

Investigation of Feeding Techniques for a Tunable Slot Antenna with a Varactor Loaded Ring Resonator

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The rapidly growing wireless industry continues to create new challenges as radio frequency components are required to be more versatile, but also occupy less space. Reconfigurable antennas can address these needs with the ability to change a fundamental parameter of a radiator and fulfill the functionality of multiple elements. The recent research regarding agile antennas has been largely focused on geometries suitable for fabricating as a part of a printed circuit board due to the desired low manufacturing costs. Accordingly, most tunable antennas apply microstrip or slotline radiating elements. Regardless of the design technology, the overall antenna performance is heavily dependent upon the utilized feeding technique. While a considerable amount of research has been done to investigate different feeding methods for microstrip antennas, their slotline counterparts have not received equally sufficient attention in the literature. However, the feed design becomes especially important for agile antennas since the current distribution along such radiators is being altered by the reconfiguration mechanism. Therefore, an appropriate feed must be chosen for an agile antenna, so that the design requirements can be met over the entire tuning range.

This work investigates different feeding techniques for a reconfigurable slot antenna with a varactor loaded ring resonator utilized as part of the tuning mechanism. The proposed feed networks are simulated in a full-wave electromagnetic solver (i.e. ANSYS HFSS), constructed, and measured to compare both performance and manufacturability. Equivalent circuits are pursued for each of the feeding mechanisms in order to provide better understanding of the structure to aid transference of the work to other antenna architectures. Additionally, design guidelines and trade-offs are also discussed for the presented geometries. Therefore, even though the investigated feeding techniques are reviewed in context of a tunable slot antenna with a varactor loaded ring resonator, the benefits and disadvantages of each of the feeds can be extended to other slot antennas.