IEEE P802.11
Wireless LANs

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| CIDs related to 27.5.1 |
| Date: May 3, 2018 |
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Abstract

Comment resolution with proposed changes to TGax D2.3 for CIDs from the WG LB for TGax related to DL MU procedure for unassociated STAs.

The CID list is: 14092, 13080, 13081, 13069, 13070 (5 CIDs).

The proposed changes on this document are based on TGax Draft 2.3.

Revisions:

* Rev 0: Initial version of the document, which contains two alternative solutions.
* Rev 1: complete the solution of using A-MPDU with MPDUs addressed to distinct STAs, by adding a capability bit for the STAs. Changes are highlighted in green.
* Rev 2: correction of erroneous CID numbers (compared to 17/1682r10)
* Rev 3:
	+ add CID #13070 in the list of resolved CIDs (from doc 18/0741r1), as solved by the proposed mechanism.
	+ Add a note in Table 9-425 according to comments received during adhoc meeting on May 2, for action frame consideration.

Interpretation of a Motion to Adopt

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

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

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

CIDs

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CID | Commenter | Clause | Page No. | Comment | Proposed Change | Resolution |
| 14092 | Yuchen Guo | 27.5.1.1 | 242L44 | An HE MU PPDU can only carry one Association response frame, which is not enough in the dense scenario. | Devise a scheme that allows multiple assocaition response frames to be carried in an HE MU PPDU | Revised.A procedure allowing multiple responses in a single HE MU PPDU is proposed. Capability is advertised for this support.Please make the changes to 802.11ax D2.3 as shown in the submission 11-18/0390r3 |
| 13080 | Pascal VIGER | 27.5.1.2 | 242L55 | a broadcast RU is a DL RU intended for multiple STAs (according 27.11.1), so this RU can convey frames addressed to several stations. This new form of RU mandates relaxing the TA addressing such that an AMPDU can aggregate frames intended to several stations (only for this special context).Typically, unassociated STAs can receive association responses from the AP they are willing to join, and each response is a unicast MPDU having a TA field set to their own individual address . | As indicated per comment, MPDUs aggregated in a AMPDU of an HE PPDU sent in a broadcast RU may have a RA field set to distinct MAC addresses (broadcast MAC address is also supported).I recommend to specify, for this specific case, that address type (individually addressed or group addressed) and address values of MPDUs may be different inside an A-MPDU sent in a broadcast RU. | Revised.Same resolution as CID 14092.Please make the changes to 802.11ax D2.3 as shown in the submission 11-18/0390r3 |
| 13081 | Pascal VIGER | 27.5.3.2.1 | 245L35 | a broadcast RU is a DL RU intended for multiple STAs (according 27.11.1), so this RU can convey frames addressed to several stations. This new form of RU mandates relaxing the TA addressing such that an AMPDU can aggregate frames intended to several stations (only for this special context).Typically, unassociated STAs can receive association responses from the AP they are willing to join, and each response is a unicast MPDU having a TA field set to their own individual address .The Note specifying that the UMRS Control fields within MPDUs carried in an A-MPDU have the same value is not applicable for broadcast RU that is addressed to several stations | Broadcast RU is a specific case that should not have such limitation in order to function properly.Please add a procedure allowing the AP to trigger several responses, one response been offered to each station addressed in the broadcast RU.As example, for the broadcast RU case, the condition can be amended as is: "the UMRS Control fields of MPDUs have the same value per given addressed STA". | Revised.Same resolution as CID 14092.Please make the changes to 802.11ax D2.3 as shown in the submission 11-18/0390r3 |
| 13069 | Pascal VIGER | 27.5.1.2 | 242L65 | a broadcast RU is a DL RU intended for multiple STAs (according 27.11.1), so this RU can convey frames addressed to several stations.Typically, unassociated STAs can receive association responses from the AP they are willing to join. | Add a NOTE specifyng that an unassociated STA may disregard any RU with a STA-ID set to 2045 in a HE MU PPDU received from a HE AP for which this STA is not in a pre-association context (that means the unassociated STA has not sent any association request to that AP). | Revised.Same resolution as CID 14092.Please make the changes to 802.11ax D2.3 as shown in the submission 11-18/0390r3 |
| 13070 | Pascal VIGER | 10.3.2.10.2 | P183L27 | Fast association is somewhere perceived as a good AP quality. HE standard shall offer a complete Multi-User support (UL + DL) for association procedure :- MU UL with sta\_id=2045 is supported, that is ok- but MU DL with broadcast RU does not yet support (or at least this is not detailled) unicast addressing of unassociated stations. | The AP should be able to aggregate several unicast response frames, inside a broadcast DL RU with aid=2045, to unassociated STAs that have prior sent their requests in uplink.Acknowlegment from those STAs can follow and be triggered thanks to  UMRS usage. | Revised.Same resolution as CID 14092.Please make the changes to 802.11ax D2.3 as shown in the submission 11-18/0390r3 |

Discussion:

**Issue:**

The draft 2.1 allows using random access for MU UL /DL transmissions for unassociated STA.

