IEEE P802.11
Wireless LANs

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| Comment Resolutions on UL MU Operation  |
| Date: 2016-09-013 |
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This document resolves the following comments:

34,35,36,~~37,38~~,39,40,42,43,44,170,~~171~~,172,173,174,175,176,432,436,460,591,593,594,676,677,678,698,699,800,815,816,859,860,862,968,977,997,1078,1079,1080,1081,1082,1184,~~1219~~,1438,1519,1522,1530,1531,1534,1538,~~1540~~,1541,1648,1665,1753,1772,1802,1828,1904,1905,1906,1909,1910,1911,1912,2173,2175,2176,2194,2255,2271,2321,2381,2382,~~2449~~,2452,2636,2637,2638,2639,2640,2641,2642,2644,2645,2646,2682,2706,2707

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| **CID** | **Commenter** | **Clause Number(C)** | **Comment** | **Proposed Change** | **Resolution** |
| 34 | Ahmadreza Hedayat | 25.5.2 | "For recipient STAs that are associated with the AP, the per-User Info field is addressed to a recipient STA if the value of the AID subfield of the Per-User Info field is equal to the AID of the STA." This statement should be changed so that the AID(s) that are used for random access are also be included. | Suggestion: "For recipient STAs that are associated with the AP, the per-User Info field is addressed to a recipient STA if the value of the AID subfield of the Per-User Info field is equal to the AID of the STA, or it is equal to the AIDs that is used for identifying availability of resource unit for random access." | Revised. Sentence clarifiedTGax editor to make the changes shown in 11-16/0929r3  |
| 35 | Ahmadreza Hedayat | 25.5.2 | The conditions in this paragrapg can be stated more efficiently. E.g. "An "Trigger Information TBD contained in the MAC Header" of individually addressed MPDUs contained in the PPDU--The following two frames shall not be present at the same time in an A-MPDU--A Trigger frame with a per-User Info field addressed to a STA--an MPDU addressed to the same STA that includes "Trigger Information Field info in MAC header TBD"", can be covered if the begining of this paragraph becomes: "An AP may transmit a PPDU that elicits an HE trigger-based PPDU from one or more UL MU capable STAs by including in the PPDU one of the below but not both:" | As in the comment, remove lines 19-26 and instead change lines 10-11 as follows: "Trigger Information Field info in MAC header TBD"", change the begining of this paragraph as follows: "An AP may transmit a PPDU that elicits an HE trigger-based PPDU from one or more UL MU capable STAs by including in the PPDU one of the below but not both:" | Revised. Sentence has been clarified in doc 16/929r1TGax editor to make the changes shown in 11-16/0929r3 |
| 36 | Ahmadreza Hedayat | 25.5.2 | This statement "An AP shall not set any subfields of the Commin Info field to a value that is not supported by all the recipient STAs of the Trigger frame. An AP shall not set any subfields of a Per User Info field to a value that is not supported by the recipient STAs of the Per User Info field." should also include the case where a STA is triggered by an HEC field with "UL MU response scheduling". | Revise this statement to include the the behavior of a STA that schedules an UL MU transmission via both Trigger frames and HEC field that inculdes UL MU Scheduling info. | Revised. The sentence has been removed since it is unnecessaryTGax editor to make the changes shown in 11-16/0929r3  |
| 37 | Ahmadreza Hedayat | 25.5.2 | When multiple Trigger frames and/or HEC feilds with UL MU response scheduling (Trigger Info) in the MAC header of MPDU(s) are carried within the same PPDU, some of the fields of the Common Info of the Trigger frame(s) and the HEC field should be the same. For instance, the duration of the upcoming trigger-based UL MU should be the same across all Trigger frame(s) and HEC fields with UL MU response scheduling (Trigger Info) in the MAC header of MPDU(s). Similarly, the LTF-type and number and GI duration should be the same across all the control fields that carry Trigger info. | Add the described behavior of the STA that aggregates multiple Trigger frames and/or HEC fields with UL MU response scheduling (Trigger Info) in MAC header of MPDU(s) within the same PPDU. | TGax editor to make the changes shown in 11-16/0929r3 |
| 38 | Ahmadreza Hedayat | 25.5.2 | Other behaviors of a STA that schedules UL MU transmission via HEC field with UL MU response scheduling should be included, such as: (a) in a unicast frame the content of HEC field with UL MU response scheduling across an AMPDU should be the same, (b) within a multicast frame there should not be any HEC field with UL MU response scheduling (since it'd not be clear which of the recepinets of the multicast frame should respond), etc | As in the comment. |  |
| 39 | Ahmadreza Hedayat | 25.5.2 | Regarding "An UL OFDMA MPDU/A-MPDU is the acknowledgement of the Trigger frame. When the AP receives MPDU correctly from at least one STA indicated by trigger frame, the frame exchange initiated by the trigger frame is successful.", it seems this rule does not consider the case where an AP schedules an UL MU transmission for multiple STAs, but the STA(s) that have assignmnets on the Primary 20MHz do not respond, in which case the primary channel could be idle for the duration of the PPDU in which case the medium could be grabbed by otehr OBSS STAs ... | Suggest to consider the case mentioned in this comment, and change this rule so that when at least one STA with RU assignment on the Primary 20MHz channel responds then the UL MU transmission is considered successful. | Reject.In case any of the STAs replies, the exchange is happening and AP should keep receiving the frame. Declaring it a failed exchange has consequences on the definition of other related behavior (e.g. backoff)In the scenario outlined by the commenter, the NAV can be used to protect the primary channel |
| 40 | Ahmadreza Hedayat | 25.5.2 | "The inter frame space between a PPDU that contains a Trigger frame and the triggered HE trigger-based PPDU is SIFS." | "The inter frame space between a PPDU that contains a Trigger frame or contains an HEC field with UL MU Scheduling and the triggered HE trigger-based PPDU is SIFS." | AcceptTGax editor to make the changes shown in 11-16/0929r3 |
| 42 | Ahmadreza Hedayat | 25.5.2 | "If the Trigger Type value of a Trigger frame is not equal to 0, the STA shall include in the response A-MPDU at least one MPDU of the required type. If the STA does not have a frame of the required type, the STA should transmit QoS Null frame." It is not the best outcome if a STA sends QoS Null frame in response to a Trigger frame when the STA does not have the specified type of frame requested in the Trigger frame. This means that the STA potentially has to pad its UL MU frame as well. Instead of requiring the STA to send a QoS Null frame which carries no useful info, it'd be better to give the choice to the STA to send other data/management frames with a minimum control info such as buffer size for a specific TID or all TIDs ... | Change this statement to give the choice to the STA to send other data/management frames with a minimum control info such as buffer size for a specic TID or all TIDs, CQI info etc ... | Reject It is not clear in which case the STA wold not have a frame of the reqired type. BA, Buffer Report, CQI, are all control frames that are ‘always available’. CSI feedback my not be available in NDP was lost, in which case STA shold fill the transmission with some frame. Including e.g. buffer size would be of little use, because this event would happen only in very limited error cases and transmitter cannot design its transmission schedule based on it. So for simplicity it seems appropriate not to define new signaling corner cases and rather just use QoS Null as a filler.If the trigger is of type Basic and may solicit a Data response, and the STA does not have a Data MPDU, then again sending a QoS null is appropriate, |
