IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR of DL MU procedure | | | | | | Date: 2017-08-24 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | Email | | Zhou Lan | Broadcom Ltd. | 190 Mathilda Pl, Sunnyvale, CA 94086 | (+1) 408 543 3450 | [zhou.lan@broadcom.com](mailto:zhou.lan@broadcom.com) | | Chunyu Hu | Broadcom Ltd. | 190 Mathilda Pl, Sunnyvale, CA 94086 |  | [chunyu.hu@broadcom.com](mailto:chunyu.hu@broadcom.com) | | Matthew Fischer | Broadcom Ltd. | 190 Mathilda Pl, Sunnyvale, CA 94086 |  | [matthew.fischer@broadcom.com](mailto:matthew.fischer@broadcom.com) | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

Comment resolution with proposed changes to TGax D1.4 for CIDs from the WG LB for TGax related to DL MU procedure.

The CID list is:

3223, 3224, 4797, 4798, 4799, 4801, 4802, 4803, 4804, 5179, 5180, 5181, 5182, 5698, 5699, 5700, 5701, 5780, 5808, 5943, 5944, 5945, 5980, 5981, 5982, 6099, 6163, 6164, 6165, 7089, 7226, 7385, 7571, 7572, 7642, 7643, ~~7647~~, 7688, 7689, 7807, 7808, 8053, 8167, 8168, 8217, 8255, 8270, 8294, 8495, 8496, 8497, 8593, 8696, 8697, 8698, 8699, 9290, 9398, 9454, 9457, 9466, 9467, 9468, 9526, 9587, 9704, 9705, 9706, 9889, 9890, 9891, 9892, 9893, 10316

The proposed changes on this document are based on TGax Draft 1.4.

**REVISION NOTES:**

R0: Initial draft with comments from group.

R1: Reflected comments from Alfred. CID 4802, 4803 and 7089 resolved with Kiseon, Abhishek Patil. RED color coding shows changes against R0.

