SmartConnect

ATZB-SAMR21-XPRO

USER GUIDE

Preface

This user guide facilitates how to get started with the Atmel® ATZB-SAMR21-XPRO extension board. ATZB-SAMR21-XPRO is targeted for evaluating the features and performance of the Atmel ATSAMR21G18-MR210UA ZigBit® wireless module. The extension board is designed to provide ZigBee wireless functionality to the Xplained Pro evaluation platform in 2.4GHz ISM band.



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1. Introduction

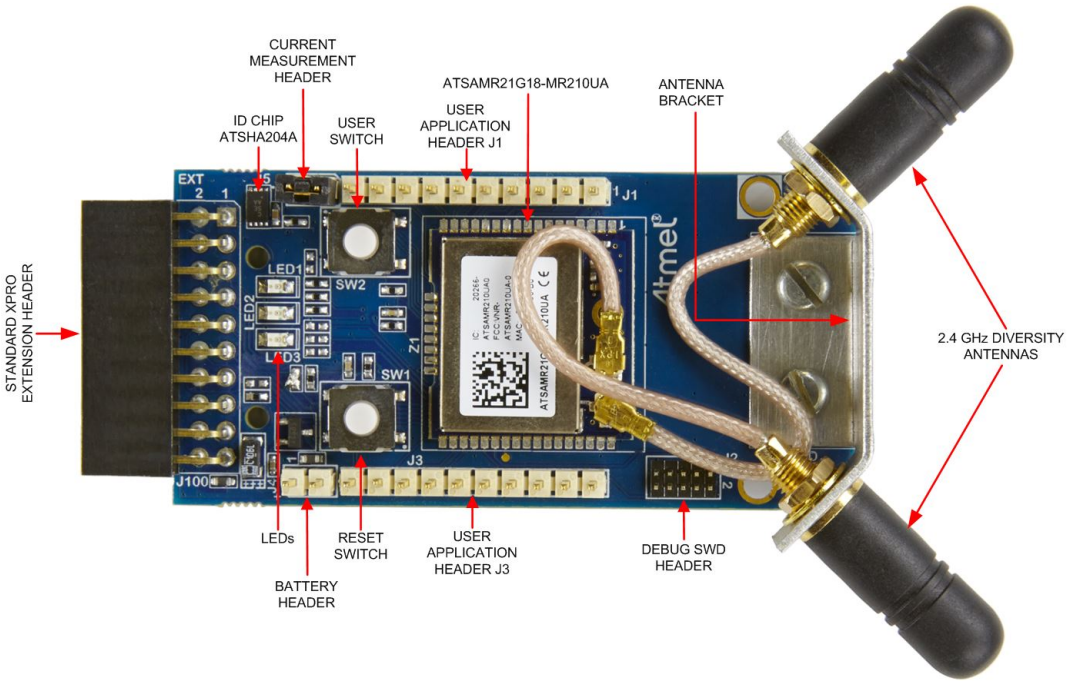
1.1. Features

- Atmel **ATSAMR21G18-MR210UA**: IEEE® 802.15.4 compliant ZigBit wireless module for 2.4GHz ZigBee® applications
  - ATSAMR21G18 (ARM® Cortex® -M0+) system in package
  - AT45DB041E 4Mb DataFlash
  - ATECC508A CryptoAuthentication™ Device
  - 2450BM15A0015E Balun-Filter
  - An RF switch and two U.FL connectors for external antennas or RF front-end connections
  - Radio module with a link budget of 103dB
  - 32.768kHz crystal oscillator
  - High precision 16MHz crystal oscillator
- Single 1.8V - 3.6V supply
- Supports Switching Antenna Diversity
- Current Measurement header
- Debug SWD header
- Digital I/O
  - Xplained Pro extension header comprising SPI, I^2C, and UART interfaces of ATSAMR21G18-MR210UA
  - One RESET button and one user button
  - Three user LEDs
- Supports with Performance Analyzer in Atmel Studio
- Operating temperature range -40 to +85°C
- Xplained Pro hardware identification system

1.2. Kit Overview

The Atmel ATZB-SAMR21-XPRO is a carrier board for ATSAMR21G18-MR210UA ZigBit for the Xplained Pro evaluation platform. They can be connected with any Xplained Pro standard extension header on any Xplained Pro MCU board to provide ZigBee wireless functionality in 2.4GHz ISM band.

