IEEE P802.11
Wireless LANs

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| Resolution for CID 11002 |
| Date: January 17, 2018 |
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 Abstract

This submission proposes resolutions for CID 11002 received for TGax LB230

Revisions:

* Rev 0: Initial version of the document.
* Rev 1: Updated based on feedback received when the doc was presented during ad-hoc (1/11/18)
	+ Removed the proposed entries for ‘Restricted RU’ in RU Allocation table
	+ Defined a new 1-bit subfield in Figure 9-25i to signal that the RU is a restricted RU
	+ Added corresponding description text and updated references
	+ Revised text to clarify that the power headroom is with respect to a particular MCS assigned by the AP for that RU (also made reference to equation 27-1).
* Rev 2: Revised based on feedback from Al Patrick
	+ Changed text to ‘aid STAs having a weak link condition to the AP’ to be consistent with baseline (‘link condition’).
* Rev 3: Offline discussions could not converge on a single solution. Therefore, 4-options are presented for TGax members to select.
* Rev 4: Updated based on offline feedback
	+ For option 3: Added ‘No Restriction’ as a choice for Power Headroom Limit subfield value = 3
	+ Revised text for option 4 to minimize spec text changes/additions
		- Single field to indicate ‘No Restriction’ and possible headroom limit values
	+ Updated field names and text referring to ‘random access RU’ to RA-RU to align with the changes proposed (and approved) in docs: 11-18/0065r3 and 11-17/1849r3
* Rev 5: added option 5 based on offline feedback
	+ The new option is a hybrid of option 2 and option 4

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.***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **CID** | **Commenter** | **Pg / Ln** | **Section** | **Comment** | **Proposed Change** | **Resolution** |
| 11002 | Abhishek Patil | 85.10 | 9.3.1.23 | Random access procedure is broken as it provides an unfair advantage to certain STAs. For instance, a STA having a strong transmit power to the AP is better positioned to successfully deliver its frames to the AP than the one with a weaker link. | As in comment | RevisedAgree with the comment. One of the key motivations behind random access feature was to help UL limited STAs close the link with the AP. However, the current spec provides no such rules to favor this behavior. As a result, STAs close to the AP and having a stronger link with the AP are allowed to use random access RUs. An AP should have the ability to regulate the availability (or eligibility) of the random access RUs based on the composition of its BSS. This contribution provides a mechanism for AP to prioritize random access RUs. The proposal requires that STAs are allowed to use random access RU only if they can meet the Target RSSI specified for the RU staying within a certain power headroom. STAs closer to the AP (i.e., with stronger signal) would not be able to meet this requirement as they would have to reduce their Txpower beyond the specified power headroom threshold. **TGax editor, please make changes as suggested in doc 11-17-1860r5.** |

**Discussion:**

One of the main motivations for OFDMA Random Access was to allow STAs that are far away from the AP and cannot send SU packets to the AP to be able to close the link with the AP. However, the spec doesn’t have any rules for OFDMA random access that favor this behavior. Currently, we allow STAs that are near to the AP to use random access. Therefore, such STAs have an unfair advantage in gaining access to the medium (i.e., they can use SU as well as random access to send frames to the AP) and their use of random RUs is detrimental to the usage of the same RUs by STAs that have the access to random RUs as the only means to communicate with the AP. Since AP has global knowledge of its BSS, there is a need for the AP to better configure its UORA parameters to enable UL limited STAs to access the resources. This proposal provides a necessary tool for an AP to regulate access to one or more random access RU(s) so that they are used by the STAs for which these random RUs were intended to.

Reference: <https://mentor.ieee.org/802.11/dcn/15/11-15-0875-01-00ax-random-access-with-trigger-frames-using-ofdma.pptx>

From slide #11:

* **OFDMA supports more flexibility on packet transmission:**
	+ Closing the link with significant asymmetry (>=10dB) in transmit power between AP and STAs located far away
	+ STAs use the Trigger frame allowing random access (TF-R) for UL transmissions on narrow bandwidth

**Option 1: Restricted RA-RU signaled via new entries in RU allocation table**

* Trigger frame format

TGax Editor: Please adding the following new rows to Table 9-25h:

|  |
| --- |
| * The encoding of B19–B13 of the RU Allocation subfield
 |
| B19 – B13 | Description | Number of entries |
| 0–36 | Possible 26-tone RU cases in 80 MHz | 37 |
| 37–52 | Possible 52-tone RU cases in 80 MHz | 16 |
| 53–60 | Possible 106-tone RU cases in 80 MHz | 8 |
| 61–64 | Possible 242-tone RU cases in 80 MHz | 4 |
| 65–66 | Possible 484-tone RU cases in 80 MHz | 2 |
| 67 | 996-tone RU cases in 80 MHz | 1 |
| 68 | 2996-tone RU case | 1 |
| 69 | Restricted 26-tone RU | 1 |
| 70 | Restricted 52-tone RU | 1 |
| 71–127 | Reserved | 57 |
| Total |  | 128 |
| NOTE—These values are in binary form in PHY (for example, see Table 28-24 (RU Allocation subfield)) |

