User's Guide
SWRU463–February 2017

SimpleLink™ CC3220 Wi-Fi® LaunchPad™ Development Kit Hardware

The CC3220 device is part of the SimpleLink™ microcontroller (MCU) platform, which consists of Wi-Fi®, *Bluetooth*® low energy, Sub-1 GHz and host MCUs, which all share a common, easy-to-use development environment with a single core software development kit (SDK) and rich tool set. A one-time integration of the SimpleLink platform enables you to add any combination of the portfolio's devices into your design, allowing 100 percent code reuse when your design requirements change. For more information, visit www.ti.com/simplelink.

The CC3220 SimpleLink LaunchPad™ Development Kit (CC3220-LAUNCHXL) is a low-cost evaluation platform for ARM® Cortex®-M4-based MCUs. The LaunchPad design highlights the CC3220 Internet-on-a chip™ solution and Wi-Fi capabilities. The CC3220 LaunchPad also features temperature and accelerometer sensors, programmable user buttons, three LEDs for custom applications, and onboard emulation for debugging. The stackable headers of the CC3220 LaunchPad XL interface demonstrate how easy it is to expand the functionality of the LaunchPad when interfacing with other peripherals on many existing BoosterPack™ Plug-in Module add-on boards, such as graphical displays, audio codecs, antenna selection, environmental sensing, and more.

Contents

SimpleLink, LaunchPad, Internet-on-a chip, BoosterPack, Code Composer Studio, Tiva are trademarks of Texas Instruments.
ARM, Cortex are registered trademarks of ARM Limited.
Bluetooth is a registered trademark of Bluetooth SIG.
IAR Embedded Workbench is a registered trademark of IAR Systems AB.
Wi-Fi is a registered trademark of Wi-Fi Alliance.
All other trademarks are the property of their respective owners.

1 Introduction

1.1 CC3220 LaunchPad™

Created for the Internet of Things (IoT), the SimpleLink Wi-Fi CC3220 device is a single-chip microcontroller (MCU) with built-in Wi-Fi connectivity for the LaunchPad ecosystem, that integrates a high-performance ARM Cortex-M4 MCU allowing customers to develop an entire application with one device. With on-chip Wi-Fi, Internet, and robust security protocols, no prior Wi-Fi experience is required for fast development.

The CC3220 LaunchPad, referred to by its part number CC3220-LAUNCHXL, is a low-cost evaluation platform for ARM Cortex-M4-based MCUs. The LaunchPad design highlights the CC3220 Internet-on-a chip solution and Wi-Fi capabilities. The CC3220 LaunchPad also features temperature and accelerometer sensors, programmable user buttons, three LEDs for custom applications, and onboard emulation for debugging. The stackable headers of the CC3220 LaunchPad XL interface demonstrate how easy it is to expand the functionality of the LaunchPad when interfacing with other peripherals on many existing BoosterPack add-on boards, such as graphical displays, audio codecs, antenna selection, environmental sensing, and more. Figure 1 depicts the CC3220 LaunchPad. There are two variants of the Launchpad: the CC3220S-LAUNCHXL and the CC3220SF-LAUNCHXL. This user's guide applies to both variants, and any differences are pointed out in relevant sections.

Multiple development environment tools are also available, including TI's Eclipse-based Code Composer Studio™ integrated development environment and IAR Embedded Workbench®. More information about the LaunchPad, the supported BoosterPack modules, and the available resources can be found at TI's LaunchPad portal. Also visit the CC3220 Wiki page for design resources and example projects.

NOTE: The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons, and must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE: All figures and references in this document apply to RevB. Most of the document also applies to higher revisions, unless otherwise stated. For the exact list of changes made across board revisions, refer to Table 10.

1.2 Key Features

- CC3220, SimpleLink Wi-Fi, Internet-on-a chip solution with integrated MCU
- 40-pin LaunchPad standard that leverages the BoosterPack ecosystem
- XDS110-based JTAG emulation with serial port for flash programming
- Two buttons and three LEDs for user interaction
- Back-channel universal asynchronous receiver/transmitter (UART) through USB to PC
- Onboard chip antenna with U.FL for conducted testing
- Onboard accelerometer and temperature sensor for out-of-box demo
- Micro USB connector for power and debug connections

1.3 Kit Contents

- CC3220 LaunchPad development tool (CC3220SF-LAUNCHXL)
- Micro USB cable
- Quick start guide

1.4 Regulatory Compliance

The CC3220 LaunchPad hardware was tested for and found to be in compliance with R&TTE, FCC, and IC regulations regarding unlicensed intentional radiators.

2 Hardware Description

Figure 1 shows the CC3220 LaunchPad EVM.

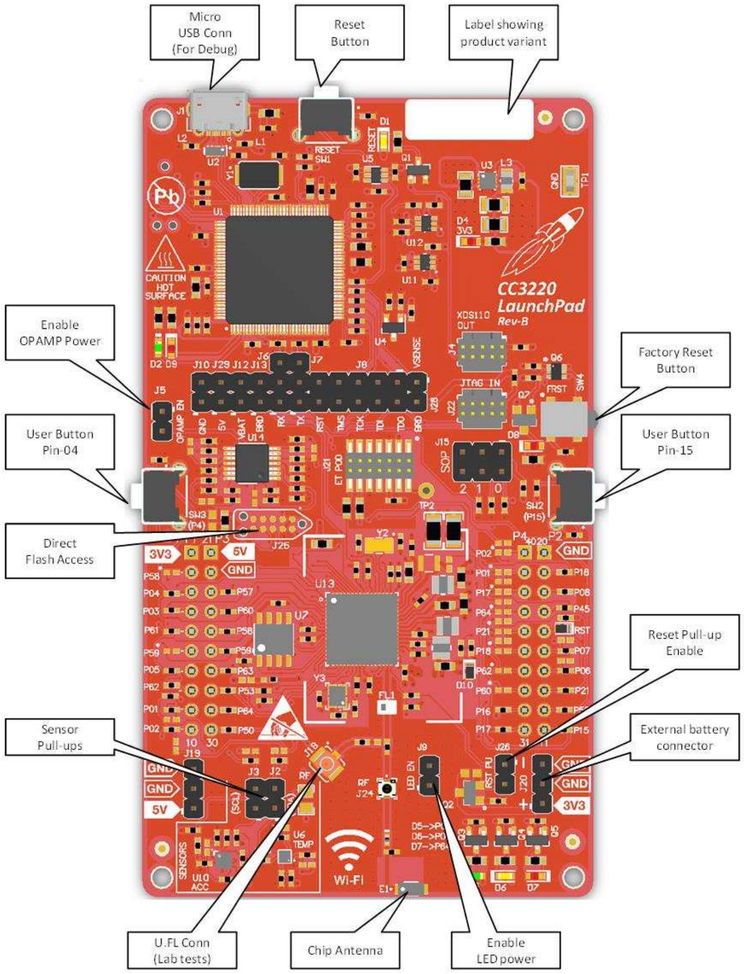

Figure 1. CC3220 LaunchPad™ EVM Overview

2.1 Block Diagram

Figure 2 shows the CC3220 block diagram.