Figure 1-1. ATZB-SAMR21-XPRO



2. Getting Started

2.1. Xplained Pro Quick Start

Steps to start exploring the Atmel Xplained Pro platform:

1. Download Atmel Studio.
2. Launch Atmel Studio.
3. Connect a USB cable (Standard-A to Micro-B or Micro-AB) between the PC and the DEBUG USB port on the kit.

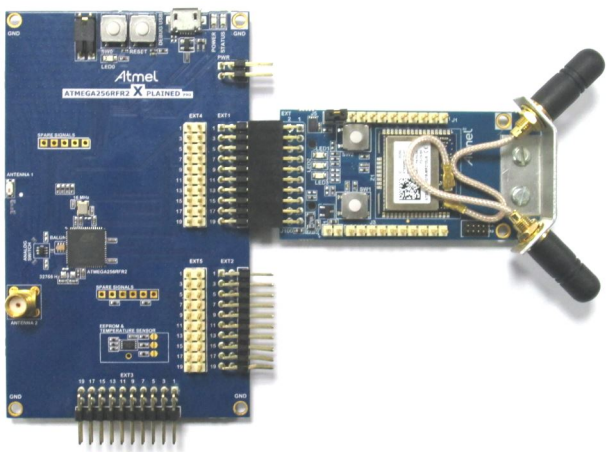
When the Xplained Pro MCU kit is connected to your computer for the first time, the operating system will perform a driver software installation.

Once the Xplained Pro MCU board is powered the green power LED will be lit and Atmel Studio will auto detect which Xplained Pro MCU- and extension board(s) are connected. Atmel Studio will present relevant information like datasheets and kit documentation. The kit landing page in Atmel Studio also has the option to launch Atmel Software Framework (ASF) example applications for the kit. The target device is programmed and debugged by the on-board Embedded Debugger and therefore no external programmer or debugger tool is needed.

2.2. Connecting XPRO with XPRO Extension

ATZB-SAMR21-XPRO Extension board has been designed to be connected with an Xplained Pro extension header marked EXT1. However, it is compatible with all Xplained Pro EXT headers. Refer to the pin-outs of your Xplained Pro evaluation kit to find out which Xplained Pro EXT headers can be used. The connection of the ATZB-SAMR21-XPRO wireless extension board with the Atmel ATMEGA256RFR2-Xplained Pro Evaluation Kit is shown below. Similarly, the extension board can also be connected with SAM4L-XPRO or any other XPROs.

Figure 2-1. Connecting ATMEGA256RFR2-XPRO with ATZB-SAMR21-XPRO Extension



Initially, the corresponding XPRO boards should be programmed with the respective Serial bridge firmware, and the ATZB-SAMR21-XPRO extension board should be programmed with Performance Analyzer firmware. After programming both XPRO and extension boards, the Performance Analyzer GUI in Atmel Studio can easily connect with the ZigBit wireless module on the extension board, and allow the user to change the channel, transmit power, modulation scheme, etc. to perform RF tests. Programming steps for both XPRO and extension board are explained in detail in Programming Wireless Assembly using Atmel Studio 7.0

2.3. Performance Analyzer

2.3.1. Introduction

The Performance Analyzer firmware together with a GUI (Wireless Composer Extension) in Atmel Studio provides a way to perform a number of basic RF functional tests.

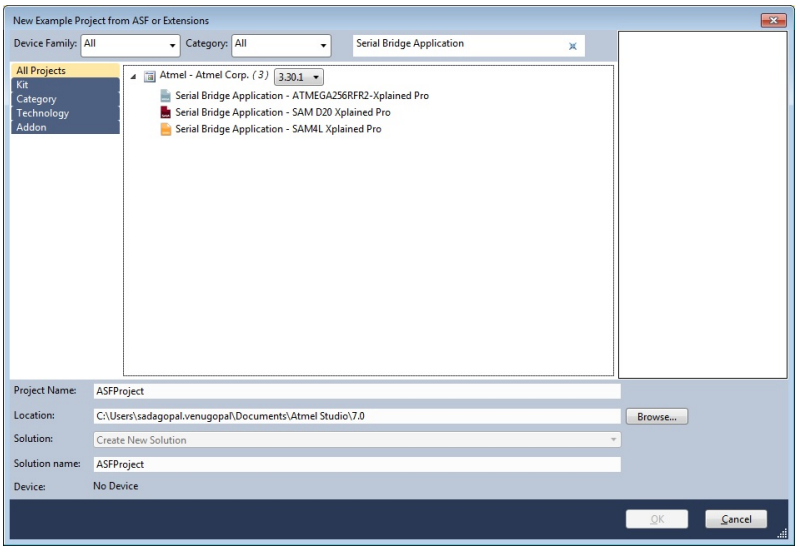
A quick-start guide and general help are available in the starting page of Performance Analyzer window.

