Appendix B: Calculating Transmitter Range

Power loss is the ratio of the power of the FM transmitter P_t and the FM radio receiver.P_r. The power loss is related to the transmission range d by

$$\sqrt{\frac{P_t}{P_r}} = d$$

Typically the power output of an FM radio is given in its spec sheet. Our battery-operated pocket radio has a P_r between 0.1 to 0.01 mW. Recall that the 2N2222A analysis revealed a power output of 124 mW. As such, the transmission range's minimum and maximum are:

$$d_{min} = \sqrt{\frac{124\ mW}{0.1\ mW}} = 35.2\ \ m = 117\ \ feet$$

$$d_{max} = \sqrt{\frac{124\ mW}{0.01\ mW}} = 111.4\ \ m = 371.3\ \ feet$$

The antenna type, carrier frequency, current coupling and environmental conditions like hills and trees all effect transmission range. The radiation efficiency ranges from 10 to 30%. As such, on the low-end, performance would yield

$$11.7 feet < d < 37.1 feet$$

The high-end yields

$$35 feet < d < 112 feet$$