

WL1835MODCOM8B WLAN MIMO and Bluetooth® Module EVM

This user's guide describes how to use the TI WL1835MODCOM8B board to evaluate the performance of the TI WL18MODGB module.

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Warning

The WL1835MODCOM8B board is tested to comply with RE Directive over temperatures from –20°C to 85°C.

This board should not be modified to operate in other frequency bands other than what they are designed for.

FCC Licensing Requirements for the Wi-Fi and Bluetooth Radio Module of the EVM:

For evaluation only; not FCC approved for resale. This kit is designed to allow:

1. Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product
2. Software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18, or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

Per TI's Regulatory Compliance Information located in the WL1835ModCOMB8B User's Guide's "Evaluation Board/Kit/Module (EVM) Additional Terms," this EVM cannot be used for production purposes and is explicitly restricted from end-product introduction.

Use of this EVM requires the developer to provide a minimum distance of at least 20 cm from the antenna to all persons in order to minimize risk of potential radiation hazards.

CAUTION

Do not leave the EVM powered when unattended.

1 Introduction

The WL1835MODCOM8B device is a Wi-Fi® MIMO, *Bluetooth*, and *Bluetooth* Low Energy (BLE) module board with the TI WL18MODGB module. WL18MODGB is built-in TI WL1835 IEEE 802.11 b/g/n and *Bluetooth* 4.2 solutions to provide the best Wi-Fi and *Bluetooth* coexistence interoperability and power-saving technologies from TI.



Figure 1. WL1835MODCOM8B Top View

FCC/IC Regulatory Compliance
FCC Part 15 Class A Compliant
IC ICES-003 Class A Compliant

(continued)

FCC ID: Z64-WL1835COM

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.

IC ID: 451I-WL1835COM

This device complies with Industry Canada licence-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 that may cause undesired operation of the device.

1.1 Features

- WLAN, *Bluetooth*, BLE on a module board
- 100-pin board card
- Dimension 76.0 mm(L) x 31.0 mm(W)
- WLAN 2.4 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 TI AM335X general-purpose EVM
- WLAN and *Bluetooth*, BLE cores are software and hardware compatible with prior WL127x, WL128x and CC256x offerings, for smooth migration to device.
- Shared HCI transport for *Bluetooth* and BLE over UART and SDIO for WLAN.
- Wi-Fi / *Bluetooth* single antenna co-existence
- Built-in chip antenna
- Optional U.FL RF connector for external 2.4-GHz band antenna
- Direct connection to battery using external switching mode power supply supporting 4.8-V to 2.9-V operation
- VIO in the 1.8-V domain

1.2 Applications

- Internet of Things Multimedia
- Home Electronics
- Home Appliances and White Goods
- Industrial and Home Automation
- Smart Gateway and Metering
- Video Conferencing
- Video Camera and Security

1.3 TI Module Key Benefits

- Reduces Design Overhead: Single WiLink8™ Module Scales Across Wi-Fi and *Bluetooth*.
- WLAN High Throughput: 80 Mbps (TCP), 100 Mbps (UDP)
- *Bluetooth* 4.2 + BLE (Smart Ready)
- Wi-Fi-*Bluetooth* Single Antenna Coexistence
- Low Power (30–50% Less than Previous Generation)
- Available as Easy-to-Use FCC, ETSI, and Telec Certified Module
- Lower Manufacturing Costs, Saving Board Space and Minimizing RF Expertise
- AM335x Linux® and Android™ Reference Platform Accelerates Customer Development and Time to Market

2.1 Pin Descriptions

| No. | Name | Type | Description |
|-----|-------------|------|--------------------------------|
| 1 | SLOW_CLK | I | Slow clock input |
| 2 | GND | G | Ground |
| 3 | GND | G | Ground |
| 4 | WL_EN | I | WLAN Enable |
| 5 | VBAT | P | Power supply input |
| 6 | GND | G | Ground |
| 7 | VBAT | P | Power supply input |
| 8 | VIO | P | Power supply input for I/O pin |
| 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 |
| 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 interrupt 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 |

| No. | Name | Type | Description |
|-----|----------------|------|---|
| 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 |
| 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 | BT_FUNC1 | O | BT_HOST_WAKE_UP Signal to wake up the host from Bluetooth |
| 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 | BT_FUNC2 | I | BT_WAKE_UP Bluetooth wakeup from host |
| 94 | N.C. | | No connection |
| 95 | GND | G | Ground |
| 96 | GPIO11 | I/O | General-purpose I/O |

| No. | Name | Type | Description |
|-----|--------|------|---------------------|
| 97 | GND | G | Ground |
| 98 | GPIO12 | I/O | General-purpose I/O |
| 99 | N.C. | | General-purpose I/O |
| 100 | GPIO10 | I/O | General-purpose I/O |

3 Electrical Characteristics

Refer to the detailed data in the WL18MODGB data sheet ([SWRS152](#)) for electrical characteristics.

4 Approved Antenna Types and Maximum Gain Values

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

- Install the antenna so that 20 cm is maintained between the antenna and user.
- Do not co-locate the transmitter module with any other transmitter or antenna.
- Operate the radio transmitter using only an antenna of a type and maximum (or lesser) gain approved by TI. [Table 1](#) lists the antennas approved by TI for use with the radio transmitter along with maximum allowable gain values. Antenna types not included in the list or having a gain greater than the maximum indicated are strictly prohibited for use with this transmitter

Table 1. Approved Antenna Types and Maximum Gain Values

| Antenna Type | Brand | 2.4–2.5 GHz | Unit |
|--------------|--------------|-------------|------|
| PCB | Ethertronics | –0.600 | dBi |
| Dipole | LSR | 2.50 | |
| PCB | Laird | 2.00 | |
| Chip | Pulse | 3.20 | |
| PIFA | LSR | 2.00 | |
| Chip | TDK | 2.4 | |

NOTE: If these conditions cannot be met (for example, with certain laptop configurations or co-location with another transmitter), the FCC/IC authorization will not be considered valid and the FCC ID/IC ID cannot be used on the final product. In these circumstances, the OEM integrator is responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

5 On-Board Antenna Configuration

5.1 VSWR

Figure 4 shows the antenna VSWR.

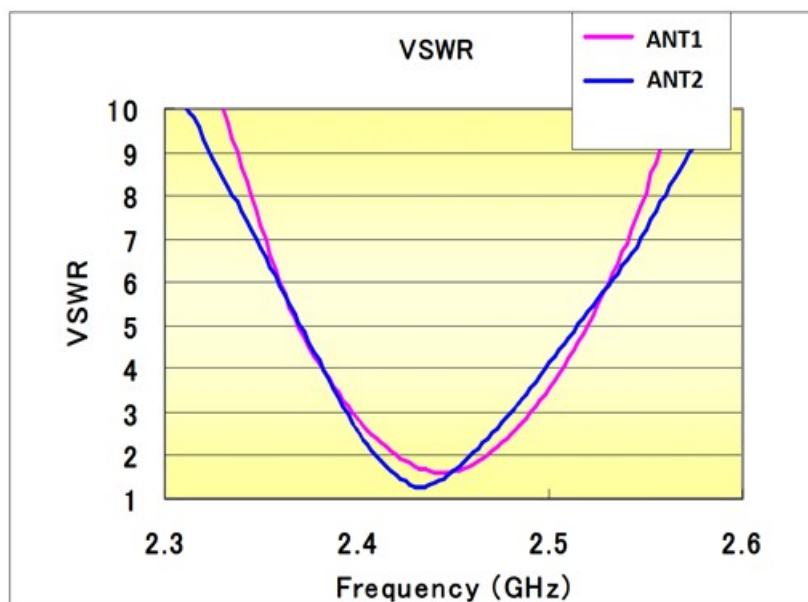


Figure 4. Antenna VSWR

5.2 Efficiency

Figure 5 shows the antenna efficiency.

