IEEE P802.11
Wireless LANs

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| Comment Resolution on MIMO BF Misc |
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Abstract

This submission proposes resolution of comments on MIMO BF received from LB# 231 (TGay Draft 1.0).

- 2 CID:

2308, 2316

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| **CID** | **Page Number** | **Line Number** | **Comment** | **Proposed Change** | **Resolution** |
| 2308 | 167 | 10 | If DMG control mode is established using ant x RF chain y, but TRN-RX/TX needs to be transmitted from ant z of RF chain y. In this case there should also be a 1 TRN-unit added to the TRN-LEN to account for antenna switching | as in comment | RevisedThis CID is related to transmission of EDMG BRP-RX/TX packet through multiple RF chains, which needs to be further clarified. It is proposed that EDMG BRP-RX/TX packets are transmitted in a similar manner to EDMG BRP-TX packets in MIMO BRP TXSS procedure. |
| 2316 | 173 | 30 | Each MIMO BF Poll frame should be sent using the DMG control mode or using a non-EDMG duplicate PPDU transmitted with the DMG control modulation class. The TA field', but responding STA can only estimate BW in this caseSTA does not know exactly in what BW it should send BRP-RX/TX packet for UL MIMO trainingThere is no CT or scrambler init defined for MIMO BF Poll frame | specify MIMO BF Poll frame is sent using EDMG control mode | Revised-Agreed in principle.In addition to MIMO BF Poll frame, transmission of MIMO BF Setup frame, MIMO BF Feedback frame and MIMO BF Selection frame in SU-MIMO or MU-MIMO BF need to be further clarified.  |

**Proposed changes to D1.4:**

10.39.9.2.2 SU-MIMO beamforming

10.39.9.2.2.3 MIMO phase

10.39.9.2.2.3.1 General

*TGay Editor: Insert the following at the end of this clause (#2308, 2316)*

MIMO BF Setup frame, MIMO BF Poll frame and MIMO BF Feedback frame sent in the MIMO phase of SU-MIMO beamforming shall be transmitted by applying spatial expansion and mapping a single space-time stream to all *N*TX transmit chains to be trained in the procedure. The MIMO BF Setup frame, MIMO BF Poll frame and MIMO BF Feedback frame should be sent using the EDMG control mode.

BRP frames sent in the MIMO phase of SU-MIMO beamforming shall be transmitted using EDMG PPDUs by applying spatial expansion and mapping a single space-time stream to all *N*TX transmit chains to be trained in the procedure. The TRN field of each EDMG BRP-RX/TX packet used in SU-MIMO beamforming shall consist of *N*TX orthogonal waveforms, as defined in 30.9.2.

At the beginning of the MIMO phase of SU-MIMO beamforming, if an implementation has not yet determined AWVs to use in some of its transmit chains (for example, if an STA has been only using a single transmit chain before the MIMO phase), the AWVs used by such chains should be selected in an implementation dependent manner.

The AWVs used in the transmission of MIMO BF Feedback frame, MIMO BF Poll frame and all fields except for the TRN field of each EDMG BRP-RX/TX packet shall be the same as those used in the transmission of MIMO BF Setup frame. Similarly, the AWVs used in the reception of MIMO BF Feedback frame, MIMO BF Poll frame and all fields except for the TRN field of each EDMG BRP-RX/TX packet shall be the same as those used in the reception of MIMO BF Setup frame.

10.39.9.2.2.3.2 Non-reciprocal MIMO phase

*TGay Editor: Change the paragraphs starting at P243L6 as follows (#2308, 2316)*

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…

In the initiator SMBT subphase, the initiator shall transmit EDMG BRP-RX/TX packets to the responder. Each EDMG BRP-RX/TX packet shall be separated by SIFS. Each transmitted EDMG BRP-RX/TX packet is used to train one or more transmit sectors and, for each transmit sector, a number of receive AWVs. In each EDMG BRP-RX/TX packet, the initiator shall include, for each selected transmit sector, TRN subfields in the TRN field of the PPDU for the responder to perform receive AWV training. For each EDMG BRP-RX/TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than zero, and the parameters RX\_TRN\_PER\_TX\_TRN and EDMG\_TRN\_M shall be set to the values of the L-TX-RX and Requested EDMG TRN-Unit M fields in the MIMO BF Setup frame received from the responder, respectively. The TX Antenna Mask field of each EDMG BRP-RX/TX packet shall indicate the TX DMG antenna(s) which is being used by the initiator to transmit the EDMG BRP-RX/TX packet. The BRP CDOWN field of each EDMG BRP-RX/TX packet shall indicate the number of remaining EDMG BRP RX/TX packets to be transmitted by the initiator in the initiator SMBT subphase.

