# TiWi-C-W Module
# *Application Guide*

Last updated
February 23, 2015

  

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# 1 Introduction

## 1.1 Purpose & Scope

The purpose of this document is to provide details regarding the design and integration of certified antennas to the TiWi-C-W module. It covers all three certified antenna options, which consist of a ceramic chip, dipole, and LSR FlexPIFA antenna. It will inform the designer as to the required PCB details required to retain the LSR modular certification for the TiWi-C-W module.

## 1.2 Applicable Documents

- *LSR 2.4 GHz FlexPIFA Antenna Datasheet (330-0149)*
- *LSR 2.4 GHz Dipole Antenna Datasheet (330-0016)*
- *LSR U.FL to RPSMA Cable Datasheet (330-0018)*

# 2 TiWi-C-W Module and Accessories

The TiWi-C-W Module is a System in Package (SIP) module. The TiWi-C-W module is certified with three antennas.

| | Part Number | Description |
|---|---|---|
|  | LSR 450-0118R<br>LSR 450-0118C | TiWi-C-W Module, Tape & Reel<br>TiWi-C-W Module, Cut Tape |
|  | Johanson<br>2450AT18A100 | 2.4 GHz Ceramic Chip Antenna |
|  | LSR<br>001-0014 | 2.4 GHz FlexPIFA Antenna with U.FL Cable |
|  | LSR<br>001-0001 | 2.4 GHz Dipole Antenna with Reverse Polarity SMA Connector |
|  | LSR<br>080-0001 | U.FL to Reverse Polarity SMA Bulkhead Cable 105 mm |
|  | Hirose<br>U.FL-R-SMT(10) | PCB Mounted U.FL Connector |

**Table 1 TiWi-C-W Module and Accessories**

  

# 3 TiWi-C-W Approved Antenna Specifications

## 3.1 Chip Antenna Specifications

The Johanson 2450AT18A100 Ceramic Chip Antenna is one option for a trace antenna design for use with the TiWi-C-W module.

| Specification | Value |
|---|---|
| Manufacturer and Part Number | Johanson 2450AT18A100 |
| Peak Gain | .5 dBi |
| Type | Ceramic Chip |
| Polarization | Linear |
| Frequency | 2400-2500MHz |

**Table 2 Chip Antenna Specifications**

### 3.1.1 Chip Antenna Typical Radiation Patterns

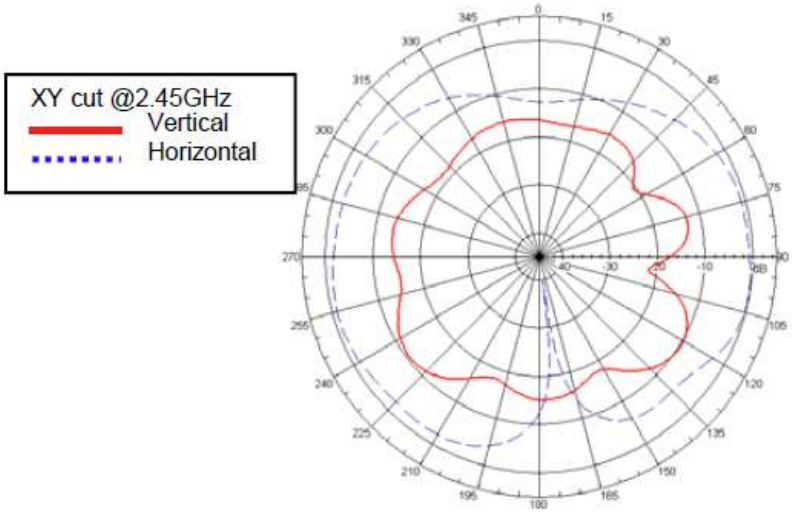


**Figure 1 Chip Antenna XY Cut Radiation Pattern**

  

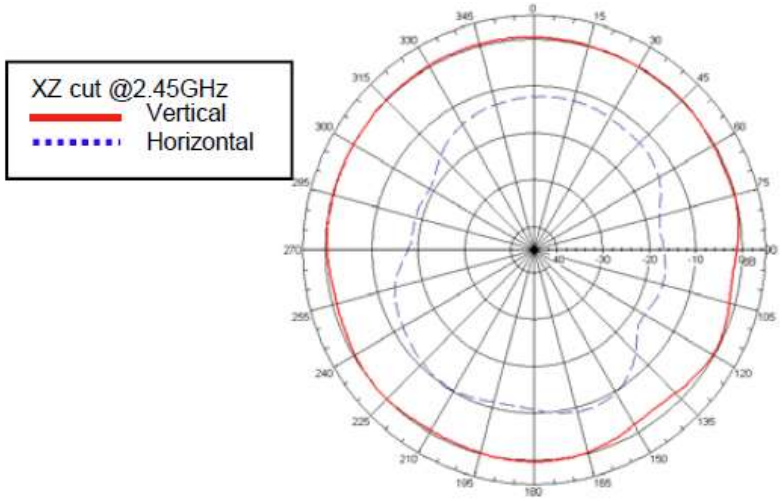


**Figure 2 Chip Antenna XZ Cut Radiation Pattern**

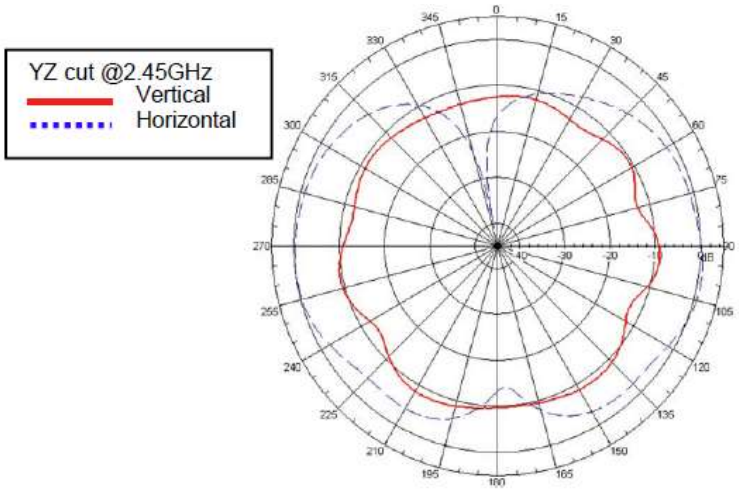


**Figure 3 Chip Antenna YZ Cut Radiation Pattern**

### 3.1.2 Mechanical Dimensions

| | In | mm |
|---|---|---|
| L | 0.126 ± 0.008 | 3.20 ± 0.20 |
| W | 0.063 ± 0.008 | 1.60 ± 0.20 |
| T | 0.051 +.004/-.008 | 1.30 +0.1/-0.2 |
| a | 0.020 ± 0.012 | 0.50 ± 0.30 |

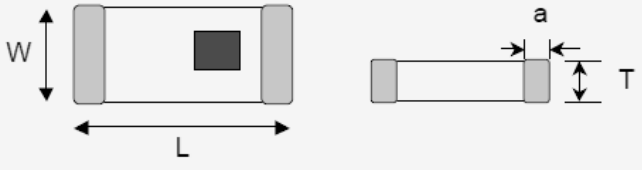


**Figure 4 Chip Antenna Dimensions**

  

## 3.2 LSR FlexPIFA Antenna Specifications

The LSR 001-0014 FlexPIFA Antenna w/U.FL cable is used in conjunction with the Hirose PCB mounted U.FL connector, to provide an externally mounted antenna solution for the TiWi-C-W module.

| Specification | Value |
|---|---|
| Manufacturer and Part Number | LSR 001-0014 |
| Peak Gain | 2.0 dBi |
| Type | Flexible Planar Inverted F Antenna (FlexPIFA) |
| Polarization | Linear |
| Frequency | 2400-2480 MHz |

