

CC3220MODASx SimpleLink™ Wi-Fi® and IoT Solution With MCU LaunchPad™ Hardware

User's Guide



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1	CC3220MODASx SimpleLink™ Wi-Fi® and IoT Solution With MCU LaunchPad™ Hardware	4
1.1	Introduction	4
1.1.1	Key Features	5
1.1.2	What is Included	5
1.2	Overview	5
1.2.1	LAUNCHCC3220MODASF Features	10
1.2.2	Key Benefits	10
1.2.3	Applications	13
1.2.4	Hardware Description	14
1.3	Connecting a BoosterPack™	16
1.4	Buttons, LEDs, Jumper Settings, and Connectors	16
1.4.1	Buttons and LEDs	16
1.4.2	JTAG Headers	17
1.4.3	I ² C Connections	18
1.4.4	Default I ² C Address	18
1.4.5	Power Connections	19
1.4.6	UART Signals	19
1.4.7	Sense on Power	20
1.4.8	2 × 20-Pin Connector Assignment	21
1.5	Electrical Characteristics	22
1.6	Antenna Characteristics	22
1.7	Circuit Design	25
1.7.1	Reference Schematic	25
1.7.2	Bill of Materials	26
1.8	Layout Guidelines	27
1.8.1	CC3220MODx Board Layout	27
1.8.2	CC3220MODAx Board Layout	31
1.8.3	General Layout Recommendations	35
1.8.4	RF Layout Recommendations (CC3220MODx)	35
1.8.5	Antenna Placement and Routing (CC3220MODx)	37
1.8.6	Transmission Line Considerations (CC3220MODx)	37
1.8.7	RF Layout Recommendations (CC3220MODAx)	39
1.9	Operational Setup and Testing (LAUNCHCC3220MODASF)	40
1.9.1	Power	40
1.9.2	Measuring the CC3220MODAx Current Draw	43
1.9.3	Clocking	45
2	Manual Information to the End User	46
2.1	RF Function and Frequency Range	46
2.2	FCC and IC Certification and Statement	46
2.2.1	FCC	46
2.2.2	CAN ICES-3(B) and NMB-3(B) Certification and Statement	47
2.2.3	End Product Labeling	48
2.2.4	Device Classifications	48
2.2.5	FCC Definitions	49
2.2.6	Simultaneous Transmission Evaluation	49

2.3	EU Certification and Statement.....	49
2.3.1	RF Exposure Information (MPE)	49
2.3.2	Simplified DoC Statement	49
2.3.3	Waste Electrical and Electronic Equipment (WEEE)	50
2.3.4	OEM and Host Manufacturer Responsibilities.....	50
2.3.5	Antenna Specifications	50
2.4	CC3220MODx Approved Antennas.....	51
2.5	Trademarks	52
	Revision History	53

CC3220MODASx SimpleLink™ Wi-Fi® and IoT Solution With MCU LaunchPad™ Hardware

1.1 Introduction

Start your design with the industry's first programmable FCC, IC, CE, MIC, and SRRC Certified wireless microcontroller (MCU) module with built-in Wi-Fi® connectivity. Created for the Internet-of-Things (IoT), the SimpleLink™ CC3220MODx and CC3220MODAx family of devices from Texas Instruments™ are wireless modules that integrate two physically separated, on-chip MCUs:

- An application processor – ARM® Cortex®-M4 MCU with a user-dedicated 256KB of RAM and an optional 1MB of Serial Flash.
- A network processor MCU to run all Wi-Fi and Internet logic layers. This ROM based subsystem includes an 802.11b/g/n radio, baseband, and MAC with a powerful crypto engine for fast, secure internet connections with 256-bit encryption.

The CC3220MODx and CC3220MODAx have four total variants:

- CC3220MODSM2MOB
 - Requires an external antenna
- CC3220MODSF12MOB
 - Requires an external antenna
 - Contains 1MB of Serial Flash
- CC3220MODASM2MON
 - Contains an integral antenna
- CC3220MODASF12MON
 - Contains an integral antenna
 - Contains 1MB of Serial Flash

The LAUNCHCC3220MODASF is a low-cost evaluation platform for MCUs based on ARM Cortex-M4F devices. The LaunchPad™ design highlights the CC3220MODASF Internet-on-a chip™ solution and Wi-Fi capabilities.

The LAUNCHCC3220MODASF also features temperature and accelerometer sensors, programmable user buttons, one RGB LED for custom applications, and onboard emulation for debugging. The stackable headers interface demonstrates how easy it is to expand the functionality of the LaunchPad when interfacing with other peripherals on existing BoosterPack™ add-on boards, such as graphical displays, audio codec, antenna selection, environmental sensing, and more.

Free software development tools are available, including TI's Eclipse-based [Code Composer Studio™](#) (CSS) and [IAR Embedded Workbench®](#). More information about the LaunchPad, the supported BoosterPacks, and the available resources are at [TI's LaunchPad portal](#). Also visit the [CC3220 Wiki page](#) for design resources and example projects.

1.1.1 Key Features

- CC3220MODASx, 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 one RGB LED for user interaction
- Backchannel 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

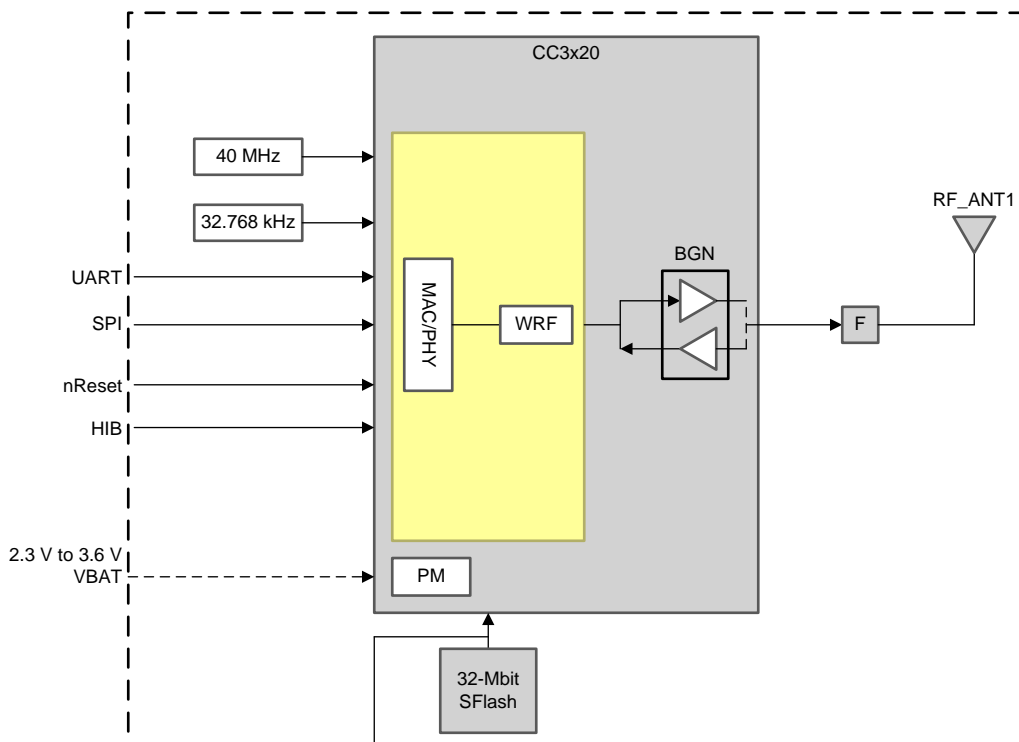
1.1.2 What is Included

Kit contents:

- CC3220MODASx LaunchPad development tool (CC3220XX-LAUNCHXL)
- Micro USB cable
- Quick start guide

1.2 Overview

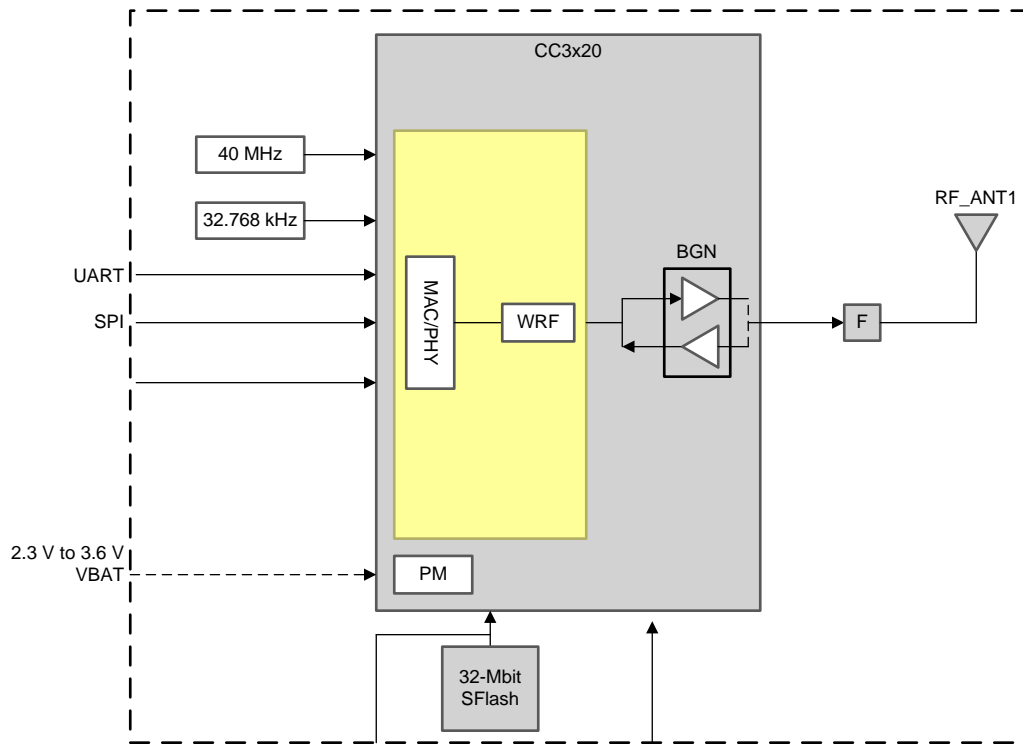
Figure 1-1 shows a functional block diagram of the CC3220MODx module.



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Figure 1-1. CC3220MODx Functional Block Diagram

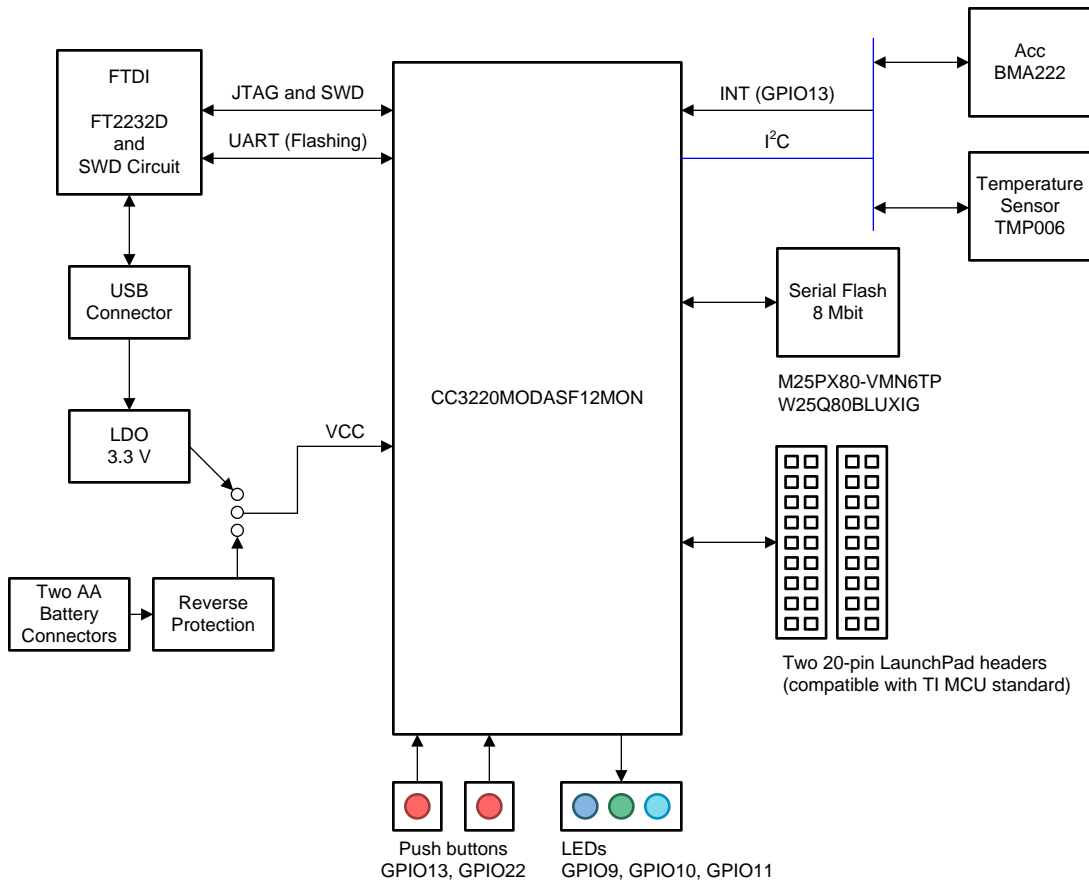
Figure 1-2 shows a functional block diagram of the CC3220MODAx module.



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Figure 1-2. CC3220MODAx Functional Block Diagram

Figure 1-3 shows a functional block diagram of the LAUNCHCC3220MODASF SimpleLink LaunchPad.



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Figure 1-3. LAUNCHCC3220MODASF Functional Block Diagram

Figure 1-4 shows the hardware implementation of the LAUNCHCC3220MODASF.