**END OF REVISION NOTES**

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.***

**CIDs**

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| 3223 | Ahmadreza Hedayat | 163.03 | 27.5.1.2 | It'd be worthwhile to clarify the restrictions on group-addressed MPDUs across RUs; e.g. only one RU can carry MPDUs with broadcast address, and at most one RU for a given group-address ID etc. "The Type and Subtype subfields in the Frame Control field and address type (individually addressed or group addressed) of MPDUs may be different across A-MPDUs in different RUs within a same HE MU PPDU." | As in the comment | Rejected-  Having multiple broadcast RUs complicates the implementation of the receiver to support simultaneous data receiption from multiple. So the group decided to have such restriction. There is no obligation for the spec to explain the reationale of the design. The current text already provides sufficient clarity for implementation.  TGax editor makes no changes to the current spec. |
| 3224 | Ahmadreza Hedayat | 163.43 | 27.5.1.2 | If a STA gain access via RA and sends BQR then it's an unsolicied BQR and should be gathered in the upper clause P163L26: "... the STA shall follow the rules defined in 27.5.2.6 (UL OFDMA-based random access) to gain access to a random RU and generate the HE trigger-based PPDU when the Trigger frame contains one or more random RU(s)." | As in the comment | Rejected-  Per “If a STA gain access via RA and sends BQR…”, this BQR is still solicited by a BQRP. So it is not an unsolicited BQR.  TGax editor makes no changes to the current spec. |
| 4797 | Alfred Asterjadhi | 162.44 | 27.5.1.1 | This sentence is not clear "An AP shall not transmit to a STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1.". Please clarify what the intention is. | As in comment | Revised-  Agree in principle.DL MU-MIMO is not supported with DL OFDMA unless the STA claims it is capable of doing it. The first part of sentence may describe the case of full bandwidth DL MU MIMO operation. The last paragraph of this section already conveyed the intended information. Prpose to delete this sentence.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4797. |
| 4798 | Alfred Asterjadhi | 162.49 | 27.5.1.1 | It is not the transmission that is padded but the PSDU in each RU. PLease rephrase. | As in commnet. | Accepted-  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4798 |
| 4799 | Alfred Asterjadhi | 162.56 | 27.5.1.1 | Unicast is not defined. Define it prior to its use. | As in comment. | Revised-  Agree in principle. In the baseline spec, unicast address is defined. Propose to change to “RA set to unicast address”.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4799. |
| 4801 | Alfred Asterjadhi | 163.13 | 27.5.1.2 | This is not enough. It has to be clear what the MPDU that is sent in the broadcast RU contains. E.g., can it be a broadcast MPDU that was sent in legacy PPDU? If yes then what is the STA receiving both expected to do? | As in comment. | Revised-  The sentence is confusing. A broadcast RU is not part of a HE MU PPDU. We propose to improve the clarity of the sentence. An legacy PPDU will not be able to use an broadcast RU unless the broadcast RU is taking the full bandwidth of the PPDU. In such case, it falls back to the legacy PPDU behaviour that is described in the baseline.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4801. |
| 4802 | Alfred Asterjadhi | 163.37 | 27.5.1.3 | It seems BQR Trigger frame is not allowed in the A-MPDU content (See 9.7.3). I don't think it is the case. Please amend to fix the inconsistency. | As in comment. | Rejected-  The purpose of BQR is for AP to learn the channel availability of the STAs to help the following DL or UL data transmission. Aggregating BQR with data doesn’t provide benefits while complicating the implementation.  TGax editor makes no changes on CID 4802. |
| 4803 | Alfred Asterjadhi | 163.36 | 27.5.1.3 | This is a weird way to say that reception of the BQR Trigger frames is optional. Find a less weird way to say the same. | As in comment. | Revised-  Agree in principle.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4803 |
| 4804 | Alfred Asterjadhi | 163.46 | 27.5.1.3 | QoS Data cannot be added because the BQR variant Trigger frame does not have TID AGG limit and MU Minimum Start Spacing indications, etc. Please remove QoS Data from the sentence. Also no need to indicate that "when the AP has indicated its support in the A-BQR Support... because the AP sends the BQR variant Trigger frame only if it supports Rx of the info. | As in comment. | Revised-  Agree in principle  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 4804. |
| 5179 | Dorothy Stanley | 162.45 | 27.5.1.1 | Regarding "Downlink MU-MIMO On Partial Bandwidth Rx", Figure 9-589cl and Table 9-262aa have "DL MUMIMO On Partial Bandwidth" | make field naming consistent | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5179 |
| 5180 | Dorothy Stanley | 162.45 | 27.5.1.1 | Regarding "An AP shall not transmit to a STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1.", what is the intent of not allowing DL MU-MIMO w/ HE MU PPDU if the STAs only support full bandwidth? Is the intent to use VHT PPDU? I would think in the future when all the devices are HE, we would not want a mix of VHT and HE PPDU's | Allow DL MU-MIMO with HE MU PPDU to HE STAs that do not support partial bandwidth. | Revised-  Agree in principle.  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5180 |
| 5181 | Dorothy Stanley | 162.56 | 27.5.1.1 | I can't find a definition for "DL OFDMA With MIMO PPDU". I can't find an HE Capabilities element with "DL OFDMA With MIMO Support" field. | Define the terms so the paragraph makes sense. | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5181. |
| 5182 | Dorothy Stanley | 163.40 | 27.5.1.3 | Regarding "The STA that receives a BQRP variant Trigger frame shall follow the rules defined in 27.5.2.3 (STA behavior) to generate the HE trigger-based PPDU when the Trigger frame contains the STA's AID in any of the Per User Info fields; otherwise the STA shall follow the rules defined in 27.5.2.6 (UL OFDMA-based random access) to gain access to a random RU and generate the HE trigger-based PPDU when the Trigger frame contains one or more random RU(s)", isn't clear.  What part of 27.5.2.3 would allow a STA to NOT generate the HE trigger-based PPDU? And in this case, does the "otherwise the STA shall" make UL OFDMA-based random access mandatory? Because my interpretation of 27.5.2.6 is that it is optional.  Need to make sure that there is no confustion that UL OFDMA-based random access is optional | as in comment | Revised-  Agree in principle. A non-AP STA can use UL OFDMA-based random access only if it claims the capability (i.e. set OFDMA RA Supports bit in HE MAC Capabilites to 1). Proposes to add a qualifier in the sentence to clarify.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5182. |
