Researchers call for reformed safety standards for wireless devices

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Millimeter-wave (mmWave) wireless technology promises to support high-bandwidth content at speeds exceeding 10 gigabits per second—a

thousand times today's current mobile phone download speeds—but with that promise comes public concern about the health risks associated with utilizing the high-frequency radio waves in that spectrum.

A multidisciplinary team of NYU researchers notes that unlike X-rays and gamma rays, which are called "ionizing radiation" and are known to cause genetic mutations due to their excessive energy levels, millimeter waves are "non-ionizing," with a million times less energy, and are known to cause mainly heating effects, which their simulations have shown to be negligible at levels below current exposure guidelines.

In June 2015 the researchers—NYU Polytechnic School of Engineering doctoral student Ting Wu, NYU WIRELESS Director Theodore "Ted" Rappaport, and Christopher Collins, a professor of radiology at the NYU Langone School of Medicine—published "The Human Body and Millimeter-Wave Wireless Communication Systems: Interactions and Implications," detailing their study, which used four models representing different body parts (both clothed and unclothed) to evaluate the thermal effects of mmWave radiation on humans. Their simulation showed the steady state temperature increases—even of clothed parts with less blood flow such as the forehead of a person wearing a hat—are negligible compared with the environmental temperature variations when the exposure intensity is similar to that likely to be used in a next-generation cellphone.

Their paper—which was chosen as the best from several hundred entries at the 2015 IEEE Conference on Communications, one of the flagship gatherings of the IEEE Communications Society—called for temperature changes in the tissues of the body to be used as a safety metric for mobile devices operating at mmWave frequencies, rather than power density, now the standard.

"Because future devices will operate on a spectrum with different

properties than today's communications devices, FCC rules and regulations on safety must be reviewed and adjusted accordingly," says Rappaport, who is the founder and director of NYU WIRELESS, the first university center to combine wireless engineering, computing, and medical applications research and home to pioneering experimentation with the mmWave spectrum. "Additionally, current safety rules regarding radio frequency exposure don't specify limits above 100GHz, but because spectrum use will inevitably move to these bands over time, safety metrics must also be codified at these frequencies."

Because magnetic resonance imaging (MRI) provides an efficient method of mapping thermal changes in the body and because the cost of such imaging is decreasing, the researchers suggest that it be employed by wireless manufacturers and regulatory bodies in the future.

"MRI systems utilize electromagnetic energy at a wide range of frequencies to provide high-resolution, three-dimensional images at ever-increasing scan speeds, and researchers in our group have shown that MRI can be used to map temperature increases caused by electromagnetic fields—from the low radio frequency to millimeter wave regime. It can thus be employed to guarantee the safety of communications devices well into the future," says Collins. "As an MRI engineer, I was gratified to collaborate on this project with NYU's other engineers to help ensure that when fifth-generation mobile technology becomes available to consumers, it will be safe and well-regulated."

More information: The research paper is available here.

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