IEEE P802.11  
Wireless LANs

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Abstract

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

***TGbf editor: Please make the following marked up changes in the indicated clauses:***

**11.55.1.3 Sensing capabilities exchange**

To enable the exchange of sensing capabilities, the Sensing Capabilities element (see 9.4.2.320 (Sensing Capabilities element)) shall be included in the following frames(\*0777):

* Probe response and (Re)Association Response frame sent by an AP that is a sensing STA.
* Association Request frame sent by an associated non-AP sensing STA.
* Measurement Query frame sent by an unassociated non-AP sensing STA.

A non-AP STA may receive an AP’s sensing capabilities (see 9.4.2.26 (Extended Capabilities element) and 9.4.2.320 (Sensing Capabilities element)) as part of an active or passive scanning procedure (see 11.1.4 (Acquiring synchronization, scanning))(\*0477).

To reduce the time for the sensing capabilities exchange between APs and non-AP STAs, an AP shall include one or more of its neighboring APs’ sensing capabilities in the Neighbor Report element(s) within the Beacon and Probe Response frames it transmits. The sensing capabilities of neighboring APs are indicated in the BSSID Information field (see Figure 9-398 (BSSID Information field format)) within the Neighbor Report element(\*0477, \*0525).

An AP may indicate the need for new sensing responders by setting the Responder Needed field in the Sensing Capabilities element within a Probe Response frame to 1(#1974, #1006). The Responder Needed field in the Sensing Capabilities element within Association Request, Association Response, Reassociation Request, Reassociation Response, and Sensing Measurement Query frames shall be set to the reserved value(#1083, #1526, #1556). If the Sensing Capabilities element is included in the Probe Request frame, the Responder Needed field in the Sensing Capabilities element shall be reserved(#1448, #1690).

NOTE—Upon receiving a Probe Response frame with Responder Needed field set to 1, an unassociated non-AP STA that intends to participate in a sensing procedure is expected to send a Sensing Measurement Query frame to the AP to solicit a Sensing Measurement Request frame. An associated non-AP STA ignores the Responder Needed field in a Probe Response frame(#1082).

If a non-AP STA intends to associate with an AP, the sensing capabilities shall be exchanged in the (re)association procedure (see 11.3.5 (Association, reassociation, and disassociation))(\*0477).

If a non-AP STA is not associated with an AP and intends to establish a sensing measurement session that is initiated by the AP, it shall transmit a Sensing Measurement Query frame to the AP carrying its sensing capabilities(\*0477). A non-AP STA may include the Sensing Capabilities element in the Probe Request frame it transmits to the AP(#1448, #1690). If the AP does not accept the unassociated non-AP STA as a sensing responder, the AP should respond to the received Sensing Measurement Query frame with a Sensing Measurement Termination frame with the Terminate All TB Measurement Setups field set to 1(#1624).

NOTE—An unassociated non-AP STA that is only a sensing responder can store an AP’s sensing capabilities if at least one of the established sensing measurement sessions initiated by the AP is not terminated. Based on the AP’s sensing capabilities, the unassociated non-AP STA can establish a sensing measurement session with the AP to perform non-TB sensing measurement exchanges.

An unassociated non-AP STA shall set the Poll Required field in the Sensing Capabilities element to 1 in any Sensing Measurement Session Query frame(#1098) that it transmits.

If the Sensing Capabilities element is included in the Probe Request frame, a non-AP STA shall set the Poll Required subfield in the Sensing Capabilities element to 1 if it intends to be polled in TB sensing measurement exchanges(#1448, #1690, #1710).

If a Sensing Capabilities element is included in a frame, the Threshold-based Reporting field in the Sensing field shall be set to 1 to indicate that the STA supports threshold-based reporting. Otherwise, the Threshold-based Reporting field shall be set to 0(#1231).