| 43 | Ahmadreza Hedayat | 25.5.2 | It seems with the same logic CTS should be included in this list: "The response generated by the STA contains an Ack frame or a BlockAck frame and the duration of the HE trigger-based PPDU is less than a TBD value". This is useful when an AP sends data frame to a set of STAs, and an RTS or MU-RTS to another set of STAs. | Revise to "The response generated by the STA contains an Ack frame, a BlockAck frame or it is a CTS frame and the duration of the HE trigger-based PPDU is less than a TBD value". | Reject.A response to MU-RTS is to be sent in legacy PPDU containing a CTS. No other frames canbe aggregated or sent in other RUs/streams |
| 44 | Ahmadreza Hedayat | 25.5.2 | It seems with the same logic CTS should be included in this list: "All HE trigger-based PPDU(s) solicited by the Trigger frame containing ACK/BA and the length of the HE trigger-based PPDU is below a TBD threshold.". This is useful when an AP sends data frame to a set of STAs and solicits ACK/BA in response, and sends RTS or MU-RTS to another set of STAs and solicits CTS in one or more 20MHz sub-channels. | Revise; "All HE trigger-based PPDU(s) solicited by the Trigger frame containing ACK/BA or CTS and the length of the HE trigger-based PPDU is below a TBD threshold." | Reject. Allowing a mix of legacy CTS response and UL Mu PPDU reponse woud be yet another new PHY mode.  |
| 170 | Alfred Asterjadhi | 25.5.2.2.1 | Some clarifications are needed in this itemized list: Clear indication when Trigger frame(s) or UL MU Response Scheduling in the HE variant HT Control fields are present in the DL PPDU that solicits a Trigger-based PPDU. For recipient STAs that are not associated with the AP a random access RU can be allocated, as such the AID value in this particular case should be 0. Also if the Trigger frame is the first frame in the A-MPDU then we need to clarify that BA/Ack frames are the second ones (baseline dictates them to be the first ones), and last but not least, the information contained in Trigger frames or UL MU Response Scheduling (which is the correct terminology to use rather than "Trigger Information field in MAC Header TBD") do not conflict with eath other (or with same signaling in different RUs of the same DL PPDU). Perform the same changes to the 3rd paragraph of 25.5.2.3 as well (those that apply of course). | As in comment. | Revised. Used AID=0 for random access. Clarified the order of the trigger and BA.It is not necessary to instruct the AP on how to avoid all possible erroneous settings of the trigger infromation across STAs, such as different duration. Given the PHY limitations, any AP should know what to do.TGax editor to make the changes shown in 11-16/0929r3 |
| 171 | Alfred Asterjadhi | 25.5.2.2.2 | What is the common address when dot11MultiBSSIDActivated is true? Replace the TBD with the address that will be used in this case for the Trigger frame. Also to say that "to which all recipient STAs are associated" is not correct since the AP can allocate a random RU at which non-associated STAs can transmit. And finally normative behavior on how to set the Padding field of the Trigger frame is missing. | As in comment. | [pending discussion] |
| 172 | Alfred Asterjadhi | 25.5.2.2.2 | These statements should be applicable to the UL MU Response scheduling signaling as well. | As in comment. | Revised TGax editor to make the changes shown in 11-16/0929r3 |
| 173 | Alfred Asterjadhi | 25.5.2.2.2 | "An UL OFDMA MPDU/A-MPDU is the acknowledgment of the Trigger frame" is only one fourth correct. This is also the case for a trigger frame that triggers UL MU MIMO, UL MU MIMO/UL OFDMA, and an MU RTS variant Trigger frame that triggers CTS frames. I have noticed this type of inconsistency throughout the draft. These type of behaviors are valid for MU frames in general, not only for OFDMA. As such ensure that normative descriptions do not apply to OFDMA only but MU MIMO as well. | As in comment. | Revised. TGax editor to make the changes shown in 11-16/0929r3 |
| 174 | Alfred Asterjadhi | 25.5.2.3 | Add the expecption of Trigger enablign SIFS response to 10.3.2.3.3 (SIFS). Also, based on the last item here it means that if CS Required subfield in the Trigger frame is 0 both PHY CS and NAVs are ignored. If this is the case then these exeptions need to be added to the virtual CS mechanisms for HE STA. | As in comment. | Revised. Added the condition based on the Trigger indication. For the details, refer to 25.5.2.4TGax editor to make the changes shown in 11-16/0929r3 |
| 175 | Alfred Asterjadhi | 25.5.2.3 | There are many missing items in the setting of the TXVECTOR parameters for the HE trigger-based PPDU. Ensure that the list is complete for the Trigger frame (according to the fields specified by the trigger frame) and for the UL MU Response Scheduling (according to the fields specified in the HE variant HT Control field, and default (from DL MU PPDU?) values for those not specified in the field). | As in comment. | Revised. Agree. See changes in this document for the Ttrigger frame response and in document 16-776 fro the UL MU reponse Scheduling HE control fieldTGax editor to make the changes shown in 11-16/0929r3 |
| 176 | Alfred Asterjadhi | 25.5.2.3 | When the Trigger Type is not equal to 0 (means MU RTS, MU BAR, MU BRP variants) we need to specify that the STA shall not solicit an immediate response from the AP to the trigger-based PPDU (e.g., the QoS Null frame if added shall have the Ack Policy to No Ack). | As in comment. | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 432 | Brian Hart | 25.5.2.2.1 | "AP AP shall not send ... unles the STA is UL MU Capable" | For 11ax to be relevant, all non-APs need to be UL MU Capable (e.g. UL OFDMA) | Revised.Removed reference to capabilityTGax editor to make the changes shown in 11-16/0929r3 |
| 436 | Brian Hart | 25.5.2.2.3 | Definition of successful is unclear | Insert xref | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 460 | Daewon Lee | 25.5.2.1 | How the AP obtains the medium access for DL MU and UL MU operation is not defined. It is not clear whether DL MU EDCA operation is same as 11ac DL MU EDCA operation or not. Given that trigger frame is control frame, it is not clear what the AC of the trigger frame should be, and how it would content for medium (e.g. using which backoff window size, etc) | Add a new section under MU operation regarding EDCA for DL MU and EDCA for UL MU either in chaper 10.22.2 HCF contention based channel access (EDCA) or chapter 25.5 MU operation. Define the details of medium access operation for MU. | Reject.the AP may use any AC to send the trigger frame |
