IEEE P802.11
Wireless LANs

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| --- |
|  NGV 60 GHz Beamforming |
| Date: 2019-9-15 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Hiroyuki Motozuka | Panasonic | 600 Saedo-cho, Tsuzuki-ku, Yokohama, Kanagawa, Japan |  | motozuka.hiroyuki@jp.panasonic.com |
| Takenori Sakamoto |  | sakamoto.takenori@jp.panasonic.com |
| Masataka Irie |  | irie.masataka@jp.panasonic.com |
| Kazu Takahashi |  | takahashi.kazu@jp.panasonic.com |
| Gaius Wee | 202 Bedok South Ave 1 Singapore 469332 |  | yaohuang.wee@sg.panasonic.com |
| Michael Sim |  | michael.simhc@sg.panasonic.com  |
| Takayuki Shimizu | Toyota Motor North America | 465 Bernardo Ave, Mountain View, CA 94043, USA |  | takayuki.shimizu@toyota.com |

Abstract

This submission proposes specification text related to operation in 60 GHz band of NGV, proposed in [3], to P802.11bd Draft D0.3.

Revision history:

r0 initial

**Proposed changes to D0.3**

# 6. Layer management

*TGbd Editor: Add the following to Draft P802.11bd D0.3:*

6.3.X DMG operation outside the context of a BSS

6.3.X.1 General

The following primitives support the DMG operation outside the context of a BSS.

6.3.X.1 MLME-DMG-OCB-START.request

6.3.X.1.1 Function

This primitive requests the MAC entity to initiate DMG operation outside the context of a BSS.

6.3.X.1.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-DMG-OCB-START.request(
 Channel Number,
 Discovery Beacon,
 DMG Parameters,
 DMG Capabilities,
 EDMG Capabilities
 VendorSpecificInfo
 )

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| Channel Number | Integer | Selected from the valid channel range for the appropriate PHY and carrier set. | Specifies a channel number to perform discovery for peer STAs outside the context of a BSS. |
| Discovery Beacon | Boolean | true, false | Indicates whether the STA is required to transmit DMG Beacon frames to discover peer STAs. |
| DMG Parameters | As defined in frame format | As defined in 9.3.4.2 (DMG Beacon) | Specifies the parameters to be advertised to peer STAs. |
| DMG Capabilities | As defined in frame format | As defined in 9.4.2.127 (DMG Capabilities element) | Specifies the parameters to be advertised to peer STAs. |
| EDMG Capabilities | As defined in frame format | As defined in 9.4.2.263 (EDMG Capabilities element) (11ay) | Specifies the parameters to be advertised to peer STAs.Optionally present if dot11EDMGOptionImplemented is true and is absent otherwise. |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements |

6.3.X.1.3 When generated

This primitive is generated by the SME for a STA to initiate DMG operation outside the context of a BSS.

6.3.X.1.4 Effect of receipt

This primitive initiates a discovery procedure and data transmission outside the context of a BSS.

6.3.X.2 MLME-DMG-OCB-START.confirm

6.3.X.2.1 Function

This primitive reports the result of the initiation of a DMG operation outside the context of a BSS.

6.3.X.2.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-DMG-OCB-START.confirm(
 ResultCode,
 VendorSpecificInfo
 )

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| ResultCode | Enumeration | SUCCESS, NOT\_SUPPORTED | Indicates the result of the MLME-DMG-OCB-START.request primitive |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements |

6.3.X.2.3 When generated

This primitive is generated by the MLME as a result of an MLME-DMG-OCB-START.request primitive to initiate a discovery procedure and data transmission outside the context of a BSS.

6.3.X.2.4 Effect of receipt

The SME is notified of the result of the initiation of a DMG operation outside the context of a BSS.

6.3.X.3 MLME-DMG-OCB-STOP.request

6.3.X.3.1 Function

This primitive requests the MAC entity to stop the DMG operation outside the context of a BSS previously started by using an MLME-DMG-OCB-START.request.

