IEEE P802.11  
Wireless LANs

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| Editorial review suggestions for Clause 11.55.3 | | | | |
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Abstract

This submission is an editorial review of 11bf D1.2 clause 11.55.3 and does not provide any specific CID resolutions.

***TGbf editor: Please make the following marked up changes in clause 11.55.3:***

* DMG sensing procedure
* Overview

The DMG sensing types include monostatic, bistatic, multistatic, passive sensing, monostatic sensing with coordination and bistatic sensing with coordination.

In monostatic sensing, the sensing transmitter and the sensing receiver are the same STA.

In bistatic sensing, the sensing transmitter and the sensing receiver are two distinct STAs.

In multistatic sensing, the sensing transmitter and more than one sensing receivers are distinct STAs. For example, one sensing transmitter and two sensing receivers.

In passive sensing, the STA receives PPDUs transmitted by one or more STAs that are not necessarily intended for DMG sensing (such as DMG Beacon frames).

Coordinated monostatic sensing is an extension of monostatic sensing, by coordinating several monostatic sensing responders(#1456). In coordinated monostatic sensing, the transmissions by one or more devices that perform monostatic sensing are coordinated by a PCP/AP.

Coordinated bistatic sensing is an extension of bistatic sensing, by coordinating multiple sensing responders by one sensing initiator.

The DMG sensing procedure defines the behavior of a single sensing initiator with one or more sensing responders. It comprises one or more of the following: DMG sensing session setup exchange (11.55.3.3 (DMG sensing session setup exchange)), DMG sensing measurement session (11.55.3.4 (DMG sensing measurement session)), DMG sensing burst (11.55.3.5 (DMG sensing burst)), DMG sensing instance (11.55.3.6 (DMG sensing instance)), DMG sensing measurement termination (11.55.3.8 (DMG sensing measurement termination)), and DMG sensing session termination (11.55.3.9 (DMG sensing session termination)).

A DMG sensing procedure may be composed of multiple DMG sensing bursts that may be composed of multiple DMG sensing instances(#1457).

NOTE—Measurements over a certain time period are required to compute the Doppler frequency shift. The occupancy time per channel access cannot exceed the TXOP limit. If a longer measurement time is needed, then the approach of the DMG sensing burst allows scheduling of the multiple channel accesses, to collect measurements for the Doppler frequency shift computation(#1287, #1657).

A sensing responder may participate in several DMG sensing measurement sessions containing multiple and possibly overlapping DMG sensing bursts.

A sensing initiator may:

* initiate several DMG sensing measurements containing multiple DMG sensing bursts with multiple and possibly overlapping sets of sensing responders.
* instruct the sensing responder
  + in the sensing receiver role or in the sensing receiver and sensing transmitter role to report at the DMG sensing instance.
  + to accumulate the results and report once per DMG sensing burst.

Figure 11-74k (DMG sensing procedure with three sensing responders) illustrates a DMG sensing procedure with an AP performing DMG sensing measurements with three non-AP STAs, which are identified by their MAC addresses A, B, and C. The example starts with a DMG sensing session setup exchange performed between the AP and STAs A, B, and C that establishes a sensing session identified by AID 1, AID 2, and AID 3, respectively.

DMG sensing measurement session procedures are then performed, defining sets of operational parameters. The AP establishes with STA A and STA B a set of operational parameters(#2216) that is assigned a DMG Measurement Session ID equal to 1, and it establishes with STA A and STA C another set that is assigned a DMG Measurement Session ID equal to 2. Operational parameters identified with the same DMG Measurement Session ID may be different among the involved STAs, besides the intra-burst and inter-burst intervals. These intervals (inter-burst and intra-burst) for both STAs are equal as per the equal DMG Measurement Session ID.

After establishing the DMG sensing measurement session, DMG sensing instances are performed. DMG sensing instances are grouped into DMG sensing bursts. Each DMG sensing burst is identified by a measurement Burst ID that is unique per DMG Measurement Session ID. Figure 11-74k presents two bursts (with Measurement Burst ID equal to 1 and Measurement Burst ID equal to 2) of the DMG Measurement Session ID equal to 1, and two bursts (with Measurement Burst ID equal to 1 and Measurement Burst ID equal to 2) of the DMG Measurement Session ID equal to 2.

Two DMG sensing bursts belonging to the DMG Measurement Session ID equal to 1 are performed with the intra-burst interval equal to T1 and the inter-burst interval equal to T2. Another two DMG sensing bursts belonging to the DMG Measurement Session ID equal to 2 are performed with different burst parameters: an Intra-burst interval equal to T3 and an inter-burst interval equal to T4.

The Sensing Instance SNs uniquely identifies the DMG sensing instance per the Measurement Burst ID. There are 3 DMG sensing instances in each burst, which have Sensing Instance SNs equal to 1, 2, and 3.



* DMG sensing procedure with three sensing responders
* Dependencies and timing-related parameters

Implementation of DMG sensing is optional for a DMG STA.

A DMG STA in which dot11DMGSensingMsmtImplemented is:

* true, is defined as a STA that supports DMG sensing. The STA:
  + shall set the Sensing support field of the Short DMG Sensing Capabilities field in the DMG Sensing Short Capabilities (9.4.2.324 (DMG Sensing Short Capabilities element)) to 1.
  + should use the timing-related parameters defined in Table 11-29c (DMG sensing procedure timing-related parameters)(\*0814).
* false, shall set the Sensing support field of the Short DMG Sensing Capabilities field in the DMG Sensing Short Capabilities (9.4.2.324 (DMG Sensing Short Capabilities element)) to 0.

|  |  |  |
| --- | --- | --- |
| * DMG sensing procedure timing-related parameters | | |
| Parameter | Value | Description |
| *aDMGSensingProcedureExpiry* | 10 s | The time limit for which a DMG sensing measurement session remains active if no frames are exchanged between its sensing initiator and sensing responder. |

* DMG sensing session setup exchange

In the DMG sensing session setup exchange of a DMG sensing procedure, the sensing initiator and the sensing responder exchange DMG sensing capabilities. The capabilities include the types of DMG sensing and the roles the STA may assume for each of the supported DMG sensing types. The DMG Sensing Short Capabilities element (see 9.4.2.324 (DMG Sensing Short Capabilities element)) and the DMG Sensing Capabilities element (see 9.4.2.322 (DMG Sensing Capabilities element)) contain the sensing capabilities of the DMG STA.

A sensing capable PCP/AP STA shall convey the DMG Sensing Short Capabilities element in the DMG Beacon and Announce frames. A sensing capable DMG STA shall include the DMG Sensing Capabilities element (see 9.4.2.322 (DMG Sensing Capabilities element)) in the probe frames and the association frames.

The DMG sensing session setup exchange is complete(#1045, #1927) when a DMG STA and a DMG PCP/AP have completed an association(#1459).

The PCP/AP STA may set up the DMG sensing measurement with the non-PCP/AP STA capable of one of the DMG sensing types.

The PCP/AP STA shall not initiate the DMG sensing measurement session with the non-PCP/AP STA if the STA is not capable of at least one of the DMG sensing types.

To coordinate more than one sensing responder, the sensing initiator of a DMG sensing procedure shall be a PCP/AP STA.

The sensing initiator may be capable to take the roles of sensing transmitter, sensing receiver, both sensing transmitter and sensing receiver, or none of them.

A sensing responder may be capable of one or more of the following roles: Sensing receiver, sensing transmitter, and both sensing transmitter and sensing receiver.

