Off-Axis Performance of Dielectric Lens Antennas

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The off-axis performance of silicon and quartz dielectric-lens antennas (hyperhemispherical, elliptical and extended-lens) have been calculated using a ray-optics/aperture-field integration technique at the University of Michigan. Detailed on-axis and off-axis calculations versus extension lengths have been calculated for:

1. Scan angle
2. Directivity
3. Gaussicity
4. Reflection loss

The on-axis and off-axis patterns were experimentally verified on an 11-element double-slot antenna array at 250 GHz placed on an extended 13.7 mm silicon lens.

The thesis also discusses the design of imaging arrays and the maximum number of allowable elements for a 0.7-1.2 dB drop in the Gaussian Coupling Efficiency in imaging systems. All results are presented in D/λ (D=diameter of lens, λ=wavelength), X/R (X=off-axis displacement, R=radius of lens) and L/R (L=extension length from hemispherical position), making them applicable at any frequency and lens diameter.

The thesis also presents novel millimeter and submillimeter-wave mixer and multipliers based either on a uniplanar crossed-slot topology, or on an off-axis input/output beam system.

Please contact Prof. Gabriel M. Rebeiz, University of Michigan, to obtain a copy of Daniel Filipovic's thesis. We trust that you will find it a valuable design tool for your on-axis and off-axis quasi-optical dielectric-lens antenna design.