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**ABSTRACT**

Femtocells are relied upon to build system limit, broaden full scale cell scope, and present new administrations. Since Femtocells offer the same recurrence band with full scale cells much of the time, the femtocell Base Station (BS) must moderate the impedance with large scale cells likewise guarantee scope in client premises. Be that as it may, ordinary femtocell BS transmit power setting have not sufficiently represented the obstruction with neighboring full scale cell Mobile Stations (MSs), prompting little femtocell client all through. In the paper, we portray a versatile force level setting plan i.e. Dispersed Power Control calculation to moderate the impedance of MSs in the premise of the got power levels. In DPC, every pair of transmitter (e.g., a MS) and collector (e.g., the BS) does not have to know the transmit power or channel nature of some other pair. At every time opening, everything it needs to know is the genuine SIR it at present accomplishes at the collector. At that point, by taking the proportion between the settled, target SIR and the variable, real SIR esteem measured for this time opening and increasing the current transmit power by that proportion, we get the transmit power for whenever space. This upgrade happens at the same time at every pair of transmitter and collector. This is the means by which DPC gives versatile nature to Femtocell.

**KEYWORDS:** Femtocells, Mobile Stations, Base Station, Distributed Power Control.

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**INTRODUCTION**

The Unlicensed range nowadays is turning out to be progressively rare, particularly those underneath 3 GHz[1]. The Federal Communications Commission (FCC's) insights demonstrate that numerous recurrence groups are being assigned to different clients, covering each other[2]. The two noteworthy impediments of remote correspondence are extent and limit. Beforehand, cell frameworks were intended for a solitary application, voice, yet instantly with the entry of third-era (3G) cell frameworks, clients foresee better nature of voice, continuous voice calls, clear video pictures and brisk downloads[3]. Femtocells give a decent answer for overcome indoor scope issues furthermore to manage the movement inside of Macro cells. They give solid and high caliber of administration to all clients. The limit issue is basic issue of any Mobile Communication Networks[4]. Indeed, even Long Term Evolution (LTE) is called as the fourth Generation of the Mobile Cellular Communication Network it couldn't make a speck for the Capacity Issue. Most important approach to build the Capacity is to part the Macro cell, in other word to utilize Femtocells in Macro cells. Femtocell is the home base station that any supporters can purchase and set it independent from anyone else effectively [5]. Versatile administrators just need to consider the radio system participation in the middle of Femtocell and Macro cell and between Femtocells [6].

In this paper, utilizing versatile force control as a part of Femtocells we decide the proper transmit power level to accomplish worthy connection execution Femtocells and relieve Intra-cell and Inter cell impedance to give fitting SINR[7]. The impedance level can be controlled by transmit force of the reference signal since it is corresponding to the most extreme transmit power [8]. Routine transmit power level setting plot that we connected in this paper is force level setting in light of uplink gathering power from Macro cell(M.S) utilizing Distributed Power Control(DPC) calculation[9].

### What are the Femtocells

Femtocells are low power access focuses which can consolidate versatile and Internet innovations inside of our home. The Femtocell unit creates an individual cellular telephone signal in the home and associates this to the administrator's system through the Internet. This will permit enhanced scope and limit for every last client inside of their home. These days, Femtocells are generally utilized all through the world. As per the ABI Research group there will be 102 million overall clients on 32 million home base stations by 2016. That is not the shocking thing as of now, in light of the fact that Femtocells now as of now achieved a large number of number with a great many clients utilizing it.

The most essential part of the Femtocell in the versatile system is expanding the limit of the whole system.

