Appendix A

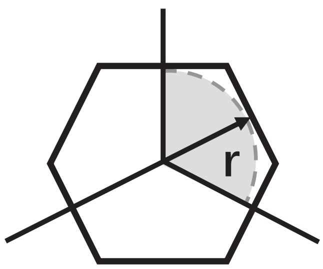
Calculation process of P_c

Obviously, there is more than one BS on some roads. The transmission from BS to a user is successful only if the user is within the transmission coverage. Hence we need to calculate the radius R of the BS coverage area. We can obtain R according to the free space model, Friis equation:

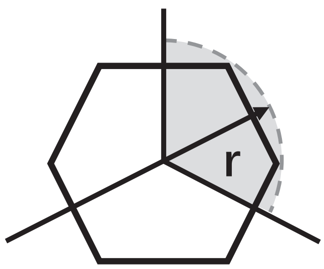
$$\frac{P_r}{P_t} = (\frac{\lambda}{4\pi R})^2 \cdot G_t \cdot G_r \tag{A.1}$$

where G_t and G_r the transmitter and receiver antenna gains, λ is the wavelength representing the effective aperture area of the receiving antenna, P_r is the minimum receive power, and P_t is the transmission power.

Considering that each BS is located at the center of the hexagonal cell and users scatter in the coverage following the HPPP of intensity λ_r, Fig.A shows the distribution of the distance r from a BS to an arbitrary user located in the coverage area, which is denoted by $F_R(r)$ and can be calculated by analyzing the intersecting area between the circle and the coverage area.



(a) $0 < r \leq \frac{\sqrt{3}}{2}R$



(b) $\frac{\sqrt{3}}{2}R < r \leq R$

Figure A.1: Two Geometric Cases

As shown in Fig.A, there are two geometric cases for the coverage boundary of BS and the circle of radius r. Then, we can determine the probability density function (pdf) of r by $f_R(r) = \frac{\mathrm{d}F_d(r)}{\mathrm{d}r}$ as Eq.(A.2).

$$f_R(r) = \frac{4r}{\sqrt{3}R^2}\begin{cases} \frac{\pi}{3}, & if\ 0 < r \leq \frac{\sqrt{3}}{2}R \\ \frac{\pi}{3} - 2\arccos\frac{\sqrt{3}R}{2r}, & if\ \frac{\sqrt{3}}{2}R < r \leq R \end{cases} \tag{A.2}$$

$$I = P_t h \sum_{i=1}^{18}((r\cos(\theta) - I_{xi})^2 + (r\sin(\theta) - I_{yi})^2)^{-\frac{\alpha}{2}} \tag{A.3}$$

$$SINR = \frac{P_t h((r\cos(\theta) - p_{xj})^2 + (r\sin(\theta) - p_{yj})^2)^{-\frac{\alpha}{2}}}{N_0 + I} \tag{A.4}$$

$$\begin{aligned} P_c &= P_R(SINR > D) \\ &= \int_{r>0}^{R}\int_{\theta>0}^{2\pi} e^{\frac{-\mu T((r\cos\theta - R)^2 + (r\sin(\theta))^2)^{\frac{\alpha}{2}}(N_0 + I(r,\theta))}{P_t}} f_R(r,\theta)d\theta dr \end{aligned} \tag{A.5}$$

Here, we use $(0, 0)$ to denote the coordinate of the target BS and $(r\cos(\theta), r\sin(\theta))$ to denote the user. Specifically, r is the distance from the BS to the user, and θ is the angle between X axis and the line connecting the origin and the user. According to the directional antennas model in System model section, the interference comes from 18 BSs' directional transmissions (ignoring the back radiation to simplify the analysis), and the coordinates are denoted as $(I_{xi}, I_{yi}),\ i = 1...18$. The coordinates of the six BSs located at the six vertices of the corresponding hexagon are represented as $(p_{xj}, p_{yj}),\ j = 1, ..., 6$. Supposing that the co-channel interference measured at the user comes from the same BS, accordingly, the interference can be calculated by Eq.(A.3).

Then, as for the user located in the $j^{th}(1 \leq j \leq 6)$ cell, we can acquire the SINR by Eq.(1) (in the submitted paper) as Eq.(A.4) .

Combing Eq.(A.3) and Eq.(A.4), the coverage probability of a user can be expressed with our assumption $h \sim exp(\mu)$ as Eq.(A.5), where D is the criterion demand of the user.