A non-AP STA shall include one ISTA Availability Window element in any Sensing Measurement Session Query frame(#1099) indicating its availability for TB sensing measurement exchanges(#1710) as well as a preferred periodicity. The periodicity of the sensing availability windows preferred by the STA is expressed in units of 10 tUs in the Count field in the ISTA Availability Information field of the ISTA Availability Window element. The value of the Count field in the ISTA Availability Information field of the ISTA Availability Window element shall be a multiple of the Beacon Interval of the recipient AP in units of 10 tUs.

**11.15.1.4 Sensing measurement session**

A sensing measurement session is an agreement between a sensing initiator and a sensing responder on operational parameters associated with sensing measurement exchanges of a given Measurement Session ID.

A sensing initiator shall transmit a Sensing Measurement Request frame to a sensing responder with which it intends to establish a sensing measurement session. A sensing initiator shall not attempt to establish more sensing measurement sessions than the value of the Max Number of Supported Sessions as Responder field(#1010, #2194) in the last Sensing Capabilities element received from the sensing responder(#1009, #1534, #1996, #2239).

NOTE—A sensing initiator does not attempt to initiate a sensing measurement setup with a STA if the latest Sensing Capabilities element received from that STA sets the Max number of Supported Setups subfield value to 0(#2190).

The Comeback field of the Sensing Comeback Info field within the Sensing Measurement Request frame shall be reserved if any of the following is true(#1101):

* The frame is sent by a non-AP STA.
* The frame is sent by an AP and is addressed to a non-AP STA that is associated with this AP.

The Comeback field of the Sensing Comeback Info field within the Sensing Measurement Request frame shall be set to 0 if the frame is sent by an AP, it is addressed to an unassociated non-AP STA, and it includes a Sensing Measurement Parameters element (see 9.4.2.319 (Sensing Measurement Parameters element))(#1560).

The Comeback field of the Sensing Comeback Info field within the Sensing Measurement Request frame shall be set to 1 if the frame is sent by an AP, it is addressed to an unassociated non-AP STA, and it does not include a Sensing Measurement Parameters element (see 9.4.2.319 (Sensing Measurement Parameters element))(#1560).

NOTE—The Comeback field is only applicable for sensing measurement setups with unassociated non-AP STAs(\*0474).

Upon reception of a Sensing Measurement Request frame with the Comeback field of the Sensing Comeback Info field set to 0, the sensing responder shall transmit a Sensing Measurement Response frame to the sensing initiator which transmitted the Sensing Measurement Request frame, according to the following rules:

* If the sensing responder accepts the requested sensing measurement session parameters in the received Sensing Measurement Request frame, it shall set the Status Code field to SUCCESS in the Sensing Measurement Response frame.
* If the sensing responder declines the requested sensing measurement session parameters in the received Sensing Measurement Request frame and provides its preferred sensing measurement parameters in the Sensing Measurement Response frame, it shall set the Status Code field to REJECTED\_WITH\_SUGGESTED\_CHANGES in the Sensing Measurement Response frame.
* If the sensing responder declines the requested sensing measurement session parameters in the received Sensing Measurement Request frame without providing its preferred sensing measurement parameters in the Sensing Measurement Response frame, it shall set the Status Code field to REQUEST\_DECLINED in the Sensing Measurement Response frame.

The sensing responder should transmit the Sensing Measurement Response frame within aSensingFrameExchangeExpiry (see Table 11-29a (Sensing procedure timing-related parameters)) timeout period in response to the Sensing Measurement Request frame. If the sensing initiator does not receive the Sensing Measurement Response frame within this timeout period, or if a Sensing Measurement Response frame is received with a status code other than SUCCESS, the sensing measurement session shall be considered unsuccessful(#1103, \*0718).

