![Taoglas logo]

Datasheet

Part No:
AHPD24510A

Description

Reference Design Evaluation Board for HP24510A with

TFM.100A & 2x HC125A

Features:

Optimum Active Electronics Design for Passive GNSS L1/L2 Antenna
Integrated TFM Module and Hybrid Couplers
Bands Covered:
• BeiDou (B1/B2b)
• GPS/QZSS (L1/L2)
• GLONASS (G1/G2/G3)
• Galileo (E1/E5b)
RoHS & Reach Compliant

Ireland & USA
ISO 9001:2015
Certified

ISO 9001
Certified
Quality Management

Taiwan
ISO 9001:2015
Certified

QA
INTERNATIONAL

UKAS
QUALITY
MANAGEMENT
046

QUALITY MANAGEMENT SYSTEM
IATF16949

CE
UKCA
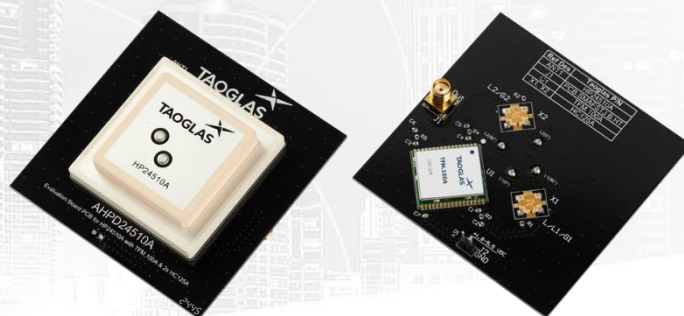
Taoglas GNSS Reference Design Evaluation Boards

The Taoglas series of GNSS Antenna Reference Boards are designed to show the optimum component layout and make it easy for you to integrate the active electronics with the passive GNSS antenna on your device PCB.

Designing active GNSS electronics can be difficult, but utilising Taoglas' **TFM Series** of front end active electronics and hybrid couplers allow you to achieve the best possible positioning performance for your device. The Taoglas TFM 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.

Features and Benefits of utilising the TFM Modules.

Ease-of-integration – Single-package solution combines impedance matching, filter efficiency and low noise design for easy, drop-in use with any antenna or GNSS receiver

Low-noise System Design – Integrated pre-filters deliver exceptional out-of-band rejection across multiple band configurations and neighbouring interference to properly set noise figure

Dual-gain Stage Architecture – Cascaded LNAs, pre-filters and optimized impedance matching deliver sufficient gain to the GNSS receiver without signal-to-noise overload

Low-profile Form Factor – Small footprint and low-profile design saves valuable real estate without the need for external components and routing

Accelerated Development Cycles – 2+ years of development by antenna and RF design experts, delivering the highest levels of integration, manufacturability and robustness in a single package

View the full series here:
https://www.taoglas.com/product-category/other-rf-components/front-end-modules/

Where used, the Taoglas **HC125A** is a low profile, high performance, 3dB hybrid coupler designed for multi-feed Multiband GNSS applications. The HC125.A is ideal for applications where balanced power and low noise amplifiers are required. For more information on the HC125A, visit the product page here.

Please visit the standard product page for the HP24510.A to download the integration files in Altium, 2D and 3D formats for your project by clicking here.

For more information or to order samples, reach out to your regional Taoglas customer support team.

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**
	■	□	■	■	■
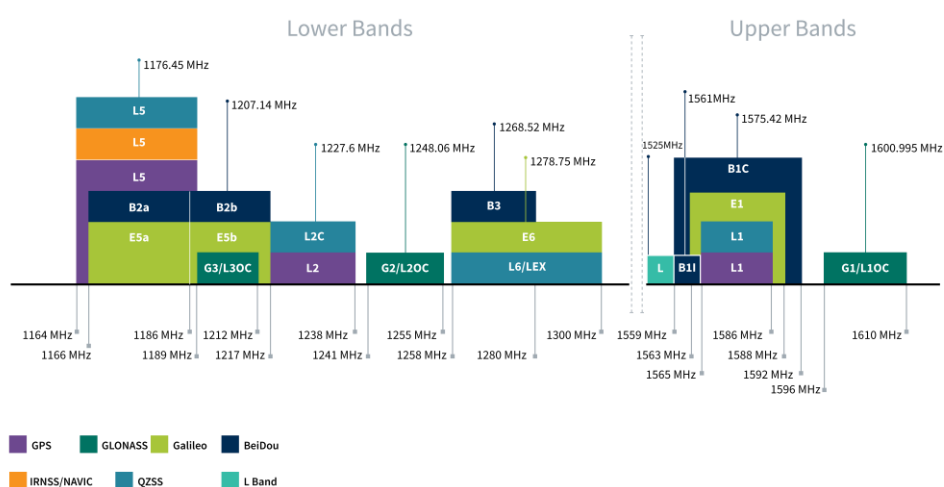
GNSS Bands and Constellations

GNSS Electrical						
Frequency (MHz)	**1207**	**1227.6**	**1248**	**1561**	**1575.42**	**1603**
Peak Gain (dBi)	29.49	31.56	27.42	30.94	31.18	29.21
Axial Ratio (dB)	3.09	2.83	3.84	0.92	0.83	0.75
PCO_x (cm)	0.57	0.67	0.82	0.70	0.67	0.62
PCO_y (cm)	0.16	0.16	0.11	-0.30	-0.33	-0.40
PCV (cm)	1.83	1.67	1.62	1.31	1.30	1.26
Group Delay Mean (ns)	32.17	33.49	37.97	34.38	30.42	33.21
Polarization	RHCP					
Impedance	50 Ω					

Mechanical	
Dimensions	70.4 x 70.4 x 22.1mm
Material	Antena: Ceramic Board: FR4
Connector	SMA(F)

