

Improved Slotted Waveguide Antenna with Optimized Corrugations and Suppressed Sidelobes for High-Power Applications

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In this work, an *S*-band slotted waveguide antenna (SWA) with optimized corrugations is presented. It is based on 10 identical longitudinal elliptical slots cut in one of the broadwalls of a WR-284 waveguide ($a = 2.84''$, $b = 1.37''$). The waveguide is shorted at one end and fed from the other, leading to a resonating SWA. Elliptical slots, which have no sharp corners, are known to be more suitable for high power applications. The SWA is initially designed for operation at 3 GHz, where the guide wavelength $\lambda_g = 138.5$ mm. The slots are spaced at $\lambda_g/2$, center to center. Their length (double the ellipse's major radius) and width (two times the minor radius) are determined, and their displacements from the broadface center-line are optimized to suppress the sidelobes to below -25 dB. The total length of the waveguide is $5\lambda_g$.

Two identical sets of metallic corrugations are then added inside on the non-slotted broadwall, as indicated in Fig. 1. Each set touches one of the narrow walls. The corrugations are positioned such that none of them exists below the area where the slots are. The number, width and height of these corrugations are optimized via ANSYS HFSS simulations. Adding them leads to a decrease in the antenna's resonance frequency, which could be translated into a reduction in the antenna's length. Another improvement they offer is a much better reflection coefficient of below -40 dB. For this setup, the SWA's gain and resulting sidelobe level remain unchanged, with and without the corrugations. Corrugation geometries that are more resistant to breakdown at high powers are investigated.

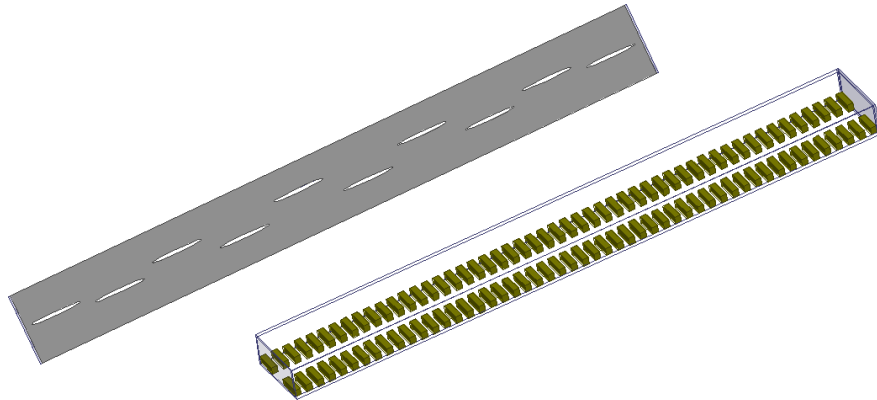


Figure 1: Proposed SWA geometry: 10 identical elliptical slots with non-uniform displacement from center-line on one broadwall, and two sets of identical corrugations on the second broadwall