6.3.X.3.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-DMG-OCB-STOP.request(

 )

6.3.X.3.3 When generated

This primitive is generated by the SME to terminate discovery procedure and data transmission operating outside the context of a BSS by the MAC entity. The MLME-DMG-OCB-STOP.request primitive shall be generated only after successful use of an MLME-DMG-OCB-START.confirm primitive.

6.3.X.3.4 Effect of receipt

This request terminates the DMG operation outside the context of a BSS when the current frame exchange sequence is completed.

6.3.X.5 MLME-OCB-DMGDISCOVEREY.indication

6.3.X.5.1 Function

This primitive indicates discovery of peer DMG STAs outside the context of a BSS.

6.3.X.5.2 Semantics of the service primitive

The primitive parameters are as follows:

MLME-OCB-DMGDISCOVEREY.indication(
 PeerInfoSet,
 VendorSpecificInfo
 )

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| PeerInfoSet | Set of PeerInfo | N/A | The PeerInfoSet is returned to indicate the results of the discovery request outside the context of a BSS. It is a set containing zero or more instances of a PeerInfo. |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25 (Vendor Specific element) | Zero or more elements |

Each PeerInfo consists of the parameters shown in the following table, in which the term peer STA refers to the STA transmitting the DMG Beacon frame, SSW frame, SSW Feedback frame, or SSW Ack frame.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid Range** | **Description** |
| PeerSTAAddress | MACAddress | Any valid individual MAC address | Specifies a channel number to perform discovery for peer STAs outside the context of a BSS. |
| Sector Sweep | As defined in frame format | As defined in 9.3.4.2 (DMG Beacon) | The values from the Sector Sweep field from the DMG Beacon frame, else null. |
| Sector Sweep Feedback | As defined in frame format | As defined in 9.5.3 (Sector Sweep Feedback field) | The values from the Sector Sweep field from the SSW, SSW Feedback, or SSW Ack frame, else null. |
| DMG Parameters | As defined in frame format | As defined in 9.3.4.2 (DMG Beacon) | The values from the DMG Parameters field from the DMG Beacon frame, else null. |
| DMG Capabilities | As defined in frame format | As defined in 9.4.2.127 (DMG Capabilities element) | The values from the DMG Capabilities element if such an element was present in the DMG Beacon frame, else null.  |
| EDMG Capabilities | As defined in frame format | As defined in 9.4.2.263 (EDMG Capabilities element) (11ay) | Specifies the parameters within the EDMG Capabilities element that are supported by the MAC entity. |

6.3.X.1.3 When generated

This primitive is generated by the MLME when the MAC entity successfully completed the beamforming training with the discovered peer MAC entities.

6.3.X.1.4 Effect of receipt

The SME is notified of the discovered peer MAC entities.

# 9. Frame formats

*TGbd Editor: Add the following to Draft P802.11bd D0.3:*

9.3.4.2 DMG Beacon

*Insert the following row before the last row in Table 9-47 (DMG Beacon frame body)*

**Table 9-45 – DMG Beacon frame body**

|  |  |  |
| --- | --- | --- |
| **Order** | **Information** | **Notes** |
| ... |  |  |
| 65 | DMG OCB | This element is optionally present if dot11OCBActivated is true |
| Last | Vendor Specific | One or more Vendor Specific elements are optionally present.These elements follow all other elements. |

9.4.2 Elements

9.4.2.1 General

*Insert the following row in Table 9-94 (Element IDs), renumbering as appropriate*

**Table 9-94 – Element IDs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Element ID** | **Element ID Extension** | **Element ID Extension** | **Fragmentable** |
| ... |  |  |  |  |
| DMG OCB (see 9.4.2.x (DMG OCB element)) | 255 | <ANA> | Yes | No |

*Insert the following paragraph after the last subclause of 9.2.4 (Frame fields)*

9.4.2.x DMG OCB element

The format of the DMG OCB element is shown in Figure 9-x1 (DMG OCB element format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | DMG OCB Parameters |
| Octets: | 1 | 1 | 1 | 1 |

**Figure 9-x1 – DMG OCB element format**

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

The DMG OCB Parameters field is defined in Figure 9-x2 (DMG OCB Parameters field format)

|  |  |  |
| --- | --- | --- |
|  | B1 | B2 B8 |
|  | Unsolicited RSS | Reserved |
| Bits: | 1 | 7 |

**Figure 9-x2 – DMG OCB Parameters field format**

The Unsolicited RSS subfield is defined in 9.5.5 (Beamforming Control field)(11ay).

