



Document version 1.0

User's hardware guide

RSS2 sensor board

Model S2 Rev 2.4



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Manifesto

The Universal IEEE 802.15.4 Sensor for WSN and IoT applications

"After using several developing platform, we needed a better solution, small, robust, flexible but still simple and cost-effective.

This document

Read this document before using and to get most out of your sensor board. Save the document for future use. New improved, corrected versions are available via <http://www.radio-sensors.com/developing/S2/users-hw-guide-rss2.pdf>

Introduction

The board is a generic communication platform for Wireless Sensors Networks (WSN) and Internet of Things (IoT). The board has a built-in PCB antenna and is designed for the IEEE802.15.4 this is commonly used in IoT and WSN's. It's designed to be simple but still flexible platform well suited for many IoT applications. The board design is proven and robust and refined over many years and projects. Board is based on proven industry standard Atmel AtMega256fRFR2 MicroContoller Unit (MCU) and is low-power and have excellent RF-performance. The board is equipped with may useful features and can server as communication platform in many IoT applications. The platform is well documented and has CE approval (pending) to support comercial applications.

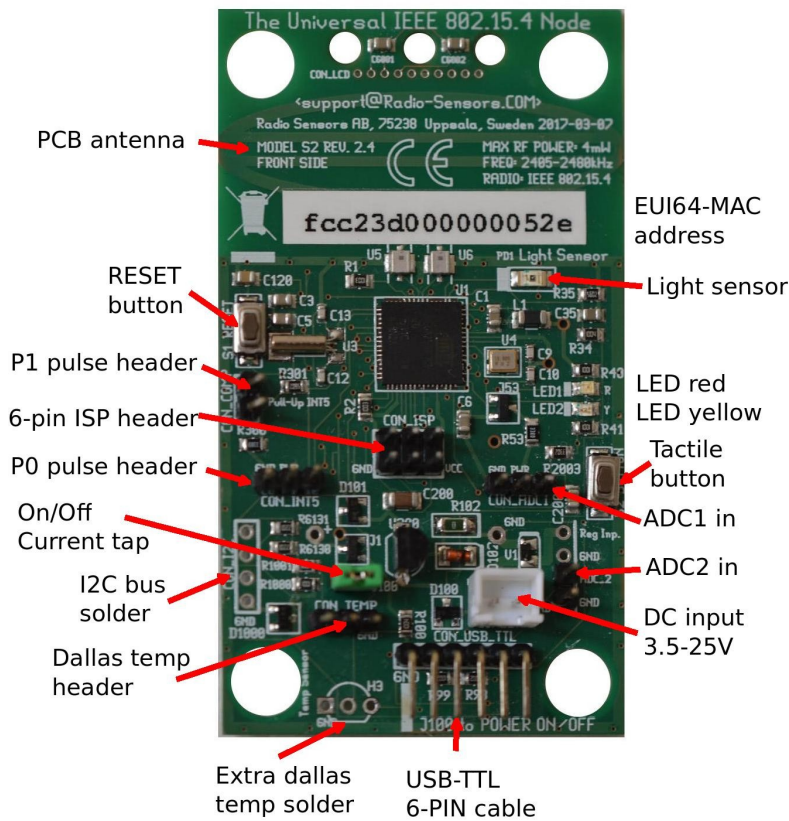
General features

- MCU AtMega256RFR2 with integrated IEEE 802.15.4 Transceiver
- Integrated high-performance PCB antenna. Supercardioid
- USB serial connection via USB-TTL cable. FTDI type 6-pin header.
- Low-Power consumption SLEEP ~15 uA @ 8MHz (RC Osc.)
- Low-Power consumption SLEEP ~45 uA @ 16MHz (XTAL)
- Low-Power voltage regulator with wide input range 3.5V-25V. TVS protected
- Newest BOSCH environmental sensor BME280, Temperature RH/ Air pressure.
- Unique EUI-64 address via I2C chip which also includes EEPROM
- Analog inputs. ADC1/AD1, (ADC2/AD2 Pin Header)
- 1 Analog input to voltage regulator. CON_BAT/V_IN
- 1 GPIO/pulse pin. w. pull-up. P0
- 1 Comparator input via separate comparator chip. P1
- 1 Programmable power pin VCC. via FET for external sensor

