USER GUIDE

Platform Getting Started Guide for SAM W25 Xplained Pro

Atmel SmartConnect

Introduction

Atmel® SAM W25 includes the Atmel 2.4GHz IEEE® 802.11 b/g/n Wi-Fi ATWINC1500 along with SAM D21 ARM® Cortex® M0+ based MCU. This getting started guide describes the SAM W25 Wi-Fi module to build state-of-the-art Internet of Things (IoT) applications. This guide explains hardware information and how to install Atmel Studio (IDE), compile examples and download Wi-Fi network controller's firmware.

The following topics will be covered:

- How to get Atmel Studio (IDE) and install it
- Update new ASF package
- Target board information
- How to get weather client example project
- How to get log message
- How to download firmware and certificate

Features

- Hardware Prerequisites
  - Atmel SAM W25 Xplained Pro Evaluation Kit
  - Atmel IO1 extension
  - Micro-USB cable (Micro-A / Micro-B)
- Software Prerequisites
  - Atmel Studio
  - Weather client example project source code

Icon Key Identifiers

INFO	Delivers Contextual Information About a Specific Topic
TIP	Highlights Useful Tips and Techniques
TO DO	Highlights Objectives to be Completed
RESULT	Highlights the Expected Result of an Assignment Step
WARNING	Indicates Important Information
EXECUTE	Highlights Actions to be Executed Out of the Target

1 Getting Started with Atmel Studio

1.1 Download and Install Atmel Studio6.2

Atmel Studio 6 is the integrated development platform (IDP) for developing and debugging Atmel ARM Cortex-M and Atmel AVR® microcontroller (MCU) based applications. The Atmel Studio 6 IDP gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code.

Atmel Studio 6.2 is now available, adding advanced debugging features such as Data and Interrupt Trace, improved RTOS integration, and better ability to debug code that has been optimized.

With the introduction of Atmel Gallery and Atmel Spaces, Atmel Studio 6 further simplifies embedded MCU designs to reduce development time and cost. Atmel Gallery is an online apps store for development tools and embedded software. Atmel Spaces is a cloud-based collaborative development workspace allowing you to host software and hardware projects targeting Atmel MCUs.

Download and install Atmel Studio 6.2 from http://www.atmel.com/microsite/atmel_studio6/.

You can find the installed directory: C:\Program Files\Atmel\Atmel Studio 6.2.

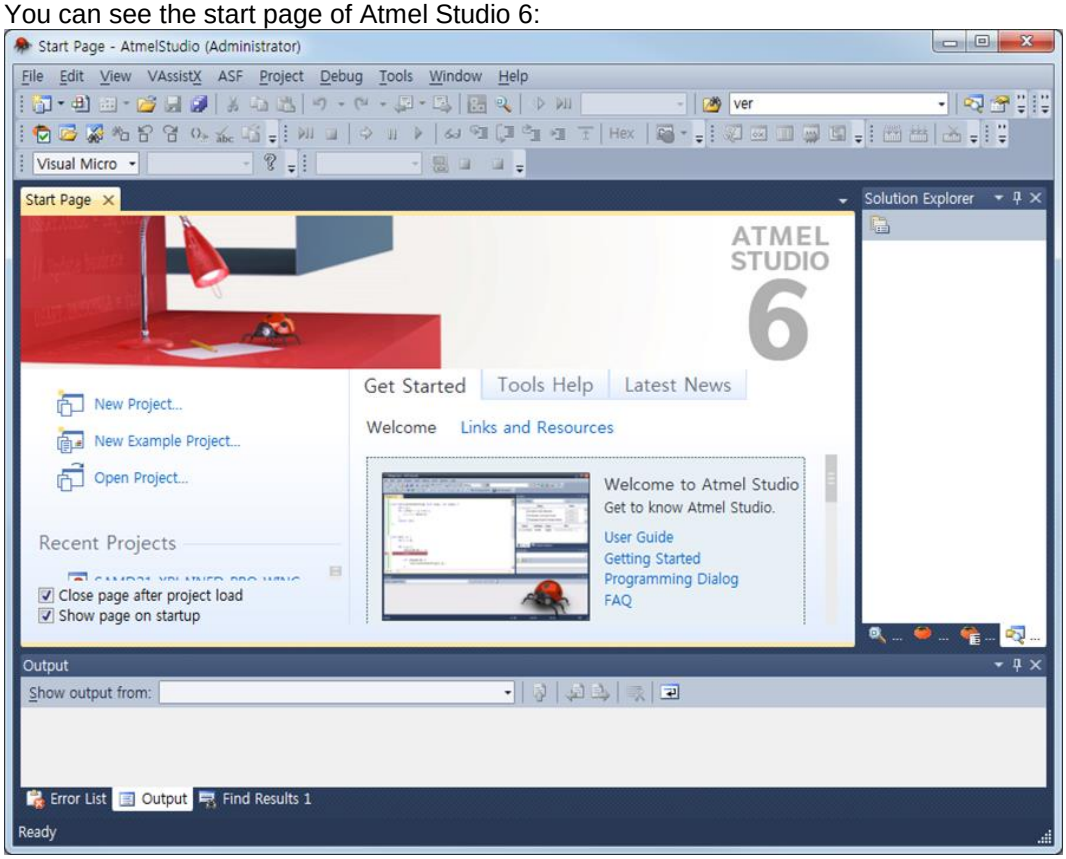
1.2 Download and Install the Latest ASF

Atmel Studio 6 is free of charge and is integrated with the Atmel Software Framework (ASF)—a large library of free source code with 1,600 ARM and AVR project examples. ASF strengthens the IDP by providing, in the same environment, access to ready-to-use code that minimizes much of the low-level design required for projects. Use the IDP for our wide variety of AVR and ARM Cortex-M processor-based MCUs, including our broadened portfolio of Atmel SAM3 ARM Cortex-M3 and M4 Flash devices.

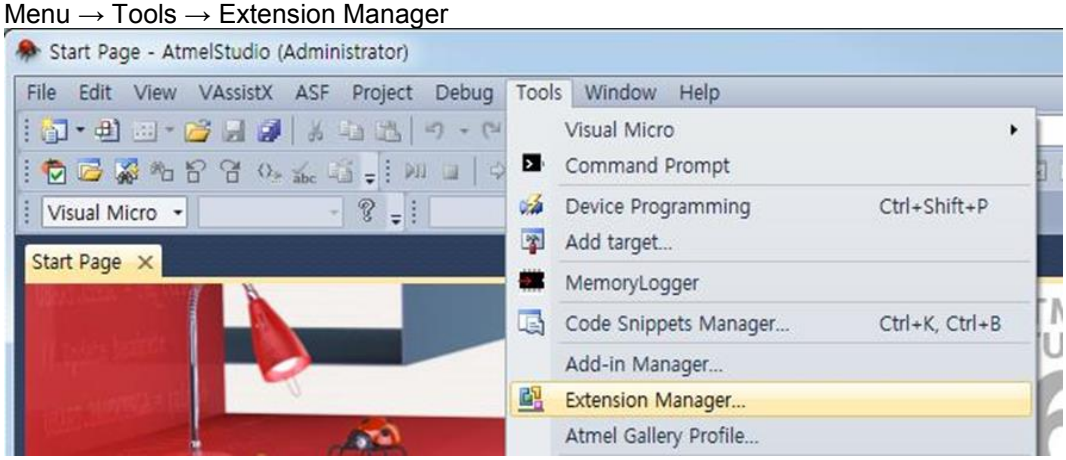
If the ASF version in your Atmel Studio is not the latest one you will be notified when Atmel Studio starts. The following procedure demonstrates how to update the ASF to the latest version. You can install other extensions in the list as well.

