

## **Statistical Characterization of Through-Wall Attenuation at 10 and 30 GHz**

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Detailed knowledge of through-wall attenuation plays a critical role in prediction of the coverage of indoor and indoor-outdoor wireless communications systems. As high-throughput systems operating in the millimetre-wave bands begin to emerge, there is a pressing need to investigate through-wall attenuation at higher frequencies. Because walls are generally complex, multi-layered structures, knowledge of the dielectric properties of the superficial wall material is generally insufficient to predict the relevant propagation behaviour. Intuition suggests that propagation characteristics will vary between general wall types, different walls of the same general type, and different locations on a given wall. Such differences will be greatest for exterior walls, moderate for interior load bearing walls, and least for interior partition walls. While past work has tended to focus on reporting isolated measurements, a more complete statistical characterization is highly desirable in practical applications.

To this end, we conducted through-wall attenuation measurements at 10 and 30 GHz at tens of exterior, interior load bearing and interior partition walls around the University of British Columbia campus. Measurement efficiency and accuracy were prime considerations so we created an automated test fixture based upon bismar slider positioners to simplify collection of measurement data at multiple points on a given wall. Based on the measured data, we developed a statistical model of through-wall attenuation that captures the manner in which through-wall attenuation (in dB) and the attenuation constant (in dB/m) varies between general wall types, different walls of the same general type, and different locations on a given wall together with a general indication of how these results scale with frequency. The results will be of tremendous value to those who need to conduct system level studies or ray tracing based simulations of indoor and indoor-outdoor wireless communications systems.