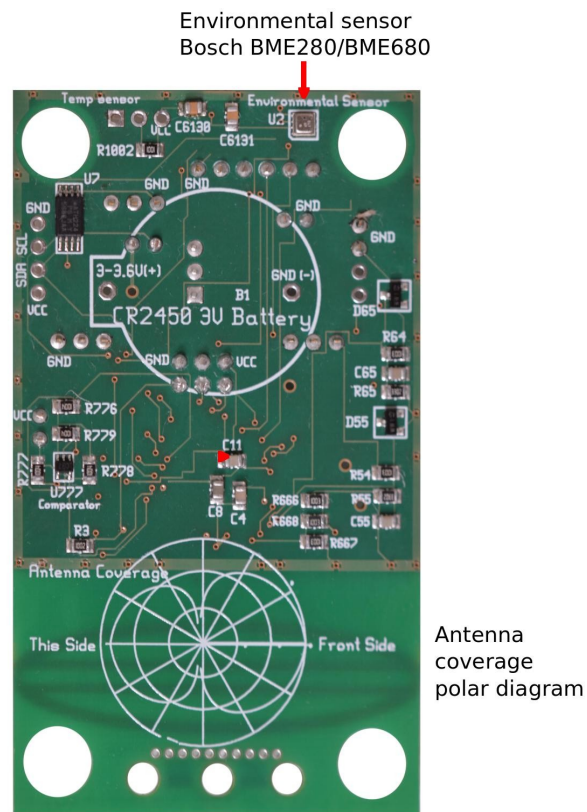
- 1 GPIO with connector intended for one-wire bus
- 2 LED's Red/Yellow for monitoring and debugging
- Connector for extra temp. sensor via cable
- Programmable via AVR 6-Pin (0.1") ISP or via USB/serial bootloader
- Compact size. PCB 80x45.5 mm. Case 90x50x32 mm standard case
- Weight 20 gr without battery and holder including standard case 70 gr
- On-board comparator typical use w. phototrans. P1
- On-board light sensor
- Connectors are through-hole for maximal robustness. Standard pin spacing 2.54mm

Board description

Front side overview



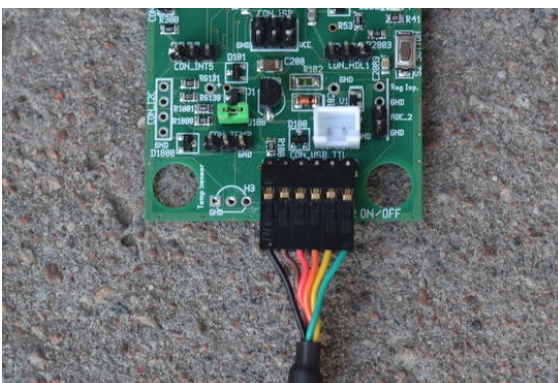
Back side overview



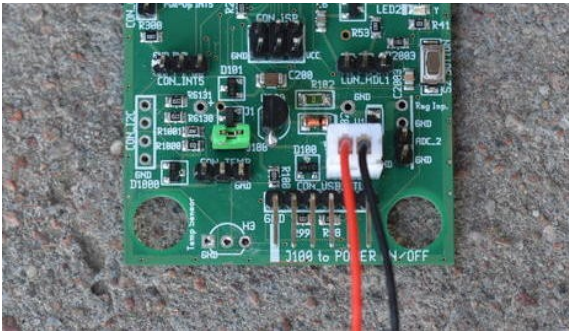
Power

The board has several power options: Note the the colors on the cables.

- Via USB TTL cable.



- DC-connector. White DC connector. 3.5-25V



Connectors

See boards description to find matching connector. Pin-out configuration are given according this view. Also silk printing on the PCB should be useful as GND and VCC pins are in many cases printed on the PCB itself. From left to right, from top to bottom. Corresponding pins in the MCU can be seen in the pin assignment table.

USB-TTL 6 pin connector/header

Standard FTDI- TTL-USB connector. Also in FTDI documentaion

GND CTS VCC TXD RXD RTS

GPIO pins CTS, TXD, RXD are TTL-logic levels

ISP 6 pin (2*) connector/header

Standard Atmel ISP connector.. CON_ISP

RESET SCK MISO

GND MOSI MOSI

DC input connector white JST-style

VCC GND

Input protected with small Transient Voltage Protection (TVS) clamping diode to conform to safety standards

P0 pulse connector/header

GND rVCC SIGNAL

rVCC is reduced over a resistor to protect short circuit current

SIGNAL is pulsed with resistor

P1 pulse connector/header

COMPARATOR

VCC

ADC1 Analog input connector/header

GND pVCC ADC1

pVCC is VCC controlled via FET via GPIO pin P_PWR PE7 on MCU. This allows controlling load with higher currents compared to GPIO. MAX 6.4V input.

ADC2 Analog input connector/header

Regulator Input (No Header)

GND (No header)

ADC1

GND

MAX 6.4V input.

Dallas temp connector/header

pVCC OW_TEMP2 GND

pVCC is VCC pulsed-up to the temp sensors externally powered.

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Flashing/Programming

ISP 6-pin header (2*3)

This Atmel standard In-System Programming (ISP) programming using the 6-pin header.

