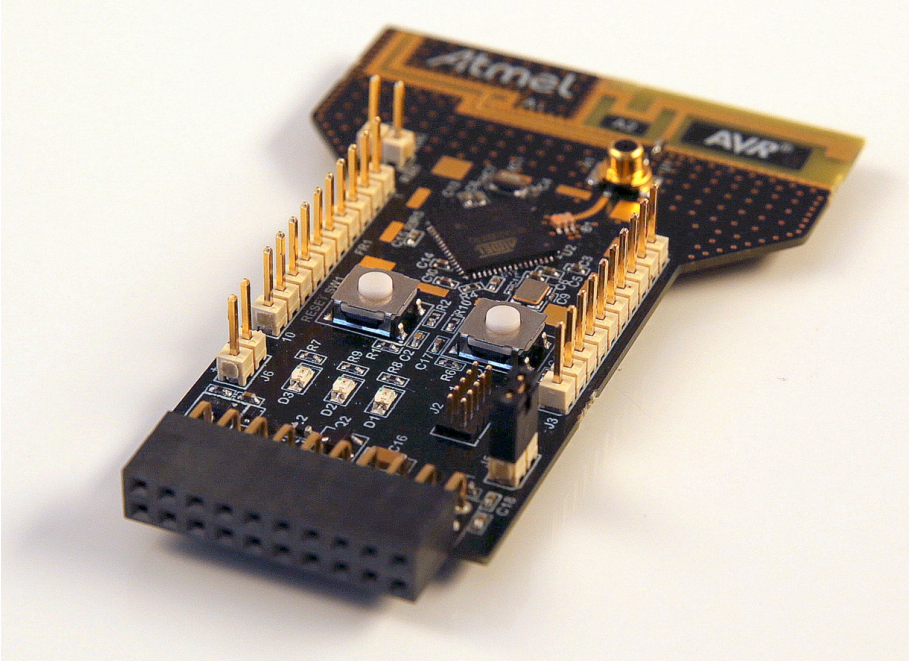
USER GUIDE

RCB256RFR2-XPRO User Guide

Introduction

This user guide describes how to get started with the Atmel® RCB256RFR2-XPRO extension board.

The extension boards is targeted for evaluating the features of the Atmel ATmega256RFR2 wireless SoC with PCB antenna.



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1. Getting Started

1.1 Features

The Atmel RCB256RFR2-XPRO extension board provide a development platform for the Atmel ATmega256RFR2 with PCB antenna.

1.2 Design Documentation and Related Links

The most relevant documents and software for the extension board.[1]

1.3 Board Assembly

The extension board can be used in number of combinations. To provide wireless communication to a Xplained Pro board, to act as a standalone wireless node, to provide wireless communication to your own prototype for SW development and HW verification.

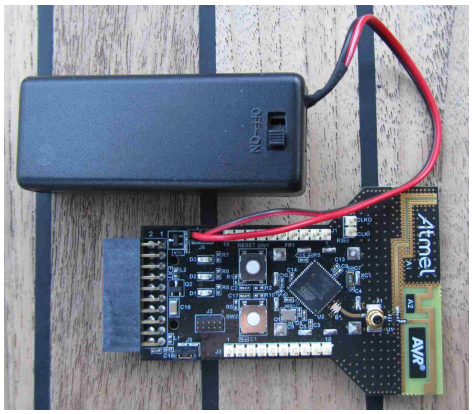
1.3.1 Connect to a Xplained Pro Board

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

Picture of SAM4L with extension.

1.3.2 Standalone Node

The Extension board can be used as a standalone node - use the 2xAAA battery pack available in Atmel store to provide power as shown in picture below.



1.3.3 In Customer Development Assembly

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

1.4 Connecting the Kit

How to connect the extension board.

1.4.1 Atmel Studio

How to connect the Extension board + Xplained Pro board assembly to Atmel Studio.

1. Download and install Atmel Studio[2].
2. Launch Atmel Studio..
3. Connect an USB cable to the DEBUG USB port and the kit will be visible in Atmel Studio.

1.4.2 Connect the Extension UART to the EBDG COM port

This section describes how to connect to the extension board UART by using the EBDG COM port.

[1] http://www.atmel.com/tools/rcb256rfr2-xpro.aspx
[2] http://www.atmel.com/tools/atmelstudio.aspx

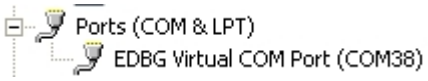
All Xplained Pro boards have an embedded debugger (EBDG) with a number of features, among them a CDC/ COM port which enables the user to connect to the extension board UART and using the boot-loader on the extension board.

1. Select a Xplained Pro board supported with a "Serial bridge application", currently supported by the Atmel SAM4L Xplained Pro and the Atmel ATmega256RFR2 Xplained Pro boards[3].
2. Download the "Wireless Library hex" extension using Atmel Studio Extension Manager.

   Atmel Studio: Tools/Extension Manager/Wireless, download and unzip in a directory of your choice.
3. Connect the EDBG USB to the PC and Program the "Serial bridge application" hex file on the Xplained Pro board.