…

In the responder SMBT subphase, the responder shall transmit EDMG BRP-RX/TX packets to the initiator. Each EDMG BRP-RX/TX packet shall be separated by SIFS. For each EDMG BRP-RX/TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than zero, and the parameters RX\_TRN\_PER\_TX\_TRN and EDMG\_TRN\_M shall be set to the values of the L-TX-RX and Requested EDMG TRN-Unit M fields in the MIMO BF Setup frame received from the initiator, respectively. The TX Antenna Mask field of each EDMG BRP-RX/TX packet shall indicate the TX DMG antenna(s) which is being used by the responder to transmit the EDMG BRP-RX/TX packet. The BRP CDOWN field of each EDMG BRP-RX/TX packet shall indicate the number of remaining EDMG BRP RX/TX packets to be transmitted by the responder in the responder SMBT subphase.

….

 In the SU-MIMO BF feedback subphase, the initiator shall send to the responder a MIMO BF Feedback frame with the TA field set to the MAC address of the initiator and the RA field set to the MAC address of the responder….

10.39.9.2.2.3.3 Reciprocal MIMO phase

*TGay Editor: Change the two paragraphs starting at P246L19 as follows (#2308, 2316)*

The initiator shall initiate the initiator SMBT subphase an MBIFS following the reception of the MIMO BF Setup frame from the responder. In the initiator SMBT subphase, the initiator shall transmit EDMG BRP-RX/TX packets to the responder. Each EDMG BRP-RX/TX packet shall be separated by SIFS. Each transmitted EDMG BRP-RX/TX packet is used to train one or more transmit sectors and, for each transmit sector, a number of receive AWVs. In each EDMG BRP-RX/TX packet, the initiator shall include, for each selected transmit sector, TRN subfields in the TRN field of the PPDU for the responder to perform receive AWV training. For each EDMG BRP-RX/TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than zero, and the parameters RX\_TRN\_PER\_TX\_TRN and EDMG\_TRN\_M shall be set to the values of the L-TX-RX and Requested EDMG TRN-Unit M fields in the MIMO BF Setup frame received from the responder, respectively. The TX Antenna Mask field of each EDMG BRP-RX/TX packet shall indicate the TX DMG antenna(s) which is being used by the initiator to transmit the EDMG BRP-RX/TX packet. The BRP CDOWN field of each EDMG BRP-RX/TX packet shall indicate the number of remaining EDMG BRP RX/TX packets to be transmitted by the initiator in the initiator SMBT subphase.

10.39.9.2.3 MU-MIMO beamforming

**10.39.9.2.3.1 General**

*TGay Editor: Insert the following at the end of this clause (#2308, 2316)*

MIMO BF Setup frames, MIMO BF Poll frames and MIMO BF Selection frames sent by the initiator in the MIMO phase of MU-MIMO beamforming shall be transmitted by applying spatial expansion and mapping a single space-time stream to all *N*TX transmit chains to be trained in the procedure. The AWVs used by such chains in the transmission of MIMO BF Setup frames and MIMO BF Selection frames should be selected in an implementation dependent manner. If an implementation has not yet determined AWVs to use in some of its transmit chains for the transmission of MIMO BF Poll frame, the AWVs used by such chains should be selected in an implementation dependent manner. MIMO BF Setup frames, MIMO BF Poll frames and MIMO BF Selection frames should be sent using the EDMG control mode.

In the non-reciprocal MU-MIMO BF feedback subphase, MIMO BF Feedback frame sent by each responder shall be transmitted by applying spatial expansion and mapping a single space-time stream to all *N*TX transmit chains. If an implementation has not yet determined AWVs to use in some of its transmit chains for the transmission of MIMO BF Feedback frame, the AWVs used by such chains should be selected in an implementation dependent manner. MIMO BF Feedback frame should be sent using the EDMG control mode.

BRP frames sent in the MIMO phase of MU-MIMO beamforming shall be transmitted using EDMG PPDUs by applying spatial expansion and mapping a single space-time stream to all *N*TX transmit chains to be trained in the procedure. The TRN field of each EDMG BRP-RX/TX packet used in MU-MIMO beamforming shall consist of *N*TX orthogonal waveforms, as defined in 30.9.2.

In the non-reciprocal MU-MIMO BF training subphase, the AWVs used by such chains in the transmission of all fields except for the TRN field of each EDMG BRP-RX/TX packet should be selected in an implementation dependent manner.

In the reciprocal MU-MIMO BF training subphase, if an implementation has not yet determined AWVs to use in some of its transmit chains for the transmission of all fields except for the TRN field of each EDMG BRP-RX/TX packet, the AWVs used by such chains should be selected in an implementation dependent manner.

10.39.9.2.3.3.2 Non-reciprocal MIMO phase

*TGay Editor: Change the four paragraphs starting at P249L22 as follows (#2308, 2316)*

In the MU-MIMO BF setup subphase, the initiator shall transmit one or more MIMO BF Setup frame (see 9.6.22.4) to each responder in the MU group. The initiator should transmit the minimum number of MIMO BF Setup frames to reach all responders in the MU group. ….

