TAOGLAS



Datasheet

Part No:
HP53311.A

Description

High Precision GNSS L1/L5 Stacked Patch 33.0 x 33.0 x 11.0 mm

Features:

High Precision GNSS Stacked Patch Antenna
Covering: GNSS L1 (1559~1610MHz) / L5 (1164~1189MHz)
Dims: 33.0 x 33.0 x 11.0 mm
AEC-Q200 Compliance
RoHS & Reach Compliant

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1. Introduction



The **Taoglas HP53311.A** brings dual-band GNSS L1/L5 performance to a compact 33.0 × 33.0 × 11.0 mm stacked ceramic patch. It's **built for space-constrained positioning, navigation and timing applications**. The L1 and L5 elements are stacked vertically in one footprint, so you get dual-frequency GNSS without the size of a typical multiband antenna.

Both the L1 and L5 patches use a dual-feed architecture, with two feed pins per band. When they're combined through a hybrid coupler such as the Taoglas HC125A, these feeds produce high-purity RHCP with improved axial ratio and a highly stable phase centre. Dual-feed patches deliver this level of performance, which single-feed designs typically can't match. Simultaneous L1 and L5 reception improves positioning accuracy and multipath mitigation. This makes the HP53311.A a strong fit for high-precision designs where board space is tight but GNSS performance can't be compromised.

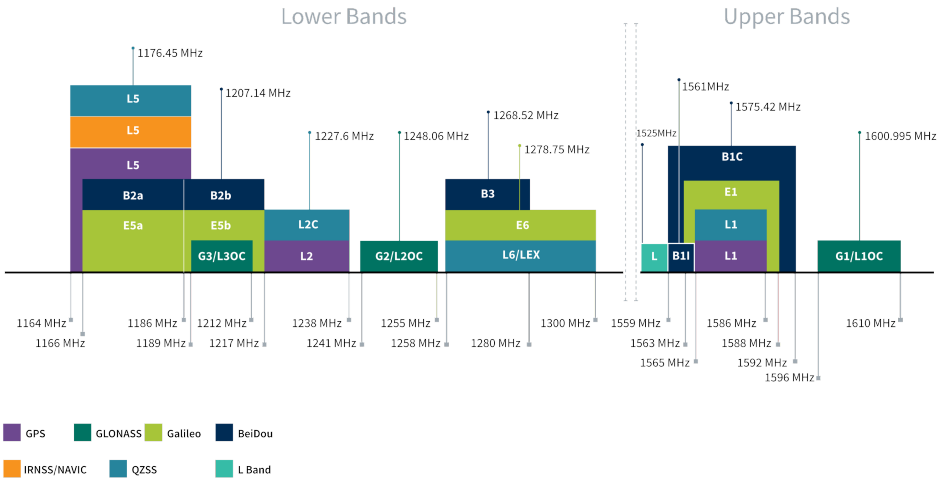
Typical Applications Include:

- Automotive telematics and lane-level navigation
- Autonomous vehicles and ADAS
- UAVs and UGV's navigation
- Micromobility (e-scooters, e-bikes)
- Delivery robots and robotic lawn mowers
- Precision agriculture
- Handheld GIS and mapping devices
- Timing and synchronization systems
- Fleet management and high-accuracy asset tracking

The HP53311.A is ideal for compact devices that need dual-frequency L1/L5 integration, and it is manufactured with AEC-Q200 compliant materials. For integration support or to discuss your application requirements, please contact your regional Taoglas customer support team.

2. Specification

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



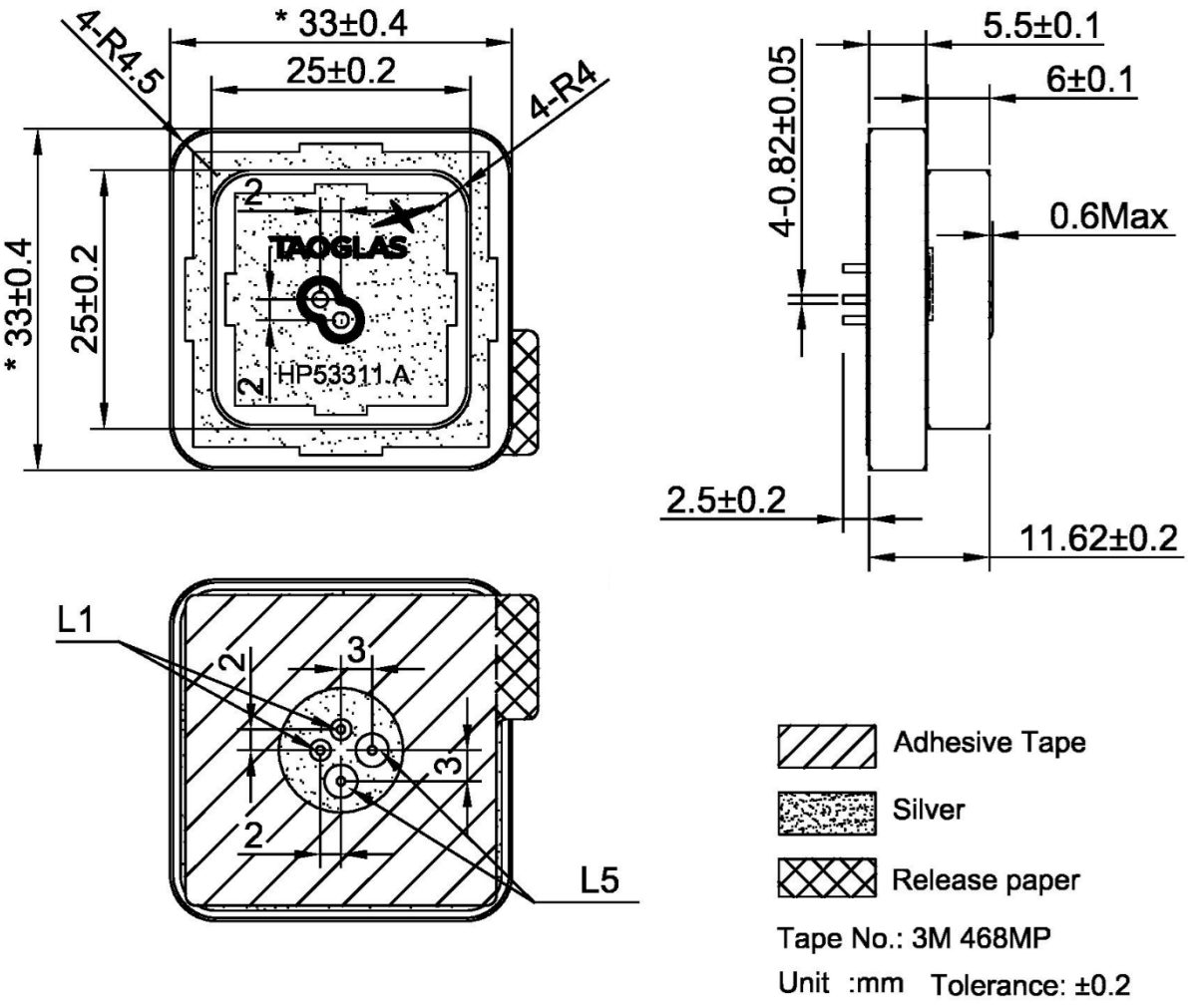
GNSS Bands and Constellations

GNSS Electrical				
Frequency (MHz)	**1176.45**	**1561**	**1575.42**	**1602**
VSWR (max.)	< 2:1	< 2:1	< 2:1	< 2:1
Efficiency (%)	47.5	66.2	78.0	62.2
Average Gain (dB)	-3.23	-1.79	-1.08	-2.06
Peak Gain (dBi)	2.23	4.18	4.82	4.33
Axial Ratio (dB)	4.22	2.56	2.40	3.71
PCO_x (cm)	1.96	2.71	2.66	2.54
PCO_y (cm)	2.02	2.02	1.94	1.85
PCV (cm)	0.03	0.01	0.01	0.01
Polarization	RHCP			
Impedance	50 Ω			
Testing completed on a 70.0 x 70.0mm Ground Plane				

Mechanical	
Dimensions	33.0 mm x 33.0 mm x 11 mm
Weight	36.2g
Material	Ceramic

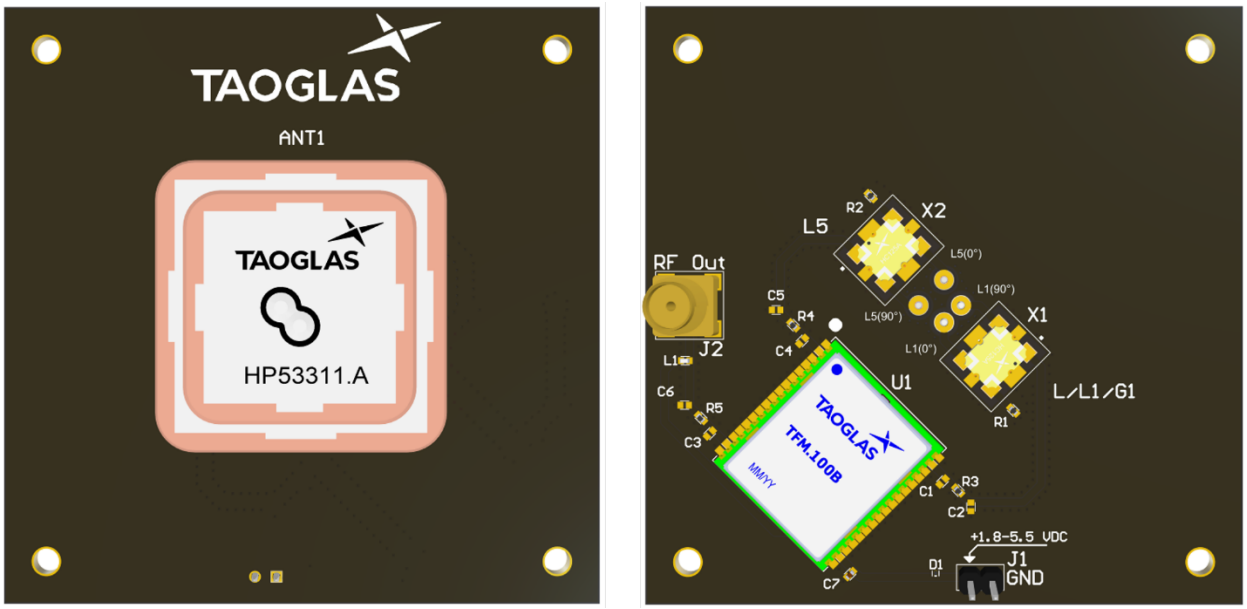
Environmental	
Operation Temperature	-40°C to 105°C
Storage Temperature	-40°C to 105°C
Relative Humidity	Non-condensing 65°C 95% RH
AEC-Q200 Compliance	

3. Mechanical Drawing



4. Integration Guide

The following is an example on how to integrate the HP53311.A into a design. This antenna has four pins, two pins are used for the L1 band, and two pins are used for the L5 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.