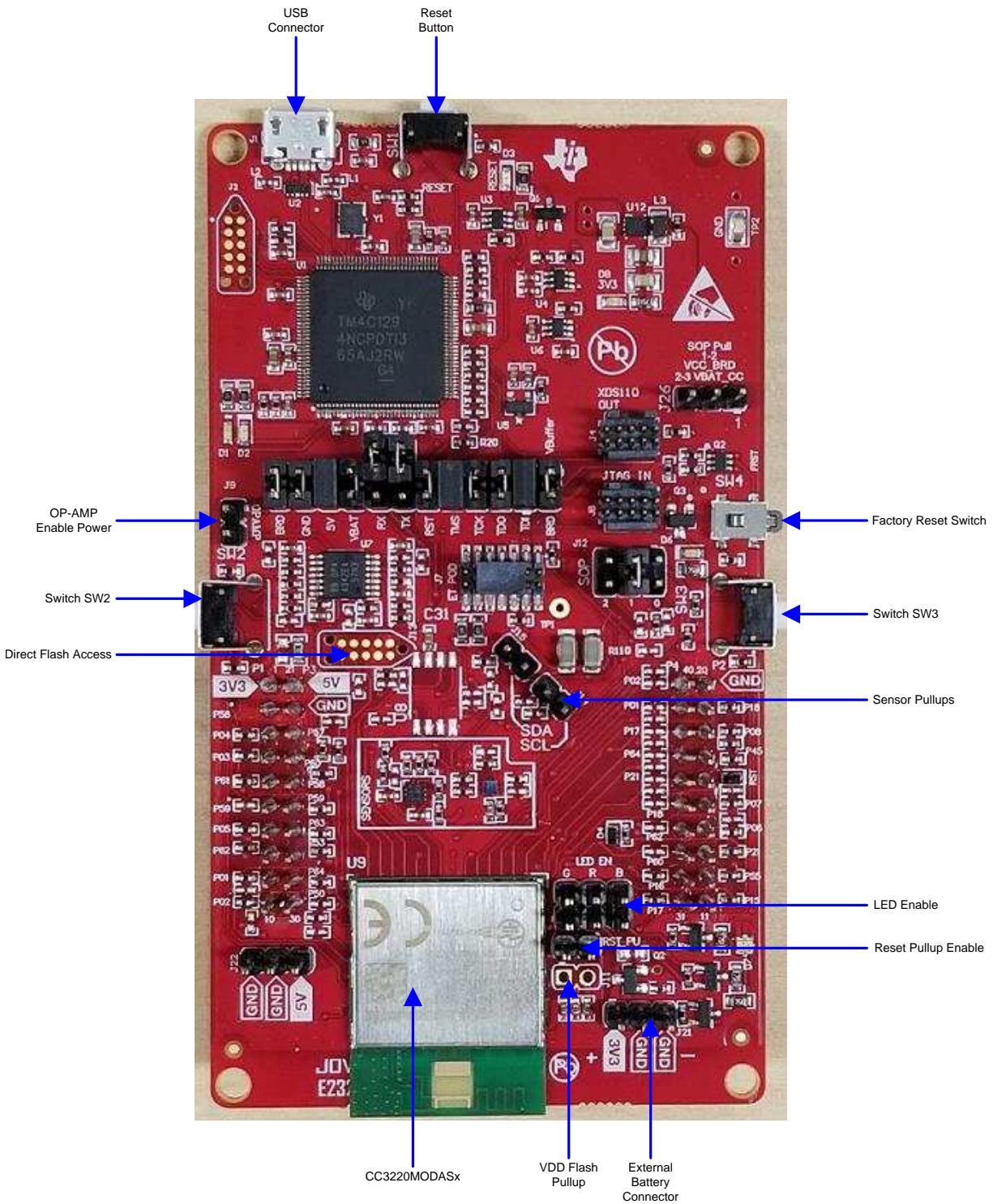


Figure 1-4. Hardware Implementation of LAUNCHCC3220MODASF

Figure 1-5 shows the top overlay of the LAUNCHCC3220MODASF.

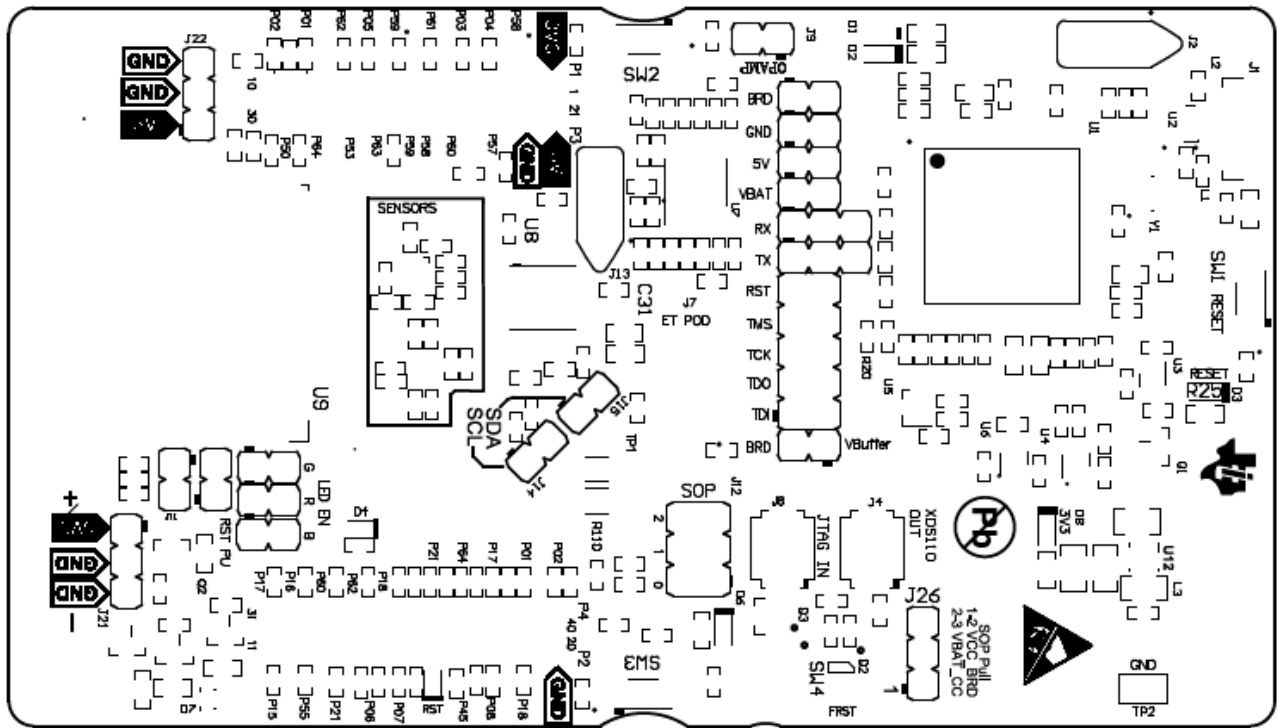


Figure 1-5. LAUNCHCC3220MODASF Top Overlay

Figure 1-6 shows the top solder of the LAUNCHCC3220MODASF.

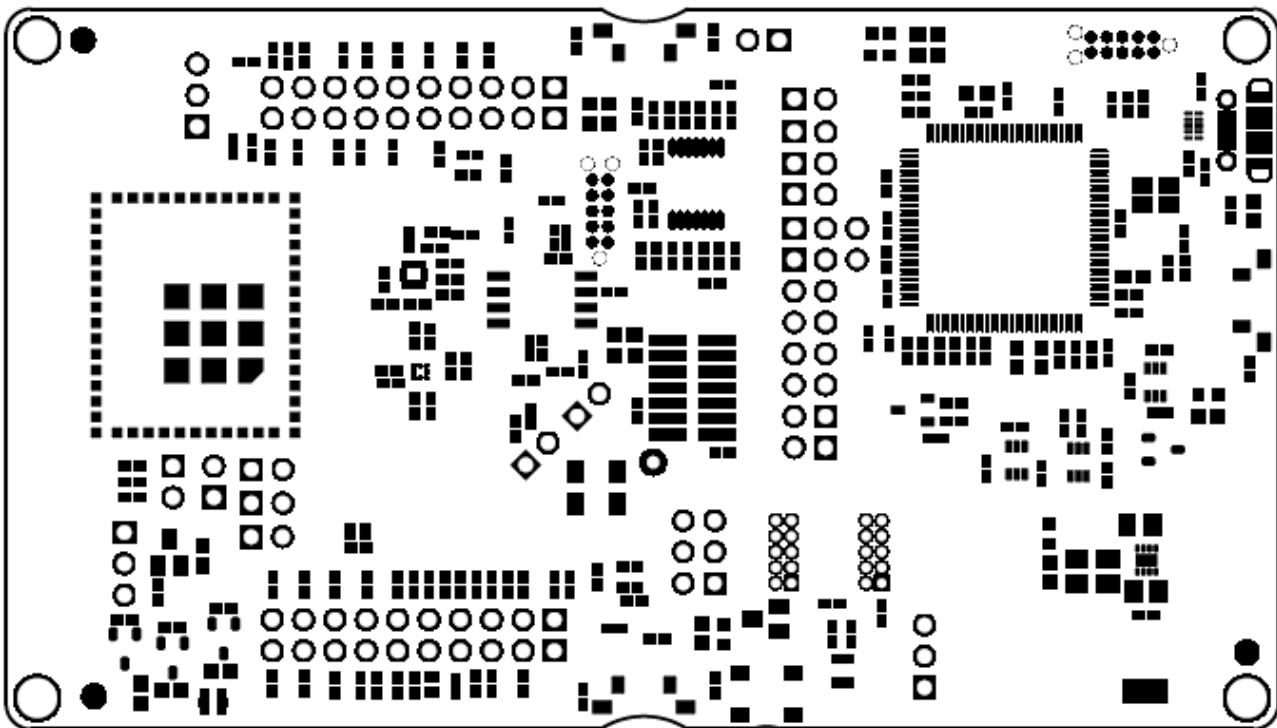


Figure 1-6. LAUNCHCC3220MODASF Top Solder

1.2.1 LAUNCHCC3220MODASF Features

The LAUNCHCC3220MODASF SimpleLink LaunchPad includes the following features:

- CC3220MODASF, 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 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 the sensors from the inter-integrated circuit (I²C) bus
- Micro-USB connector for power and debug connections
- Headers for current measurement and external JTAG connection (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 highly optimized antenna (200 m typical in open air using an access point with 6-dBi antenna AP)
- Can be powered externally, with two AA or two AAA alkaline batteries working down to 2.3-V typical (typ)
- Four-layer PCB
- Dimensions: 103.1 mm (L) × 58.42 mm (W)

1.2.2 Key Benefits

The CC3220MODx and CC3220MODASx modules offer the following benefits:

- CC3220MODS and CC3220MODAS are Wi-Fi modules that consist of the CC3220SM2ARGK while the CC3220MODSF and the CC3220MODASF consist of the CC3220SF12ARGK single-chip MCUs, respectively. The fully integrated, industrial temperature grade, green modules include all required clocks, SPI Flash, and passives.
- The CC3220MODAx modules include an integral antenna for easy integration into the host system.
- CC3220MODx and CC3220MODAx SimpleLink Wi-Fi wireless MCU System-on-Chip (SoC) is a single-chip with two separate execution environments:
 - User application dedicated ARM Cortex-M4 MCU
 - Network processor MCU to run all Wi-Fi and Internet logical layers
- FCC, IC, CE, MIC, and SRRC certified
- Wi-Fi CERTIFIED™ modules, can request certificate transfer for Wi-Fi Alliance members
- 1.27-mm pitch LGA package for easy assembly and low-cost PCB design
- Applications MCU subsystem
 - ARM Cortex-M4 core at 80 MHz
 - Embedded memory
 - CC3220MODS and CC3220MODAS variant includes 256KB of RAM
 - CC3220MODSF and CC3220MODASF variant is flash-based MCU with integrated 1MB of Flash and 256KB of RAM
 - Peripheral drivers in ROM
 - McASP supports two I2S channels
 - SD
 - SPI
 - I²C
 - UART

- 8-bit synchronous image interface
- Four general-purpose timers (GPTs) with 16-bit PWM mode
- One watchdog timer module
- 4-channel, 12-Bit Analog-to-Digital Converters (ADCs)
- Debug interfaces: JTAG, cJTAG, and SWD
- Wi-Fi network processor subsystem
 - Wi-Fi Internet-on-a-chip dedicated ARM MCU completely offloads Wi-Fi and Internet protocols from the application MCU
 - Wi-Fi modes
 - 802.11b/g/n station
 - 802.11b/g/n access point supports up to four stations
 - Wi-Fi Direct® client and group owner WPA2 personal and enterprise security: WEP, WPA, WPA2 PSK, and WPA2 Enterprise (802.1x)
 - IPv4 and IPv6 TCP and IP stack
 - Industry-standard BSD socket application programming interfaces (APIs)
 - 16 simultaneous TCP or UDP sockets
 - 6 simultaneous TLS and SSL sockets
 - IP addressing: StaticIP, LLA, DHCPv4, DHCPv6 with DAD
 - SimpleLink technology connection manager for autonomous and fast Wi-Fi connections
 - Flexible Wi-Fi provisioning With SmartConfig™ technology, AP mode, and WPS2 options
 - RESTful API support using internal HTTP server
 - Embedded network applications running on dedicated network processor
 - Wide set of security features
 - Hardware features:
 - Separation execution environments
 - Device identity
 - Hardware crypto engine for advanced fast security, including: AES, DES, 3DES, SHA2, MD5, CRC, and Checksum
 - Initial secure programming
 - Debug security
 - JTAG and debug ports are locked
 - Personal and enterprise Wi-Fi security
 - Secure sockets (SSLv3, TLS1.0, TLS1.1, TLS1.2)
 - Networking security
 - HTTPS server
 - Trustee root-certificate catalog
 - TI root-of-trust public key
 - SW IP protection
 - Secure key storage
 - File system security
 - Software tamper detection
 - Cloning protection
 - Secure boot: validate integrity and authenticity of runtime binary during boot
 - Embedded network applications running on dedicated network processor
 - HTTP and HTTPS web server with dynamic user callbacks
 - mDNS, DNS-SD, and DHCP servers

- Ping
 - Recovery mechanism: can recover to factory defaults or to complete factory image
- Wi-Fi TX power
 - 17.0 dBm at 1 DSSS
 - 16.5 dBm at MCS0
- Wi-Fi RX sensitivity
 - –95.0 dBm at 1 DSSS
 - –73.5 dBm at 54 OFDM
- Application throughput
 - UDP: 16 Mbps
 - TCP: 13 Mbps
- Power-management subsystem
 - Integrated DC-DC converter with a wide-supply voltage:
 - V_{BAT} : 2.3 to 3.6 V
 - Advanced low-power modes:
 - Shutdown: 1 μ A
 - Hibernate: 6 μ A
 - Low-power deep sleep (LPDS): 135 μ A (measured on CC3220MODS and CC3220MODSF with 256-KB RAM retention)
 - RX traffic (MCU active): 59 mA (measured on CC3220MODS; CC3220MODSF consumes an additional 15 mA) at 54 OFDM
 - TX traffic (MCU active): 223 mA (measured on CC3220MODS; CC3220MODSF consumes an additional 15 mA) at 54 OFDM, maximum power
 - Idle connected (MCU in LPDS): 710 μ A (measured on CC3220MODS and CC3220MODSF with 256-KB RAM retention) at DTIM = 1
- Additional integrated components
 - 40.0-MHz crystal
 - 32.768-kHz crystal (RTC)
 - 32-Mbit SPI Serial Flash RF filter and passive components
- LGA package for easy assembly and low-cost PCB design
 - CC3220MODx: 1.27-mm pitch, 63-pin, 20.5-mm \times 17.5-mm
 - CC3220MODAx: 1.27mm pitch, 63-pin, 20.5-mm \times 25.0-mm
- Operating temperature
 - Ambient temperature range: –40°C to +85°C
- Module supports SimpleLink developers ecosystem

1.2.3 Applications

The CC3220MODx and CC3220MODAx modules are designed for the following Internet of Things (IoT) applications:

- Cloud connectivity
- Internet gateway
- Home and building automation
- Appliances
- Access control
- Security systems
- Smart energy
- Industrial control
- Smart plug and metering
- Wireless audio
- IP network sensor nodes
- Asset tracking
- Medical devices

1.2.4 Hardware Description

Figure 1-7 shows the top view of the LAUNCHCC3220MODASF.

