IEEE P802.11
Wireless LANs

|  |
| --- |
| Comment resolutions for 27.6.3 |
| Date: 2018-03-01 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Alfred Asterjadhi | Qualcomm Inc. | 5775 Morehouse Dr, San Diego, CA 92109 | +1-858-658-5302 | aasterja@qti.qualcomm.com |
| George Cherian | Qualcomm Inc. |  |  |  |
| Abhishek Patil | Qualcomm Inc. |  |  |  |

Abstract

This submission proposes resolutions for multiple comments related to TGax D2.0 with the following CIDs:

* 11432, 11433, 11766, 11767, 11768, 12513, 12515, 12516, 12697, 12698,
* 12699, 12779, 13218, 13219, 13220, 13222, 13223, 13224, 13225, 13226,
* 13227, 13228, 13287, 13288, 13289, 13290, 13291, 13550, 13553, 13556,
* 13712, 13776, 14274 (33 CIDs)

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Includes changes related to suggestions/feeback received during presentation and offline. Changes are highlighted in green.

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.***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **P.L** | **Comment** | **Proposed Change** | **Resolution** |
| 11432 | Bo Sun | 256.43 | "BRP trigger" that BRP is short for Beam Refinement Protocol in 11ad of 802.11-2016. There is confilict between two abbreviations. | as comment | Revised –Agree in principle. Proposed resolution is to replace “BRP” with “BFRP” throughout the draft.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 11432. |
| 11433 | Bo Sun | 256.45 | "BRP trigger" that BRP is short for Beam Refienement Protocol in 11ad of 802.11-2016. | as comment | Revised –Agree in principle. Proposed resolution is to replace “BRP” with “BFRP” throughout the draft.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 11433. |
| 11766 | GEORGE CHERIAN | 264.52 | Please clarify how a TB soundng is done with a single STA. If not possible, please clarify that too:"An HE beamformer initiates an HE trigger-based (TB) sounding sequence by sending a broadcast NDP Announcement frame that contains two or more STA Info fields, where each STA Info field is addressed to an HE beamformee" | As in the comment | Rejected –HE TB sounding with a single STA is not possible since TB sounding is intended to be performed with multiple STAs (although the AP is always free to send a BRP Trigger frame to only one STA). If only one STA then non-TB sounding is the go to sequence. The existing text is the same as the text mentioned by the comment so no changes would be needed. |
| 11767 | GEORGE CHERIAN | 265.29 | Make it clear that the HE Beamformer is an AP in the following sentence: "An HE beamformer thattransmits an HE NDP Announcement frame to one or more HE non-AP STA beamformee shall set theAID11 field in each STA Info field to the 11 LSBs of the AID of the non-AP STA to which the STA Infofield is addressed to." | As in the comment | Rejected –The statement as currently is covers the case fo the HE beamformer being an AP and also a TDLS STA. As such it is correct. No changes are necessary. |
| 11768 | GEORGE CHERIAN | 265.03 | Add normative requirement to cpature the following: "The HE sounding sequence is a non-TB sounding sequence if the HE NDP Announcement frame is an individually addressed frame; otherwise it is a TB soundingsequence" | As in the comment | Revised –Agree in principle with the comment. Proposed resolution converts the declarative statement into a normative statement where these sequences are defined.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 11768. |
| 12513 | Liwen Chu | 264.41 | The parameters of SU sounding is decided by beamformee. | Fix the issue mentioned in comment. | Revised –Agree with comment and fixed the issue by clarifying this aspect.Proposed resolution also ensures consistency between the statements in subclause 9.3.1.20 and 28.3.15.2 on who decides the parameters. Noteworthy that the cited paragraph is removed since it provided duplicate behavior with another paragraph found later in the subclause. The changes focused in this latter paragraph.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 12513. |
| 12515 | Liwen Chu | 264.30 | TB based sounding is in one TXOP. The SU sounding is not clearly say this. Make SU sounding clear that the sounding feedback is in one TXOP. | As in comment | Rejected –We have multiple instances that mention that the sounding sequences are within the same TXOP. As such there is no need for additional statements for this purpose.  |
| 12516 | Liwen Chu | 267.05 | Partial BW Info should also be reserved since full BW sounding is always required for SU sounding. | As in comment | Revised –Agree in principle. Added the Partial BW Info subfield as part of the fields that are ignored by the STA that is the intended receiver of the NDPA.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 12516. |
| 12697 | Mark RISON | 266.05 | "An HE beamformer that transmits an HE NDP Announcement frame and sets the Feedback Type And Ngsubfield of the STA Info field to indicate MU shall indicate Ng = 4 or Ng = 16 in the Feedback Type And Ngsubfield of the STA Info field (see Table 9-25a (Feedback Type And Ng subfield and Codebook Size sub-field encoding))." -- this is a necessary consequence of the field encodings | Delete the cited text | Accepted |
| 12698 | Mark RISON | 267.58 | "A non-AP HE beamformee that receives a broadcast HE NDP Announcement frame from the HE beam-former with which it is associated and that contains the HE beamformee's 11 LSBs of the AID in any of theSTA Info fields and also receives an HE NDP a SIFS after the HE NDP Announcement frame shall computethe HE compressed beamforming feedback using the feedback type, Ng and codebook size indicated in thereceived HE NDP Announcement frame. " -- what if it's broadcast but has only one STA Info field? | Change the cited text to "A non-AP HE beamformee that receives an HE NDP Announcement frame from the HE beam-former with which it is associated, that has more than one STA Info field and that contains the HE beamformee's 11 LSBs of the AID in any of theSTA Info fields and also receives an HE NDP a SIFS after the HE NDP Announcement frame shall computethe HE compressed beamforming feedback using the feedback type, Ng and codebook size indicated in thereceived HE NDP Announcement frame. " | Revised –The existing rule and the proposed rule are equivalent since an HE NDPA frame that is broadcast cannot have only one STA Info field. However, agree with the commenter’s suggested terminology so that it is consistent with other parts of the descriptions. Keeping broadcast terms since it is consistent with other parts as well.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 12698. |
