preamble punctured channel. |
| 13987 | 28.1.1 | 328.1 | Why are we referring to the regulatory requirements of VHT? | Create a separate section for regulatory requirements under Clause 28. | Revised—HE operates in 2.4 GHz and 5 GHz band. Current sentence in 28.1.1 is exclusive to 5 GHz band.TGax Editor to make the changes for CID13987 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 13996 | 28.1.1 | 328.40 | HE TB PPDU does not support 0.8 us GI | Change "0.8 ++s and 1.6 ++s GI duration on both HE-LTF and data symbols when the 2x HE-LTF is used (transmit and receive)" to "0.8 ++s and 1.6 ++s GI duration on both HE-LTF and data symbols when the 2x HE-LTF is used in HE SU PPDUs (transmit and receive)" | Revised—“0.8 μs and 1.6 μs GI duration on both HE-LTF and data symbols when the 2x HE-LTF is used (transmit and receive)” is qualified for various PPDU formats.TGax Editor to make the changes for CID13996 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 13998 | 28.1.1 | 328.46 | It is optional for an HE AP STA to receive HE MU PPDUs, and for an non-AP HE STA to transmit HE MU PPDUs. HE AP STA does not transmit HE TB PPDUs, and non-AP HE STA does not receive HE TB PPDUs. | Change "3.2 ++s GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used (transmit and receive)" to "3.2 ++s GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used in HE SU PPDUs (transmit and receive)" | Revised—“3.2 μs GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used (transmit and receive)” is qualified for various PPDU formats.TGax Editor to make the changes for CID13998 as suggested in proposed resolution in IEEE 802.11-18/0725r0 |
| 14001 | 28.1.1 | 28.1.1 | Language (style) of mandatory/optional features for AP and non-AP STAs are vastly different. E.g. AP section generally says "feature X (transmit)", while non-AP section generally says "support transmission of X". | Fix the language/style of section 28.1.1 | Reject—D2.3 has improved has ameliorated language consistency issues. While one may say further improvements can be made, at this point the text is technically correct and offers good readability. |
| 14004 | 28.1.1 | 330.20 | A non-AP HE STA cannot transmit any HE MU PPDU. It can transmit only a single RU - full BW or 106 tones. | Change "Transmission of HE MU PPDU" to "Transmission of HE MU PPDUs with a single RU spanning the entire PPDU bandwidth, or 20 MHz HE MU PPDUs with a single RU with 106 tones in the Primary 20 MHz channel" | Accept— |
| 14008 | 28.1.1 | 330.52 | The assigned RU is in the Primary 80 MHz. | Add ", where the assigned RU is within the Primary 80 MHz channel" at the end of P330L52. | Accept— |
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**==============================================================================**

**Resolution for CID 12766, 12066**

**TGax Editor: Please make the following changes to section 9.4.1.65 HE CQI-only Report field under the Table 9-76g (HE CQI-Only Report information)**

**Ncqi is the number of RU indices for which the CQI-only report is sent back to the beamformer. Ncqi = (RU End Index – RU Start Index) + 1, where RU Start Index and RU End Index are subfields in the HE MIMO Control field. (#12766) ~~Ncqi is a function of the RU Start Indec and RU End Index subfields in the HE MIMO Control field.~~** The RU indices *ruidx*(0) and *ruidx*(*Ncqi* - 1) correspond to the RU Start Index and RU End Index subfields, respectively. The RU index *ruidx*(*i*) = *ruidx*(*i* - 1) + 1, where 1 ≤ *i* ≤ *Ncqi* - 2. The 26-tone RU subcarrier indices for 20 MHz, 40 MHz, and 80 MHz, are defined in Tables 28-6, 28-7, and 28-8, respectively. (#12066)

**….**

The *AvgSNRk,i* in Table 9-76h (Average SNR of RU index k for space-time stream i subfield) is found by computing the arithmetic mean of the SNR per subcarrier in decibels for space-time stream *i* over the sub-carriers in RU index *k* for which the feedback is being requested. SNR per subcarrier calculation is defined in 9.4.1.63 (HE Compressed Beamforming Report field). It is recommended that SNR per subcarrier computation is done on at least on 4 subcarriers in a 26-tone RU. (#12066)

