

ATWINC15x0/ATWINC3400

Integrated Serial Flash Memory Download Procedure

Introduction

The ATWINC1500/ATWINC3400 features an on-chip microcontroller and integrated SPI Flash memory for the system firmware. The serial Flash memory also stores the root certificate required for the TLS/SSL connection and the power gain values used by the transceiver. This application note details the download procedure of firmware, TLS/SSL root certificates, and TX power gain values into WINC serial Flash through different supported serial interfaces like SPI/UART. This document also covers some useful troubleshooting tips for download failures.



Features

- Firmware download procedure
- Root certificate download procedure
- Gain table values download procedure
- Modified provisioning webpage download
- Troubleshooting tips
- Common download procedure for WINC1500 and WINC3400

Table of Contents

Int	roduc	tion	.1						
Fe	atures	5	1						
1.	1. Firmware Update Project4								
	1.1. 1.2.	Import Firmware Update Project Project Overview	. 4 . 4						
	1.3. 1.4.	Firmware Version Mismatch Indication Downloading Interfaces	5 6						
2.	Seria	al Flash Download via Serial Bridge	7						
	2.1. 2.2.	Serial Flash Download Using SAM Xplained Pro Board Serial Flash Download Using Custom Host MCU	.7 .9						
3.	Seria	al Flash Download via Built-in UART1	2						
	3.1. 3.2.	Hardware Setup	12 13						
4.	Dow	nload Failure Troubleshooting1	5						
	 4.1. 4.2. 4.3. 4.4. 	Failed To Find Any COM Port Found More Than One Matching Tool Listing More Than One COM Port Failed To Initialize Programmer: Invalid Chip ID	15 16 16 17						
5.	4.5. Cust 5.1.	omized Provisioning Webpage Download1 Batch Script	19 20						
6.	TLS/	SSL Certificates Download2	21						
	6.1.	Batch Script	21						
7.	Gain 7.1. 7.2.	Values Download 2 Modify Gain Values 2 Batch Script 2	22 22 22						
8.	Docu	ument Revision History	23						
The Microchip Web Site									
Customer Change Notification Service									
Customer Support									
Microchip Devices Code Protection Feature									
Le	gal No	ptice2	25						

Trademarks	. 25
Quality Management System Certified by DNV	26
Worldwide Sales and Service	.27

1. Firmware Update Project

The WINC1500 or WINC3400 Firmware Update Project is retrieved through the Atmel Software Framework (ASF). The latest Firmware Update Project contains the new firmware images as well as the batch script files used to download the firmware, TLS/SSL root certificate, provisioning webpage, and TX power gain values into the Wi-Fi Network Controller (WINC) through SPI/UART.

1.1 Import Firmware Update Project

Prerequisites: Install Atmel Studio. The latest version is available on the Atmel Gallery or found on the Atmel Studio Extensions manager.

1. Search for "Firmware Update Project" from the "New Example Project" of ASF menu in Atmel Studio.

Figure 1-1. Firmware Update Project in ASF



2. Select the appropriate "WINC Firmware Update Project (vxx.x.x)" corresponding to the intended host MCU Xplained Pro board and then press the **OK** button to import firmware update project and related documentation.

1.2 Project Overview

The Firmware Update Project appears as a regular project in Atmel Studio.

Figure 1-2. Firmware Update Project Overview



/src/firmware folder - Contains the new WINC firmware as well as:

- The download_all.bat script To download the WINC firmware, TLS/SSL root certificate, and TX power gain values.
- The modify_provisioning_webpage.bat To update the WINC firmware image with a custom modified HTTP provisioning webpage.

/src folder – Contains update scripts to download the WINC firmware, TLS/SSL root certificate, and TX power gain values at one go using a serial bridge through host MCU Xplained Pro boards.

1.3 Firmware Version Mismatch Indication

When there is an update for the WINC, it usually combines the Wi-Fi software API for the host MCU and a binary firmware for the WINC. To ensure the compatibility between the Wi-Fi software API on the host MCU and the WINC, a major/minor version number is used and verified at the Wi-Fi driver init.

When a version mismatch is detected at start-up, the Wi-Fi driver initialization fails and the $m2m_wifi_init()$ function returns the firmware version mismatch error code. The required baud rate configuration on terminal window is 115200 8-N-1-N.

Figure 1-3. Firmware Version Mismatch Error Code



Setting the CONF_WIFI_DEBUG to '1' in the conf_winc.h configuration file of the host application project provides more information about the version mismatch error.

Figure 1-4. Firmware Version Mismatch Error

🚾 COM31 - Tera Term VT	_ 0 %
File Edit Setup Control Window Help	
WINC1500 TCP client example	*
SAMD21 XPLAINED PRO	
Compiled: Oct 21 2016 16:36:46	
(APP) (INFO)Chip ID 1503a0	
(APP)(INFO)Firmware ver : 19.4.4	
(APP)(INFO)Min driver ver : 19.4.0	
(APP)(INFO)Curr driver ver: 19.3.0	
(APP)(ERR)[m2m wifi init][469]Mismatch Fir	mawre
Version	
main: m2m wifi init call error!(-13)	
	*

In this scenario, a firmware update with the appropriate firmware version number is expected. Each ASF release is tied to one particular WINC driver/firmware release.