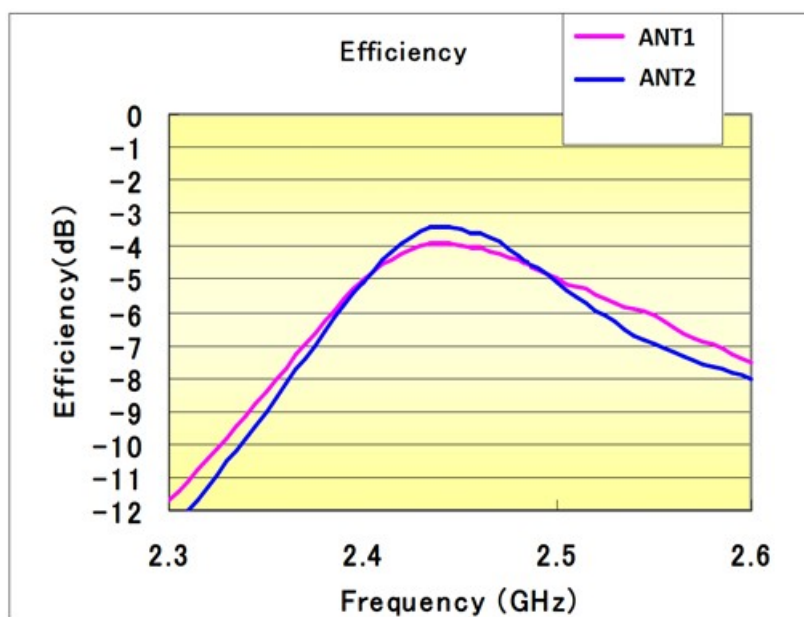


Figure 5. Antenna Efficiency

5.3 Radio Pattern

Figure 6 shows the radio pattern of the WL1835MODCOM8B device.

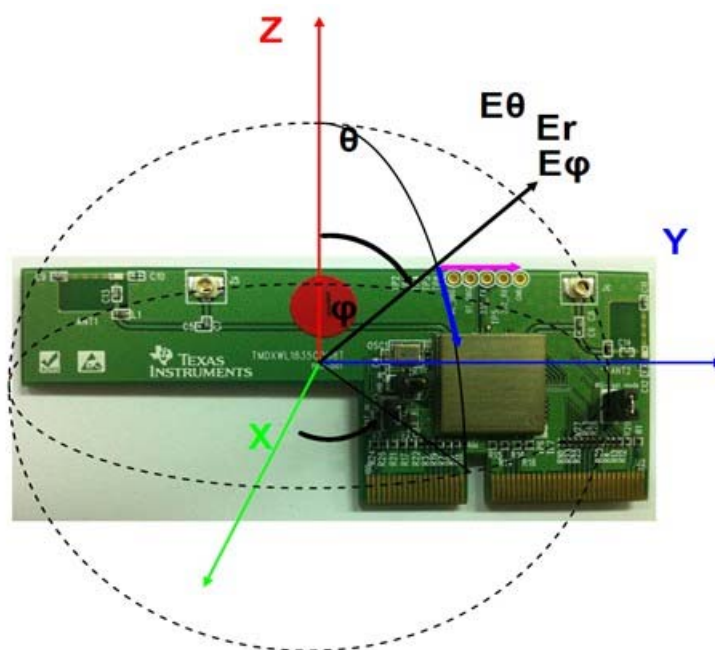


Figure 6. Radio Pattern

5.4 ANT1

Figure 7 shows the ANT1 polarization of the WL1835MODCOM8B device.