1. Run Atmel Studio 6.2.

2. You can see the start page of Atmel Studio 6:

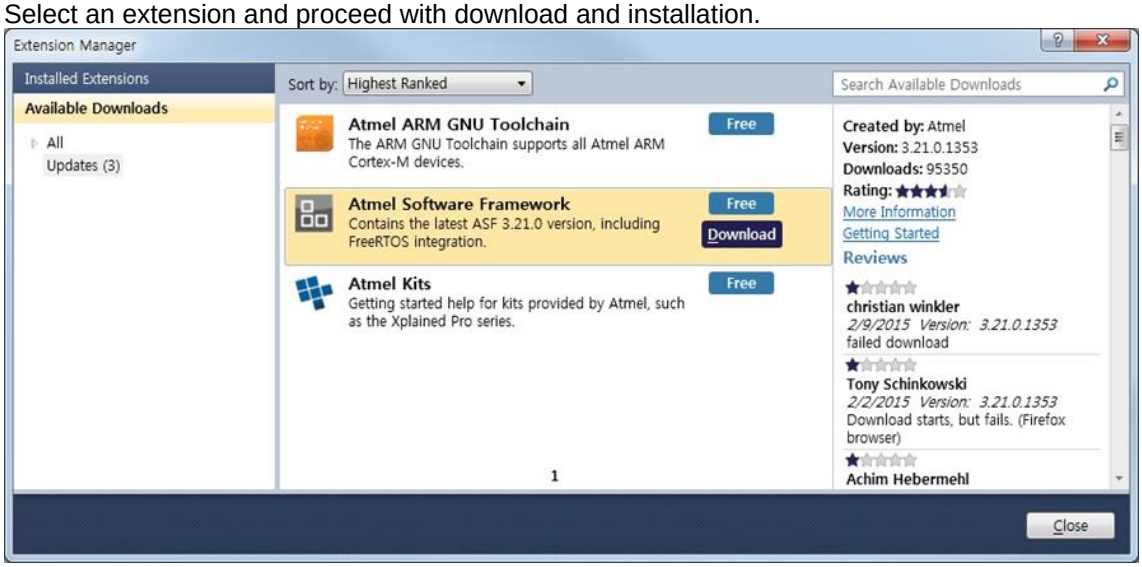


3. Update ASF to the latest version.
Menu → Tools → Extension Manager



Available Downloads → Updates → Atmel Software Framework

4. Select an extension and proceed with download and installation.



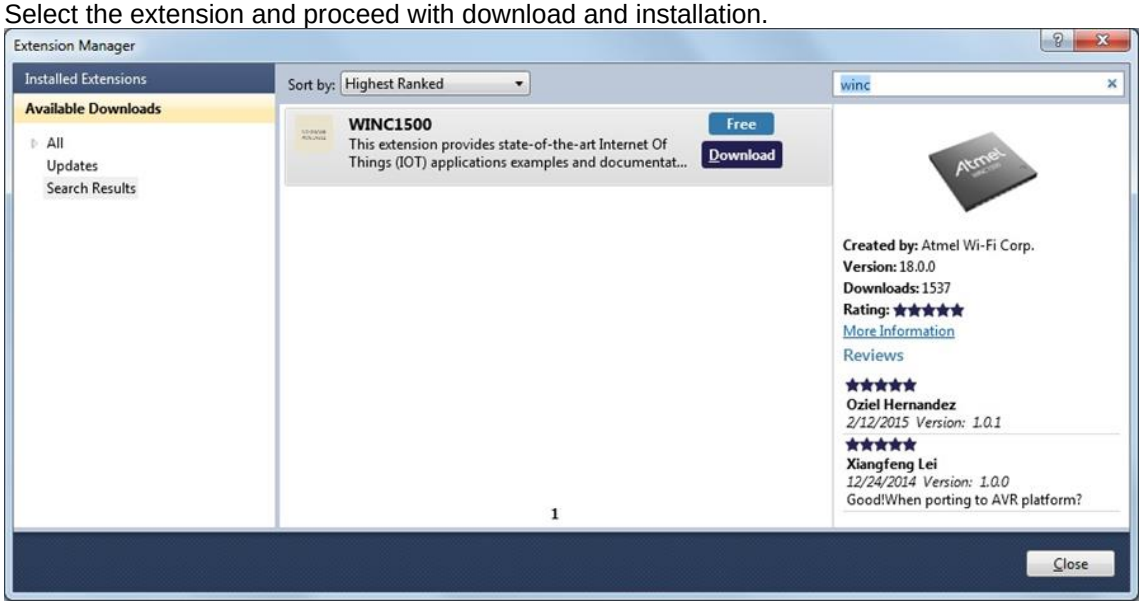
TIPS Restart Atmel Studio to take effect of newly installed extension.

1.3 Download and Install the latest ATWINC1500 Extension Package (Not yet released in Atmel Gallery)

ATWINC1500 Extension package contains the ATWINC1500 software (latest firmware, firmware update tools and example projects).

TIPS As an Atmel Studio Extension (**.vsix** file), which can be found on the Atmel Gallery web site (http://gallery.atmel.com/) or using the Atmel Studio Extension manager.

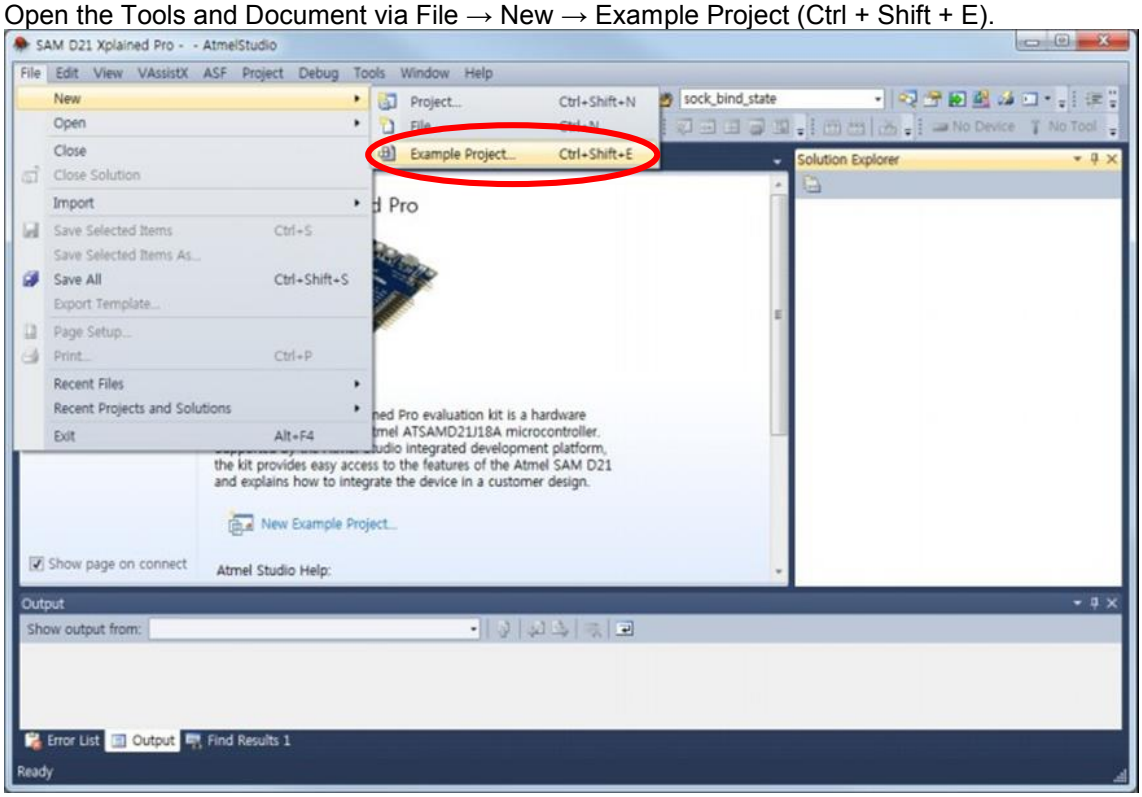
1. Atmel Studio → Menu → Tools → Extension Manager.
2. Input “winc” in the search window then you can find the ATWINC1500 extension.
3. Select the extension and proceed with download and installation.



