

---

## AT86RF231 Radio Board HW Manual



### Features

- Contains AT86RF231 radio transceiver.
- Covers the 2.4GHz ISM band.
- On board ID chip for easy IEEE MAC address

---

**AVR<sup>®</sup>**

**Microcontrollers**

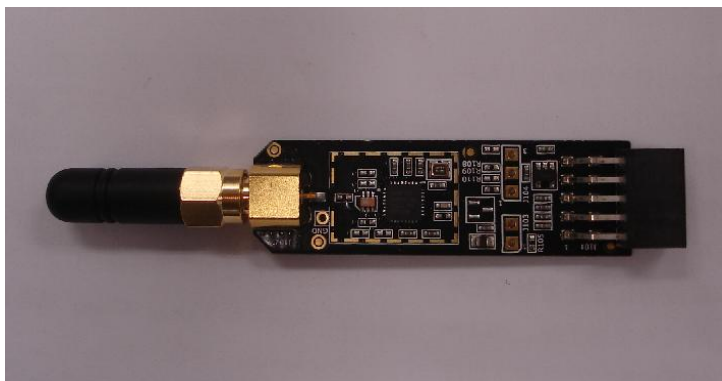
---

**Application Note**

### 1 Introduction

AT86RF231 Radio Board contains AT86RF231 radio transceiver. It is highly acclaimed networking devices within low power personal area networks. The AT86RF231 Radio Board sports an Atmel standardized 10-pin connector that will enable the Radio board to be connected to ATMEL microcontroller – so as a customer you will be able to evaluate Atmel radio transceivers in virtually any application segment.

**Figure 1-1.**AT86RF231 Radio Board HW Overview



## 2 Related Items

**AVR32 Studio** (Atmel's free IDE)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=4116](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4116)

**GNU Toolchain** (Atmel's free Compiler and Utilities)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=4118](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4118)

**JTAGICE mkII** (On-chip programming and debugging tool)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=3353](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=3353)

**AVR ONE!** (On-chip programming and debugging tool)

[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=4279](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4279)

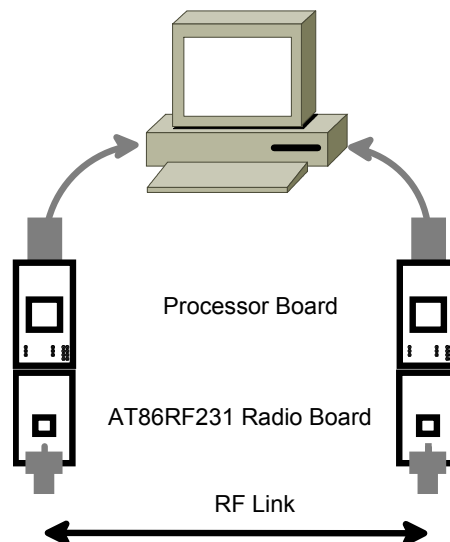
## 3 Overview

This section gives an overview of the Radio Board from a system perspective and what the kit contains and its minimum requirements. A set of condensed instructions are then given on how to get the evaluation application for the kit up and running in the shortest time possible.

AT86RF231 radio board: miniature carrier board with the AT86RF231 radio transceiver mounted, SMA antenna connector, one wire ID chip and Atmel standard 10-pin connector.

Figure 3-1 shows how the two processor boards paired with the radio frequency boards also available in the kit can form a wireless peer to peer data connection over USB.

