TI CC3000 BoosterPack Evaluation Module Board

User's Guide

TEXAS INSTRUMENTS

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About This Manual

This user guide describes how to use the TI CC3000 BoosterPack evaluation module (EVM) board to evaluate the performance of the TI CC3000 module.

Related Documentation From Texas Instruments

- *TI SimpleLink™ CC3000 Module – Wi-Fi 802.11b/g Network Processor Data Sheet* (SWRS126)
- CC3000 wiki

If You Need Assistance

The primary sources of CC3000 information are the device-specific data sheets and user's guides. For the most up-to-date version of the user's guide and data sheets, see the CC3000 module product page.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

SimpleLink is a trademark of Texas Instruments.
Wi-Fi is a registered trademark of Wi-Fi Alliance.

Revision History

Changes from Original (November 2012) to A Revision **Page**

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

Introduction

This user's guide describes how to use the TI CC3000 BoosterPack EVM board to evaluate the performance and functionality of the TI CC3000 module. The TI CC3000 module is a self-contained Wi-Fi® solution that enables Internet connectivity for a wide variety of embedded applications. This document details the key parts and features of the CC3000 BoosterPack EVM board along with the different options available for the user and includes layout guidelines to assist in PCB development.

CC3000 BoosterPack EVM Board

2.1 BoosterPack EVM Board Top View

Figure 2-1 shows the top view of the CC3000 BoosterPack EVM board.
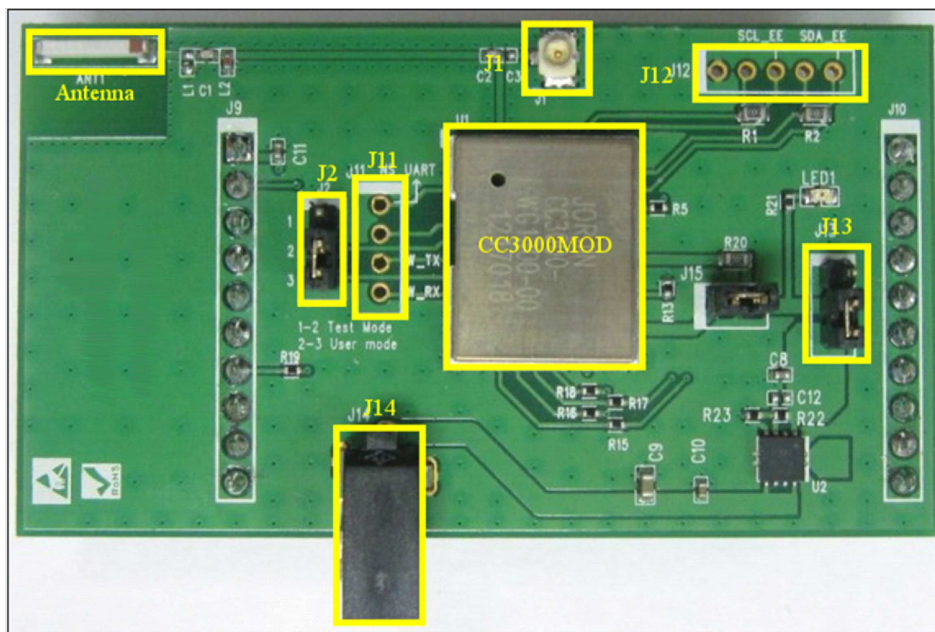
SWRU331-001

Figure 2-1. BoosterPack EVM Board (Top View)

Table 2-1 describes the key parts and jumpers mounted on top of the CC3000 BoosterPack EVM board.

Table 2-1. Key Parts of CC3000 BoosterPack EVM Board Top View

Part Name	Description
CC3000MOD	Core module for performance evaluation. For more information, see the CC3000 module datasheet (SWRS126).
Antenna	Can be used for radiated testing by reworking the capacitor to correct pads
J1	U.FL RF connector used for conductive power tests
J2	Used to swap between test mode and operation mode. When pins 2 and 3 are shorted, J2 runs in operation mode. When pins 1 and 2 are shorted, J2 runs in test mode.
J11	Through-hole test points (for more information, see Table 2-3)
J12	Through-hole test points (for more information, see Table 2-4)
J13	Used to switch between external power and power from the motherboard. Can be used for power measurements. Connect pins 1 and 2 for power from the LaunchPad flash programmer and debugging tool. Connect pins 2 and 3 for external power.
J14	DC jack for external power supply. If power is not supplied from the motherboard, ensure that external power is applied.

Table 2-2 describes the J2 configuration of the CC3000 EVM board.