| 591 | EVGENY KHOROV | 25.5.2.2.1 | Is it prohibited to have more than one Trigger frame in an A-MPDU? | Prohibit to have more than one Trigger frame in A-MPDU or explain the behavior for this case. In the latter case, modify the sentence as follows: If several Trigger Frames are aggregated in an A-MPDU, the trigger frames shall be the first frames in the A-MPDU). | Revised. Multiple trigger are allowed, but must be identical. The ordering of the Trigger was also clarified.TGax editor to make the changes shown in 11-16/0929r3 |
| 593 | EVGENY KHOROV | 25.5.2.2.3 | What is the AP behaviour if no transmission occurs after a trigger frame. | Specify a timeout after which the transmision is considered unsuccessful and the AP can transmit again using channel access rules. | Revised.Referred to existing secions for the recovery behaviorTGax editor to make the changes shown in 11-16/0929r3 |
| 594 | EVGENY KHOROV | 25.5.2.2.1 | A Trigger frame may allocate Random access RUs for associated STAs, which is currently forbidden by the referred para | Add such a case to the list | RevsiedTGax editor to make the changes shown in 11-16/0929r3 |
| 676 | Huizhao Wang | 25.5.2.2.1 | "Trigger Information TBD contained in the MAC header" is not needed. The Per User Trigger Information field serves the purpose already, there is no need to have a duplicate trigger mechanism in MAC header. | Remove this sentence | Reject. The HE Control field provides enhanced trigger functionality needed for efficient ACK operation.  |
| 677 | Huizhao Wang | 25.5.2.2.2 | Frames other than Trigger frame transmitted in broadcast RU shall be duplicated in other RU or spatial stream assigned to a STA recipient (a technical contribution will be followed later) | Add: A none trigger frame is transmitted in a broadcast RU, shall be duplicated to a RU or spatial streams assigned to a STA recipient | Revised. There is no "duplicated RU" transmitted to a STA. Added clarification to the groupcastTGax editor to make the changes shown in 11-16/0929r3 |
| 678 | Huizhao Wang | 25.5.2.3 | Response with QoS NULL to Trigger Frame type equal to 0 only | Replace "If the STA does not have a frame of the required type", with: "If the Trigger frame type is equal to zero, and the STA does not have response frame to send, the STA should transmit Qos NULL frame" | Revised. TGax editor to make the changes shown in 11-16/0929r3 |
| 698 | Jae Seung Lee | 25.5.2.2.1 | There are TBDs in the subclause. | Remove the TBDs. | Revised. Several TBDs are addressed as resolution of comments that propose a specific solution TGax editor to make the changes shown in 11-16/0929r3 |
| 699 | Jae Seung Lee | 25.5.2.3 | There are TBDs in the subclause. | Remove the TBDs. | Revised. Several TBDs are addressed as resolution of comments that propose a specific solutionTGax editor to make the changes shown in 11-16/0929r3 |
| 800 | Jing Ma | 25.5.2.3 | In current spec draft, DATARATE or MCS aren't included in the TXVECTOR parameter list set by a STA transmitting an HE trigger-based PPDU | "The MCS parameter shall be set to the value indicated by the MCS subfield of the per-User Info field of the trigger frame" should be added in the TXVECTOR parameter list | RevisedMultiple TXVECTOR paramters were added See resolution in doc 16/929r1 |
| 815 | Jinsoo Ahn | 25.5.2.2.3 | EDCA mechanism need to be applied on AP access procedures for UL MU | Insert the following"An AP shall transmit its trigger frame with EDCA parameters defined for UL MU Trigger frame, regardless of access category of UL PPDU contents." | Revised.  |
| 816 | Jinsoo Ahn | 25.5.2.2.3 | AP needs to determine to transmit either DL Data or Trigger Frame based on EDCA internal contention and AP shall control its internal contention success probability of UL MU | Insert the following"An AP could configure backoff counter window of UL MU access category for internal contention based on its buffer status feedback information to get UL MU channel access opportunity. Specific configuration method is TBD." | RejectThis proposed resolution is incomplete and unclear. The AP can use any AC to send a trigger frame |
| 859 | Ju-Hyung Son | 25.5.2.3 | The "Trigger Information Field info in MAC Header TBD" seems to be the same field defined in 9.2.4.6.4.2 UL MU response scheduling. This field only signals UL PPDU Length and RU Allocation. Then, a STA transmitting an HE trigger-based PPDU by using the "Trigger Information Field info in MAC header TBD" lacks detailed descriptions on how to set TXVECTOR parametes such as CP\_LTF\_TYPE, SIG-A\_CONT, DCM, CODING\_TYPE, and NSTS. | Please clarify how to set CP\_LTF\_TYPE, SIG-A\_CONT, DCM, CODING\_TYPE and NSTS TXVECTOR parameters when a STA transmitting an HE trigger-based PPDU based on the "Trigger Information Field info in MAC Header TBD". | RevisedMultiple TXVECTOR paramters were added TGax editor to make the changes shown in 11-16/0929r3 |
| 860 | Ju-Hyung Son | 25.5.2.3 | The behavior of a STA that receives a "Trigger Information Field info in MAC header TBD" should be clearly defined. | Add the following text in line 47:"If the "Trigger Information Field info in MAC header TBD" is received, the STA shall include in the response A-MPDU at least one MPDU of the immedate acknowledgement and may include one or more additional MDPUs." | Reject. The fact that the Ack is to be sent is already covered by the , the STA shall include in the reponse A-MPDU at least one MPDU of the required type". The allowance to include one or more other MPDUS is defined in the A-MPDU context section. it is not clear whic other MPDUs the commenter wants to allow |
| 862 | Ju-Hyung Son | 25.5.2.2.1 | In the Table 9-422 A-MPDU contents in the data enabled in immediate response context in P802.11REVmc\_D5.2, Ack and HT-immediate BlockAck is defined to be at the start of the A-MPDU. In cascading scenarios, Trigger MPDU can be aggregated with Ack/BA MPDU within A-MPDU in DL MU PPDU format. It still would be logical to place the Ack/BA MPDU at the start of the A-MPDU as a immediate response to the previous PPDU. If there is no Ack/BA MPDU in the A-MPDU, Trigger MPDU can be at the start. | Change the text in line as follows, added texts in red:"If a Trigger frame is aggregated with other frames (except Ack/BA frame) in an A-MPDU, the Trigger frame shall be the first frame in the A-MPDU. If a Trigger frame is aggregated with Ack/Ba frame, the Trigger frame shall be the second frame next to the Ack/Ba frame in the A-MPDU." | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 968 | kaiying Lv | 25.5.2.2.3 | An UL MU-MIMO MPDU/A-MPDU is also the acknowledgement of the Trigger frame. | change "An UL OFDMA MPDU/A-MPDU is the acknowledgement of the Trigger frame" to "An UL OFDMA or MU-MIMO MPDU/A-MPDU is the acknowledgement of the Trigger frame" | Revised‘is the acknowledgement’ is nto a right terminology. For the resolution, the clause related to TXOP continuation and recovery are referred. TGax editor to make the changes shown in 11-16/0929r3 |
