TEXAS INSTRUMENTS WL1837MODCOM8I WLAN MIMO and Bluetooth Module User Guide

User's Guide
SWRU382–November 2014
WL1837MODCOM8I WLAN MIMO and Bluetooth® Module
Evaluation Board for TI Sitara™ Platform

The WL1837MODCOM8I is a Wi-Fi® dual-band, Bluetooth, and BLE module evaluation board (EVB) with the TI WL1837 module (WL1837MOD). The WL1837MOD is a certified WiLink™ 8 module from TI that offers a high throughput and extended range along with Wi-Fi and Bluetooth coexistence in a power-optimized design. The WL1837MOD offers A 2.4- and 5-GHz module solution with two antennas supporting industrial temperature grade. The module is FCC, IC, ETSI/CE, and TELEC certified for AP (with DFS support) and client. TI offers drivers for high-level operating systems, such as Linux®, Android™, WinCE, and RTOS.TI.

Contents

Overview

Figure 1 shows the WL1837MODCOM8I EVB.

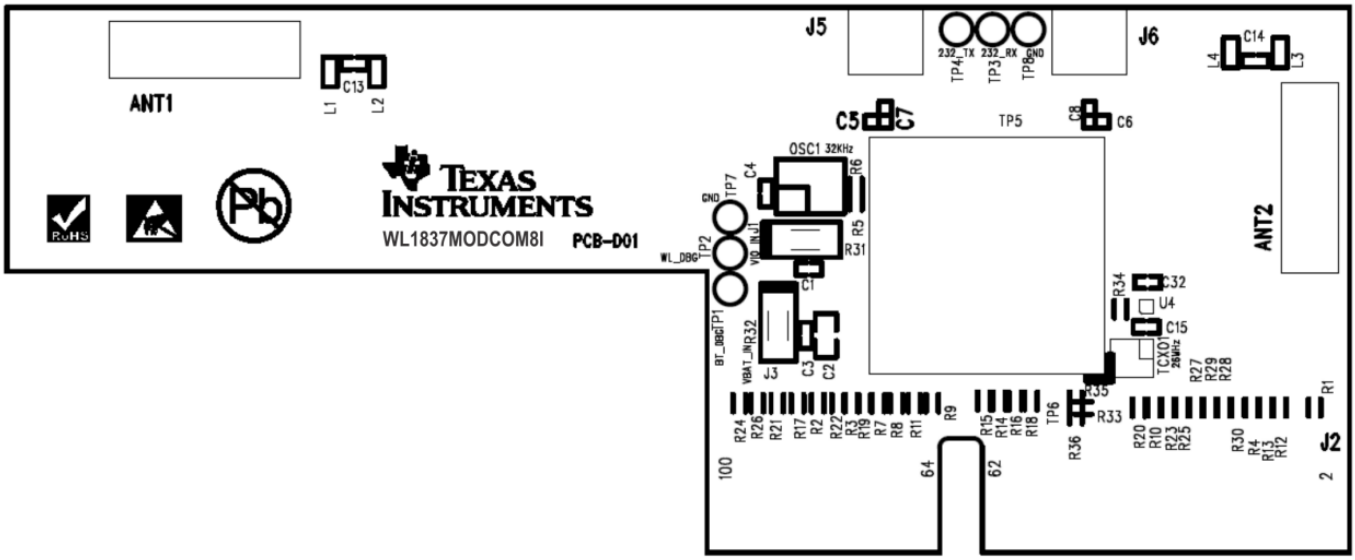

Figure 1. WL1837MODCOM8I EVB (Top View)

1.1 General Features

The WL1837MODCOM8I EVB includes the following features:

- WLAN, Bluetooth, and BLE on a single module board
- 100-pin board card
- Dimensions: 76.0 mm (L) x 31.0 mm (W)
- WLAN 2.4- and 5-GHz SISO (20- and 40-MHz channels), 2.4-GHz MIMO (20-MHz channels)
- Support for BLE dual mode
- Seamless integration with TI Sitara and other application processors
- Design for the TI AM335X general-purpose evaluation module (EVM)
- WLAN and Bluetooth, BLE, and ANT cores that are software- and hardware compatible with prior WL127x, WL128x, and BL6450 offerings for a smooth migration to the device
- Shared host-controller-interface (HCI) transport for Bluetooth, BLE, and ANT using UART and SDIO for WLAN
- Wi-Fi and Bluetooth single-antenna coexistence
- Built-in chip antenna

- Optional U.FL RF connector for external antenna
- Direct connection to the battery using an external switched-mode power supply (SMPS) supporting 2.9- to 4.8-V operation
- VIO in the 1.8-V domain

1.2 Key Benefits

The WL1837MOD offers the following benefits:

- Reduces design overhead: Single WiLink 8 module scales across Wi-Fi and Bluetooth
- WLAN high throughput: 80 Mbps (TCP), 100 Mbps (UDP)
- Bluetooth 4.1 + BLE (Smart Ready)
- Wi-Fi and Bluetooth single-antenna coexistence
- Low power at 30% to 50% less than the previous generation
- Available as an easy-to-use FCC-, ETSI-, and Telec-certified module
- Lower manufacturing costs save board space and minimize RF expertise.
- AM335x Linux and Android reference platforms accelerate customer development and time to market.

1.3 Applications

The WL1837MODCOM8I device is designed for the following applications:

- Portable consumer devices
- Home electronics
- Home appliances and white goods
- Industrial and home automation
- Smart gateway and metering
- Video conferencing
- Video camera and security

Board Pin Assignment

Figure 2 shows the top view of the EVB.

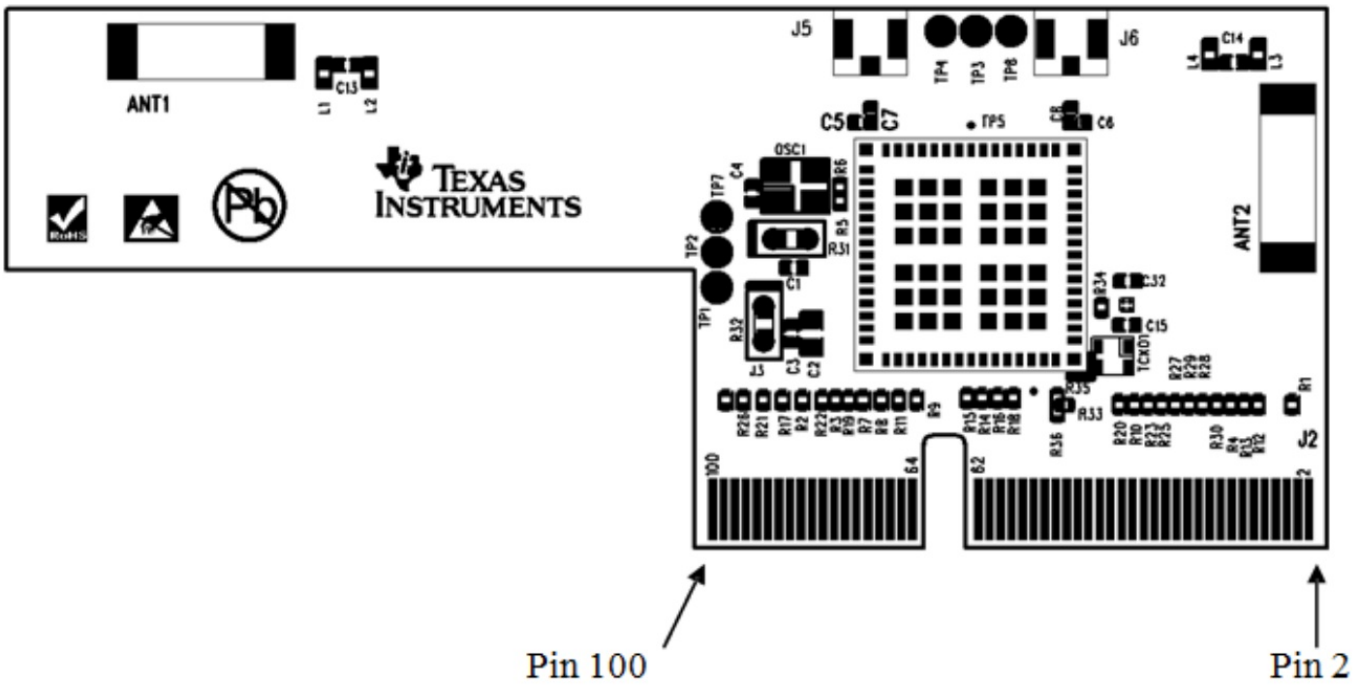

Figure 2. EVB Top View

Figure 3 shows the bottom view of the EVB.