| 5698 | Guoqing Li | 162.53 | 27.5.1.1 | The reference to HE MU PPDU should not be the padding section for trigger-based PPDU, it should refer to the DL MU PPDU padding section | Correct the reference | Revised-  Agree in principle.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5698. |
| 5699 | Guoqing Li | 162.45 | 27.5.1.1 | Do line 44-47 and line 56-59 say the same thing? | Clarify | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5699. |
| 5700 | Guoqing Li | 162.56 | 27.5.1.1 | There is terminology called "DL OFDMA with MIMO PPDU" | Use a difined terminology | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5700. |
| 5701 | Guoqing Li | 162.58 | 27.5.1.1 | There is no field called "DL OFDMA With MIMO Support field" in HE Capabilities Element | Use a defined terminology or define it. | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5701. |
| 5780 | Hanseul Hong | 162.58 | 27.5.1.1 | DL OFDMA with MIMO Support field is not present in HE capabilites element | add it in HE capabilities element | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5780. |
| 5808 | Huizhao Wang | 163.43 | 27.5.1.3 | If a STA canot find its STA-ID in BQRP trigger frame, then this BQRP is not intended to it, and should not respond | Remove the text: "otherwise the STA shall follow the rules defined in 27.5.2.6 (UL OFDMA-based random access) to gain access to a random RU and generate the HE trigger-based PPDU when the Trigger frame contains one or more random RU(s)." | Rejected-  In the case that AP has no knowledge of which non-AP has clear channel for receiption. It is a smart way for AP to collect such information through OFDMA ramdom access. There is no technical justification to forbit this usage.  TGax editor makes no changes on CID 5808. |
| 5943 | James Yee | 163.27 | 27.5.1.3 | The spec says "A non-AP STA reports its channel availability information (unsolicited BQR) to the AP to which it is associated using the BQR A-Control field of frames it transmits as defined below...". It is not clear what is the definition of "a channel is available". For example, does it requires CCA idle during an interval of PIFS immediately in prior? | Please clarify. | Revised-  Agree in principle. Propose to add reference pointing to section 28.3.17.6.5.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 5943. |
| 5944 | James Yee | 163.46 | 27.5.1.3 | The spec says "The STA shall include in the HE trigger-based PPDU one or more QoS Null or QoS Data frames containing the BQR A-Control field with the channel availability information...". It is not clear what is the definition of "a channel is available" in this context. | Suggest to generate the response according to inter-NAV. | Rejected-  The NAV checking rules are already defined in 27.5.2.4 UL MU CS mechanism.  TGax editor makes no changes on CID 5944. |
| 5945 | James Yee | 163.46 | 27.5.1.3 | The spec says "The STA shall include in the HE trigger-based PPDU one or more QoS Null or QoS Data frames containing the BQR A-Control field with the channel availability information of the STA ...". It should also mention if the BQR A-Control field shall be the same or what happens if they are not exactly the same (e.g. the last BQR A-Control recevied shall be used). | As suggested | Rejected-  The restriction is already specified in section 10.9. No need to repeat the same information. |
| 5980 | Jarkko Kneckt | 163.43 | 27.5.1.3 | It is unclear whether BQRP Trigger variant that allocates RUs for random access requires that a HE trigger-based PPDU transmitted in the RU for random access contains a BQR information in the A-Control field. | Please clarify is a STA that detects RUs for random access required to transmit BQR reports in a Trigger-based PPDU in a RU allocated for random access. Please clarify is the same requirement used for other Trigger variants as well? | Rejected-  A STA who detects RU that is allocated for OFDMA random access in BQRP Trigger variant doesn’t have to use OFDMA random access if it has been named in other RUs.  TGax editor makes no changes on CID 5980. |
| 5981 | Jarkko Kneckt | 163.43 | 27.5.1.3 | The non-AP STA should not be forced to perform random access. The use of random access for the BQR transmission should be voluntary for the STAs. If all STAs are required to transmit BQR in random access when a Trigger contains random access RUs, the power consumption of hte STA increases unnecessarily and transmisison overhead in random access becomes high. | The non-AP STAs transmission in the RUs allocated for random access should be optional. Change the wording to say that if RUs for random access are included a non-AP STA may respond... | Revised-  Agree in principle. Per resolution of CID 5182, add qualifier to regulate when a STA can use OFDMA random access to report the BQR.  TGax editor makes no changes on CID 5981. |
| 5982 | Jarkko Kneckt | 163.47 | 27.5.1.3 | The BQR support in AP and STA is already described in lines 35 -39. The second bullet has a lot of repetition. | delete the end of hte sentence. Delete:"when the AP has indicated...". | Rejected-  BQR is optional function for AP and STA, it is necessary to have these sentence to clarify the condition that BQR can be used.  TGax makes no changes on CID 5982. |
| 6099 | Jian Yu | 162.56 | 27.5.1.1 | DL OFDMA with MIMO PPDU is not clear. DL OFDMA with MIMO support field is not shown in the HE Capabilities element. There is only DL MUMIMO On Partial Bandwidth field | Modify the paragraph accordingly | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 6099. |
| 6163 | Jinjing Jiang | 163.19 | 27.5.1.3 | It is confusing to see "HE bandwidth query report opertion for DL MU" belongs to the DL MU operation. It should be similar to buffer status report operation, residing in the UL MU operation | As in the comments; please clarify | Revised-  Agree in principle. Propose to move the whole section from 27.5.1 HE DL MU operation to under 27.5 and make the title general to UL and DL MU operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 6163. |