1.4 Downloading Interfaces

The WINC serial Flash download (WINC firmware, TLS/SSL root certificate, and TX power gain values) is done by connecting a Windows computer to:

- Host MCU UART (typically the EDBG COM port when using an Xplained Pro board) The host MCU is connected to the WINC via SPI, thus, host MCU UART acts as a serial bridge between a Windows computer and a WINC device.
- WINC built-in UART

2. Serial Flash Download via Serial Bridge

As the WINC device is connected to host MCU through SPI interface, upgrading the WINC serial Flash via the host MCU is an easier solution. Since the WINC provides transparent access to host MCU, the WINC serial Flash can be read/written from host MCU. The host MCU can program the serial (SPI) Flash without the need for operational firmware in the WINC. The host MCU running the serial bridge firmware is connected between a Windows computer and a WINC SPI to download the firmware to a WINC serial Flash.

2.1 Serial Flash Download Using SAM Xplained Pro Board

The /src/firmware/Tools/serial_bridge contains the serial bridge binary images for a few of SAM-based host MCUs. This serial bridge firmware uses UART interface available on SAM Xplained Pro boards.

The batch script files available in /src folder contains the scripts to program the platform specific serial bridge binary image on the host MCU before it starts the WINC serial Flash download. EDBG on SAM Xplained Pro board is used for programming serial bridge image. The script uses the Atmel Studio atprogram.exe commands for programming the host MCU via EDBG of SAM Xplained Pro boards.

2.1.1 Hardware Setup

The download procedure requires that the WINC module is attached on EXT1 of the SAM Xplained Pro kit. Plug a Micro-USB cable from a Windows computer to the debug USB port of the Xplained Pro kit. **Figure 2-1. USB Connection With Xplained Pro Kit**



2.1.2 Batch Script

A list of batch (.bat) script files in the /src folder of "WINCXXXX_Firmware_Update_Project (vxx.x.x)" is used to trigger a WINC serial Flash download.

1. Ensure that the SAM Xplained Pro board is connected to a PC via debug USB port. The virtual EDBG COM port of the board is now listed in the device manager.

- 2. Run the sam_xplained_pro_firmware_update.bat script that corresponds to the connected SAM Xplained Pro board.
- 3. The batch script programs a serial bridge binary on the host MCU to redirect firmware data from the computer (EDBG virtual COM port) to the WINC chip (via SPI). The serial bridge application also performs the WINC power-up sequence, thus ensuring that the WINC bootloader is in the appropriate state to start a download.

Figure 2-2. Serial Bridge Firmware Programming : Success



4. During the download process, the batch script provides information about the output the firmware version being programmed onto the WINC as well as the previously installed firmware version.

Figure 2-3. Displaying Firmware Version

5. After several seconds, the following message appears to indicate that the WINC download procedure is successfully completed.

Figure 2-4. WINC Serial Flash Download : Success



Result: The WINC chip firmware, TLS/SSL root certificates, and TX power gain values are successfully updated. Refer to Download Failure Troubleshooting in case of failure.

Note: The serial Flash download using EDBG virtual COM of SAM Xplained Pro on Virtual OS is unsupported at present.

2.2 Serial Flash Download Using Custom Host MCU

The serial bridge example application is available in ASF for a few of the SAM-based host MCUs.

Prerequisites: Install latest version of the Atmel Studio.

 Search for "Serial Bridge Example" from the "New Example Project" of ASF menu in Atmel Studio. The search result lists the available Serial Bridge example projects for supported host MCU Xplained Pro board of the WINC device.

Figure 2-5. Serial Bridge Example Projects in ASF

New Example Proj	ect from ASF or Extensions	×
Device Family All Projects Kit Category Technology Addon	R All Category: All Serial Bridge Example X Image: Serial Bridge Example SAM D21 Xplained Pro X X Image: WiNC1500 Serial Bridge Example - SAM D21 Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM R21 Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM R21 Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM SX Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM SX Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM SX Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAM SX Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAMG53 Xplained Pro X X X Image: WiNC1500 Serial Bridge Example - SAMG55 Xplained Pro X X X X Image: WiNC1500 Serial Bridge Example - SAMG55 Xplained Pro X X X X X Image: WiNC1500 Serial Bridge Example - SAMG55 Xplained Pro X X X X X X X X X X	WINCL500 Ftreware WINCL500 Ftreware WINCL500 Ftreware SAN D21 Nphise Pro SAN D21 Nphise Pro Trip reject includes tools and documen- naine to update the WINC1600 Wi-F1 dock firmware, root conflictents and for the second s
Proiect Nam	WINC1500 FIRMWARE UPDATE PROJECT2	
Location:	D:\WiFi support\WINC1500 SERIAL BRIDGE EXAMPLE3	Browse
Solution:	Add to Solution	•
Solution nar	WINC1500 SERIAL BRIDGE EXAMPLE3	
Device:	ATSAMD21J18A	
		OK Cancel

2. Select the appropriate "WINC Serial Bridge Example" project corresponding to the intended host MCU Xplained Pro board and then press the **OK** button to import the project and related documentation.