**Figure 3-1 AT86RF231 Radio Board used in conjunction with PC**

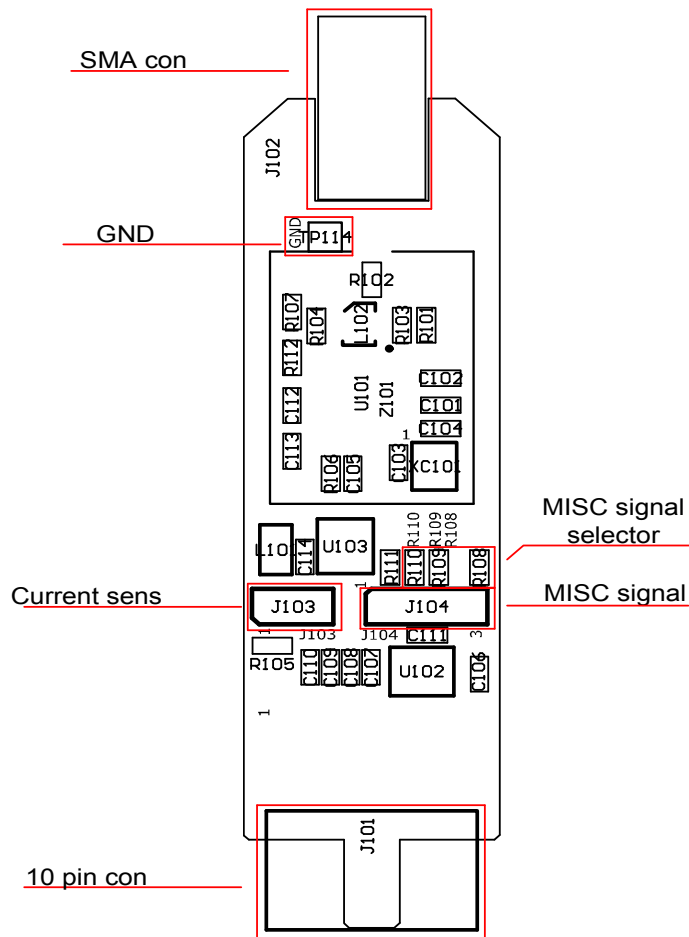


## 4 Hardware Description

This chapter describes the hardware about AT86RF231 Radio Board.

**AT86RF231 Radio Transceiver:** Second generation 2.4GHz ISM band radio transceiver with front ends for antenna diversity and external power amplifier and encryption accelerators.

**Figure 4-1 Radio Board Overview**





## 4.1 Connectors

There are two main connectors on the board; one is the female SMA antenna connector and in the opposite direction of the board is a 10-pin dual row header. See Table 4-1 for pinout of this header.

**Table 4-1. Radio Board 10-pin header**

Pin	Name	Name	Pin
1	Reset	Misc	2
3	Interrupt	Sleep Transmit	4
5	Chip Select	MOSI	6
7	MISO	SCK	8
9	GND	VCC (1.8 – 3.6V)	10

There are also two single row headers on the board:

- **J103 (Not mounted):** Two pin header that can be soldered in to do current measurement with an ampere meter. R105 must be unsoldered to enable this feature.
- **J104 (Not mounted):** Three pin header that can be soldered in to access the auxiliary (Miscellaneous) signals from the radio transceiver.

## 4.2 Crystal

A high accuracy 16MHz crystal is mounted and used by the radio transceiver for carrier frequency generation.