| 6164 | Jinjing Jiang | 163.35 | 27.5.1.3 | The paragraph from line 35 to 50 should be rewritten to reflect that if an HE AP solicits the BQR report, the STA shall include in the HE trigger-baseed PPUD blabla...Current texts seems mandating the BAR A-Control fields in HE trigger-based PPDU even not being queried by the AP | As in the commnets | Revised-  Agree in principle. Propose to move the whole section from 27.5.1 HE DL MU operation to under 27.5 and make the title general to UL and DL MU operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 6164. |
| 6165 | Jinjing Jiang | 163.03 | 27.5.1.2 | Here HE MU PPDU payload seems only describing the DL version, how about the UL one | Add "DL" in front of the subsection title | Revised-  Agree in principle. Propose to move the whole section from 27.5.1 HE DL MU operation to under 27.5 and make the title general to UL and DL MU operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 6165. |
| 7089 | Junichi Iwatani | 163.11 | 27.5.1.2 | There is no definition for "broadcast RU" | Define or explain | Revised-  Adding definition of broadcast RU in section 3.2.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7089. |
| 7226 | Katsuo Yunoki | 162.36 | 27.5.1 | STA behavior after receiving MU DL PPDU should be explained. (e.g. how to respond ACK, Block ACK) | STA behavior after receiving MU DL PPDU should be explained. (e.g. how to respond ACK, Block ACK) | Rejected-  The ACK/BA procedure for the DL MU is defined in section 27.4. There is no need to repeat same information in two places of the spec. |
| 7385 | Laurent Cariou | 163.17 | 27.5.1.3 | It is not mentioned on which bandwidth the report is provided, while the bitmap depends on the bandwidth | Clarify | Rejected-  It is already defined in section 9.2.4.6.4.7.  TGax editor makes no changes on CID 7385. |
| 7571 | Liwen Chu | 163.16 | 27.5.1.3 | The channel query can be used by both UL and DL MU. Move the subclause outside of DL MU subclause and change the title accordingly. | As in comment | Revised-  Per proposed resolution for CID 6165, move 27.5.1.3 to 27.5.6 making it general to both UL and DL operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7571. |
| 7572 | Liwen Chu | 163.46 | 27.5.1.3 | Add management frame after QoS Null, QoS Data frames | As in comment | revised-  Agree in principle. Not management frame but rather Action No Ack frame. There is a table that we call out explicitly for these types. See suggestion  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7572. |
| ~~7647~~ | ~~Liwen Chu~~ | ~~162.36~~ | ~~27.5.1~~ | ~~The rules about when the DL MU frame exchange is successful is missing from the draft.~~ | ~~Add the related rules.~~ |  |
| 10316 | Zhou Lan | 163.16 | 27.5.1.3 | BQR now is in the section of DL MU operation. However it should be useful for the AP to make right decision on UL MU scheduling as well | Extend BQR to UL MU operation | Revised-  Per proposed resolution for CID 6165, move 27.5.1.3 to 27.5.6 making it general to both UL and DL operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 10316. |
| 7642 | Liwen Chu | 162.52 | 27.5.1.1 | A-MPDU in HE DL MU PPDU doesn't use the rules in 27.10.3. Padding rules for A-MPDU in VHT PPDU is used. | As in comment | Revised-  Agree in principle. Change reference to 27.10.2.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7642. |
| 7643 | Liwen Chu | 162.56 | 27.5.1.1 | Paragraph at L56 is duplicated with the paragraph at L44. | Remove the paragraph at L44 | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7643. |
| 7688 | Lochan Verma | 162.46 | 27.5.1.1 | Downlink MU-MIMO on Partial Bandwidth Rx' is no HE Capability | Replace with ""An AP shall not transmit to a STA an HE MU PPDU with HE-SIG-B assigning MU-MIMO RU in an DL OFDMA PPDU when the RU does not span the entire PPDU bandwidth, to a STA from which it has not received an HE Capabilities element with DL MU-MIMO on Partial Bandwidth subfield set to 1". " | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7688. |
| 7689 | Lochan Verma | 162.56 | 27.5.1.1 | DL OFDMA With MIMO Support is no capability in HE capabilities | Delete lines 56-59. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7689. |
| 7807 | Mark Hamilton | 163.19 | 27.5.1.3 | Use proper normative verbs | Change "delivers" to "shall deliver" | Accepted-  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7807. |
| 7808 | Mark Hamilton | 163.21 | 27.5.1.3 | Use proper normative verbs | Change "can" to "may". Same thing at P163L35, P164L47, P167L2, P171L12, P171L52, P174L36. | Accepted-  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 7808. |
| 8053 | Massinissa Lalam | 162.58 | 27.5.1.1 | There is no "DL OFDMA With MIMO Support" field defined in the HE Capabilities element subclause 9.4.2.218. Either add this field if missing or refer to the correct one(s). So far the intent of the sentence is not really clear for me to decide to which already existing fields of the HE Capabilities element to refer. Does the sentence refer to a DL OFDMA transmission plus DL MU-MIMO on some RUs, or just DL OFDMA with more than one spatial streams on some RUs? | As in comment. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 8053. |
| 8167 | Ming Gan | 163.23 | 27.5.1.3 | "explicitly deliver BQRs in any frame sent to the AP", what is "any frame". It is not clear. Actually it requires this frame contains A-control field. | change "any frame" to "any frame which contains A-Control field" | Rejected-  There is no need to put redunt info in the spec. The only way for a STA to report BQR is through BQR A-control.  TGax editor makes no changes on CID 8167. |
| 8168 | Ming Gan | 163.21 | 27.5.1.3 | "implicititly" and "explicitly" seem redudant. Non-AP STA always carries available channle bitmap in the A-Control field in these two modes | delete "implicititly" and "explicitly" | Rejected-  It is necessary to differentiate these two usage cases of BQR.  TGax editor makes no changes on CID 8168. |
| 8217 | Osama Aboulmagd | 163.20 | 27.5.1.3 | what does "efficient way" mean? How the word "efficient" is defined? | delete the fisrt sentence or qualify the word "efficient" | Rejected-  BQR provides AP the per 20MHz channel availability information so that AP doesn’t make blind scheduling decision to send DL MU PPDU to STAs that doesn’t have corresponding channels availale. Deleting the sentence will only blur people’s understanding of the mechanism.  TGax editor makes no change on CID 8217. |
