Abstract

The goal of this work is to study advanced modulation formats that use differential phase shift keying with direct detection, what means that there is no local oscillator at the receiver.

The beginning of the work consisted in a bibliographic search about the modulation and detection of differential phase shift keying formats, including the study of RZ pulse formats and the insertion of an offset in the differential phase, a parameter that is not well studied in the consulted references.

After an introduction about these modulation formats, the degradation due to the fiber dispersive effects is evaluated through simulation with several formats based on offset differential phase shift keying.

To assess the system performance an analytical method to calculate the bit error probability, based on the gaussian approach, was developed.

To finish, the simulation, done in MatLab®, and the study of a transmission system that consists on normalized fiber spans with dispersion compensation was executed. 25 channels are wavelength-multiplexed, each with a bit rate of 40 Gbit/s, spaced by 50 GHz. To achieve higher Q factors, the bandwidths of the multiplexer, demultiplexer and electrical filter at the receiver, as well as the optical power at the input of the transmission fiber and dispersion compensating fiber were optimized.

It was concluded, through the analysis of all channels's Q factor, that the performance of the different channels is more uniform in RZ formats than in NRZ formats. By simulation, it was proven that offset differential phase shift keying allows a transmission distance of 480 km with a good performance, with dispersion compensation and without the use of forward error correction. At 640 km the system performance is unacceptable.

Keywords: differential phase shift keying, offset differential phase shift keying, ultra dense wavelength-division multiplexing, advanced modulation formats, communication system performance.