IEEE P802.11
Wireless LANs

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|  CR on 10.22.2.8 TXOP limits |
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Abstract

This submission proposes resolutions for multiple comments related to TGax D1.0 with the following CIDs:

* 6189, 7040, 9412

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Including HE SU sounding case
* Rev 2: Editorials
* Rev 3: Modifying Control MPDU and maximally fragmented MSDU condition, adding HE MU sounding condition,
* Rev 4: Restoring Control MPDU condition to its original state, making a separate condition for HE sounding
* Rev 5: Editorials

***Editing instructions formatted like this are intended to be copied into the TGax Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGax Editor: Editing instructions preceded by “TGax Editor” are instructions to the TGax editor to modify existing material in the TGax draft. As a result of adopting the changes, the TGax editor will execute the instructions rather than copy them to the TGax Draft.***

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| CID | Page.line | Comment | Proposed Change | Resolution |
| 6189 | 133.25 | The baseline spec does not allow a transmission that exceeds the TXOP limit for any fragmentable data. TXOP limit rules must be updated for HE STAs capable of dynamic fragmentation. | As per comment | Revised –Agree in principle with the comment.HE fragmentation has different rules on generating fragments. The referred paragraph is revised so that it could be applied properly to HE STAs.TGax editor to make the changes shown in 11-17/0088r5 under the heading that include CID 6189. |
| 7040 | 132.53 | From the dynamic fragmentation capabilities in HE STA, 11ax needs to revise exception rules that allow a STA to exceed the TXOP limit. TXOP limit exception rules should be revised for HE STAs considering dynamic fragmentation capabilities. | As per comment. | Revised –Agree in principle with the comment.HE fragmentation has different rules on generating fragments. The referred paragraph is revised so that it could be applied properly to HE STAs.TGax editor to make the changes shown in 11-17/0088r5 under the heading that include CID 7040. |
| 9412 | 133.25 | In the baseline, there are several exceptions that allows a STA to exceed the TXOP limit which can be avoided in HE BSS (regarding dynamic fragmentation). For better channel utilization of HE AP, the TXOP limit exception rules must be further clarified for HE STAs. | As per comment | Revised –Agree in principle with the comment.HE fragmentation has different rules on generating fragments. The referred paragraph is revised so that it could be applied properly to HE STAs.TGax editor to make the changes shown in 11-17/0088r5 under the heading that include CID 9412. |

**Discussion:**

The following paragraph is quoted from 11mc, D8.0, 10.22.2.8 TXOP limits. In the paragraph, several cases are listed where non-zero TXOP limit value could be exceeded by a transmission of a TXOP holder. The basic idea of this paragraph is to forbid TXOP limit violation when the MAC could avoid it, but allow it as an exception when the MAC is subject to constraints outside its control.
If the TXOP limit is long enough for transmission of one MSDU, no exceptions are necessary. However, if the size of an MSDU is very large or AP sets very short TXOP limit, transmission of an MSDU may not be possible to keep the TXOP limit. In such case, MAC may fragment the MSDU to avoid TXOP limit violation, but there are few constraints outside its control.

*The TXOP holder may exceed the TXOP limit only if it does not transmit more than one Data or Management frame in the TXOP, and only for:*

* *Retransmission of an MPDU, not in an A-MPDU consisting of more than one MPDU*
* *Initial transmission of an MSDU under a block ack agreement, where the MSDU is not in an A-MPDU consisting of more than one MPDU and the MSDU is not in an A-MSDU*
* *Transmission of a Control MPDU or a QoS Null MPDU, not in an A-MPDU consisting of more than one MPDU*
* *Initial transmission of a fragment of an MSDU or MMPDU, if a previous fragment of that MSDU or MMPDU was retransmitted*
* *Transmission of a fragment of an MSDU or MMPDU fragmented into 16 fragments*
* *Transmission of an A-MPDU consisting of the initial transmission of a single MPDU not containing an MSDU and that is not an individually addressed Management frame*
* *Transmission of a group addressed MPDU, not in an A-MPDU consisting of more than one MPDU*
* *Transmission of a null data packet (NDP)*
* *Transmission of a VHT NDP Announcement frame and NDP or transmission of a Beamforming Report Poll frame, where these fit within the TXOP limit and it is only the response and the immediately preceding SIFS that cause the TXOP limit to be exceeded.*

As HE STAs gain more capabilities, some cases above became avoidable and some other cases could be misused by HE STAs.