| 8255 | Pascal VIGER | 163.17 | 27.5.1.3 | Buffer Query Report following MU-RTS procedure may be inefficient. As MU-RTS scheme relies on 802.11ac (contiguous band) and BQR supports punctured band among a whole similar BW, there is chance that HE STAs indicate in their BQR some 20 MHz channels that are not protected by MU-RTS/CTS. The usage of not protected channels may be problematic for legacy devices. | The MU-RTS variant may be enhanced to support emission of CTS frames along a punctured bandwidth. A HE STA already has the possibility to sense various 20MHz channels, determine those free, and emit on a specific (sub-)channel (according BQR capability). During its MU-RTS/CTS scheme, the HE AP may inform HE STAs which are BQR-capable (through a single bit in MU-RTS TF) that it is ready to receive CTS on non-contiguous channels | Rejected-  MU-RTS/CTS frame exchange needs to be in legacy format for legacy protection. It is almost not impossible to amend on legacy CTS frame for per 20MHz channel availability information.  TGax editor makes no changers on CID 8255. |
| 8270 | Pascal VIGER | 163.13 | 27.5.1.2 | Following sentence is unclear : "An MPDU sent in a broadcast RU of an HE MU PPDU shall not include information intended for a STA that is identified as the recipient of another RU in the same HE MU PPDU." This lets think a broadcast RU is not destined to any station. Isn't it a unicast RU instead ? | as per comment | Rejected-  It is designed that 11ax receiver has no capability of simultaneous decoding of multiple RUs. So if the a RU is intended for a particular user, then no other MPDU should be addressing to that user in the MPDU/A-MPDU in the broadcast RU.  TGax editor makes no changes on CID 8270. |
| 8294 | Patrice Nezou | 163.13 | 27.5.1.2 | "An MPDU sent in a broadcast RU of an HE MU PPDU shall not include information intended for a STA that is identified as the recipient of another RU in the same HE MU PPDU." Does it mean that broadcasted RU can not be mixed with any other types of RU ? | as per comment | Rejected-  Duplicated CID of CID 8270. |
| 8495 | Robert Stacey | 162.56 | 27.5.1.1 | DL OFDMA With MIMO PPDU is not defined. There is no such thing as a DL OFDMA With MIMO Support field. The capability that most closely resembles this is the DL MU-MIMO On Partial Bandwidth field. | Describe in terms of TXVECTOR parameters. | Revised-  Agree in principle. There is no definition of DL OFDMA with MIMO PPDU. DL OFDMA with MIMO is a feature defined in Table 9-262aa.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 8495. |
| 8496 | Robert Stacey | 163.03 | 27.5.1.2 | "The Type and Subtype subfields ... may be different... ": Meaningless statement. | Remove statement | Rejected-  The sentence helps to clarify the Type and Subtype settings of MPDUs transmitted in different RU of the same HE MU PPDU  TGax editor makes no changes on CID 8496. |
| 8497 | Robert Stacey | 163.08 | 27.5.1.2 | "Two STA-ID fields in HE-SIG\_B..." We hide the PHY details behind the PHY service interface so this statement should be made in terms of the TXVECTOR parameter STA\_ID\_LIST. Since STA\_ID\_LIST has a subclause of its own (27.11.1) might as well do it there. | Define in terms of TXVECTOR parameters: "An AID shall appear only once in the TXVECTOR parameter array STA\_ID\_LIST." A statement regarding the 2046 entry can be made in the PHY clause itself. The TXVECTOR just needs to identify the used resources. HE-SIG-B is then built (in the PHY) using this infomation and "2046" entries added as needed. | Revised-  Agree in principle. Propose to modify the following sentence for consistency.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 8697. |
| 8593 | Sheng Sun | 163.27 | 27.5.1.3 | what does "channel availability" mean? | clarify | Rejected-  Kindly refer to section 9.2.4.6.4.7 Bandwidth Query Report (BQR) Control for the per 20MHz CCA info.  TGax editor makes no changes on CID 8593. |
| 8696 | Sigurd Schelstraete | 162.49 | 27.5.1.1 | "The transmission of each RU in an HE MU PPDU shall be padded to end at the same time". This requirement is already covered by the various decriptions of PHY and MAC padding. Since there is no further information on how to implement the padding here, it is better to change this to an informative statement. | Change to "The transmission of each RU in an HE MU PPDU are padded to end at the same time" | Rejected-  Padding is a mandatory behavior for DL MU operation. The current sentence provides just sufficient information.  TGax editor makes no changes on CID 8696. |
| 8697 | Sigurd Schelstraete | 162.58 | 27.5.1.1 | There is no "DL OFDMA With MIMO Support field" in HE Capabilities. Should this be "DL MUMIMO On Partial Bandwidth" field? | Clarify | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 8697. |
| 8699 | Sigurd Schelstraete | 163.20 | 27.5.1.3 | "allocating DL MU and UL MU resources". Section 27.5.1.3 is called "HE bandwidth query report operation for DL MU". Should the title be changed or should UL MU resources be deleted? | Clarify | Revised-  Per CID 6165, move 27.5.1.3 to 27.5.6.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 8699. |
| 9290 | Tomoko Adachi | 161.58 | 27.5.1.1 | There is no DL OFDMA With MIMO Support field defined. It should be DL MU-MIMO on Partial BW field. | Change "... with the DL OFDMA With MIMO Support field set to 1." to "... with the DL MU-MIMO Partial BW field set to 1." | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9290. |
| 9398 | Woojin Ahn | 163.49 | 27.5.1.3 | The HE STA shall not solicit an immediate response for the frames carried in the trigger-based PPDU (e.g., by setting the Ack Policy subfield of the frame to Normal Ack or Implicit BAR). --> MPDUs transmitted in HE TB PPDU shall not set Ack type subfield to BlockAck either. Only No Ack is possible in this case. | The HE STA shall set the Ack Policy subfield of the frames carried in the trigger-based PPDU to No Ack | Rejected-  The HE STA may want to know if the transmitted HE TB is correctly received in order to avoid retransmission of the BQR.  TGax editor makes no changes on CID 9398. |
| 9454 | Xiaofei Wang | 162.56 | 27.5.1.1 | There is no definition of "UL OFDMA with MIMO PPDU" | Either define "UL OFDMA with MIMO PPDU" or use other defined terminology | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9454. |
| 9457 | Xiaofei Wang | 162.44 | 27.5.1 | There are two occurrence of "STA" in this sentence, it is unclear to which "the STA" is referring. Please rephrase and clarify. | Change the sentence "An AP shall not transmit to a STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1." into "Unless a STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1, an AP shall not transmit to that STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA." | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9457. |
