IEEE P802.11
Wireless LANs

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| Comment Resolution on the SISO Phase of MU-MIMO BF |
| Date: 2018-2-12 |
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Abstract

This submission proposes resolution of comments on MU-MIMO beamforming (in particular, 10.38.9.2.3.1 General and 10.38.9.2.3.2 SISO phase) received from LB# 231 (TGay Draft 1.0).

- 10 CID:

1340, 2022, 2023, 2311, 2312, 1147, 1146, 2313, 2310, 1246

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| **CID** | **Page Number** | **Line Number** | **Comment** | **Proposed Change** | **Resolution** |
| 1340 | 168 | 37 | "The execution of the MU-MIMO beamforming protocol uses the EDMG Group ID Set element transmitted by the AP or PCP of the BSS." - poor wording | replace perhaps with : "The MU-MIMO beamforming protocol uses the EDMG Group ID set element transmitted by the AP or PCP of the BSS." | Accepted-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 1340. |
| 2022 | 168 | 37 | It would be useful to insert the reference to the Group Set ID | Please add reference where Group ID set defined | Accepted-Similar change should be made on the first occurrence of the other frames or elements.TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 2022. |
| 2023 | 169 | 26 | "I-TXSS" is not defined in IEEE 802.11-2016 | "I-TXSS" shall be replaced by "initiator TXSS" in whole draft standard. | Accepted-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 2023. |
| 2311 | 169 | 38 | If I-TXSS is present then the feedback phase starts SIFS after this. However it is not clear when the SISO feedback procedure as described on pg 170 starts if this is not the case. | Please complete the behaviour. | Rejected-If I-TXSS is not present, since there is no specific timing requirement for starting the SISO Feedback subphase, no additional text is needed.  |
| 2312 | 169 | 47 | If AP sends I-TXSS but responder does not hear it due to collision, it may send EDMG Channel Measurement Feedback element with either sector ID or awv ids based on a prior successful TXSS. In this case AP would parse the EDMG sector ID order wrong based on CDOWN | add a bit in DMG beam refinement element in the polling BRP frame to indicate I-TXSS in SISO phase of MU-MIMO training is present. The responder should not respond to polling if it does not receive such I-TXSS and the bit is set to 1 | Rejected-Notice that the Sector Sweep Frame Type field of the DMG Beam Refinement element accompanying the EDMG Channel Measurement Feedback element indicates the type of packet or frame used in last sector sweep (see 18/0092r0). As a result, the error case mentioned in the comment can be avoided.  |
| 1147 | 169 | 8 | in the last responder TXSS' does not seem correct | change to 'in the last initiator TXSS' | Accepted-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 1147. |
| 1146 | 170 | 2 | "TX antenna" should be "TX DMG antenna" | as per comment | Revised-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 1146. |
| 2313 | 170 | 4 | EDMG BRP request element should be mandatory in SISO phase because it is used by DL-MIMO phase in p171 L7 | Add a sentence 'The BRP frame shall include an EDMG BRP request element for requesting the L-TX-RX and TRN-Unit M configuration for the downlink MIMI phase training | Revised-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 2313. |
| 2310 | 170 | 5 | The entire SISO phase of MU-MIMO BF training should be optional if UL-MIMO phase is used because the SISO Feedback subphase does not help responders determine what awv/sector they should test in UL BPR-RX/TX packet | "change to '(mandatory for DL MIMO phase)' for SISO Feedback subphase | Rejected-Notice that UL-MIMO phase is based on the assumption that the initiator has antenna pattern reciprocity. The SISO phase is necessary for RX sector down-selection at the beginning of the UL-MIMO phase. |
| 1246 | 170 | 5 | Graphics in IEEE-SA standards should not include shading, as it reproduces on hardcopy poorly. | Remove the shading in the boxes. | Revised-TGay editor to make the changes shown in 11-18/0298r0 under all headings that include CID 1246. |

**Proposed changes to D1.0:**

10.38.9.2.3 MU-MIMO beamforming

10.38.9.2.3.1 General

***#1: Change this subclasue as follows (CID#1340):***

An EDMG STA is MU-MIMO capable if the MU-MIMO Supported subfield of the Beamforming Capability field in the STA’s EDMG Capabilities element (see 9.4.2.250) is one. The MU-MIMO beamforming protocol enables an MU-MIMO capable initiator and one or more MU-MIMO capable responders in an MU group to establish an antenna configuration which allows the initiator to transmit an EDMG MU PPDU to the responders in the MU group, such that the mutual interference among the streams transmitted in the MU PPDU is minimized. In this context, the method of minimizing interference is implementation dependent.

