WIDE Exercises

1. In the year 2000 the American operator AT&T decided to swap its IS-136 TDMA system for GSM. The reason for this was twofold: the benefits of scale using GSM handsets and the need for additional capacity.

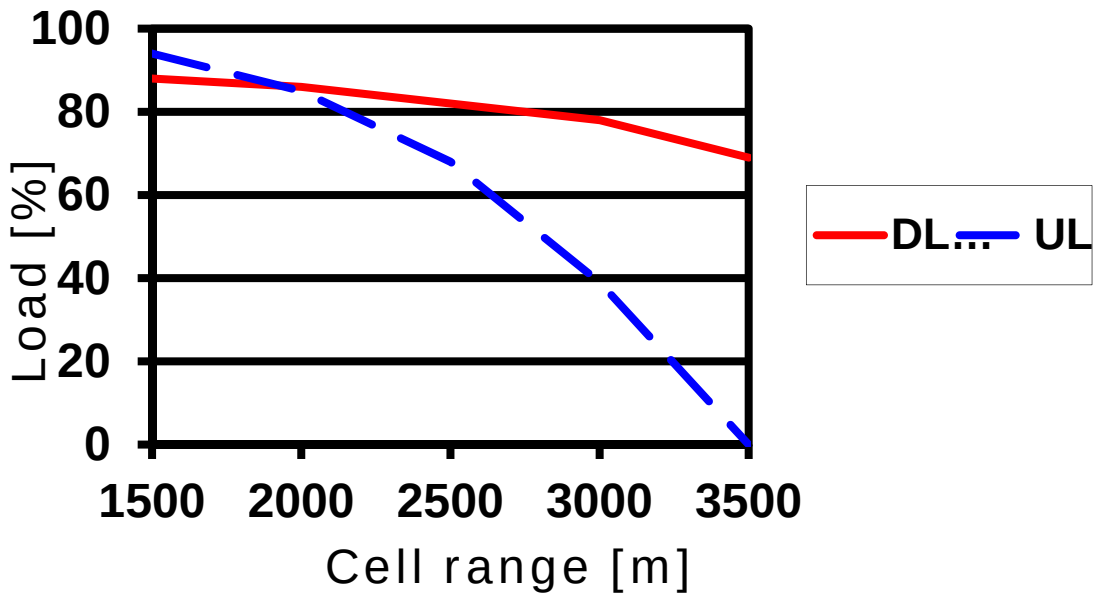
   At the time AT&T had 10MHz of spectrum in the 800-band. IS-136 was a TDMA system using radio channels 30 kHz wide with 3 time slots each. The system used a 7/21 cell plan.

   a. Approximately, how many base stations would AT&T have needed in order cover the capacity need in NY City if the regulator FCC would have allowed a maximum blocking rate of 2%?
   b. Approximately, how many base stations would they have needed if they had used GSM instead?

   NY city is approximately 116 km2 and the population around 8 million. AT&T had in the year 2000 around 10% penetration. Each user is supposed to load the system with ~25mErl in the peak hour

2. WCDMA (UMTS) and GSM1800 are almost at the same frequency band so a comparison is pretty relevant. For speech the two link budgets don't differ much. From a coverage perspective the maximum cell radius is about 3-5km for both systems. Using the example below, If an operator has 5MHz,

   a. How much more voice capacity does he get with WCDMA compared to GSM in a suburban cell that has a radius of about 3km.
   b. In an urban cell with a radius of a few hundred meters.



3. You are to plan build a HSDPA network in down town Stockholm with a minimum data through put of 4Mbps outdoors. The average height of the buildings in Stockholm is 20m and the 18 dBi BTS antennas are typically mounted 5m above the roof tops.

   a) What will be your average cell radius assuming you are LoS with the BTS antenna
   b) What will be your average cell radius assuming you are indoors and that the wall penetration loss is 20dB?

4. Make a simple estimation on how many more WCDMA voice users you can have in an office space using an indoor DAS system compared to using an outdoor macro base station 1000m away.

   The Macro base station antenna is assumed to have a gain of 18dBi, the noise factor for the system is around 5dB and the noise level at for the uplink at the base station receiver is assumed to be -103dBm (for more details see Table).

   The DAS system is assumed to have 0dB loss to the base station but around 38 dB noise figure.

Parameter Assumptions

System	**DAS**	**Macro**
Pathloss *L*	80dB	131+wall attenuation
Noise Power *N*	-73dBm	-103dBm
Terminal Power: P_{max}	24dBm	24dBm
Antenna Gain *G*	4dBi	18dBi