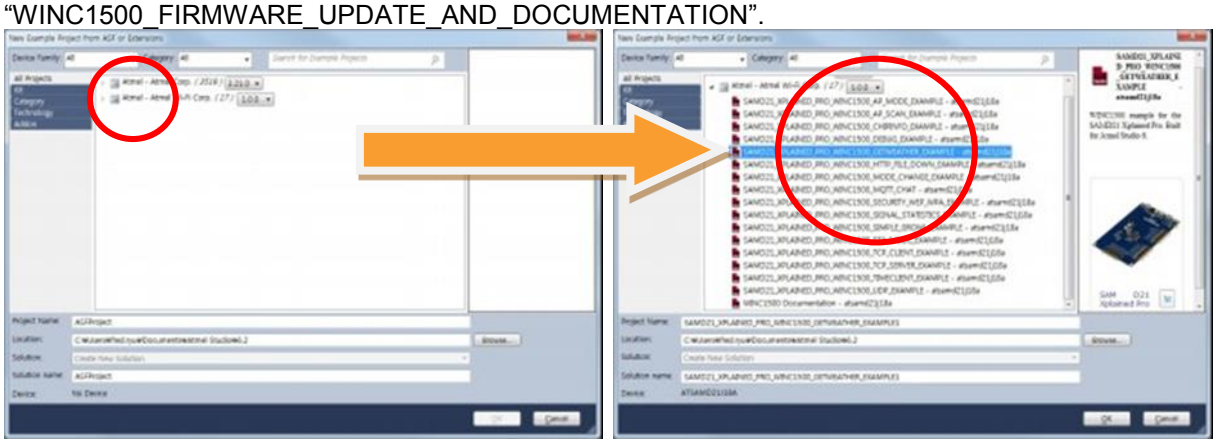
TIPS Restart Atmel Studio to take effect of newly installed extension.

4. Restart Atmel Studio.

5. Open the Tools and Document via File → New → Example Project (Ctrl + Shift + E).



6. Input “FIRMWARE” in the search window then you can find an example named like “WINC1500_FIRMWARE_UPDATE_AND_DOCUMENTATION”.



This project contains documentation and tools to upgrade Wi-Fi network controller’s firmware to the specific version which is matched up with the Wi-Fi driver in example projects. It also contains documentation on how to run example projects in this extension.

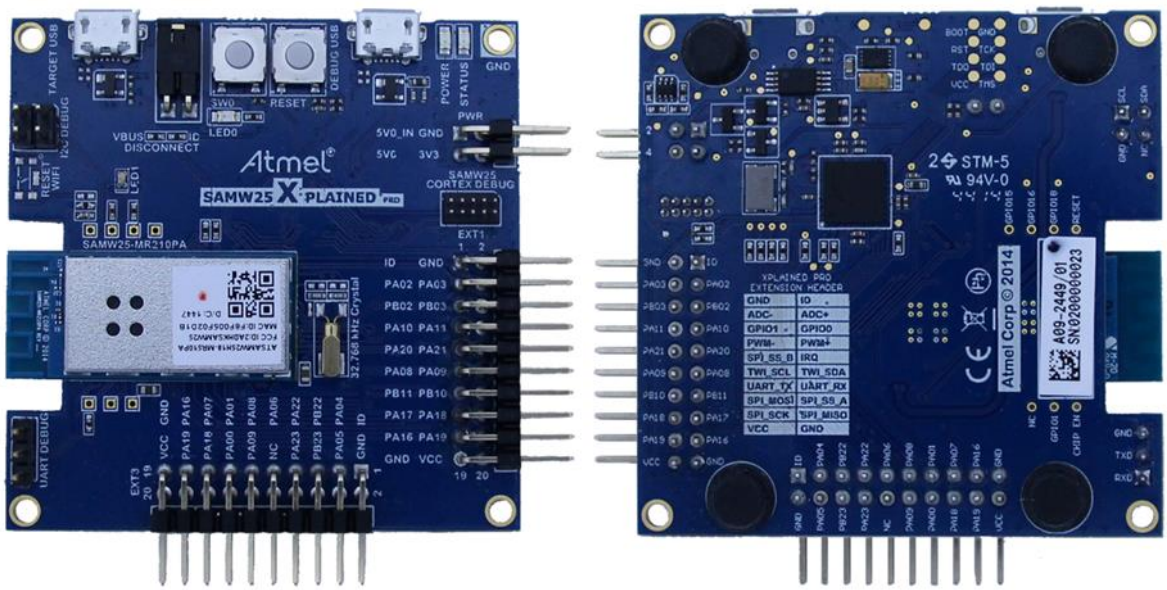
2 Getting Started with Atmel Hardware

This chapter introduces Atmel Evaluation Kits for testing IoT applications. The SAM W25 is essential but the IO1 extension board and the OLED1 extension board are optional.

2.1 Atmel SMART SAMW25-XPRO Evaluation Kit

The Atmel | SMART SAM W25 Wi-Fi module is based on the industry-leading Atmel ATWINC1500 low-power Wi-Fi 2.4GHz IEEE 802.11 b/g/n SoC (System on Chip) and the latest Atmel ARM Cortex-M0+ microcontroller technology.

This turnkey system provides an integrated software solution with application and security protocols such as TLS, integrated network services (TCP/IP stack) which are available through Atmel Studio 6 integrated development platform (IDP).



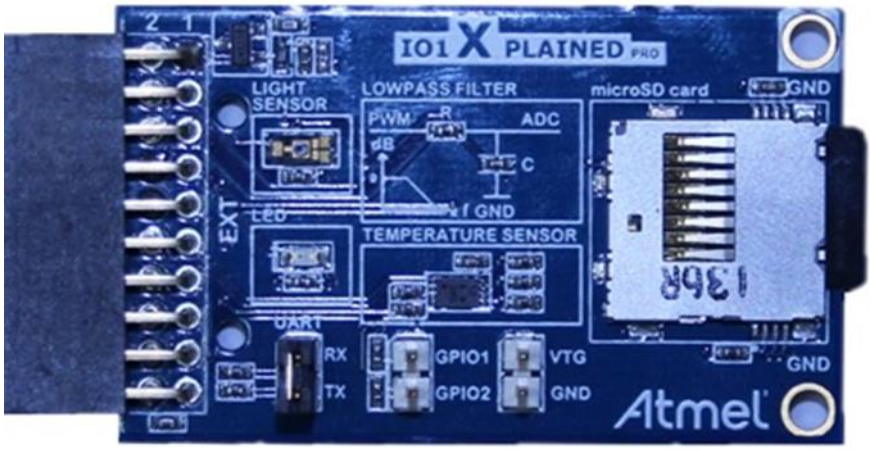
- Turnkey system with integrated software that includes TLS 1.0 and a TCP/IP stack WPA2 personal and enterprise security
- Single-band 2.4GHz IEEE 802.11 b/g/n Wi-Fi ATWINC1500
- Atmel | SMART ARM Cortex M0+-based SAM D21; 256KB Flash; 32KB SRAM
- Serial Peripheral Interface (SPI)
- Over-the-air updates
- ATECC108A CryptoAuthentication™ engine with ultra-secure hardware-based key storage for secure connectivity
- Extreme low power
- Compact footprint: 33.8 x 14.9mm
- Operating Voltage: 2.7 to 3.6V
- Worldwide acceptance: FCC (USA), CE (Europe) and TELEC
- RoHS compliant
- Network services – DHCP, DNS, TCP/IP (IPv4), UDP, HTTP, HTTPS

Here is the link for more detailed information about SAM W25:

http://www.atmel.com/tools/atsamw25.aspx

2.2 Atmel IO1-XPRO Sensor Extension Board

Atmel IO1 Xplained Pro extension board is a generic extension board for the Xplained Pro platform. It connects to any Xplained Pro standard extension header on any Xplained Pro MCU board. The extension board utilizes all functions on the standard Xplained Pro extension header to further enhance the feature set of Xplained Pro MCU boards.