A sensing initiator of the DMG sensing types:

* monostatic and coordinated monostatic shall be capable to take the roles of both sensing transmitter and sensing receiver, or neither of them.
* bistatic and coordinated bistatic shall be capable of the sensing transmitter and/or the sensing receiver role.
* multistatic shall be capable of the sensing transmitter role(#2122, #2213).

A sensing responder of the DMG sensing types:

* monostatic and coordinated monostatic shall be capable to take the roles of both sensing transmitter and sensing receiver.
* bistatic and coordinated bistatic shall be capable of the sensing transmitter and/or the sensing receiver role.
* multistatic shall be capable of the sensing receiver role(#2122).

The Beam Azimuth, Beam Elevation, Azimuth Beamwidth, and Elevation Beamwidth fields within the Beam Descriptor field shall be reported in earth coordinates if the Earth Coordinates field within the Short DMG Sensing Capabilities field is equal to 1, and in an arbitrary STA’s coordinate system if the Earth Coordinates field is equal to 0(\*0506).

* DMG sensing measurement session

The DMG sensing measurement session is a procedure that allows a sensing initiator and a sensing responder to exchange and agree on operational parameters associated with DMG sensing bursts and DMG sensing instances. Operational parameters may include intra-burst and inter-burst schedule, number of instances per burst, roles of sensing initiator and sensing responder, DMG sensing type, DMG sensing measurement report types, and other parameters. Operational parameters agreed between the sensing initiator and the sensing responder are assigned a DMG Measurement Session ID.

The sensing initiator and sensing responder may:

* need to perform DMG beamforming training before the DMG sensing measurement session procedure.
* perform an FTM procedure (see 11.21.6 (Fine timing measurement (FTM) procedure)) to obtain the distance between them and their relative orientation prior to DMG sensing measurement session.

A DMG sensing measurement session is initiated with the sensing initiator sending a DMG Sensing Measurement Request frame containing a DMG Sensing Measurement Session element to the sensing responder.

The sensing initiator shall set the:

* DMG Measurement Session ID field in the DMG Sensing Measurement Session element to a unique value identifying the measurement.
* Report Type field to the type of report to be used in the measurement if feedback is provided (see Table 9-401v (Report Type field definition))(#1383).

In the DMG Sensing Measurement Session element, the sensing initiator shall set the Sensing Type field 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 a sensing type of bistatic, the RX Initiator field is set to 1 to indicate that the sensing initiator is the sensing receiver in the bistatic measurements. It is set to 0, if the sensing initiator is the sensing transmitter in the bistatic measurements.

If the sensing initiator has set the Report Type field to either DMG Sensing Image Range-Doppler, DMG Sensing Image Doppler-Direction, DMG Sensing Image Range-Doppler Direction or Target, the sensing initiator may set the Multiple Golays field to 1 to request measurement with different Golay sequences per each DMG sensing instance.

With the polarization information contained in the Beam Descriptor field of DMG Sensing Beam Descriptor element (see 9.4.2.323 (DMG Sensing Beam Descriptor element)), the sensing initiator could setup polarization sensing by setting the beam indices in the TX Beam List subelement and RX Beam List subelement to obtain the co-polarization (e.g. H-H and V-V when linear polarization is adopted) and cross-polarization (e.g. H-V and V-H when linear polarization is adopted) sensing results for the DMG sensing types: bistatic, coordinated bistatic and multistatic. If the DMG sensing type is equal to coordinated monostatic, only the TX Beam List subelement is present in the DMG Sensing Measurement Session element (see 9.4.2.325 (DMG Sensing Measurement Session element)). A sensing initiator could realize the polarization sensing, by setting the Polarization Sensing field in the Measurement Session Control field of the DMG Sensing Measurement Session element to 1, to indicate polarization sensing by the sensing responder(s) for all the beams indicated in the TX Beam List subelement(#2064).

During the measurement, the sensing initiator shall set the beam list in the:

* TX Beam List subelement to the list of beams that are used by the sensing transmitter.
* RX Beam List subelement to the lists of beams that are used by the sensing receiver.

Each beam index in the TX Beam List and RX Beam List is an index of the beam descriptors the sensing transmitter and sensing receiver published in their DMG Sensing Beam Description elements for transmit and receive, respectively. If the Sensing Type field within the DMG Sensing Measurement Session element is equal to coordinated monostatic, the RX Beam List subelement is not present.

For coordinated monostatic sensing:

* If the sounding phase instance happens in parallel, the sensing initiator should assign the 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 Session element in the DMG Sensing Measurement Request frame.
* Any PPDU shall be constructed according to non-EDMG or EDMG PHY specifications. Sensing with a TRN field in a PPDU is an optional mode for the coordinated monostatic sensing.

If present, the Peer Orientation field contains the azimuth, elevation, and range of the sensing responder as measured by the sensing initiator. If present, the LCI field contains the location of the sensing initiator. The azimuth and elevation fields in the Peer Orientation field within the Measurement Session Control field shall be reported in earth coordinates, if the Earth Coordinates field in the Short DMG Sensing Capabilities field is equal to 1, and in an arbitrary STA’s coordinate system, if the Earth Coordinates field is equal to 0(\*0506).

The sensing initiator may include a DMG Sensing Scheduling subelement in the Optional Subelements field within the DMG Sensing Measurement Request frame. If the SP field is equal to 0 in the Measurement Session Control field (Figure 9-1002bn (Measurement Session Control field format)), the DMG Sensing Scheduling subelement contains the scheduling of the measurement as proposed by the sensing initiator. The sensing initiator shall set the:

* Start of Burst field to the time of the start of the burst in TSF units.
* Intra-Burst Interval field to the time between the start of successive instances in a burst.
* Inter-Burst Interval field to the time between the start of successive bursts.
* Number TX Beams Per Instance field to the number of TX AWV patterns to be used in each instance.
* Repeat Per Instance field to the number of times the sensing transmitter goes through the Number TX Beams Per Instance within the instance (see 11.55.3.6.3 (Bistatic DMG sensing instance)).

If the SP field is equal to 1 in the Measurement Session Control field (Figure 9-1002bn (Measurement Session Control field format)), the DMG Sensing Scheduling subelement and the Extended Schedule element (9.4.2.131 (Extended Schedule element)) contain the scheduling of the measurement as proposed by the sensing initiator. The AllocationType field in the Allocation field of the Extended Schedule element (Figure 9-629 (Allocation field format)) shall be set to SP for DMG sensing. The Source AID field in the Allocation field of the Extended Schedule element shall be set to 0, indicating a PCP/AP as the sensing initiator. The Destination AID field in the Allocation field of the Extended Schedule element shall be set to the AID of the sensing responder scheduled by the sensing initiator to participate in the sensing instances during the airtime allocation(#1384).

The sensing initiator shall set the:

* Allocation Start for DMG sensing field to the time of the start of the burst in TSF units. Every DMG sensing burst starts at



* Distance Between DMG sensing Bursts field to the time between the start of successive burst.
* Allocation Block Period field to the time measured in the number of beacon intervals(#2173) between the start of successive instances in the burst.
* Number of Blocks field to the number of instances in the burst.
* Allocation Block Duration field equal to the time allocated for an instance(#1385).
* Number TX Beams Per Instance field to the number of TX AWV patterns to be used in each instance.
* Repeat Per Instance field to the number of times the sensing transmitter goes through the Number TX Beams Per Instance within the instance (see 11.55.3.6.3 (Bistatic DMG sensing instance)).

