Development of a Photonics-based Wireless Signal Receiver for Terahertz Communication at 375 GHz

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The evolution toward Beyond 5G/6G networks necessitates the integration of an expansive array of base stations within the network infrastructure. Concurrently, there is an escalating demand for communication capacity, necessitating network densities exceeding Tbps/km² [1]. To construct networks of such unprecedented density, deployment of numerous small cells is essential. Traditional fiber-optic networks have been the backbone for mobile backhaul and fronthaul, facilitating connectivity between base stations and remote antenna units. Nonetheless, in the advent of Beyond 5G/6G, deploying optical fiber for all connections becomes impractical [2]. Consequently, there is a growing anticipation for the development of integrated network technologies that enable seamless convergence of high-capacity wireless and optical fiber systems, exemplified by terahertz (THz) wireless communication modalities.

Recently, we demonstrated the principle of the THz receiver at 100 GHz [3]. The system employs an antenna-integrated electro-optic (EO) polymer modulator, which generates the optical sideband by receiving RF signal with the integrated antennas then the generated modulation sideband is down-converted to the baseband by the optical coherent detection. Owing to the capability of the frequency up-converted RF signal for transmission via optical fiber networks, this receiver design facilitates the convergence of wireless and optical fiber systems.

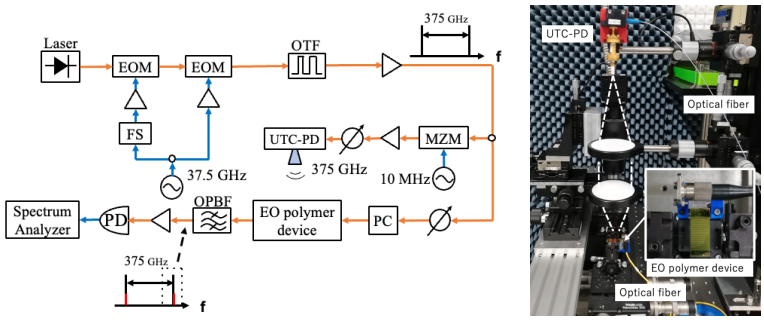

Fig.1 Photonics-based THz signal receiver system

Figure 1 illustrates the schematic of a THz wireless signal receiver. Selected components of the frequency comb generated by the EOMs are used as an optical LO signal. This dual-tone signal is subsequently introduced to the EO polymer device. In the proof-of-concept experiment, 375 GHz RF signal is generated using a uni-traveling-carrier photodiode (UTC-PD). In the presentation, we will show the basic characteristics of the system.

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References

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