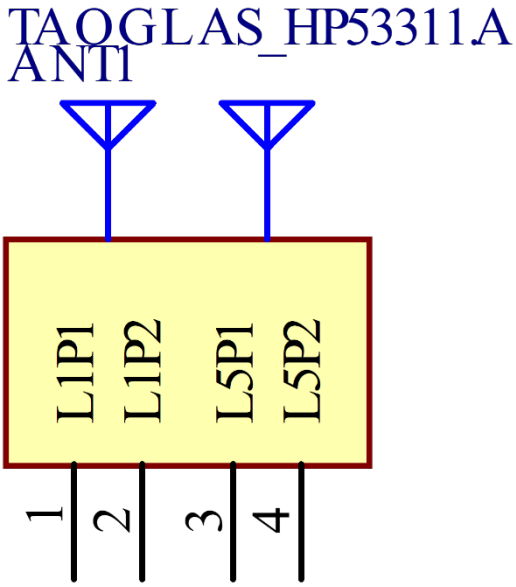


Top and Bottom view of PCB reference design.

Note: For the HP53311.A Altium, 2D formats and the 3D model Integration files, please visit the product page on www.taoglas.com.

4.1 Schematic and Symbol Definition

The circuit symbol and pin definitions for the HP53311.A is shown below. The antenna has 4 pins as indicated below.

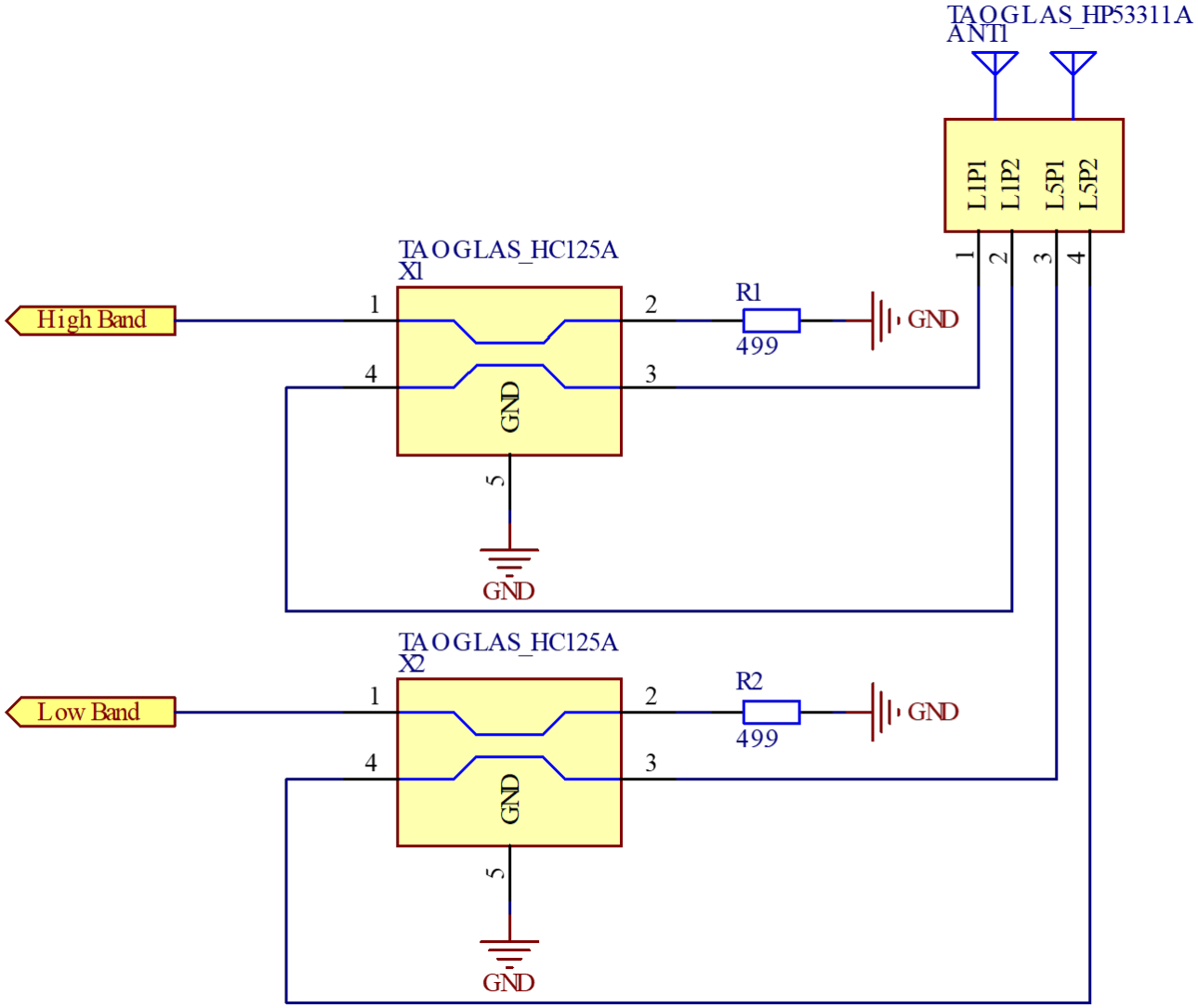


Pin	Description
1	L1 (0°)
2	L1 (90°)
3	L5 (0°)
4	L5 (90°)

4.2 Schematic Layout

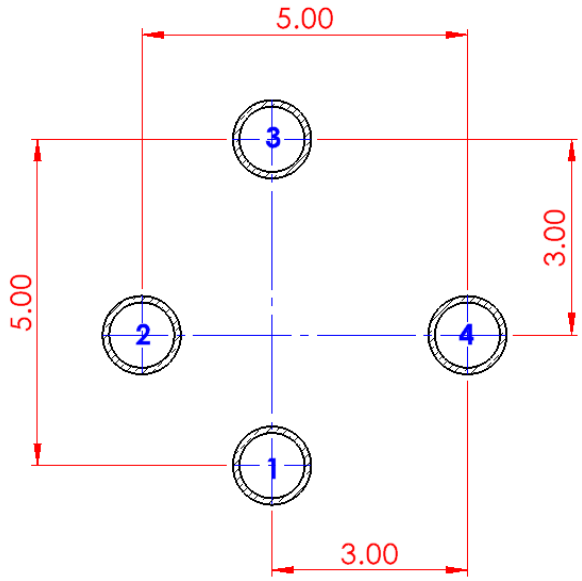
The HP53311.A uses two orthogonal feeds that need to be combined in a hybrid coupler to ensure optimal axial ratio and RHCP Gain is achieved. Taoglas recommends our HC125A, a high-performance hybrid coupler specifically engineered for use with our multi feed patches.

Two HC125A's are required for this GNSS antenna, one for the high band (1559- 1610MHz) and another for the low band (1164MHz – 1189MHz). 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)

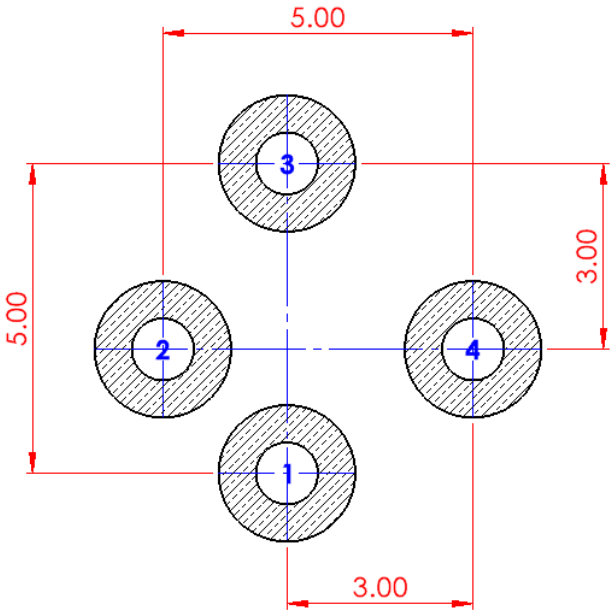


Designator	Type	Value	Manufacturer	Manufacturer Part Number
R1,R2	Resistor	49.9 Ohms	Panasonic	ERJ-2RKF49R9X

