Abstracts

Attenuation Characteristics of Circular Dielectric Waveguide at Millimeter Wavelengths

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Experiments were done to determine the practicality of using circular dielectric waveguide for a low-loss transmission line at millimeter wavelengths. The lowest order mode on a circular dielectric guide will propagate regardless of how small the guide diameter is. Thus it is possible to make the attenuation factor of a circular dielectric guide arbitrarily small by reducing its diameter. Loss measurements for several different diameters of polystyrene and Teflon rods were made at 72.70 GHz. The measurements were made by directly probing long sections of dielectric guide and plotting the average power as a function of length on an X-Y plotter. Dielectric constants were measured from the standing wave patterns of polystyrene Teflon, and fused quartz rods at 71.0 GHz. Teflon rods exhibited attenuation factors from 0.8 dB/m to 2.2 dB/m depending on the diameter. This is an improvement over silver waveguide at this frequency. Polystyrene rods were found to have attenuation factors ranging from 3.9 dB/m to 12.5 dB/m, again depending on the diameter of the rod. The measured dielectric constants are consistent with previously published data. The various attenuation factors are related to the intrinsic loss tangent of the dielectric using the theory of the HE/sub 11/ mode. Values of tan delta derived from measurements of different rods are consistent indicating that the experimental results are valid. The problem of radiation from dielectric rods is discussed. The experimental results are not conclusive but it appears likely that radiation loss is negligible.

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