Title: Electronic Systems at MMW/THz frequencies for short-range communications

General description

In the past years, the ever increasing demand on the capacity of wireless communication indicates the data rate will reach beyond 100 Gbit/s with the same trend. One solution is to improve the spectrum efficiency by using advanced modulation formats within regulated narrowband in millimetre-wave band, this technique however will consume higher link linearity, larger link dynamic range and more complex transceiver as cost. On the other hand, ultrahigh data rates beyond 100 Gbit/s (eventually Tbit/s) are still very difficult, as the achievable data rate is upper limited according to Shannon's channel capacity theorem. Alternatively, to overcome the channel congestion in the long run, there have been increasing interests in extending the carrier frequency for ultra-fast wireless communication into higher frequency band.

In the past decade, there has been a significant surge of progress in enabling integrated, compact and efficient chip-scale THz technology, which could close the THz gap in meaningful ways. This progress is a result of a concerted effort stretching across a wide range of areas including solid-state and photonic devices. Therefore, the technology for such systems is gradually becoming available. It would be desirable to have integrated (on-chip) electronic/photonic systems able to generate, transmit and receive the signals required for short-range high-capacity applications with minimum space occupation and at an affordable cost.

Students task description

The students should identify the basic requirements of a system usable for short-range high-capacity applications, in terms of performances, but also price, size, and availability. Then, they should identify the basic technologies and topologies for an electronic/photonic implementation of a communication system.

Recommended background

Students must have knowledge on mm-wave and THz technology and components (transmitters, receivers, optics).

Site URL

N/A

References:

X. Yu *et al.*, "Exploring THz band for high speed wireless communications," *2016 41st International Conference on Infrared, Millimeter, and Terahertz waves (IRMMW-THz)*, Copenhagen, Denmark, 2016, pp. 1-2, doi: 10.1109/IRMMW-THz.2016.7758359.

Sengupta, K., Nagatsuma, T. & Mittleman, D.M. Terahertz integrated electronic and hybrid electronic–photonic systems. *Nat Electron* **1**, 622–635 (2018). https://doi.org/10.1038/s41928-018-0173-2

X. Yu, Y. Chen, M. Galili, T. Morioka, P. U. Jepsen and L. K. Oxenløwe, "The prospects of ultra-broadband THz wireless communications," *2014 16th International Conference on Transparent Optical Networks (ICTON)*, Graz, Austria, 2014, pp. 1-4, doi: 10.1109/ICTON.2014.6876675.