Datasheet

Inception Series

Part No:
HP2356.A

Description

Inception Series Low Profile High Precision GNSS L1/L2 Passive Patch Antenna

Features:

Compact, 6mm thick Innovative 'patch within a patch' design
Bands Covered:
- BeiDou (B1I)
- GPS/QZSS (L1/L2)
- Galileo E5b
- GLONASS (G1)

Dual Feed SDM Configuration
Dimensions: 35mm x 35mm x 6mm
RoHS & Reach Compliant

1. Introduction

The Taoglas Inception Series HP2356.A, is a multi-band GNSS passive patch antenna designed for optimum positional accuracy and positioning. It utilizes an innovative ceramic patch within a patch antenna design with optimized gain for GPS L1/L2, Galileo, GLONASS and BeiDou bands and measures just 35*35*6mm. This ground-breaking design allows customers to integrate a multi-band L1/L2 GNSS patch into devices where this would not have been possible before due to height constraints. At only 6mm in height, the HP2356,A can be used in a variety of applications where typical stacked patch designs are too tall for the device.

Typical Applications Include:

- Wearables
- Navigation
- Compact Asset Trackers
- Industrial Tracking
- Precision Agriculture
- Autonomous Vehicles & Robotics

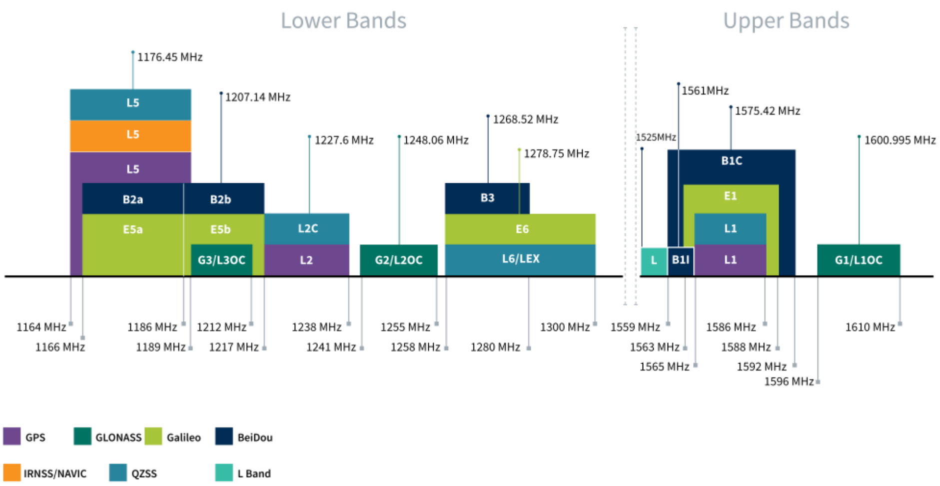
The HP2356.A has been tuned and tested on a 70 x 70mm ground plane and exhibits excellent radiation patterns. It is optimized to cover the bands required for the next generation of L1/L2 Multiband GNSS receivers that are currently available on the market.

If you require an easy to integrate active electronic circuit for the HP2356.A, the Taoglas TFM.100A can be designed onto the device PCB alongside the antenna. The module features a SAW/LNA/SAW/LNA topology in both the low and high band signal paths to prevent unwanted out-of-band interference from overdriving the GNSS LNAs or receiver. The SAW filters have been carefully selected and placed to provide excellent out-of band rejection while also maintaining low noise figure. Care should be taken when integrating this antenna into a customer device.

Patch antennas can be specifically tuned to customer-specific device environments, subject to NRE and MOQ. Contact your regional Taoglas customer support team to request these services or additional support to integrate and test this antenna's performance in your device.

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 1207 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
	■	□	■	□	□



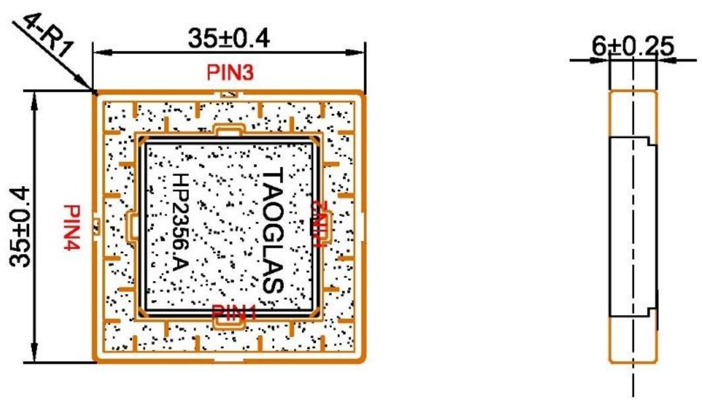
GNSS Bands and Constellations

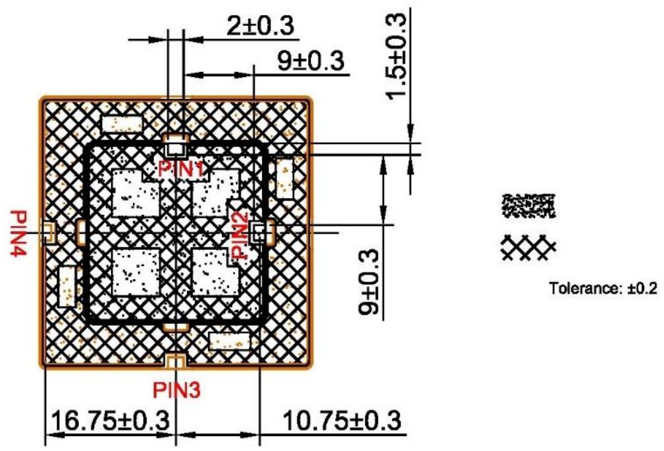
GNSS Electrical					
Frequency (MHz)	**1207**	**1227.6**	**1561**	**1575.42**	**1603**
VSWR (max.)	1.5:1	1.5:1	1.5:1	1.5:1	1.5:1
Efficiency (%)	15	36.5	24.9	55.2	26.0
Average Gain (dB)	-8.32	-4.38	-6.03	-2.58	-5.84
Peak Gain (dBi)	-2.69	1.25	-1.80	1.60	-1.6
Axial Ratio (dB)	2.07	3.34	2.59	2.86	1.77
Polarization	RHCP				
Impedance	50 Ω				

Mechanical	
Dimensions	35 x 35 x 6mm
Weight	30g
Material	Ceramic

Environmental	
Operation Temperature	-40 - +85°C
Storage Temperature	-40 - +85°C
Humidity	Non-condensing 65°C 95% RH
Moisture Sensitivity Level (MSL)	3