   Atmel Studio: Tools/Device Programming, select the XPRO-EDBG as Tool and click Apply.

   Select "Memories" and locate the "Serial bridge application" hex file and click Program.
4. The UART on EXT1 should now be connected to the EDBG COM port at 9600baud.



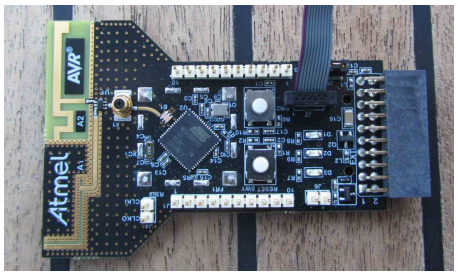
1.5 Programming

How to program the extension.

1.5.1 JTAGICE

How to program using the AVR® JTAGICE mkII or JTAGICE3.

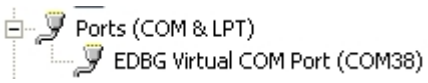
1. Connect the JTAGICE USB to the PC.
2. Connect the JTAGICE to the Extension board connector (J2) as shown on picture.
3. Go to Atmel Studio: Tools/Device Programming, and select the JTAGICE connected as Tool and click Apply.
4. Select Device = ATmega256RFR2.
5. Select "Memories" and locate the source hex or elf file and click Program.
6. If new fuse settings go to "Production file" and upload the elf file and program the fuses.



1.5.2 Bootloader

This section describes how to use the bootloader to program the ATmega256RFR2 on the Extension board .

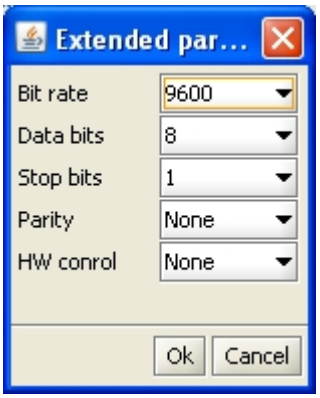
1. Use a Xplained Pro board with a "Serial bridge application" “Connect the Extension UART to the EBDG COM port” on page to connect the Extension board UART to the Embedded debugger COM port or connect the "Extension board UART" using any other level shifter solution you might have.



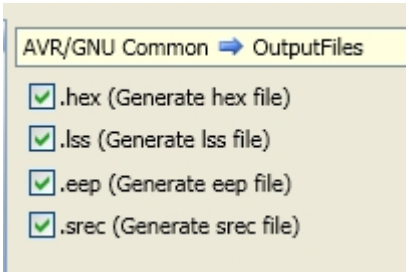
[3] http://www.atmel.com/products/microcontrollers/avr/xplainedpro.aspx

2. Start the "Bootloader PC tool". “ How to Install the "Bootloader PC tool"” on page

3. Set "Connection" to Serial and "Port" to the COM port number.
4. Configure the serial port settings as (click symbol at the right of Port setting).



5. "Select srec file", the file have to be of SREC format.
   Atmel Studio output files can be of SREC format.

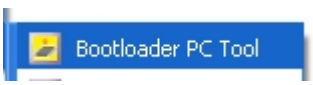


6. Deselect EEPROM erase if not required.
7. Click "Upload".
8. Press the HW reset button (SW1) on the device if requested. The Bootloader PC tool will be waiting for approximately 30 seconds for the button to be released. If this does not happen, programming will be aborted.
9. Exit the GUI and reset the board - your new application should be up and running.

1.5.2.1 How to Install the "Bootloader PC tool"

How to install the Bootloader PC GUI tool

1. Run the "Bootloader_PC_Tool_Setup_...exe" provided in the "Atmel AVR2054 Serial Bootloader" extension from the Extension Gallery and complete the installation.
2. The Bootloader PC Tool is now available in the Atmel program folder.



1.6 Available Example Code

SW examples provided for ATmega256RFR2 in Atmel Studio.

2. Performance Analyzer

2.1 Introduction

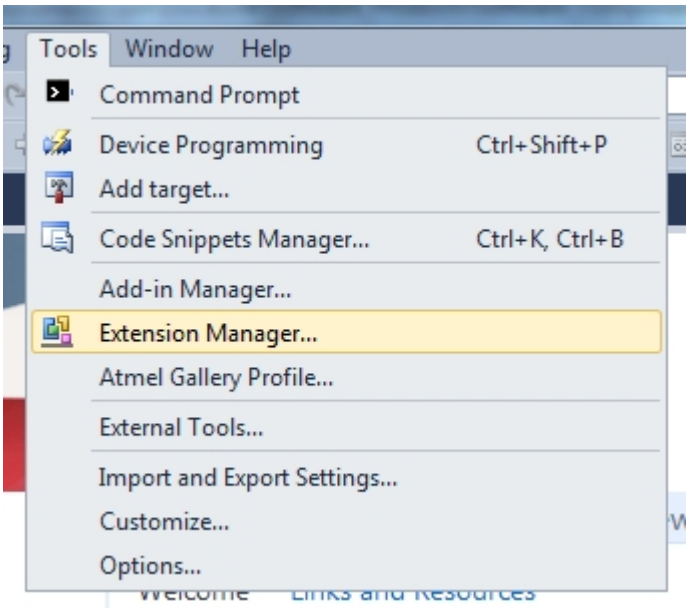
The Performance Analyzer FW together with the GUI in Atmel Studio Wireless Composer Extension provides a number of basic functional RF tests.