Note: This project can be considered as a base for implementing serial bridge for custom-specific host MCUs. Porting of serial bridge firmware to custom host MCU is not within the scope of this document.

2.2.1 Batch Script

The <code>download_all.bat</code> is located in the <code>src/firmware</code> folder of the

"WINCXXXX_Firmware_Update_Project", which triggers the serial Flash download.

- 1. Program the host MCU with the custom implemented serial bridge firmware.
- 2. Ensure that the WINC device connected to the host MCU is powered up and that the host UART is connected to a PC.
- 3. In a Windows shell, run the command download all.bat UART to start the download.
- 4. During the download process, the batch script provides information about the output firmware version being programmed onto the WINC as well as the previously installed firmware version.

Figure 2-6. Displaying Firmware Version



5. After several seconds, the following message appears to indicate that the WINC download procedure is successfully completed.





Result: The WINC chip firmware, TLS/SSL root certificates, and TX power gain values are successfully updated. Refer to Download Failure Troubleshooting in case of failure.

3. Serial Flash Download via Built-in UART

The serial Flash download is done using the built-in UART of the WINC device. Prior to running any update script, setup the hardware as required.

Note: WINC3400 does not support download through built-in UART at present.

3.1 Hardware Setup

3.1.1 Power-On Sequence

To perform a serial Flash download using the WINC built-in UART, it is mandatory that the WINC chip is in the right bootloader state. To do so, the host MCU must power-up the WINC chip and then perform the Reset sequence as defined in the *IEEE 802.11 b/g/n SmartConnect IoT Module Datasheet* (*DS70005304A*). This is done very easily from the host MCU by calling the m2m bsp init() function.

```
int main(void)
{
    /* Initialize the board. */
    system_init();
    /* Initialize the BSP. */
    nm_bsp_init();
    while(1) {
    }
}
```

3.1.2 UART Pin assignment

The pin assignment of WINC1500 module UART are described in the following table. On ATWINC1500 Xplained Pro, TX, and RX are available on through holes labeled as "DEBUG_UART" for easy identification.

Table 3-1. UART Pin Mapping of WINC1500 Module

ATWINC1500 Module Pin Name	ATWINC1500 Xplained Pro Pin Name	Function
J14	UART_TX	TXD
J19	UART_RXD	RXD

3.1.3 Hardware Connection

Depending on the WINC-Xpro board version, it may feature a Micro-USB plug, which is connected to the WINC built-in UART via an FTDI module. In this case, the PC must have the latest FTDI driver installed to see the corresponding virtual serial COM port.

Figure 3-1. USB Connection With WINC Built-In UART



When a Micro-USB plug is not present on the WINC-Xpro board, the RX, TX, and GND UART signals (see Table 3-1) that are available on the board can be connected to a PC using a third-party serial-to-USB converter.

3.2 Batch Script

The download_all.bat batch script is located in the src/firmware folder of the "WINCXXXX_Firmware_Update_Project" that triggers the download through built-in UART.

- 1. Ensure that the host MCU is powered up and that the WINC built-in UART is connected to a PC via a serial-to-USB converter.
- 2. In a Windows shell, run the command <code>download_all.bat UART</code> to start the download.

Note: The gain setting values for the SAMW25 module is different than the gain setting values of the WINC1500 module. The above command downloads the WINC1500 module gain values. The command for the SAMW25 module to incorporate the gain values is: download all.bat UART SAMW25

3. During the download process, the batch script provides information about the output firmware version being programmed onto the WINC as well as the previously installed firmware version.

Figure 3-2. Displaying Firmware Version

4. After several seconds, the following message appears to indicate that the WINC download procedure is successfully completed.

Figure 3-3. WINC Serial Flash Download : Success

```
>Start erasing...
Done
#Erase time = 0.032000 sec
>Writing the certificate to SPI flash...
>Start programming...
Done
#Programming time = 0.219000 sec
Done
>>This task finished after 2.23 sec
ок.
   *****
    ##
                                                                       ##
    ##
##
                    #######
## #1
                                 ###
                                         ######
                                                  ######
                                                                       ##
##
                           ##
                                             ## ##
                                ## ##
                                        ##
                                                      ##
                                  ##
                                                                       ##
##
    ##
##
                    ##
                           ##
                              ##
                                      ##
                                                ##
                              ## ## ##
## ## ######
######### #!
                    ######
    ##
                     ##
                                             ##
                                                                       ##
                                                      ##
    ##
                                     ## ##
                                              ## ##
                                                                       ##
                    ##
                              ##
                                                       ##
    ##
                    ##
                              ##
                                     ##
                                        ######
                                                 ######
                                                                       ##
    ##
                                                                        ##
    Programming ends successfully
Press any key to continue . .
```

Result: The WINC chip firmware, TLS/SSL root certificate, and TX power gain values are successfully updated. Refer to Download Failure Troubleshooting in case of failure.