If an unassociated non-AP STA intends to participate in a sensing measurement session initiated by an AP, it shall transmit a Sensing Measurement Query frame to solicit a Sensing Measurement Request frame from the AP. Upon reception of a Sensing Measurement Query frame from an unassociated STA, the AP should transmit a Sensing Measurement Request frame to the unassociated STA within a aSensingFrameExchangeExpiry (see Table 11-29a (Sensing procedure timing-related parameters)) timeout period to initiate a sensing measurement session. If the unassociated non-AP STA does not receive a Sensing Measurement Request frame from the AP within a aSensingFrameExchangeExpiry (see Table 11-29a (Sensing procedure timing-related parameters)) timeout period, then it shall consider the solicitation to the AP to initiate a sensing measurement session unsuccessful(\*0718).

Upon reception of a Sensing Measurement Request frame with the Comeback field of the Sensing Comeback Info field set to 1, a non-AP STA shall transmit a Sensing Measurement Query frame to the AP after aSensingComebackAfter (see Table 11-29a (Sensing procedure timing-related parameters)) and before aSensingComebackBefore (see Table 11-29a (Sensing procedure timing-related parameters)) to solicit a Sensing Measurement Request frame from the AP. Both STAs(#1085) start a corresponding unassociated STA comeback timer when the exchange of the Sensing Measurement Query frame and the Sensing Measurement Request frame with the Comeback field of the Sensing Comeback Info field set to 1 completes. The unassociated STA comeback timer shall be set to aSensingComebackBefore (see Table 11-29a (Sensing procedure timing-related parameters)).

If an AP intends to request one of the unassociated non-AP STAs in this TB sensing measurement exchange to participate in another sensing measurement session as a sensing responder, the AP may set the Comeback field of the corresponding User Info field in the Sensing Polling Trigger frame to 1.

If the sensing responder is an unassociated non-AP STA, the sensing initiator shall assign the sensing responder to be polled in the TB sensing measurement exchange by setting the Poll Assigned field in the TB Sensing Specific subelement of the Sensing Measurement Parameters element in the Sensing Measurement Request frame to 1(#1548, #1549, #2109).

The Measurement Session ID shall be assigned by a sensing initiator to a sensing responder during the establishment of a sensing measurement session. The same Measurement Session ID may be assigned to different sensing responders(#1951, #1979). The <sensing initiator’s MAC address, Measurement Session ID> tuple should be used to uniquely identify the corresponding sensing measurement session.

During a sensing measurement session, the sensing initiator shall assign the role(s) of a sensing responder as one of the following(#1532) (see 9.4.2.319 (Sensing Measurement Parameters element)):

* Sensing receiver
* Sensing transmitter
* Sensing transmitter and sensing receiver

In both TB and non-TB sensing measurement exchanges, if a sensing initiator assigns in a Sensing Measurement Request frame the role of sensing receiver to the sensing responder and sets the Sensing Measurement Report Requested field to 1, the sensing responder shall send Sensing Measurement Report frames in sensing measurement exchanges that result from the sensing measurement session(#1106, #1863).

In non-TB sensing measurement exchanges, if a sensing initiator assigns in a Sensing Measurement Request frame the role of sensing receiver to the sensing responder and sets the Sensing Measurement Report Requested field to 0, the sensing responder shall not send Sensing Measurement Report frames in sensing measurement exchanges that result from the sensing measurement session(\*0474).

NOTE—Whether the sensing measurement report is requested or not, sensing measurements are available locally to the SME of the sensing receiver(#1428, #1429).

If a sensing initiator assigns in a Sensing Measurement Request frame only the role of sensing receiver to the sensing responder and sets the Sensing Measurement Report Requested field to 0, the sensing initiator shall also assign the sensing responder to be polled in the TB sensing measurement exchange by setting the Poll Assigned field in the TB Sensing Specific subelement of the Sensing Measurement Parameters element in the Sensing Measurement Request frame to 1(#1550, #1551).

Operational parameters defined in the Sensing Measurement Parameters field of the Sensing Measurement Parameters element, and in the TB Sensing Specific subelement or the Non-TB Sensing Specific subelement, in the establishment of a sensing measurement session corresponding to a Measurement Session ID shall be fixed until the session is terminated(#1108, #1431, #1533, #1713, #1811).