| 977 | kaiying Lv | 25.5.2.3 | Whether a triggered STA performs CS before sending trigger based PPDU is determined by the CS Required subfield in trigger frames. | Suggest to change to "The CS Required subfield in a Trigger frame is 1,and the UL MU CS Condition described in 25.5.2.4 (UL MU CS mechanism)indicates the medium is idle, or the CS Required subfield in a Trigger frame is 0" | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 997 | kaiying Lv | 25.5.2.3 | STA behavior under power control in UL MU operation should be considered | Comment resolution and supporting PPT will be provided | Revised. This is resoved based on doc 775r1 |
| 1078 | Kiseon Ryu | 25.5.2.2.1 | Trigger frame containg AID 0 can elicit an HE trigger-based PPDU from unassociated STAs as well as associated STAs. The AID only for unassociated STAs needs to be defined to aggregate an MDPU for unassociated STA in an HE MU PPDU or HE trigger based PPDU. | 1. Add the text "or AID 0" after "AID of the STA" on the line 162. Replace "TBD" with "the Per User Info field is addressed to AID TBD or AID 0" on the line 17 | Revised. TGax editor to make the changes shown in 11-16/0929r3 |
| 1079 | Kiseon Ryu | 25.5.2.2.1 | Trigger information can be included a MAC header as the HE variant HT Control field with Control ID 0 (i.e. UL MU response scheduling). | On the line 19, 25,Replace "Trigger Information TBD contained in the MAC Header" with "the HE variant HT Control field with Control ID 0" | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1080 | Kiseon Ryu | 25.5.2.2.2 | Trigger information can be included a MAC header as the HE variant HT Control field with Control ID 1 (i.e. UL MU response scheduling). | Replace "a "Trigger Information Field info in MAC header TBD" with "an HE variant HT Control field with Control ID 0." | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1081 | Kiseon Ryu | 25.5.2.2.2 | Trigger frame containg AID 0 can elicit an HE trigger-based PPDU from unassociated STAs as well as associated STAs. The AID only for unassociated STAs needs to be defined to aggregate an MDPU for unassociated STA in an HE MU PPDU or HE trigger based PPDU. | 1. Add the text "or AID 0" after "AID of the STA" on the line 112. Replace "TBD" with "the Per User Info field is addressed to AID TBD or AID 0" on the line 12 | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1082 | Kiseon Ryu | 25.5.2.2.2 | Trigger information can be included a MAC header as the HE variant HT Control field with Control ID 1 (i.e. UL MU response scheduling). | Replace "Trigger Information Field info in MAC header TBD" with "HE variant HT Control field with Control ID 0" | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1184 | Lei Huang | 25.5.2.1 | "in either UL MU OFDMA UL MU-MIMO, or both" should be "in UL OFDMA, UL MU-MIMO, or both" | change "in either UL MU OFDMA UL MU-MIMO, or both" to "in UL OFDMA, UL MU-MIMO, or both" | Accept |
| 1219 | Liwen Chu | 25.5.2.3 | The Ack Policy of MPDU other than Trigger Type is not clear. Addthe related rules. | As in comment. |  |
| 1438 | Mark RISON | 25.5.2.2.3 | "An UL OFDMA MPDU/A-MPDU is the acknowledgement of the Trigger frame. When the AP receivesMPDU correctly from at least one STA indicated by trigger frame, the frame exchange initiated by thetrigger frame is successful." -- sounds as if an UL OFDMA MPDU is the ack and an A-MPDU is not required | Delete "/A-MPDU" | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1519 | Mark RISON | 25.5.2.2.1 | "a PPDU with the TXVECTOR parameter FORMAT set to HE\_TRIG" -- does this differ from an HE trigger-based PPDU? | Change to "an HE trigger-based PPDU" | Accept |
| 1522 | Mark RISON | 25.5.2.2.1 | "by including in the PPDU at least one of" -- if more than one is included, what happens if they differ? | Add a statement which explains the behaviour (e.g. this and that field shall have the same value) | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1530 | Mark RISON | 25.5.2.2.3 | "When the AP receives MPDU correctly from at least one STA indicated by trigger frame, the frame exchange initiated by the trigger frame is successful." -- what is the significance of the success? Is this about the rules for TXOP continuation? Or something else? | Clarify what the significance of success v. failure is, at least by cross-reference | Revisedthe clause related to TXOP continuation and recovery are referred. TGax editor to make the changes shown in 11-16/0929r3 |
| 1531 | Mark RISON | 25.5.2.2.3 | "When the AP receives MPDU correctly from at least one STA indicated by trigger frame, the frame exchange initiated by the trigger frame is successful." -- hm, but a frame exchange includes stuff following after SIFS, so it's not really that the frame exchange is successful, it's that the transmission of the Trigger frame is successful | Reword in terms of success of the TF transmission | Revisedthe clause related to TXOP continuation and recovery are referred. TGax editor to make the changes shown in 11-16/0929r3 |
| 1534 | Mark RISON | 25.5.2.3 | "The CP\_LTF\_TYPE parameter shall be set to the value indicated by the CP-LTF subfield of the Common Info field of the eliciting Trigger frame" -- and what if there wasn't a TF but just a trigger MAC header? Ditto for the subsequent parameters | Explain how the parameters is set in that case | RevisedTXVECTOR paramters are definedTGax editor to make the changes shown in 11-16/0929r3 |
| 1538 | Mark RISON | 25.5.2.3 | "The content of each individual A-MPDU in an HE MU PPDU is based on the rules specified in 10.13.1 (A-MPDU contents) and the additional rules described in this clause." -- does "this clause" mean "this subclause"? | If it does, then just simplify and say "with the following additional rule:". If it does not, it's too general, and specific rules need to be pointed to | RevisedRemove the sentence since it is obvious that any A-MPDU follows the A-MPDU context rulesTGax editor to make the changes shown in 11-16/0929r3 |
| 1540 | Mark RISON | 25.5.2.3 | "one MPDU of the required type" -- where are the required types specified? Table 9-ax2 just says what the trigger type is, not what MPDUs are required in response | Add something to Table 9-ax2 giving the required response type |  |
| 1541 | Mark RISON | 25.5.2.3 | "If the STA does not have a frame of the required type, the STA should transmit QoS Null frame." -- but it could also transmit a Beacon frame? Or nothing? Also missing article before "QoS" | Clarify what the STA may alternatively do if it does not do what is recommended | Revisedthe STA shall either not transmit the response or transmit QoS Null frameTGax editor to make the changes shown in 11-16/0929r3 |
|  |  |  |  |  |  |
