IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CR for remaining CIDs on Triggered TXOP Sharing Procedure-part 1 | | | | |
| Date: 2021-10-25 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Dibakar Das | Intel |  |  | [Dibakar.das@intel.com](mailto:Dibakar.das@intel.com) |
| Laurent Cariou |  |  |  |
| Dmitry AKhmetov |  |  |  |

Abstract

This submission addresses the following CIDs (changes are relative to 11be draft 1.2):

6123, 6128, 6133, 6124, 7588, 7706, 8292, 8293, 5708, 4737, 7809, 7810, 8318, 5153, 5237, 5518, 5734, 7558, 8322, 8323, 8324, 8327, 4193, 4821.

Rev0: initial version

Rev2: address comment to harmonize TXOP mode sharing field usage.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Page** | **Line** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 6123 |  |  | 35.2.1.3 | It is not clear what the channel access conditions are during TXS. Is everything required to be SIFS-separated? Is PIFS recovery allowed? | Clarify | **Revised**  The current text in 35.2.1.3.2 AP behavior allows both PIFS recovery and SIFS based transmissions depending on the current channel conditions.  **TGbe editor:** no further changes needed |
| 6128 |  |  | 35.2.1.3 | It is not clear whether a STA transmitting under TXS is required to account for used\_time when operating under admission control | Clarify | **Revised.**  The relationship between used\_time and time allocations done through Trigger frames is not specified in 11ax draft. Since TXS is a type of TF it is not specified here either.  **TGbe editor:** no further changes needed |
| 6133 |  |  | 35.2.1.3 | Is PIFS recovery allowed during TXS? What are the recovery mechanisms for errors, ensuring OBSS STAs don't grab the medium? How is it ensured that there are no gaps > SIFS (or PIFS, if PIFS recovery allowed), again so OBSS STAs don't grab the medium (should there be a requirement to fill the TXS SP, as there is to fill the HE TB PPDU duration?)? | Clarify | **Revised.**  PIFS recovery is allowed per spec. OBSS STAs may grab the medium if the medium is not protected by AP sending the TF (e.g., via a prior frame setting NAV for entire TXOP). If that happens, AP needs to  follow the rules defined in 35.2.1.3 about regaining access to medium once allocation is over.  **TGbe editor:** no further changes needed |
| 6124 | 104 | 55 | 9.3.1.22.5 | "a scheduled  STA can transmit PPDU(s) addressed to its associated AP or addressed to  another STA." -- is the "or" here inclusive or exclusive? | Clarify | **Revised.**  The “or” is inclusive in the sense that it may transmit multiple PPDUs within the allocation: some to its associated AP and others to some other STA. Since MU-DL transmission cant be done by a non-AP STA it will likely not be able to transmit simultaneously to AP and another STA.  **TGbe editor:** no further changes needed |
| 7588 | 137 | 24 | 9.4.2.295c.2 | "Indicates support for transmitting or responding to a TXOP sharing trigger frame that does not solicit TB PPDU." Shouldn't the "TXOP sharing trigger frame" be a "MU-RTS TXS Trigger frame"? | Change it to read "Indicates support for transmitting or responding to a MU-RTS TXS Trigger frame that does not solicit TB PPDU." | **Revised.**  Agree in principle. Also made corresponding changes to the third column.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
|  |  |  |  |  |  |  |
