Building an End User focused THz based Ultra High Bandwidth Wireless Access Network: The TERAPOD Approach

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***Abstract*—The TERAPOD project aims to investigate and demonstrate the feasibility of ultra high bandwidth wireless access networks operating in the Terahertz (THz) band. The proposed TERAPOD THz communication system will be developed, driven by end user usage scenario requirements and will be demonstrated within a first adopter operational setting of a Data Centre. In this article, we define the full communications stack approach that will be taken in TERAPOD, highlighting the specific challenges and aimed innovations that are targeted.**

***Index Terms*—Terahertz Communication, Resonance Tunnelling Diodes, Uni-travelling Carrier PhotoDiode, Skotky Barrier Diode, Standardisation**

I. Introduction

The TERAPOD project aims to investigate and demonstrate the feasibility of ultra high bandwidth wireless access networks operating in the Terahertz (THz) band. The proposed TERAPOD THz communication system will be developed, driven by a selected set of end user usage scenario requirements. The project ambitiously aims to demonstrate the TERAPOD THz communication system within a first adopter operational setting of a Data Centre and will significantly progress innovations across the full THz communications system stack.

TERAPOD takes a multi-pronged approach to demonstrate the feasibility of THz communication within a Data Centre by leveraging breakthroughs recently made in THz devices, systems, metrology, protocols and standardization. The layered approach will ensure that all system requirements aligned to demonstration within a Data Centre will be integrated into development activities.

The remainder of this article is structured as follows; Section 2 highlights the current challenges and related work in the area of THz Communication. Section 3 outlines the TERAPOD approach to building an end to end THz communications system. Section 4 highlights the main innovations targeted by the TERAPOD project and expected impacts. Section 5 concludes the article by summarising the project targeted outcomes.

II. Related Work

The demand for bandwidth in wireless communications has doubled every 18 months since 1980 following the well-known Edholm's law [1]. A 2016 Cisco report [2] concludes that by 2020, Wi-Fi and mobile devices will account for 66 percent of all IP traffic up from 48 percent in 2015, while the global internet traffic is expected to grow three-fold between 2015 and 2020. This growing demand results essentially from increased traffic requirements from existing users, which translates into higher wireless data-rate requirements. In order to support these future demands, there is an urgent need to develop new technology platforms beyond currently available wireless technology where only marginal gains are possible.

With expected demands for 100 Gbit/s wireless connectivity in a near future, finding solutions in existing frequency bands below 100 GHz is very challenging. Millimetre wave bands, around 60 GHz and E-band (71-95 GHz) are already being used for in-room data distribution and point-to-point backhaul of mobile communications data, and are being investigated for fixed-wireless access. For example, in the 60 GHz band, 7 to 9 GHz of spectrum has been allocated worldwide. However, in order to achieve 100 Gbit/s, spectral efficiencies of the order of 10-15 bit/s/Hz have to be achieved, which is a huge technical challenge.