* AP allocates UL resource units used by multiple unassociated STAs to initiate association procedure simultaneously.
* The multi-STA BlockAck (M-BA) mechanism allows acknowledging an MU UL transmission made by an unassociated STA. As unassociated STAs do not have AID assigned by the AP, the MAC address field in the M-BA frame is used to identify an unassociated STA.
* For MU DL transmission, a broadcast RU (with AID= 2045) can be used by the AP to send association response frames to an unassociated STA to complete the association procedure.

Current issue in a HE MU PPDU: an A-MPDU must be addressed to only one STA and only one downlink RU with AID 2045 is allowed for each MU DL transmission. Only one unassociated STA is addressed in a HE MU PPDU.



We propose to enhance the association procedure by gathering all responses sent by the AP within only one HE MU PPDU:

Inside the HE MU PPDU, **a single RU with STA\_ID=2045 concatenates association responses to several unassociated STAs**.

For a complete association process, 3 requests and 3 responses are exchanged between the AP and each unassociated STAs. Based on the draft 2.1, the unassociated STAs can transmit their request (Probe, Authentication and Association) using the UORA procedure (RU with AID=2045) and the AP can transmit a unique response for instance within a HE MU PPDU (only one RU with AID = 2045 per HE MU PPDU). Our solution proposes gathering all responses of the AP within only one HE MU PPDU. If *n* is the number of unassociated willing to associate with an AP, the delay gain is (*n*-1)/*n* for a complete association process (97% for 36 unassociated STAs).

**Solution:**

The broadcast RU with AID=2045 is used to convey concatenated MPDU frames addressed to unassociated stations:

* A-MPDU aggregation is slightly modified to allow MPDUs of the same A-MPDU to be addressed to different stations.
* A STA keeps only the MPDU or MPDUs having a MAC address equal to the STA’s MAC address.
* As already envisaged in the draft 2.2, the UMRS control field (renamed as TRS control field since D2.3) inside a retrieved MPDU identifies which RU is to be used during a MU UL transmission to send to the AP an acknowledgement frame.
* The request management frames may have been received by any previous MU or SU communications.
* A capability bit is added in the HE MAC Capabilities Information field. This informs the HE AP of which STAs to consider in this multi-STA A-MPDU aggregation scheme.



**Proposed text**

* HE MAC Capabilities Information field

***TGax Editor: Please add a new subfield (e.g. B42) ‘Multi-STA aggregation in DL Broadcast RU MU Support’ from HE MAC Capabilities: Please add the corresponding entry from the Figure 9-589ck and corresponding row from Table 9-262z as follow:***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B33 | B34 | B35 | B36 | B37 | B38 | B39       B41 | B42 | B43  B47 |
|  | QTP Support | BQR Support | SR Responder | NDP Feedback Report Support | OPS Support | A-MSDU In A-MPDU Support | Multi-TID Aggregation Tx Support(#12379) | Multi-STA Aggregation in a Broadcast RU Support(#14092) | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 5 |
| * HE MAC Capabilities Information field format
 |

The subfields of the HE MAC Capabilities Information field are defined in Table 9-262z (Subfields of the HE MAC Capabilities Information field).

|  |
| --- |
| * Subfields of the HE MAC Capabilities Information field
 |
| Subfield | Definition | Encoding |
| … | … | … |
| A-MSDU In A-MPDU Support | Indicates support by a STA to receive an ack-enabled A-MPDU in which an A-MSDU is carried in a QoS Data frame for which no block ack agreement exists. | Set to 1 if supported.Set to 0 otherwise. |
| Multi-STA Aggregation In Broadcast RU Support | For an AP, indicates support for generating an A-MPDU that contains frames addressed to several stations, in a DL Broadcast RU.For a non-AP STA, indicates support for receiving an A-MPDU that contains frames addressed to several stations, in a DL Broadcast RU. | Set to 1 if the STA supports the Multi-STA aggregation functionality in a DL Broadcast RU.Set to 0 otherwise. |

9.7.3 A-MPDU contents

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 14092, 13080, 13081):***

*Change the 3rd paragraph as follows:*

All of the MPDUs within an A-MPDU are addressed to the same RA. All of the MPDUs within an A-MPDU have the same TA. All QoS Data frames within an A-MPDU that have a TID for which an HT-immediate block ack agreement exists have the same value for the Ack Policy subfield of the QoS Control field.

When transmitted by an HE AP in a RU intended for multiple STAs (broadcast RU), the MPDUs within an A-MPDU may have different RAs corresponding to the MAC addresses the multiple STAs, or the broadcast MAC address. A HE AP shall only aggregate MPDU frames addressed to multiple STAs in a broadcast RU of an HE MU PPDU, for those STAs that set the Multi-STA Aggregation In Broadcast RU Support subfield to 1in the HE MAC Capabilities Information field.

