IEEE P802.11
Wireless LANs

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| Comment resolution for UL OFDMA-based random access (UORA) |
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Abstract

The document contains comment resolutions to 18 CIDs and an associated proposal of evolution of the clauses 27.5.2.6 and 27.10.4.

The submission solves 18 CIDs

The solved CIDs are: 3237, 6005, 6007, 6106, 7104, 7105, 7106, 7415, 7416, 7426, 7545, 8152, 8221, 9533, 9571, 9918, 10173, 10176.

Red-color text (review mode): CIDs solved

**References:**

**[1] Draft P802.11ax\_D1.2**

**[2] 11-17-0010-11-00ax-comments on tgax-d1-0**

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| **CID** | **Pg, Li** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 3237 | 173,30 | 27.5.2.6.2 | "For an initial HE trigger-based PPDU transmission or following a successful HE trigger-based PPDU transmission, 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 initial HE trigger-based PPDU transmission or following a successful HE trigger-based PPDU transmission, an HE STA shall set the value of OCW to the OCWmin obtained from the most recent OCWmin indicated in the RAPS element from the HE AP, and shall initialize its OBO counter to a random value in the range of 0 and OCWmin." | Revised – Agree in principle. The commenter asks to clarify the sentence describing the OBO management. The related sentence has been modified:”… an HE STA shall initialize its OBO counter to a random integer value in the range of 0 and OCW.” |
| 6005 | 173,30 | 27.5.2.6.2 | The OCWmin value use for UL MU OFDMA random access is not clearly defined. Is the OCW set to OCWMin value everytime a new OCWMin value is obtained by the STA? | Please clarify does a reception of new OCWMin value set the OCW value to OCWMin. | Revised – Agree in principle. The commenter asks to clarify the OCWmin value and its usage. A new sentence has been added for clarification: “After each successful HE TB PPDU transmission, an HE STA shall set the value of OCW to the OCWmin obtained from the most recent OCWmin indicated in the RAPS element …” |
| 6007 | 174,15 | 27.5.2.6.3 | The OCW value should be updated for each failed transmission, not only if a frame is retransmitted. Currently it is not clear how OCW is handled if the STA transmits a new frame. | Change the text:" If a response to a HE Trigger-based PPDU transmitted in random RU requiring immediate response is not received, the STA shall update its OCW to 2 X OCW +1, until the the OCW reaches value of OCWmax. | Revised – Agree in principle.The commenter asks to clarify the update of the OCW value upon a failed transmisison.The following sentence has been updated: “If the HE TB PPDU is not successfully transmitted in the randomly selected RU, the STA shall update its OCW to 2 x OCW + 1 for every retransmission, until the OCW reaches the value of OCWmax.” |
| 6106 | 172,23 | 27.5.2.6 | An emergency service mechanism should be introduced in UL OFDMA based random access procedure to further prioritize he emergency traffic | Add the details, will bring a proposal | Revised - Agree in principle. A mechanism to prioritize the different types of traffic already exists such as EDCA mechanism. The proposed resolution is to use the Preferred AC subfield to restrict the number of STAs contending to the random RUs according to their buffered traffic type. With this mechanism, if an AP wants to implement an emergency service based on random access procedure, it can specify a dedicated value for the Preferred AC subfield. Finally, eligible random RUs are defined to filtrer among the set of random RUs available in a Trigger frame. |
| 7104 | 173,33 | 27.5.2.6.2 | "it shall set the value of OCW to the OCWmin╥╟╟and shall initialize its OBO counter to a randomvalue in the range of 0 and OCWmin."There is not enough explanations for the usage of OCW. It seems that "range of 0 and OCWmin" should be "range of 0 and OCW". | Add or modify explanations on OCW and OBO counter. | Revised – Agree in principle.The OBO counter is now initialized in the range of 0 and OCW.  |
| 7105 | 173,37 | 27.5.2.6.2 | The exact timing to decrement the OBO counter is not clarified. | Clarify procedures for decrementing the OBO counter. | Revised – Agree in principle.The comment is asking to clarify the timing for decrementing the OBO counter.The OBO counter is updated upon the reception of a Trigger frame containing random RUs. |
| 7106 | 173,41 | 27.5.2.6.2 | "decrement their nonzero OBO counters by 1"In Figure 27-1, the number of RUs is 2. Then it seems that "decrement.. by 2" is correct. | as in comment | Revised – Agree in principle.The related figure 27-1 has been redesigned. The associated text has been modified and adopted in the contribution 17/0443r2. |
| 7415 | 173,36 | 27.5.2.6.2 | If the OBO counter is equal to the number of RUs assigned for random access, the HE STA shall also decrement its OBO counter to zero. | Change"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."to"For an HE STA, if the OBO counter is not larger 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." | Revised – Agree in principle. The comment is asking to precise what to do when the OBO is exactly equal to the number of RUs assigned for random access.The text is now “ … if the OBO counter is not larger than the number of RUs assigned …” |