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

2.2 Program Installation

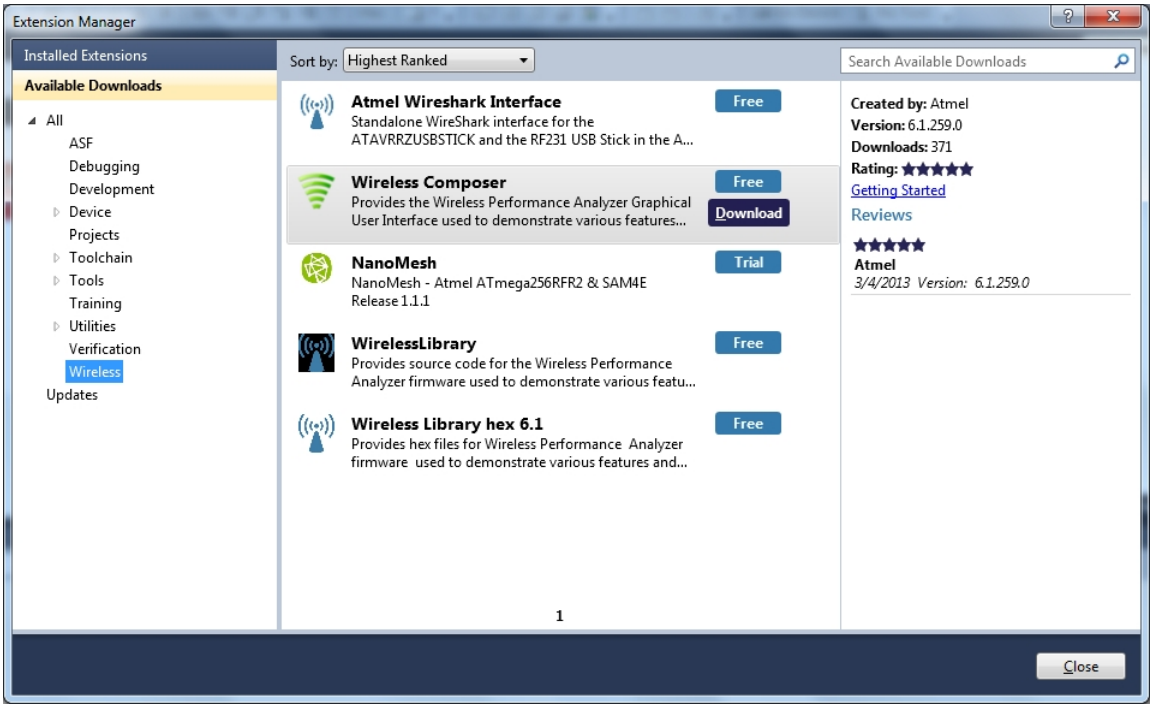
How to install necessary SW.

1. Install Atmel Studio[1].
2. Once Studio is installed and started use the Tools - Extension Manager to install the Wireless Composer.



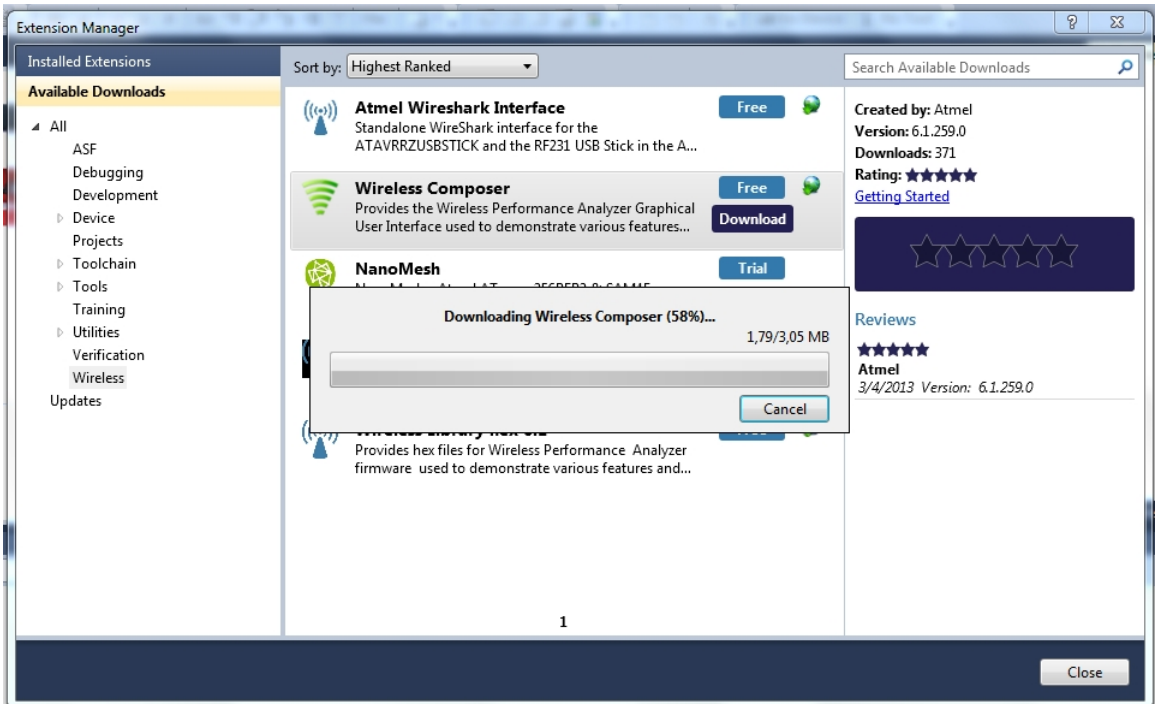
Select Wireless and Wireless Composer.