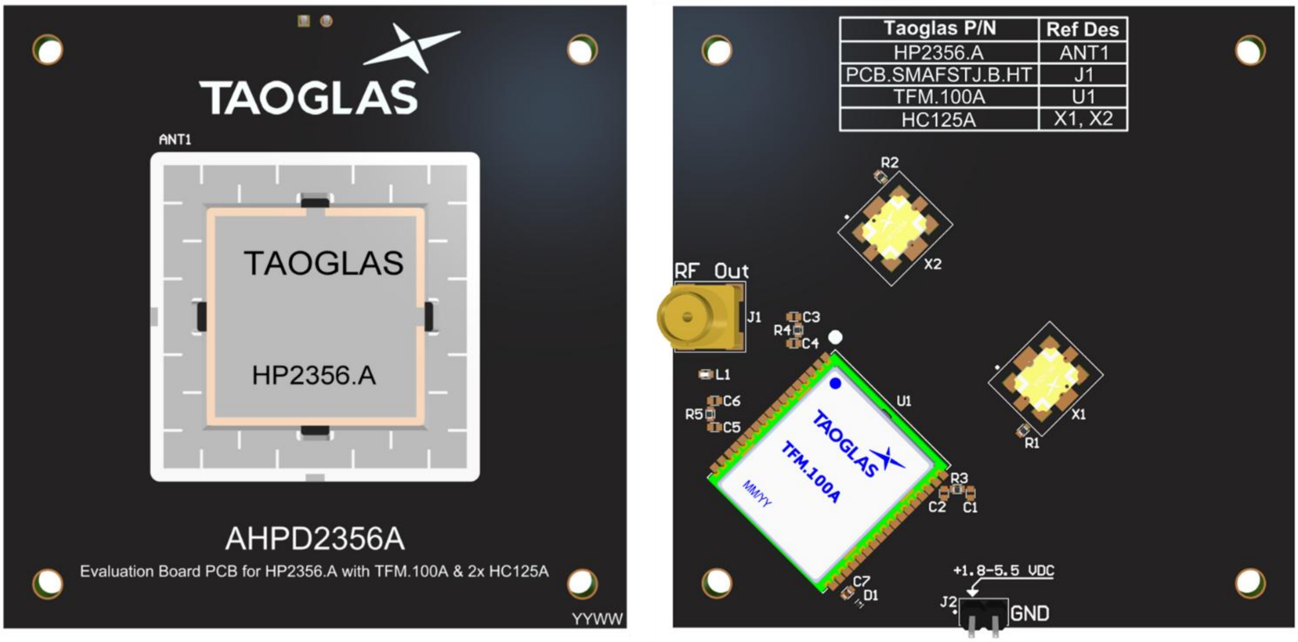
3. Mechanical Drawing





4. Antenna Integration Guide

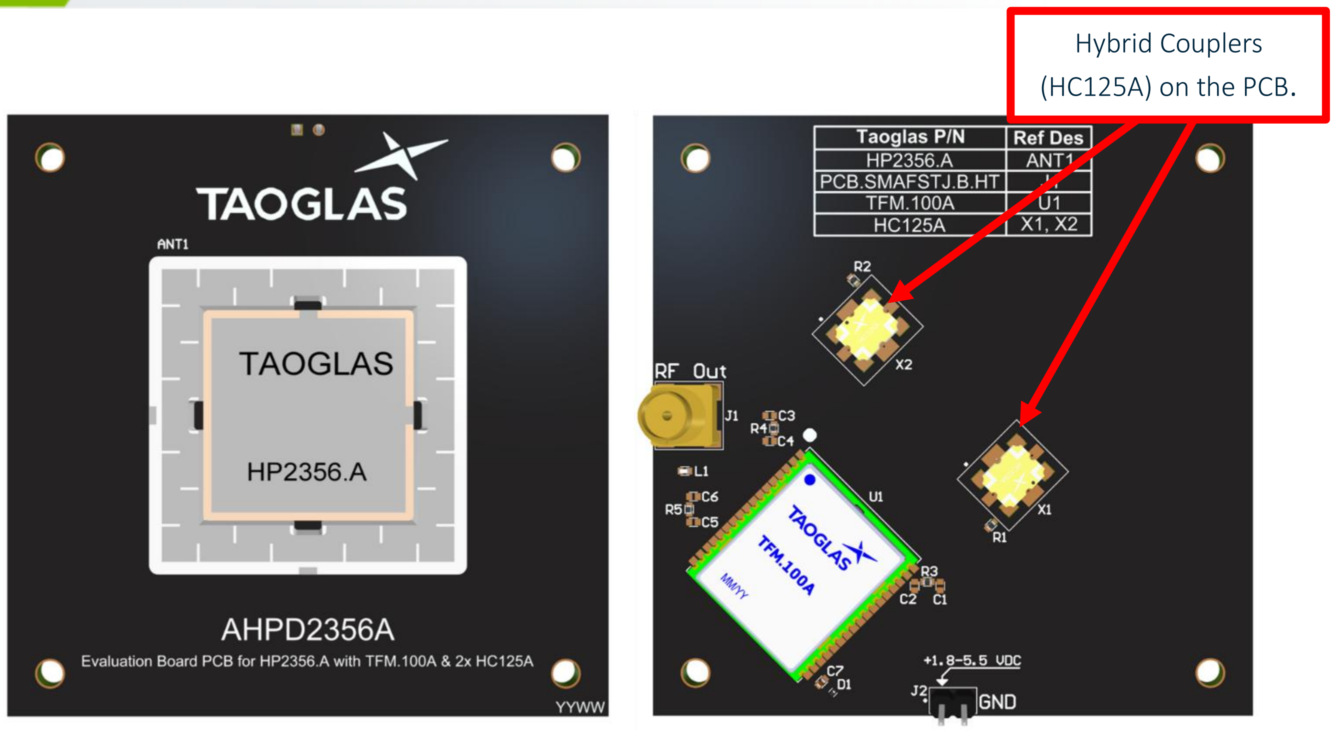
The following is an example on how to integrate the HP2356.A into a design. This antenna has twelve pins, two pins are used for the L1 band, and the other two pins are used for the L2 band. Hybrid couplers (HC125A) are used to combine the feeds for the L1 & L2 bands, to create a Right Hand Circular Polarized (RHCP) signal at the output of the hybrid couplers. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance before being presented to the GNSS Module. Taoglas recommends our TFM.100A, a high-performance GNSS Module specifically engineered for use with our multi feed patch antennas.



Top and bottom view of reference design board.

Please find the Integration files in Altium, 2D formats and the 3D model for the HP2356.A here:
https://www.taoglas.com/product/inception-series-multi-band-gnss-l1-l2-low-profile-patch-antenna/

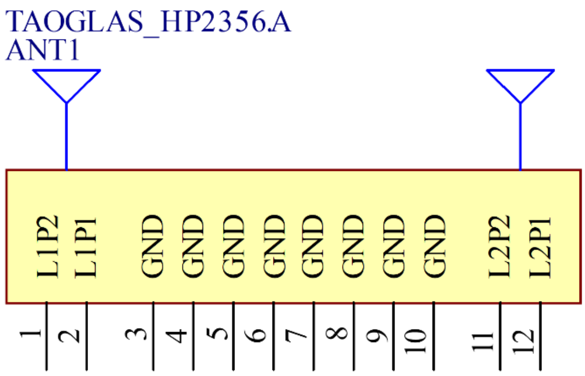
4.1 Schematic Symbol and Pin Definitions



Above are the 3D models of the HP2356.A and [HC125A](#) on the reference design board.

The circuit symbol for the HP2356.A is shown below. The schematic symbol for the antenna has 12 pins as indicated below.

Feed	Description
1	L1 (90˚)
2	L1 (0˚)
3-10	Ground
11	L2 (90˚)
12	L2 (0°)



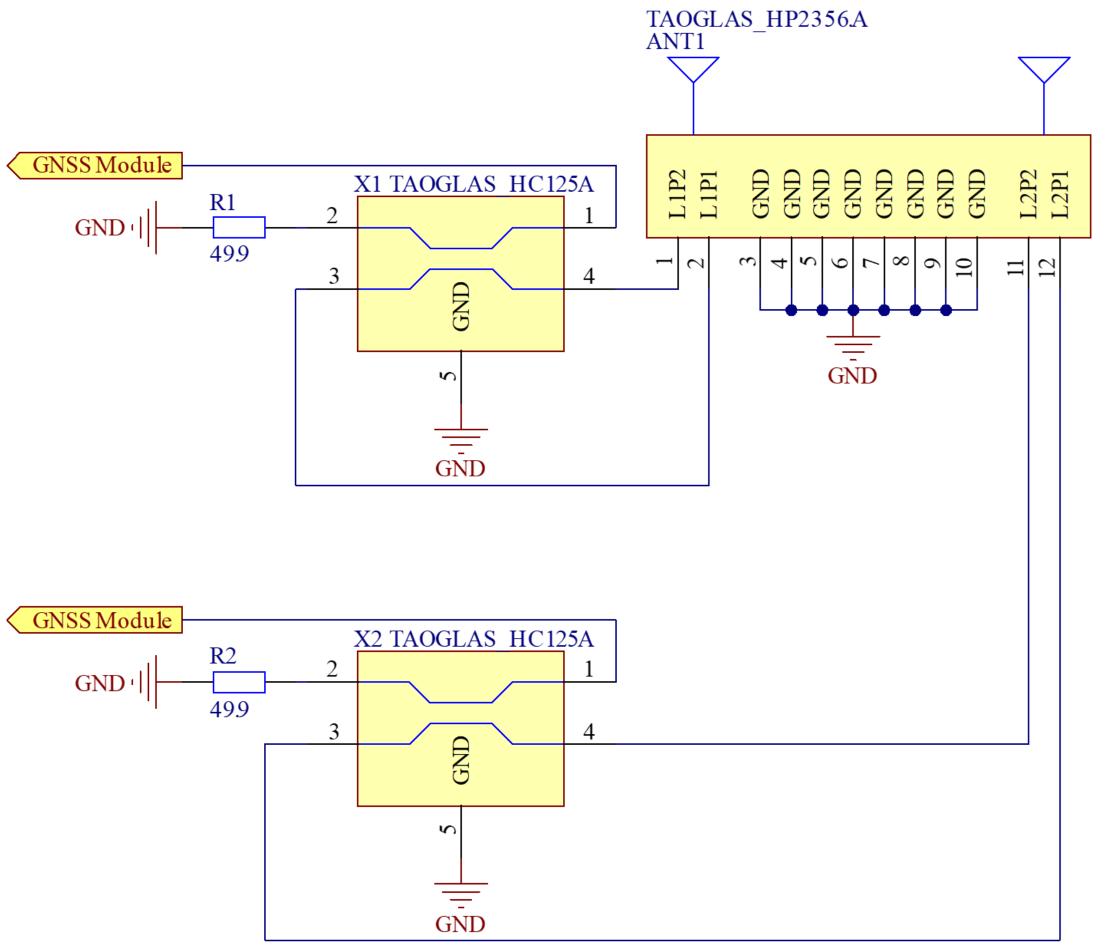
Above is a schematic symbol of HP2356.A and a table of the pin definitions.

4.2 Schematic Layout

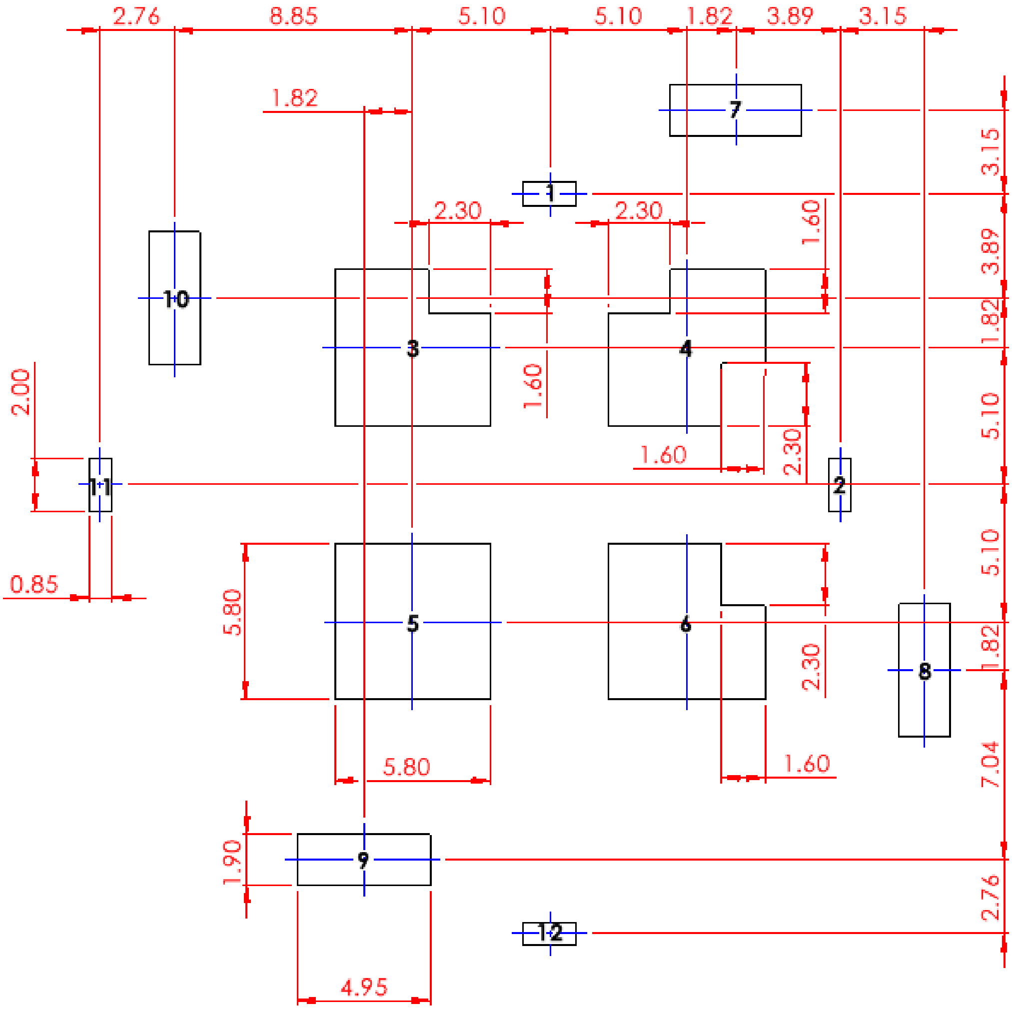
The HP2356.A uses two orthogonal feeds that need to be combined in a hybrid coupler to ensure optimal axial ratio and RHCP Gain is achieved. Taoglas recommends our HC125A, a high-performance hybrid coupler specifically engineered for use with our multi feed patches.

