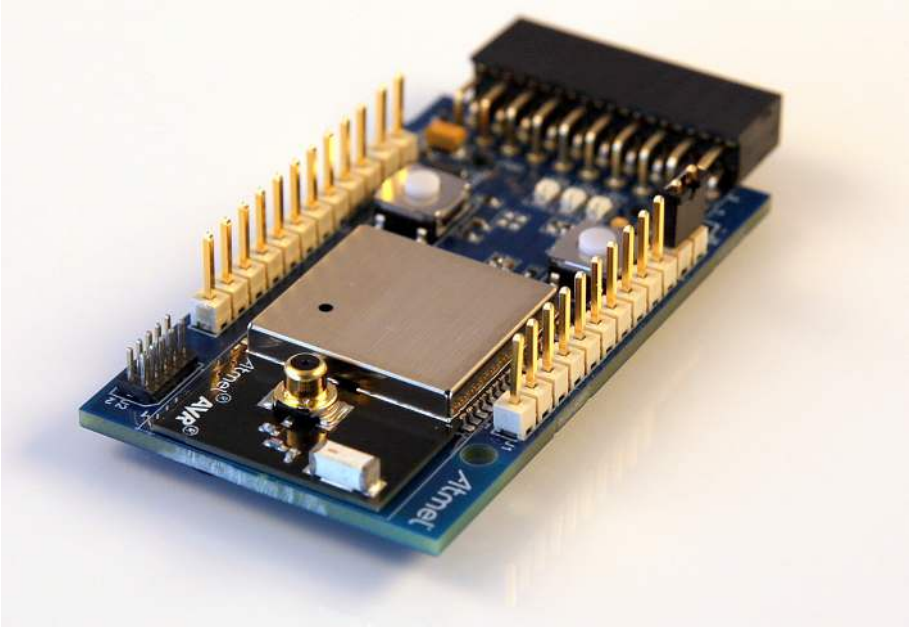
USER GUIDE

ZigBit Extension User Guide

Introduction

This user guide describes how to get started with the Atmel® ZigBit® extension boards.

The ZigBit extension boards is targeted for evaluating the features of the Atmel ZigBits, currently supporting ATmega256RFR2 wireless SoC, the AT86RF212B and AT86RF233 radio transceivers.



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1. Getting Started

1.1 Features

The ZigBit extensions is a range of Extension boards providing a development/prototyping platform for the ZigBits.

1.2 Design Documentation and Related Links

The following list contains links to the most relevant documents and software for the extension boards.

http://www.atmel.com/tools/ATZB-256RFR2-XPRO.aspx

http://www.atmel.com/tools/ATZB-X-212B-XPRO.aspx

http://www.atmel.com/tools/ATZB-X-233-XPRO.aspx

http://www.atmel.com/tools/ATZB-212B-XPRO.aspx

http://www.atmel.com/tools/ATZB-A-233-XPRO.aspx

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.

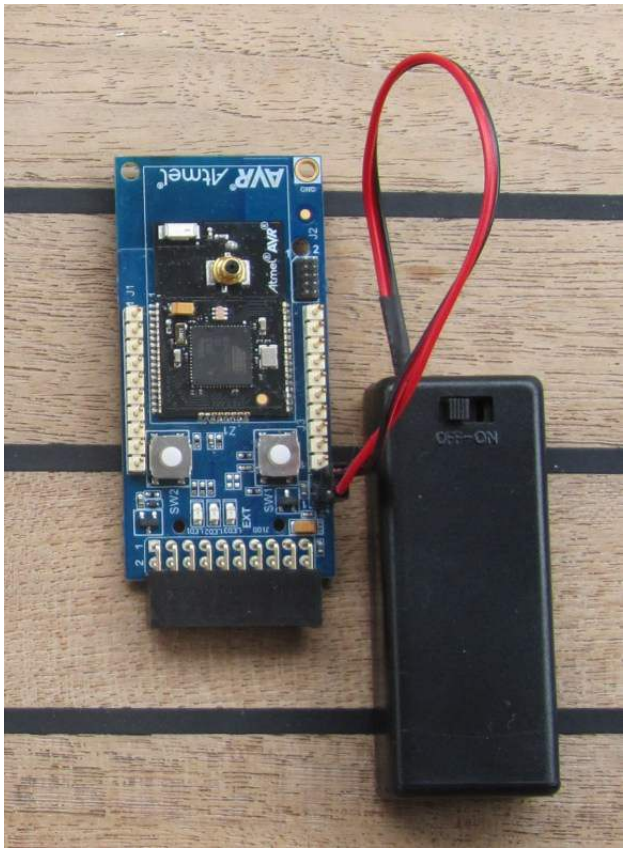
1.3.1 Connect to a Xplained Pro Board

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

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 Figure 1-1, “Board Powered by External Battery Pack” on page 3.