| 12699 | Mark RISON | 267.06 | "The HE beamformee that is theintended receiver of an HE NDP Announcement frame that has only one STA Info field shall ignore the values of the Nc subfield, Ng subfield (B26 of the STA Info subfield) and Codebook Size subfield" -- and then do what for those params? And if the Feedback Type And Ng subfield is 0 (previous sentence) then only SU-type feedback can be provided | Change the cited text to "The HE beamformee that is the intended receiver of an HE NDP Announcement frame that has only one STA Info field shall ignore the values of the Feedback Type And Ng, Codebook Size and Nc subfields and shall provide SU-type feedback" | Revised –Agree in principle. Added suggested normative behavior while clarifying that the HE beamformee also decides the other parameters.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 12699. |
| 12779 | Mark RISON | 266.34 | " For example, the HE beam-former can request full 80 MHz bandwidth feedback for Ng = 4 by setting the RU Start Index and RU EndIndex subfields in the STA Info field to 0 and 36, respectively, as shown in Table 28-8 (Data and pilot sub-carrier indices for RUs in an 80 MHz HE PPDU). For Ng = 4 and 160 or 80+80 MHz full bandwidth feed-back, the RU Start Index and RU End Index subfields are 0 and 74, respectively." -- there is no reason to do this by example since the set of cases is small | Spell it out in a table for all the combinations of Ng (2 options) and BW (4 options) | Revised –Agree in principle with the comment. Proposed resolution is to provide the possible combinations of BW. Ng rules are already specified in P266L6.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 12779. |
| 13218 | Robert Stacey | 264.32 | This is a definition for the HE non-TB sounding sequence. Write it as such. | Replace with "An HE non-TB sounding sequence is a sounding sequence where the initiating frame is an individually addressed HE NDP Announcement frame with a single STA Info field. An individually addressed HE NPD Announcement frame shall have one and only one STA Info field. The RA field of the HE NDP Announcement frame shall be set to to the address of the STA addressed in the STA Info field." Remove the associated RA field statement at P265L20. | Revised –Agree in principle with the comment. Proposed resolution accounts fro the suggested change. Same thing is done for the TB sounding sequence to keep consistency in the definition style.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13218. |
|  |  |  |  |  |  |
| 13219 | Robert Stacey | 264.34 | The sounding procudure for STAs with different operating channel widths and for STAs with full bandwdith/partial bandwidth capabilities is not clearly defined. For example, can a beamformee with 20 MHz operating channel width participate in 80 MHz MU sounding? If so, does it need to be partial bandwidth capable or can it participate even if it is only full bandwidth capable? | Clarify the rules for STAs with different operating channel widths and full bandwidth/partial bandwidth capabilities. My take: a 20 MHz operating STA should be able to participate in 80 MHz sounding. If it is only full bandwidth capable then it should send an 80 MHz report with junk for tones it can't report on. We could greatly simplify things if we made partial bandwidth support a requirement. | Revised –Agree in principle with the comment. Proposed resolution is to explicitly specify what the rules are for the inclusion of a beamformee that operates in a BW that is less than the one that is specified by the beamformer.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13219. |
| 13222 | Robert Stacey | 264.42 | "based on parameters" is too vague. | Add a set of statements that restrict what the HE beamformer can send based on the beamformee capability. For example, "An HE beamformer shall not initate a non-TB sounding sequence with an HE NDP Announcement frame with a Feedback And NG Type field that indicates an Ng not supported by the HE beamformee. Etc." | Revised –Agree in principle with the comment. A proposed resolution along the lines suggested by the commenter was motioned in the January F2F meeting (refer to document 11/18/0042r1):*“An HE beamformer shall not request a type of sounding feedback or feedback using sounding parameters that are not supported by the HE beamformee. The HE beamformer shall not solicit sounding feeback using an HE sounding sequence that is not supported by the HE beamformee”* As such no new changes are needed. The proposal is to replicate the instruction to the editor (although it will already appear in D2.2 and as such the instruction can be technically be ignored by the editor.TGax editor to make the changes shown in 11-18/0042r1 under all headings that include CID 12688, 13209, 13212, 13213, 13214, 13215, 13216, 13217. |
| 13223 | Robert Stacey | 264.42 | "may initiate... only if..." is not the right construct here. Also, "based on parameters supported" is too vague. | Add a set of statements that restrict what the HE beamformer can send based on the beamformee capability: "An HE beamformer shall not send an HE NDP Announcement frame with a STA Info field addressed to a HE beamformee if one or more of the following conditions apply: - The Feedback Type And Ng field HE NDP Annoucement frame indicates SU and Ng = 16 and the HE beamformee has set the Ng = 16 SU Feedback subfield in the HE PHY Capabilities Information field in the HE Capabilities element to 0 - The Feedback And Ng Type field indicates MU and Ng = 16 and the HE beamformee has set the Ng = 16 MU Feedback subfield [...] to 0 - The Feedback And Ng field indicates MU, the Codebook Size field indicates {x, y} and the HE beamformee has set the ..., etc." | Revised –Agree in principle with the comment. A proposed resolution along the lines suggested by the commenter was motioned in the January F2F meeting (refer to document 11/18/0042r1):*“An HE beamformer shall not request a type of sounding feedback or feedback using sounding parameters that are not supported by the HE beamformee. The HE beamformer shall not solicit sounding feeback using an HE sounding sequence that is not supported by the HE beamformee”*As such no new changes are needed. The proposal is to replicate the instruction to the editor (although it will already appear in D2.2 and as such the instruction can be technically be ignored by the editor.TGax editor to make the changes shown in 11-18/0042r1 under all headings that include CID 12688, 13209, 13212, 13213, 13214, 13215, 13216, 13217. |
| 13224 | Robert Stacey | 264.48 | This could be more specific | "An HE beamformer shall not initiate a HE non-TB sounding sequence with an HE NDP Announcement frame where the Partial BW field indicates less than full bandwidth." | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13224. |