The initiator shall initiate the MU-MIMO BF training subphase a MBIFS following the transmission of the MIMO BF Setup frame. In the MU-MIMO BF training subphase, the initiator shall transmit one or more EDMG BRP-RX/TX packets to the remaining responders in the MU group. Each EDMG BRP-RX/TX packet shall be separated by SIFS. Both the TA and RA fields of each transmitted EDMG BRP-RX/TX packet shall be set to the MAC address of the initiator. If a responder whose corresponding bit in the Group User Mask field within the last received MIMO BF Setup frame from the initiator was equal to 1 receives an EDMG BRP-RX/TX packet with both the TA and RA fields equal to the MAC address of the initiator, the responder should perform receive AWV training. For each EDMG BRP-RX/TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than zero. The parameters RX\_TRN\_PER\_TX\_TRN and EDMG\_TRN\_M shall be set in such a manner that the number of TRN subfields included in the TRN field used for receive AWV training is the maximum number of receive sectors across all the remaining responders based on the L-TX-RX subfields and the EDMG TRN-Unit M subfields in the feedback from all the remaining responders in the SISO phase. The TX Antenna Mask field of each EDMG BRP-RX/TX packet shall indicate the TX DMG antenna(s) which is being used by the responder to transmit the EDMG BRP-RX/TX packet. The BRP CDOWN field of each EDMG BRP-RX/TX packet shall indicate the number of remaining EDMG BRP RX/TX packets to be transmitted by the initiator in the MU-MIMO BF training subphase.

The initiator shall initiate the MU-MIMO BF feedback subphase a MBIFS following the transmission of the EDMG BRP RX-TX packet with the BRP CDOWN field set to 0. In the MU-MIMO BF feedback subphase, the initiator shall transmit a MIMO BF Poll frame to poll each remaining responder to collect MU-MIMO BF feedback from the preceding MU-MIMO BF training subphase. The TA field of each MIMO BF Poll frame shall be set to the BSSID of the initiator and the RA field shall be set to the MAC address of the corresponding responder. …

The initiator shall initiate the MU-MIMO BF selection subphase an MBIFS following reception of the MIMO BF Feedback frame from the last remaining responder. In the MU-MIMO BF selection subphase, the initiator shall transmit one or more MIMO BF Selection frames to each responder in the MU group. The initiator should transmit the minimum number of MIMO BF Selection frames to reach all responders in the MU group. The TA field of the MIMO BF Selection frame shall be set to the BSSID of the initiator and the RA field shall be set to the broadcast address….

10.39.9.2.3.3.3 Reciprocal MIMO phase

*TGay Editor: Change the four paragraphs starting at P253L9 as follows (#2316, 2308)*

In the MU-MIMO BF setup subphase, the initiator shall transmit one or more MIMO BF Setup frame to each responder in the MU group. The initiator should transmit the minimum number of MIMO BF Setup frames to reach all responders in the MU group. The TA field of each MIMO BF Setup frame shall be set to the BSSID of the initiator and the RA field shall be set to the broadcast address…

The initiator shall initiate an MU-MIMO BF training subphase a MBIFS following the transmission of the MIMO BF Setup frame. In the MU-MIMO BF training subphase, the initiator shall transmit a MIMO BF Poll frame to each remaining responder in the MU group. The TA field of each MIMO BF Poll frame shall be set to the BSSID of the initiator and the RA field shall be set to the MAC address of the corresponding responder. …

Upon receiving a MIMO BF Poll frame for which a remaining responder is the addressed recipient, the responder shall transmit one or more EDMG BRP-RX/TX packet to the initiator, where the TXVECTOR parameter EDMG\_TRN\_LEN is set to a value larger than zero, and the parameters RX\_TRN\_PER\_TX\_TRN, EDMG\_TRN\_M and EDMG\_TRN\_P are set to the values of the L-TX-RX field, the Requested EDMG TRN-Unit M field and the Requested EDMG TRN-Unit P field in the corresponding MIMO BF Poll frame received from the initiator, respectively. The TX Antenna Mask field of each EDMG BRP-RX/TX packet shall indicate the TX DMG antenna(s) which is being used by the responder to transmit the EDMG BRP-RX/TX packet. The BRP CDOWN field of each EDMG BRP-RX/TX packet shall indicate the number of remaining EDMG BRP RX/TX packets to be transmitted by the responder.

The initiator shall initiate the MU-MIMO BF selection subphase an MBIFS following reception of the EDMG BRP RX/TX packet with the BRP CDOWN field equal to 0 from the last responder in the MU group. In the MU-MIMO BF selection subphase, the initiator shall transmit one or more MIMO BF Selection frame to each responder in the MU group. The initiator should transmit the minimum number of MIMO BF Selection frames to reach all responders in the MU group. The TA field of the MIMO BF Selection frame shall be set to the BSSID of the initiator and the RA field shall be set to the broadcast address.

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