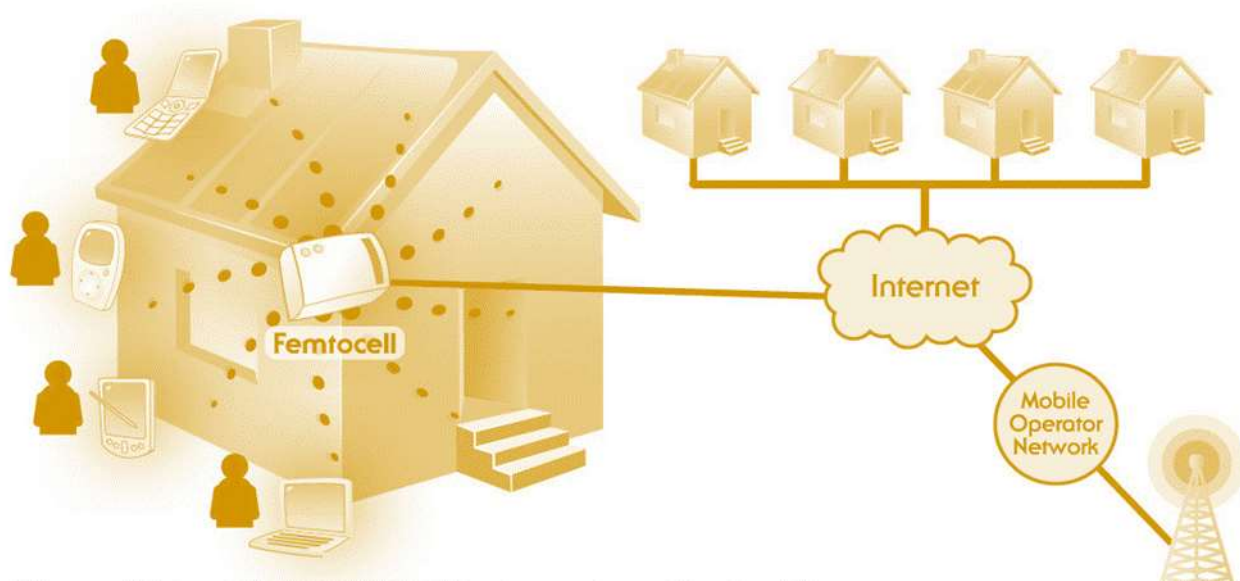


Figure 1. Femtocell Architecture

### FEMTOCELLS FROM OTHER MOBILE CELLULAR TECHNOLOGIES AND BENEFITS

**Good Standardization of the innovation:** The Standardization of the Femtocells nowadays is turning out to be completely perfect with the standard cell phones and different gadgets working in the portable extent. Numerous standard conventions like UMTS, GSM, LTE, Mobile WiMAX, CDMA and other present and future portable conventions institutionalized by 3GPP2, 3GPP and IEEE is additionally extremely agreeable with Femtocells. The Femto Forum, which is the association to create and execute Femtocells all through the world, is profoundly contributing for the institutionalization issues. Similarity with above conventions and advances can give a chance for Femtocells to give administrations with more than 3 billion existing gadgets in around the world.

**Powerful utilization of constrained range:** The proficiency of restricted range is huge issues of any administrator organization. Working in authorized range permits administration suppliers to give benefits high caliber and separated from the any sort of obstructions which could compound the limit and nature of administrations.

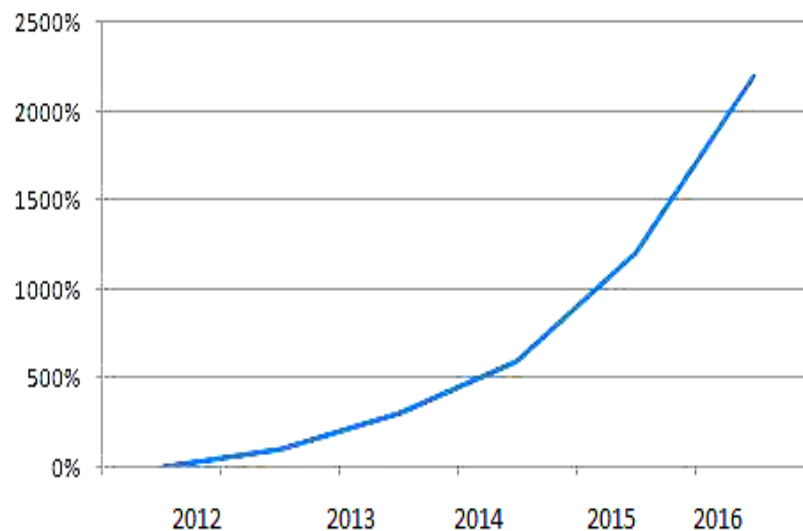
**Raising limit and autonomous scope for clients:** As pointed above Femtocells reduces the limit of the system, as well as enhance the scope in the home which can permit them to have a free scope. Contrast with the straightforward repeaters which are utilized simply build the scope, Femtocells can give a high information rate to set number of clients.

