**Evaluation of Harmful Interference in Realistic Operating Environments**

Sakshi Srivastava* and Jennifer T. Bernhard
Electromagnetics Laboratory
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign, Urbana, IL 61801

With the unprecedented rise of the wireless devices available to the public comes an inevitable congestion in the frequency spectrum. In such a situation, it is necessary to utilize the spectrum judiciously and promote spectrum sharing. Interference may occur when two or more devices share the same part of the spectrum. Whether this interference can be harmful and cause significant disruption of communication of the desired signal depends on a number of factors.

The International Telecommunication Union Radio Regulations define harmful interference as "interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations" (Radio Regulations, 2016 ed., vol. 1. ITU, p. 23). While this definition is being used to keep interference at bay, it may be too open-ended for newer technologies to be introduced in the market, since it creates uncertainty about not meeting this unspecific metric. To reduce the uncertainty around what constitutes both harmful and acceptable levels of interference, we need to more carefully define exactly what these terms mean from a technical point of view. Without this definition, it will be difficult moving forward to convince regulators, engineers, and users to spend resources and time in the development of technology and policies that can support spectrum sharing. (T. X. Brown, IEEE DySPAN, pp. 11--29, 2005). In order for engineers to develop and deploy devices capable of spectrum sharing, it is important to provide more concrete constraints on the transmitters, the receivers, and the physical factors, so that truly harmful interference can be avoided or mitigated by newer technology.

This presentation will explore the need for more efficient spectrum management, focusing on identifying specific factors that make any interference harmful and the ways in which these factors affect the desired signal. The factors discussed in the presentation include input power, frequency of operation and bandwidth, antenna properties, and intended operating environment. It also sheds light on using antenna radiation pattern and other design trade-offs that could be used to reduce or avoid interference. In order to achieve this, multiple configurations of transmitters and receivers are simulated in an indoor setting, and the power received from each transmitter at each receiver is evaluated. This allows one to acquire information about the power received and consequently, the interference caused, as a function of the factors mentioned above. We explore how to interpret these results and provide several alternate definitions of harmful interference for a number of usage scenarios.