| 13225 | Robert Stacey | 264.52 | This is a definition for the HE TB sounding sequence. Write it as such. | "An HE TB sounding sequence is a sounding sequence where the initiating frame is a broadcast HE NDP Annoucment frame that contains two or more STA Info fields." Remove the statement at P265L20. | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested changes. TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13225. |
| 13226 | Robert Stacey | 264.52 | Why does the HE TB sounding sequence require two STA Info fields in the HE NDP Announcement frame? Surely the fact that the HE NDP is broadcast is sufficient? How would a STA behave it it received a broadcast HE NDP Annoucement with one STA Info field and it was the STA addressed by that STA Info field? | Define an HE TB sounding sequence as one where the HE NDP Announcement is broadcast: "An HE TB sounding sequence is a sounding sequence initiated by a broadcast HE NDP Announcement frame. A broadcast NDP Annoucement frame may include one or more STA Info fields." | Rejected –A broadcast NDPA that would be addressed to one STA would be a pathological case since all STAs would be required to parse this frame, while the frame is really intended only to one STA. In this case, when the NDPA is addressed to one STA only (one STA Info field) the RA field is set to the MAC address of the STA so that there is no ambiguity and no requirement for the other STAs that are not intended receivers of the frame. As such the AP is not allowed to send a broadcast NDPA that has only one STA Info field. |
| 13227 | Robert Stacey | 264.57 | Can an HE TB sounding sequence solicit SU-type feedback? CQI feedback? Presumably since we have capability fields for triggered feedback of each of these. | Replace with "The HE NDP Annoucement frame in an HE TB sounding sequence shall not solicit MU, SU or CQI feedback unless all the STAs addressed in the STA Info fields have indicated support for triggered feedback of that type in the Triggered MU Beamforming Feedback, Triggered SU Beamforming feedback, or Triggered CQI Feedback subfield, respectively, in the HE PHY Capabilities Information field of the HE Capabilities element." | Revised –Agree in principle with the comment. A proposed resolution along the lines suggested by the commenter was motioned in the January F2F meeting (refer to document 11/18/0042r1):*“An HE beamformer shall not request a type of sounding feedback or feedback using sounding parameters that are not supported by the HE beamformee. The HE beamformer shall not solicit sounding feeback using an HE sounding sequence that is not supported by the HE beamformee”* As such no new changes are needed. The proposal is to replicate the instruction to the editor (although it will already appear in D2.2 and as such the instruction can be technically be ignored by the editor.TGax editor to make the changes shown in 11-18/0042r1 under all headings that include CID 12688, 13209, 13212, 13213, 13214, 13215, 13216, 13217. |
| 13228 | Robert Stacey | 264.61 | This statement is extremely vague. | Make individual specific statements such as "shall not solicit feedback with codebook x unless the beamformee supports codebook x". | Revised –Agree in principle with the comment. A proposed resolution along the lines suggested by the commenter was motioned in the January F2F meeting (refer to document 11/18/0042r1):*“An HE beamformer shall not request a type of sounding feedback or feedback using sounding parameters that are not supported by the HE beamformee. The HE beamformer shall not solicit sounding feeback using an HE sounding sequence that is not supported by the HE beamformee”* As such no new changes are needed. The proposal is to replicate the instruction to the editor (although it will already appear in D2.2 and as such the instruction can be technically be ignored by the editor.TGax editor to make the changes shown in 11-18/0042r1 under all headings that include CID 12688, 13209, 13212, 13213, 13214, 13215, 13216, 13217. |
| 13287 | Robert Stacey | 264.61 | It is not clear if there are restrictions on the feedback variants that can be part of a TB sounding sequence. Can SU feedback be return? (If so we will need tighter rules on generating the report based on parameters in the NDP Announcement). Can CQI feedback be returned? Note that we have capabilitiy bits for triggered feedback of each of these types. | Identify the feedback types that can be used with TB sounding | Revised –Agree in principle with the comment. A proposed resolution along the lines suggested by the commenter was motioned in the January F2F meeting (refer to document 11/18/0042r1):*“An HE beamformer shall not request a type of sounding feedback or feedback using sounding parameters that are not supported by the HE beamformee. The HE beamformer shall not solicit sounding feeback using an HE sounding sequence that is not supported by the HE beamformee”* As such no new changes are needed. The proposal is to replicate the instruction to the editor (although it will already appear in D2.2 and as such the instruction can be technically be ignored by the editor.TGax editor to make the changes shown in 11-18/0042r1 under all headings that include CID 12688, 13209, 13212, 13213, 13214, 13215, 13216, 13217. |
| 13289 | Robert Stacey | 265.35 | The statement at P264L61 covers the setting of the HE NDP Annoucement fields based on the HE beamformee capabilities. The restrictions on the HE beamformer setting of the HE NPD Annoucement fields is not dependent on whether this is triggered or non-triggered; even for non-triggered (or SU) the HE beamformer should not use paramters the HE beamformee can't support. The one STA Info field is not accurate; the condition is that the HE NPD Announcement frame is individually addressed. It is also not clear why we have capability bits for everything (Ng=16, codebook size) but we still let the STA decided how to respond. This doesn't make sense even for non-triggered. | Remove the ability of the HE beamformee to set parameters; let the HE beamformer always decide parameters based on HE beamformee's capabilities. | Rejected –The sounding protocol defines two sequences:1. HE non-TB sounding sequence wherein the HE beamformee is the one that decides the parameters for the generated sounding feedback. This is because the sounding feedback is carried in an SU PPDU for which the beamformee decides the transmit parameters as such controls its length and the amount of CBF it can include (as such it can also control the parameters of the generated feedback)
2. HE TB sounding sequence wherein the HE beamformee is the one that decides the feedback parameters. This is because the sounding feednback in this case is carried in HE TB PPDU for which the beamformer decides the transmit parameters as such controls its length and the amount of CBF that the beamformee(s) can include (as such it needs to also control the parameters of the generated feedback which directly impacts the sizes of the feedback).