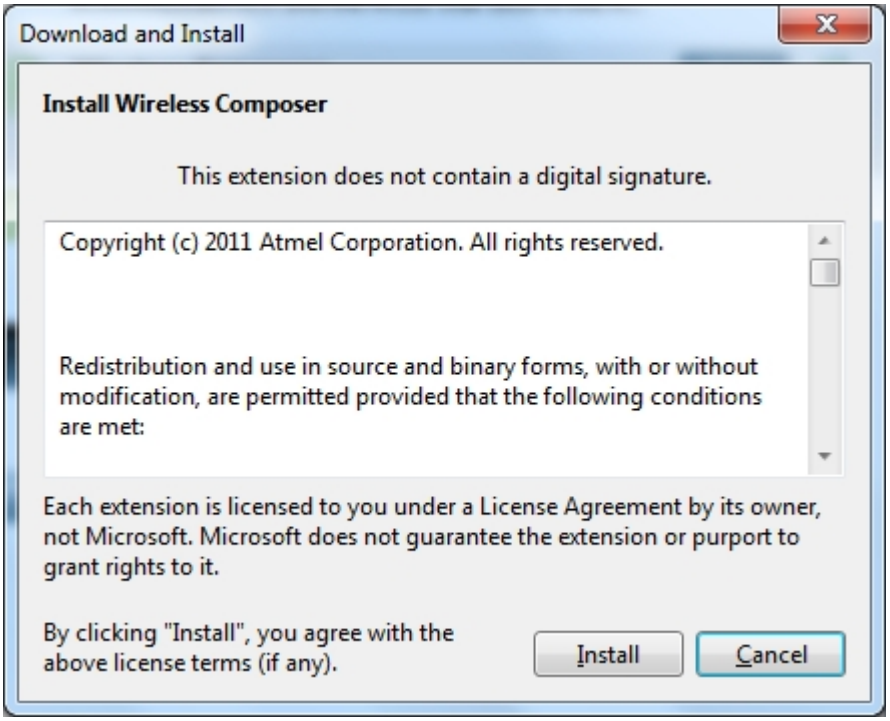
[1] http://www.atmel.com/tools/atmelstudio.aspx



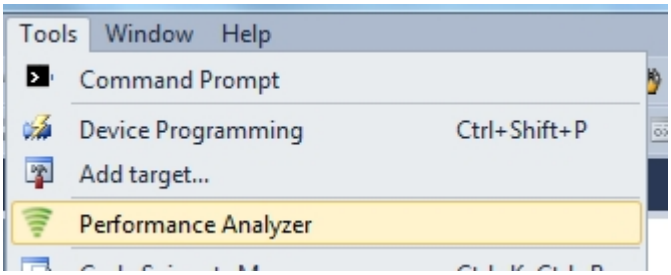
Log in to Atmel Gallery.

Click download again and download starts.