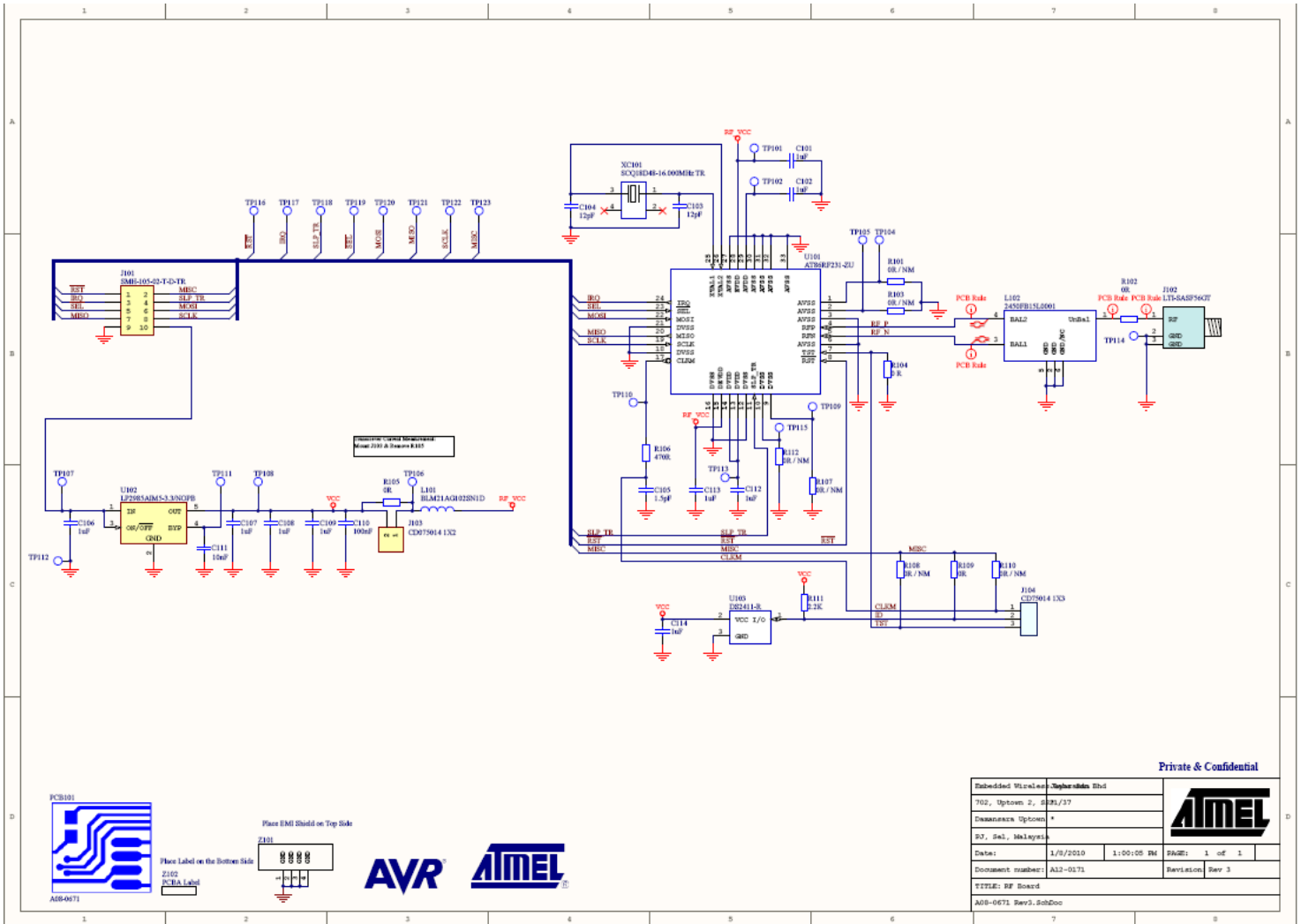
## 4.3 RF Front End

Since the output from the radio transceiver itself is a balanced signal pair, a balun is needed to transform into a 50Ohm single ended signal fed to the SMA connector. Johanson Technology provides one balun for the AT86RF231.

- **2450FB15L0001:** 2.45 GHz filter balun optimized for AT86RF231.



Figure 4-2 AT86RF231 Radio Board schematic



Private & Confidential

Embedded Wireless	Singapore		
702, Uptown 2, #09/17			
Damanraa Opticon *			
PJ, Sel., Malaysia			
Date:	1/8/2010	1:00:05 PM	SAGE: 1 of 1
Document number:	A12-0171	Revision:	Rev 3
TITLE: RF Board			
A08-0671 Rev3_SobDoc			



## 5 Connecting Radio Board to a Custom Board

The AT86RF231 Radio Board is used in conjunction with the processor board.

Table 4-1 shows the pinout of the standardized 10-pin bus.

It is possible to add the Radio Board to any routing as long as the required signals are available. This is possible due to the Radio Board being able to be mounted on the squid cable included in this kit. With this squid cable it is possible to route all 10 signals down onto a custom hardware. The remainder of this chapter shows a few examples on how to wire these signals.

### 5.1 Default Supported Kits

Besides from being used on the processor boards the Radio Board can be attached to wide range of Atmel evaluation and starter kits. The following kits are supported directly. If you do not find your preferred kit here, please take a look at section 5.2.

**Table 5-1.** Plug and Play Kits

Kit Name	Comment
<b>STK600</b>	
- Any ATxmega device	Any of the digital ports can be used.
- ATmega164/324/644/1284P	
<b>STK500</b>	
- ATmega164/324/644/1284P	
<b>XPLAIN</b>	Any of the digital ports can be used.
<b>EVK1104</b>	Connect to WLESS header.
<b>EVK1105</b>	Connect to WLESS header.

### 5.2 Squid Cable

There are two squid cables (10pin male header to single wires) included in the kit. The intended use of this special cable assembly is to plug the radio frequency board onto it, and connect the ten single wires to any hardware platform that does not have the standard auxiliary connector available.

**Table 5-2.** Squid Cable Pinout

PIN	PIN
<b>Pin 1 (Brown):</b> Reset	<b>Pin 2 (Red):</b> Miscellaneous
<b>Pin 3 (Orange):</b> Interrupt	<b>Pin 4 (Yellow):</b> Sleep Transmit
<b>Pin 5 (Green):</b> Chip Select	<b>Pin 6 (Blue):</b> Master Out Slave In
<b>Pin 7 (Purple):</b> Master In Slave Out	<b>Pin 8 (Grey):</b> SPI Clock
<b>Pin 9 (White):</b> Ground	<b>Pin 10 (Black):</b> Vcc

## 5.3 Example AVR32: EVK1100

Intentionally left blank.

## 5.4 Example ARM7: AT91SAM7X-EK

Intentionally left blank.

