IEEE P802.11
Wireless LANs

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| Comment Resolutions on Clause 9.4.1.63 (HE Beamforming Report information)  |
| Date: 2017-02-28 |
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Abstract

This submission proposes resolutions for the following 24 comments on 9.4.1.63 (HE Beamforming Report information) of TGax D1.0:

6341, 6339, 7355, 7354, 7349,

3425, 3539, 3340, 3439, 3436,

3434, 3431, 3430, 3428, 3427,

9265 9266, 9840, 7756, 8665

8666, 8667, 8669, 8670

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: CID 3440, 8665 revised.
* Rev 2: 8665 edited.

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** |
| 6341 | 9.4.1.63 | 58.26 | Imprecise language: "estimates the ... channel, and based on that channel ...". As worded, the basis appears to be the channel, not the estimated channel. If the esimated channel is meant, say so | Change "based on that channel" to "based on that estimated channel". | Reject—‘That channel’ is pretty clear. Furthermore, identical language used in 11ac. See 9.4.1.49 in REVmc\_D8.0. |
| 6339 | 9.4.1.63 | 58.24 | In the context of a draft specification, what exactly is meant by the wording "The beamforming matrix V is formed by the beamformee as follows"? Is this intended as a mandatory requirement, or is it a recommendation? At present it's worded simply as a statement of fact. If the beamformee carries this step out incorrectly, would the device be non-compliant with the specification? | Rewrite to clarify whether the actions described are mandatory or optional. | Reject—Text describes how beamforming feedback matrix V is formed by the beamformee. Incorrect V matrix leads to imprecise steering matrix calculation by the beamformer. Thus a beamformee that carries this step out incorrectly would only hurt itself.Furthermore, identical language used in 11ac. See 9.4.1.49 in REVmc\_D8.0. |
| 7355 | 9.4.1.65 | 66.13 | The name of the subfield "Average SNR of RU index k for space-time stream i" is not correct. | Replace "Average SNR of RU index k for space-time stream i subfield" with "Average SNR for space-time stream i for the RU index k subfield". | Reject—In Table 9-76h, subscript k occurs before subscript i, in AvgSNR\_{k,i}(dB). Hence, the title of the table is correct. |
| 7354 | 9.4.1.65 | 66.7 | The name of the subfield "Average SNR of space-time stream i for the RU index k" is not correct. | Replace "Average SNR of space-time stream i for the RU index k subfield" with "Average SNR for space-time stream i for the RU index k subfield". | Reject—In Table 9-76h, subscript k occurs before subscript i, in AvgSNR\_{k,i}(dB). Hence, the title of the table is correct. |
| 7349 | 9.4.1.64 | 63.54 | The name of the field is not correct. | Replace "MU Exclusive Beamforming Report field" with "HE MU Exclusive Beamforming Report field". | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 7349. |
| 3425 | 9.4.1.63 | 58.28 | Equation (8-1) missing | Add reference and/or detailed equation (8-1) | Revised—Replace Equation (8-1) with Equation (9-1). Please refer to Equation (9-1) in REVmc\_D8.0.TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3425. |
| 3539 | 9.4.1.63 | 59.38 | The S-tone and E-tone description needs clarification when comparing and referencing tables 9-76c and 9-76d. | Add underlined text (without the underline) and remove strikethrough text from line 38 to 49 as follows:The S-tone and E-tone corresponding to the possible RU indices for 20MHz, 40MHz and 80 MHz channels are listed in Table 9-76c and Table 9-76d. (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng = 4) for Ng = 4 are shown in Table 9-76c, and for Ng = 16 for in Table 9-76d. (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng = 16) for Ng = 16.For 160 MHz, to determine the S-tone and E-tone, RUs 37 to 73 occupying the higher 80 MHz use the same entries in Table 9-76c (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng = 4) and Table 9-76d (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index Ng = 16) as RUs 0 to 36 occupying the lower 80 MHz.For 20 MHz, scidx(i), where 1 ╘δ± i ╘δ± Ns ╘δ± 2, includes all subcarrier indices between the S-tone and the E-tone subcarrier indices described in Table 9-76e (Feedback subcarrier indices for 20 MHz bandwidth for Ng = 4 and Ng = 16) for Ng = 4 and Ng = 16. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3539. |
| 3440 | 9.4.1.64 | 64.30 | Equation (9-2) reference in Table 9-76f calls out subcarrier k=scidx(0) and k=scidx(1). Equation 9-2 in IEEE 802.11-2016 (Rev D8.0) in clause 9.4.1.51 specifies k=sscidx(0) and k=sscidx(1)There appears to be an ambiguity in equation in 9-2 and with k=scidx(\_) | Fix references for subcarrier k=scidx(0) and k=scidx(1) in Table 9-76f (lines 30-54) to match assumptions with equation 9-2 in clause 9.4.1.51 in IEEE 802.11-2016 (Rev D8.0) | Revised—Eq 9-2), k refers to sscidx(0) to sscidx(Ns’-1).For 11ax, k refers to scidx(0) to scidx(Ns-1).Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3440. |
