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Study of Indoor Radio Coverage Performance of Dual Technology Co-Existing MIMO Antenna Platform for Low Power Wireless Base Station

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Abstract—In this paper, we present the radiated mode indoor radio coverage performance study of a co-existing dual technology, dual 4×4 Multiple Input Multiple Output (MIMO) antenna platform. The antenna platform is targeted to be used for low power wireless radio Base Station (BS) applications. One of the 4×4 MIMO antenna pairs operates in the 2.5–2.7 GHz licensed Long Term Evolution (LTE) band while the other MIMO antenna pair operates in the 2.4 GHz unlicensed Wireless Fidelity (Wi-Fi) Industrial Scientific Medical (ISM) band. This radio performance study is carried out to analyze, predict and verify the impact of multi-radio co-existence on the radiated mode indoor coverage performance in an Over-The-Air (OTA) scenario. The study involves OTA radio propagation modeling, prediction and verification both for a near field and far field scenario. While the near field coverage is studied in a small form factor controlled shield box environment, the far field coverage study is undertaken over a 780 ft^2 indoor enterprise coverage area. The test result shows the worst case LTE signal level is –77.7, –75, and –76.03 dBm, respectively, over a 3.6 m obstructed radial Line Of Sight (LOS) distance.

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INTRODUCTION

With the pervasive nature of modern wireless technologies, there is an ever demanding need to maximize the end-to-end system throughput for the end user requirements and applications [1, 2]. In order to support this requirement and to enhance the last-mile radio access performance, the wireless Base Stations (BS) are increasingly becoming lower powered units with the effective and efficient usage of multi-standard radio access technologies and architectures [3].

Generally these are two major categories of radio access technologies, such as the licensed radio technology and the un-licensed radio technology. While the licensed radio technology must be compliant to the Third Generation Partnership Project (3GPP) [4, 5] such as Long Term Evolution (LTE), the unlicensed radio technology must be compliant to the Wireless-Fidelity (Wi-Fi) 802.11 standards [6].

In many cases, the modern multi-standard radio base stations incorporate a mix of radio hardware sub-blocks which co-exist as part of the same radio device or system (Fig. 1). Here, the LTE radio is the first set of radio technology and Wi-Fi is the second set of radio technology. In this context of co-existing dual wireless technologies, it is crucial to analyze any adverse impact effect of one technology onto the other in a simultaneous operational mode.

Ng et al. [7] has analyzed inter-3GPP radio system co-existence related aspects and parameters in detail. The Universal Mobile Telecommunication Systems (UMTS)-to-Wi-Fi antenna co-existence aspects are shown in [8] with real antenna orientation in a measurement scenario but these are purely taken from the antenna impacts of scattering parameters (S-parameters). Farshad et al. [9] experimentally investigated co-existence aspects among different 802.11 radios with a stress to the system level throughput and antenna polarization aspects for single-band and dual band cases.

DECLARATION

The authors declare that the work has not been published previously.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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