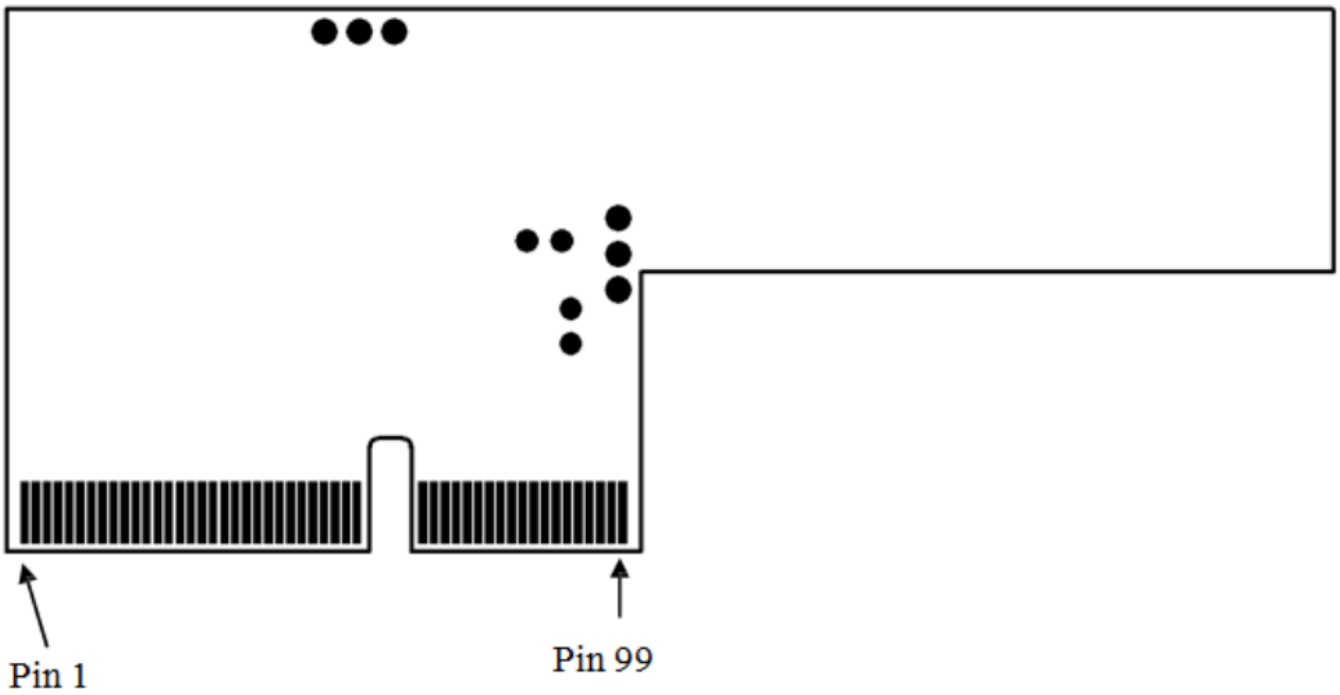

Figure 3. EVB (Bottom View)

2.1 Pin Description

Table 1 describes the board pins.

Table 1. Pin Description

No.	Name	Type	Description
1	SLOW_CLK	I	Slow clock input option (default: NU)
2	GND	G	Ground
3	GND	G	Ground
4	WL_EN	I	WLAN enable
5	VBAT	P	3.6-V typical voltage input
6	GND	G	Ground
7	VBAT	P	3.6-V typical voltage input
8	VIO	P	V_{IO} 1.8-V (I/O voltage) input
9	GND	G	Ground
10	N.C.		No connection
11	WL_RS232_TX	O	WLAN tool RS232 output
12	N.C.		No connection
13	WL_RS232_RX	I	WLAN tool RS232 input
14	N.C.		No connection
15	WL_UART_DBG	O	WLAN Logger output

16	N.C.		No connection
17	N.C.		No connection
18	GND	G	Ground
19	GND	G	Ground
20	SDIO_CLK	I	WLAN SDIO clock

Table 1. Pin Description (continued)

No.	Name	Type	Description
21	N.C.		No connection
22	GND	G	Ground
23	N.C.		No connection
24	SDIO_CMD	I/O	WLAN SDIO command
25	N.C.		No connection
26	SDIO_D0	I/O	WLAN SDIO data bit 0
27	N.C.		No connection
28	SDIO_D1	I/O	WLAN SDIO data bit 1

29	N.C.		No connection
30	SDIO_D2	I/O	WLAN SDIO data bit 2
31	N.C.		No connection
32	SDIO_D3	I/O	WLAN SDIO data bit 3
33	N.C.		No connection
34	WLAN_IRQ	O	WLAN SDIO interrupts out
35	N.C.		No connection
36	N.C.		No connection
37	GND	G	Ground
38	N.C.		No connection
39	N.C.		No connection
40	N.C.		No connection
41	N.C.		No connection
42	GND	G	Ground
43	N.C.		No connection

44	N.C.		No connection
45	N.C.		No connection
46	N.C.		No connection
47	GND	G	Ground
48	N.C.		No connection
49	N.C.		No connection
50	N.C.		No connection
51	N.C.		No connection
52	PCM_IF_CLK	I/O	Bluetooth PCM clock input or output
53	N.C.		No connection
54	PCM_IF_FSYNC	I/O	Bluetooth PCM frame sync input or output
55	N.C.		No connection
56	PCM_IF_DIN	I	Bluetooth PCM data input
57	N.C.		No connection
58	PCM_IF_DOUT	O	Bluetooth PCM data output

59	N.C.		No connection
60	GND	G	Ground
61	N.C.		No connection
62	N.C.		No connection
63	GND	G	Ground
64	GND	G	Ground
65	N.C.		No connection
66	BT_UART_IF_TX	O	Bluetooth HCI UART transmit output
67	N.C.		No connection

No.	**Name**	**Type**	**Description**
68	BT_UART_IF_RX	I	Bluetooth HCI UART receive input
69	N.C.		No connection
70	BT_UART_IF_CTS	I	Bluetooth HCI UART Clear-to-Send input
71	N.C.		No connection
72	BT_UART_IF_RTS	O	Bluetooth HCI UART Request-to-Send output

73	N.C.		No connection
74	RESERVED1	O	Reserved
75	N.C.		No connection
76	BT_UART_DEBUG	O	Bluetooth Logger UART output
77	GND	G	Ground
78	GPIO9	I/O	General-purpose I/O
79	N.C.		No connection
80	N.C.		No connection
81	N.C.		No connection
82	N.C.		No connection
83	GND	G	Ground
84	N.C.		No connection
85	N.C.		No connection
86	N.C.		No connection
87	GND	G	Ground

88	N.C.		No connection
89	BT_EN	I	Bluetooth enable
90	N.C.		No connection
91	N.C.		No connection
92	GND	G	Ground
93	RESERVED2	I	Reserved
94	N.C.		No connection
95	GND	G	Ground
96	GPIO11	I/O	General-purpose I/O
97	GND	G	Ground
98	GPIO12	I/O	General-purpose I/O
99	TCXO_CLK_COM		Option to supply 26 MHz externally
100	GPIO10	I/O	General-purpose I/O

2.2 Jumper Connections
The WL1837MODCOM8I EVB includes the following jumper connections:

- J1: Jumper connector for VIO power input
- J3: Jumper connector for VBAT power input
- J5: RF connector for 2.4- and 5-GHz WLAN and Bluetooth
- J6: Second RF connector for 2.4-GHz WLAN

Electrical Characteristics

For electrical characteristics, see the WL18xxMOD WiLink™ Single-Band Combo Module – Wi-Fi®, Bluetooth®, and Bluetooth Low Energy (BLE) Data Sheet (**SWRS170**).

