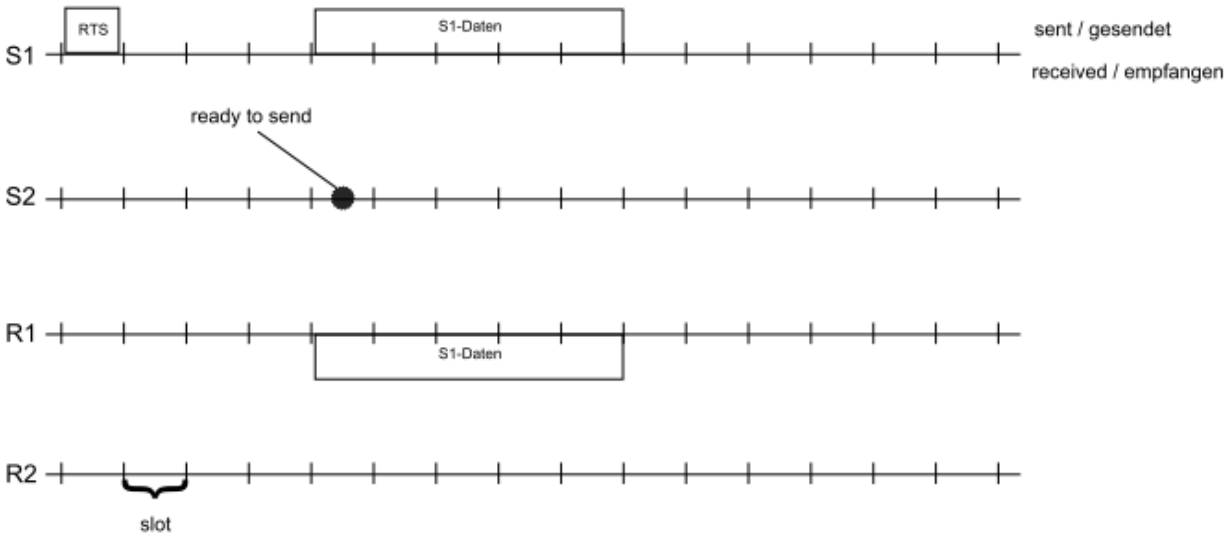
a.)

Please draw a constellation of four stations (two senders (S_1 und S_2), two receivers (R_1 und R_2)) where the *exposed terminal* problem can happen. Draw the *transmission range* and the *detection range* for the senders into your drawing.

b.)

Four stations (two senders (S_1 und S_2), two receivers (R_1 und R_2)) are situated in a constellation where the *exposed terminal* problem happens. The communication is clocked, meaning transmissions start only at the beginning of a time slot. The simple *RTS/CTS* protocol for MAC is used. IFS amounts to one time slot.

In the diagram below one transmission from S_1 to R_1 and the related sent RTS packet are already depicted. Please complete the drawing with sent and received RTS, CTS and ACK packets belonging to the transmission of S_1. Please draw sent packets above the line and received packets below the line. Signal propagation delays can be neglected. Please pay attention to draw all packets at sender and receiver correctly.

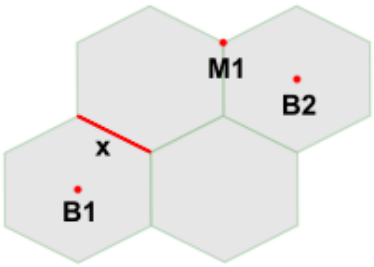


c.)

Imagine a cell phone network (cell-based). Frequencies are bound to *equilateral* hexagons (compare to the Figure below). The network contains three stations (B_1, B_2 und M_1). M_1 is a mobile station. This means it will NOT always be at the location marked in the figure!

- The length of each hexagon side is $x = 100m$.
- All stations send with the same frequency $f = 2.4GHz$.
- The maximum transmission power of the stationary senders B_1 and B_2 is $P_b = 100W$.
- The maximum transmission power of M_1 ist $P_m = 500mW$.

Note: Signal strength is damped using the *Friis* transmission equation: $g\frac{1}{f^2 d^\alpha}$, where d is the distance and f the frequency. Use $\alpha = 2$ (line-of-sight) and $g = 5.6 * 10^{14}\frac{m^2}{s^2}$ for your calculations.



We consider the following scenario: B_1 and B_2 use full power to transmit to M_1. M_1 is located at B_2 (Please note: This is different than illustrated in the fiugre!). M_1 wants to receive the signal from B_2. The signal transmitted by B_1 is received as noise. There are no other sources of noise present.

Calculate the signal-to-noise ratio (SNR) for M_1. Please write the complete formula and constitute all values, before giving your final answer.