Dynamic Spectrum Allocation Scheme for Heterogeneous Network: BER Analysis

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***Abstract*—The latest advancement in wireless communication technology enables mobile users to communicate with each other more easily and at a very high speed. With the developed technology that encourages fast delivery of data and signal, mobile users can experience the best kind of service provided by the network operators. However, with the increasing number of users in an area that consists of femtocell and macrocell users, the data and signal transmission can sometimes be corrupted with the presence of cross-tier interference. This interference occurs when the femtocell and macrocell operate in the same carrier frequency. Therefore, such interference mitigation method must be implemented in order to maximize the throughput and increase the spectral efficiency of a wireless network. In this paper, a Dynamic Spectrum Allocation (DSA) scheme is proposed in order to correlate with the bit error rate, which will in turn contribute to throughput maximization factor in a heterogeneous network.**

***Index Terms*—Dynamic Spectrum Allocation (DSA); Bit Error Rate (BER); Heterogeneous Network (HetNet)**

I. INTRODUCTION

There are many interference mitigation techniques for wireless networks that have been studied by researchers all over the world. These techniques were tested and implemented in their researches and most of them produce positive results. One of the interference mitigation techniques is the Multi-Layer Rate Splitting Scheme [1]. The authors proposed a novel distributed power allocation algorithm that shows that the performance of cell-edge user equipment in a tri-sectored network can be enhanced by using this method with the proposed power allocation algorithm [2]. Moreover, the authors in [3] designed power control strategies to mitigate inter-AN interference in the downlink part of a network where they developed a set of algorithms to solve this constrained power control problem based on an iterative function evaluation method. Besides that, the authors in [4] studied on the evaluation of three state-of-the-art FFR deployment schemes for OFDMA-based two-tier heterogeneous networks. They proved that the average gains in spectral efficiency (of the network are higher for the proposed scheme.

In [5], the authors introduced cooperative communication schemes with interference management for cooperative wireless networks that are based on best relay and user selection method. They maximize the received SNR while minimizing the interference by an optimal time slot allocation for the users. The technique successfully enhanced the system performance and interference management. Besides that, the authors in [6] proposed a method for interference mitigation in two ways. Firstly, from the signaling point of view, power constraint is employed and secondly from the transmission point of view, a joint cross-tier and intra-tier interference mitigation sub-scheme are utilized. They explain that the proposed method achieves significant enhancement in SE compared to conventional schemes. Moreover, in [7], a basic co-channel HetNet deployment scenario with two cell layers is measured which results in enhancing energy efficiency and system performance in terms of both cell edge users' SINR and system capacity.

Apart from that, the DSA technique has been widely studied in previous researches for various types of implementations. In [8], in order to assure the fairness of the spectrum allocation, the proposed DSA scheme is said to consider not only the spectrum utilization but also the wireless systems' economic factor. Furthermore, it also restrains the presence of inter-system interference accordingly. However, it did not study that much regarding throughput maximization, which is an impending factor for interference mitigation. Authors [9] have proposed a novel cross-layer DSA for cluster-based cognitive radio ad hoc network where it divides the network into clusters based on three values, namely spectrum availability, the power level of node and current speed of the node. It is said to outperform the conventional protocols in terms of throughput, power consumption and packet transmission delay. However, it did not mention thoroughly on the interference mitigation matter.

In [10], the proposed DSA scheme maximizes the achievable throughput for secondary S-D by formulating the spectrum allocation problem as a linear integer optimization problem under spectrum availability constraint, spectrum span constraint and interference-free constraint. It is a good approach as it is tested on a heterogeneous network where the interference is very likely to occur.

The study in [11] proposed channel allocation problem to maximize the spectrum usage of a cognitive radio network that employs opportunistic spectrum access. It also achieves channel allocation robustness and regulates network interference. Authors [12] have proposed a DSA algorithm to integrate both interweave and underlay spectrum access schemes. The algorithm considers several factors such as the locations of the nodes, the interference in the networks and the communications of the users. The authors in [12] also proposed Energy Harvesting (EH) method for cognitive radio networks to prolong their lifetime. Since Secondary Users (SUs) can either access the spectrum or harvest energy, EH is integrated by the implementation of DSA, in order to increase