The latest version of Atmel Studio is 7.0. This section guides the user to install necessary wireless extension and programming the wireless assembly (XPRO + ATZB-SAMR21-XPRO) using Atmel Studio 7.0.

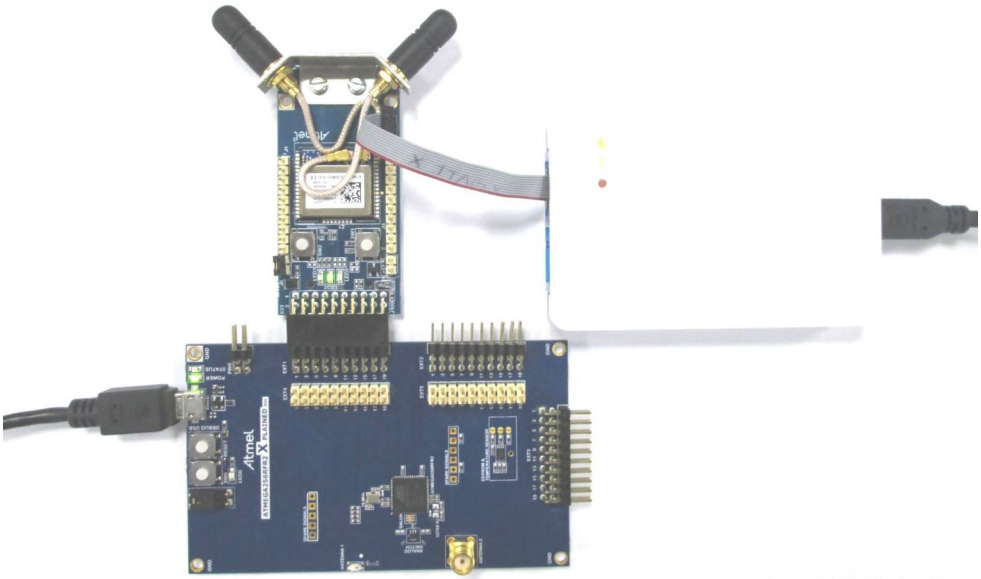
2.3.2. Programming Wireless Assembly using Atmel Studio 7.0

The following steps explain the way to program the wireless assembly and get started.

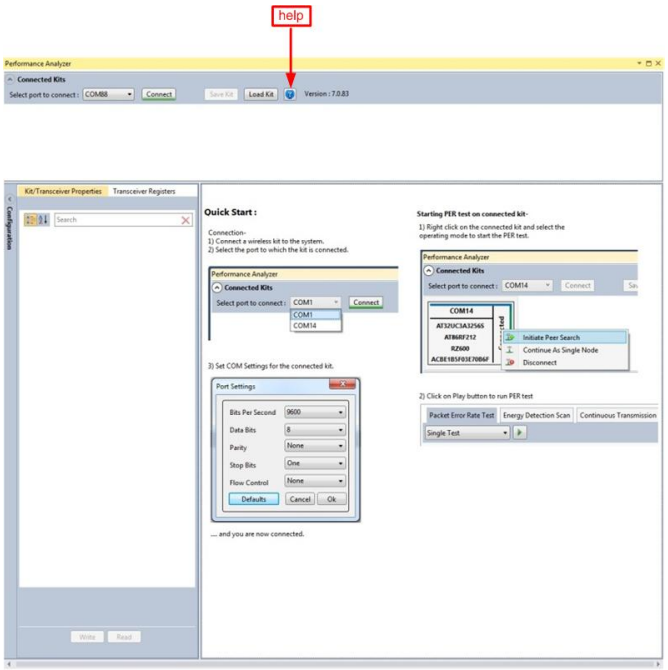
1. Connect the Debug USB port of the XPRO board with PC using the USB cable to power on/ program the board.
2. Program the XPRO board using on-board Embedded Debugger (EDBG) with Serial Bridge Application firmware available at "New Example Project from ASF or Extensions" in Atmel Studio. "Serial Bridge Application - ATMEGA256RFR2-Xplained Pro" and "Serial Bridge Application - SAM4L Xplained Pro" firmwares are available for ATMEGA256RFR2-XPRO and ATSAM4L-XPRO boards respectively. After programming, the XPRO board is able to communicate with suitable extension board through UART interface.



