



# TAOGLAS®



# Datasheet

## GNSS Dual Feed Stacked Patch

**Part No:**  
HP24510A

### Description

Passive High Precision GNSS L1/L2 Stacked Patch Ceramic Antenna

### Features:

Bands Covered:

- BeiDou (B1/B3)
- GPS/QZSS (L1/L2)
- GLONASS (G1/G2/G3)
- Galileo (E1/E5b)
- L Band Corrections

Dual pin, dual feed, 4-pin configuration

Dimensions: 45 x 45 x 10mm

RoHS & Reach Compliant

|           |                                  |           |
|-----------|----------------------------------|-----------|
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# 1. Introduction



The Taoglas HP24510A is a high performance, multi-band passive GNSS antenna that has been carefully designed to provide fantastic positional accuracy on the L1/L2 GNSS spectrum. It covers GPS/QZSS L1/L2, GLONASS G1/G2/G3, Galileo E1/E5b, BeiDou B1/B3, as well as SBAS (WAAS/EGNOS/GAGAN/SDCM/SNAS) as well as the L Band at 1525MHz.

Correct implementation of the HP24510A allows the user to achieve higher location accuracy, as well as stability of position tracking in urban environments. The stacked patch construction has excellent performance across the full bandwidth of the antenna.

Its design has an even gain across the hemisphere, giving excellent axial ratio, which in turn makes it extremely resilient to multipath rejection and provides excellent phase centre stability to ensure a location is correctly established in a navigation system.

Typical applications that benefit from high precision capabilities include:

- Autonomous Driving
- Precision Agriculture
- Telematics & Container / Asset Tracking
- Timing Accuracy Synchronization
- Precision Positioning for Robotics

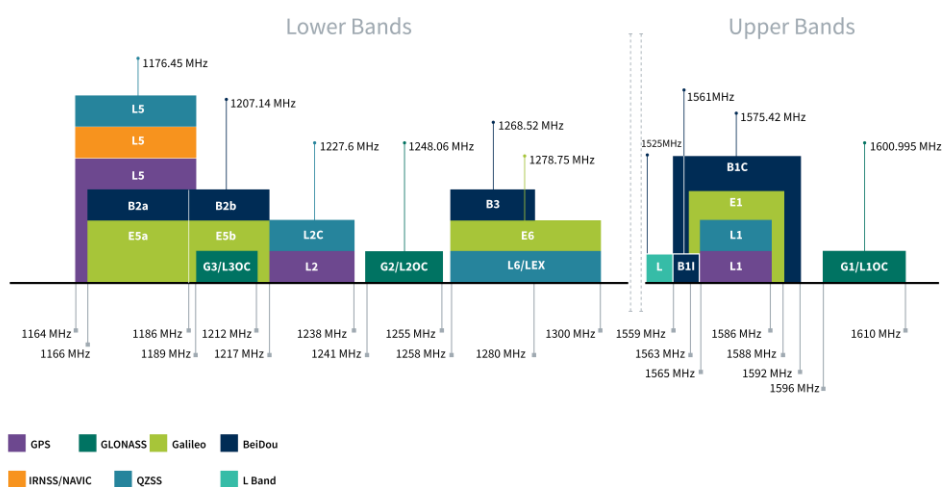
The HP24510A is the latest embedded addition to Taoglas' product portfolio of high precision GNSS antennas. When used on the base and/or the rover as part of an RTK configuration, the HP24510A can achieve genuine cm-level accuracy with proven results.

Full integration guidelines are contained in Section 7 of this datasheet including the Taoglas HC125.A hybrid coupler that will be required for use for dual pin feed patch integrations.

Contact your regional Taoglas Customer Services team for more information on any of the products listed above or for support regarding integration.

## 2. Specification

| GNSS Frequency Bands |                         |                           |                    |                    |                   |
|----------------------|-------------------------|---------------------------|--------------------|--------------------|-------------------|
| GPS                  | L1<br>1575.42 MHz       | L2<br>1227.6 MHz          | L5<br>1176.45 MHz  |                    |                   |
|                      | ■                       | ■                         | □                  |                    |                   |
| GLONASS              | G1<br>1602 MHz          | G2<br>1248 MHz            | G3<br>1207 MHz     |                    |                   |
|                      | ■                       | ■                         | ■                  |                    |                   |
| Galileo              | E1<br>1575.24 MHz       | E5a<br>1176.45 MHz        | E5b<br>1201.5 MHz  | E6<br>1278.75 MHz  |                   |
|                      | ■                       | □                         | ■                  | □                  |                   |
| BeiDou               | B1C<br>1575.42 MHz      | B1I<br>1561 MHz           | B2a<br>1176.45 MHz | B2b<br>1207.14 MHz | B3<br>1268.52 MHz |
|                      | ■                       | ■                         | □                  | ■                  | □                 |
| L-Band               | L-Band<br>1542 MHz      |                           |                    |                    |                   |
|                      | ■                       |                           |                    |                    |                   |
| QZSS (Regional)      | L1<br>1575.42 MHz       | L2C<br>1227.6 MHz         | L5<br>1176.45 MHz  | L6<br>1278.75e6    |                   |
|                      | ■                       | ■                         | □                  | □                  |                   |
| IRNSS (Regional)     | L5<br>1176.45 MHz       |                           |                    |                    |                   |
|                      | □                       |                           |                    |                    |                   |
| SBAS                 | L1/E1/B1<br>1575.42 MHz | L5/B2a/E5a<br>1176.45 MHz | G1<br>1602 MHz     | G2<br>1248 MHz     | G3<br>1207 MHz    |
|                      | ■                       | □                         | ■                  | ■                  | ■                 |



GNSS Bands and Constellations

| GNSS Electrical                       |             |        |       |           |       |         |       |
|---------------------------------------|-------------|--------|-------|-----------|-------|---------|-------|
| Frequency (MHz)                       | 1207        | 1227.6 | 1248  | 1525-1559 | 1561  | 1575.42 | 1603  |
| VSWR (max.)                           | 1:1         | 1:1    | 1:1   | 1:1       | 1:1   | 1:1     | 1:1   |
| Passive Antenna Efficiency (%)        | 39.93       | 61.54  | 45.47 | 55.72     | 68.52 | 69.41   | 61.1  |
| Passive Antenna Gain at Zenith (dBic) | 1.23        | 3.48   | 2.95  | 4.01      | 4.21  | 4.43    | 4.27  |
| Axial Ratio (dB)                      | 1.84        | 0.54   | 1.31  | 0.5       | 0.7   | 0.84    | 0.95  |
| PCO (cm)                              | 3.4         | 3.4    | 3.0   | 1.9       | 1.9   | 2.0     | 2.2   |
| PCV (cm)                              | 0.6         | 0.6    | 0.6   | 0.3       | 0.2   | 0.2     | 0.2   |
| Group Delay Mean (ns)                 | 11.58       | 12.94  | 13.58 | 10.29     | 10.98 | 11.01   | 11.11 |
| Group Delay Variation (ns)            | 3           | 6      | 3     | 0         | 1     | 2       | 0     |
| Polarization                          | RHCP        |        |       |           |       |         |       |
| Radiation Pattern                     | Directional |        |       |           |       |         |       |
| Impedance                             | 50 $\Omega$ |        |       |           |       |         |       |

\*Tested on a 70x70mm Evaluation Board.

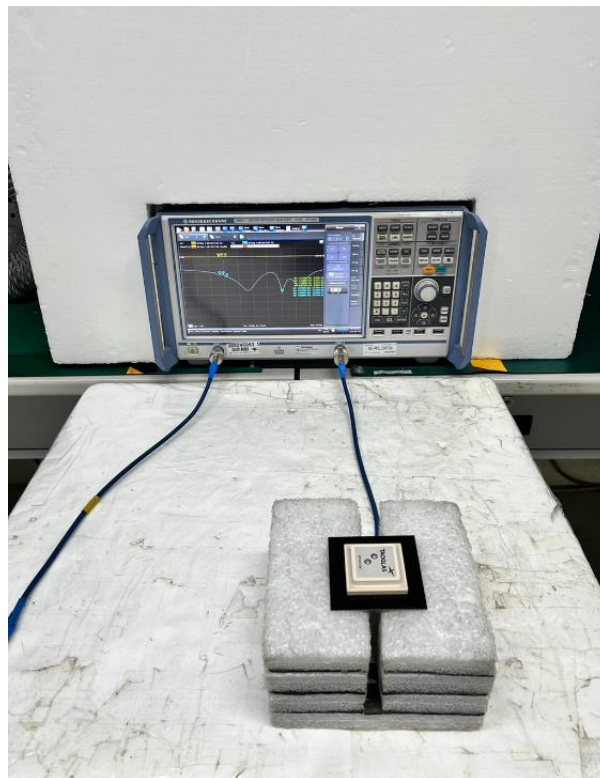
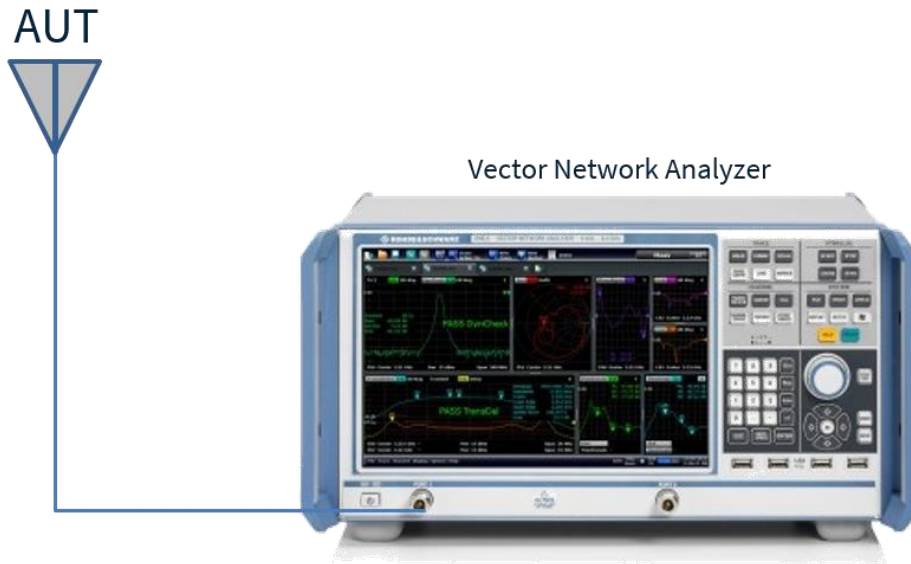
| LNA and Filter Electrical Properties |                   |        |      |           |      |         |      |
|--------------------------------------|-------------------|--------|------|-----------|------|---------|------|
| Frequency (MHz)                      | 1207              | 1227.6 | 1248 | 1525-1559 | 1561 | 1575.42 | 1603 |
| Noise Figure (dB)                    | 2.0               | 2.3    | 2.4  | 2.4       | 2.1  | 1.8     | 2.3  |
| Gain (dB)                            | 29.2              | 29.4   | 28.6 | 28.8      | 28.5 | 28.3    | 26.9 |
| Input Voltage (V)                    | + 1.8 to 5.5      |        |      |           |      |         |      |
| Current consumption (mA)             | 18 $\pm$ 3        |        |      |           |      |         |      |
| Outer Band Attenuation (dB)          | > 65dB @ LTE Band |        |      |           |      |         |      |

| Mechanical                                 |                      |
|--|----------------------|
| Dimensions                                 | 45x45x5.1mm          |
| Total Dimension (Including Shielding Case) | 60x60mm              |
| Connector                                  | IPEX MHFI (U.FL)     |
| Cable                                      | 1.37mm Coaxial Cable |
| Material                                   | Ceramic              |
| Weight                                     | 70g                  |

| Environmental       |                            |
|---------------------|----------------------------|
| Temperature Range   | -40°C to 85°C              |
| Storage Temperature | -40°C to 85°C              |
| Humidity            | Non-condensing 65°C 95% RH |