In order to preserve the flexibility but also to provide constraints when needed the current sounding rules are necessary: beamformee decides the feedback parameters for non-TB sounding sequence and the beamformeer decides the feedback parameters for TB sounding sequence. |
| 13288 | Robert Stacey | 265.01 | The definitions for HE non-TB sounding sequence and HE TB sounding sequence have already been given at P264L32 and P264L52. The new requirement here is that the HE NDP Annoucement is always followed by an HE NDP. | Replace the paragraph with "An HE beamformer that initiates an HE non-TB sounding sequence or HE TB sounding sequence shall transmit an HE NDP PPDU a SIFS after the HE NDP Announcement frame." | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13288. |
| 13290 | Robert Stacey | 266.29 | Explicit rules are missing for a STA supporting partial bandwidth and that has an operating channel width less that the sounding channel width. | Add expicit rules such as "The HE beamformer shall not solicit feedback from an HE beamformee with 20 MHz operating channel width that outside the range 0 to 9." Take care of all permutations (20, 40, 80, 160 MHz sounding with 20, 40, 80, 160 MHz operating channel width beamformees). | Revised –Agree in principle with the comment. Proposed resolution accounts for the suggested change.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13290. |
| 13291 | Robert Stacey | 266.29 | There are no rules for including a beamformee with operating channel width narrow than the sounding bandwidth. | Define rules | Revised –Agree in principle with the comment. Proposed resolution is to explicitly specify what the rules are for the inclusion of a beamformee that operates in a BW that is less than the one that is specified by the beamformer.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13291. |
| 13550 | SUNGEUN LEE | 264.45 | Fix the ference for HE beamformee | Change the reference from 27.6.1a to 27.6.2 (Sounding sequences and support) in P802.11ax D2.0 | Accepted  |
| 13553 | SUNGEUN LEE | 266.27 | HE NDP Anouncement frame would be sent as non-HT duplicate PPDU for wider BW, so in order for better clarification, explict description for non-HT duplicate PPDU is worthwhile. | add the non-HT duplicate PPDU format so that 'is received in a non-HT PPDU or non-HT duplicate PPDU' | Revised –Agree with comment. Incorporated plus some minor editorials.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13553. |
| 13556 | SUNGEUN LEE | 266.39 | Total 74 RUs for 26-tone exists for 160MHz or 80+80MHz PPDU, so RU End Index subfield should be 73 | Change the RU End Index subfield to 73 | Revised –Agree. Incorporated.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 13556. |
| 13712 | Tomoko Adachi | 265.55 | "Rx HE-MCS Map For <= 80 MHz and Rx HE-MCS Map For > 80 MHz subfields" There are not such subfields but "Rx HE-MCS Map <= 80 MHz", "Rx HE-MCS Map 160 MHz", and "Rx HE-MCS Map 80+80 MHz" instead. | Change to "Rx HE-MCS Map <= 80 MHz, Rx HE-MCS Map 160 MHz, and Rx HE-MCS Map 80+80 MHz subfields". | Accepted |
| 13776 | Yanjun Sun | 266.53 | Fix the field name to OM Control (also appears on P267L1) | Change OMI Control field to OM Control field | Accepted |
| 14274 | Yusuke Tanaka | 266.48 | Brackets are not needed in L48 and L61. | As commented. | Revised –Agree in principle. Proposed resolution is to clarify this aspect.TGax editor to make the changes shown in 11-18/0312r1 under all headings that include CID 14274. |