The HC125A is required for the high GNSS band of operation (1559- 1610MHz) for this antenna. This hybrid coupler should be placed close to the antenna feed pads and terminated correctly using a 49.9 Ohm resistor.

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

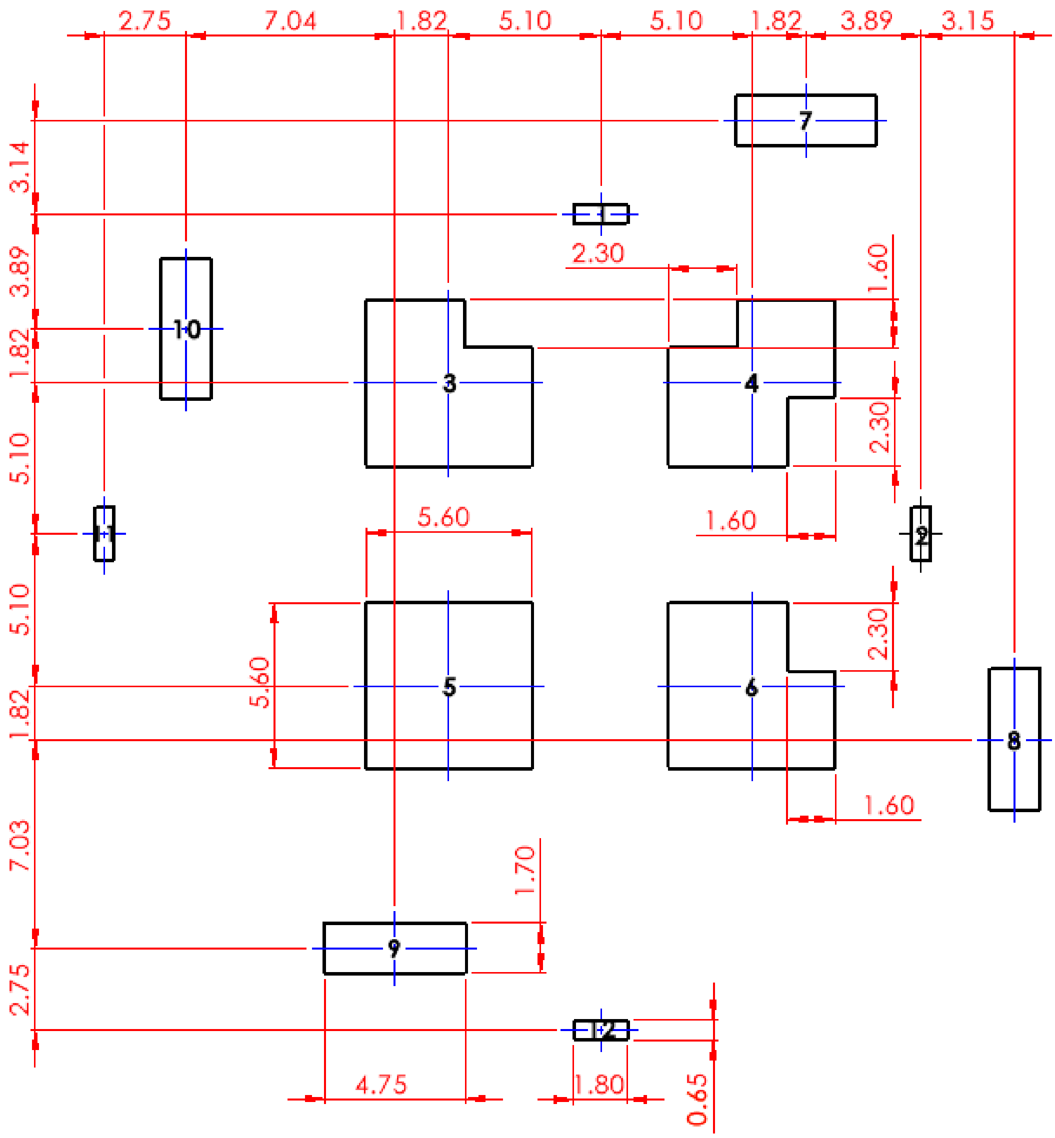


4.3 Antenna Footprint



PADS: 1,2,11 & 12 - ARE ALL THE SAME
PADS: 7,8,9 & 10 - ARE ALL THE SAME
PADS:3,4,5 & 6 - ARE ALL THE SAME
(EXCULDING CUT-OUTS)

4.4 Top Solder Paste

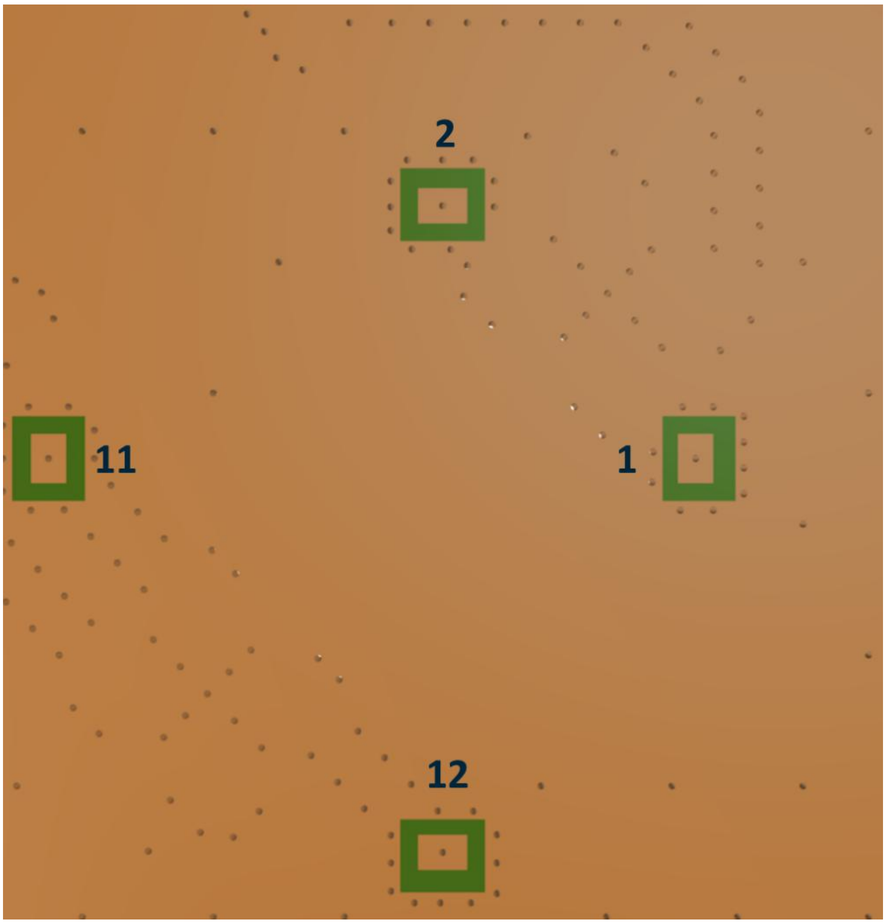


PADS: 1,2,11 & 12 - ARE ALL THE SAME
PADS: 7,8,9 & 10 - ARE ALL THE SAME
PADS:3,4,5 & 6 - ARE ALL THE SAME
(EXCULDING CUT-OUTS)

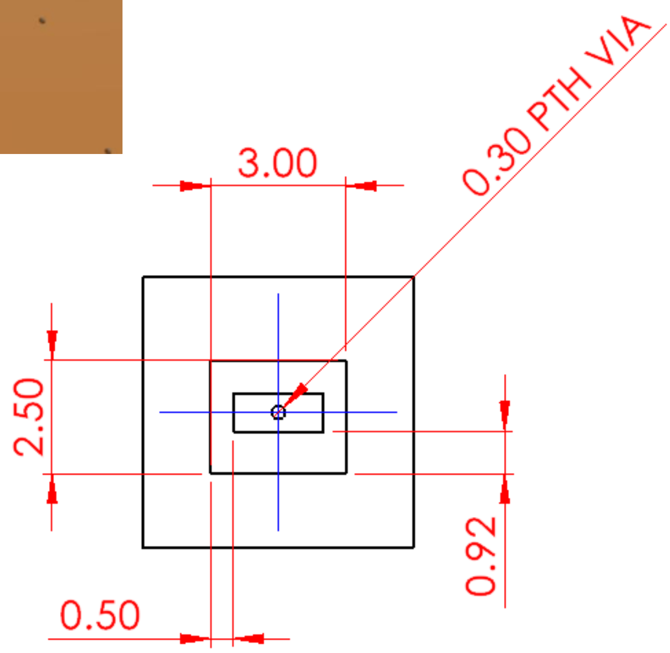
4.5 Copper Clearance for HP2356.A

The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the HP2356.A clearance area for Pin 1 (L1P2(90˚) Pad), Pin 2 (L1P1(0˚) Pad), Pin 11 (L2P2(90˚) Pad) and Pin 12 (L2P1(0˚) Pad). The copper keep out area only applies to the top layer.

There should be a 3x2.5mm copper clearance area around the antenna pins on the PCB.



