IEEE P802.11
Wireless LANs

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| DMG Passive Sensing based on A-BFT |
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Abstract

This document presents draft text for a DMG Passive Sensing based on A-BFT, which uses [1] as a reference.

Red texts are new contents specifically added to [1] for A-BFT.

Blue texts are modifications based on [1] for A-BFT.

**Discussion**

This document proposes text for DMG passive sensing based on A-BFT.

***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 | 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 the direction of DMG Beacon or SSW frame or Short SSW PPDU and the location of the sensing transmitter.

The Accurate Timing subfield indicates that the time interval between beacons or SSW frames or Short SSW PPDUs is sample accurate.

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

The Earth Coordinates subfield indicates that the sensing transmitter 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 Info element**

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

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

Figure 3 - DMG Passive Sensing Info element

The Num Sectors field contains the number of Sector Descriptor fields in the attached Sector Descriptors element. It is equal to the number of sectors used in the BTI/A-BFT by the sensing transmitter.

The Passive Sensing Info Control field has the structure in Figure 4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 B4 | B5 B7 |
|  | Constant | The Next Beacon/A-BFT | LCI Present | Beacon/A-BFT | Reserved |
| bits: | 1 | 1 | 1 | 2 | 3 |

Figure 4 – Passive Sensing Info Control field

The Constant subfield is set to 1 to indicate that the sensing transmitter will use the same set of sectors in all BTIs/A-BFTs. It is set to 0 otherwise.

The Next Beacon/A-BFT subfield is set to 1 to indicate that the Sector Descriptors describe the next BTI/A-BFT, it is set to 0 if they describe the previous BTI/A-BFT. It is reserved if the 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 Info element. It is set to 0 otherwise.

The LCI field is defined in 9.4.2.21.10.

The Beacon/A-BFT subfield is set to 0 to indicate that the Passive Sensing Info Control field is used for Beacon. It is set to 1 to indicate that Passive Sensing Info Control field is used for A-BFT.

**9.4.2.y1 DMG Sector Descriptors element**

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element Id | ElementLength | Element ID Extension | Sector Descriptor 1 | … | 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 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 - 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 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 or SSW or Short SSW using the azimuth and elevation described.

The DMG Ant Id is equal to the DMG Ant Id used in the beacon or SSW or Short SSW 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: Replace Figure 9-1073 with the following figure:***

**9.5.3 Sector Sweep Feedback field**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B5 | B6 B7 | B8 B15 | B16 | B17 | B18 B21 | B22 | B23 |
|  | Sector Select | DMG Antenna Select | SNR Report | Poll Required | Passive Sensing Enabled | Reserved | Unsolicited RSS Enabled | EDMG Extension Flag |
| Bits | 6 | 2 | 8 | 1 | 1 | 4 | 1 | 1 |

The Passive Sensing Enabled subfield indicates support for DMG passive sensing by providing information about the directions of SSW frames and the location of the sensing transmitter.

***TGbf Editor: Replace Figure 28-43 with the following figure:***

**28.9.1 Short SSW PPDU**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | PPDU type | Direction | AddressingMode | Source AID | DestinationAID | CDOWN | RF ChainID |
| Bits | 1 | 1 | 1 | 8 | 8 | 11 | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | SISO Feedback Duration | Passive Sensing Enabled | FCS |
| Bits | 10 | 1 | 4 |

The Passive Sensing Enabled subfield indicates support for DMG passive sensing by providing information about the directions of Short SSW PPDUs and the location of the sensing transmitter.

***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 11.21.18.3:***

DMG Passive Sensing based on A-BFT allows a PCP/AP to use SSW frames or Short SSW PPDUs of the sensing transmitter during A-BFT for sensing by enabling a PCP/AP to acquire information about the directions of SSW or Short SSW, and the location of sensing transmitter.

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

A PCP/AP requests information about the transmissions from the sensing transmitter during A-BFT by sending an Information Request frame with the Element ID of the DMG Passive Sensing Info element in the Request element field. The sensing transmitter responds with an Information Report frame that includes a DMG Passive Sensing Info element and one or more DMG 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 Sector Descriptors element | 255 | <ANA> | Yes | Yes |

**References:**

[1] <https://mentor.ieee.org/802.11/dcn/22/11-22-0241-07-00bf-pdt-dmg-passive-sensing.docx>

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