

NIKON METROLOGY

*Antenna Design Guide*

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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 antenna to the radio module. It covers the externally mounted antenna. It will inform the reader as to the required PCB layout details and provide expected performance specifications.

## 1.2 Applicable Documents

- *Ethertronics Prestta 1000423 Antenna Datasheet*

## 1.3 Antenna Specifications

Specification	Value		
Type	Isolated magnetic Dipole		
Polarization	Linear Vertical		
Weight	1.6g		
Size	26.7 x 5.0 x 7.1 mm (Antenna); 40.0 x 15.0 x 1.2 mm (PCB)		
WLAN a/b/g/n + Japan Antenna (GHz)	2.390-2.490 b, g	5.150-5.350 a	5.70-5.900 a
Peak Gain	-0.6dBi	4.5dBi	3.5dBi
Average Efficiency	55%	75%	65%
VSWR Match	3.0:1 max	2.5:1 max	3.0:1 max
Feed Point Impedance	50 $\Omega$ unbalanced (other if required)		

## 2 PCB Layout Requirements

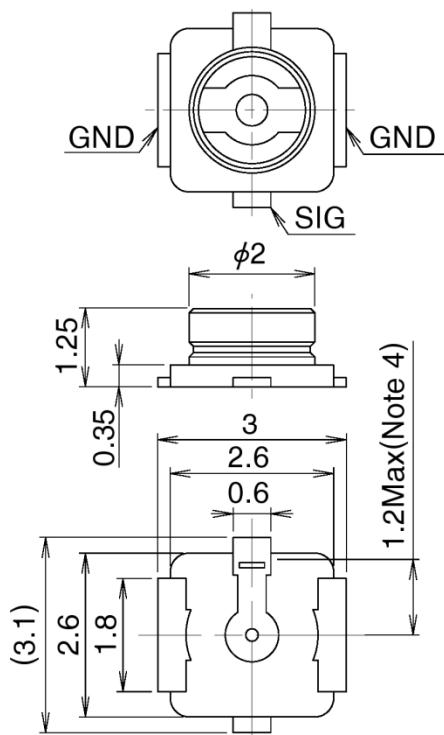
Since this module and its approved antenna has been certified by the FCC and Industry Canada (IC) as a Modular Radio, the end user is authorized to integrate this module into an end-product, and is solely responsible for the Unintentional Emissions levels produced by the end-product

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 the approved antenna:

1. Ethertronics Pressta WLAN Embedded Antenna 1000423

### 2.1 Antenna PCB Layout Requirements



### Recommended PCB Mounting Pattern

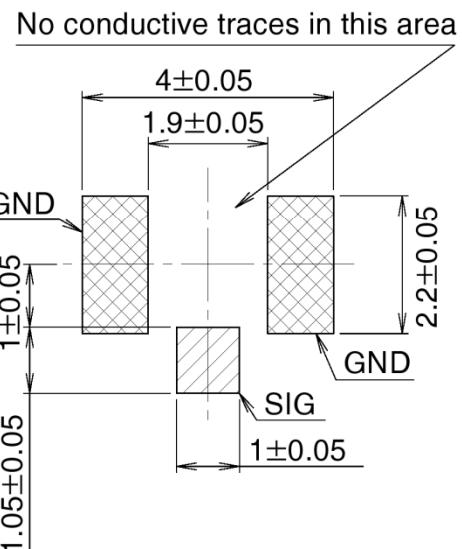
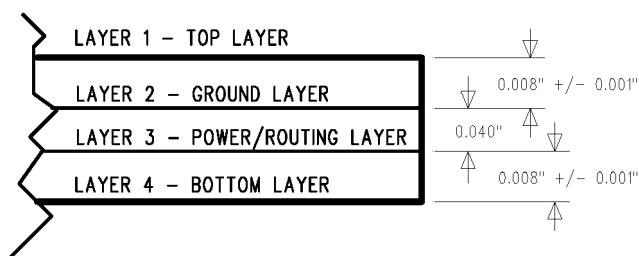
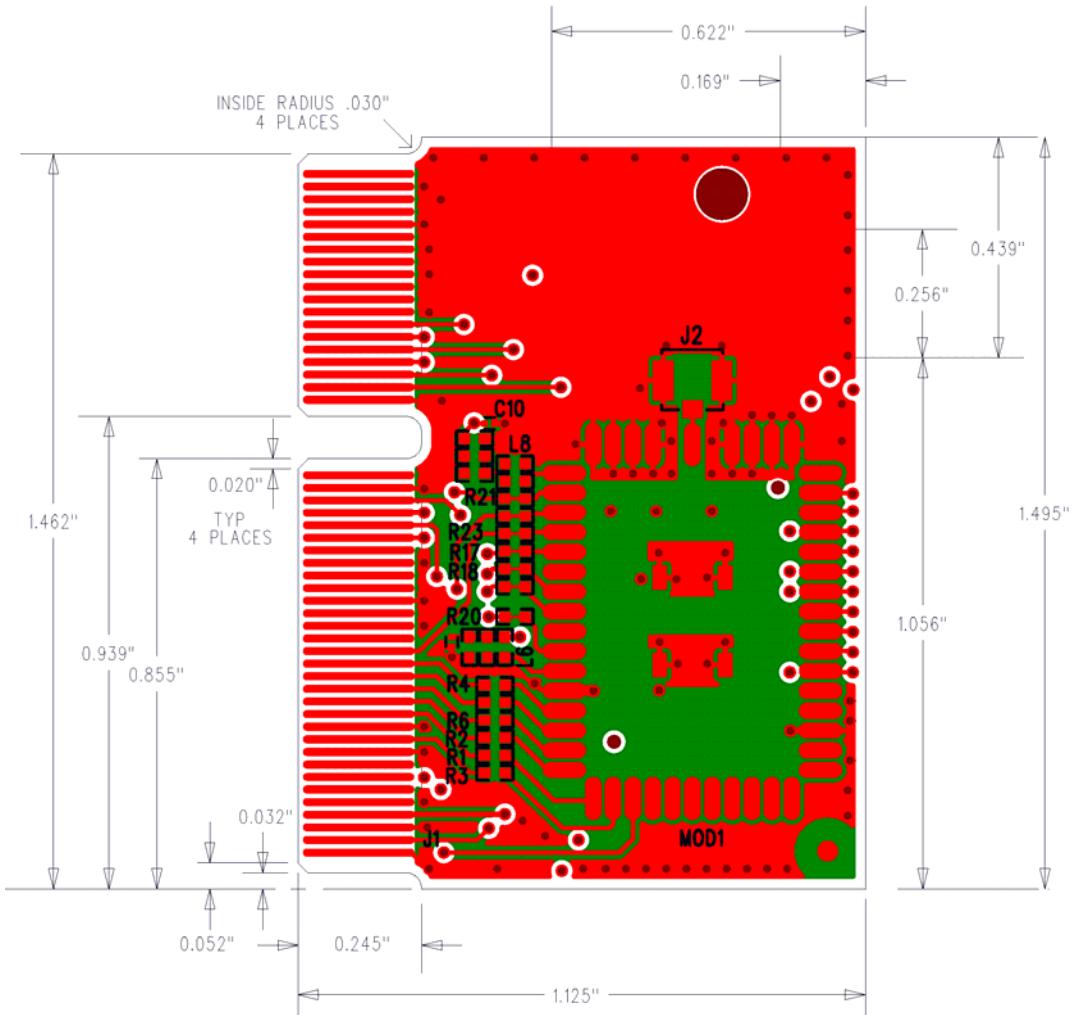


Figure 11 – Antenna PCB Layout Requirements

## 2.2 Dipole Antenna Reference Design PCB



\*\*\* Material thickness between Layer 2 and Layer 3 may be adjusted to meet Total Thickness requirement.

