IEEE P802.11
Wireless LANs

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| DMG Passive Sensing |
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Abstract

This document presents draft text for a DMG Passive Sensing

REV4 – Deal with optionality in the beacon. Remove next Beacon field, replaced location available with location available for passive sensing. Made use of fragmented option for Beam Descriptors element. Allignment of DMG Sensing name.

Rev 5 – clarifying that Sensing Support subfield is for general sensing

REV 6-7 Location and Earth coordinates for all sensing type. Return of the next Beacon field.

**Discussion**

In this document we propose text for DMG passive sensing.

This text is based on SFD text:

(Motion 57, 22/0002r0) To support DMG passive sensing, DMG Sensing Information Request and DMG Sensing Information Response frames are defined that provide information about the DMG Beacon frame. Sensing information may include:

* Azimuth and elevation for each Sector ID (of beacons)
* Location information of the PCP/AP”

**Discussion 2**

The Short Sensing Capability element ifs mainly transmitted in the beacon. Therefore, besides covering the passive sensing capability, it also includes the main DMG Sensing capability bit. A device that is interested in sensing can then get the DMG Sensing Capability element through a probe request/response or association request/response.

***TGbf Editor: insert the following text as a new clause 9.4.2.x1***

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

**9.4.2.x1 DMG Sensing Short Capabilities element**

The DMG Sensing Short Capabilities element contains fields that are used to advertise optional DMG sensing capabilities. The element may be present in DMG Beacons, Association Request, Association Response, Reassociation Request, Reassociation Response, Probe Request, Probe Response Information Request, and Information Response frames.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element Id | Element Length | Element ID Extension | Short Sensing Capabilities |
| octets: | 1 | 1 | 1 | 1 |

Figure 1 - DMG Sensing Short Capabilities element

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

The Short Sensing Capabilities field is described in Figure 2.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 | B5 B7 |
|  | Sensing Support | Passive Sensing Support | Accurate Timing of Beacons | Location Available  | Earth Coordinates | Reserved |
| bits: | 1 | 1 | 1 | 1 | 1 | 3 |

Figure 2 - Short Sensing Capabilities field

The Sensing Support subfield indicates support for any type of DMG sensing (except DMG passive sensing) as described in 11.21.18.3 (DMG sensing (SENS) procedure).

The Passive Sensing Support subfield indicates support for DMG passive sensing by providing information about beacons direction and optional location.

The Accurate Timing of Beacons subfield indicates that the time interval between beacons is sample accurate.

The Location Available subfield indicates that the AP can provide its location for passive sensing.

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.

**9.4.2.y1** **DMG Passive Sensing Beacon Info element**

The DMG Passive Sensing Beacon Info element contains an optional LCI and the number of sectors to be described in adjoining Beacon Sector Descriptors elements.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | ElementLength | Element ID Extension | Num Sectors | Beacon info control | LCI |
| octets: | 1 | 1 | 1 | 1 | 1 | 0 or 16 |

Figure 3 - DMG Passive Sensing Beacon Info element

The Num Sectors field contains the number of Beacon Sector Descriptor fields in the attached Beacon Sector Descriptors element. It is equal to the number of sectors used in the BTI.

The Beacon Info Control field has the structure in Figure 4.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 B7 |
|  | Beacon Constant | The Next Beacon | LCI Present | Reserved |
| bits: | 1 | 1 | 1 | 4 |

Figure 4 - Beacon Info Control field

The Beacon Constant subfield is set to 1 to indicate that the AP will use the same set of sectors in all BTIs. It is set to 0 otherwise.

The Next Beacon subfield is set to 1 to indicate that the Beacon Sector Descriptors describe the next BTI, it is set to 0 if they describe the previous BTI. It is reserved if the Beacon Constant subfield is set to 1.

The LCI Present subfield is set to 1 to indicate that LCI field is present in the DMG Passive Sensing Beacon Info element. It is set to 0 otherwise.

The LCI field is defined in 9.4.2.21.10.

**9.4.2.y1 DMG Beacon Sector Descriptors element**

The DMG Beacon Sector Descriptors element contains a set of beacon sector descriptors for DMG passive sensing.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | ElementLength | Element ID Extension | Beacon Sector Descriptor 1 | … | Beacon Sector Descriptor N |
| octets: | 1 | 1 | 1 | 8 | … | 8 |

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

The Beacon Sector Descriptor field has the structure in Figure 5.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B11 | B12 B23 | B24 B31 | B32 B39 | B40 B47 | B48 B55 | B56 B58 | B59 B63 |
|  | Sector Azimuth | Sector Elevation | Azimuth Beamwidth | Elevation Beamwidth | Sector Gain | Sector Id | DMG Ant Id | Reserved |
| bits: | 12 | 12 | 8 | 8 | 8 | 8 | 3 | 5 |

Figure 5 - Beacon Sector Descriptor field

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

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

The Sector Id field is equal to the Sector Id used in the beacon using the azimuth and elevation described.

The DMG Ant Id is equal to the DMG Ant Id used in the beacon using the azimuth and elevation described.

***TGbf Editor: insert the following text at 9.3.4.2***

**9.3.4.2 DMG Beacon**

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

|  |  |  |
| --- | --- | --- |
| 64 | DMG Sensing Short Capabilities  | The DMG Sensing Short Capabilities is optionally present |

***TGbf Editor: insert the following text at 9.3.4.2***

**11.21.18.3.6 DMG Passive sensing**

DMG Passive Sensing allows a STA to use beacon transmission for sensing by enabling a STA to acquire information about the beacons directions and the AP location.

A PCP/AP advertises the capability to perform passive sensing in the DMG Sensing Short Capabilities element. The PCP/AP shall set the Sensing Supported subfield of the Short Sensing Capabilities field to 1 to indicate it supports any type of sensing. The PCP/AP shall set the Passive Sensing Support subfield to 1 if it supports DMG passive sensing. The PCP/AP shall set the Accurate Timing of Beacons to 1 if the SBIFS between beacon transmission in the BTI is exactly $aSBIFSTime\pm \frac{T\_{C}}{2}$ where $T\_{C}$ is defined in Table 20-4 (Timing related parameters). The PCP/AP shall set the Location Available subfield to 1 if it can provide an LCI field in a DMG Passive Sensing Beacon Info element.

A STA requests information about the beacon transmission from a PCP/AP by sending an Information Request frame with the Element Id of the DMG Passive Sensing Beacon Info element in the Request element field. The PCP/AP responds with an Information Report frame that includes a DMG Passive Sensing Beacon Info element and one or more DMG Beacon Sector Descriptors elements as defined in 11.28.1.

***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 Short Capabilities element | 255 | <ANA> | Yes | NO |
| DMG Beacon Sector Descriptors element | 255 | <ANA> | Yes | Yes |

**References:**

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