# POWER PROFILE

## Power consumption for a node

### Global Constants

Power required to turn on mcu,sensor and to change between rx and tx of radio
$(P_{off \to on})_{mcu}$, $(P_{off \to on})_{sensor}$, $(P_{rx \to tx})_{radio}$ $(P_{tx \to rx})_{radio}$

Power in idle state for mcu,sensors and the idle and receive state for radio
$(P_{idle})_{mcu}$, $(P_{idle})_{sensor}$, $(P_{idle})_{radio}$, $(P_{rx})_{radio}$

Power for different modes and switching between them
$(P_{on \to sleep})_{mcu}$, $(P_{sleep})_{mcu}$, $(P_{sleep \to on})_{mcu}$, $(P_{on \to sleep})_{radio}$, $(P_{sleep})_{radio}$, $(P_{sleep \to on})_{radio}$

Power for procssing packet, sending packet and reading sensor
$P_{procss\_packet}$, $P_{send\_packet}$, $P_{read\_sensor}$

An array of total Power of the node over time and the time at which the power changes $P_{total}$, timex

The following modes $P_{mode}$ have been used

- SENSE_SEND = 7

- ON = 6

- TX = 5

- RECIEVE = 4

- IDLE = 3

- SLEEP = 2

- OFF = 0

### Functions/Equations

**Turn On Node** $(P_{on})_{node} = (P_{off \to on})_{mcu}$

**Idle State** $P_{idle\_state} = P_{mcu\_state} + P_{radio\_state} + P_{sensor\_state}$

    **MCU** $P_{mcu\_state} = (P_{idle})_{mcu}$
    **Radio** $P_{radio\_state} = \text{RX} * (P_{rx})_{radio} + (1 - \text{RX}) * (P_{idle})_{radio}$

    RX = Whether Radio in Recieve state or idle state

**Sleep Node** $P_{sleep} = P_{mcu\_state} + P_{radio\_state} + P_{sensor\_state}$

**MCU** $P_{mcu\_state} = (P_{on \rightarrow sleep})_{mcu}$

**Radio** $P_{radio\_state} = (P_{on \rightarrow sleep})_{radio}$

**Sensor** $P_{sensor\_state} = 0$

**Wakeup Node** $P_{wakeup} = P_{mcu\_state} + P_{radio\_state} + P_{sensor\_state}$

**MCU** $P_{mcu\_state} = (P_{sleep \rightarrow on})_{mcu}$

**Radio** $P_{radio\_state} = (P_{sleep \rightarrow on})_{radio}$

**Sensor** $P_{sensor\_state} = 0$

**Sense Send Message** $P_{message} = P_{mcu\_state} + P_{radio\_state} + P_{sensor\_state}$

**MCU** $P_{mcu\_state} = P_{procss\_packet}$

**Radio** $P_{radio\_state} = P_{send\_packet}$

**Sensor** $P_{sensor\_state} = (P_{off \rightarrow on})_{sensor} + P_{read\_sensor}$

**Switch TX RX** $P_{switch} = \text{MODE} * (P_{tx \rightarrow rx})_{radio} + (1 - \text{MODE}) * (P_{rx \rightarrow tx})_{radio}$
$\text{MODE} = 0(RX \rightarrow TX)/1(TX \rightarrow RX)$

**Update Power** $P_{total_{i+1}} = P_{total_i} + P_{consumed}$