

In this paper, we propose a new combination of RZ coding and m-array quadrature amplitude modulation (mQAM) to improve the performance of an all-optical OFDM system. Numerical simulation is used to evaluate the performance of the proposed all-optical OFDM system, which uses coupler-based inverse fast Fourier transform/fast Fourier transform without any nonlinear compensation. The system employs 29 subcarriers where each subcarrier is modulated with a symbol rate of 25Gsymbol/s. The results show that the nonlinear phase noise due to fiber nonlinearity is mitigated when the RZ-4QAM and RZ-16QAM format is employed. At the transmission distance of 550km, the error vector magnitude (EVM) reduces from 12.7% to 10.7% when the RZ-4QAM format is adopted instead of 4QAM. The required optical signal-to-noise ratios (OSNRs) to achieve a BER of  $10^{-5}$  are reduced by about 1.9dB and 5.8dB when adopting the RZ-4QAM and RZ-16QAM all optical OFDM systems, as compared to the 4QAM and 16QAM all-optical OFDM systems.