



TAOGLAS®



Datasheet

Guardian HP

Part No:
MA990.A.001

Description

Guardian HP 9-in-1 Combination Adhesive Mount Antenna
1*Active Dual-band GNSS, 8*5G/4G MIMO

Features:

Low-profile IP67 Rated Housing
8*5G/4G MIMO
1*GNSS – GPS/GLONASS/BeiDou/Galileo L1/L2
Cables: GNSS 1m of RG-174, 5G/4G 1m of TGC-1.5DS
Connectors: SMA Male Straight
Dimensions: 148 x 134 x 20.5mm
CE Certified
RoHS & Reach Compliant

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1. Introduction



The Taoglas MA990 Guardian HP has been designed to be the smallest 9-in-1 combination antenna in the world. The MA990 Guardian HP is also the worlds first 9-in-1 antenna with dual-band GNSS and high performance 5G/4G allowing it to be compatible with the next generation of modules and routers. The MA990 combines all 9 antenna elements in one low-profile heavy-duty, IP67 rated waterproof, adhesive mount external enclosure.

It comes with 1* Active dual-band GPS/GLONASS/BeiDou/Galileo L1/L2 coverage, 8* 5G/4G Cellular MIMO. The MA990 has been designed as a low profile solution for IoT and Automotive applications where space is at a premium allowing it to be installed in the headliners of vehicles or on the back window of a vehicle.

This is an ideal external combination antenna solution that is used where drilling a hole through the roof of a vehicle or a metal panel for an external antenna is not feasible or desired and can be covertly installed via the adhesive pad supplied with the antenna.

Typical applications include:

- Passenger Bus / Rail / Air Applications.
- Automotive and Heavy Equipment Vehicle Tracking and Telematics
- HD Video over 5G/4G
- First Responder and Emergency Services

The MA990 Guardian HP has been specifically designed to hit certain 5G bands required for modules, for example MIMO 4 and MIMO are tuned from 600-6000MHz while MIMO 3 and MIMO 6 are tuned from 3000-6000MHz to cover high band 5G and C-band/CBRS applications. This data is shown below in the performance table, and it is recommended to use the suitable connections for your required frequency bands by reviewing this table before connecting the antenna to your device.

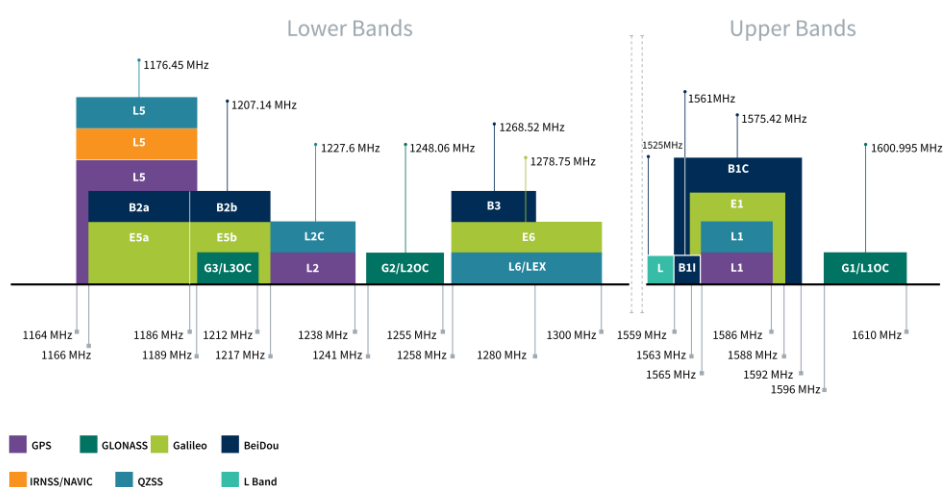
Taoglas also provides services to ensure optimum overall performance for your entire system by working closely with the customer to design in the best antenna and potential additional components for your system.

5G/4G applications demand high-speed data uplink and downlink. High efficiency and high gain MIMO antennas are necessary to achieve the required signal to noise ratio and throughput required to solve these challenges. Taoglas also takes care to ensure high isolation between the MIMO antennas to prevent self interference. Low loss cables are used to keep efficiency high over longer cable lengths. In contrast, smaller MIMO antennas with poorer quality thin cables will have reduced efficiency and isolation, which would lead to a large drop in system throughput, increased incidences of signal drops, and may indeed not make a system connection at all.

Cable type and length, and connector types are fully customizable and the Guardian HP can also be customized for any variation of antennas below 9-in-1 and the addition of Wi-Fi/Single Band GNSS is also possible. Contact your regional Taoglas customer support team for more information.

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)	GPS_L2	GLONASS_G2	BeiDou_B1	Galileo_E1	GPS_L1	GLONASS
	1207-1239	1241-1248	1559-1563	1563-1587	1564-1587	1593-1610
Efficiency (%)	63.2	47.5	36.3	69.1	69.1	36.1
Average Gain (dB)	-1.99	-3.23	-4.40	-1.60	-1.60	-4.42
Peak Gain (dBi)	4.24	3.19	0.92	3.69	3.69	0.82
Axial Ratio	13.7	22.2	17.4	8.6	6.6	19.1
Impedance	50 Ω					
Polarization	RHCP					

LNA and Filter Electrical Properties						
Frequency (MHz)	GPS_L2	GLONASS_G2	BeiDou_B1	Galileo_E1	GPS_L1	GLONASS
	1207-1239	1241-1248	1559-1563	1563-1587	1564-1587	1593-1610
Gain (dB)	19.8	19.6	22.7	22.6	22.6	21.4
Noise Figure (dB)	3.8	4.4	2.4	2.3	2.3	2.4
Return Loss (dB)	< -10					
Input Voltage (V)	+ 1.8 to 5.5					
Current consumption (mA)	16.8 $\pm$ 3					
Outer Band Attenuation (dB) (reference level from 0dB)	30 @ Fc +/-100MHz 40 @ Fc +/-200MHz					

5G/4G Electrical								
Band	Frequency (MHz)		Efficiency (%)	Average Gain (dB)	Peak Gain (dBi)	Impedance	Polarization	Max. input power
5G NR B71	617-698	MIMO 1	-	-	-	50 Ω	Linear	3W
		MIMO 2	-	-	-			
		MIMO 3	-	-	-			
		MIMO 4	39.9	-3.99	0.48			
		MIMO 5	36.8	-4.34	0.07			
		MIMO 6	-	-	-			
		MIMO 7	-	-	-			
		MIMO 8	-	-	-			
LTE 700	698-806	MIMO 1	-	-	-			
		MIMO 2	-	-	-			
		MIMO 3	-	-	-			
		MIMO 4	41.8	-3.78	1.09			
		MIMO 5	43.7	-3.59	2.24			
		MIMO 6	-	-	-			
		MIMO 7	-	-	-			
		MIMO 8	-	-	-			
LTE 800/900	824-960	MIMO 1	-	-	-			
		MIMO 2	-	-	-			
		MIMO 3	-	-	-			
		MIMO 4	49.1	-3.08	2.94			
		MIMO 5	51.1	-2.92	3.86			
		MIMO 6	-	-	-			
		MIMO 7	-	-	-			
		MIMO 8	-	-	-			
5G NR 1500	1427-1518	MIMO 1	-	-	-			
		MIMO 2	36.2	-4.41	2.20			
		MIMO 3	-	-	-			
		MIMO 4	37.4	-4.27	-0.12			
		MIMO 5	41.8	-3.78	0.14			
		MIMO 6	-	-	-			
		MIMO 7	39.0	-4.08	1.62			
		MIMO 8	-	-	-			
5G NR n66	1710-2170	MIMO 1	53.2	-2.74	4.00			
		MIMO 2	53.0	-2.75	2.21			
		MIMO 3	-	-	-			
		MIMO 4	45.7	-3.40	3.53			
		MIMO 5	51.4	-2.89	3.25			
		MIMO 6	-	-	-			
		MIMO 7	52.6	-2.79	2.44			
		MIMO 8	52.7	-2.78	3.58			
LTE 2600	2300-2690	MIMO 1	49.0	-3.10	3.28			
		MIMO 2	47.9	-3.20	1.87			
		MIMO 3	-	-	-			
		MIMO 4	47.0	-3.28	3.31			
		MIMO 5	44.5	-3.51	2.60			
		MIMO 6	-	-	-			
		MIMO 7	45.0	-3.47	2.75			
		MIMO 8	47.1	-3.27	4.50			
5G NR n78	3300-3800	MIMO 1	51.5	-2.88	5.39			
		MIMO 2	-	-	-			
		MIMO 3	41.0	-3.87	3.95			
		MIMO 4	45.2	-3.45	2.87			
		MIMO 5	47.7	-3.21	2.46			
		MIMO 6	37.9	-4.21	4.21			
		MIMO 7	-	-	-			
		MIMO 8	52.0	-2.84	5.08			
LTE 5200	5150-5925	MIMO 1	50.9	-2.93	5.18			
		MIMO 2	-	-	-			
		MIMO 3	53.7	-2.70	5.34			
		MIMO 4	45.1	-3.46	7.07			
		MIMO 5	41.9	-3.78	6.62			
		MIMO 6	46.3	-3.34	4.24			
		MIMO 7	-	-	-			
		MIMO 8	51.5	-2.88	4.83			

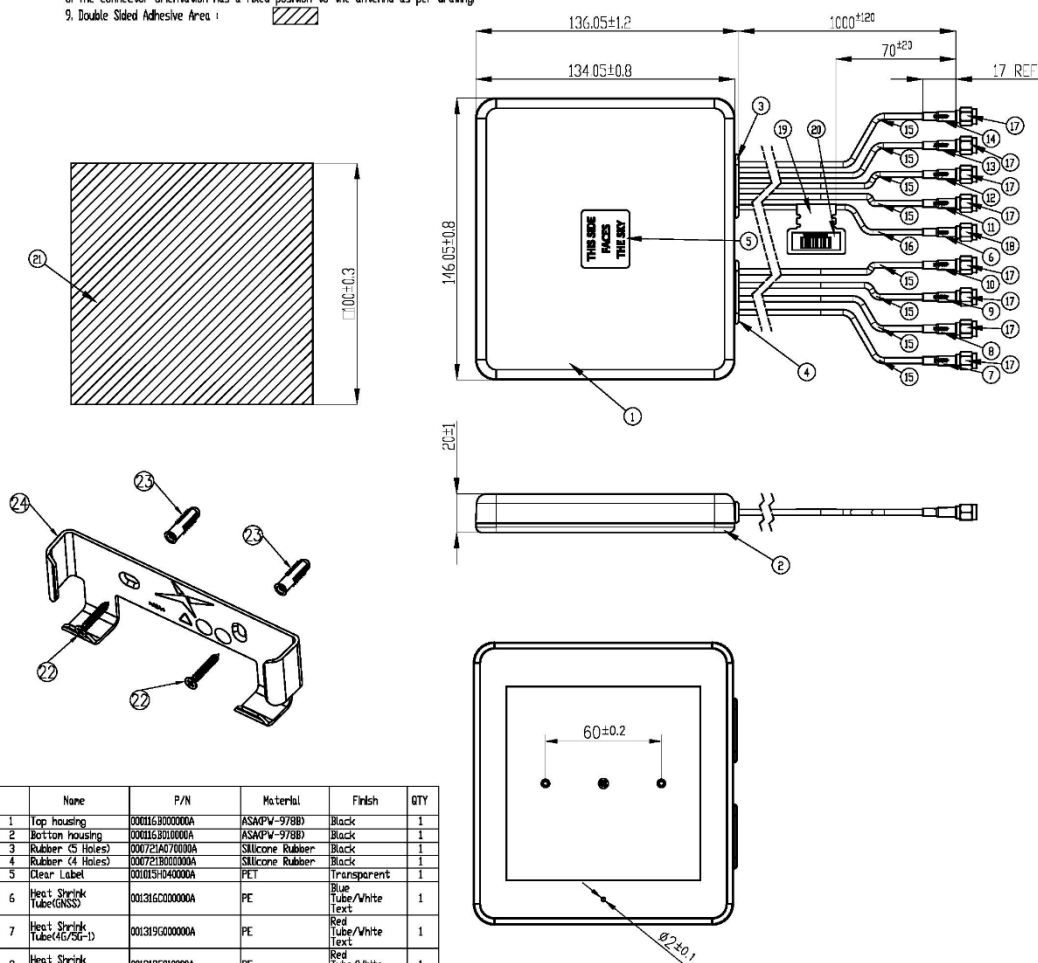
Mechanical	
Dimensions	146 x 134 x 20.5mm
Weight	800g
Cable	1m TGC-1.5DS for 5G/4G – Fully Customizable 1m RG174 for GNSS – Fully Customizable
Connector	5G/4G: SMA Male Straight – Fully Customizable GNSS: SMA Male Straight – Fully Customizable
Housing Material	ASA
Adhesive	CR4305 + 3M 9448HK

Environmental	
IP Rating	IP67
Operation Temperature	-40°C ~ +85°C
Storage Temperature	-40°C ~ +85°C
Humidity	Non-condensing 65°C 95% RH

3. Mechanical Drawing

NOTES:

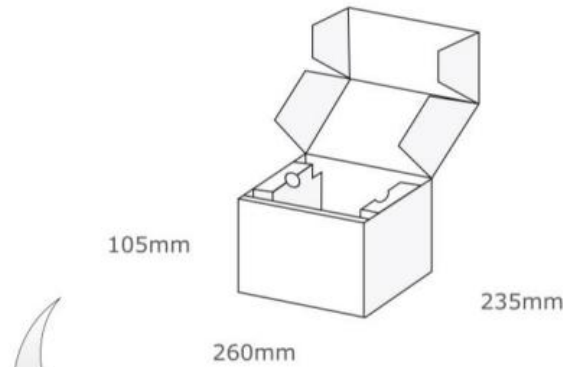
1. All material must be RoHS compliant.
2. Color Codes: PANTONE Black / Plastics Color 0720-1-1.
3. Finish: Mirror Polish / SPI A-2.
4. Deburring: Less than 0.02mm.
5. No gate, parting line and any other tooling marks on appearance of product.
6. Once product have any crack/break/thread damage or any structural tooling issue, molding supplier need to correct the issue unconditionally.
7. Use this drawing together with the corresponding 3D CAD database file to fully describe the part.
8. The connector orientation has a fixed position to the antenna as per drawing.
9. Double Sided Adhesive Area: 



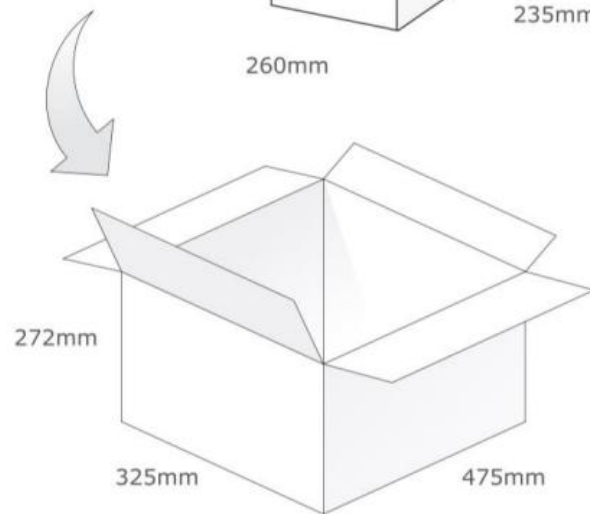
	Name	P/N	Material	Finish	QTY
1	Top housing	00616-900000A	ASA/PW-9/88D	Black	1
2	Bottom housing	00616-800000A	ASA/PW-9/88D	Black	1
3	Rubber (5 Holes)	006721A07000A	Silicone Rubber	Black	1
4	Rubber (4 Holes)	006721B00000A	Silicone Rubber	Black	1
5	Clear Label	001013104000A	PET	Transparent	1
6	Heat Shrink Tube(GNSS)	001316C00000A	PE	Blue Tube/White Text	1
7	Heat Shrink Tube(4G/5G-1)	001319G00000A	PE	Red Tube/White Text	1
8	Heat Shrink Tube(4G/5G-2)	001319G01000A	PE	Red Tube/White Text	1
9	Heat Shrink Tube(4G/5G-3)	001319G02000A	PE	Red Tube/White Text	1
10	Heat Shrink Tube(4G/5G-4)	001319G03000A	PE	Red Tube/White Text	1
11	Heat Shrink Tube(4G/5G-5)	001319G04000A	PE	Red Tube/White Text	1
12	Heat Shrink Tube(4G/5G-6)	001319G11000A	PE	Red Tube/White Text	1
13	Heat Shrink Tube(4G/5G-7)	001321A00000A	PE	Red Tube/White Text	1
14	Heat Shrink Tube(4G/5G-8)	001321A01000A	PE	Red Tube/White Text	1
15	1G-15dB Cable	301319101000A	PE	Black	8
16	RG174 Cable	301319C00000A	PVC	Black	1
17	SWAMP ST-15dB	200221E00012A	Brass	Au Plated	8
18	SWAMP ST-15dB	200221C04001A	Brass	Au Plated	1
19	Empty Label	001013500000A	PEPA	White	1
20	Barcode Label	001013501000A	PET	White	1
21	Double Sided Adhesive(Black Foam)	001019C01000A	CR4305+3M9448-K	White Liner	1

