

Getting Started Guide for the SmartFusion[®]2 KickStart Kit

SMARTFUSION[®]2



Libero version 11.6
Document version 1.0
September, 2015

Table of Contents

Overview.....	3
What's in the Box?.....	4
What's on the Web?.....	4
Key Features of the KickStart Board.....	5
Board Level Block Diagram	6
Example Design Requirements.....	7
Software.....	7
Hardware	7
Optional Hardware Requirements.....	7
PC Setup	8
Download and Install the USB UART/JTAG Driver	8
Installing a Serial Console on a Windows 7 Host	12
Download the Windows Test Utility Software	13
Android Setup.....	14
Setting Up the KickStart Evaluation Board	19
Hardware Design Block Diagram	20
Windows and Android Test Utilities.....	21
KickStart Board Features Used with the Test Utilities.....	21
Windows Test Utility Operation	22
Android Test Utility Operation.....	24
What's Next.....	29
Appendix I: Determining the Virtual COM Port.....	30
Appendix II: Getting Help and Support.....	32
Avnet Website	32
Microsemi Website	32
Revision History	33

Overview

Avnet's SmartFusion2 KickStart Kit features the Microsemi M2S010S SmartFusion®2 SoC FPGA, a secure and integrated programmable system-on-a-chip device with 10k logic elements and a 166 MHz ARM® Cortex®-M3 processor. This low power SmartFusion2 device is flash-based and single event upset (SEU) immune. Unlike existing SmartFusion2 development boards, Avnet's KickStart Board does not require a separate JTAG emulator or power supply, as this is now integrated onto the USB-powered board. For communications, Microchip's RN4020 Bluetooth Low Energy module is provided in addition to USB serial. Two tiny, low power on-board sensors give engineers access to ambient light, gyrometer, accelerometer, and temperature sensors. The Arduino and Pmod-compatible interfaces provide for the easy addition of existing custom modules and therefore facilitate easy and rapid prototyping.

This document describes a simple SmartFusion2 SoC FPGA design implemented on the Avnet KickStart Evaluation Board. This example design integrates pushbutton switch user input to change the color of LEDs on the board and manipulate their brightness with a custom Pulse Width Modulator (PWM) block in the FPGA fabric. Other board LEDs, an ambient light sensor, a motion sensor, and Bluetooth Low Energy (BLE) are also integrated and demonstrated with the supplied Windows® and Android™ software applications. These applications demonstrate the reading of sensors and switches to display their data as well as writing to the board LEDs to change their color (red, green, amber, or off).

What's in the Box?

- Avnet KickStart Board
- USB-A to USB micro-B cable
- Quick Start Card

What's on the Web?

- Avnet Design Resource Center KickStart Kit Home Page
www.em.avnet.com/SmartFusion2-KickStart
- Avnet Support Forum
community.em.avnet.com/t5/SmartFusion2-KickStart-Board/bd-p/SmartFusion2-KickStart
- Getting Started Guide (this document)
- Hardware User Guide
- Test utilities for Windows and Android
- Tutorials and Reference Designs
- Schematics
- Errata
- Board BOM

Key Features of the KickStart Board

FPGA SoC

- Microsemi SmartFusion2 M2S010S secure SoC FPGA

Communication

- USB FlashPro5 JTAG programming/debug & serial port
- Bluetooth LE using Microchip RN4020 module with MLDP profile

Expansion connectors

- Arduino compatible interface for custom and development shields
- 3 Pmod compatible interfaces for pluggable peripherals

General Purpose I/O

- 4 user LEDs
- 2 pushbutton switches
- 6 test pins

Special Function Peripherals

- Maxim MAX 44009 ambient light sensor
- Motion and temperature sensor

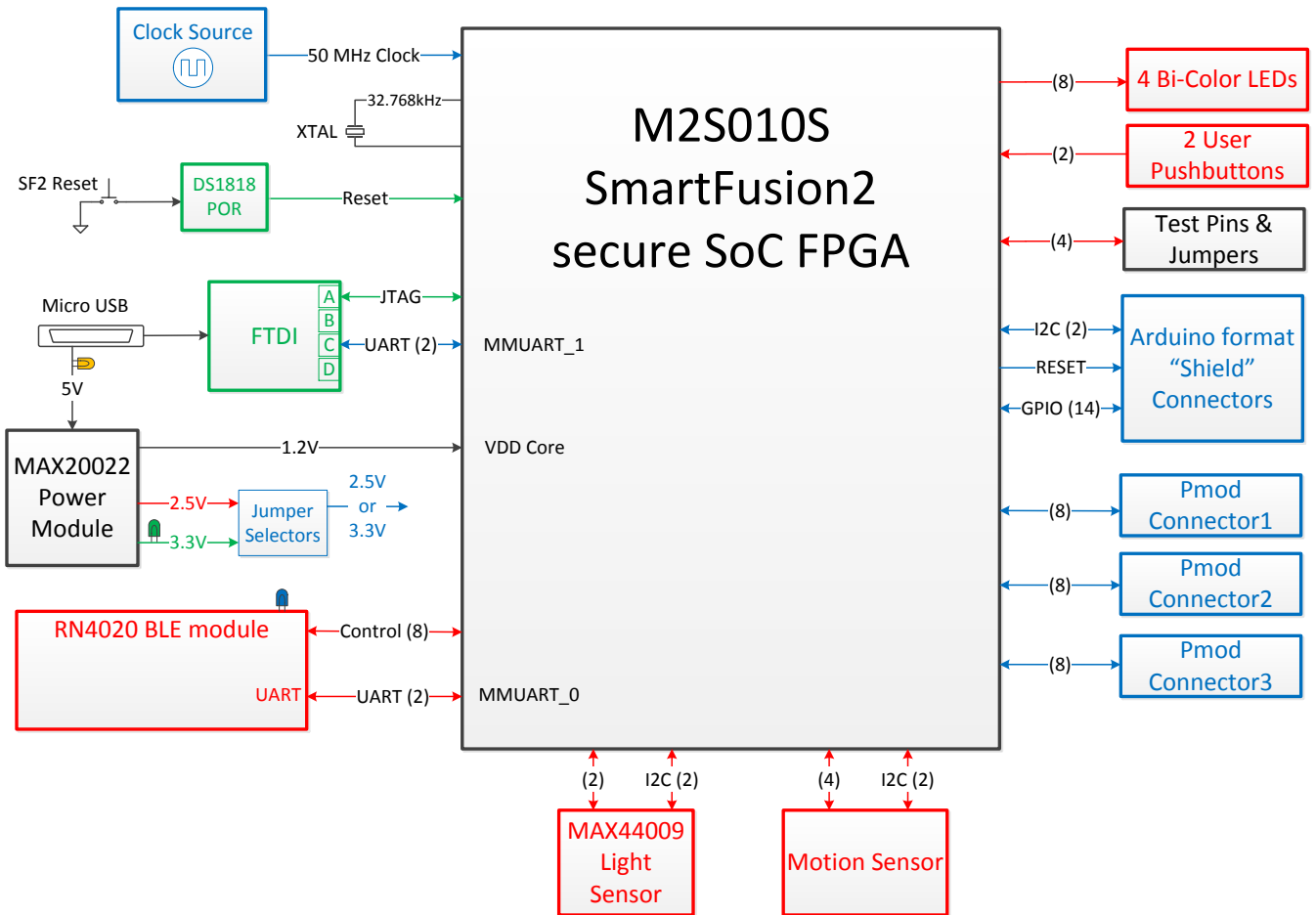
Clocking

- 50MHz LVCMOS oscillator

Power

- Maxim MAX20022 Power management IC

Board Level Block Diagram



Example Design Requirements

The following items are required for proper completion of this getting started guide tutorial.

Software

The software requirements for this guide are:

- Windows 7, Windows 8.1
- USB UART/JTAG drivers
- Windows SmartFusion2 KickStart Tester utility

The software requirements for the Android Test Utility are:

- Android 4.4 (KitKat) and later

Hardware

The hardware setup used by this example design includes:

- Avnet KickStart board
- USB-A to USB-micro B cable

Optional Hardware Requirements

The Android hardware setup used by this example design includes:

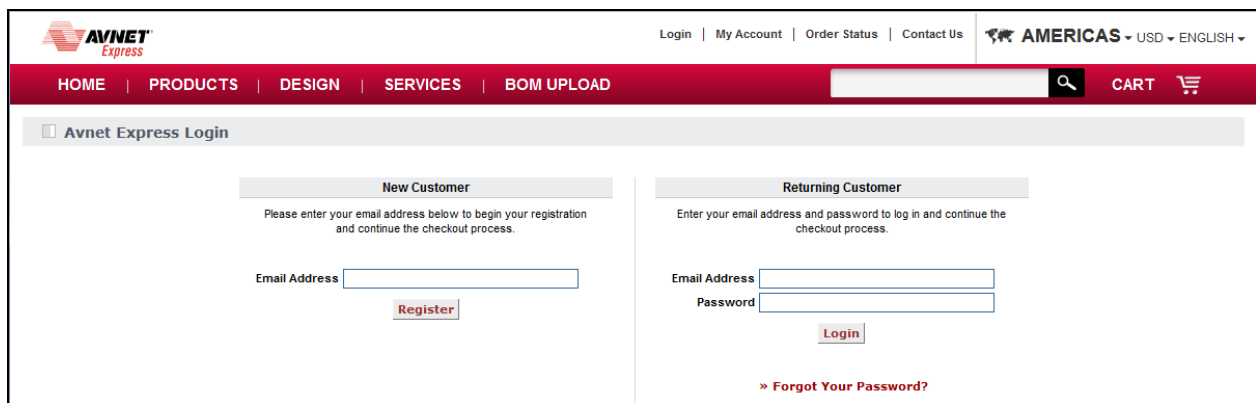
- Android tablet or smartphone with Bluetooth LE / BT Smart / BT 4.0 (or later)