| 1648 | Matthew Fischer | 25.5.2.2.1 | What trigger information in the MAC header? | Define what trigger information can be found in a MAC header. | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1665 | Oghenekome Oteri | 25.5.2.3 | -- The L\_LENGTH parameter shall be set to the value indicated by the L-SIG Length field of the eliciting Trigger Frame or of the "Trigger Information Field info in MAC header TBD". | Define TBD | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1753 | Peter Loc | 25.5.2.2.1 | Trigger frame using the trigger information field in the MAC header is not defined but referenced in many places, making it difficult to follow the functional description. | Define the trigger information field in the MAC header. | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1772 | Po-Kai Huang | 25.5.2.2.1 | UL MU response scheduling is already defined in HE variant HT control in 9.2.4.6.4.2 for the trigger frame information purpose. Hence, "Trigger Information TBD contained in the MAC Header" can be replaced with "UL MU repsonse scheduling in HE variant HT control" | Replace "Trigger Information TBD contained in the MAC Header" with "UL MU repsonse scheduling in HE variant HT control." Replace "Trigger Information Field info in MAC header TBD" with "UL MU repsonse scheduling in HE variant HT control" in other sections | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 1802 | Robert Stacey | 25.5.2.1 | UL MU capabilies are not present in HE Capabilities element. | verify the Figure number of Figure 18-5. | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1828 | Rojan Chitrakar | 25.5.2.3 | L-SIG Length field is not correct | Change "L-SIG Length field" to "length subfield of the Common Info field". | RevisedUpdated the TXVECTOR paramters settings  |
| 1904 |  | 25.5.2.1 | Missing subfield in HE Capabilities element | Text refers to "UL MU OFDMA Capable subfield of the HE Capabilities element". No such subfield is currently defined. Add appropriate subfield in HE Capabilities element. | Revised.Support for UL OFDMA is going to be mandatory. No capability necessary. Removed the corresponding text |
| 1905 | Sigurd Schelstraete | 25.5.2.1 | Missing subfield in HE Capabilities element | Text refers to "UL MU MIMO Capable subfield of the HE Capabilities element". No such subfield is currently defined. Add appropriate subfield in HE Capabilities element. | RevisedDefined in doc 930TGax editor to make the changes shown in 11-16/0930r2 |
| 1906 | Sigurd Schelstraete | 25.5.2.2.1 | Is it allowed for a STA to send a trigger frame? | Clarify | Revised.NoTGax editor to make the changes shown in 11-16/0929r3 |
| 1909 | Sigurd Schelstraete | 25.5.2.3 | The first bullet states that the L\_LENGTH of the frame responsing to the Trigger frame should be the same as the L\_LENGTH of the trigger frame. The L\_LENGTH value determines the length of the transmission. It's unlikely that both frames will have the same length. Doing this as written would incur 100% overhead for every trigger-based PPDU. | Remove "the L-SIG Length field of the eliciting Trigger frame or of" | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1910 | Sigurd Schelstraete | 25.5.2.3 | TBD | Define | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1911 | Sigurd Schelstraete | 25.5.2.3 | What is SIG-A\_CONT? | Define | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 1912 | Sigurd Schelstraete | 25.5.2.3 | TBD | Define | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 2173 | stephane baron | 25.5.2.3 | MU UL OFDMA : data selection"4.5.6 Traffic differentiation and QoS support" of 802.11REVmc\_D4.3When QMF service is enabled, Management frames might be transmitted using an access category other than the access category assigned to voice traffic.The behavior for UL MU for random access is unknown (which access category queue to use for UL OFDMA) | draft shall disclose details for data selection in general, and also especially in regards to QMF support. | Reject. It is not clear what the commenter is requesting. The UL MU Random access is governed by the rules in "25.5.2.6.1 Random access procedure", which only define one 'class' of backoff parameters.A new proposal would be needed to enable the requested behaviorIf the comenter is referring to the class used for trigger frame, please note the trigger frame is not a management frame. |
| 2175 | stephane baron | 25.5.2.2.1 | Rules for soliciting UL MU frames are not defined for non associated STAs | define the TBD | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 2176 | stephane baron | 25.5.2.2.2 | Trigger Frame setting with multiple BSSIDs:in case of multiple BSSIDs, the TA shall be set to a common address TBD | The common address can be the base MAC address of the AP, that is the 48-bit MAC address with the n LSBs set to zero (n being the number of BSSs/VAPs managed by the AP) | RevisedSet to the basic BSSIDTGax editor to make the changes shown in 11-16/0929r3 |
| 2194 | Tomoko Adachi | 25.5.2.2.1 | It says "If a Trigger frame is aggregated with other frames in an A-MPDU, the Trigger frame shall be the first frame in the A-MPDU."But the Trigger frame is not decided to be the first frame in the A-MPDU in the SFD. | Open the discussion to aggregate where to set the Trigger frame in the A-MPDU.I think if the response frame such as Ack/BA/M-BA is present, it should be set earlier than the Trigger frame in the A-MPDU.In relation to this, Table 9-426a, Table 9-426b, and Table 9-426c in pages 37 and 38 should be revisited to clarify the order of the frames. | RevisedClarified the order, which is ACK/BA first, then triggerTGax editor to make the changes shown in 11-16/0929r3 |
| 2255 | Weimin Xing | 25.5.2.2.1 | In REVmc5.0, the protocol also say that ACK/BA occurs at the start of the A-MPDU. and here we also say"If a Trigger frame is aggregatedwith other frames in an A-MPDU, the Trigger frame shall be the first framein the A-MPDU." If a Trigger frame is aggregated with a BA/ACK frame, which frame go first?If the Trigger frame and the BA frame addressed to the same STA, it's better put the BA first, then this STA can kown which frames are wrong in the previous transmission and need be retransmited in next UL PPDU. | clarify BA/ACK and Trigger frame which shall be the first frame of the A-MPDU. | RevisedClarified the order, which is ACK/BA first, then triggerTGax editor to make the changes shown in 11-16/0929r3 |
| 2271 | Woojin Ahn | 25.5.2.2.3 | When AP accesses the medium for triggering HE TRIG PPDU, AP can be aware of the ACs of the triggering UL traffic by buffer status reports. For fair medium contention, AP must consider the ACs of allocable UL traffics reported from the buffer status reports. | Insert the following at 25.5.2.2.3 line 57"UL MU medium access rule shall consider the ACs of allocable UL traffics reported from the buffer status reports." | Reject. The proposed resolution is incomplete. Also, STAs are allowed to send any TID, hence AP would not know how the allocated UL MU PPDU would be used by the STA.  |
| 2321 | Yasuhiko Inoue | 25.5.2.1 | Following expressions are not clear to me. "Trigger Information TBD contained in the MAC Header" in line 19, and"Trigger Information Field info in MAC header TBD" in line 25. | Clarify, please. | RevisedAl occurrences are now referred to as “UL MU Response Scheduling A-Control subfield”TGax editor to make the changes shown in 11-16/0929r3 |
| 2381 | Yonggang Fang | 25.5.2.2.1 | change a "PPDU" to a "Trigger frame" for easy understanding as the "HE trigger-based PPDU shall be elicited by the trigger frame. |  | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 2382 | Yonggang Fang | 25.5.2.2.1 | What is the definition of trigger frame and trigger information? |  | RevisedTrigger frame is a welld defiend frame in clause 8 |
