Exercise 7 - Solution

Task 7.1

$$A_{eff} = A_1 \cdot \frac{\rho_{\text{AluCore}}}{\rho_{\text{Alu}}} = 0.01185m^2$$

$$Q[W] = \frac{K_1 \cdot A_{eff} \cdot (T_1 - T_2)}{L_1} W = 426.6W$$

Task 7.2

1. Earth albedo: about 20% to 40% of the sun light hitting the Earth's surface is reflected and thus influences satellites
2. Earth IR: the Earth itself emitts an infrared radiation that influences satellites

Task 7.3

1. $$L[dB] = 92.4dB + 20log_{10}(2) + 20log_{10}(10^8) = 258.42dB$$
2. $$L = \frac{L[dB]}{0.3dB} = 861.4m$$
3. **Free Space Path Loss**: Steady decrease of power flux as the radio wave is popagating away from the source antenna (no real loss).
   Cable loss: Real loss of signal power due to dissipation in the medium with ohmic losses.

Task 7.4

$P_1 = 50W$, $P_2 = 25W$

$$P_1[dBW] = 10log_{10}(50) = 16.99dBW$$
$$P_2[dBW] = 10log_{10}(25) = 13.979dBW$$

$\Rightarrow$ reduced power: $G_t \approx 3dB$

$$G_t = 20log_{10}(D) \Rightarrow D = 10^{\frac{3}{20}} = 1.4125$$

$\Rightarrow$ Increasing the groundstation antenna diameter by a factor 1.4125 compensates the 3dB.