Table 2-2. J2 Configuration of the CC3000 EVM Board

Mode	Description
Test mode: CC3000 radio tool[1]	Connect pins 1 and 2. Test mode is used with the CC3000 radio tool to operate, test, and calibrate the CC3000 chipset designs during development. This tool uses the RS232/UART pins to run radio frequency (RF) RX and TX tests on the CC3000 module. For more information, see the CC3000 wiki.
Functional mode: Normal mode	Connect pins 2 and 3. Normal mode is for regular functionality between the host platform and the CC3000 module.

[1]   For more information about test software for the PC, see the CC3000 wiki.

Table 2-3 describes the signals on J11.

Table 2-3. Header J11 of the CC3000 BoosterPack EVM Board Top View

Pin	Pin Name	Pin Type	Descriptions
1	Reserved	–	Reserved
2	Reserved	–	Reserved
3	WL_RS232_TX	Output	RS232 transmit output; used for radio tool serial interface in test mode. Leave floating in functional mode.
4	WL_RS232_RX	Input	RS232 receive output; used for radio tool serial interface in test mode. Leave floating in functional mode.

Table 2-4 describes the signals on J12.

Table 2-4. Header J12 of the CC3000 BoosterPack EVM Board Top View

Pin	Pin Name	Pin Type	Descriptions
1	GND	–	Ground
2	SCL_CC3000	Output	I^2C clock signal output from the CC3000 module. This pin is connected to SCL_EEPROM through a 0-Ω resistor and is not used by end users.
3	SCL__EEPROM	Input	I^2C clock signal input from EEPROM inside the CC3000 module. This pin is connected to SCL_CC3000 using a 0-Ω resistor and is not used by end users.
4	SDA_CC3000	Input and output	I^2C data signal from the CC3000 module. This pin is connected to SDA_EEPROM using a 0-Ω resistor and is not used by end users.
5	SDA_EEPROM	Input and output	I^2C data signal from EEPROM inside the CC3000 module. This pin is connected to SDA_CC3000 using a 0-Ω resistor and is not used by end users.

2.2   CC3000 BoosterPack EVM Board Bottom View

The two BoosterPack mating connectors (J9 and J10) connect to the host platform and mount to the bottom of the BoosterPack EVM board, as shown in Figure 2-2.
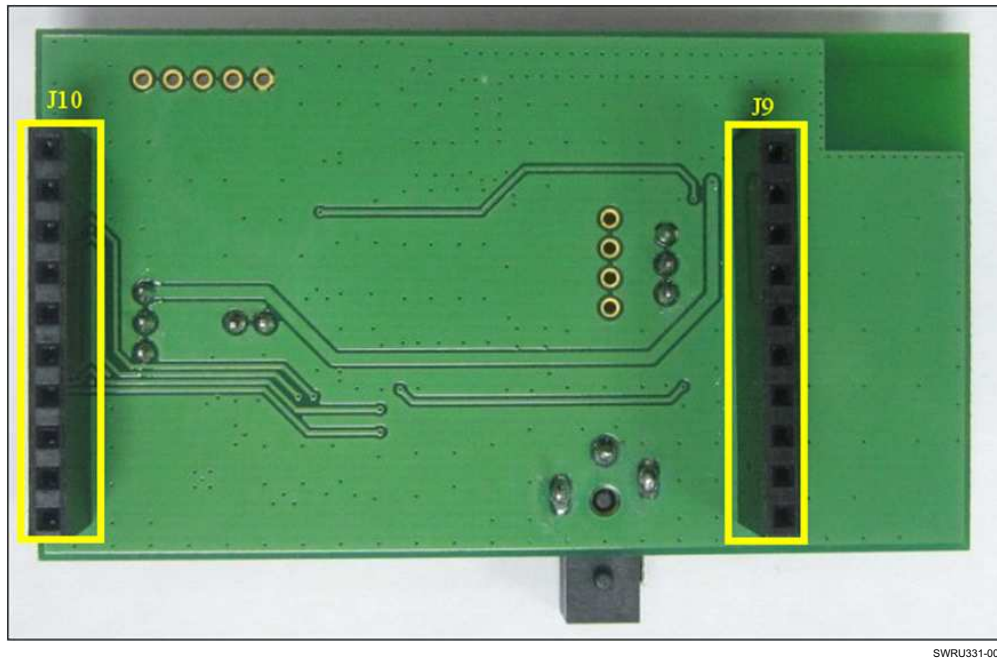

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Figure 2-2. CC3000 BoosterPack EVM Board (Bottom View)

Table 2-5 describes the signals on J9.