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

Front View

Ref Des	Taoglas P/N
ANT1	HP24510A
J1	PCB.SMAFSTJ.B.HT
U1	TFM.100A
X1, X2	HC125A

Side View

Back View

AHPD24510A
Evaluation Board PCB for HP24510A with TFM.100A & 2x HC125A
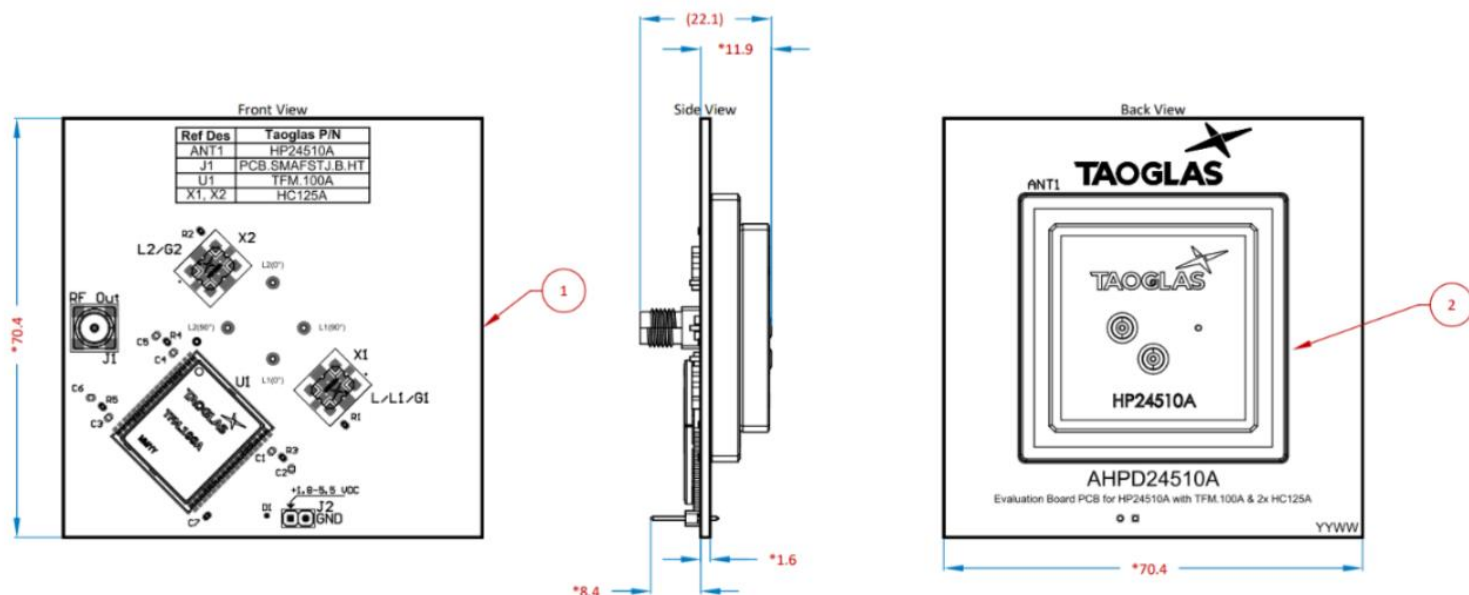
Bill Of Materials

Line #	Description	Quantity	MFG	MFGPN
1	SMD_AHPD24510A_Dual Layer_L70.4_W70.4_H1.6mm_NP-140_35um_Glossy Black	1	Taoglas	AHPD24510A
2	HP24510A - GNSS L1,L2 L-Band Dual Feed Stacked 45*45*10mm	1	Taoglas	HP24510A

The following is an example on how to integrate the TFM.100A into a design. In this example, the HP24510A (L1/L2) is used as the antenna. 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, before being presented to the corresponding inputs on the TFM.100A. The TFM.100A is powered from a separate power DC supply (1.8V-5.5V). The output of the TFM.100A can then be fed to a relevant GNSS receiver module. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.
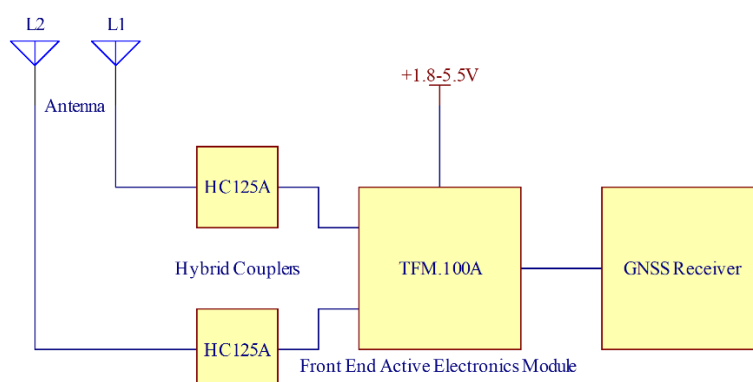
Block Diagram of integration of the TFM.100A
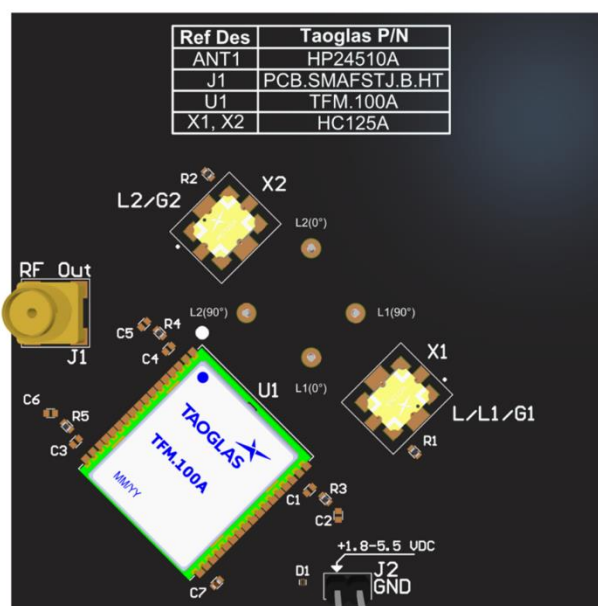
Top and bottom view of PCB.

4.1 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 a 49.9 Ohm resistor. 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)

The output of each of the hybrid couplers can be fed into the relevant inputs of the TFM.100A module. Matching components with the TFM.100A are required for the module to have optimal performance in the spaces specified in the schematic below. Additional matching components may be necessary for your device, Taoglas recommends incorporating extra component footprints, forming a "pi" network, between the TFM.100A and the HC125A's. Matching components should also be placed between the RF output pin and the GNSS receiver module input pin.

Taoglas recommends placing an ESD diode and decoupling capacitor (100pF) on the input pin of the supply rail. Note: The RF In & RF out of the TFM module are all DC-blocked internally. External DC block capacitors are not required.
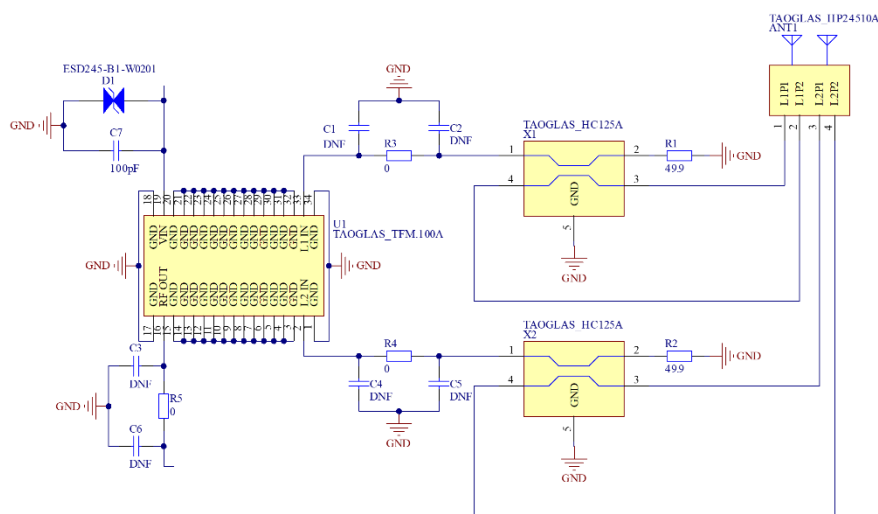
Schematic above shows how the TFM.100A and HP24510A are integrated.