4. Packaging

1 No. MA990.A.001 per small box
Box Dimensions - 260*235*105mm
Weight - 1.16Kg



1 Outer Carton
Carton Dimensions - 540*490*240mm
8 pcs MA990.A.001 per carton
Weight - 9.9Kg



5. Antenna Characteristics

5.1 Test Set-up

AUT

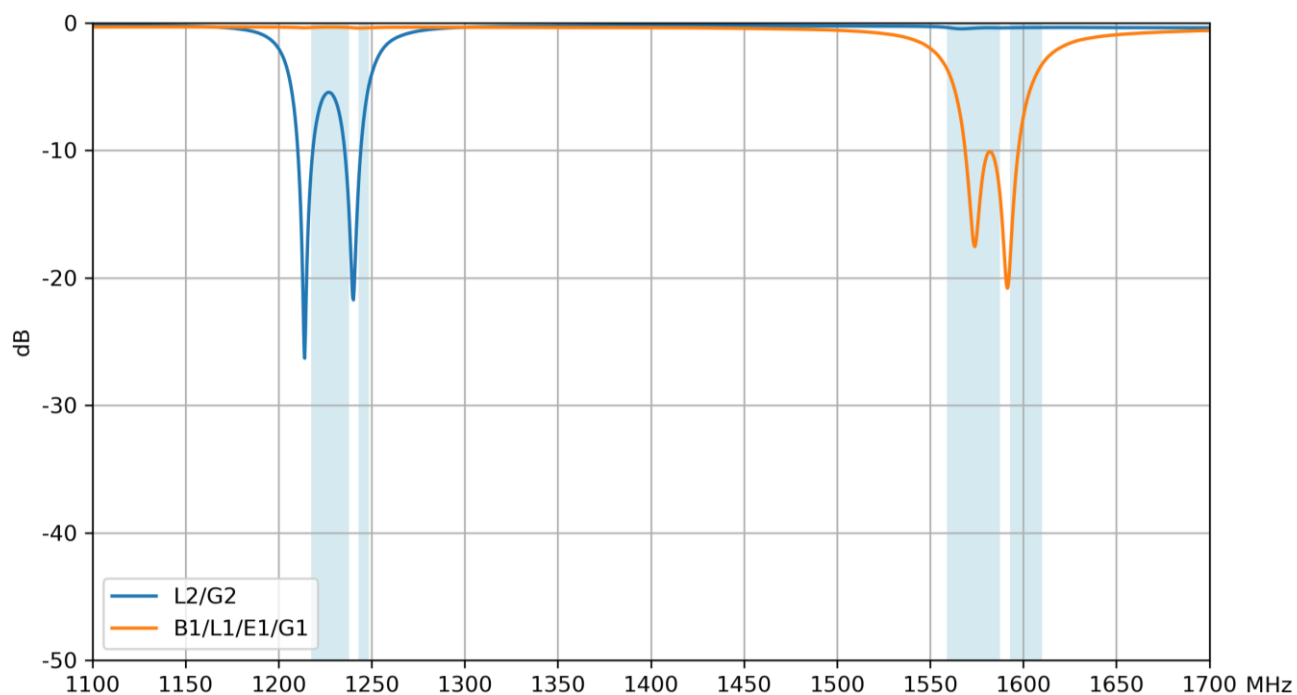


Vector Network Analyzer

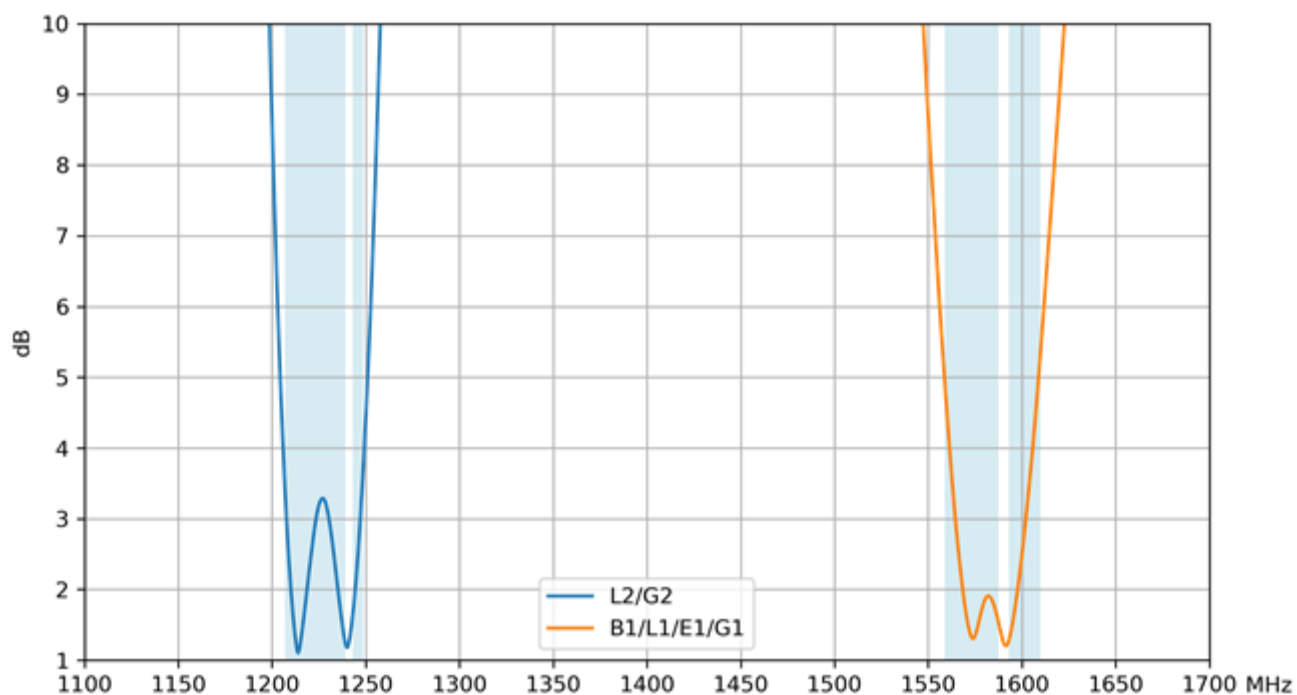


VNA Test Set-up

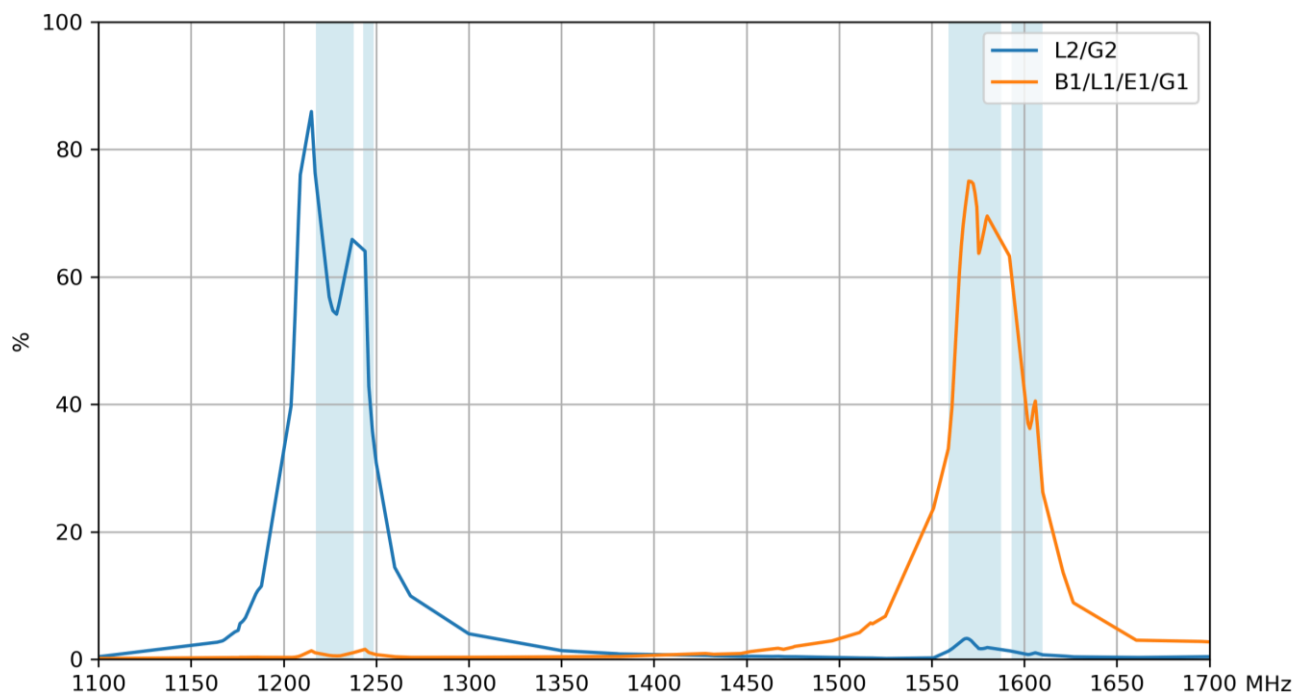
5.2 Return Loss - GNSS



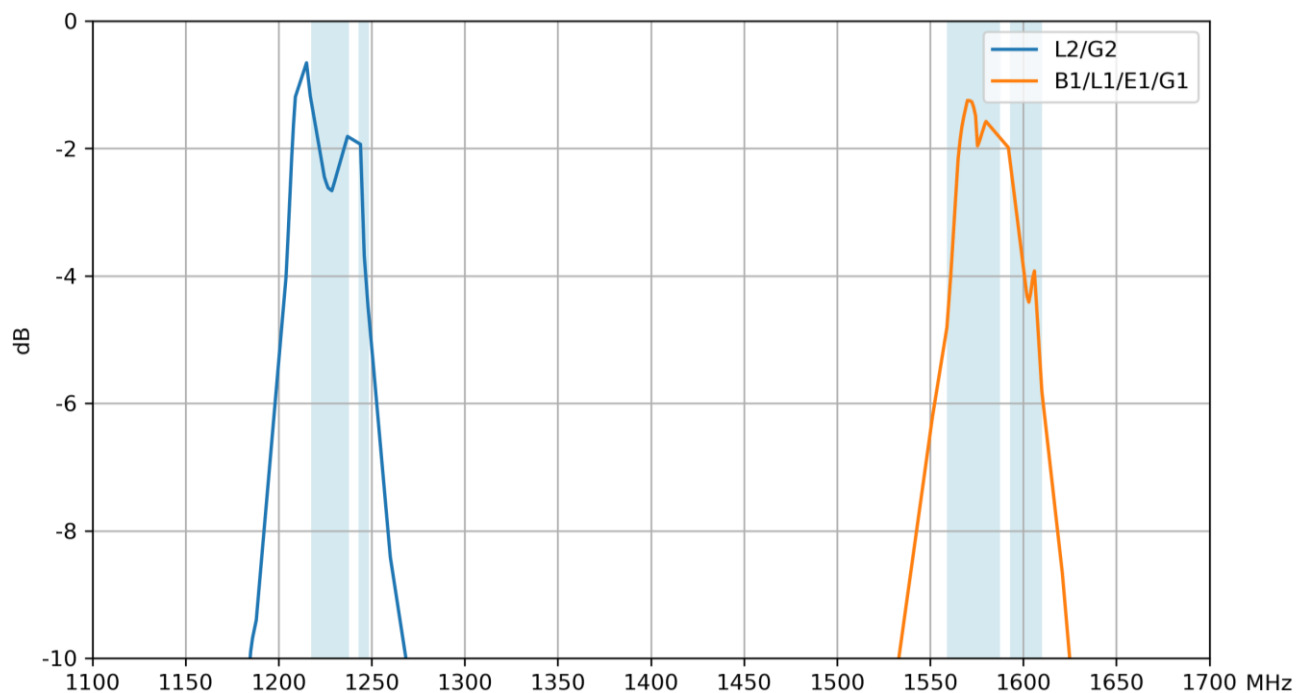
5.3 VSWR - GNSS



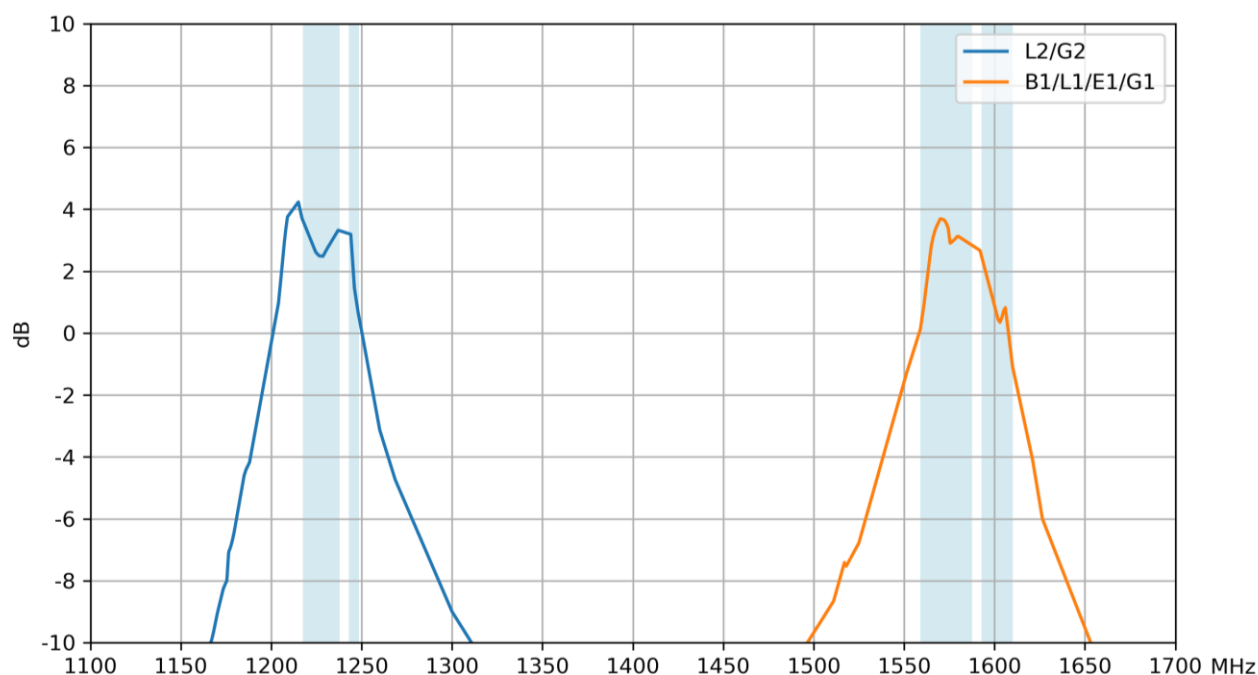
5.4 Efficiency - GNSS



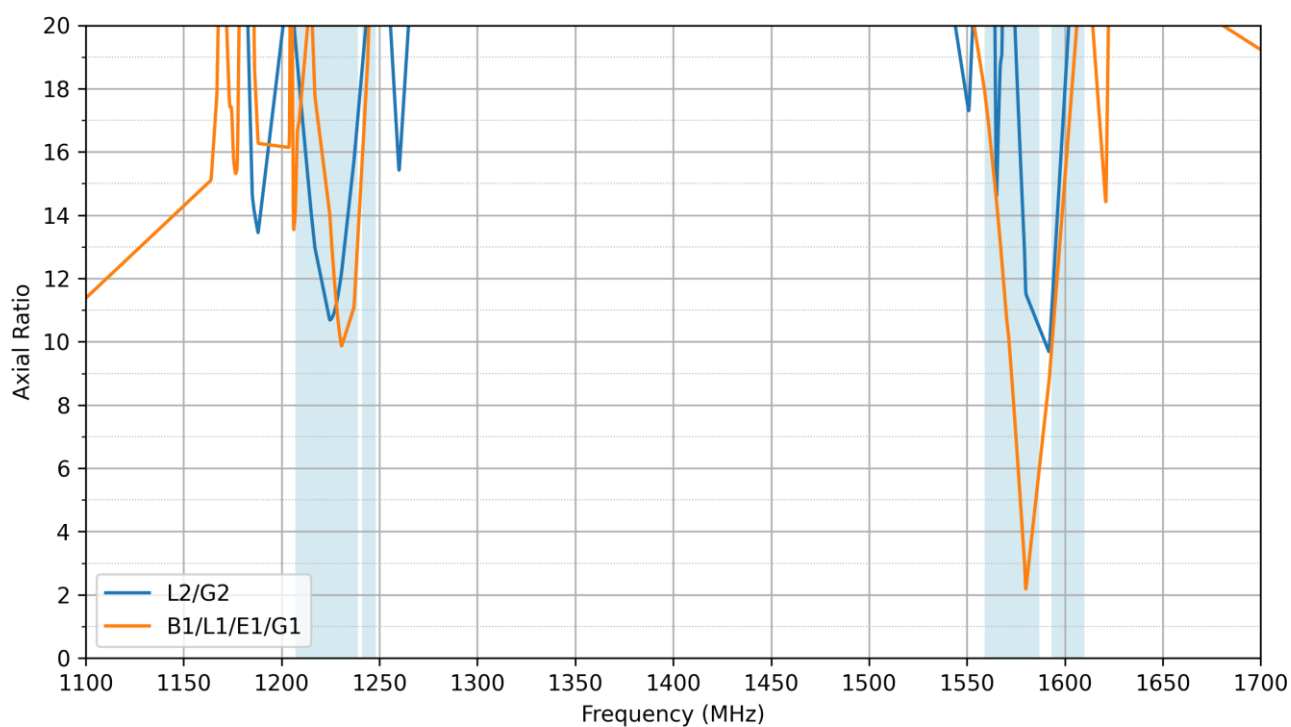
5.5 Average Gain - GNSS



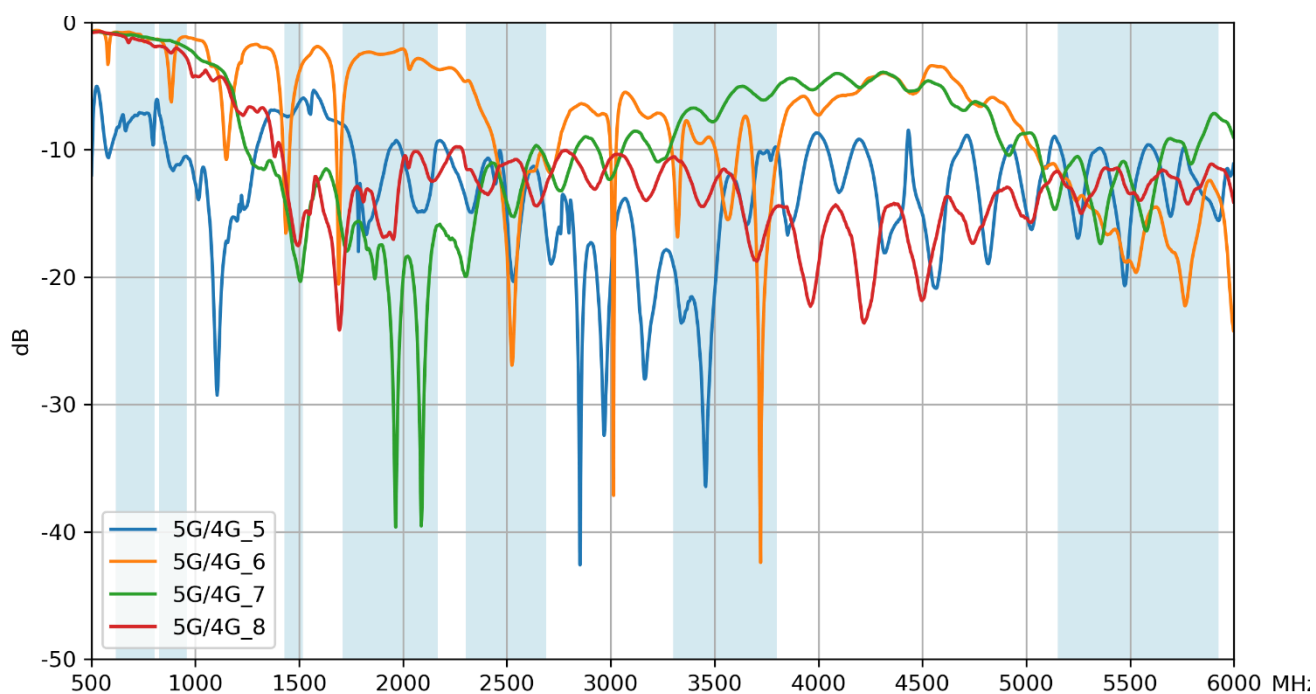
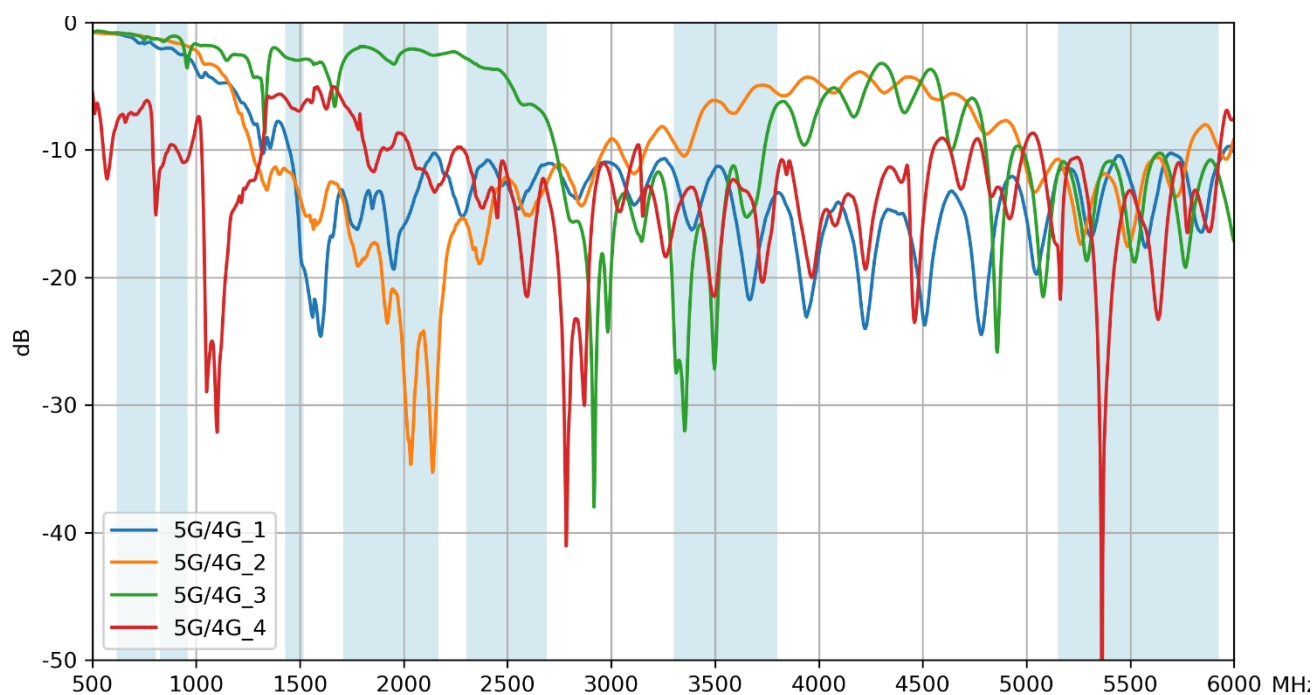
5.6 Peak Gain - GNSS