| 7416 | 173,46 | 27.5.2.6.2 | "..AID value 0If the selected RU.." should be changed to "..AID value 0. If the selected RU.." | as per comment | Revised. – Agree in principle.The text has been modified.  |
| 7426 | 173,56 | 27.5.2.6.2 | The sentence "If the HE trigger-based PPDU is successfully transmitted in the randomly selected RU, then the STA shall set its OCW to OCWmin" is redundant (see L30-L34 of P173). | remove the sentence "If the HE trigger-based PPDU is successfully transmitted in the randomly selected RU, then the STA shall set its OCW to OCWmin". | Accepted.The redundant sentence was removed. |
| 7545 | 173,33 | 27.5.2.6.2 | Is a new attempt to use UL OFDMA random access after a successful UL OFDMA based random acces transmission, considered 'Initial HE triggered-based PPDU transmission' in L30?If yes, what happens if the OBO counter is not 0 when new attempt starts, should OBO counter still needs to be re-initialized as described in L 33? | describe whether a new attempt to use UL OFDMA should use the residual OBO counter values, or re-initialize it. | Revised – Agree in principle. The solution is already described in p.188 l.12: “If the OBO counter is not zero and does not decrement to 0, the STA resumes with its OBO counter in the next Trigger frame with RUs assigned for random access.” |
| 8152 | 173,25 | 27.5.2.6.2 | The overall procedure shown in Figure 27-1 is not really described very well. Its not clear to the reader. | Add an explanation in the paragraphe that introduces Figure 27-1 | Revised - Agree in principle.The Figure 27-1 was redesigned. The associated text description was inserted in the adopted contribution 17/0443r2. |
| 8221 | 173,17 | 27.5.2.6 | In Figure 27-1, what does M-BA mean? | I think it mean Multi-STA BlockAck. If correct please make the changes. | Revised - Agree in principle.The Figure 27-1 was redesigned. The associated text description was inserted in the adopted contribution 17/0443r2. |
| 9533 | 173,11 | 27.5.2.6.2 | Figure 27-1--Illustration of the UL OFDMA-based random access procedure is ambiguous.(1) IFS except the left side one is not specified.(2) Not clear why the OBO value of a STA changes depending on the height of a Trigger frame.(3) Not clear the timing of decrementing the OBO value. | The figure should be modified to explain the change of the OBO in relation to time. | Revised - Agree in principle.The Figure 27-1 was redesigned. The associated text description was inserted in the adopted contribution 17/0443r2. |
| 9571 | 172,45 | 27.5.2.6.1 | If HE STA can use OFDMA based random access for any AC traffic, it may create fairness concern on the higher priority AC. | suggest random access transmission is separated according to the Access Category | Revised - Agree in principle. In an EDCA medium access procedure, the fairness between ACs is achieved by the backoff mechanism. In order to limit the fairness issues created by the OFDMA random access procedure, an MPDU selection method for the random access procedure is proposed based on the Preferred AC subfield specified by the AP, and supported by eligible random RUs.  |
| 9918 | 173,30 | 27.5.2.6.2 | What does "initial HE trigger-based PPDU transmission" mean? If this implies the first HE trigger-based PPDU transmission within a TXOP of the serving AP, it means that OCW is reset for every TXOP, which may not be the preferred operation. Further clarification is needed. | As in the comment. | Revised – Agree in principle. The sentence “For an initial HE trigger-based PPDU transmission …” has been removed. To simplify the draft, it has been replaced by “After each successful HE TB transmission …” |
| 10173 | 172,45 | 27.5.2.6.1 | "An HE STA shall use the OCWmin and OCWmax values indicated in the RAPS element within the most recently received Beacon or Probe Response regardless of the access category of traffic the HE STA intendsto transmit."What's the reason that a STA using OFDMA random access will neglect the AC of the traffic? | Give the technical reasons. Otherwise, the OFDMA random access should also consider the AC of traffic. | Revised - Agree in principle. The comment is asking why the OCWmin and OCWmax values are independent from the access categories. The random access procedure uses a dedicated random backoff called OBO counter.The sentence text “regardless of the access category of traffic the HE STA intends to transmit” is deleted and an MPDU selection method for the random access procedure is proposed based on the preferred AC field and eligible random RUs. (Same resolution as the CID9571’s). |
| 10176 | 173,36 | 27.5.2.6.2 | There is a confliction in the descriptions for STA1 to decrease its OBO counter when following below the two sentences. "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 " and "HE STA1 and STA2 decrement their nonzero OBO counters by 1 in every RU assigned to AID value 0 for random access within the Trigger frame". | modify the sentences to make the descritions coincide with each other. | Revised – Agree in principleDuplicated comment with CID #7106. The related figure 27-1 has redesigned. The text has been modified and adopted in the contribution 17/0443r2. |