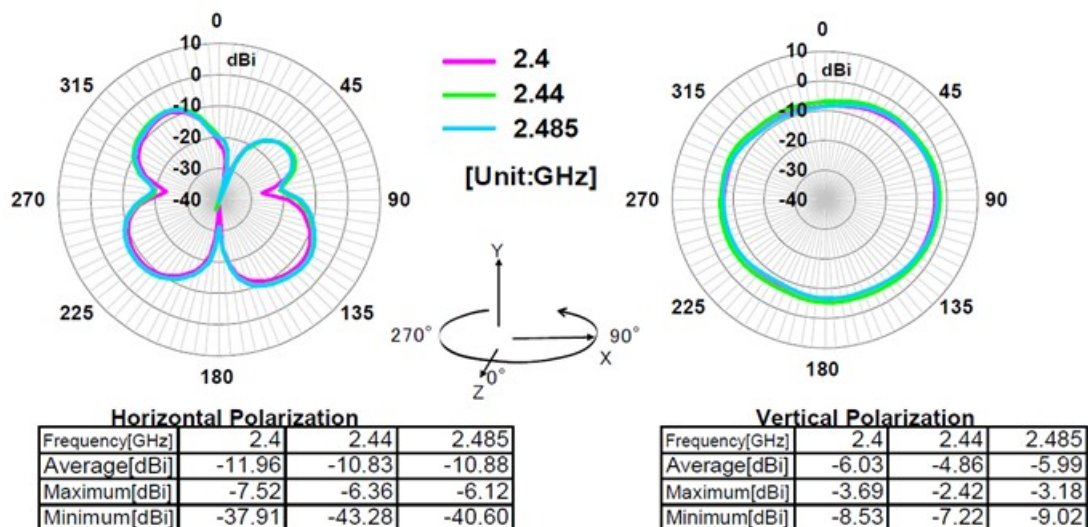


Figure 7. ANT1 Polarization

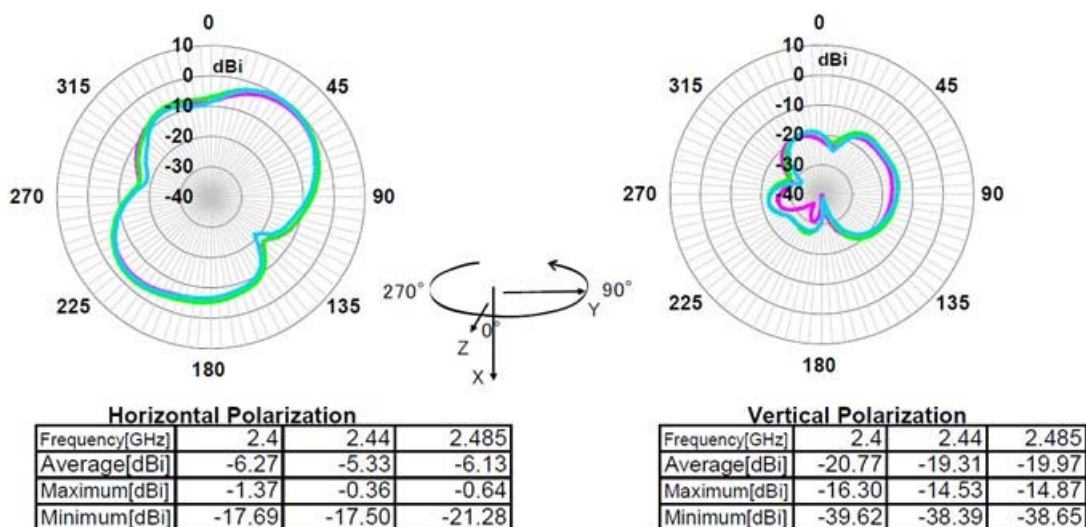


Figure 8. ANT1 Polarization

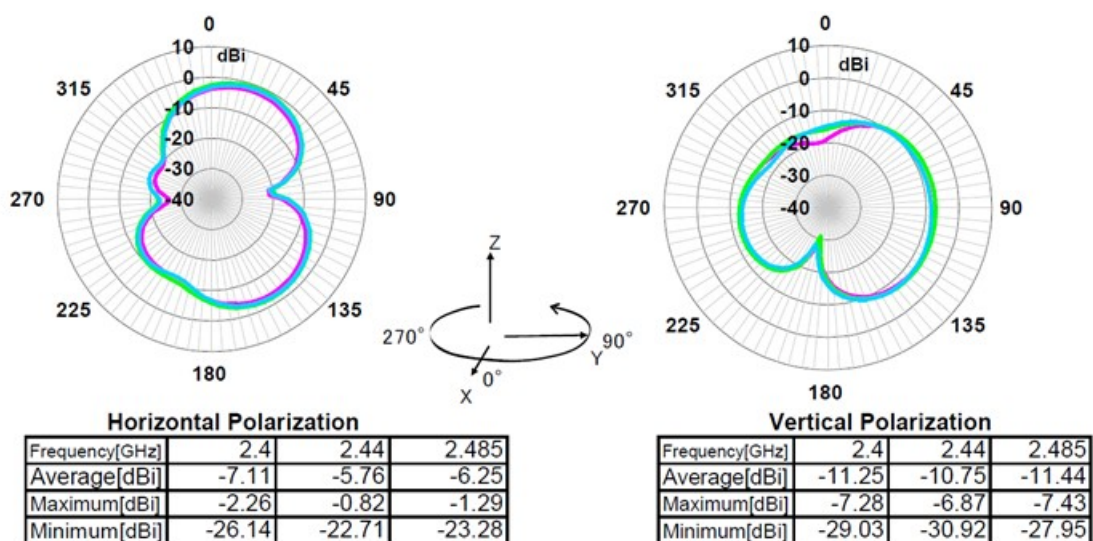


Figure 9. ANT1 Polarization

5.5 ANT2

Figure 10 shows the ANT2 polarization of the WL1835MODCOM8B device.

