IEEE P802.11
Wireless LANs

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| Comment Resolution on MIMO BF (Part II) |
| Date: 2019-04-18 |
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Abstract

This submission proposes resolution of comments on MIMO BF received from LB #239 (TGay Draft 3.0).

- 8 CID: 4124, 4125, 4129, 4130, 4243, 4248, 4337, 4126

***CIDs regarding MIMO BF:***

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| **CID** | **Page.Line Number** | **Comment** | **Proposed Change** | **Resolution** |
| 4124 | 286.09 | Is there an expectation that the AWV combinations exchaged during the SU-MIMO Feedback phase be used in the next exchange between the initiator and respodner? | Add text saying that these combinations will be used only when indicated using RTS/CTS in CT and that SISO transmissions will contiue to use previous antenna setups. | Revised-Agreed in principle with the commenter. |
| 4243 | 286.18 | "Each subphase shall be separated by an MBIFS" may not be true if the reciprocal MIMO phase is performed within a TDD SP. | modify the text to address the case that the reciprocal MIMO phase is performed within a TDD SP. | Revised-Agreed in principle with the commenter. |
| 4125 | 288.18 | "The determined best transmit and receive sector combinations for the initiator link shall be treated as the best receive and transmit sector combinations for the responder link, respectively, where = The algorithm for determining the best transmit sector combinations for the initiator link is implementation dependent": The MIMO feedback for the initiator to responder link does not have a receive "sectors" that may be used as transmit sectors for the responder to initiator link. | Add text saying that for the respodner to initiator the transmit sector are determined by the respodner for each combination. | Revised-Agreed in principle with the commenter. |
| 4248 | 292.48 | When a MIMO BF Feedback frame with the ComeBack Delay field set to a non-zero value is followed by a MIMO BF Poll frame, the separation between them may not be SIFS. | modify the text to clarify the case mentioned in the comment | Revised-Agreed in principle with the commenter. |
| 4129 | 293.22 | "RX AWV of User k corresponding to TX DMG Antenna j ": The MU-MIMO initiator has no information about the respodner RX AWVs. It has information only about RX DMG antennas. | Replace RX AWV with RX DMG Antenna ID throughout this subclause | Revised-Note that a receiver is able to derive the RX AWV based on the SISO ID subset index. The proposed modifications clarify that the SISO ID subset index indicates the RX AWV from a receiver’s perspective. |
| 4337 | 294.06 | "The Antenna Pattern Reciprocity field in the initiator's DMG Capabilities element equals one". How does this relate to the DMG antenna reciprocity? Do we have to have both? Is one a superset of the other? | Clarify the reciprocity types and their applicability here. | Rejected-The reciprocal MU-MIMO phase requires the initiator’s antenna pattern reciprocity but does not require DMG antenna reciprocity. Note that DMG antenna reciprocity means the best TX DMG antenna is the same as the best RX DMG antenna, which is not utilized during the reciprocal MU-MIMO phase. |
| 4130 | 295.50 | "indicate the RX AWV of User k corresponding to TX DMG Antenna j": this repeats the issue of RX AWV, the initiator does not know anything about the respodner RXAWVs, as it has AWV IDs of transmit sectors, the fact that these are also RX AWVs is just confusitn | Replace RX AWV with RX DMG Antenna ID | Revised-Note that a receiver is able to derive the RX AWV based on the SISO ID subset index. The proposed modifications clarify that the SISO ID subset index indicates the RX AWV from a receiver’s perspective. |
| 4126 | 289.04 | "MIMO BF Setup frames, MIMO BF Poll frames and MIMO BF Selection frames should be sent using the EDMG control mode": why limit to EDMG control mode. EMDG control mode is necessary if an EDMG TRN field is added, which is not the case for these frames. | replace "EDMG control mdoe" with "MCS 0" | Rejected-For reciprocal MU-MIMO training, if MIMO BF Poll frames are sent using the DMG control mode or using a non-EDMG duplicate PPDU transmitted with the DMG control modulation class, STA does not know exactly in what BW it should send BRP-RX/TX packet.  |

**Proposed changes to D3.0:**

**TGay editor: change the paragragh (P286L7) as follows (CID 4124):**

… The algorithms for determining the 𝑁𝑡𝑠𝑐(𝐼) best transmit sector combinations for the initiator link and for determining the 𝑁𝑡𝑠𝑐(𝑅) best transmit sector combinations for the responder link are implementation dependent. The transmit sector combinations to be used for the initiator link and the responder link are indicated using either RTS/DMG CTS frames with a control trailer or a DMG CTS-to-self frame with a control trailer at the beginning of a SU-MIMO channel access procedure (see 10.40.11.4.3).

**TGay editor: change the paragragh (P288L17) as follows (CID 4124, 4125):**

… The algorithm for determining the 𝑁𝑡𝑠𝑐(𝐼) best transmit sector combinations for the initiator link is implementation dependent. The transmit sector combinations to be used for the initiator link and the responder link are indicated using either RTS/DMG CTS frames with a control trailer or a DMG CTS-to-self frame with a control trailer at the beginning of a SU-MIMO channel access procedure (see 10.40.11.4.3).

**TGay editor: add the following paragragh (P293L26) (CID 4124):**

The MU-MIMO transmission configuration to be used for MU-MIMO transmission is indicated using either a RTS frame with a control trailer or a DMG CTS-to-self frame with a control trailer at the beginning of a MU-MIMO channel access procedure (see 10.40.11.4.4).