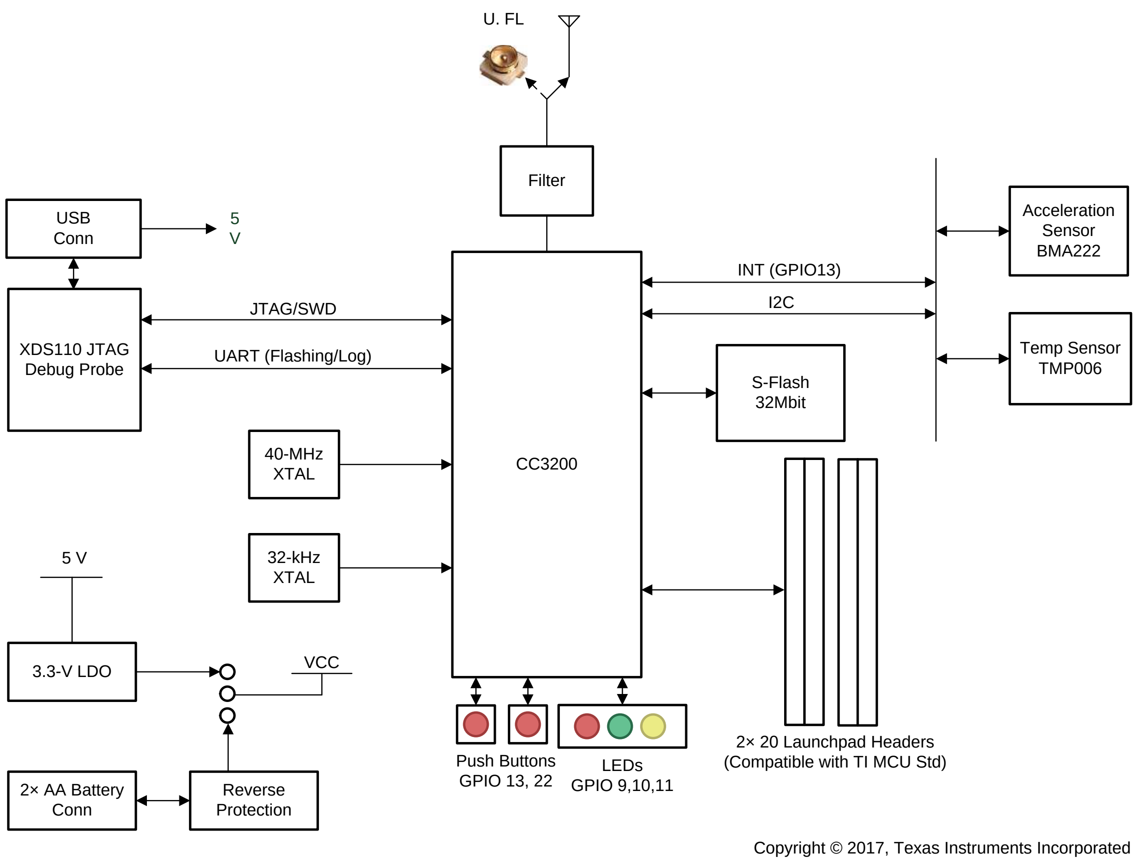

Figure 2. CC3220 Block Diagram

2.2 Hardware Features

- CC3220, SimpleLink Wi-Fi, Internet-on-a chip solution with integrated MCU
- 40-pin LaunchPad standard that leverages the BoosterPack ecosystem
- TI Standard XDS110-based JTAG emulation with serial port for flash programming
- Supports both 4-wire JTAG and 2-wire SWD
- Two buttons and three LEDs for user interaction
- Virtual COM port UART through USB on PC
- Onboard chip antenna with U.FL for conducted testing selectable using 0-Ω resistors
- Onboard accelerometer and temperature sensor for out-of-box demo, with option to isolate them from the inter-integrated circuit (I2C) bus
- Micro USB connector for power and debug connections
- Headers for current measurement and external JTAG connection with an option to use the onboard XDS110 to debug customer platforms
- Bus-powered device, with no external power required for Wi-Fi
- Long-range transmission with a highly optimized antenna (200-meter typical in open air with a 6-dBi antenna AP)
- Can be powered externally, working down to 2.3 V (typical)

2.3 Connecting a BoosterPack™

A compatible BoosterPack can be stacked on top of the LaunchPad using the 2-pin × 20-pin connectors. The connectors do not have a key to prevent the misalignment of the pins or reverse connection.

Ensure that the VCC and 5-V pins are aligned with the BoosterPack module header pins. On the CC3220 LaunchPad, a small white 3V3 tag symbol is provided near Pin 1 (see Figure 3) to orient all BoosterPack modules. This same marking, provided on compatible BoosterPack modules, must be aligned before powering up the boards.

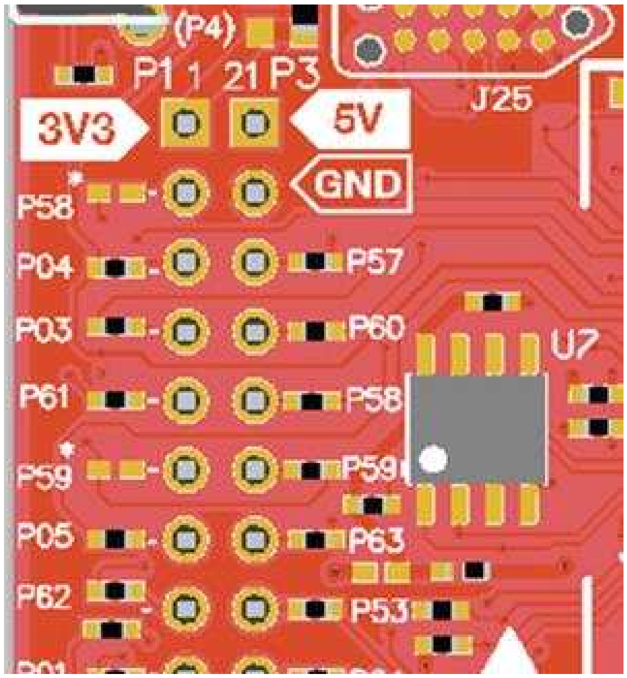

Figure 3. Pin 1 Marking on the CC3220LP (3V3 Tag)

2.4 Wired Connections, Jumper Settings, Buttons, and LEDs

2.4.1 JTAG Headers

The headers are provided on the board to isolate the CC3220 device from the onboard XDS110-based JTAG emulator. These jumpers are shorted by default when the board is shipped from TI.

To connect an external emulator, remove these jumpers and place the external emulator on the JTAG IN connector. Figure 4 and Table 1 are for default configurations, and Figure 5 shows the external emulator connection.