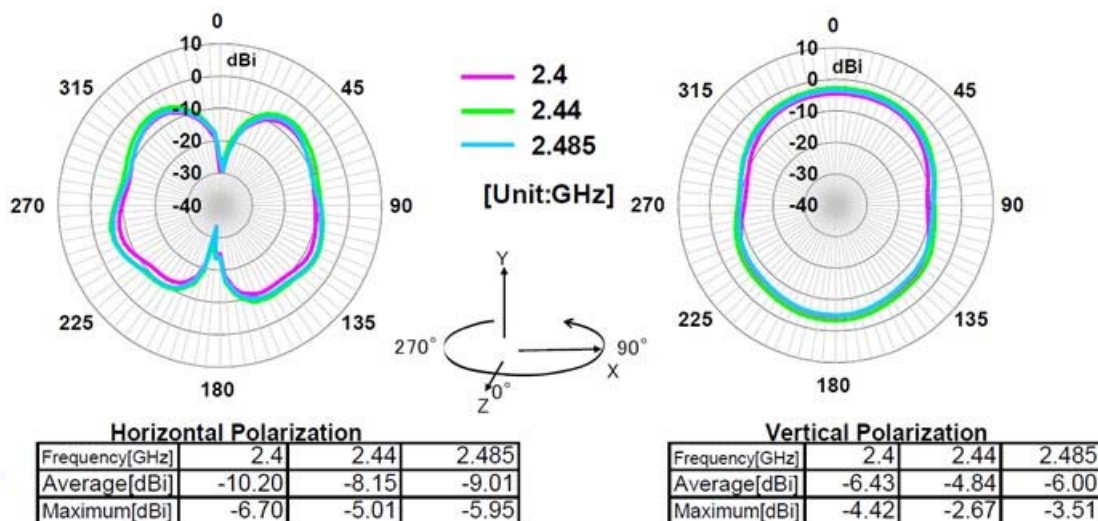


Figure 10. ANT2 Polarization

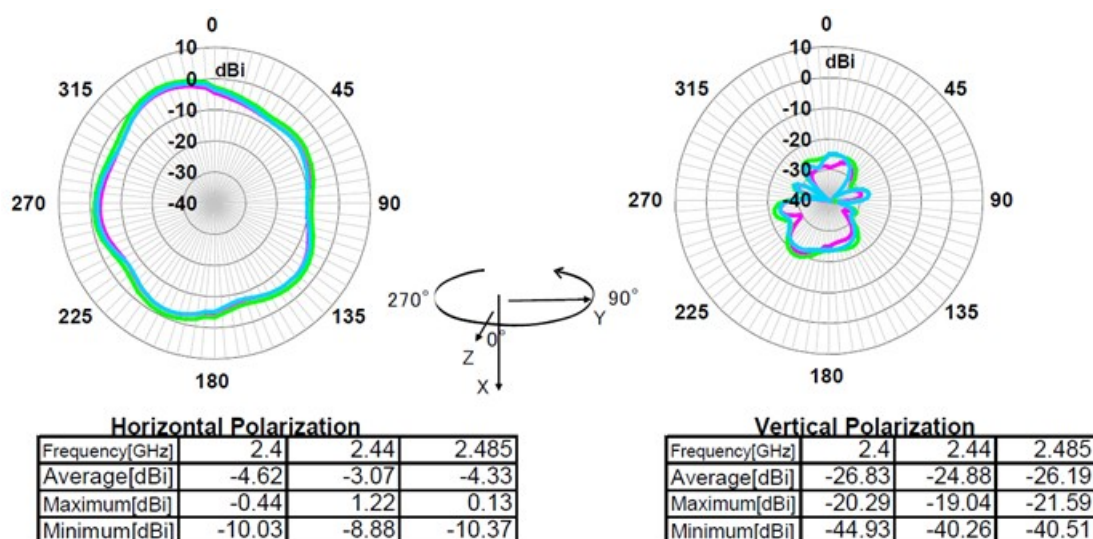


Figure 11. ANT2 Polarization

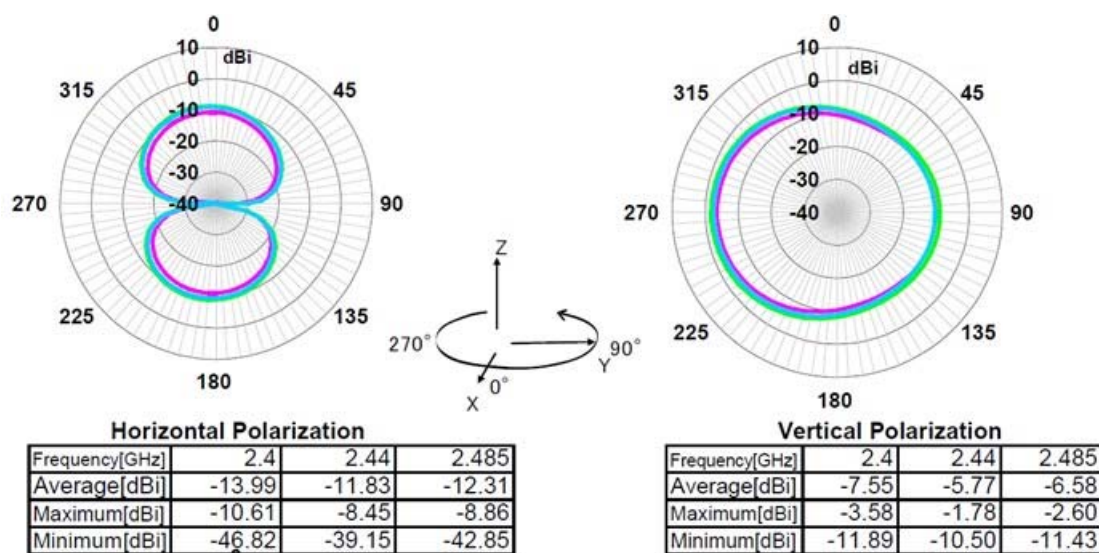


Figure 12. ANT2 Polarization

6 Circuit Design

6.1 Schematic

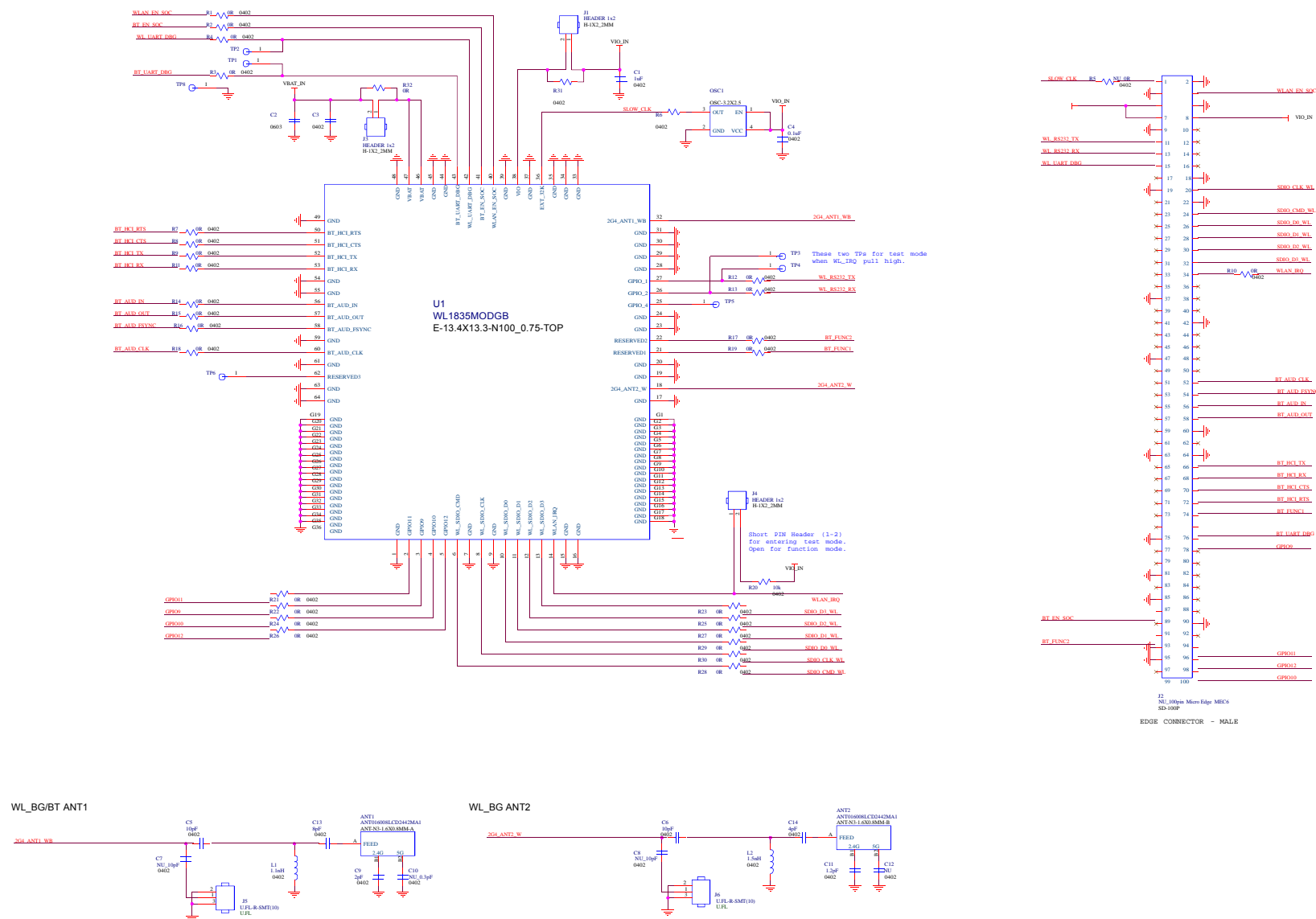


Figure 13. Schematic

6.2 Bill of Materials (BOM)

Table 2 lists the bill of materials.

Table 2. BOM

| | | | |
|----|--|---------------------|--|
| 1 | TI WL1835 Wi-Fi/ <i>Bluetooth</i> Module | WL18MODGB | U1 |
| 2 | XOSC 3225 / 32.768 kHz / 1.8 V / ± 50 ppm | 7XZ3200005 | OSC1 |
| 3 | ANT / Chip / 2.4 GHz, 5 GHz / Peak Gain >5 dBi | ANT016008LCD2442MA1 | ANT1, ANT2 |
| 4 | CON Male 1x2 / Pitch | P301-SGP-040/028-02 | J1, J3, J4 |
| 5 | DC JUMPER / PITCH 2.0 mm | CMJ-20BB | J1, J3 |
| 6 | Mini RF Header Receptacle | U.FL-R-SMT-1(10) | J5, J6 |
| 7 | IND 0402 / 1.1 nH / ± 0.05 nH / SMD | LQP15MN1N1W02 | L1 |
| 8 | IND 0402 / 1.5 nH / ± 0.05 nH / SMD | LQP15MN1N5W02 | L2 |
| 9 | CAP 0402 / 1.2 pF / 50 V / C0G / ± 0.1 pF | GJM1555C1H1R2BB01 | C11 |
| 10 | CAP 0402 / 2.2 pF / 50 V / C0G / ± 0.1 pF | GJM1555C1H2R2BB01 | C9 |
| 11 | CAP 0402 / 4 pF / 50 V / C0G / ± 0.1 pF | GJM1555C1H4R0BB01 | C14 |
| 12 | CAP 0402 / 8 pF / 50 V / C0G / ± 0.1 pF | GJM1555C1H8R0BB01 | C13 |
| 13 | CAP 0402 / 10 pF / 50 V / NPO / $\pm 5\%$ | 0402N100J500LT | C7, C8 |
| 14 | CAP 0402 / 0.1 μ F / 6.3 V / X7R / $\pm 10\%$ | 0402B104K100CT | C3, C4 |
| 15 | CAP 0402 / 1 μ F / 6.3 V / X5R / $\pm 10\%$ / HF | GRM155R60J105KE19D | C1 |
| 16 | CAP 0603 / 10 μ F / 6.3 V / X5R / $\pm 20\%$ | C1608X5R0J106M | C2 |
| 17 | RES 0402 / 0R / $\pm 5\%$ | WR04X000 PTL | R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32 |
| 18 | RES 0402 / 10K / $\pm 5\%$ | WR04X103 JTL | R20 |

7 Layout Guidelines

7.1 Board Layout

Figure 14 shows the WL1835MODCOM8B 4-layer board. Table 3, Figure 15, Figure 16, Figure 17, Figure 18, and Figure 19 show instances of good layout practices.