| 7706 | 137 | 25 | 9.4.2.295c.2 | The modified MU-RTS has a defined name and the same name should be used in this table for consistency. | please used the defined TXOP sharing MU-RTS for consistency in the spec | **Revised.**  Made corresponding changes to the entire entry.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8292 | 137 | 27 | 9.4.2.295c.2 | There is no a modified MU-RTS frame, please change it to TXOP sharing trigger frame. | as in comment. | **Revised.**  Made corresponding changes to the entire entry.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8293 | 137 | 25 | 9.4.2.295c.2 | There is no a modified MU-RTS frame, please change it to TXOP sharing trigger frame. | as in comment. | **Revised.**  Made corresponding changes to the entire entry.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 5708 | 243 | 53 | 35.2.1.3 | Trigger TXOP sharing procedure will introduce some fairness issue similar to UL Trigger based transmission. Reuse UL MU EDCA parameters or define a new EDCA parameters for this procedure | As in comment | **Revised.**  MU EDCA parameter based rules are exclusive to 11ax Basic Trigger frame exchange that results in transmission of TB PPDUs to the AP. We revised the text to have the MU EDCA rules also apply to the case when Triggered TXOP Sharing procedure results in transmission of UL frames.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 4737 | 244. | 53 | 35.2.1.3 | Is the new proposed Triggered TXOP sharing procedure considered as "UL MU Data" delivery? If a STA uses "UL MU Data Disable" OMI to request to disable UL MU Data procedure, does this request also disable the triggered TXOP sharing procedure (where the responding frame, in case of sharing mode = 1 e.g., is a SU PPDU to AP)? Please add text to describe the expected behavior. | As commented | **Revised**    As per the rules described in Table 9-24b in 11ax draft 8.0, the UL MU Data Disable applies only to the Basic Trigger frames that solicit TB PPDUs. For Triggered SU operation, the corresponding TF is different, TB PPDU are not transmitted and the recovery rules allow AP to reuse any unused time. As such the UL MU Data Disable OMI does not apply to this procedure. We modified the text slightly to reflect that.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 7809 | 244 | 48 | 35.2.1.3.2 | PIFS can not be tranmistted. The sentence "The medium is determined to be idle by the CS mechanism at the end of the allocated time in which case it may transmit PIFS after the end of the allocated time." lacks an object on "it may transmit PIFS". | It should be "The medium is determined to be idle by the CS mechanism at the end of the allocated time in which case it may transmit a PPDU at PIFS after the end of the allocated time" | **Revised.**  Re-worded the text to align with similar usage of PIFS:  See P1981L12 of REVme 0.1: **“**A STA shall not commence the transmission of an RTS with a bandwidth signaling TA until at least **a PIFS** **after** the immediately preceding frame exchange sequence.”  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 7810 | 244 | 51 | 35.2.1.3.2 | SIFS can not be tranmistted. The sentence "The last PPDU transmission by the AP ended less than aSIFSTime before the end of the allocated time in which case it may transmit SIFS after the end of the last PPDU transmission" lacks an object on "it may transmit SIFS". | It should be "The last PPDU transmission by the AP ended less than aSIFSTime before the end of the allocated time in which case it may transmit a PPDU at SIFS after the end of the last PPDU transmission." | **Revised.**  Re-worded the text to align with similar usage of PIFS:  See P1981L12 of REVme 0.1: **“**A STA shall not commence the transmission of an RTS with a bandwidth signaling TA until at least **a PIFS** **after** the immediately preceding frame exchange sequence.”  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8318 | 244 | 48 | 35.2.1.3.2 | change PIFS to "At the TxPIFS slot boundary." | as in comment. | **Reject**  The term slot boundary seems to be typically used with reespect to end of a medium busy event and not exactly apply to the end of allocation event as in our case. |