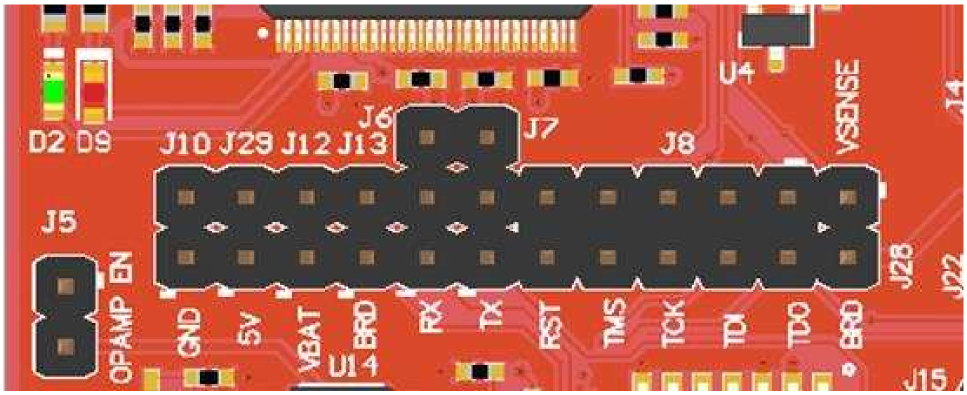

Figure 4. Default Jumper Configuration for JTAG Lines

Table 1. JTAG Header Pin Definitions

Reference	Usage	Comments
J8 (TCK) [(1)]	JTAG / SWD	Jumpers populated: onboard emulator connected Jumpers not populated: onboard emulator disconnected
J8 (TMS) [(1)]	JTAG / SWD	
J8 (TDI)	JTAG	
J8(TDO)	JTAG	

(1) For the SWD mode, only TCK and TMS must be shorted to the CC3220.

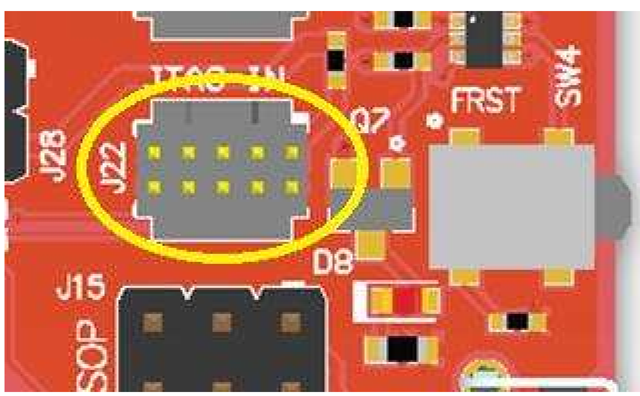

Figure 5. JTAG IN Connector (J22, Circled)

2.4.2 I2C Connections

The board features an accelerometer and a temperature sensor for the out-of-box demo. These are connected to the I2C bus, and can be isolated using the jumpers provided (shown as yellow jumpers J2 and J3 in Figure 6).

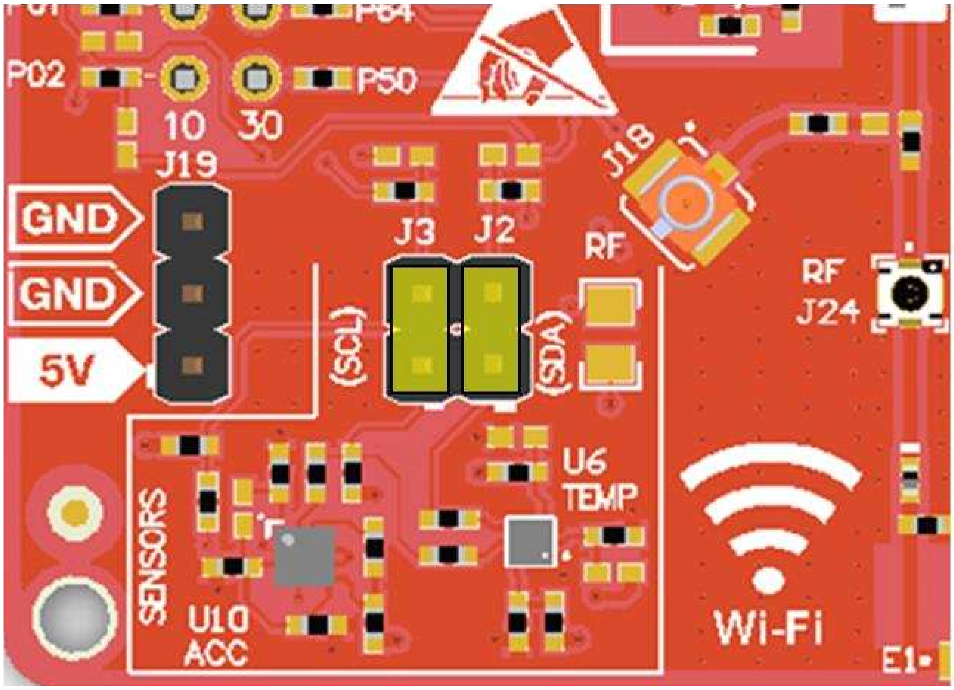

Figure 6. I2C Bus Connections

By removing J2 and J3, the accelerometer and the temperature sensors are isolated from the I2C bus. This measure also removes the I2C pullup resistors from the sensor side of the circuit, and therefore any connection to the circuit requires the user to install external pullup resistors.

Table 2 lists the I2C jumper definitions.

Table 2. I2C Jumper Definitions

Reference	Usage	Comments
J2	I2C SDA	Populated: CC3220 SDA connected to onboard sensors with pullup
		Open: CC3220 SDA disconnected from onboard sensors
J3	I2C SCL	Populated: CC3220 SCL connected to onboard sensors with pullup
		Open: CC3220 SCL disconnected from onboard sensors

2.4.2.1 Default I2C Addresses

Table 3 lists the default I2C addresses of the onboard sensors.

Table 3. Default I2C Addresses (of Onboard Sensors)

Sensor Type	Reference Designator on LP	Part Number (Manufacturer)	Default Slave Address (in Hex)
Temperature (MEMS IR Thermopile)	U6	TMP006 (TI)	0x41
Accelerometer (Triaxial)	U10	BMA222E (Bosch)	0x18

2.4.3 Power Connections

The board can be powered by using the onboard micro USB connector. An onboard DC-DC converter provides 3.3 V for the CC3220 and the rest of the board to operate. This supply can be isolated from the DC-DC using the jumpers on the board. See the yellow jumpers in Figure 7.

