

# A NOMA Based VLC-RF Communication System for a Small Cell

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## ABSTRACT

Visible Light Communication (VLC) is a Light Emitting Diode (LED) based hybrid illumination and data communication technology that offers a license-free spectrum with higher data rates. By incorporating VLC with Non-orthogonal Multiple Access (NOMA) where multiple users are served in the same resource block, massive connectivity among devices can be accomplished. In this paper, we proposed a NOMA based VLC-RF communication system for small cell networks. The proposed system consists of a Base Station (BS) with NOMA-RF transmitters, Decode and Forward (DF) relays and end-users with VLC receivers. The DF relays decode the received NOMA-RF signals from the BS and forwards the signals as NOMA coded VLC signals to the users. The performance of the proposed system was evaluated by comparison of the error rates and achievable rates of NOMA systems with those of an OMA system. Furthermore, to enable green communication, we extend the proposed system with Simultaneous Wireless Information and Power Transfer (SWIPT). Our analysis shows that NOMA based VLC-RF systems provide the trade-off between data rates and error performance of the system. The proposed system improves system throughput whereas lower the error performance with higher error rates of the link compared to the OMA system. Moreover, the enhanced energy efficiency of the proposed system is achieved by the extension of the system with

SWIPT. Proposed NOMA based VLC-RF communication system can be applied to small cells of smart cities.

**Keywords:** Visible Light Communication (VLC); Non-orthogonal Multiple Access (NOMA); Simultaneous Wireless Information and Power Transfer (SWIPT); NOMA-VLC

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