This paper develops a theory on the proof of the radiation resistance in frequency-domain partial element equivalent circuit (PEEC) model. Specifically, the total power dissipated on the imaginary part of the complex inductance and capacitance derived from the PEEC model is found to be the total radiated or scattered power when the structure is internally excited by independent sources, or externally by incident waves, respectively. Accordingly, the imaginary part of the complex inductance and capacitance represents a radiation resistance network of the structure. Numerical simulations based on PEEC and commercial electromagnetic simulation tool are presented for comparison, and some physical implications are discussed.