IEEE P802.11
Wireless LANs

|  |
| --- |
| Resolution for CIDs on UL OFDMA-based Random Access |
| Date: 2016-09-12 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Chittabrata Ghosh | Intel Corporation | 3600 Juliette Lane, Santa Clara, CA-94054 | +1-415-244-8904 | chittabrata.ghosh@intel.com |

Abstract

This submission contains resolution text to CIDs 47, 48, 179, 180, 450, 600, 701, 801, 820, 988, 1084, 1199, 1201, 1913, 1914, and 2384 that should be incorporated in P802.11ax D0.5:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Page Number** | **Line Number** | **Comment** | **Proposed Change** | **Resolution** |
| 47 | 60 | 34 | Is it OCWmi or OCWmin-1? "For an initial UL PPDU transmission, when an HE STA obtains the value of OCWmin from the HE AP, it shall set the value of OCW to the OCWmin and shall initialize its OBO counter to a random value in the range of 0 and OCWmin." | "For an initial UL PPDU transmission, when an HE STA obtains the value of OCWmin from the HE AP, it shall set the value of OCW to the OCWmin and shall initialize its OBO counter to a random value in the range of 0 and OCWmin-1." | **Rejected**Since the OCWmin and OCWmax values are given by 2^(EOCWmin) – 1 and 2^(EOCWmax) – 1 values, the OBO counter will draw a random number in the range of 0 and OCWmin.  |
| 48 | 60 | 34 | Clarify other situations that a STA initializes its OCW to OCWmin? "For an initial UL PPDU transmission, when an HE STA obtains the value of OCWmin from the HE AP, it shall set the value of OCW to the OCWmin and shall initialize its OBO counter to a random value in the range of 0 and OCWmin." | As in the comment | **Revised**Agree in principle and mentioned about the other case of a successful transmission of an HE Trigger-based PPDUTGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 179 | 77 | 60 | What is this TBD parameter that the AP indicates in the Trigger frame to initiate random access following the Trigger frame? Please clarify. Also specify that a random RU is identified by an AID value equal to 0 (perhaps this is the TBD parameter?). | As in comment | **Revised**Agree in principle and revised the text by removing the TBD parameter and clarifying that the parameter is the OCW range indicated in the UL OFDMA-based Random Access Parameter Set element. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 180 | 78 | 1 | Better terminologies can be used in this subclause (instead of sub-section). E.g., termed sounds awkward (simply state maintains an OBO counter, not sure what OBO stands for, please expand the acronym). Also a couple of TBDs need to be defined in P78L8 (other parameters for random access are TBD), L28 (method of indication of OCWmin is TBD), and L48 (value of AID is TBD) | As in comment | **Revised**The word “sub-section” has already been replaced by “subclause” OBO stands for OFDMA Backoff;The sentence “Other parameters for random access are TBD” in P78L8 is deleted;Since it is specified that OCWmin is carried in Beacon frame (IEEE motion passed, slide101 in 11-16/0512r4) or Probe Response frame. The sentence “method of indication of OCWmin is TBD” in L28 is deleted;It is specified that AID value 0 is used for random access. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 450 | 46 | 20 | The random access procedure does not discuss about an ACK or Multi-STA BAframe following an UL PPDU transmission in the selected RU. | Suggest to include a line of text as following: "The STA receives an ACK or a Multi-STA BA if the AP receives a single UL PDDU inthe randomly selected RU." | **Revised** TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx. |
| 600 | 60 | 48 | The standard shall provide a mechanism to change Trigger-based Random access contention parameters on the fly | Either introduce a new information element or extend the format of the trigger frame | **Revised**TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 701 | 60 | 8 | There are TBDs in the subclause. | Remove the TBDs | **Revised**TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 801 | 60 | 31 | Current spec draft does not specify the exact format of the trigger frame for random access, which should be different from the current trigger frame format defined in 9.3.1.23 | The frame format of trigger frame for random access should be clarified | **Revised**Agreed in principle; we propose to keep the basic variant Trigger frame format unchanged, but in order to indicate random access RUs, AID 0 is used in the User identifier subfield of the Per User Info field. In other words, any non-zero AID in the User Identifier subfield is used for assignment of scheduled RUs. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 820 | 60 | 34 | According to draft text, an HE STAs reset its OBO couter every time when it obtains the value of OCW from HE AP. Althogh it provides immediate congestion control, it cannot provide higher priority for long waiting STAs unlike conventinal 802.11 channel access. | Change the followings"For an initial UL PPDU transmission, when an HE STA obtains the value of OCWmin from the HE AP, it shall set the value of OCW to the OCWmin and shall 'get new random value in the range of 0 and OCWmin, an HE STA sets OBO counter to the random value if it is smaller than the original OBO counter.'(initialize its OBO counter to a random value in the range of 0 and OCWmin.") | **Rejected**The proposed change from the commenter does not provide a mechanism to support his comment. Moreover, for fairness among users, such priority in UL OFDMA-based random access is not beneficial, since the control is on the AP in scheduling a trigger frame for random access (different from EDCA-based channel access).  |
| 988 | 60 | 44 | The illustration of the UL OFDMA-based random access procedure in Figure 25-1 should be consistent with the following description "If the OBO counter for an HE STA is smaller than the number of RUs assigned to AID value TBD in a Trigger frame, then the HE STA shall decrement its OBO counter to zero. Otherwise, the HE STA decrements its OBO counter by a value equal to the number of RUs assigned to AID value TBD in a Trigger frame." | Please make the illustration simple and consistent with the description "If the OBO counter for an HE STA is smaller than the number of RUs assigned to AID value TBD in a Trigger frame, then the HE STA shall decrement its OBO counter to zero. Otherwise, the HE STA decrements its OBO counter by a value equal to the number of RUs assigned to AID value TBD in a Trigger frame." Change the corresponding Figure 25-1 as well. | **Revised** Agreed in principle and re-drew the figure for improved consistency.TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 1084 | 59 | 60 | Clarify the TBD parameter in the text "The HE AP indicates a TBD parameter in the Trigger frame for HE STAs to initiate random access following the Trigger frame transmission." | Clarify it | **Revised**TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 1199 | 60 | 28 | The method of OCWmin indication is currently TBD. Optimal OCWmin values mainly depend on the number of STAs which varies slowly. Hence,reporting of OCWmin via beacon or probe response information element may be a good way to do this. | Define an information element for reporting OCWmin | **Revised**Agreed in principle and based on the motion that passed in May 2016 (mentioned below), revised this document. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 1201 | 60 | 28 | The CWOmin announced by the AP using TBD method seems to me a constant parameter which STAs used as it is. However, it may bebeneficial if the STAs can adjust its value based on local information it knows to lessen collision probability | If needed, define a mechanism for STAs to adjust CWOmin value based on STA local parameter information it knows. | **Revised**Agreed in principle and based on the motion that passed in May 2016 (mentioned below), revised this document. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 1913 | 59 | 60 | TBD parameter | Define | **Revised**TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 1914 | 60 | 8 | TBD | Define | **Revised**TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |
| 2384 | 47 | 3 | OCWmin is used by STA, but the mechanism of delivering OCWmin to STA is not defined. | Define | **Revised**Agree in principle and defined the UL OFDMA-based Random Access Parameter Set element. Created a separate subclause 9.4.2.215 discussing the element. TGax Editor to make the changes as in 11-16-1222-01-00ax-25.5.2.6\_UL\_OFDMA\_based\_random\_access.docx.  |