4.3 Antenna Footprint



Top



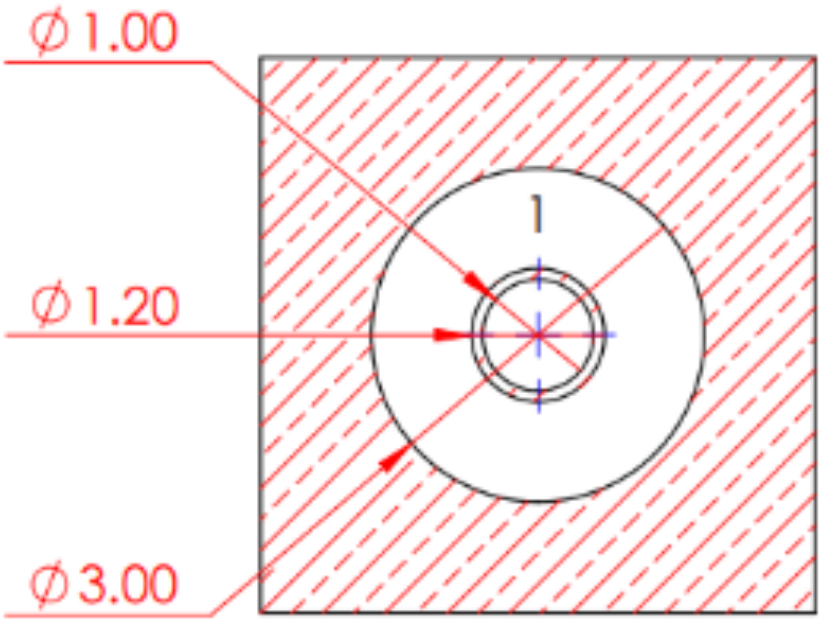
Bottom

Pin	Description
1	L1 (0˚)
2	L1 (90˚)
3	L5 (0˚)
4	L5 (90˚)

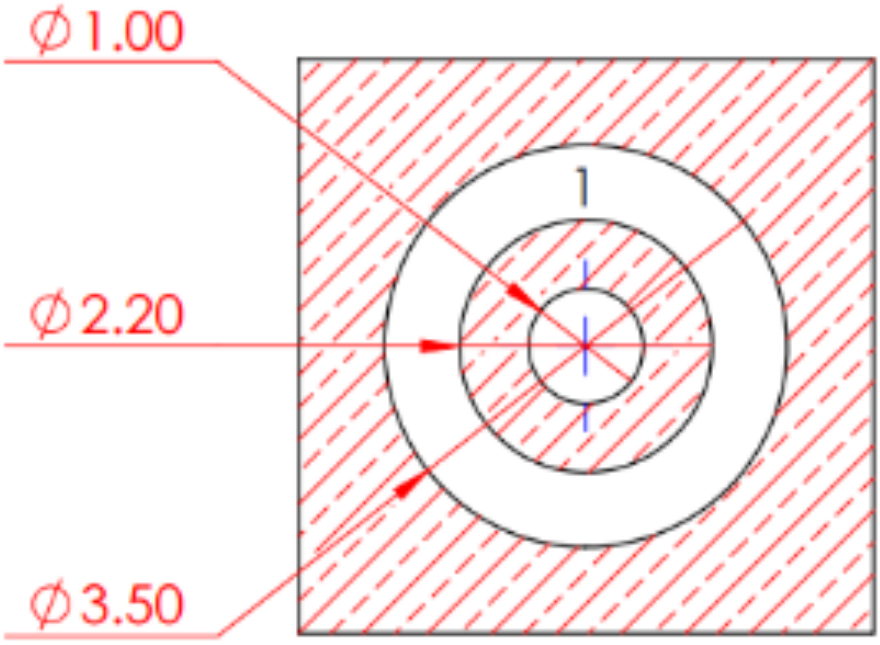
4.4 Copper Clearance

The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the HP53311.A clearance area for Pin 1 (L1P1(0˚) Pad), Pin 2 (L1P2(90˚) Pad), Pin 3 (L5P1(0˚) Pad) and Pin 4 (L5P2(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 Ø3mm copper clearance around the antenna pins on the top side of the PCB with a Ø3.5mm copper clearance around the antenna pins on the bottom side.



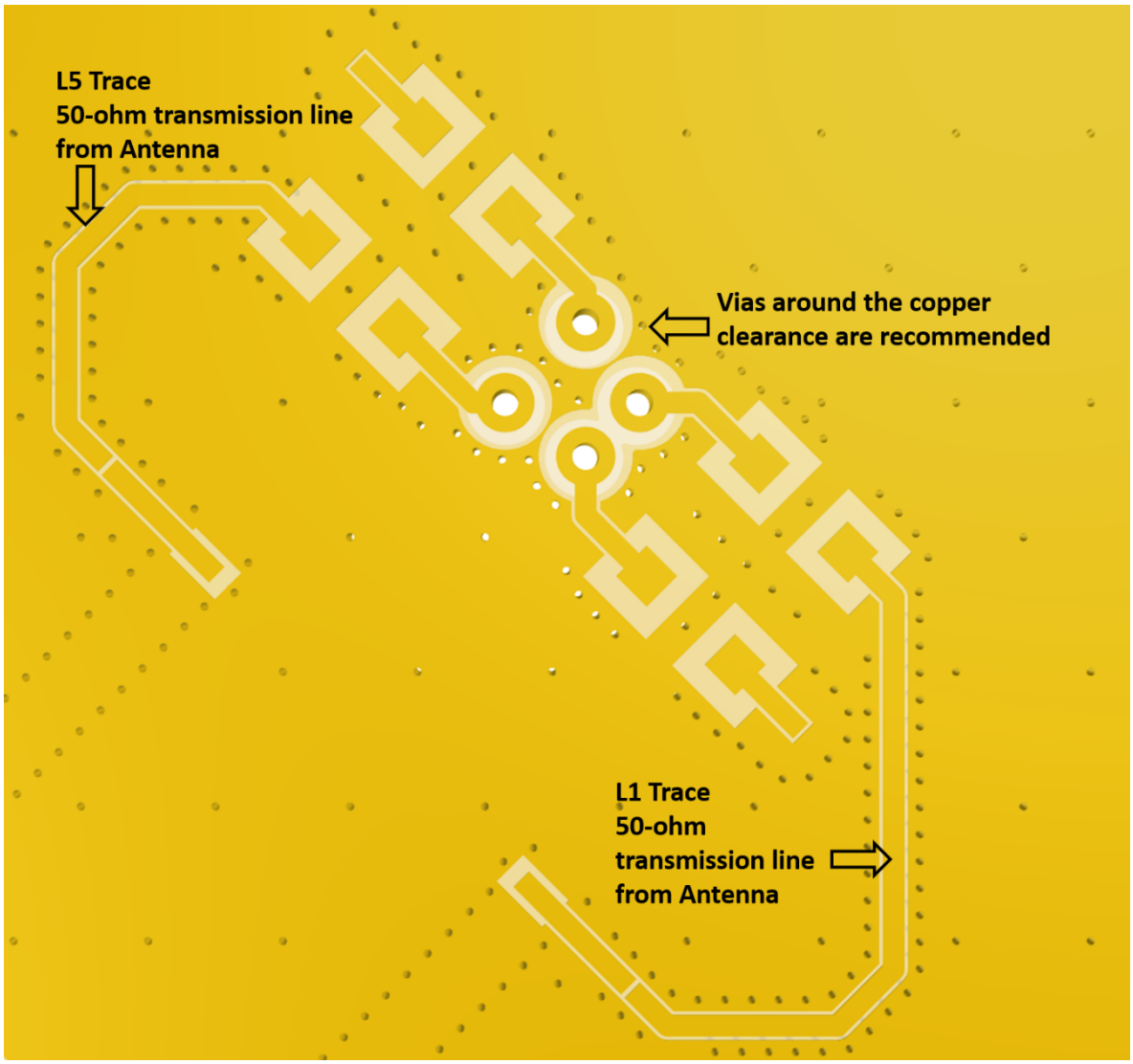
Top



Bottom

4.5 Antenna Integration

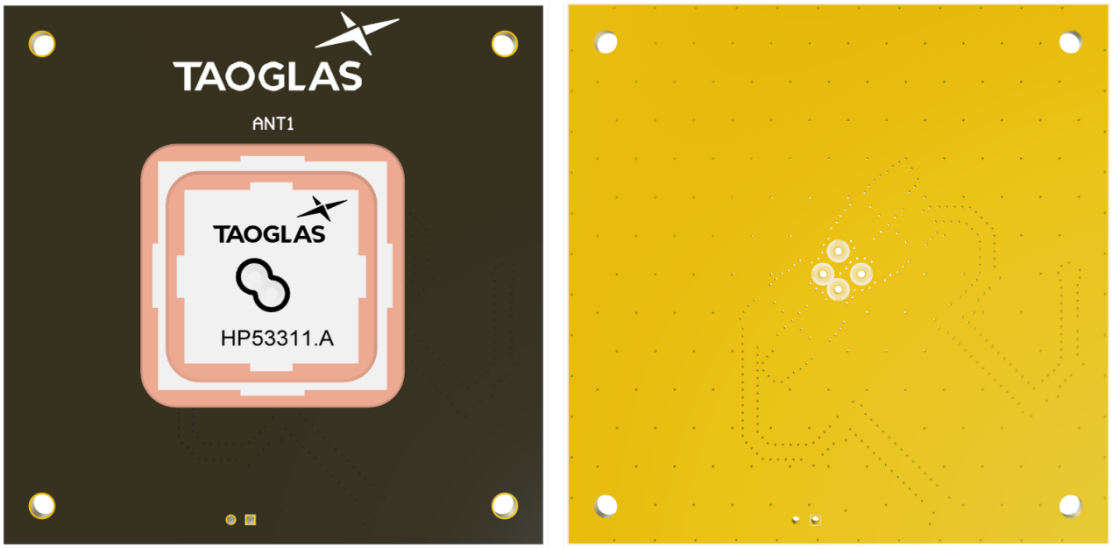
The HP53311.A should be placed in the centre of the PCB to take advantage of the ground plane. The RF traces must maintain a 50 Ohm transmission line. Ground vias should be placed around the copper clearance area.



