IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PDT-DMG-Multi-Static-Instance | | | | |
| Date: 2022-02-23 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Assaf Kasher | Qualcomm |  |  | akasher@qti.qualcomm.com |
|  |  |  |  |  |

Abstract

The document presented the PDT draft text for DMG Multi-Static Sensing Instance

**Discussion:**

This document presents draft text for the following SFD text

*7.3.5.2.1 Initiation*

In a multistatic instance of one or more sensing responders the following rules shall apply:

* Number of sensing responders in each instance of the same DMG Measurement Setup ID may be different
* The sensing initiator shall send the Multistatic Instance Request frame to each sensing responder it invites to participate in the sensing instance
* The sensing responder shall not respond with the Multistatic Instance Response frame to the sensing initiator later than in SIFS time
* The sensing responder that responded to the sensing initiator shall remain active to receive the Multistatic PPDU (name of this PPDU is TBD)
* The format of the Multistatic Instance Request frame and the Multistatic Instance Response frame is TBD

*7.3.5.2.2 Sounding*

(Motion 58, 21/2023r0) A multi-static EDMG sensing measurement instance has the following parts:

* An Instance Request frame (frame type TBD) sent to each STA sequentially, and each STA responds to it.
* A multi-static EDMG sensing PPDU. The format of the EDMG sensing PPDU is TBD.
* A feedback part in which the sensing initiator polls each sensing responder for a report, and the sensing responders respond with a report.

**More Discussion**

We propose to use the TDD Beamforming (control) Frame as the basis for The Multi-Static Instance Request frame. The reason for that is that we need a control frame for fast response. However, we do not want to create a new frame due to the scarcity of control frame code. The TDD beamforming frame is used for beamforming which is indirectly connected to sensing and is also a frame that has 3 types, which can be extended to 4. It is also already a frame with variable size, which make it easier to extend.

***TGbf Editor: insert the following text as 9.3.1.25***

**9.3.1.25 TDD Beamforming frame format**

**9.3.1.25.1 Overview**

***Editor: Change the last line of Table 9-56—TDD Beamforming Frame Type subfield definition:***

|  |  |
| --- | --- |
| 3 | ~~Reserved~~ DMG Sensing |

***Editor: Change the title of Table 9-55—TDD Beamforming frame usage to “TDD Beamforming frame usage when TDD Beamforming frame type is not DMG Sensing***

***Editor: Insert a new table 9-55a after Table 9-55—TDD Beamforming frame usage***

Table 1 - TDD Beamforming fraem usage when Frate type subfield is set to 3 (DMG Sensing)

|  |  |  |
| --- | --- | --- |
| **TDD Group Beamforming**  **field value** | **TDD Beam Measurement**  **field value** | ***Frame Usage*** |
| 0 | 0 | DMG Multi-Static Sensing Request |
| 0 | 1 | DMG Sensing Response |
| 1 | 0 | DMG Sensing Poll |
| 1 | 1 | Reserved |

***Editor: insert the following as new subclauses after 9.3.1.25.4 TDD SSW Ack frame***

**9.3.1.25.5 DMG Multi-Static Sensing Request**

The TDD Beamforming information field of a DMG Sensing Request frame is shown in Figure 1.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B7 | B8 B15 | B16 B23 | B24 B26 | | B27 B34 | |
|  | Measurement Setup Id | Measurement Burst Id | Sensing Instance Number | | STA Multi-Static Id | First Beam Index | |
| bits: | 8 | 8 | 8 | 3 | | | 8 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B35 B37 | B38 B39 | B40 B47 | B48 B55 |
|  | Num of STAs in Instance | Num of PPDU in Instance | EDMG TRN Length | RX TRN-Units per Each TX TRN-Unit |
| bits: | 3 | 2 | 8 | 8 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B56 B57 | B58 B61 | B62 B63 | B64 | B65 B71 |
|  | EDMG TRN-Unit P | EDMG TRN-Unit M | EDMG TRN-Unit N | TRN Subfield Sequence Length | Reserved |
| bits: | 2 | 4 | 2 | 1 | 7 |

Figure 1 - TDD Beamforming Information field for the DMG Mulit-Static Sensing Request

The Measurement Setup Id, Measurement Burst Id and Sensing Instance Number fields identify the sensing measurement and the instance.

The STA Multi-Static Id field indicates the order of the receiving STA in the Multi-Static Sensing PPDU.

The Num of STAs in Instance field indicates the number of STA participating in the instatnce.

The First Beam Index field is an index into the Tx Beam List in the DMG Sensing Measurement Setup element. It indicates the first beam to be used in the Sensing Instance

The Num of PPDUs in instance indicates how many DMG Multi-Static Sensing PPDUs are present in the instance.

The Start of #N PPDU fields indicate the time between the end of the DMG Sensing Request frame and the start of N’th DMG Multi-Static Sesnsing PPDU in the instance. It is set to 0 if the number of PPDUs is less than N.