Designator	Type	Value	Manufacturer	Manufacturer Part Number
C1, C2, C3, C4, C5, C6	Capacitor	Not Fitted	-	-
C7	Capacitor	100pF	Murata	GRM1555C1H101JA01D
D1	Diode	-	Infineon	ESD245B1W0201E6327XTSA1
R1, R2	Resistor	49.9 Ohms	Panasonic	ERJ-2RKF49R9X
R3, R4, R5	Resistor	0 Ohms	YAGEO	RC0402JR-070RL

4.2 Module Integration

The TFM.100A should be placed as close to the signal input and output as possible to shorten the length of the transmission lines. The RF IN/OUT traces must maintain a 50 Ohm transmission line. A Pi Matching Network is recommended for the RF IN transmission lines, the values and components for the matching circuit will depend on the tuning needed. Ground vias should be placed beside each ground pad and the DC Voltage input should be between +1.8 and +5.5 VDC. It's recommended that the DC Voltage input should be coupled with a 100pF Capacitor and an ESD Diode.
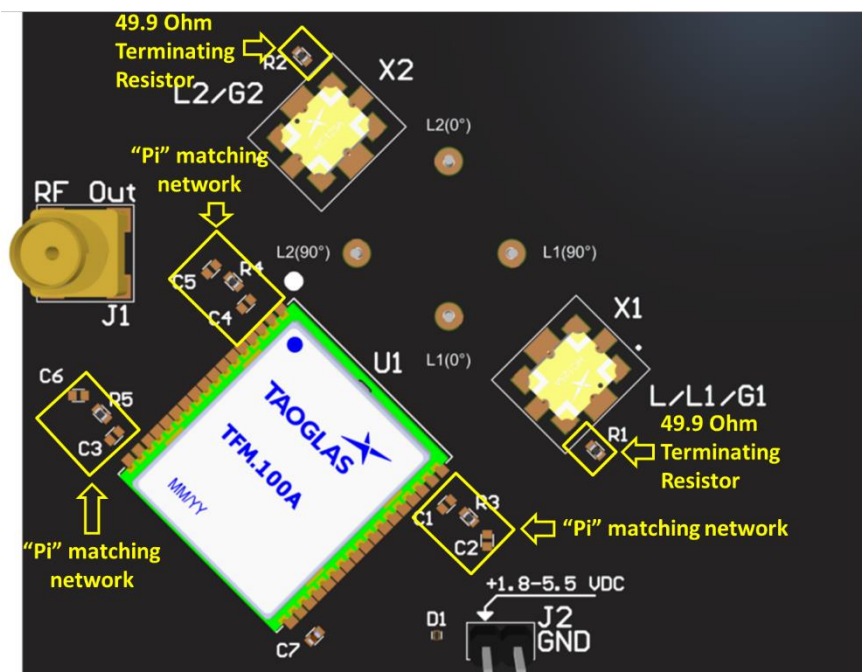
Bottom view of the PCB, showing "Pi" matching network.
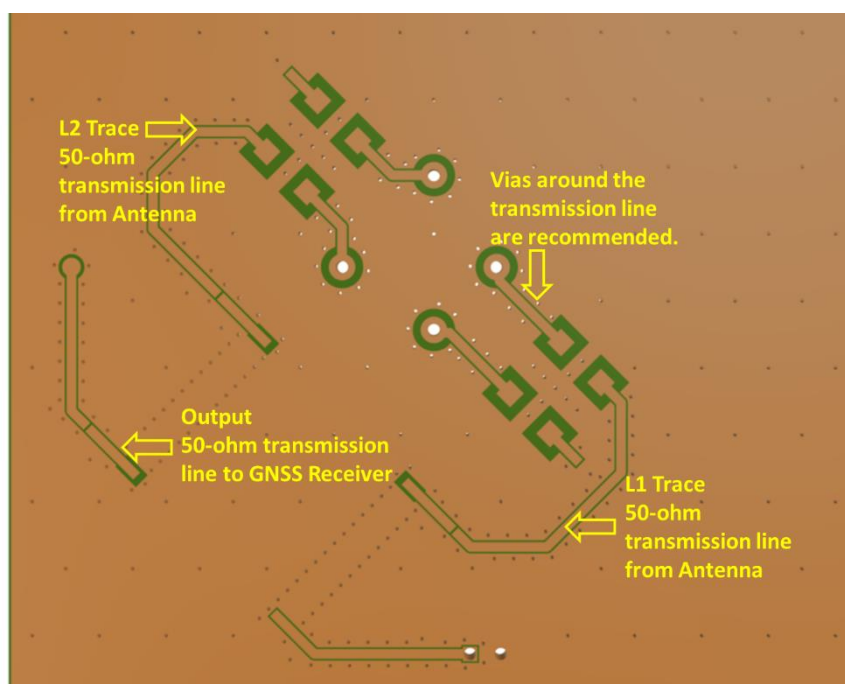
Bottom view of the PCB, showing "Pi" matching network.

The bottom side image shown below highlights the antenna connection to the hybrid couplers (HC125A's). It highlights the outputs of the hybrid couplers connected to the relevant inputs of the TFM.100A module. It shows the 49.9 Ohm terminating resistor's necessary for the hybrid coupler's(HC125A). It also demonstrates the output of the TFM.100A module that needs to be connected to a GNSS receiver input. It displays the DC connection required with ESD diode and decoupling capacitor. Taoglas recommends using a minimum of 70x70mm ground plane (PCB) to ensure optimal performance.
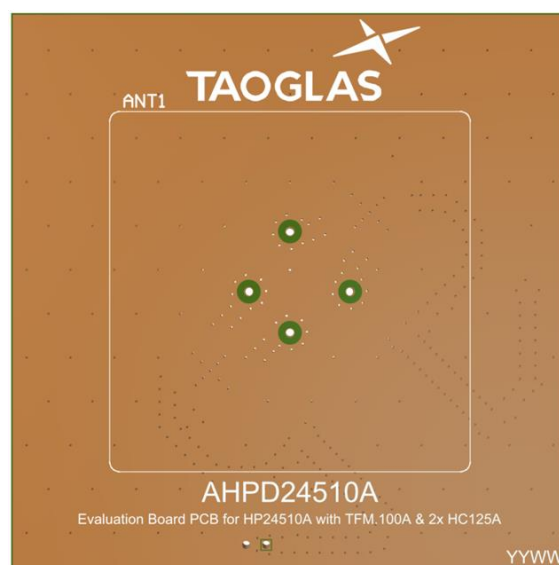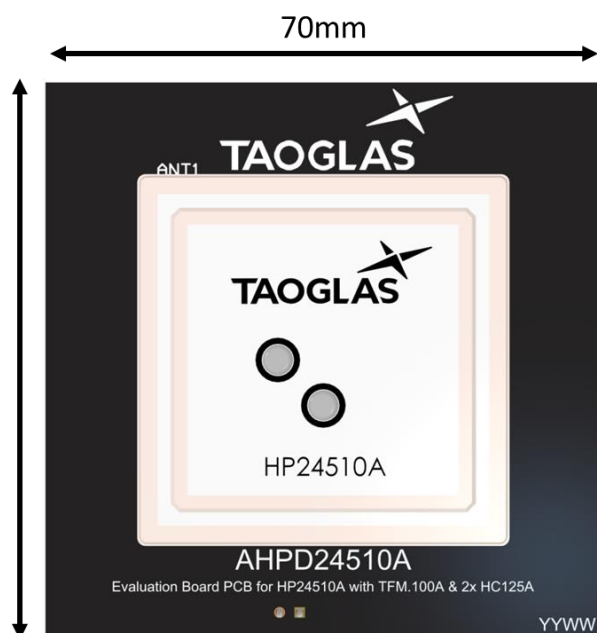
Top Side (HP24510A placement on 70x70mm PCB)
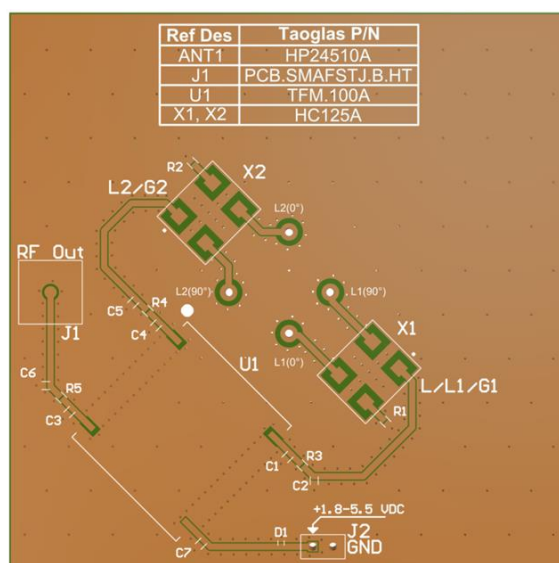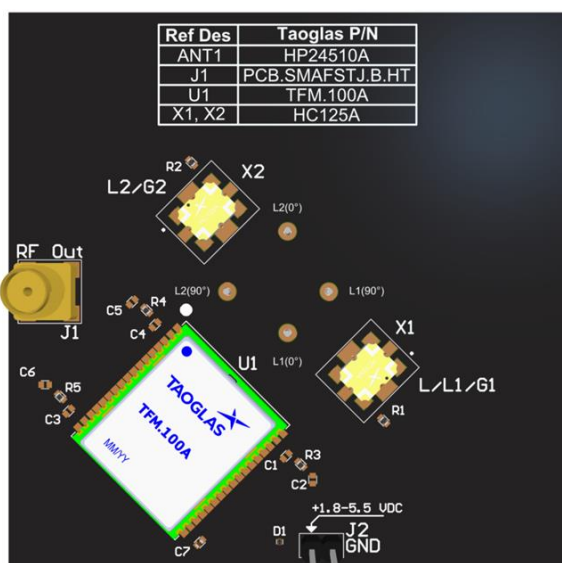
Bottom side (TFM.100A placement including HC125.A's)