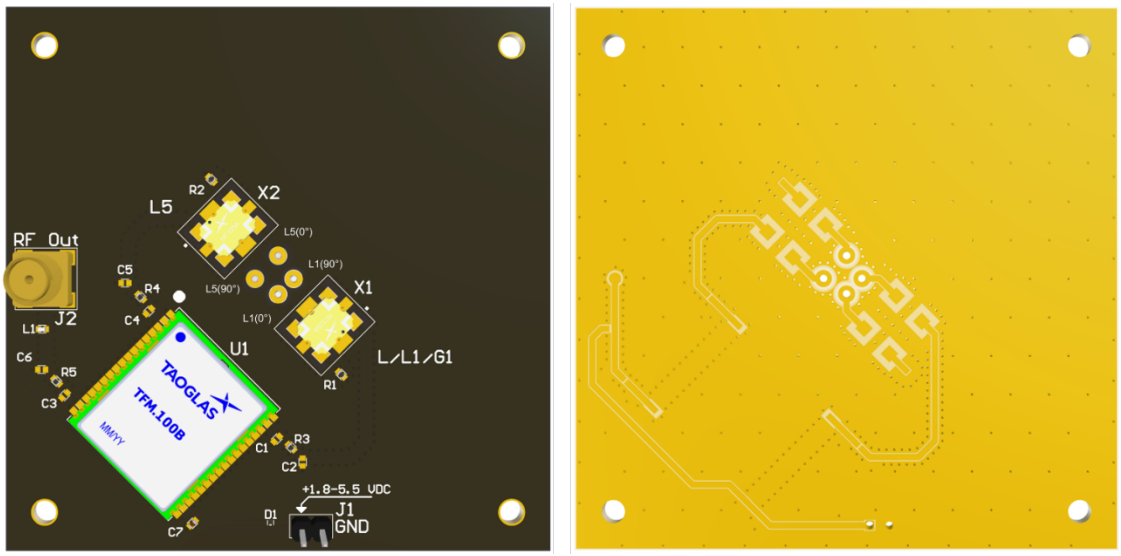
Bottom view of the PCB reference design, showing transmission lines and integration notes

4.6 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 (70x70mm PCB reference design)

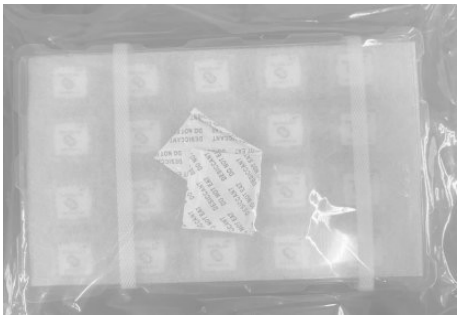


Bottom Side

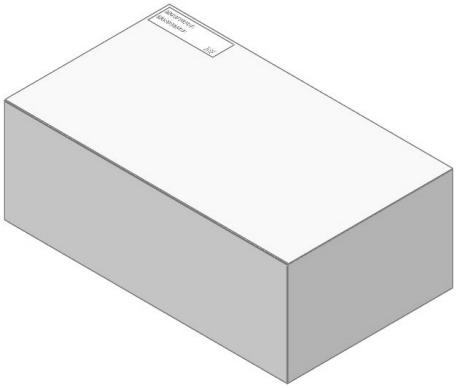
5. Packaging



- ☑ 20 PCS / Tray
- ☑ Tray (mm): 250 x 170 x 17



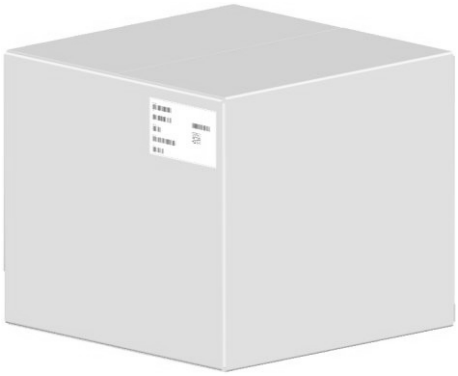
- ☑ 60 PCS / Vacuum package
- ☑ Vacuum bag (mm): 410 x 210
- ☑ 2 PCS / Desiccant



- ☑ 60 PCS / Box
- ☑ Box (mm): 280 x 187 x 70
- ☑ Weight (Kg): 2.47 ±3%

weight without packaging (g): 36.2 ±3%

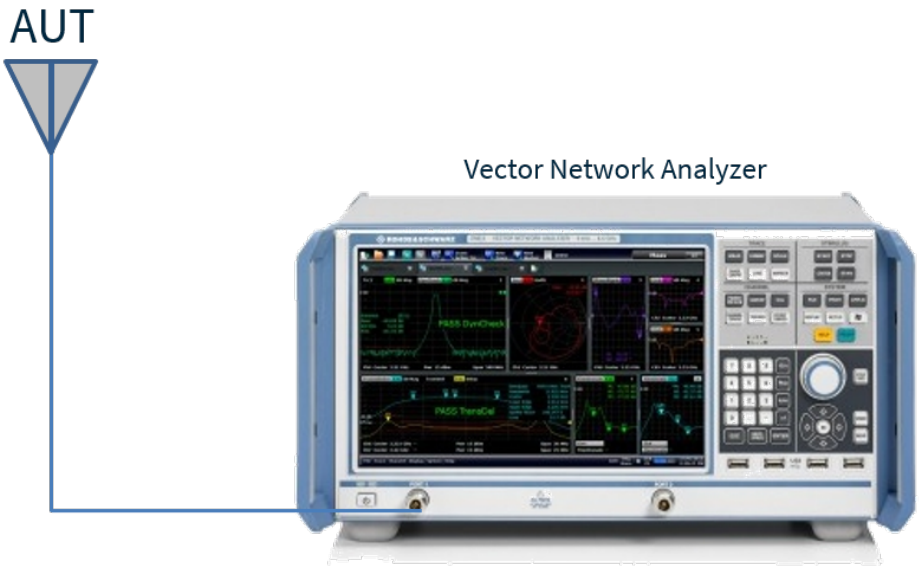
- ☑ SPQ Label

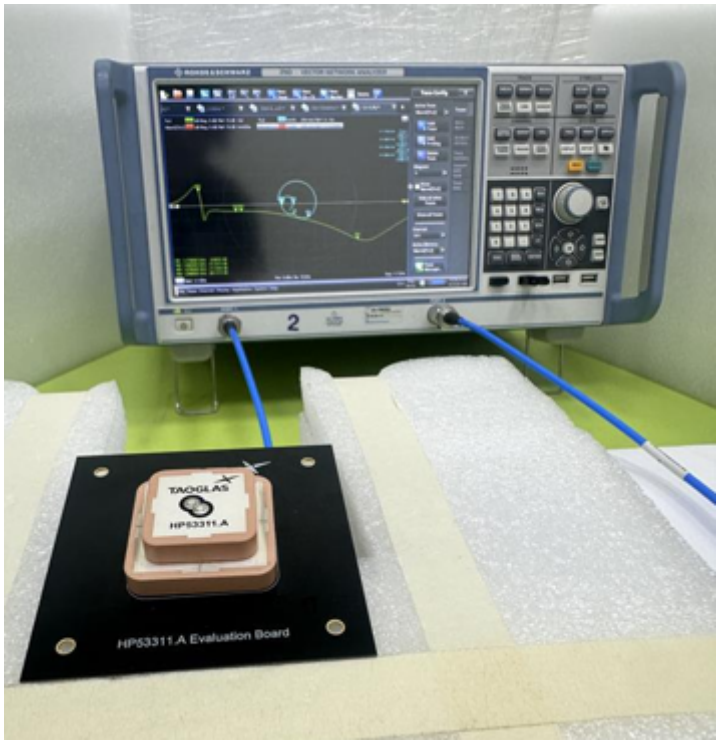


- ☑ 240 PCS / Carton
- ☑ Carton(mm): 405 x 293 x 185
- ☑ Weight (Kg): 10.44 ±3%
- ☑ Carton Label

