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| Proposed Draft Text: Beamforming |
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Abstract

This submission proposes the draft text on Beamforming for TGbe D0.1

Revisions:

* Rev 0: Initial version of the document.

34.3.13.1 General

SU-MIMO and DL MU-MIMO beamforming are techniques used by a STA with multiple antennas (the beamformer) to steer signals using knowledge of the channel to improve throughput. With SU-MIMO beamforming all space-time streams in the transmitted signal are intended for reception at a single STA in an RU. With DL MU-MIMO beamforming, disjoint subsets of the space-time streams are intended for reception at different STAs in an RU of size greater than or equal to 242-tones.

For SU-MIMO and DL MU-MIMO beamforming in RU or MRU r, the receive signal vector in subcarrier k (where subcarrier $k$ is one of the subcarriers in RU or MRU $r$, $k\in K\_{r}$) at beamformee $u$, $y\_{k,u}=\left[y\_{k,0},y\_{k,1},\cdots ,y\_{k,N\_{RX\_{u}}-1}\right]^{T}$, is shown in Equation (34‑XX), where $x\_{k}=\left[x\_{k,0}^{T},x\_{k,1}^{T},\cdots ,x\_{k,N\_{user,r}-1}^{T}\right]^{T}$ denotes the transmit signal vector in subcarrier k for all Nuser,r beamformees, with $x\_{k,u}=\left[x\_{k,0},x\_{k,1},\cdots ,x\_{k,N\_{STS,r,u}-1}\right]^{T}$ being the transmit signal for beamformee u.

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| $$y\_{k,u}=H\_{k,u}×\left[Q\_{k,0},Q\_{k,1},\cdots ,Q\_{k,N\_{user,r}-1}\right]×x\_{k}+n$$ | (34‑XX) |

where

$H\_{k,u}$ is the channel matrix from the beamformer to beamformee u in subcarrier k with dimensions $N\_{RX\_{u}}×N\_{TX}$

$N\_{RX\_{u}}$ is the number of receive antennas at beamformee u

$Q\_{k,u}$ is a steering matrix for beamformee u in subcarrier k with dimensions $N\_{TX}×N\_{STS,r,u}$

$N\_{user,r}$ is the number of EHT MU PPDU recipients (see Table 34-X (Frequently used parameters)) in RU or MRU r

n is a vector of additive noise and may include interference

The DL MU-MIMO steering matrix $Q\_{k}=\left[Q\_{k,0},Q\_{k,1},\cdots ,Q\_{k,N\_{user,r}-1}\right]$ can be determined by the beamformer using the beamforming feedback for subcarrier $k$ from beamformee $u$, where $u=0,1,\cdots ,N\_{user,r}-1$. The feedback report format is described in 9.4.1.X (EHT Compressed Beamforming Report field) and 9.4.1.X (EHT MU Exclusive Beamforming Report field). The steering matrix that is computed (or updated) using new beamforming feedback from some or all of participating beamformees might replace the existing steering matrix$Q\_{k}$for the next DL MU-MIMO data transmission.

For SU-MIMO beamforming, the steering matrix $Q\_{k}$ can be determined from the beamforming feedback matrix $V\_{k}$ that is sent back to the beamformer by the beamformee using the compressed beamforming feedback matrix format as defined in 19.3.12.3.6 (Compressed beamforming feedback matrix). The feedback report format is described in 9.4.1.X (EHT Compressed Beamforming Report field).

34.3.13.3 HE/EHT Beamforming feedback matrix V

Upon receipt of an EHT sounding NDP, the beamformee computes a set of matrices for feedback to the beamformer as described in 27.3.16.2 (Beamforming Feedback Matrix V).

34.3.13.3 HE/EHT CQI feedback

If the HE/EHT NDP Announcement frame requests CQI feedback, then upon receipt of the HE/EHT sounding NDP, the beamformee computes CQI feedback as described in 9.4.1.XX (HE/EHT CQI Report field). The CQI feedback, $CQI\_{s,r,u}$, for beamformee $u$ in RU or MRU $r$ for space-time stream $s$ shall be estimated using the method described in 9.4.1.XX (HE/EHT CQI Report field). The CQI values to be fed back are derived from quantized SNRs according to Table 9-93h (Average SNR of RU index k for space-time stream i subfield). The beamformee shall transmit the CQI feedback for space-time stream $1,…,N\_{c}$ for each of the RU or MRU indices for which the CQI report is being requested by the beamformer. The beamformer may use the CQI feedback to determine the best range of RUs or MRUs for a compressed beamforming/CQI report or for RU or MRU assignment during a subsequent MU transmissions. The actual use is implementation specific.