1. The fourth bullet allows a TXOP holder to exceed the TXOP limit value for *Initial transmission of a fragment of an MSDU or MMPDU, if a previous fragment of that MSDU or MMPDU was retransmitted*.
Even though the initial transmission of the first fragment is subject to the TXOP limit rules, MAC must be able to rate select down in case of retransmission and that might cause the violation of the TXOP limit. In static fragmentation, if any of previous fragments of the same MSDU had been retransmitted, the MAC cannot change the size of subsequent fragments. For this reason, transmissions of any subsequent fragments of the MSDU are allowed to violate the TXOP limit rule considering the lower rate selection.
However, in dynamic fragmentation, the MAC can always resize subsequent fragments so that they could fit into the TXOP limit even with lower rate. Hence the fourth bullet should not be applied to transmission of dynamic fragmentation. Otherwise, the HE STA could make subsequent fragments of any sizes without considering the TXOP limit.
2. The fifth bullet allows a TXOP holder to exceed the TXOP limit value for *Transmission of a fragment of an MSDU or MMPDU fragmented into 16 fragments*.
In static fragmentation, once the size of the first fragment of an MSDU is defined, the number of total fragments and the size of each fragment are also defined at the same time. Therefore, if the first fragment of an MSDU is generated and it requires the total number of fragments to be 16, then each fragment may violate the TXOP limit including the first fragment since the MAC cannot produce fragments any further.
However, in dynamic fragmentation, the MAC may not predict how many fragments will be produced until when the last fragment(MF=0) is generated. Hence, for dynamic fragmentation, until the FN reaches 15, all initial transmissions of previous dynamic fragments must be subject to the TXOP limit rule, and only the 16th fragment may cause the TXOP limit to be exceeded.
3. Referring the ninth bullet, the baseline considers the sounding sequence as an exception of the TXOP limit rule. We added HE NDPA in the sentence so that the same rule can be applied to the HE sounding we sequence.
Additionally, as the HE MU sounding sequence is also defined in 11ax, we added the sequence to the exception rules. Following the same logic of the baseline, we only allow the responding feedback frame and the preceding SIFS to exceed the TXOP limit, and the soliciting frames (HE NDPA++NDP++BRP Trigger) must fit within the TXOP limit.
4. An originator of using dynamic fragmentation must generate the first dynamic fragment of an MSDU thereof the size must be greater than the minimum fragment size specified by the recipient. Since MAC cannot generate the first dynamic fragment of an MSDU smaller than the minimum fragment size, transmission of the first fragment may exceed the TXOP limit. In this case, however, the originator must make the fragment as small as possible. Therefore, the size of the first fragment must be set to the minimum fragment size.

**10.22.2.8 TXOP limits**

**TGax Editor: *Insert the following paragraphs below before the last paragraph of subclause 10.22.2.8*** *in page 133 of D1.0 (#CID 6189, 7040, 9412)*

The TXOP holder may exceed the TXOP limit only if it does not transmit more than one Data or Management frame in the TXOP, and only for:

* Retransmission of an MPDU, not in an A-MPDU consisting of more than one MPDU
* Initial transmission of an MSDU under a block ack agreement, where the MSDU is not in an A-MPDU consisting of more than one MPDU and the MSDU is not in an A-MSDU
* Transmission of a Control MPDU or a QoS Null MPDU, not in an A-MPDU consisting of more than one MPDU
* Initial transmission of a fragment of an MSDU or MMPDU under static fragmentation, if a previous fragment of that MSDU or MMPDU was retransmitted (#6189, 7040, 9412)
* Transmission of a fragment of an MSDU or MMPDU fragmented into 16 fragments under static fragmentation (#6189, 7040, 9412)
* Transmission of the 16th fragment of an MSDU or MMPDU or A-MSDU under dynamic fragmentation (#6189, 7040, 9412)
* Initial transmission of the first fragment of an MSDU or MMPDU or A-MSDU under dynamic fragmentation, where the size of the first fragment is equal to the minimum fragment size specified by the receiver STA and the MSDU or MMPDU or A-MSDU is not in an A-MPDU consisting of more than one MPDU (#6189, 7040, 9412)
* Transmission of an A-MPDU consisting of the initial transmission of a single MPDU not containing an MSDU and that is not an individually addressed Management frame
* Transmission of a group addressed MPDU, not in an A-MPDU consisting of more than one MPDU
* Transmission of a null data packet (NDP)
* Transmission of a VHT NDP Announcement frame and NDP or transmission of a Beamforming Report Poll frame, where these fit within the TXOP limit and it is only the response and the immediately preceding SIFS that cause the TXOP limit to be exceeded.
* Transmission of an HE NDP Announcement frame and NDP or transmission of an HE NDP Announcement frame and NDP and BRP Trigger frame or transmission of a BRP Trigger frame, where these fit within the TXOP limit and it is only the response and the immediately preceding SIFS that cause the TXOP limit to be exceeded. (#6189, 7040, 9412)

Except as described above, a STA shall fragment an individually addressed MSDU or MMPDU so that the

initial transmission of the first fragment does not cause the TXOP limit to be exceeded.

NOTE 3—The TXOP limit is not exceeded for:

* Initial transmission of an MPDU containing an unfragmented though fragmentable (see 10.2.7 (Fragmentation/ defragmentation overview) and 27.3 (Fragmentation)) MSDU/MMPDU (#6189, 7040, 9412)
* Initial transmission of the first fragment of a fragmented MSDU/MMPDU under static fragmentation, except for an MSDU/MMPDU fragmented into 16 fragments (#6189, 7040, 9412)
* Initial transmission of an A-MSDU
* Initial transmission of a fragment of a fragmented MSDU/MMPDU under static fragmentation, if no previous fragment of that MSDU/ MMPDU was retransmitted, except for an MSDU/MMPDU fragmented into 16 fragments (#6189, 7040, 9412)
* Initial transmission of a fragment of a fragmented MSDU/MMPDU/A-MSDU under dynamic fragmentation, except for, either the first fragment of a fragmented MSDU/MMPDU/A-MSDU using the minimum fragment size specified by the receiver STA, or the 16th fragment of a fragmented MSDU/MMPDU/A-MSDU (#6189, 7040, 9412)
* Transmission of an A-MPDU consisting of a single MPDU containing an A-MSDU or individually addressed Management frame, unless this is a retransmission of that MPDU
* Transmission of an A-MPDU consisting of more than one MPDU, even if some or all of the MPDUs are retransmissions