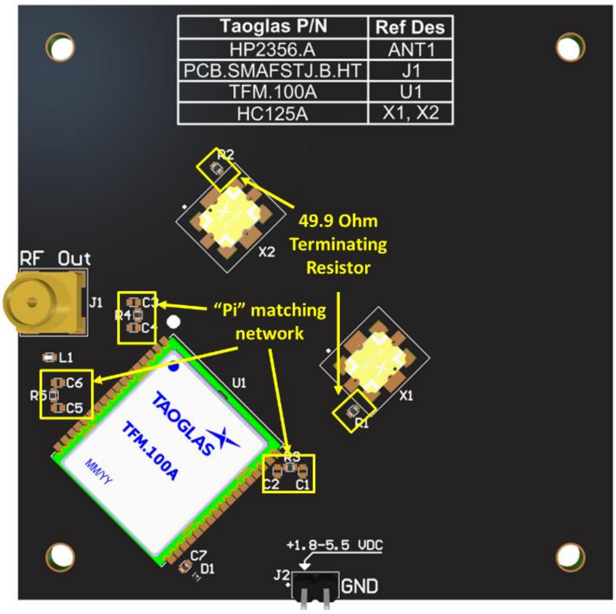
3D Image of Copper Clearances for HP2356.A.



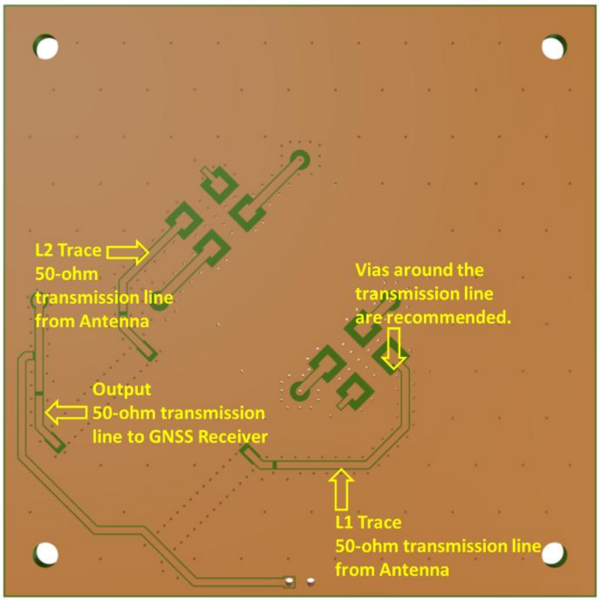
Copper Clearances Pad Details of the HP2356.A.

4.6 Antenna Integration

The HP5354.A should be placed in the centre of the final design board to take advantage of the ground plane. The RF traces must maintain a 50 Ohm transmission line. From the hybrid coupler a "Pi" Matching Network is recommended for the RF transmission lines, the values and components for the matching circuit will depend on the tuning needed. Also shown is the 49.9 Ohm terminating resistor necessary for the hybrid coupler (HC125A). Ground vias should be placed around the transmission lines and the copper clearance area.



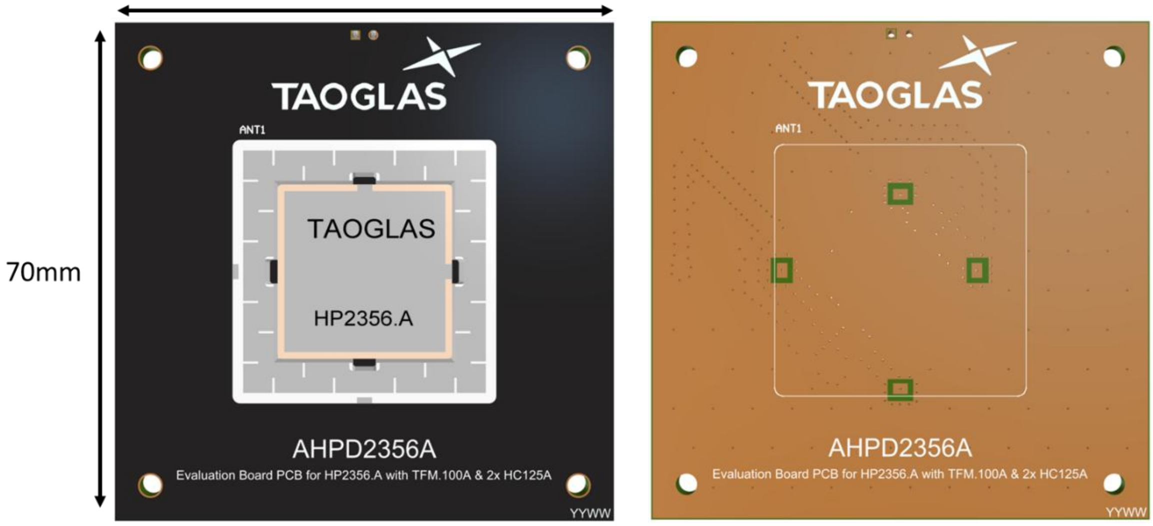
Bottom view of the reference design board, showing "Pi" matching network.



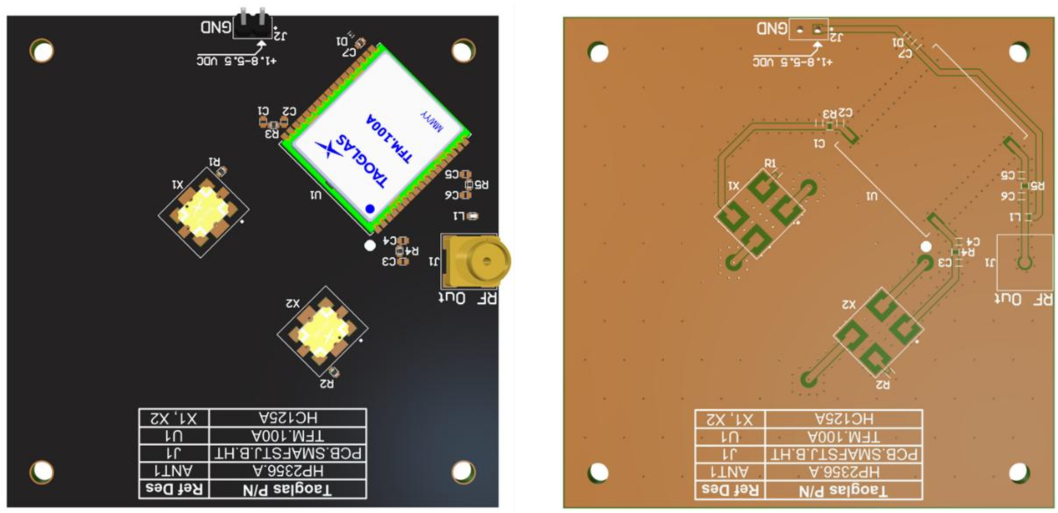
Bottom view of the reference design board, showing transmission lines and integration notes.

4.7 Final Integration

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



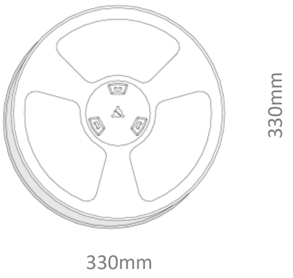
Top Side (HP2356.A placement on 70x70mm reference design board)



Bottom side (TFM.100A) placement including HC125A)

