Virtual Antenna Mapping MIMO Techniques in a Massive MIMO Test-bed for Backward Compatible LTE Mobile Systems

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Abstract—This paper proposes a virtual antenna mapping method for backward compatible massive or large-scale antenna multiple input multiple output (MIMO) base stations that provide communication services for legacy user equipment (UE) that can recognize only two or four base station antennas. The proposed method adopts and improves the omnidirectional beamforming that has been pioneered in previous works with proposing new method of determining antenna array coefficients through shifting the discrete Fourier transform (DFT) basis vectors for Zadoff-Chu (ZC) sequences. In the proposed method, the number of the parameters to be optimized is only two although the number of transmit antennas is hundreds or more (e.g., 500 antennas was proved in the paper as an example). Moreover, with the independent properties of the shifted versions of ZC sequences, this paper proves the fact that the coefficient vectors consisting virtual transmit antennas are independent when the channel gains work as the coefficients of them. This characteristic gives diversity with the pre-codes because two pre-code vectors must independent which means their linear combination with the non-zero channel gains or coefficients cannot be zero. The computer simulation results provide four important findings; the most important is that the actual number of virtually mapped physical antennas is inversely proportional to the transmit power per antenna.

Keywords — massive MIMO, virtual antenna techniques, omnidirectional beamforming, large array antennas, precoding techniques

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