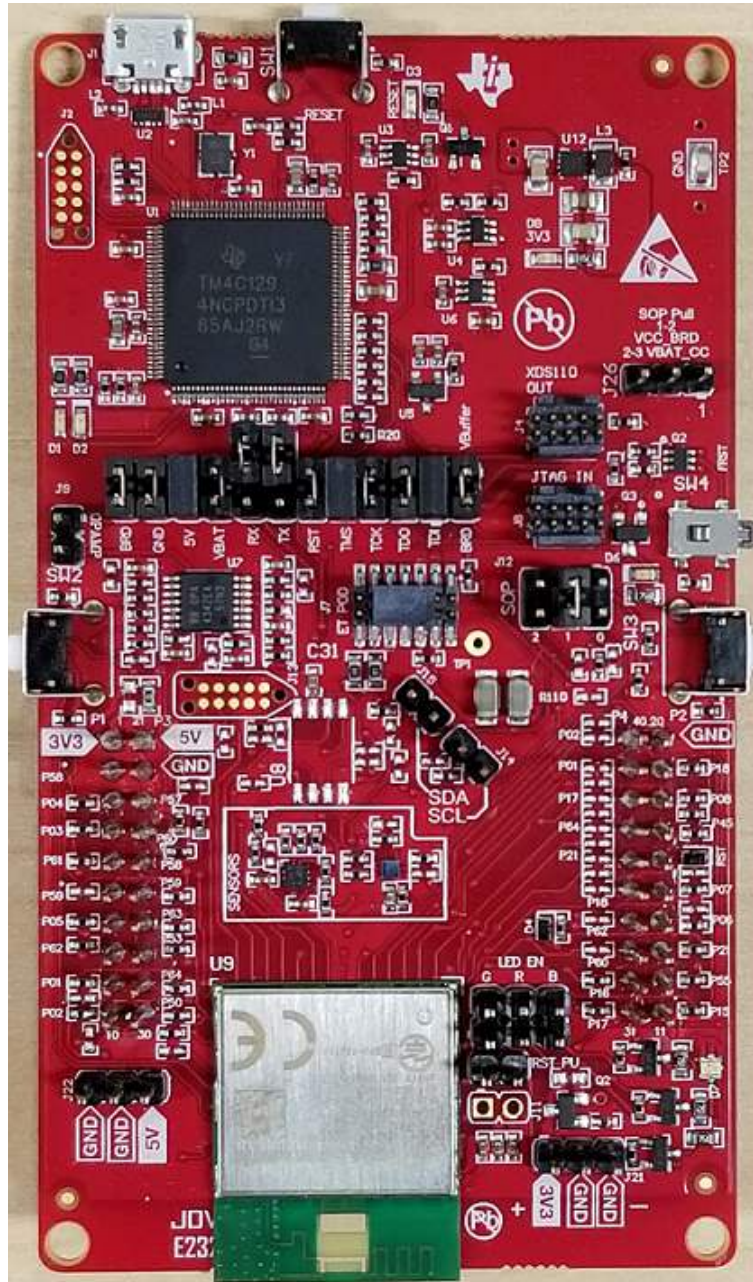


Figure 1-7. LAUNCHCC3220MODASF Top View

Figure 1-8 shows the bottom view of the LAUNCHCC3220MODASF.

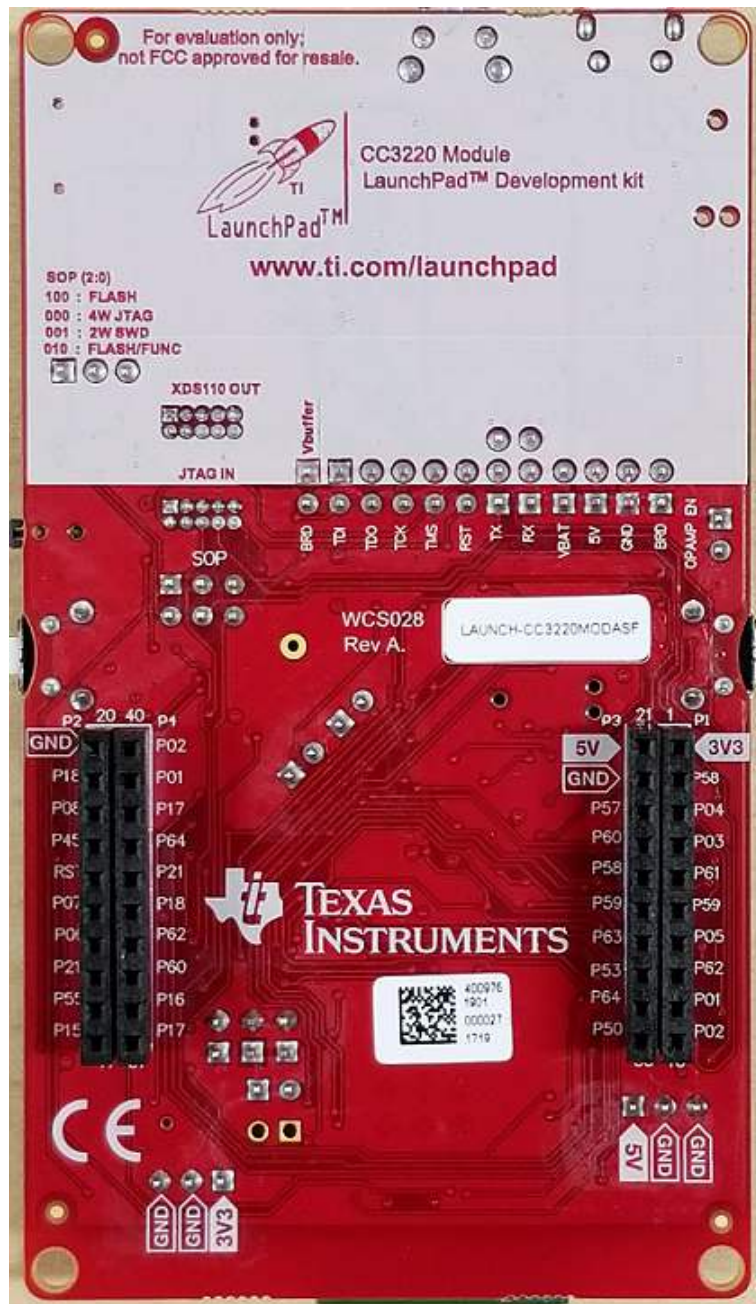


Figure 1-8. LAUNCHCC3220MODASF Bottom View

1.3 Connecting a BoosterPack™

A compatible BoosterPack can be stacked on top of the LaunchPad using the 2 × 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 header pins. On the LAUNCHCC3220MODASF LaunchPad, a small white symbol is provided near pin 1 (see Figure 1-9) to orient all BoosterPacks. This same marking, provided on compatible BoosterPacks, must be aligned before powering up the boards.

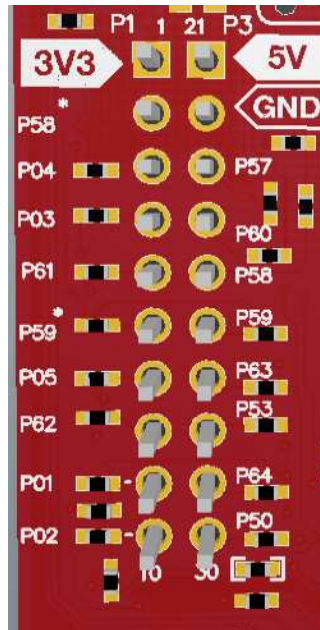


Figure 1-9. Pin 1 Marking on the LaunchPad™ (Tag With 3V3 Mark)

1.4 Buttons, LEDs, Jumper Settings, and Connectors

1.4.1 Buttons and LEDs

Table 1-1 lists the push-button settings.

Table 1-1. Push Buttons

Reference	Use	Comments
SW1	Reset	This button is used to reset the CC3220MODASF device. This signal is also output on the 20-pin connector to reset any external BoosterPack which may be stacked. The reset button can be isolated using the jumper block at the center of the board.
SW2	GPIO_13	When pushed, GPIO_13 is pulled to VCC.
SW3	GPIO_22	When pushed, GPIO_22 is pulled to VCC.
SW4	Factory default	Pressing this button and toggling the 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 1-2 lists the LED settings.

Table 1-2. LEDs

Reference	Color	Use	Comments
D3	Yellow	nRESET	This LED is used to indicate the state of nRESET pin. If this LED is glowing, the device is functional.
D2, D1	Green	Debug	Indicates state of the JTAG emulator. For TI use only.
D8	Red	Power	Indicates when the 3.3-V power is supplied to the board.
D7	RGB	GPIO_11 ⁽¹⁾	Glowes when the GPIO is logic-1.
	RGB	GPIO_10 ⁽¹⁾	Glowes when the GPIO is logic-1.
	RGB	GPIO_09	Glowes when the GPIO is logic-1.
D6	FRST	Factory reset	Indicates that the push-button for the factory reset is pressed down.

⁽¹⁾ GPIO_10 and GPIO_11 are used as I²C also. So whenever the pullups are enabled, the LEDs glow by default without configuring the GPIOs.

1.4.2 JTAG Headers

The headers are provided on the board to isolate the CC3220MODASF module from the onboard XDS10-based JTAG emulator. These jumpers are shorted by default when the board is shipped from TI (see Figure 1-10).

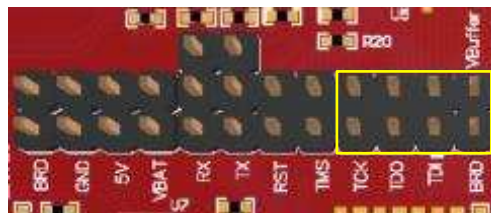


Figure 1-10. Jumpers on JTAG Lines

To connect an external emulator, remove the jumpers highlighted in Figure 1-10 and place the external emulator on the JTAG IN connector (see Figure 1-11).



Figure 1-11. JTAG Input Connector for Using External Emulator

Table 1-3 lists the JTAG headers.

Table 1-3. JTAG Headers

Reference	Use	Comments
J3 5 – 6 (TCK) ⁽¹⁾	JTAG	Short: Routes the onboard emulator to the CC3220 device. Open: Isolate the onboard emulator from the CC3220 device.
J3 7 – 8 (TMS) ⁽¹⁾		
J3 3 – 4 (TDI)		
J3 1 – 2 (TDO)		

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

1.4.3 I²C Connections

The board features an accelerometer and a temperature sensor for the out-of-box demo. These components are connected to the I²C bus and can be isolated using the jumpers provided (see Figure 1-12).

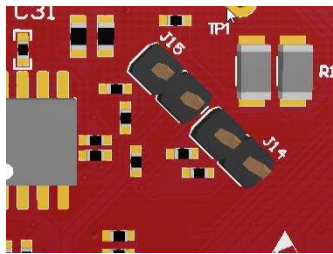


Figure 1-12. I²C Connections

By removing J15 and J14, the accelerometer and the temperature sensors are isolated from the I²C bus. Note that this setup also removes any pullup resistor from the I²C bus and any sensors connected to the bus require external pullups.

Table 1-4 lists the I²C connection jumper settings.

Table 1-4. I²C Jumper Settings

Reference	Use	Comments
J15	I2C SDA	Short: Connect the CC3220MODASF I ² C bus to the onboard sensors with pullup. Open: Isolate the sensors from the CC3220 device.
J14	I2C SCL	Short: Connect the CC3220MODASF I ² C bus to the onboard sensors with pullup. Open: Isolate the sensors from the CC3220 device.

1.4.4 Default I²C Address

Table 1-5 lists the default I²C address.

Table 1-5. Default I²C Address

Sensor Type	Reference	Part Number	Slave Address
Temperature sensor	U10	TMP006	0x41
Accelerometer	U11	BMA222E	0x18

1.4.5 Power Connections

The board can be powered using the onboard micro USB connector. An onboard DC-DC converter provides 3.3 V for the CC3220MODASF device and the rest of the board to operate. This supply can be isolated from the DC-DC converter using the jumpers on the board.

Table 1-6 lists the power jumper settings.

Table 1-6. Power Jumper Settings

Reference	Use	Comments
J18	Current measurement	Measures the current flowing into the CC3220MODASF device. This jumper also includes the serial flash and any stacked BoosterPack.
J16	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.
J9	OPAMP EN	If uninstalled, this jumper cuts off the power supply to the OPAMP. This can be used to enable low power measurements.
J23, J24, J25	LED EN	If uninstalled, the LEDs connected to the GPIO would be disabled. This can be used to enable low power measurements.
J17	VSENSE	This jumper is used to power the level shifters located on the emulator side of the board. The level shifters can be powered by shorting this jumper. Removing this jumper enables low current measurement.
J19	5-V power	5-V output from the USB VBUS (has a diode drop of up to 0.4 V)
J21	3.3-V power input	Can be used to power the board from an external 2 × AA battery pack. This jumper has built-in reverse voltage protection to prevent the battery from being plugged in the reverse manner.

1.4.6 UART Signals

The board supports a USB-based virtual COM port, using the Tiva MCU. The LaunchPad is shipped with the UART lines from the CC3220MODASF connected to the UART on the Tiva MCU (see Figure 1-13). The CC3220MODASF UART can also be routed to the 20-pin connector for use as a GPIO or an external UART (see Figure 1-14). The selection is performed using jumpers on the board.

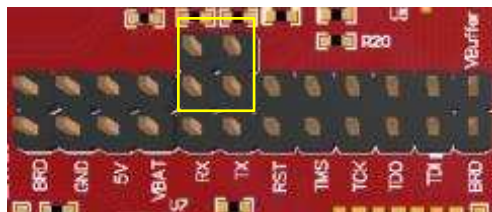


Figure 1-13. UART Routed to the USB COM Port

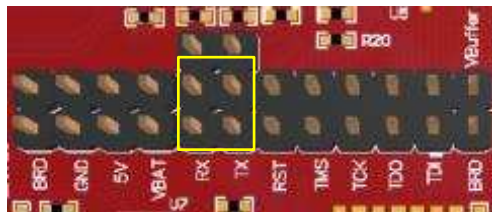


Figure 1-14. UART Routed to the 20-Pin Connector

Table 1-7 lists the UART signals.

