IEEE P802.11
Wireless LANs

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| LB239 HBF Sounding CIDs |
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Abstract

This document proposes resolution to several CIDs on HBF sounding

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| 4131 | 296.30 | 30 | 10.43.10.2.4.1 | "The relationship between a transmitted signal, φá╡φ▓Ö, and a received signal, φá╡φ▓Ç, in a hybrid beamforming 30 transmission can be represented as": This is formulas are valid only in a flat channel or in a single freqeuncy bin. | submission willl be provided |

Proposed Resolution: **Revise**

***TGay Editor: Change the text in P296L30-31 (10.43.10.2.4.1) as follows:***

The relationship between a transmitted signal, 𝒙, and a received signal, 𝒀, in a hybrid beamforming transmission (in a flat channel or single frequency bin), can be represented as

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| 4132 | 298.22 | 22 | 10.43.10.2.4.3.1 | "the initiator (or responder) may send TRN fields to the responder (initiator) to measure the baseband channel": what does "may" mean? The initiator declared it is a Hybrid BF training procedure, therefore it must send TRN Field. The training is not supposed to happpen on other fields. | submission willl be provided |
| 4133 | 298.27 | 27 | 10.43.10.2.4.3.1 | "The spatial mapping matrix, Q, for transmission that uses digital beamforming should be computed using the 27 last analog combination decided between a pair of STAs (that is, on the current AWVs used by the STAs).": The spatial matrix is used for measurement not for calculation | submission willl be provided |
| 4135 | 299.17 | 17 | 10.43.10.2.4.3.2.1 | "In the initiator sounding subphase, the initiator shall transmit EDMG BRP-TX packets to the responder." The anouncement phase allows a single transmit combination, the initiator and respodner a set to use this combination for both the PDSU trasnmission and the TRN field, only one PPDU is needed. | submission willl be provided |
| 4136 | 299.21 | 21 | 10.43.10.2.4.3.2.1 | "Each transmitted 20 EDMG BRP-TX packet is used to train one or more transmit sectors based on the AWVs of the DMG 21 antennas selected during the hybrid beamforming announcement phase by the announcement frame": only one transmit combination is defined in the anouncement phase | submission willl be provided |
| 4137 | 299.27 | 27 | 10.43.10.2.4.3.2.1 | "and the parameters RX\_TRN\_PER\_TX\_TRN and EDMG\_TRN\_M shall be 27 set to values based on the desired configuration". In a BRP-TX packet RX\_TRN\_PER\_TX\_TRN shall be set to 0. Also where was the desired cofiguration indicated | submission willl be provided |
| 4138 | 299.32 | 32 | 10.43.10.2.4.3.2.1 | "the number of remaining EDMG BRP RX/TX" no BRP-RX packets were mentioned above, only BRP-TX packet. | submission willl be provided |
| 4139 | 299.28 | 28 | 10.43.10.2.4.3.2.1 | "The initiator may transmit each EDMG BRP-TX packet to train multiple TX DMG antennas simultaneously" in the anouncement phase, the initiator inidicated it will be using a specific DMG antenna set based in the a specific transmit sector combination. I believe it shall use this combination to transmit the sector in an orthogonal TRN field | submission willl be provided |

Proposed Resolution: **Revise**

**Discussion:**

Hybrid BF training is used to enable transmission using an optimal expansion matrix Q based on the measured channel between transmitter and receiver. Hybrid BF training occurs after analog MIMO training has completed. In the announcement phase of Hybrid BF training, a specific combination of DMG antennas and TX sectors is selected and the receiver in the sounding phase knows what RX DMG antennas and AWVs should be used. Given that combination, there is no point in transmission in multiple sectors, as the text currently describes, or transmitting multiple packets. A TRN field of a single packet will provide all the required information. The packet may even be an EDMG BRP-RX PPDU, since no change in AWV is expected during the transmission of the TRN field. Even the feedback procedure does not describe how multiple feedback can be sent. The channel access procedure for MIMO indicates that if a seclected sector combination is indicated, it should be used throughout the TxOp. Therefore, the training shall happen in MIMO mode, rather than sequentialy.