TGax Editor: Please add the following new bullets at the end of the paragraph below Table 9-25h:

* The value 69 indicates 26-tone restricted RU [121: 96].
* The value 70 indicates 52-tone restricted RU [121: 70].
* **UL OFDMA-based Random Access (UORA) Parameter Set element**

TGax Editor: Please make the following changes to Figure 9-589ct:

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0             B2 | B3             B5 | B6         B7 |
|  | EOCWmin | EOCWmax | UORA Power Headroom Limit |
| Bits: | 3 | 3 | 2 |
| * **OCW Range field format**
 |

TGax Editor: Please add the following new paragraph and table at the end of this section:

UORA Power Headroom Limit subfield carries the power headroom threshold value. A restricted RU (see Table 9-25h) is considered as an eligible RA-RU by a non-AP STA only if the STA can satisfy the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding this threshold. Table 9-262add (Encoding of UORA Power Headroom Limit subfield) shows the encoding for UORA Power Headroom Limit subfield.

|  |
| --- |
| Table 9-262add – Encoding of UORA Power Headroom Limit subfield |
| Field value | Encoding |
| 0 | 5 dB |
| 1 | 10 dB |
| 2 | 15 dB |
| 3 | 2 dB |

* General

TGax Editor: Please modify the 9th paragraphs in section 27.5.5.1 as follows:

An unassociated HE STA shall initialize the range of OFDMA contention window (OCW) and UORA power headroom limit upon reception of the UORA Parameter Set element from the intended HE AP. If the HE STA has not received UORA Parameter Set element from the AP it wishes to communicate with, it shall use the default value UORA Power Headroom Limit = 3 (20 dB), OCWmin = 7 and OCWmax = 31 to be used upon reception of a Trigger frame containing RU with an AID12 subfield equal to 0 or 2045. Each time an unassociated HE STA communicates with a different AP using random access it shall initiate its OFDMA random access backoff (OBO) and UORA power headroom limit based on the default values or based on the parameters from the received UORA Parameter Set element for that AP.

TGax Editor: Please add following two new paragraphs after the 9th paragraph in section 27.5.5.1 as follows:

An AP may include one or more restricted RU(s) (see Table 9-25h) to restrict RA-RUs to aid STAs having a weak link to the AP.

A STA that intends to access one of the restricted RU (see Table 9-25h) shall follow the procedure described in 27.5.5.2 (UORA procedure) only if the STA satisfies the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding the UORA power headroom limit specified in the UORA Parameter Set element.

**Option 2: Restricted RA-RU signaled via RA-RU Information subfield**

* Trigger frame format

TGax Editor: Please update Figure 9-52i and add a new paragraph after the figure as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | B26 | B27 B30 | B31 |
|  | Restricted RA-RU | Number of RA-RU | No Further RA RU |
| Bits: | 1 | 4 | 1 |
| * **SS Allocation/RA-RU Information subfield format (AID12 subfield is 0 or 2045)**
 |

The Restricted RA-RU is set to 1 to indicate if the RA-RU is regulated to aid STAs having a weak link condition to the AP. A value of 1 in this subfield indicates that a STA receiving the Trigger frame is permitted to use this RA-RU only if it can meet the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) with power headroom less than or equal to the value specified in the UORA Power Headroom Limit subfield carried in the UORA Parameter Set element.

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

TGax Editor: Please make the following changes to Figure 9-589ct:

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0             B2 | B3             B5 | B6         B7 |
|  | EOCWmin | EOCWmax | UORA Power Headroom Limit |
| Bits: | 3 | 3 | 2 |
| * **OCW Range field format**
 |

TGax Editor: Please add the following new paragraph and table at the end of this section:

UORA Power Headroom Limit subfield carries the power headroom threshold value. A restricted RU (see Figure 9-25i) is considered as an eligible RA-RU by a non-AP STA only if the STA can satisfy the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding this threshold. Table 9-262add (Encoding of UORA Power Headroom Limit subfield) shows the encoding for UORA Power Headroom Limit subfield.

|  |
| --- |
| Table 9-262add – Encoding of UORA Power Headroom Limit subfield |
| Field value | Encoding |
| 0 | 5 dB |
| 1 | 10 dB |
| 2 | 15 dB |
| 3 | 2 dB |