5. Antenna Characteristics

5.1 Peak Gain
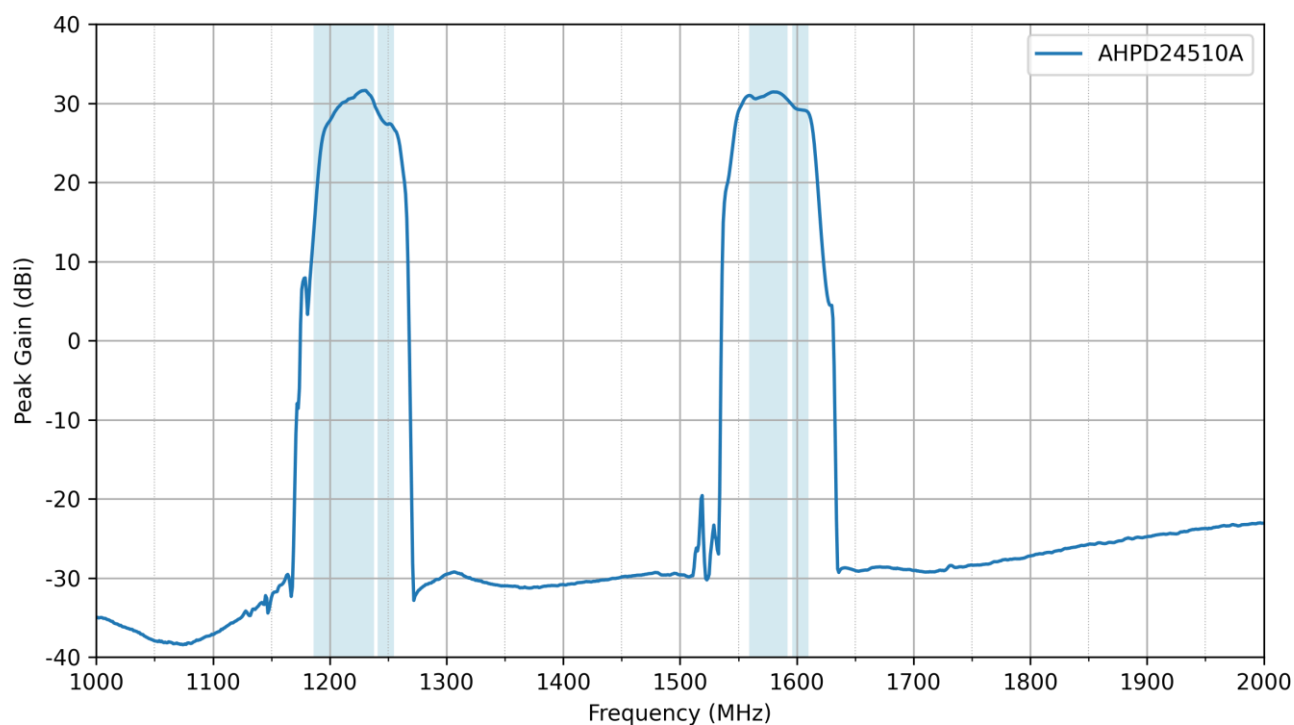
5.2 Axial Ratio
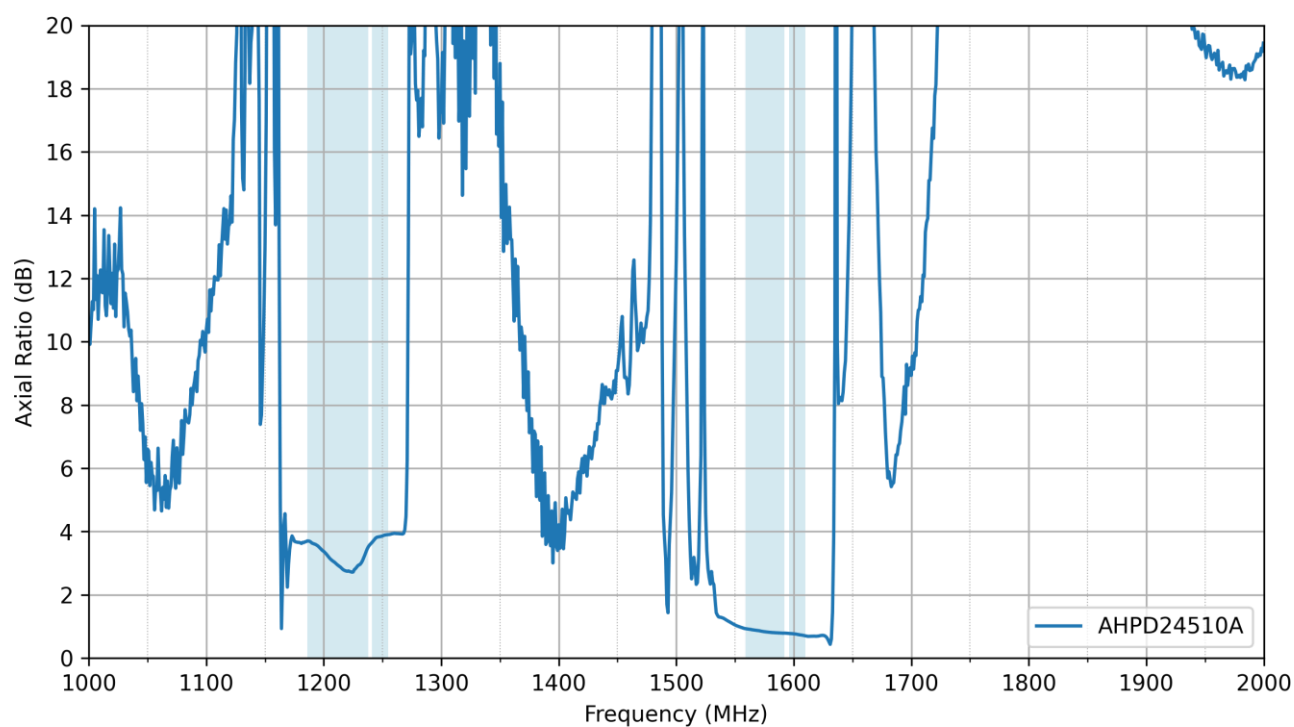
5.3 PCO
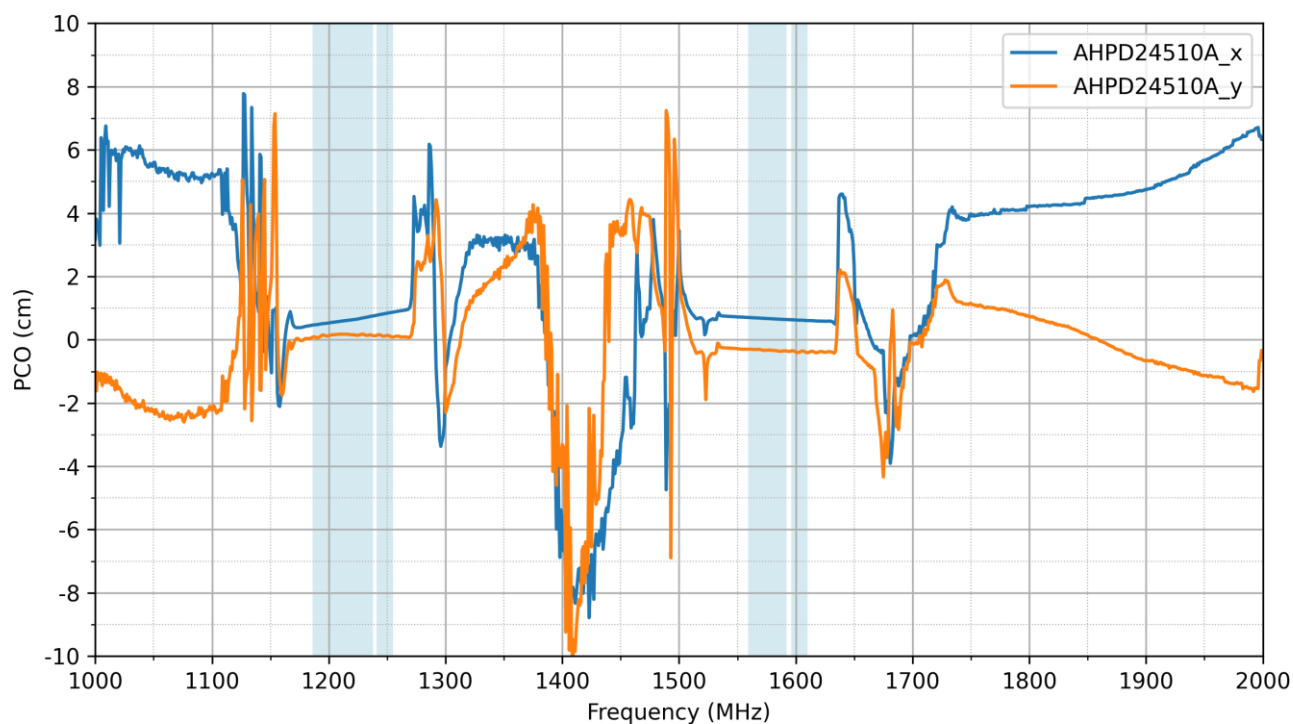
5.4 PCV
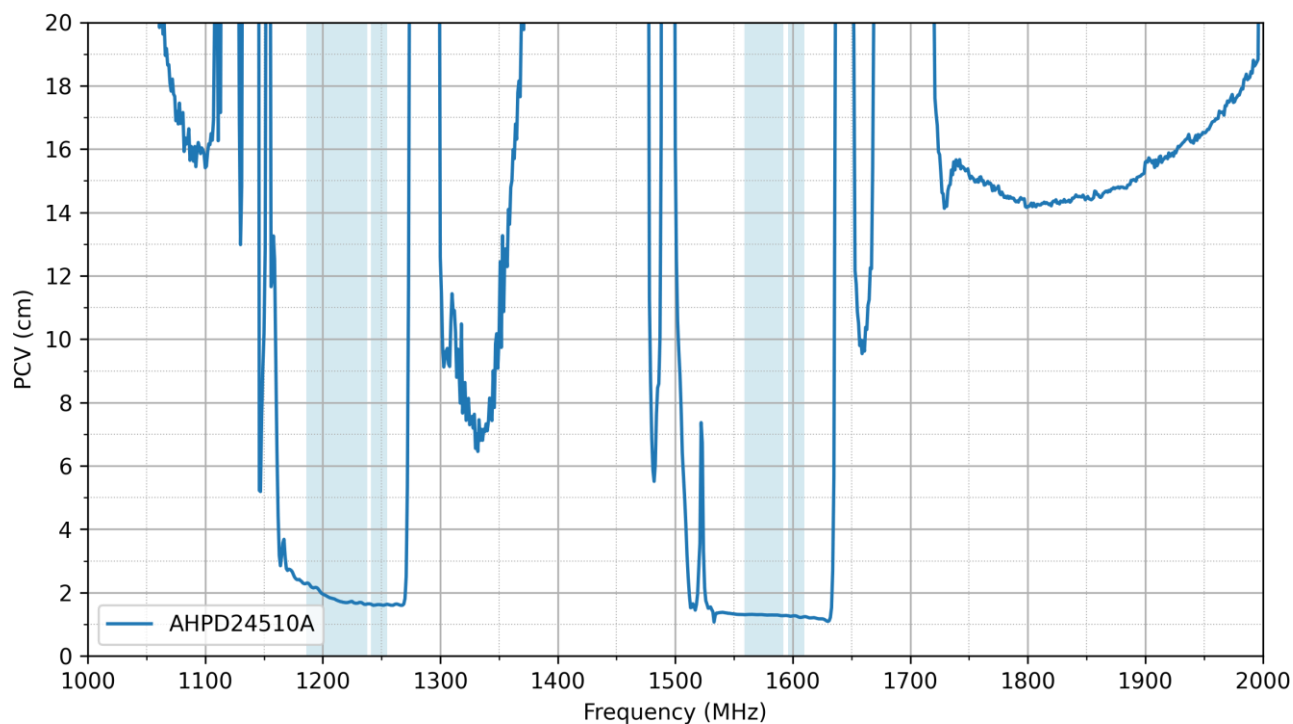
6. Radiation Patterns

