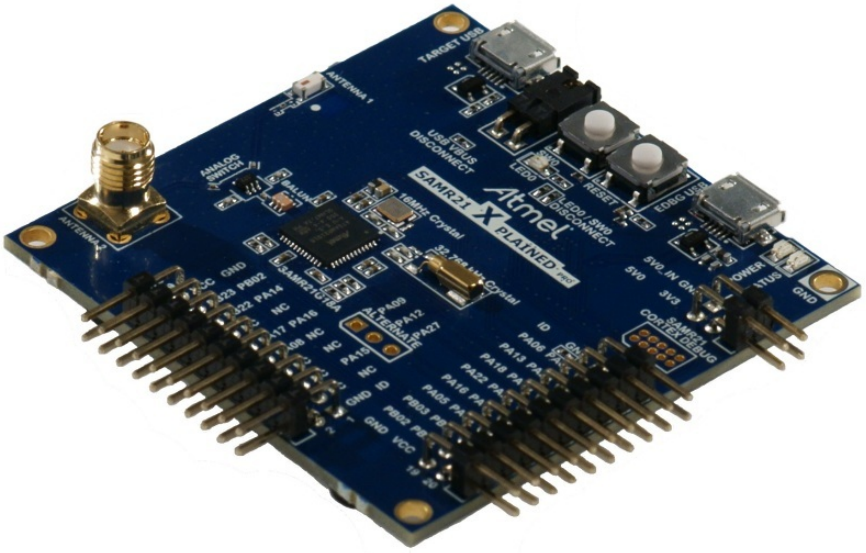
USER GUIDE

Atmel SAM R21 Xplained Pro



Preface

The Atmel® SAM R21 Xplained Pro evaluation kit is a hardware platform to evaluate the ATSAMR21G18A microcontroller.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATSAMR21G18A and explains how to integrate the device in a custom design.

The Xplained Pro MCU series evaluation kits include an on-board Embedded Debugger, and no external tools are necessary to program or debug the ATSAMR21G18A.

The Xplained Pro extension kits offers additional peripherals to extend the features of the board and ease the development of custom designs.

