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|----------------------------------------------------------------------------------|---------------------|--------------------------------------|
|  | Document Number 001 | DOC – Wifi Module Installation Guide |
|                                                                                  | Revision            | 006                                  |

### **DYSON CONFIDENTIAL INFORMATION**

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## 1. Installation of the Radio Module

The device WIFIAMFA001 is only used in Dyson products. This module is factory mounted in the Dyson Environmental Products.

This module is not supplied to the end user on its own and the WIFIAMFA001 module will only be installed or replace on the end products by Dyson Engineers. As such a simple installation guide is given for reference only.

## 2. Compliance Statement

### FCC (Federal Communications Commission) statements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) The device may not cause harmful interference, and
- 2) The device Module must accept any interference received, including interference that may cause undesired operation.

This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Important 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.

This transmitter must not be co-located or operating in conjunction with any other antennas or transmitters.

It is the responsibility of the host device manufacturer to ensure continued compliance with FCC rule part 15B once the module has been installed in the host device.

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

The concerned end product must be labelled to say  
"Contains FCC ID: **QVHWIFIAMFA001**"

### Industry Canada statements

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- 1) The device may not cause interference, and
- 2) The device must accept any interference, including interference that may cause undesired operation of the device.

Important note: To comply with Industry Canada RF exposure limits, the antenna used for this device must be installed to provide a separation distance of at least 20cm from all persons.  
RF exposure is in accordance with RSS-102, section 2.5.2.

The concerned end product must be labelled to say  
"Contains IC: **7986A-WIFIAMFA001**"

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#### Declarations d'Industry Canada

Cet équipement est conforme aux normes d'exemption de licence RSS d'Industry Canada. Son utilisation est soumise aux deux conditions suivantes:

- 1) Le dispositif ne doit pas provoquer d'interférence, et
- 2) Le dispositif doit accepter toute interférence, y compris des interférences susceptibles de provoquer un fonctionnement indésirable de l'équipement.

Remarque importante: Pour respecter les limites d'exposition aux radiofréquences d'Industry Canada, l'antenne utilisée pour cet appareil doit être installée pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes.

L'exposition aux RF est conforme à la norme RSS-102, section 2.5.2.

Le produit final concerne doit porter une étiquette avec la mention:

"Contient IC: 7986A-WIFIAMFA 001"

### 3. Antenna Configuration & Specification

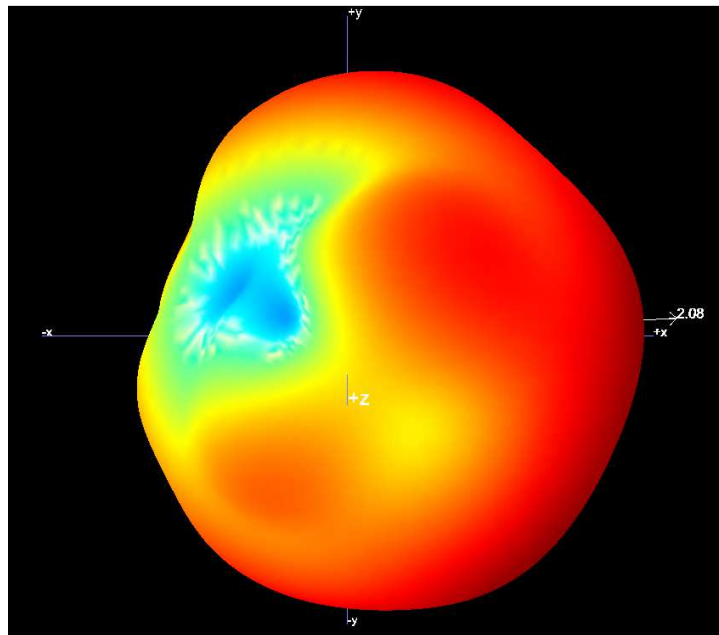
The antenna is a double sided PCB printed monopole. It is L-shape on top side and Inverted F IFA on the other side as shown in the Figures 1, 2 below.

| Antenna Specification |                     |
|-----------------------|---------------------|
| Type                  | PCB Printed Antenna |
| Frequency range       | 2.4 to 2.5GHz       |
| Maximum Gain          | 2.08dBi             |
| Impedance             | 50 ohm              |
| VSWR                  | $\leq 2:1$          |