| 5153 | 245 | 11 | 35.2.1.3.2 | Figure 35-1--Example of MU-RTS TXS Trigger frame with TXOP Sharing Mode subfield value equal to 1 soliciting UL PPDUPIFSMU: Shows "Data to Non-AP STA 2". Context of STA 2 is not evident. Suggest to replace with 'any other STA'.  Similar comment on Fig 35-2, for "Non-AP STA 3" | As in the comment | **Revised.**  Replaced with “another STA”.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 5237 | 245 | 48 | 35.2.1.3.3 | In Figure 35-2, "Time allocated in MU-RTS TX TF" should be changed to "Time allocated in MU-RTS TXS TF". Same for Figure 35-1. | As in comment | **Revised.**  Made the corresponding change.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 5518 | 245 | 18 | 35.2.1.3 | In Figure 35-1, SU PPDU should be EHT MU PPDU for a single user since there is only two PPDU formats of EHT MU PPDU and EHT TB PPDU. | As in comment | **Revised.**  We replaced “SU PPDU” with “non-TB PPDU”.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 5734 | 245 | 55 | 35.2.1.3.2 | Figure 35-2, it would be good to indicate the duration before the AP can send Data to non-AP STA 3 | as in comment | **Revised.**  In the figures we now show examples where PIFS based separation is used. Since the other transmissions are SIFS separated as in baseline, we don’t show them.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 7558 | 245 |  | 35.2.1.3 | Figure 35-1 has a frame transmitted to Non-AP STA 2 but such STA doesn't appear in the figure. Non-AP STA 2 should be added as one of the STAs communicating with the AP, or add dots to show that there is potentially other STAs and change the description inside the last frame transmitted from the AP to say "Data to another non-AP STA". And is CTS-to-self fundamental for this operation? Seems not. The CTS-to-self at the beginning of the sequence should be deleted.  The same for Figure 35-2 on Non-AP STA 3. | As in comment. | **Revised.**  Added text to say its to another STA. While CTS-to-self is not fundamental, we added this to show that the TXS frame need not be first frame in the TXOP.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8322 | 245 | 20 | 35.2.1.3.2 | Change "MU-RTS TX TF" to "MU-RTS TXS Trigger frame" | as in comment. | **Revised.**  Made the corresponding change.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8323 | 245 | 22 | 35.2.1.3.2 | TXOP shall include the CTS-to-self. | Please clarify it | **Revised.**  Made the corresponding change.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8324 | 245 | 33 | 35.2.1.3.2 | TXOP Sharing Mode subfield equal to 2 has two different cases: Uplink transmission and P2P transmission. It's better to give an example how to use in the mixed cases: Both the P2P and Uplink traffic need be transmitted. | as in comment. | **Revised.**  Agreed in principle. Made the corresponding change to Figure 35-2 .  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 8327 | 245 | 49 | 35.2.1.3.2 | TXOP shall include the CTS-to-self. | Please clarify it | **Revised.**  Made the corresponding change.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 4193 | 245 | 8 | 35.2.1.2.2 | Speaking of figures, maybe good to add time separations between the frames (SIFS, PIFS and such). Also please use same artistic formatting of other figures in the draft being created so that they are similar. | As in comment. | **Revised.**  Added the separation for the Mode 2 in Fig 35-2. Since the remaining follows baseline SIFS separation, did not change the rest. Also tried to increase resolution for the text.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |
| 4821 | 245 | 69 | 35.2.1.3.3 | In many typical scenarios a device has one interface that's associated to an AP while the other interface is engaged in a peer-to-peer service. The Triggered TXOP sharing procedure should be extended to work for those cases. | Extend the Triggered TXOP sharing procedure s.t. time allocated by an AP to an associated STA can be used by interfaces collocated with that STA interface. | **Revised.**  Added text to clarify this is possible except that some transmissions such as STA-to-OBSS AP is not possible.  **TGbe editor:** make the changes identified below in https://mentor.ieee.org/802.11/dcn/21/11-21-1731-00-00be-CR-remaining-35.2.1.3-part1.docx. |