**Table 3 LSR FlexPIFA Antenna Specifications**

### 3.2.1 U.FL Connector Drawing

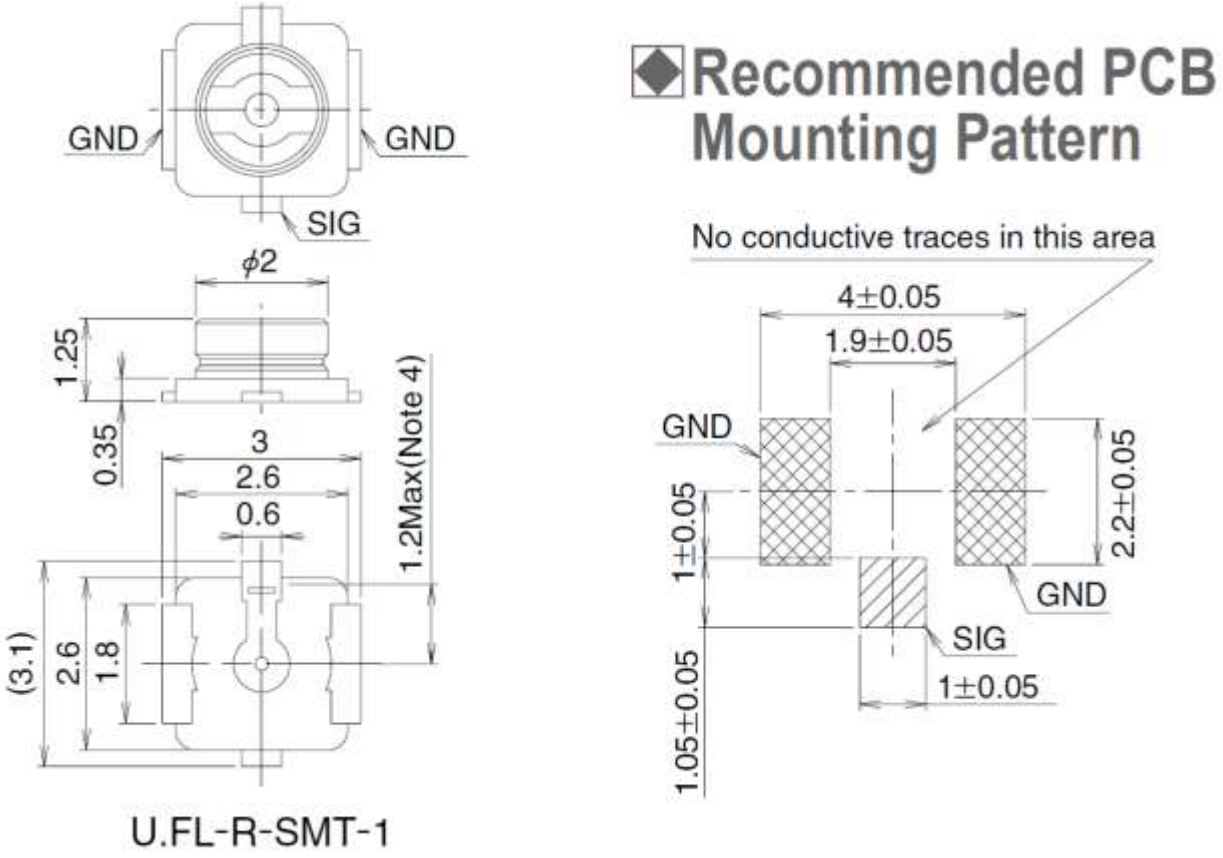


**Figure 5 – U.FL Connector Drawing**

  

### 3.2.2 Mechanical Dimensions

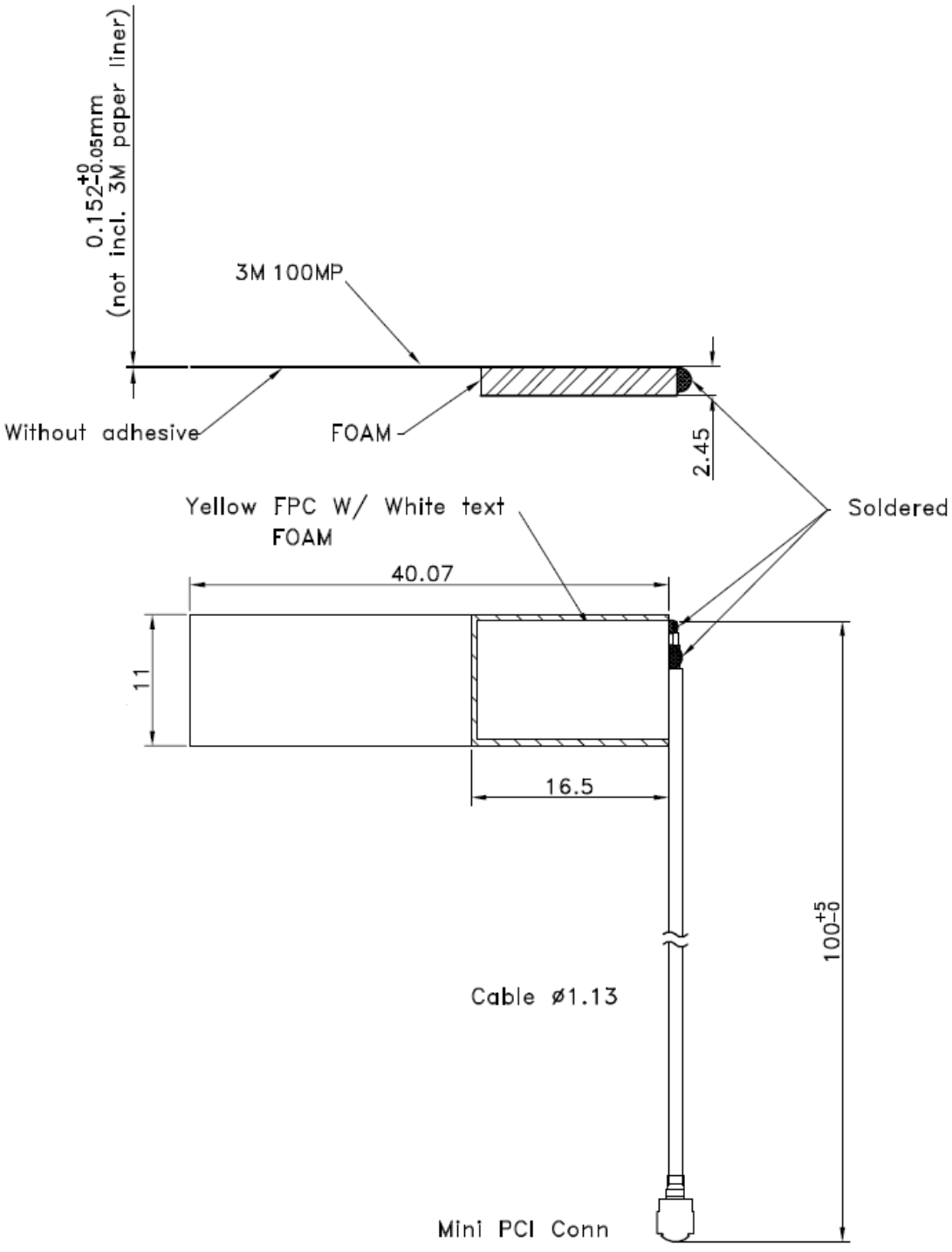


**Figure 6 LSR FlexPIFA Antenna Dimensions**

  

### 3.2.1 FlexPIFA Antenna Typical Radiation Patterns

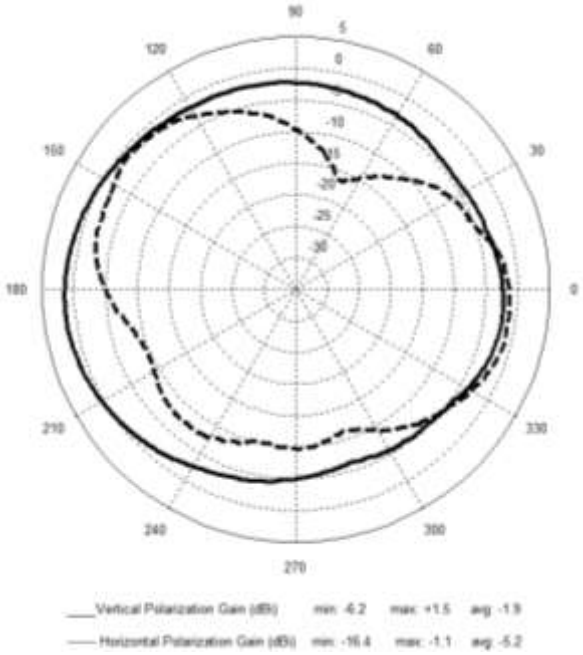


**Figure 7 FlexPIFA Antenna Azimuth Plane Radiation Pattern**

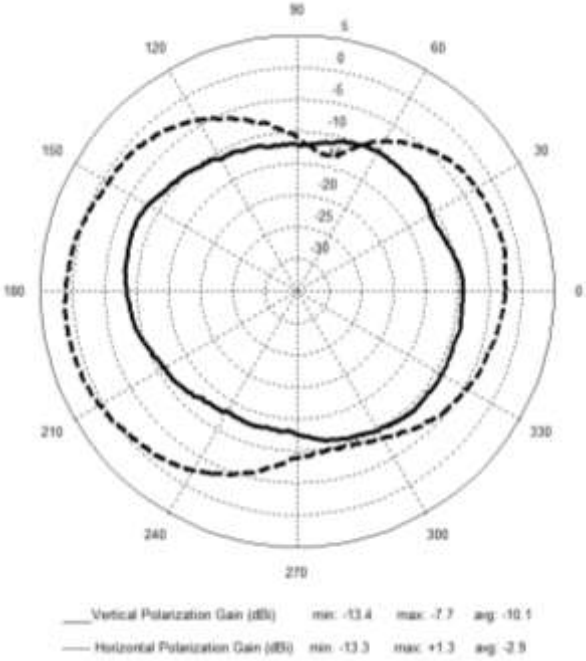


**Figure 8 FlexPIFA Antenna Primary Elevation Radiation Pattern**

  