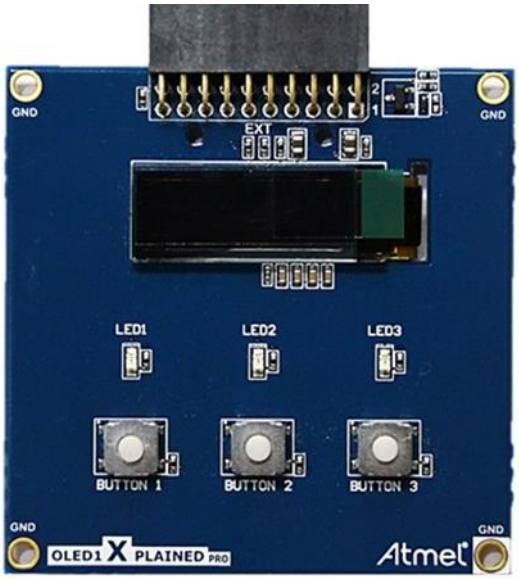
- microSD card connector
  - 2GB microSD card included
  - Accessed with SPI interface
- PWM
  - LED control
  - PWM → Low pass filter → ADC
- ADC
  - PWM → Low pass filter → ADC
  - Light sensor
- UART
  - Loopback interface via pin header
- TWI
  - AT30TSE758 Temperature sensor with EEPROM
- Xplained Pro hardware identification system

Here is the link for more detailed information about AT IO1:

http://www.atmel.com/images/atmel-42078-io1-xplained-pro_user-guide.pdf

2.3 Atmel OLED1-XPRO Display Extension Board

Atmel OLED1 Xplained Pro is an extension board to the Atmel Xplained Pro evaluation platform. The board enables the user to experiment with user interface applications with buttons, LEDs and a display.



- UG-2832HSWEG04 monochrome OLED display
  - 128 x 32 Pixels
  - Controlled by 4-wire SPI interface, up to 100MHz
- Three LEDs
- Three Mechanical push buttons
- Xplained Pro hardware identification system

Here is the link for more detailed information about AT OLED1:

http://www.atmel.com/images/atmel-42077-oled1-xplained-pro_user-guide.pdf

3 Getting Started with IoT Examples

This chapter introduces IoT examples and describes how to run an example on the SAM W25 board.

3.1 Organization of IoT Examples

All of these examples are included in ASF Package and there are various IoT examples using Wi-Fi module.

Basic Examples

These examples describe basic Wi-Fi operation in 'how-to' manner:

- How to read chip ID (to identify H/W revision of Wi-Fi controller)
- How to set debug message level
- How to get MAC address of the Wi-Fi module
- How to start Wi-Fi in specific operation mode, such as:
  - STA Mode (Station mode), AP mode (Access Point mode), P2P mode (client mode)
- How to switch mode among STA, AP, and P2P modes during the runtime
- How to scan APs nearby
- How to set deep sleep mode
- How to connect to secure Wi-Fi with using WEP/WPA/WPA2 security
- How to connect to enterprise security network
- How to connect to security WPS
- How to set packet monitoring
- How to get RF signal status by reading RSSI value
- How to set AP provision
- How to set HTTP provision

Protocol Examples

After basic code examples, user may be interested in how to send and receive network packets. Here are protocol examples that can be extended for IoT application.

- UDP protocol example
- TCP protocol example
- NTP Time client – retrieve network time for IoT application
- MQTT protocol client example
- Send email – send an email from SMTP server
- Location client – get the current location of the network provider using HTTP

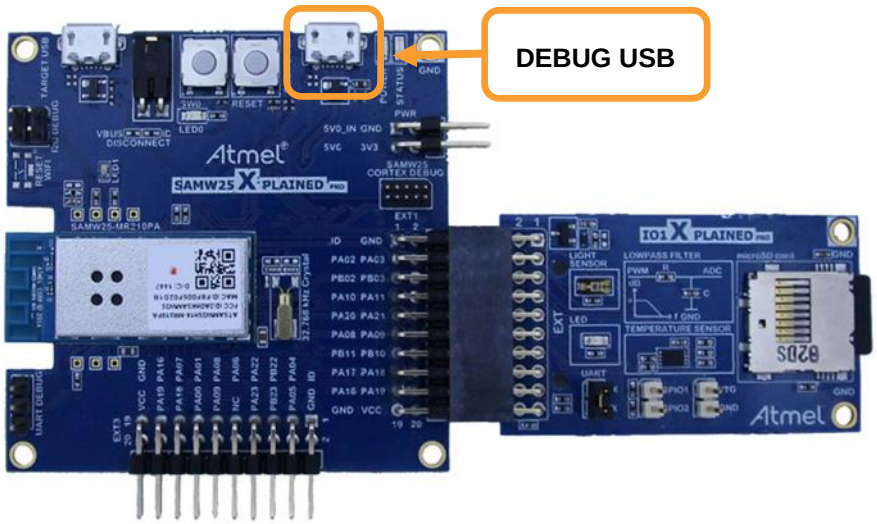
Advanced Examples

These examples demonstrate more complex function like:

- Growl client – demonstrates using RESTful API over SSL (essential for IoT application)
- MQTT Chat client – demonstrate how to send and receive IoT information using MQTT protocol
- Weather client – get the current weather information of the network provider and utilize the IO1 sensor device
- Wi-Fi serial - useful for chatting or controlling a remote device
- OTA Firmware Upgrade – Wi-Fi network controller's firmware upgrade via OTA server
- SSL connection - Set up an SSL connection

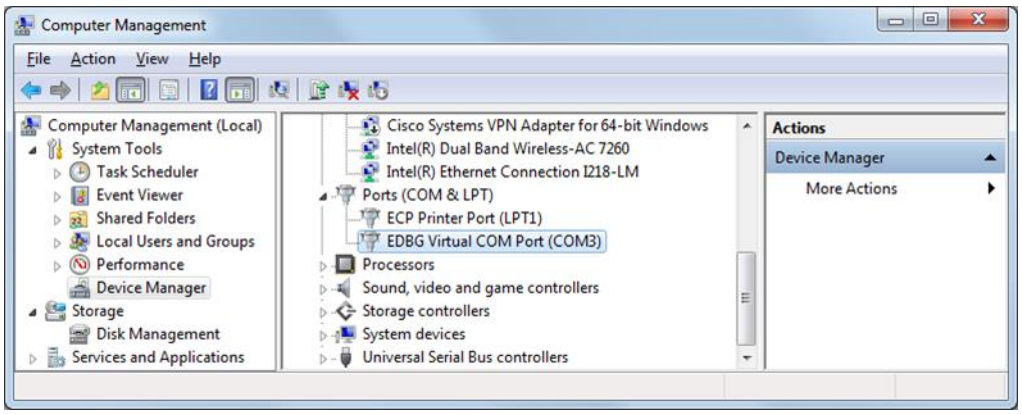
3.2 Connect the Board

The SAM W25 Wi-Fi module comes with a Wi-Fi software API. The purpose of this API is to provide an abstraction of the binary protocol used between the host processor and the Wi-Fi network controller while keeping an easy and reliable solution to add wireless capabilities to any user application. This software is based on the Atmel Software Framework (ASF).