6.1 Test Setup
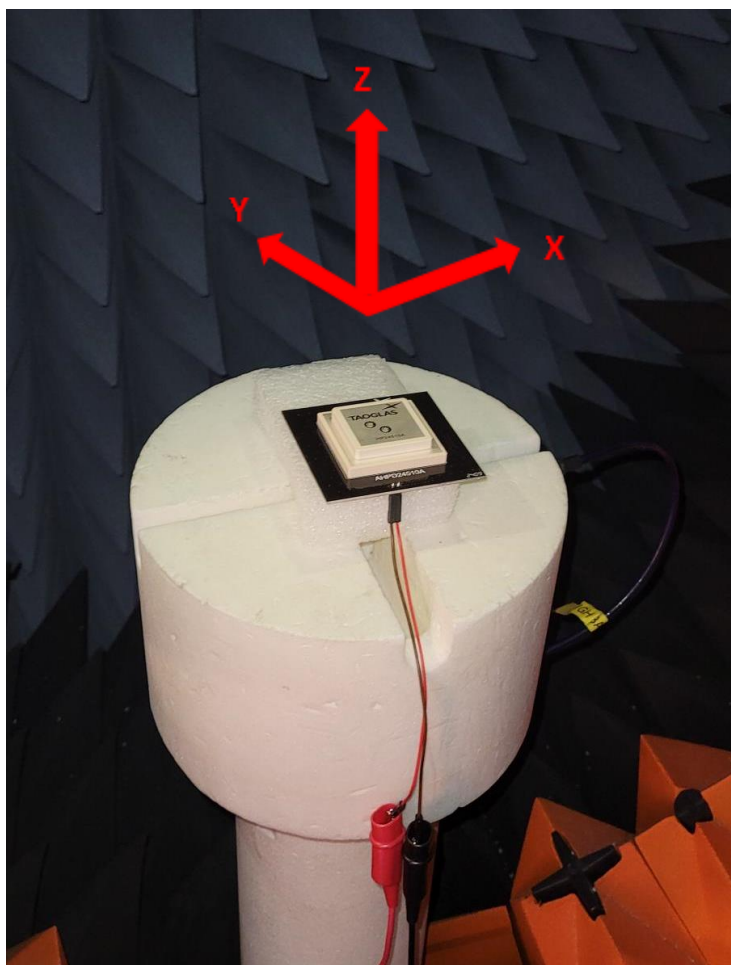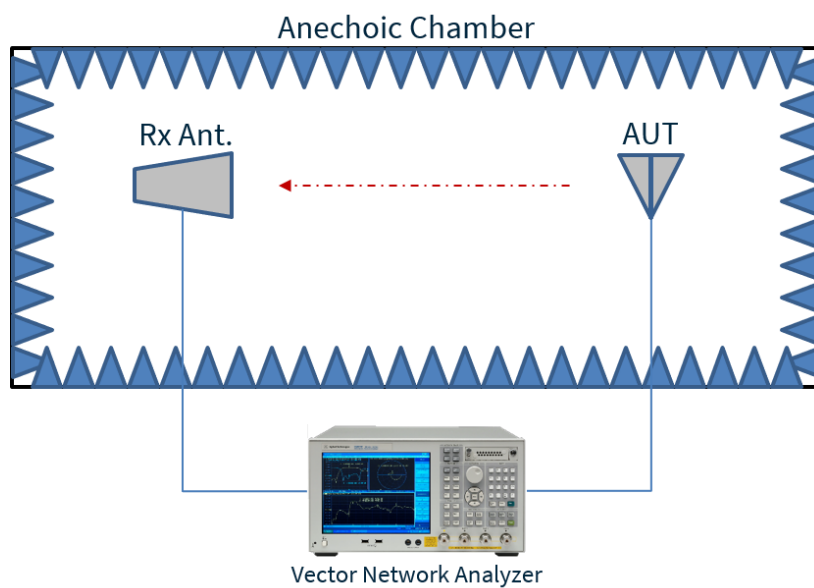
Chamber Test Set-up

XZ Plane	YZ Plane	XY Plane
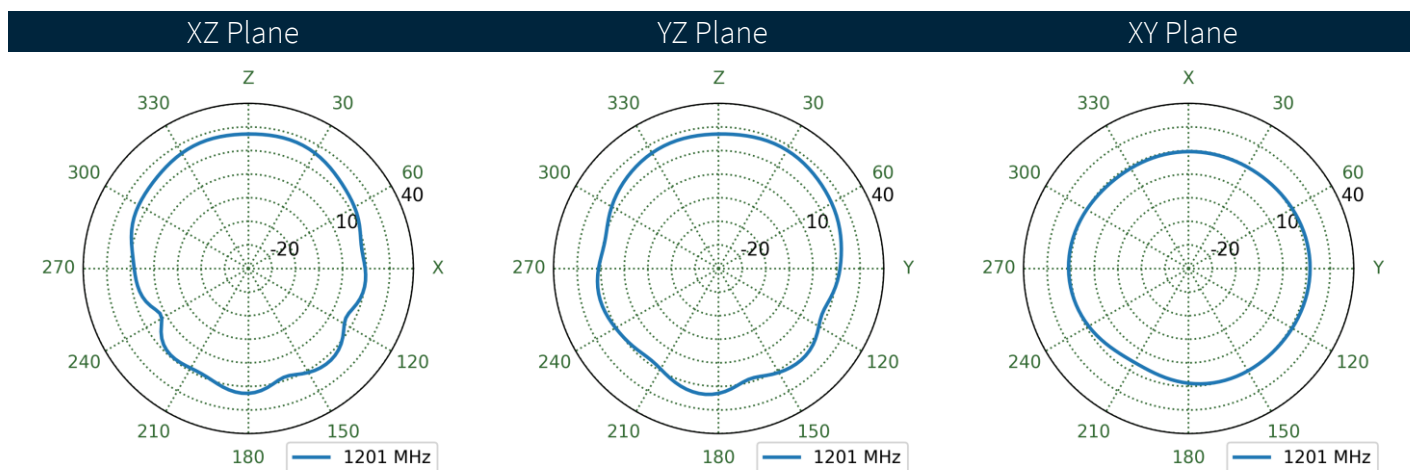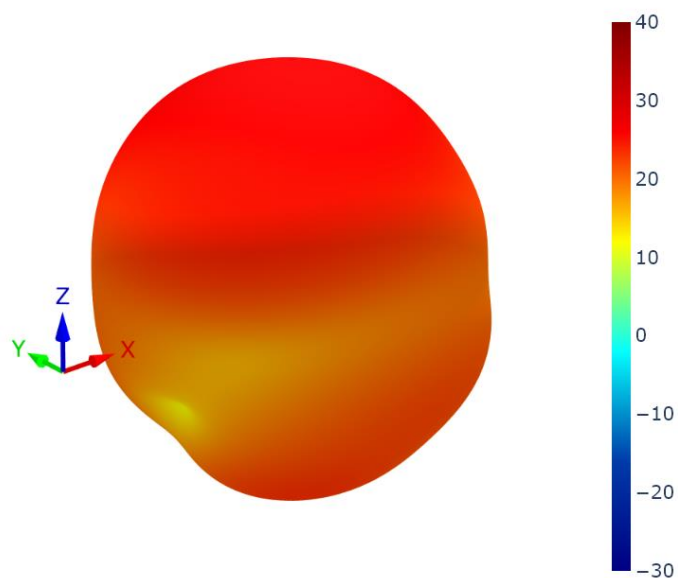
6.3 | Patterns at 1227 MHz
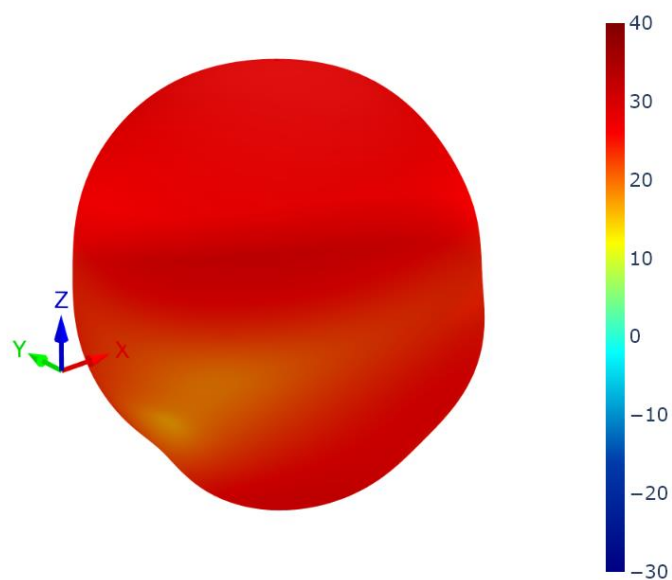
XZ Plane	YZ Plane	XY Plane