PC Setup

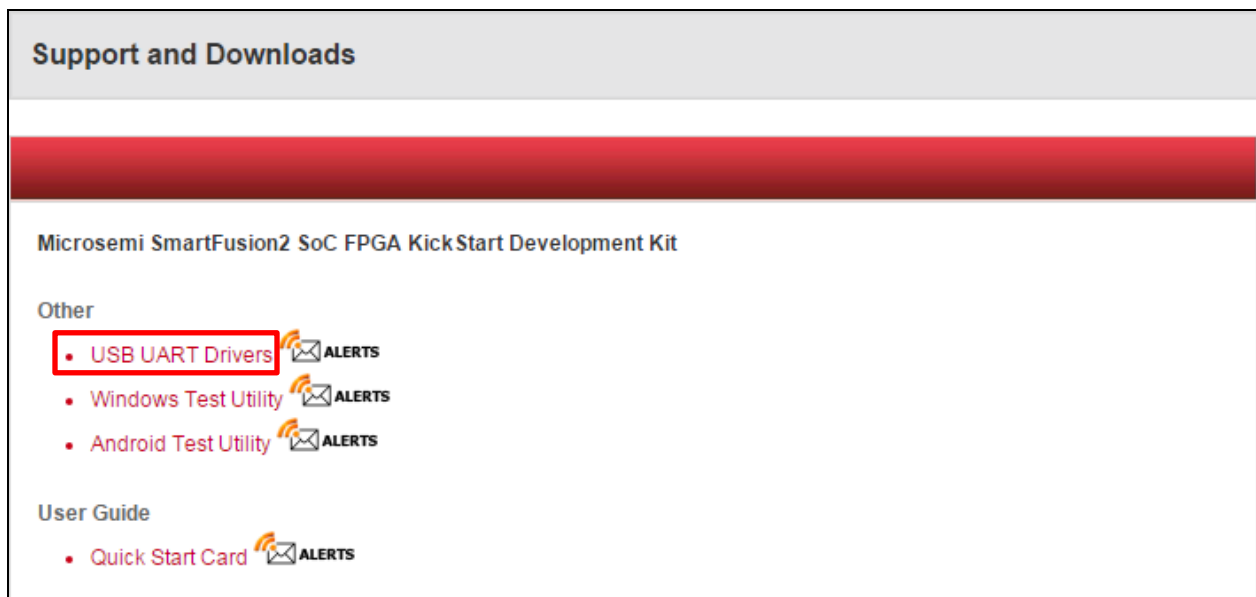
Download and Install the USB UART/JTAG Driver

The USB UART/JTAG drivers must be installed prior to running the Windows SF2 KickStart Tester utility. These drivers are included with the Microsemi Libero SoC tools installation and are also installable separately. **If the Libero tools have not been installed yet**, follow the instructions below to install these drivers. See [Appendix I: Determining the Virtual COM Port](#) for information on identifying the COM port in use on the host PC.

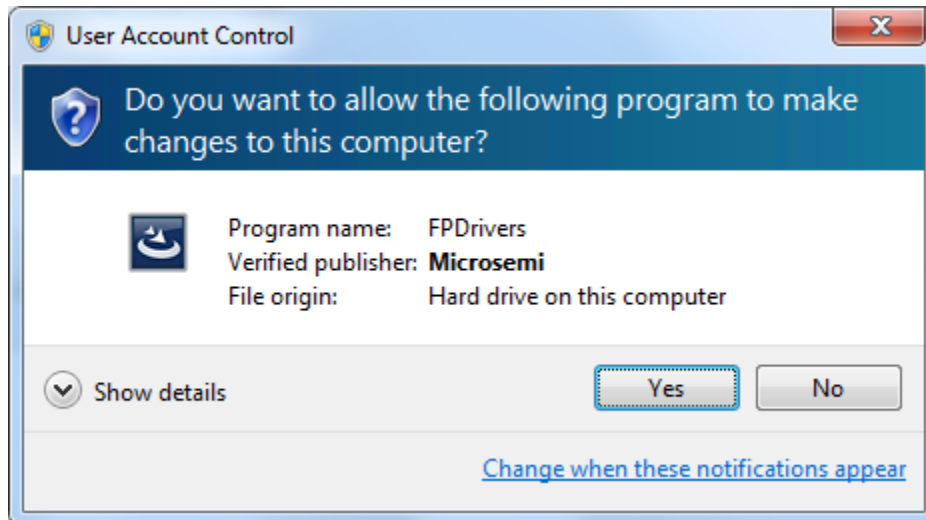
1. Use a web browser to navigate to www.em.avnet.com/SmartFusion2-KickStart. Click on the **Support Files & Downloads** link to enter the Avnet DRC page for the SmartFusion2 KickStart Kit. You will be prompted to either register or provide your login credentials:



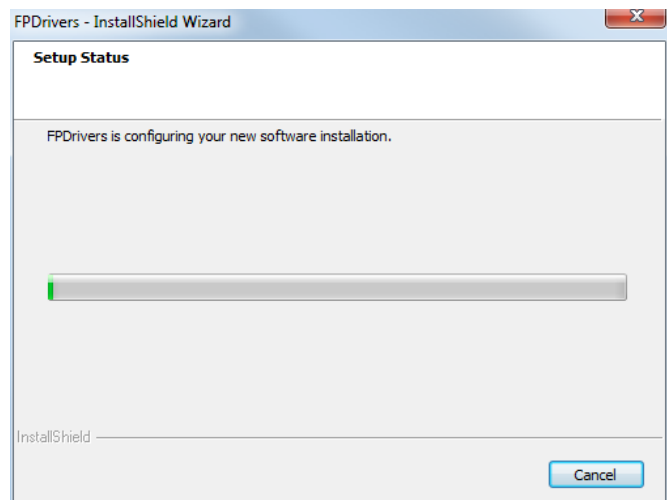
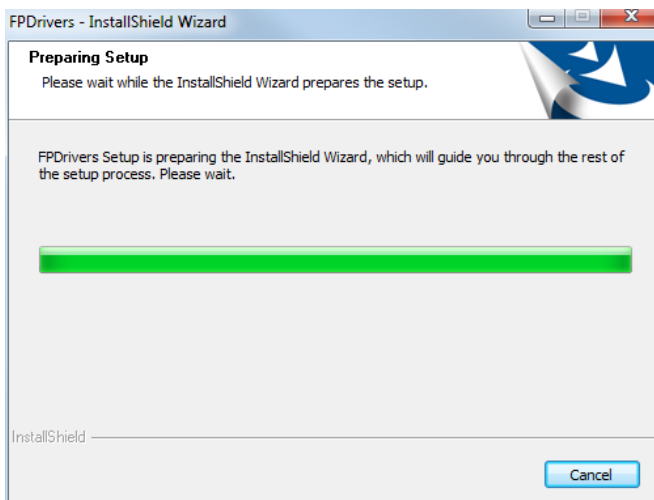
2. Scroll to the bottom of the page and click to download the **USB Drivers**. Download and extract the zip archive to a folder of your choice. Do not close the browser window.



- Using Windows Explorer, navigate to the <installation>\USB_Drivers folder and double-click the **FPDrivers.exe** application executable.
- If prompted, click **Yes** to allow the application to make changes to the computer.



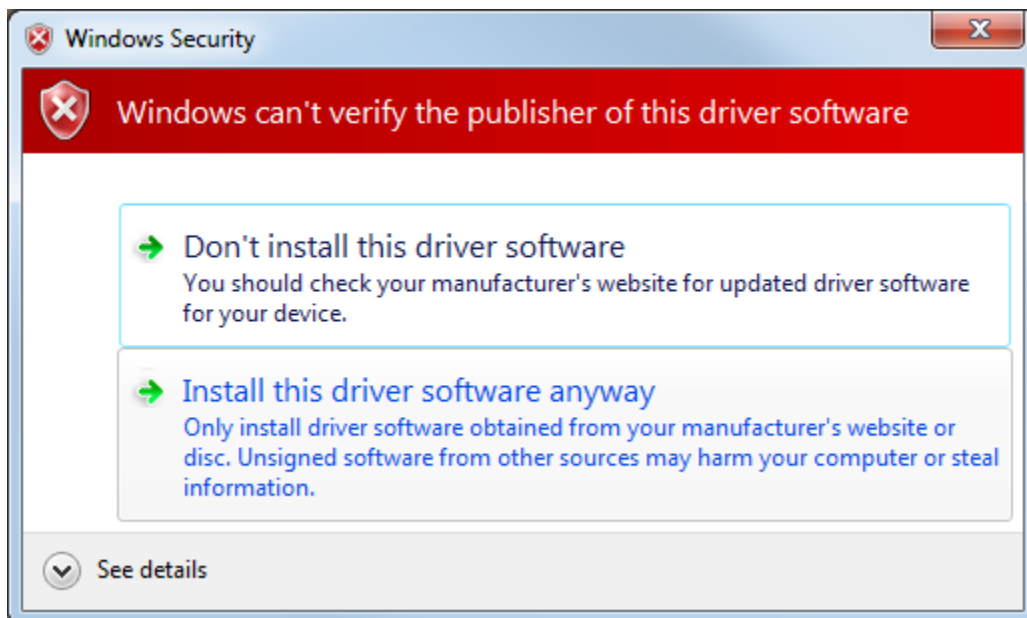
- You will see a couple of status windows as the installer prepares and installs the files.