**Association with the portable administrator system:** As appeared in Figure 1.1 Femtocells interface with the

versatile administrator system utilizing standard private broadband associations, including DSL and link through the web. The web association can be any sort of system such as committed or particular broadband line of portable administrator organization or some other web supplier organizations. That is the friendliness purpose of Femtocells.

**Ease of support:** The customary endorsers can set up the Femtocells without anyone else. That is the reason Femtocells can make the operation and upkeep issues simple for portable system administrators. The supporters can keep up their Femtocells without anyone else's input and just thing to accomplish for portable administration suppliers is focusing for participation of Femtocells inside of full scale cells and other neighboring Femtocells like impedance observing and so forth.

**Adaptability of utilization:** Not just customary endorsers set up the Femtocells, additionally versatile system administrator organizations could set up Femtocells deliberately in the spots where congested or far off regions.



**Figure 2. Data Traffic Growth**

In Figure 2 we can see that the growth of the data traffic within recent years. To meet such a continuously increasing huge demand of data traffic mobile technologies should be developed quickly. That's why everybody wants to develop a fourth generation technology of the mobile cellular network.

#### **Advantages for Operator**

Deployment of Femtocells proves to be useful for operators in the sense that cost gets optimized along with increased coverage. The subscriber satisfaction improves due to better spatial correlation among capacity need and infrastructure. Reliability of the microcell gets assured as well.

#### **Customer's advantages and disadvantages**

User advantages include, low power transmission which results in a extended battery life. Better indoor reception, cheaper services are collateral benefits as well. Overall the bandwidth subscribed for is used more effectively. Initial capital may be high as this technology is somewhat new. Broadband may get congested due to backhauling. IP security is also an issue which must be paid heed to.

#### **The Power Control Techniques**

**The Conventional Power Control:** In Third Generation systems (i.e. WCDMA) every UE (both Femto and Macro users) in one cell uses the total transmission bandwidth. In OFDMA (i.e. LTE), an UE is given certain part of the total transmission bandwidth, so to control UE's transmit power spectral density (PSD) instead of the total

power is more practical. The transmit PSD is the same on the assigned resource clusters. The UE total transmission power is calculated as:

$$Tx\ Power = Tx\ PSD * M;$$

Where M is the number of assigned resource cluster and T x PSD is transmit power spectral density. Conventional power control technique compensates path loss between UE and BS. In the BS all target SINRs are the same level.

$$Tx\_PSD\_dBm = \min\{Tx\_max, 10\log(M) + SINRtar + I\_dBm + PL\_dBm\};$$

Where *SINRtar* is Target SINR, *I\_dBm* is average uplink interference per resource cluster, *PL\_dBm* is Path Loss(that includes shadow fading), *Tx\_max dBm* is UE's max transmit power in dBm.

**UMTS LTE Uplink Power Control:** UMTS LTE supports a power control scheme that allows for Macro User Equipment to get different target Signal to Interference and Noise Ratio (SINR) instead of the same target SINR according to its path loss to Macro Base Station.

$$Tx\_PSD\_dBm = \min\{Tx\_max, 10\log(M) + SINRtar + I\_dBm + \alpha * PL\_dBm\};$$

$\alpha$  is slope parameter which specifies how quickly the target SINR.

For the Femtocell Users, they require more high speed for different data services. That's why a different target SINR is needed for different Femtocell user.

**LTE Uplink Power Control:** The Power Control methods of the LTE UL depend on the different schemes and processing on the parameters. Depending on the compensation of slow channel variations or fast channel variations, it is called Fast Power Control and Slow Power Control. And depending on the cooperation to the Base Station, it is called Open Loop Power Control or Closed Loop Power Control.

**Open Loop Power Control:** The power is set at the mobile terminal using parameters and measures obtained from signals sent by the Femto Base Station (FBS). Here, no feedback is sent to the BS regarding the power used for transmission.