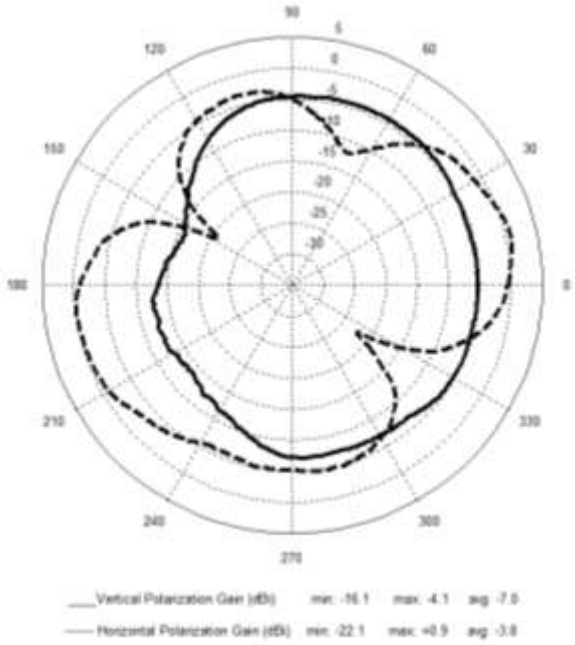


**Figure 9 FlexPIFA Antenna Secondary Elevation Radiation Pattern**

  

## 3.3 Dipole Antenna Specifications

The LSR 001-0001 Dipole Antenna is used in conjunction with the LSR 080-0001 U.FL to Reverse Polarity SMA Cable, and the Hirose PCB mounted U.FL connector Figure 5, to provide an externally mounted antenna solution for the TiWi-C-W module.

| Specification | Value |
|---|---|
| Manufacturer and Part Number | LSR 001-0001 |
| Gain | +2 dBi |
| Impedance | 50 ohms, Nominal |
| Type | Dipole |
| Polarization | Linear Vertical |
| VSWR | ≤2.5：1, Maximum |
| Frequency | 2400-2500MHz |
| Weight | 13g |
| Size | 105 mm x 10 mm |
| Antenna Color | Black |

**Table 4 Dipole Antenna Specifications**

  

### 3.3.1 Dipole Antenna Typical Radiation Patterns

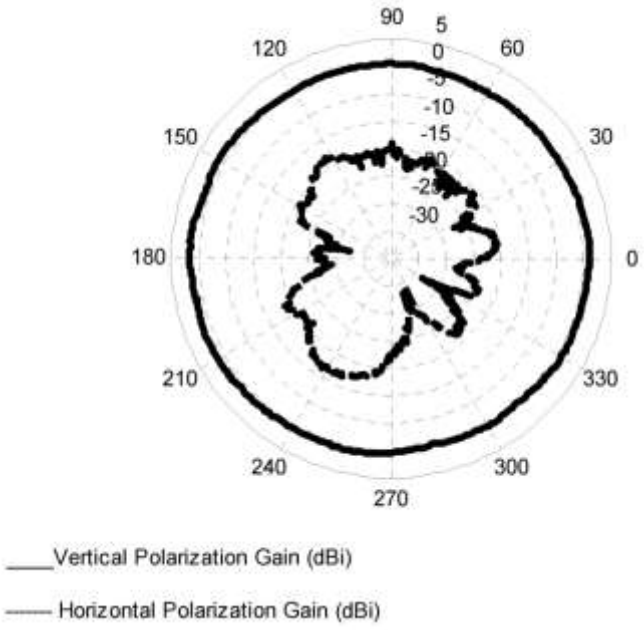


**Figure 10 Dipole Antenna Radiation Pattern (LSR Antenna Straight @ 2405 MHz)**

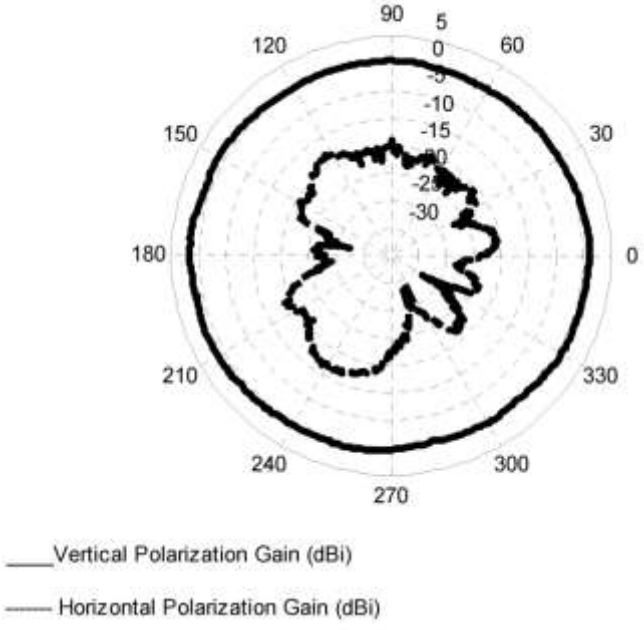


**Figure 11 Dipole Antenna Radiation Pattern (LSR Antenna Folded 90° @ 2405 MHz)**

  

### 3.3.2 Mechanical Dimensions

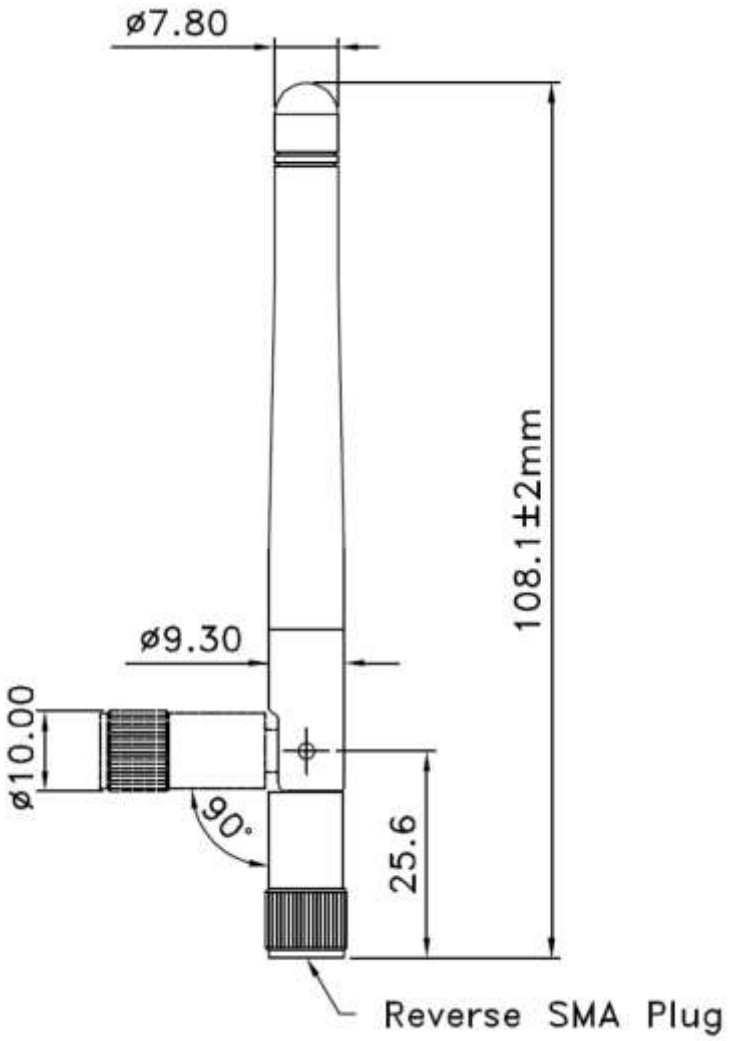


**Figure 12 LSR Dipole Antenna Dimensions**

# 4 PCB Layout Requirements

Since this module and its associated set of approved antennas has been certified by the FCC and Industry Canada (IC) as a Modular Radio, the end user is authorized to integrate this module into an end-product, and is solely responsible for the Unintentional Emissions levels produced by the end-product.