- Click **Next** to continue the installation:



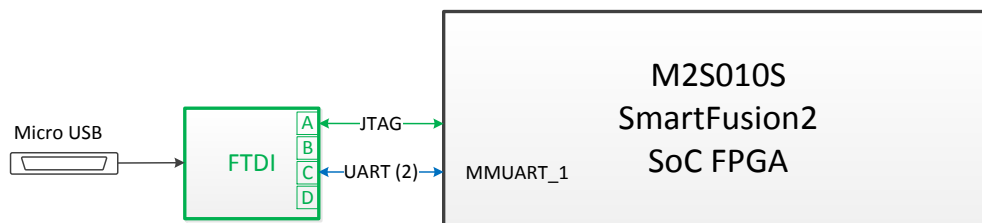
- Windows will complain that it can't verify the publisher of the drivers. This is OK. Click **Install this driver software anyway** to continue:



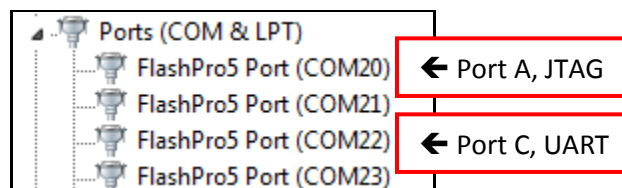
8. Click **Finish** to complete the installation. The USB UART drivers are now ready to use.



9. The FTDI USB chip on the KickStart board provides four COM ports, but only two are used. Port A is used for JTAG communication with the SmartFusion2 SoC FPGA and Port C is a standard serial UART:



10. However, all four ports are displayed in the Windows Device Manager. The Libero tools (Port A) and the Windows Test Utility (Port C) are designed to know which COM port to connect to. The remaining ports are phantom with no system connection:

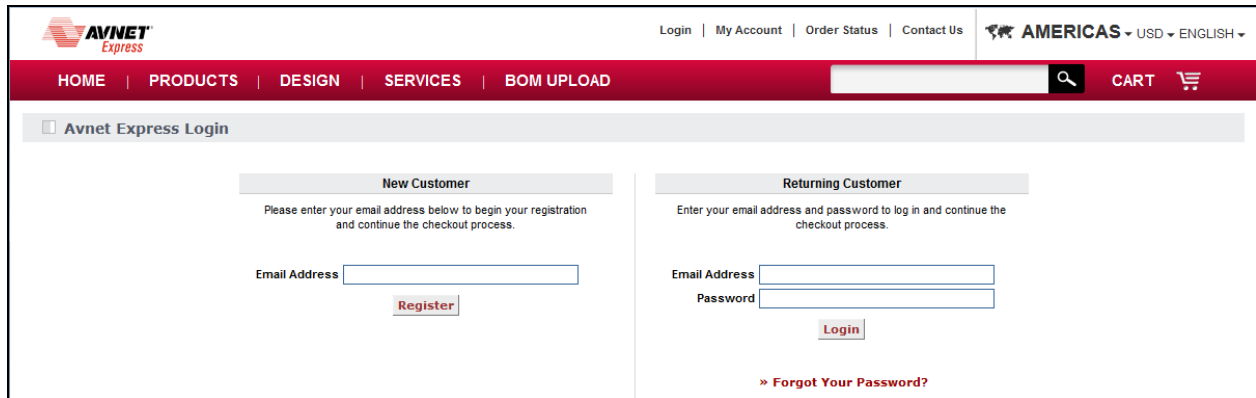


Installing a Serial Console on a Windows 7 Host

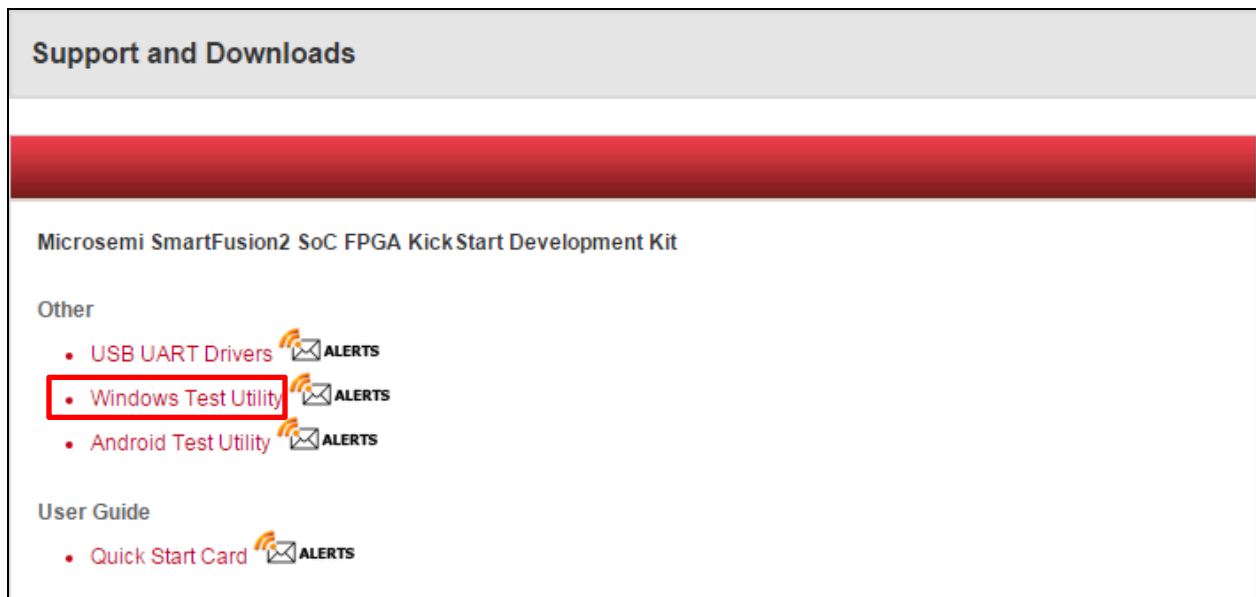
Starting with Windows 7, Microsoft no longer includes the HyperTerminal terminal emulator software. A suitable free and open-source replacement for HyperTerminal is TeraTerm. Download and install instructions for TeraTerm can be found at <http://en.sourceforge.jp/projects/ttssh2>.

Download the Windows Test Utility Software

1. Open the web browser you used earlier. If you closed the browser then open a new one and navigate to www.em.avnet.com/SmartFusion2-KickStart. Click on the **Support Files & Downloads** link to enter the Avnet DRC page for the SmartFusion2 KickStart Kit. You may be prompted to either register or provide your login credentials:



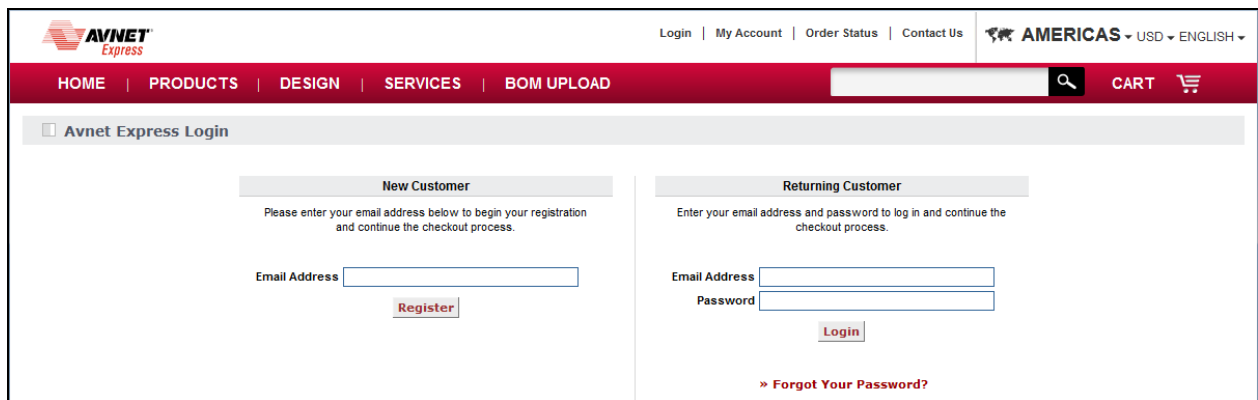
2. Scroll to the bottom of the page and click to download the **Windows Test Utility**. Download and extract the zip archive to a folder of your choice where you have permissions to create folders. Note the location of the extracted **SF2KickStartTester.exe** software application. You will need this later. Do not close the browser window.



Android Setup

The KickStart Board is equipped with a Bluetooth 4.1 Low Energy (BLE) module from Microchip, making the board a great platform for prototyping low bandwidth wireless applications. If you have an Android tablet or smartphone you can download and install the Android Test Utility and interact with the LEDs, switches, and sensors on the KickStart Board over the Bluetooth interface.