**Resolution for CID 12812 and 12813**

**28.3.2.7 20 MHz operating non-AP HE STAs**

**TGax Editor: Please add the following red text to the end of section 28.3.2.7 (20 MHz operating non-AP HE STAs)**

**An HE AP STA shall not allocate any RU’s in a 40 MHz HE MU PPDU or HE TB PPDU to a 20 MHz operating non-AP HE STA that sets the 20 MHz in 40 MHz HE PPDU In 2.4 GHz Band subfield in the HE PHY Capabilities Information field in the HE Capabilities element to 0.(#12812)**

**An HE AP STA shall not allocate any RU’s in an 160/80+80 MHz HE MU PPDU or HE TB PPDU to a 20 MHz operating non-AP HE STA that sets the 20 MHz in 160/80+80 MHz HE PPDU In 2.4 GHz Band subfield in the HE PHY Capabilities Information field in the HE Capabilities element to 0.(#12813)**

**Resolution for CID 13996, 13998**

**28.1.1 HE PHY Introduction**

**TGax Editor: Please make the following changes to section 28.1.1 (CIDs: 13996)**

An HE STA shall support the following features:

* **…**
* **0.8 us and 1.6 us GI duration on both HE-LTF and data symbols when 2x HE-LTF is used in HE SU PPDUs and HE ER SU PPDUs (transmit and receive) (#13396)**
* **3.2 μs GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used in HE SU PPDUs and HE ER SU PPDUs (transmit and receive)** (#13998)

**An HE AP shall support the following features:**

* **40 MHz and 80 MHz channel widths and all RU sizes and locations applicable to the 40 MHz and 80 MHz channel width in 5 GHz band (transmit and receive)**
* **0.8 us and 1.6 us GI duration on both HE-LTF and data symbols when 2x HE-LTF is used in HE MU PPDU (transmit) (#13396)**
* **1.6 us GI duration on both HE-LTF and data symbols when 2x HE-LTF is used in HE TB PPDU (receive) (#13396)**
* 1.6 μs GI duration on both the HE-LTF and Data field symbols when the 1x HE-LTF is used (receive) for full bandwidth UL MU-MIMO if the HE AP supports UL MU-MIMO
* **3.2 μs GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used in HE MU PPDUs (transmit) or HE TB PPDU (receive)** (#13998)

**A non-AP HE STA shall support the following features:**

* **A 20 MHz-only non-AP HE STA shall support 26-, 52-, and 106-tone RU sizes and locations in 40 MHz channel width in the 2.4 GHz band and 40 MHz and 80 MHz channel width in 5 GHz band (transmit and receive)**
* **0.8 us and 1.6 us GI duration on both HE-LTF and data symbols when 2x HE-LTF is used in HE MU PPDU (receive) (#13396)**
* **1.6 us GI duration on both HE-LTF and data symbols when 2x HE-LTF is used in HE TB PPDU (transmit) (#13396)**
* 1.6 μs GI duration on both HE-LTF and data symbols when the 1x HE-LTF is used (transmit) for full bandwidth UL MU-MIMO if the non-AP HE STA supports UL MU-MIMO(#13997)
* **3.2 μs GI duration on both HE-LTF and data symbols when the 4x HE-LTF is used in HE MU PPDUs (receive) or HE TB PPDU (transmit)** (#13998)

**Resolution for CID 13987**

**TGax Editor: Please create new section 28.3.23 Regulatory requirements**

**28.3.23 Regulatory requirements**

Wireless LANs (WLANs) implemented in accordance with this standard are subject to equipment certification and operating requirements established by regional and national regulatory administrations. The PHY specification establishes minimum technical requirements for interoperability, based upon established regulations at the time this standard was issued. These regulations are subject to revision or may be superseded. Requirements that are subject to local geographic regulations are annotated within the PHY specification. Regulatory requirements that do not affect interoperability are not addressed in this standard. Implementers are referred to the regulatory sources in Annex D for further information. Operation in countries within defined regulatory domains might be subject to additional or alternative national regulations.

**References:**

1. **IEEE P802.11axTM/D2.3, Apr 2018.**