Antenna Characteristics

4.1 VSWR

Figure 4 shows the antenna VSWR characteristics.

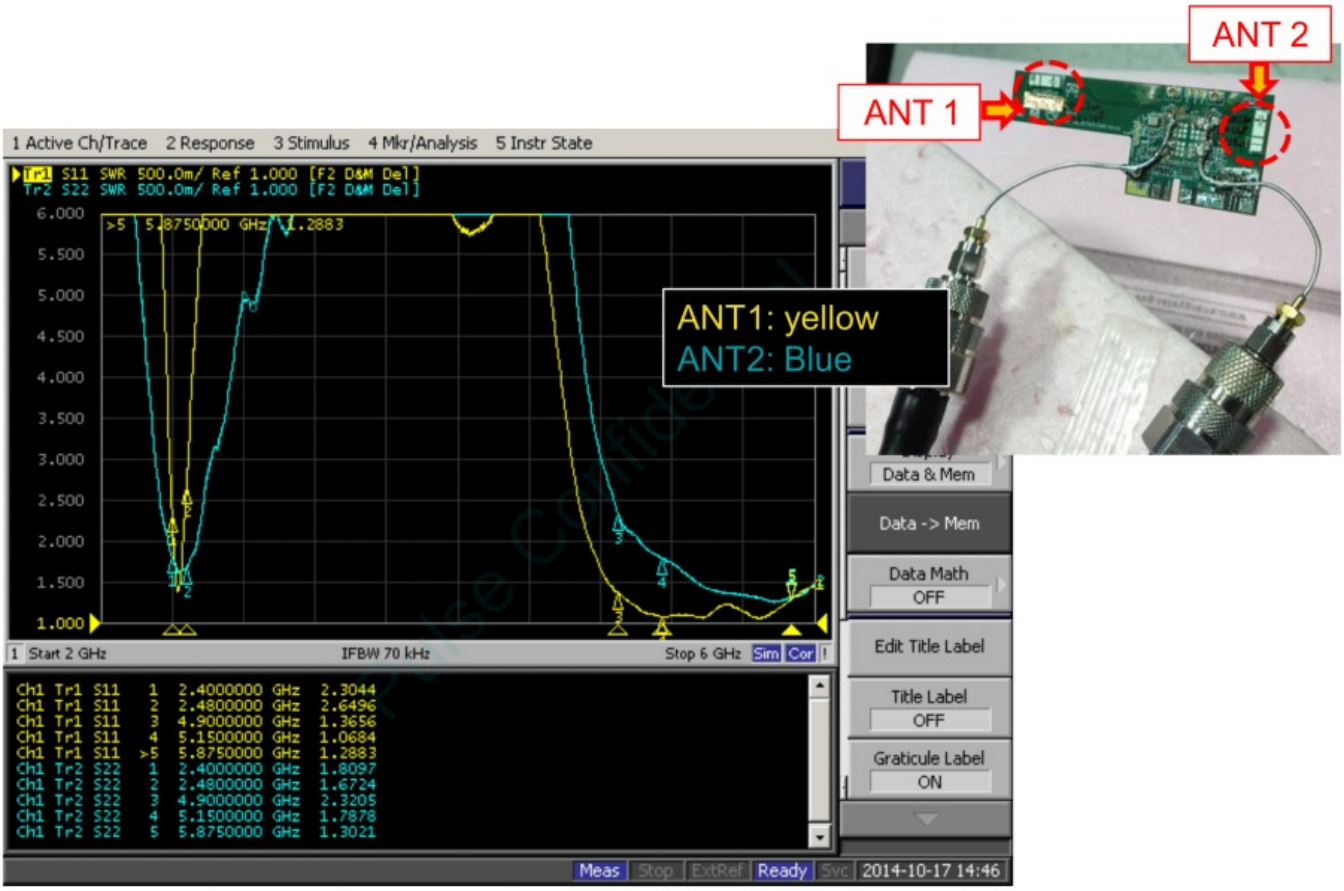

Figure 4. Antenna VSWR Characteristics

4.2 Efficiency

Figure 5 shows the antenna efficiency.

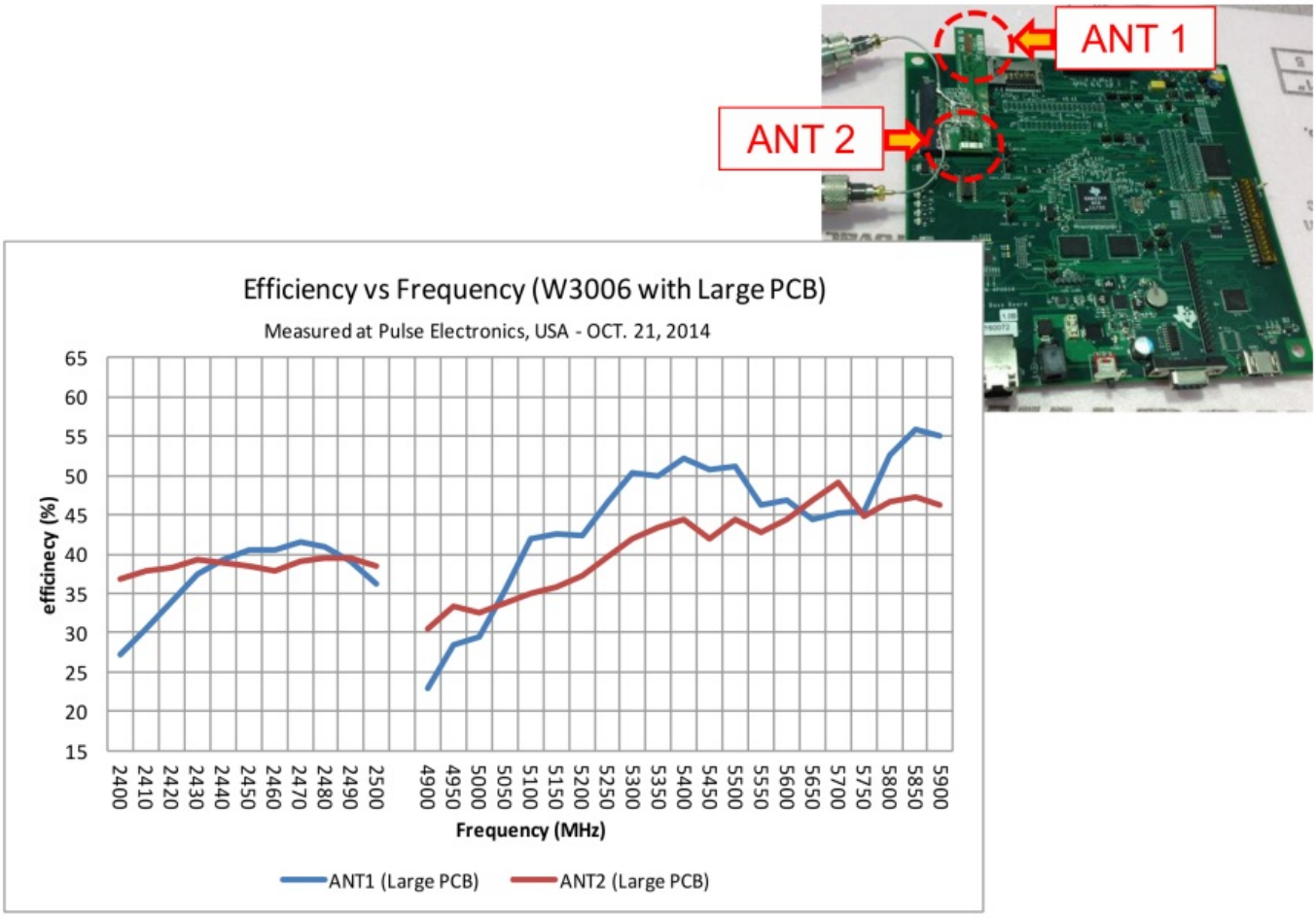

Figure 5. Antenna Efficiency

4.3 Radio Pattern

For information on the antenna radio pattern and other related information, see productfinder.pulseeng.com/product/W3006.