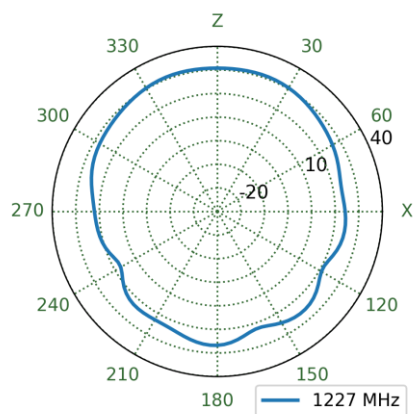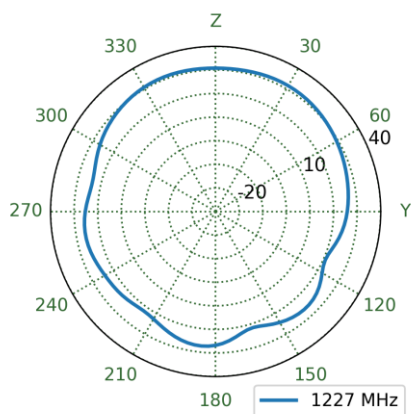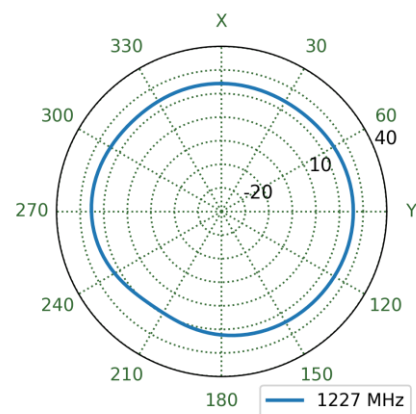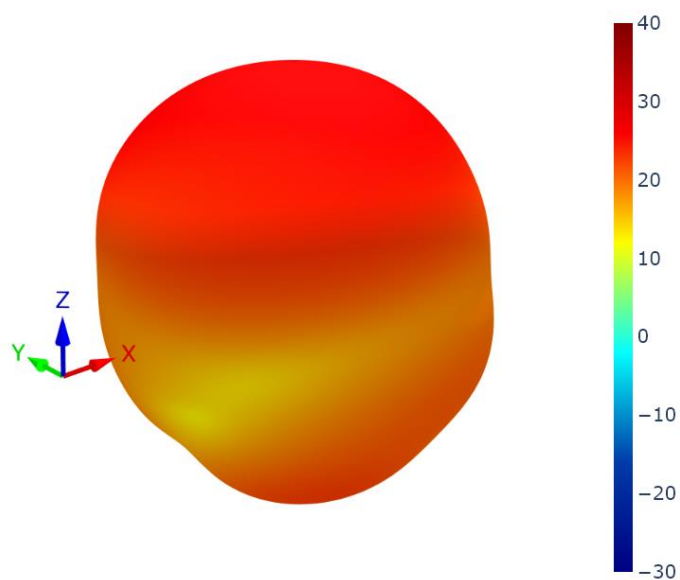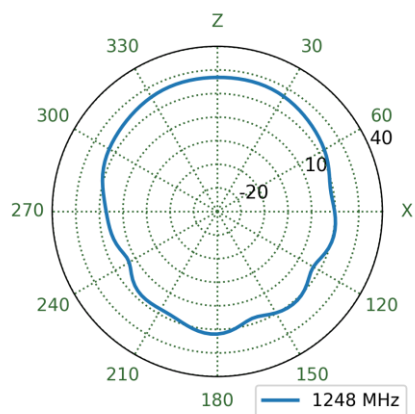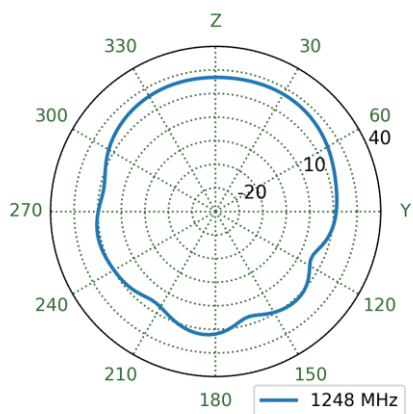
XZ Plane	YZ Plane	XY Plane
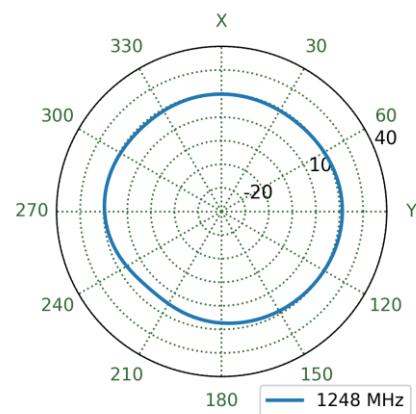
6.5 Patterns at 1561 MHz
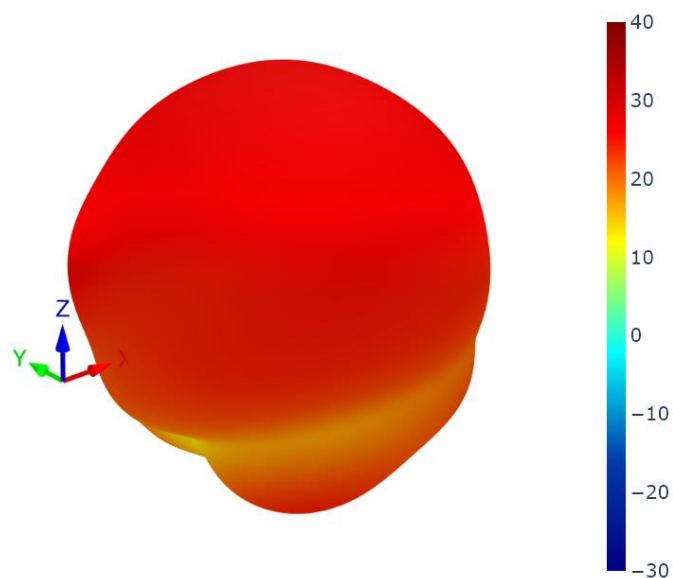
XZ Plane	YZ Plane	XY Plane
