### IEEE P802.11Wireless LANs

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| 11ax D3.0 MAC Comment Resolution for Random Access with multiple BSS |
| Date: 2018-09-07 |
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Abstract

This submission proposes resolution for comment 16540 :

From the letter ballot of TGax LB233,

Changes relative to D3.1.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Remove CID 16539, as same resolution is already addressed in doc 11-18/1266r0. Update some text to simplify the wording.
* Rev 2: Update discussion text.
* Rev 3: The previous revisions present solution based on RA-RU allocation per BSSID, which seems more beneficial when number of contending STAs is large. Discussions occurred during adhoc meeting where attendance requested possibility to keep the all-BSSID option. Complementary solution is thus provided in green

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 D3.0 Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGax D3.1 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** | **P.L** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 16540 | Pascal Viger | 296,18 | 27.5.5.1 | When AP supports the multiple BSS function, the UORA procedure can not trigger several (that means either individual or all) BSSs at a time. | For an AP with dot11MultiBSSIDActivated equal to true, if the RA-RU is intended for more than one associated STA in random access, AID12 value is set to 0 for transmitted BSSID or to the value of the BSSID Index field corresponding to that BSS (see 9.4.2.74 (Multiple BSSID-Index element)) for a nontransmitted BSSID.Thus the AID values are 0 to n - 1 when the AP transmits a Multiple BSSID element and n is equal to the number of BSSs advertised by the AP in the Multiple BSSID element.Additionnaly, if the RA-RU is intended for associated STA on all its BSSs, the AID12 value is set to 2047. | Revised – Agree in principle with the commenter. Revision is done according to the suggestion of triggering individual BSSs of a multiple BSSID set, by using BSS Index value as AID (same principle as for DL MU PPDU).**TGax editor, please make changes as shown in doc 11-18/1458r3 for CID16540** |

**Discussion:**

When a multiple BSS set is activated, the 802.11ax D3.1 standard mandates that:

* the MaxBSSID Indicator field contains a value assigned to *n*, where 2*n* is the maximum number of BSSIDs in the multiple BSSID set, including the reference BSSID (see 9.4.2.46).
* the BSSID Index field is a value between 1 and 2*n*– 1 that identifies the nontransmitted BSSID (see 9.4.2.74).

A DL MU PPDU (see 27.11.1 STA\_ID\_LIST) can already use a BSSID Index value : “*if the RU is intended for more than one associated STA in any of its BSSs that is not a recipient of an individually addressed RU, the STA\_ID\_LIST element is set to 0 for transmitted BSSID or to the value of the BSSID Index field corresponding to that BSS*”.

We propose to extend this usage of BSSID values for RA-RU in UL, so that Trigger Frame for random access can assign RUs to different BSSs of a multiple BSS set. This allows stations from various BSSs to be randomly triggered for uplink communication, within a single channel access.

So, a multiple-BSS TF is still identified by setting the TA field to the transmitted BSSID value, but in addition, the AP can associate some RA-RUs to a specific BSS through the AID12 field value:

* Value 0 is for transmitted BSSID (classical)
* Value between 1 and 2*n*– 1 (this is the BSSID Index) identifies a nontransmitted BSSID.

Enhancement: All-BSSID Allocation, as live comments received during adhoc meeting

Additional resolution is issued in order to address comments during adhoc meeting: if the RU is intended for more than one associated STA on all its BSSs, the AID12 is set to 2047. (same AID value as used in DL MU PPDU for addressing all the BSSs).

**Proposed text for CID#16540**

***(Track change on)***

* Rules for soliciting UL MU frames
* General

***TGax Editor: Please make the following changes to the 3rd paragraph in 27.5.3.2.1 (11ax D3.1 P283L6):***

An AP that transmits a PPDU may solicit an HE TB PPDU from one or more STAs through one of the following mechanisms:

* Including in the PPDU one or more Trigger frames that include one or more User Info fields with one of the following AID12 subfield settings:
* The AID12 subfield is equal to the 12 LSBs of the AID of the STA if(#15324) the User Info field is addressed to a STA that is associated with the AP.
* The AID12 subfield is between 0 and 2n– 1 if(#15324) the User Info field is addressed to STAs that are associated with the identified AP and that follow the UL OFDMA-based random access procedure described in 27.5.5 (UL OFDMA-based random access (UORA)) , where value 0 identifies the transmitted BSSID and values between 1 and 2n -1 identify the corresponding nontransmitted BSSID (see 9.4.2.74).
* The AID12 subfield is set to 2047 if the User Info field is addressed to STAs that are associated with any BSS of the identified AP and that follow the UL OFDMA-based random access procedure described in 27.5.5 (UL OFDMA-based random access (UORA)).
* The AID12 subfield is set to 2045 if(#15324) the User Info field is addressed to STAs that are not associated with the AP and that follow the UL OFDMA-based random access procedure described in 27.5.5 (UL OFDMA-based random access (UORA)).
* Padding for Trigger frame or frame containing TRS Control subfield(#14137)

***TGax Editor: Please make changes as shown below (11ax D3.1 P284L37):***

An AP transmitting a Trigger frame that contains at least one User Info field with AID12 subfield set to 0 (i.e., an RA-RU for STAs associated to the transmitted BSSID), or between 1 to 2n– 1 (i.e., an RA-RU for STAs associated to a nontransmitted BSSID), or set to 2047 (i.e., an RA-RU for associated STAs on all its BSSs) (18/741r3) shall ensure that the duration of the PPDU that follows *AssocUoraBSYM* is greater than or equal to the largest *MinTrigProcTime* of all associated HE STAs, where

*AssocUoraBSYM* is the OFDM symbol of the PPDU that contains either:

* the last bit of *SCH* if(#15329) the PSDU is BCC encoded, or
* the last coded bit of the LDPC codeword that encodes the last bit of *SCH* if(#15330) the PSDU is LDPC encoded.

*SCH* is the last User Info field with AID12 subfield indicating an RA-RU for STAs associated with the BSS or a BSS of the multiple BSSID set when dot11MultiBSSActivated equals to true.(#15328)

* **Allowed settings of the Trigger frame fields and TRS Control subfield(#14137)**

***TGax Editor: Please make the following changes to the 12th paragraph in 27.5.3.2.3 (11ax D3.1 P286L33):***

(#15085)An AP may indicate an unassigned RU by using value 2046 in the AID12 subfield. An AP shall put a User Info field with AID12 subfield equal to 2046 after User Info fields with an AID12 subfield less that 2046. A Trigger frame shall not contain more than one User Info field with the same value in the AID12 subfield unless(#15335) the value of the AID12 subfield is 0 or between 1 to 2n– 1 which corresponds to a BSSID Index of a multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element) when the AP has dot11MultiBSSActivated equal to true, or greater than 2007. If(#15336) a Trigger frame contains User Info fields with the same value in the AID12 subfield, then they shall appear in a contiguous block. If(#15337) a Trigger frame contains User Info fields with AID12 subfield equal to 0 or between 1 to 2n– 1 corresponding to a BSSID Index of a multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true or greater than 2007, then they shall appear after User Info fields with values of AID12 subfield greater than 0 or greater than 2n-1 corresponding to the last BSSID Index of a multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true, and less than 2008 (if any present). If an individually addressed Trigger frame contains one User Info field, then the AID12 subfield of the User Info field shall be set to the 12 LSBs of the AID of the non-AP STA addressed by the RA field(#Ed).

* STA behavior for UL MU operation

***TGax Editor: Please make the following changes to the 5th paragraph in 27.5.3.3 (11ax D3.1 P288L50):***

A STA shall transmit an HE TB PPDU a SIFS after a received PPDU, if all(#11319) the following conditions are met:(#11990)

