

Abstract

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Evaluation of Visible Light Communication System Performance in the Presence of Sunlight Irradiance

The market demand of high wireless communication services on the move is increasing rapidly the 5G networks will not be based on single technology. Visible light communication (VLC) systems provide an interesting complementary solution to the looming spectrum crises due to the increasing market demand rate is much higher than the achievements of current network solutions. VLC systems provide many interesting characteristics energy efficiency , high speed , license free operation band. Also provide an interesting motive to the expansion of the wireless applications services in the environment that RF interference is a barrier. Although VLC systems provides many competitive advantages, there are challenges remain. The performance of the VLC system is investigated in the presence of the clear sky sunlight irradiance over the year. Sunlight irradiances varies as function of the time of day , day of the year, locations longitude and latitude. The evaluation of the system performance is conducted over the year for two representative locations , Cairo –Egypt and Glasgow- Scotland. Furthermore, the system evaluation is extended to cover the impact of cloud coverage on the system performance. An evaluation of system performance over different metrological condition for Cairo-Egypt and Berlin -Germany has conducted. A SNR, BER and achievable data rate are evaluated for the different representative locations for the most common surfaces reflectivities in the indoor environments. Also a comparative analysis of the system performance over different metrological conditions and when the shot noise assumed as Gaussian has developed. Moreover, The paper provide in depth sensitivity analysis of the system performance in the indoor environments for different room shapes over different metrological conditions. The impact of the LED panels placement on the system performance ,availability and reliability the analysis has conducted with respect to the distance from the room wall and distance from the room windows. Furthermore, a design tool for VLC systems has developed , the tool is capable of providing the optimum LED arrangement in the indoor environment that provide optimum SNR , fulfil the illumination constrains and minimize the fluctuation the SNR across the room to assure the QoS. The LED arrangement tool, can be applied for any room size ,LED specification, evaluation workplace, LED panels size and anywhere on the world. The energy efficiency is one of wireless communication systems metrics. The paper report an evaluation of the system performance on the sunny environment where sunlight illumination is sufficient and no need to turn the illumination on. The paper evaluation of system performance as function of the number of LED chips employed. The research provide design and operation guidelines for simplify system adoptions process.