Circuit Design

5.1 EVB Reference Schematics

Figure 6 shows the reference schematics for the EVB.

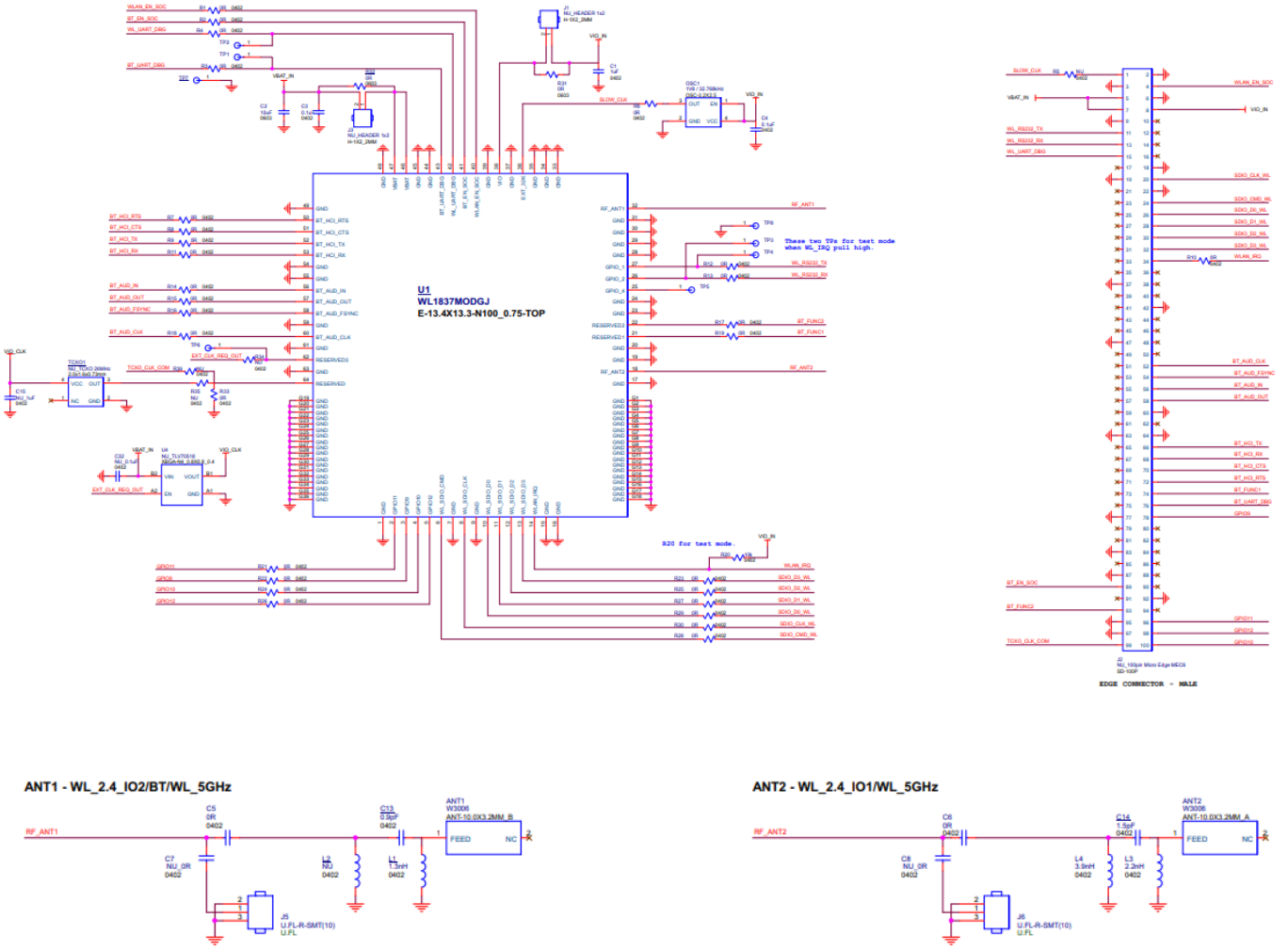

Figure 6. EVB Reference Schematics

5.2 Bill of Materials (BOM)

Table 2 lists the BOM for the EVB.

Table 2. BOM

Item	Description	Part Number	Package	Reference	Qty	Mfr
1	TI WL1837 Wi-Fi / Bluetooth module	WL1837MODGI	13.4 mm x 13.3 mm x 2.0 mm	U1	1	Jorjin
2	XOSC 3225 / 32.768KHZ / 1.8 V /±50 ppm	7XZ3200005	3.2 mm × 2.5 mm × 1.0 mm	OSC1	1	TXC

3	Antenna / Chip / 2.4 and 5 G Hz	W3006	10.0 mm × 3.2 mm × 1.5 mm	ANT1, ANT2	2	Pulse
4	Mini RF header receptacle	U.FL-R-SMT-1(10)	3.0 mm × 2.6 m m × 1.25 mm	J5, J6	2	Hirose
5	Inductor 0402 / 1.3 nH / ±0.1 nH / SMD	LQP15MN1N3B02	0402	L1	1	Murat a
6	Inductor 0402 / 1.8 nH / ±0.1 nH / SMD	LQP15MN1N8B02	0402	L3	1	Murat a
7	Inductor 0402 / 2.2 nH / ±0.1 nH / SMD	LQP15MN2N2B02	0402	L4	1	Murat a
8	Capacitor 0402 / 1 pF / 50 V / C0G / ±0.1 pF	GJM1555C1H1R0BB0 1	0402	C13	1	Murat a
9	Capacitor 0402 / 2.4 pF / 50 V / C0G / ±0.1 pF	GJM1555C1H2R4BB0 1	0402	C14	1	Murat a
10	Capacitor 0402 / 0.1 µF / 10 V / X7R / ±10%	0402B104K100CT	0402	C3, C4	2	Walsin
11	Capacitor 0402 / 1 µF / 6.3 V / X5R / ±10% / HF	GRM155R60J105KE1 9D	0402	C1	1	Murat a

12	Capacitor 0603 / 10 µF / 6.3 V / X5R / ±20%	C1608X5R0J106M	0603	C2	1	TDK
13	Resistor 0402 / 0R / ±5%	WR04X000 PTL	0402	R1 to R4, R6 to R19, R21 to R30, R33, C5, C6(1)	31	Walsin
14	Resistor 0402 / 10K / ±5%	WR04X103 JTL	0402	R20	1	Walsin
15	Resistor 0603 / 0R / ±5%	WR06X000 PTL	0603	R31, R32	2	Walsin
16	PCB WG7837TEC8B D02 / Layer 4 / FR4 (4 pcs / PNL)		76.0 mm × 31.0 mm × 1.6 mm		1	

(1) C5 and C6 are mounted with a 0-Ω resistor by default.

