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# Printed Dipole Antennas for Vehicular Communication Systems

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This article is dedicated to the design of efficient, low cost, self-mirrored Wi-Fi based printed dipole antennas in which the radiating element and ground plane are on the same plane which are mirror images of each other. Mirrored design allows the antenna to be easily integrated into the circuitry. This configuration achieves higher gain compared to traditional monopole and dipole designs which can be easily mounted to any part of the vehicle without altering the aesthetics of the vehicle and ensuring efficient communication framework for Vehicle -to -Everything communication system (V2X). With extensive research, the design parameters of the PDA - the shape of the radiating element, feed location, and the spacing between the radiating element and ground plane are optimized. Simulation analysis is carried out using Ansys HFSS and is validated experimentally using Vector Network Analyzer (VNA). The real-world test measurements for the PDA, by integrating with the communication modules, are done both in indoor and outdoor environments, thus proving the effectiveness of the proposed antenna as a potential candidate for communication applications. The proposed antenna can configured as printed dipole antenna arrays for high gain communication systems.

It is not just a vision for the future; it is a living reality, steadily reshaping the way we experience transportation and opening the doors to a more intelligent, sustainable, and connected world. The article focuses on simple yet optimal designs for printed dipole antennas, facilitating easy integration for establishing WiFi communication links in V2X systems. While WiFi technology has some drawbacks, it performs well in most rural terrains. The antenna system can also be modeled into arrays to enhance gain and improve the overall system performance. Moreover, the proposed antennas can be adapted to work in other frequency bands including multiband systems, mm-wave systems, which opens up various applications in V2X communication domain

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