IEEE P802.11
Wireless LANs

|  |
| --- |
| LB272 Resolutions for DMG SR2SR Sensing |
| Date: July 11, 2023 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Ning Gao | OPPO |  |  | gaoning1@oppo.com |
| Pei Zhou |  |  | zhoupei1@oppo.com |
|  |  |  |  |

Abstract

This submission proposes resolutions to the following CIDs:

* 1291, 1292, 1293, 1294, 1295, 1460.

The text used as reference is 802.11bf D1.2.

Revisions:

* Rev 0: Initial version of the document.

**Comments:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page** | **Comment** | **Proposed Change** | **Resolution** |
| 1291 | 11.55.3.6 | 203.55 | Motion passed text in doc. 11-22/1958r3 was missing in d1.0, "The sensing initiator may update the transmit beams assigned to the responder in DMG Sensing Measurement Setup Request frame by setting the Updated TX Beam List subfield in the TDD Beamforming Information field in the DMG Sensing Request frame." Editor forgot to incorporate this sentence into d1.0. | Please add the missing text into 11bf draft. | **Revised.**The motion passed text mentioned by the commenter was missing in draft 1.0.Agree to add the text to the last draft.TGbf Editor make changes as in doc.: 11-23/0535r0 |
| 1293 | 9.4.2.325 | 122.37 | It is better to change the "RX Initiator" in Figure 9-1002bm-Measurement Setup Control field format to "RX Responder", since it is commonsensical that the sensing initiator sets TX/RX role for sensing responder(s) by DMG Sensing Measurement Setup Request frame. | As in comment. | **Revised.**Agree with the commenter.TGbf Editor make changes as in doc.: 11-23/0535r0 |
| 1294 | 11.55.3.4 | 199.50 | It is better to change the "RX Initiator subfield” to "RX Responder subfield", since it is commonsensical that the sensing initiator sets TX/RX role for sensing responder(s) by DMG Sensing Measurement Setup Request frame. | As in comment. | **Revised.**Agree with the commenter.TGbf Editor make changes as in doc.: 11-23/0535r0 |
| 1295 | 11.55.3.6.4 | 212.05 | DMG SR2SR sensing can be realized under coordinated bistatic DMG sensing type. For example, Sensing Initiator sets Sensing Responder 1 as transmitter, Sensing Responder 2 as receiver, Sensing Responder 3 as receiver by setting the "RX Responder (revised from RX Initiator)" subfield in Measurement Setup Control field. Then, Sensing Initiator indicates Sensing Responder 1's peer STA is Sensing responder 2, and Sensing Responder 3's peer STA is Sensing initiator by adding a ''peer STA ID element'' into related frames. | As in comment. The commenter will provide a solution for DMG SR2SR sensing case. | **Revised.**Agree with the commenter.TGbf Editor make changes as in doc.: 11-23/0535r0 |
| 1460 | 11.55.3.4 | 199.06 | "If the sounding phase in a coordinated monostatic sensing instance happens in parallel, the sensing initiator should assign transmit beams to different sensing responders (e.g. to avoid interference across multiple sensing responders) by setting the TX Beam List subelement in the DMG Sensing Measurement Setup element in the DMG Sensing Measurement Setup Request frame." The sentence is unnecessary and does not have a normative meaning. The DMG Sensing Beam Descriptor elements are different among the responders, so by definition, the initiator sets up the TX Beam List separately per each monostatic responder. There is no need for the paragraph. | Remove the paragraph | **Revised.**This paragraph provides valuable recommendations for readers and engineers. It is better to leave it as a note.TGbf Editor make changes as in doc.: 11-23/0535r0 |
| 1292 | 11.55.3.4 | 200.06 | The sounding phase of a coordinated bistatic DMG sensing instance may also happen in parallel. So, the sensing initiator can also assign transmit beams and receive beams to different sensing responders to avoid interference acorss multiple sensing responders by setting the TX/RX Beam List subelements. | Add one paragraph "If the sounding phase in a coordinated bistatic sensing instance happens in parallel, the sensing initiator should assign transmit and/or receive beams to different sensing responders (e.g. to avoid interference across multiple sensing responders) by setting the TX Beam List subelement and/or RX Beam List subelement in the DMG Sensing Measurement Setup element in the DMG Sensing Measurement Setup Request frame." | **Revised.**The sounding phase of a coordinated bistatic DMG sensing instance may also happen in parallel if DMG SR2SR sensing is supported. As explained in the ‘Resolution’ for CID 1460, it is better to make it as a note.TGbf Editor make changes as in doc.: 11-23/0535r0 |

**Discussion**

In coordinated bistatic DMG sensing, PCP/AP acts as sensing initiator can transmit DMG Sensing Measurement Setup Request frames to multiple sensing responders one by one. If sensing initiator sets one sensing responder (i.e., sensing responder 2) as sensing transmitter and another sensing responder (i.e., sensing responder 3) as sensing receiver, DMG SR2SR sensing can be realized by indicating responders’ peer STAs.