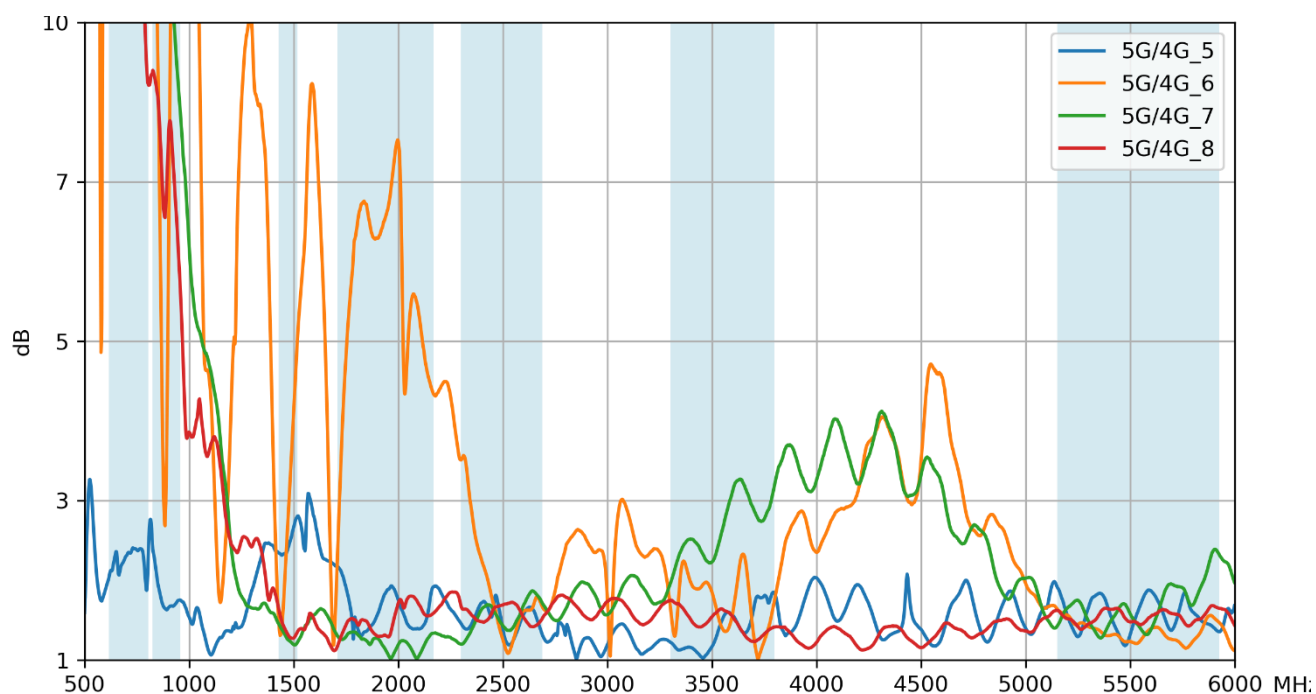
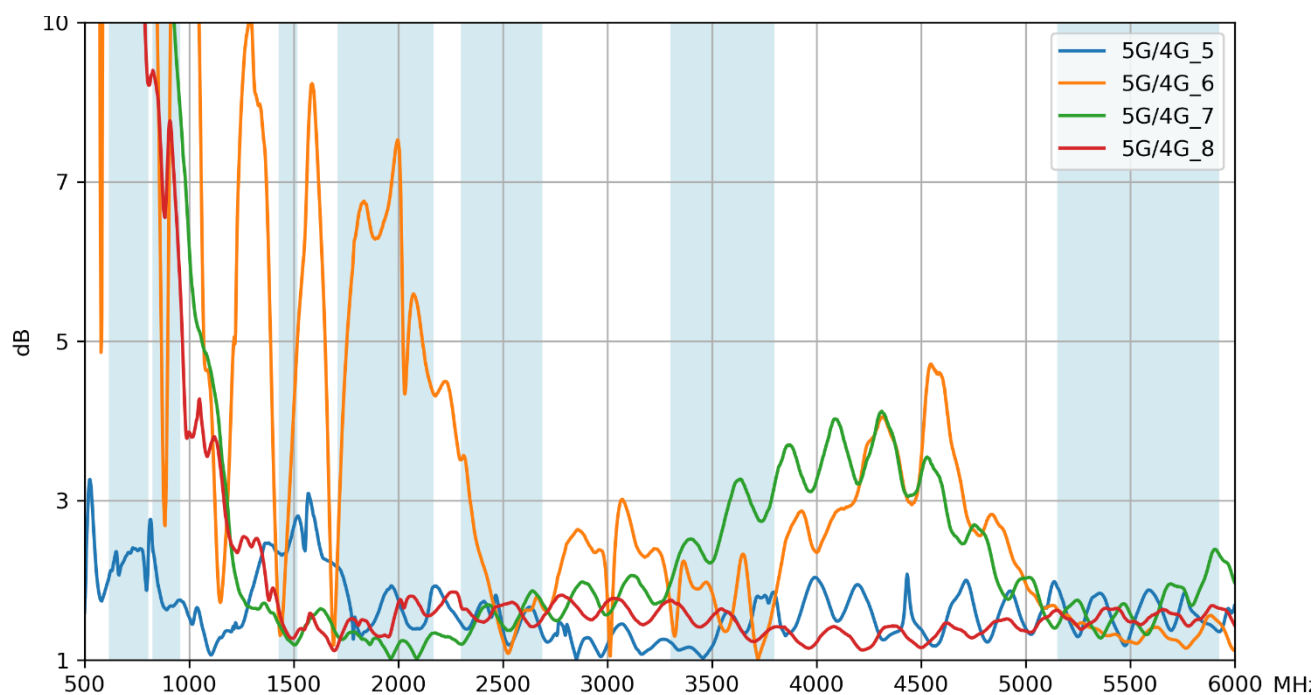
5.7 Axial Ratio - GNSS



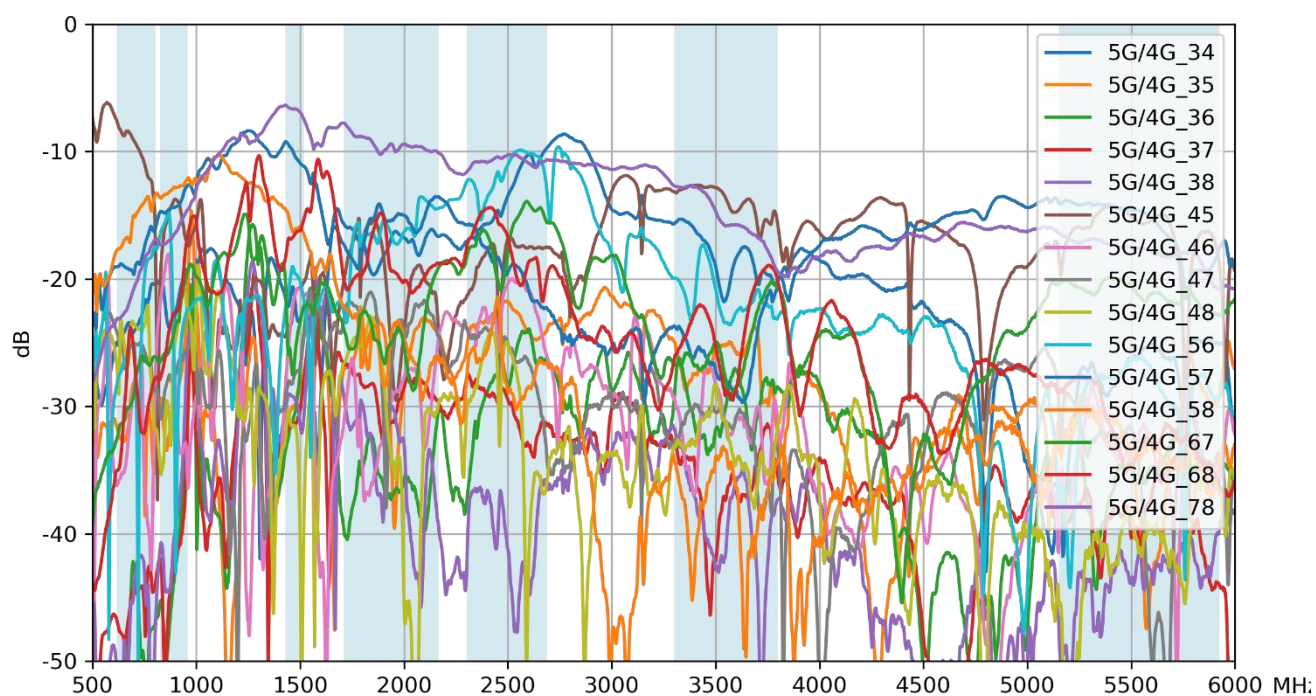
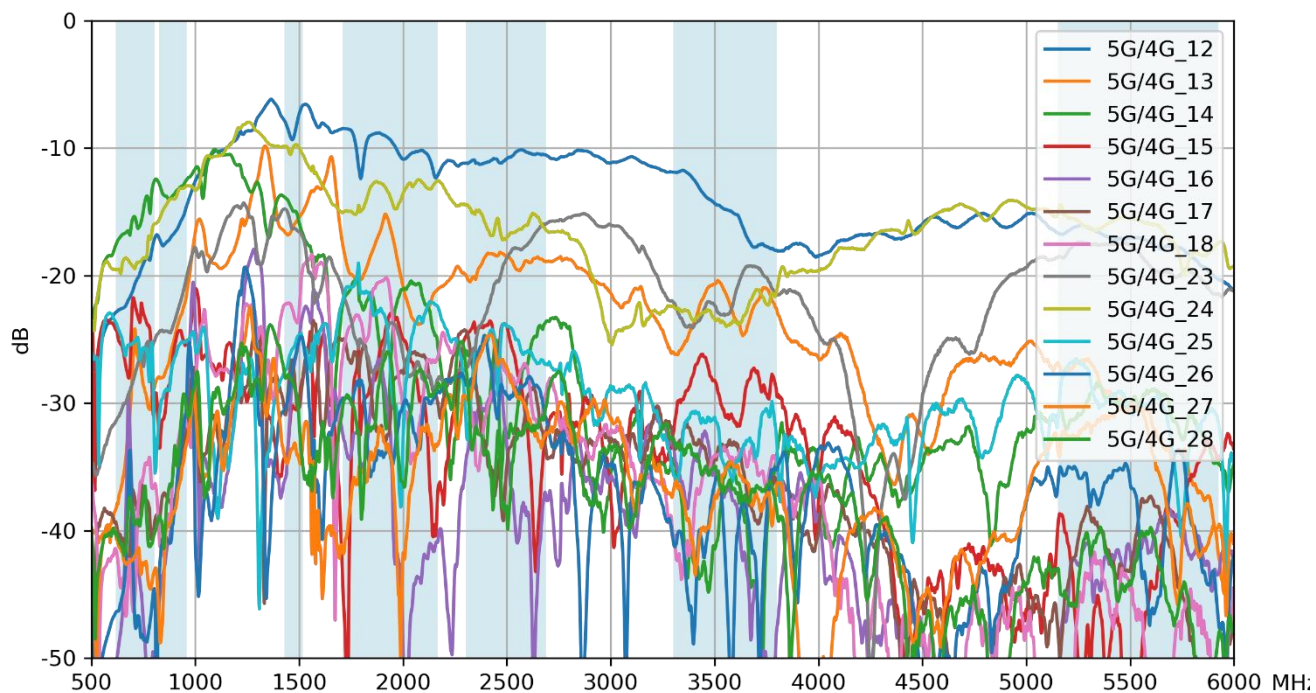
5.8 Return Loss – 5G-4G



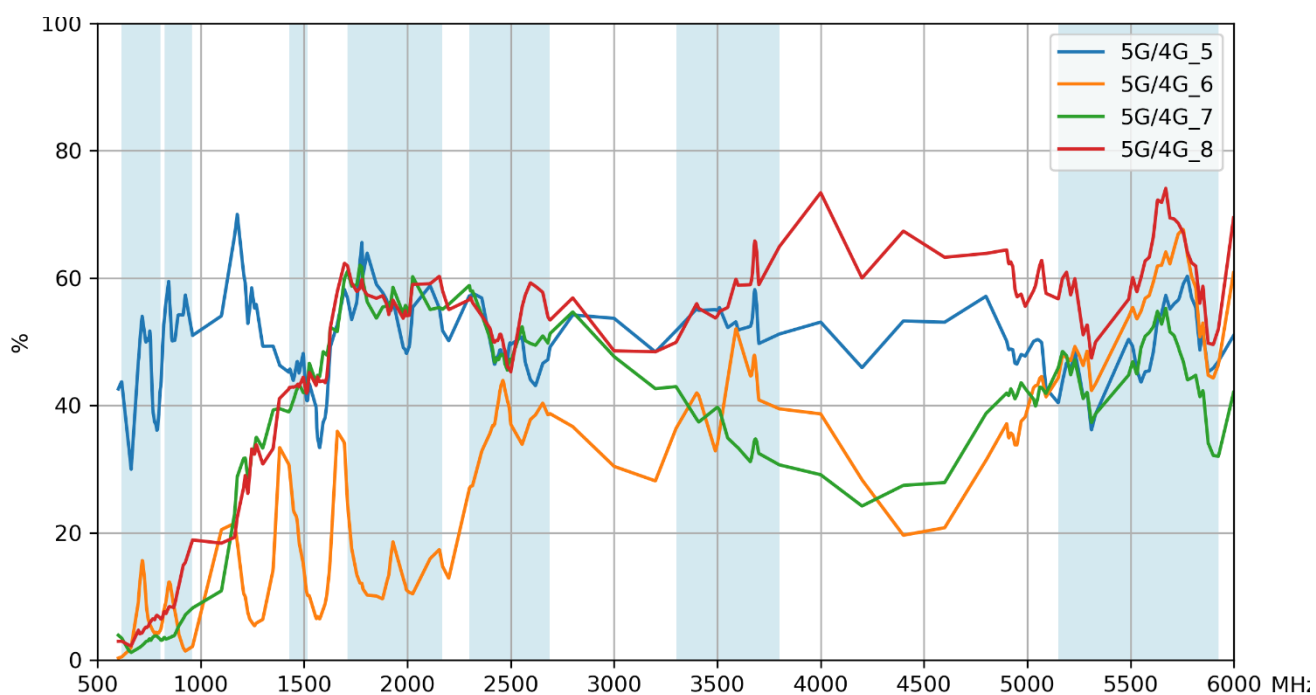
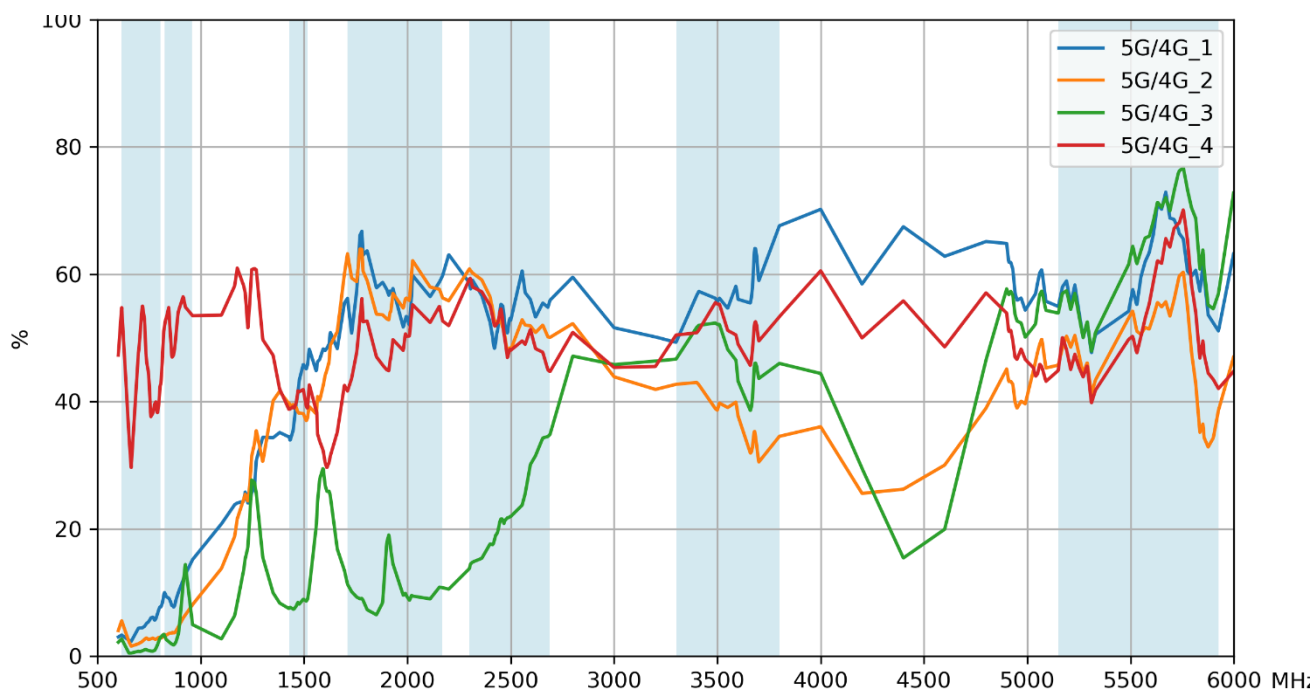
5.9 VSWR – 5G-4G