Table 1-7. UART Signals

Reference	Use	Comments
J5, J6	UART for flash programming	Short 1 – 2: Route the signals to the 20-pin connector. Short 2 – 3: Route the signals to the USB for flash programming.

1.4.7 Sense on Power

The CC3220MODASF module can be set to operate in four different modes based on the state of the sense on power (SOP) lines. The SOP lines are pins 23, 24, and 34 on the CC3220MODx and CC3220MODAx modules. Table 1-8 lists the state of the device.

Table 1-8. SOP[2:0]

Value	Function
100	Flash programming
000	Functional mode + 4-wire JTAG
001	Functional mode + SWD
010	Functional mode + flash

NOTE: SOP[2:0] corresponds to J12 in the LaunchPad schematic design.

Figure 1-15 shows the SOP jumpers.

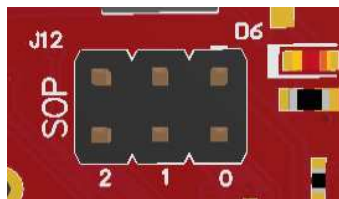


Figure 1-15. SOP Jumpers

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

1.4.8 2 × 20-Pin Connector Assignment

Table 1-9, Table 1-10, Table 1-11, and Table 1-12 show the signal assignment on the 2 × 20-pin connectors.

NOTE: All signals are 3.3-V CMOS logic levels and are referred to with respect to the CC3220 IC. For example, UART_TX is an output from the CC3220 IC. For the SPI lines, the CC3220MODASF can act as a master or slave.

Table 1-9. P1 Connector Assignment

Pin Number	MCU Standard Definition	CC3220MODASx Pin Map	CC3220MODASx Pin Number	Primary Function
P1.1	VCC (3.3 V)	VCC (3.3 V)	—	VCC (3.3 V)
P1.2	ANALOG_IN	GPIO_03*	58	ADC_CH1
P1.3	UART_RX	GPIO_13	4	UART0_RX
P1.4	UART_TX	GPIO_12	3	UART0_TX
P1.5	GPIO	GPIO_06	61	GPIO
P1.6	ANALOG_IN	GPIO_04*	59	ADC_CH2
P1.7	SPI_CLK	GPIO_14	5	SPI_CLK
P1.8	GPIO	GPIO_07	62	GPIO
P1.9	I2C_SCL	GPIO_10	1	I2C_SCL
P1.10	I2C_SDA	GPIO_11	2	I2C_SDA

Table 1-10 lists the P2 connector assignment.

Table 1-10. P2 Connector Assignment

Pin Number	MCU Standard Definition	CC3220MODASx Pin Map	CC3220MODASx Pin Number	Primary Function
P2.1	GND	GND	—	GND
P2.2	GPIO	GPIO_28	18	GPIO
P2.3	SPI_CW (wireless)	GPIO_17	8	SPI_CS
P2.4	TEST	GPIO_31	45	GPIO
P2.5	RST	RESET_OUT	—	RESET_OUT
P2.6	SPI_MOSI	GPIO_16	7	SPI_DOUT
P2.7	SPI_MISO	GPIO_15	6	SPI_DIN
P2.8	SPI_CS (display) / GPIO	GPIO_25	21	GPIO
P2.9	SPI_CS (other) / GPIO	GPIO_01	55	GPIO
P2.10	GPIO	GPIO_22	15	GPIO

Table 1-11 lists the P3 connector assignment.

Table 1-11. P3 Connector Assignment

Pin Number	MCU Standard Definition	CC3220MODASx Pin Map	CC3220MODASx Pin Number	Primary Function
P3.1	5 V	5 V	—	5 V
P3.2	GND	GND	—	GND
P3.3	ANALOG_IN	GPIO_02	57	ADC_CH0
P3.4	ANALOG_IN	GPIO_05	60	ADC_CH3
P3.5	ANALOG_IN	GPIO_03	58	ADC_CH1
P3.6	ANALOG_IN	GPIO_04	59	ADC_CH2
P3.7	ANALOG_IN / AUD_FS	GPIO_08	63	AUD_SYNC
P3.8	ANALOG_IN / AUD_CLK	GPIO_30	53	AUD_CLK
P3.9	ANALOG OUT / AUD_OUT	GPIO_09	64	AUD_DOUT
P3.10	ANALOG OUT / AUD_IN	GPIO_00	50	AUD_DIN

Table 1-12 lists the P4 connector assignment.

Table 1-12. P4 Connector Assignment

Pin Number	MCU Standard Definition	CC3220MODASx Pin Map	CC3220MODASx Pin Number	Primary Function
P4.1	PWM	GPIO_11*	2	PWM
P4.2	PWM	GPIO_10*	1	PWM
P4.3	PWM	GPIO_24*	17	PWM
P4.4	PWM	GPIO_09*	64	PWM
P4.5	CCAP	GPIO_25*	21	CCAP / GPIO
P4.6	CCAP	GPIO_28*	18	CCAP / GPIO
P4.7	GPIO	GPIO_07*	62	GPIO
P4.8	GPIO	GPIO_05*	60	GPIO
P4.9	GPIO	GPIO_23	16	GPIO
P4.10	GPIO	GPIO_24	17	GPIO

The signal mappings are as indicated in Table 1-9 through Table 1-12. All of the signals are referred to by the pin number in the SDK and Table 1-9 through Table 1-12 show the default mappings. Some of the pins are repeated across the connector. For example, pin 62 is available on P1 and P4, but only P1 is connected by default. The signal on P4 is marked with an asterisk (*) to signify that it is not connected by default. The signal on P4 can be routed to the pin by using a 0-Ω resistor in the path. For the exact resistor placement, see the full design implementation at [CC3220MODx SimpleLink™ Wi-Fi® and Internet of Things Hardware Design Files](#).

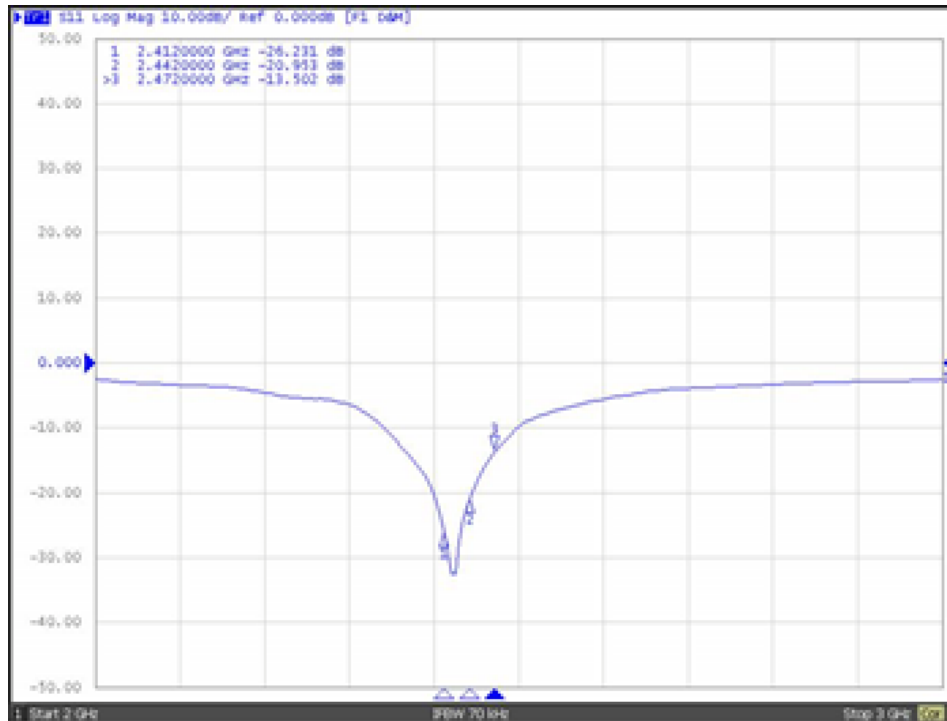
1.5 Electrical Characteristics

For electrical characteristics for the CC3220MODx and CC3220MODAx modules, see [CC3220MOD SimpleLink™ Wi-Fi® CERTIFIED™ Wireless Module Solutions \(S and SF\)](#).

1.6 Antenna Characteristics

The CC3220MODSM2MOB and the CC3220MODSF12MOB reference design detail the use of an on-chip antenna. For more information on the antenna VSWR, efficiency, and electrical characteristics, see [AH316M245001-T](#).

The CC3220MODASM2MON and CC3220MODASF12MON devices have an integral antenna. This antenna has a nominal efficiency of 70%, and a maximum gain of 2.5 dBi. Figure 1-16 shows the measured S-parameters of the integral antenna on the CC3220MODAx.



Antenna Clearance Size: 58 mm x 6.0 mm x 1.6 mm

S-parameter	Frequency	Antenna Return Loss (dB)
APCB with via hole trace	2412 MHz	-26.23
	2442 MHz	-20.95
	2472 MHz	-13.50

Figure 1-16. Integral Antenna S-Parameters on CC3220MODAx Modules

Figure 1-17 shows the measured radiation pattern of the integral antenna on the CC3220MODAx in the X-Z plane.

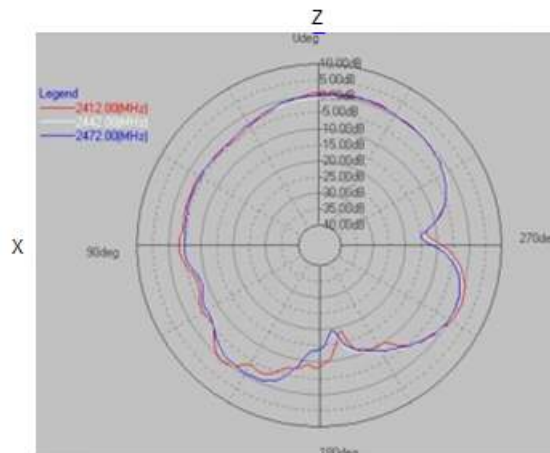


Figure 1-17. CC3220MODAx X-Z Plane Radiated Pattern of the Integral Antenna

Figure 1-18 shows the measured radiation pattern of the integral antenna on the CC3220MODAx in the Y-Z plane.

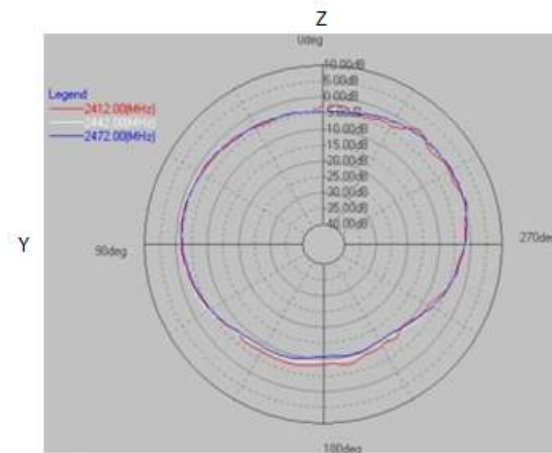


Figure 1-18. CC3220MODAx Y-Z Plane Radiated Pattern of the Integral Antenna

Figure 1-19 shows the measured radiation pattern of the integral antenna on the CC3220MODAx in the X-Y plane.

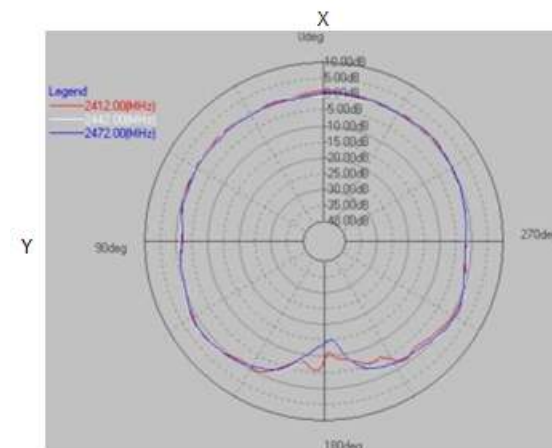


Figure 1-19. CC3220MODAx X-Y Plane Radiated Pattern of the Integral Antenna

1.7 Circuit Design

1.7.1 Reference Schematic

Figure 1-20 shows the typical application schematic using the CC3220MODx module.

The CC3220MODx and CC3220MODAx modules share the same reference schematic. The difference between the two references is the antenna and its matching circuitry. Pin 31 is not accessible to the designer in the CC3220MODAx module because it contains an integral antenna. The full LAUNCHCC3220MODAx reference schematic is available at [CC3220MODx SimpleLink™ Wi-Fi® and Internet of Things Hardware Design Files](#).

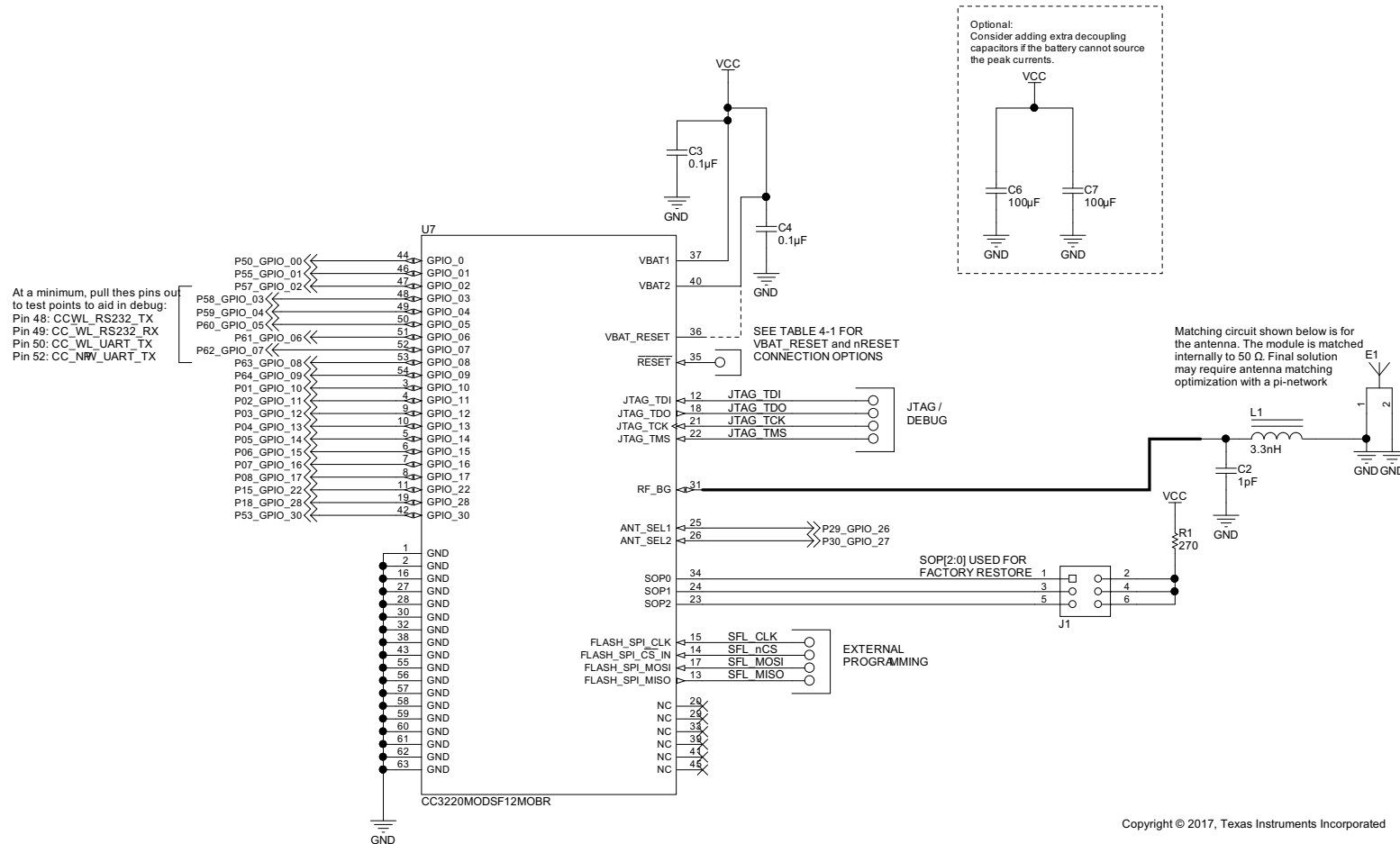


Figure 1-20. CC3220MODx Typical Application Schematic

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1.7.2 Bill of Materials

The CC3220MODx and CC3220MODAx modules share the same reference BOM. The difference between the two references is the antenna and its matching circuitry. Pin 31 is not accessible to the designer in the CC3220MODAx module because it contains an integral antenna.