* UL OFDMA-based random access (UORA)
* General [#10173]

A STA that supports UORA shall set the UL OFDMA RA Support subfield in the HE MAC Capa-bilities Information field of the HE Capabilities element to 1. Otherwise, it shall set the UL OFDMA RA Support subfield to 0.

UORA 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. An RU for random access is identified by an AID12 subfield contained in a User Info field of a Trigger frame that is equal to one of the following:

* 0 to indicate a random RU that is intended for associated STAs
* 2045 to indicate a random RU that is intended for unassociated STAs

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 9.4.2.220 (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) in the RAPS element for HE STAs to initiate random access following the Trigger frame transmission.

 **TGax Editor: *Make the following changes in section 27.5.2.6.2, D1.2 p186, line 33***

An HE STA shall use the OCWmin and OCWmax values indicated in the RAPS element within the most recently received Beacon or Probe Response. [#10173]

 NOTE—If the STA does not receive the RAPS element, the STA does not transmit any HE TB PPDU using random access RUs.

A non-AP STA with dot11OFDMARandomAccessOptionImlemented set to true shall maintain an internal OFDMA backoff (OBO) counter. The STA shall follow the random access procedure defined in 27.5.2.6.2 (UORA procedure) to contend for an RU assigned for random access.

* UORA procedure [#3237,#6005,#6106,#7104,#7105,#7415,#7426,#9571,#9918,#10173]

In this subclause, the random access procedure is described with respect to UL OFDMA contention parameters. The procedure is also illustrated in Figure 27-1 (Illustration of the UL OFDMA-based random access procedure).



Figure 27-1. Illustration of the UL OFDMA-based random access procedure

The OFDMA contention window (OCW) is an integer with an initial value of OCWmin. An HE AP indicates the values of OCWmin and OCWmax in the RAPS element in a Beacon or Probe Response frame for the UORA operation. OCWmax is the upper limit of OCW.

**TGax Editor: *Make the following changes in section 27.5.2.6.2, D1.2 p187, line 38***

After each successful HE TB PPDU transmission[#9918], an HE STA shall set the value of OCW to the OCWmin obtained from the most recent OCWmin [#6005] indicated in the RAPS element from the HE AP and shall initialize its OBO counter to a random integer value in the range of 0 and OCW [#3237, #7104].

An HE AP that transmits a Trigger frame for random access, uses the AID value 0 to indicate ran-dom RUs allocated for STAs associated with it, and the AID value 2045 to indicate random RUs allocated for STAs not associated with it.

An HE STA is allowed to participate to the random access procedure only if the HE STA has some data frame to send and only if the received Trigger frame contains at least one eligible random RU. An eligible random RU is defined as a RU satisfying at least one of the following constrainst:

* The AP specifies a value of AC\_BK in the Preferred AC subfield in the Trigger Dependent User Info field and the AID12 value is equal to 0 for an associated HE STA.
* The AP specifies a value of AC\_BK in the Preferred AC subfield in the Trigger Dependent User Info field and the AID12 value is equal to 2045 for a non-associated HE STA.
* The AP specifies a value different from AC\_BK and defined in Table 9-25i (Preferred AC subfield encoding) in the Preferred AC subfield in the Trigger Dependent User Info field, the AID12 value is equal to 0 for an associated HE STA and the HE STA should have at least one MPDU ready to be transmitted in the access category equals to the Preferred AC subfield in the Trigger Dependent User Info field.
* The AP specifies a value different from AC\_BK and defined in Table 9-25i (Preferred AC subfield encoding) in the Preferred AC subfield in the Trigger Dependent User Info field, the AID12 value is equal to 2045 for a non-associated HE STA and the non-associated HE STA should have at least one MPDU ready to be transmitted in the access category equals to the Preferred AC subfield in the Trigger Dependent User Info field. [#6106, #9571, #10173].