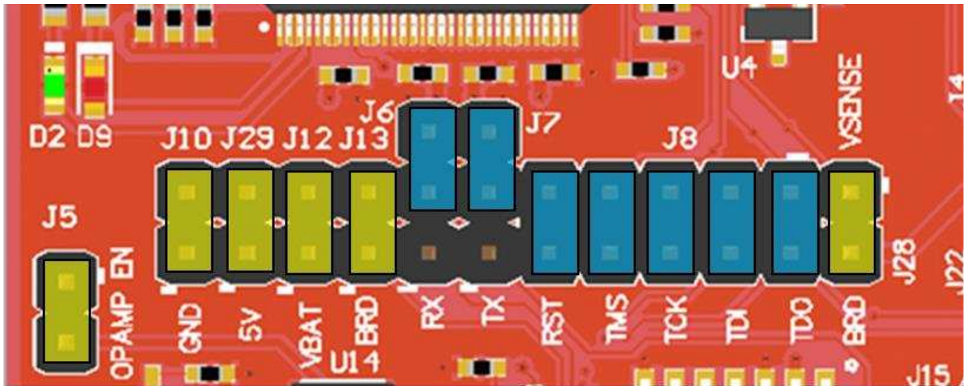

Figure 7. Power Jumpers J5, J10, J29, J12, J13, and J28

NOTE: The blue jumpers in Figure 7 are previously discussed and are populated by default. Figure 7 does not show unpopulated jumpers (which would be populated normally).

Table 4 lists the jumper settings for the LaunchPad Power.

Table 4. Jumper Settings for LaunchPad™ Power

Reference	Usage	Comments
J5	OPAMP EN	If uninstalled, the power supply to the OPAMP is cut off. This can be used to enable low-power measurements
J10	GND	Ground reference
J29	+5 VDC power jumper	Connects J19, +5 VDC to emulator section
J12	Current measurement	Measures the current flowing into the CC3220 device. Also includes the serial flash and any stacked BoosterPack.
J13	Board power	Short: Supply the board power from the onboard DC-DC converter. The board power includes the sensors, LED, and the OPAMP used to drive the ADC input.
J28	VSENSE	Used to power the level shifters on the emulator side of the board. The level shifters can be powered by shorting this jumper. Removing this jumper enables low-current measurement.

The board can be powered by an external supply when USB power is not available, by using either J19 or J20. J9 is also available to remove any current draw from LEDs being driven by the GPIOs. See Table 5.

Table 5. External Supply Connections and LED Enable Jumper

Reference	Usage	Comments
J19	5-V power input	Used to power the board from an external 2× AA battery pack. J19 has in-built reverse voltage protection to prevent the battery from being plugged in the reverse manner.
J20	3.3-V power input	Used to power the board from an external 2× AA battery pack. J20 has in-built reverse voltage protection to prevent the battery from being plugged in the reverse manner.
J9	LED EN	If uninstalled, the LEDs connected to the GPIO are disabled, which can be used to enable low-power measurements.

2.4.4 Reset Pullup Jumper

Table 6 lists the reset pullup jumper.

Table 6. Reset Pullup Jumper

Reference	Usage	Comments
J26	RESET pullup	Install this jumper to enable the pullup resistor on the nRESET pin of the device, when the board is powered from a battery connected to J20.

2.4.5 Sense on Power (SOP)

The CC3220 can be set to operate in four different modes, based on the state of the sense-on-power (SOP) lines. These SOP lines are pins 21, 34, and 35 on the CC3220 device. The state of the device is described in Table 7, and the SOP jumpers are shown in Figure 8.

Table 7. SOP[2:0] (J15, J16, and J17 on LP)

Binary Value	Function
000	Functional mode and 4-wire JTAG
001	Functional mode and 2-wire JTAG
011	Factory default
100	Flash programming

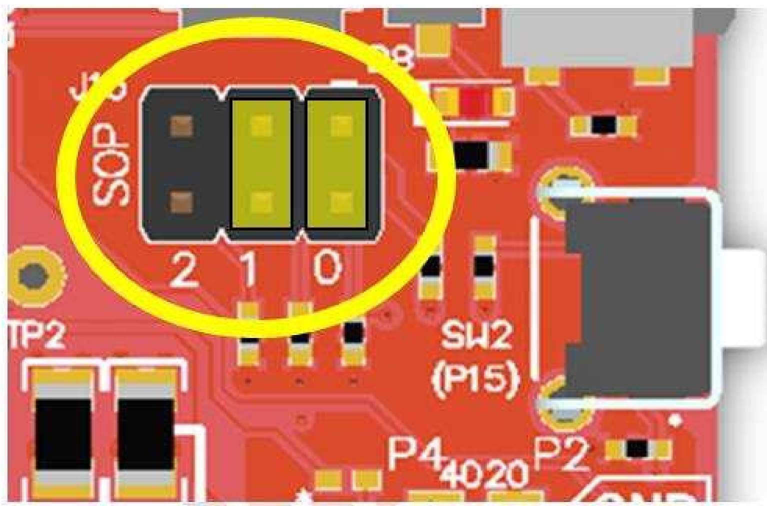

Figure 8. SOP Jumpers (Default Setting Shown)

NOTE: SOP[2:0] corresponds to J15, J16, and J17 in the LaunchPad schematic design.

NOTE: No jumpers on the block ensure that the line is pulled low using 100-kΩ pulldown resistors. Placing the jumper pulls the pin high using a 1-kΩ resistor.

2.4.6 UART Signals

The board supports a USB-based virtual COM port, using the Tiva™ ARM® MCU. The Launchpad is shipped with the UART lines from the CC3220 connected to the UART on the Tiva MCU. The CC3220 UART can also be routed to the 20-pin connector for use as a GPIO or external UART. The selection is performed using jumpers on the board.

Figure 9 shows the UART routed to USB com port and Figure 10 shows the UART routed to 20-pin header connector.