## 6 Firmware

**Table 6-1.** Firmware Layout

Path	File	Comment
<b>/Applications</b>		Parent folder for kit applications
/Applications/TAL_Examples/Wireless_UART		Parent folder for wireless UART application
/Applications/TAL_Examples/Wireless_UART/Src		Source Folder
<b>/PAL</b>		Processor Abstraction Layer
/PAL/AVR32		Parent folder for AVR32 processor specific code
/PAL/AVR32/Generic/Inc		Generic include files shared by all AVR32 devices.
/PAL/AVR32/Generic/Src		Generic source code shared by all AVR32 devices.
/PAL/AVR32/UC3A3256		Parent folder for all AT32UC3A3256 specific code
/PAL/AVR32/UC3A3256/Boards/RZ600		Board specific code for the RZ600 kit
/PAL/AVR32/UC3A3256/Inc		Include files for the processor code
/PAL/AVR32/UC3A3256/Src		Source files for the processor specific code
<b>/TAL</b>		Transceiver Abstraction Layer
/TAL/AT86RF231/Inc		Include files specific to the AT86RF231 radio transceiver
/TAL/AT86RF231/Src		Source files specific to the AT86RF231 radio transceiver.
<b>/Resources</b>		Common resources used by all layers
/Resources/Buffer_Management/Inc		
/Resources/Buffer_Management/Src		
/Resources/Queue_Management/Inc		
/Resources/Queue_Management/Src		



## 7 Appendix

### 7.1 FCC Statements

#### 7.1.1 Equipment usage

This equipment is for use by developers for evaluation purposes only and must not be incorporated into any other device or system.

#### 7.1.2 Compliance Statement (Part 15.19)

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. These devices may not cause harmful interference, and
2. These devices must accept any interference received, including interference that may cause undesired operation.

#### 7.1.3 Warning (Part 15.21)

Changes or modifications not expressly approved by Atmel Norway could void the user's authority to operate the equipment.

#### 7.1.4 Compliance Statement (Part 15.105(b))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 7.1.5 FCC ID

- A09-1563 : **AIBA091563**



## **EVALUATION BOARD/KIT IMPORTANT NOTICE**

This evaluation board/kit is intended for use for **FURTHER ENGINEERING, DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY**. It is not a finished product and may not (yet) comply with some or any technical or legal requirements that are applicable to finished products, including, without limitation, directives regarding electromagnetic compatibility, recycling (WEEE), FCC, CE or UL (except as may be otherwise noted on the board/kit). Atmel supplied this board/kit "AS IS," without any warranties, with all faults, at the buyer's and further users' sole risk. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Atmel from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge and any other technical or legal concerns.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER USER NOR ATMEL SHALL BE LIABLE TO EACH OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

No license is granted under any patent right or other intellectual property right of Atmel covering or relating to any machine, process, or combination in which such Atmel products or services might be or are used.

Mailing Address: Atmel Corporation, 2325 Orchard Parkway, San Jose, CA 95131



## Headquarters

---

**Atmel Corporation**  
2325 Orchard Parkway  
San Jose, CA 95131  
USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 487-2600

## International

---

**Atmel Asia**  
Unit 1-5 & 16, 19/F  
BEA Tower, Millennium City 5  
418 Kwun Tong Road  
Kwun Tong, Kowloon  
Hong Kong  
Tel: (852) 2245-6100  
Fax: (852) 2722-1369

---

**Atmel Europe**  
Le Krebs  
8, Rue Jean-Pierre Timbaud  
BP 309  
78054 Saint-Quentin-en-  
Yvelines Cedex  
France  
Tel: (33) 1-30-60-70-00  
Fax: (33) 1-30-60-71-11

---

**Atmel Japan**  
9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
Tel: (81) 3-3523-3551  
Fax: (81) 3-3523-7581

## Product Contact

---

**Web Site**  
<http://www.atmel.com/>

---

**Technical Support**  
[avr@atmel.com](mailto:avr@atmel.com)

---

**Sales Contact**  
[www.atmel.com/contacts](http://www.atmel.com/contacts)

**Literature Request**  
[www.atmel.com/literature](http://www.atmel.com/literature)

**Disclaimer:** The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. **EXCEPT AS SET FORTH IN ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.** Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© 2012 Atmel Corporation. All rights reserved. Atmel®, Atmel logo and combinations thereof, AVR®, AVR Studio®, STK® and others, are the registered trademarks or trademarks of Atmel Corporation or its subsidiaries. Windows® and others are registered trademarks or trademarks of Microsoft Corporation in U.S. and/or other countries. Other terms and product names may be trademarks of others.