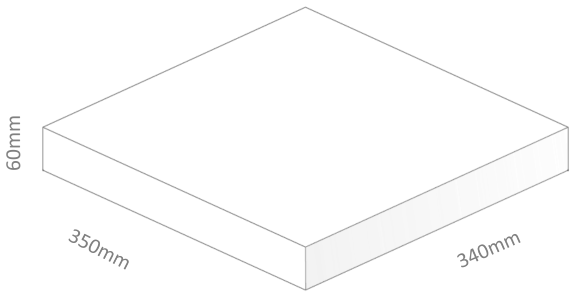
5. Packaging

100pcs HP2356.A per Reel
2pcs 3g Desiccant
1pcs Humidity test paper

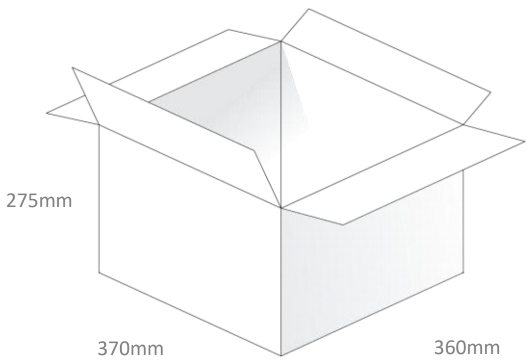


100pcs HP2356.A per Vacuum bag

100pcs HP2356.A per Inner Carton
Dimensions: 350 x 340 x 65mm
Weight: 3.3Kg

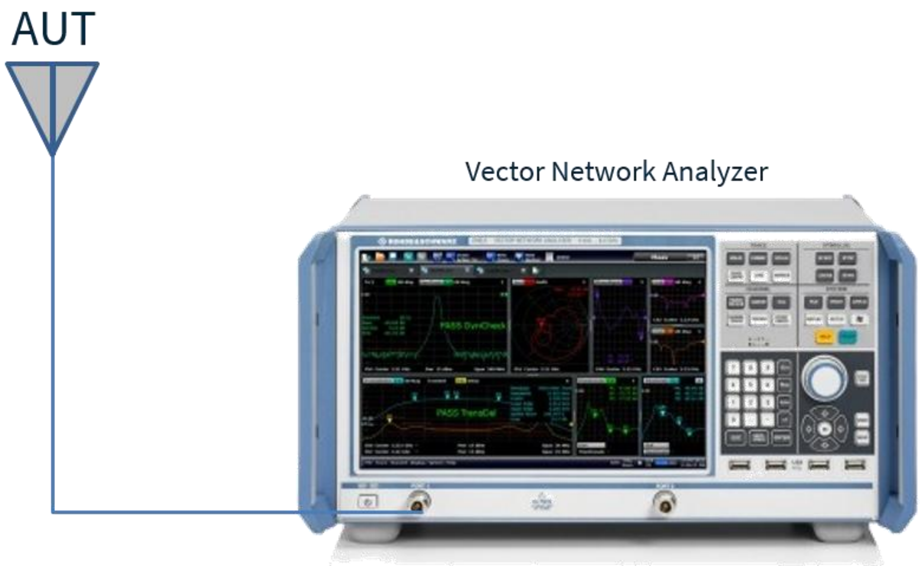


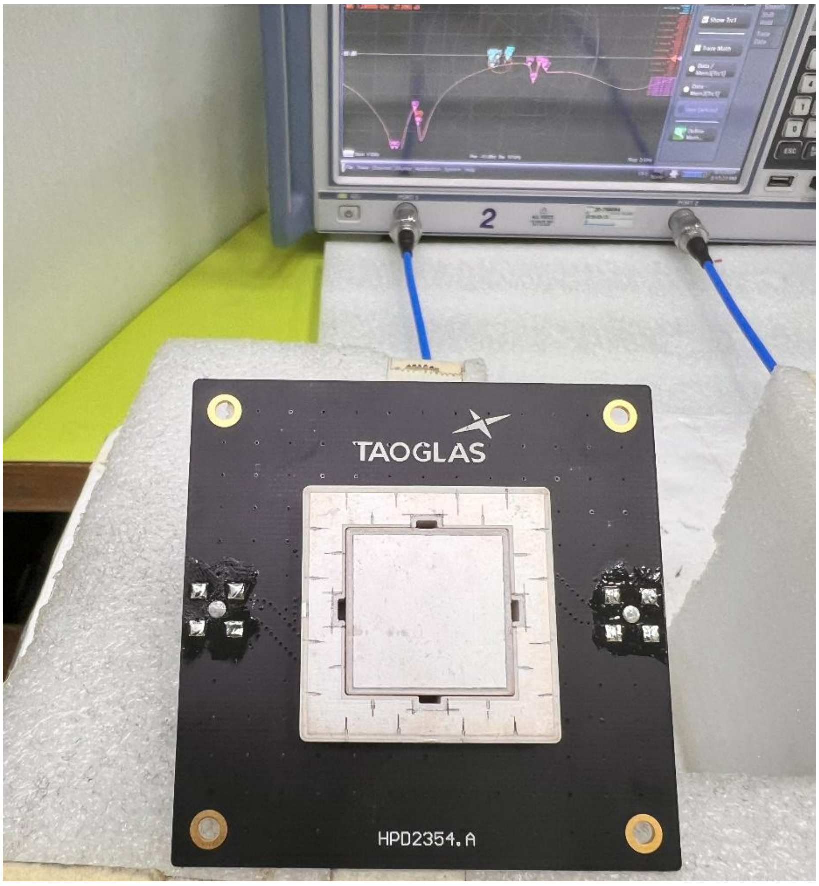
400pcs HP2356.A per Box
Dimensions: 370 x 360 x 275mm
Weight: 14Kg