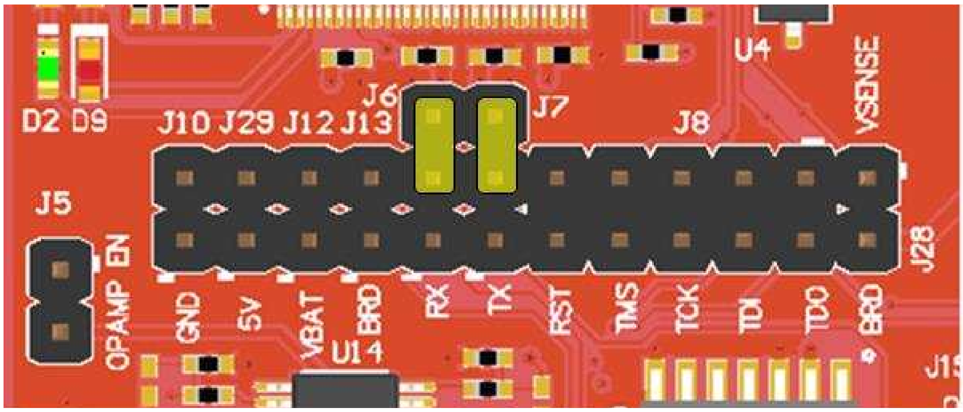

Figure 9. UART Routed to USB COM Port

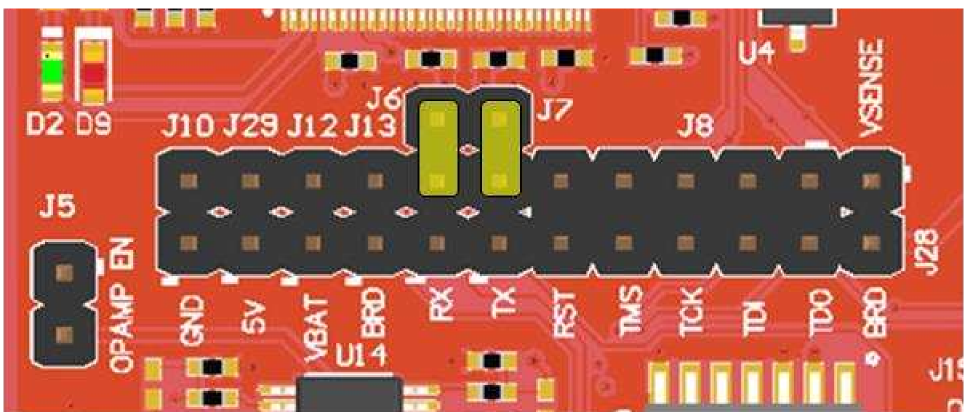

Figure 10. UART Routed to 20-Pin Header Connector

2.4.7 Push Buttons and LED Indicators

Table 8 list the push-button definitions.

Table 8. Push-Button Definitions

Reference	Usage	Comments
SW1	RESET	This is used to reset the CC3220 device. This signal is also output on the 20-pin connector to reset any external BoosterPack which may be stacked. The reset can be isolated using the jumper block at the center of the board.
SW2	GPIO_22	When pushed, GPIO_22 is pulled to VCC.
SW3	GPIO_13	When pushed, GPIO_13 is pulled to VCC.
SW4	Factory Default	Pressing this button and toggling RESET restores the factory default image on the serial flash. This can be used to recover a corrupted serial flash, provided the s-flash was programmed with a recovery image.

Table 9 lists the LED indicators.

Table 9. LED Indicators

Reference	Color	Usage	Comments
D1	Yellow	nRESET	Indicates the state of the nRESET pin. If this LED is on, the device is functional.
D2, D9	Green	Debug	Indicates the state of the JTAG emulator. For TI use only.
D4	Red	Power	Indicates when the 3.3-V power is supplied to the board.
D5	Green	GPIO_11 (1)	On when the GPIO is logic-1
D6	Yellow	GPIO_10 (1)	On when the GPIO is logic-1
D7	Red	GPIO_09	On when the GPIO is logic-1
D8	Red	Factory Reset	Indicates that the push-button for the factory reset is pressed.

(1) GPIO_10 and GPIO_11 are also used as I2C. Thus, when the pullup resistors are enabled, the LEDs are on by default, without configuring the GPIOs.

2.4.8 BoosterPack™ Header Pin Assignment

The TI BoosterPack header pinout specification can be found at Build Your Own BoosterPack. Also refer to BoosterPack Pinout Standard.

The CC3220 LaunchPad follows this standard, with the exception of naming. (P1:P4 is used instead of J1:J4.) See Figure 11 for CC3220 pin-mapping assignments and functions.

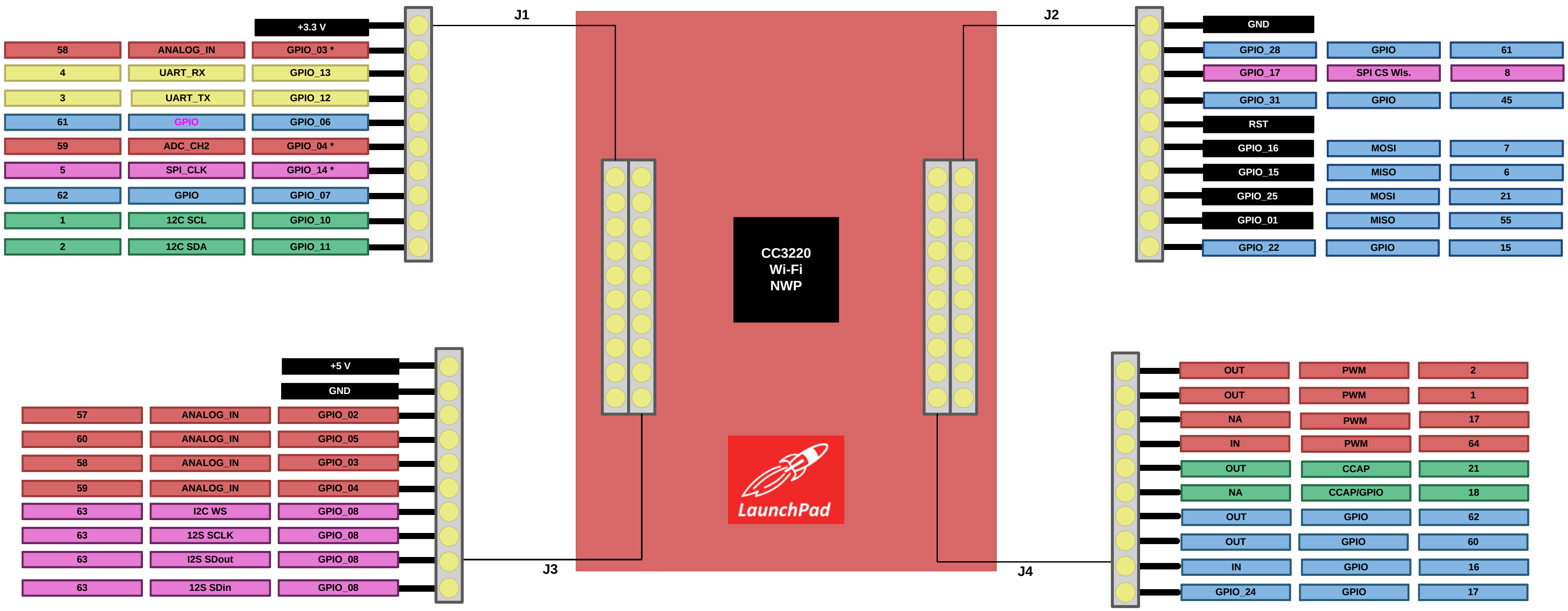

Figure 11. CC3220 BoosterPack™ Header Pin Assignments

NOTE: RESET output is an open-drain-type output and can only drive the pin low. The pullup ensures that the line is pulled back high when the button is released. No external BoosterPack can drive this pin low.

All the signals are referred to by the pin number in the SDK; Figure 11 shows the default mappings. Some of the pins are repeated across the connector. For instance, pin 62 is available on P1 and P4, but only P1 is connected by default. The signal on P4 is marked with a * (star) to signify that it is not connected by default. The signal can be routed to the pin by using a 0-Ω resistor in the path. For the exact resistor placement, see the CC3200 SimpleLink Wi-Fi Wireless MCU Launch Pad Board Design Files.

