Title: Permittivity measurement techniques and applications

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Biography: Philip Bartley received a BS and MS in Electrical Engineering from Old Dominion University in 1973 and 1976. He received his Ph.D. from the University of Georgia in 2005. He was a microwave systems engineer and district manager at the Hewlett Packard Company. He has taught at the Southern Polytechnic State University, Old Dominion University and the University of Georgia. In 1997 he was named ASAE teacher of the year at the University of Georgia. While at Georgia he worked with the Agricultural Research Service of the USDA. This work involved measuring the permittivity of agricultural products. These measurements can be correlated to moisture content, fruit ripeness and product quality. He is currently working with Agilent Technologies developing materials property measurement techniques. He has written numerous technical papers. His current interests include using electromagnetic property measurements as a sensor for agricultural, pharmaceutical, medical, biological and chemical processes.

Abstract: An overview of the techniques commonly used for measuring the permittivity, dielectric properties, of materials is given. Examples of measurement systems used to measure permittivity from a few hertz to 1 THz are discussed. The physical/chemical mechanisms that determine the permittivity of a material are examined. A review of applications where the knowledge of permittivity is important is included. These applications include the obvious electrical engineering applications and the not so obvious applications in other fields of science. Examples of physical properties that can be correlated to permittivity will be given. These examples include moisture content, biomass, bulk density, bacterial content, cancer detection, chemical reaction and fruit ripeness. This tutorial will be of interest to engineer and scientists involved in the design and development of electrical/electronic components, circuits and systems. This includes scientists and engineers involved in the development of low-observable or stealth vehicles. It will also be of interest to scientists and engineers involved in sensor development and design.