After receiving a DMG Sensing Measurement Request frame, a DMG STA responds with a DMG Sensing Measurement Response frame.

The sensing responder shall set the:

* DMG Measurement Session ID field in the DMG Sensing Measurement Response frame to the value set in this field in the DMG Sensing Measurement Request frame sent by the sensing initiator(#2123).
* Status Code field in the DMG Sensing Measurement Response frame to:
  + SUCCESS, if it accepts the DMG measurement session request(#1046, #2005).
  + REJECTED\_WITH\_SUGGESTED\_CHANGES, if it rejects the request but accepts the schedule that is included in the DMG Sensing Scheduling subelement included in the DMG Sensing Measurement Session element.
  + REQUEST\_DECLINED if it rejects the request.

The sensing responder shall set the Sensing Type and RX Initiator fields to the same value that was in the DMG Sensing Measurement Setup element within the DMG Sensing Measurement Session Request frame(#1047, #1483). If present:

* the Peer Orientation field contains the azimuth and elevation of the sensing initiator as measured by sensing responder.
* the LCI field contains the location of the sensing initiator.

If the sensing initiator has set the Report Type field in the DMG Sensing Measurement Session element equal to the values 3, 5, 6, or 7 (that is, the values indicating Doppler reporting), the sensing responder shall include a Burst Response Delay subelement in the DMG Sensing Measurement Session element with the Burst Response Delay field set to the time in milliseconds, it needs to calculate the response to the DMG sensing burst, defined in the sensing initiator’s DMG Sensing Measurement Session element.

If the sensing responder indicated REJECT\_WITH\_SCHEDULE, the DMG Sensing Scheduling subelement indicates the proposed schedule from the sensing responder.

The sensing initiator requests a DMG sensing measurement session separately with each sensing responder. Operational parameters established upon session negotiation are identified by the DMG Measurement Session ID. The same DMG Measurement Session ID may be asserted to the agreement with different sensing responders if the sensing initiator schedules to address the sensing responders in the same DMG sensing measurement exchanges(#1387).

* DMG sensing burst

A DMG sensing burst is a set of scheduled DMG sensing instances so that the time difference between the instances within each DMG sensing burst, may be shorter than the time difference between consecutive DMG sensing bursts. One or more sensing responders may be scheduled for sensing within a DMG sensing burst(#1484).

To enable low velocity Doppler shift measurements(#1388), a set of repeated measurements over a long period may be needed. A DMG sensing burst enables such measurement.

The sensing initiator shall:

* start the DMG sensing instances organized in the measurement burst, when an MLME-DMG-SENSMSMTSTART.confirm primitive with the ResultCode equal to SUCCESS is received.
* assign to each measurement burst a Measurement Burst ID. The Measurement Burst ID shall be unique within the range of the Measurement Burst ID field per a DMG Measurement Session ID (see 9.3.1.25.5 (DMG Sensing Request frame)).

Each DMG sensing burst shall be composed of Number of Instances per Burst DMG sensing instances. The beginning of each DMG sensing instance shall be separated from the beginning of the previous DMG sensing instance by an Intra-Burst Interval time.

* address each sensing responder associated with the DMG Measurement Session ID at each DMG sensing instance of the burst. The sensing initiator shall access the medium to transmit a DMG Sensing Request frame or a BRP frame to each sensing responder at each DMG sensing instance in a burst. For each sensing responder, the time of the first access in an instance, shall be separated by an Intra-Burst Interval time from the first access in the previous DMG sensing instance(#2074).

Each DMG sensing instance in a burst is assigned a Sensing Instance SN. The Sensing Instance SN shall be unique per a Measurement Burst ID. The Instance SN in a measurement burst shall increment sequentially. The first instance of the measurement burst shall have Sensing Instance SN equal to 1.

The DMG Sensing Request frames sent to the different sensing responders in a DMG sensing instance shall be indicated with the same Measurement Burst ID, DMG Measurement Session ID, and Instance SN (#2076).

If the value of the Report Type field in the DMG Measurement Session element (9.4.2.325 (DMG Sensing Measurement Session element)) that is associated with the burst, is equal to 3, 5, 6 or 7 (report types containing Doppler measurements) the sensing initiator shall follow the following rules(#2006, #2121):

* The DMG sensing instances included in the measurement should not contain a reporting phase except for the first or last instance in a burst. The DMG sensing instance containing the reporting phase may require separate medium access. The Number of Instances per Burst does not include the instance intended for the reporting.
* The values of the following fields in the DMG Sensing Request frame shall be the same among all DMG sensing instances belonging to the same Measurement Burst ID(#2007):
* Sensing Type
* STA ID
* First Beam Index
* Num of STAs in Instance
* Num of PPDUs in Instance
* EDMG TRN Length
* RX TRN-Units per Each TX TRN-Unit
* EDMG TRN-Unit P
* EDMG TRN-Unit M
* EDMG TRN-Unit N
* TRN field Sequence Length
* BW

At the successful transmission of the DMG Sensing Measurement Response frame, the sensing responder that is part of the DMG measurement session of the burst, shall be available at the medium on the sensing instances at the time scheduled by the sensing initiator (see 11.55.3.4 (DMG sensing measurement session)).

During a DMG sensing burst, the sensing transmitter and the sensing responder shall follow the rules of the sensing instances of different DMG sensing types defined in the subclauses 11.55.3.6.2 (Coordinated monostatic DMG sensing instance), 11.55.3.6.3 (Bistatic DMG sensing instance), 11.55.3.6.4 (Coordinated bistatic DMG sensing instance), and 11.55.3.6.5 (Multistatic EDMG sensing instance).



* Example of a DMG sensing burst

Figure 11-74l (Example of a DMG sensing burst) illustrates a DMG sensing burst when an AP performs a DMG sensing procedure with two non-AP STAs, which are identified by their MAC addresses A and B. The example starts with a DMG sensing session setup exchange performed between the AP and STAs A and B that establishes a sensing session identified by AID 1 and AID 2, respectively.

DMG sensing measurement session procedures are then performed, defining sets of operational parameters. The AP establishes a set, with STA A and STA B that is assigned a DMG Measurement Session ID set to 1. Operational parameters identified with the same DMG Measurement Session ID may be different among the involved STAs, besides the intra-burst and inter-burst intervals. The intervals (inter-burst and intra-burst) for both STAs are equal as per the equal DMG Measurement Session ID.

After the DMG measurement session is established, DMG sensing instances are performed. DMG sensing instances are grouped in DMG sensing bursts. Each DMG sensing burst is identified by the Measurement Burst ID. It is unique per DMG Measurement Session ID. The figure presents two bursts (with Measurement Burst ID equal to 1, and Measurement Burst ID equal to 2 with a DMG Measurement Session ID equal to 1). Two DMG sensing bursts are performed with the intra-burst interval equal to T1 and the inter-burst interval equal to T2.

The Sensing Instance SNs uniquely identifies the DMG sensing instance per the Measurement Burst ID. There are 3 DMG sensing instances in each burst, which have Sensing Instance SNs equal to 1, 2, and 3. The sensing instances include the initiation and sounding phases and do not include the reporting phase. DMG sensing results are aggregated and reported for each burst.

The report phase is delayed by the time it takes for the sensing responder to calculate the reported result. During the reporting phase, the AP separately polls the sensing responder and obtains the report. Each DMG sensing report is identified with the sensing responder’s MAC Address and AID with the DMG Measurement Session ID and Measurement Burst ID.

