An Efficient Algorithm for Femto-macrocell Coexistence

By
Rawan Shabbar

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Committee Members

Prof. Ahmad Al-Shunali (Chairman)
Dr. Haythem Bany Salameh (Co-adviser)
Prof. Bassam Harb (Member)
Prof. Nasser Abdullatif (Member)

Signature and Date

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Abstract

Femtocell is one of the promising technologies that works on providing an efficient solution for the rapid growth in wireless telecommunication networks. Based on deploying very small cells (Femtocells) within much larger, already-existed, cells (Macrocells), Femtocells work on improving indoor coverage and increasing both spectral efficiency and data rate. This improvement can be achieved by reusing the available spectrum for the Macrocell, and being closer to the user. However, the coexistence of Femto- and Macro- cells has led to the appearance of interference issue, which is considered as the most challenging in Femtocell deployment. Two types of interference have been defined, the first type is the co-tier interference which is the interference occurs between adjacent Femtocells. The second type is the cross-tier interference which is the interference occurs between Macro- and Femto- cells.

In this thesis, efficient algorithm to reduce downlink cross-tier interference in a Femtocell-based network is proposed. Unlike previously proposed solutions, proposed algorithm aims at increasing spectrum through joint power/channel control. Power control mechanism, in the introduced algorithm, aims at increasing the network capacity by reusing the same spectrum bands of the Macrocell network. This can be done after finding the appropriate transmit power from Femtocell Access Point (FAP) side that keeps the cross-tier interference within an acceptable level. Whereas, two types of channel assignment mechanisms are used to study the performance of the network; Worst Multi-Channel (WMC) assignment, and Best Multi-Channel (BMC) assignment. Also, the proposed algorithm allows frequency reuse among Femtocell users to achieve better throughput performance.

To investigate the effectiveness of the proposed algorithm, extensive simulation experiments have been carried out. Simulation results show that the proposed algorithm significantly improved the throughput. An improvement of 90.83% has been achieved compared to previous schemes that are
based on exclusive channel occupancy model in a Femto- Macro- cell coexistence based network. And an improvement of 4.07% has been achieved compared to joint power control and channel assignment mechanism in which no frequency reuse is allowed among Femtocell users.

Key words: Femtocell, Macrocell, cellular network, power control, channel assignment, interference management.