Figure 1-1. Board Powered by External Battery Pack



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 ZigBit signal are available.

1.4 Connecting the Kit

How to connect the extension board.

1.4.1 Atmel Studio

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

1. Download and install Atmel Studio[1].
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.

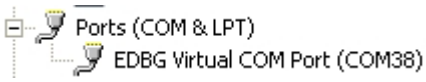
All Xplained Pro boards have an embedded debugger (EBDG) with a number of features, among them a CDC/ COM port which enables the user to connect to on-board SW and using the boot-loader on the extension boards.

1. Select a Xplained Pro board supported with a "Serial bridge application", currently supported by the SAM4L- XPRO and the ATmega256RFR2-XPRO boards.
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 XPRO 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 and JTAGICE3.

1. Connect the JTAGICE USB to the PC.
2. Connect the JTAGICE to the Extension board connector (J2) as shown in Figure 1-2, “Connecting the JTAGICE3” on page 5.
3. Go to Atmel Studio: Tools → Device Programming, and select the JTAGICE connected as Tool and click Apply.
4. Select Device = ATxmega256A3U or ATmega256RFR2.
5. Select "Memories" and locate the source hex or elf file and click Program.

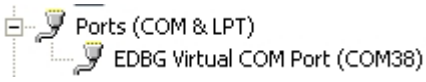
[1] http://www.atmel.com/tools/atmelstudio.aspx

Figure 1-2. Connecting the JTAGICE3

1.5.2 Bootloader

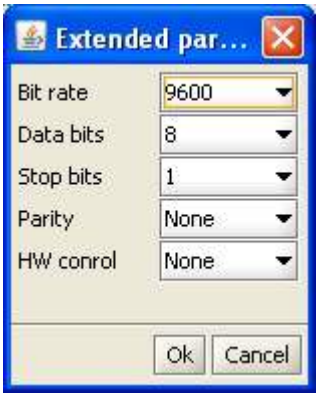
This section describes how to use the bootloader to program the ZigBit on the Extension board.

1. Use a Xplained Pro board with a "Serial bridge application" (“Connect the Extension UART to the EBDG COM port” on page 4) 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.



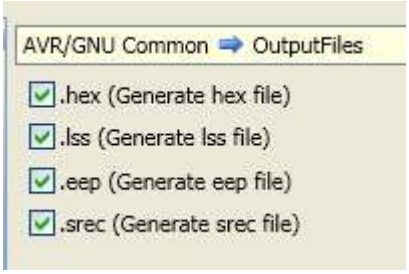
2. Start the "Bootloader PC tool" “How to Install the "Bootloader PC tool"” on page 6

3. Set "Connection" to Serial and "Port" to the COM port number.
4. Configure the serial port settings as (clik 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 in Atmel Studio ASF.

2. Performance Analyzer

2.1 Introduction

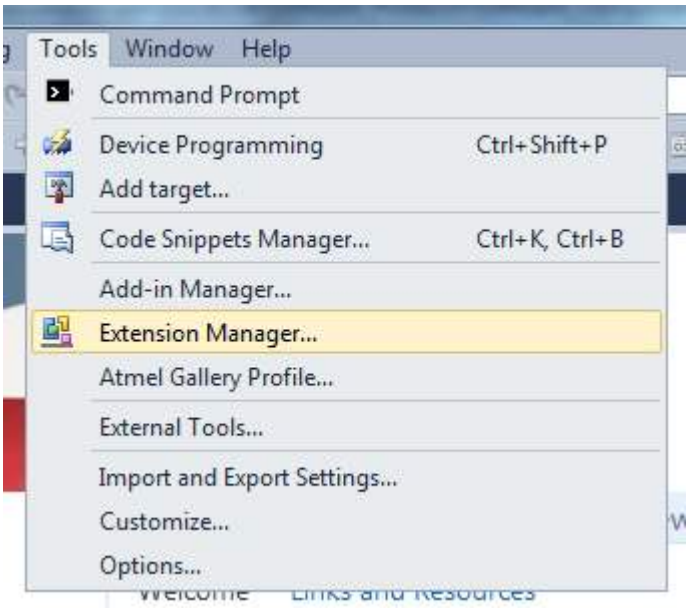
The Performance Analyzer FW together with the GUI in Atmel Studio Wireless Composer Extension provides a number of basic functional RF tests.