Table 2-5. Header J9 of the CC3000 BoosterPack EVM Board (Bottom View)

Pin	Pin Name	Pin Type	Descriptions
1	VBAT_IN	Power In	Battery voltage input to module. For the MSP430 host platform, VIO_HOST = VBAT_IN. For other platforms that have different voltage levels from the battery voltages, R14 can be removed.
2	VBAT_SW_EN	Input	Active-high enables signal from the host device
3	Reserved	–	Reserved
4	Reserved	–	Reserved
5	Reserved	–	Reserved
6	Reserved	–	Reserved
7	WL_SPI_CLK	Input	Host interface SPI clock input
8	Reserved	–	Reserved
9	Reserved	–	Reserved
10	Reserved	–	Reserved

Table 2-6 describes the signals on J10.

Table 2-6. Header J10 of the CC3000 BoosterPack EVM Board (Bottom View)

Pin	Pin Name	Pin Type	Descriptions
1	GND	–	Ground
2	WL_SPI_IRQ	Output	Host interface SPI interrupt request
3	WL_SPI_CS	Input	Host interface SPI chip select
4	Reserved	–	Reserved
5	Reserved	–	Reserved
6	WL_SPI_DIN	Input	Host interface SPI data input
7	WL_SPI_DOUT	Output	Host interface SPI data output
8	Reserved	–	Reserved
9	Reserved	–	Reserved
10	Reserved	–	Reserved

2.3 Antenna

The ACX ceramic mounts on the BoosterPack EVM board with a specific layout and matching circuit for the radiation tests conducted in FCC, CE, and IC certifications. Figure 2-3 shows the location of the ACX ceramic antenna on the BoosterPack EVM board and the RF trace routing from the CC3000 module to the antenna.

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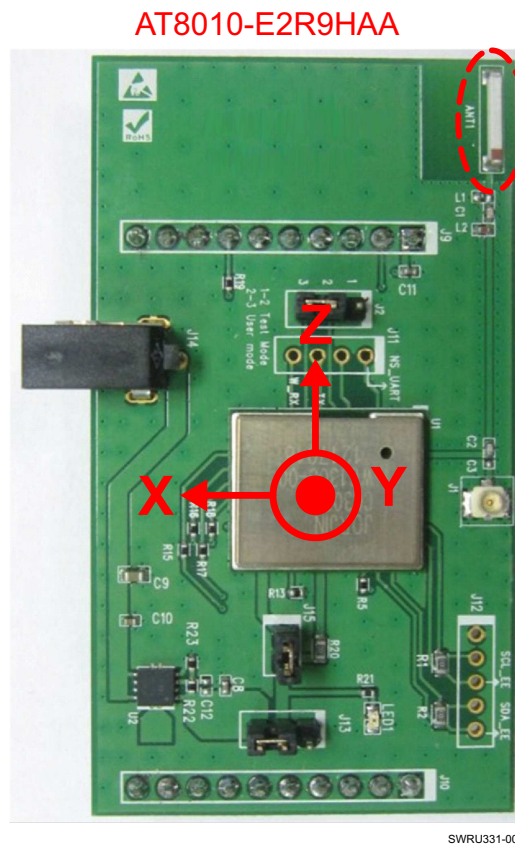
Figure 2-3. Antenna Location and RF Trace Routing

Figure 2-4 shows the matching circuit between the antenna and the BoosterPack EVM board.
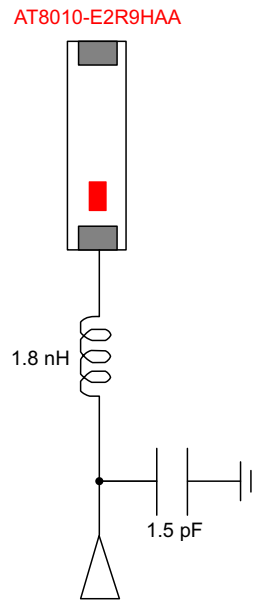
Figure 2-4. Matching Circuit Between the Antenna and the CC3000 BoosterPack EVM Board

