IEEE P802.11  
Wireless LANs

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | CR for 27.3.1 | | | | | | Date: 2017-07-09 | | | | | | Author(s): | | | | | | Name | Affiliation | Address | Phone | email | | Laurent Cariou | Intel |  |  | Laurent.cariou@intel.com | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |

Abstract

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

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGax Draft. This introduction is not part of the adopted material.

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

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

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| **CID** | **Section** | **Page** | **Comment** | **Proposed change** | **Resolution** |  |  |
| 6994 | 27.3 | 152.00 | Why is there no mention of the No-Fragmentation field in the ADDBA Extension element? | Define the impact/status of the No-Fragmentation field in the ADDBA Extension element? | Rejected– it is already clarified that the No-fragmentation field is reserved when transmitted by an HE STA. |  |  |
| 6598 | 27.3.1 | 152.41 | Descriptive language used where it seems normative language must have been intended: an HE STA "supports" static fragmentation. How do you know what it supports? Apparently what is meant is that an HE STA shall support static fragmentation. If so, it would be better to say so. | Change "An HE STA supports" to "An HE STA shall support". | Revised – agree in principle with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 6983 | 27.3.1 | 152.41 | There is no need to call "legacy" fragmentation "static fragmentation", it is adequate to simply refer to it as fragmentation, with the references provided. | Delete the insertion "static" | Revised – agree in principle with the comments. Make the changes as proposed in doc 1335r1. |  |  |
| 6984 | 27.3.1 | 152.41 | Aren't there more than on fragmentation procedure? Shouldn't this be fragmentation procedures? | Replace "procedure" with procedures" | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 7796 | 27.3.1 | 152.41 | Use proper normative verbs | Change these sentences to, "An HE STA shall support the ... In addition, an HE STA may support the ..." | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 8434 | 27.3.1 | 152.41 | "An HE STA supports the static fragmentation procedure...". The procedure that is supported by an HE STA is the fragmentation procedure, not the static fragmentation procedure. What is called "static fragmetnation" is just a small part of that procedure (i.e., the genreation of uniformly sized fragments). | Change to read "An HE STA supports the fragmentation procedure defined in 10.2.7, ,,," | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 6599 | 27.3.1 | 152.42 | Descriptive language used where it seems normative language must have been intended: an HE STA "can also support" dynamic fragmentation. The ability of a device to do so should not be in question; what is apparently intended is that an HE STA is permitted to do so. If so, it would be better to say so. | Change "can" to "may". | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 7797 | 27.3.1 | 152.45 | U | Change "can" to "may". Same thing at P157L21, and P158L1. | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 6600 | 27.3.1 | 152.46 | Descriptive language used where it seems normative language must have been intended: "An HE STA can dynamically fragment". The ability of a device to do so should not be in question; what is apparently intended is that an HE STA is permitted to do so. If so, it would be better to say so. | Change "can" to "may". | Revised – agree with the commenter. Make the changes as proposed in doc 1335r1. |  |  |
| 6986 | 27.3.1 | 152.48 | Reading this paragraph one could interpret that dynamic fragmentation suspends all fragmentation rules in 10.2.7. I don't believe that this is the intent. Clarify that dynamic fragmentation allows for several of the fragmentation rules in 10.2.7 to be ignored, not all of them. | Clarify the paragraph so that it is clear that only some fragmentation rules in 10.2.7 do not apply to HE dynamic fragmentation. | Revised – modify the sentence to simply state that dynamic fragmentation relaxes some of the rules from 10.2.7. Make the changes as in 1335r1. |  |  |
| 6987 | 27.3.1 | 152.51 | It is interesting that dynamic fragmentation provides further flexibility in aggregating the data to minimize padding - but there is no reference to dynamic fragmentation in 2.7.5 (MU operation). Either provide more information in this paragraph on how dynamic fragmentation makes MU operation more efficient, or provide some information in 2.7.5 on how dynamic fragmentation could be used to make MU operation more efficient. | Remove the reference to MU operation or provide some useful explanation as to how MU operation is improved by dynamic fragmentation. | Revised – agree with the commenter. No need to get into such details. Make the changes as defined in 1335r1. |  |  |