* General

TGax Editor: Please modify the 9th paragraphs in section 27.5.5.1 as follows:

An unassociated HE STA shall initialize the range of OFDMA contention window (OCW) and UORA power headroom limit upon reception of the UORA Parameter Set element from the intended HE AP. If the HE STA has not received UORA Parameter Set element from the AP it wishes to communicate with, it shall use the default value UORA Power Headroom Limit = 3 (20 dB), OCWmin = 7 and OCWmax = 31 to be used upon reception of a Trigger frame containing RU with an AID12 subfield equal to 0 or 2045. Each time an unassociated HE STA communicates with a different AP using random access it shall initiate its OFDMA random access backoff (OBO) and UORA power headroom limit based on the default values or based on the parameters from the received UORA Parameter Set element for that AP.

TGax Editor: Please add following two new paragraphs after the 9th paragraph in section 27.5.5.1 as follows:

An AP may include one or more restricted RU(s) (see Figure 9-25i) to restrict RA-RUs to aid STAs having a weak link condition to the AP.

A STA that intends to access one of the restricted RU (see Figure 9-25i) shall follow the procedure described in 27.5.5.2 (UORA procedure) only if the STA satisfies the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding the UORA power headroom limit specified in the UORA Parameter Set element.

**Option 3: Restricted RA-RU signaled via UORA Parameter set element (2-bits)**

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

TGax Editor: Please make the following changes to Figure 9-589ct:

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0             B2 | B3             B5 | B6         B7 |
|  | EOCWmin | EOCWmax | UORA Power Headroom Limit |
| Bits: | 3 | 3 | 2 |
| * **OCW Range field format**
 |

TGax Editor: Please add the following new paragraph and table at the end of this section:

UORA Power Headroom Limit subfield carries the power headroom threshold value. A RA-RU is considered as an eligible RA-RU by a non-AP STA only if the STA can satisfy the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding this threshold. Table 9-262add (Encoding of UORA Power Headroom Limit subfield) shows the encoding for UORA Power Headroom Limit subfield.

|  |
| --- |
| Table 9-262add – Encoding of UORA Power Headroom Limit subfield |
| Field value | Encoding |
| 0 | 5 dB |
| 1 | 10 dB |
| 2 | 15 dB |
| 3 | No Restriction |

* General

TGax Editor: Please modify the 9th paragraphs in section 27.5.5.1 as follows:

An unassociated HE STA shall initialize the range of OFDMA contention window (OCW) and UORA power headroom limit upon reception of the UORA Parameter Set element from the intended HE AP. If the HE STA has not received UORA Parameter Set element from the AP it wishes to communicate with, it shall use the default value UORA Power Headroom Limit = 3 (No Restriction), OCWmin = 7 and OCWmax = 31 to be used upon reception of a Trigger frame containing RU with an AID12 subfield equal to 0 or 2045. Each time an unassociated HE STA communicates with a different AP using random access it shall initiate its OFDMA random access backoff (OBO) and UORA power headroom limit based on the default values or based on the parameters from the received UORA Parameter Set element for that AP.

TGax Editor: Please add following two new paragraphs after the 9th paragraph in section 27.5.5.1 as follows:

An AP shall advertise a power headroom limit in the UORA Parameter set element that it transmits to restrict RA-RUs to aid STAs having a weak link condition to the AP.

A STA that intends to access one of the RA-RU shall follow the procedure described in 27.5.5.2 (UORA procedure) only if the STA satisfies the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding the UORA power headroom limit specified in the UORA Parameter Set element.

**Option 4: Restricted RA-RU signaled via UORA Parameter set element (8-bits)**

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

TGax Editor: Please make the following changes to Figure 9-589cs:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | OCW Range | UORA Power Headroom Limit |
| Octets: | 1 | 1 | 1 | 1 | 1 |
| * **UORA Parameter Set element format**
 |

UORA Power Headroom Limit subfield carries the power headroom threshold value. A RA-RU is considered as an eligible RA-RU by a non-AP STA only if the STA can meet the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding this threshold. Table 9-262add (Encoding of UORA Power Headroom Limit field) shows the encoding for UORA Power Headroom Limit field.

|  |
| --- |
| Table 9-262add – Encoding of UORA Power Headroom Limit field |
| Field value | Encoding |
| 0 – 20 | Values 0 to 20 map to 5 dB to 25 dB |
| 25 – 254 | Reserved |
| 255 | No Restriction |

* General

TGax Editor: Please modify the 9th paragraphs in section 27.5.5.1 as follows:

An unassociated HE STA shall initialize the range of OFDMA contention window (OCW) and UORA power headroom limit upon reception of the UORA Parameter Set element from the intended HE AP. If the HE STA has not received UORA Parameter Set element from the AP it wishes to communicate with, it shall use the default value UORA Power Headroom Limit = 255 (No Restriction), OCWmin = 7 and OCWmax = 31 to be used upon reception of a Trigger frame containing RU with an AID12 subfield equal to 0 or 2045. Each time an unassociated HE STA communicates with a different AP using random access it shall initiate its OFDMA random access backoff (OBO) and UORA power headroom limit based on the default values or based on the parameters from the received UORA Parameter Set element for that AP.