The sensing initiator and sensing responder may perform an FTM procedure (see 11.21.6.4 ((FTM) Measurement exchange) to obtain the distance and relative orientation between both STAs for each DMG sensing burst(#2178).

* DMG sensing instance
* General

The SME shall initiate a DMG sensing instance by issuing an MLME-DMG-SENSMSMTSTART.request that shall include a list of peer STA addresses and parameters of the DMG Sensing Request frame for each of the STAs(#1227, #1814).

A DMG sensing instance:

* is limited to one TXOP or SP. The SP shall be used if the SP field is set to 1 in the Measurement Session Control field of the DMG Sensing Measurement Session element (9.4.2.325 (DMG Sensing Measurement Session element)). Otherwise, the SP shall not be used.
* belongs to one DMG Measurement Session ID.
* includes the following phases: initiation phase, sounding phase, and reporting phase. The sounding phase is mandatory; the initiation and reporting phases are optional.
* is identified with the Sensing Instance SN. The Sensing Instance SN shall be sequential in increasing order and be unique in range.
* may belong to a DMG sensing burst(#1389). The Sensing Instance SN shall be unique per the Measurement Burst ID.

DMG sensing measurement exchanges of the DMG sensing types:

* monostatic and the bistatic may contain an initiation phase.
* coordinated monostatic, coordinated bistatic, and multistatic shall contain an initiation phase.

The reporting phase is mandatory if the sensing responder is either in the sensing receiver role, or in the sensing transmitter and sensing receiver role(#2008).

* Coordinated monostatic DMG sensing instance
* General

A coordinated monostatic DMG sensing instance is a DMG sensing procedure of sensing type Coordinated Monostatic. It can be performed in two modes: sequential and parallel. It includes an initiation phase, a sounding phase, and may include a reporting phase(#1485).

A coordinated monostatic DMG sensing instance is initiated by the sensing initiator with the transmission of a DMG Sensing Request frame(s) and the reception of DMG Sensing Response frame(s) from sensing responders. It is then followed by the sounding phase in which DMG monostatic sensing PPDUs are transmitted and received by the sensing responder(s).

The measurement covers the number of transmit AWVs indicated by the Number TX Beams Per Instance field within the DMG Sensing Scheduling subelement of the DMG Sensing Measurement Session element (see 9.4.2.325 (DMG Sensing Measurement Session element)).

The sensing initiator shall determine the parameters of the DMG monostatic sensing PPDUs transmitted and received by the sensing responders in a way which is compatible with the sensing responders’ capabilities and covers all the desired transmit beams indicated in TX Beam List subelement (see 9.4.2.325.1 (TX Beam List subelement)). The first beam used by the sensing responders to transmit and receive DMG monostatic sensing PPDUs in a DMG sensing instance is indicated by the First Beam Index field. The sensing responders will cycle through the Num TX Beams Per Instance beams to transmit and receive the DMG monostatic sensing PPDUs. If the Repeat Per Instance field of the DMG Sensing Scheduling subelement  is greater than 1, the sensing responder will repeat the Num TX beams Per Instance Beams in DMG sensing instances  times.

If the Polarization Sensing field within the Measurement Session Control field in the DMG Sensing Measurement Session element is set to 1, sensing responders shall transmit and receive DMG monostatic sensing PPDUs with different transmuting/receiving polarization combinations to receive co-polarization and cross-polarization sensing results for all the beams indicated in the TX Beam List subelement(#2064).

All the DMG monostatic sensing PPDUs transmitted and received by the sensing responders shall be separated by SBIFS. If a report is configured in the DMG sensing instance, the sensing responders shall report no longer than SIFS after their last DMG monostatic sensing PPDU or after the polling by the sensing initiator. The report may be based on Channel Measurement Feedback elements or DMG Sensing Report elements. The presence and type of the report is indicated by the DMG Sensing Report Control field of the DMG Sensing Report Control element.

The number of sensing responders in each coordinated monostatic DMG sensing instance of the same DMG Measurement Session ID may be different.

* Sequential coordinated monostatic DMG sensing instance

In a sequential coordinated monostatic DMG sensing instance, the following rules shall apply:

* The sensing initiator shall interact with each intended sensing responder one by one in order of the STA ID field of the DMG Sensing Request frame.
* For each sensing responder, 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 to a sensing responder to request it to participate in the coordinated monostatic DMG sensing instance. The Monostatic Sounding Mode field within the TDD Beamforming Information field in the DMG Sensing Request frame shall be set to 1 to identify the sequential mode. The sensing responder shall not respond with the DMG Sensing Response frame to the sensing initiator, later than a SIFS after the request.
* In the sounding phase, the sensing responder shall transmit the first DMG monostatic sensing PPDU no later than a SIFS after the DMG Sensing Response frame(#1303). DMG monostatic sensing PPDUs transmitted by the same sensing responder shall be separated by a SBIFS.
  + If the Sensing Instance SN field of the TDD Beamforming Information field in the DMG Sensing Request frame is equal to:
    - 1, the DMG monostatic sensing PPDUs shall cover the number of transmitting AWV indicated by the Num of TX Beams Per Instance field and the times theRepeat Per Instance field in the DMG Sensing of repetition indicated by Scheduling subelement within the DMG Sensing Measurement Session element. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS shall be equal to the Sounding Duration field of the DMG Sensing Instance Duration element delivered by the sensing responder within the DMG Sensing Measurement Response frame.
    - *i* (*i* > 1), the DMG monostatic sensing PPDUs shall cover the number of transmitting AWV indicated by the Num of TX Beams in Instance field and the times of repetition indicated by the Num of Repeat in Instance field in the TDD Beamforming Information field within the DMG Sensing Request frame with Sensing Instance SN field set to *i* - 1. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS shall be equal to the Sounding Duration field of the DMG Sensing Response frame of the instance with the Sensing Instance SN field set to *i -* 1.
* In the reporting phase, if the report is needed (see 9.4.2.325 (DMG Sensing Measurement Session element)), the sensing responder shall send a DMG Sensing Measurement Report frame to the sensing initiator(#1436) no later than a SIFS after the last DMG monostatic sensing PPDU.
  + If the Sensing Instance SN field of the TDD Beamforming Information field in the DMG Sensing Request frame is equal to:
    - 1, the duration of the transmission of the DMG Sensing Measurement Report frame shall be equal to the Report Duration field of the DMG Sensing Instance Duration element delivered by the sensing responder in the DMG Sensing Measurement Response frame.
    - *i* (*i* > 1), the duration of the transmission of the DMG Sensing Measurement Report frame shall be equal to the Report Duration field of the DMG Sensing Response frame of the instance with the Sensing Instance SN field set to *i -* 1.
* The sensing initiator shall interact with the next sensing responder no later than a SIFS after the DMG Sensing Measurement Report frame of the current sensing responder.

The value of the Duration field of the first DMG Sensing Request frame in instance *i* shall be calculated by Equation (11-9).





In Equation (11-9),

*  is the value of the Num of STAs in Instance field within the DMG Sensing Request frame in DMG sensing instance *i*
*  is the TXTIME of a DMG Sensing Request frame
*  is the TXTIME of a DMG Sensing Response frame
*  is the value of the Sounding Duration field of the DMG Sensing Response frame delivered by the sensing responder *n* in DMG sensing instance *i* - 1 (*i* > 1).  is the value of the Sounding Duration field of the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frame delivered by sensing responder *n*
*  is the value of the Report Duration field of the DMG Sensing Response frame delivered by the sensing responder *n* in DMG Sensing instance *i* - 1 (*i* > 1).  is the value of the Report Duration field of the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frame delivered by the sensing responder *n*

The value of the Duration field of other frames in DMG Sensing instance *i* shall be calculated as the subtraction of the duration of the frame and previous interframe space from the preceded value.