| 9413 | 27.3.2 | 152.52 | It is not allowed to generate a dynamic fragment from an MSDU of service class QoSNoAck, since it requires BA agreement. It is necessary to allow it for better efficiency | As per comment | Revised – the spec currently allow fragmentation for MSDUs without BA agreement, if the receiver support the fragmentation capability. |  |  |
| 5410 | 27.3.2 | 152.53 | The dynamic fragmentation requires more capability than the static fragmentation for the originator. Therefore, the spec should define the related transmitter requirements as in Subclause 10.3.2.11 of the baseline spec. | As per comment | Rejected – for fragmentation level 1 and 2, nothing changes. The only issue may be for fragmentation level 3. The resolution for this comment requires more details from the commenter. Propose to reject it unless a presentation is brought by the commenter. |  |  |
| 9399 | 27.3.2 | 152.53 | Static fragmentation allows only one outstanding fragment per TID. However, level 3 Dynamic fragmentation allows multiple outstanding fragments per TID per SN with different sizes. It is necessary to define an appropriate Fragment Number Space in order for an level 3 originator to refer when it generates a new fragment | Define Fragment Number Space | Rejected – the problem seems to be real, and focused only on fragmentation level 3. The resolution for this comment requires more details from the commenter. Propose to reject it unless a presentation is brought by the commenter. |  |  |
| 6989 | 27.3.2 | 152.55 | The phrase "a dynamic fragment" does not make any sense as it is used. As the fragment, dynamic or not, is always contained in a MPDU. So a dynamic fragment can not be an MPDU as stated. | Correct the sentence to so that it is a meaningful statement. As it is I'm not sure what the intended meaning of the sentence is. | Revised – remove the sentence and rewrite the paragraph to clarify the meaning. Make the changes as defined in 1335r1. |  |  |
| 8435 | 27.3.2 | 152.55 | In 10.5 there is a statement referencing conditions defined in 27.3.2 that need to be met. The single paragraph in 27.3.2 is a mixture of conditions, a statement permitting fragmentation of A-MSDUs and a procedure for fragmenting where the length of each fragment is not uniform. Separate the conditions from the other statements. | Define a non-uniformly fragmentated MSDU, A-MSDU or MMPDU: "With a non-uniformly fragmented MSDU, A-MSDU or MMPDU, the length of each fragment is not necessarily the same. The length of the first fragment is greater than or equal to the minimum fragment size indicated in the Minimum Fragment Size subfield of the HE Capabilities Information field in the HE Capabilities element sent by the recipient STA. If the length of the MSDU, A-MSDU or MMPDU is less than the minimum fragment size, then the MSDU, A-MSDU or MMPDU is not fragmented." And then define the conditions under which it can be used: "An HE STA may non-uniformly fragment an MSDU, A-MSDU or MMPDU provided the following conditions are met: 1) The recipient STA has indicated support for level 1, level 2 or level 3 fragmentation in the HE Fragmentation Support subfield of the HE Capabilities Information field of the HE Capabilities element, 2) ..." | Revised – agree in principle with the commenter. Clarify the differences with legacy fragmentation. Make the changes as defined in 1335r1. |  |  |
| 6988 | 27.3.2 | 152.58 | The rules defined in 10.2.7 do not list any the rules listed in this paragraph. Hence the list in this paragraph is not a list of rules defined in 10.2.7 and 10.5 which are not being followed as stated in the paragraph. These all seem to be new additional rules or behaviors. | Either provide a list of the rules from 10.2.7 and 10.5 that are now being excepted or rephrase the paragraph so that it is correct. | Revised – agree with the commenter. Clarify what is defined in 10.2.7 and what is defined in this new section. Make the changes as in 1335r1. |  |  |
| 6990 | 27.3.2 | 152.63 | The statement that reception dynamic fragments is not mandatory, does not belong here. The requirement to receive an MPDU containing a dynamic fragmented payload may be optional, but that should be made clear in the PICs not here in the specification. The specification should only say that a STA may receive an MPDU that contains dynamically fragmented MSDU/A-MPDU/MMPDU. The restriction, if any, is that an HE AP should only send a MPDU containing dynamically fragmented MSDU/A-MPDU/MMPDU to a HE STA that can receive it. | Remove or correct this bulleted so that it is providing some useful information. | Revised – agree with the commenter. Make the changes as defined in doc 1335r1. |  |  |

