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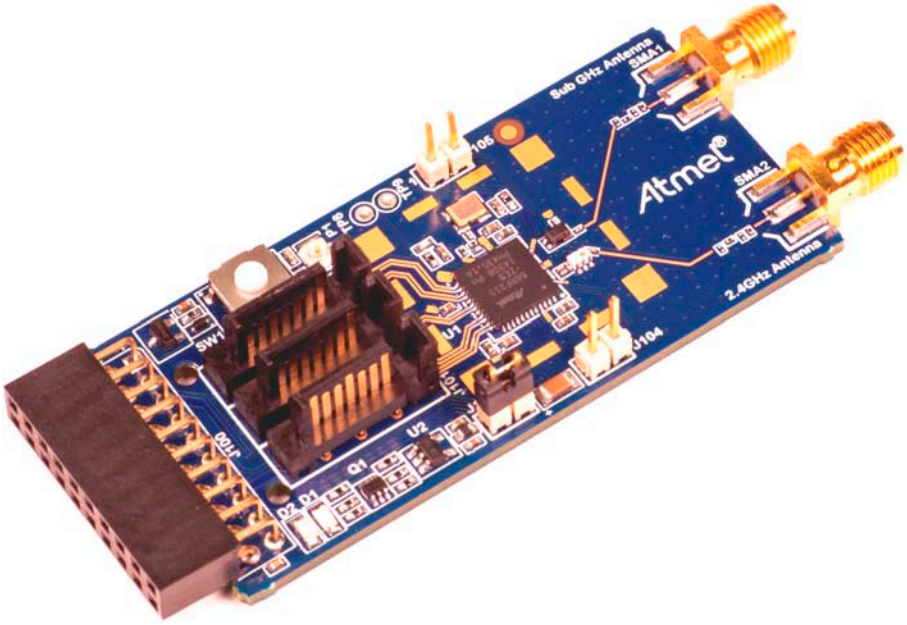
USER GUIDE

REB215-XPRO Extension Board

Introduction

This user guide facilitates how to getting started with the Atmel® REB215-XPRO extension board.

The extension board is targeted for evaluating the features and performance of the Atmel AT86RF215 radio transceiver.



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1. Getting Started

1.1 Features

The REB215 extension board is a template design for the AT86RF215.

1.2 Design Documentation and Related Links

The most recent and relevant documents and software for the REB215-Xpro extension board [1].

1.3 Board Assembly

The extension board provides wireless communication to an Xplained PRO board or to your own prototype for software development and hardware verification.

1.3.1 Connect to a Xplained Pro Board

The extension board can be connected to any Xplained PRO main board using the extension header.

1.3.2 In Customer Development Assembly

The extension board can be wired into the customer prototype assembly by using an on-board connectors, all relevant signals are available at on-board connectors.

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[1] http://www.atmel.com/tools/reb215-xpro.aspx

2. Performance Analyzer

2.1 Introduction

The Performance Analyzer Firmware with the GUI in Atmel Studio Wireless Composer Extension provides basic functional RF tests.

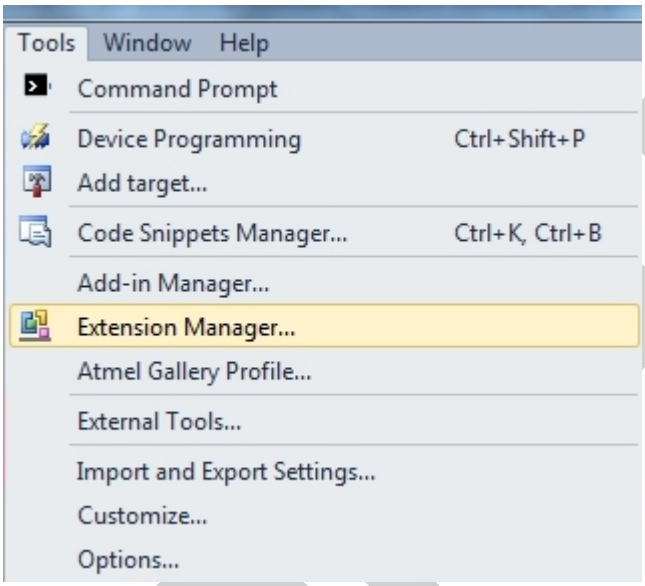
A quick start guide and general help is provided in Wireless Composer once started.