**TGay editor: add the paragragh (P296L4) as follows (CID 4124):**

The MU-MIMO transmission configuration to be used for MU-MIMO transmission is indicated using either a RTS frame with a control trailer or a DMG CTS-to-self frame with a control trailer at the beginning of a MU-MIMO channel access procedure (see 10.40.11.4.4).

**TGay editor: change the following paragragh (P292L48) (CID 4248):**

Each MIMO BF Poll frame and MIMO BF Feedback frame shall be separated by SIFS except the case that a MIMO BF Feedback frame with the ComeBack Delay field set to a nonzero value is followed by a MIMO BF Poll frame.

**TGay editor: change the paragragh (P293L20) as follows (CID 4129):**

… In more details, if User *k* in Configuration *i* participated in the non-reciprocal MU-MIMO BF training, the Configuration *i* User *k* SISO ID Subset Index/RX Antenna ID for Antenna *j* subfield indicates the RX AWV of User *k* corresponding to TX DMG Antenna *j* in Configuration *i* from a receiver’s perspective. …

**TGay editor: change the paragragh (P295L47) as follows (CID 4130):**

… In more details, if User k in Configuration i participated in the reciprocal MU-MIMO BF training, the Configuration i User k AWV feedback ID for Antenna j subfield, the Configuration i User k BRP CDOWN for Antenna j subfield and the Configuration i User k RX Antenna ID for Antenna j subfield indicate the RX AWV of User k corresponding to TX DMG Antenna j in Configuration I from a receiver’s perspective. …

**TGay editor: change the following paragraghs (P287L4) as follows (CID 4243):**

In the MIMO phase outside of a TDD SP, the responder shall send a MIMO BF Setup frame a SIFS following the reception of the MIMO BF Setup frame from the initiator. In the MIMO phase in a TDD SP, upon reception of the MIMO BF Setup frame from the initiator, the responder shall send a MIMO BF Setup frame within the earliest occurring TDD slot the responder is assigned to and with slot category of the TDD slot set to Basic TDD slot as indicated in the TDD Slot Schedule element.

The TA field and the RA field of the MIMO BF Setup frame shall be set to the MAC address of the responder and the initiator, respectively. The MIMO BF Setup frame shall indicate the same dialog token value in the Dialog Token field as in the MIMO BF Setup frame received from the initiator. In the MIMO Setup Control element of the MIMO BF Setup frame, the SU/MU and Initiator fields shall be set to 0, and the Non-reciprocal/Reciprocal MIMO Phase field shall be set to 1. The L-TX-RX field and the Requested EDMG TRN-Unit M field shall indicate the number of TRN subfields requested for receive AWV training in the following initiator SMBT subphase. Based on the SNRs of the transmit sectors collected from the initiator in the SISO phase, the responder may select a subset of candidate receive sectors per DMG antenna to reduce the initiator SMBT training time. Each DMG antenna should have the similar number of candidate receive sectors in order to avoid biasing a DMG antenna.

When the MIMO phase is performed outside of a TDD SP, the initiator shall initiate the initiator SMBT subphase an MBIFS following the reception of the MIMO BF Setup frame from the responder. When the MIMO phase is performed in a TDD SP, upon reception of the MIMO BF Setup frame from the responder, the initiator shall initiate the initiator SMBT subphase within the earliest occurring TDD slot the initiator is assigned to and with slot category of the TDD slot set to Basic TDD slot as indicated in the TDD Slot Schedule element.

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. When performed within a TDD SP and there is not enough time within a TDD slot to transmit all EDMG BRP-RX/TX packets, the remaining EDMG BRP-RX/TX packets are transmitted within the earliest occurring TDD slot the initiator is assigned to and with slot category of the TDD slot set to Basic TDD slot as indicated in the TDD Slot Schedule element. 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 0, 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.

When the MIMO phase is performed outside of a TDD SP, the responder shall initiate the SU-MIMO BF feedback subphase an MBIFS following the reception of an EDMG BRP-RX/TX packet with the BRP CDOWN field set to 0 from the initiator. When the MIMO phase is performed in a TDD SP, upon reception of an EDMG BRP-RX/TX packet with the BRP CDOWN field set to 0 from the initiator, the responder shall initiate the SU-MIMO BF feedback subphase within the earliest occurring TDD slot the responder is assigned to and with slot category of the TDD slot set to Basic TDD slot as indicated in the TDD Slot Schedule element.

In the SU-MIMO BF feedback subphase, the responder shall send a MIMO BF Feedback frame to the initiator with the TA field set to the MAC address of the responder and the RA field set to the MAC address of the initiator. The MIMO BF Feedback frame shall carry the dialog token in the Dialog Token field that identifies the SU-MIMO BF training. In the MIMO Feedback Control element of the MIMO BF Feedback frame, the SU/MU and Link Type field shall be set to 0. If the MIMO BF Feedback frame contains SU-MIMO BF feedback for the initiator link, the ComeBack Delay field shall be set to 0. Otherwise, the ComeBack Delay field shall be set to a nonzero value which indicates when the responder will be ready with SU-MIMO BF feedback for initiator link. If the ComeBack Delay field is set to 0 and for 2.16+2.16 GHz or 4.32+4.32 GHz channels, the Channel Aggregation Present subfield of the MIMO FBCK-TYPE field should be set to 1. The Number of TX Sector Combinations Present subfield of the MIMO FBCK-TYPE field shall indicate the number of best transmit sector combinations, 𝑁𝑡𝑠𝑐(𝐼), recommended by the responder for initiator link.