2.5 Power

2.5.1 USB Power

The LaunchPad is designed to work from the USB-provided power supply. The LaunchPad provides addresses as a bus-powered device on the computer. When the board is powered from the USB connector, the jumpers must be placed on the following headers, as shown in Figure 12.

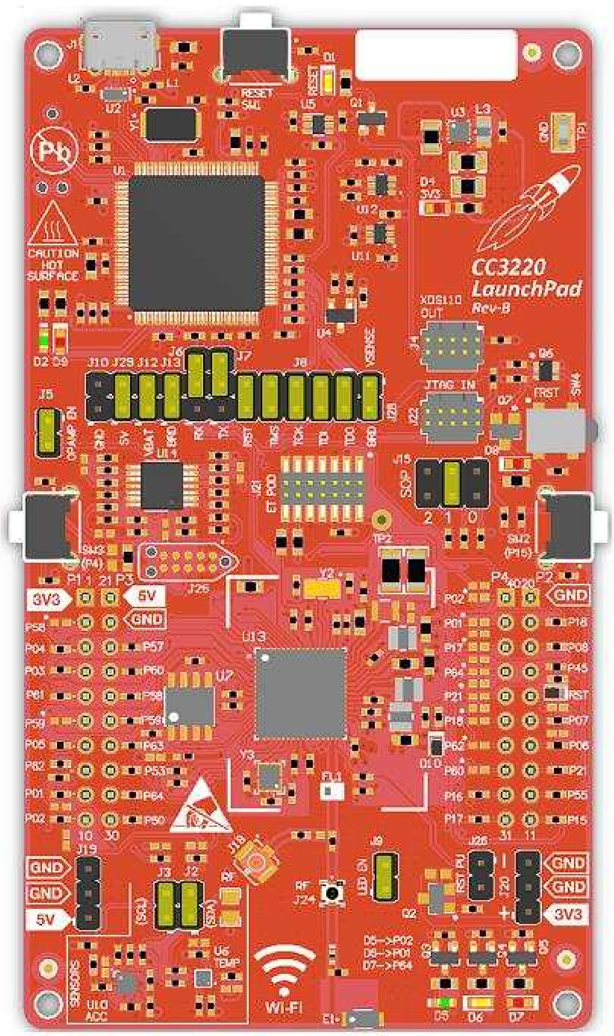

Figure 12. Powering From USB Jumper Settings

2.5.2 Battery Power

The LaunchPad can also be powered from an external battery pack by feeding the voltage on the J20 header. This input features reverse voltage protection to ensure that the board is not damaged due to an accidental reverse voltage. Perform the following steps before using the board with a battery.

1. Remove the USB cable.
2. Plug in the battery pack on J20 with the correct polarity (see Figure 13).
3. Connect the jumper across J12 and J13 as shown in Figure 13.

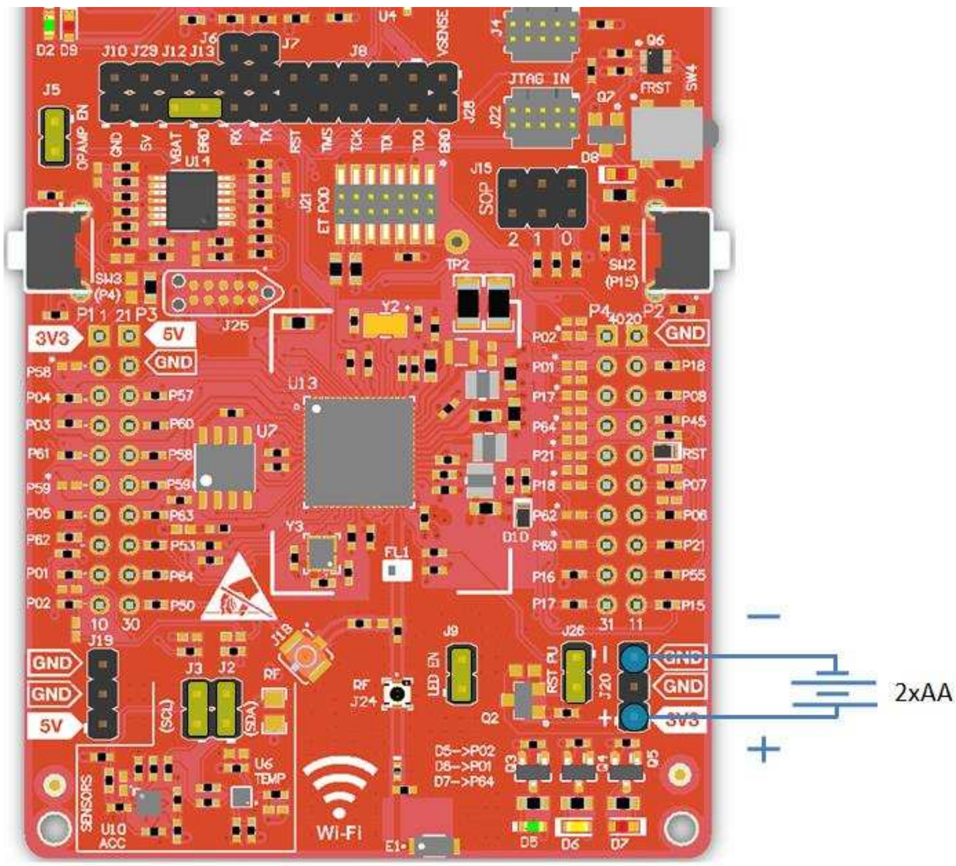

Figure 13. Powering the CC3220LP From Battery

2.5.3 Battery Powering Only the CC3220 and U7 (Onboard Serial Flash)

In some cases, there may be a requirement to power only the CC3220 and the serial flash from the battery. The usage may not require LEDs, OPAMP for the ADC, and the sensors. In this case, the other sections can be powered off by removing the appropriate jumpers. The board would appear as shown in Figure 14.