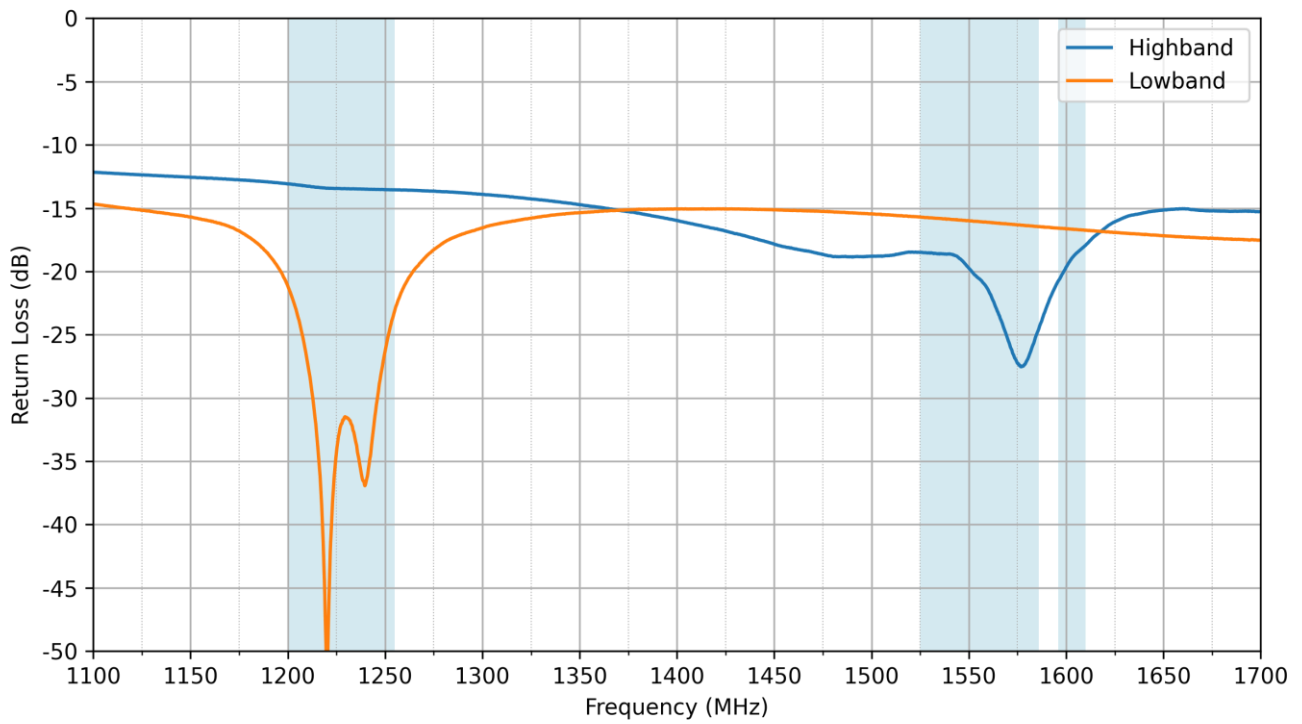
### 3. Antenna Characteristics

#### 3.1 Test Setup

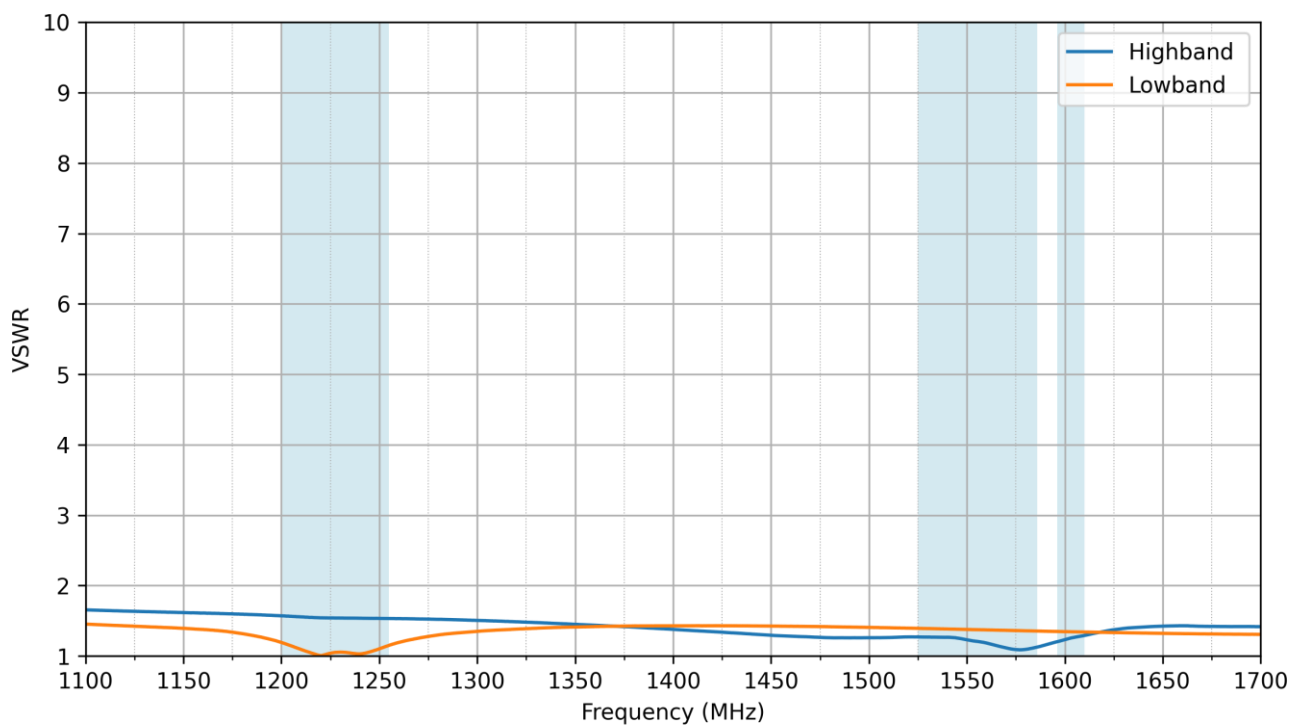


VNA Test Setup – Tested on 70x70mm Evaluation Board.

