











uplink pilot powers of the other users. Therefore, each user can maximize its EE independently. Unfortunately, the EE  $\eta_k$  ( $r_k$ ,  $p_k$ ) function is not quasi-concave in general. But, with practical system parameters, we have shown that the EE function is strictly quasi-concave with respect to each coordinate,  $r_k$  and  $p_k$ . Therefore, we have proposed an iterative uplink pilot power and downlink transmission rate adaptation algorithm to maximize the EE of users. We have proved that for any arbitrary starting point, the algorithm converges to a point that satisfies the first-order necessary condition. From simulation analysis, the existing system has energy efficiency capacity in terms of bps. In proposed method, it can improve by using maximal ratio combiner principle can increase the EE capacity in mbps, high SNR and low bit error rate. Currently, our work considers the case of  $M = K$  in a single-cell environment. In future work to the case of  $M > K$  and to a multi-cell environment will be interesting future research topics.

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