6. Antenna Characteristics

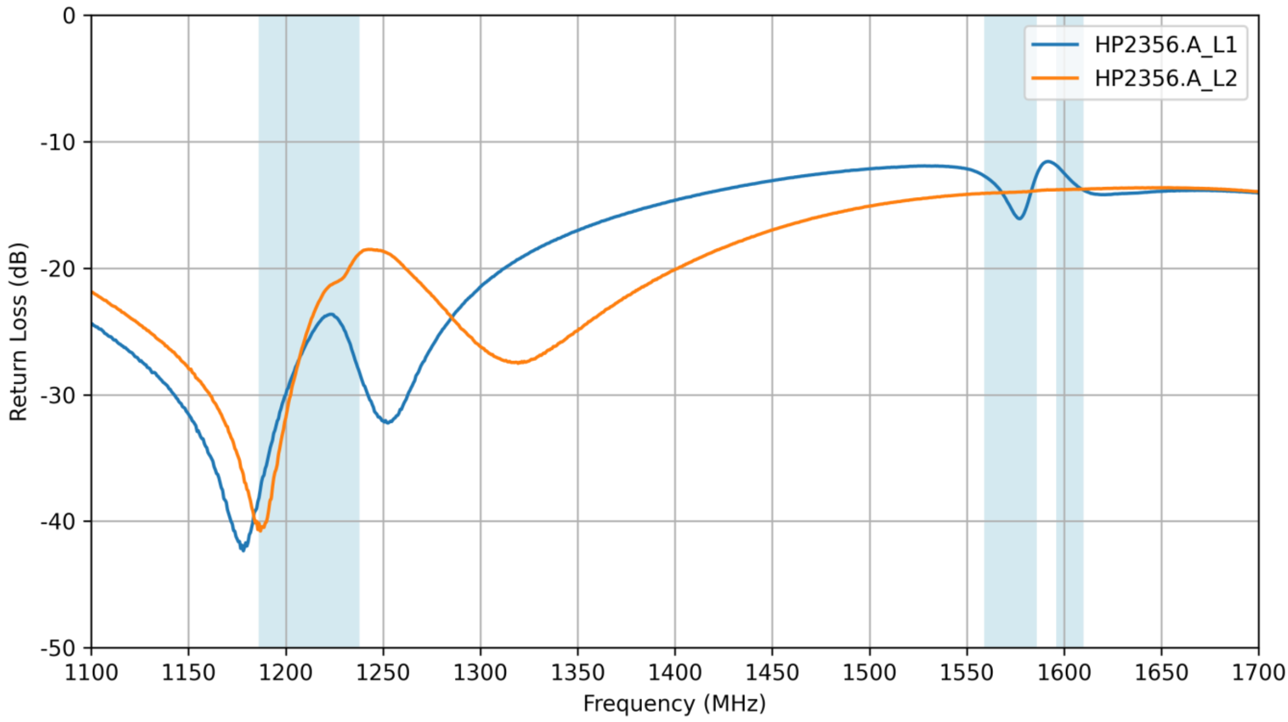
6.1 Test Setup



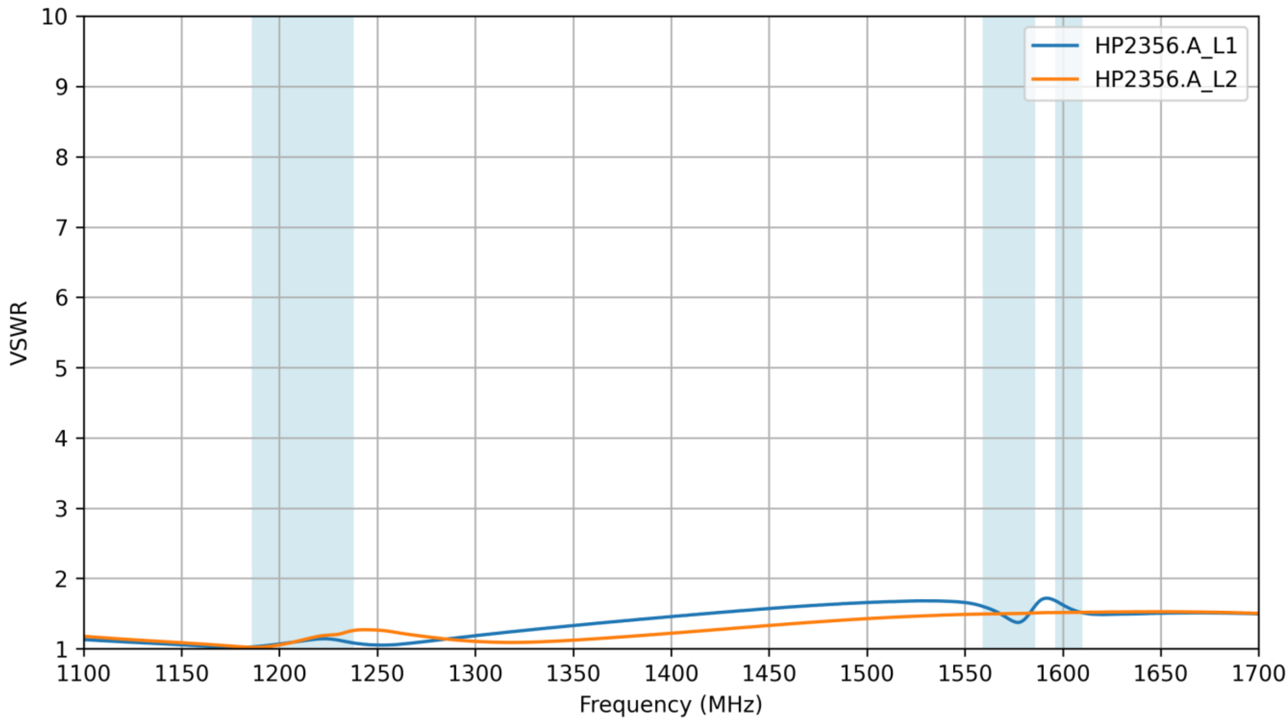


VNA Test Set-up

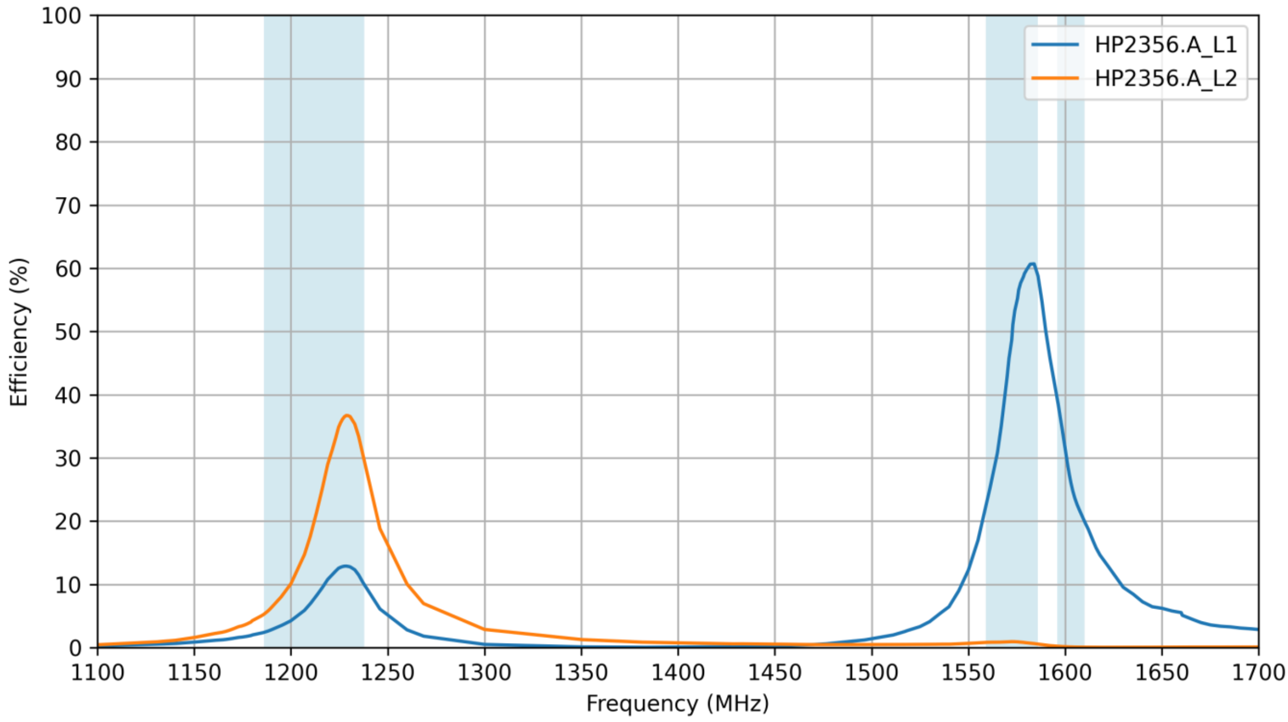
6.2 Return Loss



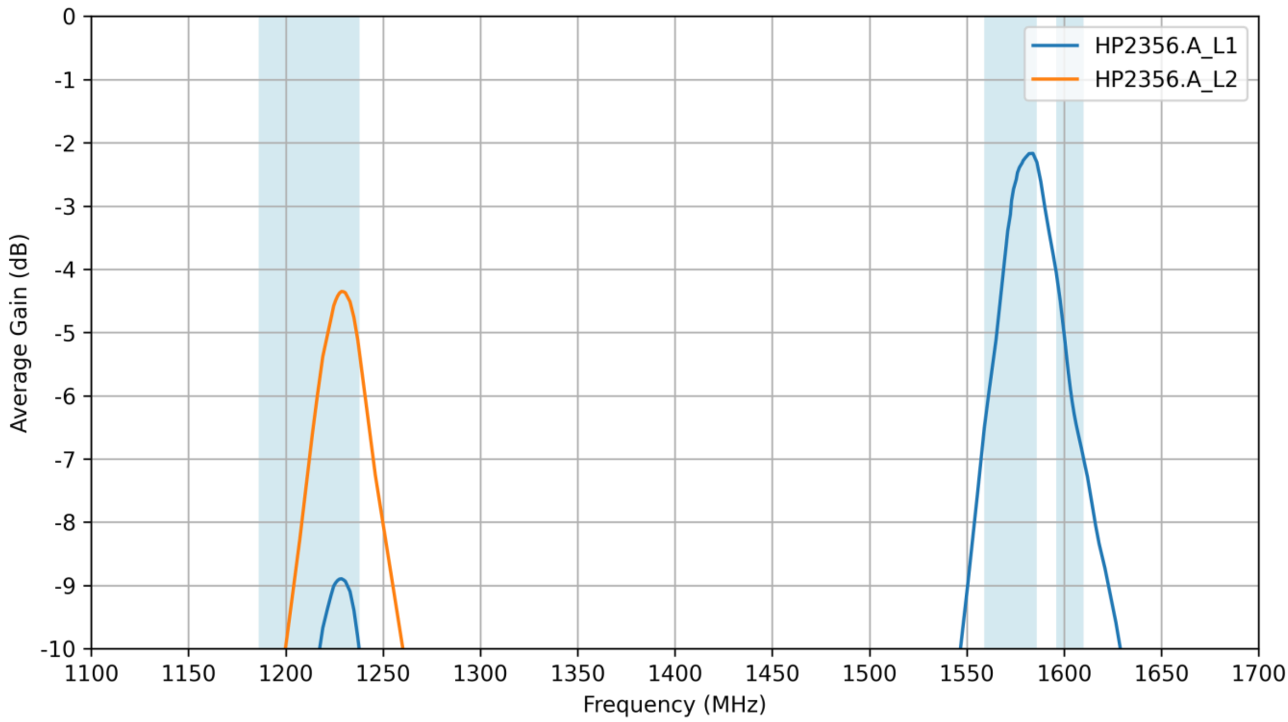
6.3 VSWR



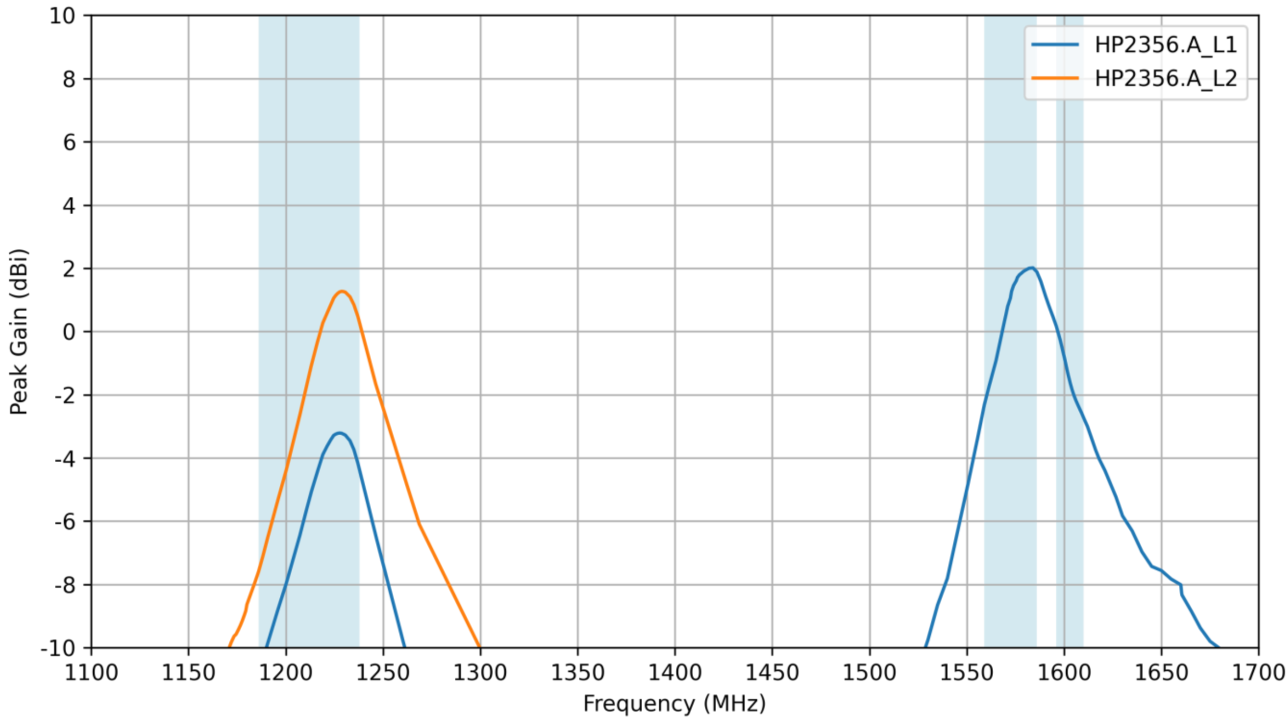
6.4 Efficiency



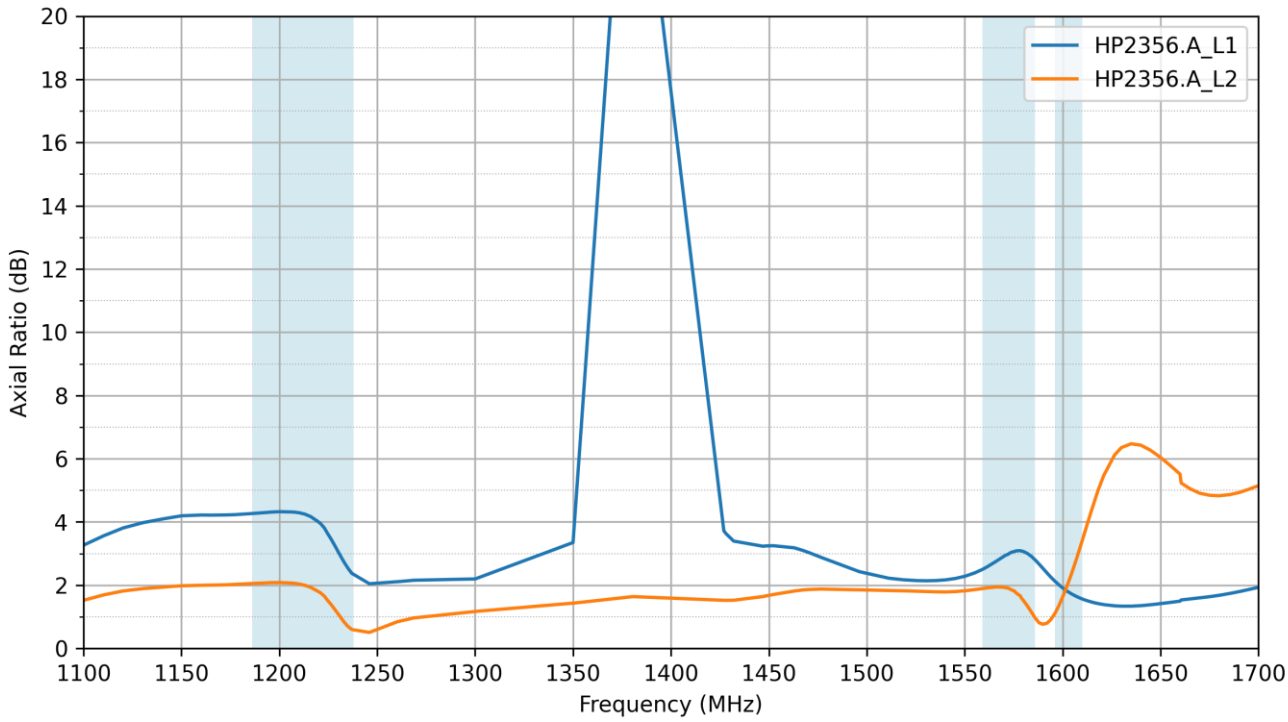
6.5 Average Gain



6.6 Peak Gain

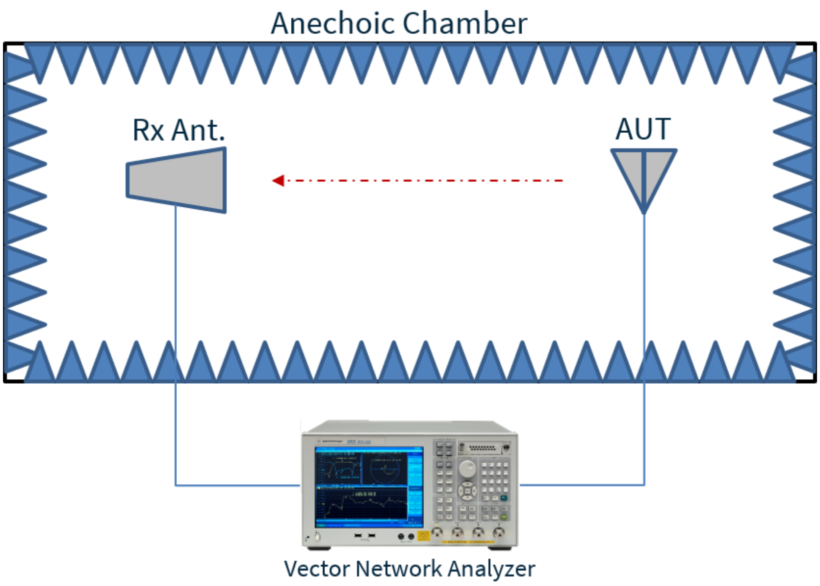


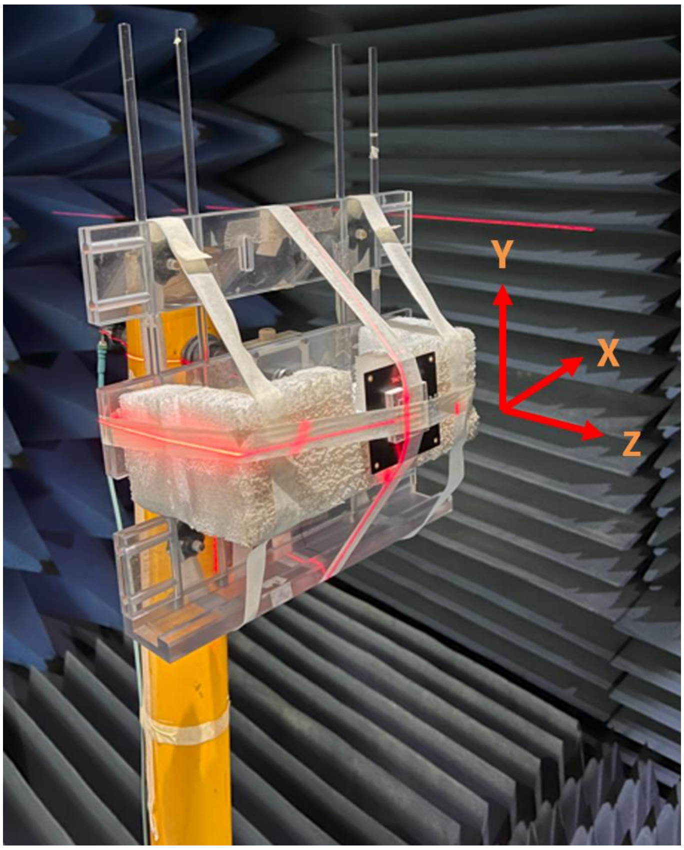
6.7 Axial Ratio



7. Radiation Patterns

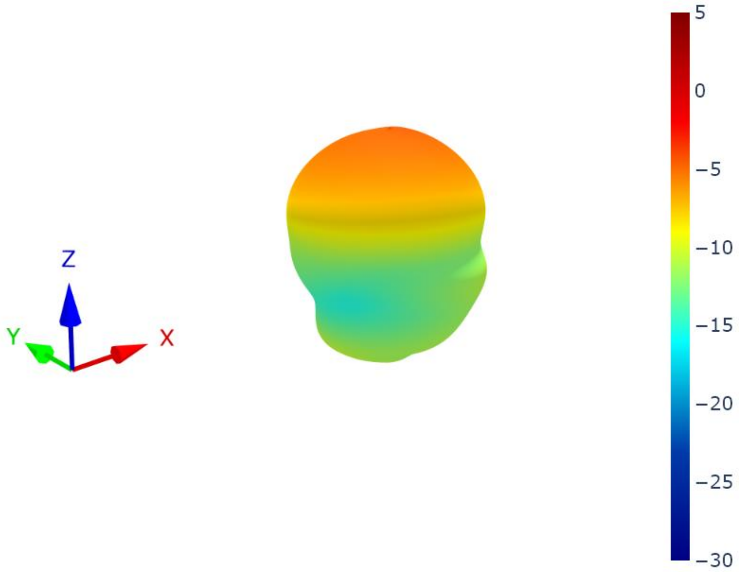