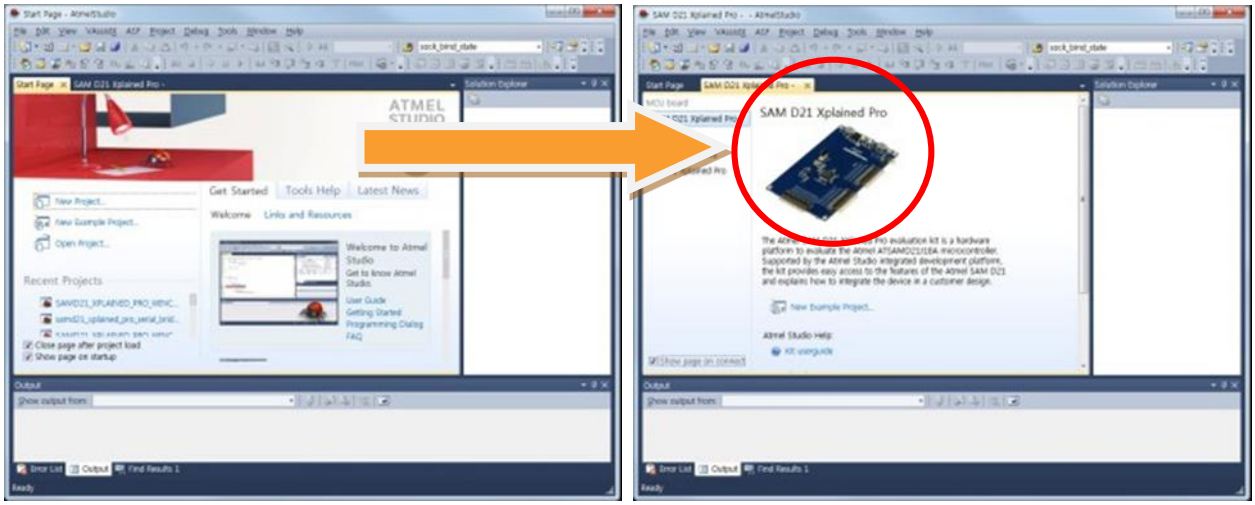


WARNING Connecting an additional ATWINC1500 Wi-Fi modules on extension headers is possible but not supported by the provided Wi-Fi Software API.

Connect the DEBUG USB port on the SAM W25 to your PC using a micro-USB cable. The SAM W25 will be visible in the Windows® Device Manager with its COM port.



Atmel Studio may detect your device automatically and show a proper page.



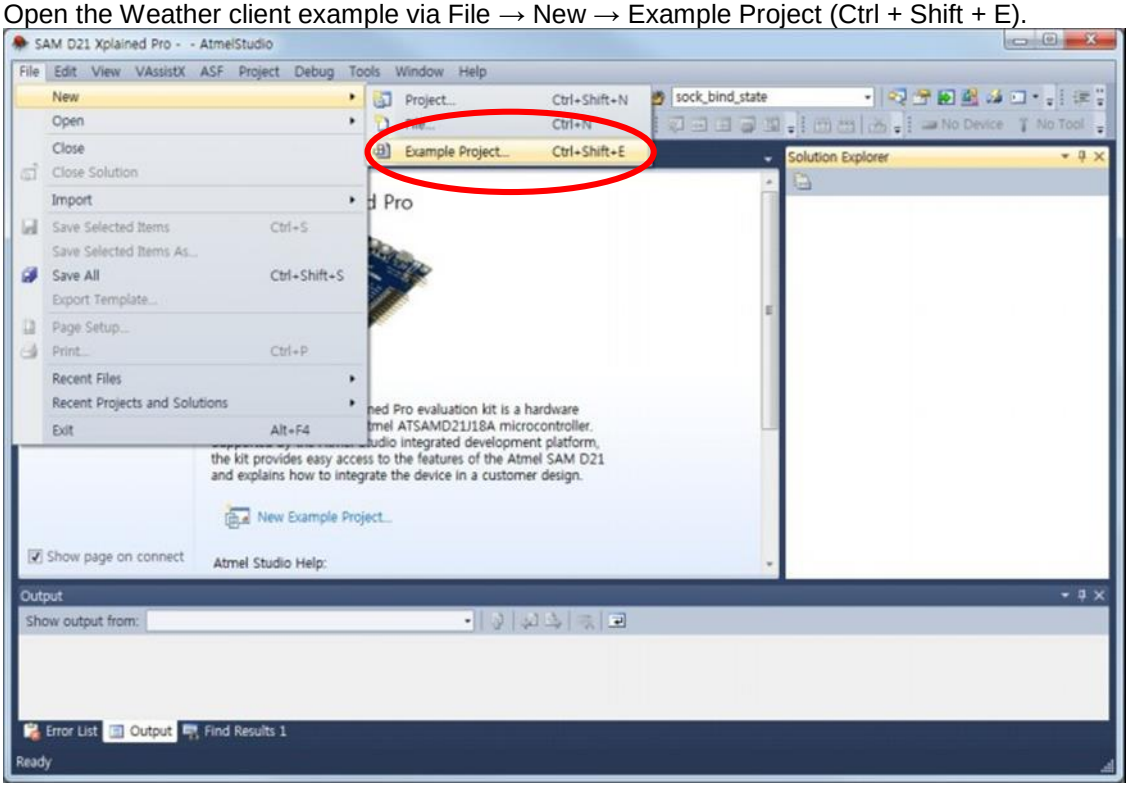
3.3 How to Get Weather Client Example Project

This example demonstrates the use of the SAM W25 Xplained Pro board to receive weather information from a weather server. It uses the following hardware:

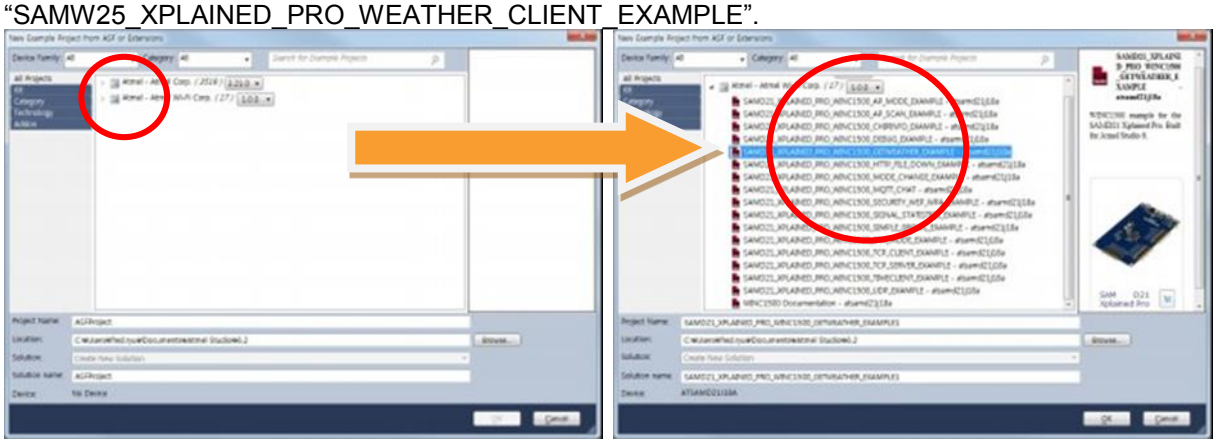
- The SAM W25 Xplained Pro
- The IO1 on EXT1 header
- A wireless access point
- A mobile device (for provisioning)