2.2 Program Installation

How to install Wireless Composer application, follow the steps:

1. Install Atmel Studio[1].
2. After installing the application, launch Atmel Studio.

   Navigate to Tools > Extension Manager > Select Extension Manager to install Wireless Composer



   Select Wireless and Wireless Composer.

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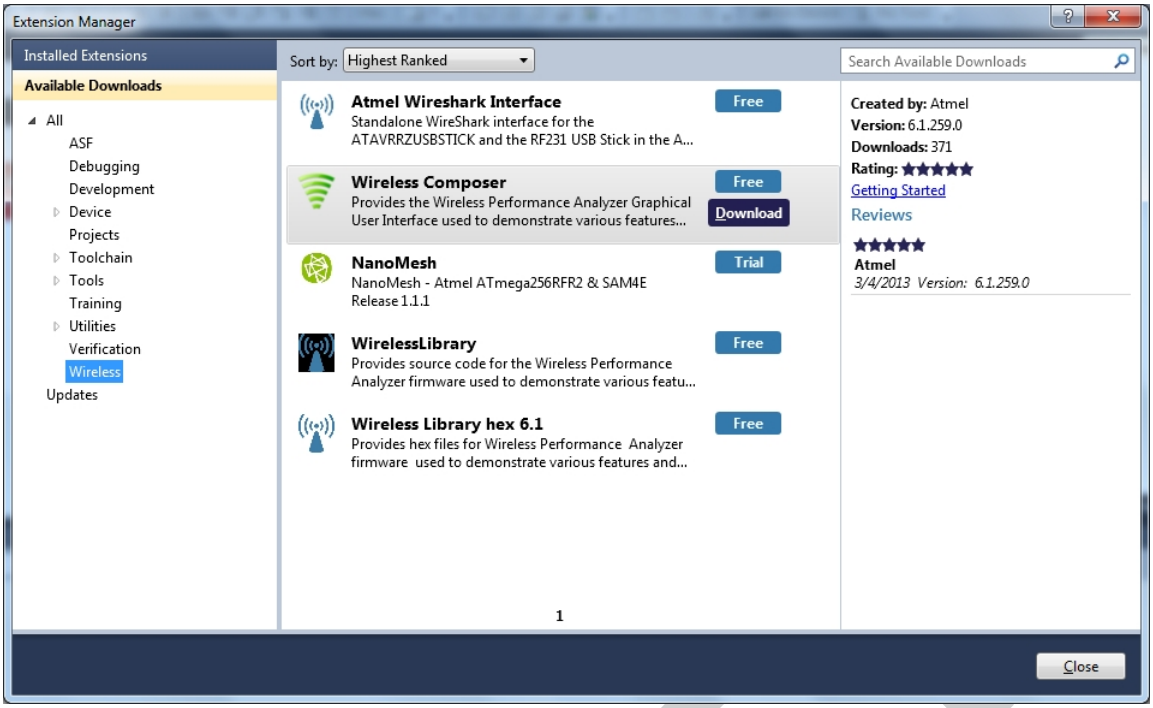
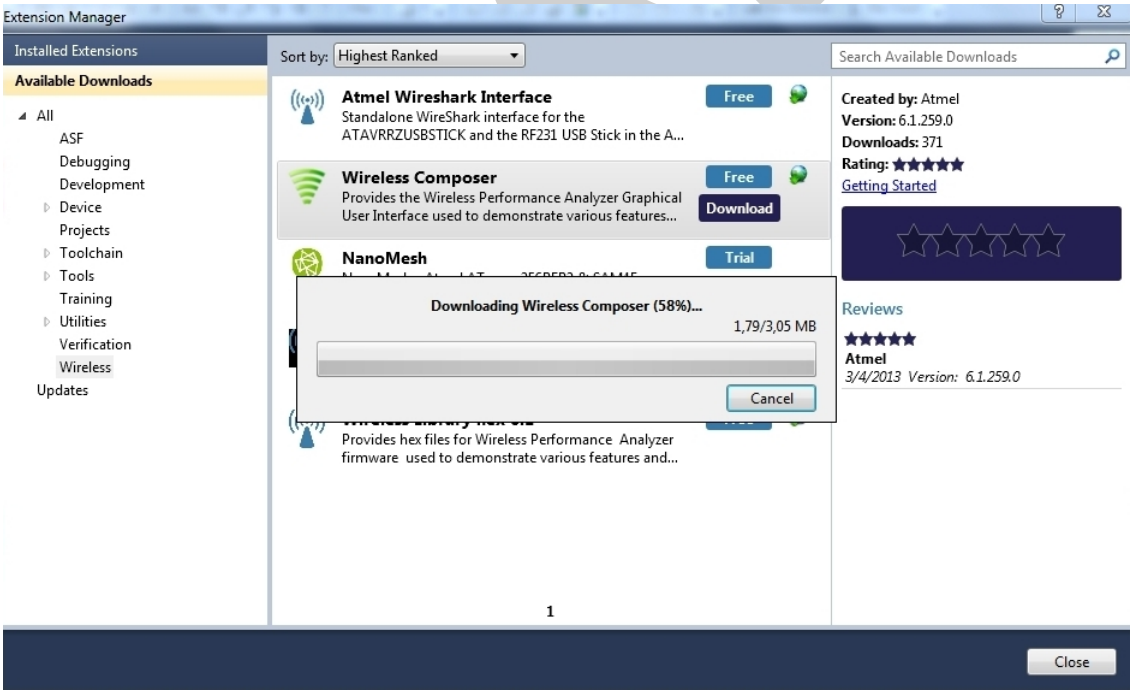
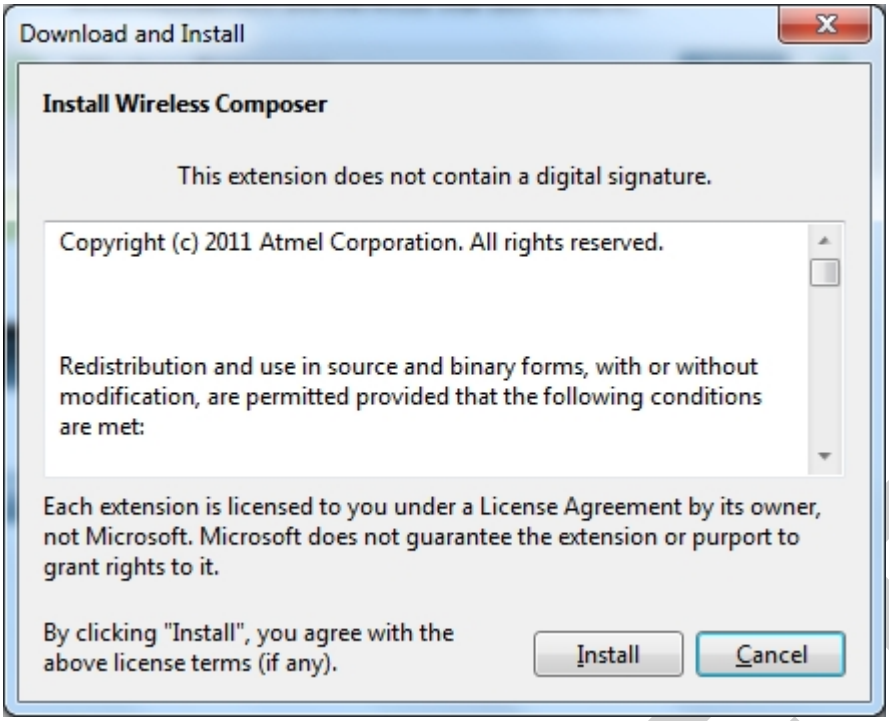
[1] http://www.atmel.com/tools/atmelstudio.aspx