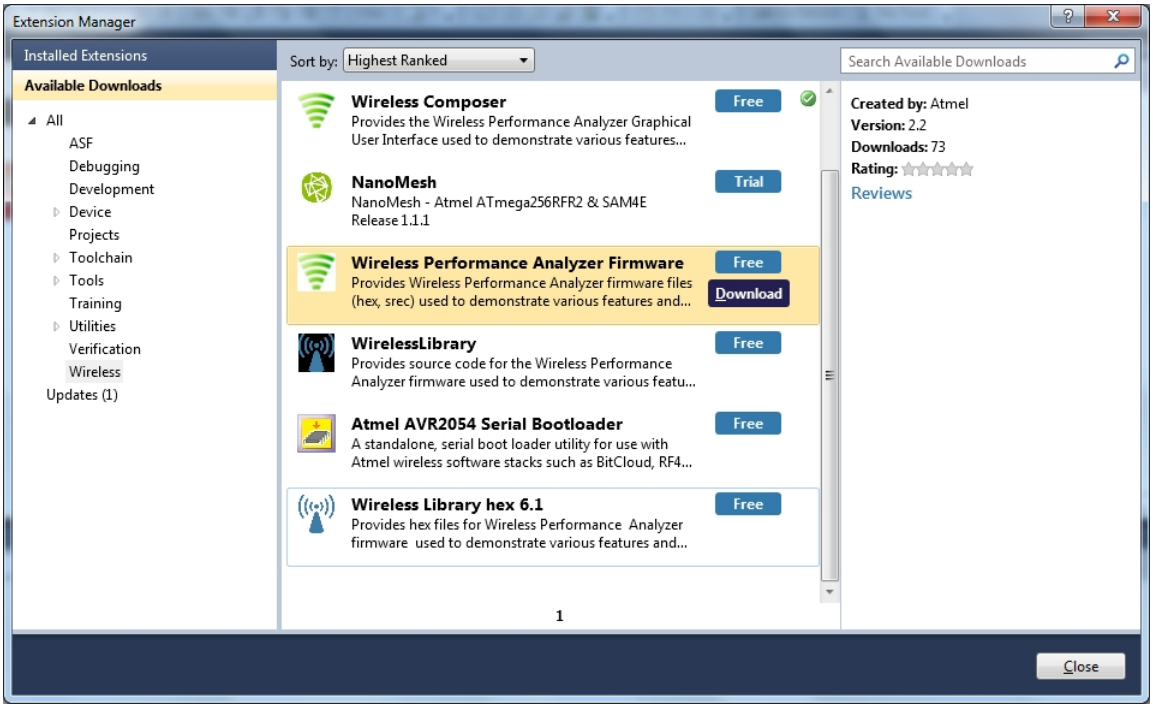
Restart Atmel Studio, allow help to make changes and the Performance Analyzer GUI is available in the Tools menu.



3. If not already preprogrammed - program the node with the Performance Analyzer FW available in the "Wireless Performance Analyzer Firmware extension" or from source code provided in ASF.

   If using an Wireless board with a µC embedded, the Performance Analyzer FW has to be programmed using the Bootloader or JTAGICE.

   If using a extension board which do not have a µC embedded, the Performance Analyzer FW has to be programmed on the Xplained Pro board using the EBDG from Atmel Studio.



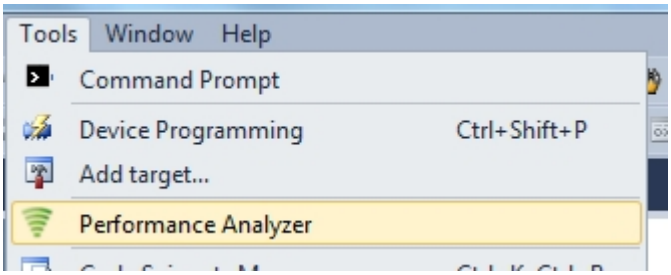
2.3 Program Use

How 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.

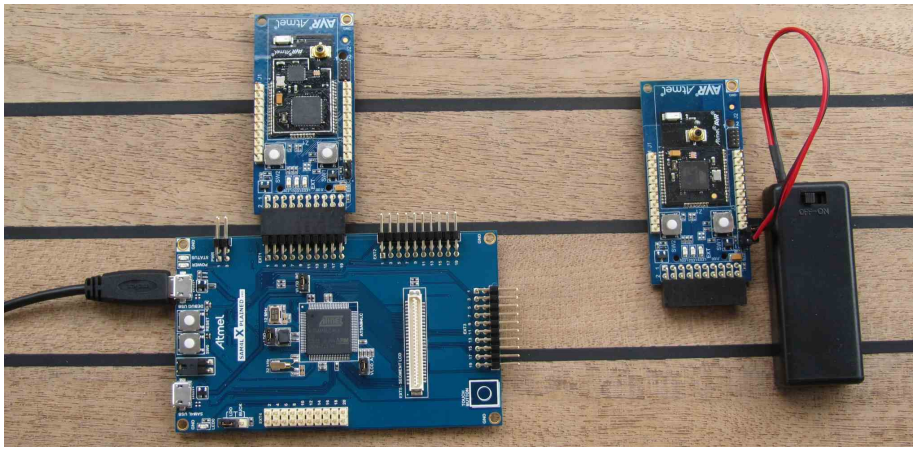
3. Start Performance Analyzer GUI, connect to the kit via the COM port and follow the quick start guide.