In order to preserve the Modular Radio certifications, the integrator of the module must abide by the PCB layout recommendations outlined in the following paragraphs. Any divergence from these recommendations will invalidate the modular radio certifications and require the integrator to re-certify the module and/or end-product.

The module must be used with one of the approved antennas:

1. Johanson Technology 2450AT18A100 Ceramic Chip Antenna.
2. LSR 001-0001 center-fed 2.4 GHz dipole antenna and 080-0001 U.FL to Reverse Polarity SMA connector cable.
3. LSR 001-0014 2.4 GHz FlexPIFA Antenna w/U.FL cable.

The module must be follow one of two trace antenna designs. The primary trace antenna design is based on a 4-Layer PCB, and the secondary trace antenna design is based on a 2-Layer PCB. Both trace antenna design CAD packages, which consist of the schematics, Bill of Materials (BOM), and PCB Layout are available from LSR.

Visit the LSR web site (**http://www.lsr.com/**) for current PCB and Schematic CAD files.

Please use the latest CAD files from the LSR web site when incorporating the TiWi-C-W module into a new design. CAD files are provided in native Mentor Grahics PADS PCB and PADS Logic formats, as well as ASCII, Gerber, and PDF formats. CAD files can also be translated to most popular CAD package. Contact LSR Tech support for CAD translation.

  

## 4.1 4-Layer Trace Antenna Design

2.4 GHz Chip Antenna Implementation
When using the certified Chip Antenna (Johanson Part Number 2450AT18A100), the PCB layout shown in Figure 13 should be followed. It is acceptable to keep the U.FL circuitry J7 and J8, and the U.FL connectors can either be populated or not.

2.4 GHz Dipole Antenna Implementation
When using the certified 2.4 GHz Dipole Antenna and U.FL to RPSMA Cable, the PCB layout shown in Figure 14 should be followed. Components J7 and J8 should be populated as shown in the schematic.

2.4 GHz FlexPIFA Antenna
When using the certified 2.4 GHz FlexPIFA Antenna w/U.FL cable, the PCB layout shown in Figure 14 should be followed. Components J7 and J8 should be populated as shown in the schematic.

  

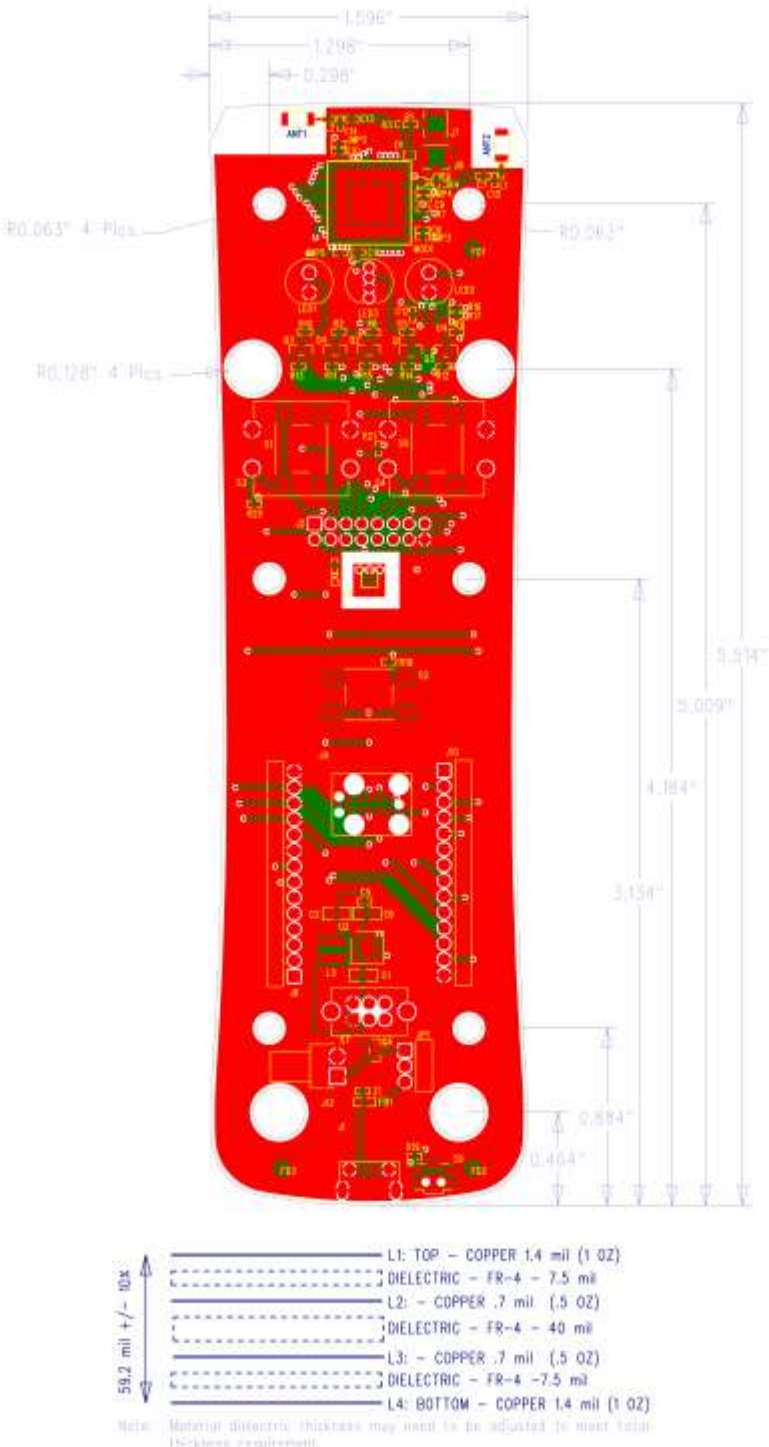


**Figure 13 4-Layer Chip Antenna Trace Design PCB Layout**

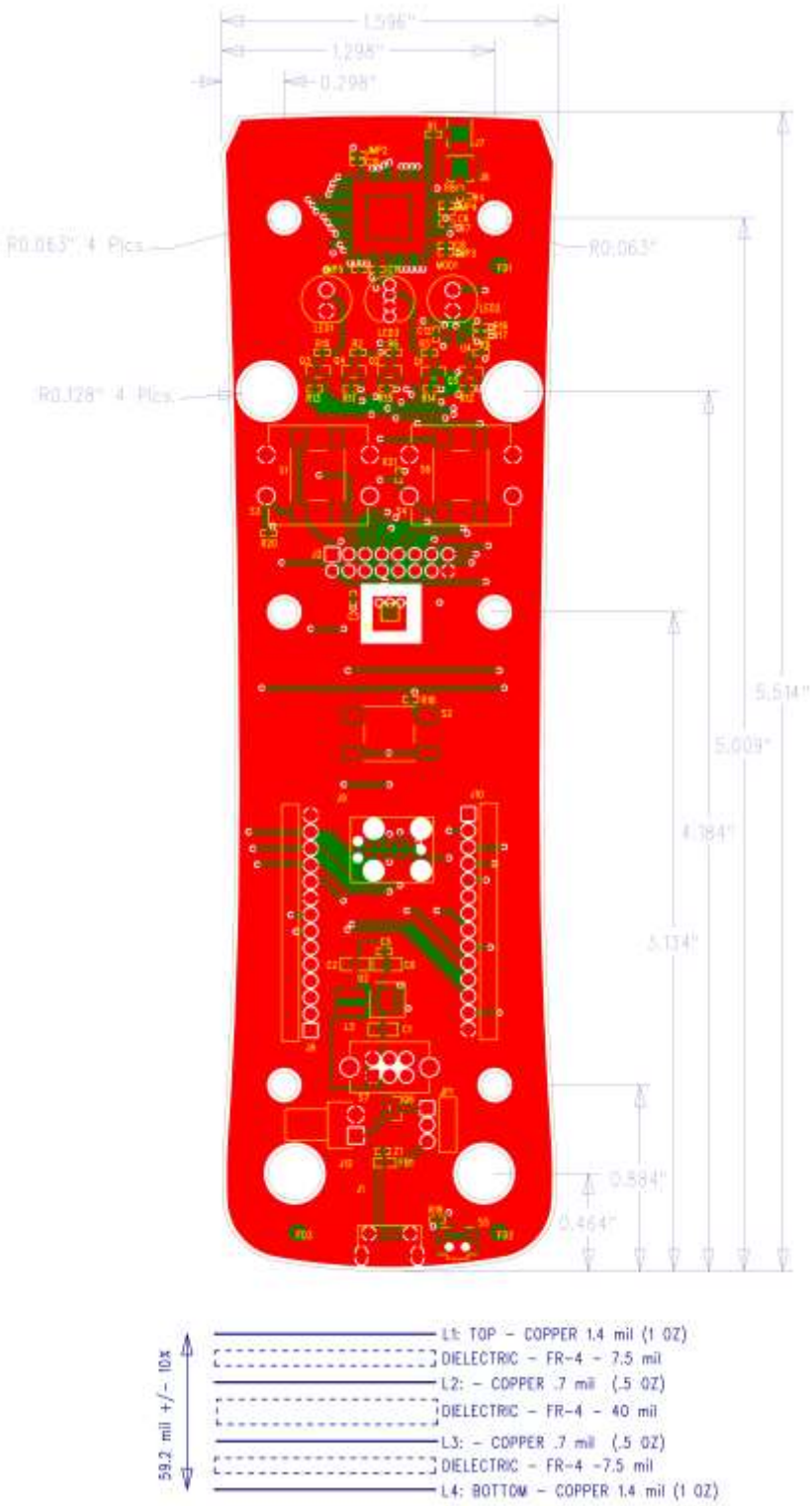


**Figure 14 4-Layer Dipole and FlexPIFA Trace Antenna PCB Layout**

  

