

In this paper, we consider a wireless-powered communication network in which a multiple-antenna two-way AF relay transfers power to multi-pair of single antenna users. A harvest-then-transmit protocol is adopted where the relay first broadcasts wireless power to all the users during a power transfer phase. Multiple pairs of users then use the harvested energy to exchange information through the relay over two phases: up-link and down-link. In the up-link phase, all the users transmit their independent signals to the relay, whereas in the down-link phase, the relay amplifies and forwards the received signals to the intended users. In order to mitigate the interference, zero-forcing reception and transmission is applied at the relay. To characterize system performance, we consider ergodic spectral and energy efficiencies in three different cases based on the knowledge of the channel state information (CSI) at the relay in the power transfer phase, namely: 1) unknown CSI; 2) partially known CSI; and 3) perfectly known CSI. In light of this, new analytical expressions for the ergodic spectral and energy efficiencies are derived for the three cases and Monte Carlo simulations are provided throughout to validate our analysis. The impacts of some important system parameters, such as energy harvesting time, energy harvesting efficiency, number of user-pairs, and relay antennas, on the adopted performance metrics are investigated.