

**FREE-SPACE MEASUREMENT OF COMPLEX
PERMITTIVITY AND COMPLEX PERMEABILITY OF
POLAR AND NON-POLAR RUBBER COMPOSITES AT
MICROWAVE FREQUENCY**



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ABSTRACT

This project involves a free-space measurement system operating in the 7.5-12.5 GHz frequency range to measure the reflection and transmission coefficients, S_{11} and S_{21} , of planar samples. It involves measurements of the dielectric constant, loss factor and loss tangent of the rubber composites. The complex electric permittivity and the magnetic permeability are calculated from the measured values of S_{11} and S_{21} using FORTRAN 77 and Borlan C++ computer programs. The measurement system consists of transmit and receive horn lens antennas, a network analyzer, mode transitions and a computer. Diffraction effects at the edges of the samples are minimized by using spot-focusing lens antennas. Errors due to multiple reflections between antennas via the surface of the samples are corrected by using a free-space LRL (line, reflect, line) calibration technique. Because of the samples used in this measurement is thin and flexible, it had to be sandwiched between two half-wavelength (at mid-band) quartz plates, to eliminates the effects of sagging. Results are reported in the operating frequency as stated above for the material used which is Teflon. To eliminate the effect of Teflon, Borlan C++ computer program is used.

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