3. Connect the ATZB-SAMR21-XPRO extension board with the programmed XPRO board to power ON the extension board. Program the extension board through SWD header with Performance Analyzer Application firmware available at "New Example Project from ASF or Extensions" in Atmel Studio using Atmel-ICE as shown below.



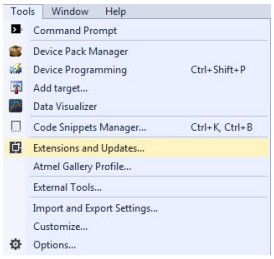
4. Open the Performance Analyzer GUI from the Tools menu in Atmel Studio.
5. Follow the Quick Start guidelines available in the starting page of Performance Analyzer window. Select COM port, click 'connect', and the Performance Analyzer can connect with ZigBit on the board.
6. Finally, the Performance Analyzer will allow to set/change the parameters like Channel Page, Channel, TX Power Register Value, etc. to perform various RF tests. For more details about the usage of Performance Analyzer, click 'help' as shown below in the Performance Analyzer page.



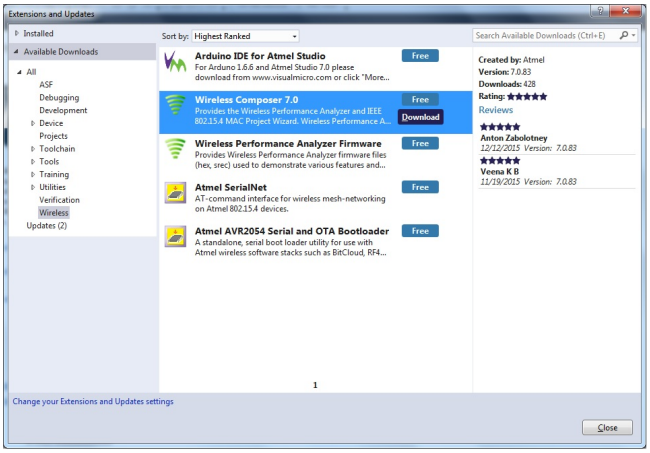
2.3.3. Installing Wireless Composer 7.0 Extension in Atmel Studio 7.0

The following steps explain how to install the necessary wireless extension tool in Atmel Studio 7.0.

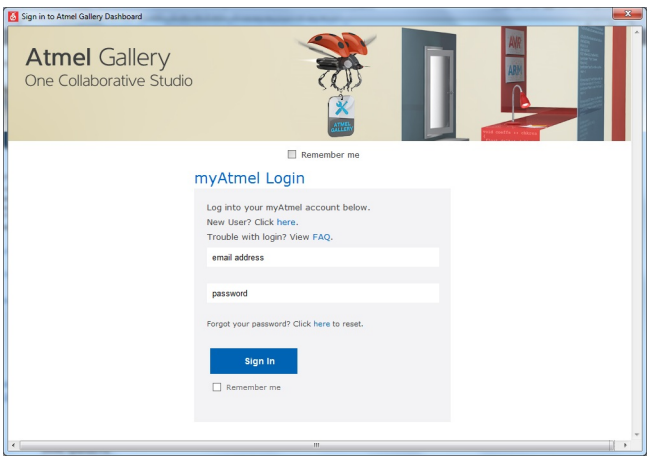
- Install and open Atmel Studio
- Go to Tools and click "Extensions and Updates... "