Programmers like AVR Dragon are fine. Check that programmer does not exceed the max voltage for MCU which is 3.6V. In most cases this is only used to flash a more serial boot loader. So board can be flashed without any external ISP programmer. RS flashes serial bootloader.

Serial via bootloader 6-pin header (1*6)

Boards are normally pre-flashed with serial bootloader. This gives makes it possible to program the node via the serial cable. After REST is pressed the boot loader is active for about 3 seconds and is ready to accepts programming commands. The RS version of stk500v2 lights the yellow when bootloader is active. Bootloader starts the programmed application.

Handling

Keep board clean and avoid direct sunlight and watre. Clean dust with soft brush.

Case

PCB has form factor for for standard Project box. G.40X IP54 but of course many varienats are possible.

Operating system

Atmel MCU industrial standard MCU. SW not covered in this document.

- Board is a officially supported platform (avr-rss2) in Contiki. (open source)
- Unofficial Arduino port.

Power usage (typical numbers)

- Atmel ATMega256RFR2 has many power improvements.
- Low-Power consumption SLEEP ~15 uA @ 8MHz (RC Osc.)
- Low-Power consumption SLEEP ~45 uA @ 16MHz (XTAL)

Mounting tips

Nylon screws, bolts and nut of size Metric 6mm (M6) avoid metal in the antenna patch for best RF performance.

Recycling

Recycling procedure is different from country. If unsure retrun boards to be recycled or RS or RS repesntative. Check your package for specific information.

Approvals

European CE RED approval is pending.

Summary: R&TTE (OLD) 73/23/EEC, 89/336/EEC and 99/5/EC

- Safety: EN 60950-1:2006 + A12: 2011
- RF: ETSI EN 300 328 V1.7.1 (2006-10)
- EMC: ETSI EN 301 489-1 V1.9.2 (2011-09), ETSI EN 301 489-17 V2.2.1 (2012-09)
- EMF: EN 62479:2010
- Human exposure to electromagnetic fields: EN 62479:2010

References

Atmel HW atmega256rfr2-atmega128rfr2-atmega64rfr2_datasheet.pdf

www.radio-sensors.com

Schematics available on web-ppage

Appendix A – pin assignments

Pin assignments: C-style format

```
/*  
  
    Pin assigments for Radio Sensors board revision 2.3/2.4  
  
    using MCUAtMega128rfa1/AtMega256rfr2  
  
    */  
  
#define BUTTON          PB0 /* Rev 2.4 only */  
  
#define ISP_1           PB1 /* SCK */  
  
#define ISP_2           PB2 /* MOSI */  
  
#define ISP_3           PB3 /* MISO */  
  
#define LED_YELLOW      PE3 /* 1k pullup to Vcc */  
  
#define LED_RED         PE4 /* 1k pullup to Vcc */  
  
#define USB_PWR         PB5 /* High if FTDI TTL-USB cable sources */  
  
#define P0              PD2 /* Pulse count input. Pullup via jumper */  
  
#define P1              PD3 /* Pulse count input via optional Comparator */  
  
#define PWR_1           PE7 /* Programmable power pin Vcc via P-FET */  
  
#define AV_IN           PF0 /* V_IN ADC input. 100k/1M volt. divider */  
  
#define A1              PF1 /* A1 ADC input. 100k/300k volt. divider */  
  
#define A2              PF2 /* A2 ADC input 100k/300k volt. divider */  
  
#define A3              PF3 /* Light sensor A3 ADC input 100k/100k volt. divider  
*/  
  
#define A3_PWR          PF4 /* Light sensor power A3_PWR */  
  
#define RX0             PE0 /* RX UART0 -- FTDI TTL-USB cable */  
  
#define TX0             PE1 /* TX UART0 -- FTDI TTL-USB cable */  
  
#define OW_BUS_0        PD7 /* One-Wire bus w temp/ID Pulled Up. Separate Vcc */  
  
#define OW_BUS_1        PD6 /* One-Wire bus extra Pulled Up. Separate Vcc */  
  
/* AVR ISP standard connected */  
  
/* 16 MHz xtal */  
  
/* RTC 32.768 Hz xtal */  
  
#define HUM_PWR         PE2 /* NOT USED */
```

Errata/Changes

Summary of changes from version 2.3 to 2.4

- CE approval from R&TTE to RED (pending)
- AtMega128RFA1 updated to AtMega256RFR2
- Environmental sensor BME280 replaces Dallas DS18B20
 - DS18B20 still possible via pin headers
- User tactile button added
- Terminal blocks replaced with pin headers
- Bootloader update. Saves RESET cause
- C1, C3 reduced to 100nF from 1uF for faster state machinery according to Atmel Application note.