Optical and Quantum Electronics (2019) 51:324
https://doi.org/10.1007/s11082-019-2020-8

A full-duplex 40 GHz radio-over-fiber transmission system based on frequency octupling

Aasif Bashir Dar[1] · **Faroze Ahmad**[1]

Received: 13 June 2019 / Accepted: 27 August 2019

Abstract
A 10 Gbps full-duplex 40 GHz radio-over-fiber (RoF) communication system is presented in this paper. A 5 GHz input Radio Frequency signal is octupled to 40 GHz using cascaded parallel Mach–Zehnder modulators (MZMs) operating at lower modulation index (m) range of 2.5–3.5. The ROF transmission system employs symmetrical inline dispersion compensation technique using tDCF and frequency re-use concept for upstream transmission. Full-duplex transmission distance of 180 kms can be achieved with quality factor (Q) $\geq$ 7 for wide range of modulation index (2.5–3.5) of MZMs, reflecting that system is tolerant to biasing variations. The transmission length can be increased to 210 kms for relatively reduced modulation index range of 3.2–3.5.

Keywords Radio-over-fiber · Mm-wave frequency · Mach–Zehnder modulator · Dispersion compensation fiber · Quality factor

1 Introduction

With increase in number portable devices in form of smart-phones, tablets and laptops, there has been tremendous shift from fixed to mobile device users. Moreover, explosion of innovative applications and services, that run on these mobile devices require high speed data connectivity. Thus, there is strong wireless bandwidth quest and network operator need to evolve to meet such bandwidth demand. Conventional wireless technology cannot cater such demand because of unavailability or congestion of frequency spectrum (Fernando 2014). To meet-up such emerging wireless bandwidth requirements, transfer from existing wireless bands to higher frequency especially millimeter (mm) wave bands is proposed as solution (Chen and Zhao 2014). Generation and distribution of such high frequency signals using traditional techniques is quite problematic. Radio-over-fiber (RoF) technology provides an integration of high-bandwidth optical fiber technology with wireless communication (Jia et al. 2007).

Various techniques for mm-wave generation in optical domain have been proposed such as Stimulated Brillouin scattering (SBS) (Yan et al. 2018), Four-Wave Mixing (FWM)

✉ Aasif Bashir Dar
daraasifshzd@gmail.com

[1] Department of Electronics and Communication Engineering, IUST, Awantipora, J&K, India