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THz Communications for 6G

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While THz communications has been a pure research topic in the last two decades, it is now seen as a candidate for the upcoming sixth generation (6G) of wireless systems [1,2,3]. This will enable the realization of wireless data rates of up to 1 Tbps. Possible applications requiring such data rates are fixed point-to-point links, such as wireless mobile backhauls links or wireless links in data centers complementing or replacing fiber links typically used in such environments. Other applications requiring high data rates are wireless connected robots or Augmented or Virtual Reality. However the high path loss at this frequency range requires high-gain antennas, which creates challenges especially for mobile scenarios in the areas of device discovery or beam tracking [4]. The harsh propagation conditions have triggered research activities on channel characterization, see e.g. [5]. Apart from exciting research going on in THz communications, discussions and activities in standardization and regulation already took off. In October 2017, IEEE published Std. IEEE 802.15.3d-2017 the worldwide first wireless communications standard operating in the 300 GHz frequency band [6]. At the World Radio Conference 2019 (WRC-2019) 137 GHz of additional spectrum has been identified for the use of THz communications [7]. Together with the already allocated 23 GHz of spectrum between 252 and 275 GHz this provides 160 GHz of available spectrum for THz communications. Furthermore, ETSI has recently kicked-off an ETSI ISG THz [8,9] to perform pre-standardization work targeting future standardization in 3GPPP. In order to support and catalyze these developments several projects dealing with THz for 6G have been started in Europe within the Smart Networks and Services Joint Undertaking (6G-SNS-JU) of the European Union [10]. The talk will provide a brief overview on the current status of the development of THz Communication systems focusing on ongoing large research projects in Europe, and at current activities at IEEE 802 and ETSI.

References

[1] Latva-aho, M. & Leppänen, K., (Eds.). (2019). Key Drivers and Research Challenges for 6G Ubiquitous Wireless Intelligence. 6G Research Visions, No. 1. University of Oulu. http://urn.fi/urn:isbn:9789526223544

[2] Pärssinen, A., Alouini, M., Berg, M., Kuerner, T., Kyösti, P., Leinonen, M. E., Matinmikko-Blue, M., McCune, E., Pfeiffer, U., & Wambacq, P. (Eds.). (2020). White Paper on RF Enabling 6G – Opportunities and Challenges from Technology to Spectrum. 6G Research Visions, No. 13. University of Oulu. http://urn.fi/ urn:isbn:9789526228419

[3] 6G-RIC Position Paper, “Toward 6G: Key Directions and research Questions”; https://6g-ric.de/download/41054/?tmstv=1673338452

[4] Doeker, T., Boban, M., Kürner, T.: A ray tracing‐assisted device discovery approach for low terahertz communications”, IETMicrow.AntennasPropag.17(8),614–623(2023).https://doi.org/10.1049/mia2.123

[5] C. Han et al., "Terahertz Wireless Channels: A Holistic Survey on Measurement, Modeling, and Analysis," in IEEE Communications Surveys & Tutorials, vol. 24, no. 3, pp. 1670-1707, thirdquarter 2022, doi: 10.1109/COMST.2022.3182539.

[6] IEEE Standard for High Data Rate Wireless Multi-Media Networks--Amendment 2: 100 Gb/s Wireless Switched Point-to-Point Physical Layer," in IEEE Std 802.15.3d-2017 (Amendment to IEEE Std 802.15.3-2016 as amended by IEEE Std 802.15.3e-2017), pp.1-55, Oct. 18, 2017

[7] T. Kürner and A. Hirata, "On the Impact of the Results of WRC 2019 on THz Communications," 2020 Third International Workshop on Mobile Terahertz Systems (IWMTS), Essen, Germany, 2020, pp. 1-3, doi: 10.1109/IWMTS49292.2020.9166206.

[8] T. Kürner, TeraHz – A candidate for 6G; Enjoy – The ETSI Magazine – January 2023, p. 14-15; [online] https://www.etsi.org/e-brochure/Magazine/January-2023/mobile/index.html#p=14

[9] S. Salous, Towards Terahertz: Part Of The 6G Picture, RF Globalnet, April 2023, [onoine] https://www.rfglobalnet.com/doc/towards-terahertz-part-of-the-g-picture-0001, visited 4 July 2023

[10] [online]https://smart-networks.europa.eu/stream-b-research-for-revolutionary-technology-advancement-towards-6g/ (visited 29 June 2023)