If the sensing initiator is an AP and it intends to assign operational parameters to a sensing responder, it shall include a TB Sensing Specific subelement in the Sensing Measurement Parameters element in a Sensing Measurement Request frame and shall assign the following(\*0777):

* The 12bit AID/USID field.
* The Poll Assigned field shall be set to 1 if the Poll Required field within the last Sensing Capabilities element received from the sensing responder is set to 1, or it intends to poll the non-AP STA in the TB sensing measurement exchange.
* The CSI Variation threshold field shall be set to the range between 0 to 10 if the sensing responder is to be part of threshold-based reporting and set to 15 if the sensing responder is to be part of basic reporting.
* The SR2SR field shall be set to 1 only if the SR2SR subfield in the last Sensing Capabilities element received from the sensing responder is set to 1.
* The RSTA Availability Information field in the
* RSTA Availability Window element containing exactly one Availability Window Information field. The Availability Window Broadcast Format subfield in the Header subfield in the RSTA Availability Information field in this RSTA Availability Window element shall be set to 0 (see 9.4.2.297 (RSTA Availability Window element)). The assigned availability window for the unassociated sensing responder shall overlap with a 10 TU interval signaled by the ISTA Availability Window element (see 9.4.2.296 (ISTA Availability Window element)) in the Sensing Measurement Setup Query frame.

If the sensing initiator includes a TB Sensing Specific subelement in a Sensing Measurement Request frame, the CSI Variation Threshold field shall be set according to the following(#1231):

If the Sensing Receiver field or the Sensing Measurement Report Requested field of the Sensing Measurement Parameters is set to 0, then the CSI Variation Threshold field is reserved.

If the last Sensing Capabilities element received from the STA addressed by the AID/USID field has the Threshold-based Reporting field set to 1, and the sensing initiator intends to use threshold-based reporting in the corresponding TB sensing measurement exchanges, then the CSI Variation Threshold field shall be set to a value in the range of 0 to 10 to indicate the CSI variation threshold (see Table 9-401s (CSI Variation Threshold field definition)). Otherwise, the CSI Variation Threshold field shall be set to 15 to indicate basic reporting is used in the corresponding TB sensing measurement exchanges.

If the sensing initiator is a non-AP STA, it shall include a non-TB Sensing Specific subelement as part of the Sensing Measurement Parameters element in a Sensing Measurement Setup Request frame and shall assign a value in the Min Time Between Measurements field which is not lower than the value of the Min Time Between Measurements field within the Sensing field in the last Sensing Capabilities element or in the non-TB Sensing Specific subelement in the last Sensing Measurement Parameters element received from the sensing responder(#1715).

If a Sensing Measurement Parameters element is included in the Sensing Measurement Request frame, the sensing initiator shall assign the following parameters in the Sensing Measurement Parameters field after accounting for the sensing capabilities of the sensing responder known from last received Sensing Capabilities element from that STA:

The requested bandwidth to be used in the transmission of SI2SR, SR2SI, and SR2SR NPDs(#2243). This value shall not be greater than the maximum bandwidth the sensing responder supports for sensing. This value is referred to as Sensing Bandwidth.

The requested number of HE-LTF repetitions that the sensing responder transmits in an SR2SI or SR2SR NDP that is either a HE Ranging NDP or a HE TB Ranging NDP in the TX HE-LTF Repetition field. This value shall not be greater than the maximum number of HE-LTF repetitions that the sensing responder is capable of transmitting. This value is referred to as Sensing Assigned SR2SI Rep.

The requested number of HE-LTF repetitions that the sensing responder receives in an SI2SR or SR2SR NDP that is either a HE Ranging NDP in the RX HE-LTF Repetition field. This value shall not be greater than the maximum number of HE-LTF repetitions that the sensing responder is capable of receiving. This value is referred to as Sensing Assigned SI2SR Rep.