1. Make sure your Android device supports Bluetooth Low Energy (LE) 4.0 or later as described in the [Optional hardware Requirements](#).
2. Open the web browser you used earlier. If you closed the browser then open a new one and navigate to www.em.avnet.com/SmartFusion2-KickStart. Click on the **Support Files & Downloads** link to enter the Avnet DRC page for the SmartFusion2 KickStart Kit. You will be prompted to either register or provide your login credentials:



Avnet Express Login

New Customer
Please enter your email address below to begin your registration and continue the checkout process.

Email Address

Register

Returning Customer
Enter your email address and password to log in and continue the checkout process.

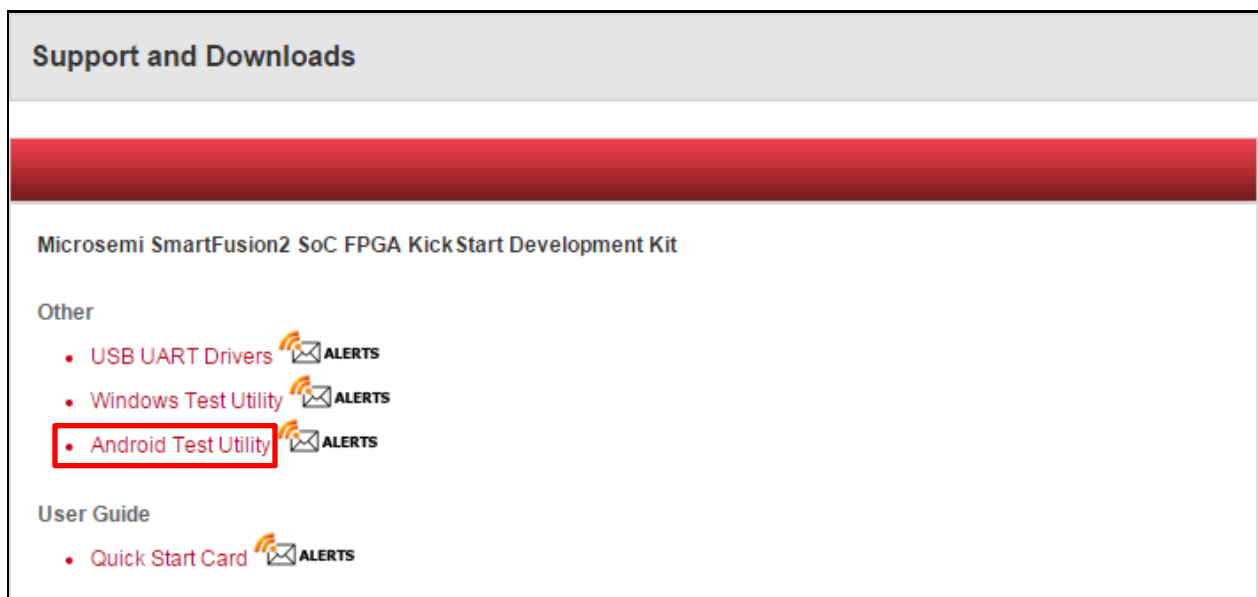
Email Address

Password

Login

[» Forgot Your Password?](#)




3. Scroll to the bottom of the page and click to download the **Android Test Utility**. Download and extract the zip archive to a folder of your choice. Note the location of the extracted software application. You will need this later. Do not close the browser window.




Support and Downloads

Microsemi SmartFusion2 SoC FPGA Kick Start Development Kit

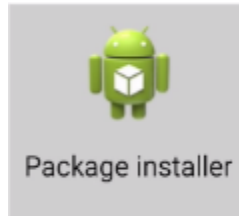
Other

- **USB UART Drivers** 
- **Windows Test Utility** 
- **Android Test Utility** 

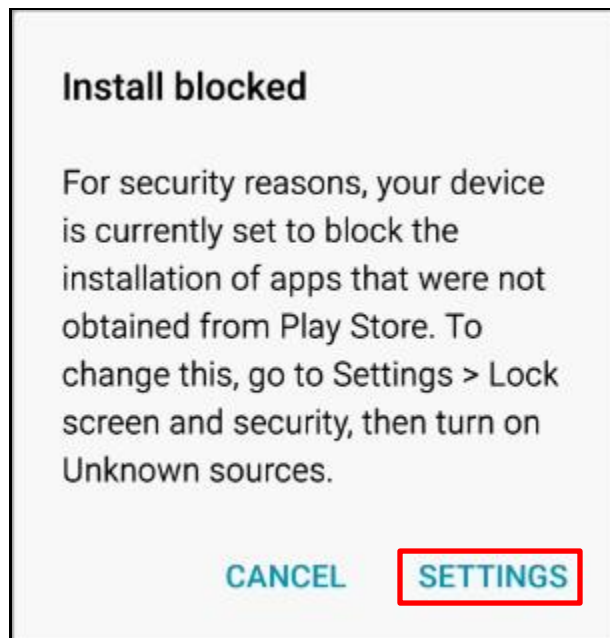
User Guide

- **Quick Start Card** 

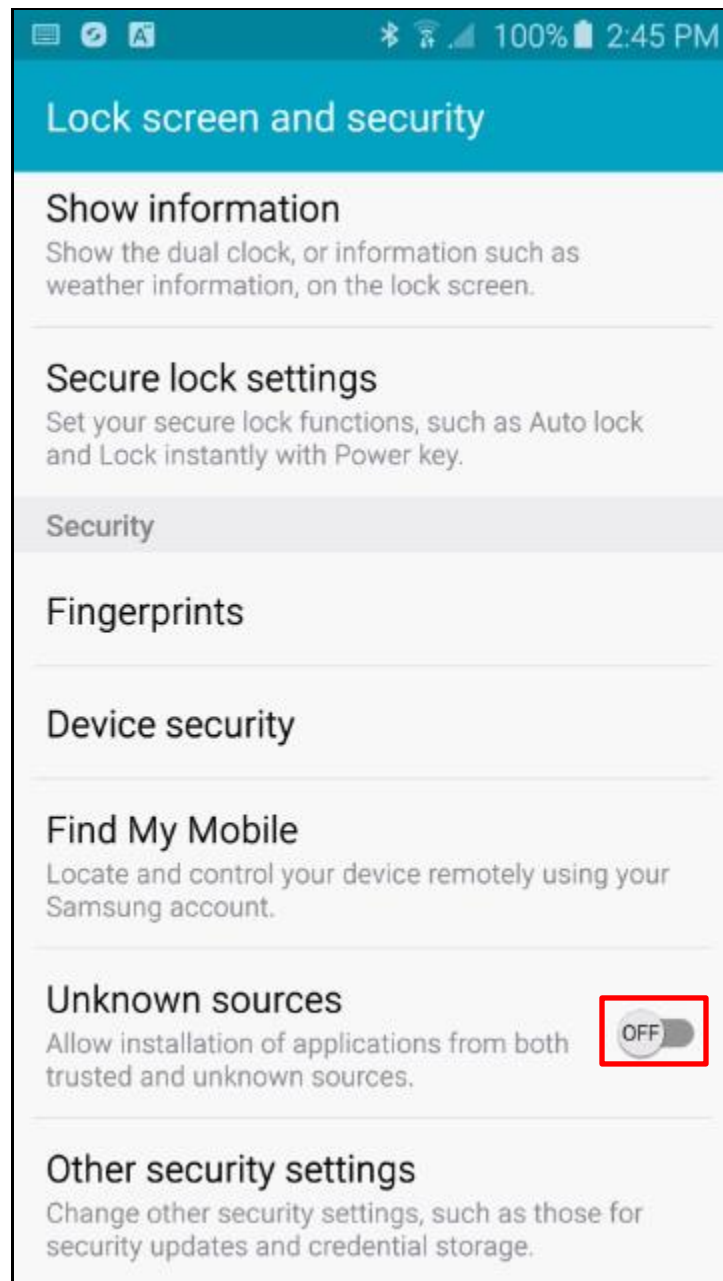
4. The easiest way to install the Android Test Utility on your Android device is via email attachment. Using your favorite PC email client, send an email to an account accessible by your Android device with the <installation>\Android_Test_Utility\KickStartAndroid.apk file as an attachment.
5. Once the email has been received on the Android device, tap on the **KickStartAndroid.apk** file attachment and you should be prompted to open the file with the Package Installer. Tap the **Package Installer** icon to install the application.



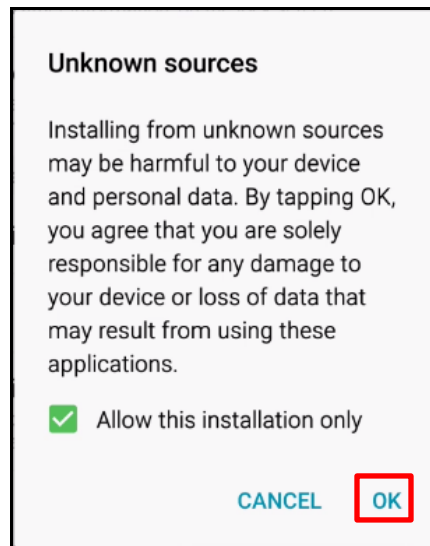
6. For security reasons your Android device may be blocked from installing applications from unknown sources. You may need to edit your device settings to allow the application to be installed. The specific procedure for doing this varies among Android versions and also depends on the phone's manufacturer, but will be similar to the following steps. Select **Settings** to go directly to the **Security Settings**.



