

# High-speed Graphene-based Sub-terahertz Receivers Enabling Wireless Communications for 6G and Beyond

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**Abstract**— In recent years, the telecommunications field has experienced an unparalleled proliferation of wireless data traffic [1]. Innovative solutions are imperative to circumvent the inherent limitations of the current technology, in particular in terms of capacity. Carrier frequencies in the sub-terahertz (sub-THz) range ( $\sim 0.2\text{--}0.3\text{ THz}$ ) can deliver increased capacity and low attenuation for short-range wireless applications [2]. Here, we demonstrate a direct, passive and compact sub-THz receiver based on graphene, which offers remarkable advantages compared with state-of-the-art sub-THz receivers. These graphene-based receivers offer a cost-effective, CMOS-compatible, small-footprint solution that can fulfill the size, weight, and power consumption (SWaP) requirements of 6G technologies [3]. We exploit a sub-THz cavity, comprising an antenna and a back mirror, placed in the vicinity of the graphene channel to overcome the low inherent absorption in graphene and the mismatch between the areas of the photoactive region and the incident radiation, which becomes extreme in the sub-THz range. The graphene receivers achieve a multigigabit per second data rate with a maximum distance of  $\sim 3\text{ m}$  from the transmitter with a high responsivity of  $0.16\text{ A/W}$ . We demonstrate a trade-off between bandwidth and responsivity by measuring a setup-limited 3 dB bandwidth of 40 GHz. Our findings enable applications such as chip-to-chip communication and close proximity device-to-device communication.

## REFERENCES

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