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

2.2 Program Installation

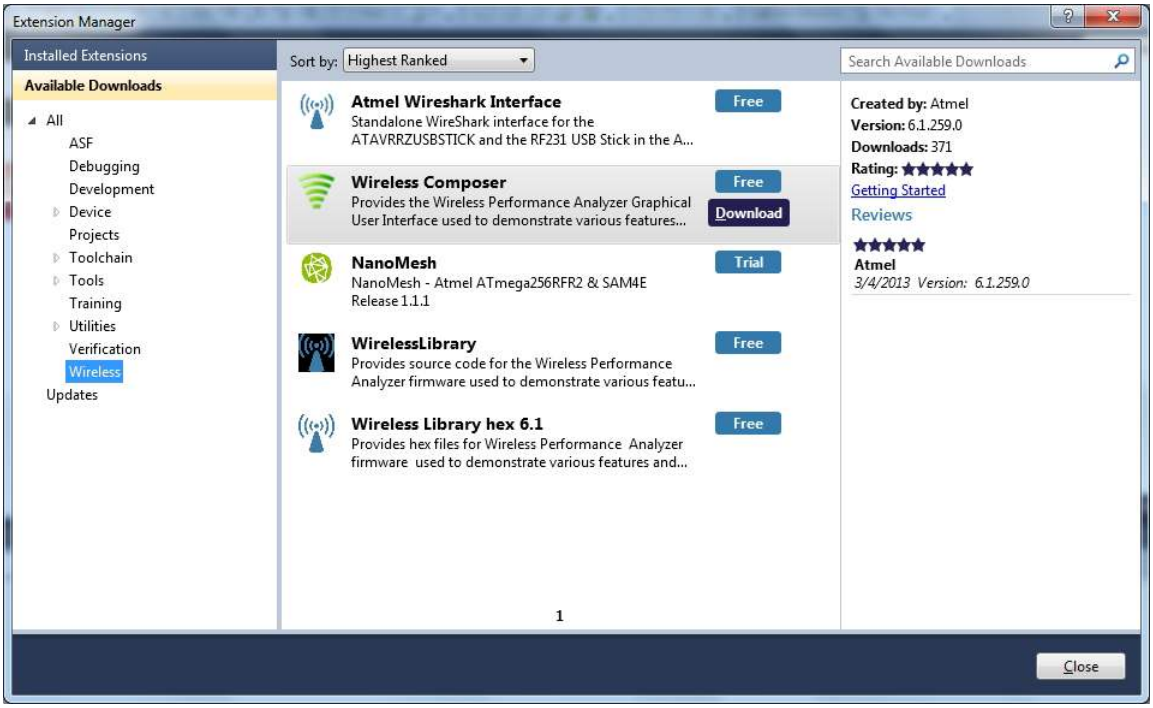
How to install necessary SW.

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



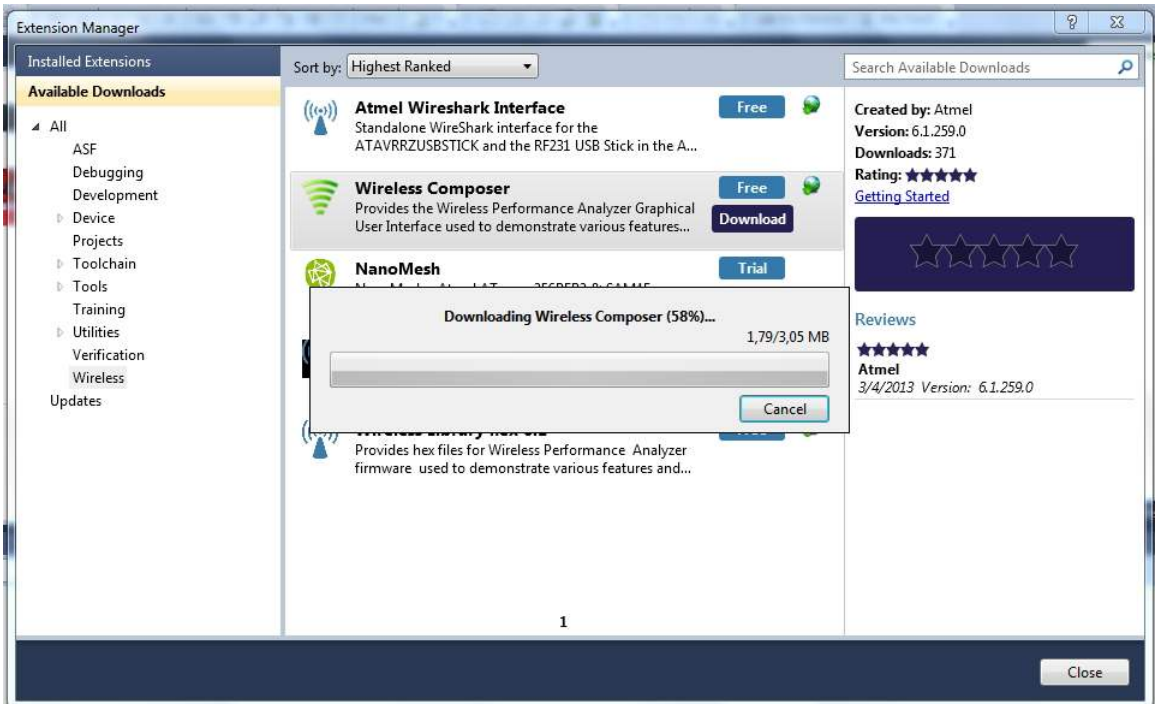
Select Wireless and Wireless Composer.