7.1 Test Setup



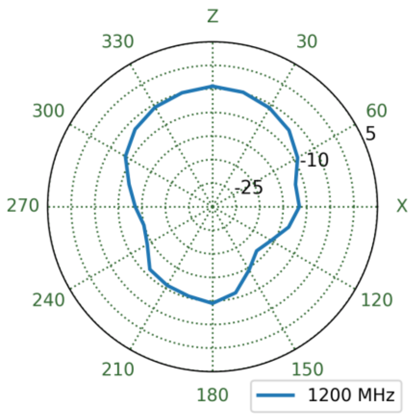


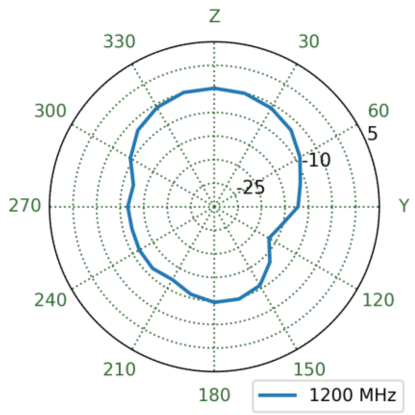
Chamber Test Set-up

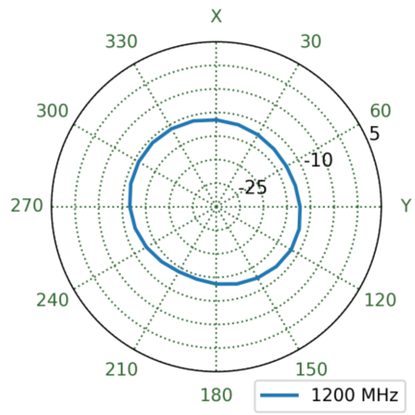
7.2 HP2356.A_L2 Patterns at 1200 MHz



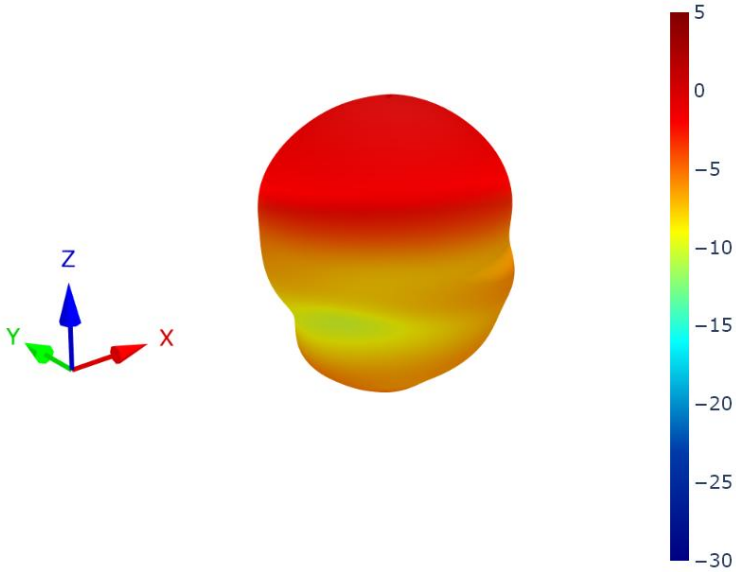
XZ Plane	YZ Plane	XY Plane



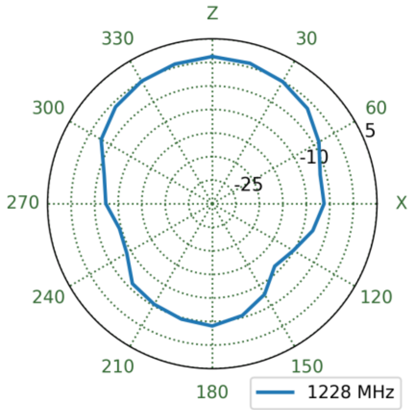


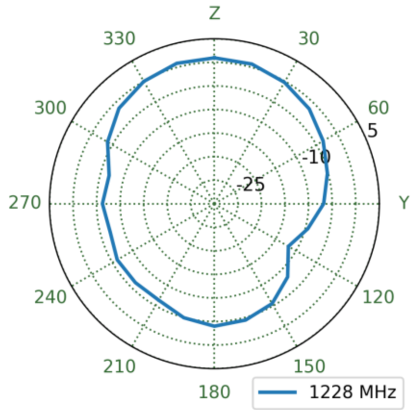


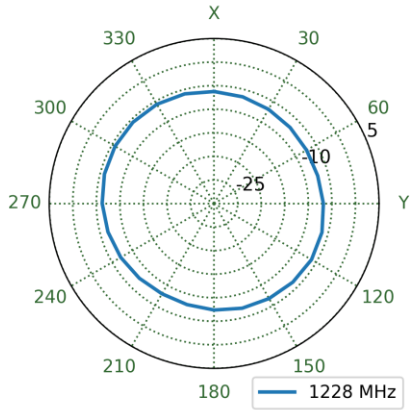
7.3 HP2356.A_L2 Patterns at 1228 MHz



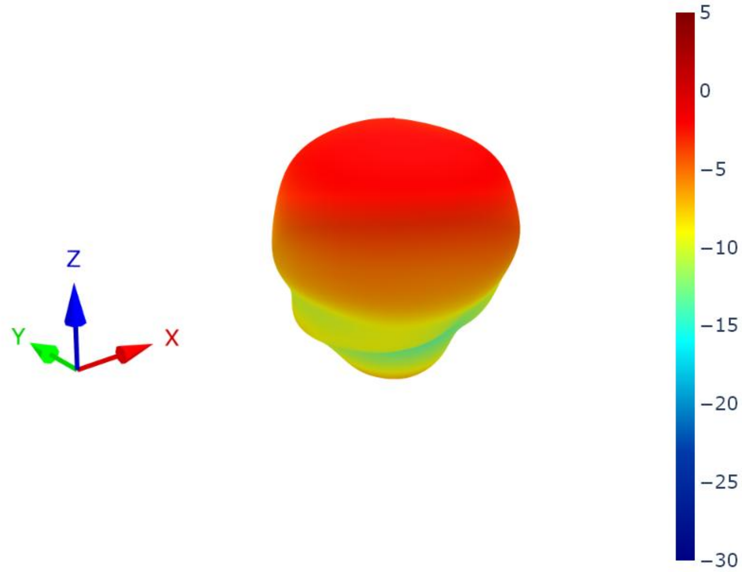
XZ Plane	YZ Plane	XY Plane

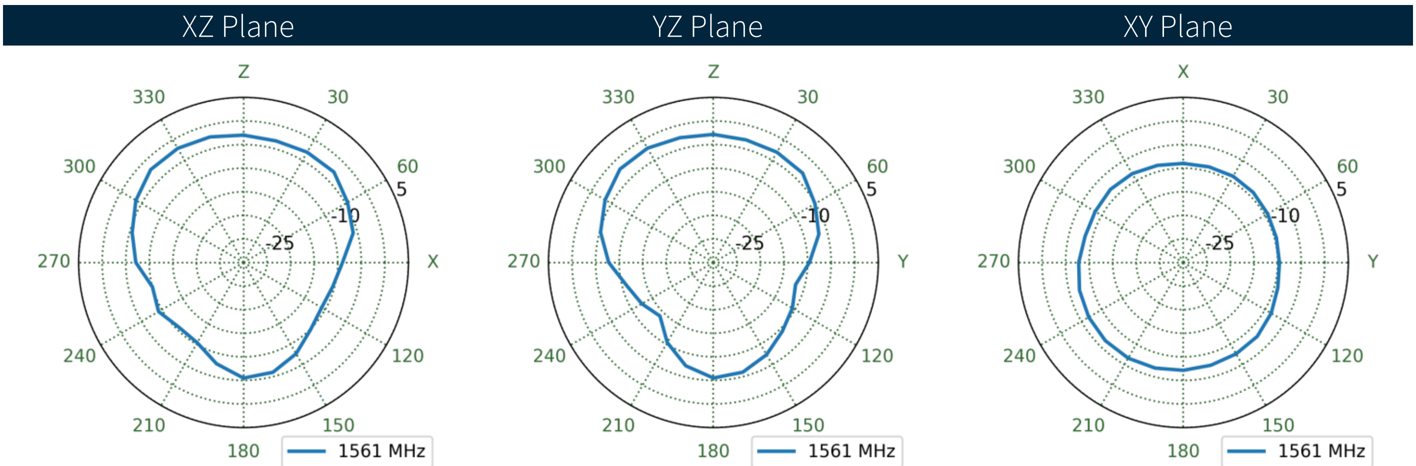




