

Abstract

Moustafa Hussein Aly

Plane Wave Scintillation Index in Slant Path Atmospheric Turbulence: Closed Form Expressions for Uplink and Downlink

The scintillation index (SI) is an important issue in studying the effect of the atmospheric turbulence in light wave propagation. As the computation time is important in case of mobile applications, a closed form for the SI of slant path is more attractive than its integral form. In a previous work (Fayed et al. in Opt Eng 55:056113, 2016), we derived the slant path SI in a closed form for spherical waves proposing a polynomial model for the refractive index structure parameter. In this paper, closed form expressions for uplink and downlink slant path SI are derived from the integral forms using the polynomial model of refractive index structure parameters for a plane wave propagating through atmospheric turbulence. The obtained results reveal the effects of propagation distance, transmitter/receiver height and elevation angle on the uplink and downlink SI. A comparison between uplink and downlink SI is carried out. The derived expressions for the plane wave are compared with that previously derived for the spherical wave. The obtained results demonstrate a way to improve the uplink SI of the plane wave by increasing the transmitter height to 150 m.