Weather Server

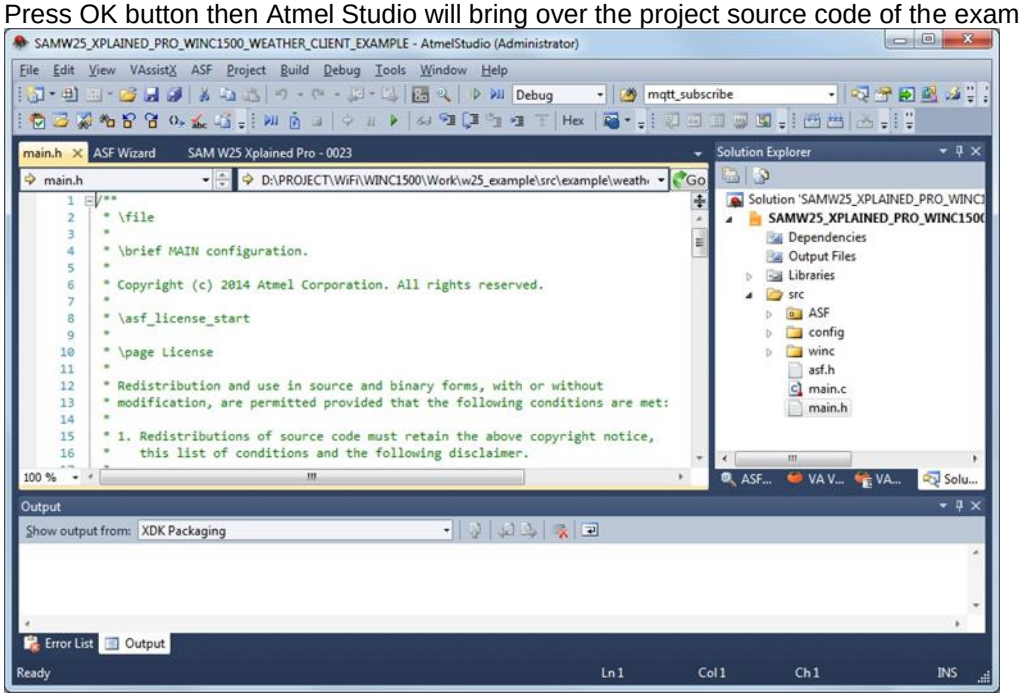
1. Open the Weather client example via File → New → Example Project (Ctrl + Shift + E).



2. Input “WEATHER” in the search window then you can find an example named like “SAMW25_XPLAINED_PRO_WEATHER_CLIENT_EXAMPLE”.



3. Press OK button then Atmel Studio will bring over the project source code of the example.

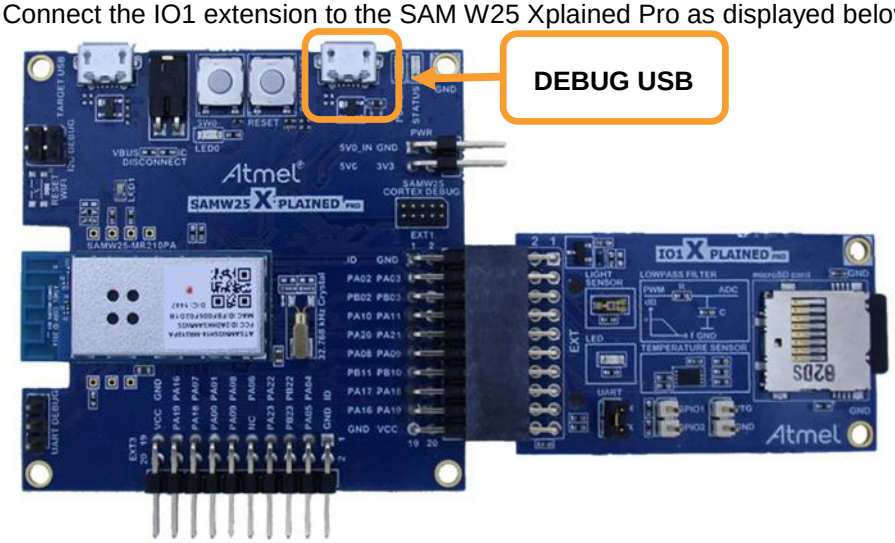


3.4 How to Build and Execute

This guide demonstrates how to build an example and execute it on the SAM W25 Xplained Pro.

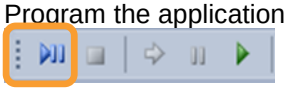
1. Build the solution (F7) and ensure you get no errors.

2. Connect the IO1 extension to the SAM W25 Xplained Pro as displayed below:

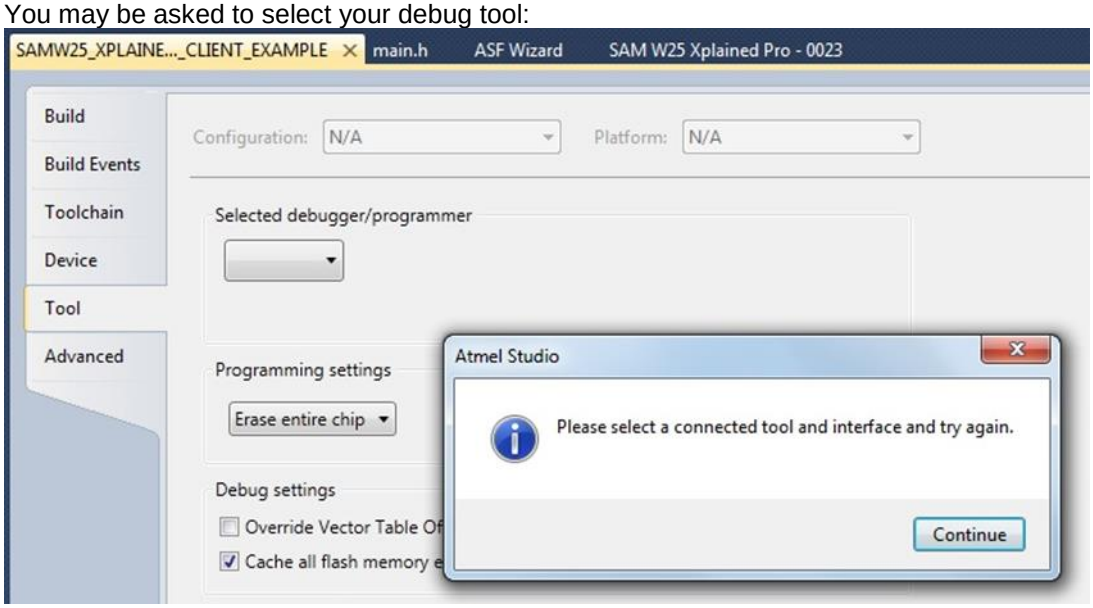


3. Connect the SAM W25 Xplained Pro board to your PC using DEBUG USB connector.

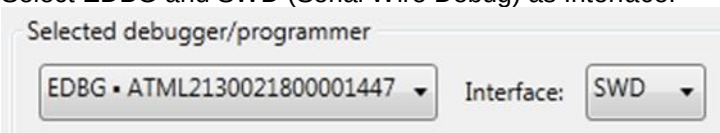
4. Program the application by clicking on the Start Debugging and Break icon.



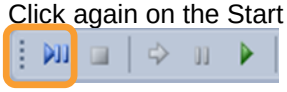
5. You may be asked to select your debug tool:



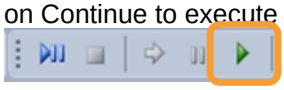
6. Select EDBG and SWD (Serial Wire Debug) as Interface:



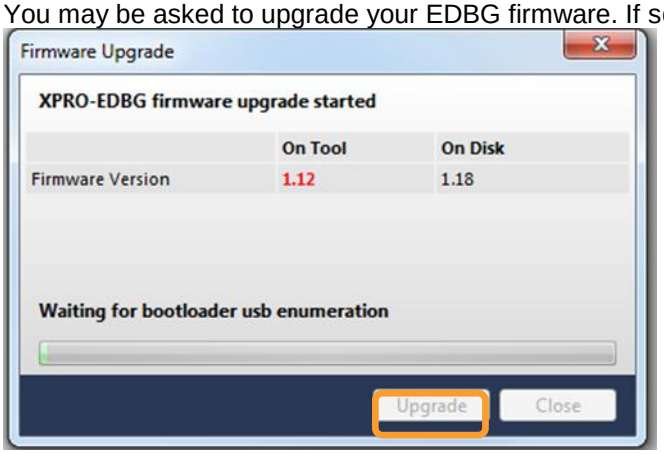
7. Click again on the Start Debugging and Break icon:



8. The application will be programmed in the SAM W25 embedded flash and breaks at main function. Click on Continue to execute the application:



RESULT You may be asked to upgrade your EDBG firmware. If so, click on Upgrade button:



WARNING Upgrade operation may take a few minutes, wait for the operation to complete.