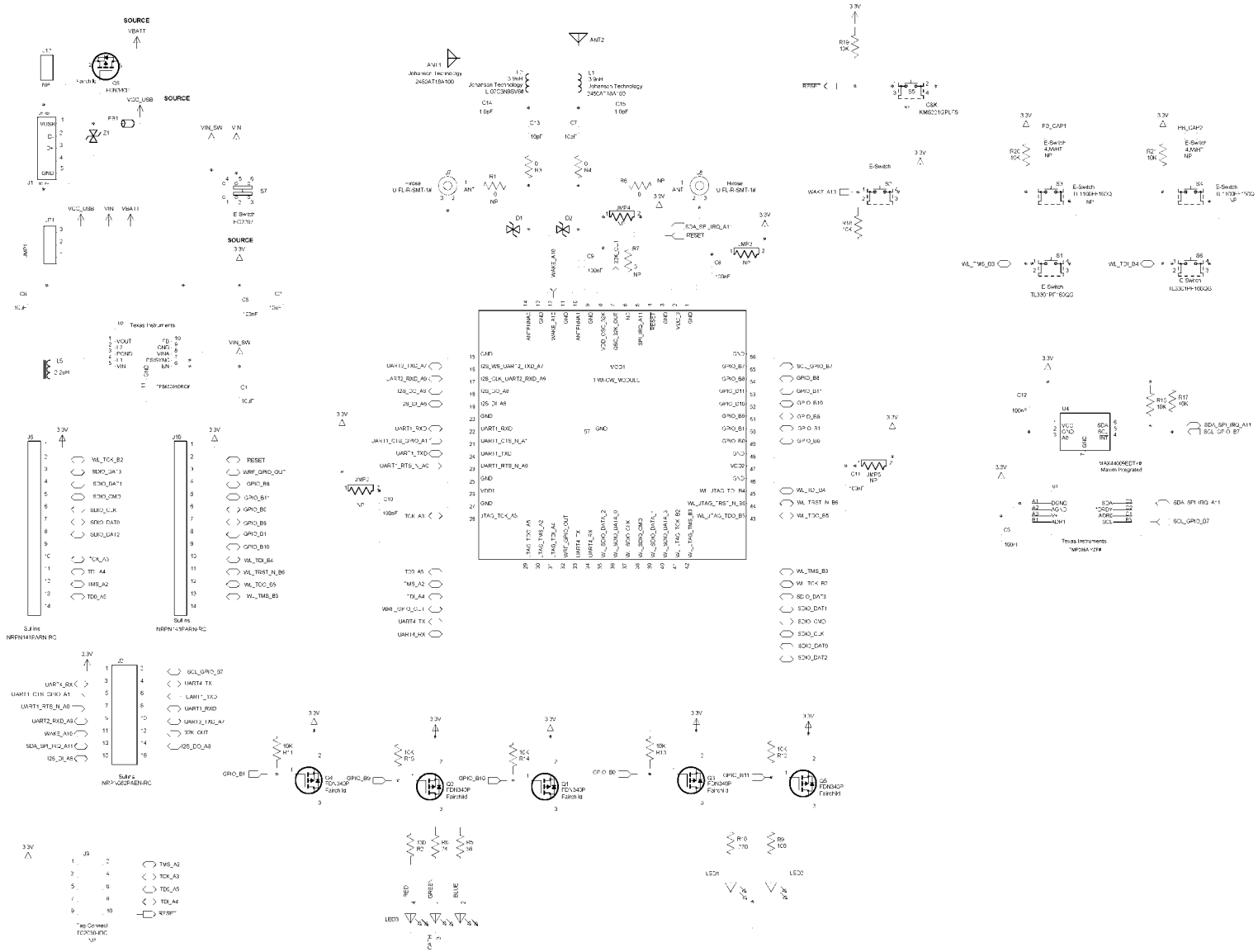

**Figure 15 4-Layer Trace Antenna Design Schematic**

| Qty | PCB Ref | Pop Option | Value | Tolerance | Manufacturer | Mfg Part Number |
|---|---|---|---|---|---|---|
| 2 | ANT1 ANT2 | | | | Johanson Technology | 2450AT18A100 |
| 3 | C1 C2 C6 | | 10uF | +/- 10% | Murata | GRM21BR61A106KE19 |
| 7 | C3 C5 C8 C9 C10 C11 C12 | | 100nF | +/- 10% | Murata | GRM155R71C104KA88 |
| 2 | C7 C13 | | 10pF | +/- 5% | Murata | GRM1555C1H100JA01 |
| 2 | C14 C15 | | 1.0pF | +/-0.25pF | Murata | L-07C2N2SV6T |
| 2 | D1 D2 | | | | Infineon | |
| 1 | FB1 | | | | Taiyo Yuden | FBMH1608HL601-T |
| 1 | J1 | | | | Molex | 1050170001 |
| 1 | J2 | | | | Sullins | NRPN082PAEN-RC |
| 2 | J6 J10 | | | | Sullins | NRPN141PARN-RC |
| 2 | J7 J8 | | | | Hirose | U.FL-R-SMT-1 |
| 1 | J9 | NP | | | Tag-Connect | TC2050-IDC |
| 1 | J12 | NP | | | TE Connectivity | 2-644803-2 |
| 1 | JMP1 | | | | Sullins | SPN02SXCN-RC |
| 4 | JMP2 JMP3 JMP4 JMP5 | NP | | | LSR | 000-0000 |
| 1 | JP1 | | | | Sullins | NRPN031PARN-RC |
| 2 | L1 L2 | | 2.7nH | +/- 0.3nH | Johanson Technology | L-07C2N7SV6T |
| 1 | L5 | | 2.2uH | +/- 20% | Coilcraft | LPS3015-222ML |
| 1 | LED1 | | | | Kingbright | WP7113SRC/DU |
| 1 | LED2 | | | | Kingbright | WP7113CGCK |
| 1 | LED3 | | | | Super Bright LEDs | RL5-RGB-DCC |
| 1 | MOD1 | | | | LSR | 450-0118 |
| 2 | PB_CAP1 PB_CAP2 | NP | | | E-Switch | 4JWHT |
| 1 | PCB1 | | | | LSR | 750-00570 |
| 6 | Q1 Q2 Q3 Q4 Q5 Q6 | | | | Fairchild | FDN340P |
| 2 | R3 R4 | | 0 | 50m Ohm Max | KOA | RK73Z1ET |
| 3 | R1 R7 R8 | NP | 0 | 50m Ohm Max | KOA | RK73Z1ET |
| 1 | R2 | | 130 | 5% | KOA | RK73B1ET131J |
| 1 | R6 | | 24 | 5% | KOA | RK73B1ET240J |
| 1 | R5 | | 56 | 5% | KOA | RK73B1ET560J |
| 1 | R9 | | 100 | 5% | KOA | RK73B1ET101J |
| 1 | R10 | | 270 | 5% | KOA | RK73B1ET270J |
| 11 | R11 12 R13 R14 R15 R16 R17 R18 R19 R20 R21 | | 10K | 5% | KOA | RK73B1ET103J |
| 3 | S1 S2 S6 | | | | E-Switch | TL3301PF160QG |
| 2 | S3S4 | NP | | | E-Switch | TL1100FF160Q |
| 1 | S5 | | | | C&K | KMS221GPLFS |
| 1 | S7 | | | | E-Switch | EG2207 |
| 1 | U1 | | | | Texas Instruments | TMP006AIYZF |
| 1 | U2 | | | | Texas Instruments | TPS63001DRC |
| 1 | U4 | | | | Maxim Integrated | MAX44009EDT+ |
| 1 | Z1 | | | | Epcos | B72590D0050H160 |

Notes:
# designates mfg material package option.
NP designates a component that is not populated.