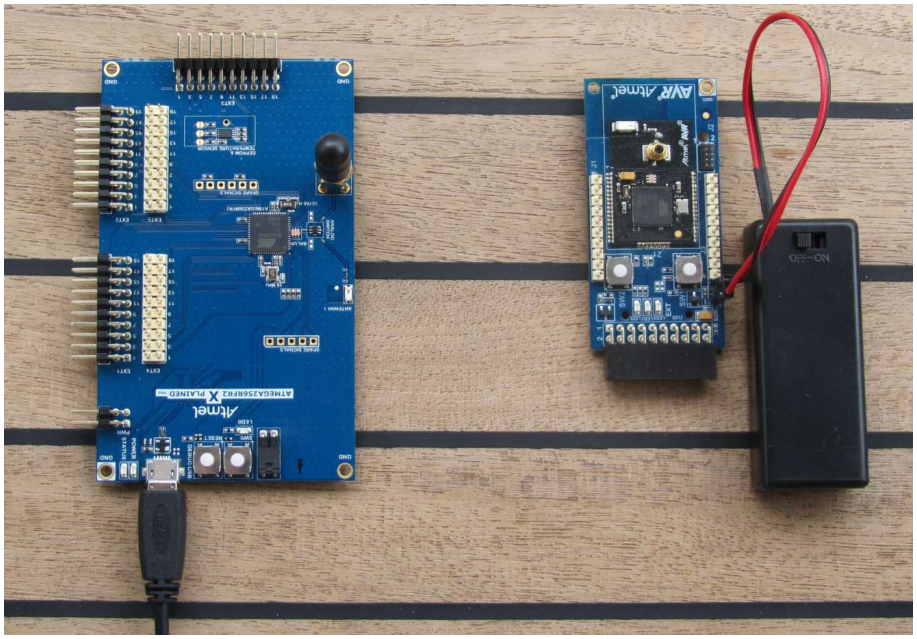
2.4 Typical Wireless Nodes

Typical board assembly.

The Atmel SAM4L Xplained Pro Evaluation Kit with Wireless Extension and remote node consisting of a Wireless extension board and a battery pack.



The Atmel ATmega256RFR2 Xplained Pro Evaluation Kit and remote node consisting of a Wireless extension board and a battery pack.



3. Xplained Pro

Xplained Pro is an evaluation platform that provides the full 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 11 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 11. 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

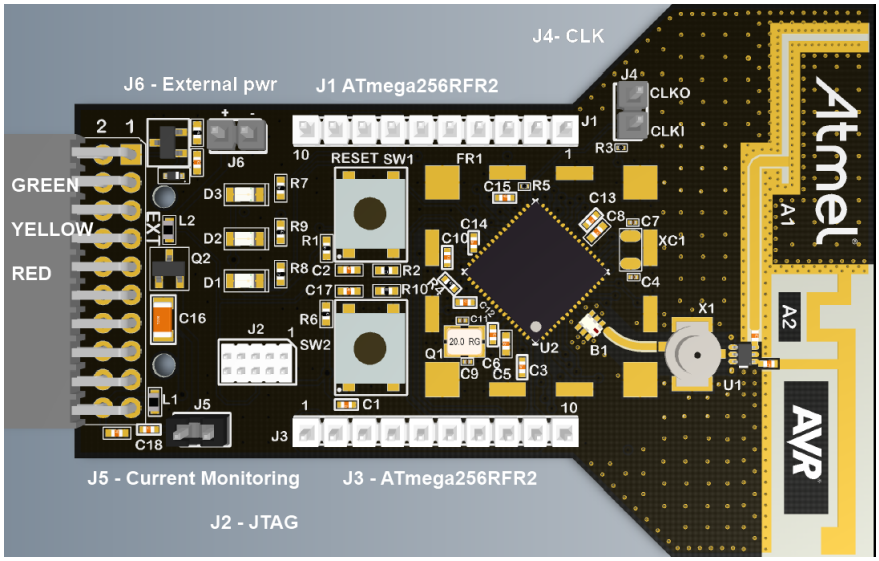
Pin number	Name	Description
1	ID	Communication line to the ID chip on extension board.
2	GND	Ground.
3	ADC(+)	Analog to digital converter , alternatively positive part of differential ADC.
4	ADC(-)	Analog to digital converter , alternatively negative part of differential ADC.
5	GPIO1	General purpose 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

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.

4. Hardware User Guide

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

J100 pin	Name	256RFR2 pin	Description
1	ID		Communication line to the ID chip on extension board.
2	GND		Ground.
3	ADC(+)	NC	
4	ADC(-)	NC (R7 NM)	DIG2.
5	GPIO1	49-PE3	General purpose IO.
6	GPIO2	NC (R6 NM)	CLK_OUT - can be disconnected by not mounting R6.
7	PWM(+)	12-RSTN	RESET to Extension board.
8	PWM(-)	33-CLKI	FEM_SEL, disable AMP to save power.
9	IRQ/GPIO	32-PD7	Interrupt request line to uC on Xplained Pro board.
10	SPI_SS_B/GPIO	50-PE4 (INT4)	Wake up interrupt to RF.
11	TWI_SDA	26-PD1	Data line for two wire interface. Always implemented, bus type.
12	TWI_SCL	25-PD0	Clock line for two wire interface. Always implemented, bus type.
13	USART_RX	28-PD3-TXD1	Receiver line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
14	USART_TX	27-PD2-RXD1	Transmitter line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
15	SPI_SS_A	36-PB0	Slave select for SPI. Should be unique if possible.
16	SPI_MOSI	38-PB2	Master out slave in line of Serial peripheral interface. Always implemented, bus type.

J100 pin	Name	256RFR2 pin	Description
17	SPI_MISO	39-PB3	Master in slave out line of Serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	37-PB1	Clock for Serial peripheral interface. Always implemented, bus type.
19	GND		Ground.
20	VCC		Power for extension board.