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1. Introduction

1.1 Features

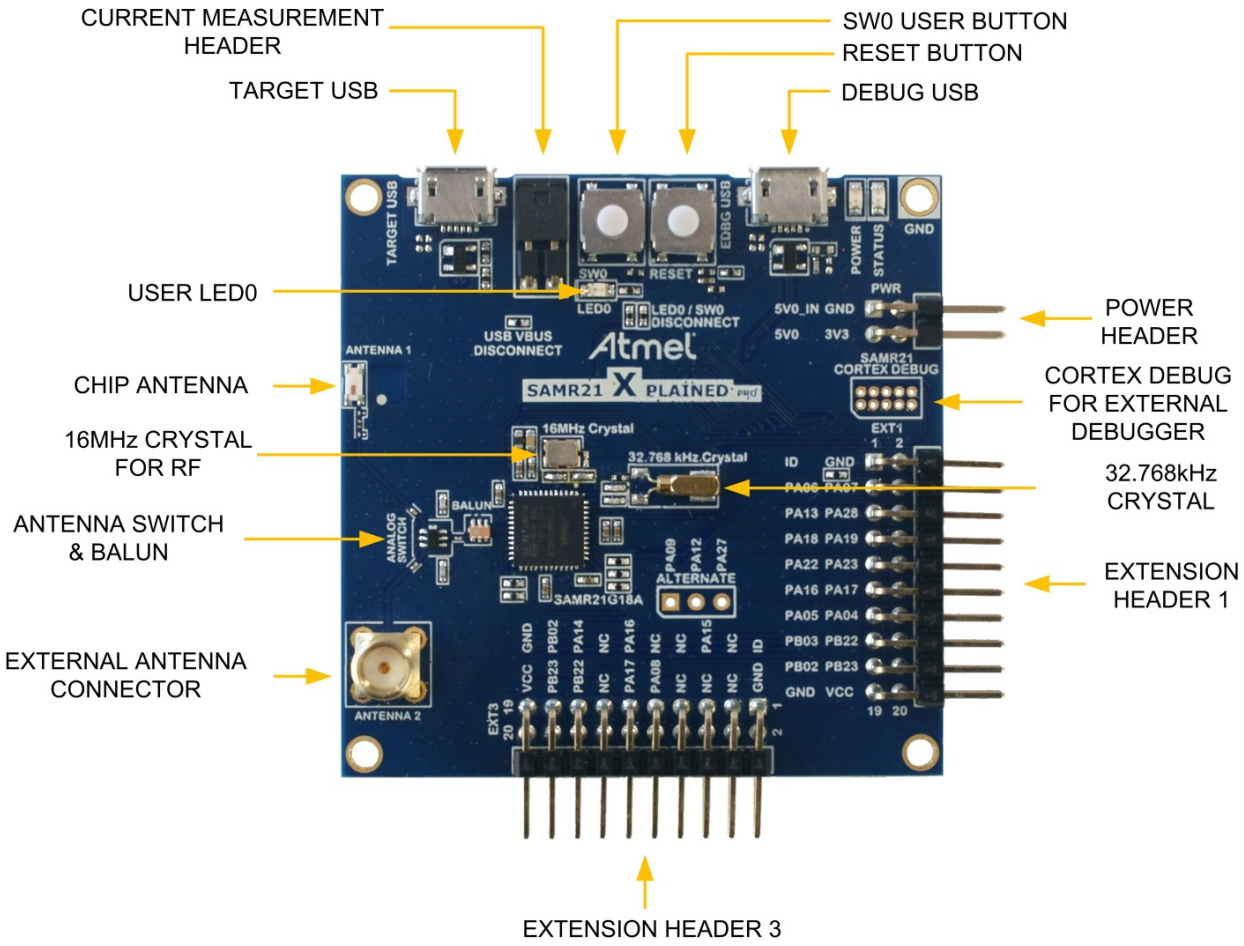
- Atmel ATSAMR21G18A microcontroller
- Embedded debugger (EDBG)
  - USB interface
  - Programming and debugging on board SAM R21 through Serial Wire Debug (SWD)
  - Virtual COM-port interface to target via UART
  - Atmel Data Gateway Interface (DGI) to target via SPI and TWI
  - Four GPIOs connected to target for code instrumentation
- Digital I/O
  - Two mechanical buttons (user and reset button)
  - One user LED
  - Two extension headers
- Antenna
  - One ceramic chip antenna (2450AT18D0100)
  - One SMA connector for external antenna
- Three possible power sources
  - External power
  - Embedded debugger USB
  - Target USB
- 32kHz crystal
- 16MHz crystal
- USB interface, device

1.2 Kit Overview

The Atmel SAM R21 Xplained Pro evaluation kit is a hardware platform to evaluate the Atmel ATSAMR21G18A.

The kit offers a set of features that enables the ATSAMR21G18A user to get started using the ATSAMR21G18A peripherals right away and to get an understanding of how to integrate the device in their own design.

Figure 1-1. SAM R21 Xplained Pro Evaluation Kit Overview



2. Getting Started

2.1 Quick-start

Three steps to start exploring the Atmel Xplained Pro Platform

- Download and install **Atmel Studio**[1]
- Launch Atmel Studio
- Connect a Micro-B cable to the DEBUG USB port

2.2 Connecting the Kit

When connecting Atmel SAM R21 Xplained Pro to your computer for the first time, the operating system will do a driver software installation. The driver file supports both 32-bit and 64-bit versions of Microsoft® Windows® XP and Windows 7.

Once connected the green power LED will be lit and Atmel Studio will autodetect which Xplained Pro evaluation- and extension kit(s) that's connected. You'll be presented with relevant information like datasheets and kit documentation. You also have the option to launch Atmel Software Framework (ASF) example applications. The target device is programmed and debugged by the on-board Embedded Debugger and no external programmer or debugger tool is needed. Refer to the Atmel Studio user guide[2] for information regarding how to compile and program the kit.

2.3 Design Documentation and Related Links

The following list contains links to the most relevant documents and software for SAM R21 Xplained Pro.

