# Performance of Planar Ortho-Mode Transducers for CMB satellite missions

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**Abstract**

Planar waveguide E-field probes have been used in a number of millimeter wave instruments although usually for single polarization detection in rectangular waveguide**.** The coupling efficiency of these types of probes is found to be high over the full waveguide bandwidth. Because of the advantages in integration, scalability and mass of planar OMTs compared to external waveguide OMTs, a planar OMT coupled to a corrugated horn is a good option for future CMB polarisation missions such as B-Pol. We estimate the performance of planar OMTs where the signals from the probes are combined after detection (power combination) and before detection (field combination) and show that under ideal circumstances the two methods give equivalent performance over a 20% bandwidth. However, field combination suppresses coupling to higher order waveguide modes and therefore enables wider bandwidth operation (up to 40%).

We present a design of an ortho-mode transducer (OMT) to separate two orthogonal linearly polarized signals traveling in a circular waveguide in the frequency band from 190-250 GHz band using 4 probes in circular waveguide. In this design, the power in each linear polarisation is divided between two opposite probes. A field combiner (hybrid coupler) combines the signals from the probes on opposite sides of the waveguide before detection using planar microstrip structures. We use Ansoft/HFSS 3-D electromagnetic simulation software and the Agilent Advanced Design System (ADS) to evaluate the performance of the design and to determine the optimal probe geometry and feed impedance. The main questions have been investigated for this technology are coupling efficiency and cross-polarization response, achievable bandwidth, and scalability.