4. Download Failure Troubleshooting

This section provides the troubleshooting tips for a specific error while downloading using batch script.

4.1 Failed To Find Any COM Port

Figure 4-1. Error : Failed To Find Any COM Port

C:\Windows\system32\cmd.exe									
SAMD21 flashing script: please	connect edbg	and p	ower up th	e board.					
Firmware check OK									
chiperase completed successfully									
Firmware Check UK									
riogramming completed successfully. Diase wait									
nde light									
Downloading Image									
*****	*****	*							
* >Programmer for WINC1500 SP:	I Flash<	*							
* Owner: Atmel Corporat	ion	*							
r_i much poth (200) / / / /fi	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		ر ام تا به						
Firmware Path (280)///11	rmware/mzm_a rmware/mzm_a	io_200	, bin						
STnitialize programmer	i iliwai e/ilizili_a	10_540							
Detecting COM ports									
5 1									
(APP)(ERR)[nm_bus_port_detect][601]failed t	o find	l any COM p	ort!					
(ERR)Failed To initialize progra	ammer								
-a1 ####################################	***		***	***	##				
######################################	****	***	***	****	## ##				
## ######	# ###	####	##		##				
## ##	## ##	##	##		##				
## ##	## ##	##	##		##				
## #####	## ##	##	##		##				
## ##	#########	##	##		##				
## ##	## ##	##	##		##				
## ##	## ##	####	########		##				
##		######		#################	##				
Press any key to continue	****	<i>######</i> ###	***	****	##				
in cost any key to continue									

The image downloader tool used to perform a serial bridge or a built-in UART download tries to look for available COM ports using Windows API. It attempts to match each COM port name with "EDBG" string or a port number "COM" string. If one of the two conditions is true, the program attempts to send a 0×12 character on the UART line. The host device is then expected to answer $0 \times 5A$ for a built-in UART update or $0 \times 5B$ for a serial bridge update.

The Failed to find any COM port error is expected when there are no response for the command.

How to fix it:

- Ensure the WINC COM port is listed in the device manager.
- Ensure the WINC COM port is not opened by any other application. For verification, try to open and close the COM port with a terminal application.
- Low quality USB cable or serial-to-USB converter (built-in UART) can introduce garbage on the UART line, thus, fail to detect the WINC COM port. Use another cable.
- When performing a built-in UART download, it is expected that the WINC bootloader is in a particular state that is only achievable after doing a clean power-up and Reset sequence. Therefore, before downloading, it is recommended to ensure a clean power-up and Reset sequence.
- Ensure that no other extension board is connected to the Xplained Pro board while performing the download.
- Ensure the project path is not exceeding the Windows maximum path length of 260 characters.

4.2 Found More Than One Matching Tool

Figure 4-2. Error : Found More Than One Matching Tool

C:\Windows\system32\cmd.exe						• 🕺
SAMD21 flashing script:	please co	nnect edbg	and po	ower up the board.		*
[ERROR] Found more than	one match	ing tool. I	Please	specify serial number.		
Fail						-
#######################################	+#########	##########	<i>#######</i> #############################	*****	##	
##					##	
##	########	###	####	##	##	
##	##	## ##	##	##	##	
##	##	## ##	##	##	##	
##	#####	## ##	##	##	##	
##	##	#########	##	##	##	
##	##	## ##	##	##	##	
##	##	## ##	####	########	##	
##					##	
#######################################	+#########	##########	<i>#######</i> #############################	*****	##	
Press any key to continu	ie					

The Found more than one matching tool error is observed when downloading using Xplained Pro board serial bridge with sam_xplained_pro_firmware_update.bat batch script. The image downloader tool tries to look for available COM ports and attempts to match each COM port name with "EDBG" string to program the serial bridge binary image on the host MCU.

How to fix it:

• All the Xplained Pro boards are enumerated with "EDBG Virtual COM Port". Ensure to connect one Xplained Pro board at a time on a PC.

