IEEE P802.11
Wireless LANs

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| CIDs related to 27.5.1 |
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Abstract

Comment resolution with proposed changes to TGax D2.2 for CIDs from the WG LB for TGAx related to DL MU procedure for unassociated STAs.

The CID list is: 14092, 13072, 13073, 13074

The proposed changes on this document are based on TGax Draft 2.2.

Revisions:

* Rev 0: Initial version of the document.

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

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| 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 response in a single HE MU PPDU is proposed.Please make the changes to 802.11ax D2.2 as shown in the submission 11-18/0390r0 |
| 13072 | 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 D2.2 as shown in the submission 11-18/0390r0 |
| 13073 | 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 D2.2 as shown in the submission 11-18/0390r0 |
| 13074 | 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 D2.2 as shown in the submission 11-18/0390r0 |

Discussion:

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.



2 solutions can be proposed to enhance the association procedure by gathering all responses sent by the AP within only one HE MU PPDU:

* **Solution 1:** A single RU with STA\_ID=2045 in a HE MU PPDU which concatenates association responses to several unassociated STAs.
* **Solution 2:** Several RUs with STA\_ID=2045 in a HE MU PPDU, each RU been intended for a given unassociated STA and using the same RU allocation used by the given unassociated STAs in the previously received HE TB PPDU carrying the association request.

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 1:

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 inside a retrieved MPDU identifies which RU is to be used during a MU UL transmission to send to the AP an acknowledgement frame.

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**Proposed text for SOLUTION 1**

9.7.3 A-MPDU contents

**TGax Editor: *Change the paragraphs below of this subclause as follows (#CID 14092, 13072, 13073):***

*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.

If a RU is intended for multiple STAs, the MPDUs within an A-MPDU may have different RAs. The RA may be the MAC address of one of the multiple STAs or a broadcast MAC address. 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, 13072, 13073)

**TGax Editor: *Make the following changes in section 27.5.1.2, D2.2 p254, line 14***

* 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. (#CID 14092, 13072, 13073)

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 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).(#13074)

* Rules for soliciting UL MU frames
* General

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**TGax Editor: *Make the following changes in section 27.5.3.2, D2.2 p254, line 52***

NOTE 1 —The UMRS 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 UMRS 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 UMRS Control field, they all have the same UMRS Control field value (see 10.9 (HT Control field operation)).(#CID 14092,13072,13073)

SOLUTION 2:

The AP sends to an unassociated STA an association response frames in a broadcast RU (AID=2045) considering the following constraints:

* Multiple broadcast RUs (AID=2045) may be inserted in a HE MU PPDU.
* If only one broadcast RU (AID=2045) is inserted in a HE MU PPDU, the broadcast RU can be addressed to one or all unassociated STAs
* If multiple broadcast RUs (AID=2045) are inserted in a HE MU PPDU, each broadcast RU is addressed to only one unassociated STA.
* To send an association response frame to an unassociated STA;
	+ the AP may use the same RU allocation for the broadcast RU (AID=2045) as the RU allocation of the RA RU (AID=2045) used by the unassociated STA to send the corresponding association request frame.

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* + The AP may use a single broadcast RU (AID=2045) embedding a broadcast MAC frame to broadcast an association response frame to all unassociated STAs;

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* + The AP can use a single broadcast RU (AID=2045) embedding a unicast MAC frame addressed to the unassociated STA.

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* An unassociated STA sending an association request frame using a RA-RU (AID=2045) shall store the RU allocation of the RA-RU (AID=2045).
* In the broadcast RU (AID=2045), the UMRS control field may be used to indicate which UL RU must be used by the unassociated STA to acknowledge the MPDU.

**Proposed text for SOLUTION 2**

**TGax Editor: *Make the following changes in section 27.5.1.2, D2.2 p254, line 14***

* 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.

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 if:

* the value is 2046, which identifies an unallocated RU; or
* the value is 2045, which identifies a broadcast RU destined to an unassociated STA. (#CID 14092,13072,13073)

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 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.

A HE AP, that received a RA RU carrying a management request frame from an unassociated STA, may transmit a management response frame in HE MU PPDU using a broadcast RU identified by a STA\_ID equal to 2045 and having the same RU allocation as the RU allocation of the received RA RU.

An unassociated non-AP STA that receives an HE MU PPDU containing broadcast RUs with the STA-ID equal to 2045, shall be considered as the recipient of a broadcast RU with the STA-ID equal to 2045 if one of the following condition occurs:

* There is only one broadcast RU with the STA-ID equal to 2045 in the HE MU PPDU.
* The STA has previously sent a management request frame in response to a Trigger frame containing RA-RU(s) with AID12 set to 2045, and the broadcast RU with STA-Id equal to 2045 has the same RU allocation as the RU allocation of the RA-RU carrying the request in the previously sent HE TB PPDU.(#CID 14092,13072,13073)

**TGax Editor: *Make the following changes in section 27.11.1, D2.2 p322, line 29***

* STA\_ID\_LIST

Each element of the TXVECTOR parameter STA\_ID\_LIST identifies the STA or group of STAs that is the recipient of an RU in the HE MU PPDU. If an RU is intended for a single non-AP STA, then the STA\_ID\_LIST element for that RU is set to the 11 LSBs of the AID of the STA receiving the PSDU contained in that RU. If an RU is intended for no user, then the STA\_ID\_LIST element for that RU is set to 2046. If an RU is intended for an AP, then the STA\_ID\_LIST contains only one element that is set to the 11 LSBs of the AID of the non-AP STA transmitting the PPDU. If an RU is intended for multiple STAs for MU-MIMO then multiple STAIDs in the STA\_ID\_LIST will refer to the same resource unit (see 27.5.3 (UL MU operation)). If an RU is intended for multiple STAs and carries a single A-MPDU then the STA\_ID\_LIST element is set as follows:

* For an AP with dot11MultiBSSIDActivated equal to false, if the RU is intended for more than one associated STA in the BSS, the STA\_ID\_LIST element is set to 0. The AP may include only one element with this value in a DL MU PPDU.
* For an AP with dot11MultiBSSIDActivated equal to true, if the RU is intended for more than one associated STA in any of its BSSs, the STA\_ID\_LIST element is set to partial virtual bitmap value assigned for the group addressed frame (see 9.4.2.6 (TIM element)). The AP may include only one element for each BSSID of the multiple BSSID set in the HE MU PPDU, and the number of such elements shall not exceed the maximum number of BSSs of the multiple BSSID set.
* For an AP with dot11MultiBSSIDActivated equal to true, if the RU is intended for more than one associated STA on all its BSSs, the STA\_ID\_LIST element is set to 2047. The AP may include only one element with this value in a DL MU PPDU.
* For an AP with dot11MultiBSSIDActivated equal to false, if the RU is intended for more than one unassociated STA, the STA\_ID\_LIST element is set to 2045. (#CID 14092,13072,13073)
* For an AP with dot11MultiBSSIDActivated equal to true, if the RU is intended for more than one unassociated STA for any of its BSSs, the STA\_ID\_LIST element is set to 2045. (#CID 14092,13072,13073)