| 9466 | xun yang | 163.20 | 27.5.1.3 | "A non-AP STA with A-BQR Support subfield of its HE Capabilities element equal to 1 delivers bandwidth query reports (BQRs) to assist the AP in allocating DL MU and UL MU resources in an efficient way." But this sentence is under the subclause of "HE bandwidth query report operation for DL MU". Then it is confusing that BQR is only for DL MU or it can be used for both DL MU and UL MU. | Please clarify. | Revised-  Per proposed resolution for CID 6165, move 27.5.1.3 to 27.5.6 making it general to both UL and DL operation.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9466. |
| 9467 | xun yang | 163.20 | 27.5.1.3 | "A non-AP STA with A-BQR Support subfield of its HE Capabilities element equal to 1 delivers bandwidth query reports (BQRs) to assist the AP in allocating DL MU and UL MU resources in an efficient way." "Asist" here is not clear. How does BQR information "asist" AP allocate the MU resources? | Please clarify. | Rejected-  The commentor asked for clarification of “asist”. Once the AP received the channel availability information from STAs, it is up to the AP to utilize the information. So “asist” here is really implementation dependent. Implementation details should not be present in the spec text.  TGax editor makes no changes on CID 9467. |
| 9468 | xun yang | 163.35 | 27.5.1.3 | Can AP solicit BQR more than one time by sending BQRP variant trigger frame? Consider the case that the availabe channels at the triggered STAs are few or the primary 20MHz is not available at all the triggered STAs, is it allowed that AP sending trigger to other STAs to know channel availability of them? | Please clarify. | Rejected-  It is really an implementation choice as described by the commentor. The current spec text already allows such usage.  TGax editor makes no changes on CID 9468. |
| 9526 | Yasuhiko Inoue | 162.56 | 27.5.1.1 | There is no field named "DL OFDMA With MIMO Support" in HE Capabilities. | Assign one reserved bit in the HE PHY Capabilities Information field of HE Capabilities element to indicate this capability. | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9526. |
| 9587 | Yongho Kim | 163.26 | 27.5.1.3 | If a non-AP STA has no capabilities on some channels, what value need to be set? And, If a non-AP STA's channel bandwidth is regulated by OMI procedure, what value need to be set? | Define it. | Rejected-  How to obtain the channel availability information is defined already in section 28.3.17.6.5 and referred in this section. If the STA is not capable of determining the interference level with 90% probability, then the bit will be set to 0.  TGax editor makes no changes on CID 9587. |
| 9704 | Yongho Seok | 162.45 | 27.5.1.1 | "An AP shall not transmit to a STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1." The Downlink MU-MIMO On Partial Bandwidth Rx subfield is not defined in the HE Capabilities element. Probably, DL MU-MIMO on Partial BW subfield should be used. | As per commnet. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9704. |
| 9705 | Yongho Seok | 162.44 | 27.5.1.1 | "An AP shall not transmit to a STA an HE MU PPDU with the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1." Even though a STA does not support a reception of the DL MU-MIMO on a partial bandwidth, it can receive the DL MU-MIMO PPDU having the HE-SIG-B that allocates multiple spatial streams from a full bandwidth. Change it as the following: "An AP shall not transmit to a STA an HE MU PPDU with the TXVECTOR parameter SIG\_B\_COMPRESSION\_MODE set to 1 and the HE-SIG-B allocating spatial streams to more than one recipient STA, unless the STA sets the DL MU-MIMO On Partial Bandwidth subfield of the HE Capabilities element to 1." | As per comment. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9705. |
| 9706 | Yongho Seok | 162.57 | 27.5.1.1 | "A STA shall not transmit a DL OFDMA With MIMO PPDU that contains a unicast RA that corresponds to a STA from which it has not received an HE Capabilities element with the DL OFDMA With MIMO Support field set to 1." What does "DL OFDMA With MIMO Support" field mean? It is not defined in the HE Capabilities element. Delete the corresponding paragraph. | As per comment. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9706. |
| 9889 | Young Hoon Kwon | 162.44 | 27.5.1.1 | What does "allocating spatial streams to more than one recipient STA" mean? Poor description, and needs rewriting. | As in the comment. | Revised-  Agree in principle. Per proposed resolution of CID 4804, this sentence will be removed.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9889. |
| 9890 | Young Hoon Kwon | 162.53 | 27.5.1.1 | This sub-clause is for HE DL MU operation, however, the padding procedure shown in 27.10.3 is for HE UL MU operation. Therefore, the padding procedure mentioned here is irrelevent. Need further clarification. | As in the comment. | Revised-  Agree in principle. Change to the correct reference for padding.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9890. |
| 9891 | Young Hoon Kwon | 162.57 | 27.5.1.1 | DL OFDMA With MIMO Support field is not defined in HE Capabilities element. Need definition for it. | As in the comment. | Revised-  Agree in principle. The right HE Capabilities bit should be refered. Per proposed resolution of CID 4804, this sentence will be removed. The corresponding sentence in 56 to 59 is modified correspondingly.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9891. |
| 9892 | Young Hoon Kwon | 163.29 | 27.5.1.3 | It is not clear how to obtain the channel availability information for each 20MHz, especially for unsolicited BQR case. For example, how to measure and when to measure the channel availability for each 20MHz is not clear. It needs further clarification. | As in the comment. | Rejected-  Please refer to section 9.2.4.6.4.7 and 28.3.17.6.5 for further details. All these information has been defined.  TGax editor makes no changes on CID 9892. |
| 9893 | Young Hoon Kwon | 163.43 | 27.5.1.3 | When a STA receives a BQRP variant Trigger frame which does not schedule an RU for the STA, it is not clear if the STA shall participate random access or not. Need further clarification. | As in the comment. | Revised-  A STA only needs to send BQR when it has indicates its capabilities in HE Capabilies.  TGax editor makes changes as shown in 11-17/1286r1 that are marked with CID 9893. |
|  |  |  |  |  |  |  |