Layout Guidelines

6.1 Board Layout

Figure 7 through **Figure 10** show the four layers of the WL1837MODCOM8I EVB.

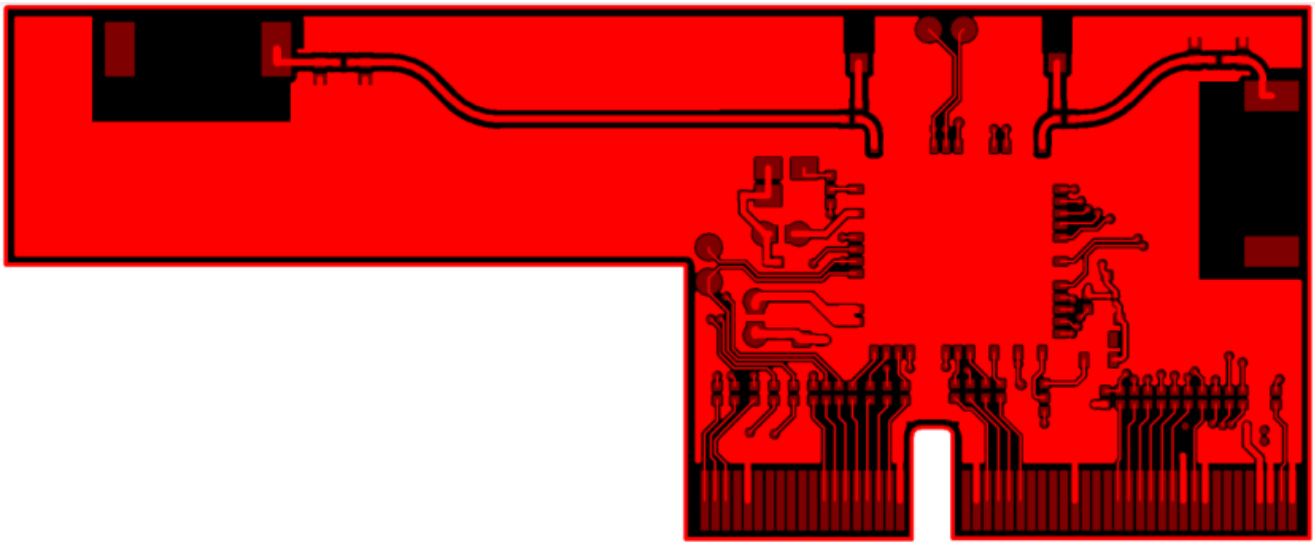

Figure 7. WL1837MODCOM8I Layer 1 Layout

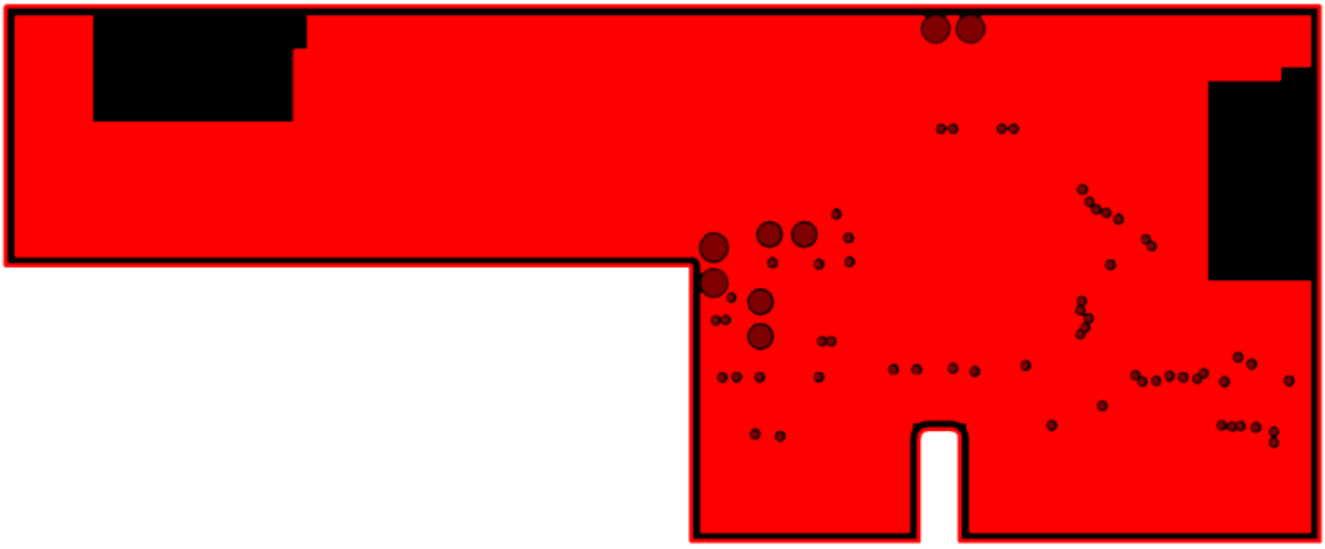

Figure 8. WL1837MODCOM8I Layer 2 Layout

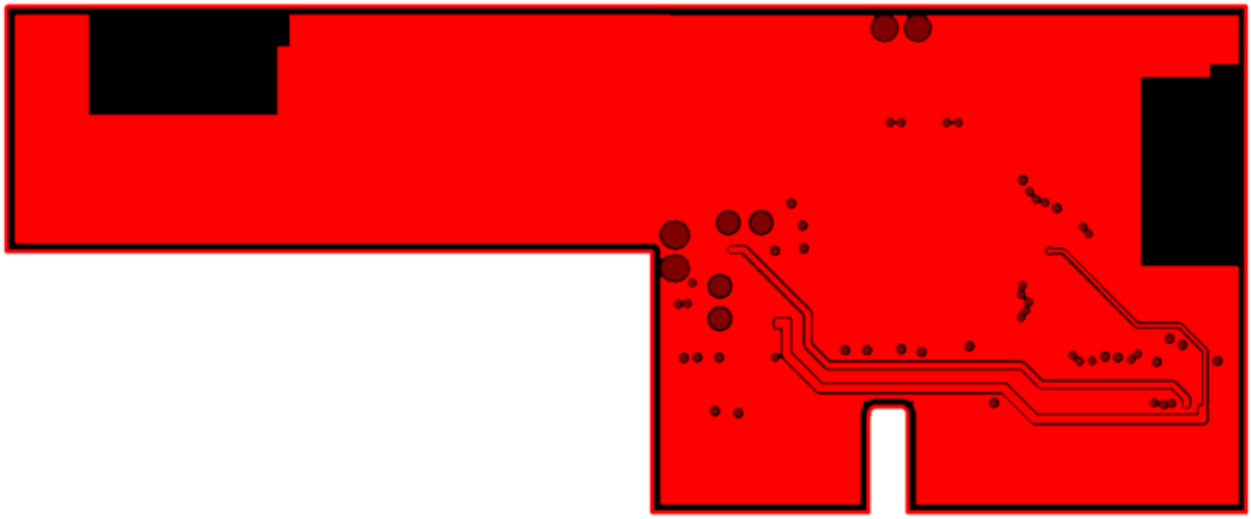

Figure 9. WL1837MODCOM8I Layer 3 Layout

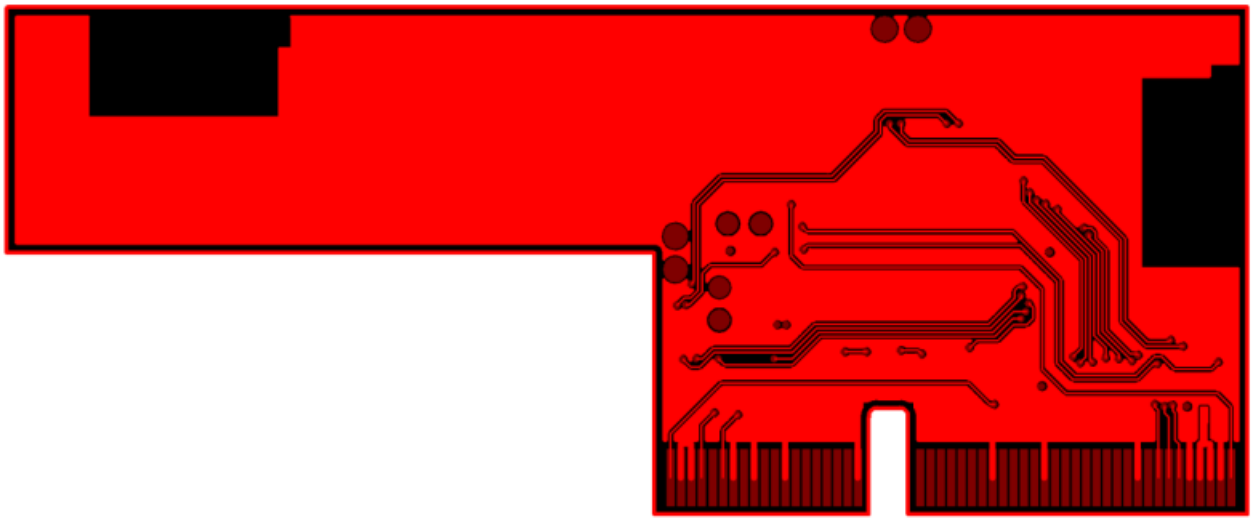

Figure 10. WL1837MODCOM8I Layer 4 Layout

Figure 11 and **Figure 12** show instances of good layout practices.

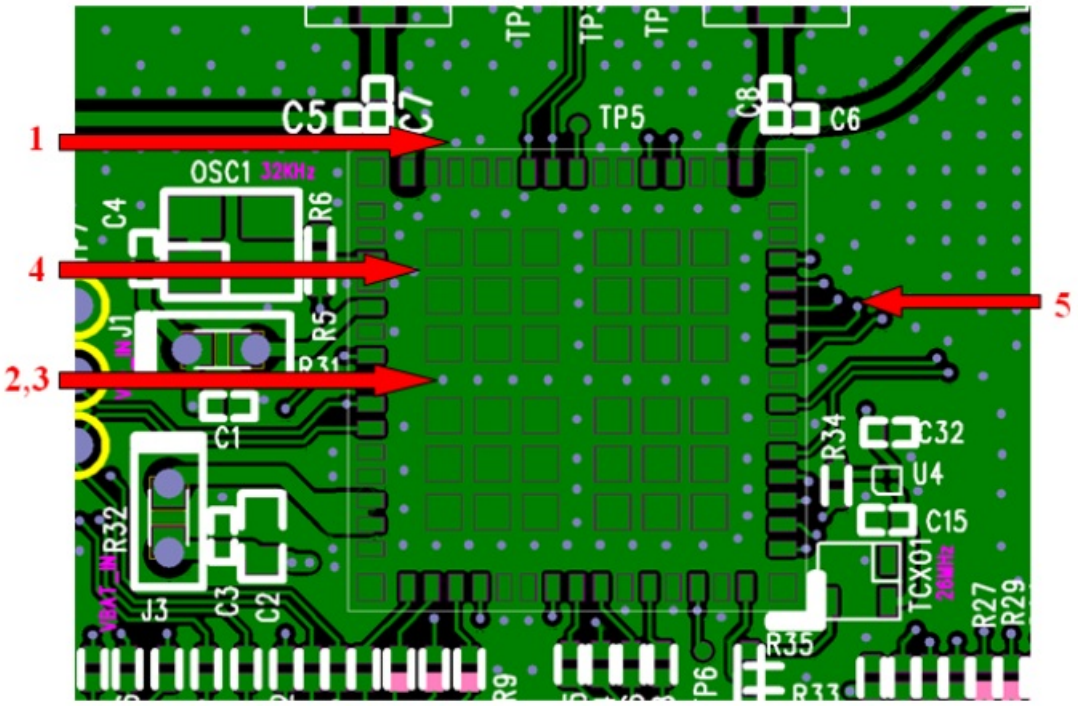

Figure 11. Module Layout Guidelines (Top Layer)

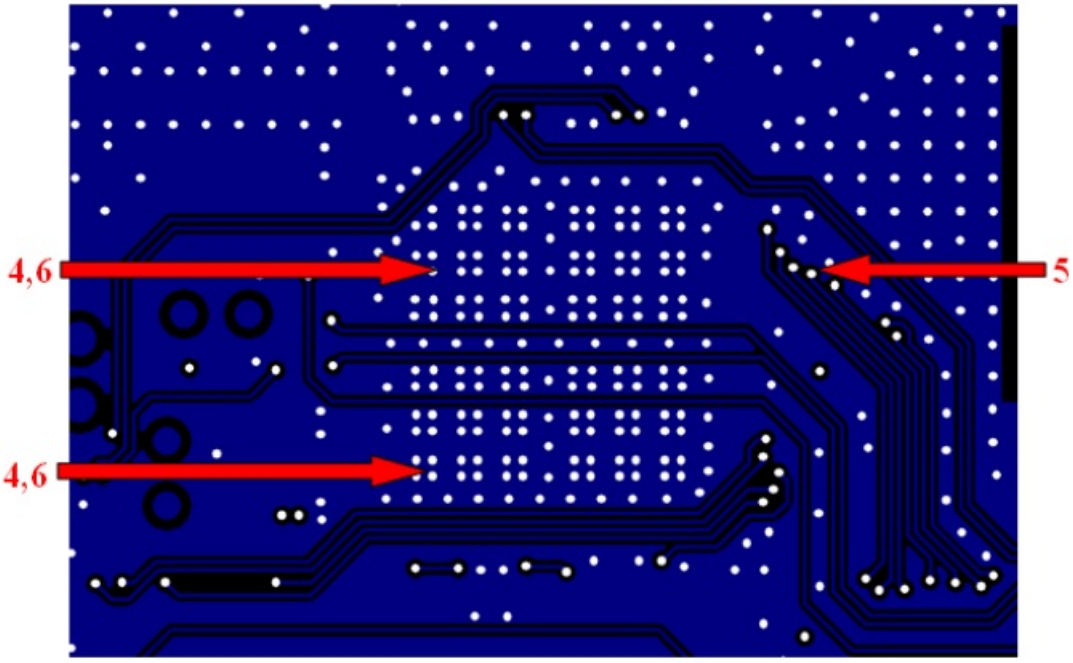

Figure 12. Module Layout Guidelines (Bottom Layer)

Table 3 describes the guidelines corresponding to the reference numbers in Figure 11 and Figure 12.

Table 3. Module Layout Guidelines

Reference	Guideline Description
1	Keep the proximity of ground vias close to the pad.
2	Do not run signal traces underneath the module on the layer where the module is mounted.
3	Have a complete ground pour in layer 2 for thermal dissipation.
4	Ensure a solid ground plane and ground vias under the module for a stable system and ther mal dissipation.
5	Increase ground pours in the first layer and have all traces from the first layer on the inner la yers, if possible.
6	Signal traces can be run on a third layer under the solid ground layer and the module mounti ng layer.

Figure 13 shows the trace design for the PCB. TI recommends using a 50-Ω impedance match on the trace to the antenna and 50-Ω traces for the PCB layout.

