Stacked Array of Groove Gap Waveguide Leaky Wave Antennas for Flat Top Radiation Pattern.

Nelson Castro[(1)], Eva Rajo-Iglesias[(1)]
ncastro@pa.uc3m.es.
[(1)]Department of Signal Theory and Communications, University Carlos III of Madrid, Leganés, Spain.

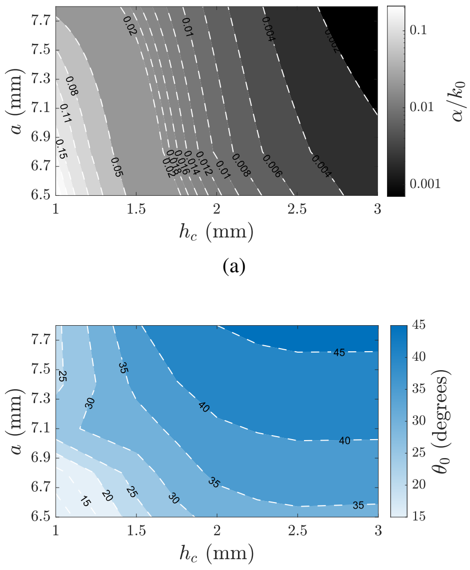

Fig. 1. Bloch wave number calculated at 28 GHz for different dimensions.of a and h_c. (a) Leakage factor α/k_0. (b) Radiation angle θ_0.

Flat-top radiation patterns are engineered to maintain consistent coverage within a specific angular range, with rapid power decay beyond this range. Various methods can be employed to shape the beam, ranging from lenses [1] to antenna arrays utilizing specific amplitude and phase excitations [2]. While the latter approach yields excellent results, it necessitates intricate design of feeding networks. Examples of flat top patterns using leaky wave antennas (LWA) based on the use of partially reflecting surfaces can be also found in the literature [3].

This article introduces a novel concept wherein flat-top radiation patterns are generated by stacking groove gap waveguide (GGWG) LWAs [4] with differing radiation angles as in Fig. 2, in such a way that the superposition of the radiated field of each antenna yields a flat topped pattern. The synthesis of stacked antennas is facilitated with precise control over both amplitude and phase distributions across the antenna aperture, achieved through the calculation of the complex Bloch wave number, as depicted in Fig. 1. This level of control allows tailoring of the radiation pattern, with objectives including minimizing side lobe levels and maximizing radiation efficiency [5]. In this context, gap waveguide technology emerges as an excellent choice for such purposes. The unit cell offers a high degree of tuneability, granting independent control over the leakage factor and phase constant.

In Fig. 3, the radiation pattern of the antennas is depicted, showcasing a flat-top pattern characterized by minimal ripple, with a 1 dB beamwidth spanning approximately 20 degrees. Moreover, the antenna keeps the capability of frequency scanning without compromising the desired radiation pattern.

The proposed design will be manufactured and experimental results presented at the conference.

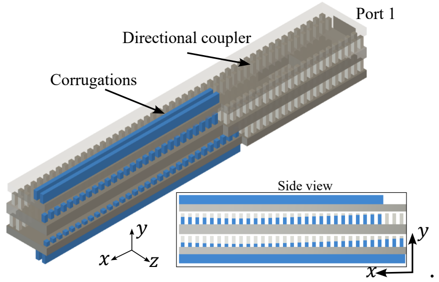

Fig. 2. Stacked leaky wave antenna array fed by E-plane directional coupler.

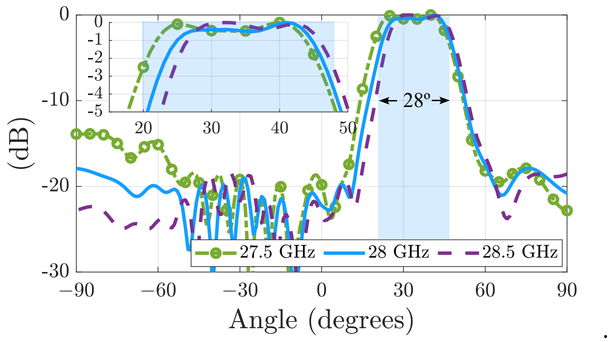

Fig. 3. Normalized radiation pattern of the leaky wave antenna array for different frequencies.

References

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