***TGay Editor: Modify the text in P299L15-33 as follows:***

The initiator shall initiate the sounding phase a SIFS duration following reception of the announcement acknowledgement frame (see 10.43.10.2.4.2.2) from the responder. In the initiator sounding subphase, the initiator shall transmit an EDMG BRP-TX packet to the responder. The EDMG BRP-TX packet shall include a BRP frame with an EDMG BRP Request element with the Digital BF Request field set to 1 indicating a request for performing digital beamforming, and the Feedback Type field set to 0 for SU transmission. The Nc Index field is reserved. The BRP-TX packet shall use the TX sector combination selected in the announcement phase in the transmission of the TRN subfield. In the EDMG BRP-TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than 0, RX\_TRN\_PER\_TX\_TRN shall be set to 0, NUM\_TX\_CHAINS shall be set to the number of TX antennas in the TX sector combination and EDMG\_TRN\_M shall be set to values based on the desired configuration. The TX Antenna Mask field within the EDMG BRP-TX packet shall indicate the transmit DMG antenna(s) which is being used by the initiator to transmit the EDMG BRP-TX packet. The same AWV combination shall be maintained during the transmission of the PPDU, including the TRN field.

***TGay Editor: Modify the text in P299L34-46 as follows:***

If the responder indicates that it will use SU-MIMO in the opposite direction (from the responder to the initiator) and requests hybrid beamforming training during the announcement phase, the initiator and responder shall delay sending feedback until after the responder completes the sounding phase. The responder shall initiate the responder sounding subphase a SIFS duration following the reception of the EDMG BRP-TX packet from the. In the responder sounding subphase, the responder shall transmit an EDMG BRP-TX packet to the initiator. The EDMG BRP-TX packet shall include a BRP frame with an EDMG BRP Request element with the Digital BF Request field set to 1 indicating a request for performing digital beamforming, and the Feedback Type field set to 0 for SU transmission. The Nc Index field is reserved. The BRP-TX packet shall use the TX sector combination selected in the announcement phase in the transmission of the TRN subfield. For each EDMG BRP-TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than 0, RX\_TRN\_PER\_TX\_TRN shall be set to 0, NUM\_TX\_CHAINS shall be set to the number of TX antennas in the TX sector combination and EDMG\_TRN\_M shall be set to values based on the desired configuration. The TX Antenna Mask field within the EDMG BRP-TX packet shall indicate the transmit DMG antenna(s) which is being used by the responder to transmit the EDMG BRP-TX packet. The same AWV combination shall be maintained during the transmission of the PPDU, including the TRN field.

***TGay Editor: Change the text in P300L8-9 as follows:***

In the case that only the initiator requested sounding , only the initiator may send the BRP frame and associated TRN fields.

***TGay Editor: Add the following text at P298L18***

A responder may request Hybrid Beamforming Training only if the initiator requested Hybrid Beamforming Training.

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| 4140 | 300.17 | 17 | 10.43.10.2.4.3.2.2 | Same issues in MU-MIMO-HBF training as in SU-MIMO: multiple packets instead of one (similar to NDP in 11ac) , no referecnce to selected configuration. | submission willl be provided |

Propsoed Resolution: **Revise**

 ***TGay Editor: Change the text in P300L17-37 as follows:***

The initiator shall initiate the hybrid beamforming sounding subphase a SIFS following the reception of the announcement acknowledgement frame(s) from the responder(s), if required, or immediately following the transmission of the DMG CTS-to-self from the initiator. In the hybrid beamforming sounding subphase, the initiator shall transmit an EDMG BRP-TX packet to the responders in the MU group. Each EDMG BRP-TX packet shall include a BRP frame with an EDMG BRP Request element with the Digital BF Request field set to 1 indicating a request for performing digital beamforming, and the Feedback Type field set to 1 for MU transmission. For digital beamforming feedback in the EDMG OFDM mode, the Nc Index field is set to the number of columns, *Nc*, in the compressed beamforming feedback matrix minus 1. The RA field in the BRP frame shall be set to the broadcast address. Each BRP-TX packet shall use the TX sector combination selected in the announcement phase in the transmission of the whole TRN field. In the EDMG BRP-TX packet, the TXVECTOR parameter EDMG\_TRN\_LEN shall be set to a value greater than 0. The TXVECTOR parameter RX\_TRN\_PER\_TX\_TRN shall be set to 0 and EDMG\_TRN\_M shall be set to a value based on the desired configuration.

The TX Antenna Mask field within the EDMG BRP-TX packet shall indicate the TX DMG antenna(s) which is being used by the initiator to transmit the EDMG BRP-TX packet.

**References:**