Table 1-13 lists the bill of materials for the CC3220MODx main engine area. The full LAUNCHCC3220MODAx reference BOM is available at [CC3220MODx SimpleLink™ Wi-Fi® and Internet of Things Hardware Design Files](#).

Table 1-13. Bill of Materials

QTY	PART REFERENCE	VALUE	MANUFACTURER	PART NUMBER	DESCRIPTION
1	C2 ⁽¹⁾	1 pF	Murata	GRM1555C1H1R0BA01D	Capacitor, ceramic, 1 pF, 50 V, ±10%, COG/NP0, 0402
3	C3, C4, C5	0.1 µF	Murata	GRM155R61A104KA01D	Capacitor, ceramic, 0.1 µF, 10 V, ±10%, X5R, 0402
2	C6, C7	100 µF	Murata	LMK325ABJ107MMHT	Capacitor, ceramic, 100 µF, 10 V, ±20%, X5R, AEC-Q200 Grade 3, 1210
1	E1 ⁽¹⁾	2.45-GHz Ant	Taiyo Yuden	AH316M245001-T	Antenna Bluetooth WLAN ZigBee® WIMAX
1	L1 ⁽¹⁾	3.3 nH	Murata	LQG15HS3N3S02D	Inductor, multilayer, air core, 3.3 nH, 0.3 A, 0.17 Ω, SMD
1	R1	270	Vishay-Dale	CRCW0402270RJNED	RES, 270, 5%, 0.063 W, 0402
1	U1	CC3220MODSF	Texas Instruments	CC3220MODSF12MOBR	SimpleLink Wi-Fi and Internet-of-Things Module Solution, a Single-Chip Wireless MCU, MOB0063A (SIP MODULE-63)

⁽¹⁾ For CC3220MODAx: C2, L1, and E1 are not present.

1.8 Layout Guidelines

The integrator of the CC3220MODx and CC3220MODAx modules must comply with the PCB layout recommendations described in the following subsections to preserve and minimize the risk with regulatory certifications for FCC, IC, CE, MIC, and SRRC. Also, TI recommends that customers follow the guidelines described in this section to achieve similar performance.

1.8.1 CC3220MODx Board Layout

The reference layout consists of a four-layer design. [Figure 1-21](#) shows the CC3220MODx top layer.

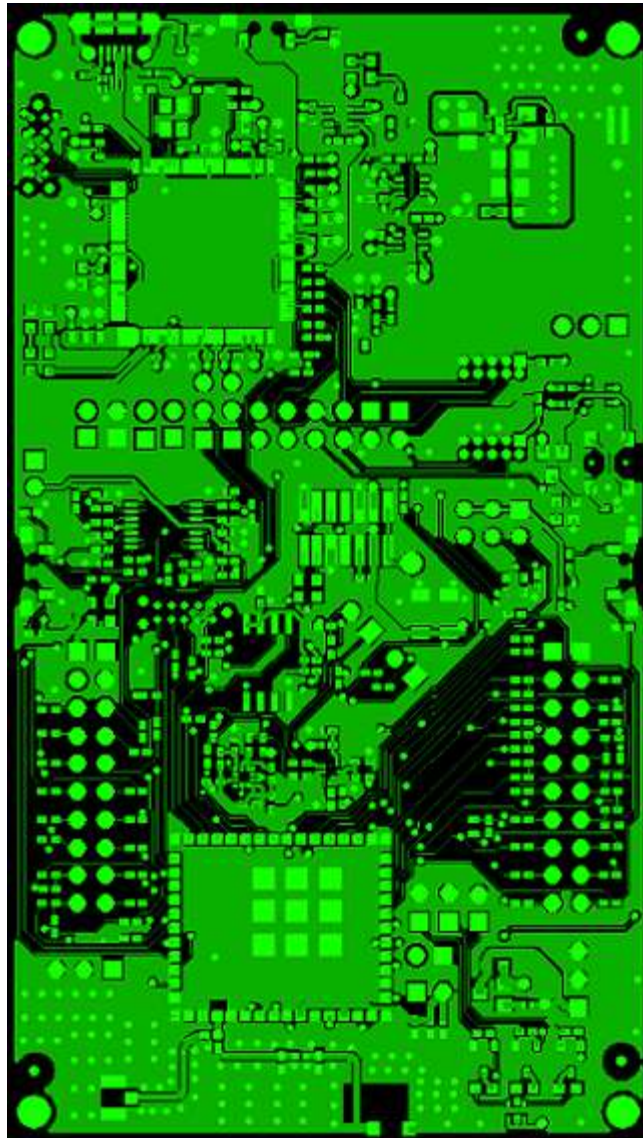


Figure 1-21. CC3220MODx Top Layer

Figure 1-22 shows the CC3220MODx first inner layer.

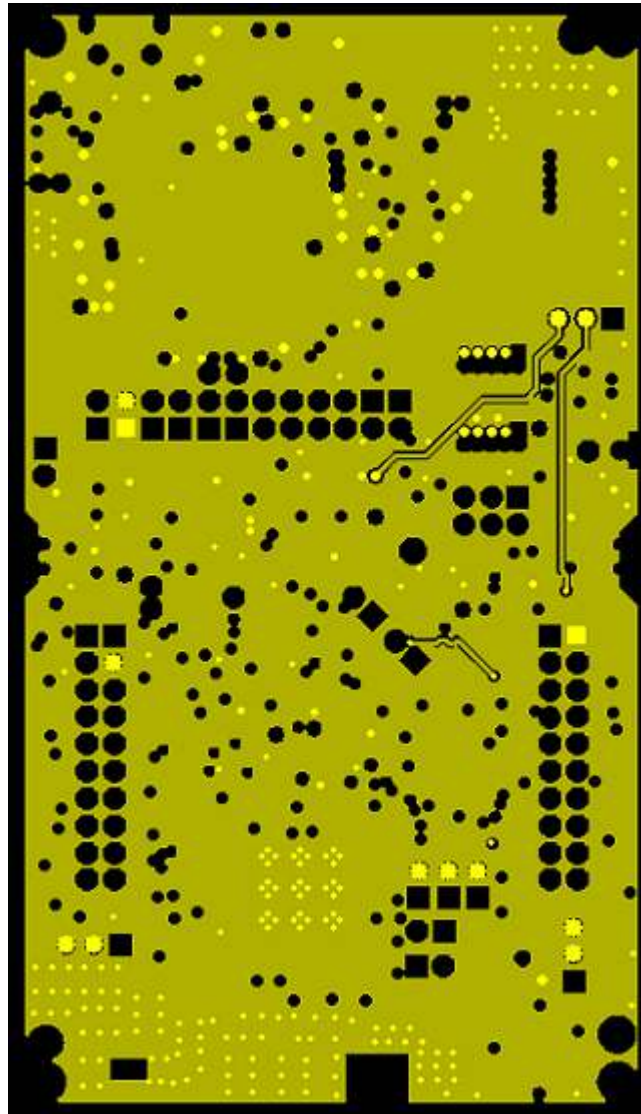


Figure 1-22. CC3220MODx First Inner Layer

Figure 1-23 shows the CC3220MODx second inner layer.



Figure 1-23. CC3220MODx Second Inner Layer

Figure 1-24 shows the CC3220MODx bottom layer.

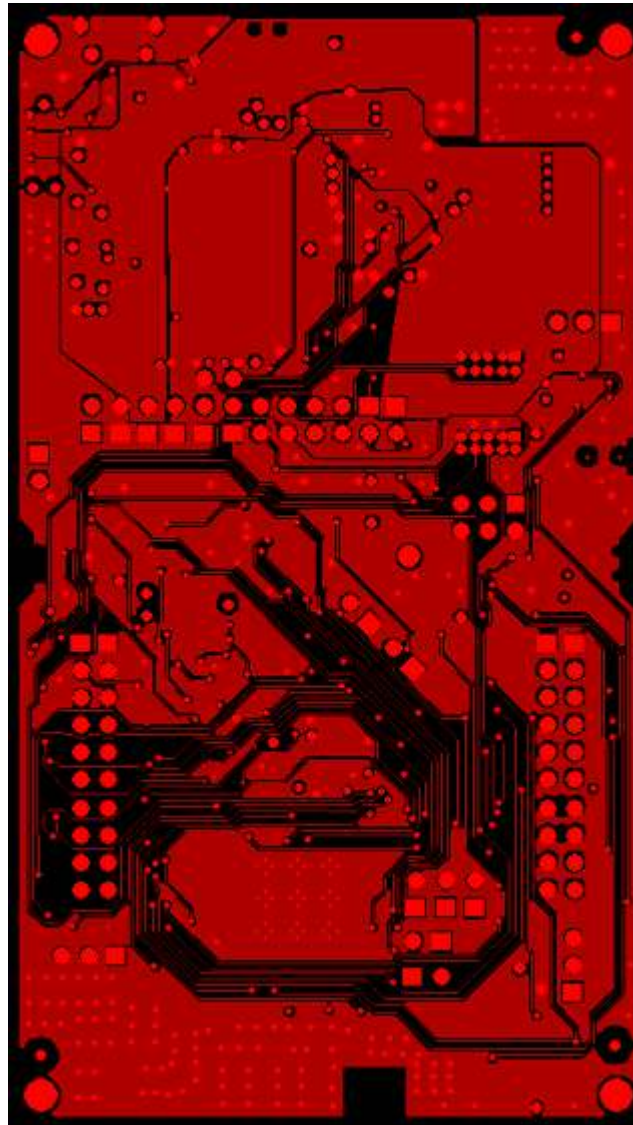


Figure 1-24. CC3220MODx Bottom Layer

1.8.2 CC3220MODAx Board Layout

The reference layout consists of a four-layer design. [Figure 1-25](#) shows the LAUNCHCC3220MODASF top layer.

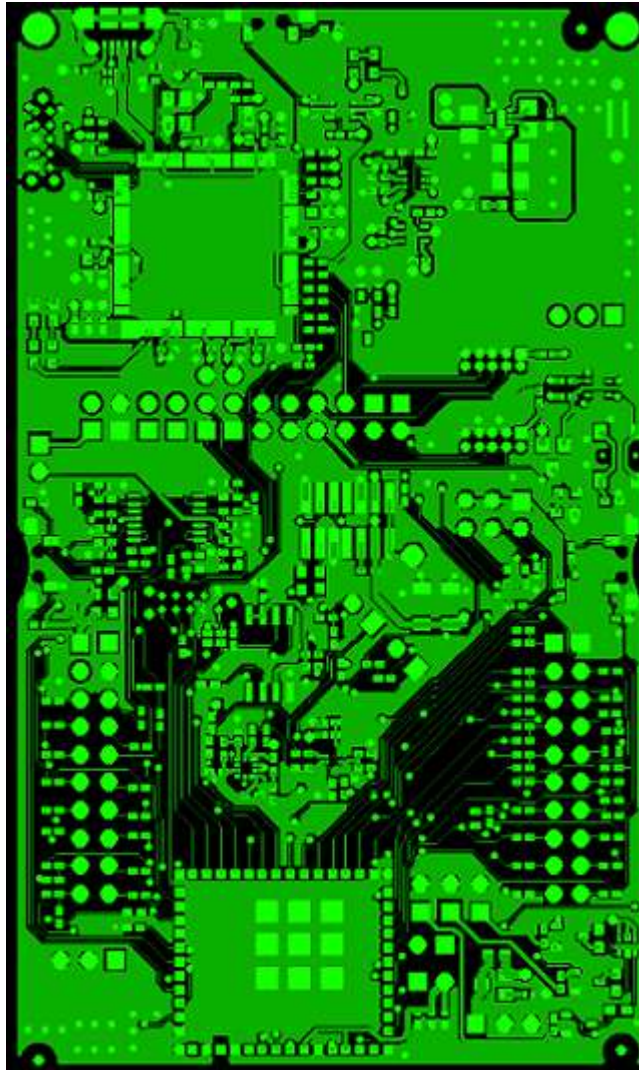


Figure 1-25. LAUNCHCC3220MODASF Top Layer

Figure 1-26 shows the LAUNCHCC3220MODASF first inner layer.