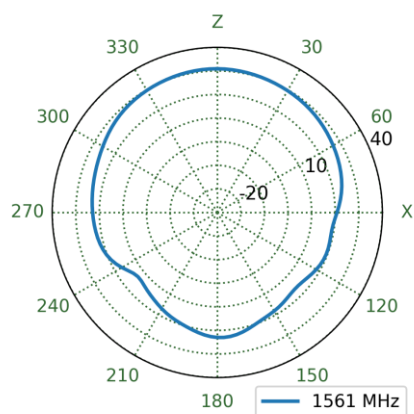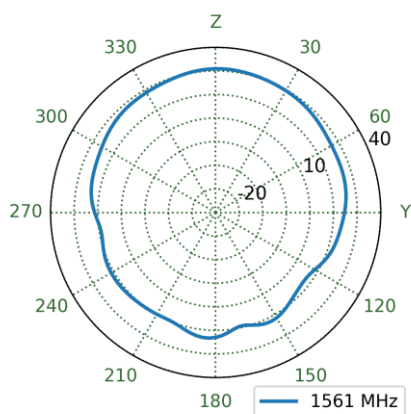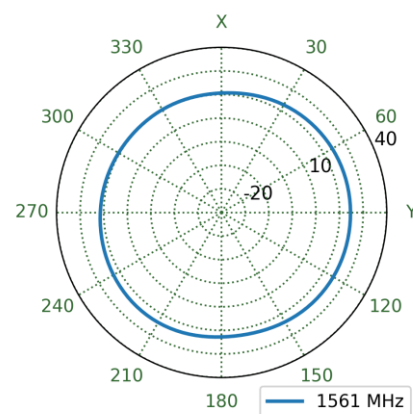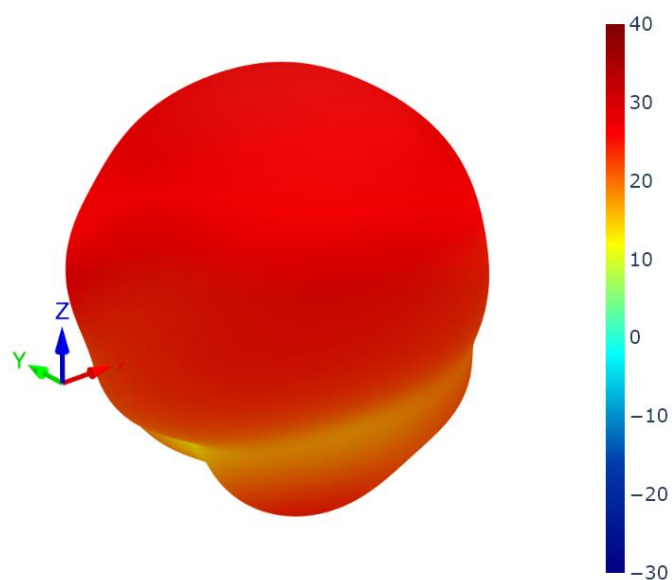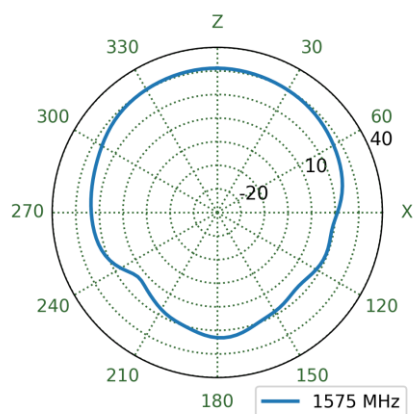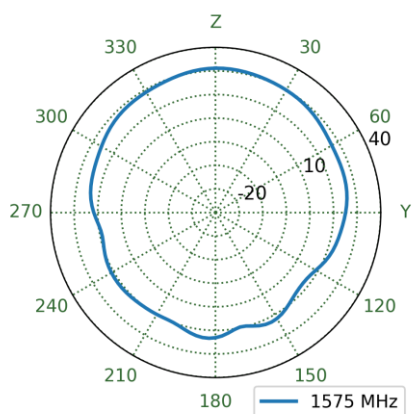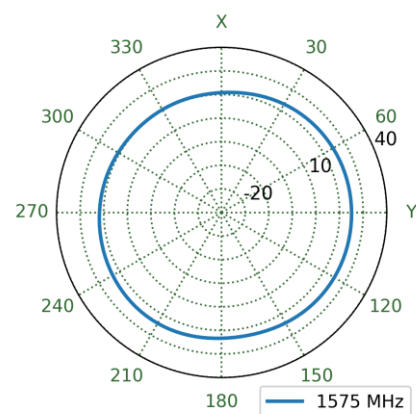
1561 MHz
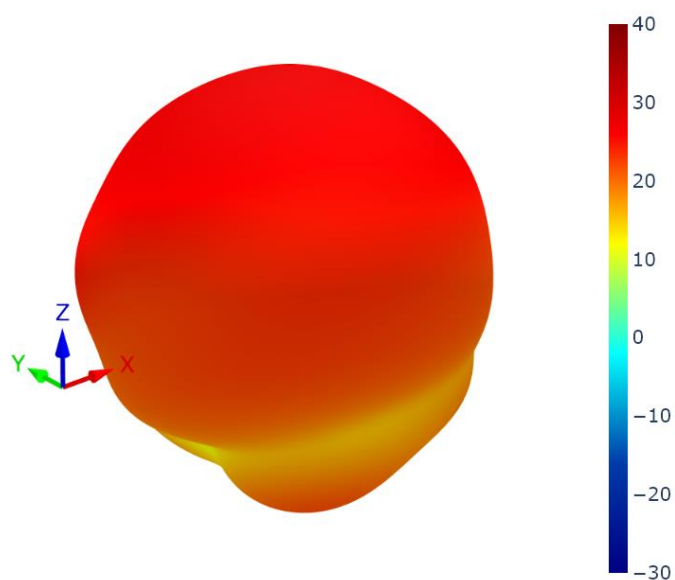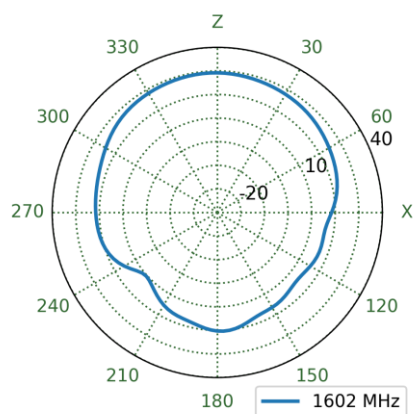
XZ Plane	YZ Plane	XY Plane