* The received PPDU contains either a Trigger frame (that is not an MU-RTS variant) with a User Info field addressed to the STA, or an MPDU addressed to the STA that contains an TRS Control subfield(#13136)(#14137). The User Info field in the Trigger frame is addressed to a STA if one of the following conditions are met:
* The AID12 subfield is equal to the 12 LSBs of the AID of the STA and the Trigger frame is sent by the AP with which the STA is associated with or by the AP corresponding to the transmitted BSSID if STA is associated with a nontransmitted BSSID and has indicated support for receiving Control frames with TA set to the transmitted BSSID by setting the Rx Control Frame To MultiBSS subfield to 1 in the HE Capabilities element that the STA transmits.(#13143)
* The AID12 subfield is 0, the STA supports the UL OFDMA-based random access procedure (see 27.5.5 (UL OFDMA-based random access (UORA))) and the Trigger frame is sent by the AP with which the STA is associated.(#13143)(18/360r2)
* The AID12 subfield is equal to the BSSID Index (value between 1 to 2n-1, see 9.4.2.74 (Multiple BSSID-Index element)) of the nontransmitted BSSID with which the STA is associated when the AP has dot11MultiBSSActivated equal to true, the Trigger frame is sent by the AP corresponding to the transmitted BSSID and the STA has indicated support for receiving Control frames with TA set to the transmitted BSSID by setting the Rx Control Frame To MultiBSS subfield in the HE MAC Capabilities Information field of the HE Capabilities element it transmits to 1, and the STA supports the UL OFDMA-based random access procedure (see 27.5.5 (UL OFDMA-based random access (UORA)).
* The AID12 subfield is 2047, the STA supports the UL OFDMA-based random access procedure (see 27.5.5 (UL OFDMA-based random access (UORA))), the STA is associated with any BSS of the AP having dot11MultiBSSActivated equal to true, and the STA has indicated support for receiving Control frames with TA set to the transmitted BSSID by setting the Rx Control Frame To MultiBSS subfield in the HE MAC Capabilities Information field of the HE Capabilities element it transmits to 1.
* The AID12 subfield is 2045, the STA supports the UL OFDMA-based random access procedure (see 27.5.5 (UL OFDMA-based random access (UORA))), and the STA is not associated with the AP.
* The CS Required subfield in the Trigger frame is 1 and the UL MU CS condition described in 27.5.3.5 (UL MU CS mechanism) indicates the medium is idle, or the CS Required subfield in a Trigger frame is 0.
* The UL MU Disable subfield is 0 and the UL MU Data Disable subfield is 0 in the most recent OM Control subfield (if any) sent by the STA to the AP or the UL MU Disable subfield is 0 and the UL MU Data Disable subfield is 1 in the most recent OM Control subfield (if any) sent by the STA to the AP and the frame that is being triggered is an acknowledgment(#17029) (see 27.8.3 (Transmit operating mode (TOM) indication)).(#11319)(#14331)
* **UL OFDMA-based random access (UORA)**
* **General**

***TGax Editor: Please make changes as shown below (11ax D3.1 P298L11):***

A non-AP HE STA(#13095) with dot11OFDMARandomAccessOptionImplemented equal to true shall set the OFDMA RA Support subfield in the HE MAC Capabilities Information field of the HE Capabilities element to 1. Otherwise, it shall set the OFDMA RA Support subfield to 0.(#14138, #14139)

NOTE—A STA that does not support UORA can contend for the WM using EDCA for sending UL frames to the AP with which it intends to communicate.

A non-AP STA with dot11OFDMARandomAccessOptionImplemented(#11985) set to true shall follow the procedure defined in 27.5.5.3 (Transmission procedure for UORA) to contend for an eligible RA-RU.(#11033, #13196)

(18/360r2)An HE AP that transmits a Trigger frame for random access, shall set the AID12 subfield of a User Info field in the Trigger frame to 0 to indicate that the RA-RU is allocated for a STA associated with it, and shall set the AID value 2045 to indicate that the RA-RU is allocated for a STA not associated with it. An HE AP with dot11MultiBSSIDActivated equal to true may also set the AID12 subfield of a User Info field in the Trigger frame to the value of a BSSID Index (see 9.4.2.74 (Multiple BSSID-Index element)) to indicate that the RA-RU is allocated for a STA associated with the nontransmitted BSSID corresponding to the BSSID Index value. An HE AP with dot11MultiBSSIDActivated equal to true may also set the AID12 subfield to value 2047 to indicate that the RA-RU is intended for all associated STAs on all its BSSs. (#14210)

***TGax Editor: Please add a note after 7th paragraph as shown below (11ax D3.1 P298L49):***

An HE BSS belonging to a Multiple BSSID set (see 11.11.14 (Multiple BSSID set)) may advertise OCW Range values via the UORA Parameter Set element carried in the Management frames sent by the transmitted BSSID. An HE AP may include the UORA Parameter Set element in a nontransmitted BSSID profile carried in the Multiple BSSID element (see 9.4.2.46 (Multiple BSSID element)) to provide different OCW Range values for STAs associated with that nontransmitted BSSID.