**Discussion: *None.***

**3.4 Abbreviations and acronyms**

**TGax Editor: *Change the definition below of this subclause as follows (#CID 11432, 11433):***

BFRP Beamforming report poll*(#11432, 11433)*

**TGax Editor: *Replace “BRP” with “BFRP” throughout the draft (#CID 11432, 11433).***

* Rules for HE sounding protocol sequences

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 13218, 11768):***An HE non-TB sounding sequence is a sounding sequence initiated by an HE beamformer with a burst of two frames comprising an individually addressed HE NDP Announcement frame with a single STA Info field followed after SIFS by an HE NDP. An HE beamformer that initiates an HE non-TB sounding sequence shall transmit an HE NDP Announcement frame with one and only one STA Info field and the RA field set to the address of the HE beamformee addressed in the STA Info field as the initial frame of the sequence. *(#13218, 11768)* An HE beamformer may initiate an HE non-TB sounding sequence with an HE beamformee to solicit SU feedback over full bandwidth (BW).

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 12513, 13550):***

 *(#13550, 12513)*.

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID, 13224):***

An HE beamformer shall not initiate an HE non-TB sounding sequence with an HE NDP Announcement frame that has a Partial BW Info field that indicates less than full bandwidth (see Table 27-AAA).*(#13224)*

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 13218, 13225, 11768):***

An HE TB sounding sequence is a sounding sequence initiated by an HE beamformer with a burst of three frames comprising a broadcast HE NDP Announcement frame with two or more STA Info fields followed after SIFS by an HE NDP followed after SIFS by a BRP Trigger frame. An HE beamformer that initiates an HE TB sounding sequence shall transmit an HE NDP Announcement frame with two or more STA Info fields, with each STA Info field addressed to an HE beamformee, and the RA field set to the broadcast address as the initial frame of the sequence. *(#13218, 13225, 11768)* An HE beamformer may initiate an HE TB sounding sequence to solicit MU feedback over full BW from an HE beamformee. An HE beamformer may initiate an HE TB sounding sequence to solicit a feedback variant only if the feedback variant is computed based on parameters supported by the HE beamformee; otherwise the HE beamformer shall not solicit a feedback variant computed based on parameters not supported by the HE beamformee (see 27.6.2 (Sounding sequences and support)).

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 11768*, *12515, 13288):***

An HE beamformer shall transmit an HE NDP a SIFS after the transmitted HE NDP Announcement frame.*(#13288)*.*(#11768)*. (#9923)

An HE AP shall not send an HE NDP Announcement frame with STA Info fields that are addressed to STAs from two or more BSSs of a multiple BSSID set to a STA unless the STA has set the Rx Control Frame To MultiBSS subfield in the HE MAC Capabilities Information field of the HE Capabilities element it transmits to 1.(#3075, #Ed)

An AP that transmits an HE NDP Announcement frame(#10149) addressed to HE STAs shall set the TA field of the frame to the MAC address of the AP, except when dot11MultiBSSIDActivated is true and the HE NDP Announcement frame(#10149) is directed to STAs from at least two different BSSs of the multiple BSSID set, in which case, the AP shall set the TA field of the frame to the transmitted BSSID. The TA field of the HE NDP Announcement frame is a bandwidth signaling TA when the HE NDP Announcement frame is sent in a non-HT duplicate PPDU (see 10.7.6.6).(#8533)

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 11766, 13218):***

 *(#11766, 13218)*An HE beamformer that transmits an HE NDP Announcement frame to an HE beamformee that is an AP, mesh STA or STA that is a member of an IBSS, shall include one STA Info field in the HE NDP Announcement frame and shall set the AID11 field in the STA Info field of the frame to 0. An HE beamformer that transmits an HE NDP Announcement frame to one or more HE non-AP STA beamformee shall set the AID11 field in each STA Info field to the 11 LSBs of the AID of the non-AP STA to which the STA Info field is addressed to. An HE NDP Announcement frame shall not include more than one STA Info fields that have the same value in the AID11 subfield.

