

Laboratory work: Path loss measurements

Preliminary exercises

Bandwidth:

1. Try to find frequency bands where following technologies operate in Finland [1]:
 - a. GSM downlink and uplink frequencies and the frequency bands different operators are using.
 - b. W-CDMA and/or HSPA downlink and uplink frequencies and the frequency bands different operators are using.
 - c. LTE downlink and uplink frequencies and the frequency bands different operators are using.
 - d. FM-radio
 - e. WLAN
 - f. Bluetooth
2. How much 1 W (Watt) is on dBm scale. How much -40dBm is in Watts? Show the equations.
3. What are the bandwidths of the described technologies and what is the shape of their spectrum. Explain briefly the shape and bandwidth of the spectrum. In addition to the bandwidth measurement on the laboratory exercise, the signal powers are measured. What kind of power levels (in dBm scale) you expect to find in the exercise?

Link budget and fading: ITU indoor propagation model

4. At the laboratory exercise you will measure the path loss of 2.4 GHz and 5.8 GHz signal when a cart is moving on the hallway according to the figure below. Use ITU indoor propagation model to compute path loss along the 10 meter distance in the hallway. Ignore loss from wall penetration.
5. Plot the indoor path loss curves with link budget calculation for both frequencies. For the 2.4 GHz gains + losses are 10 dB including antenna gains, cable and connector losses etc. For the 5.8 GHz the gains + losses is approximately 0 dB. The transmission power is 10 dBm.
6. What kind of path loss curve you expect to see in the laboratory exercise when the scenario is in real life?
7. Explain receive diversity concept and why it improves the link performance on fast fading channel?

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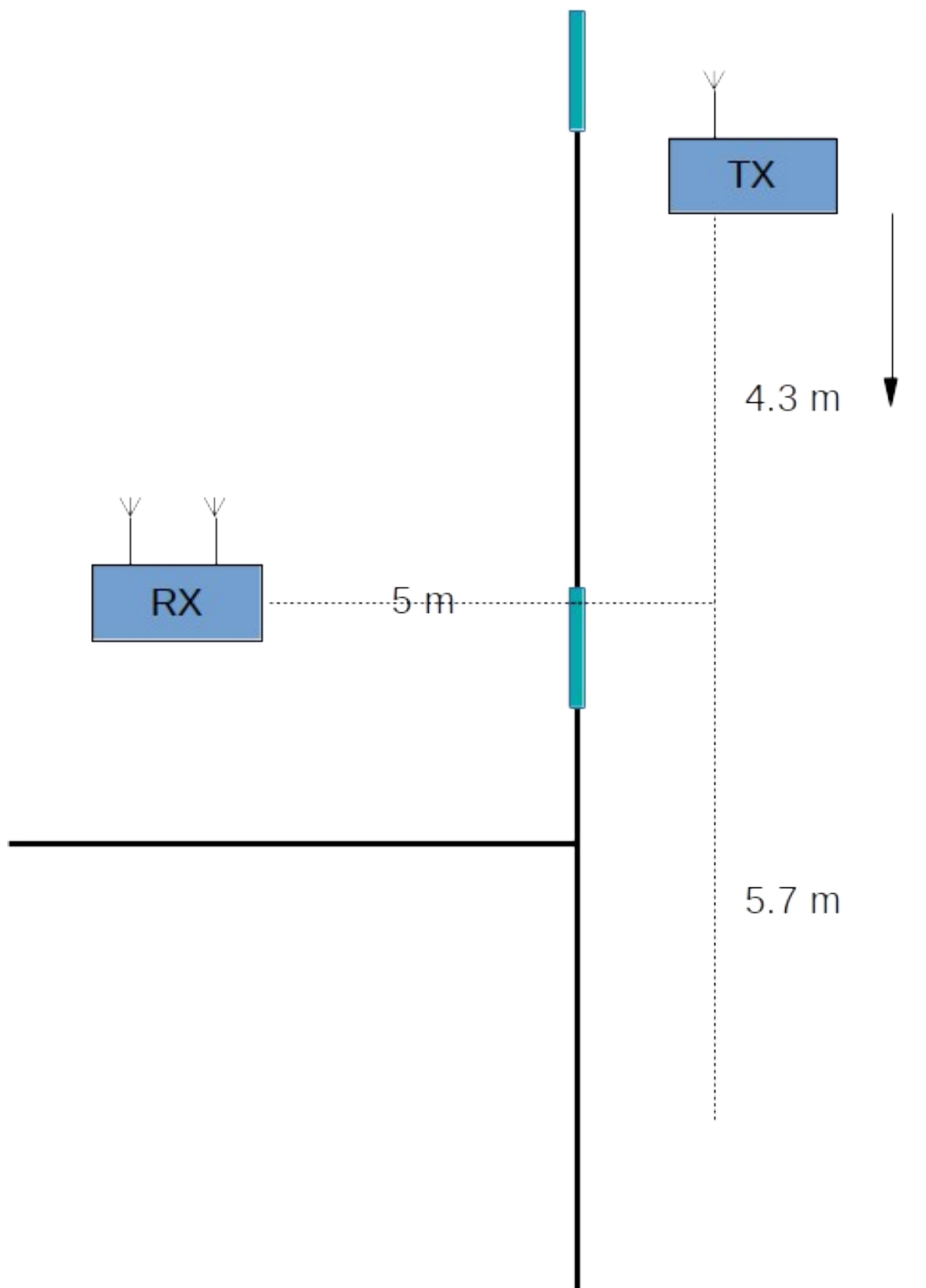


Figure 1 Geometry of the moving transmitter in hallway

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[1] For mobile networks: <https://www.traficom.fi/en/communications/communications-networks/frequencies-and-license-holders-public-mobile-networks>