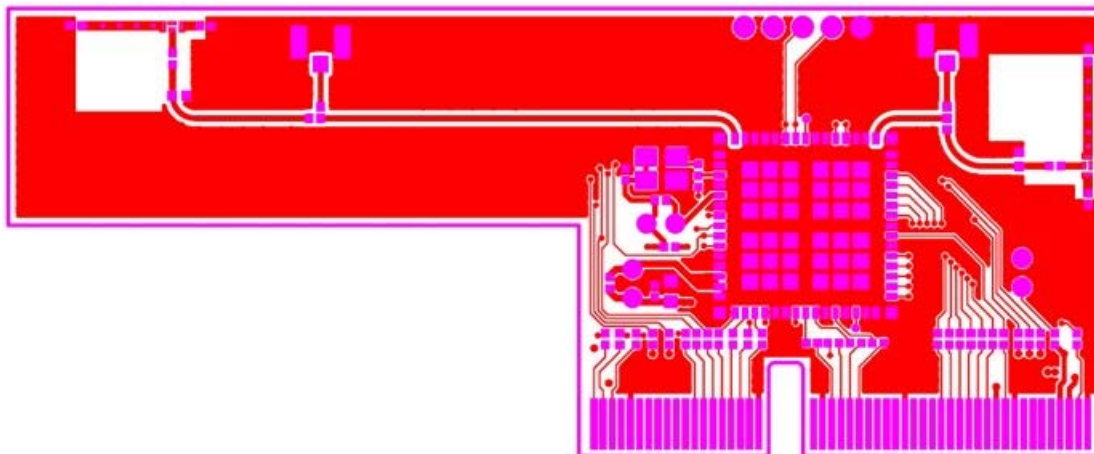


Figure 14. Layer 1

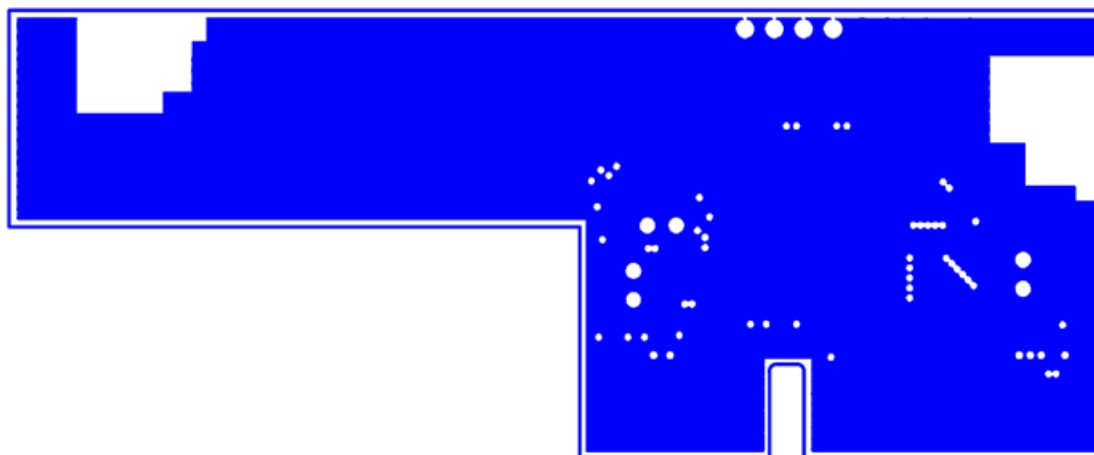


Figure 15. Layer 2

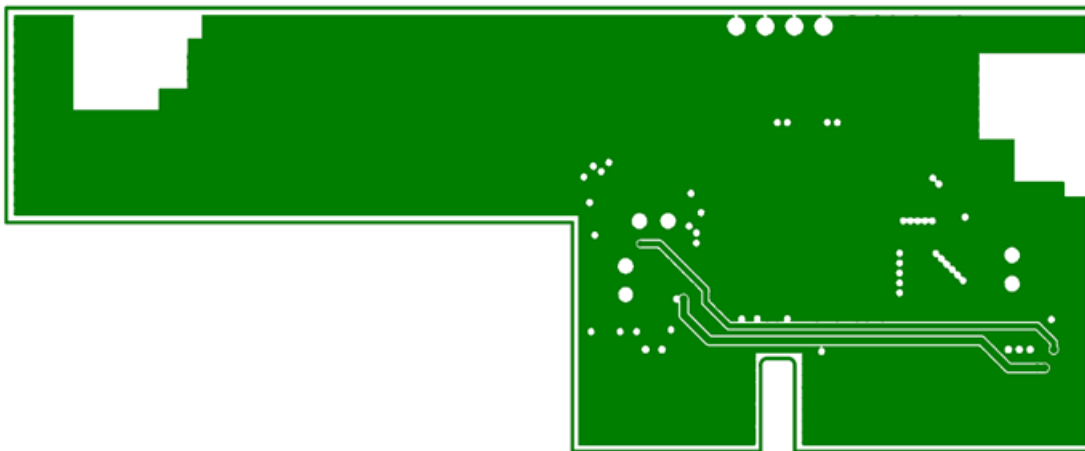


Figure 16. Layer 3

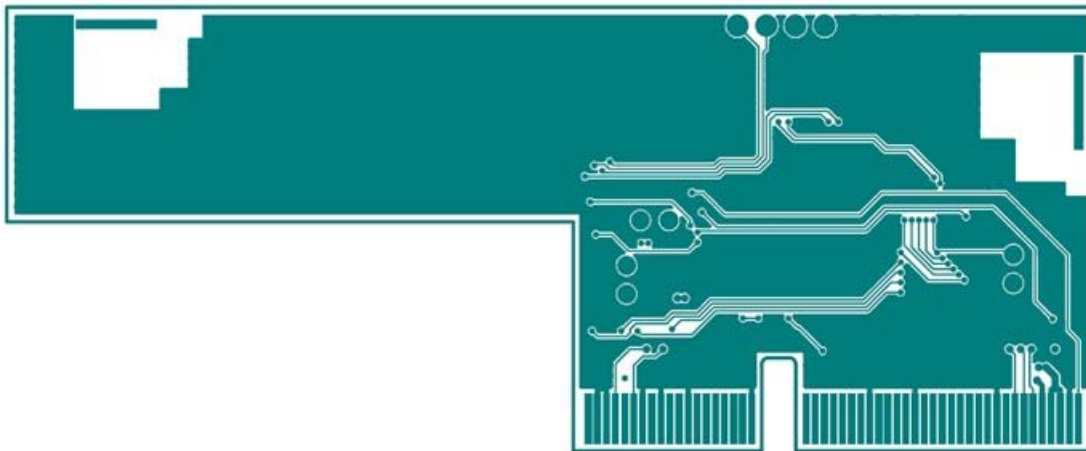


Figure 17. Layer 4

Table 3. Module Layout Guidelines

| Reference | Guideline Description |
|-----------|---|
| 1 | The proximity of ground vias must be close to the pad. |
| 2 | Signal traces must not be run underneath the module on the layer where the module is mounted. |
| 3 | Have a complete ground pour in layer 2 for thermal dissipation. |
| 4 | Have a solid ground plane and ground vias under the module for stable system and thermal dissipation. |
| 5 | Increase the ground pour in the first layer and have all of the traces from the first layer on the inner layers, if possible. |
| 6 | Signal traces can be run on a third layer under the solid ground layer, which is below the module mounting layer. |

Note: at least an equivalent 1dB loss (in the form of trace, cable or 1-dB pi-pad loss) is required between the output of the WL18MODGB module and the U.FL connector to be compliant with the current Z64-WL18SBMOD and 451I-WL18SBMOD module certification.