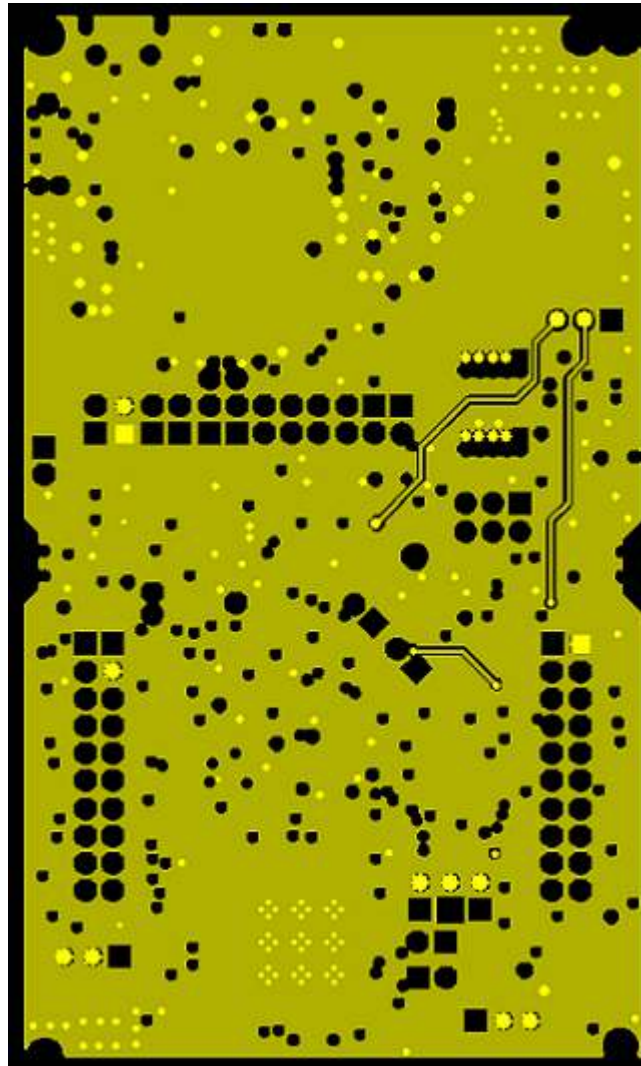


Figure 1-26. LAUNCHCC3220MODASF First Inner Layer

Figure 1-27 shows the LAUNCHCC3220MODASF second inner layer.

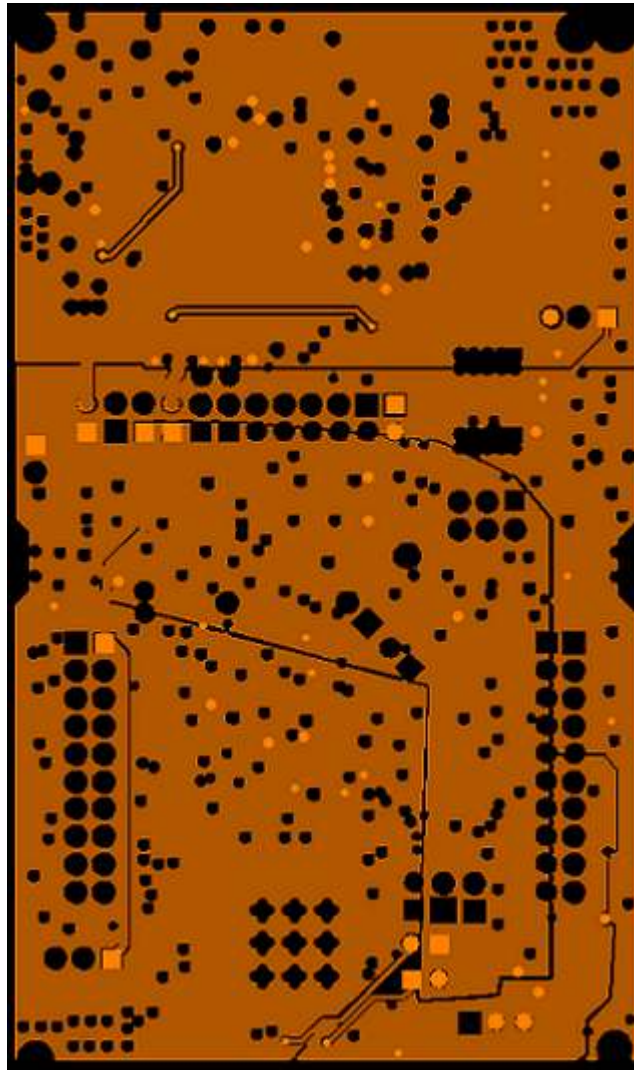


Figure 1-27. LAUNCHCC3220MODASF Second Inner Layer

Figure 1-28 shows the LAUNCHCC3220MODASF bottom layer.

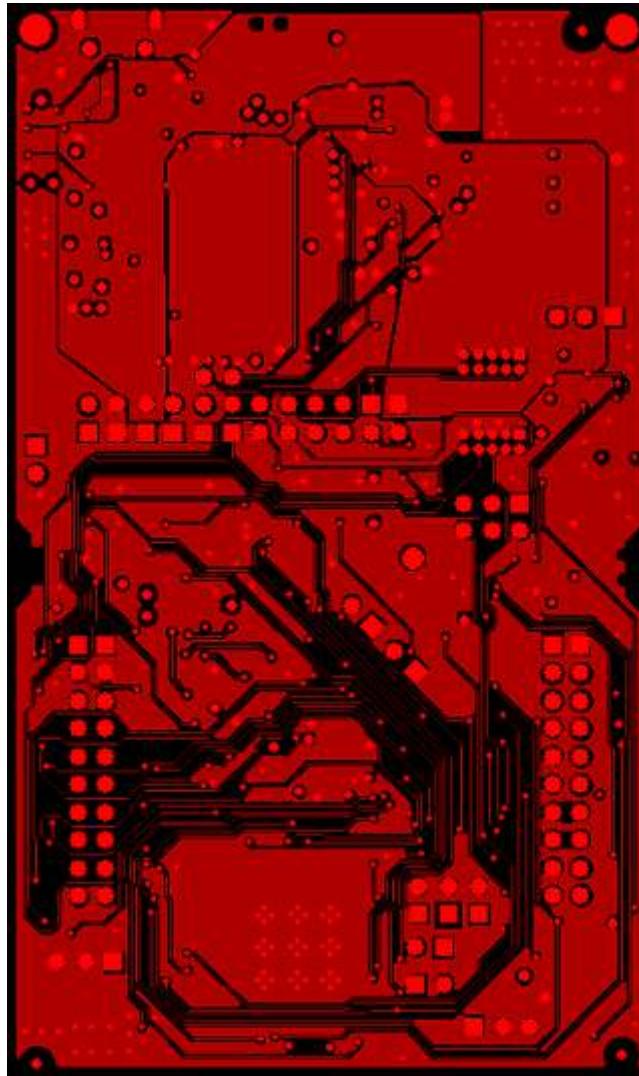


Figure 1-28. LAUNCHCC3220MODASF Bottom Layer

1.8.3 General Layout Recommendations

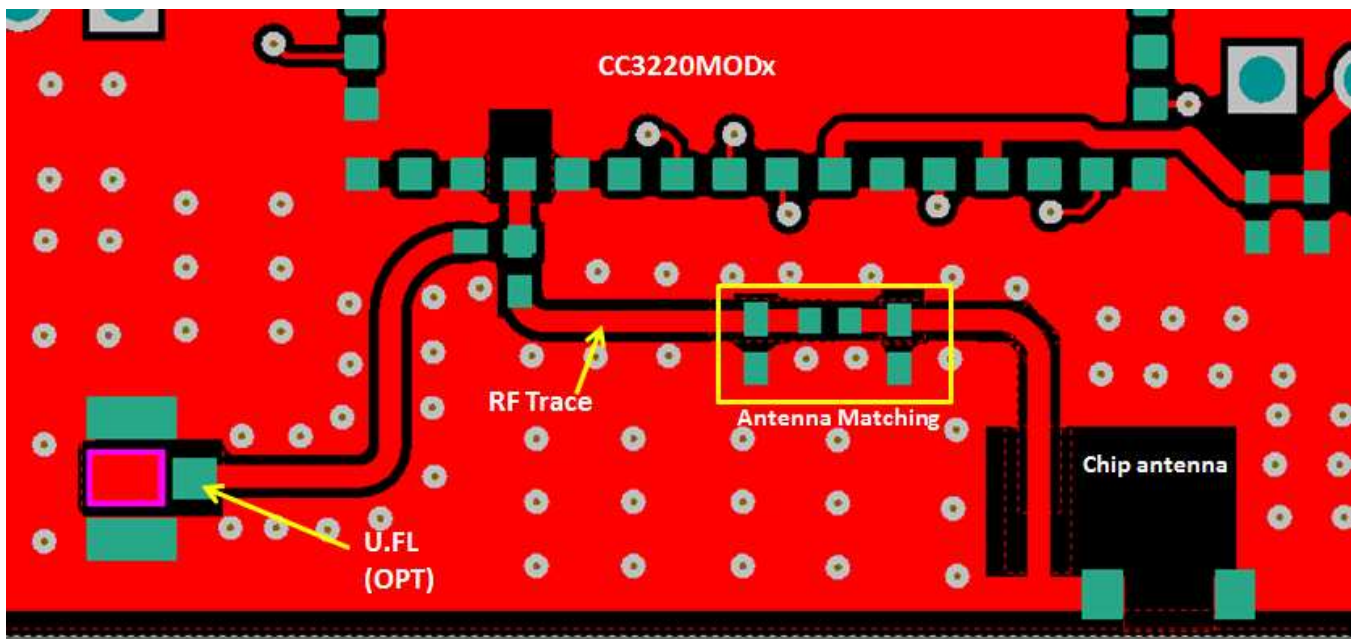
Ensure that the following general layout recommendations are followed:

- Have a solid ground plane and ground vias under the module for stable system and thermal dissipation.
- Do not run signal traces underneath the module on a layer where the module is mounted.

1.8.4 RF Layout Recommendations (CC3220MODx)

The RF section of this wireless module gets top priority in terms of layout. It is very important for the RF section to be laid out correctly to ensure optimum performance from the module. A poor layout can cause low-output power, EVM degradation, sensitivity degradation, and mask violations.

Figure 1-29 shows the RF placement and routing of the CC3220MODx module.



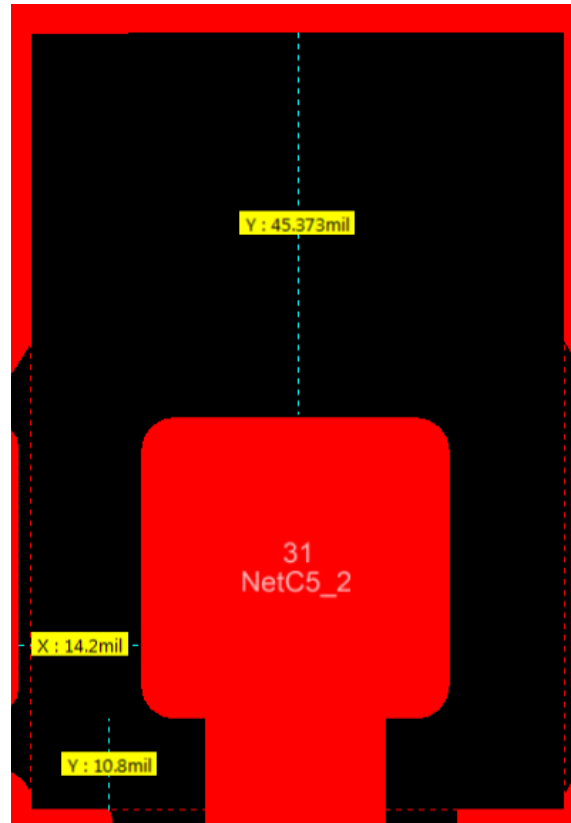
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Figure 1-29. RF Section Layout

Use the following RF layout recommendations for the CC3220MODx module:

- RF traces must have 50-Ω impedance.
- RF trace bends must be made with gradual curves, and 90 degree bends must be avoided.
- RF traces must not have sharp corners.
- There must be no traces or ground under the antenna section.
- RF traces must have via stitching on the ground plane beside the RF trace on both sides.
- RF traces must be as short as possible. The antenna, RF traces, and the module must be on the edge of the PCB product in consideration of the product enclosure material and proximity.

For optimal RF performance, ensure the copper cut out on the top layer under the RF-BG pin (pin 31) is as shown in [Figure 1-30](#).



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Figure 1-30. Top Layer Copper Pullback on RF Pads

1.8.5 Antenna Placement and Routing (CC3220MODx)

The antenna is the element used to convert the guided waves on the PCB traces to the free space electromagnetic radiation. The placement and layout of the antenna are the keys to increased range and data rates. [Table 1-14](#) provides a summary of the recommended antennas to use with the CC3220MODx module.

Table 1-14. Antenna Guidelines

SR NO.	GUIDELINES
1	Place the antenna on an edge or corner of the PCB.
2	Ensure that no signals are routed across the antenna elements on all the layers of the PCB.
3	Most antennas, including the chip antenna used on the LaunchPad, require ground clearance on all the layers of the PCB. Ensure that the ground is cleared on inner layers as well.
4	Ensure that there is provision to place matching components for the antenna. These must be tuned for best return loss when the complete board is assembled. Any plastics or casing must also be mounted while tuning the antenna because this can impact the impedance.
5	Ensure that the antenna impedance is 50 Ω because the module is rated to work only with a 50- Ω system.
6	In case of printed antenna, ensure that the simulation is performed with the solder mask in consideration.
7	Ensure that the antenna has a near omnidirectional pattern.
8	The feed point of the antenna is required to be grounded. This is only for the antenna type used on the CC3220MODx LaunchPad. See the specific antenna data sheets for the recommendations.

1.8.6 Transmission Line Considerations (CC3220MODx)

The RF signal from the module is routed to the antenna using a Coplanar Waveguide with ground (CPW-G) structure. CPW-G structure offers the maximum amount of isolation and the best possible shielding to the RF lines. In addition to the ground on the L1 layer, placing GND vias along the line also provides additional shielding. [Figure 1-31](#) shows a cross section of the coplanar waveguide with the critical dimensions.

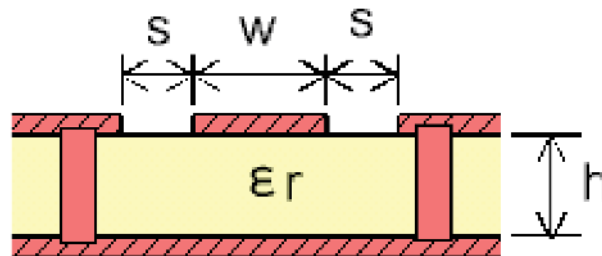


Figure 1-31. Coplanar Waveguide (Cross Section)

Figure 1-32 shows the top view of the coplanar waveguide with GND and via stitching.

