Measurements of Radiowave Propagation in a Partially Constructed Building

Andrew C. M. Austin*, Michael J. Neve, and Kevin W. Sowerby
Department of Electrical, Computer, and Software Engineering,
The University of Auckland, Auckland, New Zealand

Reliable models to predict radio signal strength are essential for the successful deployment of wireless communications systems within buildings. In particular, these models are used to plan access-point placement to achieve sufficient signal coverage throughout a building, while ensuring low-levels of interference between co-channel access-points. Widely used empirical models (e.g., S. Siedel and T. Rappaport, IEEE T-AP 40(2), 1992) are based on extensive measurement campaigns in a number of buildings, and typically use distance-dependency relationships to predict the pathloss. Additional 'tuning' factors, such as variable floor attenuation can be included to improve the model accuracy.

One of the unresolved questions with empirical models is the extent to which internal "soft" walls and partitions affect propagation. The long-standing view is that radiowave propagation is dominated by "hard" structural elements of the building, e.g., concrete floors and steel supports which act to guide/constrain radio waves, while "soft" partitions do not fundamentally alter these dominant propagation mechanisms. More recently this assumption has been challenged via the use of large and novel computational analysis, which has shown the cumulative effect of many "soft" partitions and interior details (such as office furniture) can alter the dominant propagation paths (A.C.M. Austin, M.J. Neve and G.B. Rowe, IEEE T-AP 59(11), 2011). However, experimental verification measurements are typically only able to be performed when the building is "occupied", i.e., with all the internal partitions already installed.

The erection of a new building provides a unique opportunity to experimentally determine the cumulative impact of "soft" walls and internal partitions on the propagation mechanisms for a multi-storey building. Figure 1 shows a contour plot of the pathloss measured with only the concrete floors and ceiling present (i.e., no internal or exterior walls). Further experiments will be performed as construction progresses, and the datasets compared to determine the impact of interior and exterior walls.

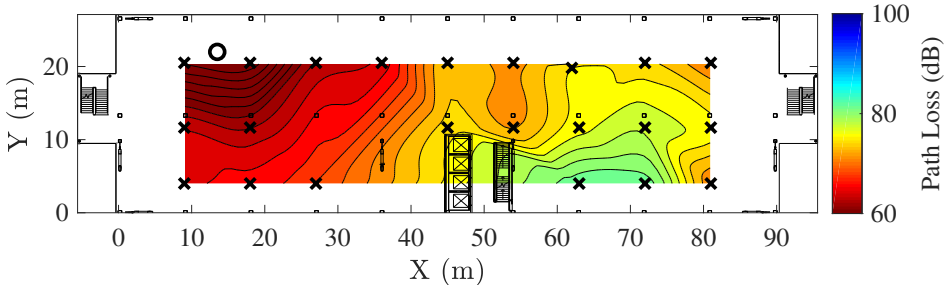

Figure 1: Contour map of pathloss measured across the floor of a building, receiver locations marked with ×, and transmitter location marked with ∘.