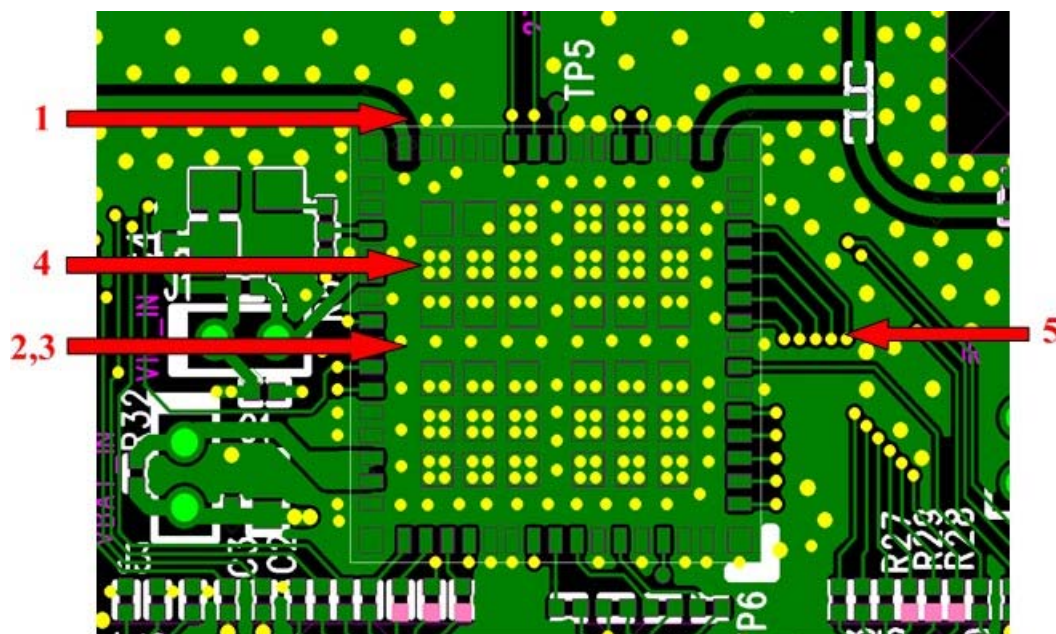


Figure 18. Module Layout Guidelines (Top Layer)

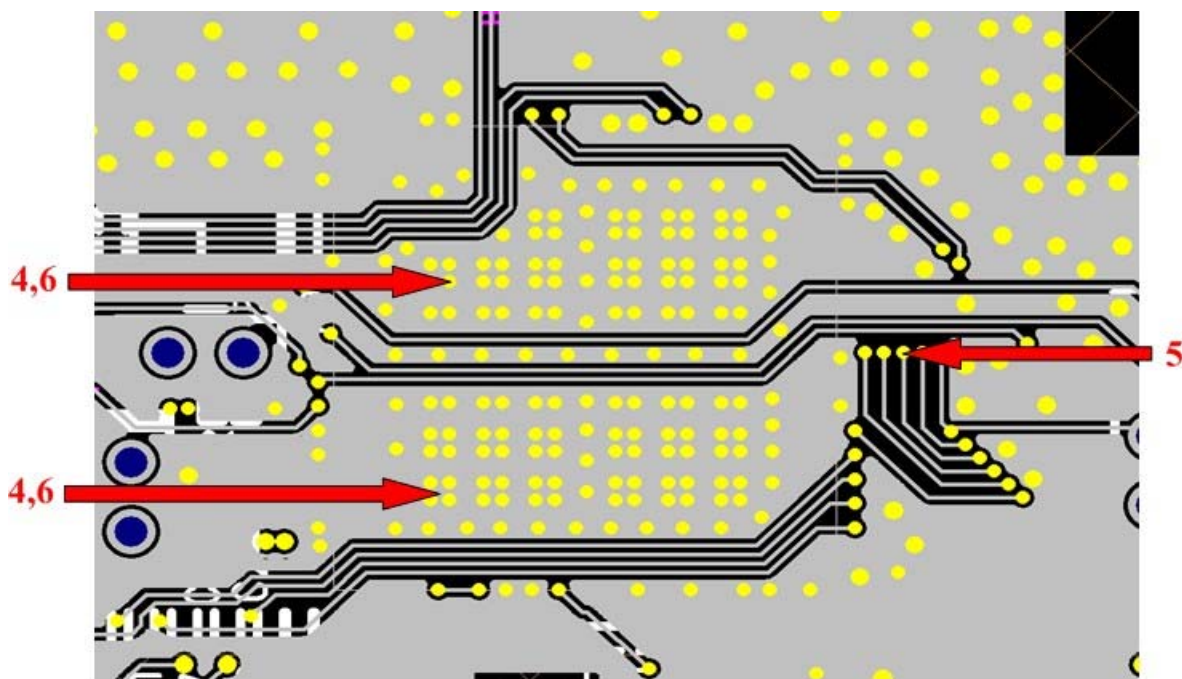


Figure 19. Module Layout Guidelines (Bottom Layer)

Figure 20 shows the trace design for the PCB. A 50- Ω impedance match on the trace to the antenna should be used. Also, 50- Ω traces are recommended for the PCB layout.

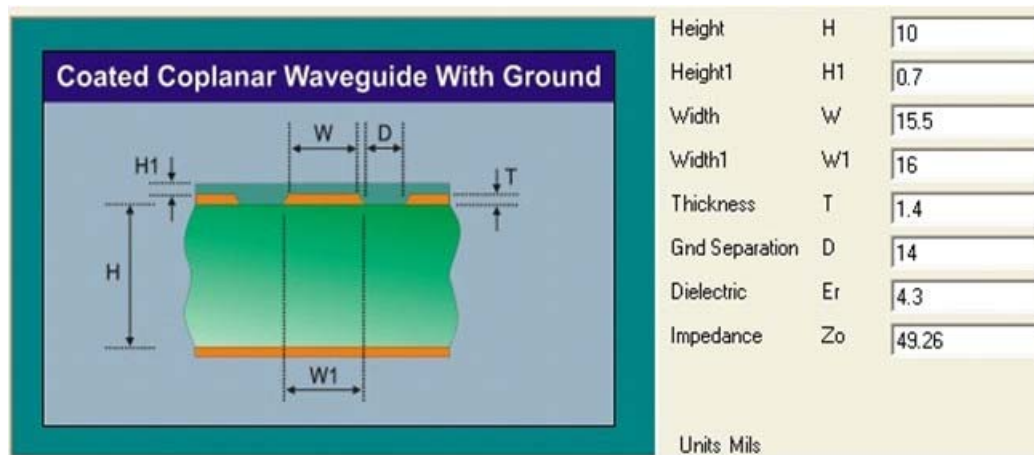


Figure 20. Trace Design for the PCB Layout

Figure 21 shows layer 1 with the trace to the antenna over ground layer 2.

