

S72-238 WCDMA systems

Tutorial 1

18.01.2002.

Exercises

1.

Cost 231 - Okomura-Hata propagation model gives for 1880 MHz average attenuation $L_c = 157.3 - 13.82 \lg(h_{BS}) + (44.9 - 6.55 \lg(h_{BS})) \lg(d) - a(h_r)$

How much increases the coverage area (50% at the cell boundary) when Base Station antennae height is increased from 30 m to 200 m, and link budget allows 155 dB attenuation?

2.

Channel characterization

Power [dB]	-3	0	-2	-6	-8	-10
Delay [μs]	0.0	0.2	0.5	1.6	2.3	5.0

a) Determine the *rms* delay and mean excess time for the channel

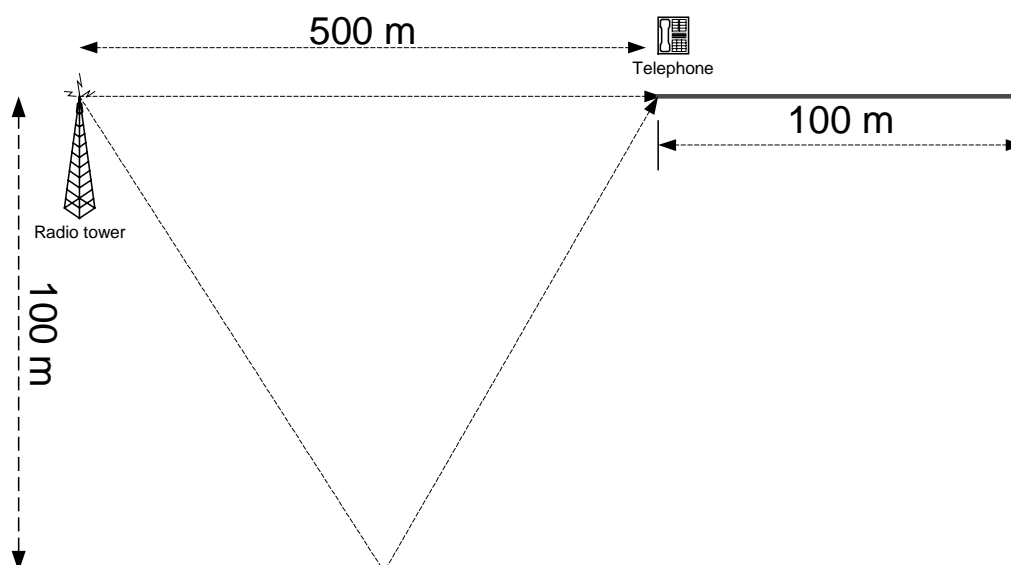
b) Determine the maximum excess delay -10 dB.

c) Estimate the coherence bandwidth of the channel.

d) (Coherence time). Assume that mobile using UMTS system traveling with $50 \frac{km}{h}$ receives the signal through this channel determine the time over which the channel appears stationary (or at least highly correlated).

3.

Calculate the signal amplitude in points along the line given in the figure below.



The wall reflection coefficient is -1 and there is no phase change. The system operates on 2 GHz frequency where only the carrier is transmitted and transmission power is 1 W. The calculations are made with granularity of 5 m.

- a) Calculate the amplitude at the receiver when only the line of sight component is considered.
- b) Calculate the amplitude change at given locations on the figure. When both paths are summed together.
- c) Assume that the receiver is capable to separate the paths and sum them together in phase. Calculate the resulting signal amplitude.
- d) Assume that the receiver is capable to separate paths that are apart at least by one symbol length. What is the symbol rate that system should have in order to separate these two paths.

4.

What is minimal separation of channel taps that the receiver can recognize when user data rate is 30 kbit/s, the system uses coding rate $1/2$ and each bit is spread with 64 bits? If two arriving signals can be separated what is the difference of path length they have traveled? The two paths can be separated if they are apart at least by one chip length.