The HE NDP Announcement frame shall indicate the *Ng*, codebook and *Nc* to be used by the intended HE beamformees(#10148) for the generation of HE compressed beamforming feedback except when the HE NDP Announcement frame contains only one STA Info field, in which case the *Ng*, codebook and *Nc* to be used for the generation of the HE compressed beamforming feedback report shall be determined by the recipient of the HE NDP Announcement frame.

An HE beamformer that transmits an HE NDP Announcement frame with more than one STA Info field shall transmit a BRP Trigger frame(#10160) a SIFS after the HE NDP to solicit HE compressed beamforming feedback from the intended HE beamformees in the same TXOP. The HE beamformer may send additional BRP Trigger frames(#10160) to solicit a subset of the HE compressed beamforming feedback in the same TXOP as shown in Figure 27-7 (An example of the sounding protocol with more than one HE beamformee).

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 13712):***

An HE beamformer that transmits an HE NDP Announcement frame and sets the Feedback Type And Ng subfield of a STA Info field to indicate MU(#10151) shall set the Nc subfield(#10150) of the STA Info field to a value less than or equal to the minimum of:

* The maximum number of supported spatial streams according to the corresponding HE beamformee's Rx HE-MCS Map  80 MHz, Rx HE-MCS Map > 80 MHz, and Rx HE-MCS Map 80+80 MHz*(#13712)* subfields in the Supported HE-MCS And NSS Set field of the HE Capabilities element sent by the HE beamformee (#9301, #9302)
* The maximum number of supported spatial streams according to the Rx NSS subfield value in the most recently received Operating Mode Notification frame, Operating Mode Notification element with the Rx NSS Type subfield equal to 0, or OM Control subfield sent by the corresponding HE beamformee (see 27.8 (Operating mode indication))(#9304)(#6010)
* The maximum Nc indicated by the Max Nc subfield in the HE PHY Capabilities Information field of the HE Capabilities element sent by the HE beamformee.(#8676, #Ed)

The HE beamformee indicates the maximum number of space-time streams it can receive in an HE NDP, *NSTS, max*, as defined in 27.6.2 (Sounding sequences and support).(#8709, #9305, #10152, #9925)

 *(#12697)*An HE beamformee may support Ng = 16 in the HE Compressed Beamforming Report field for both SU and MU feedback types. A beamformer shall not request Ng = 16 for SU or MU feedback in an HE NDP Announcement frame unless the beamformee indicates support in the Ng = 16 For SU Feedback subfield or Ng = 16 For MU Feedback subfield, respectively, in the HE PHY Capabilities Information field of the HE Capabilities element it transmits (see 9.4.2.237 (HE Capabilities element)).

An HE beamformee may support a codebook size (ϕ, ψ) = {4, 2} in the HE Compressed Beamforming Report field for SU feedback type. A beamformer shall not request codebook size (ϕ, ψ) = {4, 2} in an HE NDP Announcement frame unless the beamformee indicates support in the Codebook Size (ϕ, ψ) = {4, 2} SU Feedback subfield in the HE PHY Capabilities Information field in the HE Capabilities element it transmits (see 9.4.2.237 (HE Capabilities element)).

An HE beamformee may support a codebook size (ϕ, ψ) = {7, 5} in the HE Compressed Beamforming Report field for MU feedback type. A beamformer shall not request the codebook size (ϕ, ψ) = {7, 5} in an HE NDP Announcement frame unless the beamformee indicates support for the Codebook Size (ϕ, ψ) = {7, 5} MU Feedback subfield in the HE PHY Capabilities Information field in the HE Capabilities element it transmits (see 9.4.2.237 (HE Capabilities element)).An HE beamformer that transmits an HE NDP Announcement frame shall set the RU Start Index and RU End Index subfields(#10154) in a STA Info field to indicate the starting 26-tone RU and the ending 26-tone RU, respectively, of the solicited HE compressed beamforming feedback (see 9.3.1.20 (VHT/HE NDP Announcement frame format)).