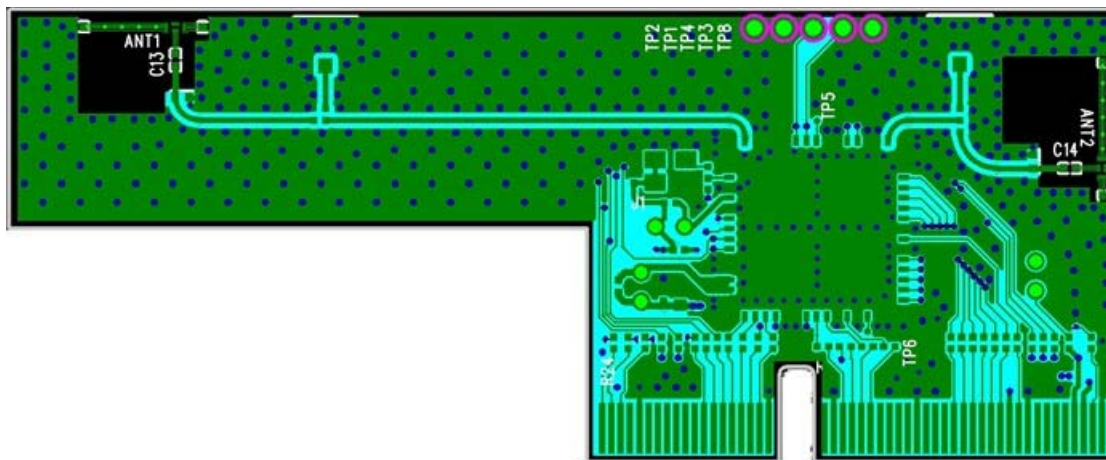


Figure 21. Layer 1 Combined With Layer 2

Table 4, Figure 22, and Figure 23 describe instances of good layout practices for the antenna and RF trace routing.

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 point, the trace starts to radiate. |
| 2 | The 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 trace. The ground layer must be solid. |
| 6 | There must be no traces or ground under the antenna section. |
| 7 | 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. |

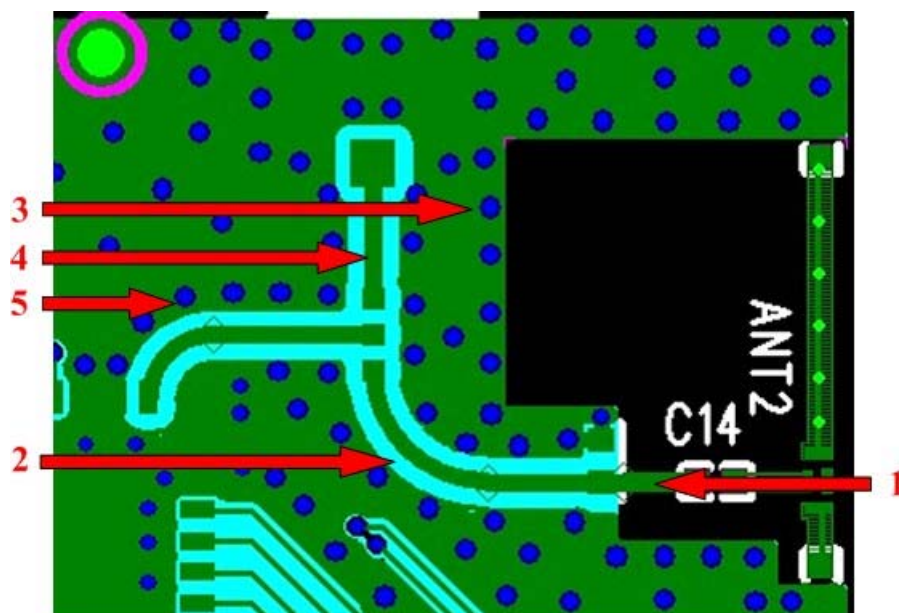


Figure 22. Top Layer – Antenna and RF Trace Routing Layout Guidelines

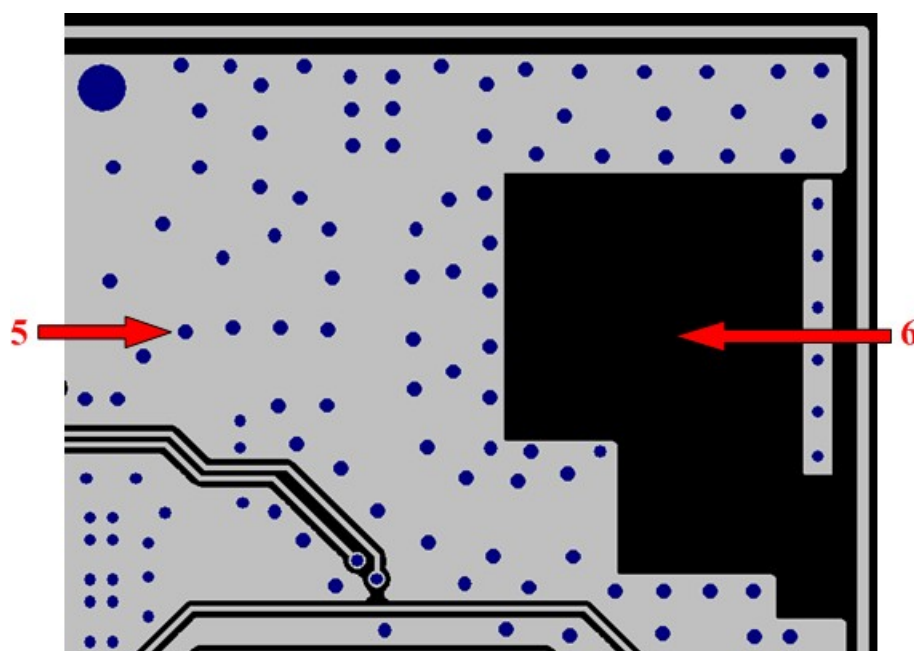


Figure 23. Bottom Layer – Antenna and RF Trace Routing Layout Guidelines

Figure 24 describes the MIMO antenna spacing. The distance of ANT1 and ANT2 must be greater than half of wavelength (62.5 mm at 2.4 GHz).