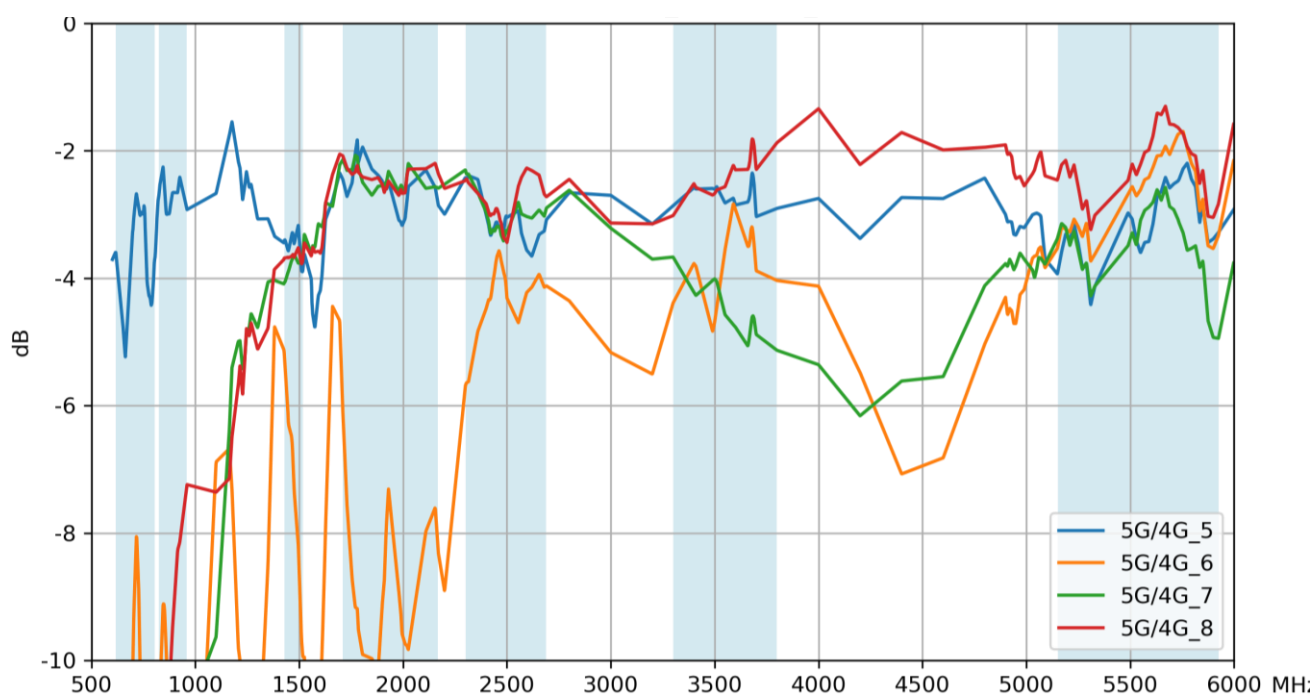
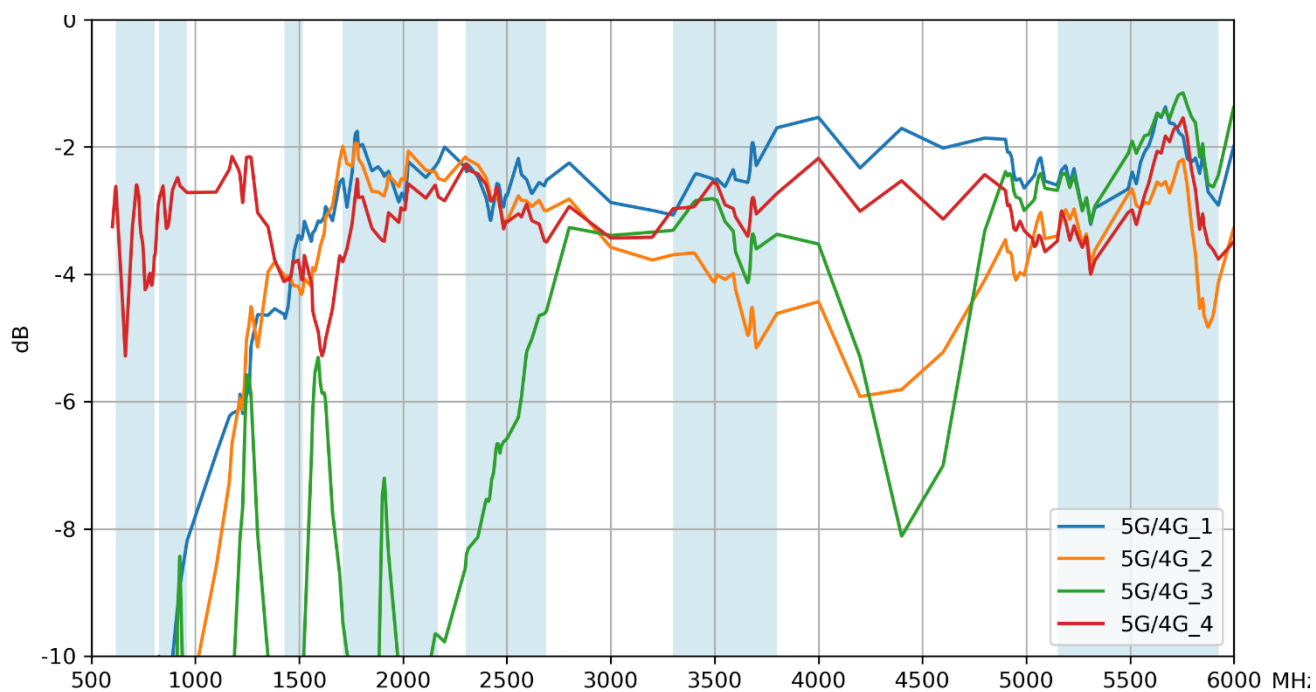
5.10 Isolation – 5G-4G



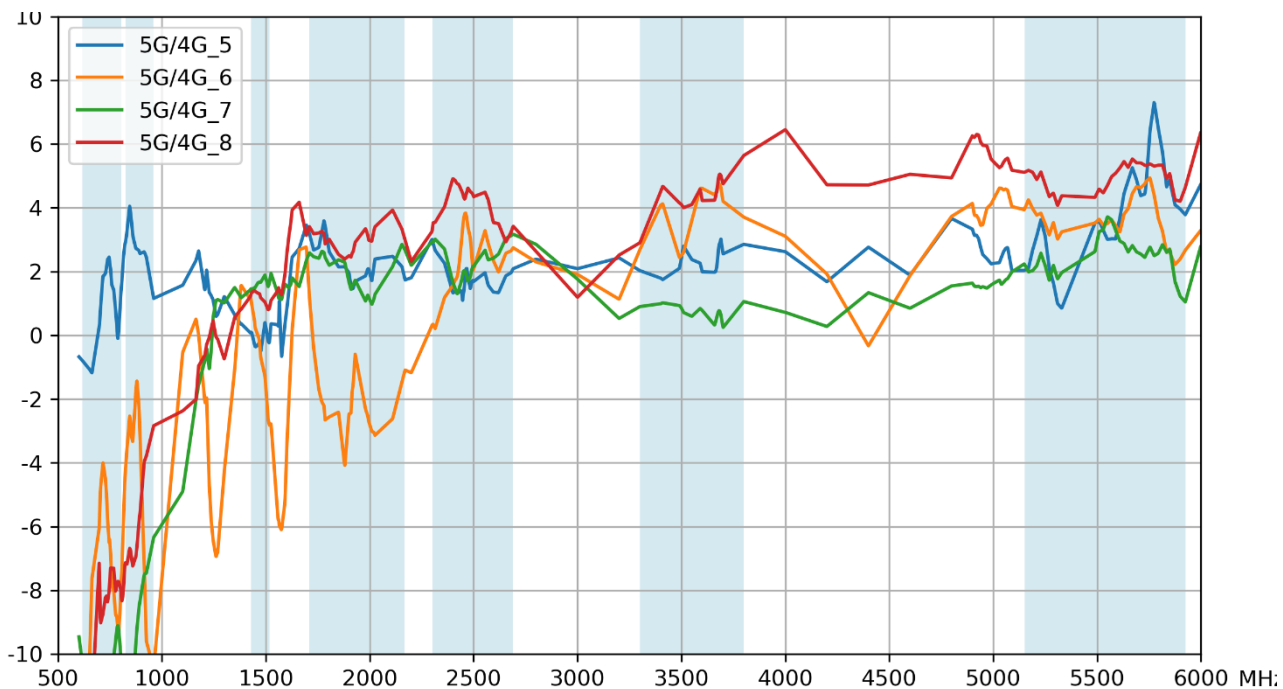
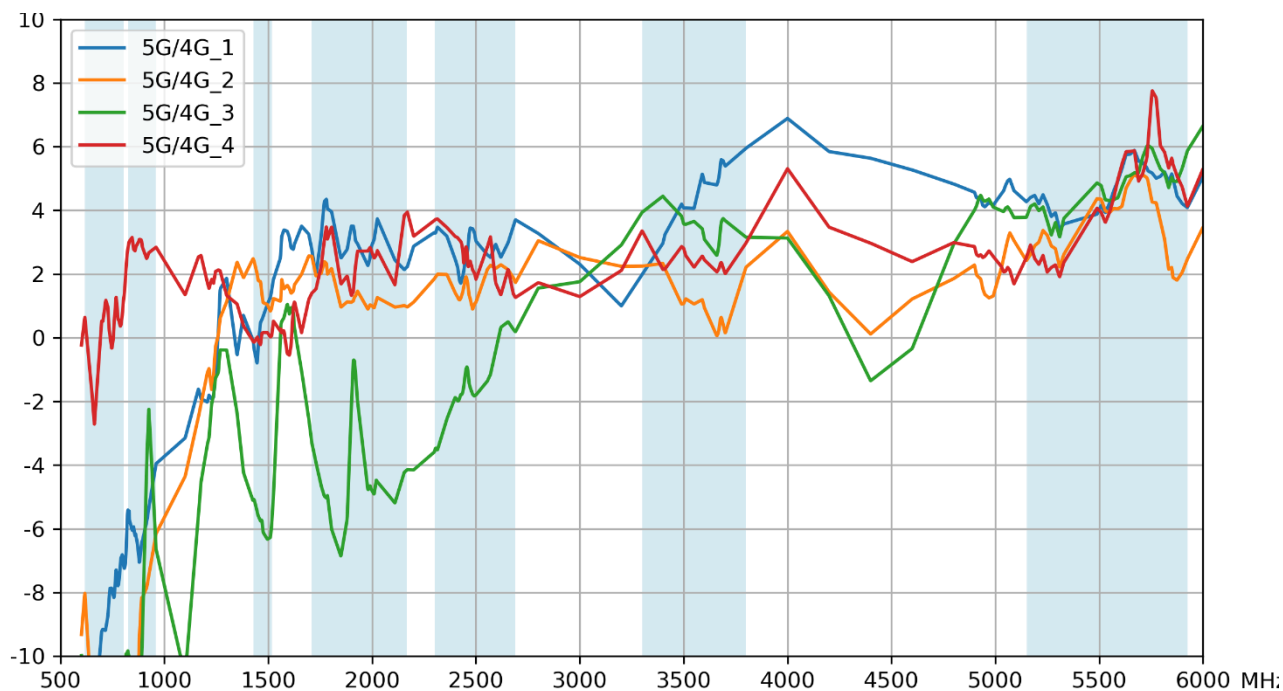
5.11 Efficiency – 5G-4G