1. **Xplained Pro products** [3] - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel AVR 8- and 32-bit microcontrollers. It consists of a series of low cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
2. **SAM R21 Xplained Pro User Guide** [4] - PDF version of this User Guide.
3. **SAM R21 Xplained Pro Design Documentation** [5] - Package containing schematics, BOM, assembly drawings, 3D plots, layer plots etc.
4. **EDBG User Guide** [6] - User guide containing more information about the onboard Embedded Debugger.
5. **Atmel Studio** [7] - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.
6. **IAR Embedded Workbench® for ARM®.** [8] This is a commercial C/C++ compiler that is available for ARM. There is a 30 day evaluation version as well as a code size limited kick-start version available from their website. The code size limit is 16KB for devices with M0, M0+ and M1 cores and 32KB for devices with other cores.
7. **Atmel sample store** [9] - Atmel sample store where you can order samples of devices.

[1] http://www.atmel.com/atmelstudio
[2] http://www.atmel.com/atmelstudio
[3] http://www.atmel.com/XplainedPro
[4] http://www.atmel.com/Images/Atmel-42243-SAMR21-Xplained-Pro_User-Guide.pdf
[5] http://www.atmel.com/Images/Atmel-42243-SAMR21-Xplained-Pro_User-Guide.zip
[6] http://www.atmel.com/Images/Atmel-42096-Microcontrollers-Embedded-Debugger_User-Guide.pdf
[7] http://www.atmel.com/atmelstudio
[8] http://www.iar.com/en/Products/IAR-Embedded-Workbench/ARM/
[9] http://www.atmel.com/system/samplesstore

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 Embedded Debugger

The SAM R21 Xplained Pro contains the Atmel Embedded Debugger (EDBG) for on-board debugging. The EDBG is a composite USB device of three interfaces; a debugger, Virtual COM Port and Data Gateway Interface (DGI).

In conjunction with Atmel Studio, the EDBG debugger interface can program and debug the ATSAMR21G18A. On the SAM R21 Xplained Pro, the SWD interface is connected between the EDBG and the ATSAMR21G18A.

The Virtual COM Port is connected to a UART port on the ATSAMR21G18A (see section "Embedded Debugger Implementation" on page 14 for pinout), and provides an easy way to communicate with the target application through simple terminal software. It offers variable baud rate, parity and stop bit settings. Note that the settings on the target device UART must match the settings given in the terminal software.

The DGI consists of several physical data interfaces for communication with the host computer. See section "Embedded Debugger Implementation" on page 14 for available interfaces and pinout. Communication over the interfaces are bidirectional. It can be used to send events and values from the ATSAMR21G18A, or as a generic printf-style data channel. Traffic over the interfaces can be timestamped on the EDBG for more accurate tracing of events. Note that timestamping imposes an overhead that reduces maximal throughput. The DGI uses a proprietary protocol, and is thus only compatible with Atmel Studio.

The EDBG controls two LEDs on SAM R21 Xplained Pro, a power LED and a status LED. Table 3-1, "EDBG LED Control" on page 6 shows how the LEDs are controlled in different operation modes.

Table 3-1. EDBG LED Control

Operation mode	Power LED	Status LED
Normal operation	Power LED is lit when power is applied to the board.	Activity indicator, LED flashes every time something happens on the EDBG.
Bootloader mode (idle)	The power LED and the status LED blinks simultaneously.	
Bootloader mode (firmware upgrade)	The power LED and the status LED blinks in an alternating pattern.	

For further documentation on the EDBG, see the EDBG User Guide[2].

3.2 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 3-2, "Xplained Pro ID Chip Content" on page 6 shows the data fields stored in the ID chip with example content.

Table 3-2. 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'

[1] http://store.atmel.com/ATSAMR21-XPRO
[2] http://www.atmel.com/Images/Atmel-42096-Microcontrollers-Embedded-Debugger_User-Guide.pdf

Data Field	Data Type	Example Content
Minimum Voltage [mV]	uint16_t	3000
Maximum Voltage [mV]	uint16_t	3600
Maximum Current [mA]	uint16_t	30

3.3 Power Supply

The SAM R21 Xplained Pro kit can be powered either by USB or by an external power source through the 4-pin power header, marked PWR. This connector is described in "Xplained Pro Power Header" on page 8. The available power sources and specifications are listed in Table 3-3, "Power Sources for SAM R21 Xplained Pro" on page 7.