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

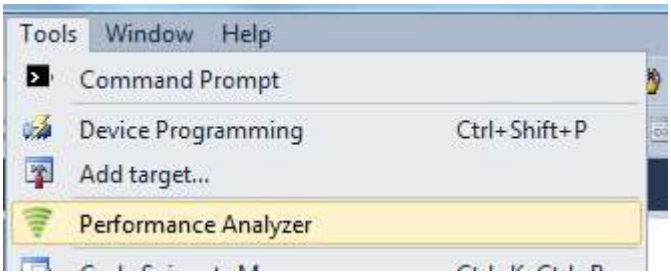


Log in to Atmel Gallery.

Click download again and download starts.



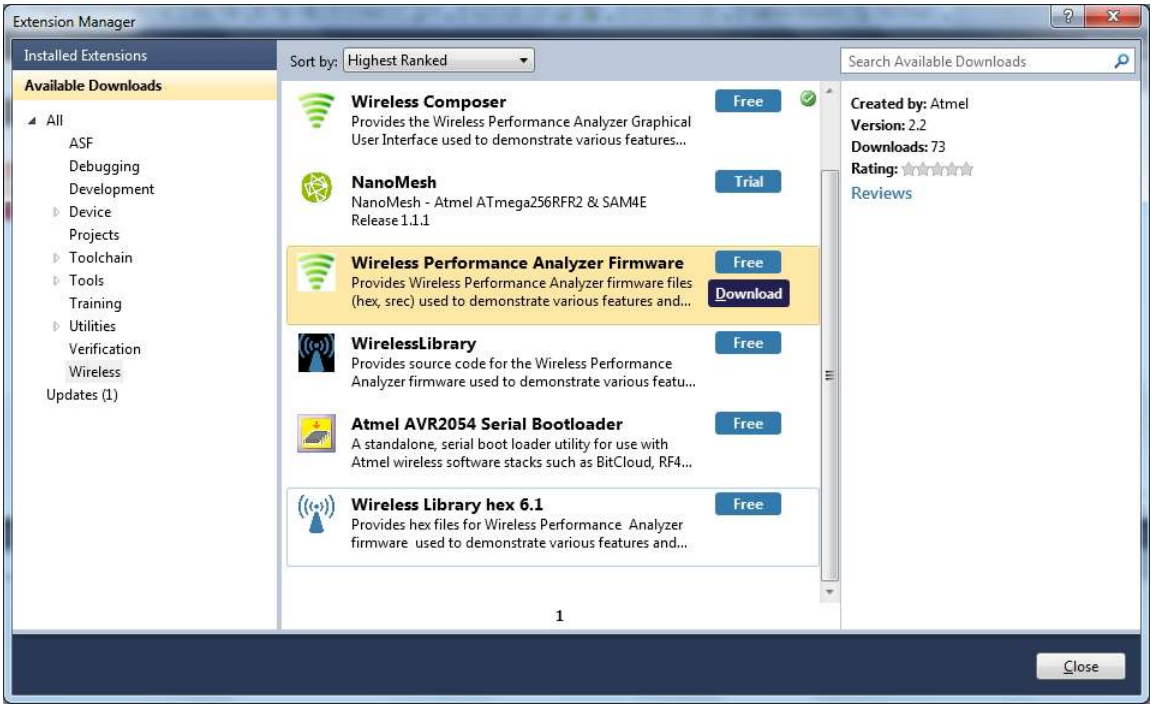
Restart Atmel Studio, allow help to make changes and the Performance Analyzer GUI is available in the Tools menu.



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.



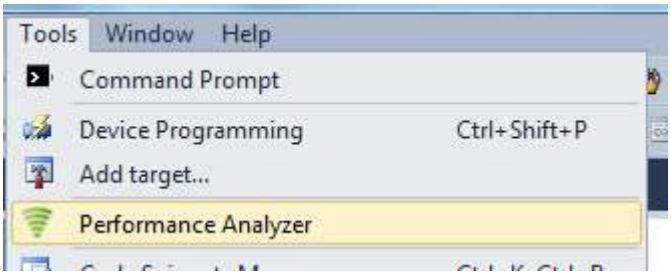
2.3 Program Use

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.

