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Integrated Coherent Radio-over-Fiber Units for Millimeter-Wave Wireless Access

(invited paper)

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Abstract - For providing wireless access as a complementary access technology to direct optical access, supporting 1–10 Gb/s per client, we propose a novel scheme based upon the transparent integration of coherent Radio-over-Fiber (CRoF) units with next generation optical access (NGOA) networks using dense WDM and a centralized electronic signal processing in the optical line termination to mitigate distortions and to achieve low costs.

This paper will concentrate on recent key technological developments that were achieved within the European IPHOBAC-NG project for constructing such CRoF units capable to provide wireless services within the E-band (60-90 GHz). In detail, GaAs-based single-sideband millimeter-wave Mach-Zehnder modulators, InP-based millimeter-wave photodiodes featuring rectangular waveguide outputs and monolithically integrated low-linewidth tunable laser diodes as well as SiGe-based millimeter-wave RF amplifier technology will be reported.

In addition, a new coherent optical heterodyne radio-over–fiber scheme is proposed for seamless integration of next generation millimeter-wave wireless access systems into a next generation passive optical network employing dense or even ultra-dense WDM. We propose and demonstrate novel radio access units (RAU) using coherent optical heterodyne detection for the generation of the millimeter-wave radio signals in the RAUs. The proposed CRoF concept supports the provision of multiple services over a single optical distribution network including next generation optical and wireless access services and high-capacity fixed wireless links for mobile backhaul. Proof-of-concept system experiments are reported including the wireless transmission of a 2.5 Gb/s data signal over 40 m (limited by lab space) at 76 GHz carrier frequency after 20 km fiber-optic transmission.