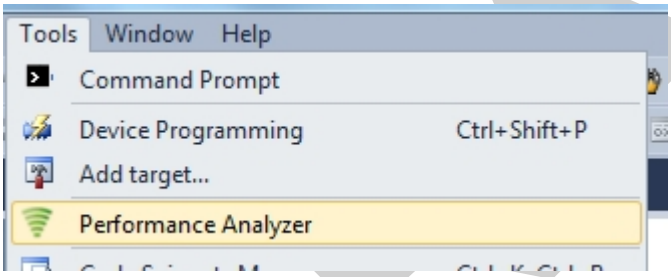
Log on to Atmel Gallery.

Click download.





Restart Atmel Studio, allow help to make changes and the Performance Analyzer GUI is available in the Tools menu.



3. If Xplained Pro board is not pre-programmed - program the board with the Performance Analyzer Firmware available in the "Wireless Performance Analyzer Firmware extension" or from source code provided in ASF by using the EDBG from Atmel studio.

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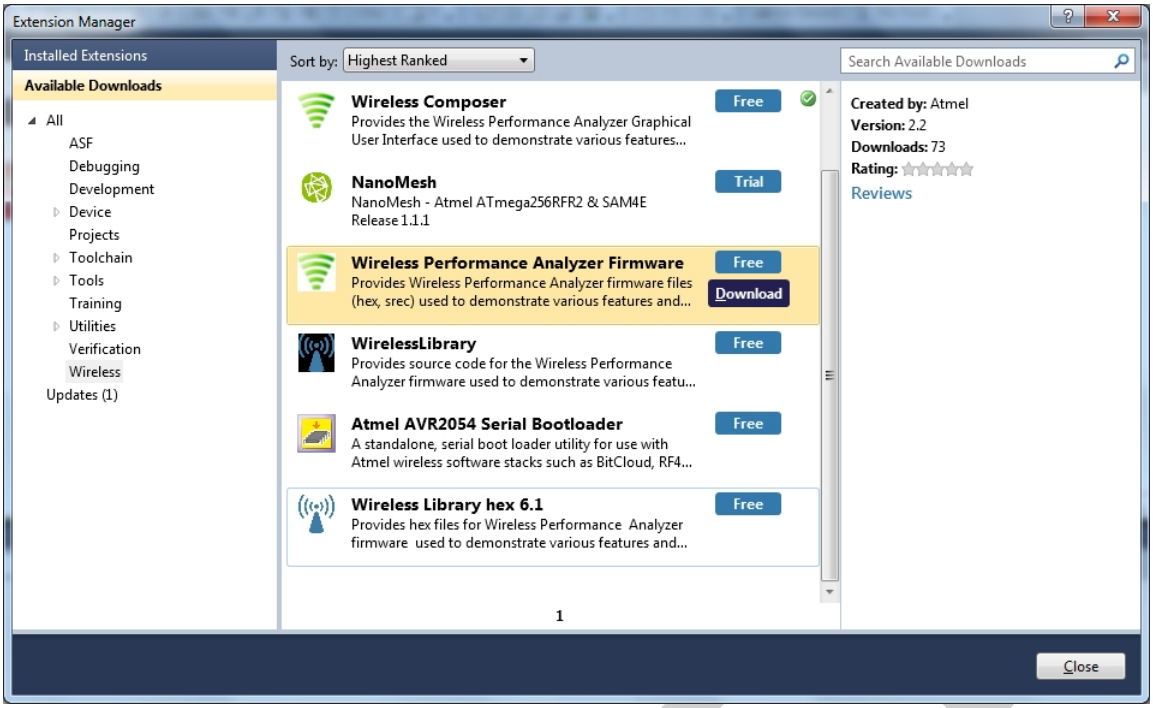


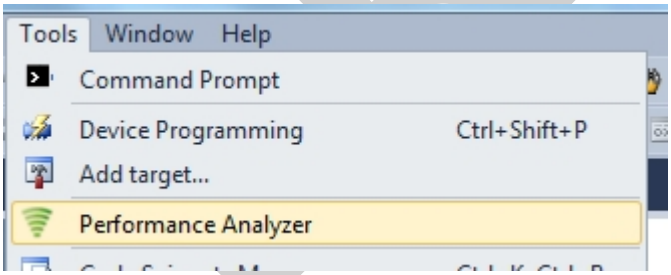
2.3 Using the Performance Analyzer

To get started.

1. Connect the Wireless board assembly, with the Performance Analyzer FW programmed, to the PC USB connector and power on, a COM port should now be available for the kit.