6. Antenna Characteristics

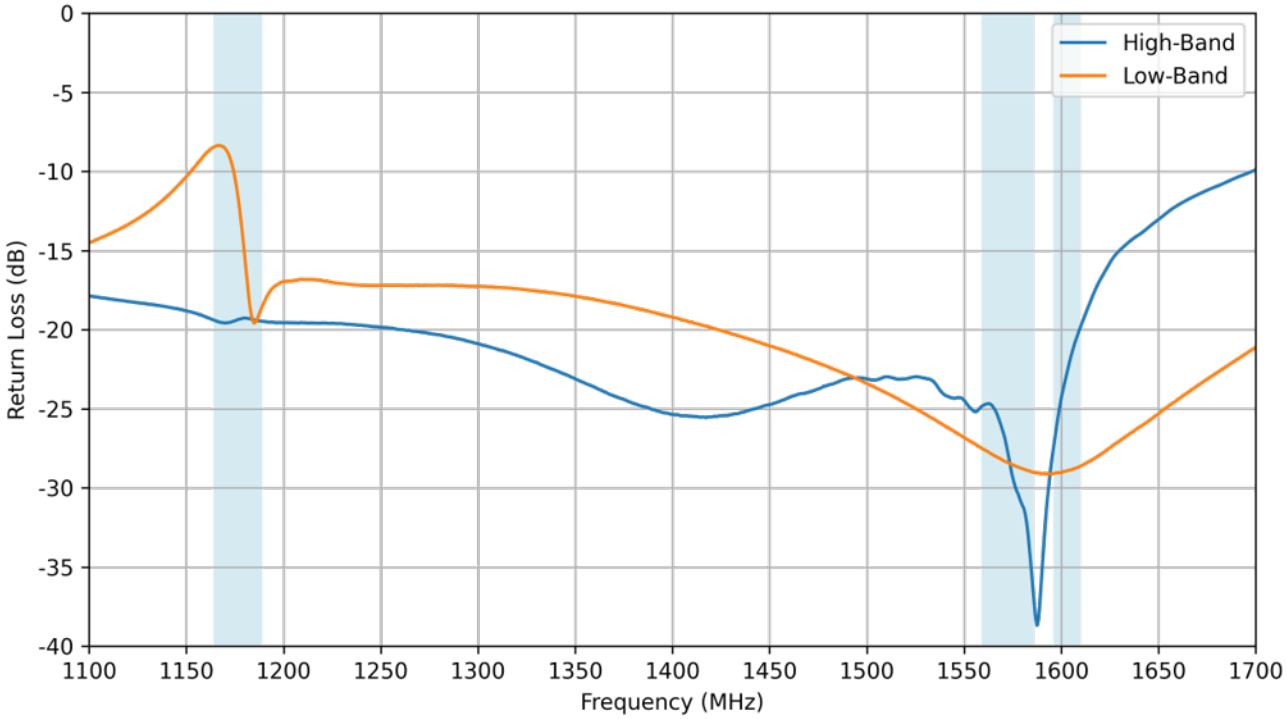
6.1 Test Setup



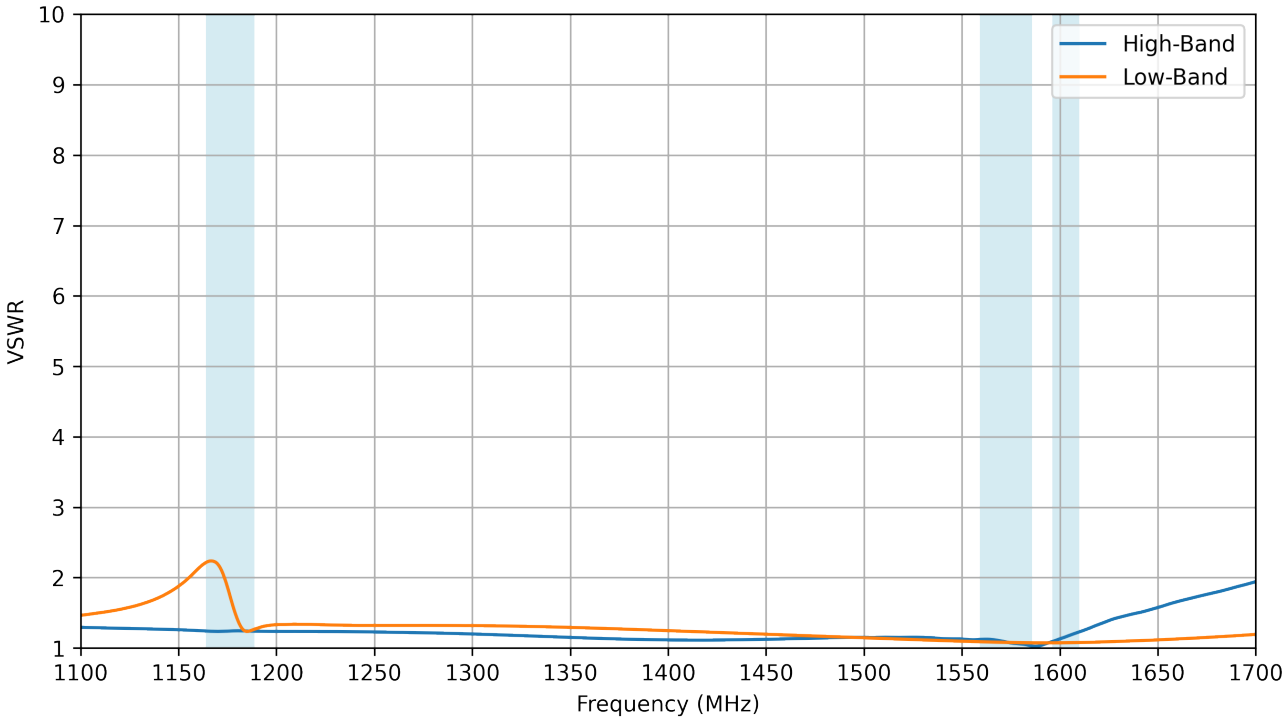


VNA Test Set-up

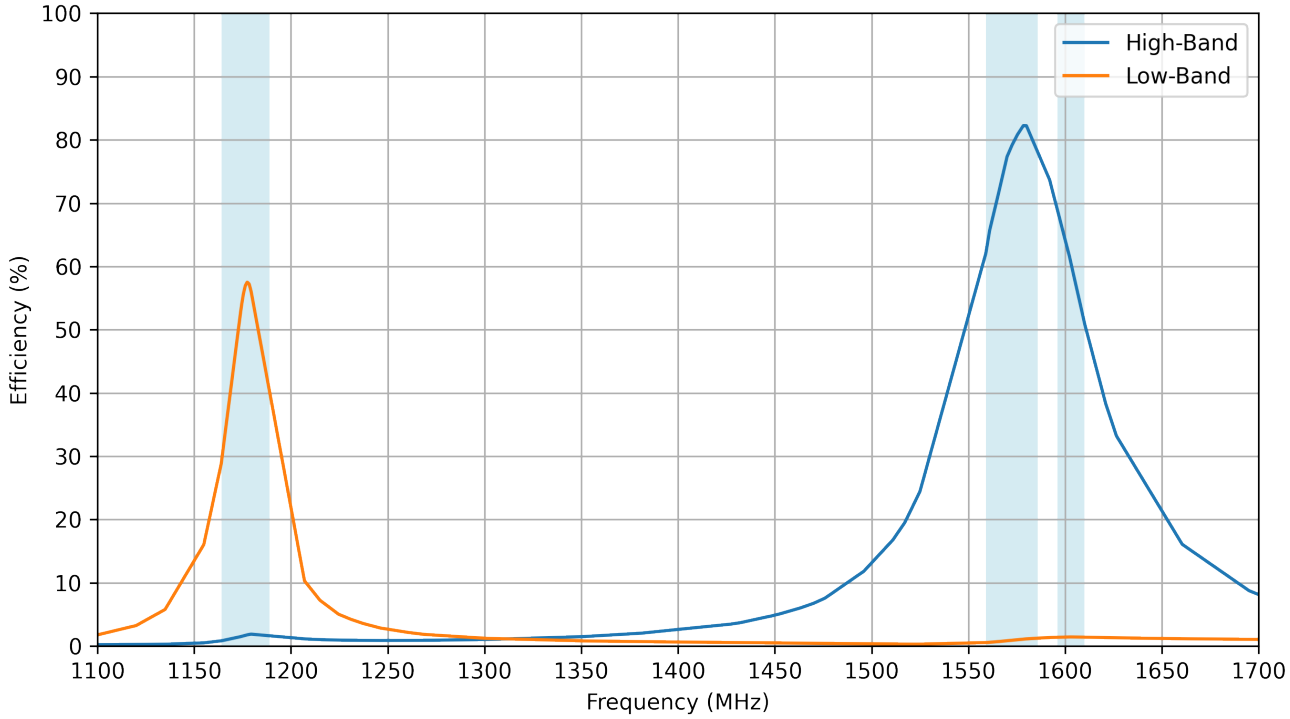
6.2 Return Loss



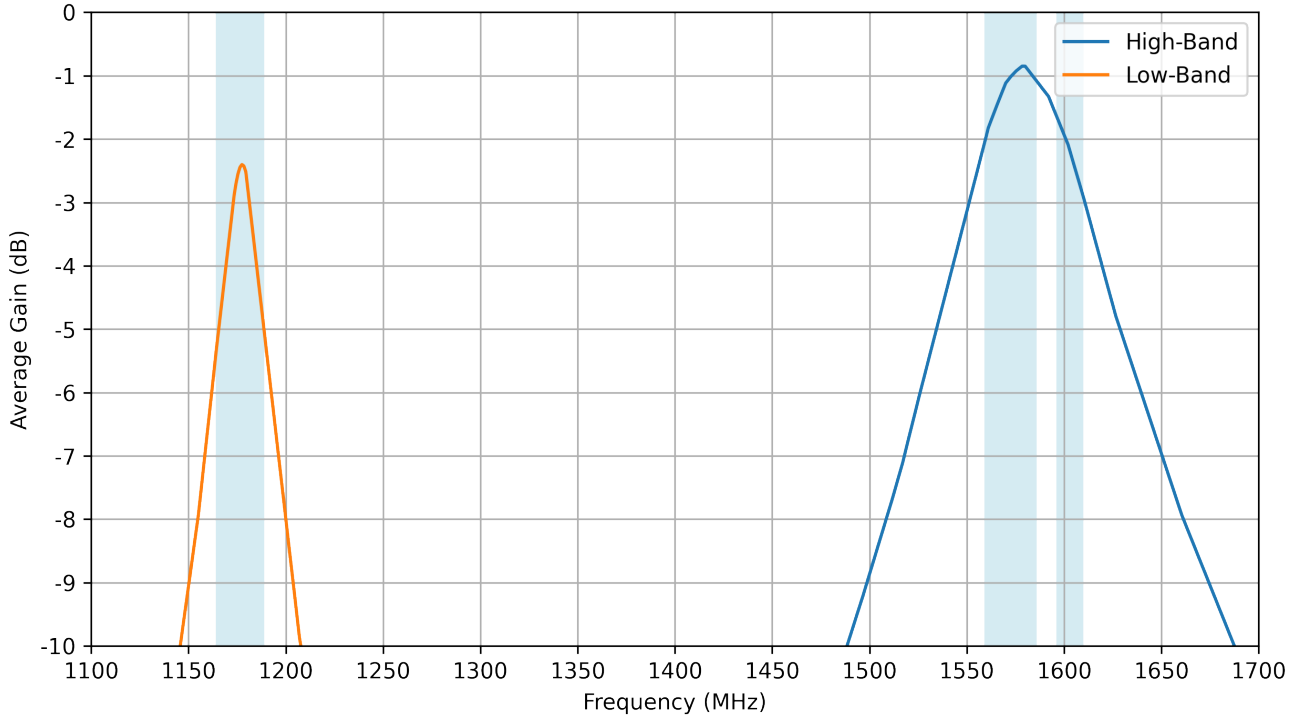
6.3 VSWR



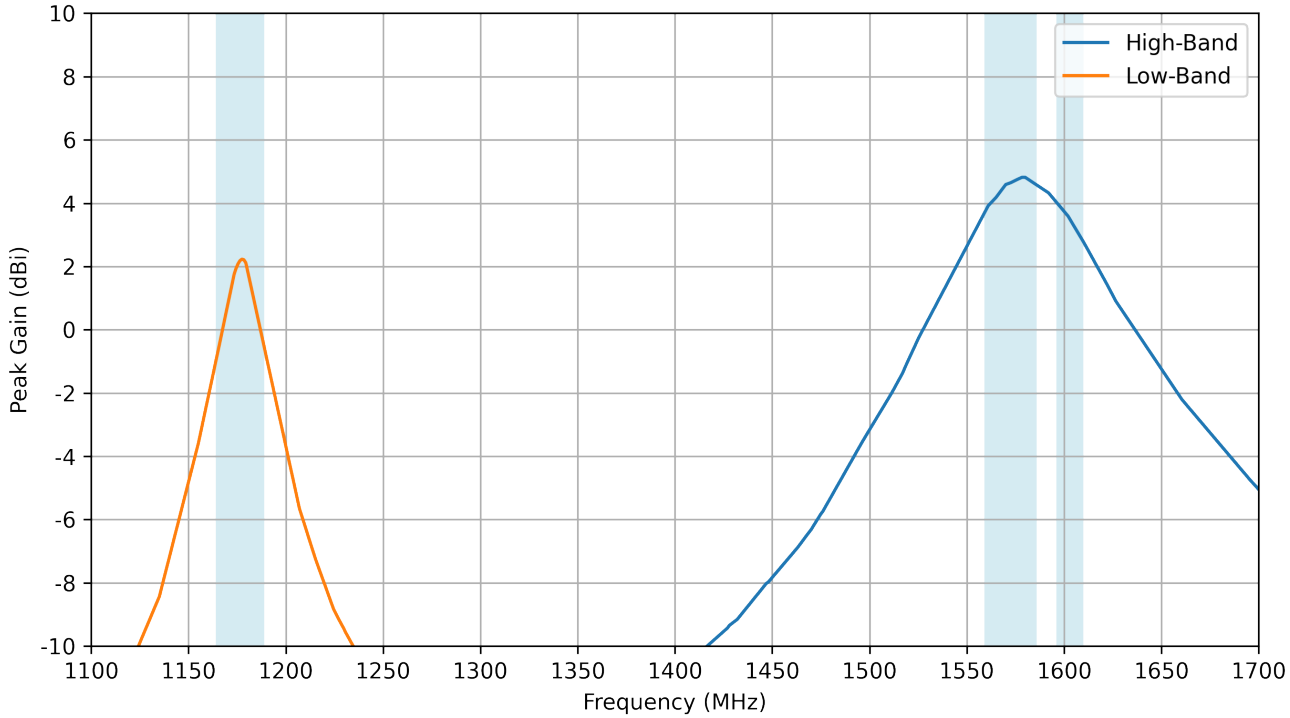