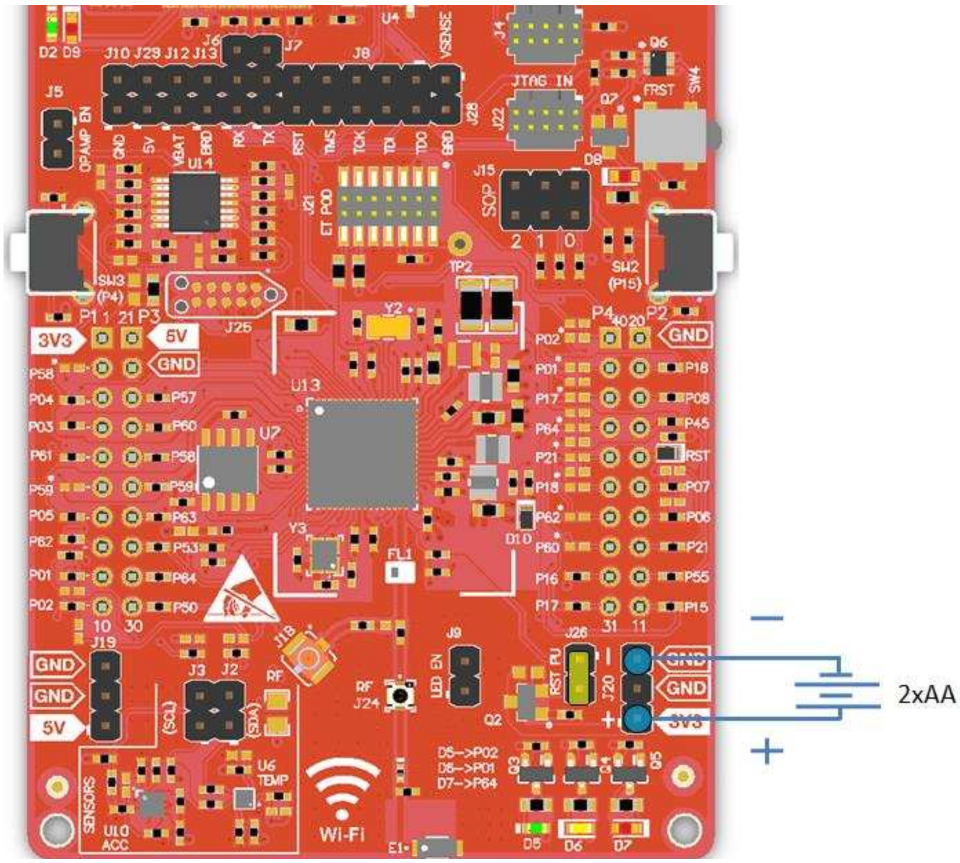

Figure 14. Only CC3220 and Serial Flash Powered by Battery

2.6 Isolated Current Measurement of the CC3220

To measure the current draw of the CC3220, use the VBAT jumper on the jumper isolation block (J12). The current measured in this mode includes only the CC3220 current and the serial flash current, and no external blocks. However, if a GPIO of the CC3220 is driving a high-current load such as an LED, then that is also included in this measurement.

2.6.1 Low Current Measurement (< 1 mA)

Follow these steps to measure ultra-low power operation of the CC3220:

1. Remove the VBAT jumper (J12); attach an ammeter across this jumper, as shown in Figure 15. The CC3220 device should not drive any high-current loads directly, such as an LED, as this can draw a large current.

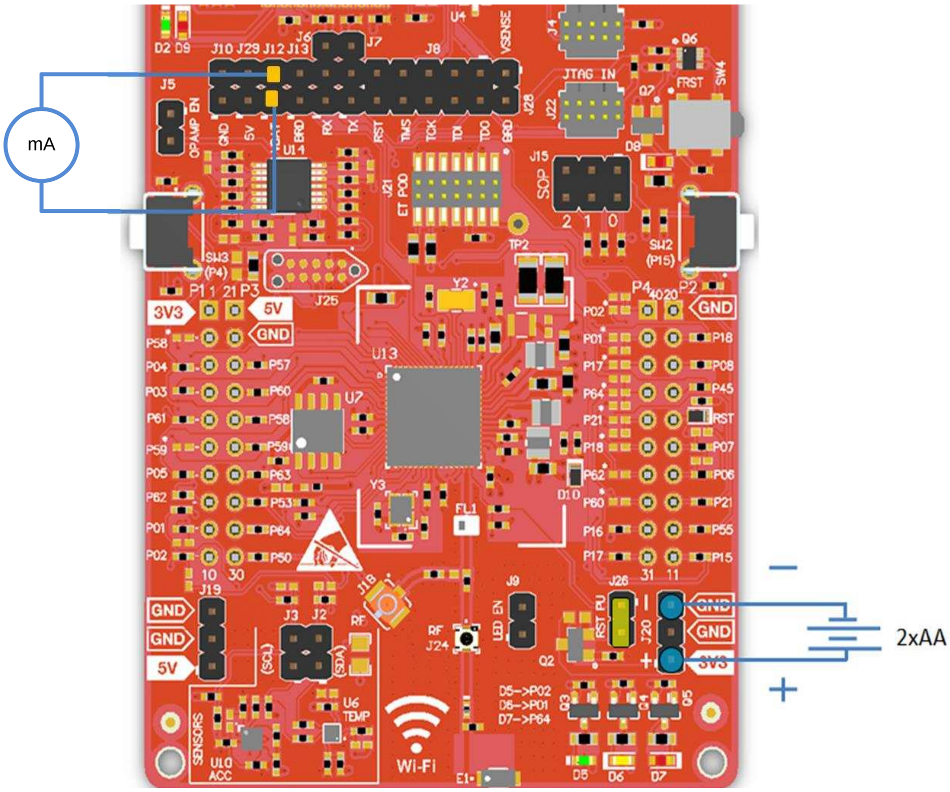

Figure 15. Low Current Measurement (<1 mA)

2. Begin target execution and set the device to low-power modes (LPDS or hibernate).
3. Measure the current. If the current levels are fluctuating, it may be difficult to get a stable measurement. It is easier to measure quiescent states.

NOTE: To measure the low-power numbers, remove the LEDs (D5, D6, and D7 on the board). Similarly, the shutdown mode leaks approximately 33 µA into the pullup resistor (R131) on the nRESET pin. This pullup resistor must also be removed to measure the total current below 1 µA in shutdown mode.

2.6.2 Active Power Measurements (>1 mA)

1. Remove the VBAT jumper (J12).
2. Solder a 0.1-Ω resistor on a wire, which can be connected to a voltmeter or oscilloscope as shown in Figure 16. Or, attach a jumper wire between J12 so that it can be used with a current probe.

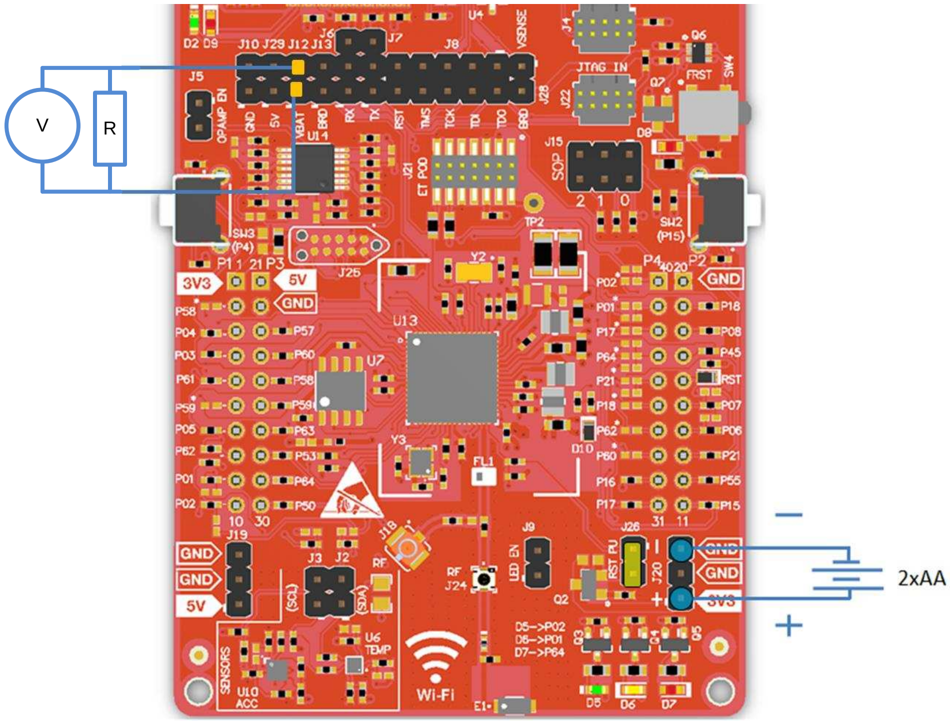

Figure 16. Active Power Measurements (>1 mA)