* Coordinated monostatic DMG sensing instances, sequential sounding mode

Figure 11-74m (Coordinated monostatic DMG sensing instances, sequential sounding mode) gives an example of two sequential coordinated monostatic DMG sensing instances. The PCP/AP is the sensing initiator and the two non-AP STAs (STA A and STA B) are sensing responders. The SP is not used and the measurement results need to be reported. In the DMG sensing measurement session phase, STA A and STA B delivered the Sounding Duration 0a, Report Duration 0a, Sounding Duration 0b, and Report Duration 0b of the first DMG sensing instance to the sensing initiator by the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frame. In this example, the sensing initiator first interacts with STA A (STA ID equal to 0) and then with STA B (STA ID equal to 1) in each DMG sensing instance.

In Instance 1, in the initiation phase of STA A, the sensing initiator sends a DMG Sensing Request frame to STA A and receives a DMG Sensing Response frame from STA A. The DMG Sensing Request frame activates STA A to be ready to participate in the sounding and reporting phases. The DMG Sensing Response frame indicates to the sensing initiator the readiness of STA A and the Sounding Duration 1a and the Report Duration 1a of Instance 2.

In the first DMG Sensing Request frame, the Monostatic Sounding Mode field is set to 1 to indicate the sequential mode and the Duration field is set to the value according to Equation (11-9). The calculation utilizes the Sounding Duration 0a, Report Duration 0a, Sounding Duration 0b, and Report Duration 0b fields delivered in the DMG Sensing Measurement Response frame.

In the following sounding phase of STA A, STA A transmits DMG monostatic sensing PPDUs and receives the reflected signal for sensing measurement. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS is equal to the Sounding Duration 0a. The measurement in the DMG monostatic sensing PPDU covers the number of transmit AWV indicated by the Number TX Beams Per Instance field and the times of repetition indicated by the Repeat Per Instance field within the DMG Sensing Scheduling subelement of the DMG Sensing Measurement Session element.

In the following reporting phase of STA A, STA A sends a DMG Sensing Measurement Report frame to the sensing initiator. The duration of the transmission of the DMG Sensing Measurement Report frame is equal to the Report Duration 0a. Then, the sensing initiator proceeds with the(#1390) initiation phase, sounding phase, and reporting phase with STA B. In the initiation phase of STA B, the sensing initiator sends a DMG Setup Request frame to STA B and receives a DMG Sensing Response frame from STA B. The DMG Sensing Response frame transmitted by STA B contains the Sounding Duration 1b and the Report Duration 1b of Instance 2.

In the following sounding phase of STA B, STA B transmits DMG monostatic sensing PPDUs and receives the reflected signal for sensing measurement. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS is equal to the Sounding Duration 0b.

In the following reporting phase of STA B, STA B sends a DMG Sensing Measurement Report frame with the report to the sensing initiator. The duration of the transmission of the DMG Sensing Measurement Report frame is equal to the Report Duration 0b.

In Instance 2, the Duration field of the first DMG Sensing Request frame is set based on Equation (11-9), which utilizes the Sounding Duration 1a, Report Duration 1a, Sounding Duration 1b, and Report Duration 1b fields delivered in the DMG Sensing Response frames in Instance 1. The measurement in DMG monostatic sensing PPDUs covers the number of transmit AWV indicated by the Num of TX Beams in Instance field and the times of repetition indicated by the Num of Repeat in Instance field in the TDD Beamforming Information field of the DMG Sensing Request frame of the Instance 1. The duration of the transmission of the DMG monostatic sensing PPDUs of STA A including the SBIFS is equal to the Sounding Duration 1a and the DMG monostatic sensing PPDUs of STA B including the SBIFS is equal to the Sounding Duration 1b. The duration of the transmission of the DMG Sensing Measurement Report frame of STA A is equal to the Report Duration 1a and the DMG Sensing Measurement Report frame of STA B is equal to the Report Duration 1b.

* Parallel coordinated monostatic DMG sensing instance

In a parallel coordinated monostatic DMG sensing instance, the following rules shall apply:

* A parallel Coordinated Monostatic DMG sensing instance 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 to each intended sensing responder to request them to participate in the coordinated monostatic DMG sensing instance. The STA ID field of the DMG Setup Request frame shall indicate the order of DMG Sensing Request frames and the Monostatic Sounding Mode field shall be set to 0 to identify the parallel sounding mode. Each sensing responder shall respond by sending an DMG Sensing Response frame a SIFS after the request. If the sensing initiator does not receive a response within the duration of a DMG Sensing Response frame plus a SIFS after a DMG Sensing Request frame, it shall send the next DMG Sensing Request frame, the duration of a DMG Sensing Response frame plus  , after the DMG Sensing Request frame(#1304, #1305, #1391, #1392).
* In the sounding phase, sensing responders shall start to send one or more DMG monostatic sensing PPDUs in parallel no later than a SIFS after the last DMG Sensing Response frame. DMG monostatic sensing PPDUs transmitted by each sensing responder shall be separated by a SBIFS.
* If the Sensing Instance SN field of the TDD Beamforming Information field in the DMG Sensing Request frame is equal to:
* 1, the DMG monostatic sensing PPDUs transmitted by each sensing responder shall cover the number of transmitting AWV indicated by the Number TX Beams Per Instance field and the times of repetition indicated by the Repeat Per Instance field within the DMG Sensing Scheduling subelement within the DMG Sensing Measurement Session element. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS shall be equal to the Sounding Duration field within the DMG Sensing Instance Duration element delivered by the sensing responder in the DMG Sensing Measurement Response frame.
* *i* (*i* > 1), the DMG monostatic sensing PPDUs shall cover the number of transmitting AWV indicated by the Num of TX Beams in Instance field and the times of repetition indicated by the Num of Repeat in Instance field within the TDD Beamforming Information field of the DMG Sensing Request frame with Sensing Instance SN field set to *i* - 1. The duration of the transmission of the DMG monostatic sensing PPDUs including the SBIFS shall be equal to the Sounding Duration field of the DMG Sensing Response frame of the instance with the Sensing Instance SN field set to *i* - 1.
* In the reporting phase, if the reports are needed (see 9.4.2.325 (DMG Sensing Measurement Session element)), the sensing initiator shall send a DMG Sensing Poll frame to each sensing responder for the report, in order of the STA ID field. Each sensing responder shall respond with a DMG Sensing Measurement Report frame to the sensing initiator, a SIFS after the DMG Sensing Poll frame. The sensing initiator shall send the first DMG Sensing Poll frame, the largest Sounding Duration plus a SIFS and a BRPIFS after the last DMG Sensing Response frame(#1391).
* If the Sensing Instance SN field of the TDD Beamforming Information field in the DMG Sensing Request frame is equal to:
* 1, the duration of the transmission of the DMG Sensing Measurement Report frame shall be equal to the Report Duration field of the DMG Sensing Instance Duration element delivered by the sensing responder in the DMG Sensing Measurement Response frame.
* *i* (*i* > 1), the duration of the transmission of the DMG Sensing Measurement Report frame shall be equal to the Report Duration field of the DMG Sensing Response frame of the instance with Sensing Instance SN field equal to *i* - 1.