The maximum isotropic antenna gain the Radio module measured in UL OTA chamber is 2.08dBi @ 2.46GHz

| Frequency  | Efficiency in % | Efficiency in dB | Maximum Gain in dBi |
|------------|-----------------|------------------|---------------------|
| 2400000000 | 81%             | -0.92            | 1.82                |
| 2420000000 | 80%             | -0.96            | 1.69                |
| 2440000000 | 84%             | -0.77            | 1.84                |
| 2460000000 | 87%             | -0.58            | 2.08                |
| 2480000000 | 86%             | -0.63            | 1.91                |
| 2500000000 | 88%             | -0.57            | 1.94                |

#### 3D Antenna Pattern



|                                                                                  |                     |                                      |
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The antenna is a double sided PCB printed monopole. It is L-shape on top side and Inverted F IFA on the other side as shown in the Figures 1, 2 below.

The antenna is printed on PCB carrier board 35mm x 35mm x 1.6mm and 4.2 FR4. The wifi module is mounted on the same board.

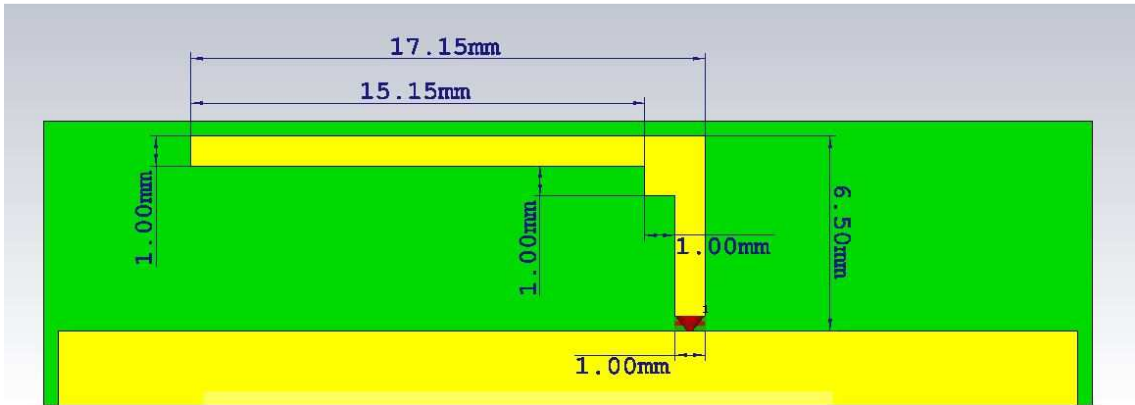


Figure1, PCB Printed antenna Top Side

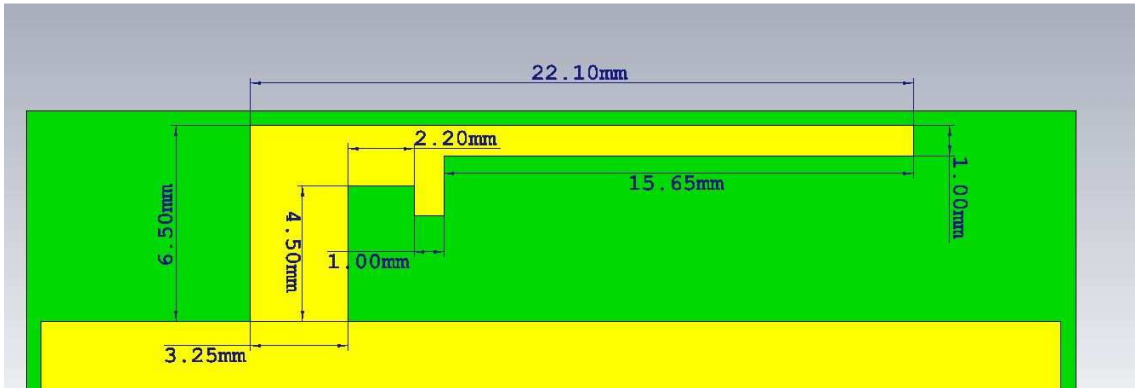


Figure2, PCB Printed antenna Bottom Side

|              |                     |                                      |
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## 4. Bare Board Specification