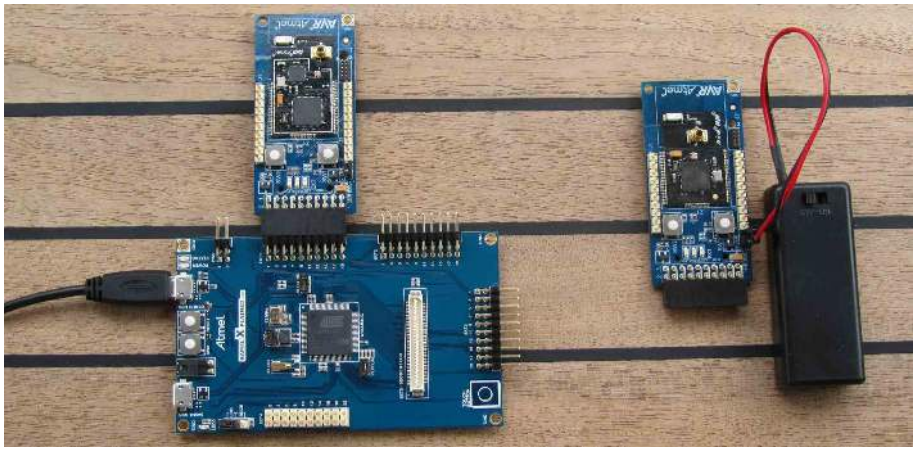
3. Start Performance Analyzer GUI, connect to the kit via the COM port and follow the quick start guide.



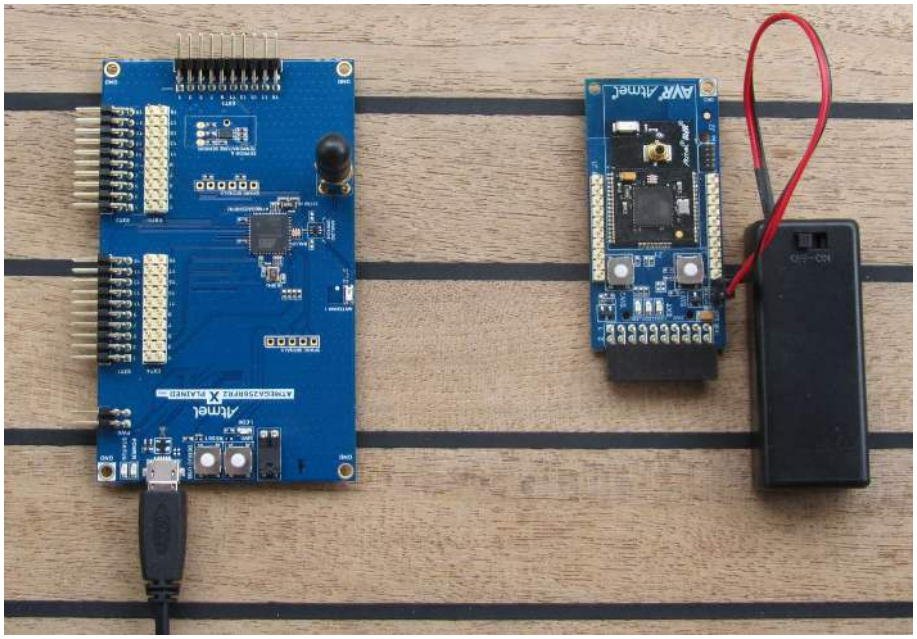
2.4 Typical Wireless Nodes

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 12 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 12. 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.