9.5.3 Sector Sweep Feedback Field

*Change Figure 9-848a as follows (Draft P802.11ay)*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | B0 B5 | B6 B7 | B8 B15 | B16 | B17 | B~~17~~18 B21 | B22 | B23 |
|  | Sector Select | DMG Antenna Select | SNR Report | Poll Required | OCB Mode | Reserved | Unsolicited RSS Enabled | EDMG Extension Flag |
| Bits: | 6 | 2 | 8 | 1 | 1 | ~~5~~4 | 1 | 1 |

**Figure 9-848a – SSW Feedback field format when not transmitted as part of an ISS and the EDMG Extension Flag subfield is 0**

The OCB Mode subfield is set to 1 if dot11OCBActivated is true, and is set to 0 otherwise. If equal to 1, this subfield indicates that the STA is operating outside the context of a BSS.

# 11. MLME

*TGbd Editor: Add the following to Draft P802.11bd D0.3:*

11.1.3.4 DMG beacon generation before establishment of a BSS

*Change the eighth paragraph and insert a new paragraph after the paragraph as follows:*

*(Note: REVmd D4.0 P2143 L34-)*

When dot11OCBActivated is false, ~~A~~a STA that is transmitting DMG Beacon frames with the Discovery Mode field equal to 1 should cease transmitting these beacons when it has received a DMG Beacon frame from another STA, or when it has received acknowledgment of a transmitted Probe Response frame. If a BSS is not initialized as a result of the channel scanning, the STA can resume transmitting DMG Beacon frames with the Discovery Mode field equal to 1.

When dot11OCBActivated is true, a STA that is transmitting DMG Beacon frames with the Discovery Mode field equal to 1 should continue transmitting these beacons for discovery of peer DMG STAs outside the context of a BSS.

11.1.4 Acquiring synchronization, scanning

11.1.4.1 General

*Add a paragraph after the last paragraph in subclause 11.1.4.1 as follows:*

Upon receipt of the MLME-DMG-OCB-START.request primitive, a DMG STA for which dot11OCBActivated is true shall start a discovery procedure outside the context of a BSS as described in 11.1.4.X (DMG Discovery outside the context of a BSS).

*Add the following subclause into subclause 11.1.4:*

11.1.4.X DMG Discovery outside the context of a BSS

This subclause applies to a DMG STA when dot11OCBActivated is true.

Upon receipt of the MLME-DMG-OCB-START.request primitive, a DMG STA shall start an operation outside the context of a BSS as described in subclause 31.3 (Operation in 60 GHz band).

Upon receipt of the MLME-DMG-OCB-START.request primitive with the Discovery Beacon parameter set to true, a DMG STA shall start transmitting DMG Beacon frames with the Discovery Mode field set to 1 and the Beacon Interval field set to a random value as described in 11.1.3.4 (DMG beacon generation before establishment of a BSS). The DMG OCB element shall be included in the DMG Beacon frames.

Upon receipt of the MLME-DMG-OCB-STOP.request primitive, a DMG STA shall terminate transmitting DMG Beacon frames.

When the STA transmitting DMG Beacon frames with the Discovery Mode field set to 1 receives one or more SSW frames or an SSW-Feedback frame with the OCB Mode subfield set to 1 during the A-BFT, the discovering STA shall issue an MLME-OCB-DMGDISCOVEREY.indication with the PeerInfoSet parameter including the PeerInfo regarding the STA transmitted the SSW frames or SSW-Feedback frame.

