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A cost-effective method for high-quality 60GHZ optical millimeter wave signal generation based on frequency quadrupling

Abstract

In this paper, we present a cost effective method to generate a high-quality quadruple frequency optical millimeter- wave (MMW) signal using an integrated dual-parallel Mach-Zehnder modulator (IDP-MZM). Not only does the method minimize the complication of the central station (CS) and its frequency demand for the devices, but the generated optical MMW signal as well has good transmission performance. By properly adjusting the direct current (DC) bias, modulation index, and using two radio frequency (RF) driving signals with 135± phase delay, a high quality dual tone optical MMW at 60 GHz is generated from a 15 GHz RF local oscillator (LO) with optical sideband suppression ratio (OSSR) as high as 32 dB and radio frequency spurious suppression ratio (RFSSR) exceeding 33 dB without optical filter when an IDP-MZM with 30 dB extinction ratio is utilized. Furthermore, the influences of a number of non-ideal parameters, such as imperfect extinction ratio, non-ideal RF driven voltage, and phase difference of RF-driven signals applied to two sub-MZMs of the IDP-MZM, on OSSR are studied through simulation. Finally, we build a Radio over Fiber system through simulation, and the transmission performance of the generated optical MMW signal is presented. The eye patterns still clear and keeps open even after 60km transmission.

Keywords

Millimeter- wave (MMW) signal; Frequency quadrupling; Cost effective method; Integrated dual-parallel Mach-Zehnder modulator (IDP-MZM)