Inter Femtocell Interference Mitigation using Multi Scheme sectoring approach

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Abstract- Throughout the years, the no. of wireless users is increasing significantly. This has given rise to the never ending demand of limited bandwidth the Mobile Network Operator (MNO) is currently operating with. This deteriorates the signal quality and reduces data-rates, resulting in connection failure and call drops. It has also been commonly seen that mostly 80% of the wireless communication traffic is being generated indoors. The introduction of Femtocell helps us manage a better coverage indoors.

To have a good performance boost of the MNO, multiple Femtocells are needed to be deployed over an area. The signal from neighboring Femtocell interferes with the host cell. So the more no. of Femtocells around us, the more interference occurs. So overall performance might not be as good as it sounds.

To tackle this problem several researches have been going on throughout recent years. We took the help of both Soft Fractional Frequency Reuse (X. XU, H. Zhang, and Q. Wang, "Inter-Cell Interference Mitigation for Mobile Communication Systems, 2011) and the Orthogonal Frequency Division Multiple Access) scheme as this two methods showed significant performance boost of a Femtocell.

In order to improve the Femtocell's performance and to reduce inter-cell interference as much as possible, we introduce a new model which basically divides the Femtocell into three radial sectors and apply multiple interference reduction schemes. The Femtocell detects the location of the Femto user equipment (FUE) and selects the best scheme applicable.

1. Sector 1: Cell Center (0~10m): No specific scheme used.
2. Sector 2: Cell Radius (10~20m): OFDMA PRB Allocation used.
3. Sector 3: Cell Edge (20~30m): SFFR technique used.

The moment the Femtocell turns ON, it sends a pilot signal to detect neighboring Femtocells. As soon as it locates its neighboring cell, it stores its location and adjusts its coverage. Then it virtually divides the cell in three radial zones as mentioned above. When the user requires a connection, the Femtocell then creates a database of SINR and Data-Rates used by all the subscribed users and divide them into classes and allocate Physical Resource Block efficiently depending on the Class of the user. We used the equation below to determine the SINR of native and our improved model.

$$SINR = \frac{Pf * Gf}{N * \Delta f + \sum(PF * GF)}$$

The graph shows the improvement we have seen using our proposed model over native model that uses no improvement schemes. We see that the SINR improved up to 2dbm at Sector 2, and about 3dbm at the Cell-Edge. So we can conclude our method is quite positive.