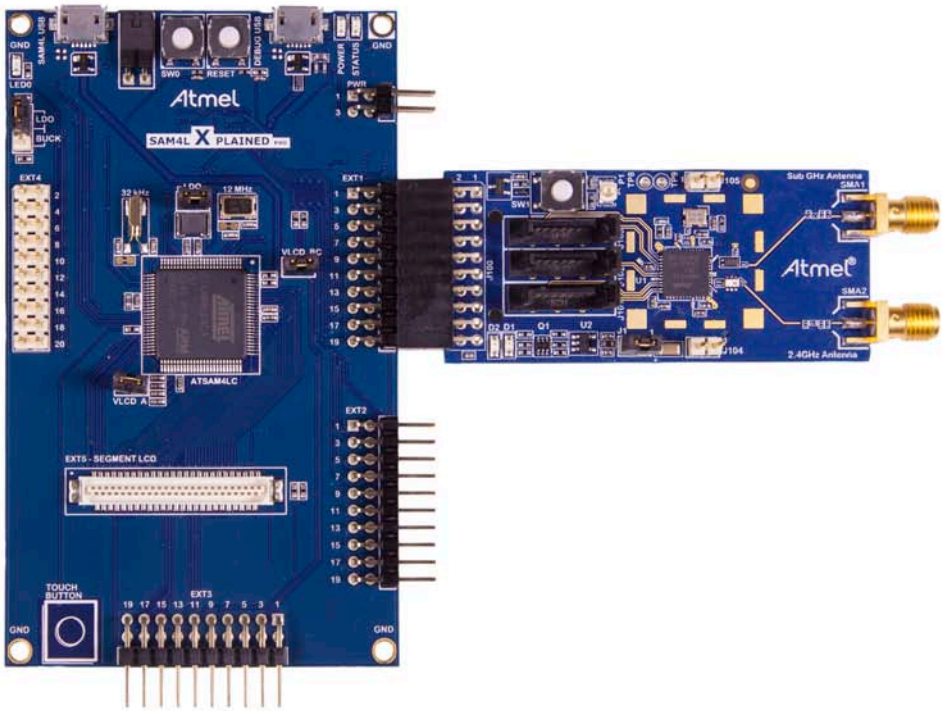
2. Power on any other wireless node assemblies of similar frequency, running the Performance Analyzer FW, and use it as a reference.

3. Start Performance Analyzer GUI, connect to the kit via the COM port and follow the quick start guide.



2.4 Typical Board Assembly

The Atmel SAM4L Xplained Pro Evaluation Kit with REB215-XPRO Wireless Extension board.


Atmel
SAM4L X PLAINED
EXT1
EXT2
EXT3
EXT4
EXT5 - SEGMENT LCD
ATSAM4LC
TOUCH BUTTON
Sub GHz Antenna
SMA1
SMA2
2.4GHz Antenna

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3. Xplained Pro

Xplained Pro is an evaluation platform that provides the complete Atmel microcontroller experience. The platform consists of a series of Microcontroller (MCU) boards and extension boards that are integrated with Atmel Studio, have Atmel Software Framework (ASF) drivers and demo code, support data streaming and more. Xplained Pro MCU boards support a wide range of Xplained Pro extension boards that are connected through a set of standardized headers and connectors. Each extension board has an identification (ID) chip to uniquely identify which boards are mounted on a Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio. Available Xplained Pro MCU and extension boards can be purchased in the Atmel Web Store[1].

3.1 Hardware Identification System

All Xplained Pro compatible extension boards have an Atmel ATSHA204 CryptoAuthentication™ chip mounted. This chip contains information that identifies the extension with its name and some extra data. When an Xplained Pro extension board is connected to an Xplained Pro MCU board the information is read and sent to Atmel Studio. The Atmel Kits extension, installed with Atmel Studio, will give relevant information, code examples and links to relevant documents. Table 3-1, “Xplained Pro ID Chip Content” on page 9 shows the data fields stored in the ID chip with example content.