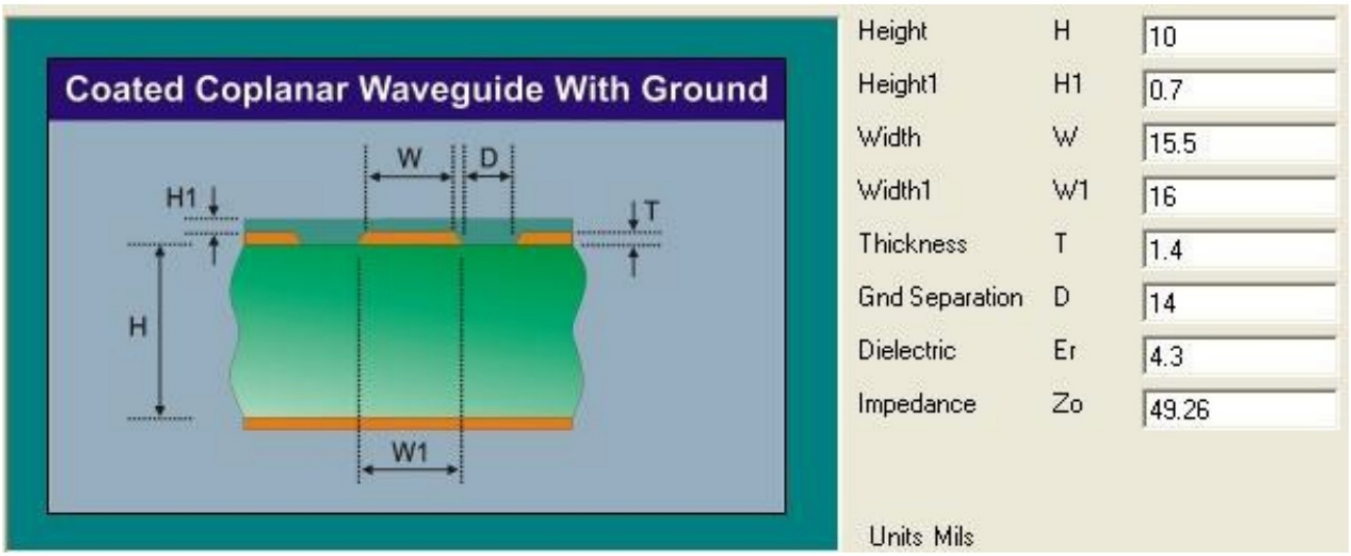

Figure 13. Trace Design for the PCB Layout

Figure 14 shows layer 1 with the trace to the antenna over ground layer 2.

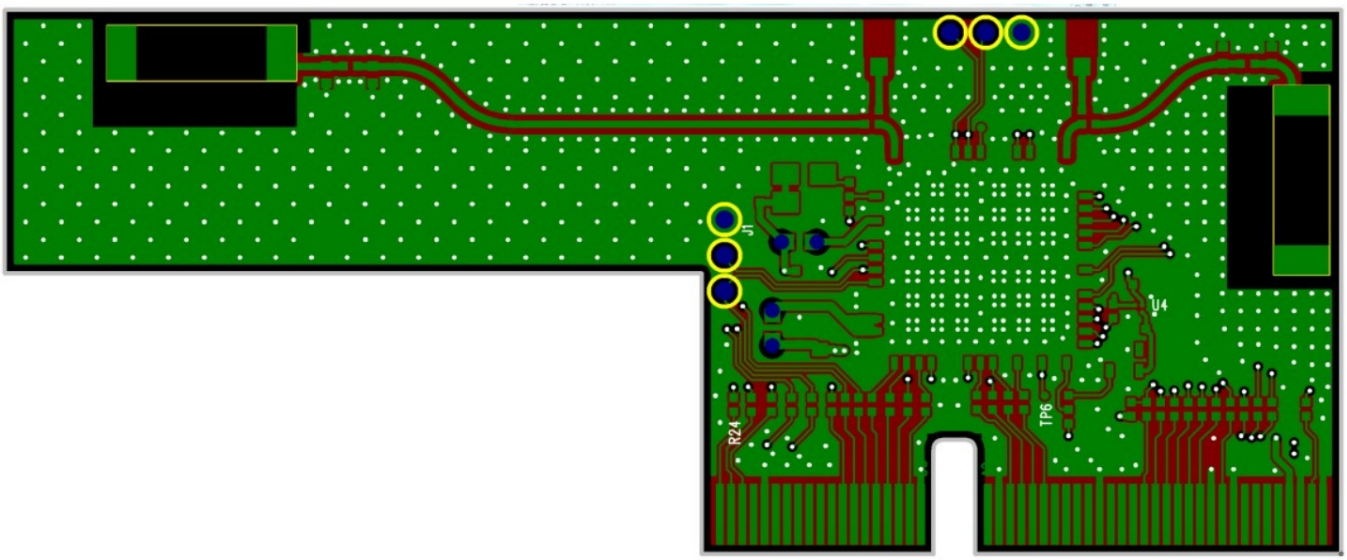

Figure 14. Layer 1 Combined With Layer 2

Figure 15 and **Figure 16** show instances of good layout practices for the antenna and RF trace routing.

NOTE: RF traces must be as short as possible. The antenna, RF traces, and modules must be on the edge of the PCB product. The proximity of the antenna to the enclosure and the enclosure material must also be considered.

