A SRR-Loaded Sub-Wavelength Waveguide with H-Plane-Bend Radiator and Improved Matching for High Power Application

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In this paper, a split-ring-resonator-loaded sub-wavelength waveguide with H-plane-bend (HPB) radiator structure is proposed. Improved matching is applied to minimize the reflected power at the input. This proposed waveguide is used as part of a high-power narrow-wall slotted waveguide antenna. The waveguide is loaded with an optimized split-ring resonator (SRR) array applying H-plane discontinuity. The S parameters of the SRR-loaded waveguide with HPB-radiator indicates resonance below the cutoff frequency. The transverse dimension of this waveguide is reduced significantly. An improved waveguide to waveguide transition design is proposed to be added at its input to reduce the insertion loss. The HPB-radiator [N.R. Devarapalli, Electromagnetic Compatibility, vol.53, no.2, pp.380-389, May 2011] is added to the output of the waveguide to minimize the reflected power at the input.

This waveguide achieves approximately 60% transverse aperture reduction from a conventional standard waveguide WR137 to WR90. With a resonance around 5.7GHz, this waveguide shows that it supports propagation below the cutoff frequency of WR90, which is 6.55GHz. A quarter-wavelength transformer and a step waveguide transition are proposed and optimized to reduce the insertion loss caused by the wave impedance difference between the proposed waveguide and the feeding C-band waveguide. The placement of the SRRs with central spacing between the rings and the step transition applying H-plane discontinuity are optimized to provide a low return loss. This SRR-loaded sub-wavelength waveguide with HPB-radiator can be applied to a sub-wavelength narrow-wall slotted waveguide antenna for high power applications.

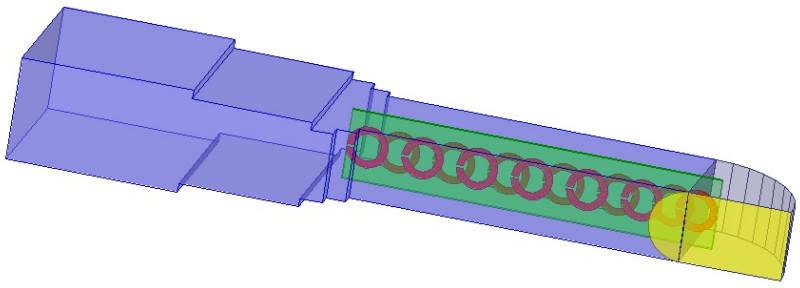

Figure 1: configuration of sub-wavelength waveguide with HPB radiator and improved matching