Table 3-3. Power Sources for SAM R21 Xplained Pro

Power input	Voltage requirements	Current requirements	Connector marking
External power	5V ± 2 % (± 100mV) for USB host operation. 4.3V to 5.5V if USB host operation is not required	Recommended minimum is 1A to be able to provide enough current for connected USB devices and the board itself. Recommended maximum is 2A due to the input protection maximum current specification.	PWR
Embedded debugger USB	4.4V to 5.25V (according to USB spec)	500mA (according to USB spec)	EDBG USB
Target USB	4.4V to 5.25V (according to USB spec)	500mA (according to USB spec)	TARGET USB

The kit will automatically detect which power sources are available and choose which one to use according to the following priority:

1. External power.
2. Embedded debugger USB.
3. Target USB.

Note External power is required when the 500mA through the USB connector is not enough to power a connected USB device in a USB host application.

3.3.1 Measuring SAM R21 Power Consumption

As part of an evaluation of the SAM R21 it can be of interest to measure its power consumption. Because the device has a separate power plane (VCC_MCU_P3V3) on this board it is possible to measure the current consumption by measuring the current that is flowing into this plane. The VCC_MCU_P3V3 plane is connected via a jumper to the main power plane (VCC_TARGET_P3V3) and by replacing the jumper with an ammeter it is possible to determine the current consumption. To locate the current measurement header, refer to Figure 1-1, "SAM R21 Xplained Pro Evaluation Kit Overview" on page 4.

Warning Do not power the board without having the jumper or an ammeter mounted. This can cause the SAM R21 to be powered through its I/O pins and cause undefined operation of the device.

3.4 Standard Headers and Connectors

3.4.1 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 3-4, “Xplained Pro Extension Header” on page 8. 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 3-4. 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.
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.

3.4.2 Xplained Pro Power Header

The power header can be used to connect external power to the SAM R21 Xplained Pro kit. The kit will automatically detect and switch to the external power if supplied. The power header can also be used as supply for external peripherals or extension boards. Care must be taken not to exceed the total current limitation of the on-board regulator for the 3.3V regulated output. To locate the current measurement header, refer to Figure 1-1, “SAM R21 Xplained Pro Evaluation Kit Overview” on page 4

Table 3-5. Power Header PWR

Pin number PWR header	Pin name	Description
1	VEXT_P5V0	External 5V input
2	GND	Ground
3	VCC_P5V0	Unregulated 5V (output, derived from one of the input sources)

Pin number PWR header	Pin name	Description
4	VCC_P3V3	Regulated 3.3V (output, used as main power for the kit)

Note If the board is powered from a battery source it is recommended to use the PWR header. If there is a power source connected to EDBG USB, the EDBG is activated and it will consume more power.

4. Hardware User Guide

4.1 Connectors

This chapter describes the implementation of the relevant connectors and headers on SAM R21 Xplained Pro and their connection to the ATSAMR21G18A. The tables of connections in this chapter also describes which signals are shared between the headers and on-board functionality.

4.1.1 I/O Extension Headers

The SAM R21 Xplained Pro headers EXT1 and EXT3 offer access to the I/O of the microcontroller in order to expand the board e.g. by connecting extensions to the board. These headers all comply with the standard extension header specified in Xplained Pro Standard Extension Header on page 7. All headers have a pitch of 2.54mm.

Table 4-1. Extension Header EXT1

Pin on EXT1	SAM R21 pin	Function	Shared functionality
1 [ID]	-	Communication line to ID chip on extension board	
2 [GND]	-	GND	
3 [ADC(+)]	PA06	AIN[6]	
4 [ADC(-)]	PA07	AIN[7]	
5 [GPIO1]	PA13	GPIO	
6 [GPIO2]	PA28	GPIO	
7 [PWM(+)]	PA18	TCC0 / WO[2]	
8 [PWM(-)]	PA19	TCC0 / WO[3]	
9 [IRQ/GPIO]	PA22	EXTINT[6]	
10 [SPI_SS_B/GPIO]	PA23	GPIO	
11 [TWI_SDA]	PA16	SERCOM1 PAD[0] I²C SDA	EXT3 and EDBG
12 [TWI_SCL]	PA17	SERCOM1 PAD[1] I²C SCL	EXT3 and EDBG
13 [USART_RX]	PA05	SERCOM0 PAD[1] UART RX	EDBG
14 [USART_TX]	PA04	SERCOM0 PAD[0] UART TX	EDBG
15 [SPI_SS_A]	PB03	SERCOM5 PAD[1] SPI SS	
16 [SPI_MOSI]	PB22	SERCOM5 PAD[2] SPI MOSI	EXT3 and EDBG
17 [SPI_MISO]	PB02	SERCOM5 PAD[0] SPI MISO	EXT3 and EDBG
18 [SPI_SCK]	PB23	SERCOM5 PAD[3] SPI SCK	EXT3 and EDBG
19 [GND]	-	GND	
20 [VCC]	-	VCC	

