Consultation on authorising higher duty cycle Network Relay points

Neul Ltd, October 2014

Question 1: Do you have any evidence to inform Ofcom's view on the potential density of higher duty cycle (up to 10%) NRPs deployments, whether this is likely to exceed 10 NRPs/ km^2 and the total number of higher duty cycle NRPs that might be deployed?

The network relay point density is highly dependent on the urbanisation where they are deployed, the antenna height relative to the building average roof height, the maximum coupling loss. We have assumed the parameters shown in Table 1 to establish the typical cell radius assuming all the terminals are located indoor.

TABLE 1: SIMULATION PARAMETERS

Parameter	value
Maximum coupling loss	162 dB
NRP antenna	Single element dipole
Terminal antenna	dipolar
Propagation model	COST 231 metropolitan
Road angle	90°
Road width	15 m
Building separation	30 m
Shadow statistic	Log Normal, σ=9 dB
Terminal height	1.5 m
Frequency	870 MHz
Building penetration Loss	20 dB

Figure 1 shows the cell radius as a function of the antenna height. The colours correspond to a roof height which is between 8 and 15 meters (15 is magenta, 8 being light blue). If we assume that the coverage needs to be 95% (top left), the cell radius could be as low as 500 meters which is a density of ~1.3 per km^2

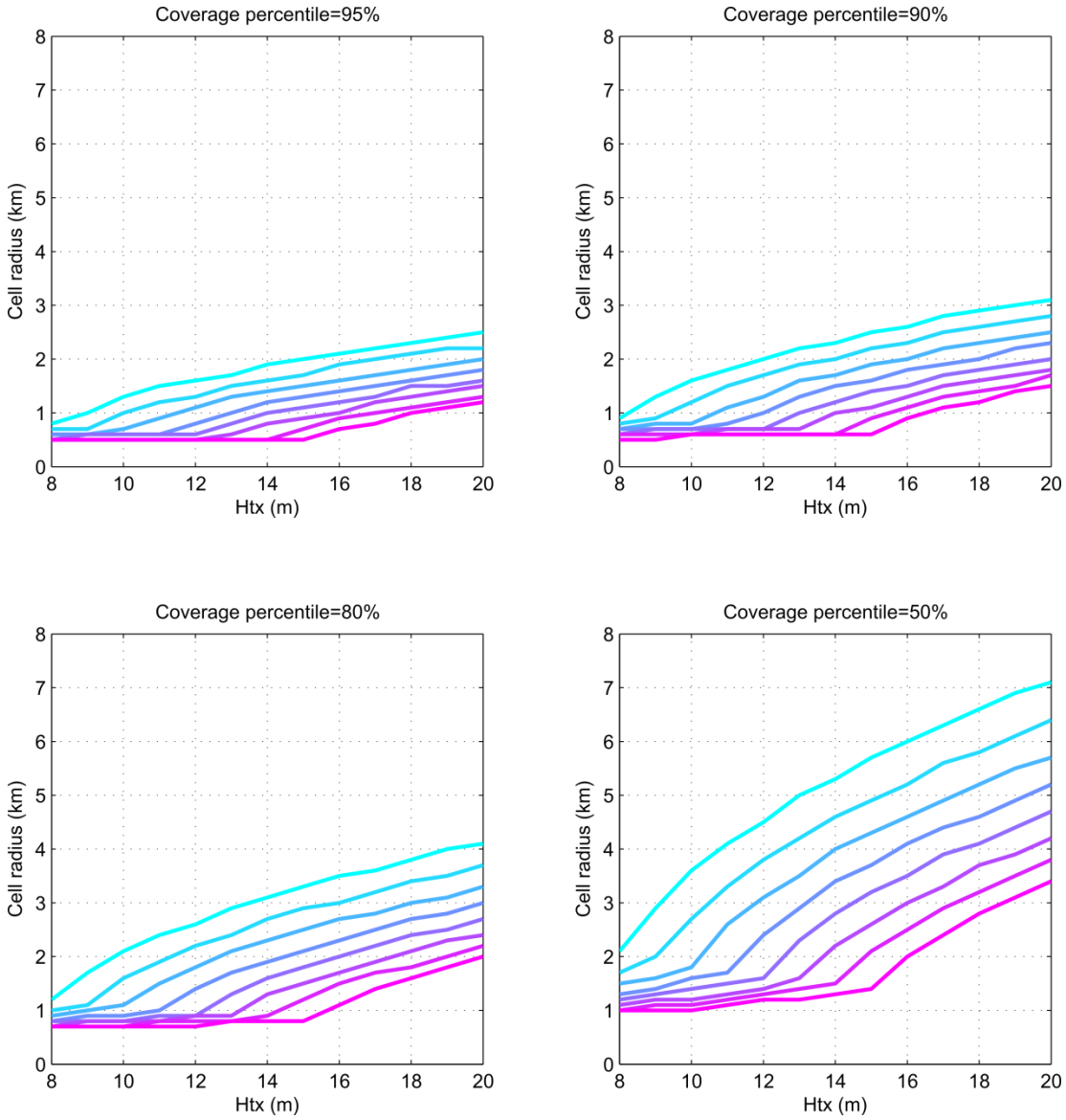

FIGURE 1: CELL RADIUS AS A FUNCTION OF ANTENNA HEIGHT FOR 95%, 90%, 80% AND 50% COVERAGE

Question 2: Do you have a view on how intra-network interference caused by NRPs deployed in large numbers within a network will be managed?

It is expected that the intra-network interference will be managed whereby each network relay point can report the interference level measured in the band. That information will then be used to allocate the best set of channels to use on the downlink.

Question 3: Do you have any evidence that networks may fail if the aggregate density of higher duty cycle NRPs reaches or exceeds 10 NRPs/ km^2?

We don't have such evidence since it is highly dependent of the type of modulation that is going to be used in the networks that are going to be deployed.

Question 5: Do you think CCA as defined by ETSI will be an effective protocol for (a) managing interference between networks? (b) Managing interference to short range devices using the 870-873 MHz band?

Although CCA with deferral is an effective method to avoid interference we think that channel adaptivity (9.4 in the ETSI spec) is another technique that could be applied. The principle would be to listen to several channels at the same time and to pick the one with the lowest noise level before transmitting. The algorithm would take into account the noise statistic over a time scale of several hours.

Question 6: Do you have a view on the costs and benefits of adding effective mitigation protocols such as Clear Channel Assessment to higher duty cycle NRPs?

We don't think that polite spectrum access will add a significant cost to the devices. We are more concerned with the ability to transmit a downlink signal at know time intervals where the terminal can wake up to obtain synchronisation and acknowledgement information.

Question 7: Do you agree with our proposals to authorise spectrum for NRPs using non-exclusive, network licences available on demand?

Yes

Question: Do you agree with the proposed licence conditions for higher duty cycle NRPs?

Yes