

The multi-antenna or multiple-input multiple-output (MIMO) technique can significantly improve the efficiency of radio frequency (RF) signal enabled wireless energy transfer (WET). To fully exploit the energy beamforming gain at the energy transmitter (ET), the knowledge of channel state information (CSI) is essential, which, however, is difficult to be obtained in practice due to the energy and hardware limitation of the energy receiver (ER). To overcome this difficulty, under a point-to-point MIMO WET setup, this paper proposes a general design framework for a new type of channel learning method based on the ER's energy measurement feedback. Specifically, the ER measures and encodes the harvested energy levels over different training intervals into bits and sends them to the ET via a feedback link of limited rate. Based on the energy-level feedback, the ET adjusts transmit beamforming in subsequent training intervals and obtains refined estimates of the MIMO channel by leveraging the technique of analytic center cutting plane method (ACCPM) in convex optimization. Under this general design framework, we further propose two specific feedback schemes based on energy quantization and energy comparison, where the feedback bits at each interval are generated at the ER by quantizing the measured energy level at the current interval and comparing it with those in previous intervals, respectively. Numerical results are provided to compare the performance of the two feedback schemes. It is shown that energy quantization performs better when the number of feedback bits per interval is large, while energy comparison is more effective vice versa.