3. Measure the voltage across the resistor using an oscilloscope with a differential probe. (For the current probe, coil the wire around the sensor multiple times for good sensitivity.) An ammeter can also be used for this measurement, but the results may be erroneous due to the switching nature of the current.

2.7 RF Connections

2.7.1 AP Connection Testing

By default, the board ships with the RF signals routed to the onboard chip antenna, as shown in Figure 17.

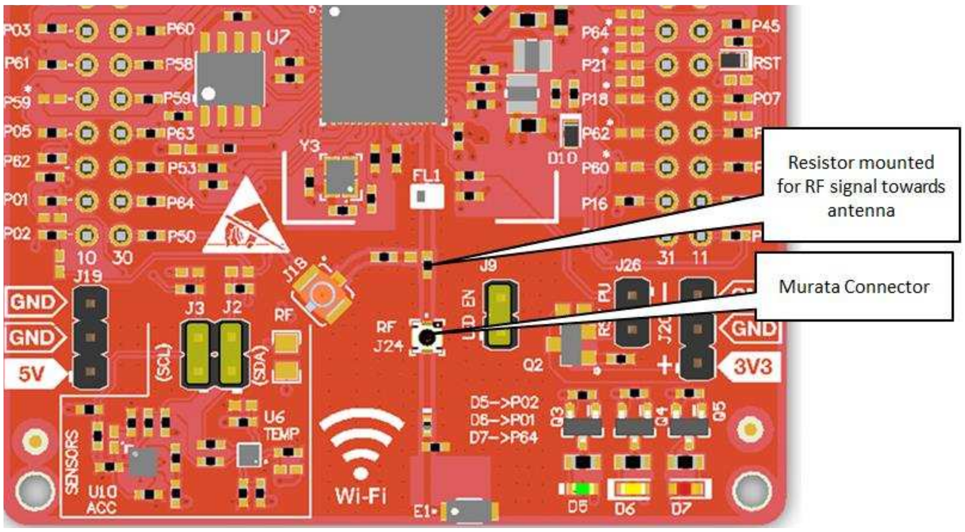

Figure 17. Using Onboard Antenna (Default Condition)

An miniature UMC connector (Murata MM8030-2610) provides a means to perform the testing in the lab using a compatible cable. Alternately, for testing the conducted measurement a U.FL connector is provided on the board. The use of this connector requires performing a rework, which involves swapping the position of a resistor. The modified board would appear as in Figure 18.

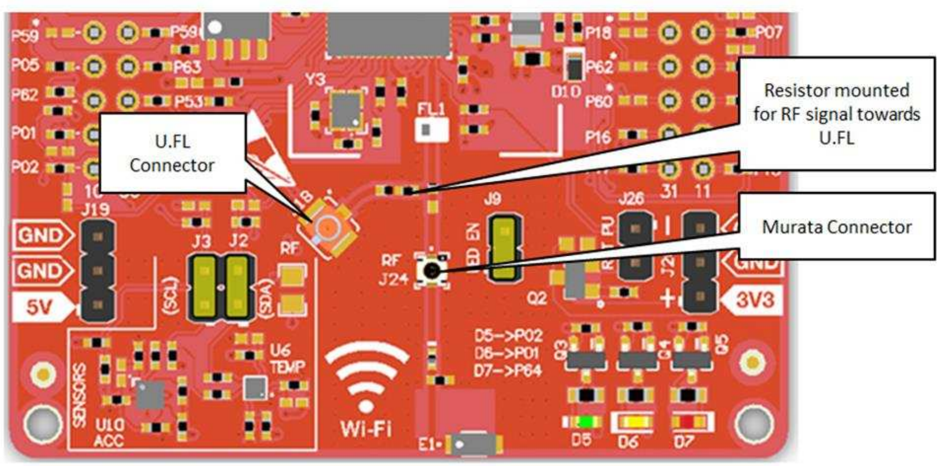

Figure 18. Board Modified for External Antenna Connections

2.8 Design Files

2.8.1 Hardware Design Files

All design files, including schematics, layout, Bill of Materials (BOM), Gerber files, and documentation are available for download from CC3220-LAUNCHXL-RD.

2.9 Software

All design files, including firmware patches, software example projects, and documentation are available from the SimpleLink Wi-Fi Platform page.

The software development kit (SDK) for the CC3220 LaunchPad can be obtained from CC3220SDK.

3 Development Environment Requirements

The following software examples with the LaunchPad require an integrated development environment (IDE) that supports the CC3220 device.

The CC3220 programmer's guide, *CC3220, CC3220S, CC3220SF SimpleLink™ Wi-Fi® and Internet of Things Solution, A Single-Chip Wireless MCU*, which has detailed information on software environment setup with examples. Refer to this document for further details on the software sample examples.

3.1 CCS

CCS 6.0 or higher is required. When CCS is launched, and a workspace directory is chosen, use *Project → Import Existing CCS Eclipse Project*. Direct it to the desired demo project directory containing main.c.

3.2 IAR

IAR 6.70 or higher is required. To open the demo in IAR, choose *File → Open → Workspace…*, and direct it to the *.eww workspace file inside the \IAR subdirectory of the desired demo. All workspace information is within this file.

The subdirectory also has an *.ewp project file; this file can be opened into an existing workspace, using *Project → Add-Existing-Project…*.

4 Additional Resources

4.1 CC3220 Product Page

For more information on CC3220 device, visit the CC3220 product page, which includes the *CC3220x SimpleLink™ Wi-Fi® Wireless and Internet-of-Things Solution, a Single-Chip Wireless MCU Data Sheet* and key documents such as the *CC3220, CC3220S, CC3220SF SimpleLink™ Wi-Fi® and Internet of Things Technical Reference Manual* and the http://www.ti.com/simplelinkwifi-wiki, which contains information on getting started, hardware details, software details including porting information, testing and certification, support, and the CC3220 community.

4.2 LaunchPad™ Wiki

Most updated information is available on the CC3220 Wiki page.

5 Change Log

Table 10. Change Log

PCB Revision	Description
Rev-A	Initial release

Revision History

Date	Revision	Notes
February 2017	SWRU463*	Initial release

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ('TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265