### 3.2 Return Loss

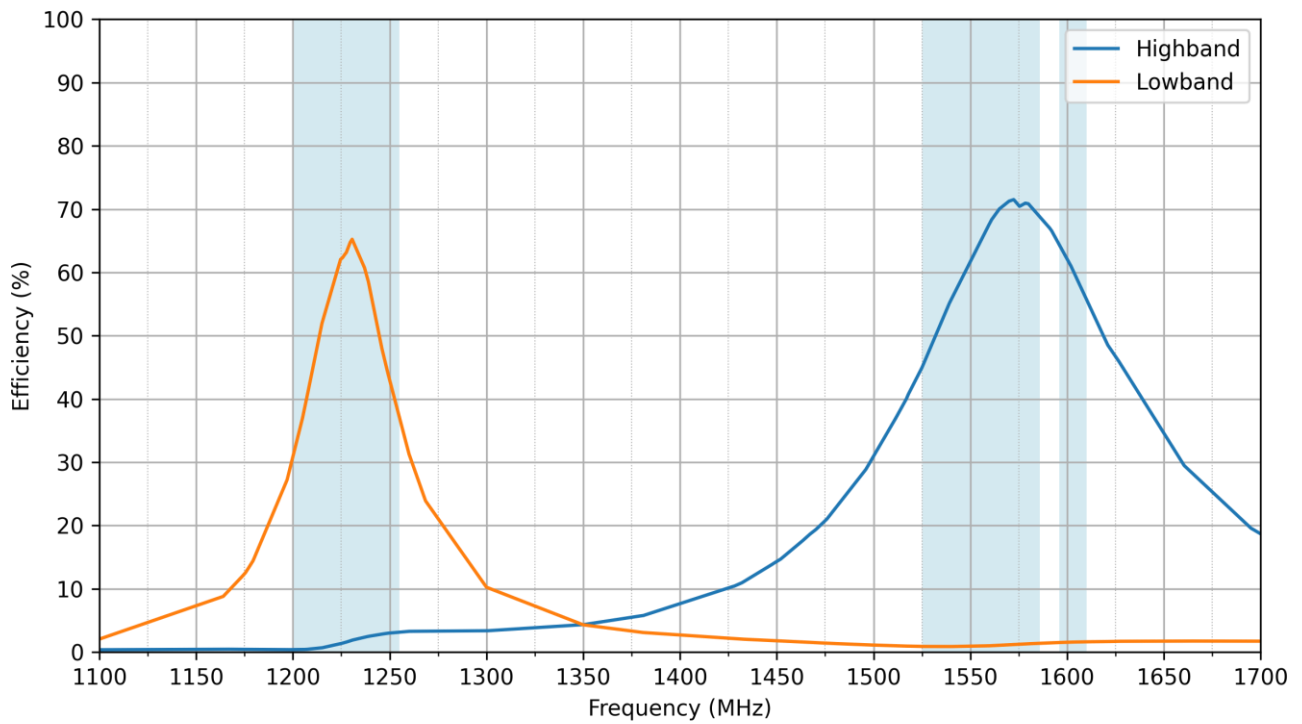


### 3.3 VSWR

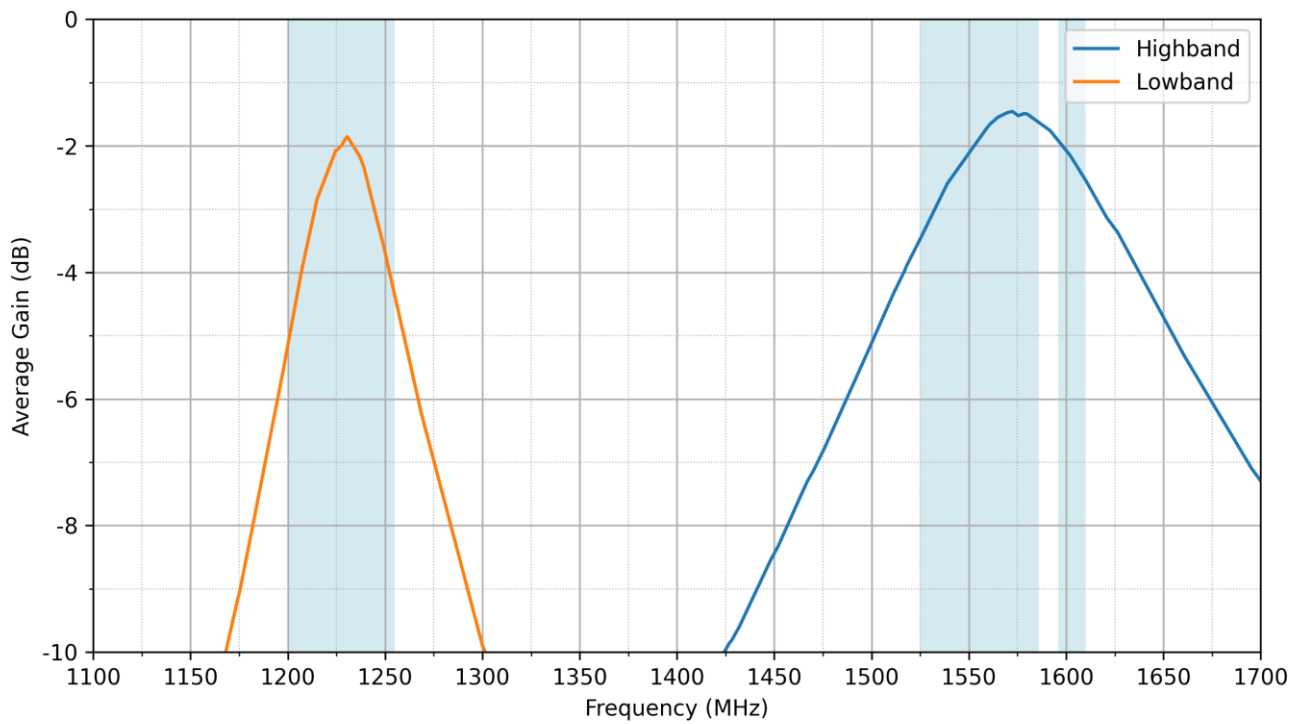




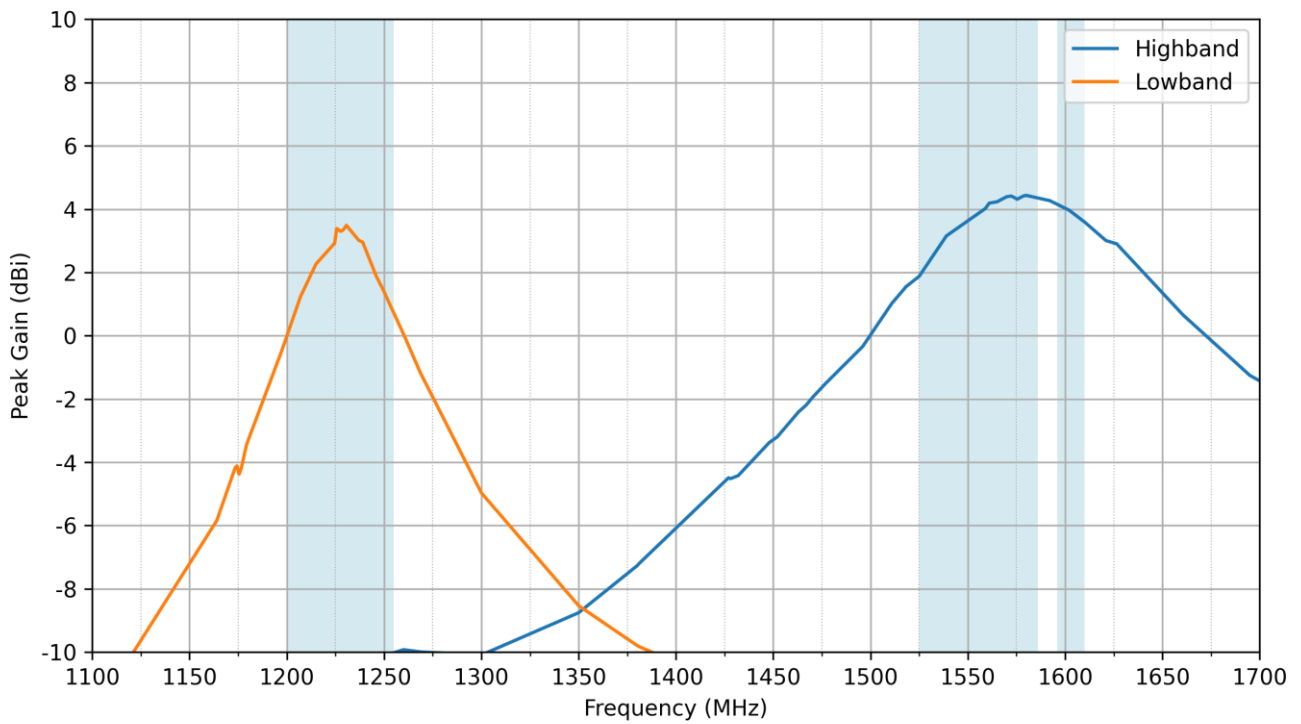
### 3.4 Efficiency



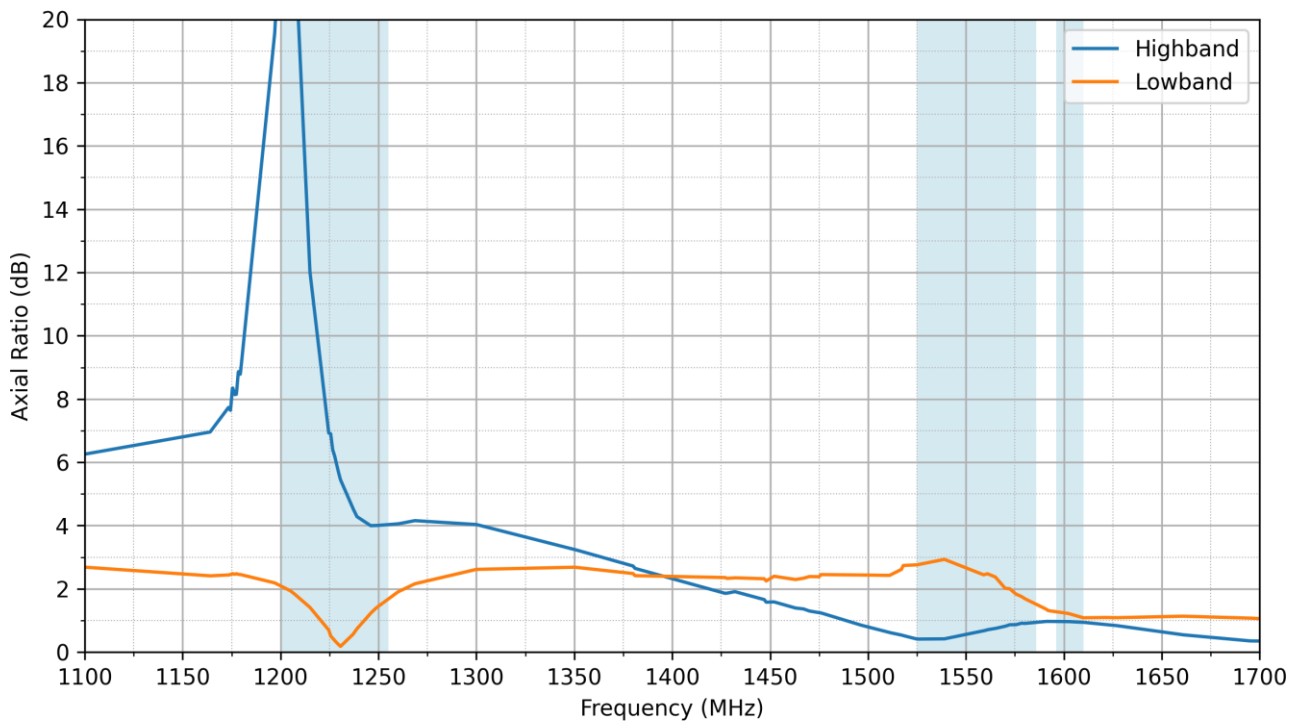
### 3.5 Average Gain



### 3.6 Peak Gain

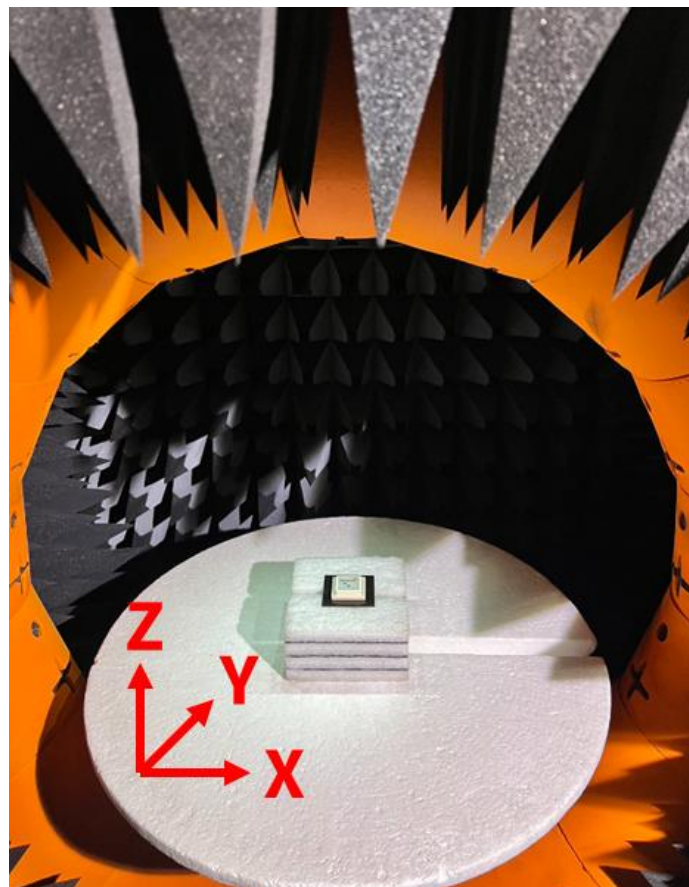
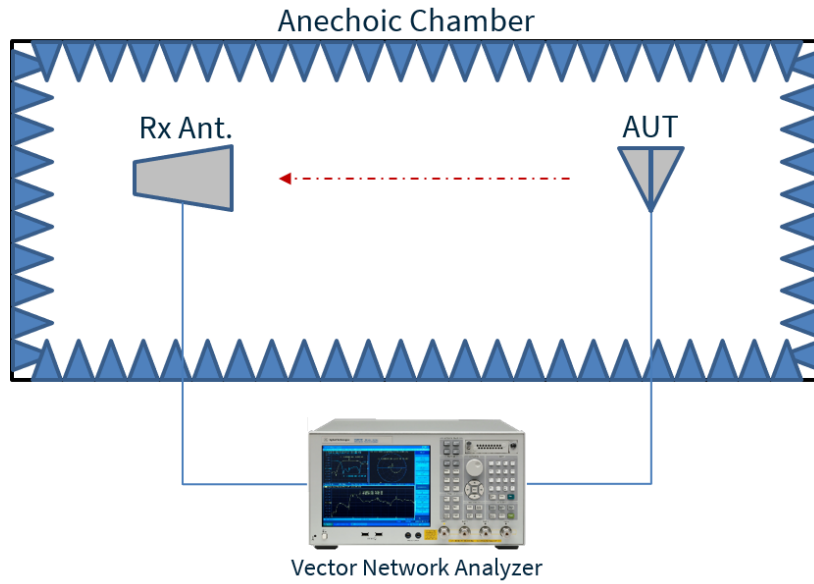


### 3.7 Axial Ratio



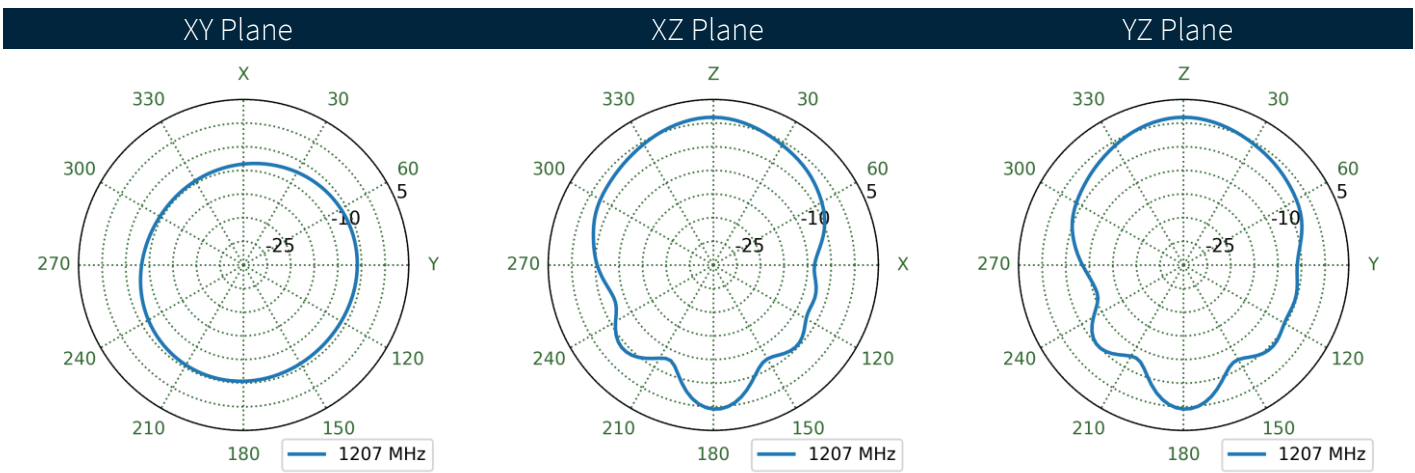
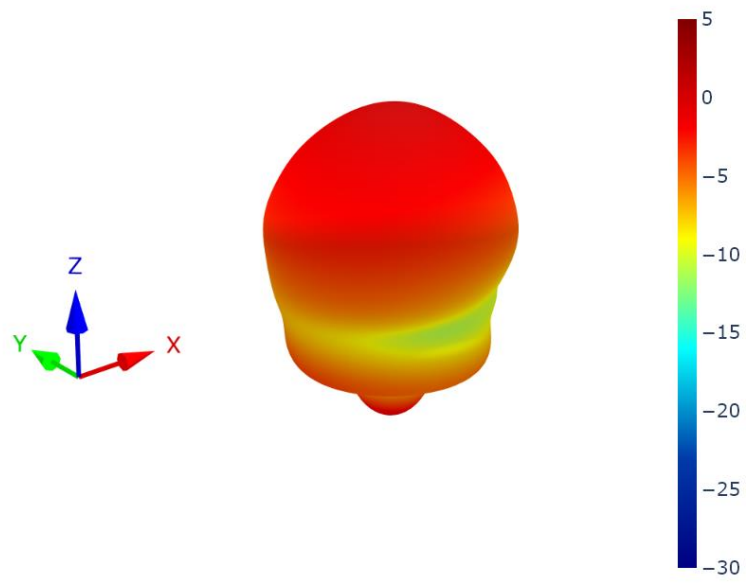
## 4. Radiation Patterns

### 4.1 Test Setup

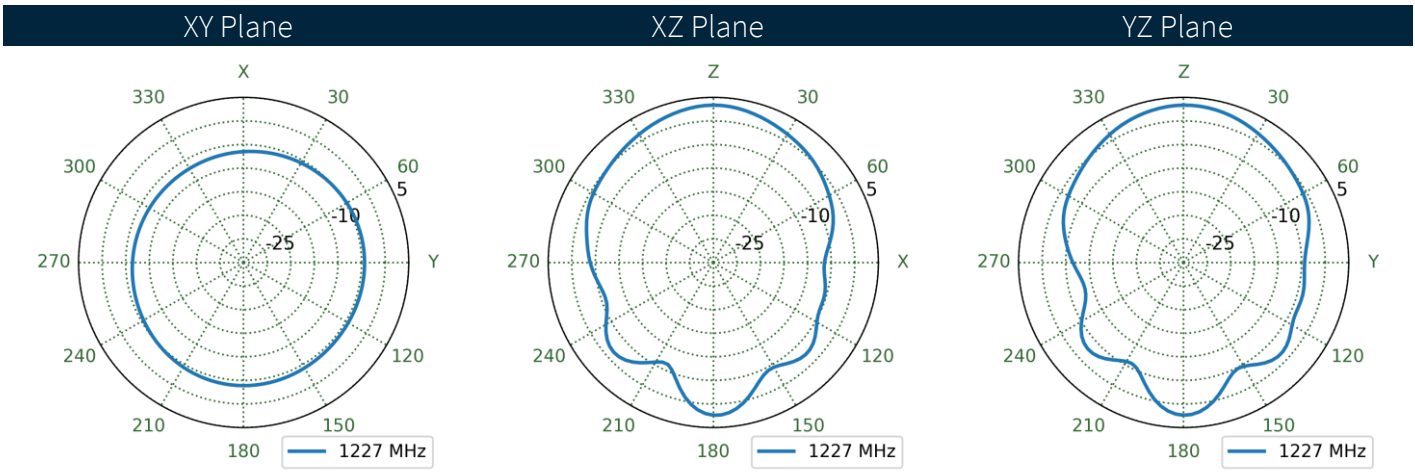
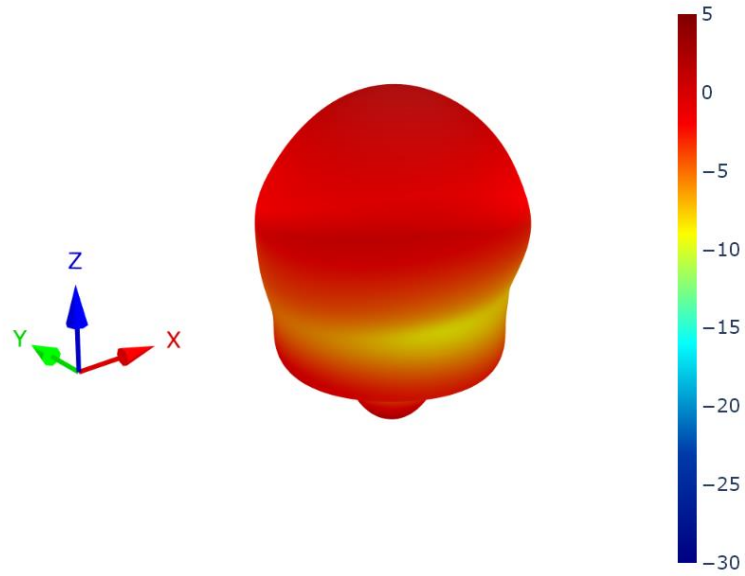


Chamber Test Setup – Tested on 70x70mm Evaluation Board.