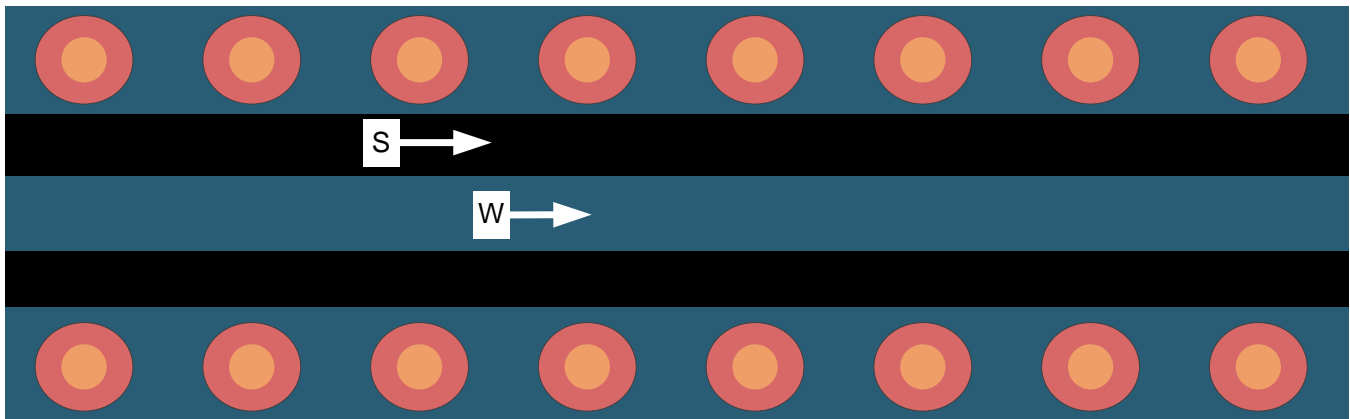


Figure 1-32. CPW With GND and Via Stitching (Top View)

The recommended values for the PCB are provided for 2-layer boards in [Table 1-15](#) and 4-layer boards in [Table 1-16](#).

Table 1-15. Recommended PCB Values for 2-Layer Board (L1 to L2 = 42.1 mils)

PARAMETER	VALUE	UNIT
W	24.5	mils
S	6.5	mils
H	42.1	mils
Er (FR-4 substrate)	4.8	

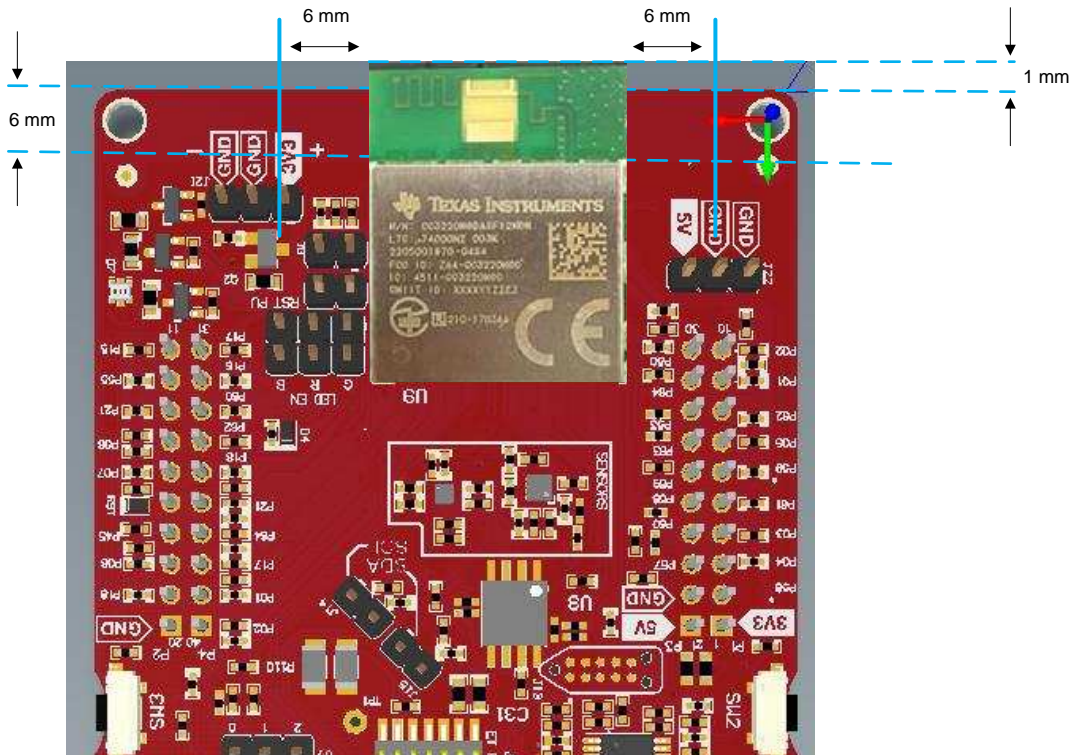
Table 1-16. Recommended PCB Values for 4-Layer Board (L1 to L2 = 16 mils)

PARAMETER	VALUE	UNITS
W	21	mils
S	10	mils
H	16	mils
Er (FR-4 substrate)	4.5	

1.8.7 RF Layout Recommendations (CC3220MODAx)

Figure 1-33 shows the guidelines to lay out the CC3220MODAx module.

- The module must have an overhang of 1 mm from the PCB edge.
- The module must have a 6-mm clearance on all layers (no copper) to the left and right of the module placement.
- There must be at least one ground-reference plane under the module on the main PCB.



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Figure 1-33. CC3220MODAx Layout Guidelines

1.9 Operational Setup and Testing (LAUNCHCC3220MODASF)

A compatible BoosterPack can be stacked on top of the LaunchPad using the two, 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 header pins. On the CC3220MODASx LaunchPad, a small white symbol is provided near pin 1 (see [Figure 1-34](#)) to orient all BoosterPacks.



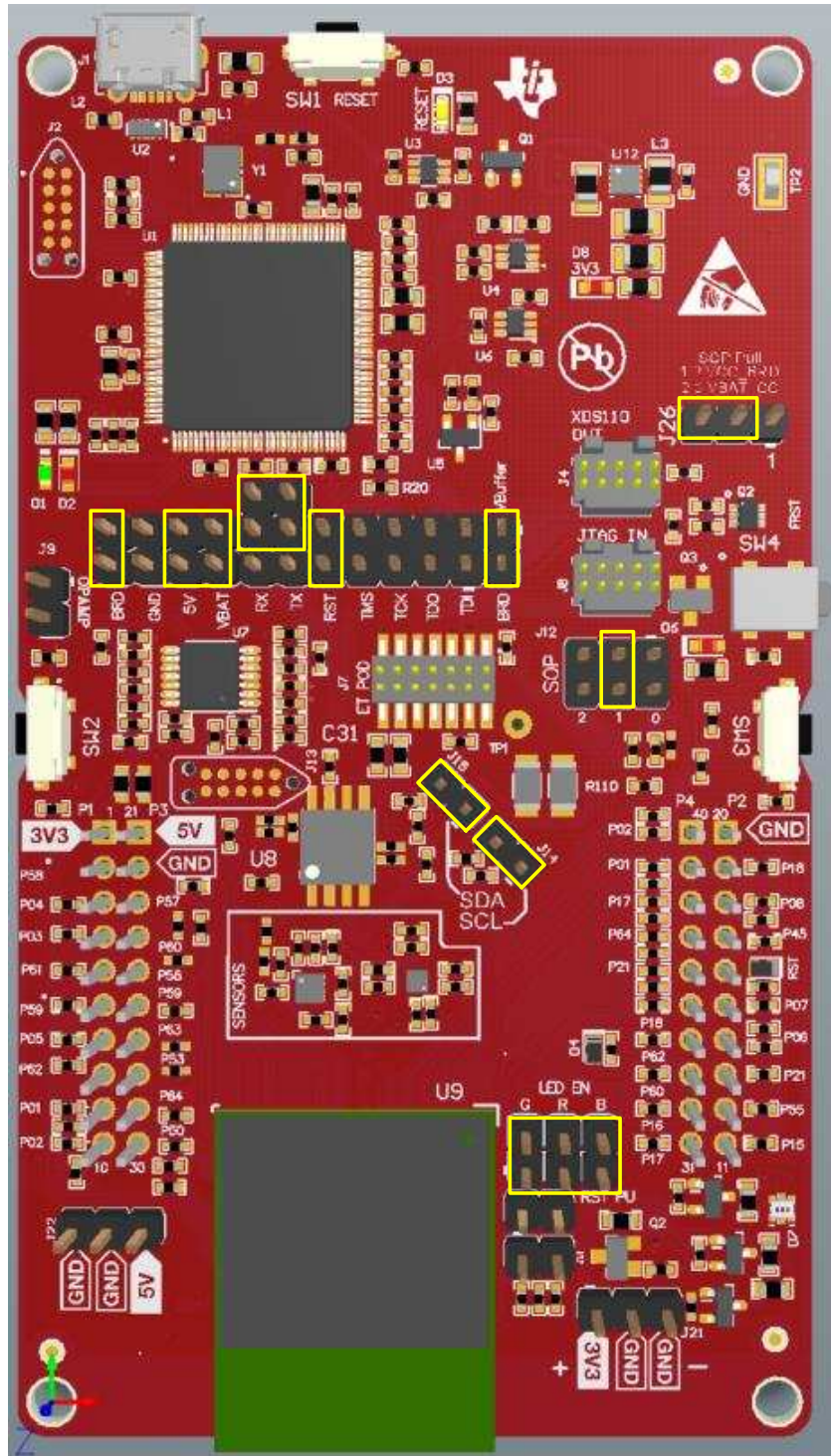
Figure 1-34. Pin 1 Marking on LaunchPad (3V3 Mark)

1.9.1 Power

The LaunchPad is designed so that it can be powered by the USB connection or by two external AA or AAA batteries.

1.9.1.1 USB Power

The LaunchPad is designed to work from the USB provided power supply. The LaunchPad enumerates as a bus-powered device on the computer. When the board is powered from the USB connector, ensure that the jumpers are placed on the following headers, shown in [Figure 1-35](#).



(1) Yellow blocks show jumper placements.

Figure 1-35. Powering From USB

1.9.1.2 Battery Power (Two 1.5 V)

The LaunchPad can also be powered from an external battery pack by feeding the voltage on the J21 header. This input features reverse voltage protection to ensure that the board is not damaged due to an accidental reverse voltage. Use the following precautions while using the board with a battery.

- Remove the USB cable.
- Plug in the battery pack on J20 with correct polarity (see [Figure 1-36](#)).

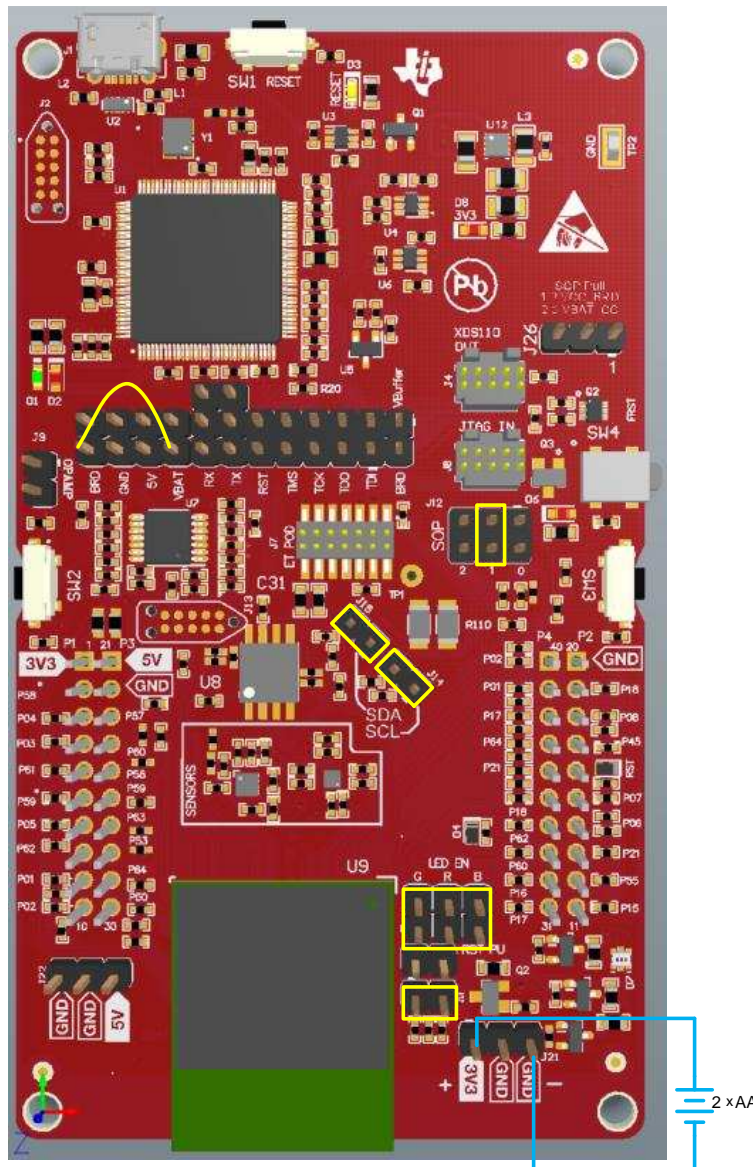


Figure 1-36. Battery Power

1.9.1.3 Battery Powering the CC3220MODASF and Serial Flash

In some cases, there may be a requirement to power only the CC3220MODASF module and the Serial Flash from the battery. The use may not require LEDs or OPAMP for the ADC and the sensors. In such a condition, the other sections can be powered off by removing the appropriate jumpers. Figure 1-37 shows how the board would look with the correct jumpers on.

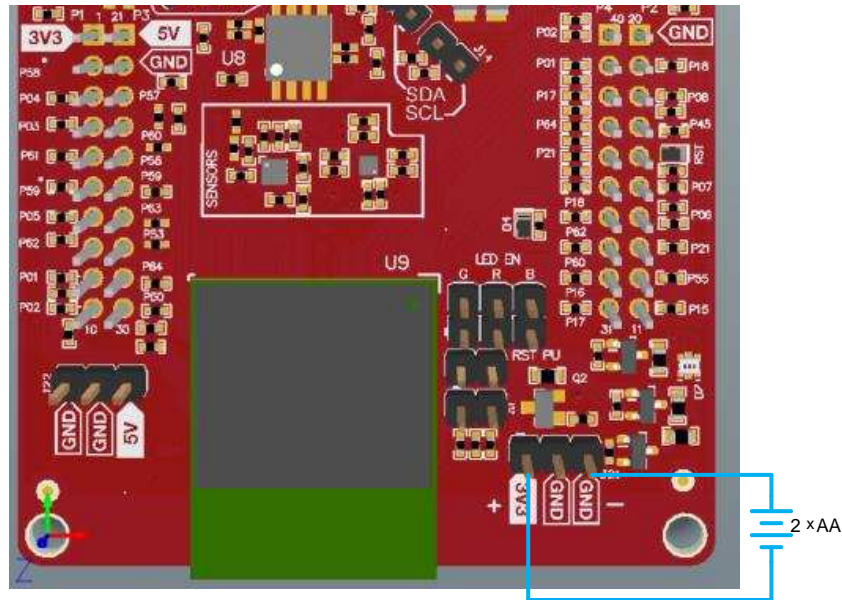


Figure 1-37. Battery Powering the CC3220MODASF and Serial Flash

1.9.2 Measuring the CC3220MODAx Current Draw

To measure the current draw of the CC3220 device when powering with a USB cable, use the VBAT jumper on the jumper isolation block (J18). The current measured in this mode includes only the CC3220MODASx device and the Serial Flash current and no external blocks. However, if a GPIO of the CC3220MODASx is driving a high current load like the LED, then that is also included in this measurement.

