Sheet 2

3.7 Suppose that a mobile station is moving along a straight line between base stations BS_1 and BS_2, as shown in Figure P3.7. The distance between the base stations is $D = 2000$ m. For simplicity, assume small scale fading is neglected and the received power (in dBm) at base station i, from the mobile station, is modeled as a function of distance on the reverse link

$$P_{r,i}(d_i) = P_0 - 10n\log_{10}(d_i/d_0) \quad \text{(dBm)} \quad i = 1,2$$

where d_i is the distance between the mobile and the base station i, in meters. P_0 is the received power at distance d_0 from the mobile antenna. Assume that $P_0 = 0$ dBm and $d_0 = 1$ m. Let n denote the path loss which is assumed to be equal to 2.9.

Assume the minimum usable signal level for acceptable voice quality at the base station receiver is $P_{r,min} = -88$ dBm, and the threshold level used by the switch for handoff initiation is $P_{r,HO}$. Consider that the mobile is currently connected to BS_1 and is moving toward a handoff (time required to complete a handoff, once that received signal level reaches the handoff threshold $P_{r,HO}$ is $\Delta t = 4.5$ seconds).

(a) Determine the minimum required margin $\Delta = P_{r,HO} - P_{r,min}$ to assure that calls are not lost due to weak signal condition during handoff. Assume that the base station antenna heights are negligible compared to the distance between the mobile and the base stations.

(b) Describe the effects of the margin $\Delta = P_{r,HO} - P_{r,min}$ on the performance of cellular systems.

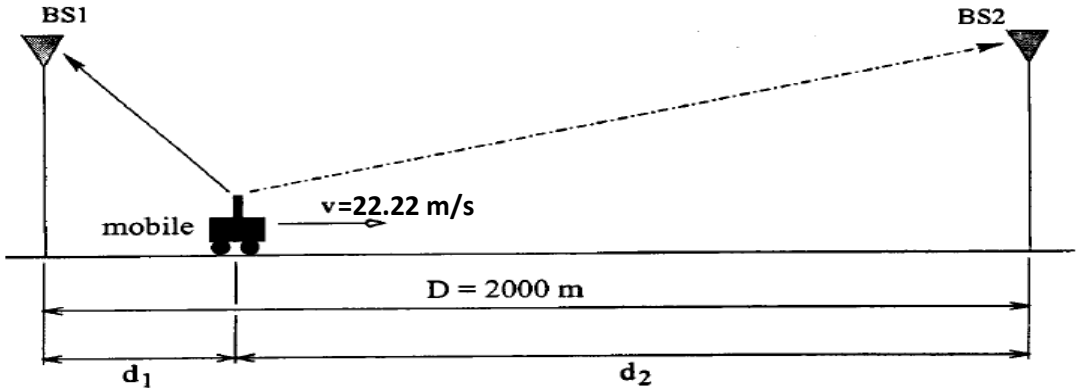

Figure P3.7 Cellular system with two base stations.

about the cluster size, path loss exponent, and the C/I values which result? How would this impact practical wireless system design?

3.16 A receiver in an urban cellular radio system detects a 1 mW signal at $d = d_0 = 1$ meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below –100 dBm. A measurement team has determined that the average path loss exponent in the system is $n = 3$. Determine the major radius of each cell if a seven-cell reuse pattern is used. What is the major radius if a four-cell reuse pattern is used?

"It is hard to fail, but it's worse never to have tried to succeed"