XZ Plane	YZ Plane	XY Plane
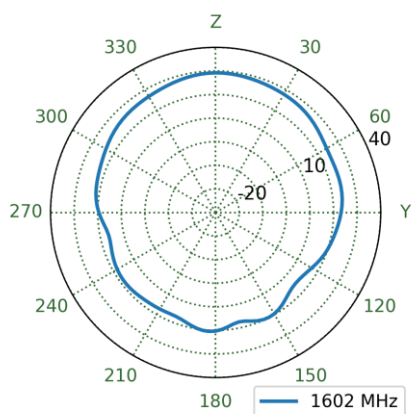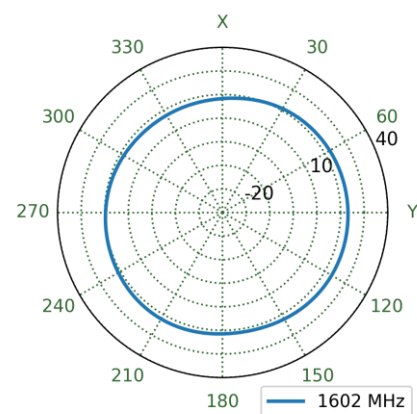
SPE-25-8-009 – AHPD24510A

Revision: A (Original First Release)	
Date:	2025-01-15
Notes:	Initial Release
Author:	Gary West

Previous Revisions

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