An HE STA may retrieve one or more frames, carried in a RU intended for multiple STAs, that are addressed to this STA based on the RA field of each MPDU frame. (#CID 14092, 13080, 13081)

**Change Table 9-425 (A-MPDU contents in the data enabled immediate response context) as follows:**

|  |  |  |
| --- | --- | --- |
| Immediate BlockAckReq | ~~At~~ In a single TID A-MPDU context, at most one BlockAckReq frame with a TID that corresponds to an HT-immediate block ack agreement.In multi-TID A-MPDU context, at most one multi-TID BlockAckReq frame with TIDs that correspond to HT-immediate block ack(#12624) agreements.This frame (if present) is the last MPDU in the A-MPDU.~~It is not~~ Neither a BlockAckReq nor a Multi-TID BlockAckReq frame is present if any QoS Data frames ~~for that TID~~ are present. | … |
| Action | At most one Action frameSee NOTE 4 (#CID 14092, 13080, 13081) |
| Trigger | One or more Trigger frames when the A-MPDU is sent by an HE AP where the Trigger Type field is Basic Trigger, MU-BAR, or BSRP. See NOTE 2 and NOTE 3. |
| NOTE 1—~~These~~ The MPDUs from the same TID all have the Ack Policy field equal to the same value, which is either Implicit Block Ack Request, Normal Ack, HTP Ack or Block Ack.NOTE 2—An AP including a Trigger frame and BlockAck frame is not required to include QoS Data in that A-MPDU.NOTE 3—The BSRP and BQRP Trigger frames can be aggregated with other MPDUs in the A-MPDU if the receiver has indicated the support of receiving these trigger types in the BSRP BQRP A-MPDU Aggregation field of the HE Capabilities element.NOTE 4—For constructing an A-MPDU with MPDU frames addressed to several receivers and carried in broadcast RU of an HE MU PPDU, the HE AP shall only consider aggregating at most one Action frame per receiver among those receiver STAs that set the Multi-STA Aggregation In Broadcast RU Support subfield to 1 in the HE MAC Capabilities Information field. (#CID 14092, 13080, 13081) |

**TGax Editor: *Make the following changes in section 27.5.1.2, D2.3 p272, line 34***

* RU addressing in an HE MU PPDU

The Type and Subtype subfields in the Frame Control field and address type (individually addressed or group addressed) of MPDUs may be different across A-MPDUs in different RUs within the same HE MU PPDU. Address type (individually addressed or group addressed) and address values of MPDUs may be different inside an A-MPDU in an RU intended for multiple STAs. In such case for constructing an A-MPDU with MPDU frames addressed to several receivers and carried in broadcast RU of an HE MU PPDU, the HE AP shall only consider those receiver STAs that set the Multi-STA Aggregation In Broadcast RU Support subfield to 1 in the HE MAC Capabilities Information field. (#CID 14092, 13080, 13081)

NOTE: An HE AP may still consider separately transmitting an A-MPDU with only MPDU frames addressed to the STA, in a DL MU PPDU or in a DL SU PPDU for a STA that sets the Multi-STA Aggregation In Broadcast RU Support subfield to 1. An HE AP still considers separately transmitting an A-MPDU with only MPDU frames addressed to the STA, in a DL MU PPDU or in a DL SU PPDU for a STA that sets the Multi-STA Aggregation In Broadcast RU Support subfield to 0. (#CID 14092, 13080, 13081)

An AP shall set one or more elements in the TXVECTOR parameter array STA\_ID\_LIST, which represents the list of STAs that are the recipients of the transmitted HE MU PPDU as described in 27.11.1 (STA\_ID\_LIST). A STA\_ID\_LIST element with a particular value shall not appear more than once in the array except is the value is 2046, which identifies an unallocated RU. If an AP sets the TXVECTOR parameter STA\_ID\_LIST to match the 11 LSBs of the AID of a non-AP STA, then the non-AP STA may disregard any non-broadcast RU as identified by other elements in the STA\_ID\_LIST and(#11302) any broadcast RU in the same HE MU PPDU.

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

NOTE: An unassociated STA may disregard any RU with a STA-ID set to 2045 in a HE MU PPDU received from a HE AP for which this STA is not in a pre-association context (that means the unassociated STA has not sent any association request to that AP).(#13069)

* Rules for soliciting UL MU frames
* General

…

**TGax Editor: *Make the following changes in section 27.5.3.1, D2.3 p275, line 15***

NOTE 1 —The TRS Control fields within MPDUs carried in an A-MPDU have the same value (see 10.9 (HT Control field operation)).

NOTE 2—When two or more individually addressed frames are received over a RU intended for multiple STAs, the TRS Control fields have the same value per given addressed STA: that is to say, if several frames addressed to a same STA (been identified by RA field set to the STA MAC address) have a TRS Control field, they all have the same TRS Control field value (see 10.9 (HT Control field operation)). (#CID 14092, 13080, 13081, 13070)