Demonstrating 300 GHz Wireless Backhaul Links – The ThoR Approach

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Abstract—This contribution presents the key achievements of the Horizon 2020 EU-Japan project ThoR (“TeraHertz end-to-end wireless systems supporting ultra-high data Rate applications”). Results of the hardware demonstration of 300 GHz backhaul links, the antenna characterisation, the software simulation and the automatic planning will be presented.

I. INTRODUCTION

Transceiver technology using spectrum in the THz range, starting around 300 GHz, has made significant progress in recent years and enables the realisation of THz communications, which is one of the candidate technologies for future 6G systems. Among the first applications are fixed point-to-point links with ultra-high data rates, for example wireless connections of backhaul/fronthaul links in cellular networks [1]. Data rates of 200 Gbps and beyond will be required to backhaul the data traffic densities of several Tbps/km² already predicted for 5G networks. The Horizon 2020 EU-Japan project ThoR (“TeraHertz end-to-end wireless systems supporting ultra high data Rate applications”) [2] has worked on solutions to realize 300 GHz backhaul links based on the recently published IEEE Std 802.15.3d-2017 [3].

II. HARDWARE DEMONSTRATION AN ANTENNA CHARACTERISATION

The ThoR concept is build on a superheterodyne approach [4], where up to four channels with a bandwidth of 2.16 GHz each are aggregated. Each of these channels is generated using industrial grade modems, that provide a signal in the frequency range of 70-80 GHz or 60 GHz, respectively [5]. These signals are up-converted to the carrier frequency of 300 GHz and transmitted. The local oscillator signal (LO) is generated using a photonic approach. At the receiver the signals are down-converted to the 70-80 GHz or 60 GHz range, respectively, and fed back into the modems. This method allows the transmission of real data with a data rate of up to 40 Gbps. In June 2022 the complete transmission system will be demonstrated by connecting two buildings at TU Braunschweig. The results will be presented in the final submission. In order to perform simulations when planning 300 GHz backhaul links accurate antenna diagrams are required. Therefore ThoR has also worked on photonics-based near-field measurement techniques and far-field antenna characterization [6].

III. SOFTWARE SIMULATION AND AUTOMATIC PLANNING

In order to show the scalability of the ThoR approach towards data rates of 200 Gbps+ software simulation is used [7]. The developed link-level simulator is able to consider also the RF hardware impairments of the components developed in ThoR [8]. Whereas the link level simulation part enables to show the scalability of the ThoR approach, the system level simulation part together with the link budget considerations taking into account weather conditions [9,10] provides a sound basis to develop automatic planning algorithms for backhaul links. Various methods for the planning of star- and ring topologies of the backhaul network have been developed [11]. This also includes a method to consider non-line-of-sight links for star topologies.

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REFERENCES


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