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 13553, 13291, 13290):***

The bandwidth of the HE NDP Announcement frame is obtained from the RXVECTOR parameter CH\_BANDWIDTH of the HE NDP Announcement frame when received in an HE/VHT/HT PPDU or from the RXVECTOR parameter CH\_BANDWIDTH\_IN\_NON\_HT when the HE NDP Announcement frame is received in a non-HT duplicate PPDU and is 20 MHz when the HE NDP Announcement frame is received in a non-HT PPDU.*(#13553, 13291, 13290)*

**TGax Editor: *Change the paragraph below of this subclause as follows (#CID 13556, 13291, 13290, 13219, 13553, 12799):***

The HE beamformer shall solicit feedback over full bandwidth when the HE NDP Announcement frame has only one STA Info field or when the STA Info field is addressed to an HE beamformee that has indicated no support for partial bandwidth feedback. The HE beamformer may solicit feedback over full bandwidth or partial bandwidth when the STA Info field is addressed to an HE beamformee that has indicated support for partial bandwidth feedback and the sequence is an HE TB sounding sequence (see 27.6.2 (Sounding sequences and support)).*(#13291, 13290, 13219)(#13556, 12779)* (#3303, #5812, #6733, #7638, #8711, #9536, #6732, #8713)For 80+80 MHz, feedback is not requested for the gap between the 80 MHz segments. The HE beamformer shall set the TXVECTOR parameter CH\_BANDWIDTH or CH\_BANDWIDTH\_IN\_NON\_HT, the RU Start Index field, and the RU End Index field of the HE NDP Announcement frame, depending on the operating channel width and partial BW support of the HE beamformee, as defined in Table 27-X. *(#13553, 13291, 13290, 12799)*

***NOTE TO EDITOR: PLEASE MOVE THE LAST TWO COLUMNS AS THE 1ST TWO COLUMNS OF THE TABLE.***

|  |
| --- |
| Table 27-X Settings for BW, RU Start Index, and RU End Index fields in HE NDP Announcement frame(#7108) |
| Bandwidth of HE NDP Announcement frame | RU Start Index field | RU End Index field | Partial BW supported by HE beamformee | Operating channel width of the HE beamformee |
| 20 MHz | 0 | 8 | NO | 20, 40, 80, 80+80/160 MHz |
| 0, …, 8 | 0, …, 8 | YES | 20, 40, 80, 80+80/160 MHz |
| 40 MHz | 0 | 17 | NO | 40, 80, 80+80/160 MHz |
| 0, …, 17 | 0, …, 17 | YES | 40, 80, 80+80/160 MHz |
| 80 MHz | 0 | 36 | NO | 80, 80+80/160 MHz |
| 0, …, 36 | 0, …, 36 | YES | 80, 80+80/160 MHz |
| 80+80/160 MHz | 0 | 73 | NO | 80+80/160 MHz |
| 0, …, 73 | 0, …, 73 | YES | 80, 80+80, 160 MHz |
| NOTE 1—The value of the RU Start Index field is always less than or equal to the value of the RU End Index field.NOTE 2—The HE beamformee does not request feedback for the gap between the two 80 MHz segments of the 80+80 MHz.NOTE 3—Partial BW feedback can only be solicited with an HE TB sounding sequence and cannot be solicited with an HE non-TB sounding sequence. |

 (17/1081r1)**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 13776, 14274):***

The HE beamformer shall use a lowest 26-tone RU, which is the lower bound of the starting 26-tone in the RU Start Index subfield of a STA Info field that is equal to the maximum of:

* The minimum 26-tone RU located within the channel width in the VHT Operation Information field of either the HE Operation element or the VHT Operation element, whicheveris present *(#14274)*, and within the channel width in the HT Operation element(#7639)
* The minimum 26-tone RU located within the channel width in the most recently received Operating Mode Notification frame, Operating Mode Notification element with the Rx NSS Type subfield equal to 0, or OM*(#13776)* Control field sent by the corresponding HE beamformee (see 27.8 (Operating mode indication))(#9926)

The HE beamformer shall use a highest 26-tone RU, which is the upper bound of the ending 26-tone RU in the RU End Index subfield of a STA Info field that is equal to the minimum of:

* The maximum 26-tone RU located within the channel width in the VHT Operation Information field of either the HE Operation element or the VHT Operation element, whichever is present,*(#14274)* and within the channel width in the HT Operation element(#7639)
* The maximum 26-tone RU located within the channel width in the most recently received Operating Mode Notification frame, Operating Mode Notification element with the Rx NSS Type subfield equal to 0, or OMI Control field sent by the corresponding HE beamformee (see 27.8 (Operating mode indication))(#9926)

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 12516, 12699, 12513):***

An HE beamformer that transmits an HE NDP Announcement frame that has only one STA Info field shall set the Nc subfield(#Ed) to 0 and the Feedback Type And Ng subfield(#Ed) to 0. The HE beamformee that is the intended receiver of an HE NDP Announcement frame that has only one STA Info field shall provide SU-type feedback and may use different Nc, Ng, and codebook size parameters from those indicated in the HE NDP Announcement frame (i.e., the HE beamformee ignores the values of the Nc subfield, Ng subfield (B26 of the STA Info subfield), Codebook Size subfield, Partial BW Info subfield)*(#12516*, *12699, 12513)*.(#8712, #10156, #9924, #9927)