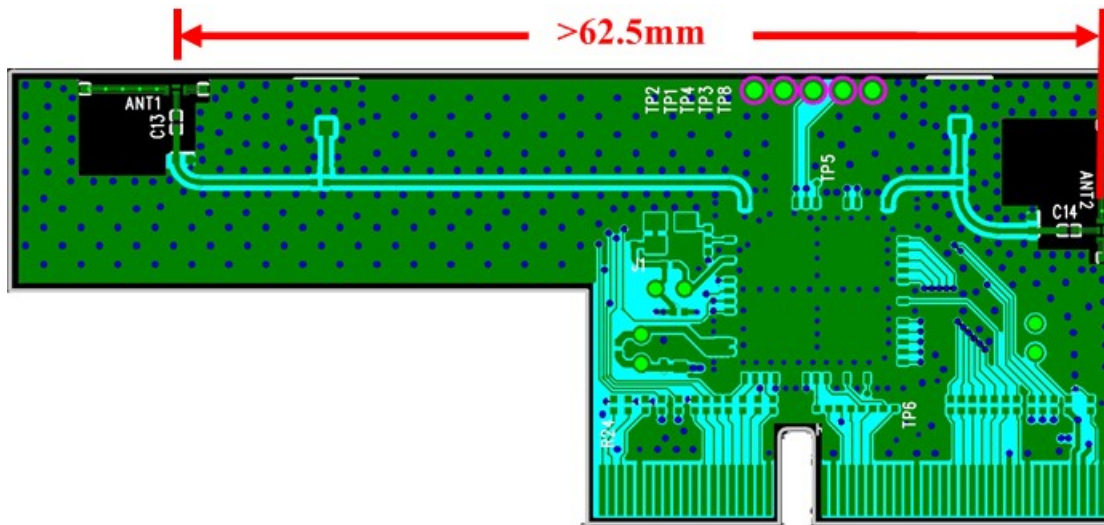


Figure 24. MIMO Antenna Spacing

The supply routing guidelines are as follows:

- 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.

The digital-signal routing guidelines are as follows:

- 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 noise. Keep the traces of these signals as short as possible. Whenever possible, maintain a clearance around these signals.

Revision History

| Changes from C Revision (March 2015) to E Revision | Page |
|---|--------------------|
| • Changed from -40° | 2 |
| • Added "Approved Antenna Types and Maximum Gain Values" section from SWRU382A..... | 9 |
| • Changed section title from "Antenna Characteristics"..... | 10 |
| • Replaced digital-signal routing guidelines. | 22 |

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

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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 which have **not** been so designated is solely at the Buyer’s risk, and that 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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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/warning as shown in this manual.

1. RF Function and Frequency Range

The WL18MODGB module is designed to operate in the BT and WLAN 2.4GHz bands. The WL18MODGB support the following WLAN channels dependent on the region of operation:

- FCC / 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:

The maximum RF power transmitted in each WLAN 2.4GHz band is 19 dBm.

The maximum RF power transmitted in each BT band is 13 dBm.

2. FCC /IC Certification and Statement

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

- The antenna must be installed such that 20 cm is maintained between the antenna and users,
- The transmitter module may not be co-located with any other transmitter or antenna.
- To comply with FCC / IC regulations limiting both 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:
 - +3.2 dBi in WLAN 2.4G

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 / 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.

2.1 FCC

The TI WL18MODGB module is certified for FCC as a single-modular transmitter. The module is an FCC-certified radio module that carries a modular grant.

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 too.
- Consult the dealer or an experienced radio or TV technician for help.

The antenna listing in Section 3.5 of this document were verified in the compliance testing. Use only the antennas on this list. A separate approval is required for all other operating configurations, including different antenna configurations

2.2 CAN ICES-3(B)/NMB-3(B) Certification and Statement

The TI WL18MODGB module is certified for IC as a single-modular transmitter. The TI WL18MODGB module meets 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 (451I-WL18MODGB) has been approved by Industry Canada to operate with the antenna types listed in Section 3.5 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 antenna listing in Section 3.5 of this document were verified in the compliance testing. Use only the antennas on this list. A separate approval is required for all other operating configurations, including different antenna configurations.

2.3 End Product Labeling

This module is designed to comply with the FCC statement, FCC ID: Z64-WL18SBMOD. The host system using this module must display a visible label indicating the following text:

- Contains FCC ID: Z64-WL18SBMOD

This module is designed to comply with the IC statement, IC: 451I-WL18SBMOD. The host system using this module must display a visible label indicating the following text:

- Contains IC: 451I-WL18SBMOD

This module is designed to comply with the JP statement, 201-135370. The host system using this module must display a visible label indicating the following text:

- Contains transmitter module with certificate number 201-135370

2.4 Device Classifications

Since host devices vary widely with design features and configurations module integrators shall follow the guidelines below 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 user's body. 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. Your preferred test lab will be able to assist in determining the appropriate device category for your host product and if a KDB or PBA must be submitted to the FCC.

Note, the module you are 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 / module combination will need to undergo testing for FCC Part 15 regardless of the device classification. Your preferred test lab will be able to assist in determining the exact tests which are required on the host / module combination.

2.5 FCC Definitions

Portable: (§2.1093) — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is / 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 structure(s) 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.

2.6 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 antenna(s) 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.

3. EU Certification and Statement

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.

3.2 Simplified DoC statement

3.2.1 WL18MODGB

Hereby, Texas Instruments declares that the radio equipment type WL18MODGB, Test Grades 01, 03, 31, and 35 are in compliance with Directive 2014/53/EU.

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

- WL18MODGB (Test Grade 01) – www.ti.com/lit/pdf/SSZQ070
- WL18MODGB (Test Grade 05) – www.ti.com/lit/pdf/SSZQ071
- WL18MODGB (Test Grade 31) – www.ti.com/lit/pdf/SSZQ072
- WL18MODGB (Test Grade 35) – www.ti.com/lit/pdf/SSZQ073

3.2.2 WL1835MODCOM8B

Hereby, Texas Instruments declares that the radio equipment type WL1835MODCOM8B is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at www.ti.com/lit/pdf/SSQZ074.

3.3 Waste Electrical and Electronic Equipment (WEEE)



Waste Electrical and Electronic Equipment (WEEE)

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.

3.4 OEM / Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product

must be reassessed against all 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.

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 following antennas 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.

3.6 WL18MODGB Approved Antennas

Table 2-1 lists the antennas approved for use with the WL18MODGB module.

| List | | | | |
|------|--------------|----------------------|-----------|----------------------|
| | Brand | Antenna Type | Model | 2.4GHz ~ 2.5GHz Gain |
| 1 | Ethertronics | PCB | 1000423 | -0.6dBi |
| 2 | LSR | Rubber Whip / Dipole | 001-0012 | 2dBi |
| 3 | | | 080-0013 | 2dBi |
| 4 | | | 080-0014 | 2dBi |
| 5 | | PIFA | 001-0016 | 2.5dBi |
| 6 | | | 001-0021 | 2.5dBi |
| 7 | Laird | PCB | CAF94504 | 2dBi |
| 8 | | | CAF94505 | 2dBi |
| 9 | Pulse | Chip | W3006 | 3.2dBi |
| 10 | TDK | Chip | ANT016008 | 2.4dBi |

Table 2-1: WL18MODGB Approved Antennas

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. **Delivery:** TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. **Limited Warranty and Related Remedies/Disclaimers:**
 - 2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.
 - 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. **Regulatory Notices:**
 - 3.1 **United States**
 - 3.1.1 **Notice applicable to EVMs not FCC-Approved:**

This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 **For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:**

CAUTION

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

FCC Interference Statement for Class B EVM devices

NOTE: 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 that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

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.

Concernant les EVMs avec appareils radio:

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: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type 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.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 Notice for EVMs delivered in Japan: Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。 http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 Notice for Users of EVMs Considered "Radio Frequency Products" in Japan: EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES (continued)

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2. 実験局の免許を取得後ご利用いただく。
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- 3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page 電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

4 *EVM Use Restrictions and Warnings:*

- 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
- 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
- 4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMS, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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