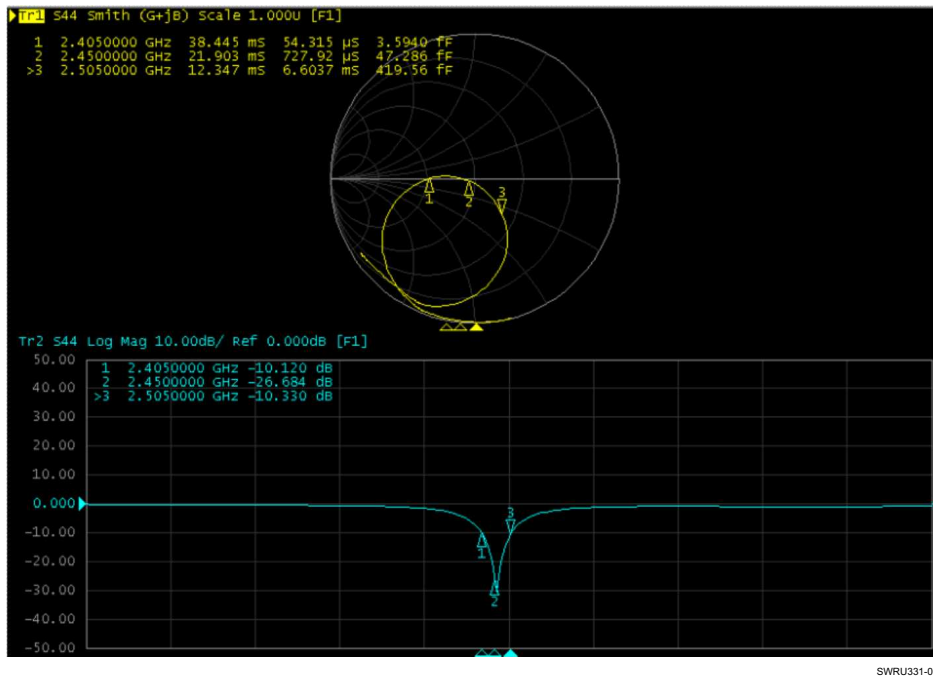The return loss is based on the matching circuit and RF trace routing, as shown in Figure 2-5.

Figure 2-5. Return Loss From the ACX Antenna and Matching Circuit

Figure 2-6 shows the antenna radiation pattern.

◆ XY-plane

Far-field Power Distribution(H+V) on X-Y Plane
Plot Peak Gain(H+V)= 1.53 dBi, Plot AvgGain(H+V)= -2.24dBi @2.45000 GHz

Unit : dBi

	Peak gain	Avg. gain
XY-plane	1.5	-2.2

◆ XZ-plane

Far-field Power Distribution(H+V) on X-Z Plane
Plot Peak Gain(H+V)= -0.13 dBi, Plot AvgGain(H+V)= -4.00dBi @2.45000 GHz

	Peak gain	Avg. gain
XZ-plane	-0.1	-4.0

◆ YZ-plane

Far-field Power Distribution(H+V) on Y-Z Plane
Plot Peak Gain(H+V)= 2.13 dBi, Plot AvgGain(H+V)= -1.22dBi @2.45000 GHz

	Peak gain	Avg. gain
YZ-plane	2.1	-1.2

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Figure 2-6. Antenna Radiation Pattern

2.4   Hardware Setup

To conduct performance tests, connect the BoosterPack EVM board to the host platform using the J9 and J10 mating connectors or the J11 and J12 single-row headers. The J9 and J10 mating connectors must line up as shown in Figure 2-7. The J11 and J12 single-row headers require the signals from the EVM board mating connectors to be wired to the host platform.
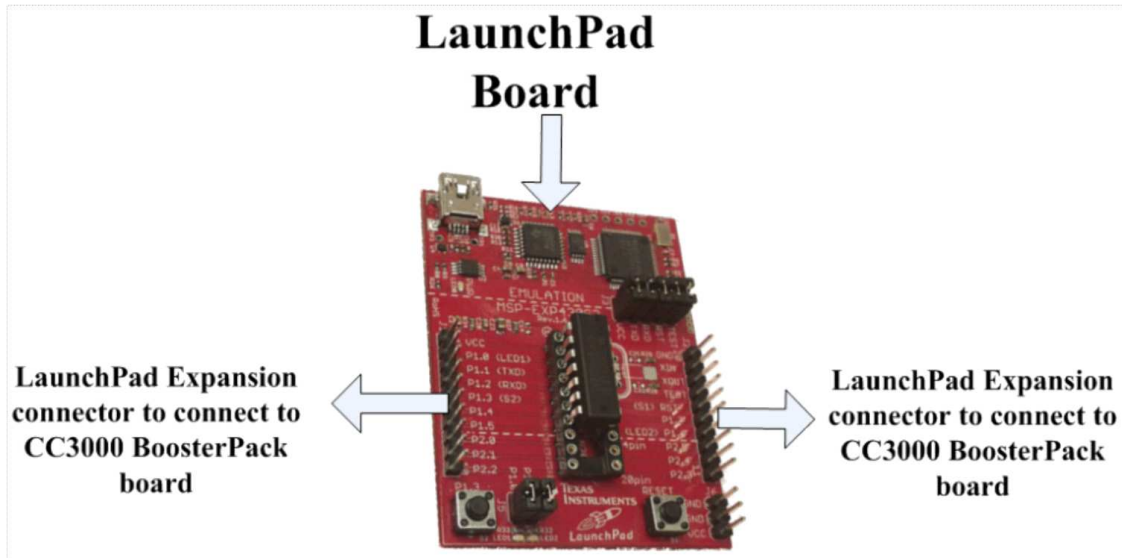
SWRU331-007

Figure 2-7. Host PCB Mating Connector Arrangement

Table 2-7 compares the pins of the LaunchPad MSP-EXP430G2 board with the CC3000 BoosterPack EVM board.