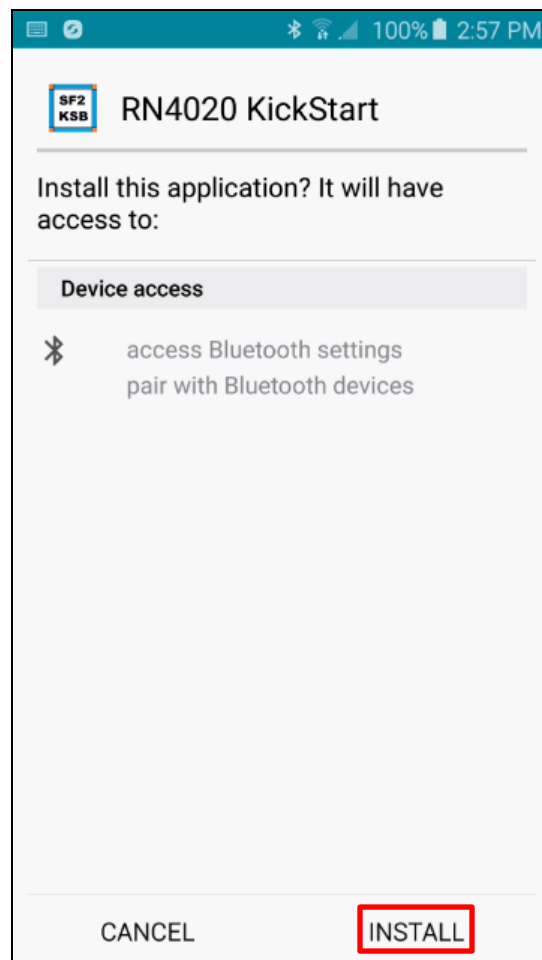
7. Look for a setting named **Unknown sources** or something similar and tap to enable installation from both trusted and unknown sources:



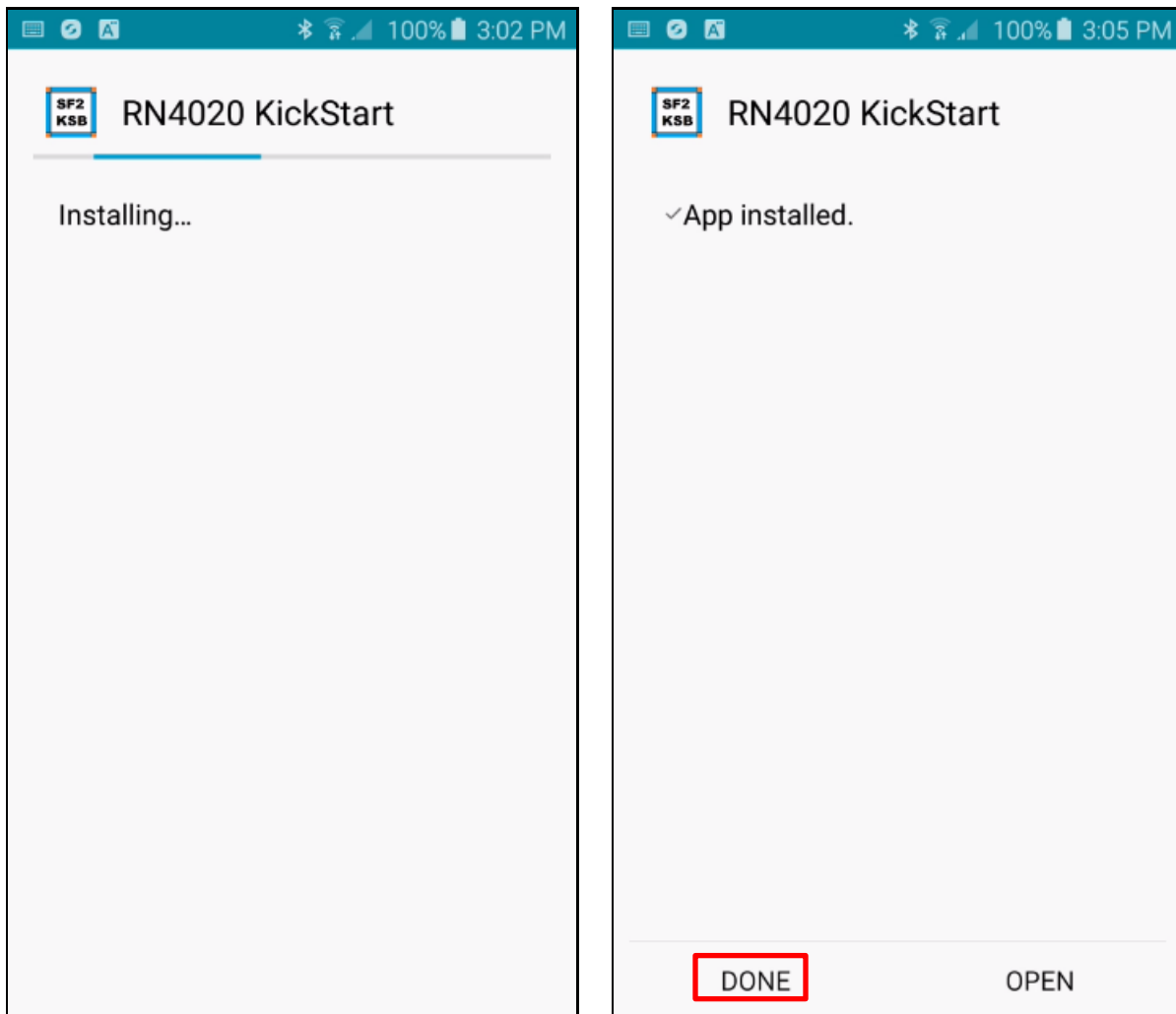
8. You may be prompted to verify that you know what you are doing, and to enable this setting for this installation only. Tap **OK** to continue:



9. Tap **INSTALL** to install the application:

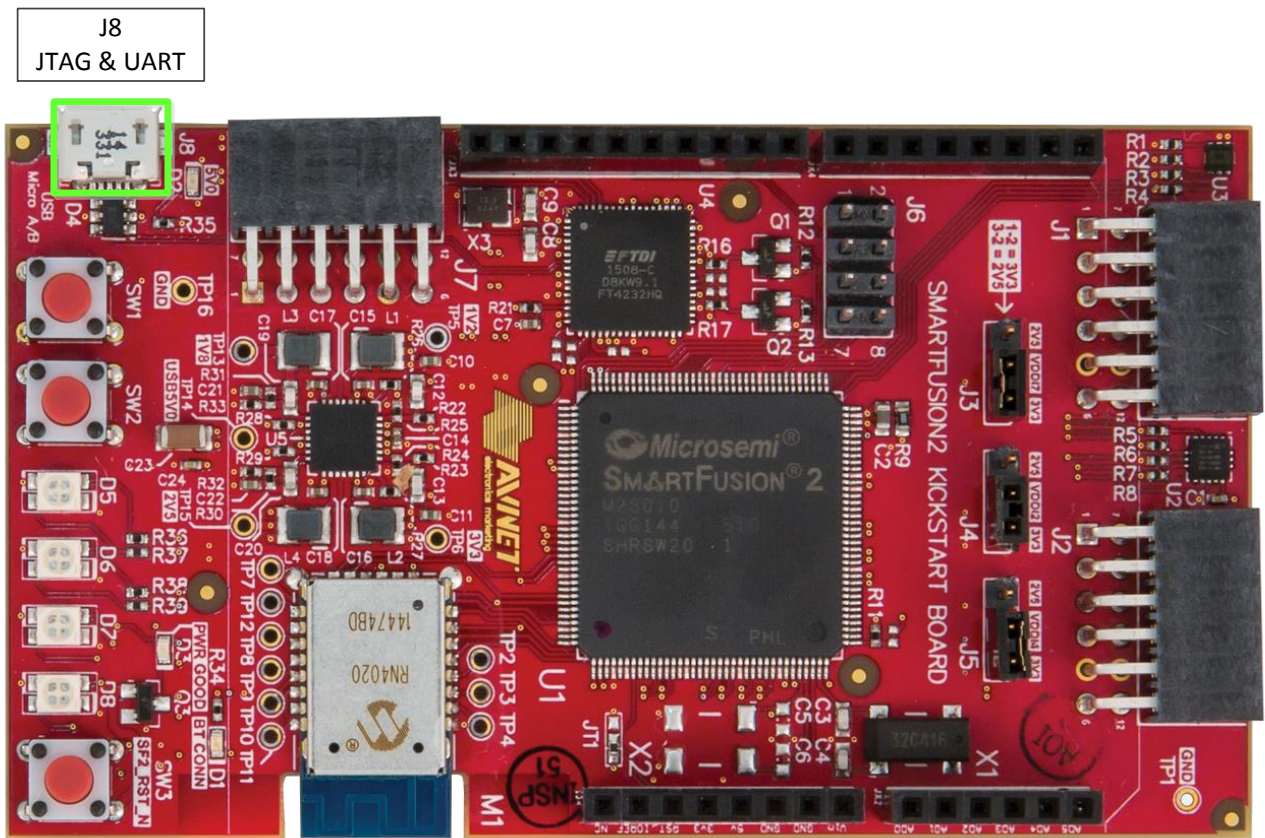


10. You may see a status window as the application installs. Tap **DONE** to close the installer. We are not ready to use the Android Test Utility yet.



