Energy Budget

3V -> 5V DC/DC Converter 90% Effective

3V, 1.25 Ah battery

WSN Node

- Radio (5V)
  - Power down 25 μA
  - Receive 50 mA
  - Transmit 150 mA

- Sensors (5V)
  - Average ~ 1 mA

WSN node is programmed to turn on radio every 5 seconds, listen on the network for 0.5 seconds, and then power down the radio.

It is estimated that it will be required to make a 10-second transmission once every 5 minutes.

Estimate how long the node can operate. Assume that 70% of the battery capacity is available.

Solution

\[ \text{Ave. receiver current} = I_R = \frac{0.5}{5} \times 50 \text{ mA} = 5 \text{ mA} \]

\[ \text{Ave. transmit current} = I_T = \frac{10}{5 \times 60} \times 150 \text{ mA} = 5 \text{ mA} \]

\[ \text{Ave current for node} = I_N = I_R + I_T + I_S = 5 + 5 + 1 \text{ mA} = 11 \text{ mA} \]

\[ \text{Power out of DC/DC} = 5 \times 11 = 55 \text{ mW} \]

\[ \text{Power into DC/DC} = 55/0.9 = 61 \text{ mW} \]

\[ \text{@ 3V for this is: } 61/3 = 20.33 \text{ mA} \]

\[ \text{# of hours battery can supply this} = \frac{0.7 \times 1.25}{0.0233} = 37.6 \text{ hours} \]