### 4.1. Bare Board Processing

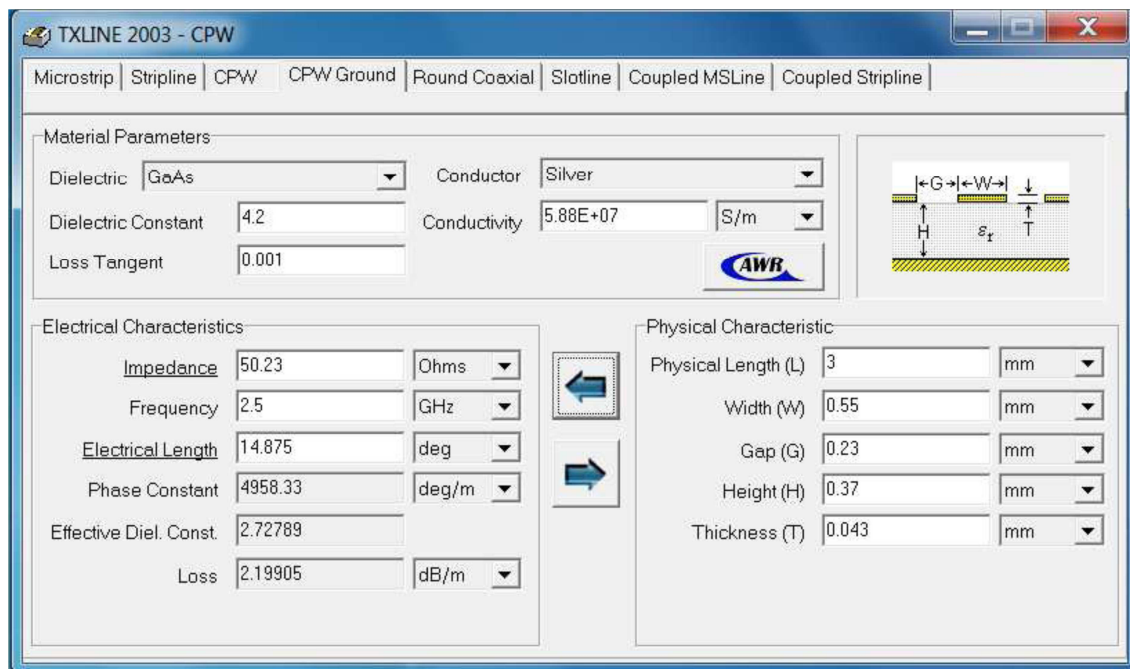
| Parameter                                       | Value                 |
|-------------------------------------------------|-----------------------|
| Material Type:                                  | RF-4                  |
| RoHS Compliance                                 | Required              |
| Nominal board thickness                         | 1.6mm                 |
| Board Finish                                    | Immersion Gold (ENIG) |
| Layers                                          | 4                     |
| Copper Thickness (Finished) Outer               | 35um                  |
| Copper Thickness (Finished) Inner               | N/A                   |
| Conformal Coating required                      | Yes                   |
| UL Release                                      | N/A                   |
| Solder Mask                                     | Photo Imageable       |
| Solder Mask Colour                              | Green                 |
| Peelable Mask                                   | N/A                   |
| Silkscreen required (Top / Bottom / Both Sides) | Top                   |
| Silkscreen Colour                               | White                 |
| Panelisation (V-Score / Rout / None)            | Routed                |

### 4.2. PCB Stack

| Layer Name     | Thickness (mm) | Material               |
|----------------|----------------|------------------------|
| TOP COPPER     | 0.0436         | COPPER FOIL 17/0       |
| FR4            | 0.185          | PREPREG 7628MR         |
| FR4            | 0.185          | PREPREG 7628MR         |
| COPPER LAYER 2 | 0.035          | 0.70 COPPER FOIL 35/35 |
| FR4            | 0.70           |                        |
| COPPER LAYER 3 | 0.035          |                        |
| FR4            | 0.185          | PREPREG 7628MR         |
| FR4            | 0.185          | PREPREG 7628MR         |
| BOTTOM COPPER  | 0.0436         | COPPER FOIL 17/0       |

### 4.3. PCB Guidelines:

1. Ground via holes must be located close to module ground pads.
2. Signal traces must not 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 via holes 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.
7. Power traces can be run on a third layer. Use ground to insulate signal traces from power. Use thick traces for power.
8. Use lots of ground stitches around the RF transmission line (0.5mm pitch)
9. RF transmission line is 50Ω grounded CPW with dimensions calculated using 'AWR txline 2003'. Dimensions calculated using the PCB stack detailed in Section 4.2 using  $\epsilon_r$  4.2, dielectric height from layer 1 to layer 2 of 0.37mm and trace plating thickness of 0.043mm. Width(W) = 0.55mm, Gap(G) = 0.23mm, Height(H)=0.37mm.



10. Lots of stitches for ground in general
11. Lots of ground stitches around the board
12. No signal or power traces running on the edge of the board.