***Modify section 27.3 Fragmentation as proposed below***

* Fragmentation and defragmentation(#8457)
* General

An HE STA shall follow (#6598) the fragmentation procedures defined in 10.2.7 (Fragmentation/defragmentation overview), 10.5 (Fragmentation), and 10.6 (Defragmentation). An HE STA may also support the dynamic fragmentation procedure defined in this subclause (#6985), which relaxes some of the rules defined in 10.2.7 to provide further flexibility in aggregating the data to fit in a constrained payload duration.

Subclauses 10.2.7 (Fragmentation/defragmentation overview) and 10.5 (Fragmentation) define the procedure to generate uniformly fragmented MSDU or MMPDU, where the length of each fragment is the same, except for the last fragment. These fragments are not allowed to be included in a A-MPDU under HT-immediate block ack agreements.

This subclause defines the procedure that generate non-uniformly fragmented MSDU, A-MSDU or MMPDU, where the length of each fragment is not required to be the same. The length of the first fragment shall be greater than or equal to the minimum fragment size indicated in the Minimum Fragment Size subfield of the HE Capabilities Information field in the HE Capabilities element sent by the recipient STA. If the length of the MSDU, A-MSDU or MMPDU is less than the minimum fragment size, then the MSDU, A-MSDU or MMPDU shall not be fragmented. We call dynamic fragments the fragments generated with dynamic fragmentation.

In addition, these procedures allow the inclusion of these dynamic fragments within a S-MPDU, A-MPDU or multi-TID A-MPDUs under HT-immediate block ack agreements.

An HE STA follows the rules defined in 27.3.2 (Fragmentation) for generating these fragments.

* Dynamic Fragmentation(#8457)
* General

An originator STA transmitting an MPDU or A-MPDU that contains one or more dynamic fragments shall solicit an immediate response from the recipient STA for each of the fragments contained in the MPDU or A-MPDU, except when the fragments are sent under level 3 dynamic fragmentation (see 27.3.2.4 (Level 3 dynamic fragmentation)).

An HE STA may transmit dynamic fragments of an A-MSDU provided the A-MSDU Fragmentation Support subfield of the HE Capabilities element transmitted by the recipient is 1.

A STA shall not transmit a fragment containing all or part of an A-MSDU that is greater than the maximum A-MSDU size as specified in Table 9-19 (Maximum data unit sizes (in octets) and durations (in microseconds)).

NOTE—The originator STA sends the fragments in order as defined in 10.5 (Fragmentation), except for level 3 dynamic fragmentation.

If the originator STA received explicit indications in response frames that none of the transmissions of previously transmitted fragments of an MSDU, A-MSDU or MMPDU have been successfully received then the STA may retransmit the full MSDU, A-MSDU or MMPDU instead of retransmitting all the failed fragments. Otherwise, the originator STA may retransmit the failed fragments, in which case the frame body length and contents of the retransmitted fragments shall be the same as previously transmitted.(#6601)

NOTE—An explicit indication is the absence of a valid Ack frame, BlockAck frame or Multi-STA BlockAck frame that is expected to be present in the first MPDU of the immediately received A-MPDU, or the absence of a BA Information field in the immediately received Multi-STA BlockAck frame for the TID of the transmitted fragment(s).

An originator STA shall not transmit to a recipient STA an MPDU or A-MPDU containing dynamic fragments that do not satisfy the conditions in the subclauses below.