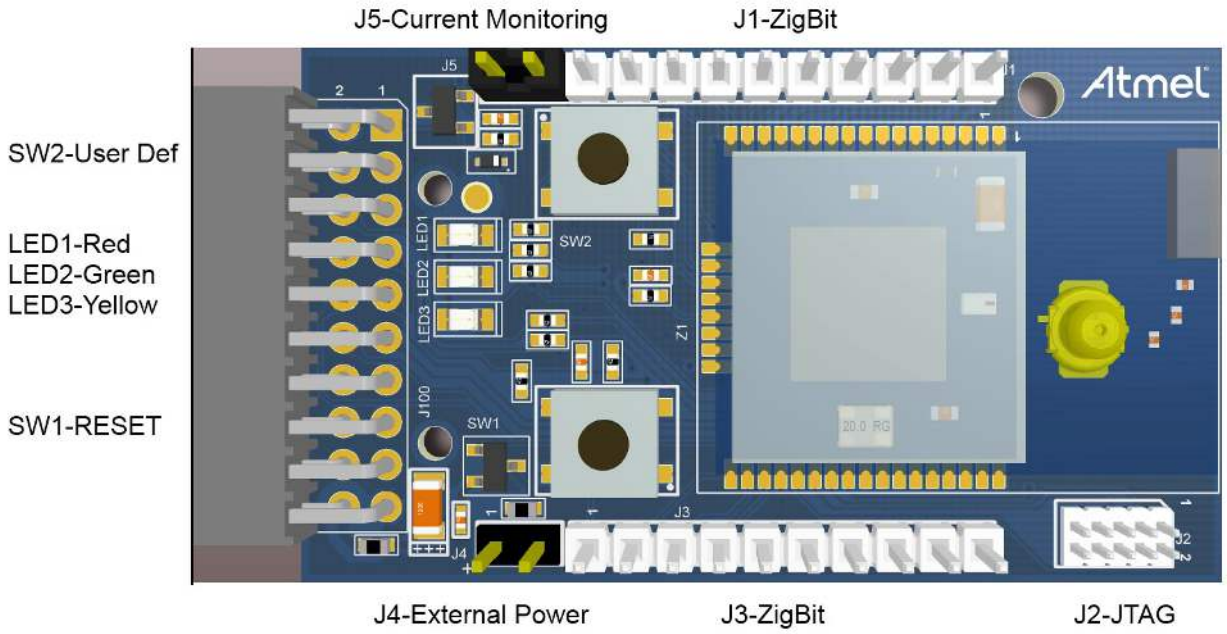
[1] http://store.atmel.com/CBC.aspx?q=c:100113

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

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	ZigBit pin	256RFR2 pin	XMEGA® pin	RF233/ RF212B pin	Description
1	ID					Communication line to the ID chip on extension board.
2	GND					Ground.
3	ADC(+)	NC	NC	NC	NC	
4	ADC(-)	34	NC (R7 NM)	NC (R7 NM)	10-DIG2	DIG2.
5	GPIO1	11	49-PE3	2-PA4	NC	General purpose IO.
6	GPIO2	39	NC (R6 NM)	NC (R6 NM)	17-CLKM	CLK_OUT - can be disconnected by not mounting R6.
7	PWM(+)	5	12-RSTN	57-RESET	8-RSTN	RESET to Extension board.
8	PWM(-)	38	33-CLKI	41-PE5	CPS U2	FEM_SEL, disable AMP to save power.
9	IRQ/GPIO	40	32-PD7	46-PF0	24-IRQ	Interrupt request line to uC on Xplained Pro board.
10	SPI_SS_B/ GPIO	35	50-PE4 (INT4)	38-PE2	11-SLP_TR	Wake up interrupt to RF.
11	TWI_SDA	37	26-PD1	36-PE0/ SDA	EEPROM	Data line for two wire interface. Always implemented, bus type.

Pin	Name	ZigBit pin	256RFR2 pin	XMEGA® pin	RF233/ RF212B pin	Description
12	TWI_SCL	36	25-PD0	37-PE1/ SCL	EEPROM	Clock line for two wire interface. Always implemented, bus type.
13	USART_RX	14	28-PD3-TXD1	29-PD3/ TXD0	NC	Receiver line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
14	USART_TX	13	27-PD2-RXD1	28-PD2_RXD0	NC	Transmitter line of Universal Synchronous and Asynchronous serial Receiver and Transmitter.
15	SPI_SS_A	6	36-PB0	30-PD4/ SS	23-SEL	Slave select for SPI. Should be unique if possible.
16	SPI_MOSI	7	38-PB2	31-PD5/ MOSI	22-MOSI	Master out slave in line of Serial peripheral interface. Always implemented, bus type.
17	SPI_MISO	8	39-PB3	32-PD6/ MISO	20-MISO	Master in slave out line of Serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	9	37-PB1	33-PD7/ SCK	19-SCLK	Clock for Serial peripheral interface. Always implemented, bus type.
19	GND					Ground.
20	VCC					Power for extension board.

4.2.2 J1 and J3

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

Table 4-2. J1

Pin	ZigBit pin	256RFR2 pin	XMEGA pin	RF233 pin	RF212B pin
J1-1	10	PE2/XCK0/AIN0	PA5	DIG1	DIG1
J1-2	11	PE3/OC3A/AIN1	PA4	FEM_CSD	NC
J1-3	13	PD2/RXD1/INT2	PD2/RXD0	NC	NC
J1-4	14	PD3/TXD1/INT3	PD3/TXD0	NC	NC
J1-5	15	PD5/XCK1	PD1/XCK0	NC	NC
J1-6	16	PD4/ICP1	PDI_DATA	NC	NC
J1-7	17	PD6/T1	PA6	NC	NC
J1-8	18	PG2/AMR	PA7	NC	NC
J1-9	19	PB4/OC2A/PCINT4	PB3	NC	NC
J1-10	20	PB6/OC1B/PCINT6	PB2	NC	NC

