Superstrate Enhanced Ultrawideband Array with Dual Polarization

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Numerous emerging multifunctional aperture and wideband radar systems require scanning front-ends with immense functional bandwidth. Current phased array technologies are limited in size, weight, and bandwidth by the associated feed and balanced-unbalanced transformers necessary for their practical implementation. Developments in a new class of ultrawideband, conformal arrays, however, promise to circumvent the classical narrowband limitation in thin, planar arrays. This is accomplished through the implementation of tightly coupled dipole elements, which harness in-plane anisotropy to achieve extremely wideband performance (>10:1) in low-profile arrays. The recently developed ultrawideband Superstrate-Enhanced & Substrate-Loaded Array (SESLA) is exemplary of this class of metamaterial arrays. It is matched across a 14:1 bandwidth, and is capable of scanning to 45 degrees in the E-, H-, and D-planes across a 13:1 bandwidth. These results have been validated via testing of an 8x8 prototype array; selected results are shown in Figure 1. Further, the design includes a feed structure which allows elements to be fed in pairs, by an unbalanced 50Ω line.

Continuing on these developments, we will present a dual-linear polarized, superstrate enhanced array, operating from 500-4500 MHz. The array incorporates an integrated balanced feed and latticed structure to accommodate two polarizations in a small, conformal package, as shown in Figure 2. This array foregoes the resistive loading in the substrate, used in previous designs. Extensive testing to verify this design will be carried out using a 9x9 prototype structure.

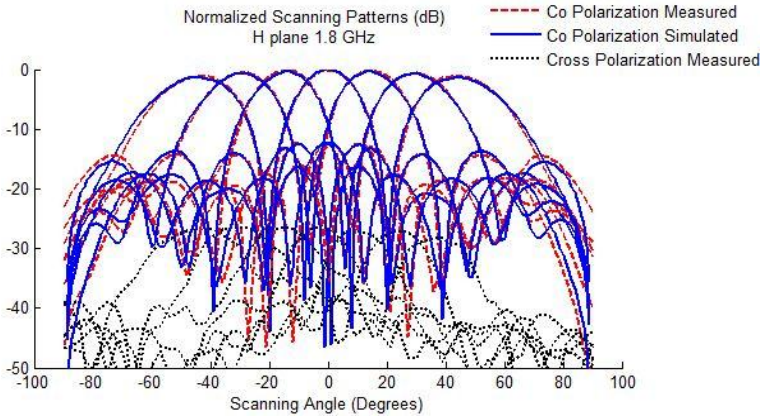

Figure 1: Scanning performance of the SESLA in H-plane at 1.8 GHz, showing ±45°, ±30°, ±15°, and broadside. The low cross polarization levels (minimum 20 dB below desired signal) present opportunity for the addition of an orthogonal structure.

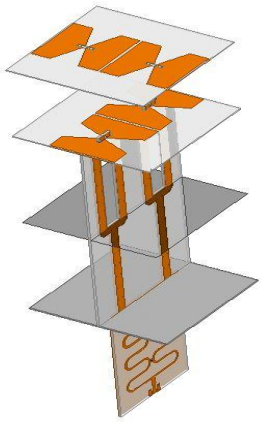

Figure 2: Unit cell showing dual polarized elements—distances exaggerated for clarity.