Table 4-2. Extension Header EXT3

Pin on EXT3	SAM R21 pin	Function	Shared functionality
1 [ID]	-	Communication line to ID chip on extension board	
2 [GND]	-	GND	
3 [ADC(+)]	-	-	
4 [ADC(-)]	-	-	
5 [GPIO1]	PA15	GPIO	
6 [GPIO2]	-		
7 [PWM(+)]	-		
8 [PWM(-)]	-		
9 [IRQ/GPIO]	-		

Pin on EXT3	SAM R21 pin	Function	Shared functionality
10 [SPI_SS_B/GPIO]	PA08	GPIO	EDBG
11 [TWI_SDA]	PA16	SERCOM1 PAD[0] I²C SDA	EXT1 and EDBG
12 [TWI_SCL]	PA17	SERCOM1 PAD[1] I²C SCL	EXT1 and EDBG
13 [USART_RX]	-	-	
14 [USART_TX]	-	-	
15 [SPI_SS_A]	PA14	GPIO	EDBG
16 [SPI_MOSI]	PB22	SERCOM5 PAD[2] SPI MOSI	EXT1 and EDBG
17 [SPI_MISO]	PB02	SERCOM5 PAD[0] SPI MISO	EXT1 and EDBG
18 [SPI_SCK]	PB23	SERCOM5 PAD[3] SPI SCK	EXT1 and EDBG
19 [GND]	-	GND	
20 [VCC]	-	VCC	

4.1.2 Other Headers and Connectors

There are two headers that are not mounted on the kit from production. These headers contains signals that are otherwise not easily accecible on the kit.

4.1.2.1 Altnernate Signals Header

The alternate signals header is marked with "Alternate" in silkscreen of the kit, the signals provided here are otherwise hard to do measurements on.

Table 4-3. Alternate Signals Header

Pin on header	Pin on SAM R21	Function
1	PA09	RFCTRL1, negative antenna switch control signal
2	PA12	RFCTRL2, positive antenna switch control signal
3	PA27	GPIO, chip select on the EDBG DGI SPI bus

4.1.2.2 Cortex Debug Connector

The Cortex debug connector is provided to enable external debuggers to be connected to the ATSAMR21G18A. The footpring is made for a 2x5 50mil connector and the pinout is shown in Table 4-4, “Cortex Debug Connector” on page 11. This header should only be used when the EDBG is disconnected from the target, for more information see “1.8V Operation” on page 13.

Table 4-4. Cortex Debug Connector

Pin on connector	Connected	Function
1	VCC Target	Voltage reference
2	PA31_SWDIO	Debug data
3	GND	GND
4	PA30_SWCLK	Debug clock
5	GND	GND
6	NC	-
7	NC	-
8	NC	-
9	GND	GND detect
10	RESETN	Target reset

4.2 Peripherals

4.2.1 Crystal

The SAM R21 Xplained Pro kit contains one crystals that can be used as clock source for the SAM R21 device. The crystal has a cut-strap next to it that can be used to measure the oscillator safety factor. This is done by

cutting the strap and adding a resistor across the strap. More information about oscillator allowance and safety factor can be found in appnote AVR4100[1].

Note The 16MHz crystal is connected directly to the RF die inside the SAM R21. The clock signal generated by the crystal is routed from the CLKM pin on the RF die to a GCLK IO pin on the microcontroller. For more information on how the RF die is connected to the microcontroller and how to configure the CLKM pin see the SAM R21 datasheet.

Table 4-5. External 32.768kHz Crystal

Pin on SAM R21	Function
PA00	XIN32
PA01	XOUT32

Table 4-6. External 16MHz Crystal

Pin on SAM R21	Function
XTAL1	XIN
XTAL2	XOUT

4.2.2 Mechanical Buttons

SAM R21 Xplained Pro contains two mechanical buttons. One button is the RESET button connected to the SAM R21 reset line and the other is a generic user configurable button. When a button is pressed it will drive the I/O line to GND.