**Closed Loop Power Control:** The UE also sends feedback to the FBS, which is then used to correct the user Tx power.

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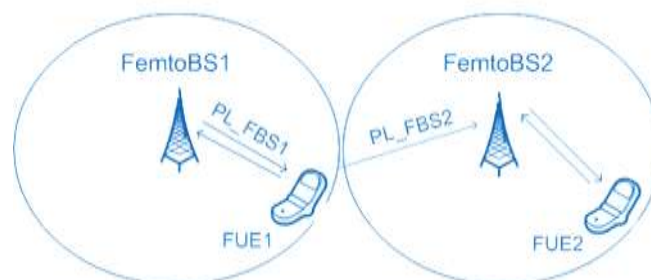
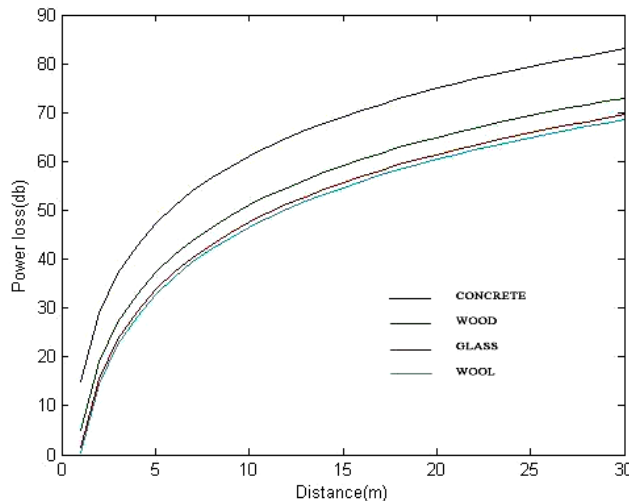


Figure 3 Uplink Interference

**Table 1 Simulation Parameters**

Parameter	Values
Number of resource clusters	50 for Femto; 60 for Macro
Carrier Frequency	2 GHz
Path Loss	Hata Model MUE $141.1 + 5.2 \cdot \log_{10}(d_{\text{MUE}})$ FUE $157.4 + 42.9 \cdot \log_{10}(d_{\text{FUE}})$
Maximum target SINR of UE	25 dB
Max. transmit power	21 dBm
Average Uplink Interference per resource cluster	$\alpha=0$ when 10dB; $\alpha=0.5$ when 15 dB $\alpha=1$ when 20 dB

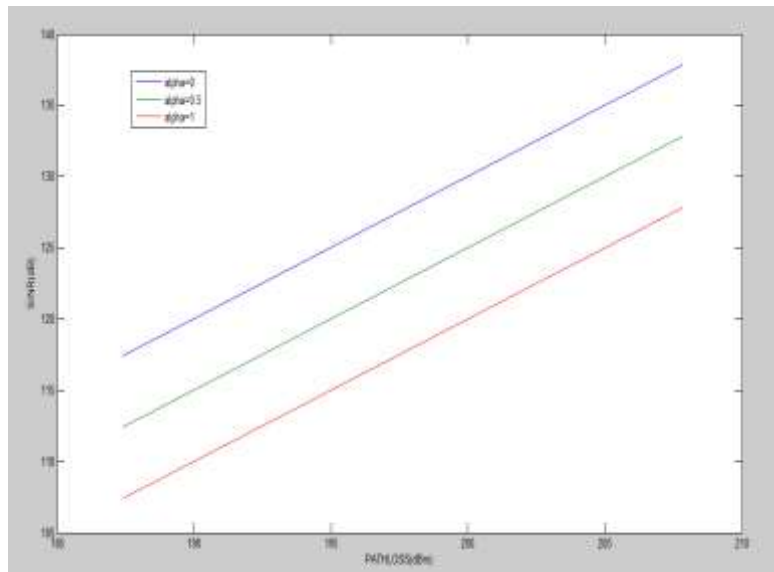
**SIMULATION AND RESULT**  
**Semi-Empirical Path Loss**



**Figure 4 Power loss vs. Transmitter-Receiver Distance**

**Inference:** The signal power loss increases substantially with increase in density of material in between transmitter and receiver. And when the distance between transmitter and base station increases it gradually saturates and becomes steady. The slope is high during smaller distances.