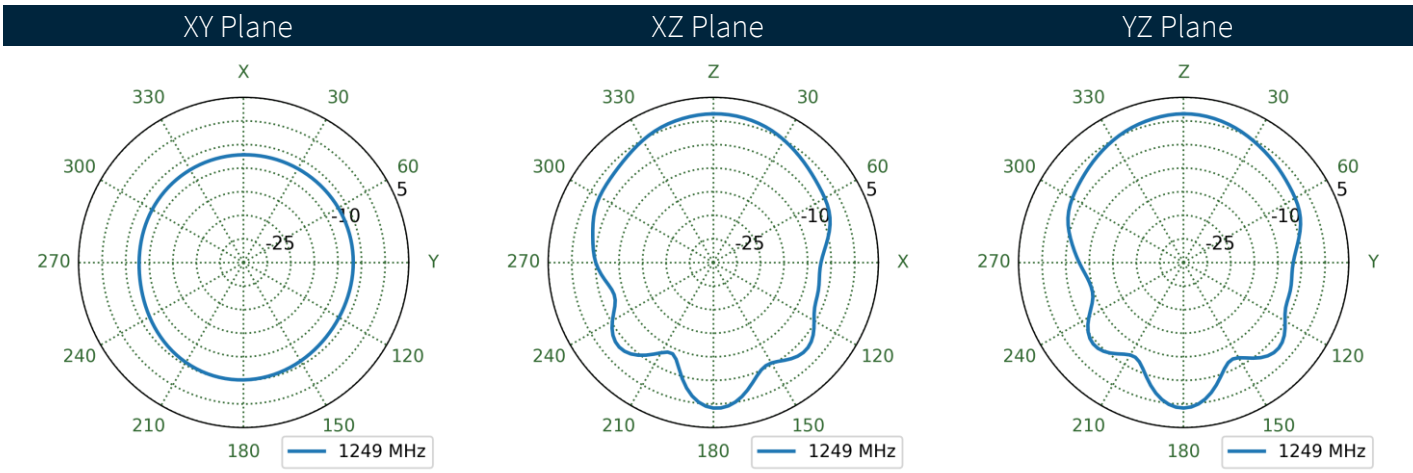
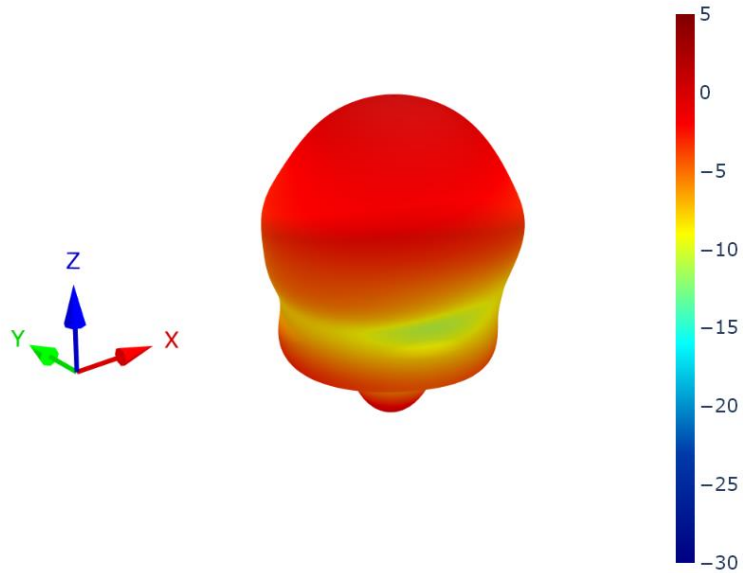
4.2 Patterns at 1207 MHz



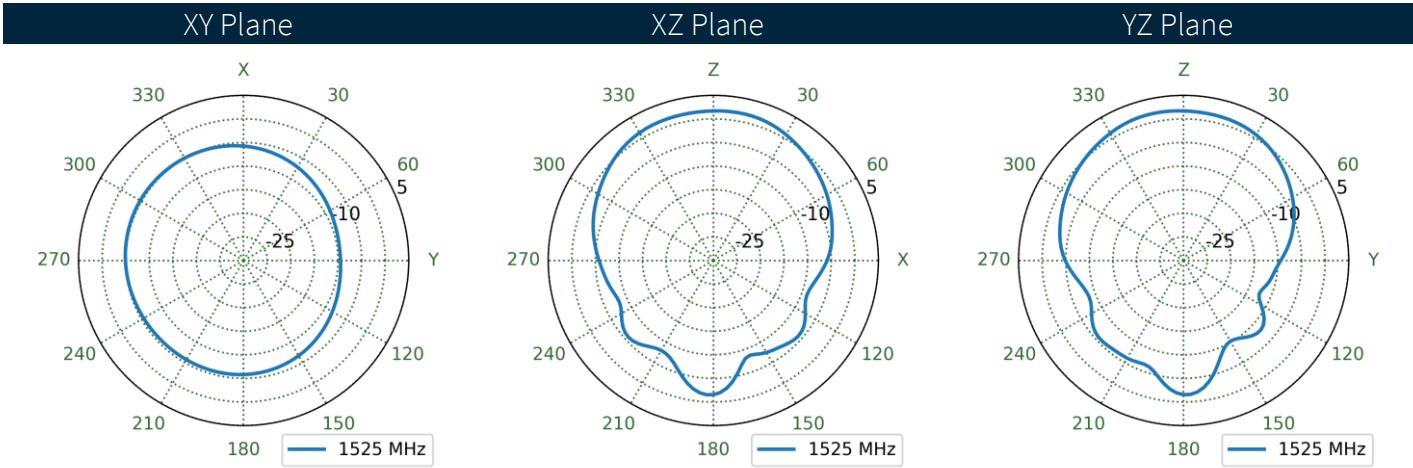
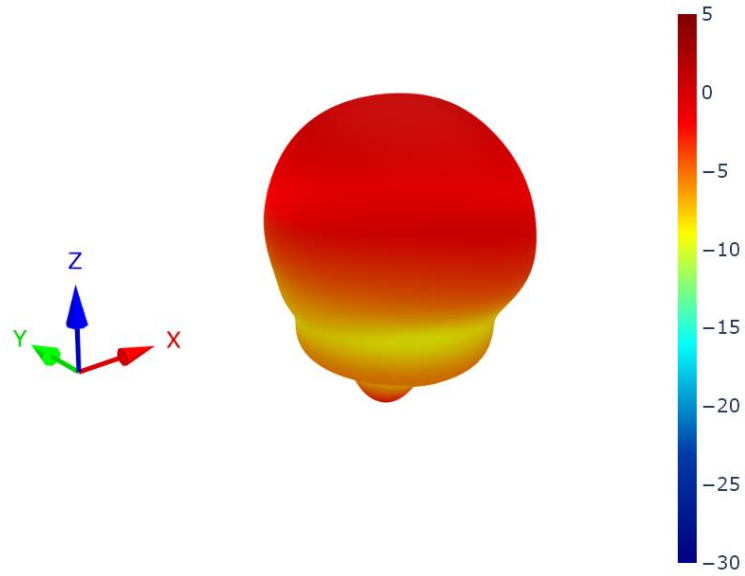
4.3 Patterns at 1227 MHz



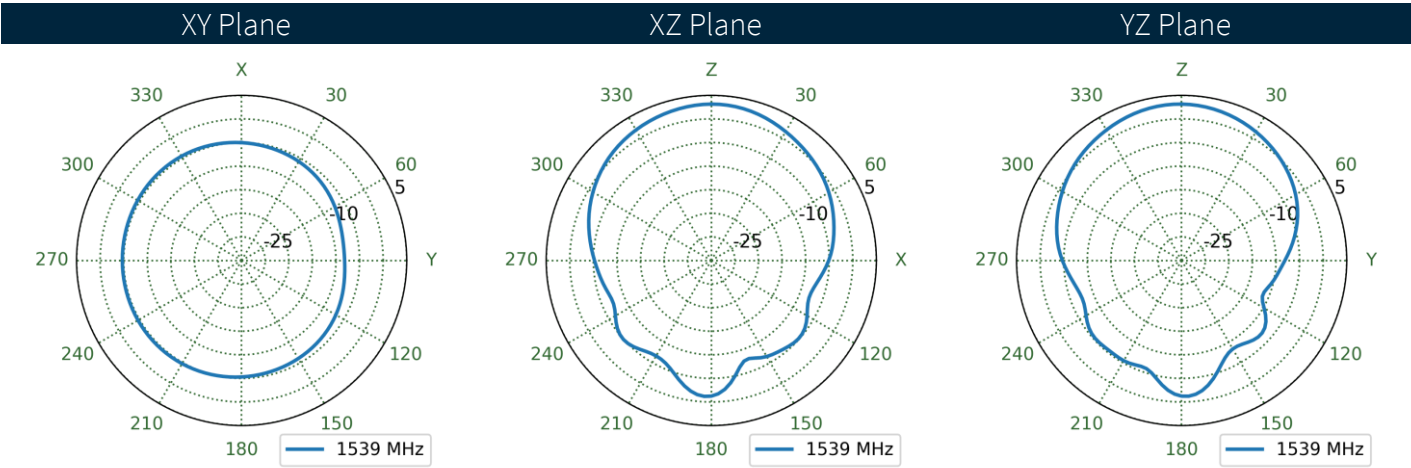
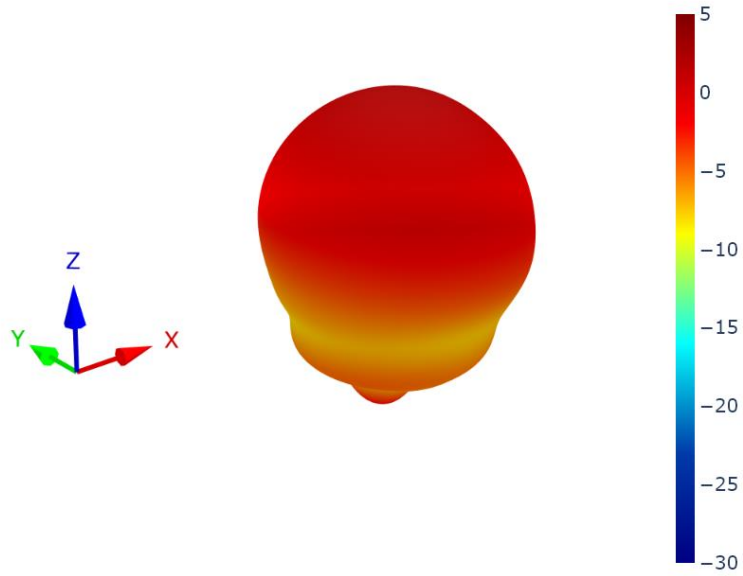
4.4 Patterns at 1249 MHz