Table 2-7. LaunchPad to BoosterPack Pin Comparison

Pin	MSP430 Port	CC3000 BoosterPack
1	VCC	VBAT_IN
2	P1.0	VBAT_SW_EN
3	P1.1/TX	NC
4	1.2/RX	NC
5	P1.3	NC
6	P1.4	NC
7	P1.5	WL_SPI_CLK
8	P2.0	NC
9	P2.1	NC
10	P2.2	NC
11	P2.3	NC
12	P2.4	NC
13	P2.5	NC
14	P1.6	WL_SPI_DOUT
15	P1.7	WL_SPI_DIN
16	T/SBWT	NC
17	T/SBW	NC
18	2.6/XOUT	WL_SPI_CS
19	P2.7/XIN	WL_SPI_IRQ
20	GND	GND

2.5 CC3000 BoosterPack Schematic

Figure 2-8 shows the CC3000 BoosterPack schematics.
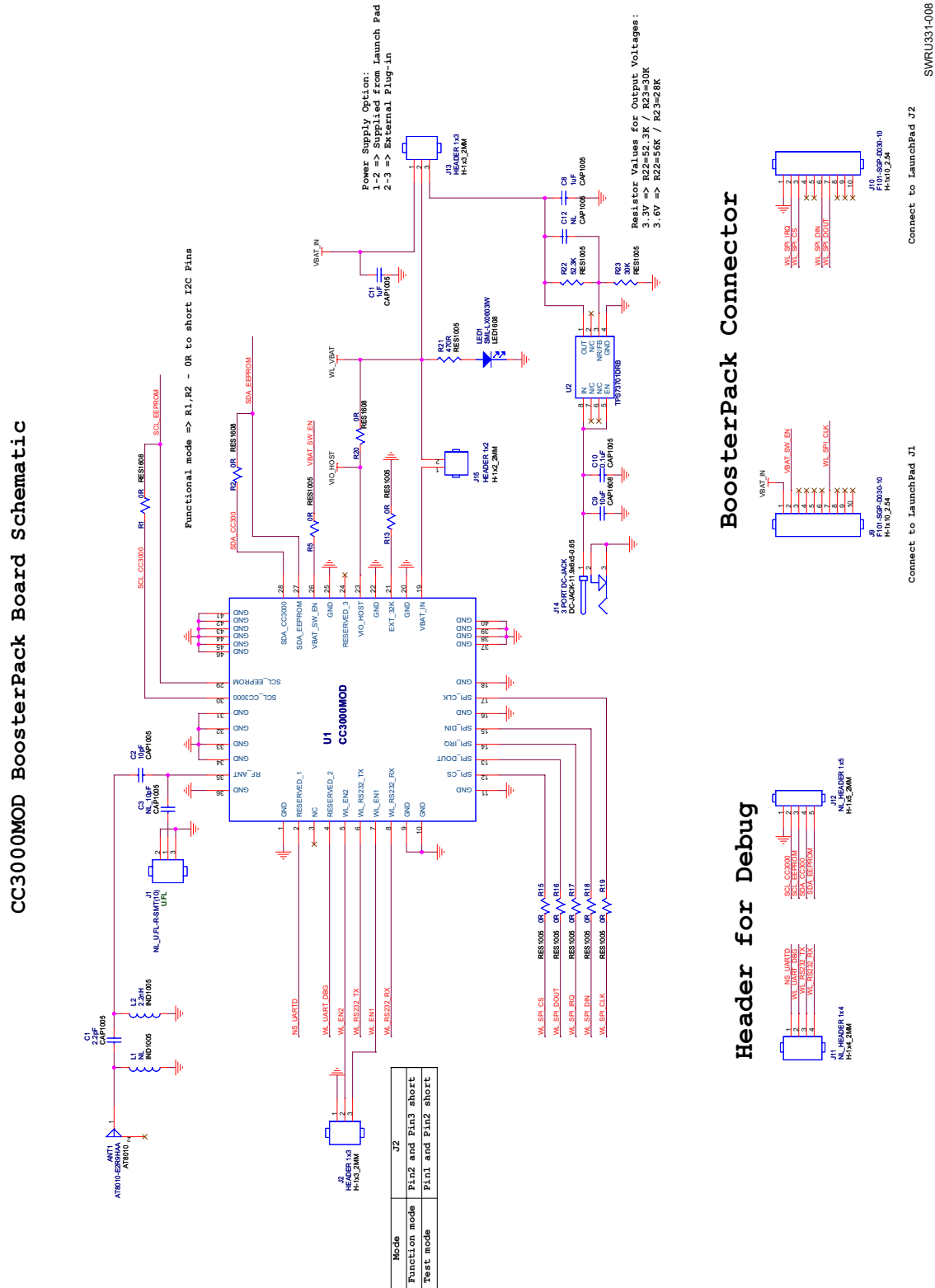
Figure 2-8. CC3000 BoosterPack Schematics