An AP indicates the value of OCWmin used by all STAs for the random RU allocation process for the next UL MU OFDMA transmissions. The value of OCWmin is transmitted through a dedicated field in the beacon frame.

[May 2016, see [125]]

Revision History:

* Rev 0: Initial version of the document
* Rev 1: Changed based on comments received in Wednesday PM 2 session of September IEEE meeting

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.***

**Resolution to CIDs 600 and 2384**

**TGax Editor: *Modify the subclause 9.3.3.1 as follows***

* Beacon frame format

Insert the following new rows (header row shown for convenience) into Table 9-27 (Beacon frame body):

|  |
| --- |
| * Beacon frame body
 |
| **Order** | **Information** | **Notes** |
| TBD | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented(#1313) is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when dot11HEOptionImplemented(#1313) is true; otherwise it is not present. |
| TBD | TWT | The TWT element is optionally present when dot11TWTOptionActivated(#1313) is true; otherwise it is not present. |
| TBD | UL OFDMA-based Random Access Parameter Set (RAPS)  | The UL OFDMA-based Random Access Parameter Set element is optionally present when dot11ULOFDMARandomAccessOptionImlemented (#600) is true; otherwise it is not present.  |

**TGax Editor: *Modify the subclause 9.3.3.10 as follows***

* Probe Response frame format

Insert the following new rows (header row shown for convenience) into Table 9-34 (Probe Response frame body):

|  |
| --- |
| * Probe Response frame body
 |
| **Order** | **Information** | **Notes** |
| TBD | HE Capabilities | The HE Capabilities element is present when dot11HEOptionImplemented(#1313) is true; otherwise it is not present. |
| TBD | HE Operation | The HE Operation element is present when dot11HEOptionImplemented(#1313) is true; otherwise it is not present. |
| TBD | UL OFDMA-based Random Access Parameter Set (RAPS)  | The UL OFDMA-based Random Access Parameter Set element is optionally present when dot11ULOFDMARandomAccessOptionImlemented (#600) is true; otherwise it is not present.  |

**TGax Editor: *Modify Table 9-77 insubclause 9.4.2.1 as follows***

* General

|  |
| --- |
| * Element IDs
 |
| Element | Element ID | Element ID Extension | Extensible |
| HE Capabilities (see 9.4.2.213 (HE Capabilities element)) | <ANA> | N/A | Yes |
| HE Operation (see 9.4.2.214 (HE Operation element)) | <ANA> | N/A | Yes |
| RAPS element (see 9.4.2.215 (UL OFDMA-based Random Access Parameter Set (RAPS) element)) | 255 | <ANA> | Yes |

**TGax Editor: *Modify the figure in Subclause 9.4.2.213 by including B28 for UL OFDMA Random Access Support***

**TGax Editor: *Please add the following text at the end of the Subclause 9.4.2.213***

The UL OFDMA Random AccessSupport field indicates support of UL OFDMA-based random access mechanism as described in 25.5.2.6 (UL OFDMA-based random access) by an HE STA. The UL OFDMA Random Access Support field is set to 0 when dot11ULOFDMARandomAccessOptionImlemented is false.

**TGax Editor*: Insert a new subclause immediately after 9.4.2.214 (HE Operations element) of 11ax Draft 0.1:***

**9.4.2.215 UL OFDMA-based Random Access Parameter Set (RAPS) element**

The metrics of the UL OFDMA-based random access mechanism (see 25.5.2.6 UL OFDMA-based random access) are signaled in the RAPS element. The format of the RAPS element is defined in Figure 9-axx (RAPS element format).

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Element ID | Length | Element ID Extension | OCW Range |
| Octets: 1 | 1 | 1 | 1 |

**Figure 9-axx – RAPS element format**

The Element ID, Length, Element ID Extension fields are defined in 9.4.2.1 (General).

The OCW Range field indicates the minimum and maximum values of the OCW (OFDMA contention window) derived from the fields defined in Figure 9-axz (OCW Range field format).

|  |  |  |
| --- | --- | --- |
| EOCW\_min | EOCW\_max  | Reserved |

 Bits 3 3 2

**Figure 9-axz – OCW Range field format**

The EOCW\_min field indicates the minimum value of OCW for the initial HETrigger-based PPDU transmission using UL OFDMA-based random access. The OCW\_min parameter is used by a STA either for an initial transmission or following a successful HE Trigger-based UL PPDU transmission and is derived from the value in the EOCW\_min field as

OCW\_min = 2EOCWmin – 1

The EOCW\_max field indicates the maximum value of OCW for UL OFDMA-based random access. The OCW\_max parameter used by a STA for its retransmission attempts of UL OFDMA-based random access is derived from the value in the EOCW\_max field as

OCW\_max = 2EOCWmax – 1

**TGax Editor: *Modify the subclause 25.5.2.6 as follows***

* UL OFDMA-based random access

A STA that supports UL OFDMA-based random access shall set the UL OFDMA\_Random Access Support subfield in the HE Capabilities element to 1; otherwise, it shall set to 0.

