EoRa Pi Battery Life Analysis - Claude

Project Specifications

Battery Configuration:

- Battery: 3000 mAh LiPo
- Average current draw: 175 µA
- Power measurement tool: Nordic Power Profiler Kit II (NPPK II)
- Accumulated charge at measurement stop: 1.76 mC (receiver in sleep mode)

Battery Life Calculations

Theoretical Maximum

- **Duration:** ~1.96 years (714 days)
- **Calculation:** 3000 mAh ÷ 0.175 mA = 17,143 hours

Realistic Estimate

- **Duration:** ~19.2 months (586 days)
- **Adjusted capacity:** 2460 mAh (82% usable capacity)
- **Calculation:** Accounts for typical LiPo efficiency and battery characteristics

Practical Limit

- **Duration:** ~13.5 months
- **Limitation:** Self-discharge becomes significant for deployments longer than 6 months
- **Self-discharge rate:** ~3% monthly for LiPo batteries

Power Measurement Details

NPPK II Measurement Results:

- Average current consumption: 175 µA
- Measurement stopped with receiver in sleep mode
- Accumulated charge: 1.76 mC at stop point
- Indicates excellent low-power sleep state performance

Design Considerations

Factors Affecting Battery Life:

- Temperature effects (cold significantly reduces capacity)
- Battery aging over time
- Actual current variations with:
    - LoRa transmission frequency
    - Sensor reading intervals
    - Environmental conditions
    - Wake/sleep cycle efficiency

Power Optimization Notes:

- 175 µA average suggests effective use of sleep modes
- Typical for LoRa module sleep current plus always-on peripherals
- Good balance between functionality and power consumption

Deployment Recommendations

Optimal Use Cases:

- Long-term IoT deployments (1+ year without battery replacement)
- Remote sensor applications
- Environmental monitoring systems

Documentation Suggestions:

- Record measurement duration for the 1.76 mC accumulation
- Document sleep/wake cycle details
- Note active transmission current peaks
- Include temperature operating range considerations

Conclusion

The EoRa Pi project demonstrates excellent power efficiency with an estimated 13-19 month battery life on a single 3000 mAh LiPo battery. The 175 µA average current consumption indicates well-optimized power management, making it suitable for long-term autonomous deployment scenarios.