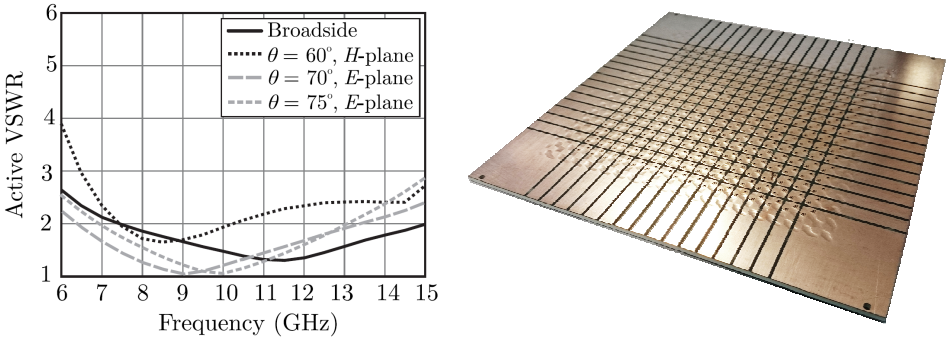
A 7- to 15-GHz Wide-Scan Dual-Polarized Array of Connected Slots with Artificial Dielectrics

Daniele Cavallo[(1)], Waqas H. Syed [(1)], and Andrea Neto[(1)]
(1) Delft University of Technology, Delft, 2628CD, The Netherlands

There has been a growing interest, in the last decade, in the development of phased arrays that can operate over wide bandwidths and wide scan ranges. Such characteristics are desired to support multifunction operation for both communication and radar applications and to reduce the number of antennas on complex platforms, where there is limited space available to accommodate an ever increasing number of sensors.

Most of the proposed solutions to realize wideband wide-scanning arrays are based on radiating elements and the feed structures that are printed on vertical printed circuit boards (PCBs). This arrangement can lead to costly assembly whose complexity increases when scaling down the array dimensions to operate at higher frequency. Recently, we proposed a concept that allows a planar implementation based on a single multi-layer PCB, which represents an advantage in terms of cost and complexity (W. H. Syed et al., IEEE TAP, 64-2, 2016). This consisted of an array of connected slots with artificial dielectrics as a superstrate. By realizing artificial dielectric slab with high equivalent permittivity, the distance between the array plane and the backing reflector can be reduced to a few millimeters without strong alterations of the active impedance, thus enabling the realization of the feed lines through standard via-hole technology. The artificial dielectric is used in place of a real dielectric because of its anisotropy, which is a key property to avoid the excitation of surface waves and the occurrence of scan blindness.

In this work, we report on the development of a prototype based on the concept introduced in (W. H. Syed et al., IEEE TAP, 64-2, 2016). Following up on that work, the design presented here is improved on a number of aspects: it is dual polarized rather than single polarized; it extends the scan range from 50 to above 60 degrees. The simulated active Voltage Standing Wave Ratio (VSWR) is shown in Fig. 1(a). The prototype array (Fig. 1(b)), consists of 512 elements, i.e. 16×16 connected slots for each of the two polarizations. The experimental testing of the prototype will be performed in the next months and the results will be presented at the conference.



(a) (b)

Figure 1. (a) Simulated unit-cell VSWR and (b) photo of the connected-slot prototype.