IEEE P802.11
Wireless LANs

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| 60GHz AOD messaging draft text |
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Abstract

This document describes the changes to the 11az Draft to enable the messaging needed for DMGz and EDGMz AOD measurement.

**Discussion 1:**

To enable AOD measurement in which the initiator performs AOD, we need to allow the responder to send the best TRN field index to the initiator. This is added to Direction Measurement Result element sent within the LMR.

***TGaz Editor: Modify the Direction Measurement Result Element as follows:***

**9.4.2.252 Direction Measurement Results element**

The Direction Measurement Results Element is used to send Angle of Arrival and Angle of Departure measurement results. It is transmitted as part of the Location Measurement Report.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element Id | Element Length | Element ID Extension | AoA Results |
| octets: | 1 | 1 | 1 | 6 |

Table 1 - Direction Measurement Results Element

The Element ID, Length and Element ID Extension fields are defined in 9.4.2.1.

The AoA Results field is defined in Table 2:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B1 B11 | B12 B22 | B23 B29 | B30 B36 | B37 B47 |  B48 |
|  | AOA Azimuth | AOA Elevation | AOA Azimuth Accuracy | AOA Elevation Accuracy | Best AWV ID  | Reserved |
| bits: | 11 | 11 | 7 | 7 | 11 | 4 |

Table 2 - AOA Results Field

The AOA Azimuth subfield contains the Angle of Arrival (AOA) azimuth result in degree/4 resolution. When this subfield is sent from an AP, the AOA is in earth coordinates (i.e. direction 0 is north).

The AOA Elevation subfield contains the AOA elevation result in degree/4 resolution.

When this subfield is sent from an AP, the AOA is in earth coordinates (i.e. elevation 0 is horizon).

The AOA Azimuth Accuracy subfield contains the AOA Azimuth result’s / estimated accuracy in degree/4 resolution.

The AOA Elevation Accuracy subfield contains the AOA Elevation result’s estimated accuracy in degree/4 resolution.

If the frame containing the Direction Measurement Result element follows an ISTA PPDU that enabled AOD by containing TRN-T subfields, the Best AWV ID field contains the index of the TRN-T subfield that was received with the highest SNR. If the ISTA PPDU than enabled AOD contained EDMG TRN-T subfields, the AWV ID field contains the AWV ID (See 30.9.2.2.5) of the TRN subfields that were received with the highest SNR.

**Discussion 2**

To enable AOD measurements in from the RSTA to the ISTA, we need to allow the ISTA to send best sector feedbacks to the RSTA. This cannot be done during the burst as during the burst the ISTA only sends ACK frames. We therefore need to define an element that will contain several BS feedback results. The RSTA will also need to send a response to the ISTA, containing the AOD results per each best sector the ISTA measured. For this we need an element that will contains several AOD measurement fields. Each AOD measurement field will have AOD Azimuth, Elevation and their accuracies.

***TGaz Editor: Add the following elements after the Direction Measurement Element***

**9.4.2.253 Multiple Best AWV ID element**

The Multiple Best AWV IDelement is used to send multiple TRN subfields indices/AWV IDs from an FTM exchange ISTA to an FTM exchange RSTA. It is carried within the Fine Timing Measurement frame.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | Element Length | Element ID Extension | Number of Best AWV ID | Best AWV ID1 |  | Best AWV IDN |
| octets: | 1 | 1 | 1 | 1 |  | Variable |  |

Table 3 – Multiple Best AWV ID element

The number of Best AWV ID fieldindicates the number of attached Best AWV IDfields. Each Best AWV ID field is 11-bit long. It indicates the index of either the TRN subfield index or the AWV ID of the of the TRN subfield(s) received with highest SNR. The choice of whether TRN subfield index or AWV ID is used depends on whether the PPDU over which the TRN subfield(s) were selected contained a DMG TRN field or an EDMG TRN field.

**9.4.2.254 Multiple AOD Feedback element**

The Multiple AOD Feedback element is used to send multiple AOD (Angle of Departure) results from an FTM exchange RSTA to an FTM exchange ISTA. It is carried within the Fine Timing Measurement frame.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | Element Length | Element ID Extension | Number of AOD Feedbacks  | AOD Feedback 1 |  | AOD Feedback N | Reserved |
| octets: | 1 | 1 | 1 | 1 |  | Variable |  |  |

Table 4 – Multiple AOD Feedback element

Each AOD Feedback field Has the structure in Table 5:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B10 | B11 B17 | B18 B28 | B29 B35 |
|  | AOD Azimuth | AOD Azimuth Accuracy | AOD Elevation | AOD Elevation Accuracy |
| bits: | 11 | 7 | 11 | 7 |

Table 5 – AOD field sturcture

The AOD Azimuth subfield contains the Angle of Departure (AOD) azimuth result in degree/4 resolution. When this subfield is sent from an AP, the AOD is in earth coordinates (i.e. direction 0 is north).

The AOD Elevation subfield contains the AOD elevation result in degree/4 resolution.

When this subfield is sent from an AP, the AOD is in earth coordinates (i.e. elevation 0 is horizon).

The AOD Azimuth Accuracy subfield contains the AOD Azimuth result’s estimated accuracy in degree/4 resolution. If the accuracy is greater or equal to 31.75 degrees the field saturates to 0xFF.

The AOD Elevation Accuracy subfield contains the AOD Elevation result’s estimated accuracy in degree/4 resolution. If the accuracy is greater or equal to 31.75 degrees the field saturates to 0xFF.

***TGaz Editor: Insert the following text after 11.24.6.4.7.2***

**11.24.6.4.7.3 AOD feedback exchange after an FTM exchange**

When an ISTA and RSTA agreed on performing an R2I AOD measurement FTM exchange as described in 11.24.6.3.2 (Negotiation of Direction Measurement for DMGz/EDMGz) the ISTA needs to send AOD measurement results to the RSTA, so that the RSTA may use these to generate the AOD estimates and send the results back to the ISTA.

To enable this, the ISTA collects the best sector results throughout the burst.

After the burst the ISTA shall send a Fine Timing Measurement frame containing a Multiple AWV ID element, and with the trigger field set to 0, to the RSTA. When the RSTA is ready with the AOD results, it should send an FTM frame containing a Multiple AOD Feedback element containing the AOD results.

Discussion 3

Unrelated to AOD messaging. When the first path AWV FTM exchange was addes to the draft, a new value of trigger was proposed. This value needs to be added to to the list of valid trigger values in **9.6.7.32 Fine Timing Measurement Request frame format.**

***TGaz Editor: Add the following text after figure 9-809 (P32L19 in D0.3)***

***Modify the text in P1422L15 (TGmd D1.0) as follows***:

The Trigger field set to 1 indicates that the initiating STA requests that the responding STA start or continue sending Fine Timing Measurement frames (see 11.22.6 (Fine timing measurement (FTM) procedure)). The Trigger field set to 0 indicates that the initiating STA requests that the responding STA stop sending Fine Timing Measurement frames. The Trigger is set to 2 to indicate the initiation of an DMGz/EDGMz FTM measumrent exchange using the first path AWV (see 11.22.6.4.7.1 (General)). Trigger field values ~~2~~3–255 are reserved.

**References:**