

5:1 Bandwidth, Dual-Polarized Dielectric Rod Antenna

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Dielectric rod antennas (DRAs) are commonly used as reflector feeds and near-field probes because they exhibit single broadside beam, good polarization purity, wide bandwidth and low scattering cross section. Particularly for multiple reflector feeds, low cross-coupling and polarization purity of DRAs make them very attractive. More importantly, DRAs provide ultra-wideband (UWB) operation with a simple and easy-to-fabricate, cost-effective structure. However, the maximum achievable bandwidth is typically limited by the waveguide feed at the low end and the onset of higher-order modes of the dielectric rod at the high end of the frequency range. In the past, multi-layered DRA designs (C.-W. Liu and C.-C. Chen, "A UWB Three-Layer Dielectric Rod Antenna with Constant Gain, Pattern and Phase Center," *IEEE Transaction on Antennas and Propagation* 60(10), Oct. 2012) have been utilized to increase the frequency coverage. However, this adds significantly to design and manufacturing complexity.

In this paper, we present a novel, UWB DRA machined entirely from bulk rexolite_1422 material that covers the 6-32GHz range. A dual-polarization, tapered twin-lead structure was integrated on the feed taper of the dielectric rod to provide a transverse electromagnetic (TEM) structure and avoid the waveguide cutoff at the low end of the frequency band. A surface-mount RF switch is integrated into the feed for polarization control. The dielectric rod is made up of a uniform dielectric material, as such, its fabrication is low-cost and straightforward using standard milling tools. The design was optimized to cover the 6-32GHz band with a stable phase center, a symmetric pattern and a high realized gain (>10dB). A prototype was fabricated and tested up to 20GHz. The measured realized gain was >10dB and the measured radiation patterns exhibit low side lobes (SLL<-20dB) and agree well with the design in both the *E*- and *H*-planes. The return loss was below -10dB over a record 5:1 frequency band, spanning 4-20GHz.