| 2449 | Yongho Seok | 25.5.2.2.2 | "If dot11MultiBSSIDActivated is true and at least two of the Trigger frame recipient STAs are associated with two different BSSIDs, then the TA shall be set to a common address TBD;"When at least two of the Trigger frame recipient STAs are associated with two different BSSIDs and they receives the Trigger frame having the TA field set to a common address, what is the value of the Address 1 field in the HE trigger-based PPDU?If the value of the Address 1 field in the HE trigger-based PPDU is set to the common address (TA field of the Trigger frame), the problem is that the PSDU carried in the HE trigger-based PPDU shall be re-encrypted. Because the ADD used in the CCMP encryption has been changed.Please clarify the value of the Address 1 field in the HE trigger-based PPDU.Proposed solution is to use the STA's associated BSSID for the Address 1 field in the HE trigger-based PPDU. | As per comment | [Needs Discsusion] |
| 2452 | Yongho Seok | 25.5.2.2.3 | "An UL OFDMA MPDU/A-MPDU is the acknowledgement of the Trigger frame."It seems that both an UL OFDMA MPDU and an UL OFDMA A-MPDU are a candidate response type of a Trigger frame.But, supporting both an UL OFDMA MPDU and an UL OFDMA A-MPDU as a response type of a Trigger frame are defined in current 802.11ax draft.In the current draft, Because the PSDU length (in byte) in the HE trigger-based PPDU is only specified by the Length field in the A-MPDU subframe.Please define how to support an UL OFDMA MPDU as a response type of a Trigger frame. Otherwise, remove UL OFDMA MPDU from the corresponding sentence. | As per comment | RevisedRemoved.TGax editor to make the changes shown in 11-16/0929r3 |
| 2636 | Young Hoon Kwon | 25.5.2.1 | There is an exception: MU-RTS/CTS exchange. | Modify the sentence to "... in either UL MU OFDMA UL MU-MIMO, or both, except for CTS frame transmission in response to a MU-RTS frame in which case soliciting MU-RTS frame indicates the frame type". | Revised |
| 2637 | Young Hoon Kwon | 25.5.2.1 | UL MU OFDMA Capable and UL MU MIMO Capable subfields are not defined in the HE Capabilities element (9.4.2.213). | Define UL MU OFDMA Capable and UL MU MIMO Capable subfields in subclause 9.4.2.213. | Revise. Support for UL OFDMA is going to be mandatory. No capability necessary. Capability for UL MU MIMO is defined in doc 930r2 |
| 2638 | Young Hoon Kwon | 25.5.2.2.1 | When an AP transmits a Trigger frame soliciting the UL MU PPDU, it is not clear how to determine which EDCAF to be used as the Trigger frame is not coming from the AP's EDCAF queue, especially for the case that the AP does not know access categories of UL MU frames. | Clarify AC for trigger frame transmission, and add corresponding explanation into subclause 10.22.2.2 of REVmc\_D5.2 spec. | Revised. An AP STA may use any AC for sending a PPDU that include only Trigger Frame(s). If the PPDu includes other types of frame in adition to a trigger frame, the AC rules must be satisfied for all transmitted frames. TGax editor to make the changes shown in 11-16/0929r3 |
| 2639 | Young Hoon Kwon | 25.5.2.2.1 | User ID allocation for random access is missing. | Describe user ID allocation rule for random access channel. | RevisedUse AID=0TGax editor to make the changes shown in 11-16/0929r3 |
| 2640 | Young Hoon Kwon | 25.5.2.2.1 | In current REVmc, an Ack/BA frame is present at the start of the A-MPDU in the control response context. Therefore, in case Trigger frame is included in an A-MPDU having Ack/BA frame, clarification has to be made which frame is present at the start of the A-MPDU. | Clarify which frame is present at the start of the A-MPDU in case Trigger/Ack/BA are included in an A-MPDU. | RevisedClarified the order, which is ACK/BA first, then triggerTGax editor to make the changes shown in 11-16/0929r3 |
| 2641 | Young Hoon Kwon | 25.5.2.2.3 | This sentence describes a case that there's only one Trigger frame in a DL PPDU. Transmission success rule for multiple Trigger frame in a DL PPDU needs to be further described. | Add the following sentence at the end of the paragraph. "When an AP transmits more than one Trigger frame in a DL MU PPDU, the frame exchanges initiated by all the trigger frames are successful if the AP receives MPDU correctly from at least one STA indicated by any of the Trigger frames.". | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 2642 | Young Hoon Kwon | 25.5.2.2.3 | AP's behavior in terms of scheduling UL resource also need to be described in this sub-clause. More specifically, transmission bandwidth for UL MU transmission needs to be described, which has been accepted in SFD. | Add the following sentence at the end of the paragraph. "An AP shall not allocate UL subchannel in any 20 MHz channel that is not occupied by the immediately preceding DL PPDU that contains trigger information. In each 20 MHz channel occupied by the immediately preceding DL PPDU that contains trigger information, there is at least one allocated subchannel." | RevisedTGax editor to make the changes shown in 11-16/0929r3 |
| 2644 | Young Hoon Kwon | 25.5.2.3 | It is not clear which AC of UL MPDUs a STA can include into the trigger-based PPDU. | Clarify the access category that a STA can use in response to a Trigger frame, and add the corresponding text in this subclause. | RevisedA STA may include MPDUs with any TID in an HE trigger-based PPDU sent in response to a Trigger Frame or to an HE Variant HT Control fieldTGax editor to make the changes shown in 11-16/0929r3 |
| 2645 | Young Hoon Kwon | 25.5.2.3 | In current spec. (REVmc\_D5.2), after transmitting a frame that requires an immediate acknowledgement, the STA shall perform ack procedure, and the retry counter value shall be incremented every time transmission of a frame fails (see 10.22.2.11.1). However in case of UL MU transmission, as a transmission is made as an immediate response to a Trigger frame, it is not clear how to handle the retry count. | As mentioned in the comment, clarify how to set retry count value in case a transmissio that requires immediate response is made as a immediate response to a Trigger frame, and modify subclause 10.22.2.11.1 of REVmc\_D5.2 accordingly. | RevisedDraft 4.0 includes resolution to this comment in clause10.22.2.2Also, See presentation 16/880 |
| 2646 | Young Hoon Kwon | 25.5.2.3 | With this condition, random access is not allowed. | Add a case that enables random access in the conditions list. | RevisedAddedTGax editor to make the changes shown in 11-16/0929r3 |
| 2682 | Yuhei Nagao | 25.5.2.2.1 | In the UL MU operation,the value of the User Identifier subfield of the Per-User Info field is undefinedfor TF recipient STAs that are not associated with the AP.We need to be clear what purpose of the User Identifier subfieldfor unassociated STAs with the AP. | Clarify | RevisedClarified TGax editor to make the changes shown in 11-16/0929r3 |
| 2706 | Yuichi Morioka | 25.5.2.2.1 | Is this restriction necessary? If single MPDU Trigger frame can be responded in SIFS, there should be no problem even if the Trigger frame is the last frame in an A-MPDU. | Remove sentence starting "If a Trigger frame is..." | RevisedControl frames are placd at the beginning of the PPDU.TGax editor to make the changes shown in 11-16/0929r3  |
| 2707 | Yuichi Morioka | 25.5.2.2.3 | What happens if the frame exchange initiated by the trigger frame is "successful"? | Define what the AP should do if the frame exchange is successful. | RevisedTGax editor to make the changes shown in 11-16/0929r3 |

