IEEE P802.11
Wireless LANs

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| --- |
| DMG Sensing Capabilities element |
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|  |  |  |  |  |

Abstract

This document presents draft text for a DMG Sensing Capability element

**Discussion**

In this document we propose text for a DMG sensing capabilities element.

This text is based on SFD text:

“(Motion 47, 21/1865r1) EDMG/DMG bistatic and multistatic sensing capability set may include (at least):

* TRN field Golay sequence lengths supported
* Maximum number of directions in Tx and Rx (Number of Tx/RX AWV sets used for sensing)
* Beam sets in which every beam has direction, gain, and beam width.”

***TGbf Editor: insert the following text as a new clause 9.4.2.x***

***Editor: insert the following new subclause:***

**9.4.2.x** **DMG Sensing Capabilities element**

The DMG Sensing capabilities element contains fields that are use the advertise optional DMG sensing capabilities. The element is present in Association Request, Association Response, Reassociation Request, Reassociation Response, Probe Request and Probe Response frames and can be present in DMG Beacon, Information Request, and Information Response frames.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Element Id | Element Length | Element Id Extension | DMG Sensing Capabilities | Golay Seq Len Supported |
| octets: | 1 | 1 | 1 | 1 | 1 |
|  | Maximum Number of Tx Directions | Maximum Number of Rx Directions |  |  |  |
| octets: | 2 | 2 |  |  |  |

Figure 1 – DMG Sensing Capabilities element

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

The DMG Sensing Capabilities field is shown in Figure 2:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|  | DMG Coordinated Monostatic | DMG bistatic RX | DMG bistatic TX | DMG Multi-static RX | Earth Coordinates Capable | DMG Sensing Image Range-Doppler | DMG Sensing Image Range-Azimuth | DMG Sensing Image Range-Elevation |
| bits: | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B8 | B9 | B10 | B11 | B12 | B13 |
|  | DMG Sensing Image Doppler-Azimuth | DMG Sensing Image Doppler-Elevation | DMG Sensing Image Azimuth-Elevation | DMG Sensing Image Range-Doppler-Azimuth | DMG Sensing Image Range-Doppler-Elevation | DMG Sensing Image Range-Azimuth-Elevation |
| bits: | 1 | 1 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B14 | B15 | B16 | B17 B24 | B25 B34 | B35 B42 | B43 B50 | B51 B55 |
|  | DMG Sensing Image Doppler-Azimuth-Elevation | DMG Sensing Image Range-Doppler-Azimuth-Elevation | DMG Sensing Targets | Maximum Range | Range Resolution | Maximum Doppler | Doppler Resolution | Reserved |
| bits: | 1 | 1 | 1 | 8 | 10 | 8 | 8 | 5 |

Figure 2 - DMG Sensing Capabilities field

The DMG Coordinated Monostatic subfield is set to 1 indicate the capability of DMG coordinated Monostatic sensing as responder.

The DMG bistatic RX subfield is set to 1 to indicate the capability to participate in DMG bistatic sensing as receiver.

The DMG bistatic TX subfield is set to 1 to indicate the capability to participate in DMG bistatic sensing as transmitter.

The DMG Multi-static RX subfield is set to 1 indicate the capability to participate in DMG multi-static sensing as a responder.

The Earth Coordinates subfield indicates that the STA is capable of sending azimuth and elevation in earth coordinate (azimuth 0 is north, elevation zero is horizon). If it is set to 0, azimuth and elevation are relative to an arbitrary STA coordinate system.

The DMG Sensing Image Range-Doppler subfield is set to 1 to indicate the capability to report two-dimension Range-Doppler image as a responder.

The DMG Sensing Image Range-Azimuth subfield is set to 1 to indicate the capability to report two-dimension Range-Azimuth image as a responder.

The DMG Sensing Image Range-Elevation subfield is set to 1 to indicate the capability to report two-dimension Range-Elevation image as a responder.

The DMG Sensing Image Doppler-Azimuth subfield is set to 1 to indicate the capability to report two-dimension Doppler-Azimuth image as a responder.

The DMG Sensing Image Doppler-Elevation subfield is set to 1 to indicate the capability to report two-dimension Doppler-Elevation image as a responder.

The DMG Sensing Image Azimuth-Elevation subfield is set to 1 to indicate the capability to report two-dimension Azimuth-Elevation image as a responder.

The DMG Sensing Image Range-Doppler-Azimuth subfield is set to 1 to indicate the capability to report three-dimension Range-Doppler-Azimuth image as a responder.

