

Shared Access Protocol (SAP) in Femtocell Channel Resources for Cellular Coverage Enhancement

Authors: Amer M. Magableh, Redha M. Radaydeh, and Mohamad-Slim Alouini

Abstract: Femtocells can be employed in cellular systems to enhance the indoor coverage, especially in the areas with high capacity growing demands and high traffic rates. In this paper, we propose an efficient resource utilization protocol, named as shared access protocol (SAP), to enable the unauthorized macrocell user equipment to communicate with partially closed-access femtocell base station to improve and enhance the system performance. The system model considers a femtocell that is equipped with a total of N separated antennas or channels to multiplex independent traffic. Then, a set of N_1 channels is used for closed-access only by the authorized users, and the remaining set of channel resources can be used for open-access by either authorized or unauthorized users upon their demands and spatial locations. For this system model, we obtain the signal-to-interference ratio (SIR) characteristics, such as the distribution and the moment generating function, in closed-forms for two fading models of indoor and outdoor environments. The SIR statistics are then used to derive some important performance measures of the proposed SAP in closed-form, such as the average bit error rate, outage probability, and average channel capacity for the two fading models under consideration. Numerical results for the obtained expressions are provided and supported by Monte-carlo simulations to validate the analytical development and study the effectiveness of the proposed SAP under different conditions.