***Please modify section 25.5.2 as follows***

### UL MU operation

#### General

The UL MU operation allows an AP to solicit immediate simultaneous response frames from one or more non-AP STAs. Non-AP STAs transmit their response frames in HE trigger-based PPDU format, in either UL OFDMA, UL MU-MIMO, or both, except when the Trigger frame is of type MU-RTS, in which case the response (CTS) is sent in a non-HT PPDU format (10.3.2.8a MU RTS/CTS procedure) (#1184)

An HE STA with dot11ULMUMIMOOptionImplemented set to true shall set the UL MU MIMO Capable subfield of the HE Capabilities element it transmits to 1; otherwise, the STA shall set it to 0.

A non-AP STA with dot11ULMUMIMOOptionImplemented equal to true is referred to as an UL MU capable STA.

#### Rules for soliciting UL MU frames

##### Allowed settings of the Trigger frame and HE Control fields

An AP may transmit a PPDU that elicits an HE trigger-based PPDU from one or more STAs by including in the PPDU: (#34)

* One or more Trigger frame(s) that includes one or more per-User Info field addressed to one or more of the recipient STA(s).
	+ For recipient STAs that are associated with the AP, the per-User Info field is addressed to a recipient STA if the value of the AID subfield of the Per-User Info field is equal to the AID of the STA or to 0 (indicating a random access allocation) (#34, 170,1078). A value of 0 also indicates that non- associated STAs can transmit on the allocated resource using the random access procedure as described in 25.5.2.6.
* An UL MU Response Scheduling A-Control subfield of individually addressed MPDU(s) contained in the DL MU PPDU that:
	+ Are carried in a VHT single MPDU format that solicits an immediate Ack frame (see 10.13.8 (Transport of VHT single MPDUs))
	+ Are carried in an A-MPDU format that solicits an immediate BlockAck frame (see 10.24.7.7 (Originator’s behavior))
	+ Are carried in a multi-TID A-MPDU format that solicits an immediate Multi-STA BA frame (see 25.10.3 (A-MPDU with multiple TIDs))of
* NOTE—The AP additionally follows the rules defined in 25.3.2 (Procedure at the originator) when fragments are present in the generated MPDU(s).

More than one Trigger frame may be aggregated in a same A-MPDU. If more than one Trigger frames are aggregated in the same A-MPDU, all of them shall have the same content.

The following two frames shall not be present in a same A-MPDU

* A Trigger frame with a Per User Info field addressed to a STA
* An MPDU addressed to a STA that contains an UL MU Response Scheduling A-Control subfield

 (#35)When one or more Trigger Frames are aggregated with other frames in an A-MPDU, the following ordering rules shall apply:

* when no Ack, Block Ack or M-BA frame is present in the A-MPDU, one of the Trigger Frames shall be the first MPDU in the A-MPDU;
* when an Ack or Block Ack or M-BA frame is also present in the A-MPDU, the ACK or Block ACK MPDU shall be the first MPDU in the A-MPDU and at least one of the Trigger frames shall follow the ACk or Block ACK MPDU.

(#2640)

 A non-AP STA shall not send a PPDU that carries a Trigger frame or an UL MU Response Scheduling A-Control field (#1906)

 If dot11MultiBSSIDActivated  is set to false, the TA field of a Trigger frame shall be set to TBD. If dot11MultiBSSIDActivated is true and at least two of the Trigger frame recipient STAs are associated with two different BSSIDs, the TA shall be set to TBD. (#2176)

The RA field of the MPDUs sent in response to a Trigger frame shall be set to TBD.(#171)

An AP shall not set any subfields of the Common Info field of a Trigger Frame to a value that is not supported by all the recipient STAs of the Trigger frame.

An AP shall not set any subfields of a Per User Info field of a Trigger Frame to a value that is not supported by the recipient STAs of the Per User Info field. An AP shall not set any subfields of an UL MU Response Scheduling A-Control subfield in an HE Variant HT Control field, to a value that is not supported by the recipient STAs of the Per User Info field.(#36)

If a Trigger frame is transmitted in a RU of a HE MU PPDU and the RU is addressed to multiple STAs (#252), then the Trigger frame shall not include any Per User Info fields addressed to a STA that is identified as recipient of another RU or spatial stream of the same HE MU PPDU.

HE Variant HT Control fields with an UL MU Response Scheduling A-Control Subfield shall not be included in a MPDU addressed to a groupcast address. (#38,677)

If an AP includes one or more Trigger Frames or HE Variant HT Control field with the an UL MU Response Scheduling A-Control Subfield, then they shall collectively elicit UL trigger-based PPDU response(s) such that at least one RU is allocated per each 20 MHz channel occupied by the eliciting PPDU. An AP shall not allocate UL sub channel in any 20 MHz channel that is not occupied by the immediately preceding DL PPDU (#2642)

If an AP includes one or more Trigger Frames or HE Variant HT Control field with the an UL MU Response Scheduling A-Control Subfield, then the values of the fields

##### AP access procedures for UL MU operation

(#172,173) When an AP receives an immediate response with at least one MPDU from at least one STA solicited by a Trigger frame, the procedures described in 9.22.2.7 (Multiple frame transmission in an EDCA TXOP) apply. (#593 1530 2631) (#39) apply.(#1531)

When an AP does not receive any immediate response with at least one MPDU from at least one STA solicited by a Trigger frame, i.e., transmission failure, the backoff procedure described in 9.22.2.2 (EDCA backoff procedure) applies. (#593)

An AP may use any AC for sending a PPDU that contains only Trigger frame(s). If the PPDU contains other type of frames in addition to a Trigger frame, the AP shall follow the rules defined in 10.22.2.6 (Sharing an EDCA TXOP).

#### STA behaviour

A STA shall not transmit an HE trigger-based PPDU unless is it explicitly triggered by an AP in one of the operation modes described in this subclause.