**Figure 12 – Antenna Certified Reference Design PCB**

## 2.3 Antenna Reference Design Schematic

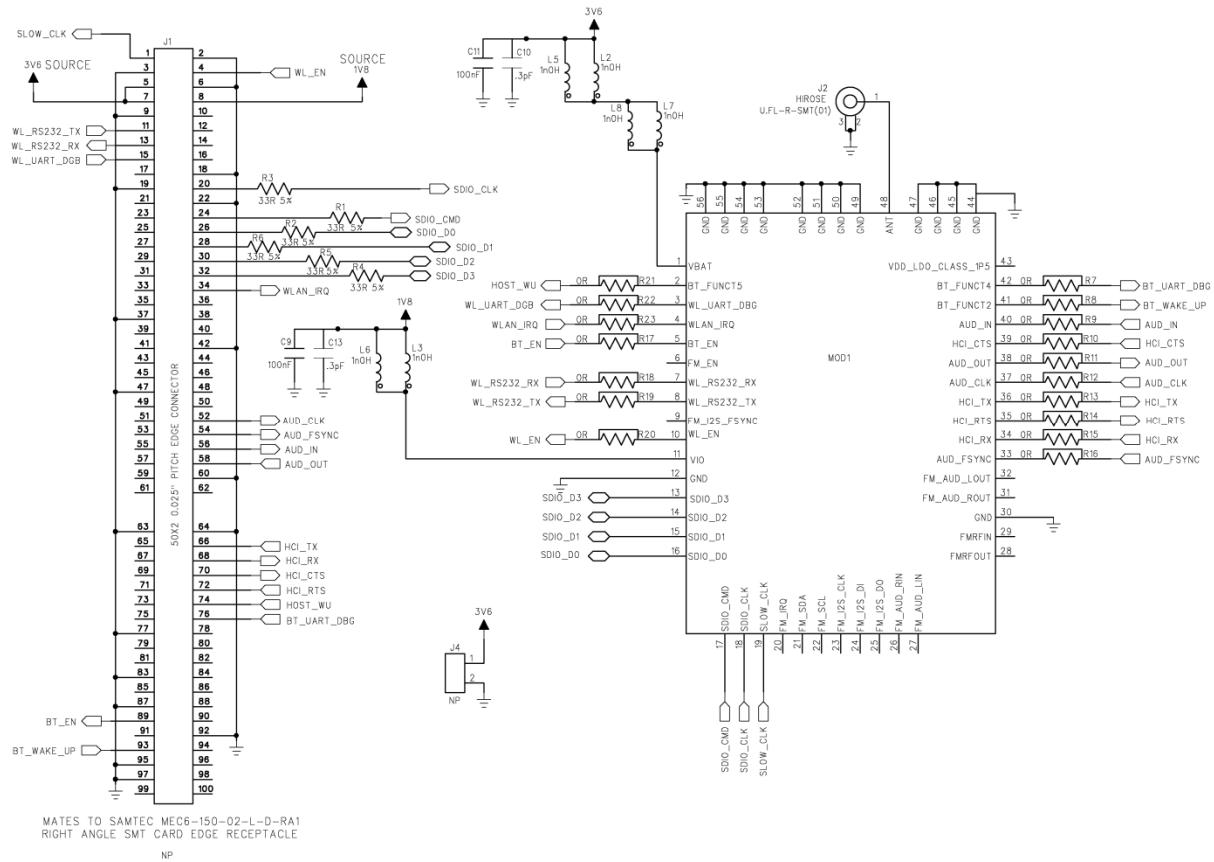


Figure 13 –Antenna Certified Reference Design Schematic

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## 3 EMC Compliance

### 3.1 Summary

The radio 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 antenna has 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: 2AA6A-SPACE" and "contains IC: 11476A-SPACE".

The module has been certified for use in a mobile configuration, which employs a minimum separation distance of 20 cm from the antenna to the human body or another transmitting radio. For separation distances of 20 cm or less, the module integrator must have the module certification re-evaluated, which will include a modification to the existing certification and additional testing for exposure and SAR requirements.

### 3.2 Module Integration Considerations – Antenna Systems

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

1. Ethertronics Prestta WLAN Embedded Antenna 1000423

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 human body to the antenna and all other radio transmitters.

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### **3.3 Module Integration Considerations – Substitute Antenna Systems**

The module's certification is only valid for the list of approved antennas presented in section 3.2. 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.

### **3.4 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.

### **3.5 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.

### **3.6 Testing Requirements for End-Product**

Once the module is integrated and the product realized in a mobile 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. Both the WLAN and BT receivers must be active for the test. The supporting test data does not need to be submitted to the FCC or IC.

### **3.7 SAR Testing Requirements for End-Product**

Since the radio module was certified in a mobile configuration, the end-product does not require SAR testing if the end-product is not used within 20cm of the human body, nor used in conjunction with another radio transmitter.

For portable configurations (antenna-to-body separations of less than 20 cm), the module integrator must have the module certification re-evaluated, which will include a modification to the existing certification and additional testing for exposure and SAR requirements.