Discussion for 4821:

In many typical peer-to-peer protocols in practice other than TDLS a client device (laptop) has one interface that’s associated to an infra-structure AP and a different interface to perform peer-to-peer operations. So, to improve QoS for P2P and other links in the BSS it makes sense to allow the TXS feature to work for such scenarios as well. So, a simple extension, without adding complexity and optimizations, would be to have a STA-2 on receipt of a TXS TF with Mode 2 to STA-1 also transmit P2P PPDUs to another peer STA-3, if (STA-1, STA-2) share the same hardware resources, channel etc. Clearly, such STAs would also need to finish all their transmission before the allocated time.

Note that the baseline spec already allows an AP to solicit PPDUs from unassociated STA (e.g., RA-RU and 11az TB Ranging). Moreover, the transmitted BSSID can solicit frames via TF from both STAs associated to it and the unassociated ones in same TXOP. So, the change with respect to baseline is just about using a single TF from the AP to solicit PPDUs from virtual STAs on same channel without need to define any additional signaling between each of the virtual STAs and the AP (e.g., addressing AID assignment etc.).

**TGbe Editor: *Modify the entry corresponding to Triggered TXOP Sharing Support in Table 9-322at as:***

Table 9-322at—Subfields of the EHT MAC Capabilities Information field

|  |  |  |
| --- | --- | --- |
| **Subfield** | **Definition** | **Encoding** |
| (#4918)Triggered TXOP Sharing Mode 1 Support | Indicates support for transmitting or responding to an MU-RTS TXS Trigger frame (#7588, 7706, 8292, 8293) with Triggered TXOP Sharing Mode field equal to 1 that does not solicit TB PPDU. | For an EHT AP: Set to 1 to indicate that the AP is capable of transmitting a an MU-RTS TXS Trigger (#7588, 7706, 8292, 8293) frame that allocates time to a STA to transmit non-TB PPDUs to the EHT AP (i.e., with Triggered TXOP Sharing Mode field equal to 1 (see 35.2.1.3 (Triggered TXOP sharing procedure))). Set to 0 otherwise. For an non-AP EHT STA: Set to 1 to indicate that the non-AP STA is capable of responding to an TXS Trigger (#7588,7706, 8292, 8293) frame that allocates time to (#8294)the STA to transmit non-TB PPDUs to the EHT AP (i.e., with Trig gered TXOP Sharing Mode field equal to 1 (see 35.2.1.3 (Triggered TXOP sharing procedure))). Set to 0 otherwise. |
| (#4918)Triggered TXOP Sharing Mode 2 Support | Indicates support for transmitting or responding to an MU-RTS TXS Trigger frame (#7588, 7706, 8292, 8293) with Triggered TXOP Sharing Mode field equal to 2 that does not solicit TB PPDU. | For an EHT AP: Set to 1 to indicate that the AP is capable of transmitting a an MU-RTS TXS Trigger (#7588, 7706, 8292, 8293) framethat allocates time to a STA to transmit non-TB PPDUs to other STAs or to its associated AP (i.e., with Triggered TXOP Sharing Mode field equal to 2 (see 35.2.1.3 (Triggered TXOP sharing procedure))). Set to 0 otherwise. For an non-AP EHT STA: Set to 1 to indicate that the non-AP STA is capable of responding to an MU-RTS TXS Trigger (#7588, 7706, 8292, 8293) frame that allocates time to (#8294)the STA to transmit non-TB PPDUs to other STAs or to its associated AP (i.e., with Triggered TXOP Sharing Mode field equal to 2 (see 35.2.1.3 (Triggered TXOP sharing procedure))). Set to 0 otherwise |

35.2.1.3.2 AP behavior

**TGbe Editor: *Revise the following text in 35.2.1.3.2 at P316L54:***

If in response to a transmitted MU-RTS TXS Trigger frame the EHT AP receives a CTS frame from the nonAP STA that was allocated time in that Trigger frame, then the AP may transmit a PPDU after the end of the  
allocated time and before its TXNAV timer has expired if any of the following conditions are satisfied:  
— The medium is determined to be idle by the CS mechanism at the end of the allocated time in which  
case it may transmit a (#7809) PIFS after the end of the allocated time.  
— The last PPDU transmission by the AP ended less than aSIFSTime before the end of the allocated  
time in which case it may transmit a (#7810) SIFS after the end of the last PPDU transmission.