| 3439 | 9.4.1.64 | 64.18 | Equation (9-2) is referenced in the text and in Table 9-76f HE MU Exclusive Beamforming Report information, and is not linked or referenced to any other documents. Equation (9-2) should be linked and referenced to its location IEEE 802.11-2016 (Rev D8.0) and clarified as a "Note" at the end of Table 9-76f. | Add note for equation 9-2 in text and/or add the following underlined text (without the underline) and reference link in Table 9-76f as a Note: "as defined in Equation (9-2) in clause 9.4.1.51 (MU Exclusive Beamforming Report Field)" | Reject—There is no precedence in the draft 1.0 about using such a phrase, where we call out a particular REV# for reference.Reference to Equation 9-2 is clear without further improvements. |
| 3436 | 9.4.1.64 | 64.53 | Missing number of bits for Delta SNR for k=scidx(Ns-1) | Add number of bits for (Ns-1) for Delta SNR | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3436. |
| 3434 | 9.4.1.64 | 64.48 | Missing number of bits for Delta SNR for k=scidx(Ns-1) | Add number of bits for (Ns-1) for Delta SNR | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3434. |
| 3431 | 9.4.1.63 | 63.21 | Calculating the AveSNRi needs more clarification. | Add the following underlined text (without the underline) and remove the strikethrough text from lines 21 through 30 as follows:The AvgSNRi in Table 9-71 (Average SNR of Space-Time Stream i subfield) is found determined by computing the SNR per subcarrier in decibels for the subcarriers in 20 MHz channel bandwidth identified in Table 9-76c (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng = 4) for Ng = 4 , and for Ng = 16 in Table 9-76d. (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng = 16) for Ng = 16, and then The computing tThe arithmetic mean is calculated of for those values. Each SNR value per subcarrier in stream i (before being averaged) corresponds to the SNR associated with the 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 matrix V. | Reject—The text is clear.Proposed resolution is not correct since SNR per subcarrier is not restricted to 20 MHz channel bandwidth. Note that the table 9-76c has S/E-tones for 20/40/80 MHz. |
| 3428 | 9.4.1.63 | 61.57 | In Table 9-76d, "FB" in 20,40, 80 MHz (S, E) FB tone labels need to be defined to follow the foregoing text. | Change "FB" to "Feedback" in column label headers: 80 MHz FB tone, 40 MHz FB tone and 20 MHz FB tone. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3428. |
| 3427 | 9.4.1.63 | 59.57 | In Table 9-76c, "FB" in 20, 40 and 80 MHz (S, E) FB tone labels need to be defined to follow the foregoing text. | Change "FB" to "Feedback" in column label headers: 80 MHz FB tone, 40 MHz FB tone and 20 MHz FB tone. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 3427. |
| 9265 | 9.4.1.63 | 60.54 | The values for RU Index 8 in 20 MHz are missing in Table 9-76c. | Add "+96, +122" in the right hand column of the row where 20 MHz 26-tone RU Index is 8. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 9265. |
| 9266 | 9.4.1.63 | 62.25 | The values for RU Index 8 in 20 MHz are missing in Table 9-76d. | Add "+96, +122" in the right hand column of the row where 20 MHz 26-tone RU Index is 8. | Revised—Proposed resolution accounts for the suggested change. Also, in Table 9-76d the 20 MHz (S,E) FB tone corresponding to RU index 0 in the last column are incorrect.TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 9266. |
| 9840 | 9.4.1.63 | 58.28 | Wrong equation referral. Correct it. | As in the comment. | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 9840. |
| 7756 | 9.4.1.63 | 58.25 | This looks like a definitive, normative requirement. | Change "may take" to "takes" | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 7756. |
| 8665 | 9.4.1.63 | 58.27 | Where is N\_RX,BFEE defined? | Define | Revised—$N\_{RX,BFEE}$ is the number of receiver chains used to receive the NDP at the beamformee Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 8665. |
| 8666 | 9.4.1.63 | 58.28 | Possibly wrong reference: "where Nr and Nc satisfy Equation (8-1)." | Correct reference | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 8666. |
| 8667 | 9.4.1.63 | 58.35 | "The HE Compressed Beamforming Report information has the same structure and order". Same as what? | Clarify | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 8667. |
| 8669 | 9.4.1.63 | 60.14 | List the values for (S,E) instead of saying "(S, E) for 80 MHz + 256" | See comment. Apply this throughout the tables 9-76c, 9-76d, | Reject—The formula is provided to avoid making table verbose and cumbersome to read. |
| 8670 | 9.4.1.64 | 64.20 | "The HE MU Exclusive Beamforming Report information has the same structure and order Table 9-76f". Sentence not clear. Same as what? | Clarify | Revised—Proposed resolution accounts for the suggested change. TGax Editor to make the changes shown in IEEE 802.11-17/0303r2 under all headings that include CID 8670. |