4.5 Patterns at 1525 MHz

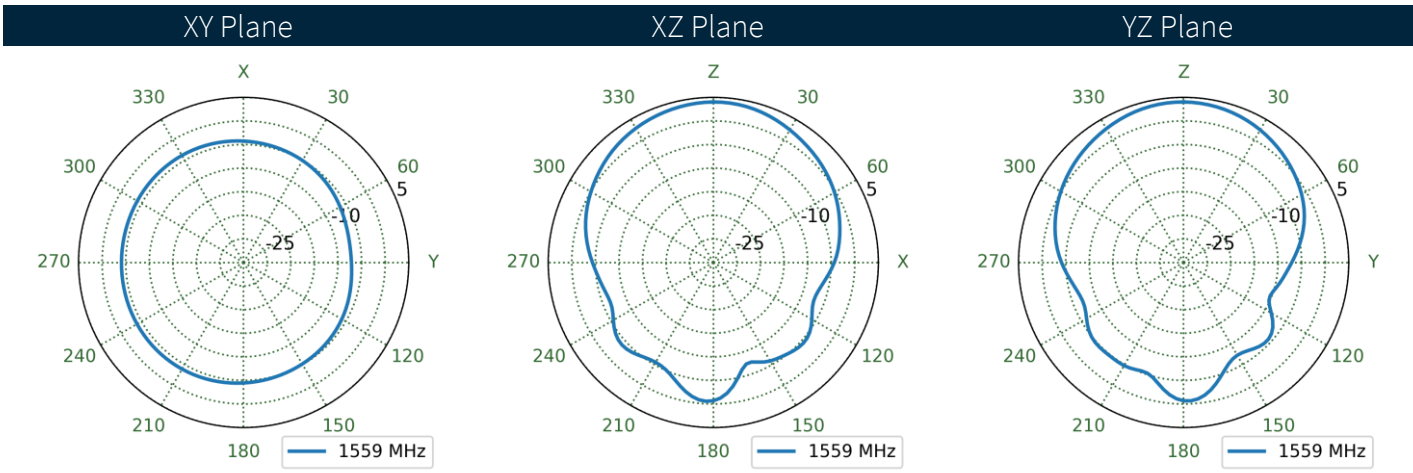
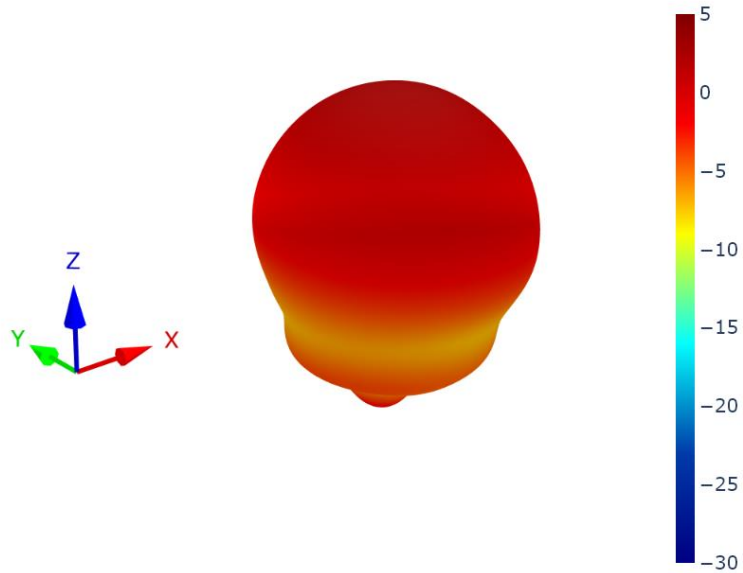


4.6 Patterns at 1539 MHz

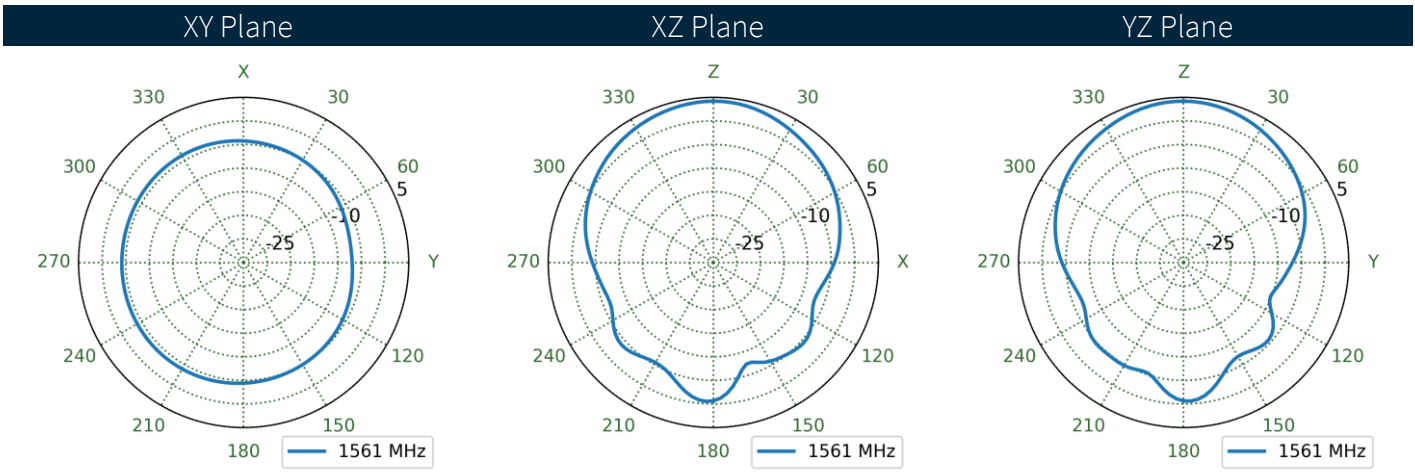
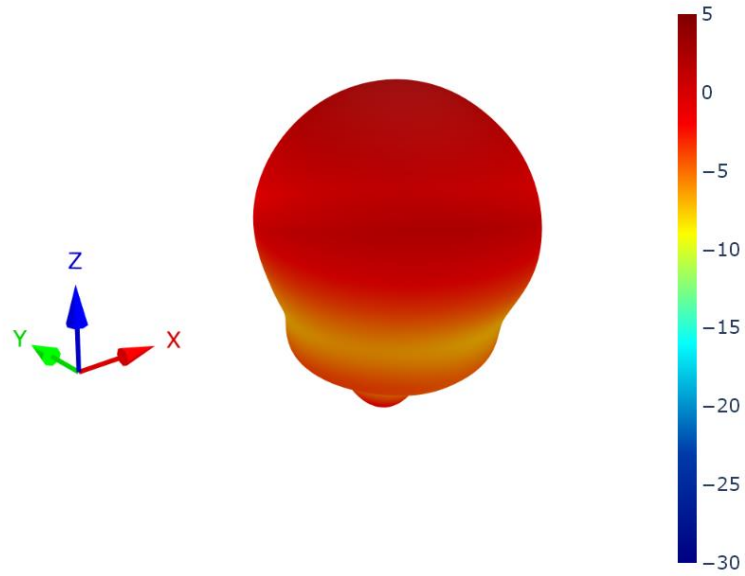




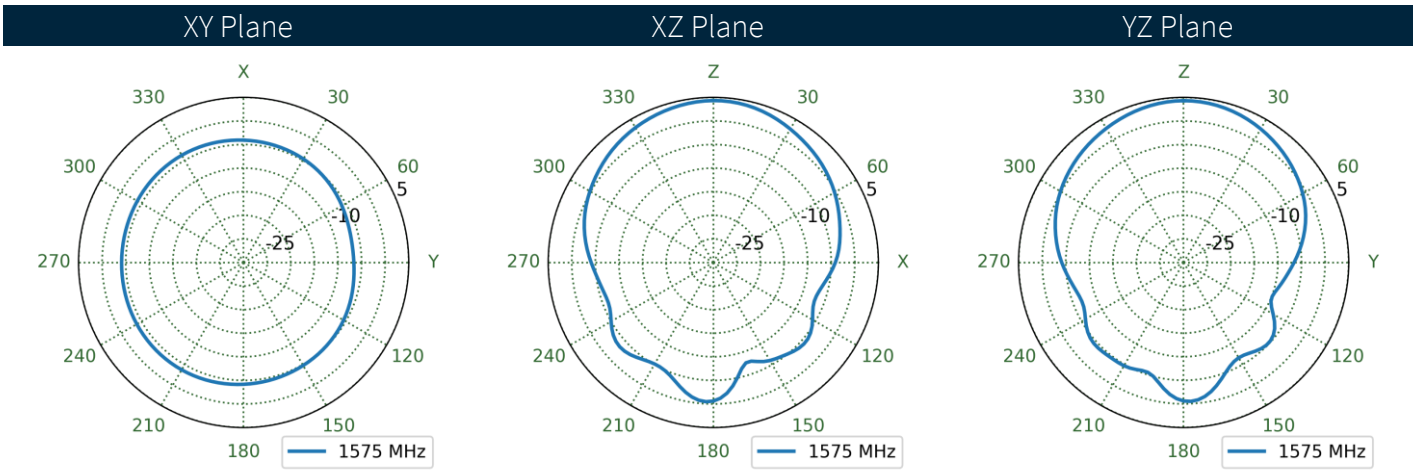
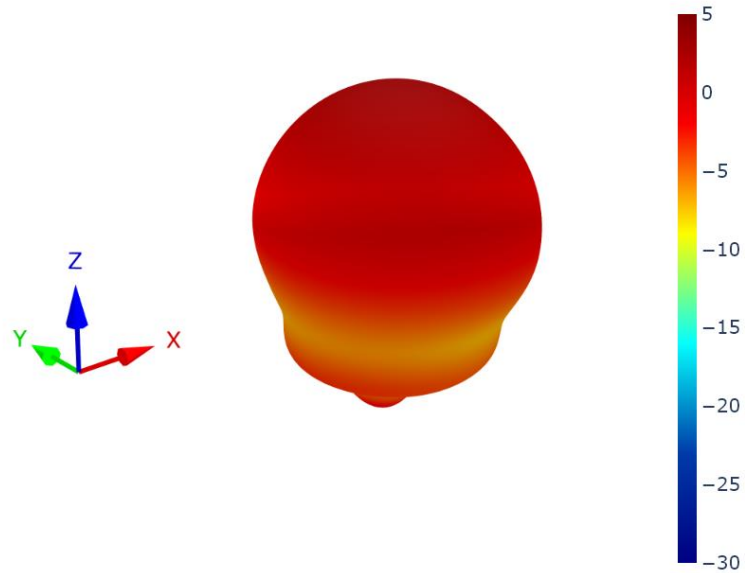
4.7 Patterns at 1559 MHz



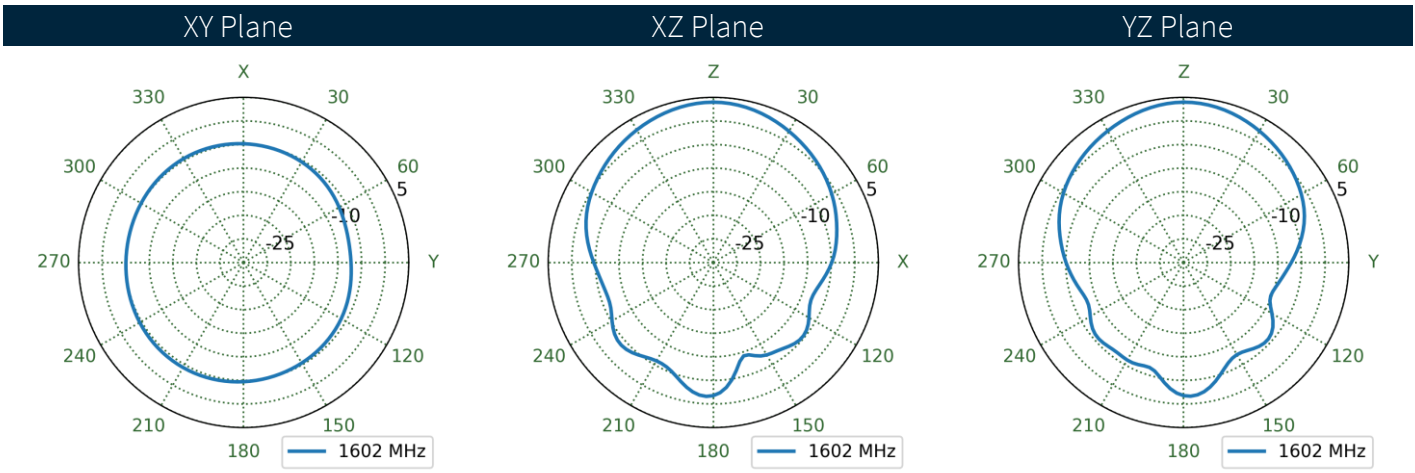
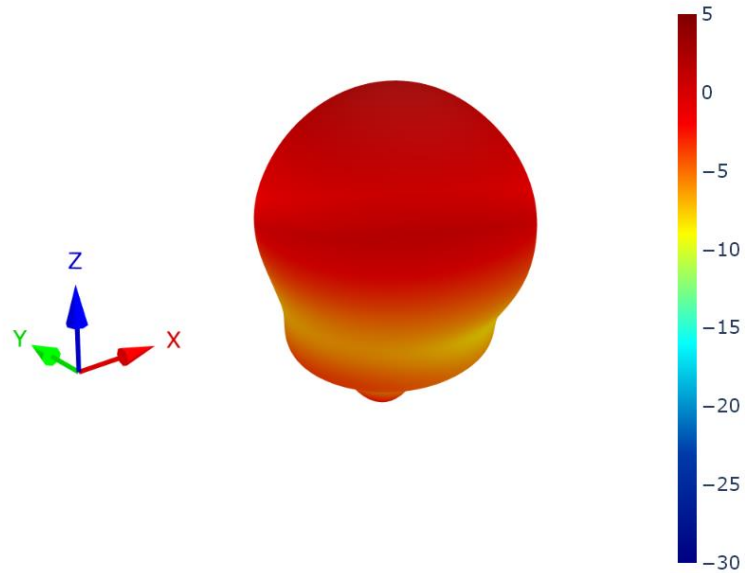
4.8 Patterns at 1561 MHz