The requested number of space-time streams the sensing responder receives in an SR2SI or SR2SR NDP in the RX STS field. This value shall not be greater than the maximum number of space-streams that the sensing responder is capable of receiving for all bandwidths smaller than or equal to the maximum bandwidth used in TB and non-TB sensing measurement exchanges. This value is referred to as Sensing Assigned SI2SR STS.

The requested number of space-time streams the sensing responder transmits in an SI2SR or SR2SR NDP in the TX STS field. This value shall not be greater than the maximum number of space-streams that the sensing responder is capable of transmitting for all bandwidths smaller than or equal to the maximum bandwidth used in TB and non-TB sensing measurement exchanges. This value is referred to as Sensing Assigned SR2SI STS.

The requested number of antennas to be used in the reception of SI2SR and SR2SR NDPs by the sensing responder. This value shall not be greater than the maximum number of antennas the sensing responder is capable of using in the reception of SI2SR and SR2SR NDPs(#2244).

The number of bits used in the encoding of each CSI value reported in a Sensing Measurement Report frame by the sensing responder in the field. This value shall be 10 bits if the field is set to 1. And this value shall be 8 bits if the field is set to 0.

The subcarrier grouping to be used in a Sensing Measurement Report frame by sensing responder in the field. This value shall be 16 if the field is set to 1. And this value shall be either 4 or 8 if the field is set to 0 (see 9.4.1.75.3 (Sensing Measurement Report Control field)).

A Sensing Measurement Response frame in which the Status Code field is equal to SUCCESS shall not include a Sensing Measurement Parameters element(#2112, #1539, #1040).

Following the successful establishment of a sensing measurement session between an AP and a non-AP STA, both STAs shall start a sensing measurement session expiry timer. The sensing measurement session expiry timer shall be set to aMeasurementSessionExpiry (see Table 11-29a (Sensing procedure timing-related parameters))(\*0477).

After a sensing measurement session between an AP and a non-AP STA is established, both STAs shall reset the sensing measurement session expiry timer for the sensing measurement session if participating in the corresponding TB and/or non-TB sensing measurement exchanges(\*0477).

A sensing measurement session established between an AP and a non-AP STA shall be terminated explicitly or implicitly if the corresponding sensing measurement session expiry timer expires at either STA(\*0477).

A typical state machine implementation of a sensing measurement session between an AP and a non-AP STA is provided in Figure 11-74a (Sensing measurement session state machine diagram)(\*0477).

**11.55.3 DMG sensing procedure**

* Overview

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

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 to coordinate 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 to coordinate 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.

A DMG sensing procedure is composed of 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. A DMG sensing burst may be composed of multiple DMG sensing instances(#1457).

NOTE—Measurements over a certain time period are needed 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.

A sensing initiator may 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, and/or it may instruct the sensing responder 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 the 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. The 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 in DMG sensing bursts. Each DMG sensing burst is identified by the measurement Burst ID. It is unique per the DMG Measurement Session ID. The figure presents two bursts (with Measurement Burst ID equals to 1 and Measurement Burst ID equals to 2) of the DMG Measurement Session ID set to 1, and two bursts (with Measurement Burst ID equals to 1 and Measurement Burst ID equals to 2) of the DMG Measurement Session ID set to 2.

Two DMG sensing bursts belonging to the DMG Measurement Session ID set 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 set to 2 are performed with different burst parameters: Intra-burst interval equal to T3 and the 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.

A STA in which dot11DMGSensingMsmtImplemented is true shall set the Sensing support field of the Short DMG Sensing Capabilities field in the DMG Sensing Short Capabilities element to 1 (9.4.2.324 (DMG Sensing Short Capabilities element)).

A STA in which dot11DMGSensingMsmtImplemented is false shall set the Sensing support field of the Short DMG Sensing Capabilities field in the DMG Sensing Short Capabilities element to 0 (9.4.2.324 (DMG Sensing Short Capabilities element)).