6.4 Efficiency



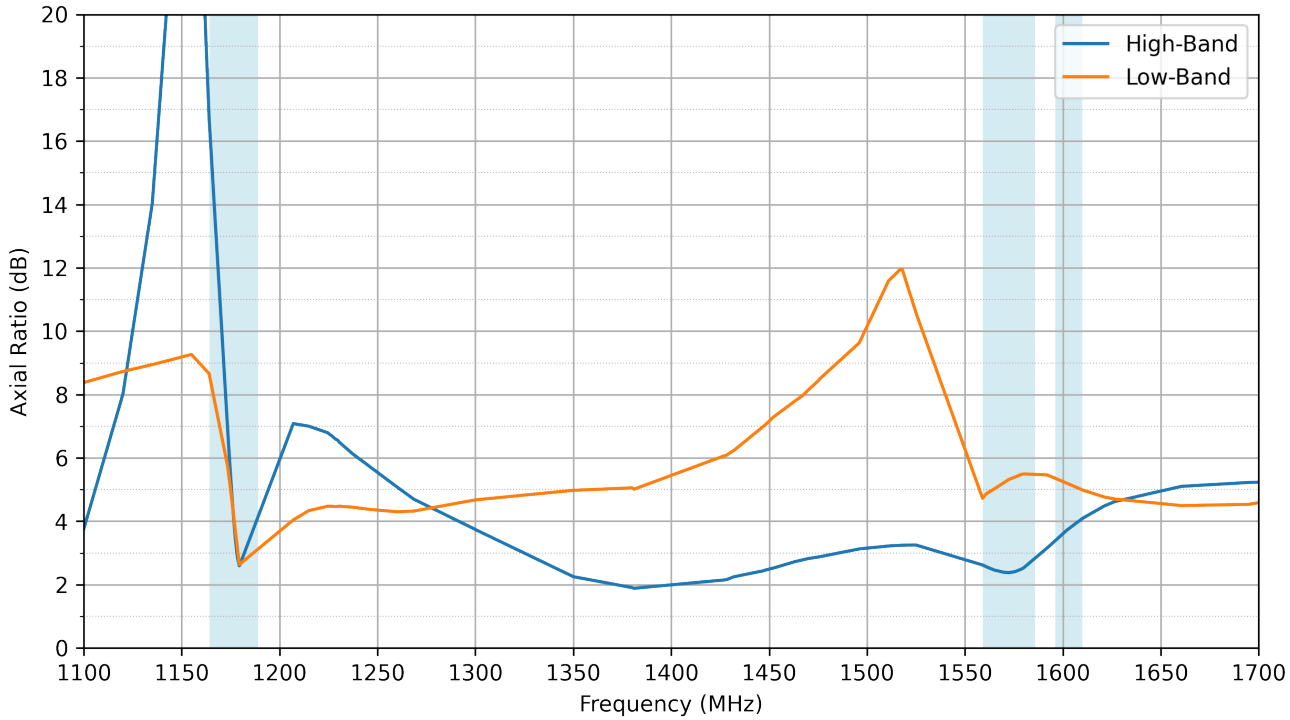
6.5 Average Gain



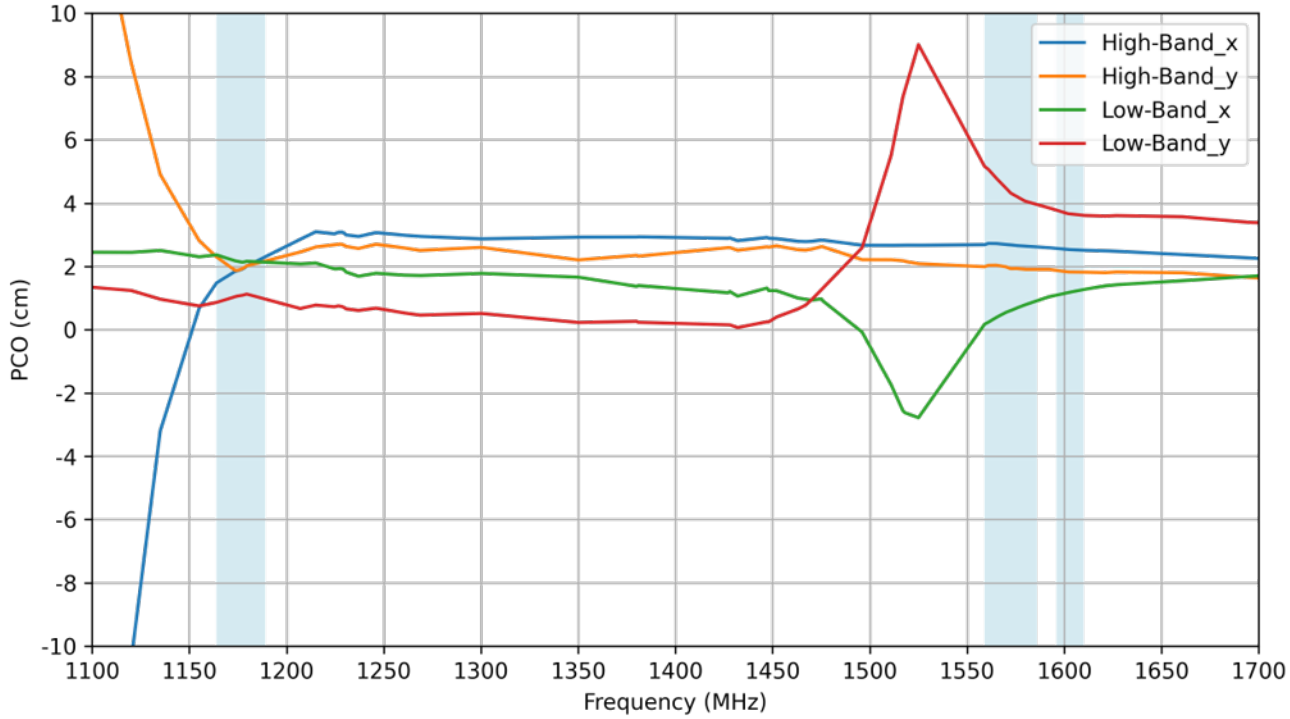
6.6 Peak Gain



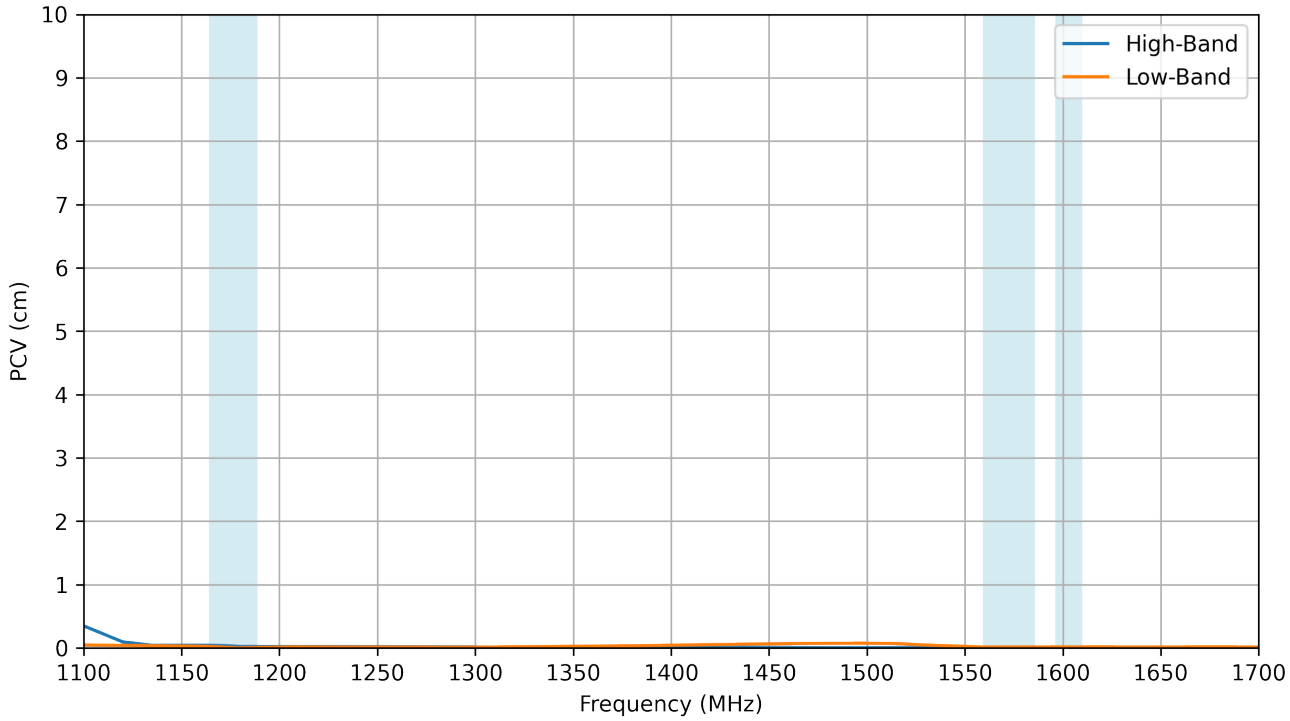
6.7 Axial Ratio



6.8 PCO

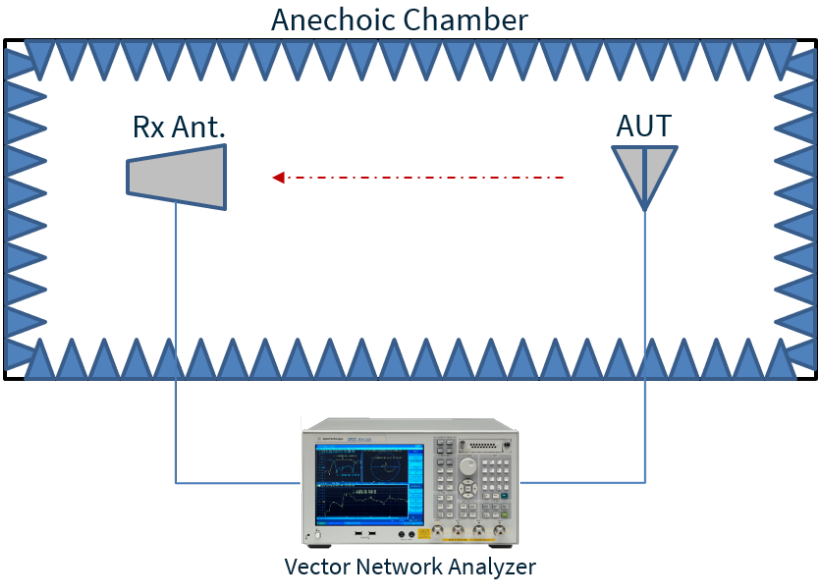

High-Band_x
High-Band_y
Low-Band_x
