Using Six Sigma Modeling Techniques to Validate and Generalize In-Building Path Loss Models

Mark McFarland and Bob Johnk
Institute for Telecommunication Sciences, Boulder, Colorado 80305
http://www.its.bldrdoc.gov

Developing a model to describe a sample (i.e., field data we collect) is only the first step of any modeling effort. Ultimately, the ambition of any researcher is to *generalize*: to use our field sample to learn about the population from which it came. When models are generalizable to a population, we have adequately characterized the phenomena we are studying, and our models are valid and useful.

Linear regression models are valid, useful, and generalizable, if and only if the four underlying assumptions of regression analysis are met: independence, linearity, homoscedacity, and normality. These assumptions concern the distribution of the errors, or residuals, from the regression model. When the assumptions are met, a model is *validated* and allows us to infer properties of the population from the sample we collected.

We developed linear regression models using field data we collected at six locations in and around the University of Colorado's Discovery Learning Center. The models describe the distance versus path loss relationships from an indoor Band 14 LTE Small Cell transmitter. In this presentation, we present our in-building path loss models and discuss model development and validation.

We present graphical and quantitative statistical methods from the Six Sigma sciences which are used to validate the four assumptions of regression modeling. These methods are used in many fields, such as finance, economics, manufacturing, pharmaceuticals, and marketing. The new knowledge we present to this field is the application of Six Sigma modeling techniques to validate and generalize radiowave propagation models.