2.6   Bill of Materials (BOM)

2.6.1   PCB Design Guidelines

The recommendations in this document are based on a two-layer PCB with the CC3000 module. The PCB is built using standard FR4 material. Both layers are used for signal routing. TI recommends keeping the traces of the SPI signals as short as possible. Table 2-8 shows the PCB stack-up data.

Table 2-8. PCB Stack-Up Data

PCB Stack Up				Impedance	
Layer	Type	Thickness		Single end	Theory value
Top side solder mask			0.50 mil		
L1	Top	copper + plating	1.82 mil	Trace 20 space 5, 50 Ω ±10%	47.57
		Prepreg	52.20 mil	mil	
L2		copper + plating	1.82 mil	mil	
Bottom side solder mask			0.50 mil		
TOTAL			56.84 mil		
			1.44 mm		

2.6.2   RF Trace

Figure 2-9 shows a 50-Ω trace design recommended for the PCB layout.
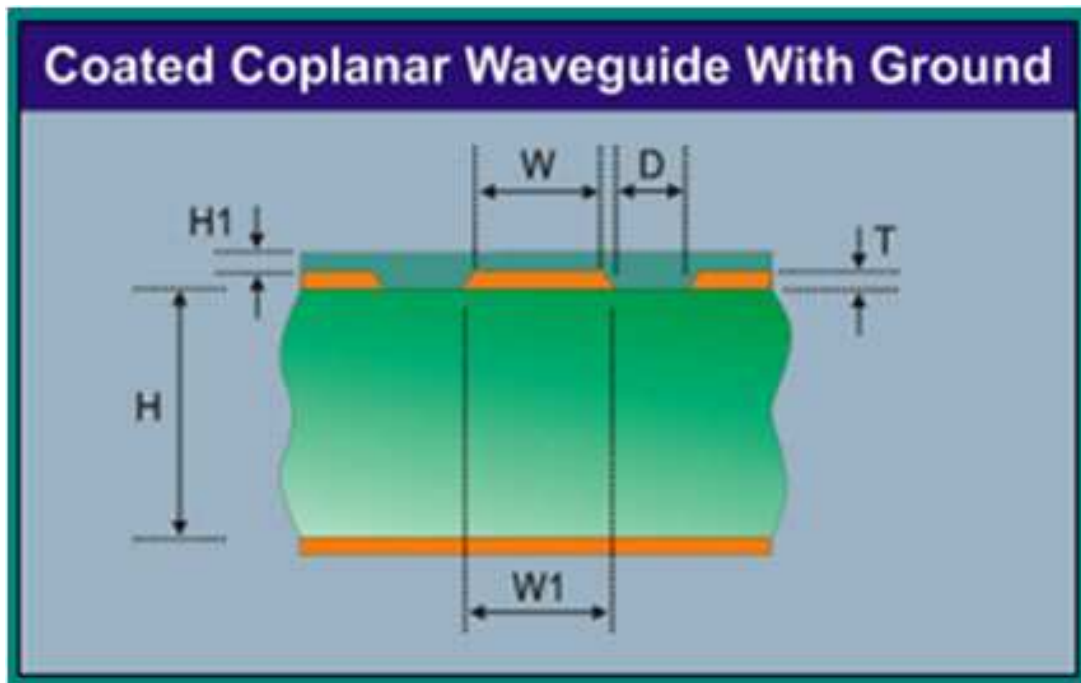
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Figure 2-9. Trace Design for PCB Layout

Table 2-9 lists the values associated with the trace design, including the measurements referenced in Figure 2-9.

Table 2-9. Trace Design Measurement Values

Measurement	Length
H (height between L1 and L2)	52.2 mil
H1 (height 1)	0.5 mil
W (width)	19 mil
W1 (width 1)	20 mil
T (thickness)	1.82 mil
S (grid separation)	5 mil
εr (dielectric)	4.3
Zo (impedance)	47.57

2.6.3 Antenna

Figure 2-10 shows the specified guidelines for the BoosterPack antenna.

