We experimentally demonstrate orbital angular momentum (OAM) modes emission from a high emission efficiency OAM emitter for 20-Gbit/s quadrature phase-shift keying (QPSK) carrying data transmission in few-mode fiber (FMF). The device is capable of emitting vector optical vortices carrying well-defined OAM efficiently with the efficiency of the device >37%. Seven modes propagate through a 2-km two-mode and a 3.6-km three-mode FMF with measured optical signal-to-noise ratio (OSNR) penalties less than 4 dB at a bit-error rate (BER) of 2 x 10⁻³. The demonstrations with favorable performance pave the way to incorporate silicon photonic integrated devices as transceivers in an OAM-enabled optical fiber communication link. (C) 2018 Optical Society of America under the terms of the OSA Open Access Publishing Agreement.