5.12 Average Gain – 5G-4G

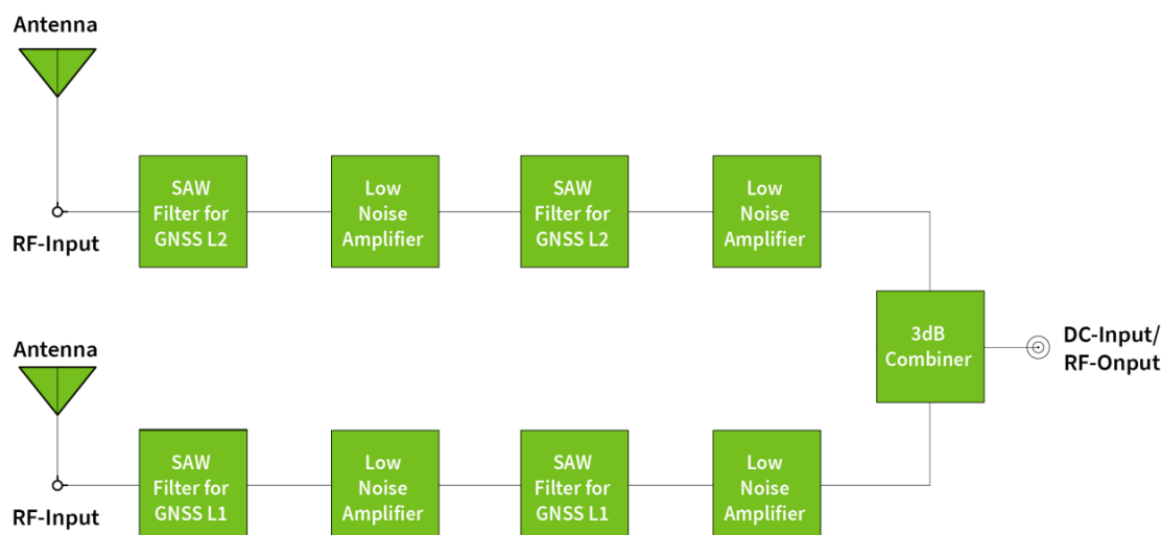


5.13 Peak Gain – 5G-4G

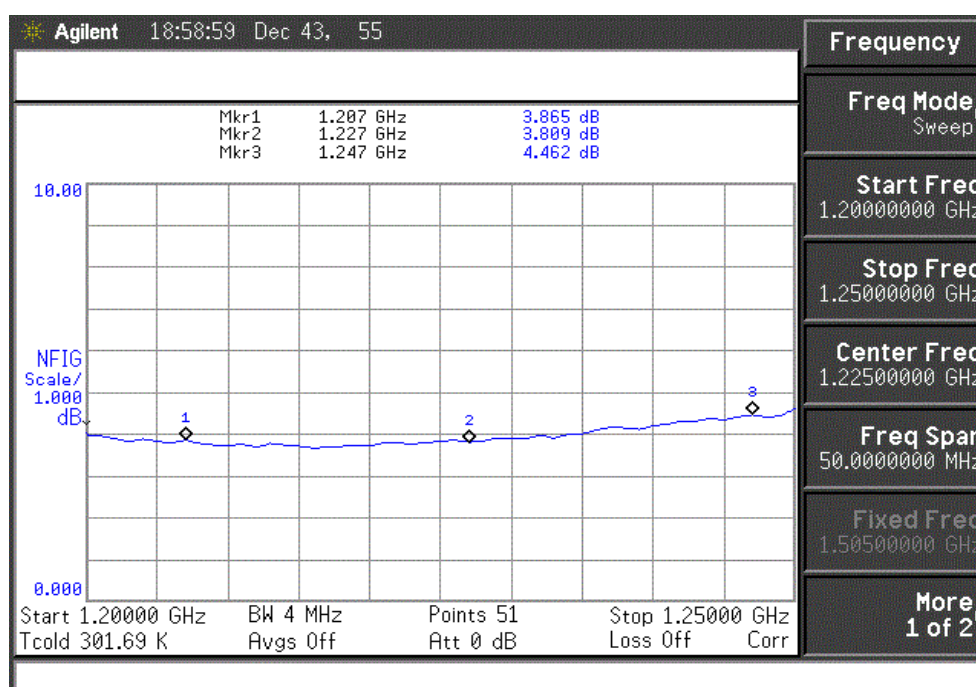


6. LNA Characteristics

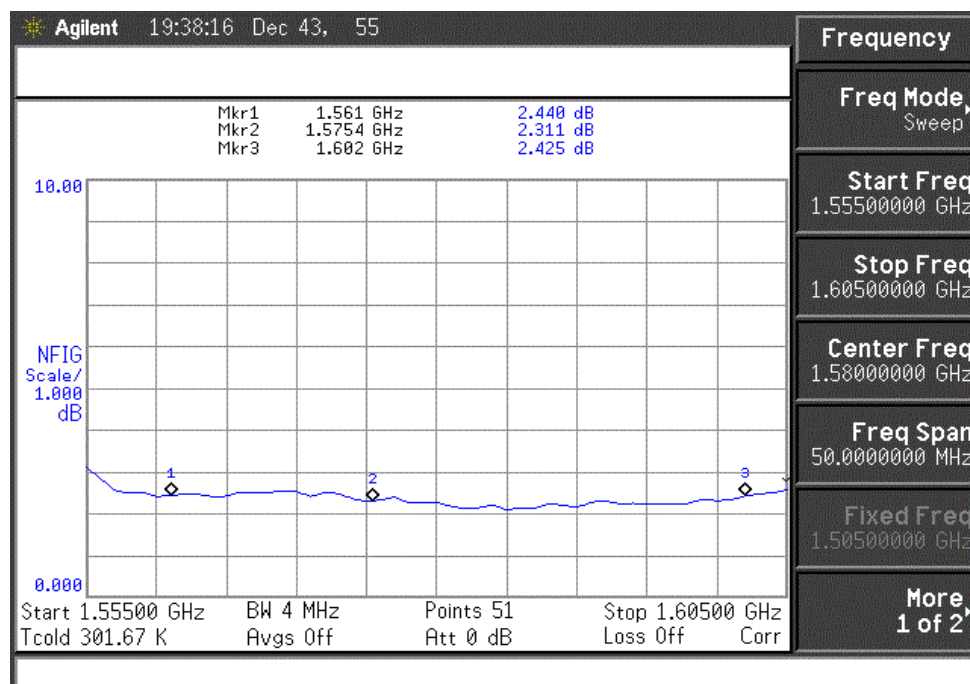
6.1 Block Diagram



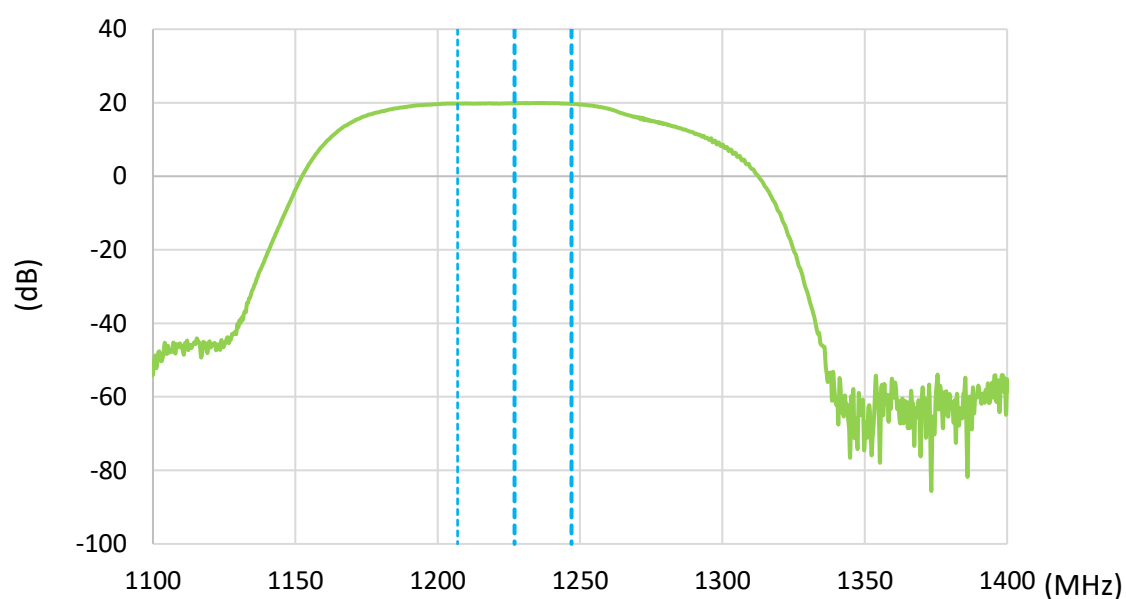
6.2 Noise Figure – Low-Band



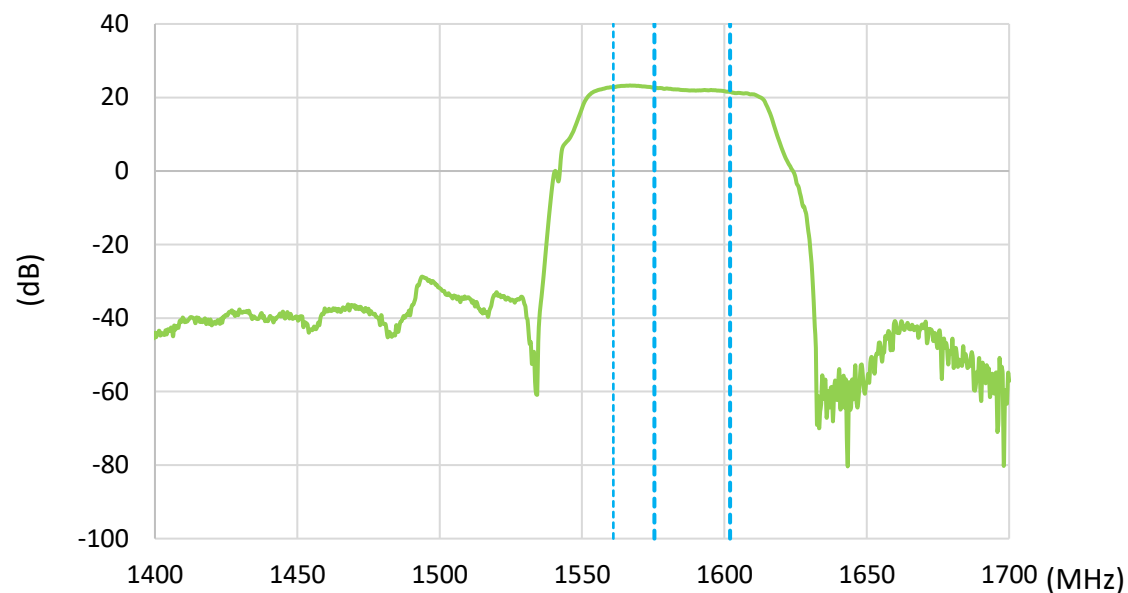
6.3 Noise Figure – High-Band



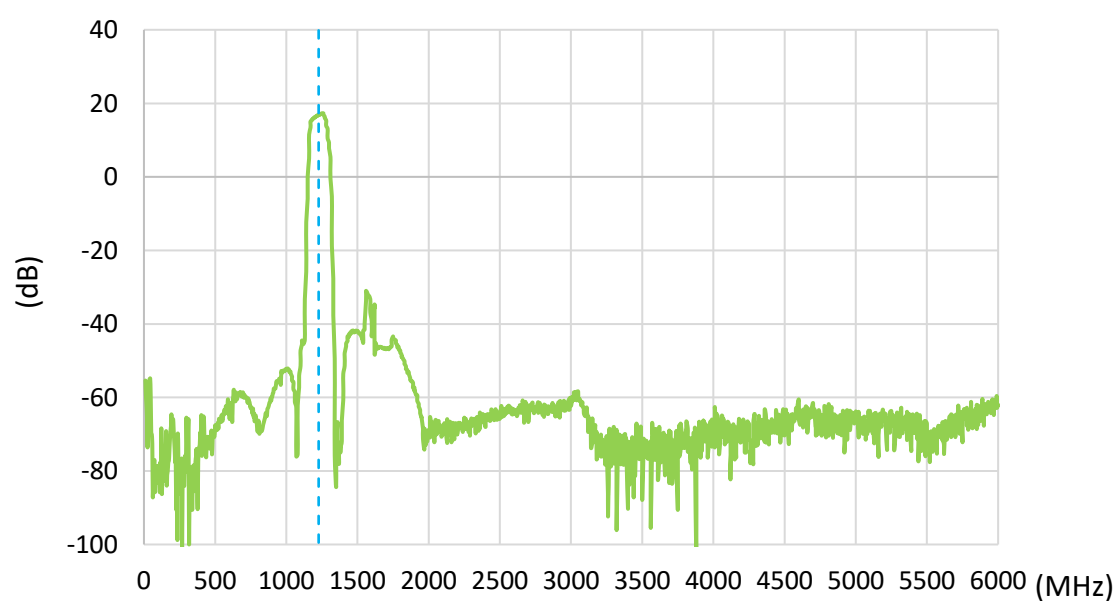
6.4 LNA Gain – Low-Band



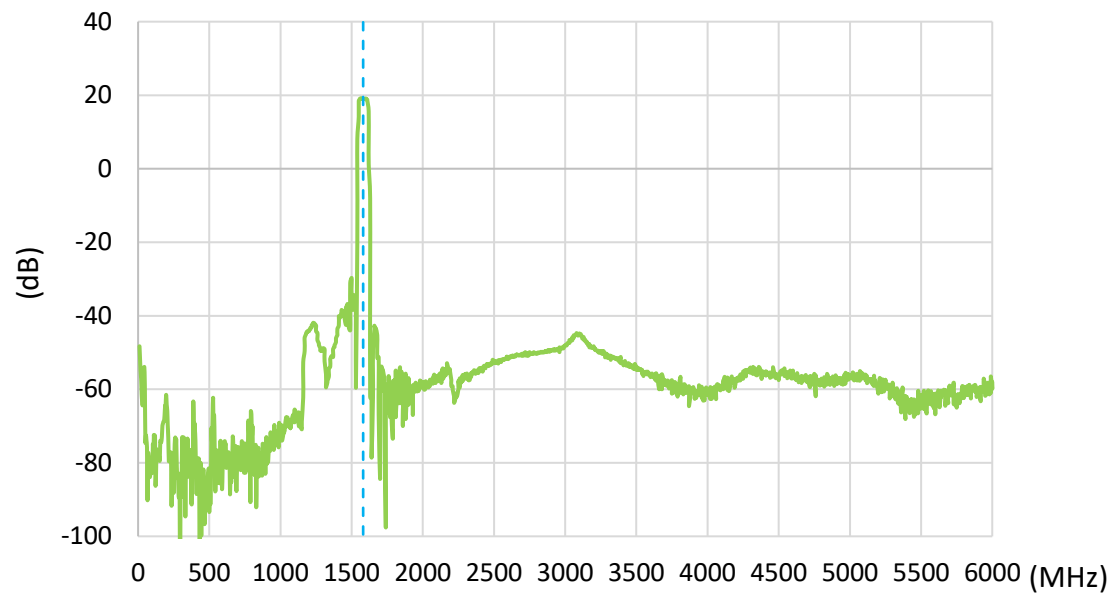
6.5 LNA Gain – High-Band



6.6 Out Of Band Rejection – Low-Band

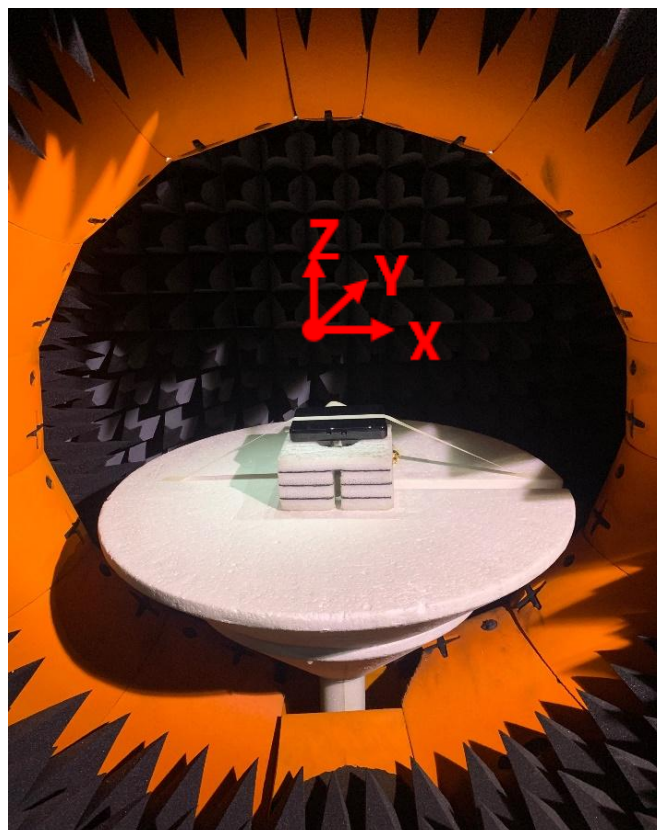
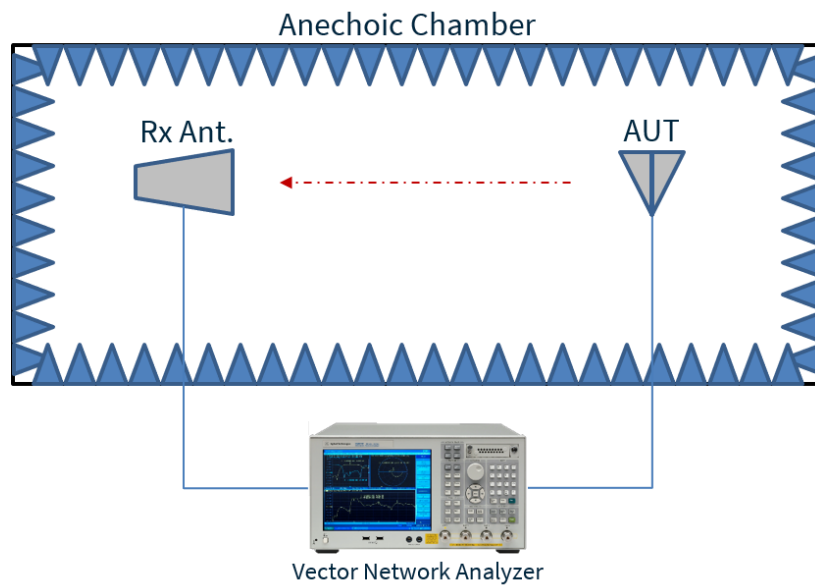


