**Investigation of parasitic loads in slotline for tunable antennas**

L. M. Szolc* and J. E. Ruyle
Department of Electrical and Computer Engineering
University of Oklahoma, Norman, OK 73019
lukasz.m.szolc-1@ou.edu and ruyle@ou.edu
http://arrc.ou.edu

Presently, there are limited resources of electromagnetic spectrum to allocate new frequency bands for desirable high data rate communications and radar systems. Therefore, modern radio devices will have to efficiently utilize the electromagnetic spectrum by identifying and operating in unoccupied frequency bands – become white space devices (WSD). For WSD applications, frequency reconfigurable antennas typically have more desirable properties than ordinary wideband radiators for many systems due to their smaller size and lower mismatch losses over a narrower band of operation. Additionally, tunable antennas have the ability to filter out noise from adjacent channels. The two most common techniques for changing the operating frequency of an antenna are the use of strategically placed switches or variable capacitive loading. The first provides a wide tuning range between discrete frequency points, while the second allows continuous reconfigurability in a narrower band. The majority of research regarding tunable radiators is performed in microstrip or slotline topologies in order to minimize overall system costs. Slot antennas have advantages over patches in applications where an omnidirectional pattern is required due to the lack of backing ground plane. On the other hand, reconfigurable antennas typically utilize active elements, for which slotline structures, unlike microstrip geometries, require additional treatment for biasing purposes. For example, N. Behdad and K. Sarabandi (IEEE Trans. Ant. Prop., 54(2), 401-408) present a dual-band tunable slot antenna for which DC separation between the varactor terminals is provided by ground plane discontinuity linked together with two lumped capacitors. Such geometry changes can often result in spurious radiation and additional losses. Consequently, new bias friendly slotline antenna geometries have to be developed.

The presented work investigates possible tuning ranges for slot antenna loading that inherently allows simpler biasing of a varactor. Parametric studies were performed in Ansoft HFSS to characterize the effects of the geometry changes on the load impedance represented by the proposed structures and the benefits of each are presented. In order to provide a greater depth of understanding, transmission line models were pursued for the successful geometries. Furthermore, design guidelines on how to maximize the tuning range while maintaining low power losses are defined. Finally, theoretical and numerical results were confirmed through fabrication and measurement of a set of geometries. The investigated structure, together with transmission line model and design guidelines, can be utilized to develop reconfigurable antennas with wide frequency tuning ranges and simplified biasing networks.