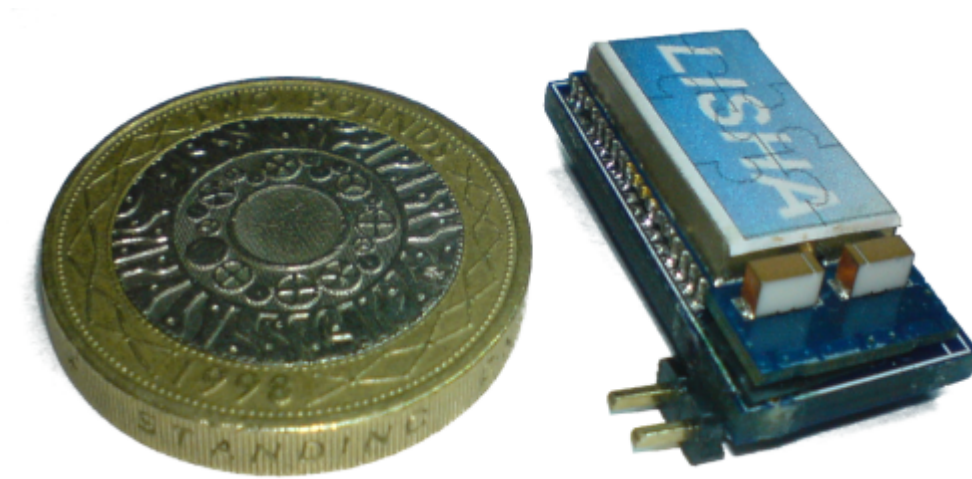# EPOSMote I

## Project Description

The EPOSMote project is based on a solid combination of the popular ATmega 1281v MCU and the latest Atmel AT86RF230 radio transceiver.

The powerful ATmega 1281v MCU features 128KB of flash memory and 8KB of RAM. The AT86RF230 transceiver offers -101dBm of Rx sensitivity and up to +3dBm of Tx power. This combination, called the "link budget" is related to its range of operation. The difference in link budget – just 9dBm – nearly triples its range. Thanks to the outperforming link budget, the range of AT86RF230 is 2.8 times that of other modules.

Some of its characteristics:

- High RX sensitivity (-101 dBm)
- Outperforming link budget (104 dB)
- Up to 3 dBm output power
- Very low power consumption:
    - < 6 µA in Sleep mode
    - 19 mA in RX mode
    - 18 mA in TX mode
- Ample memory resources (128K bytes of flash memory, 8K bytes RAM, 4K bytes EEPROM)
- Wide range of interfaces (both analog and digital):
    - 9 spare GPIO, 2 spare IRQ lines
    - 4 ADC lines + 1 line for supply voltage control (up to 9 lines with JTAG disabled)
    - UART with CTS/RTS control
    - USART
    - I2C
    - SPI
    - 1-Wire
    - Up to 30 lines configurable as GPIO
- Capability to write own MAC address into the EEPROM
- Optional antenna reference designs
- IEEE 802.15.4 compliant

- 2.4 GHz ISM band
- BitCloud embedded software, including UART bootloader and AT command set

Our module implements the robust IEEE 802.15.4/ZigBee stack that supports a self-healing, self-organizing mesh network, while optimizing network traffic and minimizing power consumption.

It also includes a low-power Dual Chip Antenna, best-in-class sensitivity for 802.15.4/ZigBee which eliminates the need for costly and time-consuming RF development and shortens time to market, while embedded OS EPOS ensures standards-based wireless connectivity for a wide range of applications.

The applications include, but are not limited to:

- Building automation & monitoring
- Lighting controls
- Wireless smoke and CO detectors
- Structural integrity monitoring
- HVAC monitoring & control
- Inventory management
- Environmental monitoring
- Security
- Water metering
- Industrial monitoring
- Machinery condition and performance monitoring
- Monitoring of plant system parameters such as temperature, pressure, flow, tank level, humidity, vibration, etc
- Automated meter reading (AMR)

## Specifications

| Parameters | Range | Unit |
|---|---|---|
| Frequency band | 2.400 — 2.483 | GHz |
| Number of channels | 16 | |
| Data rate | 250 | kbps |
| Max output power | 3 | dBm |
| 2nd harmonic | -28 | dBm |
| 3rd harmonic | -26 | dBm |
| Sensitivity (PER 1%) | -101 | dBm |
| Adjacent Channel Rejection | 27 | dB |
| Alternate Channel Rejection | 53 | dB |
| Supply voltage | 1.8 – 3.6 | V |
| Current consumption, RX | 19 | mA |
| Current consumption, TX | 18 | mA |
| Current consumption (Sleep mode) | 6 | µA |

| Flash memory | 128 | kB |
|---|---|---|
| RAM | 8 | kB |
| EEPROM | 4 | kB |
| Operating Temperature | -40 — +85 | °C |

## Electric Characteristics

Test Conditions (unless otherwise stated): Vcc= 3 V, f=2.45 GHz, Tamb= 25 °C

| Parameters | Range | Unit |
|---|---|---|
| Supply Voltage (Vcc) | 1.8to 3.6 | V |
| Current Consumption: RX mode* | 19 | mA |
| Current Consumption: TX mode* | 18 | mA |
| Current Consumption: Radio is turned off,MCU is active for 50% of the time* | 14 | mA |
| Current Consumption: Power Save mode* | 6 | µA |

(*) Noted parameters are measured under the following conditions:

- BitCloud Software is running at 4 MHz clock rate, DTR line management is turned off
- all interfaces are set to the default state (see Pin Assignment Table)
- output TX power is 0 dBm
- JTAG is not connected
- Vcc = 3.0 V

## RF Characteristics

| Parameters | Range | Unit | Condition |
|---|---|---|---|
| Frequency Band | 2.400 to 2.4835 | GHz | |
| Number of Channels | 16 | | |
| Channel Spacing | 5 | MHz | |
| Transmitter Output Power | -17 to +3 | dBm | Adjusted in 16 steps |
| Receiver Sensitivity | -101 | dBm | PER = 1% |
| On-Air Data Rate | 250 | kbps | |
| TX Output / Rx Input Nominal Impedance | 100 | Ohms | For balanced output |

## ATmega1281V Microcontroller Characteristics

| Parameters | Range | Unit |
|---|---|---|
| On-Chip Flash Memory Size | 128K | bytes |
| On-Chip RAM Size | 8K | bytes |

| On-Chip EEPROM Size | | 4K | bytes |
|---|---|---|---|
| Operation Frequency | | 4 | MHz |

## Module Interfaces Characteristics

| Parameters | Range | Unit | Condition |
|---|---|---|---|
| UART Maximum Baud Rate | 38.4 | kbps | |
| ADC Resolution / Conversion Time | 10 / 200 | Bits / µs | In the single conversion mode |
| ADC Input Resistance | > 1 | MOhm | |
| ADC Reference Voltage (Vref) | 1.0 to Vcc-0.3 | V | |
| ADC Input Voltage | 0 ÷Vref | V | |
| I2C Maximum Clock | 222 | kHz | |
| GPIO Output Voltage (High/Low) | 2.3 / 0.5 | V | (-10 / 5 mA) |
| Real Time Oscillator Frequency | 32.768 | kHz | |