4.3 Listing More Than One COM Port

Figure 4-3. Listing More Than One COM Port

🔤 Administrator: C:\Windows\System32\cmd.exe - download_all.bat UART
Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation. All rights reserved.
D:\Projects\WINCSP430-firmware-upgrade-process\WINC1500_FIRMWARE_UPDATE_PROJECT_ demo\src\firmware>download_all.bat UART Mode UART Downloading Image
* >Programmer for WINC1500 SPI Flash< * * Owner: Atmel Corporation *
Firmware Path (2B0)///firmware/m2m_aio_2b0.bin Firmware Path (3A0)///firmware/m2m_aio_3a0.bin >>Initialize programmer. Detecting COM ports Found WINC1500 serial bridge (COM51) Found WINC1500 serial bridge (COM10)
Please enter COM port number to program: 51 Chip id 1503a0 >Waiting for chip permission OK.
NOW Programming Firmware Image Version Firmware ver : 19.4.4 Min driver ver : 19.3.0 Firmware Build Nov 19 2015 Time 22:36:45
Previous Firmware Image Version Firmware ver : 19.4.4 Min driver ver : 19.3.0 Firmware Build Nov 19 2015 Time 22:36:45

The More than one COM port is listed when downloading using download_all.bat where the host MCU contains the serial bridge firmware or download through built-in UART. The image downloader tool used to perform a serial bridge or a built-in UART download tries to look for available COM ports and attempts to match each COM port name with "EDBG" string or a port number "COM" string. If one of the two conditions is true, the program attempts to send a 0x12 character on each UART line. The host

© 2017 Microchip Technology Inc.

device is then expected to answer $0 \times 5A$ for a built-in UART update or $0 \times 5B$ for a serial bridge update. If the expected response is received on all UART lines, the script lists all the detected COM ports.

How to fix it:

• Input COM port number of the intended device to be downloaded when Please enter COM port number to program: displays as shown in the preceding figure.

Note: For each downloading of WINC chip firmware, TLS/SSL root certificates, and TX power gain values, it is required to provide a COM port number. To avoid this, it is possible to force the image downloader tool to use a specific COM port number from the start. For example, to use COM56, run the script such as this: download all.bat UART 56.

4.4 Failed To Initialize Programmer: Invalid Chip ID

Figure 4-4. Error : Failed To Initialize Programmer - Invalid Chip ID

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
D:\Projects\WINCSP430-firmware-upgrade-process\WINC1500_FIRMWARE_UPDATE_PROJECT_
demo\src\firmware>download_all.bat UART
Mode UART
Downloading Image...
    >Programmer for WINC1500 SPI Flash<
* Owner: Atmel Corporation *
Firmware Path (2BO) ../../firmware/m2m_aio_2bO.bin
Firmware Path (3AO) ../../firmware/m2m_aio_3aO.bin
>>Initialize programmer.
Detecting COM ports...
Found WINC1500 serial bridge (COM51)
>>(ERR):Invalid chip ID = 0x00000000
>>(ERR):Connect NMC1500 Dx Fail
(ERR)Failed To initialize programmer
Fail
     **********************
     ##
                             ########
                                            ###
                                                      ####
                                                              ##
                                                                                          ##
     ##
                             ##
##
                                                                                          ##
                                                       ##
                                                              ##
     ##
                                          ##
                                                       ##
                                                              ##
                                                                                          ##
                             ######
                                                       ##
                                                                                          ##
     ##
                                                              ##
                                         ##
                                                 ##
     ##
                             ##
                                                       ##
                                                              ##
                                                                                          ##
                                         #####
                                                 ###
     ##
                                                                                          ##
                             ##
                                         ##
                                                 ##
                                                       ##
                                                              ##
     ##
                                                      ####
                                                              ########
                                                                                          ##
                              ##
     ##
                                                                                          ##
     Press any key to continue .
```

The Failed to initialize programmer with Invalid chip ID error typically happens when there is garbage or noise on the UART line preventing from reading the correct chip ID value.

How to fix it:

• Try connecting the PC and the WINC with a different cable. A clean power-up and Reset sequence of the WINC is necessary to start over with the WINC bootloader in the appropriate state.

4.5 Failed To Initialize Programmer: Waiting For Chip Permission Figure 4-5. Error : Failed To Initialize Programmer - Waiting For Chip Permission

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
D:\Projects\WINCSP430-firmware-upgrade-process\WINC1500_FIRMWARE_UPDATE_PROJECT_
demo\src\firmware>download_all.bat UART
Mode UART
Downloading Image...
   >Programmer for WINC1500 SPI Flash<
* Owner: Atmel Corporation *
Firmware Path (2B0) ../../firmware/m2m_aio_2b0.bin
Firmware Path (3A0) ../../firmware/m2m_aio_3a0.bin
>>Initialize programmer.
Detecting COM ports...
Found WINC1500 serial bridge (COM51)
Chip id 1503a0
>Waiting for chip permission...
(ERR)Failed To initialize programmer
Fail
    ########
    ##
                                        ###
                                                 ####
                                                        ##
                                                                                 ##
                                                                                 ##
    ##
                          ##
##
                                                  ##
                                                        ##
    ##
                                                  ##
                                                        ##
                                                                                 ##
                                      ##
                                           ##
                                                  ##
                          ######
                                                                                 ##
    ##
                                     ##
                                            ##
                                                        ##
                                     #########
    ##
                          ##
                                                  ##
                                                        ##
                                                                                 ##
    ##
                                                  ##
                                                                                 ##
                          ##
                                     ##
                                            ##
                                                        ##
    ##
                           ##
                                     ##
                                             ##
                                                 ####
                                                        ########
                                                                                 ##
    ##
                                                                                 ##
    Press any key to continue .
```

After printing the correct chip ID of the WINC, the image downloader tool programs a small binary (programmer firmware) to assist with WINC Flash programming. At this stage the image downloader changes the UART baud rate from 115200 to 500000 to speed up the actual transfer of the firmware image. Once the baud rate change is made, the chip permission is verified to ensure the UART connection is reliable. Failing at this stage means that the current setup does not support such a high baud rate.