**Discussion:**

Clarifying the language as suggested.

**Proposed Changes to Draft Text of TGax D1.4:**

TGax editor: change section 3.2 as follows

**3.2 Definitions specific to IEEE 802.11**

…

**resource unit (RU):** a group of 26, 52, 106, 242, 484, 996 or 2x996 subcarriers as an allocation unit.

**broadcast RU:** a resource unit (RU) within an HE MU PPDU identified by the STA-ID value 0, 2045 and by the STAID values 2045, 2047 and 0 to n-1 when the AP transmits a Multiple BSSID element and n is equal to the number of BSSs advertised by the AP in the Multiple BSSID element (#7089)

…

TGax editor: change section 27.5.1.1 as follows

**27.5.1.1 General**

HE DL MU operation allows an AP to transmit simultaneously to one or more non-AP STAs in DL OFDMA, DL MU-MIMO or both.

~~An AP shall not transmit to a STA an HE MU PPDU with an HE-SIG-B field(#6656) allocating spatial streams to more than one recipient STA, unless the STA sets the Downlink MU-MIMO On Partial Bandwidth Rx subfield of the HE Capabilities element to 1.~~ (#CID 4797, 5179 5180, 5181, 5699, 5700, 5701, 5780, 6099, 7643, 7688, 7689, 9891, 9889, 8053, 8697, 9290, 9454, 9457, 9704, 9705, 9706)

The ~~transmission~~ PSDU (#CID 4798) on(#6162) each RU in an HE MU PPDU shall be padded to end at the same time, indicated by the L-SIG field as described in 28.3.10.5 (L-SIG).

The padding procedure for each A-MPDU in an HE MU PPDU is defined in 27.10.2 (A-MPDU padding for an HE SU PPDU, HE ER SU PPDU and HE MU PPDU) ~~27.10.3 (A-MPDU padding for an HE TB PPDU)~~. (# CID 7642, 9890, 5698)

A STA shall not transmit a ~~DL OFDMA with MIMO PPDU~~ HE MU PPDU of DL MU MIMO with OFDMA allocated in a RU that is addressed to a STA, (#8495 4799) ~~that contains a unicast RA that corresponds to a STA from which it has not~~ unless the AP has received an HE Capabilities element with the Partial Bandwidth DL MU-MIMO subfield in the HE PHY Capabilities Information field(#7088) (#CID 7688, 7689, 9891).set to 1 by the STA.