6.7 Out Of Band Rejection – High-Band



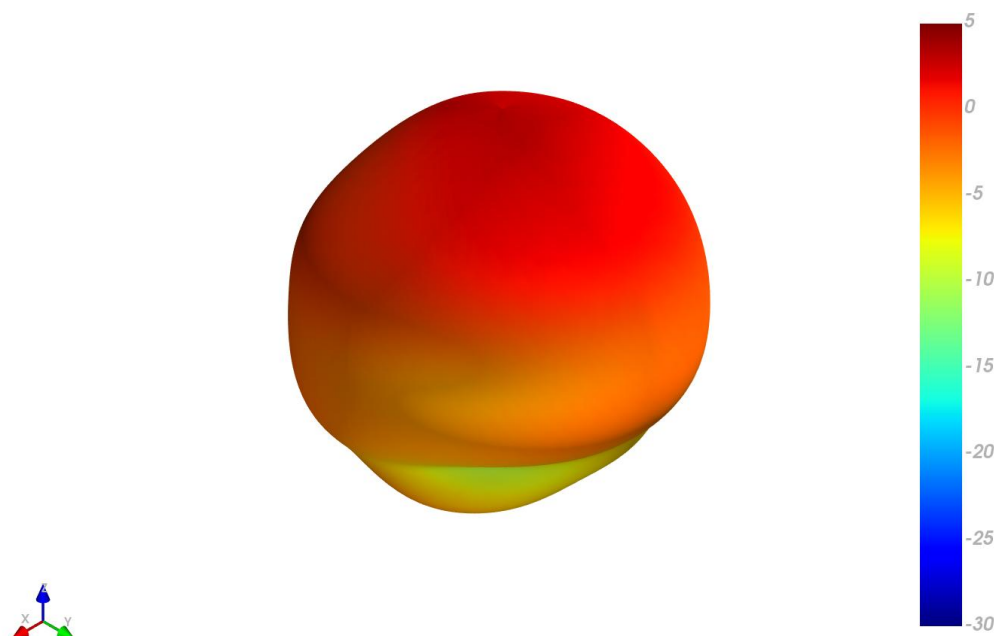
7. Radiation Patterns

7.1 Test Setup

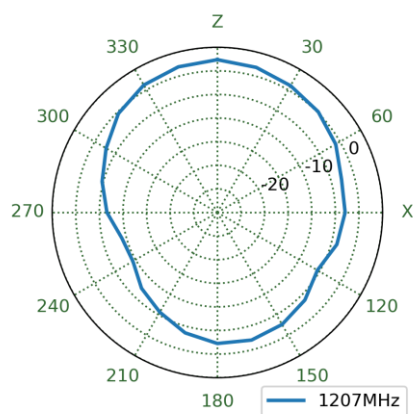


Chamber Test Set-up

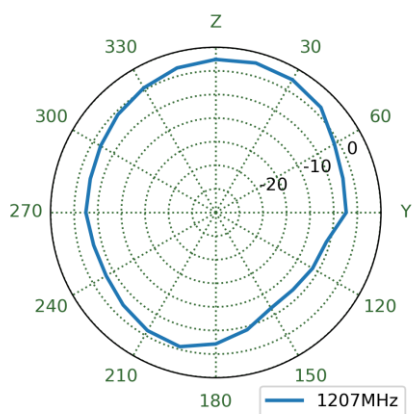
7.2 GNSS Patterns at 1207 MHz



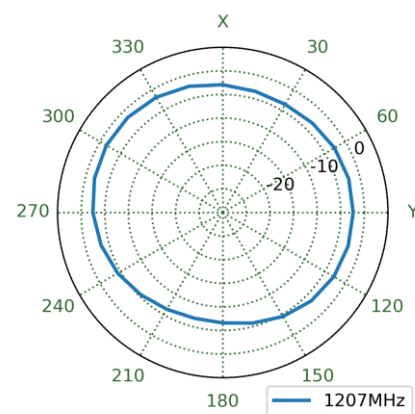
XZ Plane



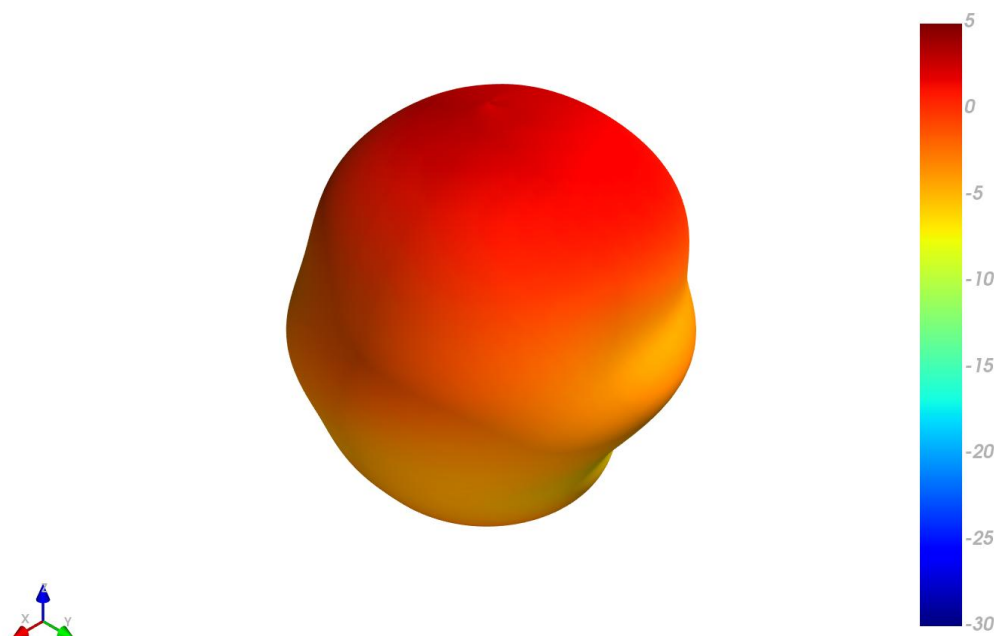
YZ Plane



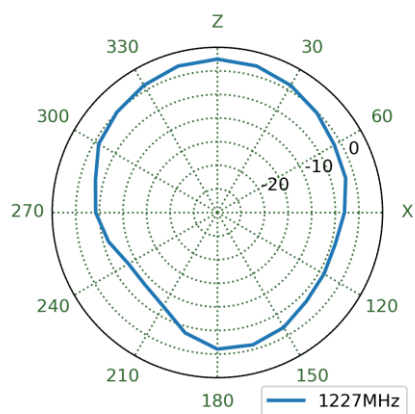
XY Plane



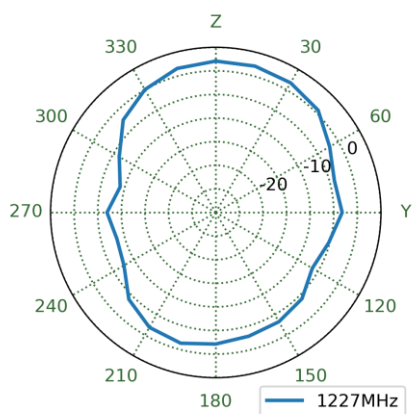
7.3 GNSS Patterns at 1227 MHz



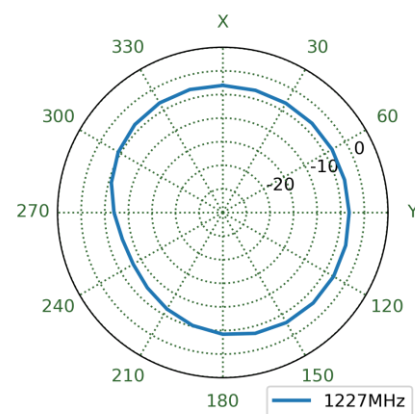
XZ Plane



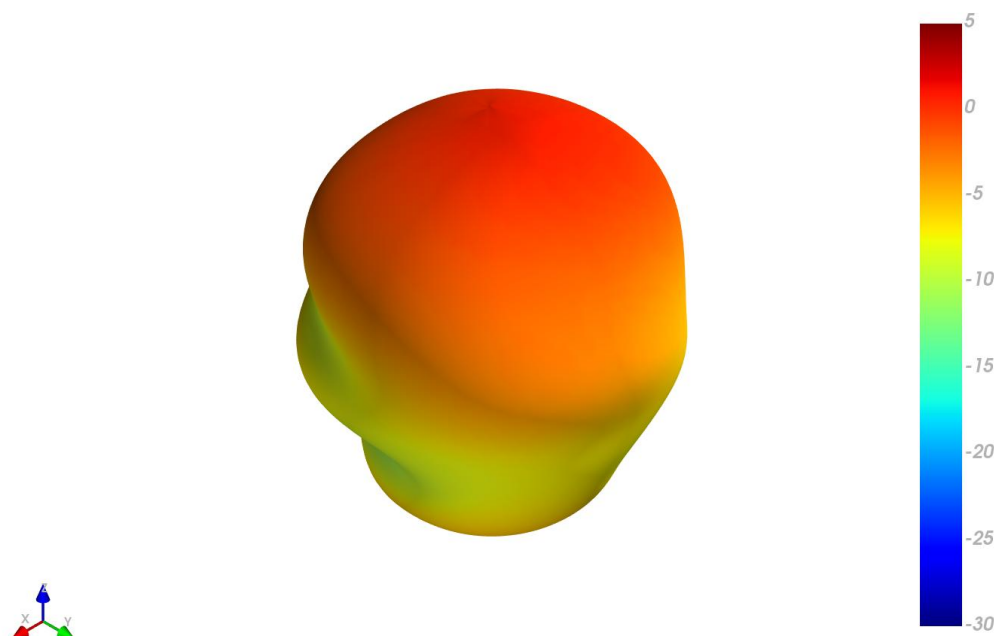
YZ Plane



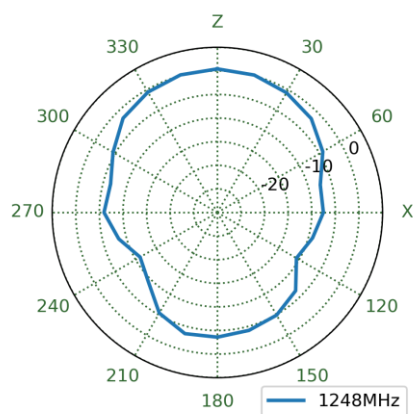
XY Plane



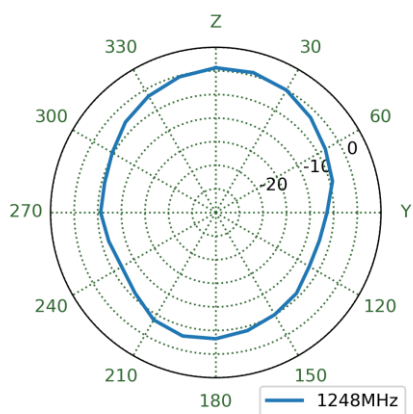
7.4 GNSS Patterns at 1248 MHz



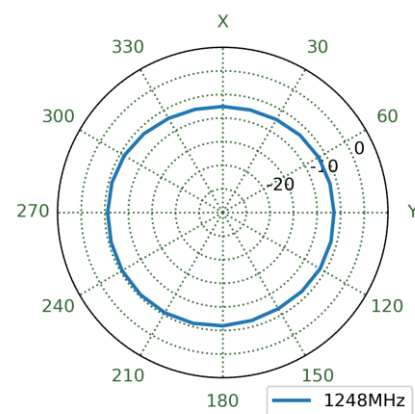
XZ Plane



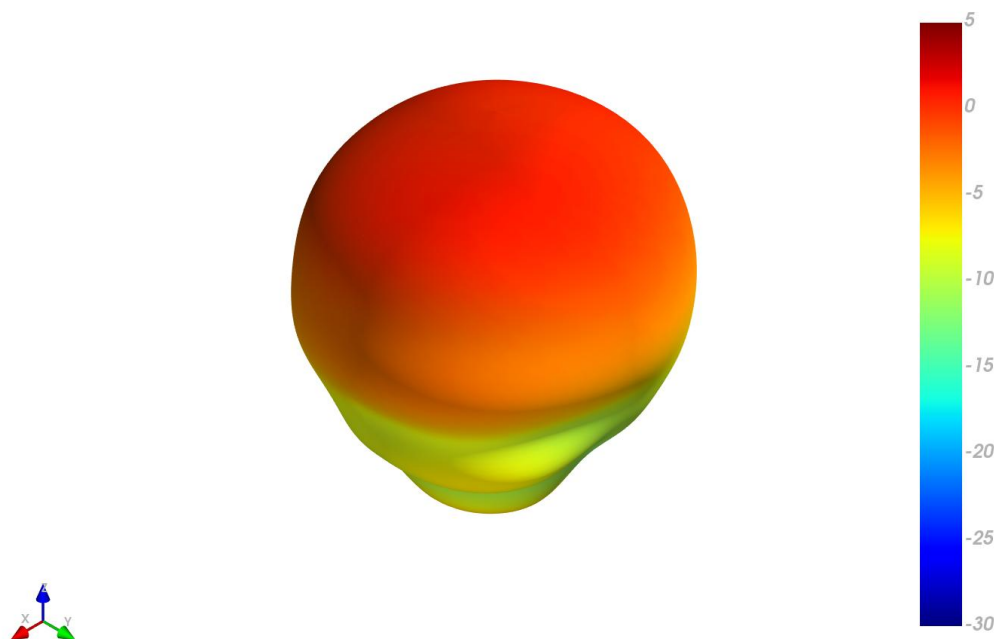
YZ Plane



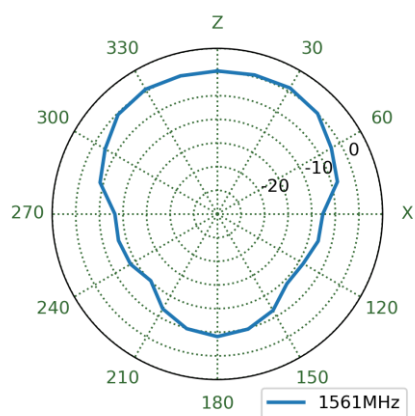
XY Plane



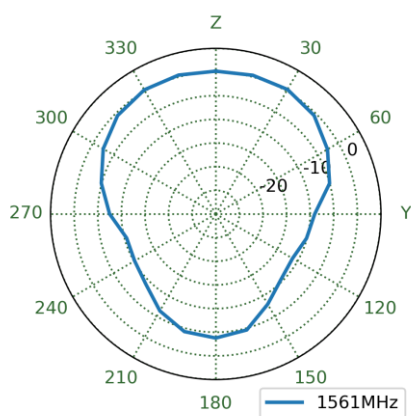
7.5 GNSS Patterns at 1561 MHz



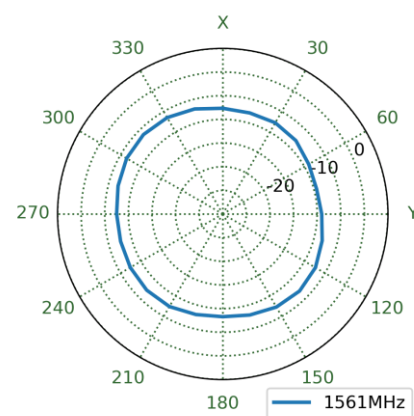
XZ Plane



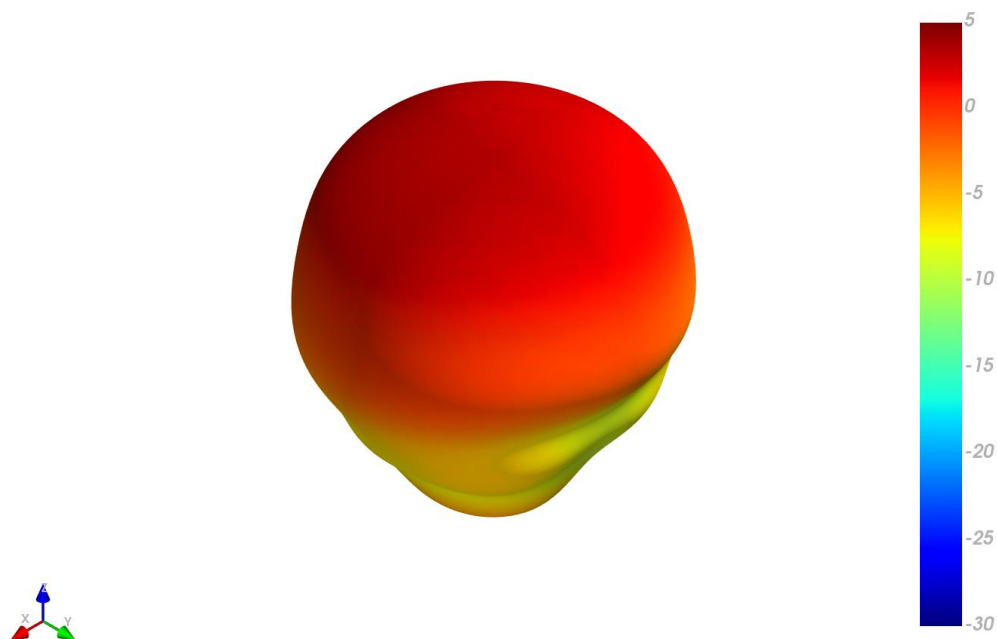
YZ Plane



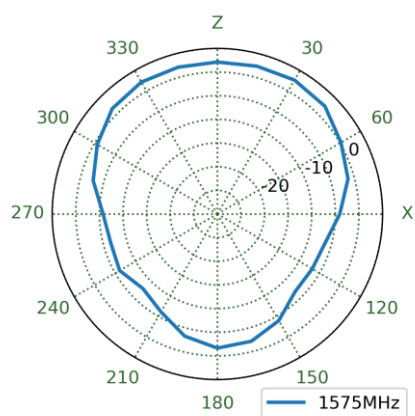
XY Plane



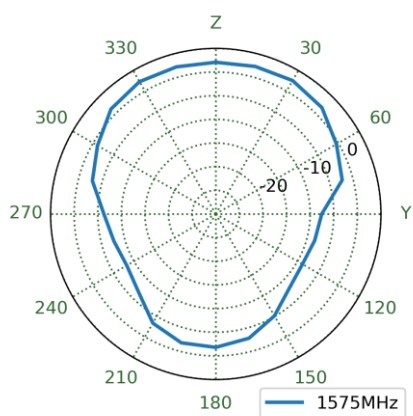
7.6 GNSS Patterns at 1575 MHz



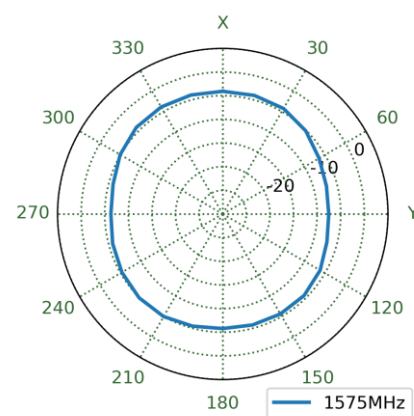
XZ Plane



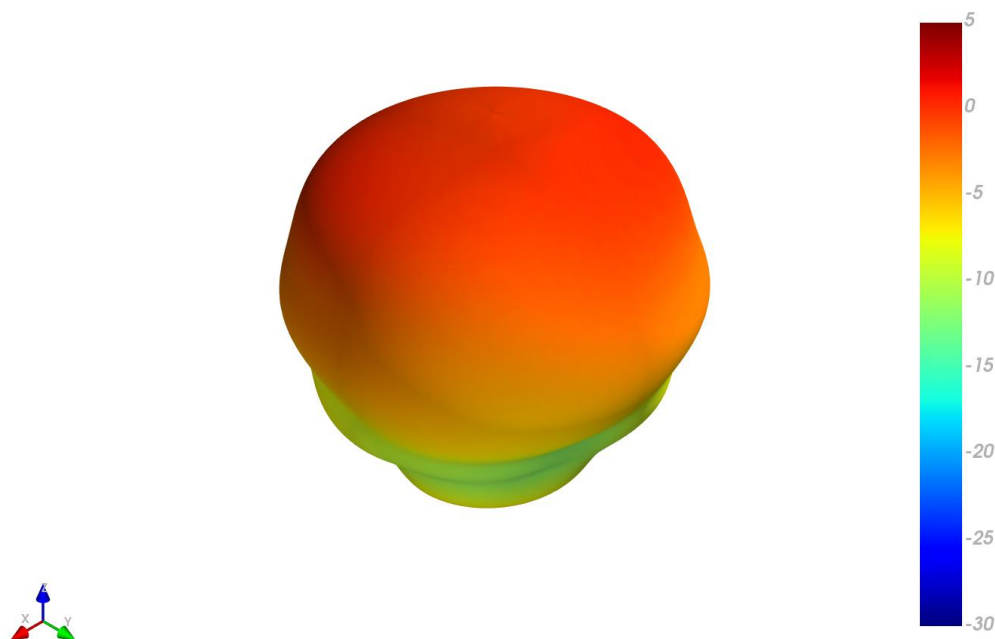
YZ Plane



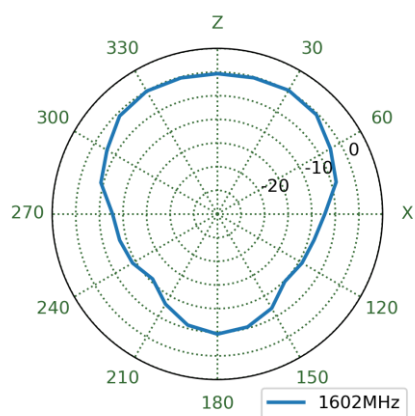
XY Plane



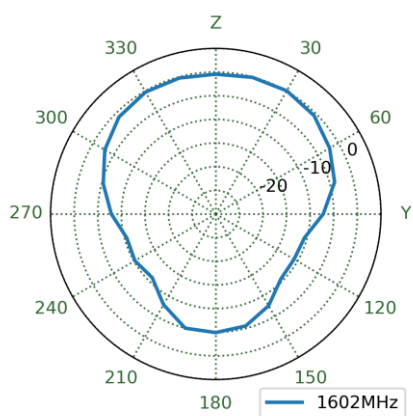
7.7 GNSS Patterns at 1602 MHz



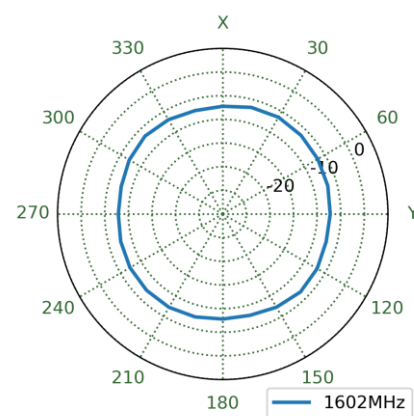
XZ Plane