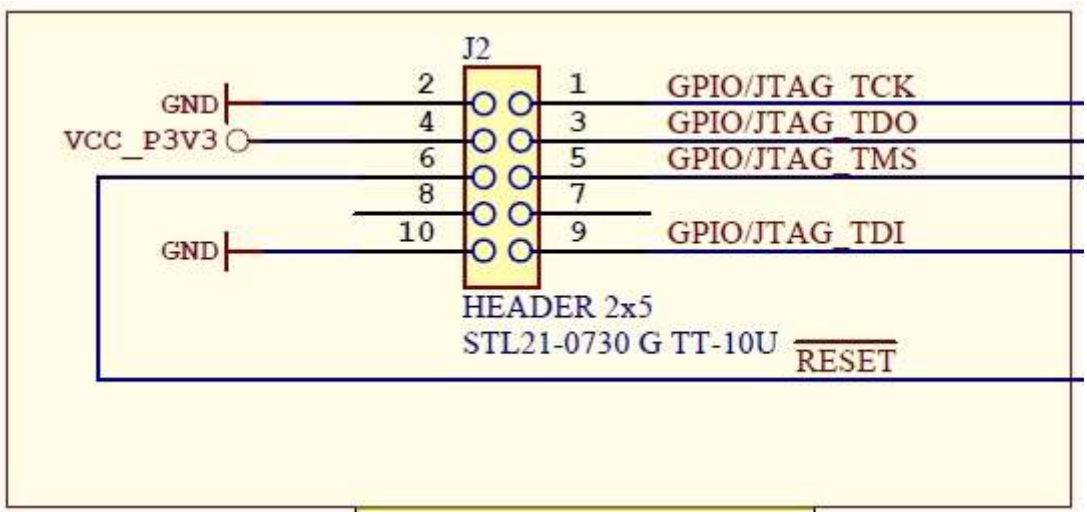
Table 4-3. J3

Pin	ZigBit pin	256RFR2 pin	XMEGA pin	RF233 pin	RF212B pin
J3-1	25	PF0/ADC0	PA0/ADC0/INT	NC	NC
J3-2	26	PF1/ADC1	PA1/ADC1/INT	NC	NC
J3-3	27	PF2/ADC2/DIG2	PA2/ADC2/INT	NC	NC
J3-4	28	PF3/ADC3/DIG4	PA3/ADC3/INT	NC	NC
J3-5	24	AREF	PB0/IAREF/INT	NC	NC
J3-6	23	PE1/TXD0	PF3/OC0D/INT/TXD0	NC	NC
J3-7	22	PE0/RXD0/PCINT8	PF2/OC0C/INT/RXD0	NC	NC

Pin	ZigBit pin	256RFR2 pin	XMEGA pin	RF233 pin	RF212B pin
J3-8	21	PB7/OC0A/OC1C/ PCINT7	PF1/OC0B/INT/XCK0	NC	NC
J3-9	34	PG5/OC0B	PE3	DIG2	DIG2
J3-10	39	PE7/ICP3/INT7/CLKO	PE4/SYNC/OC1A	FEM_SEL	CLKM

4.2.3 JTAG (J2)

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



4.2.4 External Power (J4)

J4 enable connection of external power supply when not inserted into an Xplained Pro mother board.

The connector has reverse voltage protection.

