# On Maximum Absorption by a Lossy Antenna – to Conjugate-Match or not to Conjugate-Match?

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The study of structures that absorb electromagnetic power efficiently is important in many application areas ranging from radar cross-section minimization to antenna-coupled bolometers for thermal sensing. In this paper, we propose an approximate analytical model for evaluating power absorption by terminal-loaded dipole antennas whose structure is lossy. Including the effect of structural losses in the analytical model is important since nowadays low cost methods of antenna production often aim to reduce the conductivity of metallization and the amount of power absorbed by the lossy antenna structure is no longer negligible relative to the power absorbed by the load. The proposed model is based on the sinusoidal approximation for the current flowing along the dipole in receiving mode and on a perturbation approach that is valid when the skin depth is smaller than the dipole thickness. The analytical model yields an approximate expression for the optimal load impedance that maximizes the power absorbed by the load and the lossy antenna structure together. An important finding is that this optimal load-impedance is different from the conjugate-matched load, which maximizes the load power. Specifically, while its reactance is approximately equal to the negative of the antenna input reactance (as in conjugate matching), its resistance can be quite different from the antenna input resistance. The accuracy of the approximate analytical expression for the optimal load impedance was verified against results obtained using a Method of Moments (MoM) solution. The expression can be used 'as is' or, if higher accuracy is desired, provide a good initial guess for a search algorithm implemented on top of a rigorous EM solver.