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Abstract : Even though there is a rapid development in new optical networks, still optical communication infrastructures remain composed of thousands of kilometers of aging optical cables. Many of them are located in a harsh environment which contributes to an increased attenuation or induced birefringence of the fibers leading to the increase of polarization mode dispersion (PMD). In this paper, we report experimental results from environmental optical cable tests and characterization in the climate chamber. We focused on the evaluation of optical network reliability in a harsh environment. For this purpose, a special thermal chamber was adopted, targeting to the large temperature changes between -60 °C and 160 C° with defined humidity. Single mode optical cable 230 meters long, having six tubes and a total number of 72 single mode optical fibers was spliced together forming one fiber link, which was afterward tested in the climate chamber. The main emphasis was put to the polarization mode dispersion (PMD) changes, which were evaluated by three different PMD measuring methods (general interferometry technique, scrambled state-of-polarization analysis and polarization optical time domain reflectometer) in order to fully validate obtained results. Moreover, attenuation and chromatic dispersion (CD), as well as the PMD, were monitored using 17 km long single mode optical cable. Results imply a strong PMD dependence on thermal changes, imposing the exceeding 200 % of its value during the exposure to extreme temperatures and experienced more than 20 dB insertion losses in the optical system. The derived statistic is provided in the paper together with an evaluation of such as optical system reliability, which could be a crucial tool for the optical network designers. The environmental tests are further taken in context to our previously published results from long-term monitoring of fundamental parameters within an optical cable placed in a harsh environment in a special outdoor testbed. Finally, we provide a correlation between short-term and long-term monitoring campaigns and statistics, which are necessary for optical network safety and reliability.

Keywords : optical fiber, polarization mode dispersion, harsh environment, aging
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