The value of the Duration field of the first DMG Sensing Request frame in DMG Sensing instance *i* shall be calculated by the Equation (11-10).



In Equation (11-10),

*  is the value of the Num of STAs in Instance field within the DMG Sensing Request frame in DMG sensing instance *i*
*  is the TXTIME of a DMG Sensing Request frame
*  is the TXTIME of a DMG Sensing Response frame
*  is the TXTIME of a DMG Sensing Poll frame
*  is the value of the Sounding Duration field of the DMG Sensing Response frame delivered by the sensing responder *n* in DMG sensing instance *i* - 1 (*i* > 1).  is the value of the Sounding Duration field of the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frame delivered by the sensing responder *n*
*  is the value of the Report Duration field of the DMG Sensing Response frame delivered by the sensing responder *n* in DMG Sensing instance *i* - 1 (*i* > 1).  is the value of the Report Duration field of the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frame delivered by the sensing responder *n*

The value of the Duration field of other frames in DMG Sensing instance *i* shall be calculated as the subtraction of the duration of the frame and previous interframe space from the preceded value.

* Coordinated monostatic DMG sensing instances, parallel sounding mode

Figure 11-74n (Coordinated monostatic DMG sensing instances, parallel sounding mode) gives an example of two parallel coordinated monostatic DMG sensing instances. The PCP/AP is the sensing initiator and the two non-AP STAs (STA A and STA B) are sensing responders. The SP is not used and the measurement results need to be reported. In the DMG sensing measurement session phase, STA A and STA B deliver the Sounding Duration 0a, Report Duration 0a, Sounding Duration 0b, and Report Duration 0b of the Instance 1 to the sensing initiator by the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frames.

In Instance 1, in the initiation phase, the sensing initiator sends a DMG Sensing Request frame to STA A (STA ID equal to 0) and receives a DMG Sensing Response frame from STA A. Then the sensing initiator sends a DMG Sensing Request frame to STA B (STA ID equal to 1) and receives a DMG Sensing Response frame from STA B. The DMG Sensing Request frames activate STA A and STA B to be ready to participate in the sounding and reporting phases. The DMG Sensing Response frames indicate to the sensing initiator the readiness of STA A and STA B, and include the Sounding Duration 1a, Report Duration 1a, Sounding Duration 1b, and Report Duration 1b of the Instance 2. Based on the STA ID field and the Num of STAs in Instance field within the received DMG Sensing Request frame, STA A infers that there is one remaining sensing responder to be initiated and estimates when the last DMG Sensing Response should end.

In the first DMG Sensing Request frame transmitted by the sensing initiator, the Duration field is set according to Equation (11-10). The sensing initiator calculates the duration based on the Sounding Duration 0a, Report Duration 0a, Sounding Duration 0b, and Report Duration 0b fields delivered in the DMG Sensing Instance Duration element within the DMG Sensing Measurement Response frames.

In the following sounding phase, STA A and STA B transmit DMG monostatic sensing PPDUs and receive the reflected signal in parallel. The duration of the transmission of the DMG monostatic sensing PPDUs of STA A including the SBIFS is equal to the Sounding Duration 0a. The duration of the transmission of the DMG monostatic sensing PPDUs of STA B including the SBIFS is equal to the Sounding Duration 0b. The measurement in DMG monostatic sensing PPDUs covers the number of transmit AWVs indicated by the Number TX Beams Per Instance field and the times of repetition indicated by the Repeat Per Instance field within the DMG Sensing Scheduling subelement of the DMG Sensing Measurement Session element.

The Sounding Duration of STA A and STA B may have different durations for different PPDU types or different Data Lengths. In the following reporting phase, after the largest Sounding Duration (Sounding Duration 0b) plus SIFS and BRPIFS from the end of the last DMG Sensing Response frame, the sensing initiator sends the first DMG Sensing Poll frame to STA A for the report and receives a DMG Sensing Measurement Report frame from STA A. Then the sensing initiator sends another DMG Sensing Poll frame to STA B for the report and receives a DMG Sensing Measurement Report frame from STA B. The duration of the transmission of the DMG Sensing Measurement Report frame of STA A is equal to the Report Duration 0a. The duration of the transmission of the DMG Sensing Measurement Report frame of STA B is equal to the Report Duration 0b.

In Instance 2, the Duration field of the first DMG Sensing Request frame is calculated by Equation (11-10) with the Sounding Duration 1a, Report Duration 1a, Sounding Duration 1b, and Report Duration 1b fields delivered within the DMG Sensing Response frames in Instance 1. The measurement in DMG monostatic sensing PPDUs covers the number of transmit AWV indicated by the Num of TX Beams in Instance field and the times of repetition indicated by the Num of Repeat in Instance field within the TDD Beamforming Information field of the DMG Sensing Request frame of the Instance 1.

The duration of the transmission of the DMG monostatic sensing PPDUs of STA A including the SBIFS is equal to the Sounding Duration 1a and the corresponding PPDUs of STA B including the SBIFS is equal to the Sounding Duration 1b.

The duration of the transmission of the DMG Sensing Measurement Report frame of STA A is equal to the Report Duration 1a and the corresponding frame of STA B is equal to the Report Duration 1b.

* Bistatic DMG sensing instance

DMG sensing instances of measurement whose Sensing Type field is equal to bistatic are bistatic DMG sensing instances. Only a single transmitting STA and a single receiving STA participate in a bistatic DMG sensing instance. The roles of the sensing initiator (sensing transmitter or sensing receiver) and sensing responder are set by the RX Initiator field of the Measurement Session Control field within the DMG Sensing Measurement Session element sent by the sensing initiator. These roles apply to all DMG sensing instances of the same measurement setup(#2075).

A bistatic DMG sensing instance in which the sensing initiator is the sensing transmitter, is composed of one or more BRP frames with a TRN field transmitted by the sensing initiator, after a BRPIFS with a BRP frame from the sensing responder. The measurement covers the number of transmit AWV combinations indicated by the Number TX Beams Per Instance field within the DMG Sensing Scheduling subelement of the DMG Sensing Measurement Session element (see 9.4.2.325 (DMG Sensing Measurement Session element)).

The beams covered start from the First Beam Index specified in the BRP Sensing element and continue with beams in the Tx Beam List subelement. For each of these AWV combinations, all the AWV combinations indicated in RX Beam List subelement (see 9.4.2.325.2 (RX Beam List subelement)) of the sensing responder are covered.

The sensing initiator shall determine the format of the TRN field (by setting the TXVECTOR 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 BRP frames in a way that it is compatible with the sensing responder capabilities and covers all the desired TX and RX beams. For example, if the number of RX beams is small, BRP RX/TX PPDUs may be used. If the number of RX beams is large, a BRP RX PPDU can be used per each TX Beam. If there is a single RX beam, a BRP TX PPDU may be used, covering several TX beams.

If either the sensing initiator or sensing responder is a non-EDMG STA or if the sensing responder has the DMG TRN RX Only Capable field equal to 1 in the Beamforming Capability subelement of the EDMG Capabilities element (see 9.4.2.265 (EDMG Capabilities element)), the sensing initiator shall use BRP-RX PPDUs, unless the number of RX Beams is equal to 1(#1835), in which case BRP-TX PPDUs should be used. In each BRP frame, the First Beam Index field indicates which is the first beam that is used in the TRN field of the PPDU. The sensing initiator will go through the Num TX Beams Per Instance TX beams. If the Repeat per Instance field of the DMG Sensing Scheduling subelement  is greater than 1, the sensing initiator shall cover the Num TX Beams Per Instance TX Beams in the DMG Sensing instance, times, going to the first one after the last one. All BRP frames transmitted by the sensing initiator shall be separated by SIFS. The sensing responder shall respond after BRPIFS with a BRP frame containing a report. The report may be based on Channel Measurement Feedback elements or DMG Sensing Report elements. The presence and type of the report is indicated by the Report Control field of the DMG Sensing Report Element (see 9.4.2.329 (DMG Sensing Report element)).