TGax editor: change section 27.5.1.2 as follows.

**27.5.1.2 RU addressing in an HE MU PPDU(#1581)**

The Type and Subtype subfields in the Frame Control field and address type (individually addressed or group addressed) of MPDUs may be different across A-MPDUs in different RUs within the(#6657) same HE MU PPDU.

An AP shall ~~may include one or more STA-ID field(s) in the HE-SIG-B field~~ set one or more elements in the TXVECTOR parameter STA\_ID\_LIST which represents the list of STAs that are the receipients (#CID 8497) of ~~a~~ the transmitted HE MU PPDU as described in 27.11.1 (STA\_ID\_LIST).(#4800) ~~Two STA-ID fields in HE-SIG-B shall not have the same value, unless the value is 2046, which is used to indicate an unallocated RU.~~ STA-ID elements that have the same value shall not appear more than once in the TXVECTOR parameter STA\_ID\_LIST except for the STA-ID element with value 2046, which identifies an unallocated RU. (#CID 8497) If an AP sets ~~one of the STA-ID fields(#6658) in the HE-SIG-B field~~ ~~field~~ an element of the TXVECTOR parameter STA\_ID\_LIST (#CID 8497) to match the 11 LSBs of the AID of a non-AP STA, then the non-AP STA may disregard any broadcast RU in the same HE MU PPDU.

An MPDU of an HE MU PPDU sent in a broadcast RU ~~of an HE MU PPDU~~ (#CID 4801) shall not include information intended for a STA that is identified as the recipient of another RU in the same HE MU PPDU.

TGax editor: Move section 27.5.1.3 to 27.5.6 and change the content as follows.

**~~27.5.1.3~~ 27.5.6 (#CID 6165, 7151, 10316, 9466)HE bandwidth query report operation for MU(#3158, #5127)**

A STA may send bandwidth query reports (BQRs) when the peer STA has indicated support by setting the BQR Support field in the HE Capabilities element it transmits to 1; otherwise the STA shall not send BQRs to the peer STA.

An AP may solicit BQRs from a non-AP STA with a BQRP Trigger frame if the non-AP STA has indicated support by setting the BQRP Support field in the HE Capabilities eement it transmits to 1; otherwise the AP shall not solicit BQRs from the non-AP STA. (#CID 5182, 5981, 9893)

~~A non-AP~~ A STA ~~with BQR Support subfield(#4727) of its HE Capabilities element equal to 1 delivers~~ may send bandwidth query reports (BQRs) to the AP to assist ~~the AP in allocating~~ DL MU and UL MU resources allocation in an efficient way. The non-AP STA ~~can~~ may (#CID 7807, 7808) either implicitly deliver BQRs in the BQR Control field(#4727) of a frame transmitted to the AP (unsolicited BQR) or explicitly deliver BQRs in any frame sent to the AP in response to a BQRP Trigger frame(#8485) (solicited BQR). (#CID 4803)

A non-AP STA reports its channel availability information (unsolicited BQR) to the AP to which it is associated using the BQR Control field(#4727) of frames it transmits as defined below:

* The HE STA may report the channel availability information as specified in section 28.3.17.6.5 (#CID 5943) in the BQR Control field(#4727) of frames it transmits if the AP has indicated its support in the BQR Support subfield(#4727) of its HE Capabilities element; otherwise the STA shall not report the channel availability information in the BQR Control field(#4727).

A HE AP ~~can~~ may (#CID 7807, 7808) solicit one or more non-AP HE STAs(#6256) that support generating BQRs, ~~with BQR Support subfield(#4727) of its HE Capabilities element equal to 1~~ (#CID 4803) ~~for their BQR(s)~~ by sending a BQRP Trigger frame(#8485) (see 9.3.1.23 (Trigger frame format)). ~~The~~ A non-AP STA that suppors generating BQR ~~with BQR Support subfield(#4727) of its HE Capabilities element equal to 1~~ responds (solicited BQR) as defined below:

* The STA that receives a BQRP Trigger frame(#8485) shall follow the rules defined in 27.5.2.3 (STA behavior for UL MU operation(#8151)) to generate the HE TB PPDU when the Trigger frame contains the STA's AID in any of the Per User Info fields; otherwise the STA ~~shall~~ follows the rules defined in 27.5.4 (UL OFDMA-based random access (UORA)) to gain access to a random access RU(17/646r4) and generate the HE TB PPDU when the Trigger frame contains one or more random access RUs(17/646r4).
* The STA shall include in the HE TB PPDU one or more QoS Null ~~or~~, ~~QoS Data~~(#CID 4804) or Action No Ack (#CID 7572) frames containing the BQR Control field(#4727) with the channel availability information of the STA ~~when the AP has indicated its support in the BQR Support subfield(#4727) of its HE Capabilities element.~~ The HE STA shall not solicit an immediate response for the frames carried in the HE TB PPDU (e.g., by setting the Ack Policy subfield of the frame to Normal Ack or Implicit BAR).

**End of proposed changes.**