Table 4-7. Mechanical Buttons

Pin on SAM R21	Silkscreen text
RESETN	RESET
PA28	SW0

4.2.3 LED

There is one yellow LED available on the SAM R21 Xplained Pro board that can be turned on and off. The LED can be activated by driving the connected I/O line to GND.

Table 4-8. LED Connections

Pin on SAM R21	LED
PA19	Yellow LED0

4.2.4 USB

The SAM R21 Xplained Pro has a Micro-USB receptable for use with the SAM R21 USB module. To be able to detect when a USB cable is connected, a GPIO / ADC is used to detect the VBUS voltage on the connector.

Table 4-9. USB Connections

Pin on SAM R21	USB
PA07	VBUS Detection
PA24	USB D-
PA25	USB D+

4.2.5 RF

The main feature of SAM R21 Xplained Pro is to show the RF capability of the ATSAMR21G18A device. This device has bidirectional 100ohm differential antenna pins, which are fed through a balun (Johanson

[1] http://www.atmel.com/images/doc8333.pdf

Technology, 2450BM15A0015[2]) to create a single 50ohm unbalanced output/input. This kit has a passive analog RF switch (Skyworks Solutions Inc, AS222-92LF[3]) connected to the unbalanced output of the balun. The switch is driven by the RFCTRL1 and RFCTRL2 pins of the ATSAMR21G18A which feature Antenna Diversity to enable the device to automatically select the best signal from two antennas (can also be selected manually). The output of the switch is connected to a ceramic chip antenna (Johanson Technology, 2540AT18D0100[4]) and a SMA connector for external antennas.

Table 4-10. RF Connections

Pin on SAM R21	RF	Shared functionality
RFP	RF balanced output (positive)	
RFN	RF balanced output (negative)	
PA09 / RFCTRL1	RF switch control signal (negative)	EDBG
PA12 / RFCTRL2	RF switch control signal (positive)	EDBG

4.3 1.8V Operation

The SAM R21 Xplained Pro board is operated at 3.3V by default, but it also has the possibility of running at lower voltages from an external supply. The EDBG is designed to run from a 3.3V supply and won't work on other voltages, therefore all connections from the EDBG and the on board 3.3V regulator to the ATSAMR21G18A have to be removed. Figure 4-1, “1.8V Operation Modifications” on page 14 shows all components that have to be removed for 1.8V operation.

When the components are removed the kit can be supplied with a desired voltage through the pins marked 3V3 (pin four) and GND (pin two) on the power header described in “Xplained Pro Power Header” on page 8.

To program and debug the ATSAMR21G18A a 2x5 50mil header has to be mounted above EXT1 as shown in Figure 1-1, “SAM R21 Xplained Pro Evaluation Kit Overview” on page 4.

[2] http://www.johansontechnology.com/datasheets/balun-filter/2450BM15A0015.pdf
[3] http://www.skyworksinc.com/uploads/documents/200252C.pdf
[4] http://www.johansontechnology.com/images/stories/ip/rf-antennas/Antenna_2450AT18D0100_v3.pdf

Note

Operating the SAM R21 Xplained Pro on other voltages than 3.3V requires physical modifications on the kit using a soldering iron and an external debugger for programming the ATSAMR21G18A.