Low-Band_y
PCO (cm)
Frequency (MHz)
10
8
6
4
2
0
-2
-4
-6
-8
-10
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700

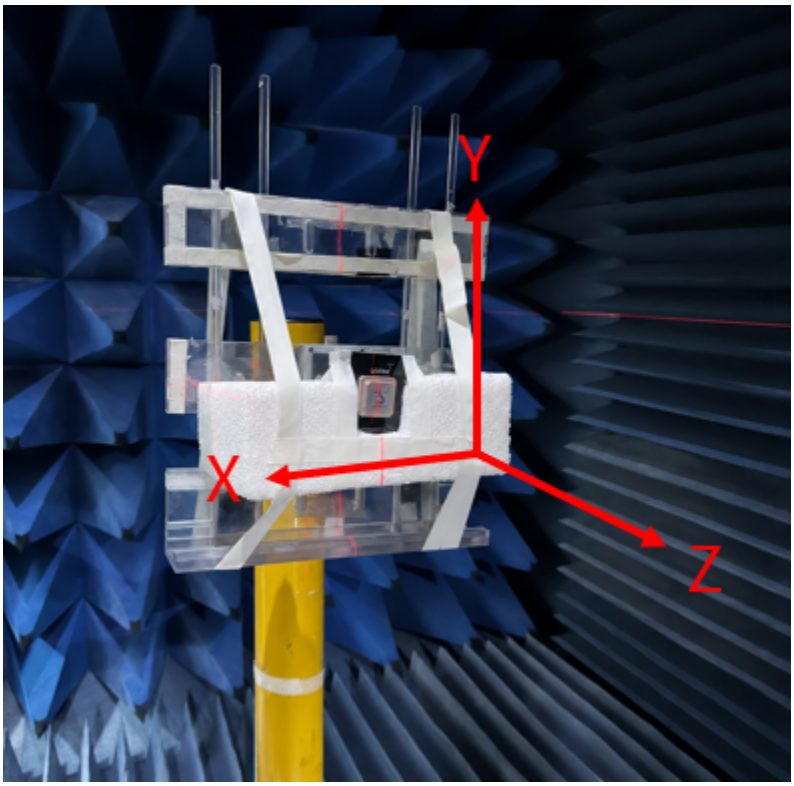
6.9 PCV


High-Band
Low-Band
PCV (cm)
Frequency (MHz)
10
9
8
7
6
5
4
3
2
1
0
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700