How to fix it:

• It is recommended to try connecting a PC and the WINC with a different cable. Also, a clean powerup and Reset sequence of the WINC is necessary to start over with the WINC bootloader in the appropriate state.

5. Customized Provisioning Webpage Download

The WINC device features a Provisioning Webpage mode that can be used to enter user credentials to connect the WINC device to the desired Access Point. The HTTP server and the actual HTML provisioning webpage is embedded in the WINC firmware, therefore, it cannot be modified from the host MCU. The firmware update project includes the HTML code used by the WINC for HTTP provisioning and also the necessary scripts to generate a new WINC firmware image with the modifed provisioning web page.



Figure 5-1. Provisioning Webpage Folder Structure

The /src/firmware – Contains the script to generate an updated WINC firmware image:

- The modify_provisioning_webpage.bat script to generate a new WINC firmware image that includes the HTML code provided in the/provisioning_webpage folder.
- The modify_provisioning_webpage_ota.bat script to generate a new WINC firmware OTA image that includes the HTML code provided in the /provisioning_webpage folder.

The /src/firmware/provisioning_webpage - Contains the WINC HTML code:

- *logo.png* Logo image displayed at the top of the provisioning page.
- *favicon.ico* Icon that appears inside the browser tab displaying the WINC provisioning page.
- *default.html* The default HTML file that appears in the browser when the user requests the WINC Home Page.

style.css - Cascading Style Sheet (CSS) used for describing the look and formatting of the default.html contents.

5.1 Batch Script

The modify_provisioning_webpage.bat batch script is located in src/firmware folder of the "WINCXXXX_Firmware_Update_Project". This script triggers the generation of new WINC firmware image that includes the HTML code provided in the src/firmware/provisioning_webpage folder.

- 1. Modify WINC HTML code in /src/firmware/provisioning_webpage folder as required.
- 2. Run the modify_provisioning_webpage.bat script.
- 3. The generated new firmware image overwrites the default firmware image located in the src/ firmware folder. The following message appears to indicate that the new WINC firmware is successfully generated.

Figure 5-2. WINC Firmware Generated with Modified Provisioning Webpage

C\Windows\system32\cmd.exe		83
Provisioning webpage has been successfully updated in firmware image >>This task finished after 0.00 sec		•
Applying modification for 3A0 image: ************************************		
Provisioning webpage has been successfully updated in firmware image >>This task finished after 0.02 sec		
Press any key to continue		

4. Follow the steps mentioned in Serial Flash Download via Serial Bridge or Serial Flash Download via Built-in UART for specific interface to download the modified Provisioning Webpage.

6. TLS/SSL Certificates Download

The WINC saves the TLS/SSL certificates inside the serial Flash in 4K sector (the maximum size of all certificates in Flash must be less than 4K). The serial Flash download process as explained in Serial Flash Download via Built-in UART also downloads the TLS/SSL certificates. However, it is also possible to download only the certificates without downloading the WINC chip firmware. For generating the certificate, refer to the *Wi-Fi Network Controller Software Design Guide Application Note (DS00002389A)*. The following procedure explains how to download the TLS/SSL certificates.

6.1 Batch Script

The RootCertDownload.bat batch script is located in src/firmware/Tools/
root_certificate_downloader/debug_uart folder of the

"WINCXXXX_Firmware_Update_Project". This script triggers the certificate to download into WINC device.

- 1. Ensure that the host MCU is powered up as mentioned in the Power-On sequence and that the WINC built-in UART is connected to a PC via a serial-to-USB converter. If the host MCU is running the serial bridge firmware, then it is also possible to download the certificates through host MCU.
- Paste the certificates in the /src/firmware/Tools/root_certificate_downloader/crt folder.
- 3. Run the RootCertDownload.bat to start the download.
- 4. After a few seconds, the following message appears to indicate that the root certificates are successfully downloaded.