**Table 5 – 4-Layer Trace Antenna Design Bill of Materials (BOM)**

  

## 4.2 2-Layer Trace Antenna Design

2.4 GHz Chip Antenna Implementation
When using the certified Chip Antenna (Johanson Part Number 2450AT18A100), the PCB layout shown in Figure 16 should be followed. It is acceptable to keep the U.FL circuitry J7 and J8, and the U.FL connectors can either be populated or not.

2.4 GHz Dipole Antenna Implementation
When using the certified 2.4 GHz Dipole Antenna and U.FL to RPSMA Cable, the PCB layout shown in Figure 17 should be followed. Components J7 and J8 should be populated as shown in the schematic.

2.4 GHz FlexPIFA Antenna
When using the certified 2.4 GHz FlexPIFA Antenna w/U.FL cable, the PCB layout shown in Figure 17 should be followed. Components J7 and J8 should be populated as shown in the schematic.

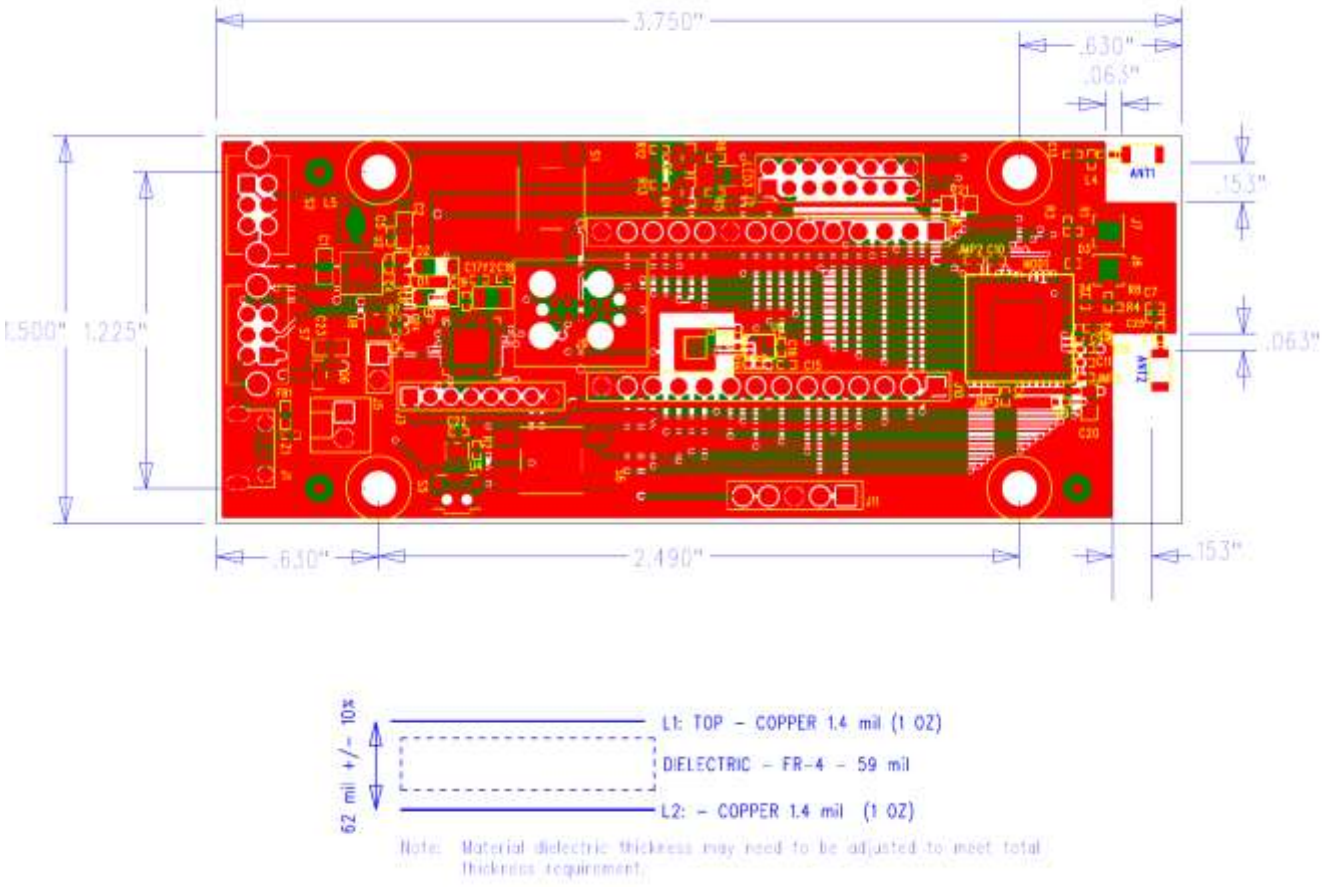


**Figure 16 2-Layer Chip Antenna Trace Design PCB Layout**

  

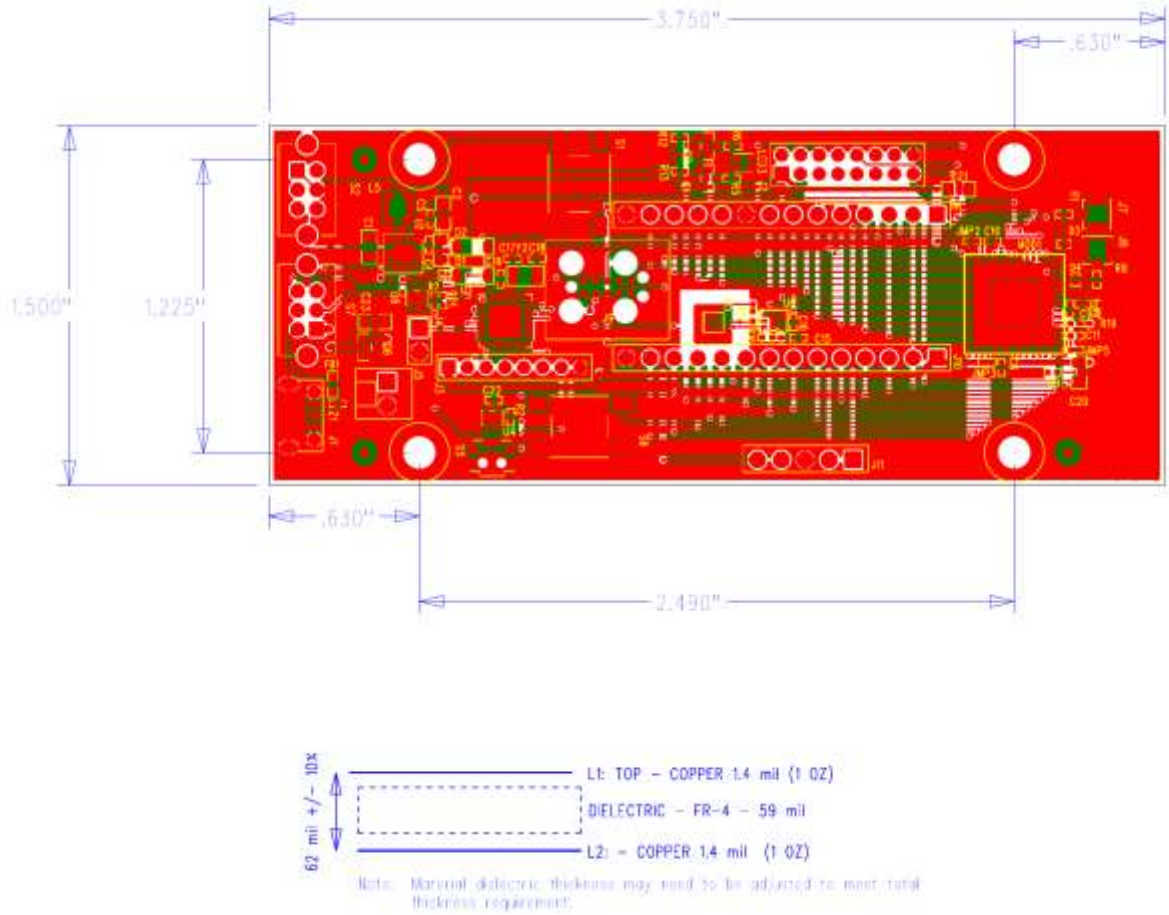


**Figure 17 2-Layer Dipole and FlexPIFA Trace Antenna PCB Layout**

  