Table 3-1. Xplained Pro ID Chip Content

Data Field	Data Type	Example Content
Manufacturer	ASCII string	Atmel’\0’
Product Name	ASCII string	Segment LCD1 Xplained Pro’\0’
Product Revision	ASCII string	02’\0’
Product Serial Number	ASCII string	1774020200000010’\0’
Minimum Voltage [mV]	uint16_t	3000
Maximum Voltage [mV]	uint16_t	3600
Maximum Current [mA]	uint16_t	30

3.2 Standard Headers and Connectors

3.2.1 Xplained Pro Standard Extension Header

All Xplained Pro kits have one or more dual row, 20-pin, 100mil extension headers. Xplained Pro MCU boards have male headers while Xplained Pro extensions have their female counterparts. Note that all pins are not always connected. However, all the connected pins follow the defined pin-out described in Table 3-2, “Xplained Pro Extension Header” on page 9. The extension headers can be used to connect a wide variety of Xplained Pro extensions to Xplained Pro MCU boards and to access the pins of the target MCU on Xplained Pro MCU board directly.

Table 3-2. Xplained Pro Extension Header

Pin Number	Name	Description
1	ID	Communication line to the ID chip on extension board.
2	GND	Ground.
3	ADC(+)	Analog to digital converter, alternatively positive part of differential ADC.
4	ADC(-)	Analog to digital converter, alternatively negative part of differential ADC.
5	GPIO1	General purpose I/O.
6	GPIO2	General purpose I/O.
7	PWM(+)	Pulse width modulation, alternatively positive part of differential PWM.
8	PWM(-)	Pulse width modulation, alternatively positive part of differential PWM.

[1] http://store.atmel.com/CBC.aspx?q=c:100113

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Pin Number	Name	Description
9	IRQ/GPIO	Interrupt request line and/or general purpose I/O.
10	SPI_SS_B/GPIO	Slave select for SPI and/or general purpose I/O.
11	TWI_SDA	Data line for two-wire interface. Always implemented, bus type.
12	TWI_SCL	Clock line for two-wire interface. Always implemented, bus type.
13	USART_RX	Receiver line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
14	USART_TX	Transmitter line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
15	SPI_SS_A	Slave select for SPI. Should be unique if possible.
16	SPI_MOSI	Master out slave in line of Serial peripheral interface. Always implemented, bus type.
17	SPI_MISO	Master in slave out line of Serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	Clock for Serial peripheral interface. Always implemented, bus type.
19	GND	Ground.
20	VCC	Power for extension board.

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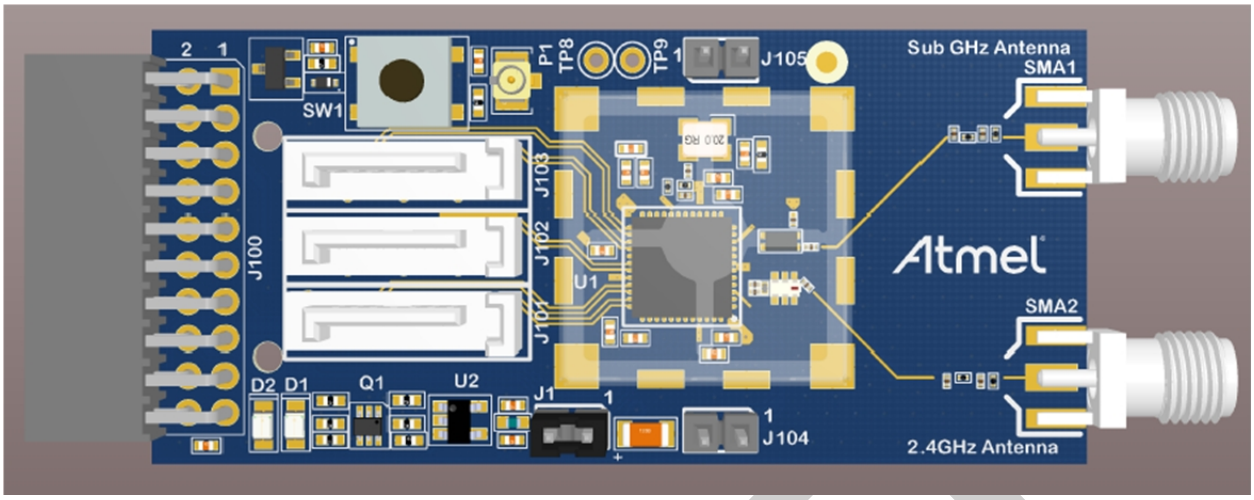
4. Hardware User Guide

4.1 Board Overview

Figure 4-1. Board overview



4.2 Headers and Connectors

The extension board connectors.