TGax Editor: Please add following two new paragraphs after the 9th paragraph in section 27.5.5.1 as follows:

The AP shall advertise a power headroom limit in the UORA Parameter set element that it transmits to restrict RA-RUs to aid STAs having a weak link condition to the AP. AP shall set the Power Headroom Limit field to 255 to indicate that RA-RUs are available without any restriction.

A STA that intends to access one of the RA-RU shall follow the procedure described in 27.5.5.2 (UORA procedure) only if the STA satisfies the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding the UORA power headroom limit specified in the UORA Parameter Set element when the UORA Power Headroom Limit field carries a value equal or less than 20.

**Option 5: Restricted RA-RU signaled via TF and variable power headroom signaled via UORA Parameter set element (8-bits)**

* Trigger frame format

TGax Editor: Please update Figure 9-52i and add a new paragraph after the figure as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | B26 | B27 B30 | B31 |
|  | Restricted RA-RU | Number of RA-RU | No Further RA RU |
| Bits: | 1 | 4 | 1 |
| * **SS Allocation/RA-RU Information subfield format (AID12 subfield is 0 or 2045)**
 |

The Restricted RA-RU is set to 1 to indicate if the RA-RU is regulated to aid STAs having a weak link condition to the AP. A value of 1 in this subfield indicates that a STA receiving the Trigger frame is permitted to use this RA-RU only if it can meet the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) with power headroom less than or equal to the value specified in the UORA Power Headroom Limit field carried in the UORA Parameter Set element.

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

TGax Editor: Please make the following changes to Figure 9-589cs:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | Element ID | Length | Element ID Extension | OCW Range | UORA Power Headroom Limit |
| Octets: | 1 | 1 | 1 | 1 | 1 |
| * **UORA Parameter Set element format**
 |

TGax Editor: Please add the following new paragraph and table at the end of this section:

UORA Power Headroom Limit field carries the power headroom threshold value. A restricted RU (see Figure 9-25i) is considered as an eligible RA-RU by a non-AP STA only if the STA can meet the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding this threshold. Table 9-262add (Encoding of UORA Power Headroom Limit field) shows the encoding for UORA Power Headroom Limit field.

|  |
| --- |
| Table 9-262add – Encoding of UORA Power Headroom Limit field |
| Field value | Encoding |
| 0 – 20 | Values 0 to 20 map to 5 dB to 25 dB |
| 25 – 255 | Reserved |

* General

TGax Editor: Please modify the 9th paragraphs in section 27.5.5.1 as follows:

An unassociated HE STA shall initialize the range of OFDMA contention window (OCW) and UORA power headroom limit upon reception of the UORA Parameter Set element from the intended HE AP. If the HE STA has not received UORA Parameter Set element from the AP it wishes to communicate with, it shall use the default value UORA Power Headroom Limit = 20 (25 dB), OCWmin = 7 and OCWmax = 31 to be used upon reception of a Trigger frame containing RU with an AID12 subfield equal to 0 or 2045. Each time an unassociated HE STA communicates with a different AP using random access it shall initiate its OFDMA random access backoff (OBO) and UORA power headroom limit based on the default values or based on the parameters from the received UORA Parameter Set element for that AP.

TGax Editor: Please add following two new paragraphs after the 9th paragraph in section 27.5.5.1 as follows:

An AP may include one or more restricted RU(s) (see Figure 9-25i) to restrict RA-RUs to aid STAs having a weak link condition to the AP. The AP shall advertise a power headroom limit in the UORA Parameter set element that it transmits to restrict RA-RUs to aid STAs having a weak link condition to the AP. AP shall set the Power Headroom Limit field to 255 to indicate that RA-RUs are available without any restriction.

A STA that intends to access one of the restricted RU (see Figure 9-25i) shall follow the procedure described in 27.5.5.2 (UORA procedure) only if the STA satisfies the Target RSSI requirement for the assigned MCS (as defined in equation 27-1) without exceeding the UORA power headroom limit specified in the UORA Parameter Set element when the UORA Power Headroom Limit field carries a value equal or less than 20.