A STA that supports DMG sensing should use the timing-related parameters defined in Table 11-29c (DMG sensing procedure timing-related parameters)(\*0814).

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| --- | --- | --- |
| 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.

The sensing capable PCP/AP STA shall convey the DMG Sensing Short Capabilities element in the DMG Beacon and Announce frames.

The 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 the 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 or coordinated monostatic shall be capable to take the roles of both sensing transmitter and sensing receiver, or neither of them.

A sensing responder of the DMG sensing types monostatic or coordinated monostatic shall be capable to take the roles of both sensing transmitter and sensing receiver.

A sensing initiator of the DMG sensing types bistatic or coordinated bistatic shall be capable of the sensing transmitter and/or the sensing receiver role.

A sensing responder of the DMG sensing types bistatic or coordinated bistatic shall be capable of the sensing transmitter and/or the sensing receiver role.

The sensing initiator of the DMG sensing type multistatic shall be capable of the sensing transmitter role(#2122, #2213).

The sensing responder of the DMG sensing type 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.

The sensing initiator and sensing responder may 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.

The sensing initiator shall set the 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 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)), sensing initiator could setup polarization sensing by properly setting the beam indices in TX Beam List subelement and RX Beam List subelement to get 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 DMG sensing types: bistatic, coordinated bistatic and multistatic. If the DMG sensing type is set to coordinated monostatic, only TX Beam List subelement is present in the DMG Sensing Measurement Session element (see 9.4.2.325 (DMG Sensing Measurement Session element)). The sensing initiator could realize the polarization sensing by setting the Polarization Sensing field in the Measurement Session Control field of DMG Sensing Measurement Session element to 1 to indicate the performing of polarization sensing by sensing responder(s) for all the beams indicated in TX Beam List subelement(#2064).

The sensing initiator shall set the beam list in the TX Beam List subelement to the list of beams that is used by the sensing transmitter during the measurement and the beam list in the RX Beam List subelement to the list of beams that are used by the receiver during the measurement. Each beam index in the TX Beam List and RX Beam List is an index into the list of 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 set to coordinated monostatic, the RX Beam List subelement is not present.

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 Session element in the DMG Sensing Measurement Request frame.

Any PPDU used for coordinated monostatic sensing 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 Peer Orientation field within the Measurement Session Control field shall be reported in earth coordinates if the Earth Coordinates field in 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 set 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. The sensing initiator shall set the Intra-Burst Interval field to the time between the start of successive instances in a burst. The sensing initiator shall set the Inter-Burst Interval field to the time between the start of successive bursts. The sensing initiator shall set the Number TX Beams Per Instance field to the number of TX AWV patterns to be used in each instance. The sensing initiator shall set the 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 set 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 equal 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

The sensing initiator shall set Distance Between DMG sensing Bursts field to the time between the start of successive bursts. The sensing initiator shall set the Allocation Block Period field to the time measured in the number of beacon intervals(#2173) between the start of successive instances in the burst. The sensing initiator shall set the Number of Blocks field to the number of instances in the burst. The sensing initiator shall set the Allocation Block Duration field equal to the time allocated for an instance(#1385).

The sensing initiator shall set the Number TX Beams Per Instance field to the number of TX AWV patterns to be used in each instance. The sensing initiator shall set the 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).

In the DMG Sensing Measurement Response frame, the sensing responder shall set the Status Code field to SUCCESS if it accepts the DMG measurement session request(#1046, #2005). It shall set the Status Code field to REJECTED\_WITH\_SUGGESTED\_CHANGES if it rejects the request but will accept with the schedule that is included in DMG Sensing Scheduling subelement included in the DMG Sensing Measurement Session element. It shall set the Status Code field to 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. If present, 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 to the values 3, 5, 6, or 7 (that is, 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 DMG sensing measurement session separately with each sensing responder. Operational parameters established upon the 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).

------ Leif Ends. -----