7. Radiation Patterns

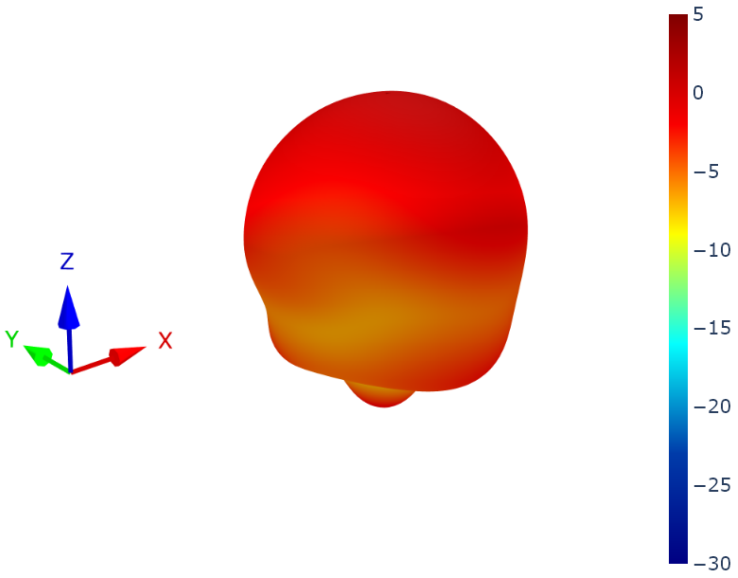
7.1 Test Setup



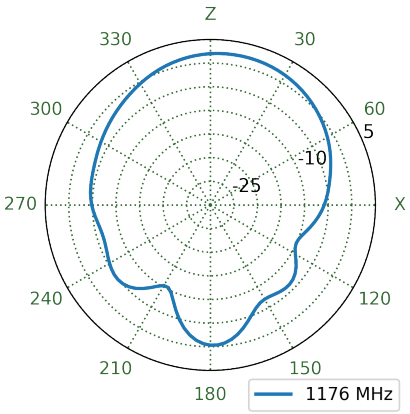


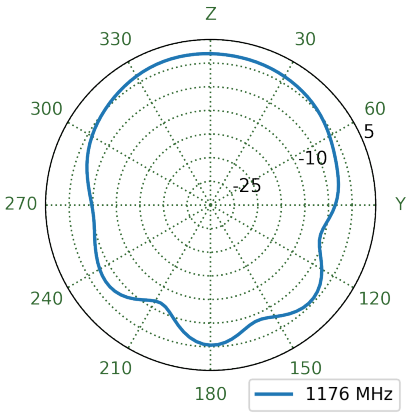
Chamber Test Set-up

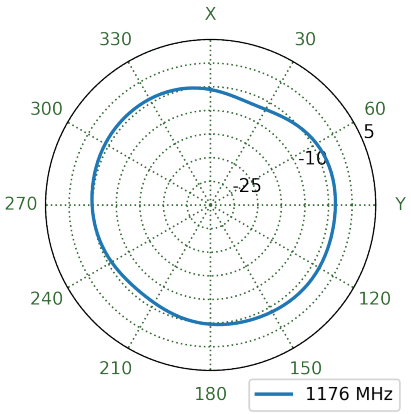
7.2 Patterns at 1176 MHz



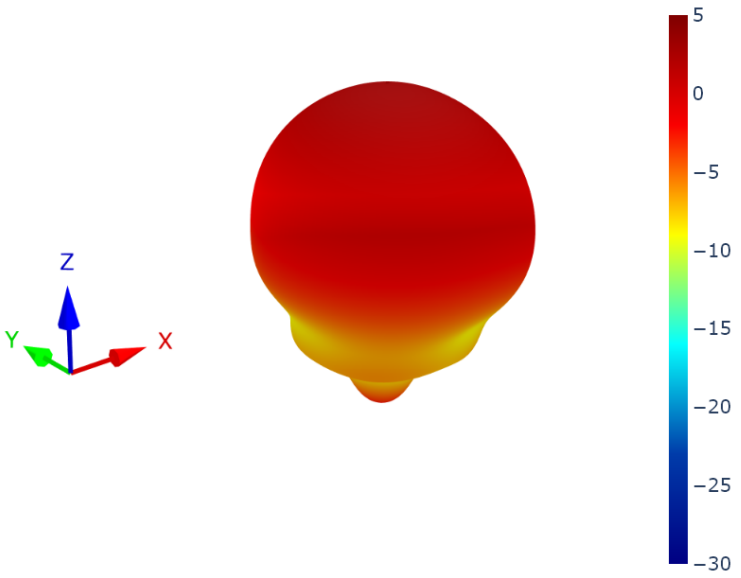
XZ Plane	YZ Plane	XY Plane



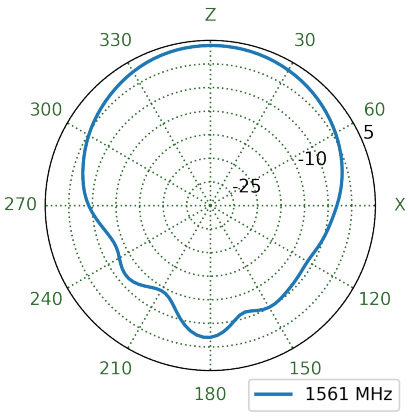




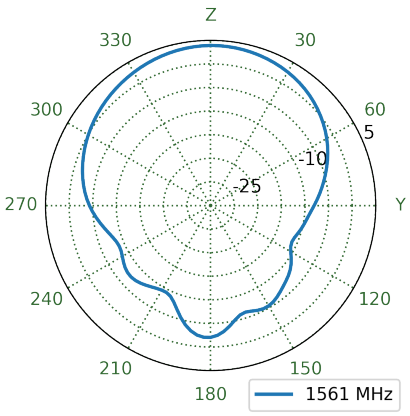
7.3 Patterns at 1561 MHz



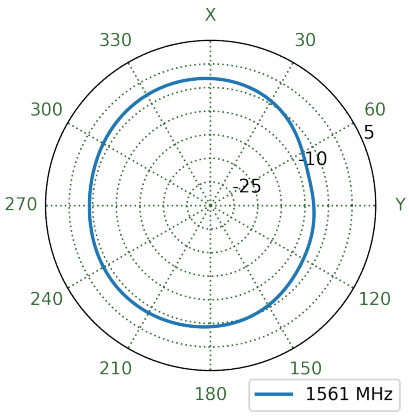
XZ Plane



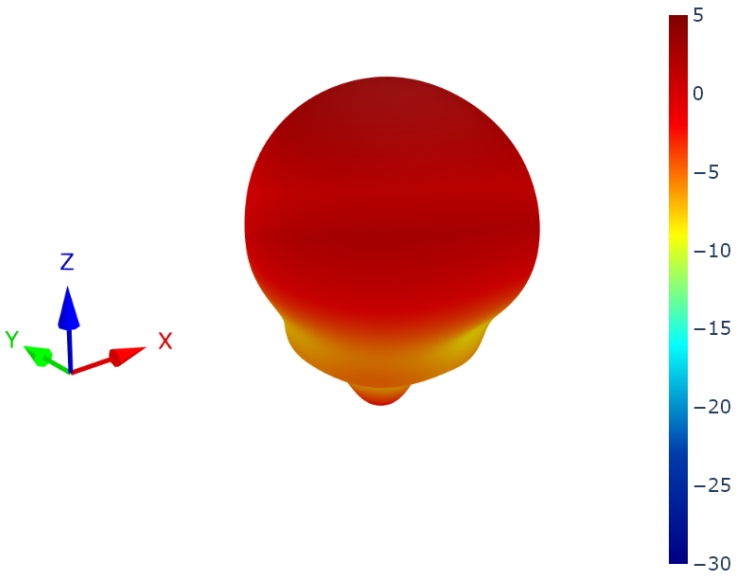
YZ Plane

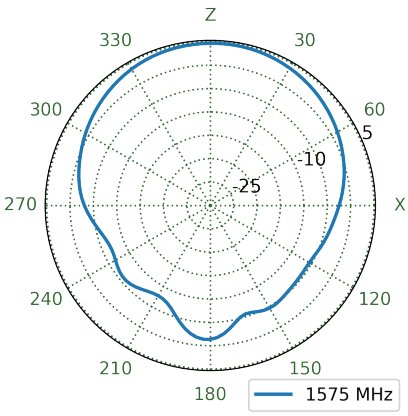
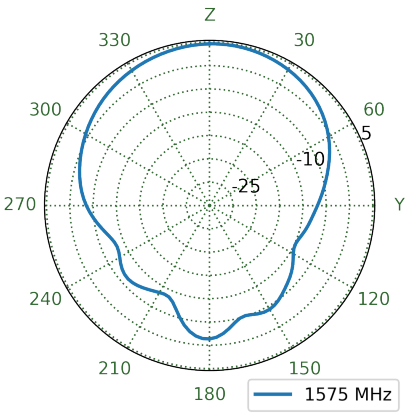
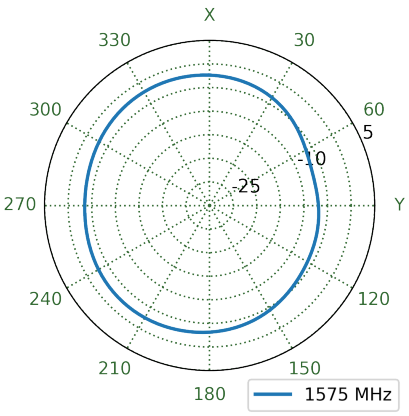


XY Plane

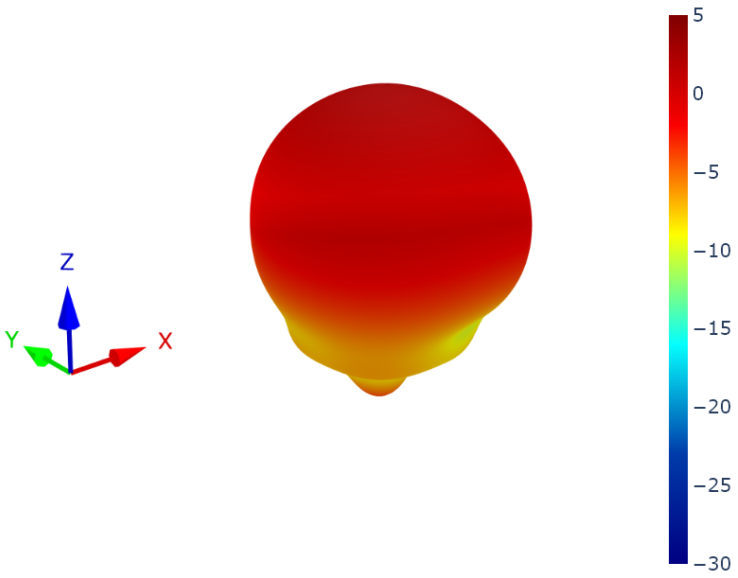


7.4 Patterns at 1575 MHz

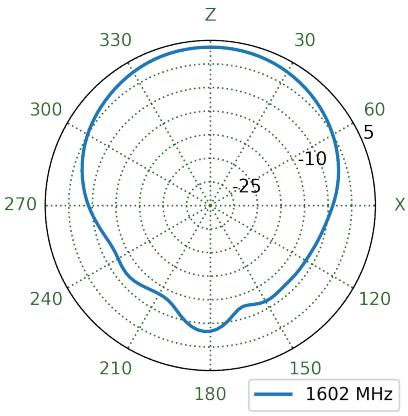


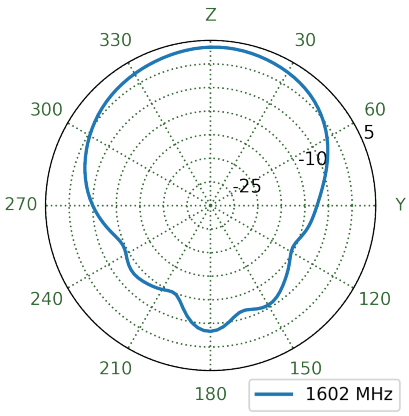
XZ Plane	YZ Plane	XY Plane
		

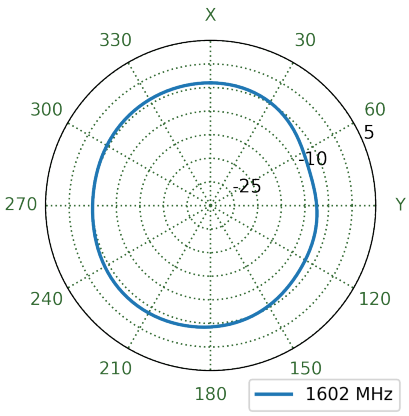
7.5 Patterns at 1602 MHz



XZ Plane	YZ Plane	XY Plane







Changelog for the datasheet

SPE-26-8-187 – HP53311.A

Revision: A (Initial Release)	
Date:	2026-08-21
Changes:	Initial Release
Changes Made by:	Gary West

Previous Revisions

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