Terahertz wireless technology could bring fiber-optic speeds out of a fiber

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Hiroshima University, the National Institute of Information and Communications Technology, and Panasonic Corporation announced the development of a terahertz (THz) transmitter capable of signal transmission at a per-channel data rate of over ten gigabits per second over multiple channels at around 300 GHz. The aggregate multi-channel data rate exceeds one hundred gigabits per second. The transmitter was implemented as a silicon CMOS integrated circuit, which would have a great advantage for commercialization and consumer use. This technology could open a new frontier in wireless communication with data rates ten times higher than current technology allows. Details of the technology were presented at the "International Solid-State Circuit Conference (ISSCC) 2016," held from January 31 to February 4 in San Francisco, California.

The THz band is a new and vast frequency resource not currently exploited for wireless communications. Its frequencies are even higher than those used by the millimeter-wave wireless local area network (from 57 GHz to 66 GHz), and the available bandwidths are much wider. Since the speed of a wireless link is proportional to the bandwidth in use, THz is ideally suited to ultrahigh-speed communications. The research group has developed a transmitter that covers the frequency range from 275 GHz to 305 GHz. This frequency range is currently unallocated, and its future frequency allocation is to be discussed at the World Radiocommunication Conference (WRC) 2019 under the International Telecommunication Union Radiocommunication Sector (ITU-R).

Today, most wireless communication technologies use lower frequencies (5 GHz or below) with high-order digital modulation schemes, such as the quadrature amplitude modulation (QAM), to enhance data rates within limited bandwidths available. The research group has successfully demonstrated that QAM is feasible at 300 GHz with CMOS and that THz wireless technology could offer a serious boost in wireless communication speed.

"Now THz wireless technology is armed with very wide bandwidths and QAM-capability. The use of QAM was a key to achieving 100 gigabits per second at 300 GHz," said Prof. Minoru Fujishima, Graduate School of Advanced Sciences of Matter, Hiroshima University.

"Today, we usually talk about wireless data-rates in megabits per second or gigabits per second. But I foresee we'll soon be talking about terabits per second. That's what THz wireless technology offers. Such extreme speeds are currently confined in optical fibers. I want to bring fiber-optic speeds out into the air, and we have taken an important step toward that goal," he added.

The research group plans to further develop 300-GHz ultrahigh-speed wireless circuits.

"We plan to develop receiver circuits for the 300-GHz band as well as modulation and demodulation circuits that are suitable for ultrahigh-speed communications," said Prof. Fujishima.

Provided by Hiroshima University