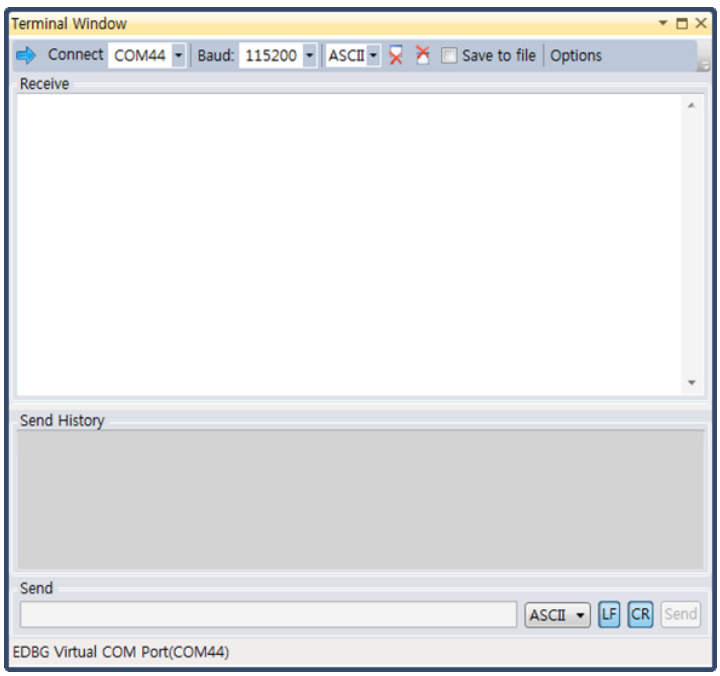
RESULT The example is now programmed and running.

Open the SAM W25 EDBG DEBUG USB serial COM port, with the following settings:

- 115200 bauds
- 8 bit data
- no parity
- one stop bit
- and no flow control

Open a serial terminal tool to see the result. You can use your preferred serial terminal, such as PuTTY, Tera Term, etc. You can also use terminal window plug-in in Atmel studio. You can install it through below menu. (Menu → Tools → Extension Manager)

Connect to the device.



RESULT Following information will be displayed on the terminal window.

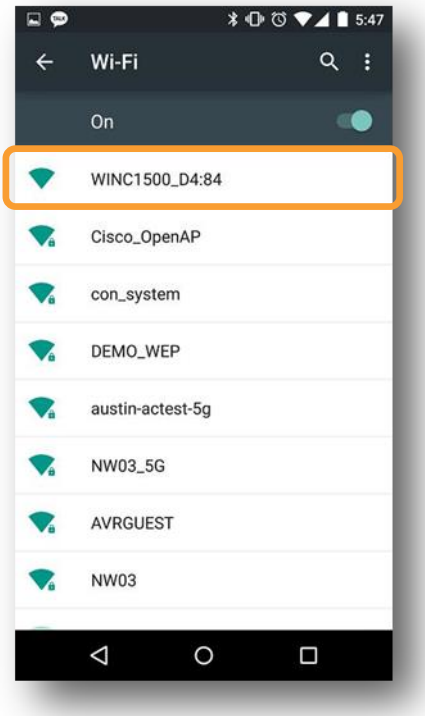
```
-- Weather client example --
-- SAMW25_XPLAINED_PRO --
-- Compiled: xxx xx xxxx xx:xx:xx –
Provision Mode started.
Connect to [atmelconfig.com] via AP[WINC1500_D4:84] and fill up the page.
```

3.5 Provisioning

As seen in the log message, the device is waiting for provisioning. In this stage, Wi-Fi network controller will run as AP mode, waiting for the user to setup a credential for a desired Access Point to use.

Some examples have this kind of provision function while some don't. It depends on the scenario of demo's purpose. To setup a desired AP:

1. Connect your mobile device to SAM W25 in Wi-Fi Setting.



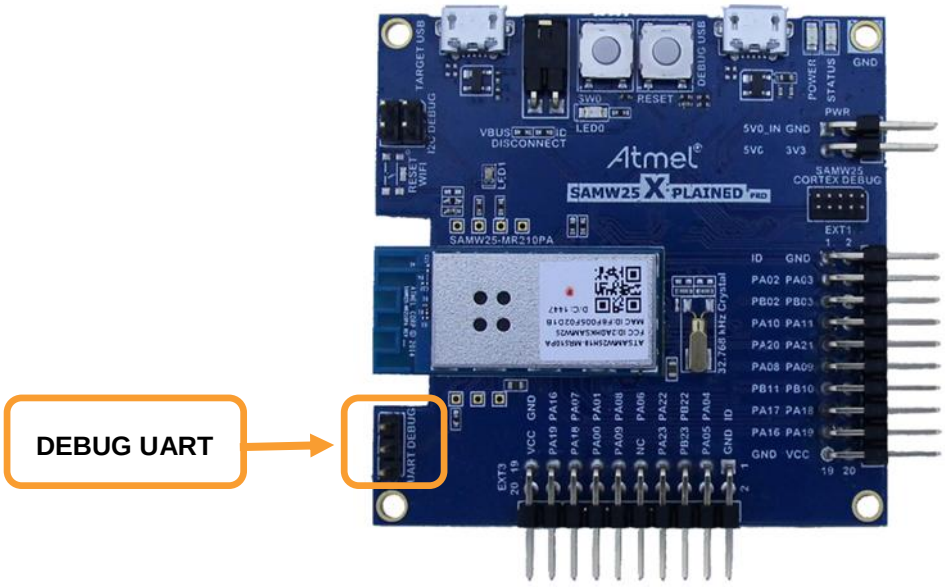
2. Browse the webpage (atmelconfig.com) for setting AP, fill up the page then press Connect button.

3. Then SAM W25 will run as a client and connect to the AP which you selected (the mobile device will be disconnected from your SAM W25).
4. After the network is online, device will communicate with the weather server. The weather info will be printed on the terminal window.

```
Wi-Fi IP is xxx.xxx.xxx.xxx
wifi_cb: M2M_WIFI_RESP_PROVISION_INFO.
Wi-Fi connected
Wi-Fi IP is xxx.xxx.xxx.xxx
Host IP is 144.76.102.166
Host Name is openweathermap.org
City: Seoul
Weather Condition: sky is clear

Temperature from sensor : 27 degrees
Temperature from server : 3 degrees
Temperature difference : 24 degrees
```

WARNING It may not be operated normally if the server connection is unstable.

4 How to Debug Wi-Fi Firmware



SAM W25 Xplained Pro board provides UART interface for debugging. You can connect the SAM W25 Xplained Pro board to your PC using a USB-to-Serial device and a debug USB connector to get firmware debug information.

