Effects of antenna proximity on received-power measurements of large-form-factor wireless devices in reverberation chambers

Willem Burger[1,2], *Student Member IEEE*; Kate A. Remley[1]*, *Senior Member, IEEE;* Christopher L. Holloway[1], *Fellow, IEEE*

[1]*National Institute of Standards and Technology (NIST), Electromagnetics Division, 325 Broadway, Boulder, CO 80305 USA, holloway@boulder.nist.gov, 303-497-6184*
[2]*Faculty of Electrical Engineering, Electromagnetics group, Technical University Eindhoven, 5612AZ Eindhoven, The Netherlands, w.t.c.burger@student.tue.nl*

Recently, the use of reverberation chambers for various measurements of wireless devices has received increased attention. The relatively low cost of reverberation chambers often allows for cost-effective free-field testing of devices having a variety of form factors. In parallel, the implementation of machine-to-machine (M2M) communication systems with large form factors such as automatic teller machines, vending machines, and parking meters has become more widespread. Recent research has shown that large form-factor devices can affect received-power measurements by decreasing the spatial uniformity of a reverberation chamber (Van de Beek et al.,"Characterizing Large-Form-Factor Devices in a Reverberation Chamber", 2012). Shadowing of the receive antenna by the load may also affect spatial uniformity on a local scale. The research presented will show the effects of these decreases in spatial uniformity and relate these effects to the proximity and orientation of a receive antenna with respect to large-form-factor loads in a reverberation chamber.

For the experiment, a receive antenna, consisting of a monopole antenna with a finite ground plane, was placed at various distances and angles with respect to a certain load in the chamber. The antenna and load, represented by a stack of blocks of RF absorbing material, were used to model a large-form-factor device. We illustrate that large-form-factor loads effectively block incoming radiation to a receive antenna, and that this effect is more pronounced when the antenna's gain pattern is oriented towards the load in the reverberation chamber. Figure 1 illustrates the blocking effect of a large load on the gain pattern of a monopole antenna. The pattern itself is shown in green, with a section in red indicating the blocked section. Figure 2 shows the effect on received power of antenna proximity and orientation with respect to the load. From Figure 2 it can be seen that the effect can be in excess of 3 dB, warranting consideration of the placement of antennas on large-form-factor devices.

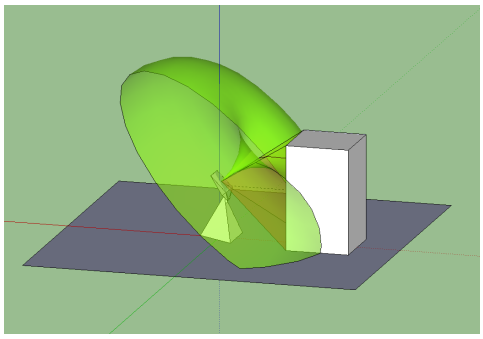

Figure 1. Effect of a large-form-factor load on received power.

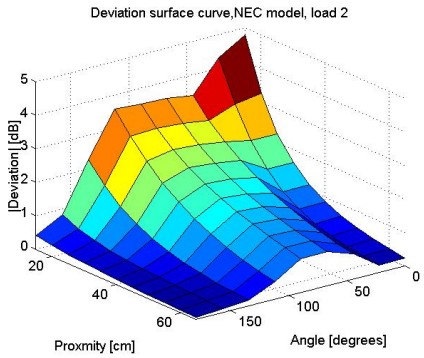

Figure 2. Attenuation surface curve for two absorber blocks