A bistatic DMG sensing instance in which the sensing initiator is the sensing receiver, is composed of a BRP frame transmitted by the sensing initiator followed after a BRPIFS with one or more BRP frames with TRN field transmitted by the sensing responder. The first transmit beam to be used by the sensing responder is indicated by the First Beam Index of the BRP Sensing element of the BRP frame sent by the sensing initiator. The sensing responder shall start transmitting using this beam indicating it in the same field in the first BRP frame it transmits(#2009, #2078). The sensing responder shall continue with the number of TX Beams indicated in the Num TX Beams Per Instance field in the DMG Sensing Scheduling subelement of the DMG Sensing Measurement Session element. For each beams, it will allow the sensing initiator to cycle through all the beams indicated in its RxBeamList. The method allocating these transmit/receive beam combinations, is the same as in a bistatic DMG sensing instance in which the sensing initiator is the sensing transmitter. All BRP frames transmitted by the sensing responder shall be separated by SIFS. There is no reporting in bistatic DMG sensing instances in which the sensing initiator is the sensing receiver.

Figure 11-74o (Example of a bistatic DMG sensing measurement) shows an example of a bistatic DMG sensing burst. The example shows three instances within the burst identified by their Sensing Instance SNs. In each instance the sensing initiator(#1437) transmits a BRP frame within a BRP PPDU (with a TRN field). The sensing responder responds in each DMG Sensing instance with a BRP frame. In this case the sensing responder is not ready with an immediate report, so in each DMG Sensing instance after the first one the report is from the previous instance (Report Delay=2). In the first DMG Sensing instance there is no report (Report Delay=1).

* Example of a bistatic DMG sensing measurement
* 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.

A 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 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 to each sensing responder, it invites to participate in the DMG 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).
* Multistatic EDMG sensing instance

A multistatic EDMG sensing instance is a DMG sensing instance of a DMG sensing procedure of sensing type multistatic.

* Initiation

A multistatic EDMG sensing instance between a sensing initiator in the sensing transmitter role and two or more sensing responders is initiated by several DMG Sensing Measurement Request frames and DMG Sensing Response frames exchanges(#2083).

The sensing initiator initiates the multistatic EDMG sensing instance by sending DMG Sensing Measurement Request frames to each of the intended sensing responders. The DMG Measurement Session ID, Measurement Burst ID, and the Sensing Instance SN fields shall have the same value in all DMG Sensing Measurement Request frames(#2084). The sensing initiator shall set the STA ID field to a value between 0 and 7 indicating the index of the sensing responder sync field in the sync field of the EDMG multistatic sensing PPDUs. EDMG multistatic sensing PPDUs shall be addressed to the sensing responder that has a STA ID equal to 0. The sensing initiator sets the First Beam Index field to a value that indicates the first beam that is used for transmission in the TRN field of the first EDMG multistatic sensing PPDU. The other beams used in the Multistatic Sensing PPDUs are the following beams in the Tx Beam List subelement. The set of beams in the DMG Sensing instance is repeated according to the Num of Repeat in Instance field(#1481). The sensing initiator sets the start of the  PPDU fields to the time, in microseconds, from the end of the DMG Sensing Request to the beginning of the  EDMG multistatic sensing PPDU in the multistatic EDMG sensing instance(#2084).

A STA that receives a DMG Sensing Request frame shall respond, after SIFS, with a DMG Sensing Response frame(#2085). The sensing responder shall remain active to receive all the EDMG multistatic sensing PPDUs in the multistatic EDMG sensing instance and poll frame.

The sensing initiator shall transmit a DMG Sensing Request frame to the next intended sensing responder, a SIFS after receiving the response from the previous sensing responder.

* Sounding

The sensing initiator shall start the transmission of EDMG multistatic sensing PPDUs, a SIFS after receiving the response from the last sensing responder. The sensing initiator shall select the format of the TRN field (by setting the following TXVECTOR parameters: TRN\_SEQ\_LENGTH, EDMG\_TRN\_LEN, RX\_TRN\_PER\_TX\_TRN, EDMG\_TRN\_P, EDMG\_TRN\_M, and EDMG\_TRN\_N) in each of the transmitted EDMG multistatic sensing PPDUs, in a way that it is compatible with the sensing responders’ capabilities and covers the desired transmit and receive beams. The selected TXVECTOR parameters shall match the values appearing in the corresponding fields of the DMG Sensing Request frames. The EDMG multistatic sensing PPDUs may be followed by up to three EDMG multistatic sensing PPDUs with the same parameters from the sensing transmitter. All the EDMG multistatic sensing PPDUs in a multistatic EDMG sensing instance shall have the same PPDU length and TRN field format.

* Reporting

The multistatic EDMG sensing instance may end with the sensing initiator polling each of the sensing responders for sensing measurement reports.

The sensing initiator sends a DMG Sensing Poll frame to each of the sensing responders, a SIFS after the transmission of the last PPDU. Each sensing responder responds after a SIFS with a DMG 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.

* An example of an EDMG multistatic sensing measurement instance

Figure 11-74p (Example of an EDMG multistatic sensing measurement exchange with two sensing responders) shows an example of an EDMG multistatic sensing measurement exchange. The DMG Sensing instance starts with the sensing initiator sending a DMG Sensing Request frame (denoted by RQ) to each of the sensing responders to initiate the burst and indicate the parameters that will be used in the TRN fields of the EDMG multistatic sensing PPDUs in the DMG Sensing instance. The sensing responders respond with DMG Sensing Response frames (denoted by RSP) indicating that they are ready to participate in the DMG Sensing instance. After receiving the response from the last sensing responder, the sensing initiator sends an EDMG multistatic sensing PPDU. Sensing responder STA A uses Sync field 1 for synchronization and sensing responder STA B uses Sync field 2 for synchronization. They then use the TRN field for sensing. After the EDMG multistatic sensing PPDU transmission, the sensing initiator uses a DMG Sensing Poll frame (denoted by Report RQ) to solicit reports from the sensing responder(\*0862). 

* Example of an EDMG multistatic sensing measurement exchange with two sensing responders
* DMG sensing measurement reporting

There are 6 types of report of DMG sensing as defined in Table 9-401v (Report Type field definition).

If the sensing initiator requested sensing type values equal to 1, 2, or 4 (that is, sensing types that do not include Doppler) in the DMG Measurement Session frame, the sensing responders provide report in each DMG Sensing instance, either through a DMG Sensing Report element or through Channel Measurement Feedback elements.

For the Channel Measurement Feedback elements, carried within a BRP frame, the measurements on which the report is based upon are defined in the Report Delay field of the Report Control field of the BRP Sensing element (see 9.4.2.330 (BRP Sensing element)). If the value of the field is equal to 1, the report is based on a measurement in the current DMG Sensing instance. If the value of the field is equal to 2, the report is based on a measurement in the previous DMG Sensing instance. The Report Type field in the first instance of the burst can be set to 0, indicating no report in this instance, or 4, indicating report of measurements in the last DMG Sensing instance of the previous burst.