1.9.2.1 Low-Current Measurement with USB Power (< 1 mA)

See the following instructions to measure ultra-lower power when powering with a USB cable (see [Figure 1-38](#)).

1. Remove the 3V3 jumper (J18) and attach an ammeter across this jumper.
2. Ensure that the CC3220MODASx device is not driving any high current loads directly, like an LED, because that can cause large current drawn.
3. Begin target execution and set the device to low-power modes (LPDS or hibernate).
4. Measure the current. Remember that if the current levels are fluctuating, it may be difficult to get a stable measurement. It is easier to measure quiescent states.

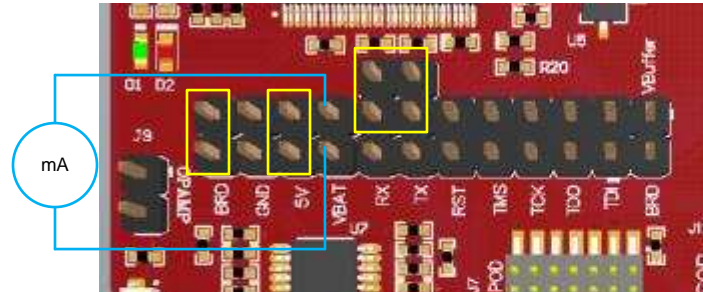


Figure 1-38. Low Current Measurement

1.9.2.2 Low-Current Measurement with Battery Power (< 1 mA)

See the following instructions to measure ultra-lower power when powering with batteries.

1. Remove the jumpers, as shown in [Figure 1-37](#).
2. Connect an ammeter in series with your external power supply.
3. Ensure that the CC3220MODASx device is not driving any high current loads directly, like an LED, because that can cause large current drawn.
4. Begin target execution and set the device to low-power modes (LPDS or hibernate).
5. Measure the current. Remember that if the current levels are fluctuating, it may be difficult to get a stable measurement. It is easier to measure quiescent states.

[Figure 1-39](#) shows the current measurement with battery power.

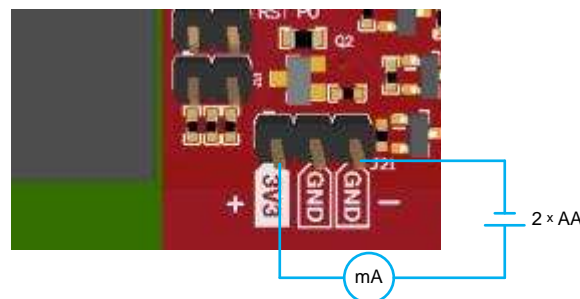


Figure 1-39. Current Measurement with Battery Power

1.9.2.3 Active Current Measurements

See the following instructions to measure active power (see [Figure 1-40](#)).

1. Remove the VBAT jumper (J18).
2. Solder a 0.1-Ω resistor on a wire which can be connected to a voltmeter/oscilloscope, as shown in [Figure 1-40](#). Or, attach a jumper across J18 so that it can be used with a current probe.
3. Measure the voltage across the resistor using an oscilloscope with a differential probe. For the current probe, coil the wire around the sensor several 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.

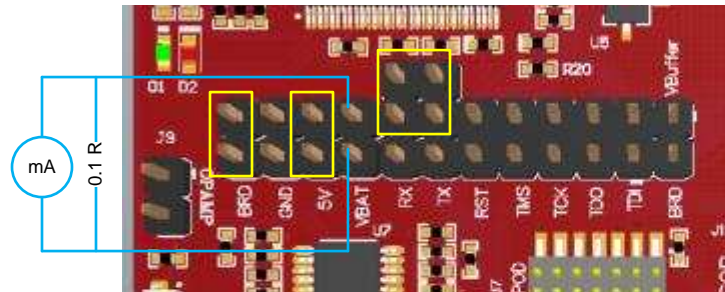


Figure 1-40. Active Current Measurement

1.9.3 Clocking

All of the required clocks are inside the module. There is no need to supply any external clock.

Manual Information to the End User

The OEM integrator must be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual must include all required regulatory information and warnings as shown in this manual.

2.1 RF Function and Frequency Range

The CC3220MODSM2MOB, CC3220MODSF12MOB, CC3220MODASM2MON, and CC3220MODASF12MON devices are designed to operate in the WLAN 2.4-GHz band. The CC3220MODSM2MOB, CC3220MODSF12MOB, CC3220MODASM2MON, and CC3220MODASF12MON devices support the following channels dependent on the region of operation:

- FCC and IC: Channels 1 through 11 (2142 MHz to 2462 MHz)
- EU: Channels 1 through 13 (2142 MHz to 2472 MHz)
- JP: Channels 1 through 13 (2142 MHz to 2472 MHz)

Note that the CC3220MODx and CC3220MODAx devices do not support determination of its region through any external mechanism. The region is set by the application SW, or at the time of programming of the device. The end user is unable to change the region of operation at any time.

NOTE: The maximum RF power transmitted in each WLAN 2.4-GHz band is 18 dBm.

2.2 FCC and IC Certification and Statement

This device is intended for OEM integrators under the following conditions:

- The antenna must be installed so 20 cm of space is maintained between the antenna and the users.
- The transmitter module may not be colocated with any other transmitter of antenna.
- To comply with FCC and IC regulations limiting maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:
 - +2.5 dBi in WLAN 2.4 G.

In the event that these conditions cannot be met (for example, certain laptop configurations or colocation with another transmitter), then the FCC and IC authorization is no longer considered valid and the FCC and IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and IC authorization.

2.2.1 FCC

The TI CC3220MODx and CC3220MODAx modules are certified for FCC as a single-modular transmitter. The module is an FCC-certified radio module that carries a modular grant.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired

operation of the device.

CAUTION

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from the one the receiver is connected to.
- Consult the dealer or an experienced radio or TV technician for help.

The antennas listed in [Section 2.4](#) of this document were verified in the compliance testing. Use only the antennas listed in [Section 2.4](#). A separate approval is required for all other operating configurations, including different antenna configurations.

2.2.2 CAN ICES-3(B) and NMB-3(B) Certification and Statement

The TI CC3220MODx and CC3220MODAx modules are certified for IC as a single-modular transmitter. The TI CC3220MODx and CC3220MODAx modules meet IC modular approval and labeling requirements. The IC follows the same testing and rules as the FCC regarding certified modules in authorized equipment.

This device complies with Industry Canada license-exempt RSS standards.

Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage.
- L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAUTION**IC RF Radiation Exposure Statement:**

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

This radio transmitter (4511-CC3120MOD) has been approved by Industry Canada to operated with the antenna types listed in [Section 2.4](#) of this document with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

The antennas listed in [Section 2.4](#) of this document were verified in the compliance testing. Use only the antennas listed in [Section 2.4](#). A separate approval is required for all other operating configurations, including different antenna configurations.

2.2.3 End Product Labeling

This module is designed to comply with the FCC statement, FCC ID: Z64-CC3220MOD. The host system using this module must display a visible label indicating the following text:

- Contains FCC ID: Z64-CC3220MOD

This module is designed to comply with the IC statement, IC: 4511-CC3220MOD. The host system using this module must display a visible label indicating the following text:

- Contains IC: 4511-CC3220MOD

This module is designed to comply with JP statement 201-170386. The host system using this module must display a visible label indicating the following text:

- Contains transmitter module with certificate module 201-170386

2.2.4 Device Classifications

Because host devices vary widely with design features and configurations, module integrators shall reference the following guidelines regarding device classification and simultaneous transmission, and seek guidance from their preferred regulatory test lab to determine how regulatory guidelines will impact the device compliance. Proactive management of the regulatory process will minimize unexpected schedule delays and costs due to unplanned testing activities.

The module integrator must determine the minimum distance required between their host device and the body of the user. The FCC provides device classification definitions to assist in making the correct determination. Note that these classifications are guidelines only; strict adherence to a device classification may not satisfy the regulatory requirement as near-body device design details may vary widely. The user-preferred test lab will be able to assist in determining the appropriate device category for the host product and if a KDB or PBA must be submitted to the FCC.

Note, the module that the user is using has been granted modular approval for mobile applications. Portable applications may require further RF exposure (SAR) evaluations. It is also likely that the host and module combination will need to undergo testing for FCC Part 15, regardless of the device classification. The preferred test lab of the user will be able to assist in determining the exact tests which are required on the host and module combination.

2.2.5 FCC Definitions

Portable: (§2.1093)—A portable device is defined as a transmitting device designed to be used so that the radiating structures of the device is or are within 20 centimeters of the body of the user.

Mobile: (§2.1091) (b)—A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Per §2.1091d(d)(4) In some cases (for example, modular or desktop transmitters), the potential conditions of use of a device may not allow easy classification of that device as either Mobile or Portable. In these cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength, or power density, whichever is most appropriate.

2.2.6 Simultaneous Transmission Evaluation

This module has not been evaluated or approved for simultaneous transmission as it is impossible to determine the exact multi-transmission scenario that a host manufacturer may choose. Any simultaneous transmission condition established through module integration into a host product must be evaluated per the requirements in KDB447498D01(8) and KDB616217D01,D03 (for laptop, notebook, netbook, and tablet applications).

These requirements include, but are not limited to:

- Transmitters and modules certified for mobile or portable exposure conditions can be incorporated in mobile host devices without further testing or certification when:
 - The closest separation among all simultaneous transmitting antennas is > 20 cm
 - or
 - Antenna separation distance and MPE compliance requirements for ALL simultaneous transmitting antennas have been specified in the application filing of at least one of the certified transmitters within the host device. In addition, when transmitters certified for portable use are incorporated in a mobile host device, the antennas must be > 5 cm from all other simultaneous transmitting antennas
- All antennas in the final product must be at least 20 cm from users and nearby persons.

2.3 EU Certification and Statement

2.3.1 RF Exposure Information (MPE)

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure. To comply with the RF exposure requirements, this module must be installed in a host platform that is intended to be operated in a minimum of 20-cm separation distance to the user.

2.3.2 Simplified DoC Statement

2.3.2.1 CC3220MODx and CC3220MODAx Modules

Hereby, Texas Instruments declares that the radio equipment type CC3220MODSM2MOB, CC3220MODSF12MOB, CC3220MODASM2MON, and CC3220MODASF12MON are in compliance with Directive 2014/53/EU.

The full text of the EU declarations of conformity are available at:


- [CC3220MODSM2MOB EC Declaration of Conformity \(DoC\)](#)
- [CC3220MODSF12MOB EC Declaration of Conformity \(DoC\)](#)
- [CC3220MODASM2MON EC Declaration of Conformity \(DoC\)](#)
- [CC3220MODASF12MON EC Declaration of Conformity \(DoC\)](#)

2.3.2.2 LAUNCHCC3220MODASF

Hereby, Texas Instruments declares that the radio equipment type LAUNCHCC3220MODASF is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity are available at [LAUNCHCC3220MODASF EC Declaration of Conformity \(DoC\)](#).

2.3.3 Waste Electrical and Electronic Equipment (WEEE)

	<p>Waste Electrical and Electronic Equipment (WEEE)</p> <p>This symbol means that according to local laws and regulations your product and/or battery shall be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Proper recycling of your product will protect human health and the environment.</p>
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2.3.4 OEM and Host Manufacturer Responsibilities

OEM and host manufacturers are ultimately responsible for the compliance of the host and module. The final product must be reassessed against all of the essential requirements of the RED before it can be placed on the EU market. This includes reassessing the transmitter module for compliance with the radio and EMF essential requirements of the RED. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

2.3.5 Antenna Specifications

In all cases, assessment of the final product must be met against the Essential requirements of RE Directive Article 3.1(a) and (b), safety and EMC respectively, as well as any relevant Article 3.3 requirements.

1. The antennas listed in [Section 2.4](#) were verified in the conformity testing, and for compliance the antenna shall not be modified. A separate approval is required for all other operating configurations, including different antenna configurations.
2. If any other simultaneous transmission radio is installed in the host platform together with this module, or above restrictions cannot be kept, a separate RF exposure assessment and CE equipment certification is required.

2.4 CC3220MODx Approved Antennas

Table 2-1 lists the antennas approved for use with the CC3220MOD module.

Table 2-1. CC3220MODx Approved Antennas

Antenna Information				
	Brand	Antenna Type	Model	2.4-GHz Gain
1	FoxCon	PCB	T77H533	2.5 dBi
2	Ethertronics	Dipole	1000423	-0.6 dBi
3	LSR	Rubber Whip / Dipole	001-0012	2.0 dBi
4			080-0013	2.0 dBi
5			080-0014	2.0 dBi
6		PIFA	001-0016	2.5 dBi
7			001-0021	2.5 dBi
8		Laird	PCB	CAF94504
9	CAF94505			2.0 dBi
10	ACX	Multilayer Chip	AT3216-BR2R7HAA	0.5 dBi
11			AT312-T2R4PAA	1.5 dBi
12	TDK	Multilayer Ceramic Chip Antenna	ANT016008LCD2442MA1	1.6 dBi
13			ANT016008LCD2442MA2	2.5 dBi
14	Mitsubishi Material	Chip Antenna	AM03DP-ST01	1.6 dBi
15		Antenna Unit	UB18CP-100ST01	-1.0 dBi
16	Taiyo Yuden	Chip Antenna / Herical Monopole	AF216M245001	1.5 dBi
17		Chip Antenna / Monopole Type	AH212M245001	1.3 dBi
18			AH316M245001	1.9 dBi
19	Antenna Technology	Dipole	AA2402SPU	2.0 dBi
20			AA2402RSPU	2.0 dBi
21			AA2402A-UFLLP	2.0 dBi
22			AA2402AU-UFLLP	2.0 dBi
23	Staf	Monopole	1019-016	2.14 dBi
24			1019-017	2.14 dBi
25			1019-018	2.14 dBi
26			1019-019	2.14 dBi
27	Map Electronics	Rubber Whip	MEIWX-2411SAXX-2400	2.0 dBi
28			MEIWX-2411RSXX-2400	2.0 dBi
29			MEIWX-282XSAXX-2400	2.0 dBi
30			MEIWX-282XRSXX-2400	2.0 dBi
31			MEIWF-HP01RS2X-2400	2.0 dBi
32	Yageo	Chip	ANT3216A063R2400A	1.69 dBi
33	May Layers Scientific	Chip	LTA-3216-2G4S3-A1	1.0 dBi
34			LTA-3216-2G4S3-A3	2.0 dBi
35	Advantech	Rubber Whip / Dipole	AN2450-5706RS	2.38 dBi

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Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Date	Revision	Description
August 2017	*	Initial release

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