# Our 5G future: in the fast lane with numerical simulation

*5G and IoT are among the hottest topics being discussed in the RF and microwave industry. Every day, activities and technological advancements depend more than ever on reliable, fast data communication.* ***Jiyoun Munn, RF Technical Product Manager at multiphysics software developer, COMSOL*** *explains how designers are now faced with one of their biggest challenges, as they strive to take real-time data usage and availability to the next level – which requires access to the best design tools, and significant advances in signal processing, device-centred communications and evolving technical standards.*

**It's expected that 5G will need to utilise higher frequency spectrums, in the millimetre wave (mmwave) range, when deploying active electronically scanned array (AESA), which enable multi-beam multiplexing and massive multi-input-output (MIMO) technologies (Figure 1). Researchers working on the frontlines of forging this ultra-fast and high bandwidth successor to 4G LTE are relying on modelling and simulation tools to optimise product development and test cycles.**

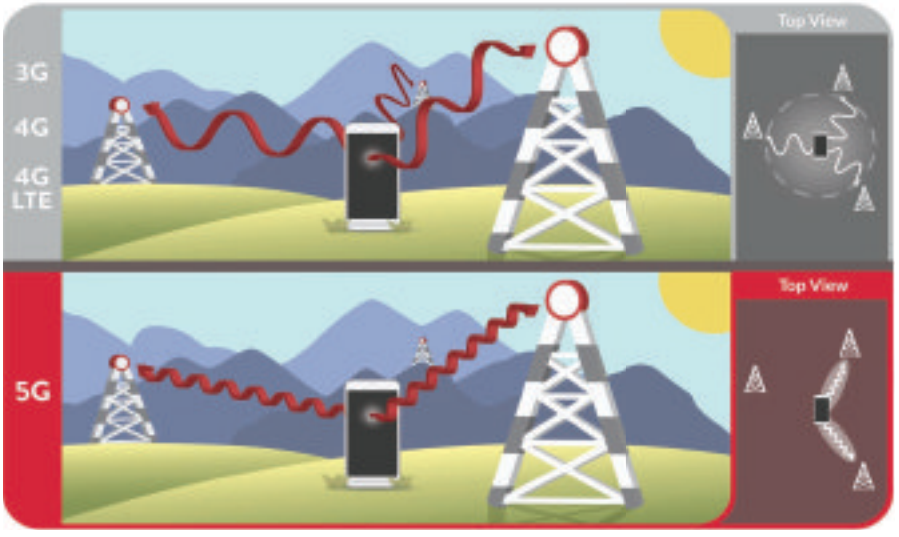


*Figure 1. Isotropic radiation pattern was preferred before the 5G era (top). Antennas generating higher gain (directivity) radiation patterns are required for 5G mmwave communication to compensate for the path loss in free space (bottom)*

Simulation supports engineers throughout the design cycle by allowing them to virtually evaluate multiple design ideas, and implement physical prototypes based on the most promising concepts. Another advantage is the possibility to investigate different boundary conditions: simulation allows engineers to efficiently measure and test several scenarios without damaging a prototype (in cases such as extreme temperature variation, structural deformation or chemical reactions). The goal of simulation is to mimic the real world as closely as possible, so that the prototype is based on numerical results that achieve the expected performance in fewer design and test iterations.

## Design simulation via apps

In preparation for the 5G rollout, designers are working through numerous obstacles, including frequency choices, propagation, reliability, battery life and interference, to name a few. Each of these challenges is represented by a unique blend of physics, requiring a simulation specialist in that specific area, who is equipped with the right tools to set up the underlying mathematical model properly. The symbiosis between designers and simulation specialists must be optimised to deliver the right product at the right time.

Simulation experts are typically the only ones who can safely provide the input data needed to get a useful output from a model. They therefore have to be involved in the iteration process every time there is a new request or change to be made in the device being simulated. Additionally, results or outputs are often presented in an environment only familiar to the specialist, so distributing information to their colleagues often requires presenting an explanation and interpretation of the results.

But what if simulation specialists could easily build simulation apps? In other words, wrap an intuitive interactive user interface around a complex mathematical model. What if users without any previous experience using simulation software could run apps specifically designed for them? Simulation apps make it possible for simulation specialists to efficiently and effectively support the designers working on the next breakthrough in the ultra-competitive landscape of wireless communication. Supplied with the right tools, designers focused on 5G implementation can freely collaborate and complement their skills with those of their colleagues and collaborators, who specialise in physics and numerical analysis.

*Simulation supports designers throughout the design cycle by allowing them to virtually evaluate several design ideas and implement physical prototypes based on the most promising concepts.*