> **NOTE:** The antenna vendor determines the antenna guidelines.
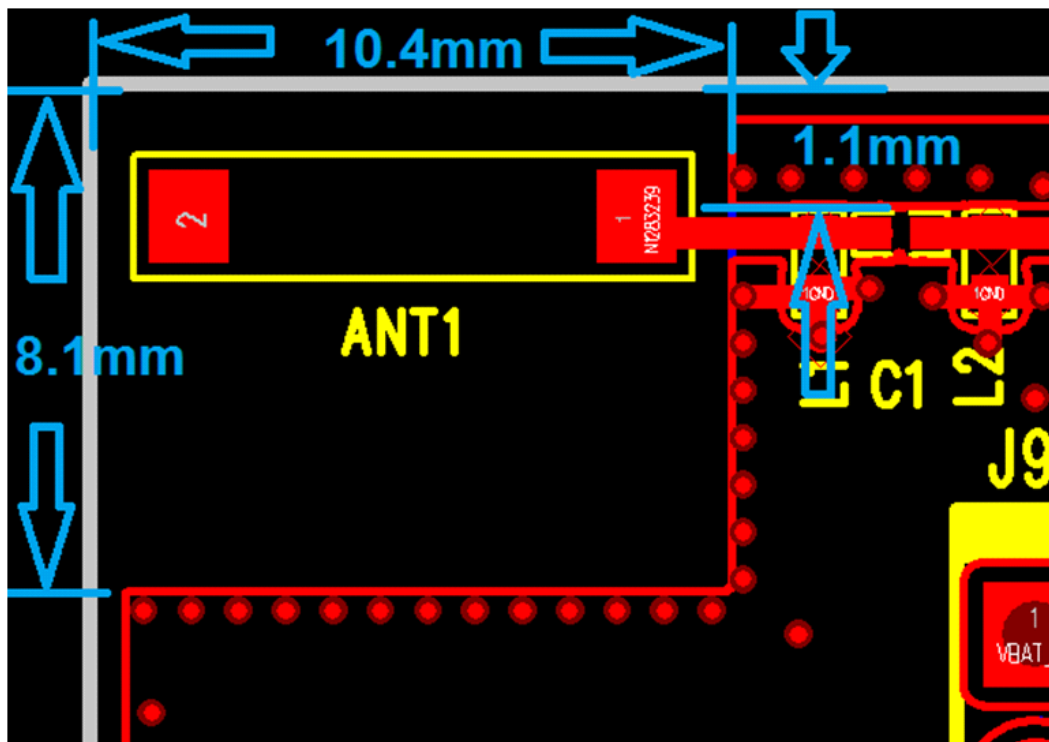
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Figure 2-10. Antenna Layout Guidelines

2.6.4 *Power Trace*

Figure 2-11 shows the power trace for VBAT_IN highlighted in white.

NOTE: VBAT_IN must have a thickness of 24 mil or more.

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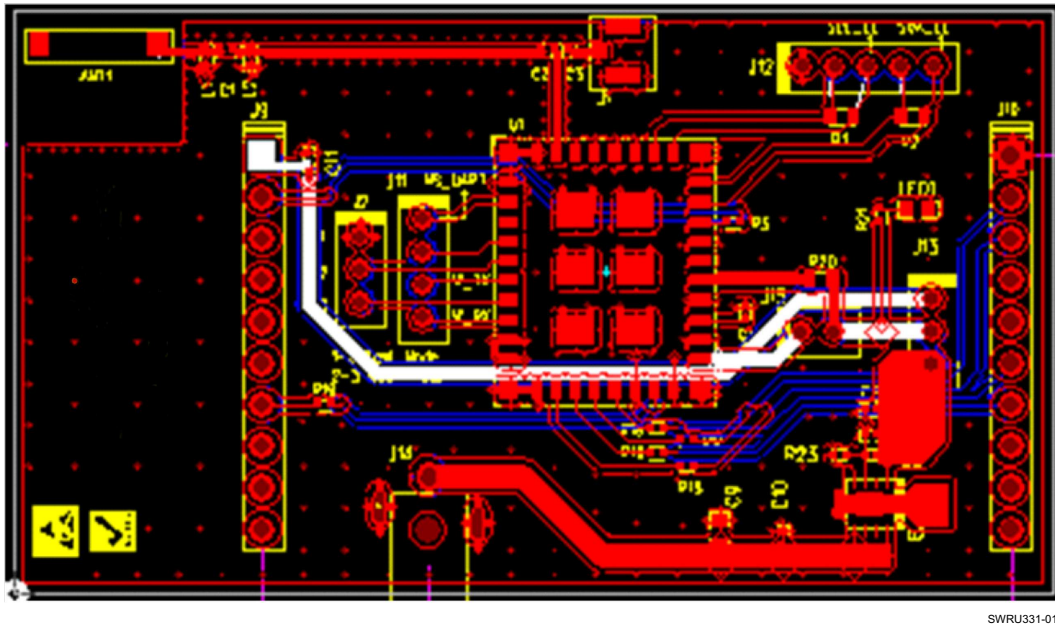
Figure 2-11. Power Trace

2.6.5 *Ground*

The PCB must have a strong ground with more ground vias under the module for system stability and thermal dissipation. Ground vias must be close to the pad.

