

## 5G Massive MIMO Base Station Panels with Dual Linear Polarized Vivaldi Array Antenna Aperture

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A dual linear polarized Vivaldi array antenna for the sub-6 GHz frequency band of the 5G spectrum is proposed. Its application in Massive MIMO base station panels is investigated for beam steering and multiple simultaneous beams. The proposed antenna exhibits well defined stable pattern quality, low variation in the impedance over a wider bandwidth and high port to port isolation in a dual polarization configuration. In addition, it provides a high front-to-back ratio and low cross polarization. The proposed design provides good polarization isolation to support both transmit and receive communications simultaneously, as desired in the 5G communications. The previous works on dual polarized massive MIMO are based on patch antenna, which are inherently narrowband and include complex multilayer stack up for achieving dual polarization with low mutual coupling. In this design, Vivaldi antenna with circular balun and microstrip feeding line provides impedance matching bandwidth from 5 GHz to 7.5 GHz.

The proposed dual polarized base station antenna panel consists of a  $4 \times 4$  Vivaldi sub-array arranged in an egg-crate shape with  $0.56\lambda_0$  inter-element spacing, where  $\lambda_0$  is free space wavelength at 6 GHz (Fig. 1). The antenna is designed on 30 mil thick Rogers TMM10 substrate with  $\epsilon_r = 9.2$  and loss tangent of 0.0022.

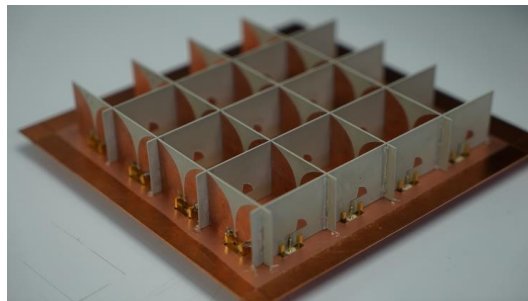


Figure 1. Photograph of the fabricated dual polarization  $4 \times 4$  sub-array Vivaldi antenna.

The proposed sub-array is then extended to  $8 \times 8$  array antenna using Keysight SystemVue simulation tool to provide beam steering of  $\pm 30^\circ$ , which is sufficient for a six sector base station system. Also, Keysight SystemVue tool is used to generate digital beamforming (DBF) based simultaneous multiple beams for the Massive MIMO arrays as a base station panel. Four simultaneous beams are presented for multi-user scenario using  $8 \times 8$  array antenna. Additional simulated and measured results on the sub-array and multiple beams will be presented during the conference.