

# Abstract

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## **Outdoor Visible Light Communication in Intelligent Transportation Systems: Impact of Snow and Rain**

A comprehensive study of outdoor visible light communication (VLC) under snow and rain effects has been conducted in this paper. This paper analyzes the expected rain attenuation of Marshal, Carbonneau, and Japan models at different precipitation levels. Snow attenuation is measured in wet and dry situations at various precipitation levels as well. Therefore, a full comparison is carried out for different attenuation effects on certain outdoor VLC design characteristics such as the maximum signal-to-noise ratio (SNR), optical power received, bit error rate (BER), and maximum coverage area. VLC with various modulation techniques is considered. The ON-OFF Keying (OOK), L-Pulse Position Modulation (L-PPM), Inverse L-Pulse Position Modulation (I-L-PPM), and Subcarrier Binary Phase-Shift Keying (SC-BPSK) are investigated. The simulation results show a considerable difference in the information received under different weather conditions depending on the type of modulation scheme used. The simulation has been done on a two-lane road, and a green traffic light-emitting diode (LED) with a wavelength of 505 nm is used as a transmitter. A non-imaging concentrator coupled with a photodetector is considered to be a cost-effective receiver.