Problem 10.7 A radar system is characterized by the following parameters: $P_t = 1$ kW, $\tau = 0.1$ μs, $G = 30$ dB, $\lambda = 3$ cm, and $T_{sys} = 1,500$ K. The radar cross section of a car is typically 5 m^2. How far away can the car be and remain detectable by the radar with a minimum signal-to-noise ratio of 13 dB?

Solution: $S_{min} = 13$ dB means $S_{min} = 20$. $G = 30$ dB means $G = 1000$. Hence, by Eq. (10.27),

$$R_{max} = \left[\frac{P_t \tau G^2 \lambda^2 \sigma_t}{(4\pi)^3 K T_{sys} S_{min}}\right]^{1/4}$$

$$= \left[\frac{10^3 \times 10^{-7} \times 10^6 \times (3 \times 10^{-2})^2 \times 5}{(4\pi)^3 \times 1.38 \times 10^{-23} \times 1.5 \times 10^3 \times 20}\right]^{1/4} = 4837.8 \text{ m} = 4.84 \text{ km}.$$