NOTE—A HE AP that advertises different UORA Parameter Set elements in its BSSID profiles may be aware that contention onto RA-RUs with AID value set to 2047 may be unfair in between STAs of all its BSSs.

* **Eligible RA-RUs**

***TGax Editor: Please make changes as shown below (11ax D3.1 P299L7):***

An HE STA(#14266) that is the intended receiver of a User Info field in a Trigger frame (i.e., the AID12 subfield equal to the 12 LSBs of the AID of the STA) shall not contend for an RA-RU(#11033) that is indicated by a Trigger frame contained in the same PPDU and shall not decrement its OBO counter.

An eligible RA-RU(#11033) is an(#16612) RA-RU(#11033) for which the HE STA is capable of generating an HE TB PPDU (i.e., the HE STA supports all transmit parameters indicated in the Common Info field and in the User info field corresponding to the RA-RU(#11033)) and shall satisfy at least one of the following conditions:

* The HE STA is not associated with the BSS it intends to transmit frames to and the AID12 value of the RA-RU(#11033) is 2045
* The HE STA is an associated STA, the TA field of the Trigger frame is set to the BSSID of the associated BSS and the AID12 value of the RA-RU(#11033) is 0
* The AP has dot11MultiBSSIDActivated equal to true, the HE STA is associated with a nontransmitted BSSID of the multiple BSSID set, the TA field of the Trigger frame is set to the transmitted BSSID, and the AID12 value of the RA-RU is set to the value of the BSSID Index field (see 9.4.2.74 (Multiple BSSID-Index element)) corresponding to that nontransmitted BSSID(#13078) with which the HE STA is associated.
* The AP has dot11MultiBSSIDActivated equal to true, the HE STA is an associated STA, the TA field of the Trigger frame is set to the transmitted BSSID, and the AID12 value is 2047.
* Power save with UORA

***TGax Editor: Please make the following changes for the 6th and 7th paragraphs in 27.14.2 (11ax D3.1 P364L61), as shown below:***

An AP shall set the No More RA-RU subfield to 1 in a User Info field with AID12 subfield equal to 0 (for an associated STA), or a BSSID Index value (for a STA associated with a nontransmitted BSSID of a multiple BSSID set, see 9.4.2.74 (Multiple BSSID-Index element)) or value 2047 when the AP has dot11MultiBSSActivated equal to true, or 2045 (for an unassociated STA) if it does not intend to allocate the corresponding RA-RUs in subsequent Trigger frames until either the end of the current TWT SP or the duration indicated by the Duration/ID field in case of no TWT SP.(#11713)

An HE STA shall decrement its OBO counter by following the procedure in 27.5.5.3 (Transmission procedure for UORA) and if the OBO counter decrements to zero then the STA shall transmit an HE TB PPDU in response to the Trigger frame. If the OBO counter decrements to a nonzero value, then the STA may enter the doze state until either the end of the current TWT SP or the duration indicated by the Duration/ID field in case of no TWT SP if no other condition requires it to remain awake and the following conditions are met:

* The More TF subfield in the Common Info field of the Trigger frame is equal to 0.
* The More TF subfield in the Common Info field of the Trigger frame is equal to 1 and the No More RA-RU subfield is equal to 1 in User Info fields with AID12 subfield equal to 0 (for an associated STA), or equal to a BSSID Index value (for a STA associated with a nontransmitted BSSID of a multiple BSSID set, see 9.4.2.74 (Multiple BSSID-Index element)) or 2047 when the AP has dot11MultiBSSActivated equal to true, or equal to 2045 (for an unassociated STA).(#11713)
* Trigger frame format

***TGax Editor: Please make the following changes after the 30th paragraph (after Fig. 9-52g) in 27.5.3.3 (11ax D3.1 P104L57), as shown below:***

The User Info field is defined in Figure 9-52g (User Info field).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0   B11 | B12    B19 | B20 | B21  B24 | B25 | B26            B31 | B32     B38 | B39 |  |
|  | AID12 | RUAllocation | UL FEC Coding Type(#11372) | UL MCS(#11372) | UL DCM(#11372) | SS Allocation / RA-RU Information(17/1849r2) | UL Target RSSI(#11372) | Reserved | Trigger Dependent User Info |
| Bits: | 12 | 8 | 1 | 4 | 1 | 6 | 7 | 1 | variable |
| * User Info field
 |