*Changes to D1.0*

***TGax Editor: Please make the following change on Pg 63, ln 54 (#7349):***

The HE (#7349) MU Exclusive Beamforming Report field is used by the HE Compressed Beamforming And CQI frame (see 9.6.28.2 (HE Compressed Beamforming And CQI frame format)) to carry explicit feedback in the form of delta SNRs.

***TGax Editor: Please make the following change on Pg 58, ln 28 (#3425, #9840, #7756, #8666):***

The beamformer transmits an NDP with $N\_{STS,NDP}$space-time streams, where $N\_{STS,NDP}$takes ~~may~~ (#7756) value between 2 and 8. Based on this NDP, the beamformee estimates the $N\_{RX,BFEE}×N\_{STS,NDP}$ channel, and based on that channel it determined Nr$×$Nc orthogonal matrix V, where Nr and Nc satisfy Equation ~~(8-1)~~(9-1) (#3425, #9840, #8666). $N\_{RX,BFEE}$ is the number of receiver chains used to receive the NDP at the beamformee.(#8665)

***TGax Editor: Please make the following change on Pg 59, ln 38 (#3539):***

The S-tone and E-tone corresponding to the possible RU indices for 20 MHz, 40 MHz, and 80 MHz channels (#3539) are listed in Table 9-76c (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng=4) for Ng=4 and Table 9-76d (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng=16) for Ng=16.

***TGax Editor: Please make the following change to Table 9-76f (HE MU Exclusive Beamforming Report Information) (#3436, #3434):***

|  |  |  |
| --- | --- | --- |
| Field | Size (Bits) | Meaning |
| Delta SNR for space-time stream 1 for subcarrier $k=scidx(0)$ | 4 | $ΔSNR\_{scidx\left(0\right),1}$ as defined in Equation (9-2) |
| … | … | … |
| Delta SNR for space-time stream Nc for subcarrier $k=scidx(0)$ | 4 | $ΔSNR\_{scidx\left(0\right),Nc}$ as defined in Equation (9-2) |
| Delta SNR for space-time stream 1 for subcarrier $k=scidx(1)$ | 4 | $ΔSNR\_{scidx\left(1\right),1}$ as defined in Equation (9-2) |
| … | … | … |
| Delta SNR for space-time stream Nc for subcarrier $k=scidx(1)$ | 4 | $ΔSNR\_{scidx\left(1\right),Nc}$ as defined in Equation (9-2) |
| … | … | … |
| Delta SNR for space-time stream 1 for subcarrier $k=scidx(Ns-1)$ | 4 (#3434) | $ΔSNR\_{scidx\left(Ns-1\right),1}$ as defined in Equation (9-2) |
| … | … | … |
| Delta SNR for space-time stream Nc for subcarrier $k=scidx(Ns-1)$ | 4 (#3436) | $ΔSNR\_{scidx\left(Ns-1\right),Nc}$ as defined in Equation (9-2) |

***TGax Editor: In Table 9-76d (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng=16) (#3428, #9266)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **80 MHz 26- tone RU index**  | **80 MHz (S, E) ~~FB~~ Feedback (#3428) tone** | **40 MHz 26- tone RU index** | **40 MHz (S, E) ~~FB~~ Feedback (#3428) tone** | **tone 20 MHz 26- tone RU index** | **20 MHz (S, E) ~~FB~~ Feedback (#3428) tone** |
| 0 | -500,-468 | 0 | = (S,E) for 80 MHz+256 |  |  |
| 1 | -484,-436 | 1 |  |  |
| 2 | -452,-420 | 2 |  |  |
| 3 | -420,-388 | 3 |  |  |
| 4 | -404,-356 | 4 |  |  |
| 5 | -372,-340 | 5 |  |  |
| 6 | -340,-308 | 6 |  |  |
| 7 | -324,-276 | 7 |  |  |
| 8 | -292,-260 | 8 |  |  |
| 9 | -260,-228 |  |  |  |  |
| 10 | -244,-196 |  |  |  |  |
| 11 | -212,-164 |  |  |  |  |
| 12 | -180,-148 |  |  |  |  |
| 13 | -164,-116 |  |  |  |  |
| 14 | -132,-84 |  |  | 0 | -122,~~-96~~-84 (#9266) |
| 15 | -100,-68 |  |  | 1 | = (S,E) for 80 MHz |
| 16 | -84,-36 |  |  | 2 | -68,-36 |
| 17 | -52,-4 |  |  | 3 | = (S,E) for 80 MHz |
| 18 | -20,20 |  |  | 4 |
| 19 | 4,52 |  |  | 5 |
| 20 | 36,84 |  |  | 6 | 36,68 |
| 21 | 68,100 |  |  | 7 | = (S,E) for 80 MHz |
| 22 | 84,132 |  |  | 8 | 84,122 (#9266) |
| 23 | 116,164 |  |  |  |  |
| 24 | 148,180 |  |  |  |  |
| 25 | 164,212 |  |  |  |  |
| 26 | 196,244 |  |  |  |  |
| 27 | 228,260 |  |  |  |  |
| 28 | 260,292 | 9 | = (S,E) for 80 MHz‒256 |  |  |
| 29 | 276,324 | 10 |  |  |
| 30 | 308,340 | 11 |  |  |
| 31 | 340,372 | 12 |  |  |
| 32 | 356,404 | 13 |  |  |
| 33 | 388,420 | 14 |  |  |
| 34 | 420,452 | 15 |  |  |
| 35 | 436,484 | 16 |  |  |
| 36 | 468,500 | 17 |  |  |

