

We have performed a series of experiments, which demonstrate the effect of open-ended coaxial diameter on the depth of penetration. We used a two-layer configuration of a liquid and movable cylindrical piece of either Teflon or acrylic. The technique accurately demonstrates the depth in a sample for which a given probe diameter provides a reasonable measure of the bulk dielectric properties for a heterogeneous volume. In addition, we have developed a technique for determining the effective depth for a given probe diameter size. Using a set of simulations mimicking four 50-  $\Omega$  coaxial cable diameters, we demonstrate that the penetration depth in both water and saline has a clear dependence on the probe diameter, but is remarkably uniform over frequency and with respect to the intervening liquid permittivity. Two different 50-  $\Omega$  commercial probes were similarly tested and confirm these observations. This result has significant implications to a range of dielectric measurements, most notably in the area of tissue property studies.