Setting Up the KickStart Evaluation Board

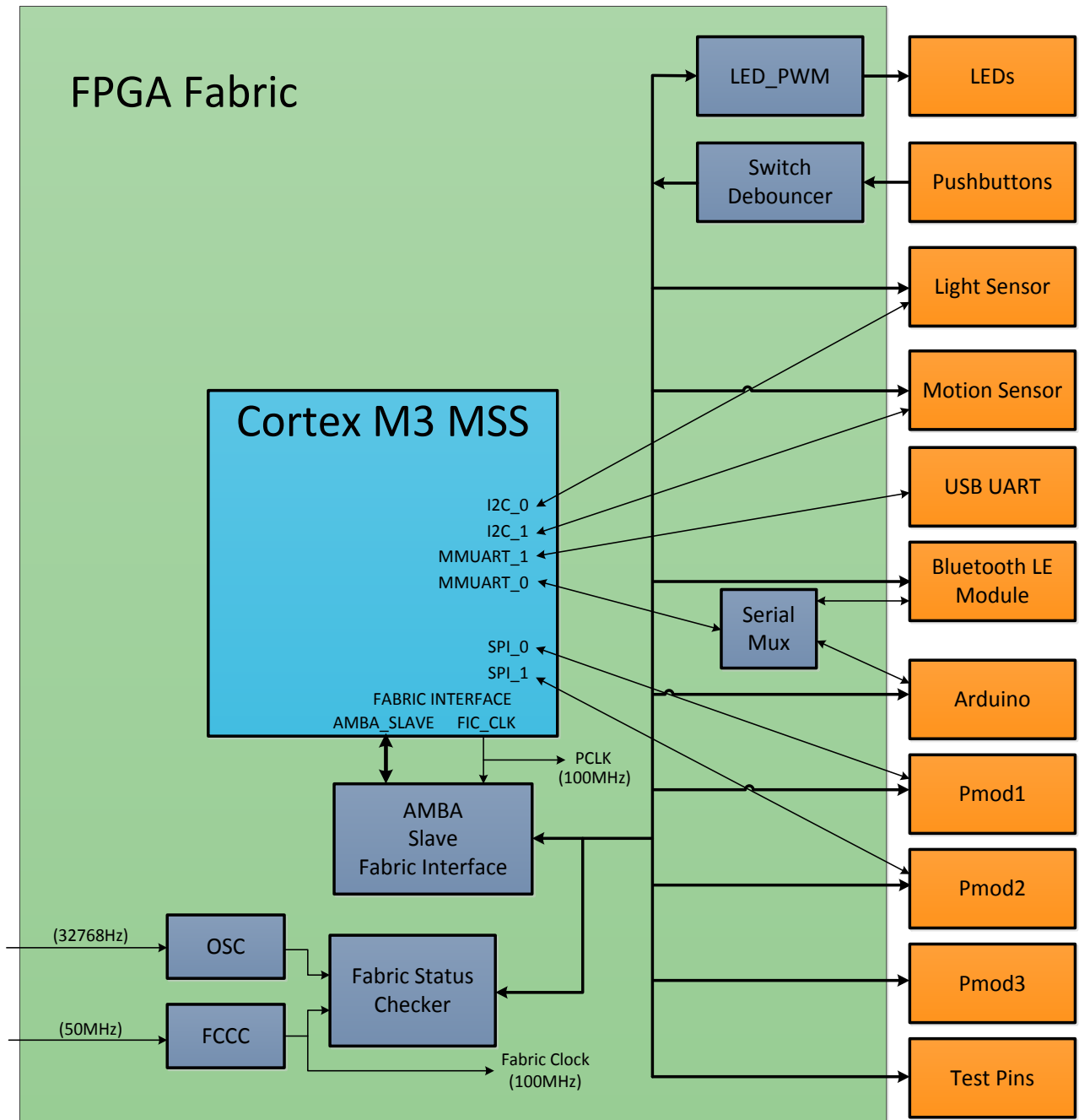
Refer to the following figure and perform the following steps to set up the board for running the example design.



1. Plug a USB cable into the PC and the combination JTAG & UART port (J8) (this will also power the board).

Hardware Design Block Diagram

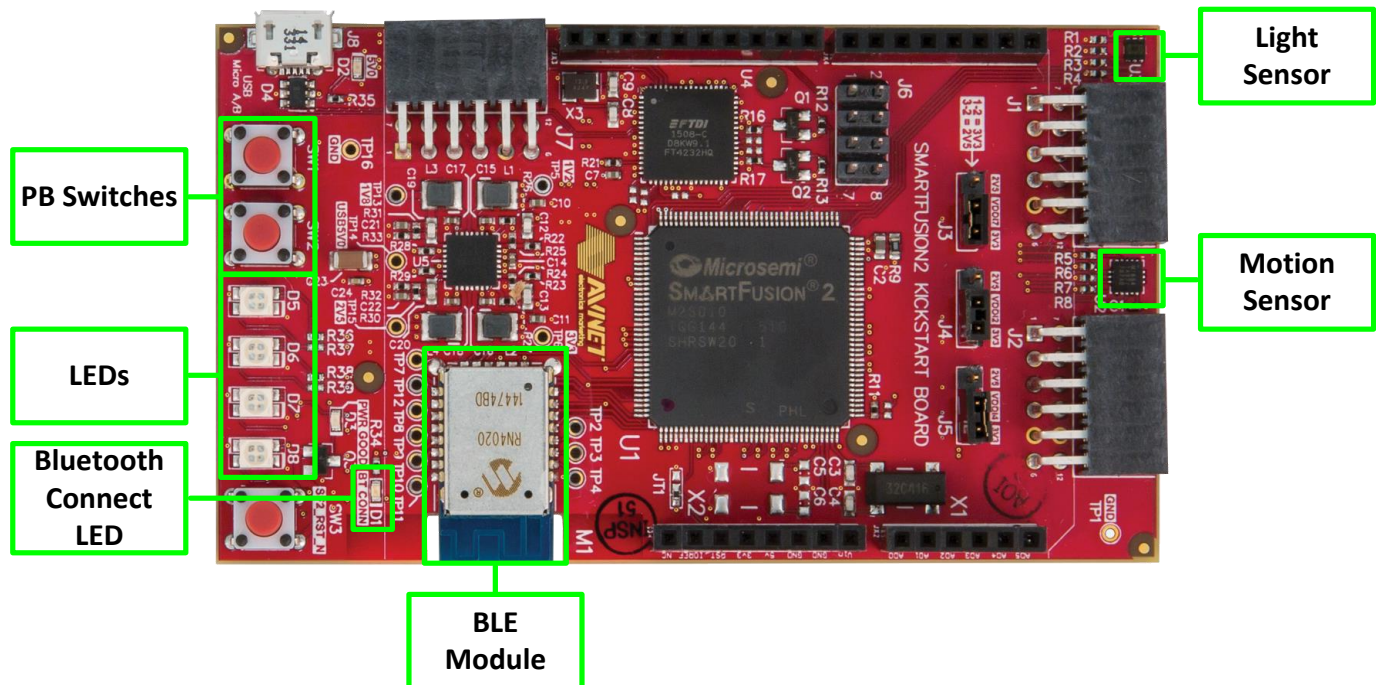
The following figure shows a high-level block diagram of the hardware design:



Windows and Android Test Utilities

KickStart Board Features Used with the Test Utilities

Refer to the figure below when running the Windows or Android Test Utility software applications. Note the location of the pushbutton switches, DIP switches, LEDs, and sensors.