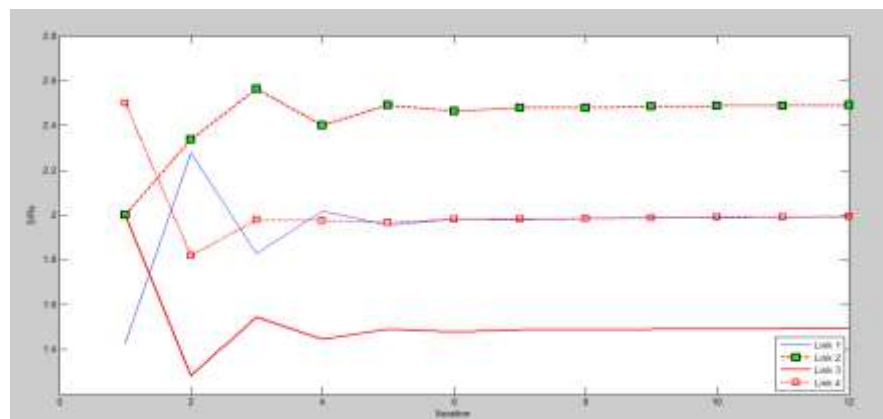
*UMTS LTE Uplink Power Control*



**Figure 5 SINR vs. Path Loss**

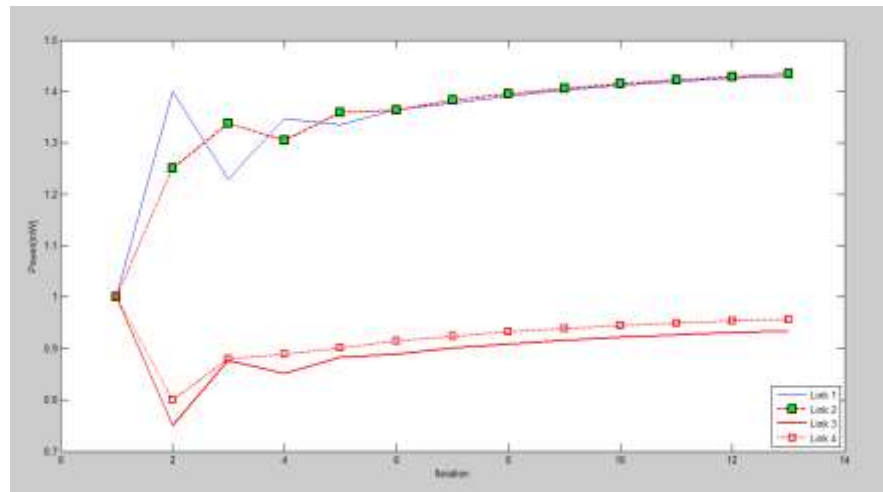
**Inference:** The SINR of the different path loss is calculated using the both power control techniques. If the slope parameter  $\alpha$  equals to 1 in the LTE power control formula, that is the same as conventional power control. And if  $\alpha$  equals to 0, then there will be no path loss compensation and there will be high interference in the FBSs. That means,  $\alpha$  should get the value of  $0 < \alpha < 1$  for compensation of path loss and good SINR at the FBS. From the simulation result, the received SINR at the FBS is compensated according to slope parameter that has good result when  $\alpha$  equals  $0 < \alpha < 1$ .

**DPC output  
Plot for SIR vs Iteration**



**Figure 6 SINRs Vs Iteration**

**Plot for Power Vs Iteration**



**Figure 7 Power vs iteration**

**Inference:** All the SIRs are now within 0.05 of the target. The power levels keep iterating, taking the SIRs closer to the target. Figure 1.5 shows the graph of power level versus the number of iterations. After about 20 iterations, the change is too small to be seen on the graph; the power levels at that time are

- p1 = 1:46 mW;
- p2 = 1:46 mW;
- p3 = 0:95 mW;
- p4 = 0:97 mW:

The resulting SIRs are shown in above Figure. We get very close to the target SIRs, by visual inspection, after about 10 iterations.

**CONCLUSION**

The Simulation reproduction gives a complete perspective about the scope of a Femtocell which is 30-40m. The SINR of the diverse way misfortune is figured utilizing the Uplink influence control strategies. Diverse clients' signs meddle with one another noticeable all around, prompting a practical SIR district with a Pareto-ideal limit. Impedance coordination in Femtocell systems can be accomplished through circulated power control with understood input. It takes care of a streamlining issue for the system as straight programming. By taking the proportion between the settled, target SIR and the variable, genuine SIR esteem measured for this timeslot, and increasing the current transmit power by that proportion, we get the transmit power for the following timeslot. This upgrade happens all the while at every pair of transmitter and recipient. With this calculation a Femtocell gadget can adjust having altered target SIR and settled Channel picks up.

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