4.2.2 J1 & J3

J1 and J3 provide access to all relevant pin's not routed to the J100 Xplained Pro interface.

Table 4-2. J1

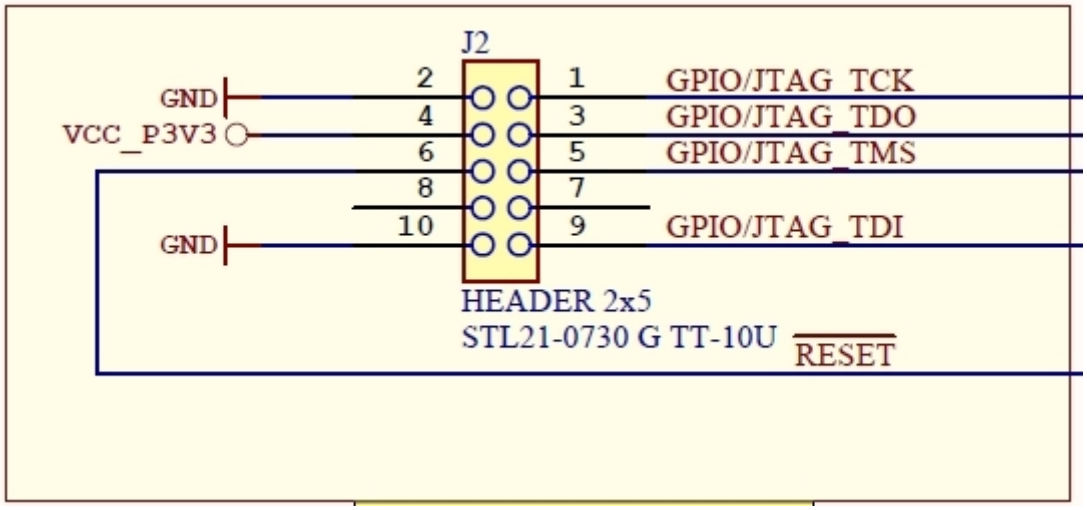
J1 pin	256RFR2 pin
J1-1	PE2/XCK0/AIN0
J1-2	PE3/OC3A/AIN1
J1-3	PD2/RXD1/INT2
J1-4	PD3/TXD1/INT3
J1-5	PD5/XCK1
J1-6	PD4/ICP1
J1-7	PD6/T1
J1-8	PG2/AMR
J1-9	PB4/OC2A/PCINT4
J1-10	PB6/OC1B/PCINT6

Table 4-3. J3

J3 pin	256RFR2 pin
J3-1	PF0/ADC0
J3-2	PF1/ADC1
J3-3	PF2/ADC2/DIG2
J3-4	PF3/ADC3/DIG4
J3-5	AREF
J3-6	PE1/TXD0
J3-7	PE0/RXD0/PCINT8
J3-8	PB7/OC0A/OC1C/PCINT7
J3-9	PG5/OC0B
J3-10	PE7/ICP3/INT7/CLKO

4.2.3 JTAG (J2)

J2 is the JTAG programming header typically used by the JTAGICE.



4.2.4 CLK (J4)

J4 enable easy connection to the CLK signals.

Table 4-4. J4 CLK

J4 pin	Function
J4-1 CLKI	ATmega256RFR2 pin 33, Input to the clock system. If selected, it provides the operating clock of the microcontroller.
J4-2 CLKO	ATmega256RFR2 pin 53, The device can output the system clock on the CLKO pin. To enable the output, the CKOUT Fuse has to be programmed.

4.2.5 Current Monitoring (J5)

J5 enables current monitoring using an external multimeter.

Connect multimeter between J5-1 and J5-2 and measure current used.

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

Important If the JTAG programmer is attached the current measurement will include any power used by the programmer.

Table 4-5. J5 Current measurement

J5 pin	Function
1 - VCC_MCU_P3V3	3.3V pin on the ATmega256RFR2
2 - VCC_P3V3	3.3V on extension board

4.2.6 External power (J6)

J6 enable connection of external power supply when not inserted into an Xplaine Pro mother board.

The connector has reverse voltage protection.