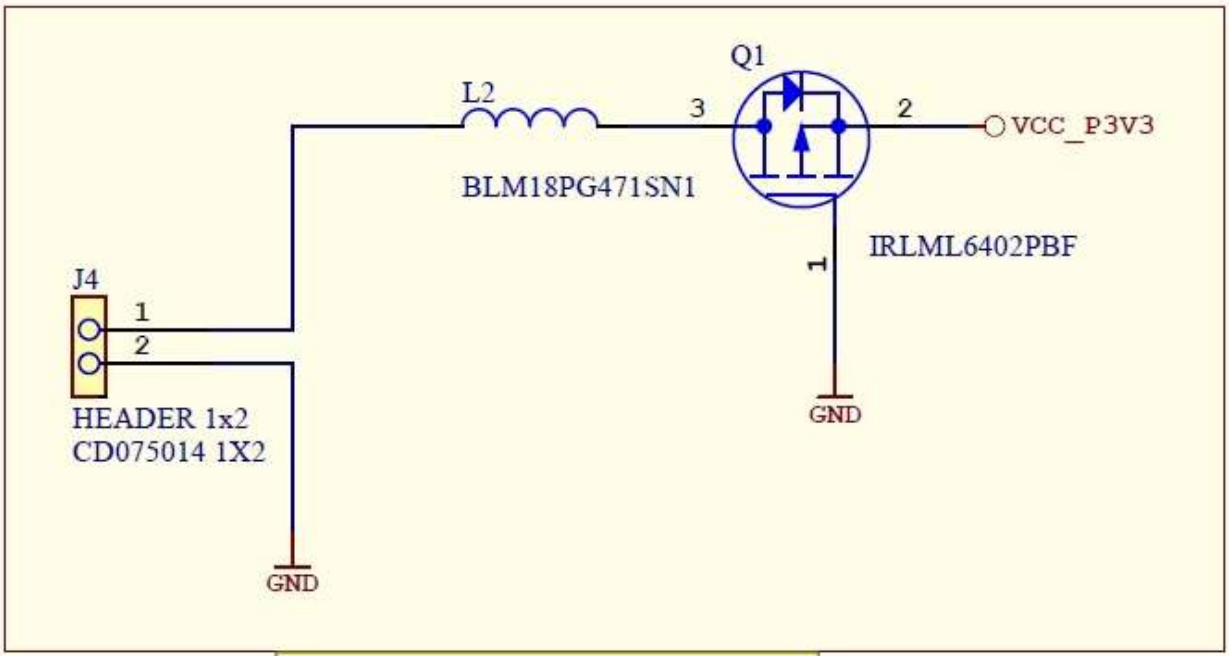


Table 4-4. J4 Power

J4 pin	Function
1 - External power	External 3.3V source - typical 2xAAA battery pack
2 - GND	Extension board GND

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 by the ZigBit.

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

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

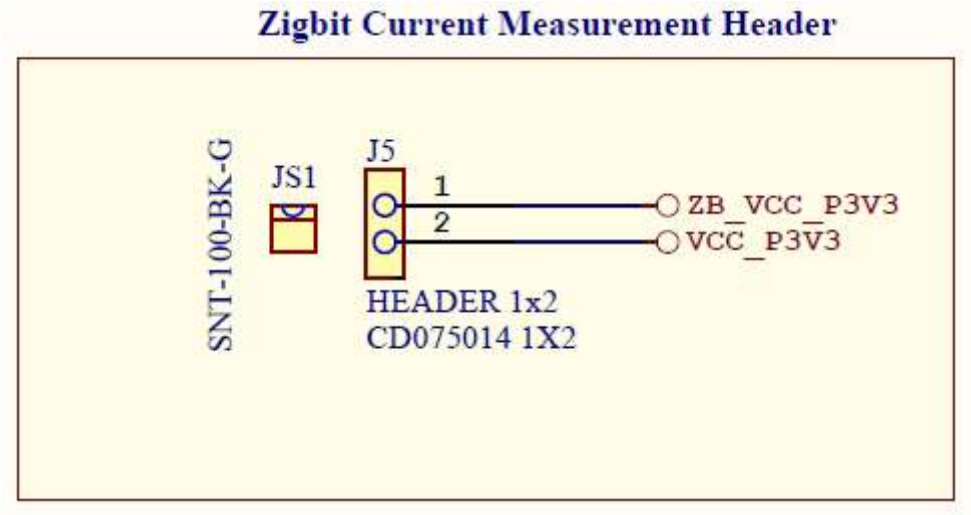


Table 4-5. J5 Current Measurement

J5 pin	Function
1 - ZB_VCC_P3V3	3.3V pin on the ZigBit
2 - VCC_P3V3	3.3V on extension board

4.3 Board GUI

4.3.1 LED's

There are three LED's available for use by application SW.

Table 4-6. LED's

LED	ZigBit pin	256RFR2 pin	XMEGA pin	AT86RF233/RF212B
LED1 - Red	17	31 - PD6	4 - PA6	NC
LED2 - Green	18	16 - PG2	5 - PA7	NC
LED3 - Yellow	10	48 - PE2	3 - PA5	NC

4.3.2 Button

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

Table 4-7. Buttons

Button	Function	ZigBit pin	256RFR2 pin	XMEGA pin	RF233 pin	RF212B pin
SW1	ZigBit Reset, press to reset	5	12 - RSTN	56 - RESET	8 - RSTN	8 - RST
SW2	User defined high signal, press to negate	22	46 - PE0	48 - PF2	NC	NC

4.4 Factory Programmed Data

The ZigBit has a preprogrammed unique MAC address - details available in the ZigBit data sheet and in “Persistent Memory” on page 19.

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

5. Persistent Memory

A persistent memory space is allocated to store product specific information. The organization of the persistent memory is 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.

6. Document Revision History

Document revision	Date	Comment
42186C	07/2014	Fixed dead links to resources in the "Getting Started" chapter
42186B	06/2014	"J100 Xplained Pro Extension Header" updated
42186A	10/2013	Initial document release

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