

Coupling element-based dual-antenna structures for mobile terminal with hand effects

Abstract

This paper presents a comprehensive simulation study on the performance of coupling element-based dual-antenna structures on a mobile terminal at the 2,000 MHz Universal Mobile Telecommunications System (UMTS) frequency band with varying two significant hand effects; vertical position of hand along terminal chassis, and distance between hand palm and terminal chassis. The results reveal that in uniformly distributed isotropic environment, there exists a gain imbalance between antenna elements due to hand effects and it is shown that a gain imbalance of 3.7 dB lead to a reduction of 1.9 dB in diversity gain at 99% reliability level using maximal ratio combining (MRC) technique. For a dual-antenna configuration, the impact of gain imbalance on diversity gain is more significant when only one antenna element is in close proximity to the hand, compared to when both antenna elements are in the presence of the hand. It is also shown that a dual-antenna structure with elements vertically oriented along the edges of a small 100 mm × 40 mm mobile terminal chassis achieves better performance in port-to-port isolation, gain imbalance and diversity gain compared to other studied dual-antenna configurations when the user's hand is present