4.2.1 J100 Xplained Pro Extension Connector

The Xplained Pro extension connectors, used to connect the extension board to the Xplained Pro board.

Table 4-1. J100 Xplained Pro Extension Header

Pin	Name	RF215		Description
		Pin	Name	
1	ID			Communication line to the ID chip on the extension board.
2	GND			Ground.
3	ADC(+)			
4	ADC(-)			
5	GPIO1			LED D2 Yellow for user function.
6	GPIO2			LED D1 Green for user function.
7	PWM(+)	13	RSTN	RESET to RF215.
8	PWM(-)			
9	IRQ/GPIO	40	IRQ	Interrupt request line to uC on Xplained Pro board.
10	SPI_SS_B/ GPIO			
11	TWI_SDA			Data line for the two wire interface to AT24MAC602 serial EEPROM.
12	TWI_SCL			Clock line for the two wire interface to AT24MAC602 serial EEPROM.
13	USART_RX			
14	USART_TX			
15	SPI_SS_A	42	SELN	Slave select for SPI. Should be unique if possible.
16	SPI_MOSI	43	MOSI	Master out slave in line of Serial peripheral interface. Always implemented, bus type.

Pin	Name	RF215		Description
		Pin	Name	
17	SPI_MISO	44	MISO	Master in slave out line of Serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	41	SCLK	Clock for Serial peripheral interface. Always implemented, bus type.
19	GND			Ground.
20	VCC			Power for extension board.

4.2.2 J104 & J105

J104 and J05 provide to control an external RF analog frontend device, external LNA, PA.

Table 4-2. J104

Pin	RF215 signal	Function
1	FEB24	External Frontend Control for 2.4GHz.
2	FEA24	External Frontend Control for 2.4GHz.

Table 4-3. J105

Pin	RF215 signal	Function
1	FEB09	External Frontend Control for Sub-1GHz.
J105-2	FEA09	External Frontend Control for Sub-1GHz.

4.2.3 Serial I/Q Data Interface (J101, J102, J103)

Low voltage differential signalling (LVDS) interface is used for the data transfer between the AT86RF215 and an external baseband processor.

Table 4-4. J101- I/Q Data Receiver 2.4GHz

Pin	RF215 signal	Function
1		Ground
2	RXDP24	B+ (Receive)
3	RXDN24	B- (Receive)
4		Ground
5	RXCLKP	A+ (Receive)
6	RXCLKN	A- (Receive)
7		Ground

Table 4-5. J102- I/Q Data Receiver Sub GHz

Pin	RF215 signal	Function
1		Ground
2	RXDP09	B+ (Receive)
3	RXDN09	B- (Receive)
4		Ground
5		A+ (Receive)
6		A- (Receive)
7		Ground

Table 4-6. J103- I/Q Data Transmitter

Pin	RF215 signal	Function
1		Ground
2	TXDP	B+ (Receive)

Pin	RF215 signal	Function
3	TXDN	B- (Receive)
4		Ground
5	TXCLKP	A+ (Receive)
6	TXCLKN	A- (Receive)
7		Ground

4.2.4 Current Monitoring (J1)

J1 enables current monitoring using an external multimeter.

Connect multimeter between J1-1 and J1-2 and measure current used.

Warning When **not** monitoring current the strap need to be inserted in order to provide power to the board.

Table 4-7. J1 Current measurement

Pin	Function
J1-1	3.3V pin on the AT86RF215
J1-2	3.3V on extension board

4.3 Board GUI

4.3.1 LEDs

There are two LEDs available for use by application SW.

Table 4-8. LEDs

LED	Function
D1 - Green	User defined function
D2 - Yellow	User defined function

4.3.2 Button

There is a button to reset the RF215 device.

Table 4-9. Buttons

Button	RF215 signal	Function
SW1	RSTN	Reset, press to reset

4.3.3 SMA Connectors

There are two SMA connectors - one 2.4GHz transmit and receive and one for Sub-1GHz transmit and receiver.

Table 4-10. SMA connectors

Connector	Function
SMA-1	RF input/output for Sub-1GHz Transceiver.
SMA-2	RF input/output for 2.4GHz Transceiver.

