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Considerations for Successful 5G Technology Deployment

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2019 is a pivotal year for 5G, the fifth-generation technology that will bring a paradigm shift in the wireless communication marketplace. 5G technology promises a multitude of benefits, including peak download speeds of 20 gigabits per second;[1] latencies (the delay before communication starts) reduced to one millisecond or less; and the potential to greatly increase the number of connected devices without reliance on a central connection point.

U.S. carriers are already rolling out 5G networks in select cities. In October 2018, Verizon launched a 5G home broadband service using a mobile hot spot in Houston, Indianapolis, Los Angeles, and Sacramento, while AT&T is targeting Dallas, Atlanta, and Charlotte. Other broadband and network providers expect to go live with 5G network access on a limited regional basis in 2019 with expected full connectivity in 2020. In parallel, by mid-year, Samsung and LG expect to launch new cell phone architecture fueled by Qualcomm's Snapdragon 855 Mobile Platform that is compatible with 5G technology. These efforts are forecasted to provide between 20 million to 100 million 5G connections by 2021 with a predicted mobile infrastructure expenditure of $2.3 billion that same year.[2]

While 5G's potential is vast, open technological and social questions remain before large-scale deployment is complete. How will 5G-compatible devices be developed and deployed? How will networks evolve to route increased traffic? How will security risks and public concerns over potential health effects of radiofrequency (RF) exposure be addressed? As 5G progresses, it will be important for device manufacturers and network providers to develop clear messages and a comprehensive plan of action to address the technological complexities, security risks, and potential health concerns associated with the deployment of 5G technology.

Some of these complexities are being addressed by 5G standards like those from the International Telecommunication Union and the 3rd Generation Partnership Project.[3,4] These standards address allocation of global radio spectrum and technical standards (ITU) and usage of the same communication protocols around the world (3GPP). In addition to technical specifications, device manufacturers and network providers also need to consider how best to minimize security risks with the shift to device-to-device communication. Today's 3G and 4G devices interact with a central point that users, in general, assume will protect their data. A 5G device will use other devices as a chain or network to get messages where they need to go. For example, a self-driving car may be on the highway communicating with hundreds of other cars. The range of 5G signals are limited, so instead of communicating directly with a central tower that is miles away, the car will talk to other nearby cars, which will forward the information along the chain to the cars in front and behind. This example highlights a potential security concern. How does one maintain data integrity when communicating directly with and through other user devices that are not under central control?

Recent publications also highlight why the entire industry needs to stay abreast of research regarding the potential effects of RF signals on human health. The National Toxicological Program (NTP), a branch of the U.S. Department

[1] https://spectrum.ieee.org/video/telecom/wireless/everything-you-need-to-know-about-5g
[2] https://www.statista.com/topics/3447/5g/
[3] http://www.3gpp.org/about-3gpp
[4] https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.5G_01-2018-PDF-E.pdf

of Health and Human Services, concluded in November 2018 that there is "clear evidence that male rats exposed to high levels of radio frequency radiation (RFR), like that used in 2G and 3G cell phones, developed cancerous heart tumors."[5] The International Commission of Non-Ionizing Radiation Protection (ICNRP) later concluded "that the NTP … studies do not provide a consistent, reliable and generalizable body of evidence that can be used as a basis for revising current human exposure guidelines" and that "consideration of their findings does not provide evidence that radiofrequency EMF is carcinogenic[6] Both ICNIRP and the IEEE International Commission for Electromagnetic Safety (ICES) are currently updating their standards to address the safe limits for human exposure for the much higher frequency of 5G signals.

Successful deployment of 5G will require an intimate understanding of the above technological, security, biological, and regulatory considerations. Exponent's multidisciplinary team of electrical engineers, epidemiologists, medical doctors, and security and regulatory experts can evaluate health-based issues; assess device-to-device signal interference; support certification of devices for network and FCC compliance; guide security requirements; and identify potential pitfalls associated with device communication and the Internet of Things (IoT).

[5] https://factor.niehs.nih.gov/2018/11/feature/1-feature-radiation/index.htm
[6] https://www.icnirp.org/cms/upload/publications/ICNIRPnote2018.pdfr

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