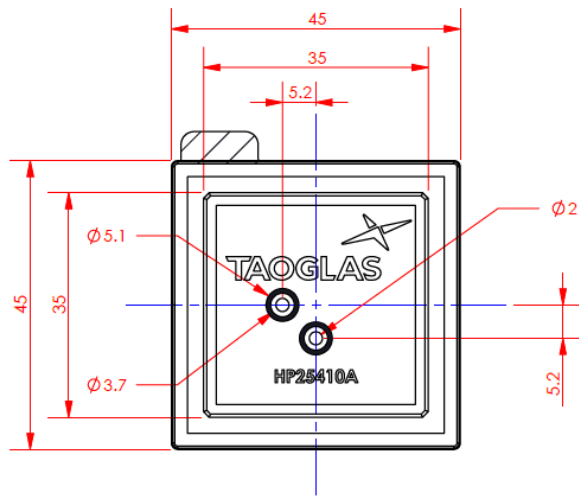
4.9 Patterns at 1575 MHz



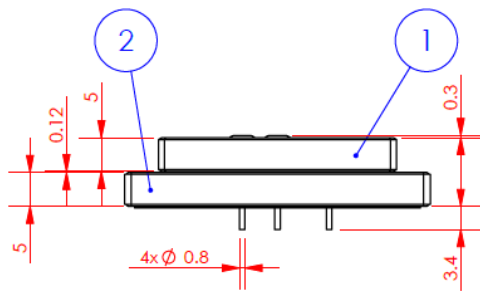
4.10 Patterns at 1602 MHz



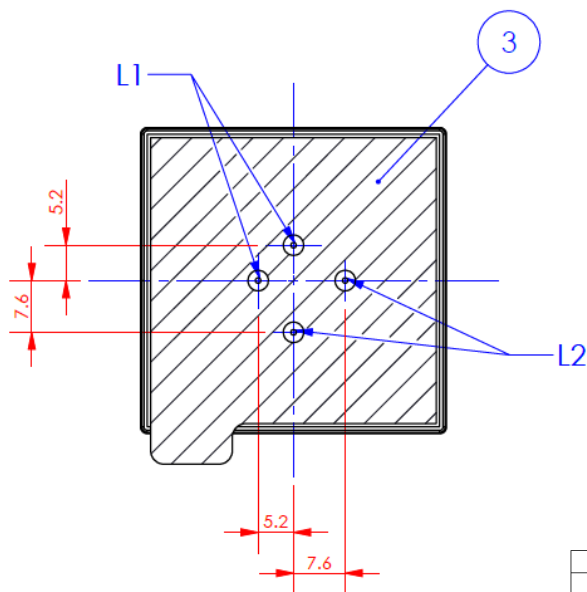
# 5. Mechanical Drawing



TOP VIEW



FRONT VIEW



BOTTOM VIEW

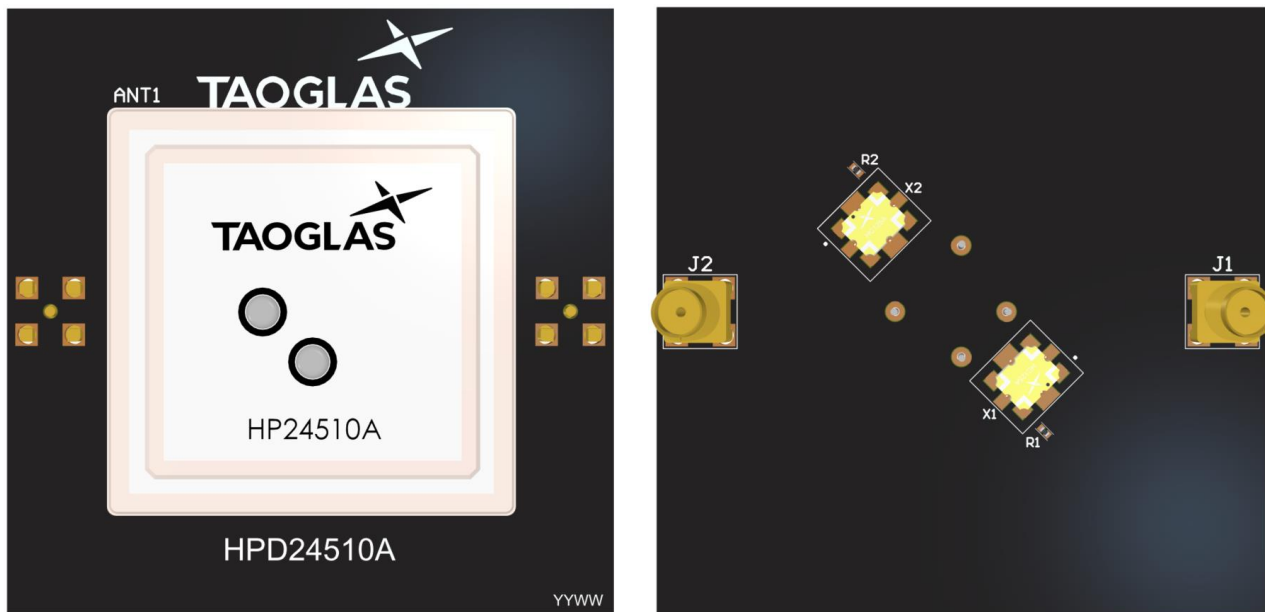
**RELEASE**

1. ALL MATERIAL MUST BE ROHS COMPLIANT.
2. USE THIS DRAWING TOGETHER WITH THE CORRESPONDING 3D CAD DATABASE FILE TO FULLY DESCRIBE THE PART.
3. THE CONNECTOR ORIENTATION HAS A FIXED POSITION TO THE ANTENNA AS PER DRAWING.
4. \*\* CRITICAL DIMENSIONS.
5. DOUBLE SIDED ADHESIVE: 

|   | Name                     | Material   | QTY |
|---|--------------------------|------------|-----|
| 1 | Top Patch (35x35x5mm)    | Ceramic    | 1   |
| 2 | Bottom Patch (45x45x5mm) | Ceramic    | 1   |
| 3 | Double Sided Adhesive    | NITTO 5015 | 1   |

## 6. Antenna Integration Guide

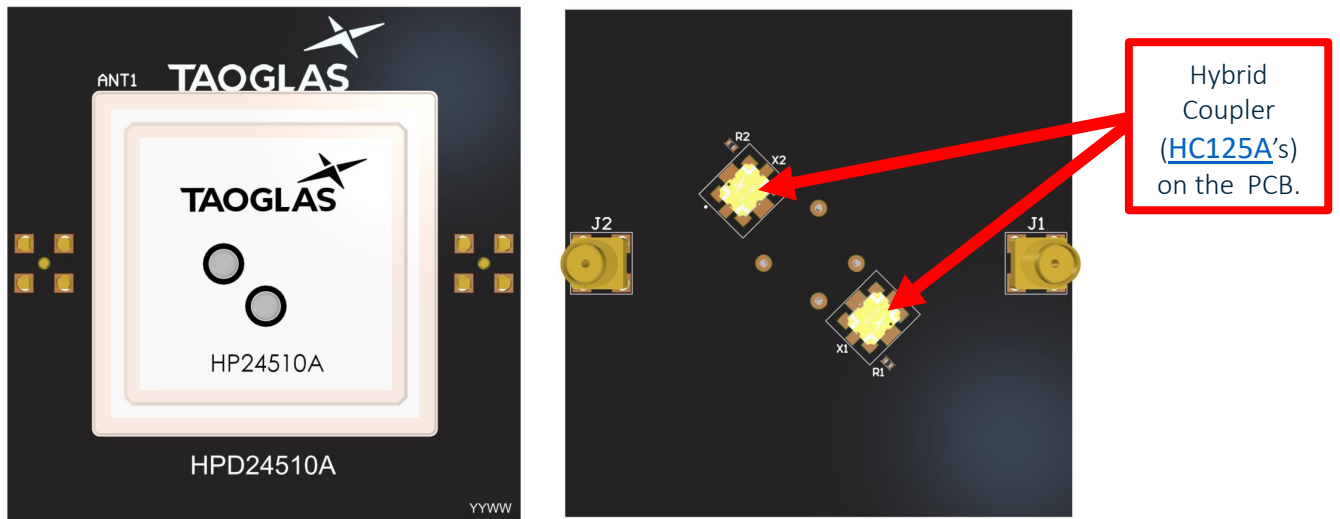
The following is an example on how to integrate the HP24510A into a design. This antenna has four pins, two pins are used for the L1 band, and two pins are used for the L2 band. Hybrid couplers ([HC125A](#)) are used to combine the feeds for each of the bands, to create a Right Hand Circular Polarized (RHCP) signal. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.



Top and bottom view of PCB.

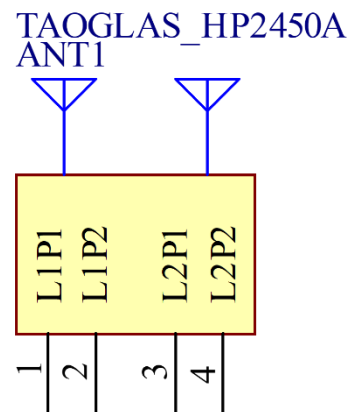
Please find the Integration files in Altium, 2D formats and the 3D model for the HP24510A here:  
<https://www.taoglas.com/product/dual-feed-gnss-l1-l2-stacked-patch-ceramic-antenna/>

## 6.1 Schematic and PIN Definition



Above are the 3D models of the HP24510A and [HC125A's](#) on the PCB.

| Pin | Description |
|-----|-------------|
| 1   | L1P1 (0°)   |
| 2   | L1P2 (-90°) |
| 3   | L2P1 (0°)   |
| 4   | L2P2 (-90°) |

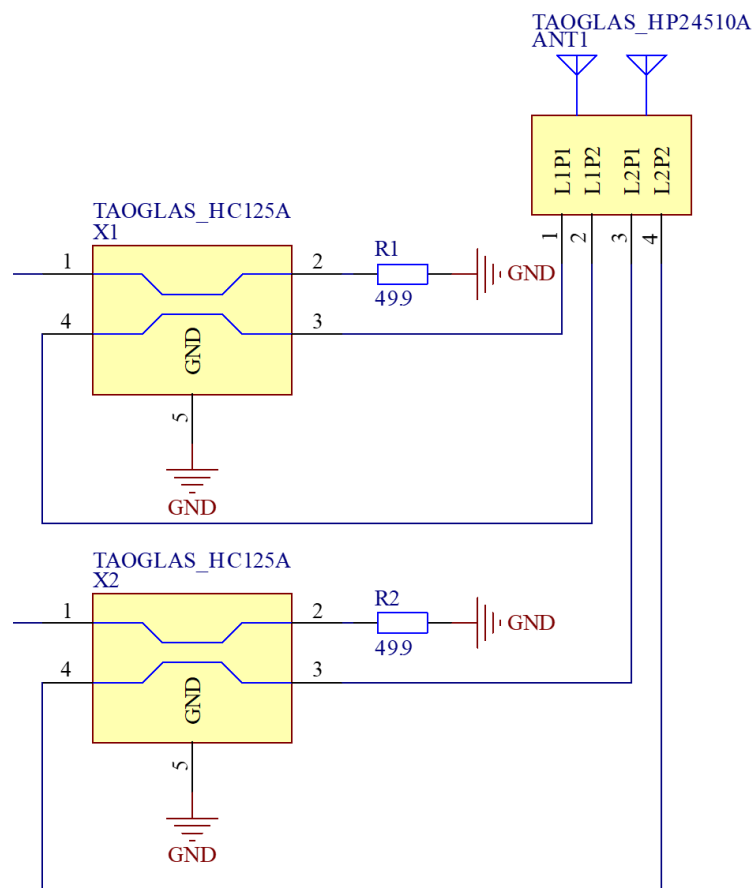


The circuit symbol for the HP24510A and pin definitions are shown above.

## 6.2 Schematic Layout

The HP24510A uses two orthogonal feeds that need to be combined in a hybrid coupler to ensure optimal axial ratio and RHCP Gain is achieved. Taoglas recommends our [HC125A](#), a high-performance hybrid coupler specifically engineered for use with our multi feed patches.