The AID12 subfield of the User Info field carries the 12 LSBs of the AID of the STA for which the User Info field is intended. An AID12 subfield that is 0, or a BSSID Index value or 2047 if the Trigger Frame is addressed to STAs from at least two different BSSs of the multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true, or 2045 indicates that the User Info field allocates one or more contiguous RUs for random access (see 27.5.5 (UL OFDMA-based random access (UORA))). An AID12 subfield that is 2046 indicates an unassigned RU (see 27.5.3.2.3 (Allowed settings of the Trigger frame fields and TRS Control subfield)). An AID12 subfield set to 4095 is reserved to indicate start of Padding field (see 27.5.3.2.2 (Padding for Trigger frame or frame containing TRS Control subfield)).

If the value of the AID12 subfield is in the range 1 to 2007, then the RU Allocation subfield of the User Info field indicates the RU used by the HE TB PPDU of the STA identified by the AID12 subfield. If the AID12 field is 0, or a BSSID Index value or 2047 if the Trigger Frame is addressed to STAs from at least two different BSSs of the multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true, or 2045, then the RU Allocation subfield indicates the first RU of one or more contiguous RA-RUs. If the AID12 field is 2046, then the RU Allocation subfield indicates the location of an unassigned RU.(#11738, #13846) The first bit, B12, is set to 0 to indicate that the allocated RU is located within the primary 80 MHz and is set to 1 to indicate that the allocated RU is located within the secondary 80 MHz. The mapping of the subsequent 7 bits, B19-B13, (#12992)to the RU allocation is defined in Table 9-25h (The encoding of B19–B13 of the RU Allocation subfield).

*(…existing text…)*

***TGax Editor: Please make changes as shown below (11ax D3.1 P106L50):***

If the AID12 field is neither 0 nor 2045, nor a BSSID Index value nor 2047 if the Trigger Frame is addressed to STAs from at least two different BSSs of the multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true, then the SS Allocation/RA-RU Information subfield(17/1849r2) of the User Info field indicates the spatial streams of the HE TB PPDU that is the response to the Trigger frame and the format is defined in Figure 9-52h (SS Allocation/RA-RU Information subfield format (AID12 subfield is neither 0 nor 2045)).

|  |  |  |
| --- | --- | --- |
|  | B26 B28 | B29 B31 |
|  | Starting Spatial Stream | Number Of Spatial Streams |
| Bits: | 3 | 3 |
| * **SS Allocation/RA-RU Information subfield(17/1849r2) format (AID12 subfield does not indicate a RA-RU)**
 |

The Starting Spatial Stream subfield indicates the starting spatial stream, STARTING\_SS\_NUM, and is set to STARTING\_SS\_NUM  1.

The Number Of Spatial Streams subfield indicates the number of spatial streams, NUM\_SS and is set to NUM\_SS  1.

If the AID12 field is 0 or 2045, or equals to a BSSID Index value or 2047 if the Trigger Frame is addressed to STAs from at least two different BSSs of the multiple BSSID set (see 9.4.2.74 (Multiple BSSID-Index element)) when the AP has dot11MultiBSSActivated equal to true, then the SS Allocation/RA-RU Information subfield of the User Info field indicates the RA-RU information and the format is defined in Figure 9-52i (SS Allocation/RA-RU Information subfield format (AID12 subfield is 0 or 2045))(#12163)(17/1849r2).

|  |  |  |
| --- | --- | --- |
|  | B26 B30 | B31 |
|  | Number Of RA-RU | No More RA-RU(#12875) |
| Bits: | 5 | 1 |
| * **SS Allocation/RA-RU Information subfield(17/1849r2) format (when AID12 subfield indicates a RA-RU)**
 |

The Number Of RA-RU subfield(#18/0065r3) indicates the number of contiguous RUs allocated for UORA. The value of the Number Of RA-RU subfield(#18/0065r3) is equal to the number of contiguous RA-RUs(#11033) minus one. The starting spatial stream and the number of spatial streams of the HE TB PPDU transmitted on each RA-RU(#11033) are 1.

The No More RA-RU subfield(#12875) is set to 1 to indicate that RA-RUs(#11033) are not allocated in subsequent Trigger frames that are sent until either the end of the current TWT SP or the duration indicated by the Duration/ID field in the case of no TWT SP.(#11713)