* Level 1 dynamic fragmentation

An originator STA may transmit to a recipient STA an MPDU or S-MPDU that contains one dynamic fragment of an MMPDU or of an MSDU that is not sent under a block ack agreement if the recipient STA has indicated a value 1 in the HE Fragmentation Support field of its HE Capabilities element. An originator STA may transmit to a recipient STA an MPDU or S-MPDU that contains one dynamic fragment of an A-MSDU if the recipient STA has indicated a value of 1 in the A-MSDU Fragmentation Support field of its HE Capabilities element.

An originator STA may transmit to a recipient STA an MPDU or S-MPDU that contains one dynamic fragment of an MSDU that is sent under a block ack agreement if(#5927, #8442, #8443) the following conditions are met:

* The HE Fragmentation Support field in the HE Capabilities element received from the STA is 1
* For the block ack agreement associated with the TID of the MSDU, the ADDBA Extension element is present and the HE Fragmentation Operation subfield is 1 in the ADDBA Response frame received from the STA.(#8444)
* Level 2 dynamic fragmentation

An originator STA may transmit fragmented MMPDUs or MSDUs that are not sent under a block ack agreement to a recipient STA using level 2 dynamic fragmentation if the HE Fragmentation Support field of the HE Capabilities element received from the STA is 2.

An originator STA may transmit fragmented MSDUs under a block ack agreement to a recipient STA using level 2 dynamic fragmentation provided the following conditions are met:

* The HE Fragmentation Support field in the HE Capabilities element received from the STA is 2
* For the block ack agreement associated with the TID of the MSDU, the ADDBA Extension element is present and the HE Fragmentation Operation subfield is 2 in the ADDBA Response frame received from the STA.

Using level 2 dynamic fragmentation, an originator STA may transmit to a recipient STA an MPDU, S-MPDU, or A-MPDU that contains:

* One dynamic fragment of an MSDU, A-MSDU if supported by the recipient, or MMPDU in an MPDU or S-MPDU
* The originator STA shall follow the rules defined in 10.13.8 (Transport of S-MPDUs) for generating the S-MPDU
* Up to one dynamic fragment of an MSDU, A-MSDU if supported by the recipient, or MMPDU for each MSDU and for the MMPDU in an A-MPDU format
* The originator STA shall follow the rules defined in 10.24.7.7 (Originator’s behavior) for generating the A-MPDU and the rules defined in 27.10.4 (A-MPDU with multiple TIDs) for generating the multi-TID A-MPDU (that may contain the fragment of the MMPDU)
* Level 3 dynamic fragmentation

An originator STA may transmit fragmented MSDUs or A-MSDU if supported by the recipient under a block ack agreement or fragmented MMPDU to a recipient STA using level 3 dynamic fragmentation provided the following conditions are met:

* The HE Fragmentation Support field in the HE Capabilities element received from the STA is 3
* For the block ack agreement associated with the TID of the MSDU or A-MSDU, the ADDBA Extension element is present and the HE Fragmentation Operation subfield is 3 in the ADDBA Response frame received from the STA.(#5928, #3302, #8158, #8544, #7539, #8545, #9188)

The level 3 fragmentation allows multiple fragments of an MSDU or A-MSDU included in the same A-MPDU, reducing the fragments transmission delay(#5928). In the level 3 fragmentation, the block acknowledgment record maintains 4 bits per MSDU or A-MSDU (one bit for each fragment of the MSDU) if at least one MPDU's Fragment Number field is of nonzero value that solicits the immediate response in the received A-MPDU, otherwise 1 bit per MSDU(#8546).

(#8546)An originator STA may transmit to a recipient STA, which has indicated a value 3 in the HE Fragmentation Support field of its HE Capabilities element, an MPDU, S-MPDU, or A-MPDU that contains:

* One dynamic fragment of an MSDU, A-MSDU if supported by the recipient, or MMPDU in an MPDU or S-MPDU
* The originator STA shall follow the rules defined in 10.13.8 (Transport of S-MPDUs) for generating the S-MPDU
* Up to four dynamic fragments of an MSDU for each MSDU and up to one dynamic fragment of an MMPDU in an A-MPDU, and up to four dynamic fragments of an A-MSDU for each A-MSDU in an A-MPDU(#8160) if supported by the recipient
* The originator STA shall set the Fragment Number subfield of each MPDU to a value less than 4
* The originator STA shall follow the rules defined in 10.24.7.7 (Originator’s behavior) for generating the A-MPDU with the exception that the A-MPDU shall contain MPDUs whose range of the Sequence Number subfields does not exceed *BL*/4, where *BL* is the length of the Block Ack Bitmap field of the BlockAck or Multi-STA BlockAck frame that corresponds to a TID of a transmitted fragment (see 10.24.7 (HT-immediate block ack extensions) and 27.4 (Block acknowledgement)).
* Defragmentation(#8457)
* General

An HE STA shall set the HE Fragmentation Support subfield of the HE Capabilities element it transmits to 0 if its dot11HEDynamicFragmentationImplemented is false. Otherwise the HE STA shall set the HE Fragmentation Support subfield as follows:

* Set to 1 if the STA supports reception of dynamic fragments following the procedure defined in 27.3.2.2 (Level 1 dynamic fragmentation)
* Set to 2 if the STA supports reception of dynamic fragments following the procedure defined in 27.3.2.3 (Level 2 dynamic fragmentation)
* Set to 3 if the STA supports reception of dynamic fragments following the procedure defined in 27.3.2.4 (Level 3 dynamic fragmentation)

Defragmentation of dynamic fragments shall follow the rules defined in 10.6 (Defragmentation) with the following exceptions:

* The recipient STA shall support the concurrent reception of dynamic fragments of a number of *outstanding* MSDUs, A-MSDUs when supported and MMPDUs from a transmitting STA that is equal to *Nmax*, where *Nmax* for MSDUs is indicated in the Maximum Number of Fragmented MSDUs subfield of the HE Capabilities element transmitted by the STA, and *Nmax* is equal to 1 for MMPDUs. The term *outstanding* refers to an MPDU containing all or part of an MSDU, A-MSDU or MMPDU for which transmission has been started, and for which delivery of the MSDU, A-MSDU or MMPDU has not yet been completed (i.e., an acknowledgment of the final fragment has not been received and the MSDU, A-MSDU or MMPDU has not been discarded due to retries, lifetime, or for some other reason).
* The recipient STA is not subject to the receive timer rules for each of the MSDUs, A-MSDUs and MMPDUs defined in 10.6 (Defragmentation).

A STA that has dot11AMSDUFragmentationOptionImplemented true shall set the A-MSDU Fragmentation Support subfield in the HE Capability element to 1. Otherwise, the STA shall set the A-MSDU Fragmentation Support subfield in the HE Capability element to 0.

A STA that has dot11AMSDUFragmentationOptionImplemented true shall be capable of receiving fragments containing all or part of an A-MSDU of arbitrary length that is less than or equal to the maximum A-MSDU size as specified in Table 9-19 (Maximum data unit sizes (in octets) and durations (in microseconds)).

An HE STA shall set the HE Fragmentation Operation subfield, if present, in the ADDBA Response frame to a value that is less than or equal to the value of HE Fragmentation Operation subfield, if present, in the received ADDBA Request frame.(#7544)

* Level 1 dynamic defragmentation

Upon reception of an MPDU or S-MPDU that carries a dynamic fragment, the recipient STA responds with an Ack frame or a Multi-STA BlockAck frame when the received fragment is contained in an MPDU or S-MPDU that solicits an immediate response(#7075, #7535, #8454, #8456, #9523, #8455). The receiver STA shall follow the rules defined in 10.3.2.9 (Ack procedure) for generating the Ack frame and the rules defined in 27.4 (Block acknowledgement) for generating the Multi-STA BlockAck frame that contains the acknowledgement for the soliciting S-MPDU that carries one dynamic fragment and carried in an HE TB PPDU.(#8455)

* Level 2 dynamic defragmentation(#8457)

Upon reception of an MPDU or A-MPDU that carries one or more dynamic fragments, the recipient STA responds with one of the following frames:

* An Ack frame when the received fragment is contained in an MPDU or S-MPDU that solicits the immediate response. The recipient STA shall follow the rules defined in 10.3.2.9 (Ack procedure) for generating the Ack frame and the rules defined in 27.4 (Block acknowledgement) for generating the Multi-STA BlockAck frame that contains the acknowledgement for the soliciting S-MPDU carried in an HE TB PPDU.
* A BlockAck frame when the received fragments, up to one fragment for each MSDU or A-MSDU, are contained in an A-MPDU that solicits an immediate response. The recipient STA shall follow the rules defined in 10.24.7.5 (Generation and transmission of BlockAck frames by an HT STA or DMG STA) for generating the BlockAck frame and the rules in 27.4 (Block acknowledgement) for generating the Multi-STA BlockAck frame, except that the STA shall:
* Set to 0 the LSB of the Fragment Number subfield in the Block Ack Starting Sequence Control subfield of the BlockAck frame or Multi-STA BlockAck frame that corresponds to a TID of a received fragment
* Set to 1 each bit of the Block Ack Bitmap field that corresponds to a Sequence Number subfield and TID subfield of a successfully received fragment contained in the soliciting A-MPDU or multi-TID A-MPDU
* Update the corresponding block ack record only when an MSDU or A-MSDU that is received in fragments is successfully reconstructed (see 10.6 (Defragmentation)). Otherwise, do not update the block ack record for that MSDU or A-MSDU.(#6604)

A recipient STA shall discard any fragments that have been received during an HT-immediate block ack(#Ed) session for a TID if it receives a BlockAckReq frame from the originator STA for that TID when the fragments have a Sequence Number field value that is less than the value of the Starting Sequence Number field of the BlockAckReq frame (where the comparison of the two values is performed modulo 4096).

* Level 3 dynamic defragmentation(#8457)

Upon reception of an MPDU or A-MPDU that carries one or more dynamic fragments, the recipient STA responds with one of the following frames:

* An Ack frame when the received fragment is contained in an MPDU or S-MPDU that solicits the immediate response. The recipient STA shall follow the rules defined in 10.3.2.9 (Ack procedure) for generating the Ack frame and the rules defined in 27.4 (Block acknowledgement) for generating the Multi-STA BlockAck frame that contains the acknowledgement for the soliciting S-MPDU carried in an HE TB PPDU.
* A BlockAck frame when the received fragments, one or more fragments for each MSDU or A-MSDU, are contained in an A-MPDU where at least one MPDU's Fragment Number field is of non-zero value that solicits the immediate response(#5928, #3302, #8158, #8544, #7539, #8545, #9118). The recipient STA shall follow the rules in 10.24.7.5 (Generation and transmission of BlockAck frames by an HT STA or DMG STA) for generating the BlockAck frame, except that the STA shall:
* Set to 1 the LSB of the Fragment Number subfield in the Block Ack Starting Sequence Control subfield of the BlockAck frame or Multi-STA BlockAck frame that corresponds to a TID of a received fragment
* Set to 1 each bit in position *B* of the Block Ack Bitmap field that corresponds to a successfully received fragment and shall set it to 0 otherwise, with *B* calculated as:  
  *B* = 4 *(SN* – *SSN) + FN*, where the operations on the sequence numbers are performed modulo(#9117) 4096  
  *SN* is the value of the Sequence Number subfield of an MPDU containing the fragment for which the receive status is indicated  
  *SSN* is the value of the Starting Sequence Number subfield of the Block Ack Starting Sequence Control subfield of the BlockAck frame  
  *FN* is the value in the Fragment Number subfield(#9116)
* Update the corresponding block ack record only when an MSDU or A-MSDU that is received in fragments is successfully reconstructed (see 10.6 (Defragmentation)). Otherwise it shall not update the block ack record for that MSDU.

The recipient STA shall discard any fragments that have not been fully assembled as an(#Ed) MSDU, A-MSDU, or MMPDU and(#5802) that have been received during an HT-immediate block ack session for a TID if it receives a BlockAckReq frame from the originator STA for that TID and(#6607) the fragments have a Sequence Number field value that is less than the value of the Starting Sequence Number field of the BlockAckReq frame (where the comparison of the two values is performed modulo 4096).