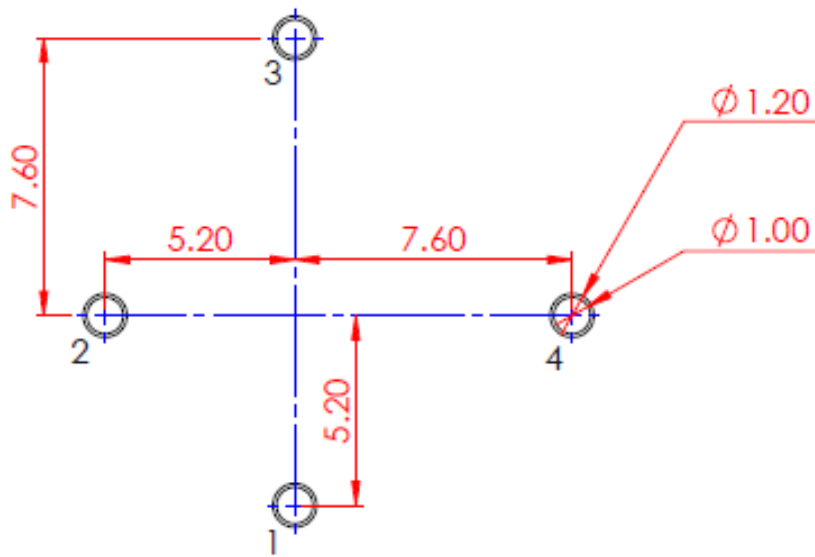
Two [HC125A](#)'s are required for this GNSS antenna, one for the high band (1559- 1610MHz) and another for the low band (1189MHz – 1254MHz). These hybrid couplers should be placed close to the antenna pins and terminated correctly using 49.9 Ohm resistors. In addition, the RF Feeds from the antenna pins for each band to the hybrid couplers must be equal in length. (Please refer to our integration files)



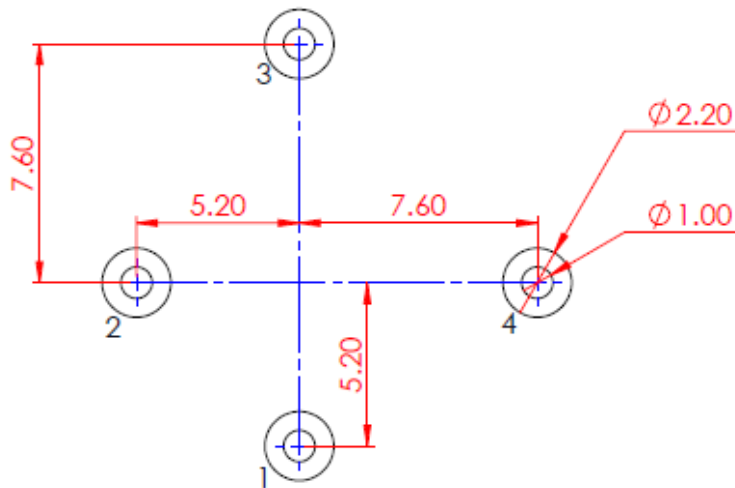
| Designator | Type     | Value     | Manufacturer | Manufacturer Part Number |
|------------|----------|-----------|--------------|--------------------------|
| R1, R2     | Resistor | 49.9 Ohms | Panasonic    | ERJ-2RKF49R9X            |



6.3 Antenna Footprint



Topside

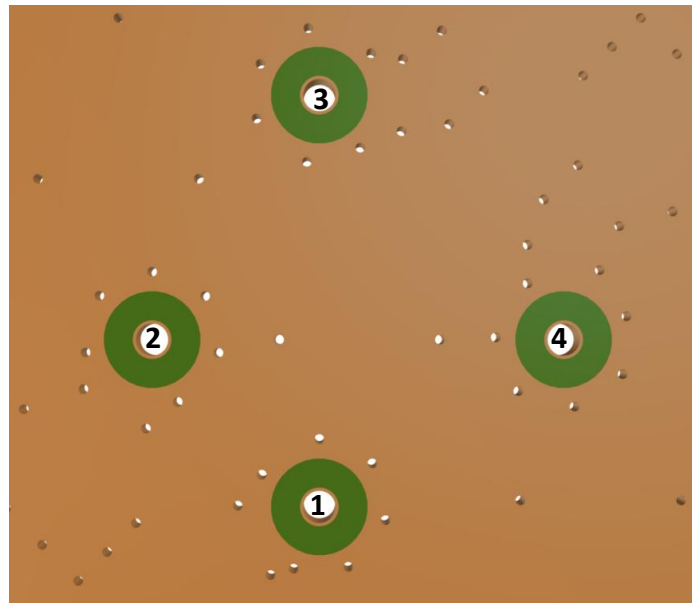


Bottom Side

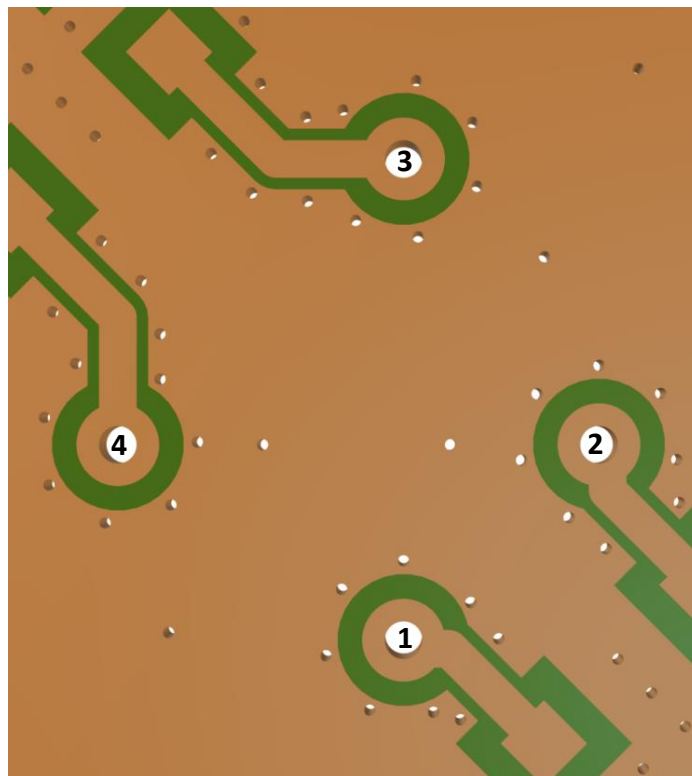
## 6.4 Copper Clearance for HP24510A

The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the HP24510A clearance area for Pin 1 (L1P1(0°) Pad), Pin 2 (L1P2(-90°) Pad), Pin 3 (L2P1(0°) Pad) and Pin 4 (L2P2(-90°) Pad). The bottom copper keep out area only applies to the bottom layer and the top copper keep out area applies to all other layers.

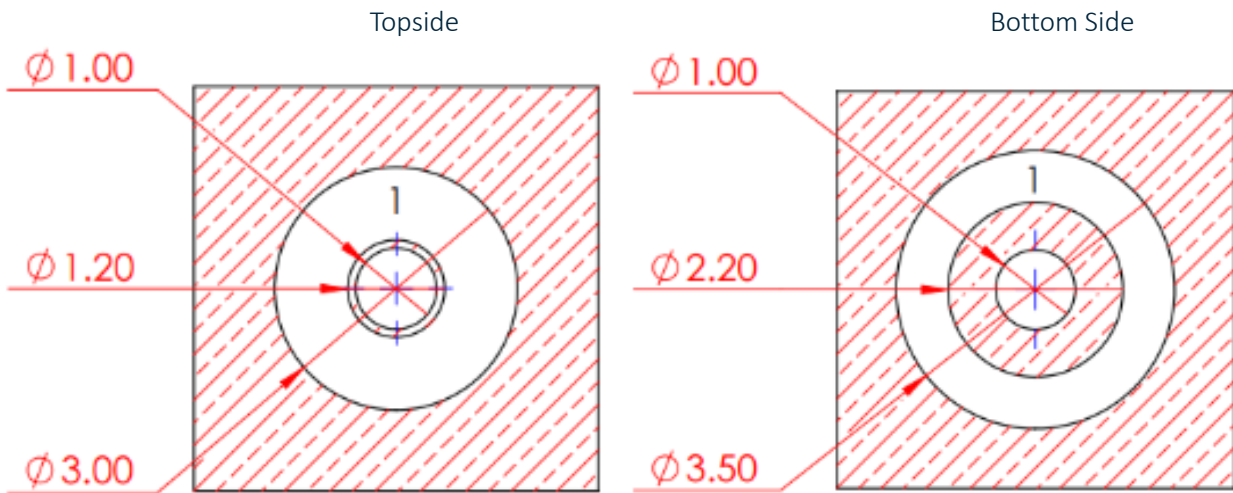
There should be a  $\varnothing 3\text{mm}$  copper clearance around the antenna pins on the top side of the PCB with a  $\varnothing 3.5\text{mm}$  copper clearance around the antenna pins on the bottom side.



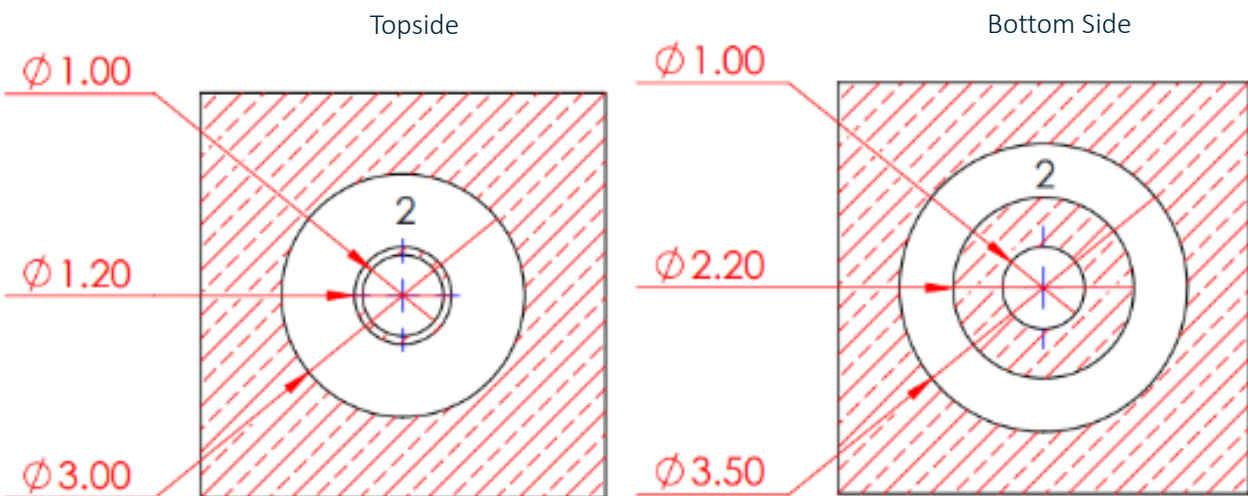
Topside



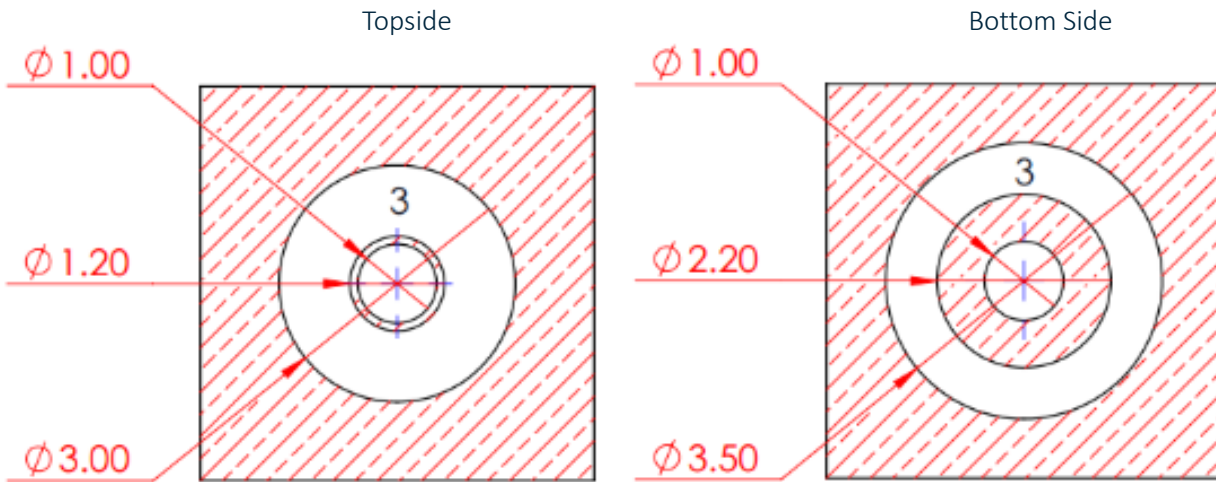
Bottom Side



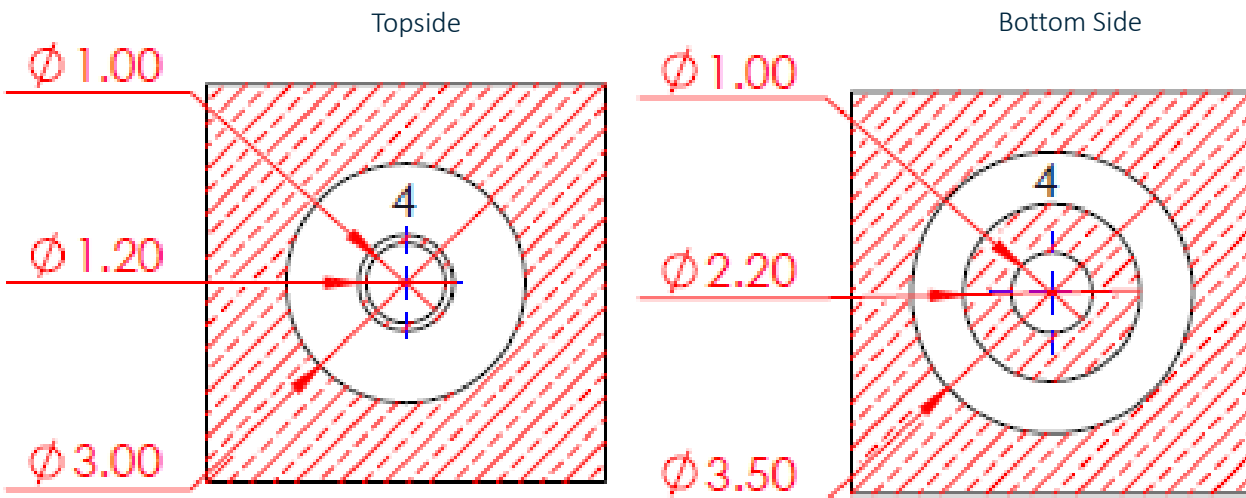
Copper Clearances for Pin 1 (L1P1(0) Pad) of the HP24510A.



