MAC layer

Exercise 1: GSM dimensionning

An operator wants to deploy a GSM network. It has bought two bandwidth : a 5 MHz large bandwidth in frequencies 890-915 MHz, and a 5 MHz large bandwidth in frequencies 935-960 MHz. The operator wants to simultaneously serve a minimum of 40 users per cell.
The first time slot of the first chosen TRX is dedicated to the broadcast channel (in downlink) and to the RACH channel (in uplink). Moreover, we consider that approximately one time slot per TRX is dedicated to signalling channels, both in uplink and downlink..

1) Compute the number of TRX that must be used per cell.
2) Deduce the necessary bandwidth per cell.

The operator can use a frequency reuse factor K=3 or a frequency reuse factor K=7.

3) In which case will the interference be higher ? Justify your answer.
4) In both cases, compute the required bandwidth in the whole network to serve at least 40 users per cell. Conclude on the feasibility of these deployments.

Exercise 2: Cellular engineering : determination of the frequency reuse factor.

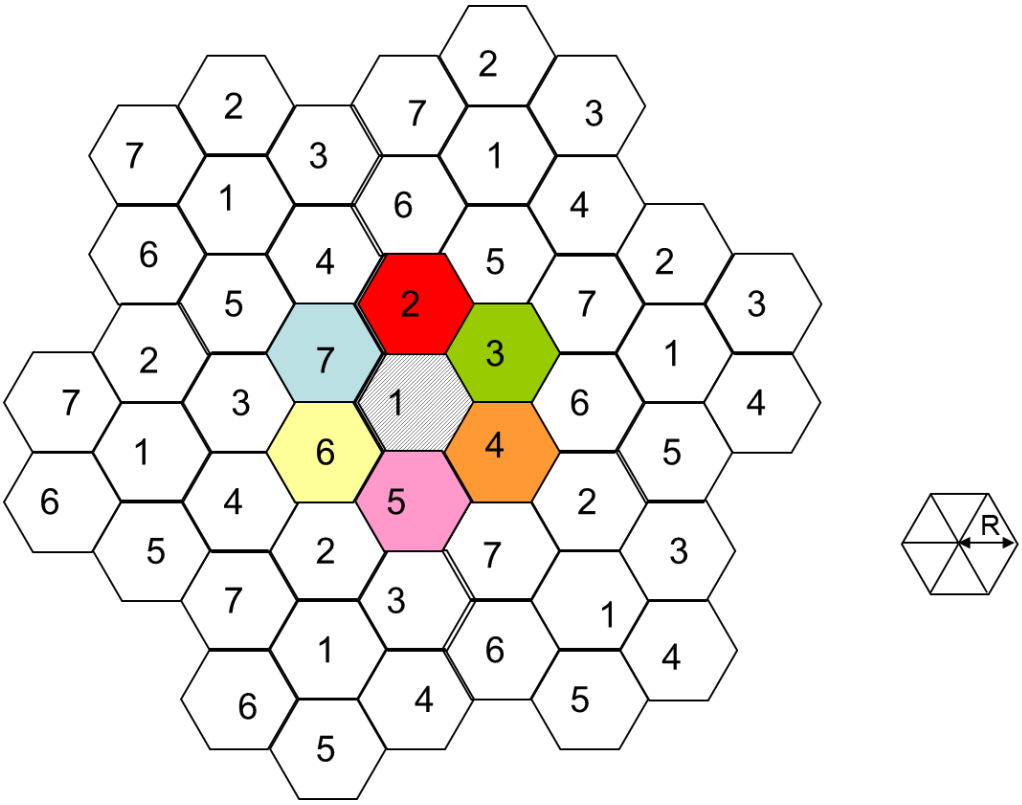

Figure 1: motif de réutilisation K=7

We consider a GSM network with hexagonal cells, with a frequency reuse factor K. On figure 1, an example with K=7 is given. All cells have the same radius R (the radius is the

distance between the base station, located at the center of the cell, and the mobile terminals that the furthest away from the base station, see. Fig.1).

1. On the given example (K=7), identify the cells that interfere with the central cell, that uses bandwidth B_1 (grey cell on Fig.1).
2. Represent how frequencies are distributed if the frequency reuse factor is K=3 or K=4.
3. When K=7, compute the distance between the center of the central cell and the other closest cells using the same bandwidth B_1
4. Proceed to the same computing when K=3 and K=4.
5. Deduce a general formula valid whatever K.