For an HE STA that is associated with the AP, if the OBO counter of an HE STA is not larger [#7415]than the number of eligible random RUs in a Trigger frame, then the HE STA shall decrement its OBO counter to zero. Otherwise, the HE STA decrements its OBO counter by the number of eligible random RUs in a Trigger frame.

In the example shown in Figure 27-4 (Illustration of the UORA procedure), HE STA 1 and HE STA 2, both associated with the AP and having a pending frame for the AP, decrement their nonzero OBO counters by the number of User Info fields in the Trigger frame where the AID12 subfield is 0. HE STA 3, which is not associated with the AP but has a pending frame for the AP, decrements its nonzero OBO counter by the number of User Info fields in the Trigger frame where the AID12 subfield is 2045. HE STA 4, which is associated with the AP and has a pending frame for the AP, is assigned RU6 and does not decrement its nonzero OBO counter. HE STA 4 will transmit its pending frame in an HE TB PPDU using the assigned RU6. HE STA 4 still has pending frame for the AP so it maintains OBO counter and resumes random access in next Trigger frame.

For an HE STA, upon the reception of a Trigger frame containing eligible random RUs, [#7105] if the OBO counter is 0 or decrements to 0, then the STA ran-domly selects one of the eligible random RUs. If the selected RU is idle as a result of both physical and virtual carrier sensing as defined in subclause 27.5.2.4 (UL MU CS mechanism), the HE STA transmits its HE TB PPDU in the selected RU following the rules of 27.10.4 (A-MPDU with multiple TIDs) [#9571, #10173].

If the selected RU is considered busy as a result of either physical or virtual carrier sensing, then the HE STA shall not transmit its HE TB PPDU in the selected RU. Instead, the STA randomly selects any one of the RUs that are assigned to AID12 subfield value 0 if it is an associated STAs or AID12 subfield value 2045 if it is an unassociated STA in the subsequent Trigger frame.

If the OBO counter is not zero and does not decrement to 0, the STA resumes with its OBO counter in the next Trigger frame with RUs assigned for random access. In the example shown in Figure 27-4 (Illustration of the UORA procedure), after receiving Trigger frame 1, HE STA 1 transmits an HE TB PPDU because its OBO counter decrements to 0. HE STA 1 then randomly selects RU2 from RU1, RU2, and RU3 which are assigned to AID12 subfield value 0. HE STA 2, HE STA 3, and HE STA 4 hold their OBO counters and wait for the next Trigger frame because their OBO counters don't decrement to 0. On receiving Trigger frame 2, HE STA 2, HE STA 3, and HE STA 4 decrement their OBO counters to 0 and each transmit their pending frame in an HE TB PPDU on a randomly selected RU.

 [#7426]

NOTE—If the transmitted HE TB PPDU does not solicit an immediate response, then the STA follows the OCW reset rule that applies to successful transmission.

The MU acknowledgment procedure for UORA follows the procedure as defined in 10.3.2.10.3 (Acknowledgement procedure for an UL MU transmission).

If a STA transmits an HE TB 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 UORA retransmission procedure as defined in 27.5.2.6.3 (Retransmission procedure for UORA).

27.5.2.6.3 Retransmission procedure for UORA [#6007]

If an HE TB PPDU soliciting an immediate response that is sent by a STA in its randomly selected RU (see 27.5.2.6.2 (UORA procedure)) fails, then the STA may attempt to retransmit the HE TB PPDU using UORA. This subclause defines the retransmission procedure that a STA may follow using UORA.

If the HE TB PPDU is not successfully transmitted in the randomly selected RU [#6007], the STA shall update its OCW to 2 x OCW + 1 for every retransmission, until the OCW reaches the value of OCWmax. Once the OCW reaches OCWmax for successive retransmission attempts, the OCW shall remain at the value of OCWmax until the OCW is reset.

* A-MPDU with multiple TIDs[#6106,#9571]

**TGax Editor: *Make the following changes in section 27.10.4, D1.2 p215, line 35 [#CID 6106,9571]:***

When the AP specifies a value defined in Table 9-25i (Preferred AC subfield encoding) in the Preferred AC subfield in the Trigger Dependent User Info field of a Basic Trigger variant Trigger frame, then an HE STA with dot11AMPDUwithMultipleTIDOptionImplemented set to true and with buffered traffic in the indicated preferred AC should aggregate at least one MPDU from any one of the TIDs from the same AC and [#6106, #9571]MPDUs from any one of the TIDs from higher AC as indicated in the Preferred AC subfield of the Trigger Dependent User Info field in the Trigger frame.