Extreme high-frequency signals enable terabits-per-second data links

31 March 2020

They used a device with two wires running parallel inside a sheath with a large diameter that facilitates increased mixing of the waveguide modes. These mixtures enable the transmission of parallel noninterfering data channels. Higher frequencies allow larger bandwidth and more data to travel through a channel, if the architecture of the channel is such that the data is not garbled by interference.

"To confirm and characterize this behavior, we measured the spatial distribution of energy at the output of the waveguide by mapping the waveguide's output port, showing where the energy is located," author Daniel Mittleman said.

The researchers created a 13- by 13-millimeter grid for the output of each possible input condition, resulting in a 169 x 169 channel matrix that provides a complete characterization of the waveguide channel. The results demonstrate a superposition of waveguide modes in the channel and allow estimation of data rates.

"It is exciting to show that a waveguide can support a data rate of 10 terabits per second, even if only over a short range. That's well beyond what anybody has previously envisioned," Mittleman said. "Our work demonstrates the feasibility of this approach to high-rate data transmission, which can be further exploited when the sources and detectors reach the appropriate level of maturity."

The researchers intend to further investigate ohmic losses, a function of the resistance of each of the cell components and caused by the metal hardware of the waveguide, which dictate the limit on the length of the channel. Their work could be used in applications that require large amounts of data to move quickly over short distances, such as between racks in a data center or for chip-to-chip communication.