Open the SAM W25 DEBUG USB serial COM port, with the following settings:

- 115200 bauds
- 8 bit data
- no parity
- one stop bit
- and no flow control

Open a serial terminal tool to see the result. (Wi-Fi Firmware Debug information).

```
(1)Chip ID = 1502b1
(1)Flash ID = c21320c2, Size = 4 MBit
(1)Working Image offset = 0x3000 Rollback =  0x40000
(2)(M2M)(Efuse) successfully loaded from bank 1.
(2)EFUSE:MAC
(2)(M2M)MAC_ADDR  = F8:F0:05:20:AE:BF
(3)NMI M2M SW  VERSION 18.0
(3)NMI MIN DRV VERSION 18.0
(3)Built at Jan 19 2015 23:48:51
(3)__ROM_FIRMWARE__
(4)(M2M)LOAD SEC
(6)(M2M)1000 400 2f000 2fc00 38000
(7)(M2M)Wifi Connect
(7)(M2M)SSID    : NW01
(7)(M2M)AUTH    : WPA-Personal
(7)(M2M)PSK     : nmisemi2
(8)(M2M)Channel : 256
```

Wi-Fi driver version and Firmware version

5 How to Download New Firmware for Wi-Fi Network Controller

As Wi-Fi host driver is coupled with Wi-Fi network controller firmware, so you have to match up the firmware version with the host driver version. You can check these versions via firmware debug message when the device is booted up.

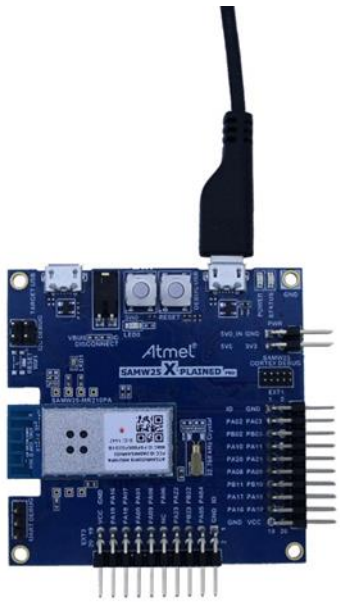
5.1 Download Firmware

This section demonstrates the use of the SAM W25 Xplained Pro board to upgrade firmware of the Wi-Fi network controller. This is a basic operation to download firmware. It uses the following hardware:

- The SAM W25 Xplained Pro

Connect the SAM W25 (DEBUG USB PORT) to the USB port on your PC.

WARNING Do not connect SAM W25 VIRTUAL COM PORT via terminal program.



1. Go to “WINC1500_FIRMWARE_UPDATE_AND_DOCUMENTATION” project directory. (Refer to Download and Install the latest ATWINC1500 Extension Package)
2. Launch the batch file.
   \src\samw25_xplained_pro_firmware_update.bat

RESULT SUCCESS firmware download. Following information will be displayed on the command window.

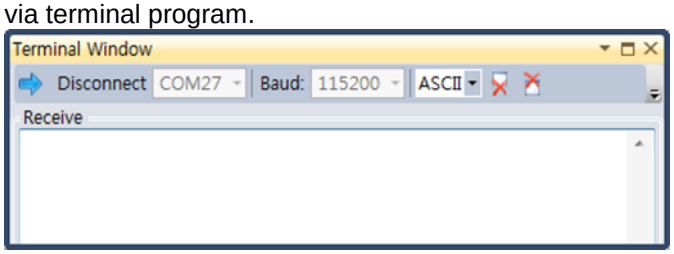
```
SAMW25 flashing script: please connect edbg and power up the board.
Firmware check OK
Chiperase completed successfully
Firmware check OK
Programming completed successfully.
Mode UART
Can not find image_builder path...
Downloading Image...
****************************************
*  >Programmer for WINC1500 SPI Flash<     *
*      Owner:  Atmel Corporation           *
****************************************
>>Init Programmer
Detecting ports...
EDBG Virtual COM Port(COM4)
(APP)(INFO)WINC1500 Serial Bridge Found
Avail port COM4
1 of ports found

. . .

>Start erasing...
Done
#Erase time = 4.633000 sec
>Start programming..
Done
#Programming time =6.661000 sec

Image downloaded successfully.

>>This task finished after 11.42 sec
OK
    ##########################################################################
##                                                                        ##
##                ########     ###     ######   ######                  ##
##                ##     ##   ## ##   ##    ## ##    ##                  ##
##                ##     ##  ##   ##  ##       ##                        ##
##                ########  ##     ##  ######   ######                   ##
##                ##        #########       ##       ##                  ##
##                ##        ##     ## ##    ## ##    ##                  ##
##                ##        ##     ##  ######   ######                   ##
##                                                                        ##
##########################################################################
Downloading ends successfully
```

RESULT FAILED firmware download. Following information will be displayed on the command window.

```
SAMW25 flashing script: please connect edbg and power up the board.
Firmware check OK
Chiperase completed successfully
Firmware check OK
Programming completed successfully.
Mode UART
Can not find image_builder path...
Downloading Image...
****************************************
*  >Programmer for WINC1500 SPI Flash<     *
*      Owner:  Atmel Corporation           *
****************************************
>>Init Programmer
Detecting ports...
EDBG Virtual COM Port(COM4)
(APP)(ERR)[nm_bus_port_detect][567]Failed to find any COM ports
0 of ports found
(ERR)Failed To intilize programmer
Fail
    ##########################################################################
##                                                                        ##
##                  ########    ###     ####  ##                    ##
##                  ##         ## ##     ##   ##                    ##
##                  ##        ##   ##    ##   ##                    ##
##                  ######   ##     ##   ##   ##                    ##
##                  ##       #########   ##   ##                    ##
##                  ##       ##     ##   ##   ##                    ##
##                  ##       ##     ##  ####  ########              ##
##                                                                        ##
##########################################################################
```

If you see a failed message, you must check your device is assembled correctly.

WARNING You must check terminal program. Do not connect SAM W25 VIRTUAL COM PORT via terminal program.



Retry firmware download again.

5.2 Download Certificate File

You need a certificate to set up a TLS connection and Wi-Fi firmware resource contains some root certificate files. This guide demonstrates how to download certificate files. It is similar to Firmware download.

It is assumed that you already have your "**Test_Root.cer**" file.

1. Go to "WINC1500_FIRMWARE_UPDATE_AND_DOCUMENTATION" project directory. (Refer to Download and Install the latest ATWINC1500 Extension Package)
2. Go to \src\firmware\Tools\root_certificate_downloader\crt. You can find some cer files in the directory. (FreeRadius_Root.cer, NMA_Root.cer, PROWL_Root.cer, Radius_Root.cer.)

   Copy your "**Test_Root.cer**" file.

   (FreeRadius_Root.cer, NMA_Root.cer, PROWL_Root.cer, Radius_Root.cer, **Test_Root.cer.**)
3. Modify the bat file as below. Find the "RootCertDownload.bat" file in \src\firmware\Tools\root_certificate_downloader\debug_uart.

   ```
   root_certificate_downloader -n 5 NMA_Root.cer PROWL_Root.cer RADIUS_Root.cer
   FreeRADIUS_Root.cer Test_Root.cer -port 0
   ```

   or

   ```
   root_certificate_downloader –n 1 Test_Root.cer -port 0
   ```
4. Launch the batch file.

   \src\samw25_xplained_pro_certificate_update.bat.

RESULT SUCCESS certificate download. Following information will be displayed on the command window.

```
...
Start erasing...
Done
#Erase time = 0.047000 sec
>Writing the certificate to SPI flash
>Start programming..
Done
#Programming time = 0.093000 sec
Done
All certificates have been downloaded
```

If you see a failed message, you must check your device is assembled well and retry downloading again.

6 Conclusion

This document explained essential part of evaluation kit and an example of use of the Atmel SAM W25 Wi-Fi module.

The following topics have been covered:

- How to get Atmel Studio (IDE) and install it
- Update new ASF package
- Target board information
- How to get weather client example project
- How to update firmware, certificates and getting log message

You have seen how to use the SAM W25 Wi-Fi module and manage module software up-to-date. It is essential part of utilizing the other SAM W25 resources.

7 Revision History

Doc Rev.	Date	Comments
42433A	03/2015	Initial document release.

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