Broadbeam Dual-Polarization UWB Dielectric Rod Antenna Design

Jae-Young Chung* and Chi-Chih Chen
The Ohio State University ElectroScience Laboratory
1320 Kinnear Road, Columbus, Ohio 43212
Chung.275@osu.edu, Chen.118@osu.edu

A novel dual-polarization dielectric rod antenna design that operates over a 9:1 bandwidth with broad beamwidth was developed at the ElectroScience Lab. Such design is useful as a reflector feed or near field probe. The key challenges of design an antenna for these applications include dual-linear polarization with more than 20 dB isolation, minimal phase center movement, ultrawide bandwidth and 3-dB beamwidth greater than 50 degree. Previous "polyrod" antenna designs were mainly for a single polarization, waveguide bandwidth and narrow beamwidth by designing the rod as a leaky wave launcher. The new design fully guides electromagnetic waves initially in a three-layer cylindrical waveguide and then radiate out at the truncated end whose geometry and composition is specially designed for minimizing internal reflection and pattern control. The diameters are 0.375", 1" and 2", and the dielectric constants from the inner most cylinder are 16, 6 and 4, respectively. These values are chosen such that the 9~18 GHz are mainly guided close to the inner most cylinder, 4~9 GHz are guided by the inner two cylinders, and 2~4 GHz are guided by the whole cylinder. The diameter is chosen to be less than the shortest wavelength in each band to produce single lobe pattern. The dielectric constant is then chosen to be high enough to effectively guide the waves in each band.

This new UWB rod antenna begins with a tapered feed section where four balanced 50 ohms coaxial cables are connected to the tip of four launcher arms. Each Launcher arm is terminated with tapered resistive film to reduce reflections. The radiation section is also gradually tapered so that waves of different frequencies can leave the guiding structure without abruptly changing the radiation positions. A low dielectric cap is added to the radiation end for reducing the reflection at the interface between high dielectric rod and air. The majority of the rod is housed inside a conducting cavity partially filled microwave absorber to eliminate stray radiation form the feed. Therefore, the only radiations occur at the tip of the rod. In our presentation, measured data of VSWR, radiation patterns, polarization, and gain would be discussed.

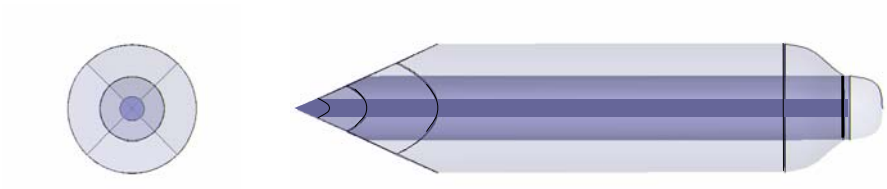

Fig.1 Cross-section and side view of the rod