An example of the HE non-TB sounding protocol with a single HE beamformee is shown in Figure 27-6 (An example of the sounding protocol with a single HE beamformee).

|  |
| --- |
|  |
| * An example of the sounding protocol with a single HE beamformee(#3304)
 |

An HE beamformee that receives an HE NDP Announcement frame from an HE beamformer with which it is associated and that contains the HE beamformee's MAC address in the RA field and also receives an HE NDP a SIFS after the HE NDP Announcement frame shall transmit its HE compressed beamforming feedback a SIFS after the HE NDP. The TXVECTOR parameter CH\_BANDWIDTH for the PPDU containing the HE compressed beamforming feedback shall be set to indicate a bandwidth not wider than that indicated by the RXVECTOR parameter CH\_BANDWIDTH of the HE NDP.(#7819)

An example of HE TB sounding protocol with more than one HE beamformee is shown in Figure 27-7 (An example of the sounding protocol with more than one HE beamformee).

|  |
| --- |
|  |
| * An example of the sounding protocol with more than one HE beamformee(#3305)
 |

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 12698):***

A non-AP HE beamformee that receives a broadcast HE NDP Announcement frame that has more than one STA Info field*(#12698)* from the HE beamformer with which it is associated and that contains the HE beamformee's 11 LSBs of the AID in any of the STA Info fields and also receives an HE NDP a SIFS after the HE NDP Announcement frame shall compute the HE compressed beamforming feedback using the feedback type, *Ng* and codebook size indicated in the received HE NDP Announcement frame(#7640). The HE beamformee shall transmit the HE TB PPDU its HE compressed beamforming feedback in response to a BRP Trigger frame(#10160)(#8485) that contains the 11 LSBs of the AID of the HE beamformee in any of the User Info fields following the rules defined in 27.5.3.3 (STA behavior for UL MU operation). If the HE NDP Announcement frame has the TA field set to the transmitted BSSID, and the HE beamformee is a non-AP STA associated to a nontransmitted BSSID that supports receiving Control frames with TA set to the transmitted BSSID, then the HE compressed beamforming feedback sent in response shall have the RA field set to either the nontransmitted BSSID or the transmitted BSSID.(#7819)

NOTE-A non-AP HE beamformee that transmits an OM Control subfield with UL MU Disable field set to 1 does not respond to BRP Trigger frames (see 27.8 (Operating mode indication)).

The value of the Sounding Dialog Token Number in the HE MIMO Control field shall be set to the same value as the Sounding Dialog Token Number field in the corresponding HE NDP Announcement frame.

The HE compressed beamforming feedback shall be transmitted in a single HE Compressed Beamforming And CQI frame unless the size of the feedback results in an HE Compressed Beamforming And CQI frame that would exceed 11 454 octets, in which case the feedback shall be segmented as defined in 27.6.4 (Rules for generating segmented feedback).

An HE beamformer shall support a maximum MPDU length for HE Compressed beamforming feedback which is the minimum between 11 454 octets and the maximum length of the HE compressed beamforming feedback that the HE beamformer intends to solicit from its HE beamformees. The HE beamformee shall not segment an HE compressed beamforming and CQI report that is CQI feedback. (#7111, #8716)

An HE beamformer that sends a BRP Trigger frame shall set the Feedback Segment Retransmission Bitmap fields of the BRP Trigger frame to all ones except when the HE beamformer intends to solicit the retransmission of segmented feedback as defined in 27.6.4 (Rules for generating segmented feedback).

NOTE—The BRP Trigger frame contains one or more User Info fields, each of the which is addressed to an HE beamformee.

**9.3.1.20 VHT/HE NDP Announcement frame format**

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 12513):***

If the HE NDP Announcement framehas more than one STA Info field then the Nc field indicates the number of columns Nc, in the Compressed Beamforming Feedback Matrix subfield minus 1. Set to 0 to request *Nc* = 1, set to 1 to request *Nc* = 2, ..., set to 7 to request *Nc* = 8. If the HE NDP Announcement frame has only one STA Info field then the Nc field is reserved.*(#12513)*

**28.3.15.2 Beamforming feedback matrix *V***

…

The beamforming feedback matrix, *Vk,u*, found by the beamformee *u* for subcarrier *k* in RU *r* shall be com-pressed in the form of angles using the method described in 19.3.12.3.6 (Compressed beamforming feed-back matrix). The angles, *(k,u)* and *(k,u)*, are quantized according to Table 9-68 (Quantization of angles). The number of bits for quantization, tone grouping factor, and the number of columns in the HE compressed beamforming feedback are set by the HE beamformer if the HE NDP Announcement frame contains more than one STA Info field. The number of bits for quantization, tone grouping factor, and the number of columns in the HE compressed beamforming feedback are determined by the beamformee only if the HE NDP Announcement frame contains a single STA Info field. The compressed beamforming feedback matrix as defined in 19.3.12.3.6 (Compressed beamforming feedback matrix) is the only Clause 28 (High Effi-ciency (HE) PHY specification) beamforming feedback matrix defined.