***TGax Editor: In Table 9-76d (Feedback subcarrier indices indicating start 26-tone RU index and end 26-tone RU index for Ng=4) (#3427, #9265)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **80 MHz 26- tone RU index**  | **80 MHz (S, E) ~~FB~~ Feedback (#3427) tone** | **40 MHz 26- tone RU index** | **40 MHz (S, E) ~~FB~~ Feedback (#3427) tone** | **tone 20 MHz 26- tone RU index** | **20 MHz (S, E) ~~FB~~ Feedback (#3427) tone** |
| 0 | -500,-472 | 0 | = (S,E) for 80 MHz+256 |  |  |
| 1 | -476,-448 | 1 |  |  |
| 2 | -448,-420 | 2 |  |  |
| 3 | -420,-392 | 3 |  |  |
| 4 | -392,-364 | 4 |  |  |
| 5 | -368,-340 | 5 |  |  |
| 6 | -340,-312 | 6 |  |  |
| 7 | -312,-284 | 7 |  |  |
| 8 | -288,-260 | 8 |  |  |
| 9 | -260,-232 |  |  |  |  |
| 10 | -232,-204 |  |  |  |  |
| 11 | -204,-176 |  |  |  |  |
| 12 | -180,-152 |  |  |  |  |
| 13 | -152,-124 |  |  |  |  |
| 14 | -124,-96 |  |  | 0 | -122,-96 |
| 15 | -100,-72 |  |  | 1 | = (S,E) for 80 MHz +4 |
| 16 | -72,-44 |  |  | 2 |
| 17 | -44,-16 |  |  | 3 | = (S,E) for 80 MHz |
| 18 | -16,16 |  |  | 4 |
| 19 | 16,44 |  |  | 5 |
| 20 | 44,72 |  |  | 6 | = (S,E) for 80 MHz ‒4 |
| 21 | 72,100 |  |  | 7 |
| 22 | 96,124 |  |  | 8 | 96,122 (#9265) |
| 23 | 124,152 |  |  |  |  |
| 24 | 152,180 |  |  |  |  |
| 25 | 176,204 |  |  |  |  |
| 26 | 204,232 |  |  |  |  |
| 27 | 232,260 |  |  |  |  |
| 28 | 260,288 | 9 | = (S,E) for 80 MHz‒256 |  |  |
| 29 | 284,312 | 10 |  |  |
| 30 | 312,340 | 11 |  |  |
| 31 | 340,368 | 12 |  |  |
| 32 | 364,392 | 13 |  |  |
| 33 | 392,420 | 14 |  |  |
| 34 | 420,448 | 15 |  |  |
| 35 | 448,476 | 16 |  |  |
| 36 | 472,500 | 17 |  |  |

***TGax Editor: Please make the following change on Pg 64, ln 20 (#8670):***

The HE MU Exclusive Beamforming Report information has the structure and order defined (#8670) in Table 9-76f (HE MU Exclusive Beamforming Report information).

***TGax Editor: Please make the following change on Pg 58, ln 35 (#8667):***

The HE MU Exclusive Beamforming Report information has the structure and order defined (#8670) in Table 9-76b (HE Compressed Beamforming Report information).

For each subcarrier included, the deviation in dB of the SNR of that subcarrier for each column of *V* relative to the average SNR of the corresponding space-time stream is computed using Equation (9-2). In Equation (9-2), $k$ is the subcarrier index in the range $scidx\left(0\right),…, scidx\left(Ns-1\right).$ (#3440)

**References:**

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