For example, sensing initiator (i.e., PCP/AP STA) transmits a DMG Sensing Measurement Setup Request frame to sensing responder 1 with RX Responder subfield set to 1 and Peer STA ID field set to Sensing initiator’s ID. Then, sensing initiator transmits a DMG Sensing Measurement Setup Request frame to sensing responder 2 with RX Responder subfield set to 0 and Peer STA ID field set to sensing responder 3’s ID. And then, sensing initiator transmits a DMG Sensing Measurement Setup Request frame to sensing responder 3 with RX Responder subfield set to 1 and Peer STA ID field set to Sensing responder 2’s ID.



Finally, in the coordinated bistatic DMG sensing instance phase, sensing initiator can initiate the following two bistatic measurements:

1) sensing initiator transmits Sensing PPDU to sensing responder 1,

2) sensing responder 2 transmits Sensing PPDU to sensing responder 3.

Therefore, the following minor changes should be made to the current 11bf draft to support DMG SR2SR sensing:

1) Change “RX Initiator subfield” to “RX Responder subfield” in the Measurement Setup Control field.

2) Add “Peer STA ID subelement” to DMG Sensing Measurement Setup element.

**Discussion end**

**9.3.1.25.5 DMG Sensing Request frame**

***TGbf Editor: Please add a new field into the Figure 9-110a—TDD Beamforming Information field format for a DMG Sensing Request frame and revise the following paragraphs as below.***



Figure 9-110a—TDD Beamforming Information field format for a DMG Sensing Request frame

The First Beam Index field is an index into the TX Beam List in the DMG Sensing Measurement Session element. It indicates the first beam to be used in the DMG sensing instance.

The EDMG TRN Length, RX TRN-Units per Each TX TRN-Unit, EDMG TRN-Unit P, EDMG TRN-Unit M, EDMG TRN-Unit N, TRN Subfield Sequence Length, BW, Sense Multiple Golays, and Sense Golay Index fields contain the values of the corresponding header fields in the EDMG multistatic sensing PPDU or BRP PPDU. These fields are reserved if the Sensing Type is set to Coordinated Monostatic.

The Coordinated Bistatic SR2SR field indicates whether the Coordinated Monostatic sensing instance is performed in SR2SR mode or not. A value of 1 indicates the SR2SR mode, a value of 0 indicates the non-SR2SR mode. This field is reserved if the Sensing Type is not set to Coordinated Bistatic.

**9.4.2.325 DMG Sensing Measurement Setup element**

***TGbf Editor: Please revise Figure 9-1002bm (Measurement Setup Control field format) and add a new subclause 9.4.2.325.5 (Peer STA ID subelement) as below.***

The Measurement Setup Control field is defined in Figure 9-1002bm (Measurement Setup Control field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | B0     B2 | B3 | B4 | B5 | B6 | B7 |
|  | Sensing Type | RX Responder(#1293) | LCI Present | Orientation Present | SP | Multiple Golays |
| Bits: | 3 | 1 | 1 | 1 | 1 | 1 |
| * Measurement Setup Control field format(#68, #356)
 |

The RX Responder subfield is set to 1 if the sensing responder is the sensing receiver in bistatic sensing, and to 0 if the sensing responder is the sensing transmitter in bistatic sensing. This field is reserved if the Sensing Type subfield is not set to 2 (Bistatic). (#1293)

…

The Optional Subelements field contains zero or more subelements. The subelement format and ordering of subelements are defined in 9.4.3 (Subelements). The Subelement ID field values for the defined subelements are defined in Table 9-401w (Subelements of DMG Sensing Measurement Setup definition).