UL OFDMA-based random access is a mechanism for HE STAs to randomly select resource units (RUs) assigned by an AP in a soliciting Trigger frame that contains RUs for random access.(#2383) An RU for random access shall be identified by an AID12 subfield equal to 0 contained in a User Info field of a Trigger frame. An HE AP may transmit a Basic Trigger frame or a BSRP Trigger frame that contains one or more RUs for random access.

The HE AP may include the RAPS element (see 9.4.2.215 (UL OFDMA-based Random Access Parameter Set (RAPS) element) in Beacon and Probe Response frames it transmits. The AP shall indicate the range of OFDMA contention window (OCW) (#179) in the RAPS element for HE STAs to initiate random access following the Trigger frame transmission.

~~An HE STA that has not received the RAPS element from the AP shall use default OCWmin and OCWmax values of 1 and 32, respectively. An HE STA that has received the RAPS element from the AP shall use the OCWmin and OCWmax values indicated in the RAPS element.~~ An HE STA shall use the OCWmin and OCWmax values indicated in the RAPS element within the most recently received Beacon or Probe Response.

Note: If the STA does not receive the RAPS element, the STA does not transmit any HE Triger-based UL PPDU using random access RUs.

The non-AP STA with dot11ULOFDMARandomAccessOptionImlemented set to true shall maintain an internal OFDMA backoff (OBO) counter (#2712). The HE STA shall follow the random access procedure defined in 25.5.2.6.1 (Random access procedure) to contend for an RU assigned for random access.

* Random access procedure

In this subclause(#1304), the random access procedure is described with respect to UL OFDMA contention parameters. The procedure is also illustrated in Figure 25-1 (Illustration of the UL OFDMA-based random access procedure). The OFDMA contention window (OCW) is an integer with an initial value of OCWmin.

|  |
| --- |
|  |
| * Illustration of the UL OFDMA-based random access procedure
 |

An HE AP indicates the values of OCWmin and OCWmax in the RAPS element within a Beacon or Probe Response frame for the random access operation. The OCWmax is the upper limit of OCW.

The random access procedure initiates with an HE STA receiving a Trigger frame for random access.

For an initial HE Trigger-based PPDU transmission or following a successful HE Trigger-based PPDU transmission (#48), when an HE STA obtains the value of OCWmin from the HE AP indicated in the RAPS element, it shall set the value of OCW to the OCWmin and shall initialize its OBO counter to a random value in the range of 0 and OCWmin.

For an HE STA if the OBO counter is smaller than the number of RUs assigned to AID value 0 in a Trigger frame, then the HE STA shall decrement its OBO counter to zero. Otherwise, the HE STA decrements its OBO counter by a value equal to the number of RUs assigned to AID value 0 in a Trigger frame. For instance, as shown in Figure 25-1 (Illustration of the UL OFDMA-based random access procedure), HE STA 1 and HE STA 2 decrement their non-zero OBO counters by 1 in every RU assigned to AID value 0 for random access within the Trigger frame.

For an HE STA if the OBO counter is zero or if the OBO counter decrements to 0, then the STA(#1551) randomly selects any one of the assigned RUs for random access and transmits its HE Trigger-based PPDU in the randomly selected RU. Otherwise, the STA resumes with its OBO counter in the next Trigger frame with RUs assigned for random access.

The MU acknowledgment procedure for random access follows the procedure as defined in 10.3.2.11.3 (MU acknowledgement procedure for an UL MU transmission)).

If a STA transmits an HE Trigger-based PPDU that solicits an immediate response in a random access RU and the expected response is not received, the transmission is considered unsuccessful and the STA invokes the UL OFDMA-based random access retransmission procedure as defined in subclause 25.5.2.6.2.