4.4 U2 Serial EEPROM

The REB215 contains a serial EEPROM, AT24MAC602 and factory programmed MAC addresses available through the I2C interface of J100.

The memory organisation is as documented in “Persistent Memory” on page 14 . The structure is located from EEPROM address 0x00, device address ‘1010’.

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5. Persistent Memory

A persistent memory space is allocated to store product specific information. The persistent memory is organized as follows:

Table 5-1. Persistent Memory

Data	Data Type	Size
Structure Revision	uint 16	2 bytes
MAC address	uint 64	8 bytes
Board information – PCBA Name	ASCII string[1]	30 bytes
Board information – PCBA Serial number	ASCII string[1]	10 bytes
Board information – PCBA Atmel Part Number	ASCII string[1]	8 bytes
Board information – PCBA Revision	uint 8	1 byte
Reserved		3 bytes
XTAL Calibration Value	uint 8	1 byte
Reserved		7 bytes
Reserved		4 bytes
CRC	uint 16	2 bytes

Notes: [1]'\0' terminated ASCII string.

The MAC address stored inside the MCU is a uniquely assigned ID for each kit and is owned by Atmel. User applications can use this unique MAC ID to address the kit.

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6. Agency Certifications

6.1 United State (FCC)

This equipment complies with Part 15 of the FCC rules and regulations. To fulfill FCC Certification requirements, an OEM manufacturer must comply with the following regulations:

1. The ATREB215-XPRO limited modular transmitter must be labelled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

Important

Contains FCC ID : VW4A091982. This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation (FCC 15.19)

(3) this certificate is valid only while transmit at 2.4GHz ISM band.

Provide SMA connector to connect external antenna for mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance. This device is approved as a mobile device with respect to RF exposure compliance, and may only be marketed to OEM installers. Use in portable exposure conditions (FCC 2.1093) requires separate equipment authorization.

Important

Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

Important

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense (FCC section 15.105).

ATREB215-XPRO is limited modular approved and requires separate approval for this module when used on an application board.

Cet appareil est conforme à la section 15 des réglementations de la FCC. Le fonctionnement de l'appareil est sujetaux deux conditions suivantes:

(1) cet appareil ne doit pas provoquer d'interférences néfastes, et

(2) cet appareil doit tolérer les interférences reçues, y compris celles qui risquent de provoquer un fonctionnement indésirable

(3) ce certificat est valable uniquement en transmission à bande ISM 2.4 GHz.

6.2 European Union (ETSI)

The ATREB215-XPRO Module has been certified for use in European Union countries at 2.4GHz ISM Band. If these modules are incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

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Furthermore, the manufacturer must maintain a copy of the modules' documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

Important The 'CE' marking must be affixed to a visible location on the OEM product. The CE mark shall consist of the initials "CE" taking the following form:

The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus. The CE marking must be affixed visibly, legibly, and indelibly. More detailed information about CE marking requirements you can find at "DIRECTIVE 1999/5/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL" on 9 March 1999 at section 12.

6.3 Canada (IC)

The ATREB215-XPRO Module complies with Industry Canada specifications RSS-210 and RSS – GenIC.

ID for ATREB215-XPRO is 11019A-091982

ATREB215-XPRO is limited modular approved and requires separate approval for this module when used on an application board.

User manuals for licence-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

(3) this certificate is valid only while transmit at 2.4GHz ISM band.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radioexempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

(3) ce certificat est valable uniquement en transmission à bande ISM 2,4 GHz.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

6.4 Using Limited Modular Certified Products

The ATREB215-XPRO Module is certified under part 15 of FCC rules. The Modular certification category of this module is “Limited Modular”. The end product using these modules hence has to undergo compliance testing and receive a new FCC ID for the final product carrying these modules. Certification of the final product lies solely with the type of design of the final product.

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Warning The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment.

Important This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation (FCC 15.19). The internal / external antenna(s) used for this mobile transmitter must provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance. This device is approved as a mobile device with respect to RF exposure compliance, and may only be marketed to OEM installers. Use in portable exposure conditions (FCC 2.1093) requires separate equipment authorization.

Important Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

Important This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense (FCC section 15.105).

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7. Document Revision History

Document revision	Date	Comment
42398A	01/2015	Initial document release

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