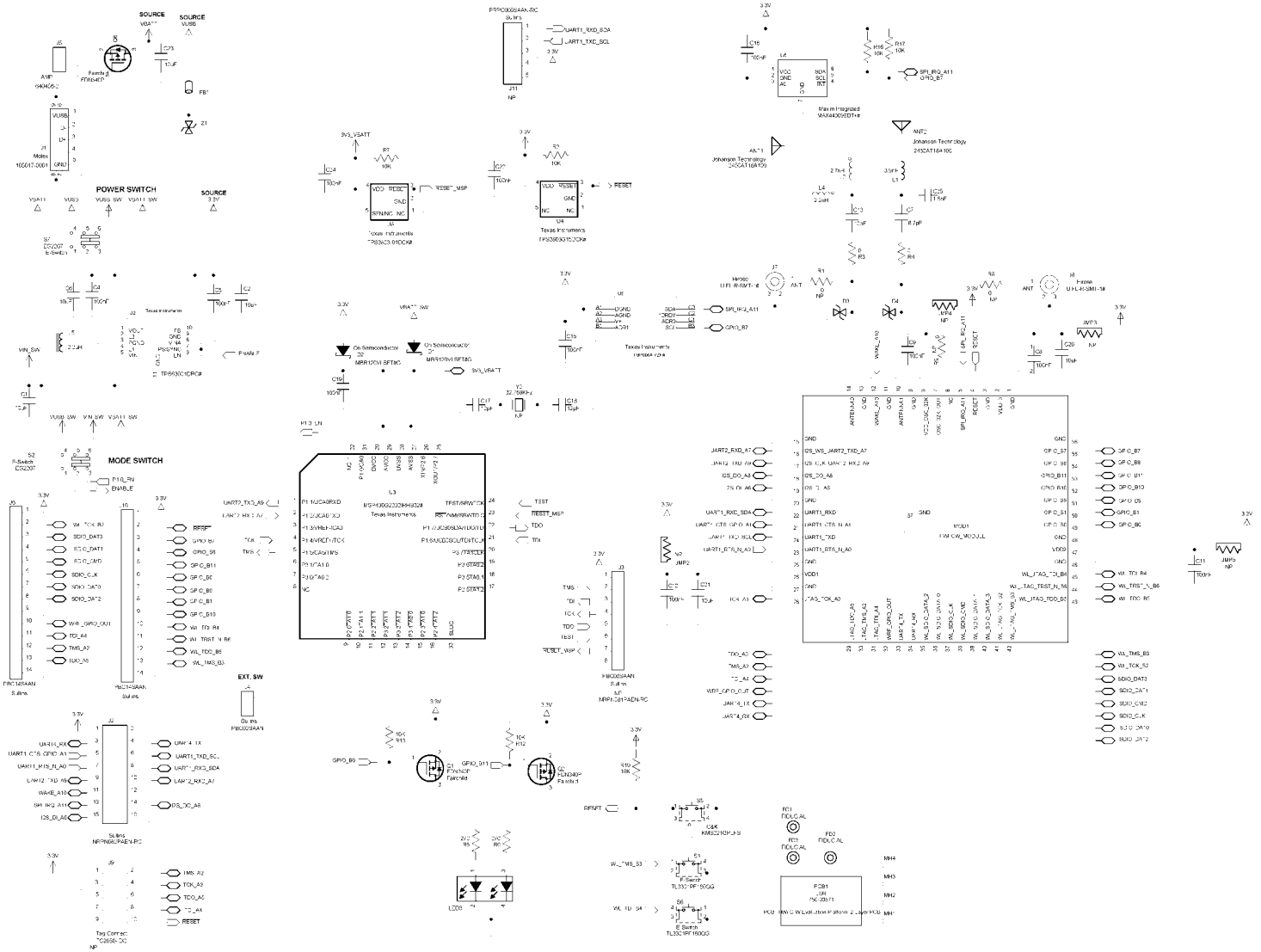

**Figure 18 2-Layer Trace Antenna Design Schematic**

| Qty | PCB Ref | Pop Option | Value | Tolerance | Manufacturer | Mfg Part Number |
|---|---|---|---|---|---|---|
| 2 | ANT1 ANT2 | | | | Johanson Technology | 2450AT18A100 |
| 6 | C1 C2 C6 C20 C21 C23 | | 10uF | +/- 10% | Murata | GRM21BR61A106KE19# |
| 11 | C4 C5 C8 C9 C10 C11 C15 C16 C19 C22 C24 | | 100nF | +/- 10% | Murata | GRM155R71C104KA88# |
| 1 | C7 | | 8.2pF | +/- 0.5pF | Murata | GRM1555C1H8R2DZ01# |
| 1 | C13 | | 10pF | +/- 5% | Murata | GRM1555C1H100JA01# |
| 2 | C17 C18 | | 12pF | +/- 5% | Murata | GRM1555C1H120JA01# |
| 1 | C25 | | 1.5pF | +/- 0.25pF | Murata | GRM1555C1H1R5CA01# |
| 2 | D1 D2 | | | | On Semiconductor | MBR120VLSFT#G |
| 2 | D3 D4 | | | | Infineon | ESD112B102ELE6327XTMA1 |
| 1 | FB1 | | | | Taiyo Yuden | FBMH1608HL601-# |
| 1 | J1 | | | | Molex | 105017-0001 |
| 1 | J2 | | | | Sullins | NRPN082PAEN-RC |
| 1 | J3 | NP | | | Sullins | NRPN081PAEN-RC |
| 1 | J4 | | | | Sullins | PBC02SAAN |
| 1 | J5 | | | | AMP | 640456-2 |
| 2 | J6 J10 | | | | Sullins | PBC14SAAN |
| 2 | J7 J8 | | | | Hirose | U.FL-R-SMT-1# |
| 1 | J9 | NP | | | Tag-Connect | TC2050-IDC |
| 1 | J11 | NP | | | Sullins | PRPC005SAAN-RC |
| 4 | JMP2 JMP3 JMP4 JMP5 | NP | | | LSR | 000-0000 |
| 1 | L1 | | 3.9nH | +/- 0.3nH | Johanson Technology | L-07C3N9SV6# |
| 1 | L2 | | 2.7nH | +/- 0.3nH | Johanson Technology | L-07C2N7SV6# |
| 1 | L4 | | 2.2nH | +/- 0.3nH | Johanson Technology | L-07C2N2SV6# |
| 1 | L5 | | 2.2uH | +/- 20% | Coilcraft | LPS3015-222MR# |
| 1 | LED3 | | | | Kingbright | APTB1612ESGC-F01 |
| 1 | MOD1 | | | | LSR | 450-0118 |
| 1 | PCB1 | | | | LSR | 750-00571 |
| 3 | Q1 Q2 Q6 | | | | Fairchild | FDN340P |
| 2 | R3 R4 | | 0 | 50mOhm Max | KOA | RK73Z1ET# |
| 3 | R1 R8 R9 | NP | 0 | 50mOhm Max | KOA | RK73Z1ET# |
| 7 | R2 R7 R12 R13 R16 R17 R19 | | 10K | 5% | KOA | RK73B1ET#103J |
| 2 | R5 R6 | | 270 | 1% | Vishay | CRCW0402270RFK# |
| 2 | S1 S6 | | | | E-Switch | TL3301PF160QG |
| 2 | S2 S7 | | | | E-Switch | EG2207 |
| 1 | S5 | | | | C&K | KMS221GPLFS |
| 1 | U2 | | | | Texas Instruments | TPS63001DRC# |
| 1 | U3 | | | | Texas Instruments | MSP430G2333IRHB32# |
| 1 | U4 | | | | Texas Instruments | TPS3803G15DCK# |
| 1 | U5 | | | | Texas Instruments | TMP006AIYZF# |
| 1 | U6 | | | | Maxim Integrated | MAX44009EDT+# |
| 1 | U8 | | | | Texas Instruments | TPS3803-01DCK# |
| 1 | Y2 | NP | | | ECS | ECS-.327-12.5-34B |
| 1 | Z1 | | | | Epcos | B72590D0050H1# |

Notes:
# designates mfg material package option.
NP designates a component that is not populated.

**Table 6 2-Layer Trace Antenna Design Bill of Materials (BOM)**

  

# 5 EMC Compliance

## 5.1 Summary

The TiWi-C-W module has been tested and approved as a Modular Radio in accordance with the appropriate FCC and IC standards. The supporting test data may be found in the modular test report.

