Effect of Ground Plane Spacing on Bandwidth for Serrated Slot RFID Antennas

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There are many applications for antennas that require a low-profile installation on a conductive object. Often the object cannot be modified to accommodate the antenna. One such example is an RFID antenna. When the antenna is installed on a conductive object, the radiation and impedance properties will be affected. It is often desirable to constrain the antenna to be planar and near to the surface of the conductive body in order to make it unobtrusive and less susceptible to damage. The ultimate consequence of these geometric constraints is limited RFID read range. Irrespective of the radiating element type (*i.e.*, dipole, slot, patch, *etc.*), as the spacing between the element and conductive object are reduced, the bandwidth and gain of the antenna are degraded. In the case of a slot, one cause of degraded bandwidth is due to energy being stored between the ground plane of the slot and the conductive back plane. This stored energy results in an increased Q and in turn, reduced bandwidth and poor radiation performance. It has been shown (J. E. Ruyle, "Small, dual band, placement insensitive antennas", Ph.D. dissertation, Dept. Elect. Comput. Eng., Univ. Illinois, Urbana, 2011) that applying serrations to the ground plane edges increases the bandwidth of the structure while also promoting more efficient radiation. In this work, the effect that ground plane serrations have on bandwidth is studied, and the trade-off between ground plane spacing and bandwidth is investigated.

The presentation outlines the techniques used to evaluate the antennas of interest and discusses simulated and measured results for a slot antennas placed at various distances from the conductive back plane. Results with and without ground plane serrations are presented that show the effect of the edge treatment and how the treatment effects change with ground plane spacing. The presentation also equips antenna designers with guidelines for selecting the proper ground plane spacing given a set of bandwidth constraints.