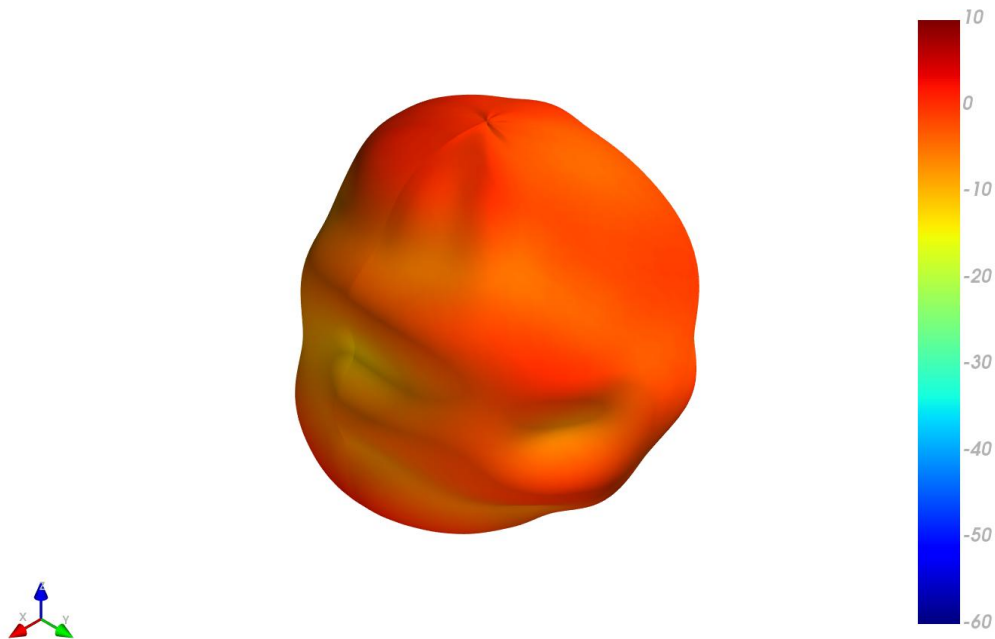
YZ Plane



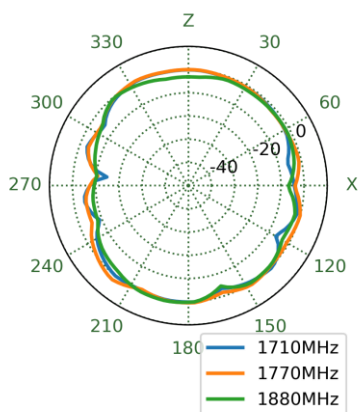
XY Plane



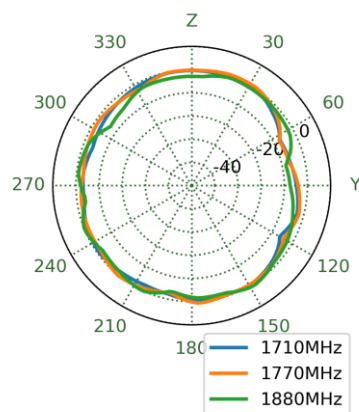
7.8 5G-4G-1 Patterns at 1770 MHz



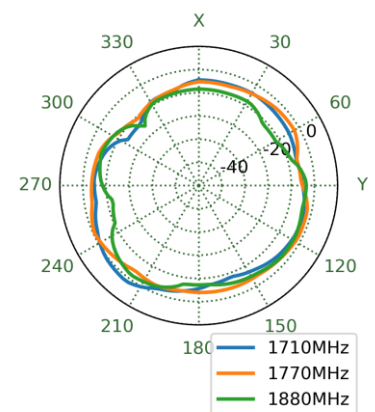
XZ Plane



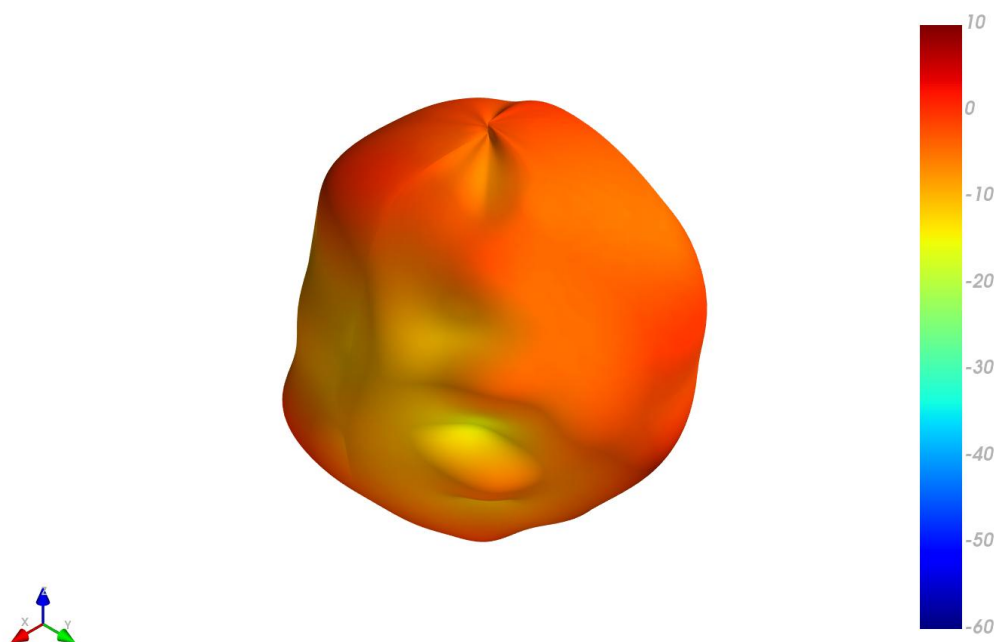
YZ Plane



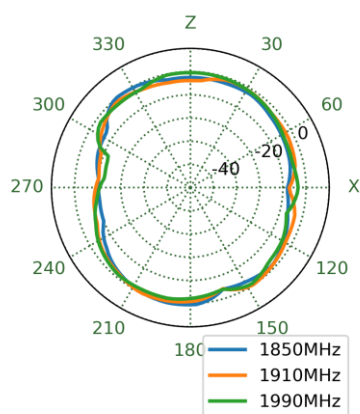
XY Plane



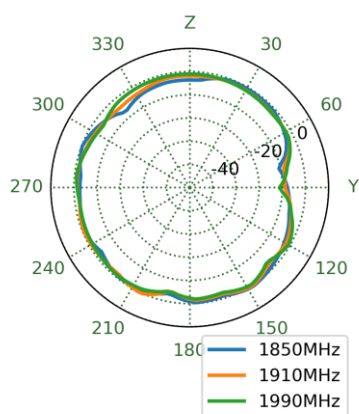
7.9 5G-4G-1 Patterns at 1910 MHz



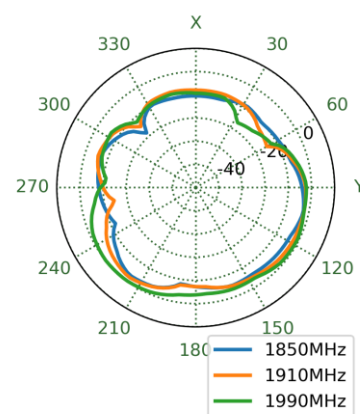
XZ Plane



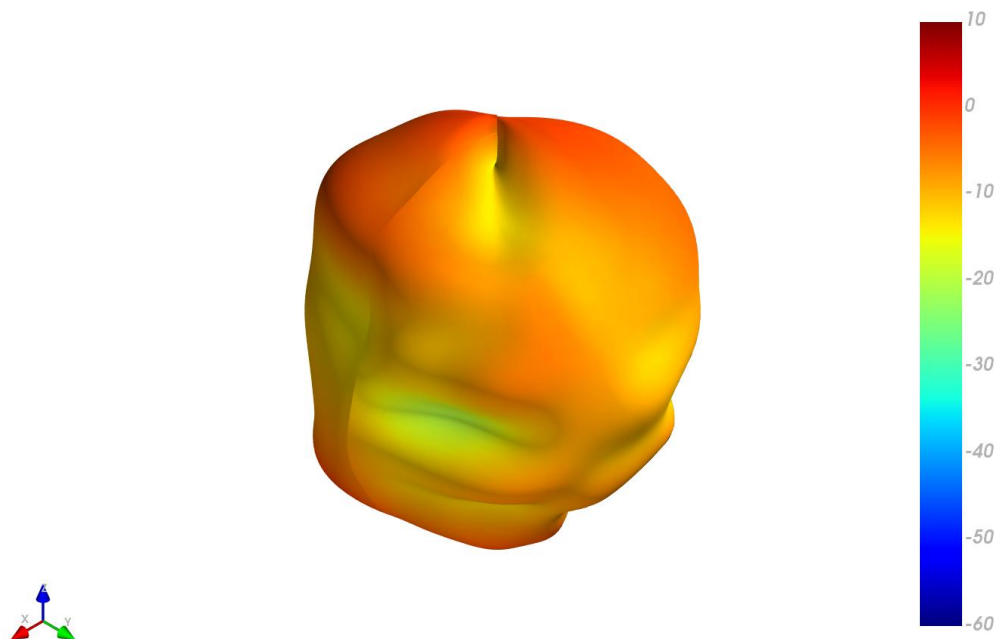
YZ Plane



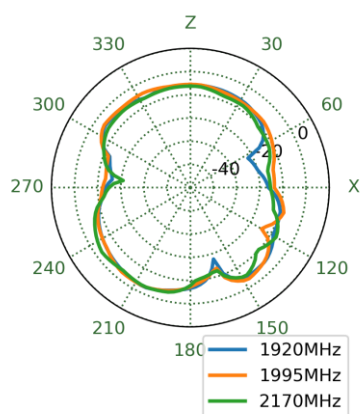
XY Plane



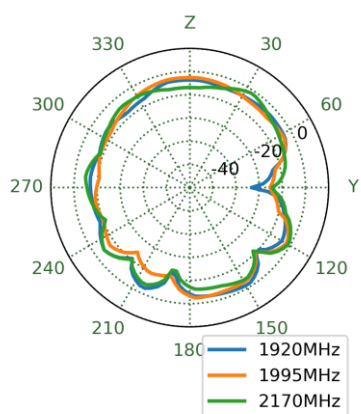
7.10 5G-4G-1 Patterns at 1995 MHz



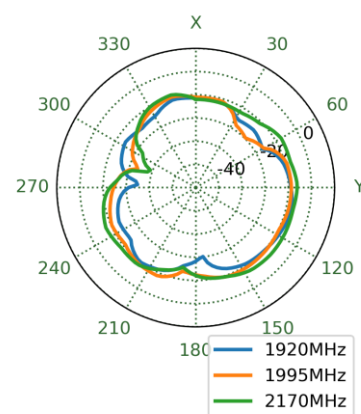
XZ Plane



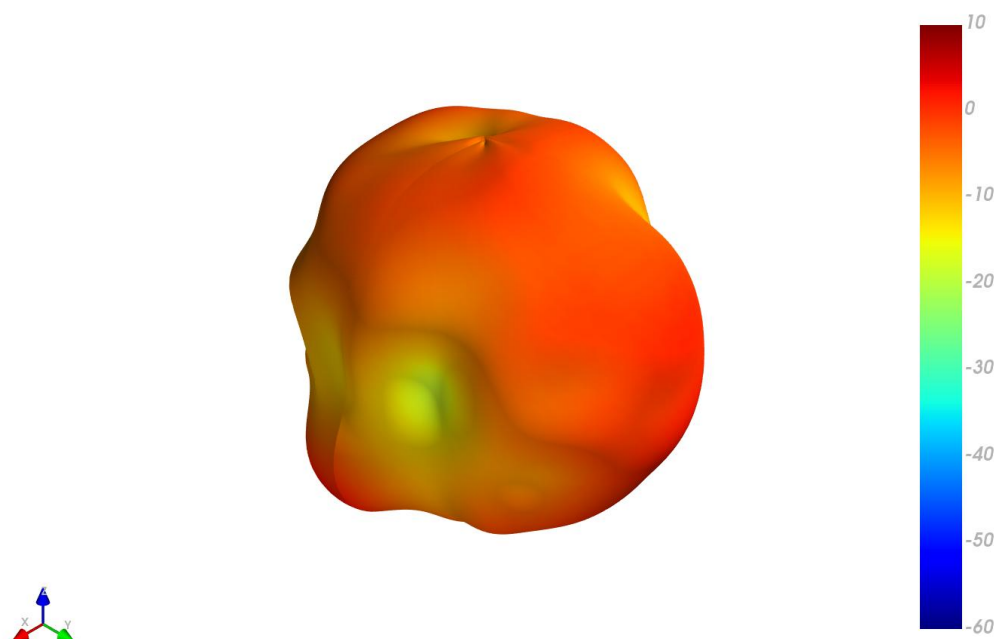
YZ Plane



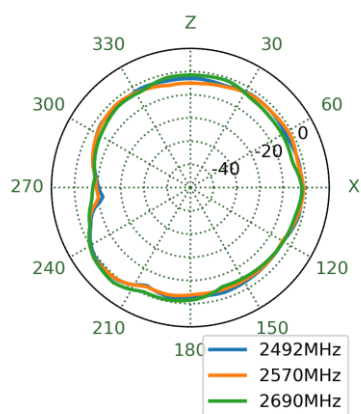
XY Plane



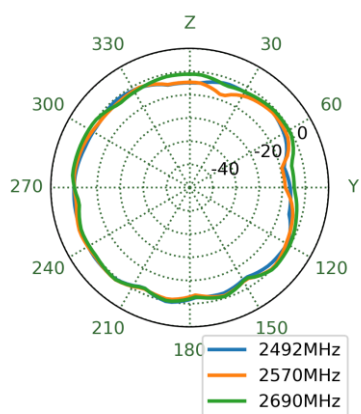
7.11 5G-4G-1 Patterns at 2570 MHz



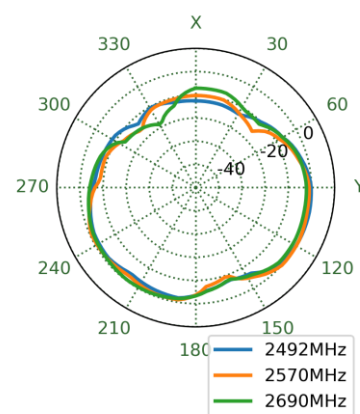
XZ Plane



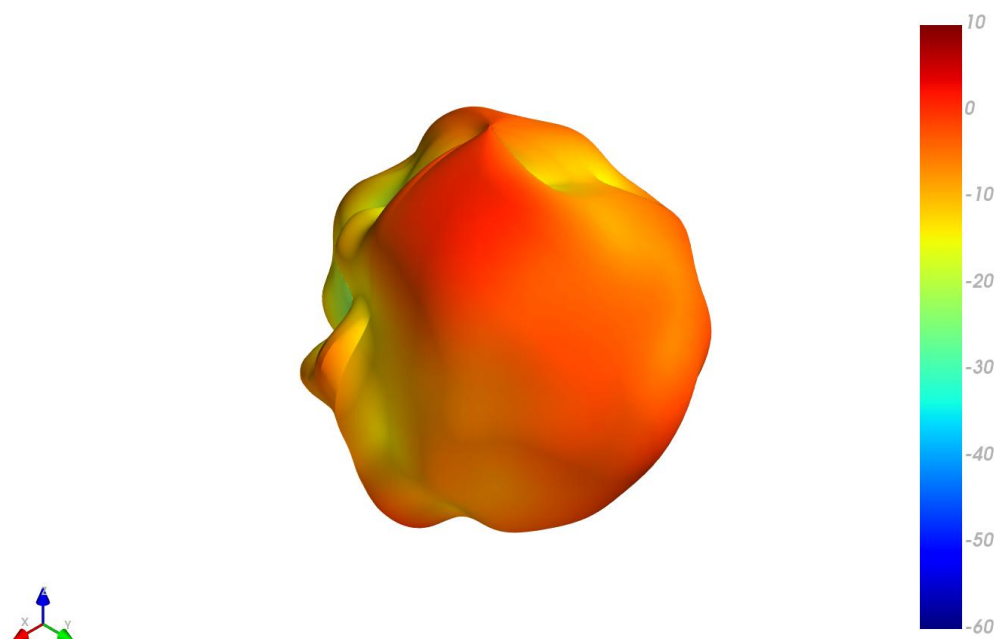
YZ Plane



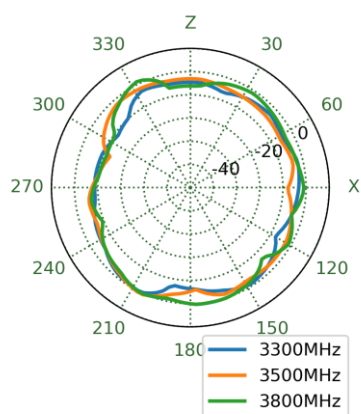
XY Plane



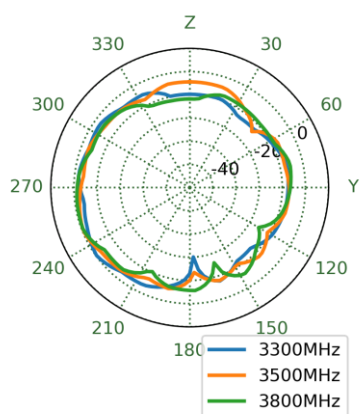
7.12 5G-4G-1 Patterns at 3500 MHz



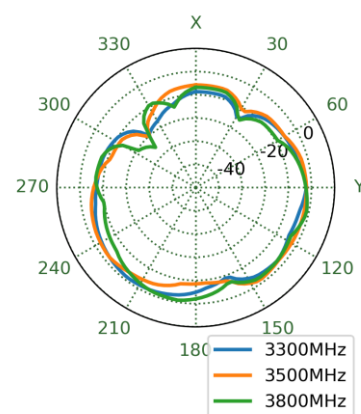
XZ Plane



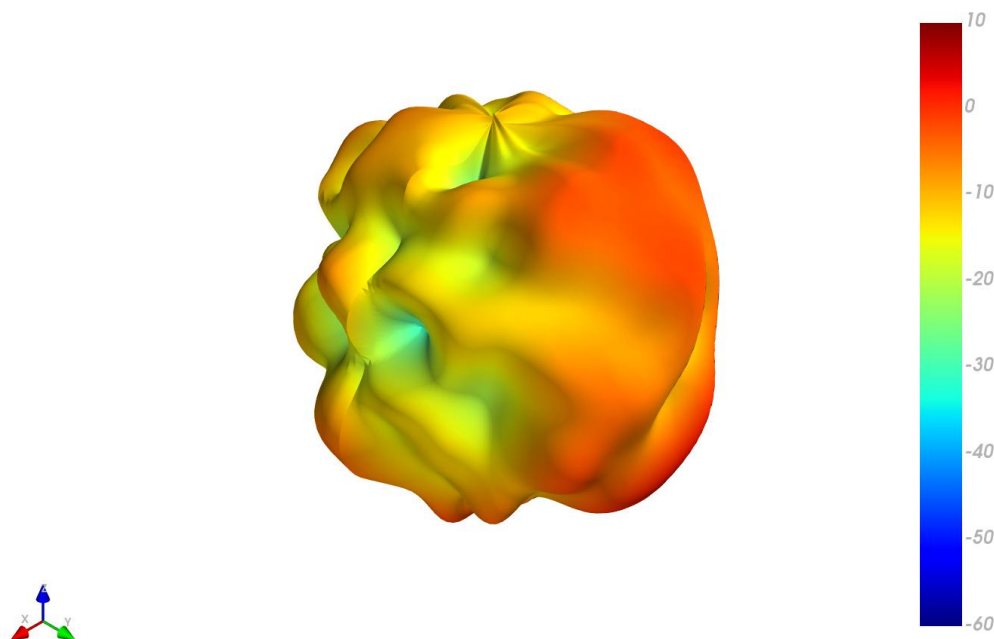
YZ Plane



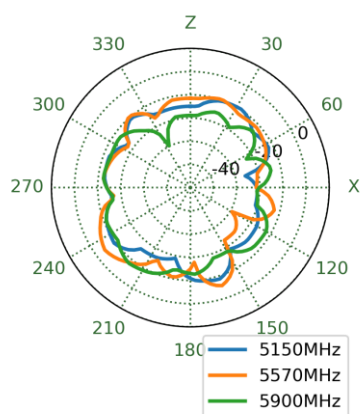
XY Plane



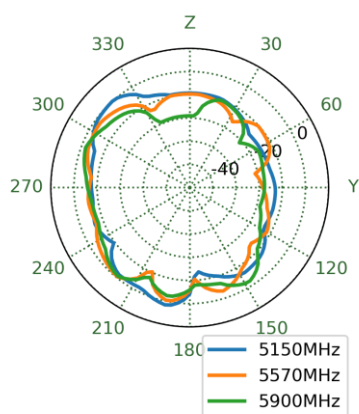
7.13 5G-4G-1 Patterns at 5570 MHz



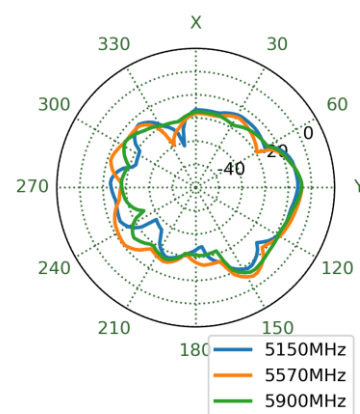
XZ Plane



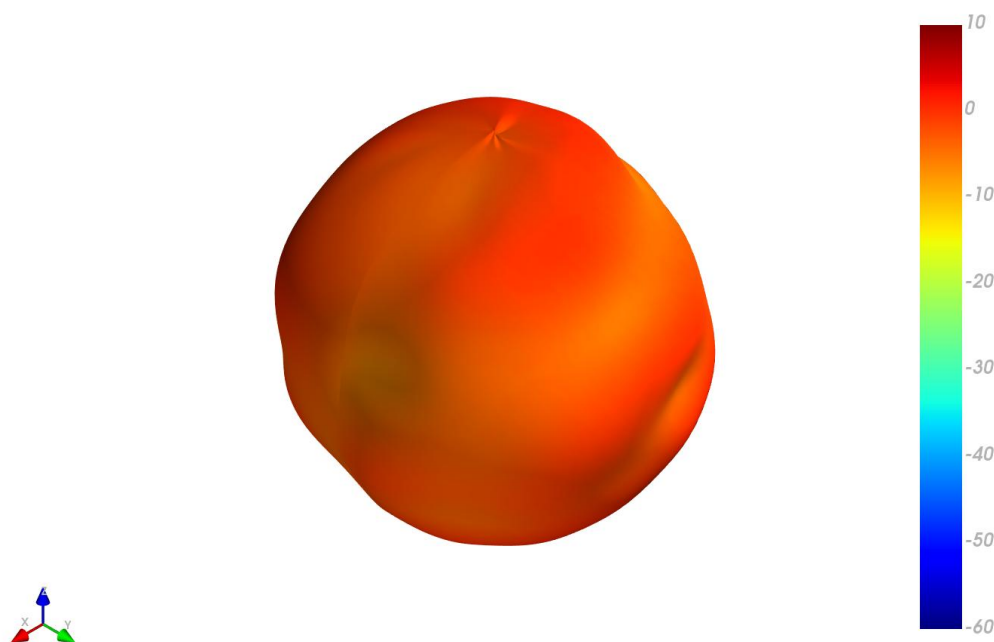
YZ Plane