The DMG Sensing Image Range-Doppler-Elevation subfield is set to 1 to indicate the capability to report three-dimension Range-Doppler-Elevation image as a responder.

The DMG Sensing Image Range-Azimuth-Elevation subfield is set to 1 to indicate the capability to report three-dimension Range-Azimuth-Elevation image as a responder.

The DMG Sensing Image Doppler-Azimuth-Elevation subfield is set to 1 to indicate the capability to report three-dimension Doppler-Azimuth-Elevation image as a responder.

The DMG Sensing Image Range-Doppler-Azimuth-Elevation subfield is set to 1 to indicate the capability to report four-dimension Range-Doppler-Azimuth-Elevation image as a responder.

The DMG Sensing Targets subfield is set to 1 to indicate the capability to report detected targets as a responder.

The Maximum Range subfield indicates the maximum supported range in meter units.

The Range Resolution subfield indicates the minimum supported range resolution in 1mm units for single channel.

The Maximum Doppler subfield indicates the maximum supported Doppler in TBD units.

The Doppler Resolution subfield indicates the minimum supported Doppler resolution in TBD units.

The Golay Seq Len Supported field is set to 1 to indicate support for EDMG Golay sequences of length $256×N\_{CB}$. It is set to 0 if only EDMG Golay sequences of length $128×N\_{CB}$ are supported.

The Maximum Number of Tx Directions is set to the maximum number of Tx AWV settings supported.

The Maximum Number of Rx Directions is set to the maximum number of Rx AWV settings supported.

The Tx Sensing Beam Description subelement is described in 9.4.2.x.1.

The Rx Sensing Beam Description subelement is described in 9.4.2.x.2.

**9.4.2.x Sensing Beam Description element**

The Tx Sensing Beam Description subelement contains a set of description of the beam patterns. The number of beam patterns is the number set in Maximum Number of Tx Directions field.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | ElementLength | Element Id Extension | Tx Flag | Start Beam Index | Beam Descriptor 1 | … | Beam Descriptor N |
| octets: | 1 | 1 | 1 | 1 | 2 | 6 | … | 6 |

Figure 3 - Tx Sensing Beam Description subelement

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

The Tx Flag is set to 1 to indicate a Tx beam description or 0 to indicate an Rx beam description.

The Start Beam Index field contains the index of the first Beam Descriptors. Since a single element can contain only 256 bytes, a single element can hold only 41 Beam Descriptor. To allow describing more beams, several Sensing Beam Description elements may be combined with each DMG Sensing Capabilities element, with the Start Beam Index indicating which of the beam descriptors are contained in each element. The indexing of the beams is separate for the Rx and Tx beams.

The Beam Descriptor field has the structure in Figure 3.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B11 | B12 B23 | B24 B31 | B32 B39 | B40 B47 |
|  | Beam Azimuth | Beam Elevation | Azimuth Beamwidth | Elevation Beamwidth | Beam Gain |
| bits: | 12 | 12 | 8 | 8 | 8 |

Figure 4 - Beam Descriptor field

The Beam Azimuth and Beam Elevation subfields contain the direction of the beam in azimuth and elevation respectively. The Beam Azimuth subfield is specified in 360º/4096 units and takes values from 0 to 4096. The Beam Elevation subfield is a 2’s complement taking values from -2048 to 2047 in 180º/4096 units.

The Azimuth Beamwidth and Elevation Beamwidth subfields contain the beam 3dB bandwidth in azimuth and elevation respectively in 180º/256.

The gain subfield contains the beam gain in 0.5dB units.

***TGbf Editor: insert the following text at 9.3.3.9***

**9.3.3.9 Probe Request frame format**

***Editor: insert the following lines as a penultimate line in Table 9-73—DMG Beacon frame body:***

|  |  |  |
| --- | --- | --- |
| 42 | DMG Sensing Capabilities  | The DMG Sensing Capabilities is optionally present |
| 43 | Sensing Beam Description | One or more Sensing Beam Description elements are present if a DMG Sensing Capabilities element is present |

***TGbf Editor: insert the following text at 9.4.2.1***

***Editor: Insert the following lines to table 9-128 Elements IDs as last lines***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| DMG Sensing Capabilities element | <ANA> | <ANA> | Yes | NO |
| Sensing Beam Description element | <ANA> | <ANA> | Yes | NO |

**References:**

<https://mentor.ieee.org/802.11/dcn/21/11-21-0504-07-00bf-specification-framework-for-tgbf.docx>