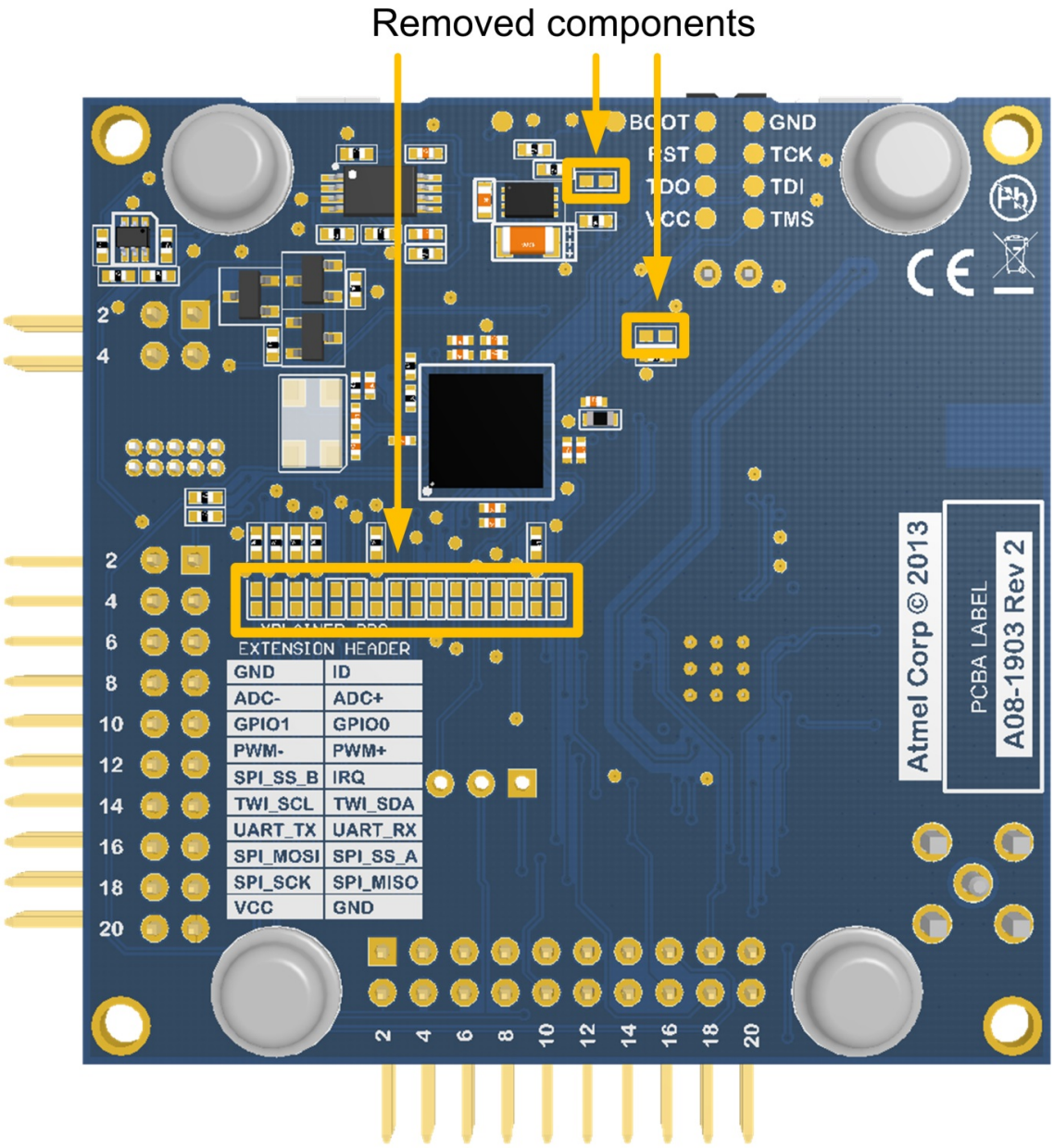
The on board LED is selected for 3.3V operation, the light level at 1.8V opeartion is very low. To increase the emitted light level the value of the series resistor can be lowered.

The EDBG functionality can be restored by re-soldering the removed components, they are all 0 ohm resistors.

Important

The voltage supplied through the power header is applied directly to the ATSAMR21G18A and the extension headers, applying a voltage greater than 3.3V may damage the board permanently.

Figure 4-1. 1.8V Operation Modifications



4.4 Embedded Debugger Implementation

SAM R21 Xplained Pro contains an Embedded Debugger (EDBG) that can be used to program and debug the ATSAMR21G18A using Serial Wire Debug (SWD). The Embedded Debugger also include a Virtual Com port interface over UART, an Atmel Data Gateway Interface over SPI and TWI and it monitors four of the SAM R21 GPIOs. Atmel Studio can be used as a front end for the Embedded Debugger.

4.4.1 Serial Wire Debug

The Serial Wire Debug (SWD) use two pins to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see “Embedded Debugger” on page 6.

Table 4-11. SWD Connections

Pin on SAM R21	Function
PA30	SWD clock
PA31	SWD data

4.4.2 Virtual COM port

The Embedded Debugger acts as a Virtual Com Port gateway by using one of the ATSAMR21G18A UARTs. For further information on how to use the Virtual COM port see “Embedded Debugger” on page 6.