The EDMG TRN Length, RX TRN-Units per Each TX TRN-Unit, EDMG TRN-Unit P, EDMG TRN-Unit M, EDMG TRN-Unit N and TRN Subfield Sequence Length subfields contain the values of the corresponding header fields in the EDMG Multi-Static Sensing PPDU

**9.3.1.25.6 DMG Sensing Poll**

The TDD Beamforming information field of a DMG Sensing of a DMG Poll frame is shown in Figure 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 B7 | B8 B15 | B16 B23 | B24 |
|  | Meausrement Setup Id | Measurement Burst Id | Sensing Instance Number | Reserved |
| bits: | 8 | 8 | 8 | 1 |

Figure 2 - TDD Beamforming Information field for the DND Sensing Poll frmae

The Meausrement Setup Id, Measurement Burst Id, and Sensing Instance Number subfields identify the instantce

9.4.2.x5 DMG Sensing Report Control Element

The DMG Sensing Report Control element is sent in a Sensing Report frame if the frame is sent by a DMG STA. The structure of the DMG Sensign Report Control Element is shown in

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element Id | Length | Element Id Extension | Report Control |
| octets: | 1 | 1 | 1 | 6 |

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

The Report Control field is defined in Figure 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 B7 | B8 B15 | B16 B23 | B24 B26 | |
|  | Meausrement Setup Id | Sensing Burst Id | Sensing Instance Number | Report Type | |
| bits: | 8 | 8 | 8 | 3 | |
|  |  |  |  |  |  | |
|  | B27 B28 | B29 B31 | B32 B42 | B43 B47 |  | |
|  | Report Delay | Num of STAs in Instance | Channel Measurement Feedback Type | Reserved |  | |
| bits: | 2 | 3 | 11 | 5 |  | |

Figure 3 - Report Control Field

The Sensing Measurement Id, Sensing Burst Id, and Instance Number fields identify the sensing measurement and the instance.



The Report Type field is set to 0 for Channel Measurement Feedback. It is set to 1 for DMG Sensing Report .

The Report Delay field takes values from Table 1:

Table 2 - Report Delay Values

|  |  |
| --- | --- |
| Value | Interpretation |
| 0 | No report in this instance |
| 1 | One report in instance |
| 2 | Report of more than one instance |

The Channel Measurement Type is defined in Figure 4

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 B7 | B8 B9 | B10 |
|  | Number Of Meausrements | Number of Taps Present | Tap Delay Present |
| bits: | 8 | 2 | 1 |

Figure 5 - Channel Measurement Type subfield format

The subfields of the Channel Measurement Type subfield are defined in Table 9-293 (FBCK-TYPE field description.)

The Channel Measurement Feedback type field is defined in 9.4.2.136 (Channel Measurement Feedback

element).

The Sensing Report frame contains more than one Channel Measurement Feedback element if the measurement information exceeds 255 octets. The method to do that is described in 9.6.21.3 BRP frame format.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Extensible** | **Fragmentable** |
| DMG Sensing Report Control Element | 255 | <ANA> | Yes | No |

***TGbf Editor: replace the text in 11.21.20.5.4 with the following text***

**11.21.20.5.4 Mulstistatic instance**

**11.21.20.5.4.1 Multistatic Instance Initiation**

A multi-static EDMG sensing measurement instance between a transmitting sensing initiator and two or more responders is initiated by several DMG Sensing Request frames and responses to the DMG Sensing Requests frames.

The initiator initiates the multi-static EDMG sensing measurement instance by sending DMG Multi-Static Sensing Request frames to each of the responding STAs. The Sensing Measurement Id and the Sensing Instance Id subfields shall be the same in all of the DMG Sensing requests. The initiator shall set the STA Multi-Static Id subfield to a value between 0 and 7 indicating the order of the STA in the sync fields of the EMDG Multi-Static sensing PPDUs. EDMG Multi-Static sensing PPDUs will be addressed to the STA that gets the value of 0 in the STA Multi-Static Id. The initiator sets the First Beam Index field to a value that indicates the first beam that is used for TX in the TRN field of the first EMDG Multi-Static sensing PPDU. The initiator sets the Start of #N PPDU subfields, to the time, in microseconds from the end the the DMG Sensing Request to the beginning of the N’th EDMG Multi-Static sensing PPDU in the instance.

A responder that receivers a DMG Sensing Request frame, shall respond after SIFS with a DMG Sensing Response frame. The sensing responder shall remain active to receive all the EDMG Multi-Static sensing PPDUs in the instance and poll frame.

The initiator shall transmit a DMG Sensing Requests to the next STA, A SIFS after receiving the response from the previous one.

**11.21.20.5.4.1 Multistatic Instance Sounding**

SIFS after receiving the response from the last STA, the initiator shall transmit the EMDG Multi-Static sensing PPDUs. The initiator shall choose the format of TRN field (by setting TX-VECTOR parameters: TRN\_SEQ\_LENGTH, EDMG\_TRN\_LEN, RX\_TRN\_PER\_TX\_TRN, EDMG\_TRN\_P, EDMG\_TRN\_M, EDMG\_TRN\_N) in each of the transmitted EMDG Multi-Static sensing PPDUs in a way that it is compatible with the responders’ capabilities and covers the desired transmit and receive beams. Those TX-VECTOR parameters shall match the values appearing in the corresponding fields in the DMG Sensing Request frames. The EMDG Multi-Static sensing PPDUs may be followed by up to three EMDG Multi-Static sensing PPDUs with the same parameters from the transmitter. All the EMDG Multi-Static sensing PPDUs in a Multistatic Instance will have the same PPDU length and TRN field format.

**11.21.18.3.5.4.1 Multistatic Instance Reporting**

The instance may end with the initiator polling each of the responders for a sensing report

A SIFS after the transmission of the last PPDU, the initiator sends a DMG Sesnsing Poll frame to each of the responders. Each responder responds after SIFS with Sensing Report Frame which includes a DMG Sensing Report Control Element and either a DMG Sensing Report Element or one or more Channel Measurement Feedback elements.

**References:**