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Analysis of polarization coding for subcarrier multiplexing quantum key distribution

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A polarization coding scheme for subcarrier multiplexing quantum key distribution (SCM-QKD) is proposed, in which the overall quantum key distribution (QKD) can be substantially increased by relying on parallel sideband channels. The polarization state of each sideband can be randomly and independently synthesized by controlling the phase difference of subcarriers. We derive the performance analysis formulas for the achievable quantum bit-error rate (QBER). Both the theoretical analysis and the numerical results show that an efficient implementation of BB84 protocol is feasible. By the proposed polarization coding in a parallel QKD system, without relying on dispersion compensation, a 6% performance gain in terms of correct-bit rate over the conventional BB84 protocol (i.e. without polarization coding) is obtained. Moreover, the proposed polarization coding aided SCM-QKD can help achieve a long-distance QKD with a low QBER.

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