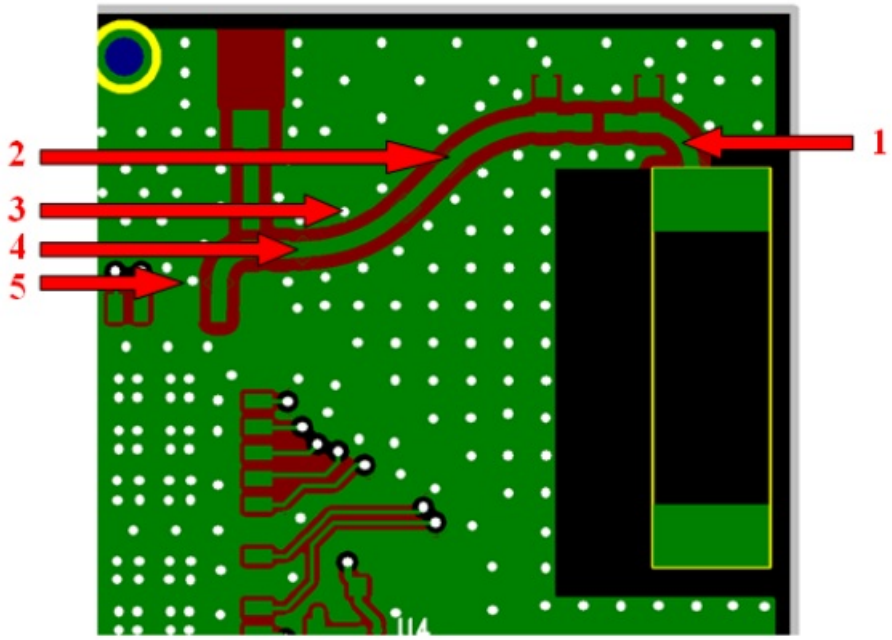

Figure 15. Top Layer – Antenna and RF Trace Routing Layout Guidelines

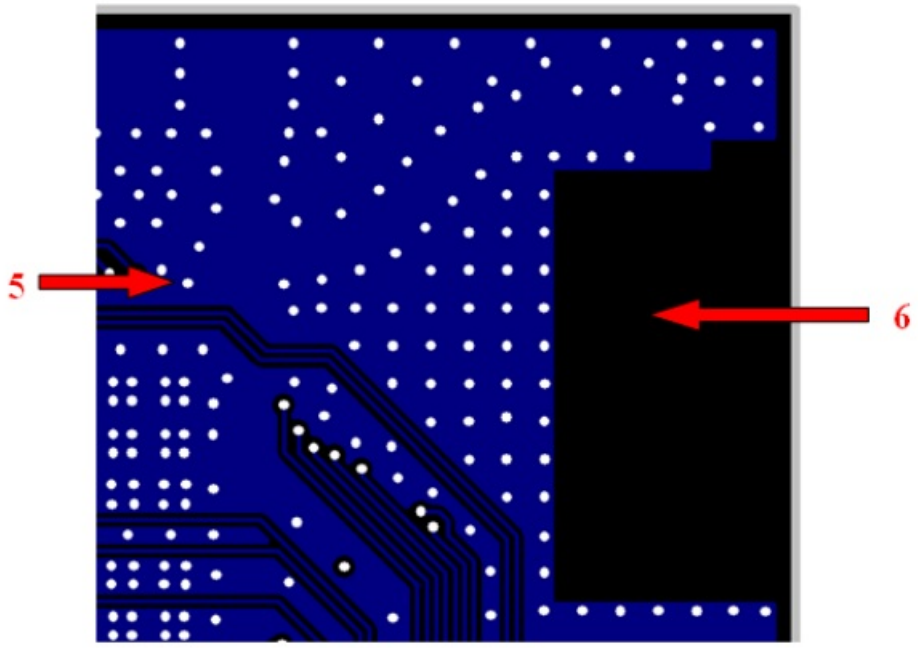

Figure 16. Bottom Layer – Antenna and RF Trace Routing Layout Guidelines

Table 4 describes the guidelines corresponding to the reference numbers in **Figure 15** and **Figure 16**.

Table 4. Antenna and RF Trace Routing Layout Guidelines

Reference	Guideline Description
1	The RF trace antenna feed must be as short as possible beyond the ground reference. At this p oint, the trace starts to radiate.
2	RF trace bends must be gradual with an approximate maximum bend of 45 degrees with trace mitered. RF traces must not have sharp corners.
3	RF traces must have via stitching on the ground plane beside the RF trace on both sides.
4	RF traces must have constant impedance (microstrip transmission line).
5	For best results, the RF trace ground layer must be the ground layer immediately below the RF t race. The ground layer must be solid.
6	There must be no traces or ground under the antenna section.

Figure 17 shows the MIMO antenna spacing. The distance between ANT1 and ANT2 must be greater than half the wavelength (62.5 mm at 2.4 GHz).

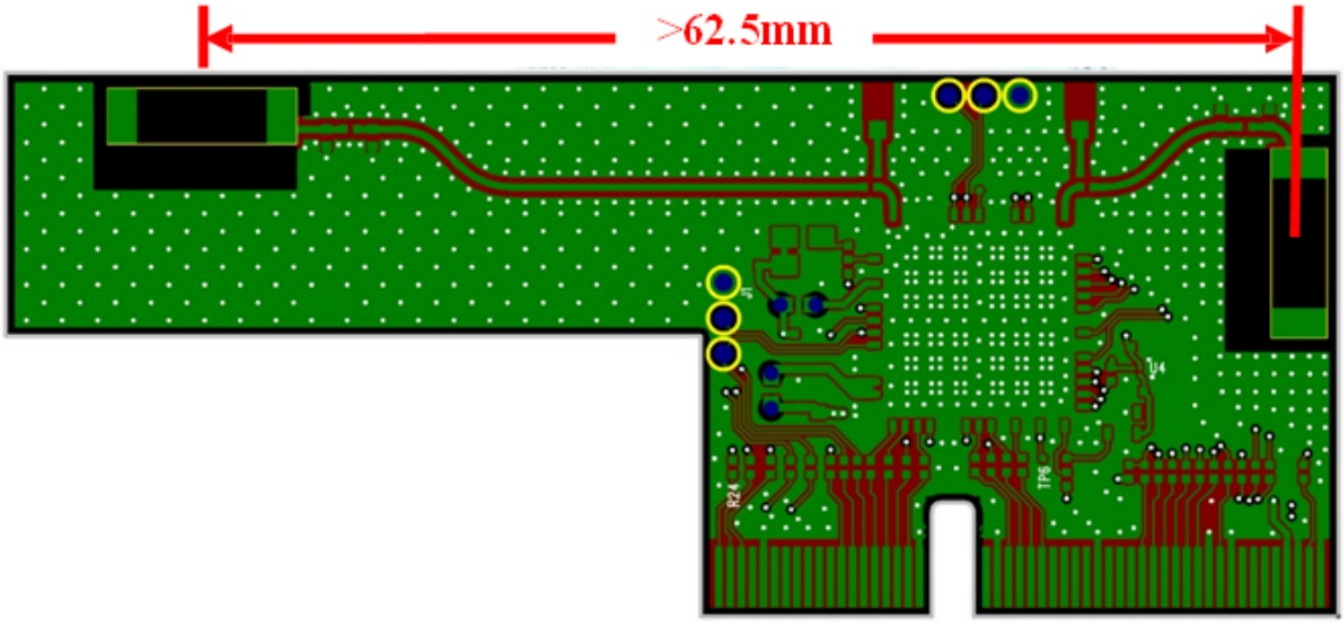

Figure 17. MIMO Antenna Spacing

Follow these supply routing guidelines:

- For power supply routing, the power trace for VBAT must be at least 40-mil wide.

- The 1.8-V trace must be at least 18-mil wide.
- Make VBAT traces as wide as possible to ensure reduced inductance and trace resistance.
- If possible, shield VBAT traces with ground above, below, and beside the traces. Follow these digital-signal routing guidelines:
- Route SDIO signal traces (CLK, CMD, D0, D1, D2, and D3) in parallel to each other and as short as possible (less than 12 cm). In addition, each trace must be the same length. Ensure enough space between traces (greater than 1.5 times the trace width or ground) to ensure signal quality, especially for the SDIO_CLK trace. Remember to keep these traces away from the other digital or analog signal traces. TI recommends adding ground shielding around these buses.
- Digital clock signals (SDIO clock, PCM clock, and so on) are a source of the noise. Keep the traces of these signals as short as possible. Whenever possible, maintain clearance around these signals.

Ordering Information

Part number:	WL1837M

Revision History

DATE	REVISION	NOTES
November 2014	*	Initial draf

related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards that anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm, and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military-grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components that have not been so designated is solely at the Buyer's risk and that the Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products	
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Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics, and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video
TI E2E Community	e2e.ti.com

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

Manual Information to the End User

The OEM integrator has to 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 shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. 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 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 that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada Statement
This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

- CAN ICES-3(B)/ NMB-3(B)
- The device could automatically discontinue transmission in case of the absence of information to transmit or operational failure. **Note** that this is not intended to prohibit the transmission of control or signaling information or the use of repetitive codes where required by the technology.
- the device for operation in the band 5150–5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
- the maximum antenna gain permitted for devices in the bands 5250–5350 MHz and 5470–5725 MHz shall comply with the e.i.r.p. limit, and
- the maximum antenna gain permitted for devices in the band 5725–5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non-point-to-point operation as appropriate.

In addition, high-power radars are allocated as primary users (i.e. priority users) of the bands 5250–5350 MHz and 5650–5850 MHz, and these radars could cause interference and/or damage to LE-LAN devices.

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

This device is intended only for OEM integrators under the following conditions:
(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
(2) The transmitter module may not be co-located with any other transmitter or antenna.
(3) This radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved by Texas Instrument. Antenna types not included in the list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this transmitter.

Antenna Gain (dBi) @ 2.4GHz	Antenna Gain (dBi) @ 5GHz
3.2	

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/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/IC authorization.

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Documents / Resources

	TEXAS INSTRUMENTS WL1837MODCOM8I WLAN MIMO and Bluetooth Module [pdf] User Guide WL18DBMOD, FI5-WL18DBMOD, FI5WL18DBMOD, WL1837MODCOM8I WLAN MIMO and Bluetooth Module, WLAN MIMO and Bluetooth Module

References

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