Figure 6-1. Root Certificates Download : Success

an Administrator: Root Certificate Downloader - Atmel Corporation	
Exponent	
Exponent 01 00 01 SIGNATURE 93 24 4A 30 5F 62 CF D8 1A 98 2F 3D EA DC 99 2D BD 77 F6 A5 79 22 38 EC C4 A7 A0 78 12 AD 62 0E 45 70 64 C5 E7 97 66 2D 98 09 7E 5F AF D6 CC 28 65 F2 01 AA 08 1A 47 DE F9 F9 7C 92 5A 08 69 20 0D D9 3E 6D 6E 3C 0D 6E D8 E6 06 91 40 18 B9 F8 C1 ED DF D8 41 AA E0 96 20 C9 CD 64 15 38 81 C9 94 EE A2 84 29 0B 13 6F 8E D8 0C DD 25 02 DB A4 8B 19 44 D2 41 7A 05 69 4A 58 4F 60 CA 7E 82 6A 0B 02 AA 25 17 39 B5 DB 7F E7 84 65 2A 95 8A BD 86 DE 5E 81 16 83 2D 10 CC DE FD A8 22 A6 D2 28 1F 0D 0B C4 E5 E7 1A 26 19 E1 F4 11 6F 10 B5 95 FC E7 42 05 32 DB CE 9D 51 5E 28 B6 9E 85 35 B EF A5 7D 45 40 72 8E 70 E6 80 E0 6F B3 33 55 48 71 B8 9D 27 8B C4 65 5F 0D 86 76 9C 44 7A F6 95 5C F6 5D 32 08 33 A4 54 B6 18 3F 68 5C F2 42 4A 85 38 54 83 5F D1 E8 CF2 AC 11 D6 A8 ED 63 6A *=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=*=	
>Writing the certificate to SPI flash >Start programming Done	
<pre>#Programming time = 0.218000 sec</pre>	
Done	
>>This task finished after 3.00 sec Press any key to continue	

Result: TLS/SSL root certificates are successfully downloaded.

7. Gain Values Download

Gain setting values are used by the RF with different rates to configure the transmission power.

7.1 Modify Gain Values

The .csv file in the src/firmware/Tools/gain_builder/gain_sheets folder holds the gain values. The following figure shows the template of the .csv file. The .csv file must be sorted based on the gain rates (Row) and for all the channels (Column).

ch	1	2	3 4	5	6	7	8	9	10	11	12	13	14
1													
2													
5.5													
11													
6													
9													
12													
18				Inser	t You	r Valu	es _						
24													
36													
48													
54													
mcs0													
mcs1													
mcs2													
mcs3													
mcs4													
mcs5													
mcs6													
mcs7													

Figure 7-1. Gain Sheet Template

7.2 Batch Script

The gain values are downloaded as part of the complete download process explained in the previous sections. It is impossible to download the gain values alone. The modified gain values can be downloaded as follows:

- 1. The .csv file in the src/firmware/Tools/gain_builder/gain_sheets folder holds the gain values. The values can be changed in the default .csv file.
- 2. If the new gain values are available in a different file, but with a different path, then open the download_all.bat from the src/firmware and update it with the new path and file such as: GAIN_FILE=-hp ../gain_sheets/samd21_gain_setting_hp.csv → GAIN_FILE=-hp c:/gain_values.csv
- 3. After modifying the gain values using either of the steps above, follow the steps mentioned in the Serial Flash Download via Serial Bridge or Serial Flash Download via Built-in UART to download the new gain values.

8. Document Revision History

Rev. A - 03/2017

Section	Changes
Document	 Updated from Atmel to Microchip template. Assigned a new Microchip document number. Previous version is Atmel 42809 revision A. ISBN number added.

The Microchip Web Site

Microchip provides online support via our web site at http://www.microchip.com/. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- Product Support Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- Business of Microchip Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Customer Change Notification Service

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at http://www.microchip.com/. Under "Support", click on "Customer Change Notification" and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.

• Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Legal Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KeeLoq, KeeLoq logo, Kleer, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

[©] 2017, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-1423-0

Quality Management System Certified by DNV

ISO/TS 16949

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.



Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office	Asia Pacific Office	China - Xiamen	Austria - Wels
2355 West Chandler Blvd.	Suites 3707-14, 37th Floor	Tel: 86-592-2388138	Tel: 43-7242-2244-39
Chandler, AZ 85224-6199	Tower 6, The Gateway	Fax: 86-592-2388130	Fax: 43-7242-2244-393
Tel: 480-792-7200	Harbour City, Kowloon	China - Zhuhai	Denmark - Copenhagen
Fax: 480-792-7277	Hong Kong	Tel: 86-756-3210040	Tel: 45-4450-2828
Technical Support:	Tel: 852-2943-5100	Fax: 86-756-3210049	Fax: 45-4485-2829
http://www.microchip.com/	Fax: 852-2401-3431	India - Bangalore	Finland - Espoo
support	Australia - Sydney	Tel: 91-80-3090-4444	Tel: 358-9-4520-820
Web Address:	Tel: 61-2-9868-6733	Fax: 91-80-3090-4123	France - Paris
www.microchip.com	Fax: 61-2-9868-6755	India - New Delhi	Tel: 33-1-69-53-63-20
Atlanta	China - Beijing	Tel: 91-11-4160-8631	Fax: 33-1-69-30-90-79
Duluth, GA	Tel: 86-10-8569-7000	Fax: 91-11-4160-8632	France - Saint Cloud
Tel: 678-957-9614	Fax: 86-10-8528-2104	India - Pune	Tel: 33-1-30-60-70-00
Fax: 678-957-1455	China - Chengdu	Tel: 91-20-3019-1500	Germany - Garching
Austin, TX	Tel: 86-28-8665-5511	Japan - Osaka	Tel: 49-8931-9700
Tel: 512-257-3370	Fax: 86-28-8665-7889	Tel: 81-6-6152-7160	Germany - Haan
Boston	China - Chongqing	Fax: 81-6-6152-9310	Tel: 49-2129-3766400
Westborough, MA	Tel: 86-23-8980-9588	Japan - Tokyo	Germany - Heilbronn
Tel: 774-760-0087	Fax: 86-23-8980-9500	Tel: 81-3-6880- 3770	Tel: 49-7131-67-3636
Fax: 774-760-0088	China - Dongguan	Fax: 81-3-6880-3771	Germany - Karlsruhe
Chicago	Tel: 86-769-8702-9880	Korea - Daegu	Tel: 49-721-625370
Itasca, IL	China - Guangzhou	Tel: 82-53-744-4301	Germany - Munich
Tel: 630-285-0071	Tel: 86-20-8755-8029	Fax: 82-53-744-4302	Tel: 49-89-627-144-0
Fax: 630-285-0075	China - Hangzhou	Korea - Seoul	Fax: 49-89-627-144-44
Dallas	Tel: 86-571-8792-8115	Tel: 82-2-554-7200	Germany - Rosenheim
Addison, TX	Fax: 86-571-8792-8116	Fax: 82-2-558-5932 or	Tel: 49-8031-354-560
Tel: 972-818-7423	China - Hong Kong SAR	82-2-558-5934	Israel - Ra'anana
Fax: 972-818-2924	Tel: 852-2943-5100	Malaysia - Kuala Lumpur	Tel: 972-9-744-7705
Detroit	Fax: 852-2401-3431	Tel: 60-3-6201-9857	Italy - Milan
Novi, MI	China - Nanjing	Fax: 60-3-6201-9859	Tel: 39-0331-742611
Tel: 248-848-4000	Tel: 86-25-8473-2460	Malaysia - Penang	Fax: 39-0331-466781
Houston, TX	Fax: 86-25-8473-2470	Tel: 60-4-227-8870	Italy - Padova
Tel: 281-894-5983	China - Qingdao	Fax: 60-4-227-4068	Tel: 39-049-7625286
Indianapolis	Tel: 86-532-8502-7355	Philippines - Manila	Netherlands - Drunen
Noblesville, IN	Fax: 86-532-8502-7205	Tel: 63-2-634-9065	Tel: 31-416-690399
Tel: 317-773-8323	China - Shanghai	Fax: 63-2-634-9069	Fax: 31-416-690340
Fax: 317-773-5453	Tel: 86-21-3326-8000	Singapore	Norway - Trondheim
Tel: 317-536-2380	Fax: 86-21-3326-8021	Tel: 65-6334-8870	Tel: 47-7289-7561
Los Angeles	China - Shenyang	Fax: 65-6334-8850	Poland - Warsaw
Mission Viejo, CA	Tel: 86-24-2334-2829	Taiwan - Hsin Chu	Tel: 48-22-3325737
Tel: 949-462-9523	Fax: 86-24-2334-2393	Tel: 886-3-5778-366	Romania - Bucharest
Fax: 949-462-9608	China - Shenzhen	Fax: 886-3-5770-955	Tel: 40-21-407-87-50
Tel: 951-273-7800	Tel: 86-755-8864-2200	Taiwan - Kaohsiung	Spain - Madrid
Raleigh, NC	Fax: 86-755-8203-1760	Tel: 886-7-213-7830	Tel: 34-91-708-08-90
Tel: 919-844-7510	China - Wuhan	Taiwan - Taipei	Fax: 34-91-708-08-91
New York, NY	Tel: 86-27-5980-5300	Tel: 886-2-2508-8600	Sweden - Gothenberg
Tel: 631-435-6000	Fax: 86-27-5980-5118	Fax: 886-2-2508-0102	Tel: 46-31-704-60-40
San Jose, CA	China - Xian	Thailand - Bangkok	Sweden - Stockholm
Tel: 408-735-9110	Tel: 86-29-8833-7252	Tel: 66-2-694-1351	Tel: 46-8-5090-4654
Tel: 408-436-4270	Fax: 86-29-8833-7256	Fax: 66-2-694-1350	UK - Wokingham
Canada - Toronto			Tel: 44-118-921-5800
Tel: 905-695-1980			Fax: 44-118-921-5820
Fax: 905-695-2078			

Application Note