Since this module and its associated set of approved antennas have been certified as a Modular Radio, this allows the end user to integrate this module into an end-product without the requirement of re-certifying the radio module. The module-integrator is responsible for the unintentional conducted and radiated emissions and must ***verify*** that the integrated product is compliant with the rules associated with unintentional radiators. The module integrator is also required to maintain an engineering record of the verification testing and declare on the product through proper labeling and marking that the device is compliant with these particular rules.

The installed module's FCC ID and IC numbers need to be clearly marked on the product with the following verbiage "Contains FCC ID: TFB-1001" and "Contains IC: 5969A-1001".

## 5.2 Module Integration Considerations - Antenna Systems

The module must be used with one of the approved antennas:

1) LSR 001-0001 2.4 GHz center-fed dipole antenna and LSR 080-0001 U.FL to Reverse Polarity SMA connector cable.
2) LSR 001-0014 2.4 GHz FlexPIFA antenna.
3) Johanson 2450AT18A100 chip antenna.

The antenna should be placed such that it is minimally disturbed by the product's packaging material. The incorporation of the largest practical free-space clearance around the antenna is important for maximizing overall performance. Further, the antenna must be placed such that at least a 20 cm separation distance is maintained from the antenna to all other radio transmitters.

## 5.3 Module Integration Considerations - Substitute Antenna Systems

The module's certification is only valid for the list of approved antennas presented in section 4. However, substitute antennas may be used in place of the approved antenna only if the antennas are of the same type and the peak gain is less than or equal to the peak gain of the similar approved antenna. Also the antennas should have similar in-band and out-of-band characteristics.

## 5.4 Module Integration Considerations - Circuit Implementation

It is recommended that all connection PCB (printed circuit board) traces to the power supply and digital control terminal be as short as possible. Though not necessarily required in all cases, it is a best practice to provide an optional shunt capacitor placement at the module pin on all active and routed power supply and digital control lines. Further, a series damping resistor placement should be incorporated between the module pin/shunt capacitor node and the source/sink of the digital control signals. This provides for effective bypassing and decoupling of digital lines from the radio module, in the event that the application circuit has longer power supply and digital routing.

## 5.5 Module Integration Considerations - Top Assembly

In addition to the recommendations given for the antenna systems and the module placement onto a product PCB, it is recommended that all wiring and interconnect systems within the product be not routed anywhere close the module and its associated circuitry on the PCB, doing so could change the emission characteristics of the module.

## 5.6 Testing Requirements for End-Product

Once the module is integrated and the product realized in a mobile or portable configuration, the product must be tested and follow the verification process for Unintentional Conducted and Radiated Emissions in accordance to the FCC and IC guidelines. The module needs to be powered and placed in the receive mode for this test. The receiver must be tuned to its lowest frequency channel, mid-frequency channel, and highest frequency channel. The supporting test data does not need to be submitted to the FCC or IC.

## 5.7 Design and Production Validation

Applications of the WLAN transceiver are supported by a specific set of antenna sub-systems: chip antennas driven through PCB traces and matching networks, and external cabled antennas driven through U.FL connectors. The antenna subsystem designs are validated in initial engineering tests prior to production release. Throughout the production life of the module, both AQL (Acceptable Quality Level) and sample tests are performed to check process stability of the modules' conducted performance. The antenna subsystems are periodically sampled on an AQL basis and checked for performance stability over the production process. Both the initial engineering design validation and the production sampling use the same procedure, techniques, and equipment.

The antenna subsystems are tested at a 50 Ohm test point reference plane for the driving point reflection parameters (1-port S-parameters) to characterize the return and mismatch losses.

The module is placed in a special engineering/production only CW mode and the output power is measured at various frequencies of interest (low, middle, high channels) to normalize consequent antenna Effective Radiated Power (ERP) pattern measurements to obtain antenna power gain in dBi (decibels above isotropic). The power gain patterns are analyzed for peak and average gain, and are monitored for statistical stability or stationarity.

This process is again performed for both initial design validation and production sample-basis test and validation.

## 5.8 Agency Certifications

FCC ID: TFB-1001, 15.247

IC ID: 5969A-1001, RSS 210

CE: Compliant to standards EN 60950-1, EN 300 328, and EN 301 489

## 5.9 Agency Statements

**Federal Communication Commission Interference Statement**

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.

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.

***FCC CAUTION*: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.**

  

**Industry Canada Statements**

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.

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 permitted for successful communication.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of 2.0 dBi (LSR Dipole), 2.0 dBi (LSR FlexPIFA), and 0.5dBi (Johanson Chip). Antennas not included in this list or having a gain greater than 2.0 dBi, 2.0 dBi, and 0.5dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of all Antennas Acceptable for use with the Transmitter

1) LSR 001-0001 2.4 GHz center-fed dipole antenna and LSR 080-0001 U.FL to Reverse Polarity SMA connector cable.
2) LSR 001-0014 2.4 GHz FlexPIFA antenna w/U.FL cable.
3) Johanson 2450AT18A100 chip antenna.

Cet appareil est conforme avec Industrie Canada , exempts de licence standard RSS (s). L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doiventêtre choisis de manière que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pascelle permise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec l'antenne (s) ci-dessous, et ayant un gain maximum de 2,0 dBi (LSR Dipole), 2.0 dBi (LSR FlexPIFA), et 0.5dBi (Johanson Chip). Antennes pas inclus dans cette liste ou présentant un gain supérieure à 2,0 dBi, 2.0 dBi, et 0.5dBi sont strictement interdits pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

Liste de toutes les antennes acceptables pour une utilisation avec l'émetteur

1) Antenne LSR 001-0001 2.4 GHz de centre-dipôle alimenté et LSR 080-0001 U.FL inverser câble connecteur SMA à polarité.
2) LSR 001-0014 antenne FlexPIFA 2,4 GHz w/U.FL câble.
3) Antenne de puce Johanson 2450AT18A100.

  

## 5.10 OEM Responsibilities To Comply With FCC and Industry Canada Regulations

The TiWi-C-W Module has been certified for integration into products only by OEM integrators under the following conditions:

This device is granted for use in Mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all person and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

***IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number 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 Industry Canada authorization.***

Le module de TiWi-C-W a été certifié pour l'intégration dans des produits uniquement par des intégrateurs OEM dans les conditions suivantes:

Ce dispositif est accordé pour une utilisation dans des configurations mobiles seul dans lequel les antennes utilisées pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 20cm de toute personne et ne pas être colocalisés avec les autres émetteurs, sauf en conformité avec la FCC et de l'Industrie Canada, multi-émetteur procédures produit.

Tant que les deux conditions précitées sont réunies, les tests de transmetteurs supplémentaires ne seront pas tenus. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requis avec ce module installé (par exemple, les émissions appareil numérique, les exigences de périphériques PC, etc.)

***NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou de co-implantation avec un autre émetteur), puis la FCC et Industrie autorisations Canada ne sont plus considérés comme valides et l'ID de la FCC et IC numéro de certification ne peut pas être utilisé sur la produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'un distincte de la FCC et Industrie Canada l'autorisation.***

## 5.11 OEM Labeling Requirements For End-Product

The TiWi-C-W module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside another device, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

"**Contains Transmitter Module FCC ID: TFB-1001"**

"**Contains Transmitter Module IC: 5969A-1001"**

or

"**Contains FCC ID: TFB-1001"**

"**Contains IC: 5969A-1001"**

The OEM of the TiWi-C-W Module must only use the approved antenna(s) listed above, which have been certified with this module.

Le module de TiWi-C-W est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une etiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

**"Contient Module émetteur FCC ID: TFB-1001"**
**"Contient Module émetteur IC: 5969A-1001"**

ou

**"Contient FCC ID: TFB-1001"**
**"Contient IC: 5969A-1001"**

Les OEM du module TiWi-C-W ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module.

  

## 5.12 OEM End-Product User Manual Statements

The OEM integrator should not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

**The user manual for the end product must include the following information in a prominent location:**

This device is granted for use in Mobile only configurations in which the antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all person and not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter product procedures.

Other user manual statements may apply.

L'intégrateur OEM ne devraient pas fournir des informations à l'utilisateur final sur la façon d'installer ou de supprimer ce module RF ou modifier les paramètres liés RF dans le manuel utilisateur du produit final.

**Le manuel d'utilisation pour le produit final doit comporter les informations suivantes dans unendroit bien en vue:**

Ce dispositif est accordé pour une utilisation dans des configurations mobiles seule dans laquelle les antennes utilisées pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 20cm de toute personne et ne pas être co-localisés avec les autres émetteurs, sauf en conformité avec FCC et Industrie Canada, multi-émetteur procédures produit.

Autres déclarations manuel de l'utilisateur peuvent s'appliquer.

  

# 6 Contacting LSR

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