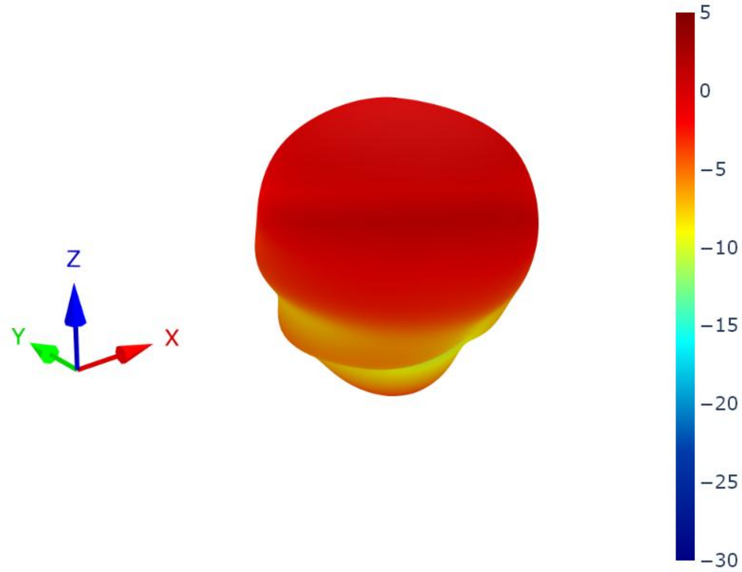


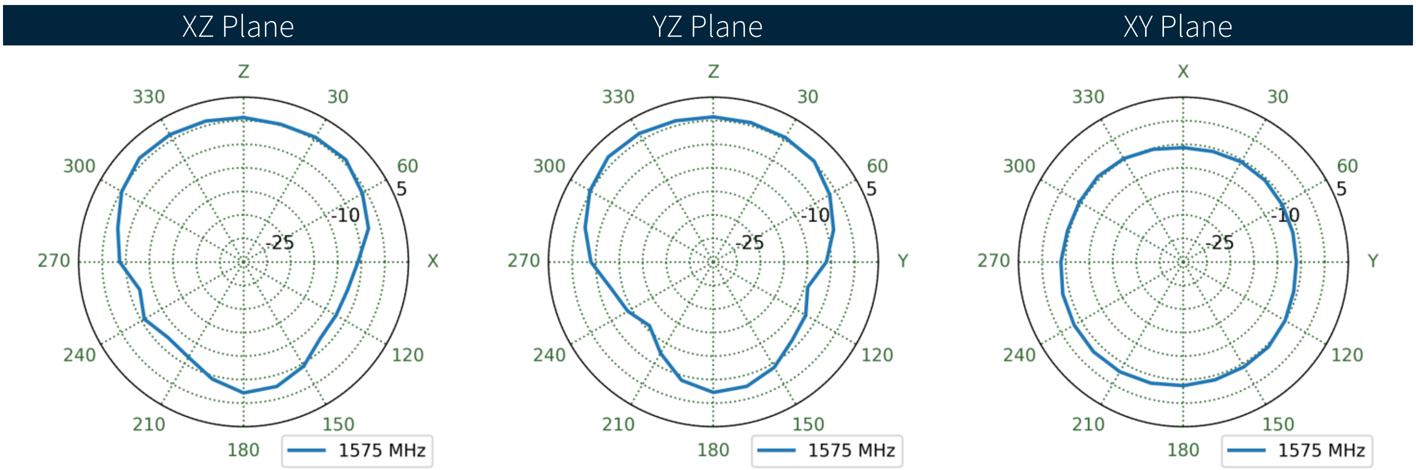
7.4 HP2356.A_L1 Patterns at 1561 MHz



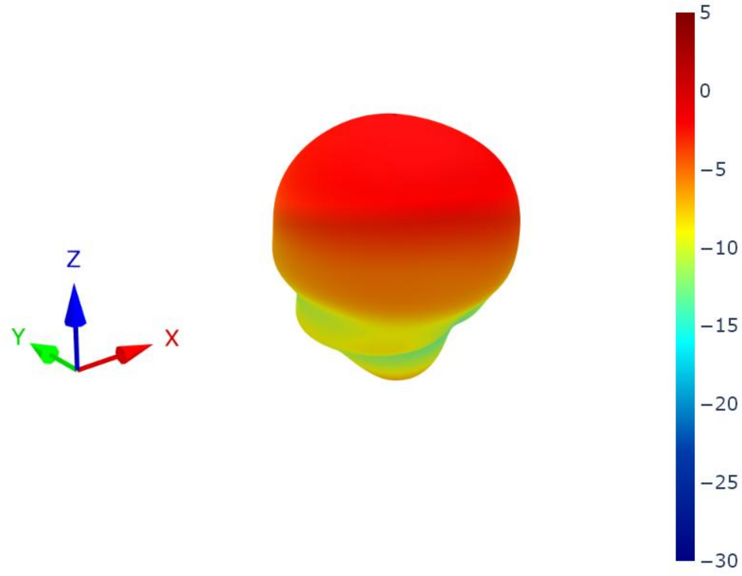


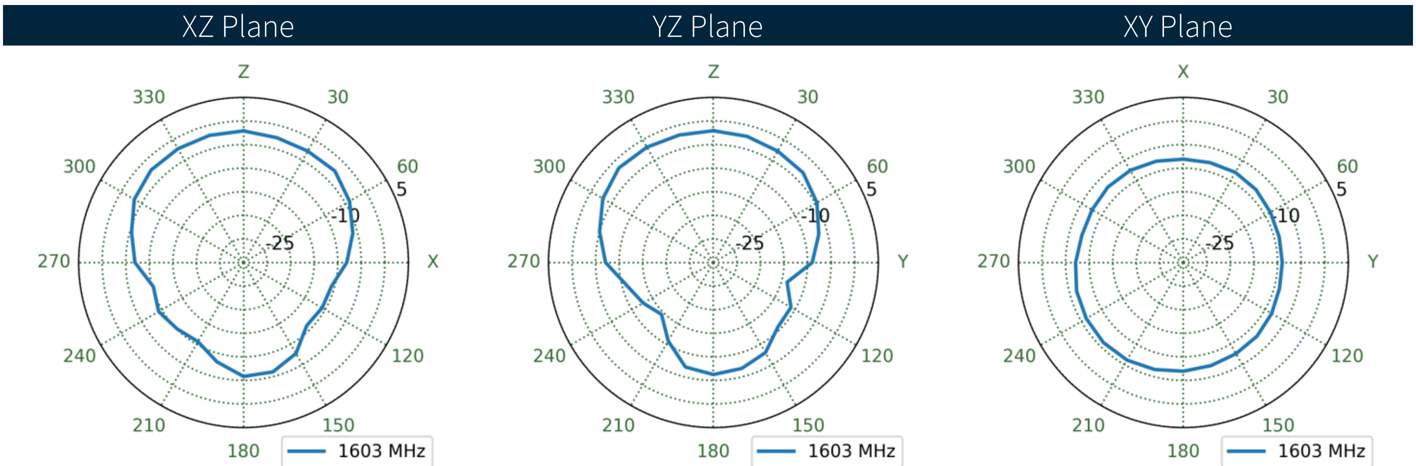
7.5 HP2356.A_L1 Patterns at 1575 MHz





7.6 HP2356.A_L1 Patterns at 1603 MHz





Changelog for the datasheet

SPE-24-8-343 - HP2356.A

Revision: A (Original First Release)	
Date:	2024-12-20
Notes:	Initial Release.
Author:	Gary West

Previous Revisions

TAOGLAS

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