

A Cavity-Backed Ring-Slot Radiator with an AMC Reflector

Riaan Ferreira*, Johan Joubert, and Johann W. Odendaal
Centre for Electromagnetism, Department of EEC Engineering, University of Pretoria,
Pretoria, South Africa, 0002, <http://www.up.ac.za/>

Design results of a small, low profile printed ring-slot antenna with uni-directional radiation properties will be presented. A single linearly polarized, a dual linearly polarized, and a dual circularly polarized version of the antenna will be shown. The ring-slot antenna radiates above an open cavity loaded with an artificial magnetic conducting (AMC) reflector (see Figure 1). This work is an extension of a previously proposed cavity-backed linear slot antenna (J. Joubert, J.C. Vardaxoglou, W.G. Whittow and J.W. Odendaal, *IEEE Trans AP*, vol. 60, no. 2, Feb. 2012, pp. 735-742). The newly proposed ring-slot radiator is significantly smaller than the linear slot radiator, and has the ability to be fed in such a way that dual linear and dual circularly polarized radiation can be achieved.

The ring-slot antenna can be fed by coplanar waveguide (CPW) or microstrip line. To obtain a good impedance match a variation of the single-layer capacitive feed (G. Mayhew-Ridgers, J. Joubert and J.W. Odendaal, *IEEE Trans AP*, vol. 51, no. 6, June 2003, pp. 1405-1407) is used. The capacitive patch is used to cancel the inductance introduced by the extended center section of the CPW (or microstrip line) feed. To obtain dual linear polarization, a second port is added, and to obtain dual circular polarization a miniaturized branch-line 90° hybrid coupler, realized in microstrip line with the circular inner conductor of the ring-slot as ground plane, is used to feed the two antenna ports. This innovative use of the inner part of the ring-slot to construct the hybrid coupler means that the size of the dual circularly polarized antenna is still exactly the same as the single linearly polarized antenna.

Results of some parametric studies will be shown, as well as simulated and experimental results for final antenna designs (with a size of $0.457\lambda_0 \times 0.457\lambda_0 \times 0.063\lambda_0$) which operate in the 2.4 GHz wireless local area network frequency band. A maximum gain of approximately 7 dBi is achieved, with good impedance bandwidth, efficiency, axial ratio, cross-polarization and front-to-back ratio. This small footprint, low profile antenna is also suitable for other applications like RFID and RF energy harvesting.

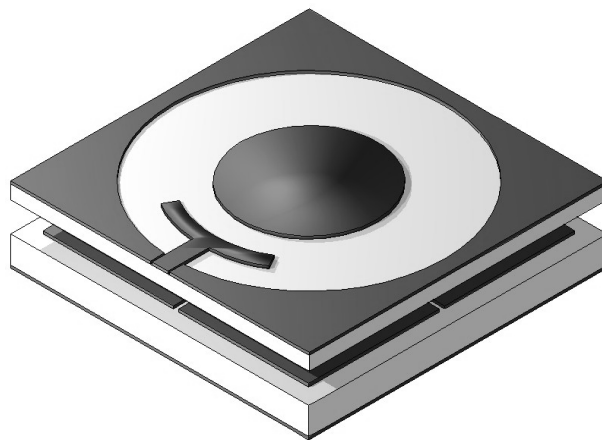


Figure 1: Single port (linearly polarized) cavity-backed CPW-fed ring-slot antenna with an AMC reflector.