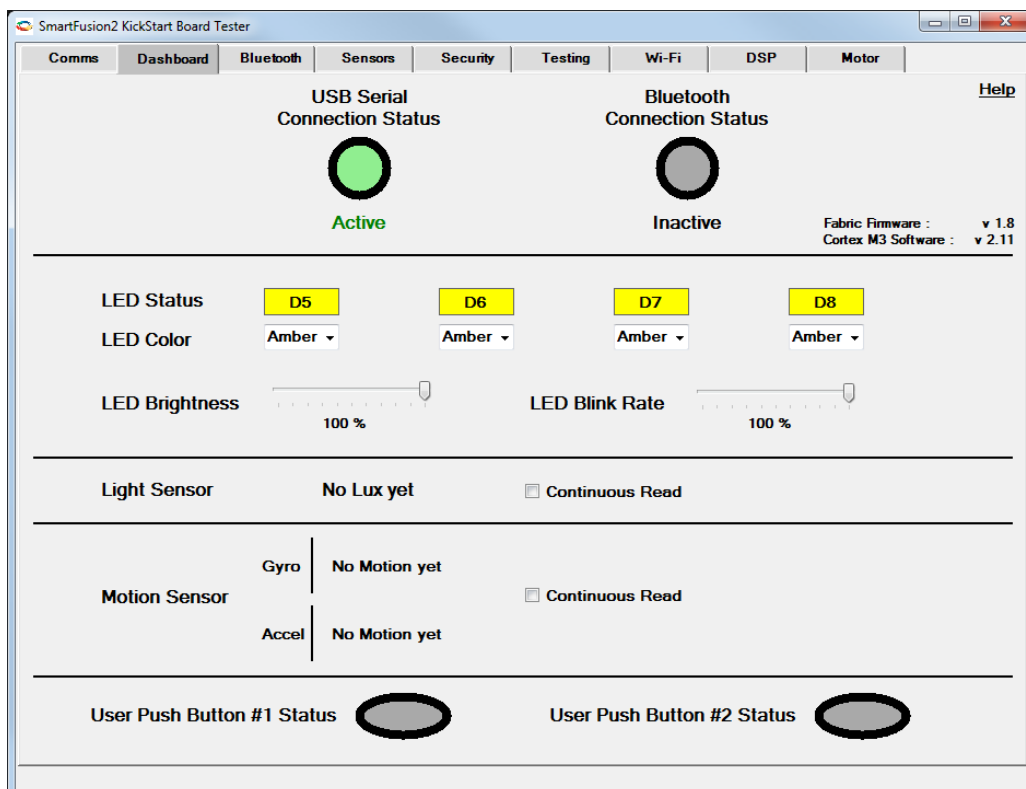


Windows Test Utility Operation

1. Be sure you have downloaded the test utility as described in [Download the Windows Test Utility Software](#).
2. Using Windows Explorer, navigate to the <installation>\Windows_Test_Utility folder and double-click the **SF2KickStartTester.exe** application executable.
3. When the application starts it will ping the available serial COM ports to identify the port connected to the USB UART port on the KickStart Board (COM22 in the screenshot below). Recall from the [Download and Install the USB UART/JTAG Driver](#) instructions that four COM ports are reported in Windows Device Manager but only two are connected to the SmartFusion2 SoC FPGA device on the KickStart board. Click on **Open Port** to open the Test Utility Dashboard:



4. The Test Utility will default to displaying the **Dashboard** tab:



5. Use this tab to interact with the LEDs and switches on the KickStart Board.
- a. Select different colors for the tri-color LEDs to display, and alter their brightness and blink rate:

LED Status	<div>D5</div>	<div>D6</div>	<div>D7</div>	<div>D8</div>
LED Color	<div>Red</div>	<div>Amber</div>	<div>Green</div>	<div>Amber</div>
LED Brightness	<div></div>		<div></div>	
	100 %		100 %	
LED Blink Rate				

- b. Press the pushbutton switches on the KickStart Board and watch the status of each switch change in the Dashboard:

User Push Button #1 Status	<div></div>	User Push Button #2 Status	<div></div>
----------------------------	-------------	----------------------------	-------------

- c. Click on **Continuous Read** to determine the status of the Light and Motion Sensors:

Light Sensor	66.6 Lux	<div><input checked="" type="checkbox"/> Continuous Read</div>	
Motion Sensor	<div><div>Gyro</div><div>X : 9 Y : -4 Z : 10</div><div>Accel</div><div>X : -240 Y : 12 Z : 15452</div></div>	<div><input checked="" type="checkbox"/> Continuous Read</div>	<div>Temperature</div> <div>33.063 °C 91.513 °F</div>

This concludes the description of the Windows Test Utility application.

Android Test Utility Operation

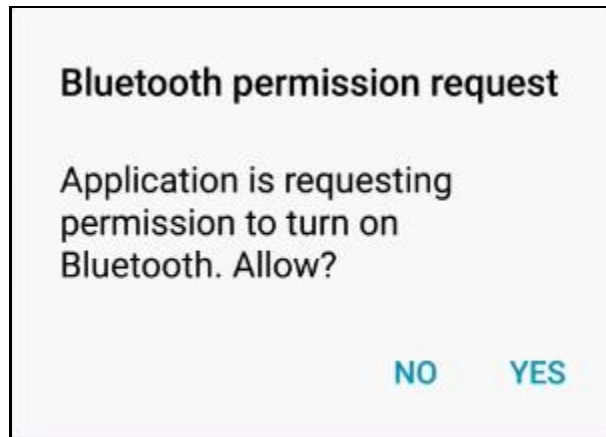
1. Be sure you have downloaded and installed the Android application as described in [Android Setup](#).
2. Do not try and use your phone's Bluetooth settings to connect to the KickStart board directly. This will cause connection issues with the Android Test Utility application.

Note: Strictly speaking the Bluetooth settings of the Android device *can* be used to connect to the KickStart board, but this will cause confusion with the test utility application if it also subsequently attempts to connect to the board.

3. Go to your Android device where the test utility application is installed and look for the application icon. Tap the icon to open the application.



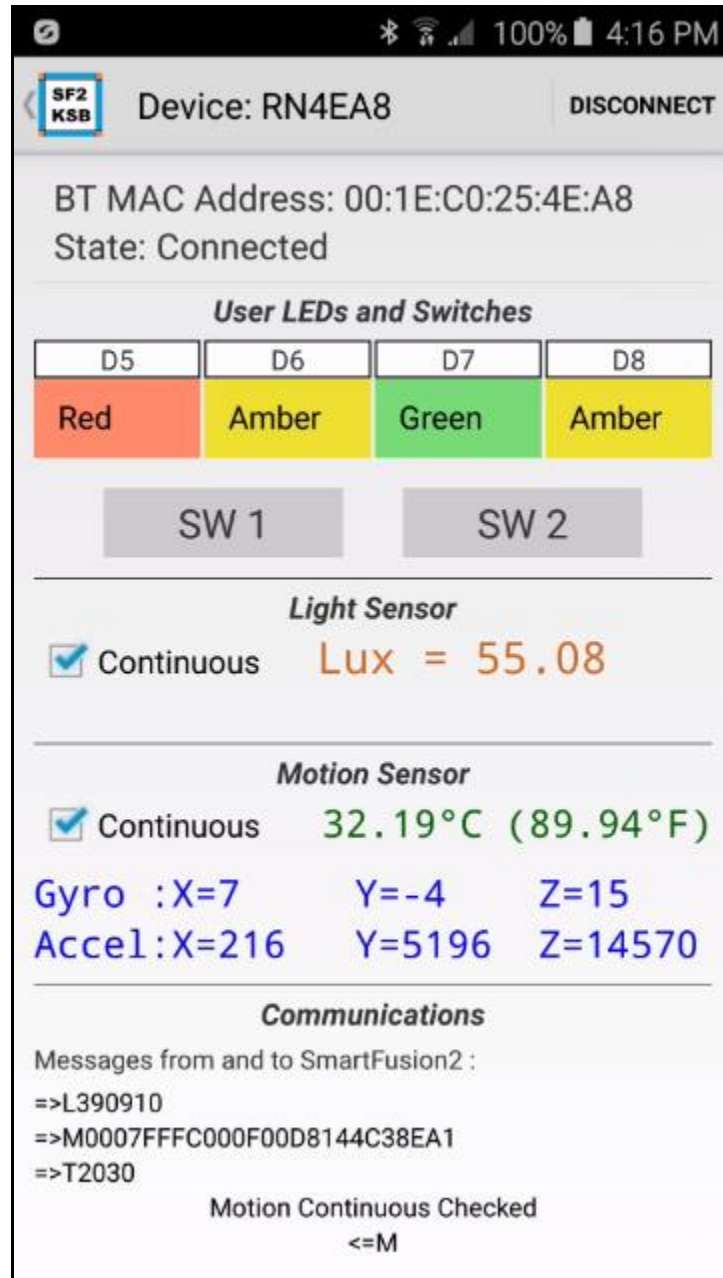
4. If the Bluetooth interface is currently disabled you will be prompted to allow the application to turn it on. Tap **YES** to continue:



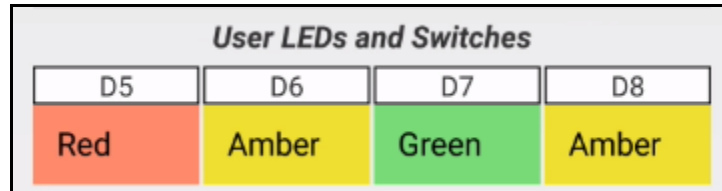
5. When the application starts it will automatically scan and find the KickStart Board. Tap on the **Device name** to open the dashboard similar to the Windows Test Utility application you probably used earlier. If the application does not connect, or if it quits unexpectedly, you may need to restart your Android device.