**TGbe Editor: *Replace Figure 35-1 with the following:***



**Figure 35-1—Example of MU-RTS TXS Trigger frame with TXOP Sharing Mode subfield  
value equal to 1 soliciting UL PPDU *(#***5153, 4193 8327 8323 8322 7558, 5237, 5518, 5734).

**TGbe Editor: *Replace Figure 35-2 with the following:***



**Figure 35-2 Example of MU-RTS TXS Trigger frame with TXOP Sharing Mode value equal to 2 *(#***5153, 4193 8327 8323 8322 7558, 5237, 8324, 5734)**.**

**TGbe Editor: *Revise the following text in 35.2.1.3.2 P330L36:***

An EHT AP shall not send (#6394)an MU-RTS TXS Trigger frame with TXOP Sharing Mode subfield equal to 1 and with the User Info field that is addressed  
to an associated non-AP STA from which it has not received an EHT Capabilities element with the   
the Triggered TXOP Sharing Mode 2 Support subfield (#7588) subfield (#5960)equal to 1.

An EHT AP shall not send (#6394)an MU-RTS TXS Trigger frame with TXOP Sharing Mode subfield equal to 2 and with the User Info field that is addressed  
to an associated non-AP STA from which it has not received an EHT Capabilities element with the   
the Triggered TXOP Sharing Mode 2 Support subfield subfield (#5960)equal to 2 (#7588).

35.2.1.3.3 Non-AP STA behavior

**TGbe Editor: *Insert the following in 35.2.1.3.3 after the last paragraph:***

A non-AP EHT STA that receives a MU-RTS TXS Trigger frame from its associated AP that contains a User Info field addressed to the STA  
shall update its CWmin[AC], CWmax[AC], AIFSN[AC] and MUEDCATimer[AC] state variables to the  
values contained in the dot11MUEDCATable, for all the ACs from which at least one QoS Data frame was  
transmitted successfully in a non-TB PPDU to the AP within the time allocated in the Trigger frame. A QoS Data frame is transmitted successfully by the STA for an AC if it requires immediate acknowledgment and the  
STA receives an immediate acknowledgment for that frame, or if the QoS Data frame does not require  
immediate acknowledgment (#5708).

The updated MUEDCATimer[AC] shall start at the end of the immediate response if a non-TB PPDU transmitted to its associated AP within the time allocated in an MU-RTS TXS Trigger frame contains at least one QoS Data frame for that AC that requires  
immediate acknowledgment, and shall start at the end of the non-TB PPDU if the transmitted non-TB PPDU  
to its associated AP does not contain any QoS Data frames for that AC that require immediate acknowledgment (#5708).

344

NOTE —A non-AP EHT STA does not update its state variables to the values contained in the MU EDCA Parameter Set element as defined in 26.2.7 (EDCA operation using MU EDCA parameters) or if any of the following apply:

— The Trigger frame addressed to the STA is not an MU-RTS TXS Trigger frame.

— The STA does not include QoS Data frames in the non-TB PPDU response sent to its associated AP in response to the MU-RTS TXS Trigger frame (#5708).

During the time allocated by an associated AP to an associated non-AP STA 1 with TXOP Sharing Mode subfield value equal to 2, another EHT STA that shares the same operating class, channel, receive antenna connector, and transmit antenna may also transmit non-TB PPDUs to another non-AP STA following the same rules as described above. The NAV set by the Duration field in the frames transmitted by such a STA shall not exceed the allocated time from the time of reception of the corresponding MU-RTS TXS frane. (#4821).

**26.9.3 Transmit operating mode (TOM) indication**

***TGbe editor: Modify the text starting in P3841L16 of Revme draft 0.1 as follows:***

An OMI responder that has transmitted the OM Control UL MU Data Disable RX Support subfield set to 1  
shall regard an OMI initiator as capable of participating in UL MU operation for TB PPDU transmissions (#4737) only for the purpose of transmission of acknowledgments if the UL MU Disable subfield is equal to 0 and the UL MU Data Disable subfield is equal to 1 in the most recently received OM Control subfield from that OMI initiator.