Copper Clearances for Pin 2 (L1P2(-90) Pad) of the HP24510A.



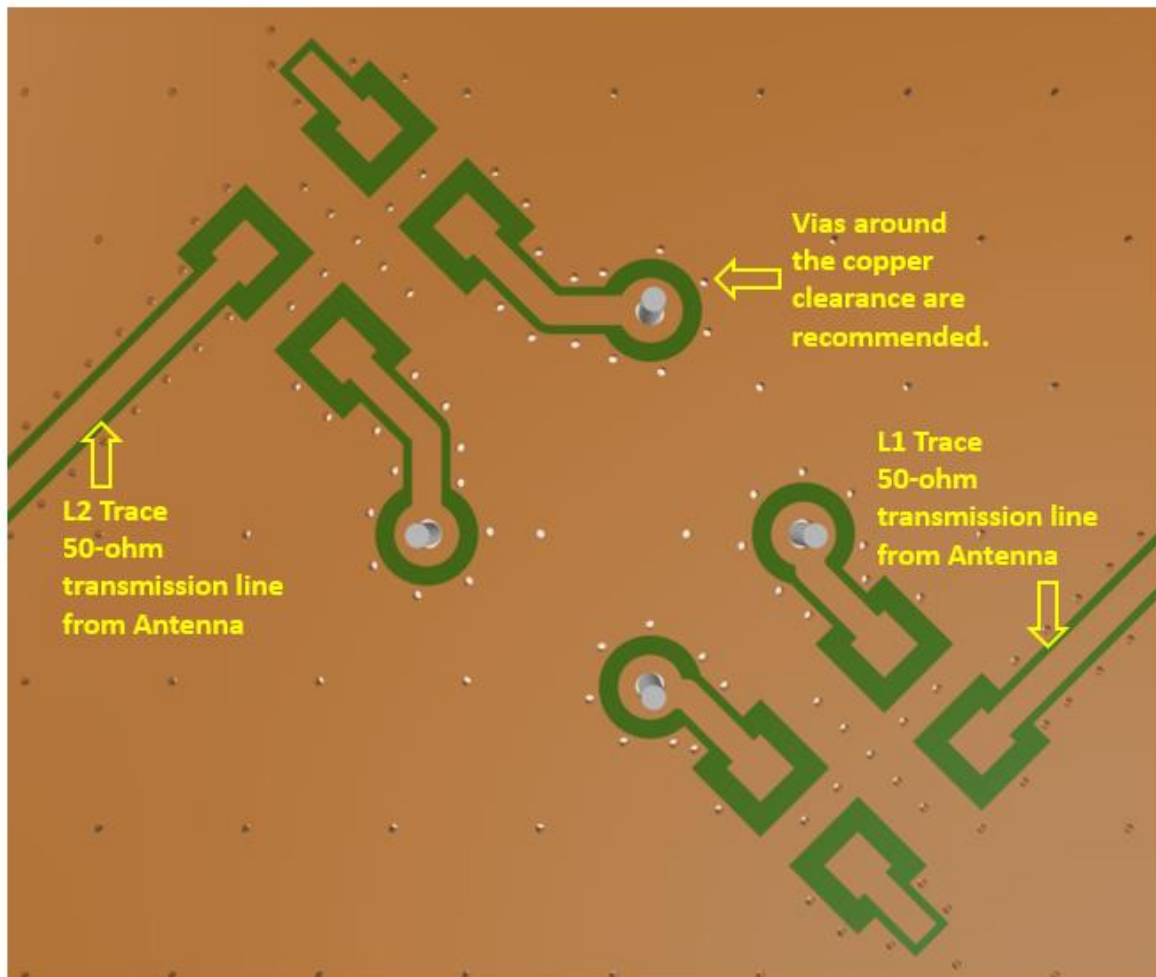
Copper Clearances for Pin 3 (L2P1(0) Pad) of the HP24510A.



Copper Clearances for Pin 4 (L2P2(-90) Pad) of the HP24510A.

## 6.5 Antenna Integration

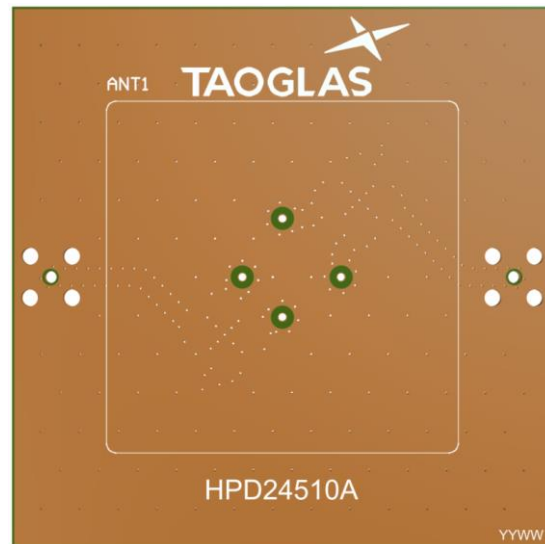
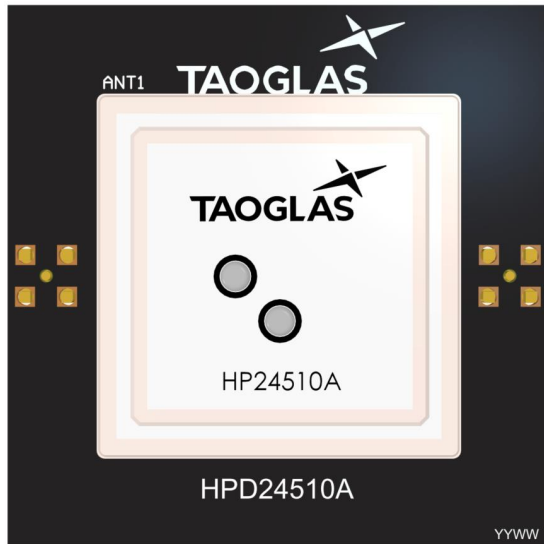
The HP24510A should be placed in the centre of the PCB to take advantage of the ground plane. The RF traces must maintain a 50 Ohm transmission line. Ground vias should be placed around the copper clearance area.



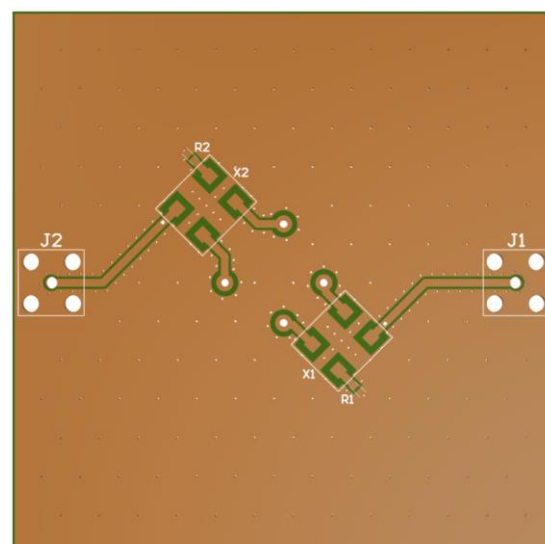
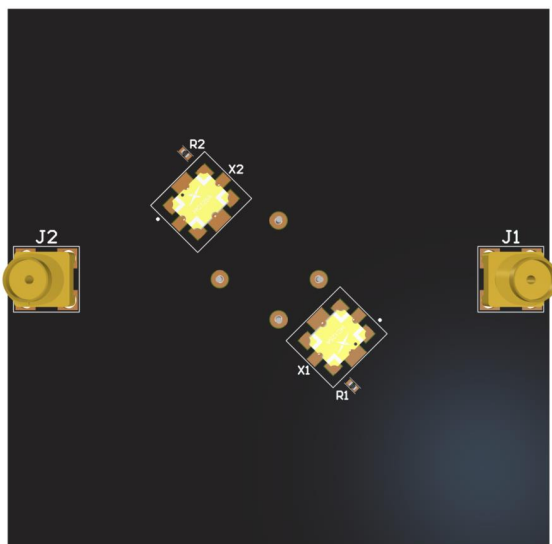
Bottom view of the PCB, showing transmission lines and integration notes.

## 6.6 Final Integration

The bottom side image shown below highlights the antenna connection to the hybrid couplers ([HC125A's](#)). It shows the 49.9 Ohm terminating resistors necessary for the hybrid couplers ([HC125A's](#)). Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.



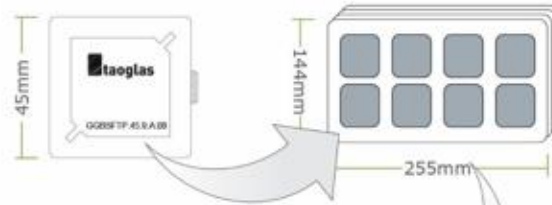
Top Side (HP24510A placement on 70x70mm PCB)



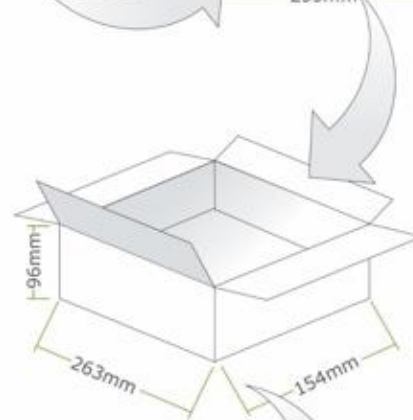
Bottom Side ([HC125A's](#) placement)

## 7. Packaging

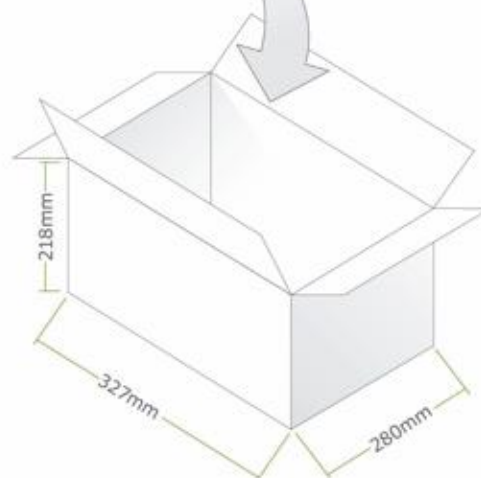
8pcs HP24510A Per Tray  
 Tray Dimensions – 255\*144\*12mm  
 Weight – 350g



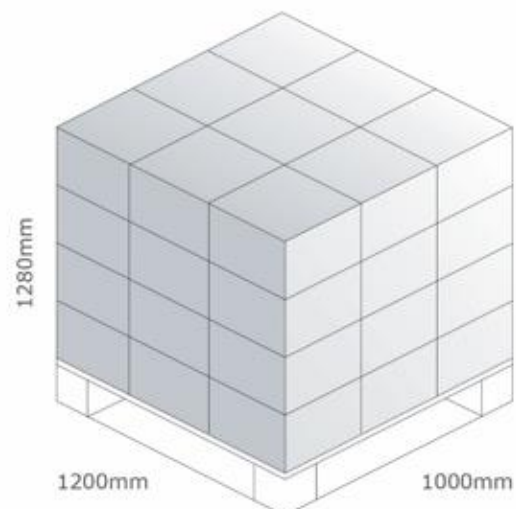
24pcs HP24510A Per S Carton  
 Carton Dimensions – 263\*154\*96mm  
 Weight – 1Kg



96pcs HP24510A Per Large Carton  
 Large Carton Dimensions – 327\*280\*218mm  
 Weight – 4Kg



Pallet Dimensions:  
 1200mm\*1000mm\*1280mm  
 36 Cartons Per Pallet  
 9 Cartons Per Layer, 4 Layers



Changelog for the datasheet

**SPE-22-8-183 – HP24510A**

**Revision: B (Current Version)**

|                  |   |
|------------------|---|
| Date:            | 2023-12-20                                |
| Changes:         | Updated datasheet to include 1207-1248MHz |
| Changes Made by: | Gary West                                 |

**Previous Revisions**

**Revision: A (Original First Release)**

|         |                 |
|---------|-----------------|
| Date:   | 2023-03-06      |
| Notes:  | Initial Release |
| Author: | Gary West       |

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