6. Much like the Windows Test Utility, the Android Test Utility allows you to set the color of the tri-color LEDs, read the pushbutton switches, and read the status of the light and motion sensors:



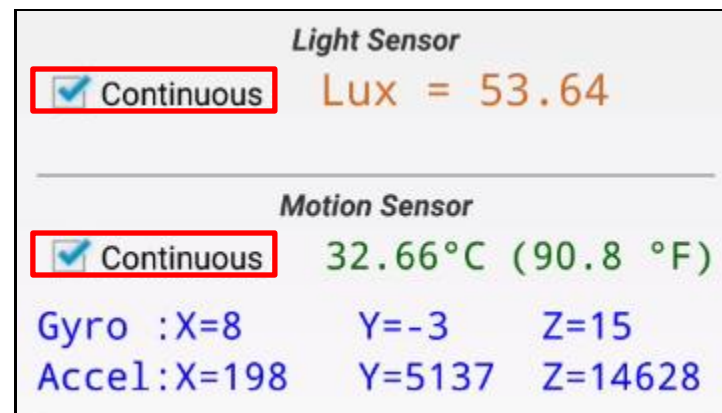
7. Use the application to interact with the LEDs and switches on the KickStart Board.
 - a. Select different colors for the tri-color LEDs to display:



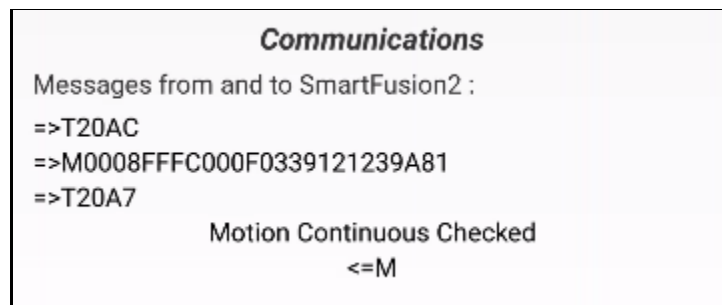
- b. Press the pushbutton switches on the KickStart Board and watch the status of each switch change:



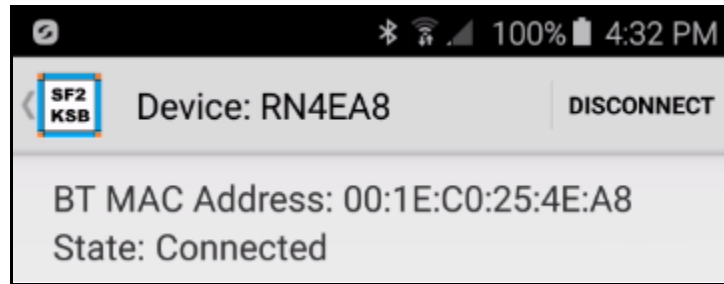
- c. Tap on **Continuous** to read the status of the light and motion Sensors:



8. You will notice that as the application reads the sensors and switches the communication messages are displayed at the bottom of the screen:



9. When finished tap DISCONNECT to close the Bluetooth connection and close the application.



This concludes the description of the Android Test Utility application.

What's Next

Now that you have taken some time to explore the Windows and Android Test Utilities and interacted with the example design programmed into the SmartFusion2 SoC FPGA device on the KickStart Board, it is time to explore how to modify this design or create a new design of your own. Please refer to the SF2 KickStart Reference Design Tutorial (included in the SF2 KickStart Reference Design files available online at www.em.avnet.com/SmartFusion2-KickStart) to learn more about this design and how to perhaps customize it for your own application using the SmartFusion2 SoC FPGA device.

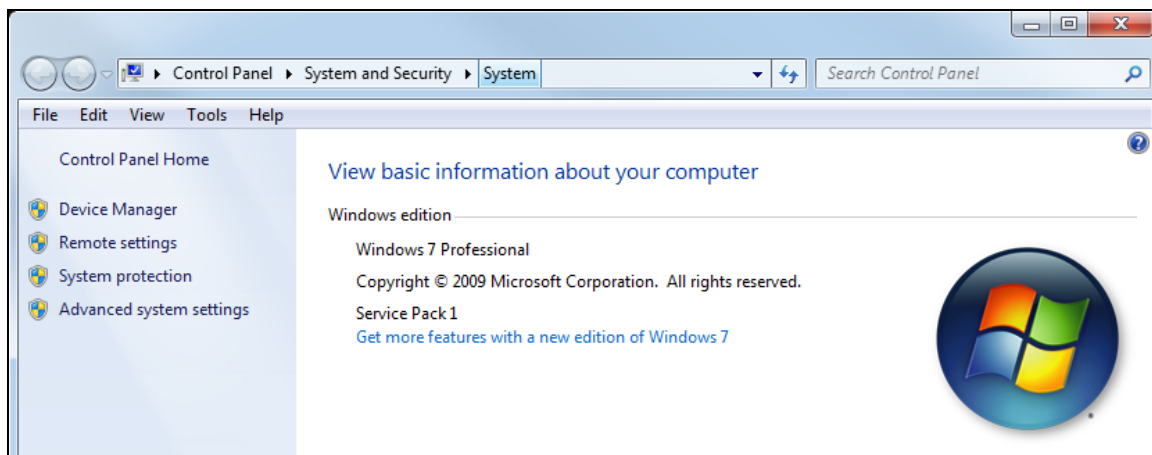
This concludes this Getting Started Guide.

Appendix I: Determining the Virtual COM Port

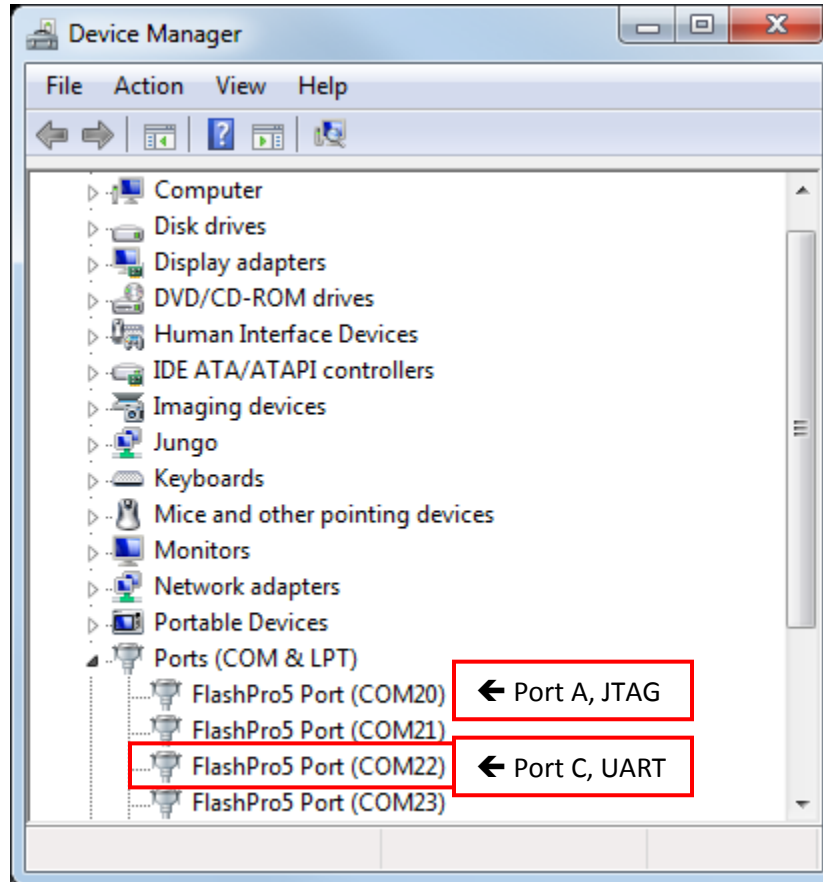
Now you can connect the evaluation board's USB-to-UART port to one of the USB ports on your PC. The new hardware detection will pop up and enumeration of the driver will be started. Once finished a virtual COMx port is created and you are ready to setup a connection using Windows HyperTerminal or comparable serial terminal emulation utility. Follow these instructions to determine the COMx port assigned to the USB-to-UART bridge:



1. Open the Device Manager by right-clicking on **Computer**, select **Properties**, then click on the **Device Manager**.



2. In the Device Manager, scroll down to Ports and expand the list. You will see the USB Serial Port and its assigned COM port. Recall from the [Download and Install the USB UART/JTAG Driver](#) instructions that four COM ports are reported in Windows Device Manager but only two are connected to the SmartFusion2 SoC FPGA device on the KickStart board. In the example below, the JTAG interface is COM20 and the UART is COM22. Make note of this COM port number for use with the Windows Test Utility that you will use elsewhere in this design tutorial. This concludes these USB UART driver and virtual COM port installation instructions.



Appendix II: Getting Help and Support

Avnet Website

- Evaluation Kit home page with Documentation and Reference Designs
www.em.avnet.com/SmartFusion2-KickStart
- Avnet support forum
community.em.avnet.com/t5/SmartFusion2-KickStart-Board/bd-p/SmartFusion2-KickStart

Microsemi Website

- More information about the SmartFusion2 KickStart Board:
www.microsemi.com/products/fpga-soc/design-resources/dev-kits/smartfusion2/kickstart-kit
- Helpful web links for more information about the SmartFusion2 family of SoC FPGA devices
 - *Family Overview*
www.microsemi.com/products/fpga-soc/soc-fpga/smartfusion2#overview
 - *Product Tables*
www.microsemi.com/products/fpga-soc/soc-fpga/smartfusion2#product-tables
 - *Documentation*
www.microsemi.com/products/fpga-soc/soc-fpga/smartfusion2#documentation
 - *Design Resources*
www.microsemi.com/products/fpga-soc/soc-fpga/smartfusion2#design-resources
- Details on the SmartFusion2 SOC FPGA family are included in the following documents:
 - *Product Brief* ([PB0115](#))
 - *Data Sheet* ([DS0451](#))
 - *Configuration User Guide* ([AC401](#))
- Microsemi SmartFusion2 product support
www.microsemi.com/products/fpga-soc/design-support/fpga-soc-support

Revision History

Version	Description	Date
1.0	Initial release for Vivado 2015.2	12 August 2015