…

The MU-MIMO beamforming protocol uses the EDMG Group ID Set element (see 9.4.2.254) transmitted by the AP or PCP of the BSS. The AP or PCP shall transmit an EDMG Group ID Set element prior to performing MU-MIMO beamforming protocol. …

10.38.9.2.3.2 SISO phase

***#2: Change this subclause as follows (CID#2022, 2023, 1147, 1146, 2313):***

…

Figure 100 depicts the SISO phase, which consists of two subphases, namely, an Initiator TXSS subphase and a SISO Feedback subphase. The initiator may perform the Initiator TXSS subphase. The Initiator TXSS subphase enables the initiator to obtain feedback from the responders in the MU group on one or more sectors for each of the initiator’s TX DMG antenna.

The initiator performs the Initiator TXSS subphase through the use of the Short SSW packet (see 30.9.1). In each Short SSW packet transmitted as part of the Initiator TXSS, the initiator shall set the Direction field to zero, shall set the Addressing Mode field to indicate MU-MIMO and shall set the Destination AID field to contain a group ID announced by the PCP or AP in the last transmitted EDMG Group ID Set element. In addition, the CDOWN field shall be set to the number of Short SSW packets remaining until the end of the Initiator TXSS subphase and the Setup Duration field shall be set to the duration of the following SISO Feedback subphase.

An MU-MIMO capable EDMG STA that receives a Short SSW packet indicating MU-MIMO transmission determines that it is an intended recipient of the packet by matching the value of the Destination AID field in the packet with a value of the EDMG Group ID field contained in the last received EDMG Group ID Set element. In case a match is found, the EDMG STA is an intended recipient of the packet if its AID is included in the EDMG Group ID field of the corresponding group. Otherwise, the EDMG STA is not an intended recipient of the packet and can ignore the remaining of the Initiator TXSS and SISO Feedback subphase, which can be done through the use of the value of the CDOWN and Setup Duration fields contained in the received Short SSW packet.

The initiator shall perform the SISO Feedback subphase. If the Initiator TXSS is present, the SISO Feedback subphase shall start MBIFS following the end of the Initiator TXSS subphase. During the SISO Feedback subphase, the initiator transmits a BRP frame (see 9.6.22.3) to poll each responder in the MU group. The DMG Beam Refinement element (see 9.4.2.130) of the BRP frame shall have the TXSS-FBCK-REQ field set to 1, the SNR Requested subfield within the FBCK-REQ field set to 1, the Sector ID Order Requested field within the FBCK-REQ field set to 1, the Channel Measurement Requested subfield within the FBCK-REQ field set to 0, all the subfields within the FBCK-TYPE field set to 0 and the EDMG Channel Measurement Present field set to 0. A responder shall respond with a BRP frame within an MBIFS following the reception of the corresponding BRP frame. The DMG Beam Refinement element of the BRP frame shall have all the subfields within the FBCK-REQ field set to 0, the SNR Present subfield within the FBCK-TYPE field set to 1, the Sector ID Order Present subfield within the FBCK-TYPE field set to 1, the Channel Measurement Present subfield within the FBCK-TYPE field set to 0, the Tap Delay Present subfield within the FBCK-TYPE field set to 0, the Link Type subfield within the FBCK-TYPE field set to 0, the EDMG Extension Flag field set to 1 and the EDMG Channel Measurement Present field set to 1. The BRP frame shall include an EDMG BRP Request element (see 9.4.2.255), in which the L-TX-RX and Requested EDMG TRN-Unit M fields indicate the number of TRN subfields requested for receive AWV training in the following non-reciprocal MU-MIMO BF training.

The last initiator TXSS may have been performed using DMG Beacon frames, SSW frames, Short SSW packets or EDMG BRP-TX packets. If the last initiator TXSS was performed using DMG Beacon or SSW frames, the EDMG Sector ID Order subfield in the EDMG Channel Measurement Feedback element indicates the sector IDs, TX antennas and RX antennas of all or a subset of sectors that were received in the last initiator TXSS. If the last initiator TXSS was performed using Short SSW packets, the EDMG Sector ID Order subfield in the EDMG Channel Measurement Feedback element indicates the CDOWNs, TX antennas and RX antennas of all or a subset of sectors that were received in the last initiator TXSS. If the last initiator TXSS was performed using EDMG BRP-TX packets, the EDMG Sector ID Order subfield in the EDMG Channel Measurement Feedback element indicates AWV feedback IDs, TX antennas and RX antennas of all or a subset of sectors that were received in the last initiator TXSS. The BRP CDOWN subfield in the EDMG Channel Measurement Feedback element indicates the BRP CDOWNs of the packets in which these sectors were received. The SNR subfield in the Channel Measurement Feedback element indicates the SNRs with which these sectors were received. If the number of sectors for a pair of TX and RX DMG antennas that were received in the last initiator TXSS is larger than 16, the BRP frame shall contain feedback for at least 16 received sectors for the pair of TX and RX DMG antennas. Otherwise the BRP frame shall contain feedback for all the received sectors for the pair of TX and RX DMG antennas.

***#3: replace Figure 52 by the following figure (CID 1246):***



1. —The SISO phase of MU-MIMO beamforming

**Straw Poll:**

* **Do you agree to accept the comment resolution as proposed in doc 11-18/0298r0?**