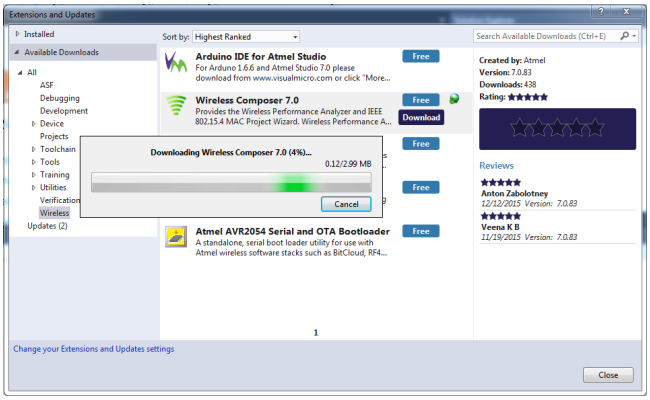


- In "Extensions and Updates" window, click on "Available Downloads". Next, click on the arrow mark on the left side of "All" and click on "Wireless". Select "Wireless Composer 7.0" and click "Download", which will lead to Atmel Gallery.



- Log in to Atmel Gallery. Click "Download" again and the download will start.

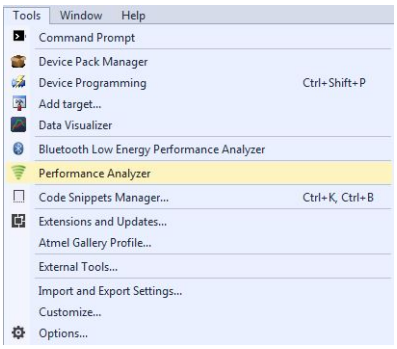




- Install Wireless Composer



- Restart Atmel Studio after the installation. The Performance Analyzer GUI will be available in Tools menu.



2.4. Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for ATZB-SAMR21-XPRO:

- **Xplained Pro products** - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. It consists of a series of low-cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
- **ATZB-SAMR21-XPRO User Guide** - PDF version of this User Guide.
- **ATZB-SAMR21-XPRO Design Documentation** - Package containing schematics, BOM, assembly drawings, 3D plots, layer plots, etc.
- **Atmel Studio** - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.
- **EDBG User Guide** - User guide containing more information about the on-board Embedded Debugger.

- **Atmel Data Visualizer** - Atmel Data Visualizer is a program used for processing and visualizing data. Data Visualizer can receive data from various sources such as the Embedded Debugger Data Gateway Interface found on Xplained Pro boards and COM ports.
- **ATZB-SAMR21-XPRO** - Product page.
- **ATSAMR21G18-MR210UA** - Datasheet of ZigBit wireless module.
- **ATSAMR21G18A-MUT** - Datasheet ARM based Wireless Microcontroller.
- **ATSHA204A-MAHCZ-T** - Datasheet of Standard XPRO extension board ID chip.

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, which 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, which are connected through a set of standardized headers and connectors. Each extension board has an identification (ID) chip to uniquely identify which boards are connected to an Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio.

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 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. The table below 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. Xplained Pro Standard Extension Header

All Xplained Pro kits have one or more dual row, 20-pin, 100mil extension header. Xplained Pro MCU boards have male headers, while Xplained Pro extensions have their female counterparts. Note that all pins are not always connected. All connected pins follow the defined pin-out description in the table below.

The extension headers can be used to connect a variety of Xplained Pro extensions to Xplained Pro MCU boards or to access the pins of the target MCU on Xplained Pro MCU boards directly.

Table 3-2. Xplained Pro Standard Extension Header

Pin number	Name	Description
1	ID	Communication line to the ID chip on an extension board
2	GND	Ground

Pin number	Name	Description
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 negative part of differential PWM
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	I^2C_SDA	Data line for I^2C interface. Always implemented, bus type.
12	I^2C_SCL	Clock line for I^2C interface. Always implemented, bus type.
13	UART_RX	Receiver line of target device UART
14	UART_TX	Transmitter line of target device UART
15	SPI_SS_A	Slave select for SPI. Should preferably be unique.
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 Users Guide

4.1. Headers and Connectors

4.1.1. ATZB-SAMR21-XPRO Extension Header

ATZB-SAMR21-XPRO has an Xplained Pro Standard Extension Header (J100) marked with EXT in PCB silkscreen. This header makes it possible to connect the board to any Xplained Pro MCU board. The pin-out definition for the extension header is shown below.