The interframe space between a PPDU that contains a Trigger frame or contains an HE variant HT Control field that solicits an immediate response and the triggered HE trigger-based PPDU is SIFS (#40)

A STA shall commence the transmission of an HE trigger-based PPDU at the SIFS time boundary after the end of a received PPDU, when all the following conditions are met

* The received PPDU contains either a Trigger frame (excluding a Trigger frame of type MU-RTS) with a Per User Info field addressed to the STA, or the PPDU contains an MPDU addressed to the STA that contains an UL MU Response Scheduling A-Control subfield.. The Per User Info field is addressed to a STA if the AID subfield is equal to the AID of the STA, if the STA is associated with the AP. If the STA is not associated with the AP, TBD.
* The CS Required subfield in a Trigger frame is 1, and (#977) the UL MU CS condition described in 25.5.2.4 (UL MU CS mechanism) indicates the medium is idle, or the CS Required subfield in a Trigger frame is 0

Otherwise, a STA shall not send an HE trigger-based PPDU

A STA transmitting an HE trigger-based PPDU in response to the reception of a Trigger frame shall set the TXVECTOR parameter as follows:

* The FORMAT parameter shall be set to HE\_TRIG
* The PE\_DURATION parameter shall be set according to the value of the Packet Extension field in the soliciting Trigger frame.
* The TXOP\_DURATION parameter shall be set according the rules defined in 25.2.1 (Updating two NAVs)
* The BSS\_COLOR parameter shall be set as follows:
	+ If the preceding Trigger frame was received in a HE PPDU: set to the value of the COLOR subfield in the HE-SIG-A field of the HE PPDU
	+ If the Trigger frame was received in a non-HE PPDU: set to the value of the BSS Color subfield of the most recently received HE Operation element for that BSS.

* The L\_LENGTH parameter shall be set to the value indicated by the Length subfield (#253) of the eliciting Trigger frame.
* The LTF\_TYPE parameter shall be set to the value indicated by the GI and -LTF Type subfield of the Common Info field of the eliciting Trigger frame
* The NUM\_STS parameter shall be set to the number of space time streams indicated by the Number Of Spatial Streams subfield of the S S Allocation field of the Per User Info field and STBC field in the Common Info field of the Trigger frame
* The CH\_BANDWIDTH parameter shall be set to the value of the BW field in the Common Info field of the eliciting Trigger frame
* The HE\_LTF\_MODE parameter shall be set to the value indicated by the MU MIMO LTF Mode subfield of the Common Info field of the eliciting Trigger frame
* The [??] parameter shall be set to the value indicated by the # of HE LTFs Symbols subfield of the Common Info field of the eliciting Trigger frame
* The STBC parameter shall be set to the value indicated by the STBC subfield of the Common Info field of the eliciting Trigger frame
* The [??]parameter shall be set to the value indicated by the LDPC Extra Symbol subfield of the Common Info field of the eliciting Trigger frame
* The SPATIAL\_REUSE parameter shall be set to the value of the Spatial Reuse field in the Common Info field of the eliciting Trigger frame
* The [??] parameter shall be set to the value of the HE-SIG-A Reserved field in the Common Info field of the eliciting Trigger frame
* The MCS parameter shall be set to the value of the MCS field in the Common Info field of the eliciting Trigger frame
* The STARTING\_STS\_NUM parameter shall be set to the value of the Starting Spatial Stream subfield of the SS Allocation field in the Common Info field of the eliciting Trigger frame
* The DCM parameter shall be set to the value indicated by the DCM subfield of the per-User Info field of the eliciting Trigger frame
* The FEC\_CODING parameter shall be set to the value indicated by the Coding Type subfield of the Per User Info field of the eliciting Trigger frame
* The RU\_ALLOCATION parameter shall be set to the value indicated by the RU Allocation field of the Per User info field of the eliciting Trigger frame
* The TXPWR\_LEVEL\_INDEX parameter shall be set to the value based on the Transmit Power Control for HE Trigger -based PPDU and based on the value of the AP Tx Power subfield in the Common Info field and the Target RSSI subfield in the Per User Info field of the eliciting Trigger Frame (**26.3.15.2 Power pre-correction**)

(# 175)

***Instruction to Editor [See 16-766 for the UL MU Scheduling case]***

The MAC padding procedure is descried in 10.42.2.1.2

The content of each individual A-MPDU in an HE MU PPDU is based on the rules specified in 9.13.1 (A-MPDU context), with the following additional rules.

If the Trigger Type value of a Trigger frame is not Basic Trigger, the STA shall include in the response A-MPDU at least one MPDU of the required type; the MPDUs included in the response shall not solicit a response. (#176)

If the Trigger type field of the soliciting trigger frame is Basic Trigger and the STA does not have a frame of the required type, the STA shall either not transmit the response or transmit QoS Null frame(s) (#1541). (#42)

A STA may include MPDUs with any TID in an HE trigger-based PPDU sent in response to a Trigger frame, subject the rules of 25.10.3 (A-MPDU with multiple TIDs) (#2644

NOTE--The frame type of MPDUs may be different across A-MPDUs within a same HE trigger-based PPPDU

**9.22.2.7 Multiple frame transmission in an EDCA TXOP**

[existing text]

A frame exchange may be one of the following:(11ac)

— A frame not requiring immediate acknowledgment (such as a group addressed frame or a frame

transmitted with an acknowledgement policy that does not require immediate acknowledgement) or

an A-MPDU containing only such frames

— A frame requiring acknowledgment (such as an individually addressed frame transmitted with an

acknowledgement policy that requires immediate acknowledgement) or an A-MPDU containing at

least one such frame, followed after SIFS by a corresponding acknowledgment frame

* A Trigger frame or a frame carrying an UL MU Response Scheduling A-Control subfield followed after SIFS by the requested immediate reponse

— Either

— a VHT NDP Announcement frame followed after SIFS by a VHT NDP followed after SIFS by a

PPDU containing one or more VHT Compressed Beamforming frames, or(#5894)

— a Beamforming Report Poll frame followed after SIFS by a PPDU containing one or more VHT

Compressed Beamforming frames(#5894)

***Add the following***

A DL MU PPDU may carry MPDUs addressed to multiple recipients, hence multiple frame exchanges are performed simultaneously. If at least one of those frame exchanges requires an immediate response (i.e. the AP includes at least one Trigger frame or UL MU Response Scheduling A-Control field) and if the AP receives an immediate response with at least one MPDU from at least one of the solicited STAs, the rules in this subclause apply. (#593 1530 2631) (#39) .(#1531)

**9.22.2.2 EDCA backoff procedure**

[existing texts]

For the purposes of this subclause, transmission failure of an MPDU is defined as follows:
— After transmitting an MPDU (even if it is carried in an A-MPDU or as part of a VHT MU PPDU that
might have TXVECTOR parameter NUM\_USERS > 1) that requires one or more immediate frame as a
response, the STA shall wait for a timeout interval of duration of aSIFSTime + aSlotTime +
aRxPHYStartDelay, starting when the MAC receives a PHY-TXEND.confirm primitive. If a PHY

RXSTART.indication primitive does not occur during the timeout interval, the STA concludes that
the transmission of the MPDU has failed.

— If a PHY-RXSTART.indication primitive does occur during the timeout interval, the STA shall wait
for the corresponding PHY-RXEND.indication primitive to recognize a valid response MDPU sent
by one of the recipients of the MPDU requiring a response. The recognition of anything else, including any
other valid frame, shall be interpreted as failure of the MPDU transmission.

[existing texts]

The backoff procedure shall be invoked by an EDCAF when any of the following events occurs:

[existing texts]

c) None of the~~The~~ expected one or more immediate responses to the initial MDPU of a TXOP of that AC is ~~not~~ received and the AC was a primary AC.