

What's News...

Qualcomm sets new benchmark for 5G data rates

By any yardstick, deployment of 5G wireless infrastructure is booming. The CTIA reports that the industry spent \$30 billion in networks last year, a 5-year high and the third year of increased capital expenditures. And in the past five years, wireless carriers have spent nearly \$140 billion for a total investment of more than \$600 billion, not including spectrum acquired at auction. In the last two years, more cell sites have been added than the previous 7 years combined. The research group IDTechEx predicts that by 2031 45 million cells will have been deployed, primarily for millimeter-wave frequencies.



Air Force unleashes massive EW program

The Air Force is about to launch what it calls Project Kaiju, which is a \$150 million program that focuses on cognitive

A Word from Sam Benzacar

5G: Will Millimeter Waves Be High Enough?

By Sam Benzacar



Even though wireless carriers are just now rolling out millimeter-wave networks, the industry is already looking toward 6G and the use of frequencies well above 100 GHz and incredibly enough even into the terahertz region. Logic dictates that if it's already difficult to overcome the limitations of the current frequencies up to 40 GHz, operating at much higher frequencies will be all but impossible, or so it would seem. For example, a full wavelength at 100 GHz is 3 mm and a minuscule 0.3 mm at 10 THz. So, theoretically, if immense challenges can be overcome, entire systems could be constructed in fractions of an inch.

Researchers throughout the world are already exploring how to make this happen, and they have great plans for it. Despite the technical technological difficulties that will be encountered, the terahertz region, defined as 300 GHz to 10 THz, offers unique benefits primarily because of extraordinary narrow beamwidths that will result from the use of active phase-array, beam steerable antennas that would make signals highly resistant to interference and extremely difficult to jam, which is why Department of Defense already uses frequencies high in the millimeter-wave spectrum for intersatellite communication. The virtually unlimited amounts of available spectrum would also make it possible to achieve data rates of a blistering 1 Tb/s (1 million Mb/s), 1000 times faster than 5G.

electronic warfare, artificial intelligence, and advanced systems integration. In EW terms, this is an extremely large contract and reflects the fact that America's fighter aircraft are expected to be operating in environments that are heavily defended by integrated air-defense systems. Both Russia and China have demonstrated these capabilities that without equally advanced countermeasures could thwart the best efforts of allied forces in the future. The program calls for high levels of autonomy and extensive use of machine learning to automate the process of threat detection, characterization, and response. It also aims to integrate multiple types of sensors within a single system, such as EO/IR as well as RF.



DARPA wants to tame the Wild West satcom environment

With the enormous growth of low-earth-orbit satellites, DARPA is seeking to collaborate with the private sector to develop seamless optical communications links between commercial and defense spacecraft. According to the program's manager, the current lack of communications link standards has resulted in a stove-piped domain in which commercial and government satellites cannot communicate with each other. The program, called Space-Based Adaptive Communications Node, hopes to change this with the end result being a cohesive communications approach that provides benefits for both private industry and DoD.



China claims to have quantum radar, again

I may be naïve, but I find it difficult to believe that speeds like this would be of use to most people because even millimeter-wave networks, once fully deployed, will allow us to download two-hour movies in a few seconds. However, when the need for terahertz operation appears, presumably at least a decade from today, there will surely be applications that can benefit from it. The most frequently mentioned include high-definition holographic gaming, high-speed wireless data distribution in data centers, wireless cognition, remote sensing, and very precise positioning and location.

As an aside, even though it's generally assumed that atmospheric absorption increases with frequency, it does not do so in a linear fashion. That is, at millimeter-wave frequencies and higher, the resonant frequencies of oxygen, hydrogen, and other gases in the atmosphere result in levels of electromagnetic energy absorption that vary with frequency. And although much of the spectrum between 600 and 800 GHz suffers massive attenuation of 100 to 200 dB/km, over a distance of 100 m this amounts to only 10 or 20 dB, which also happens to be the typical coverage of a small cell, so it might be a tolerable level.

Suffice it to say that if there is a need, technology will provide an answer; the question is whether it will actually need to.

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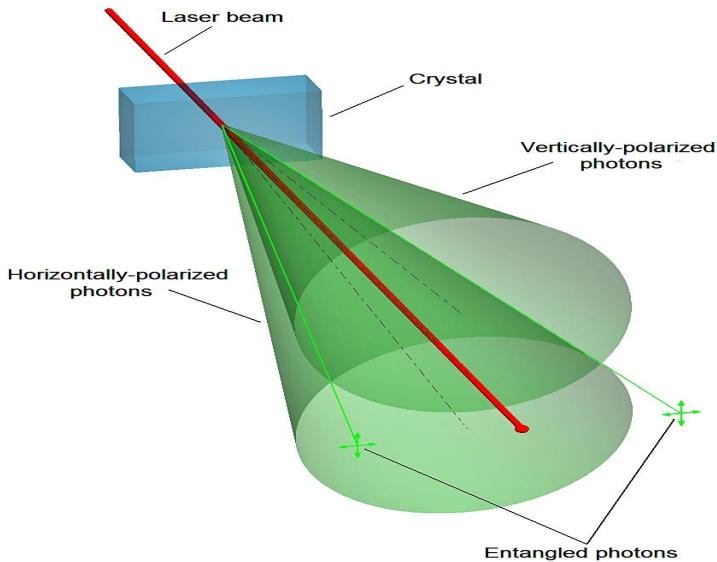
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Researchers in China have gone on record as saying they have developed a quantum radar that can detect stealth aircraft. Quantum radar is the Holy Grail of researchers, is extraordinarily complicated, and some believe it may not even be possible. However, the researchers at Tsinghua University explained in her a paper appearing in the Chinese Journal of Radars that even though it is a formidable undertaking if achievable quantum radar could make all types of stealth countermeasures useless. The researchers also claimed to have tested a scaled-down version of such a device in the university's laboratory that increased the chances of a stealth aircraft being detected by up to 95%.

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