Figure 2-12 shows the ground routing for the CC3000 BoosterPack EVM board.

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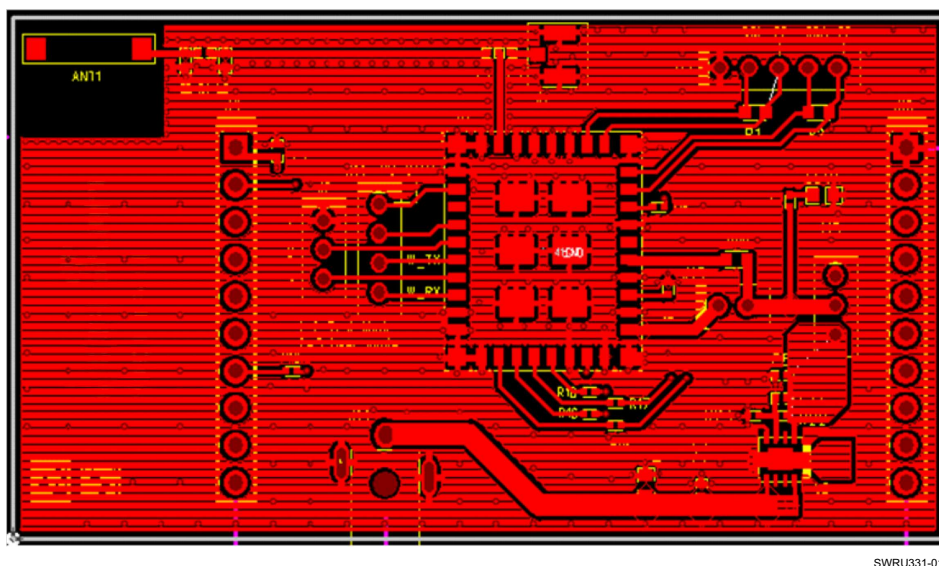
Figure 2-12. Ground Routing for the CC3000 BoosterPack EVM Board

Application Development

TI supports the CC3000 BoosterPack paired with the TI MSP-EXP430G2 Launchpad, a microcontroller (MCU) test platform.

The CC3000 BoosterPack lets users easily develop a complete Wi-Fi solution paired with the MSP-EXP430G2 Launchpad platform.

For example applications, see the CC3000 wiki.

The CC3000 BoosterPack also can be used on other platforms with the same connector interface. The TI wiki also has a host driver porting guide to assist with porting to other platforms.

Figure 3-1 shows the Launchpad MSP-EXP430G2 test platform and the CC3000 BoosterPack EVM board.
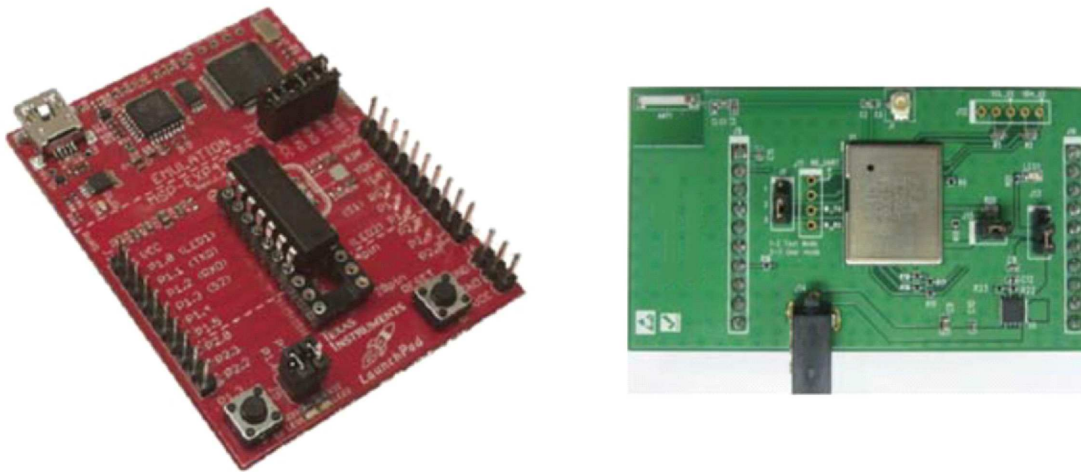
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Figure 3-1. MSP-EXP430G2 Test Platform and CC3000 BoosterPack EVM Board

To order the MSP-EXP430G2 test platform, see the MSP430 LaunchPad Value Line Development Kit.

IMPORTANT NOTICE

Products		Applications	
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