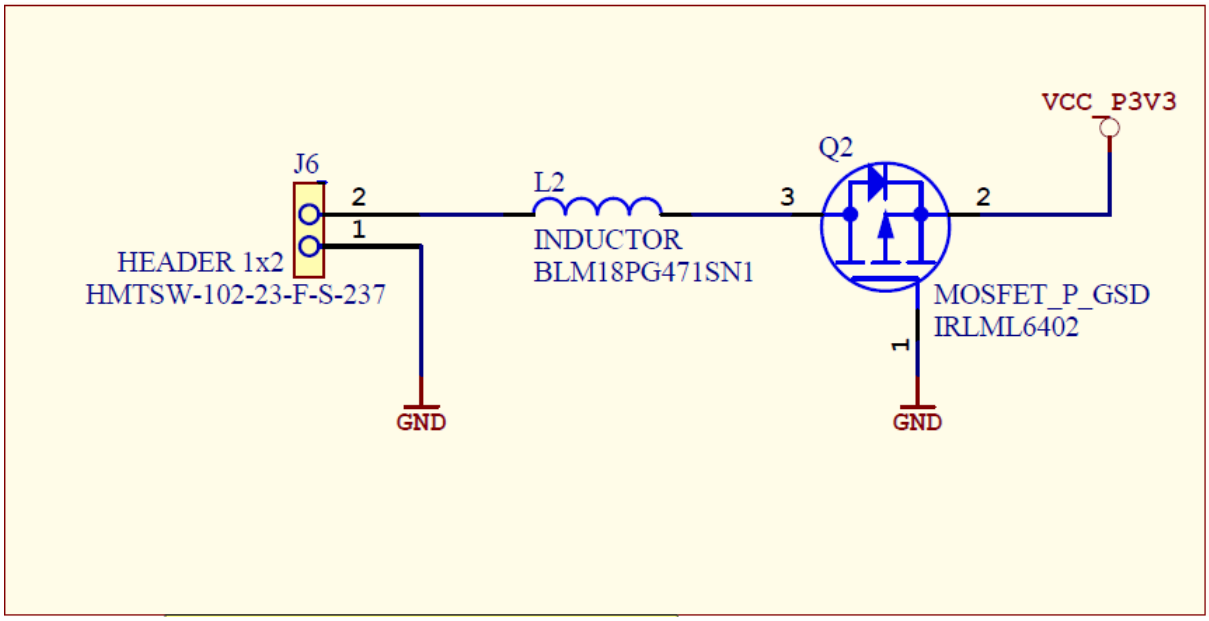


Table 4-6. J6 power

J6 pin	Function
1 - External power	External 3.3V source - typical 2xAAA battery pack
2 - GND	Extension board GND

4.3 Board GUI

4.3.1 LED's

There are three LEDs available for use by application SW.

Table 4-7. LED's

LED	256RFR2 pin
LED1 - Red	31 - PD6
LED2 - Green	16 - PG2
LED3 - Yellow	48 - PE2

4.3.2 Button

There are two buttons - one RESET and one for general use by application SW.

Table 4-8. Buttons

Button	Function	256RFR2 pin
SW1	Reset, press to reset	12 - RSTN
SW2	User defined high signal, press to negate	46 - PE0

4.4 Factory Programmed Data

MAC address and board information is programmed during production in the ATmega256RFR2 User Memory.

See “Persistence Memory” on page 17 for more details.

The extension board comes with a Bootloader and the Performance Analyzer preprogrammed.

5. Persistence Memory

A dedicated memory space is allocated to store product specific information and called the Persistence Memory. The organization of the persistence memory is as follows:

Table 5-1. Persistence Memory

Data	Size
Structure Revision	2 bytes
MAC address	8 bytes
Board information – PCBA Name	30 bytes
Board information – PCBA Serial number	10 bytes
Board information – PCBA Atmel Part Number	8 bytes
Board information – PCBA Revision	1 byte
XTAL Calibration Value	1 byte
Reserved	7 bytes
Reserved	4 bytes
CRC	1 bytes

The MAC address stored inside the MCU is a uniquely assigned ID for each ZigBit® and owned by Atmel. User of the ZigBit application can use this unique MAC ID to address the ZigBit in end-applications. The MAC ID can be read from the ZigBit using the Performance Analyzer Application that is supplied through Atmel Studio Gallery Extension.

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 ATRCB256RFR2-XPRO 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 : VW4A092007. This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

a. this device may not cause harmful interference, and

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

The internal antenna used for this 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).

ATRCB256RFR2-XPRO is limited modular approved and required 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.

6.2 European Union (ETSI)

The ATRCB256RFR2-XPRO Module has been certified for use in European Union countries. 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.

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 ATRCB256RFR2-XPRO Module complies with Industry Canada specifications RSS-210 and RSS – GenIC

ID for ATRCB256RFR2-XPRO is 11019A-092007

ATRCB256RFR2-XPRO is limited modular approved and required 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts 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.

This equipment complies with radio frequency exposure limits set forth by Industry Canada for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the device and the user or bystanders.

Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par Industrie Canada pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers

CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment. The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

This Module is labelled with its own IC ID. If the IC ID Certification Number is not visible while installed inside another device, then the device should display the label on it referring the enclosed module. In that case, the final end product must be labelled in a visible area with the following: “Contains Transmitter Module IC:11019A-092007 ” (Mention IC ID) OR “Contains IC: 11019A-092007 ”

Ce module est étiqueté avec son propre ID IC. Si le numéro de certification IC ID n'est pas visible lorsqu'il est installé à l'intérieur d'un autre appareil, l'appareil doit afficher l'étiquette sur le module de référence ci-joint. Dans ce cas, le produit final doit être étiqueté dans un endroit visible par le texte suivant: “Contains Transmitter Module IC: 11019A-092007 ” OR “Contains IC: 11019A-092007 ”

6.4 Using Limited Modular Certified Products

The ATRCB256RFR2-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.

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 expo- sure 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).

7. Document Revision History

Document revision	Date	Comment
42203A	10/2013	Initial document release

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