For the DMG Sensing Report element or Channel Measurement Feedback elements carried within a DMG Sensing Report frame, the measurements on which the report is based are indicated by the fields DMG Measurement Session ID, Measurement Burst ID, and Sensing Instance SN in the Report Control field of the DMG Sensing Report Control element (see 9.4.2.328 (DMG Sensing Report Control element)).

If the sensing initiator requested sensing type values equal to 3, 5, 6 or 7 (that is, sensing types that include Doppler), sensing responders provide a report for the whole burst at the end of the burst. The sensing initiator may use the DMG Sensing Poll frame to poll each of the sensing responders  milliseconds after the end burst, where  is the time specified in Burst Report Delay field in the Burst Response Delay subelement of the DMG Measurement Session element sent by each sensing responder. If the sensing responder specifies  or if the sensing initiator does not poll a sensing responder, the report will be provided in the first instance of the next burst.

If the sensing initiator requested sensing type values equal to 2, 3, 4, 5 or 6 (that is, sensing types that include DMG Sensing Image) and the Report Phase field is equal to 1 within the Report Type Control field, the sensing responder shall include both the Reflection Power and Reflection Phase fields within the Reflection subelements; otherwise, the Reflection subelements shall include the Reflection Power field only(\*0505).

If the Polarization Fusion field within the DMG Sensing Measurement Session element of the DMG Sensing Measurement Request frame (see 9.6.21.8 (DMG Sensing Measurement Request frame format)) is equal to 0, the sensing responder shall report sensing results with different transmitting/receiving polarization combinations separately in the DMG Sensing Report element(s). During the DMG sensing measurement report, the Polarization Mode field within the DMG Sensing Report Control field indicates the polarization information (e.g. H-H, or H-V) of the sensing result contained in the DMG Sensing Report element. If the Polarization Fusion field within the DMG Sensing Measurement Session element of the DMG Sensing Measurement Request frame is equal to 1, the sensing responder shall report fused sensing results in the DMG Sensing Report element(s). During the DMG sensing measurement report, the Polarization Mode field within the DMG Sensing Report Control field shall be set to 5 to indicate that the sensing result contained in the DMG Sensing Report element is fused, based on different polarizations results. The fusion method is implementation specific(#2064).

* DMG sensing measurement termination

After a DMG sensing session is established (see 11.55.3.3 (DMG sensing session setup exchange)), a DMG sensing measurement session is terminated either explicitly or implicitly. Under the explicit DMG sensing measurement termination, a DMG STA uses the DMG Sensing Measurement Termination frame (see 9.6.21.11 (DMG Sensing Measurement Termination frame format)) for the DMG sensing measurement session termination. Under the implicit sensing measurement session termination, the DMG sensing measurement session is terminated after the expiration of the DMG sensing procedure expiry timer.

A DMG sensing measurement session(s) may be terminated explicitly at any time by either the sensing initiator or the sensing responder by transmitting an individually addressed DMG Sensing Measurement Termination frame.

The explicit DMG sensing measurement session termination is initiated by issuing an MLME-DMG-SENSMSMTTERMINATION.request primitive. Upon reception of this primitive, the DMG STA shall initiate the termination of the sensing measurement session(s) by transmitting the DMG Sensing Measurement Termination frame with the RA field set to the MAC address indicated in the primitive. The DMG STA that initiates the termination of the DMG sensing measurement session(s), shall issue an MLME-DMG-SENSMSMTTERMINATION.confirm primitive, upon completion of the transmission of the DMG Sensing Measurement Termination frame and terminate the indicated DMG sensing measurement session(s). A DMG STA that receives a DMG Sensing Measurement Termination frame addressed to it, shall issue an MLME-DMG-SENSMSMTTERMINATION.indication primitive and shall terminate the indicated DMG sensing measurement session(s).

For the implicit DMG sensing measurement session termination of a DMG sensing measurement session, the sensing initiator and the sensing responder shall use the DMG sensing procedure expiry timer. The DMG sensing procedure expiry timer maintains the DMG measurement session identified with the DMG Measurement Session ID between the sensing initiator and the sensing responder. The DMG sensing procedure expiry timer shall be set to *aDMGSensingProcedureExpiry* at

* the success of the procedure specified in 11.55.3.4 (DMG sensing measurement session)(#2087);
* the exchange of DMG Sensing Request and DMG Sensing Response frames is completed in the coordinated DMG sensing instance (see 11.55.3.6.2 (Coordinated monostatic DMG sensing instance), 11.55.3.6.4 (Coordinated bistatic DMG sensing instance), and 11.55.3.6.5 (Multistatic EDMG sensing instance)); or
* the exchange of the BRP frames is completed in the Bistatic DMG sensing instance (see 11.55.3.6.3 (Bistatic DMG sensing instance)).

Upon expiry of the DMG sensing procedure expiry timer, the sensing initiator and sensing responder shall terminate the DMG sensing measurement session and issue an MLME-DMG-SENSMSMTTERMINATION.confirm primitive to the SME.

Once the DMG sensing measurement session between a sensing initiator and a sensing responder is terminated, the sensing responder shall not participate in any sensing measurement exchange associated with the DMG Measurement Session ID.

* DMG sensing session termination

In the DMG sensing session termination, a PCP/AP and a non-PCP and non-AP STA terminate the DMG sensing session established between them. If the DMG sensing session between a PCP/AP and a non-PCP and non-AP STA is terminated, all active DMG sensing measurement sessions established between the PCP/AP and the non-PCP and non-AP STA shall be terminated.

The DMG sensing session between a PCP/AP and an associated non-PCP and non-AP STA shall be terminated when the non-PCP and non-AP STA disassociates with the PCP/AP, i.e., the DMG sensing session termination procedure is the disassociation procedure.

* DMG passive sensing

DMG Passive Sensing allows a STA to use DMG Beacon frame transmissions for sensing by enabling a STA to acquire information about the beacons direction and the PCP/AP location.

A PCP/AP advertises the capability to perform passive sensing in the DMG Sensing Short Capabilities element (see 9.4.2.324 (DMG Sensing Short Capabilities element)). The PCP/AP shall set the Sensing Support field(#1505) of the Short DMG Sensing Capabilities field to 1 to indicate that it supports any type of sensing. The PCP/AP shall set the Passive Sensing Support field 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 transmissions in the BTI is exactly  where  is defined in Table 20-4 (Timing related parameters). The PCP/AP shall set the Location Available field to 1, if it can provide an LCI field in a DMG Passive Sensing Beacon Information element (see 9.4.2.331 (DMG Passive Sensing Beacon Information element)).

A STA requests information about a DMG Beacon frame transmission from a PCP/AP by sending an Information Request frame with the Element ID of the DMG Passive Sensing Beacon Information element in the Request Element field. The PCP/AP responds with an Information Response frame that includes a DMG Passive Sensing Beacon Information element and one or more DMG Beacon Sector Descriptor elements (see 9.4.2.332 (DMG Beacon Sector Descriptor element)). The Sector Azimuth, Sector Elevation, Azimuth Beamwidth, and Elevation Beamwidth fields in the Sector Descriptors field within the DMG Beacon Sector Descriptor element shall be reported in earth coordinates if the Earth Coordinates field within the Short DMG Sensing Capabilities field is equal to 1 and in an arbitrary STA’s coordinate system if the Earth Coordinates field is equal to 0(\*0506).