**Table 9-401w—Subelements of DMG Sensing Measurement Setup definition**

|  |  |  |
| --- | --- | --- |
| **Subelement ID** | **Subelement Name** | **Extensible** |
| 1 | TX Beam List | Yes |
| 2 | RX Beam List | Yes |
| 3 | DMG Sensing Scheduling | Yes |
| 4 | Burst Response Delay | Yes |
| 5 | Peer STA ID | Yes |
| 6-255 | Reserved | No |

**9.4.2.325.5 Peer STA ID subelement**

The Peer STA ID subelement is defined in Figure 9-1002xx (Peer STA ID subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | AID/USID |
| Octets: | 1 | 1 | 1 |

**Figure 9-1002xx—Peer STA ID element format**

Peer STA ID element is present in DMG Sensing Measurement Setup element only when sensing initiator intends to initiate coordinated bistatic DMG sensing instance - DMG SR2SR variant (see 11.55.3.6.4 (Coordinated bistatic DMG sensing instance)). The AID/USID subfield uniquely identifies a sensing responder’s peer DMG STA.(#1295)

**11.55.3.4 DMG sensing measurement setup**

***TGbf Editor: Please revise clause 11.55.3.4 (DMG sensing measurement setup) and add the following content as below.***

…

The sensing initiator and sensing responder may need to perform DMG beamforming training before the DMG sensing measurement setup procedure.

The sensing initiator (i.e., PCP/AP STA) shall allocate time for sensing responders (i.e., non-PCP/AP STAs) to perform DMG beamforming training with each other before the DMG sensing measurement setup procedure, if it intends to perform coordinated bistatic DMG sensing instances - DMG SR2SR variant (see 11.55.3.6.4 (Coordinated bistatic DMG sensing instance)).

…

In the DMG Sensing Measurement Setup element, the sensing initiator shall set the Sensing Type subfield to the sensing type that will be used in the measurement. The sensing initiator shall not request a sensing type that the sensing responder has not indicated it is capable of in the DMG Sensing Capabilities element (see 9.4.2.322 (DMG Sensing Capabilities element)). For sensing type of bistatic, the RX subfield is set to 1 to indicate that the sensing responder is the sensing receiver in the bistatic measurements. It is set to 0 if the sensing responder is the sensing transmitter in the bistatic measurements. (#1294) For sensing type of coordinated bistatic, sensing initiator (i.e., PCP/AP STA) may initiate two sensing responders (i.e., non-PCP/AP STA) to perform DMG SR2SR sensing. The Peer STA ID element in DMG Sensing Measurement Setup element indicates a sensing responder’s peer STA.(#1295)

…

**11.55.3.4 DMG sensing measurement setup**

***TGbf Editor: Please revise replace the following paragraph with the content below.***

Note: If the sounding phase in a coordinated monostatic sensing instance happens in parallel, the sensing initiator should assign transmit beams to different sensing responders (e.g. to avoid interference across multiple sensing responders) by setting the TX Beam List subelement in the DMG Sensing Measurement Setup element in the DMG Sensing Measurement Setup Request frame. If the sounding phase in a coordinated bistatic sensing instance happens in parallel, the sensing initiator should assign transmit and/or receive beams to different sensing responders (e.g. to avoid interference across multiple sensing responders) by setting the TX Beam List subelement and/or RX Beam List subelement in the DMG Sensing Measurement Setup element in the DMG Sensing Measurement Setup Request frame.(#1292, #1460)

**11.55.3.6 DMG sensing instance**

**11.55.3.6.1 General**

***TGbf Editor: Please add the following paragraph into the 6th paragraph in subclause 11.55.3.6.1 (General).***

…

DMG sensing measurement instances of the DMG sensing types coordinated monostatic, coordinated bistatic, and multistatic shall contain an initiation phase.

The sensing initiator may update the transmit beams assigned to the responder in DMG Sensing Measurement Setup Request frame by setting the Updated TX Beam List subfield in the TDD Beamforming Information field in the DMG Sensing Request frame.(#1291)

…

***TGbf Editor: Please modify the subclause 11.55.3.6.4 Coordinated bistatic DMG sensing instance as bellow.***

**11.55.3.6.4 Coordinated bistatic DMG sensing instance**

A coordinated bistatic DMG sensing instance is a DMG sensing instance of a DMG sensing procedure of sensing type coordinated bistatic.

**11.55.3.6.4.1 Coordinated bistatic DMG sensing instance - non-SR2SR variant**

A non-SR2SR coordinated bistatic DMG sensing instance is initiated by a set of bistatic DMG sensing instance requests answered by sensing responses. It is then followed by a set of DMG bistatic sensing instances.

In the non-SR2SR coordinated bistatic DMG sensing instance, the following rules shall apply:
— Number of sensing responders in each coordinated bistatic DMG sensing instance of the same DMG Measurement Session ID may be different.

— The sensing initiator shall send a DMG Sensing Request frame with Coordinated Bistatic SR2SR field equals 0 to each sensing responder it invites to participate in the sensing instance(#1300, #2080).

— The sensing responder shall respond with a DMG Sensing Response frame to the sensing initiator within a SIFS(#1301, #2010, #2082).