Table 4-1. ATZB-SAMR21-XPRO Extension Header J100

Pin on EXT	Function	Description
1	ID_DATA	Communication line to ID chip
2	GND	Ground
3	ADC(+)	NC
4	ADC(-)	NC
5	FEM_CSD	NC
6	CLK_OUT	NC
7	PWM(+)	RESET to ZigBit
8	PWM(-)	NC
9	IRQ/GPIO	NC
10	SPI_SS_B/GPIO	GPIO for Atmel Authentication Chip ATECC508A communication
11	TWI_SDA	Data line for I^2C interface between host and ZigBit
12	TWI_SCL	Data line for I^2C interface between host and ZigBit
13	UART_RX	ZigBit UART Transmit
14	UART_TX	ZigBit UART Receive
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_TARGET	Power for extension board

4.1.2. Battery Connector (J4)

A battery can be used to power up the board using the Battery Connector (J4). This is a secondary option to power up the board. This mode of power up can be used during programming the kit using Atmel-ICE or as a standalone Receiver node. The most common primary mode of power source is from XPRO board through 20-pin extension Header.

4.1.3. Current Measurement Header (J5)

The current measurement header (J5) can be used to measure the current consumed by the board by removing the jumper and connecting an Ammeter/Multimeter across the two pins of J5.

4.1.4. User Application Connectors (J1 and J3)

There are two User Application Connectors (J1 and J3). UART, ADC, USB, and some GPIO signals of ZigBit are available in these connectors for user application. The users can use these signals based on their application.

Table 4-2. J1 Connector

Pin on connector	ZigBit Signal	ZigBit Pin	Kit Function
1	GPIO	10	YELLOW_LED
2	NC	11	UNUSED_PIN11
3	RXD1	13	RX
4	TXD1	14	TX
5	NC	15	UNUSED_PIN15
6	NC	16	UNUSED_PIN16
7	FEM_RX_TX	17	RED_LED
8	ANT_DIV_P	18	GREEN_LED
9	GPIO/USB_DM	19	GPIO/USB_DM
10	GPIO/USB_DP	20	GPIO/USB_DP

Table 4-3. J3 Connector

Pin on connector	ZigBit signal	ZigBit Pin	Kit Function
1	ADC0	25	ADC0
2	ADC1	26	ADC1
3	NC	27	UNUSED_PIN27
4	NC	28	UNUSED_PIN28
5	AREF	24	GPIO/AREF
6	TXD0	23	GPIO
7	RXD0	22	Push button
8	NC	21	UNUSED_PIN21
9	NC	34	UNUSED_PIN34
10	NC	39	UNUSED_PIN39

4.1.5. Debug SWD Header J2

Serial Wire Debug Header is available on the board for Programming and Debugging ZigBit wireless module.

Table 4-4. SWD Header J2

Pin on connector	ZigBit signal
1	VCC_P3V3
2	SWDIO
3	GND
4	SWDCLK
5	GND
6	NC
7	NC
8	NC
9	GND
10	RESET

4.2. ATZB-SAMR21-XPRO Peripherals

4.2.1. LED

There are three LEDs (Green, Red and Yellow colors) on the board that are controlled by ZigBit. Normally the Green LED is used for Power supply indication and the other two LEDs are for User Application indication.

4.2.2. Button

There are two buttons. SW1 is to reset the ZigBit module and SW2 is for User Application.

5. Hardware Revision History and Known Issues

5.1. Identifying Product ID and Revision

The revision and product identifier of the ATZB-SAMR21-XPRO can be found by looking at the sticker on the bottom side of the PCB. The identifier and revision are printed in plain text as A09-nnnn\rr, where nnnn is the identifier and rr is the revision. Also the label contains a 10-digit serial number unique to each board.

The product identifier for the ATZB-SAMR21-XPRO is A09-2630.

5.2. Revision

Revision 2 is the latest revision for the ATZB-SAMR21-XPRO. There are no known issues.

6. 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.

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7. Document Revision History

Doc. rev.	Date	Comment
42695A	08/2016	Initial document release.



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