When the STA transmitting DMG Beacon frames with the Discovery Mode field set to 1 receives one or more DMG Beacon frames with a DMG OCB element in each of the DMG Beacon frames from a peer DMG STA, the STA may perform an SLS during the A-BFT following the reception of the DMG Beacon frames, if exists, or during the DTI. When the STA completes the SLS and an optional BRP procedure, if performed, successfully, and the address of the peer DMG STA is an address that is newly detected, the STA shall issue an MLME-OCB-DMGDISCOVEREY.indication with the PeerInfoSet parameter including the PeerInfo regarding the STA transmitted the DMG Beacon frames. If the source address of the DMG Beacon frame is not an address that is newly detected, the STA may issue an MLME-OCB-DMGDISCOVEREY.indication with the PeerInfoSet parameter including the PeerInfo regarding the STA transmitted the DMG Beacon frames.

Upon receipt of the MLME-DMG-OCB-START.request primitive with the Discovery Beacon parameter set to false, a DMG STA shall not transmit DMG Beacon frames. When the STA receives one or more DMG Beacon frames with the DMG OCB element or one or more SSW frames or an SSW-Feedback frame with the OCB Mode subfield set to 1, and the source address of the received frame is an address that is newly detected, the STA should issue an MLME-OCB-DMGDISCOVERY.indication with the PeerInfoSet parameter including the PeerInfo regarding the STA transmitted the DMG Beacon frames.

When a DMG STA complete a beamforming training including an SLS or BRP initiated by a peer STA successfully during the operation outside the context of a BSS, and the address of the peer STA is an address that is newly detected, the STA shall issue an MLME-OCB-DMGDISCOVEREY.indication with the PeerInfoSet parameter including the PeerInfo regarding the peer STA.



**Figure 11-x – DMG Discovery outside the context of a BSS**

# 31. Next Generation V2X (NGV) MAC specification

*TGbd Editor: Add the following to Draft P802.11bd D0.3:*

31.3.3 DMG Beamforming outside the context of a BSS

A DMG STA with dot11OCBActivated true may transmit DMG Beacon frames as described in 10.42.4 (Beamforming in BTI) outside the context of a BSS. The DMG STA shall set the Discovery Mode field to 1 and include a DMG OCB element in each of the DMG Beacon frames when the STA performs beamforming training with the DMG Beacon frame outside of the context of a BSS.

When a DMG STA with dot11OCBActivated receives a DMG Beacon frame with a DMG OCB element, the STA may perform beamforming training as described in 10.42.5 (Beamforming in A-BFT). When the DMG STA transmits SSW frames during the A-BFT after a BTI in which the STA received a DMG Beacon frame with a DMG OCB element, the STA shall set the OCB Mode subfield to 1 in the SSW frames transmitted during the A-BFT.

If a responder DMG STA that receives a DMG Beacon frame with a DMG OCB element has successfully completed an SLS or a BRP with the initiator STA that transmitted the DMG Beacon frame recently, the responder STA should not transmit SSW frames during the A-BFT following the BTI to avoid a collision during the A-BFT.

# Annex B

## B.4 PICS proforma—IEEE Std 802.11-2016

*TGbd Editor: Change the text on rows for CFDMG and CFEDMG on the table in subclause B.4.3 of Draft P802.11bd D0.3 as follows.*

**B4.X.2 NGV MAC features**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Protocol capability** | **References** | **Status** | **Support** |
| ... |  |  |  |  |
| NGVM1.2 | NGV operation in 60 GHz band  | 31.3 (Operation in 60GHz band) | CFNGV60:M | Yes  No  N/A  |
| ... |  |  |  |  |
| NGVM3.1 | DMG OCB element | 9.4.2.x DMG OCB element | CFNGV60:M | Yes  No  N/A  |
| NGVM3.2 | DMG beamforming outside the context of a BSS | 31.3.3 DMG beamforming outside the context of a BSS | CFNGV60:M | Yes  No  N/A  |

**Straw Poll:**

* **Do you agree to adopt the proposed text in 11-20/1303r0 and instruct the TG editor to incorporate the text into Draft P802.11 D0.3?**

**References**

[1] Draft P802.11REVmd D4.0

[2] Draft P802.11ay D5.0

[3] 11-20/1302r0 NGV 60 GHz beamforming