be expressed as:

$$\mathcal{C}^b = \begin{cases} P_1 + Q_1 + R_1 - \frac{\gamma}{2}(T_1 - U_1), & 0 < b \leq b_1 \\ P_2 + Q_2 + R_1 + R_2 - \frac{\gamma}{2}(T_1 + T_2 - U_1 - U_2), & b_1 < b \leq b_2 \\ P_3 + Q_1 + R_2 - \frac{\alpha}{2}(T_2 - U_2), & b_2 < b < Y \end{cases}$$  \tag{9}$$

where $P_1 = \frac{(b + d_{bp2})C_s}{Y}$, $Q_1 = \frac{(Y - b - d_{bp2})\log_2 K_\gamma}{Y}$, $R_1 = \frac{\beta \log_2 10}{2Y} [Y^2 - (b + d_{bp2})^2]$, $\alpha = 1.87$ and $Y$ is the length of the room. $T_1 = Y \log_2 (Y - b) - (b + d_{bp2})\log_2 d_{bp2}$, $U_1 = \left(\frac{Y - b - d_{bp2}}{\ln 2}\right) + b \log_2 \frac{Y - b}{d_{bp2}}$. $C_s$ in $P_1$ equals $\log_2 (1 + 10^{b/10})$ bit/s/Hz where $\gamma_s$ is the saturation SNR threshold. $P_2 = \frac{(d_{bp1} + d_{bp2})C_s}{Y}$, $Q_2 = \frac{(Y - d_{bp1} - d_{bp2})\log_2 K_\gamma}{Y}$, $R_2 = \frac{\beta \log_2 10}{2Y} (b - d_{bp1})^2$, $T_2 = (b - d_{bp1})\log_2 d_{bp1}$ and $U_2 = \frac{b - d_{bp1}}{\ln 2} + b \log_2 \frac{d_{bp1}}{b}$. $K_\gamma$ in $Q_2$ is $P_{FAP} 10^{3.67 \times 10^{-12} + P_{wall}} 10^{2.2 + P_{wall} + \log_2 10}$, where $P_{FAP}$ and $P_{micro}$ are the transmitting power of FAP and micro-cell station, respectively. $\gamma_{micro}$ is the expected value of the antenna gain from the micro-cell base station. $f$ is the operation frequency. $d_{bp1} = B \exp [-W(F)]$ and $d_{bp2} = B \exp [-W(-F)]$ where $B = 10^{\frac{\ln 10}{200}} \left(\frac{K_\gamma}{10^{\frac{\pi}{10}}}\right)^\frac{1}{2}$, $F = \ln \frac{10^{10}}{200} B$, $W$ is \textit{Lambert} $W$ function. Finally, $P_3 = \frac{(Y - b + d_{bp1})C_s}{Y}$, $Q_3 = \frac{(b - d_{bp1})\log_2 K_\gamma}{Y}$, $b_1 = \sqrt{\frac{K_\gamma}{10^{\frac{\pi}{10}}}}$ and $b_2 = Y - \sqrt{\frac{K_\gamma}{10^{\frac{\pi}{10}}}}$. 

It can be shown that the function is convex and that according to the first rule of finding the maximum value of a function, stationary points can be determined by differentiating Eq. (9) (Note: $\frac{\partial d_{bp1}}{\partial b} = \frac{B \exp [-W(F)] \ln 10}{200(1 + W(F))}$ and $\frac{\partial d_{bp2}}{\partial b} = \frac{B \exp [-W(-F)] \ln 10}{200(1 + W(-F))}$) and then solving the differentiated function for zeros. The resulting expression is a closed form expression, but is unfortunately too long for the scope of this paper. All the stationary points are tested in order to verify the type of the stationary points (max) by checking if the corresponding value in the second-order differential function of Eq. (9) is negative. Finally, the mean capacity value(s) corresponding to all the stationary points are compared with all endpoints of the interval.

Figure 5: 1 FAP optimal location and ERG performance with respect to outdoor micro-cell interference.