Table 4-12. Virtual COM Port Connections

Pin on SAM R21	Function
PA04	SERCOM0 PAD[0] UART TXD (SAM R21 TX line)
PA05	SERCOM1 PAD[1] UART RXD (SAM R21 RX line)

4.4.3 Atmel Data Gateway Interface

The Embedded Debugger features an Atmel Data Gateway Interface (DGI) by using either a SPI or I²C port. The DGI can be used to send a variety of data from the SAM R21 to the host PC. For further information on how to use the DGI interface see “Embedded Debugger” on page 6.

Table 4-13. DGI Interface Connections When Using SPI

Pin on SAM R21	Function
PA27	GPIO SPI SS (Slave select) (SAM R21 is Master)
PB02	SERCOM5 PAD[0] SPI MISO (Master In, Slave Out)
PB22	SERCOM5 PAD[2] SPI MOSI (Master Out, Slave in)
PB23	SERCOM5 PAD[3] SPI SCK (Clock Out)

Table 4-14. DGI Interface Connections When Using I²C

Pin on SAM R21	Function
PA16	SERCOM1 PAD[0] I²C SDA (Data line)
PA17	SERCOM1 PAD[1] I²C SCL (Clock line)

Four GPIO lines are connected to the Embedded Debugger. The EDBG can monitor these lines and time stamp pin value changes. This makes it possible to accurately time stamp events in the SAM R21 application code. For further information on how to configure and use the GPIO monitoring features see “Embedded Debugger” on page 6.

Table 4-15. GPIO Lines Connected to the EDBG

Pin on SAM R21	Function
PA08	GPIO0
PA09	GPIO1
PA12	GPIO2
PA14	GPIO3

5. Kit Specific Data

One of the user pages in the EDBG is programmed with data specific to the SAM R21 Xplained Pro. The data can be read through the I^2C interface connected to the EDBG, for detailed information see the EDBG User Guide[1]. All data is stored as little endian.

Table 5-1. MAC64Register, Offset: 0x00

Name	Description	Size [bits]
MAC64	MAC64 Address (hex)	64

[1] http://www.atmel.com/Images/Atmel-42096-Microcontrollers-Embedded-Debugger_User-Guide.pdf

6. Agency Certification

6.1 United States (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. This equipment (SAM R21 Xplained Pro) is for use for evaluation purposes only and must not be incorporated into any other device or system.

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 colocated 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).

6.2 European Union (ETSI)

The SAM R21 Xplained Pro Evaluation kits has been certified for use in European Union countries. 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)

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 20cm 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 20cm de distance entre le dispositif et l'utilisateur ou des tiers

Important Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

6.4 List of Antennas Tested With This Product

Table 6-1. List of Tested Antennas

Antenna Number	Make	Model/Part #	Antenna Gain (dBi)	Type of Antenna
Antenna 1	Johanson Technology	2450AT18D0100	1.5dBi	Ceramic Antenna
Antenna 2	Techfun Co., Ltd	M01-SS2	0dBi	External Antenna

Important If professional users including, but not limited to Research and Development engineers wants to configure the power settings higher than those specified in page 7 of the FCC test report number 19660076 001, they are advised to use the antenna / device only in a shielded room.

7. Hardware Revision History and Known Issues

7.1 Identifying Product ID and Revision

The revision and product identifier of Xplained Pro boards can be found in two ways, through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

By connecting a Xplained Pro MCU board to a computer with Atmel Studio running, an information window will pop up. The first six digits of the serial number, which is listed under kit details, contain the product identifier and revision. Information about connected Xplained Pro extension boards will also appear in the Atmel Kits window.

The same information can be found on the sticker on the bottom side of the PCB. The sticker on SAM R21 Xplained Pro shows the identifier and revision plain text as *A09-nnnn\rr* where *nnnn* is the identifier and *rr* is the revision. A uniqly assigned MAC64 address in hex, FCC ID and IC id are also printed on the sticker. A serial number string is embedded in the matrix-barcode.

The serial number string has the following format:

```
"nnnnrrssssssssss"
n = product identifier
r = revision
s = serial number
```

The kit identifier for SAM R21 Xplained Pro is 2127.

7.2 Revision 3

Revision 3 of SAM R21 Xplained Pro is the initial released version, there are no known issues.

8. Document revision history

Document revision	Date	Comment
42243B	06/2014	Fixed RF switch control pin-mapping to be correct and updated the Agency Certification chapter.
42243A	02/2014	Initial document release.

9. 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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