— The sensing responder that responded to the sensing initiator shall remain active to receive the BRP PPDU.

— The order of sounding is indicated in the STA ID field within the DMG Sensing Measurement Request frame.

— BRP frames transmitted in a coordinated bistatic instance shall have the DMG Sensing field in the BRP Request field set to 1. The Sensing Instance SN in the BRP Sensing element in BRP frames transmitted as part of the instance shall have the same value as the Sensing Instance SN transmitted by the sensing initiator in the DMG Sensing Request frame(#1298).

**11.55.3.6.4.2 Coordinated bistatic DMG sensing instance - SR2SR variant**

A SR2SR coordinated bistatic DMG sensing instance is initiated by a set of DMG Sensing Request frames answered by DMG Sensing Response frames. It is then followed by a set of BRP frames exchanged between sensing responders and a DMG Sensing Measurement Report frame received by the sensing initiator.

In the SR2SR coordinated bistatic DMG sensing instance, the following rules shall apply:

* The sensing initiator shall interact with each intended bistatic DMG sensing peer one by one.
* For each bistatic DMG sensing peer, the interaction shall include an initiation phase, a sounding phase, and a reporting phase.
	+ In the initiation phase, the sensing initiator shall send a DMG Sensing Request frame with Coordinated Bistatic SR2SR field equals 1 to each sensing responder it invites to participate in the sensing instance. The sensing responder shall respond with a DMG Sensing Response frame to the sensing initiator within a SIFS. For each bistatic DMG sensing peer, the sensing initiator shall send a DMG Sensing Request frame to the sensing responder in the sensing receiver role first, then send another DMG Sensing Request frame to the sensing responder in the sensing transmitter role. The sensing responder in the sensing receiver role that responds to the sensing initiator shall remain active to receive the BRP PPDU.
	+ In the sounding phase, the sensing responder in the sensing transmitter role that responds to the sensing initiator shall send a BRP frame with TRN field to the peer sensing responder a SIFS after the DMG Sensing Respond frame. The sensing responder in the receiver role shall respond a BRP frame with report within a BRPIFS. The EDMG TRN Length, RX TRN-Units per Each TX TRN-Unit, EDMG TRN-Unit P, EDMG TRN-Unit M, EDMG TRN-Unit N, TRN Subfield Sequence Length, BW in the header of the BRP PPDU transmitted by the sensing responder in the sensing transmitter role shall have the same value as the EDMG TRN Length, RX TRN-Units per Each TX TRN-Unit, EDMG TRN-Unit P, EDMG TRN-Unit M, EDMG TRN-Unit N, TRN Subfield Sequence Length, BW transmitted by the sensing initiator in the DMG Sensing Request frame. The BRP frame transmitted in a coordinated bistatic instance shall have the DMG Sensing field in the BRP Request field set to 1. The First Beam Index, DMG Measurement Session ID, Measurement Burst ID and Sensing Instance SN in the BRP Sensing element in BRP frames transmitted as part of the instance shall have the same value as the First Beam Index, DMG Measurement Session ID, Measurement Burst ID and Sensing Instance SN transmitted by the sensing initiator in the DMG Sensing Request frame.
	+ In the reporting phase, the sensing responder in the sensing transmitter role shall send a DMG Sensing Measurement Report frame to the sensing initiator a SIFS after receiving the BRP frame with report.



Figure 11-74x—Coordinated bistatic DMG sensing instances – SR2SR variant

Figure 11-74x (Coordinated bistatic DMG sensing instances – SR2SR variant) gives an example of a bistatic DMG sensing instances. The PCP/AP is the sensing initiator and two non-AP STAs (STA A and STA B) are sensing responders. The STA A and STA B form a bistatic DMG sensing peer where the STA A is in the sensing receiver role and the STA B in the sensing transmitter role.

In the initiation phase, the initiator firstly sends a DMG Sensing Request frame to the STA A first to invite it participating this instance and receive the DMG Sensing Response frame. Then, the sensing initiator sends another DMG Sensing Request frame to the STA B and receive the response. After that, in the sounding phase, the STA B will directionally send a BRP frame with TRN to the STA A to measurement the environment and receive a BRP frame with report from STA A after a BRPIFS. Finally, in the reporting phase, the STA A sends a DMG Sensing Measurement Report frame to the sensing initiator to report the sensing result.

**SP: Do you support the resolutions to CIDs 1291, 1292, 1293, 1294, 1295 and 1460,**

**as specified in doc.: 11-23/0535r0 and incorporate the text changes into the latest TGbf draft.**