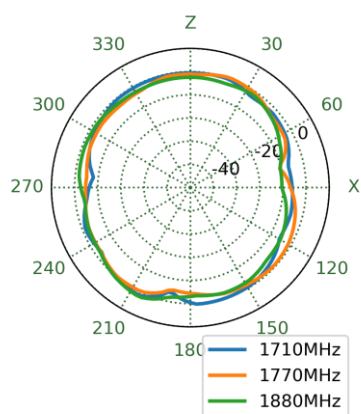
XY Plane



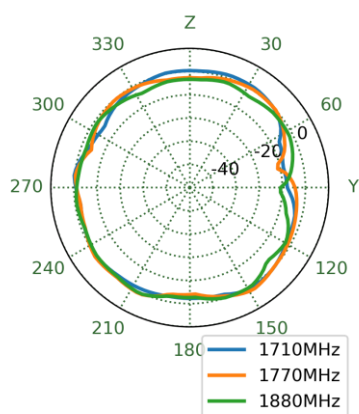
7.14 5G-4G-8 Patterns at 1770 MHz



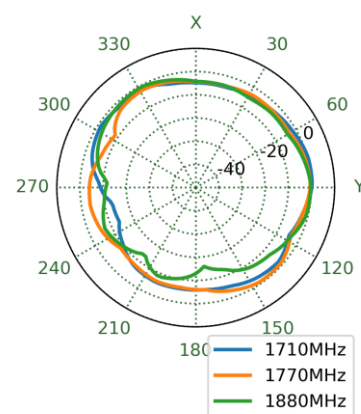
XZ Plane



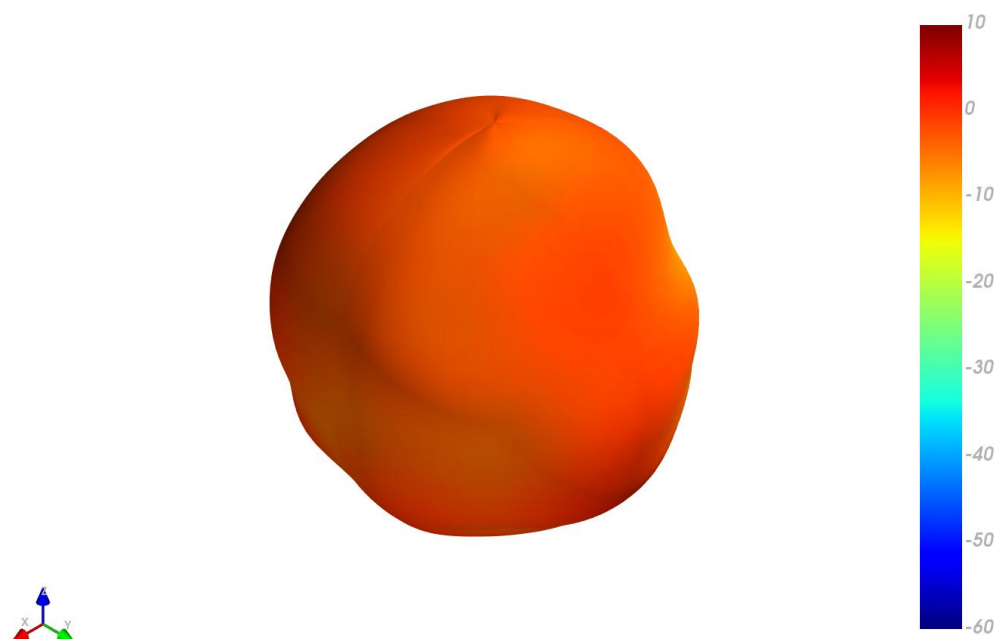
YZ Plane



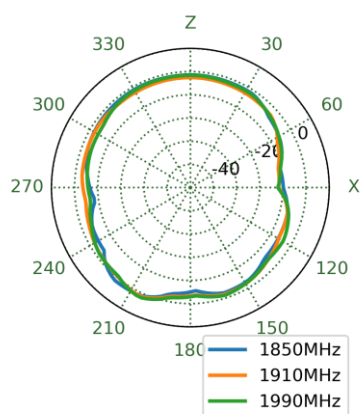
XY Plane



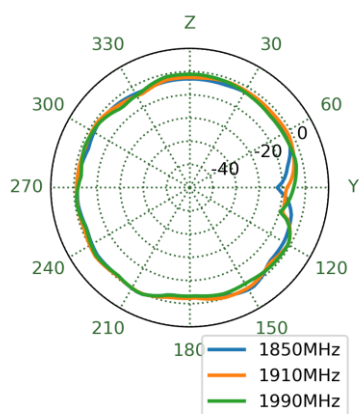
7.15 5G-4G-8 Patterns at 1910 MHz



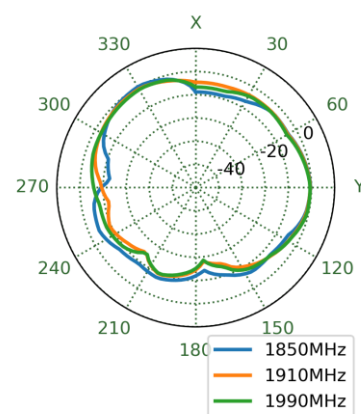
XZ Plane



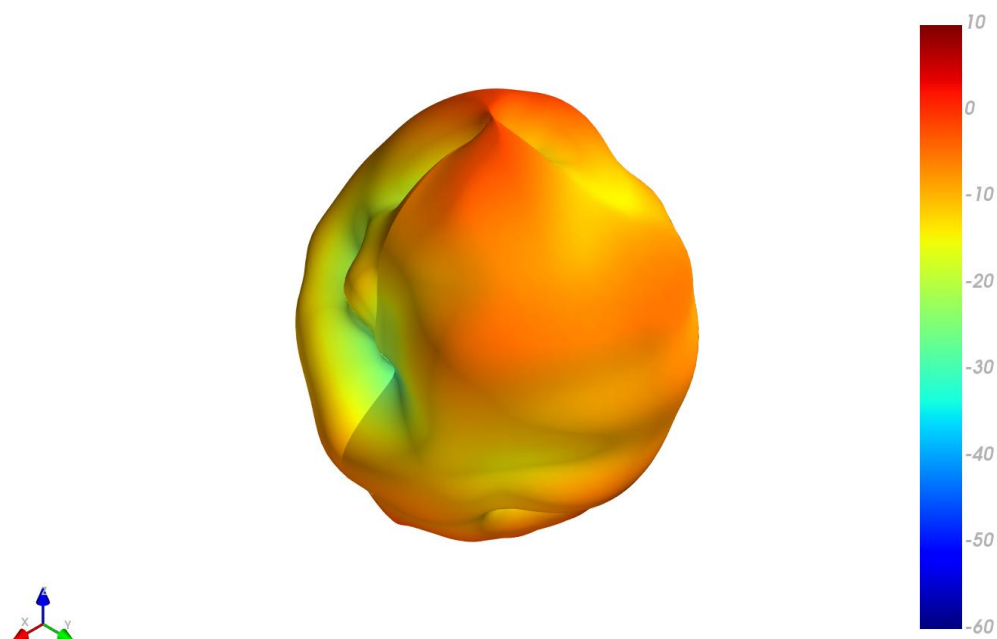
YZ Plane



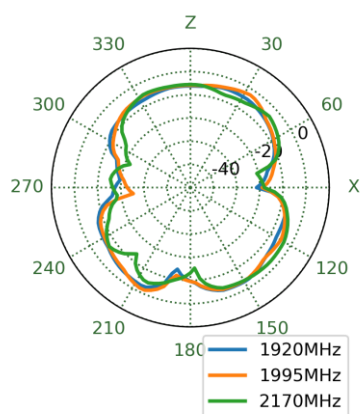
XY Plane



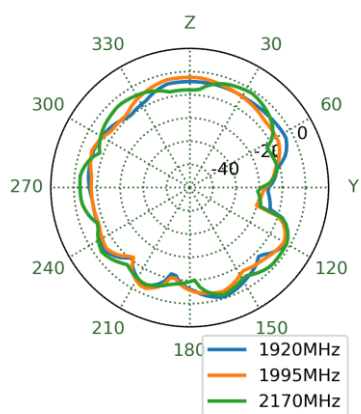
7.16 5G-4G-8 Patterns at 1995 MHz



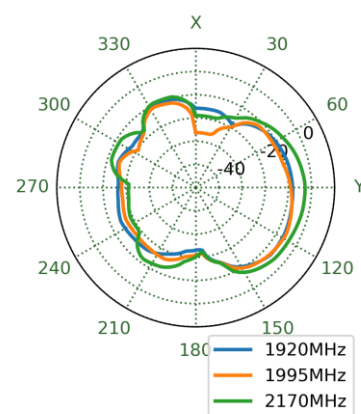
XZ Plane



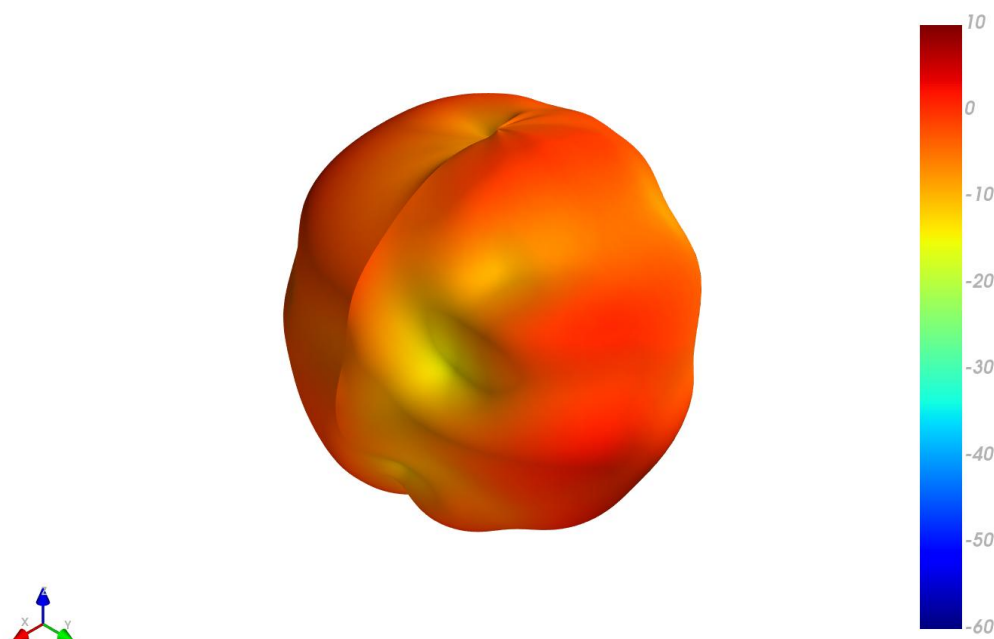
YZ Plane



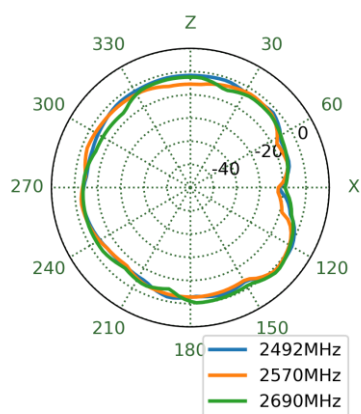
XY Plane



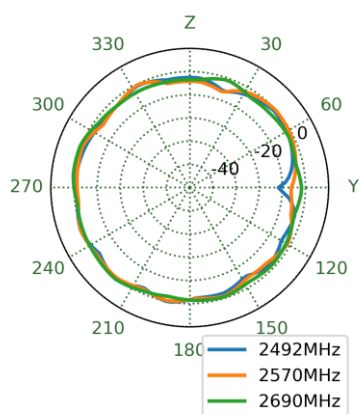
7.17 5G-4G-8 Patterns at 2570 MHz



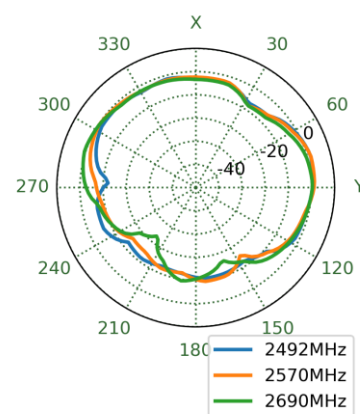
XZ Plane



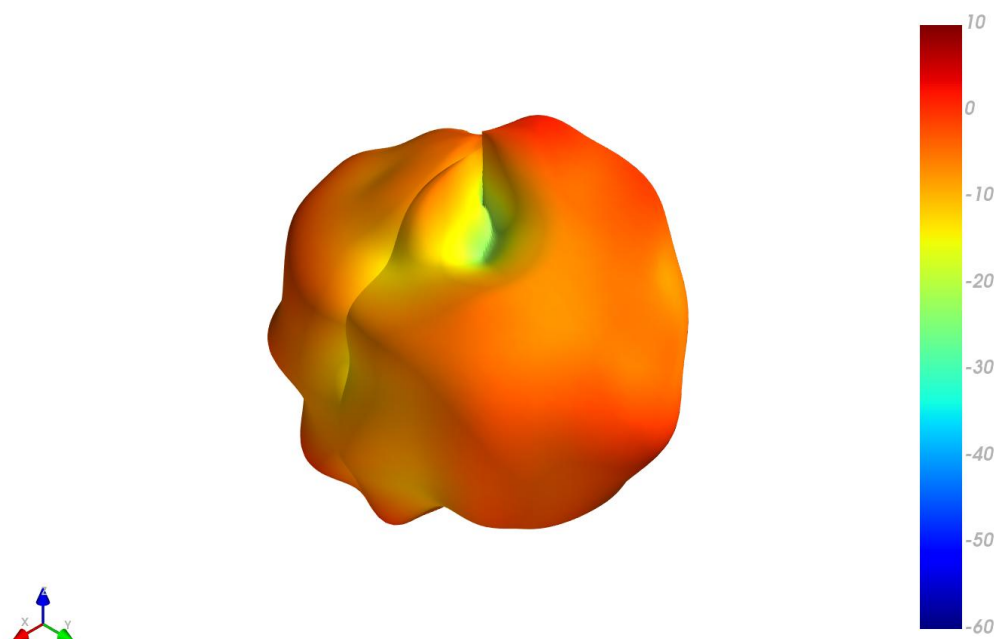
YZ Plane



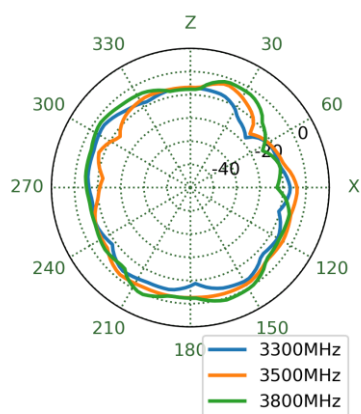
XY Plane



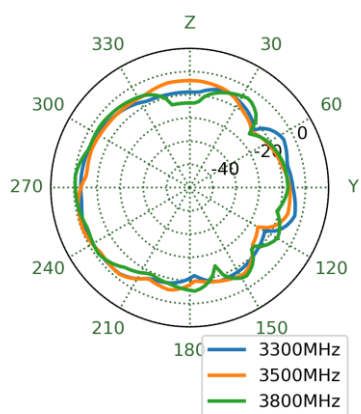
7.18 5G-4G-8 Patterns at 3500 MHz



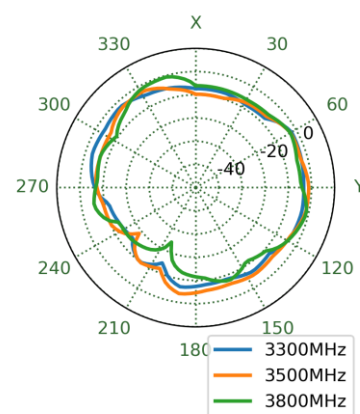
XZ Plane



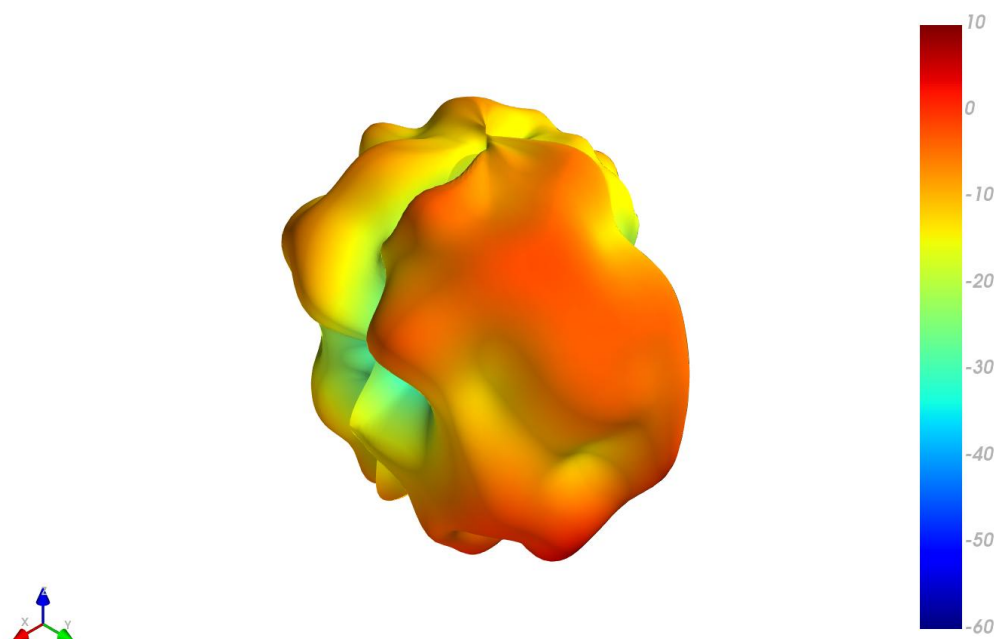
YZ Plane



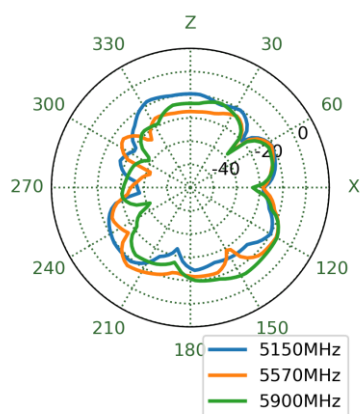
XY Plane



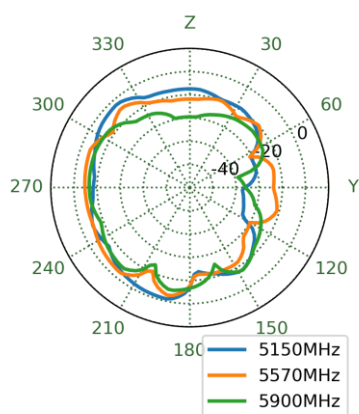
7.19 5G-4G-8 Patterns at 5570 MHz



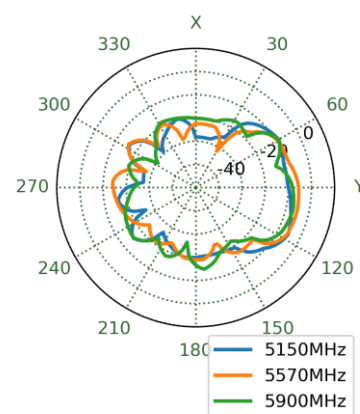
XZ Plane



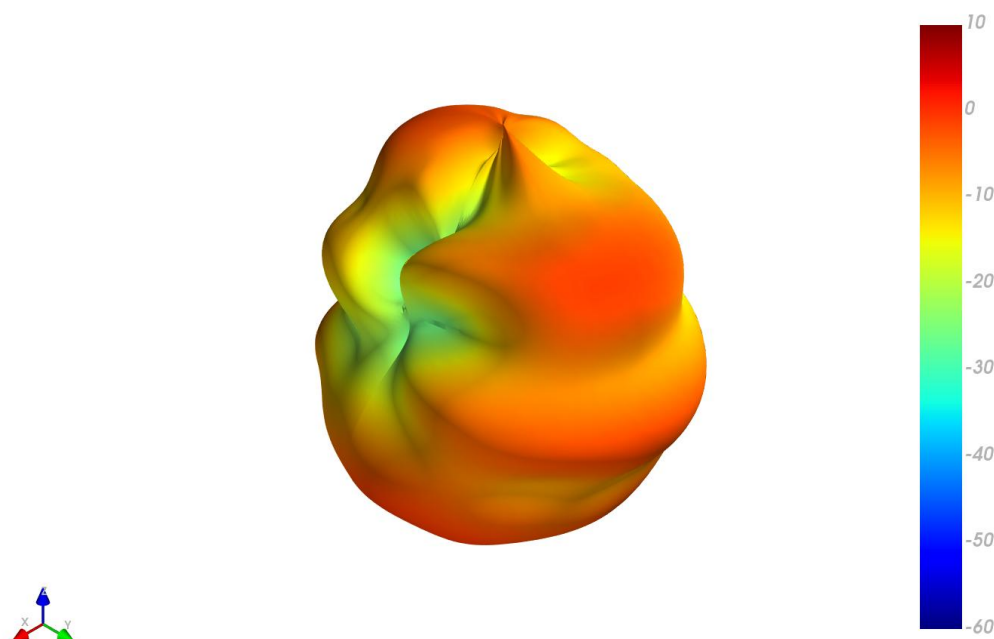
YZ Plane



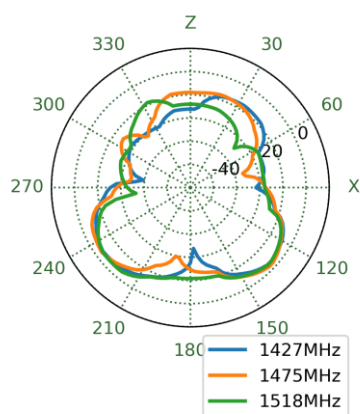
XY Plane



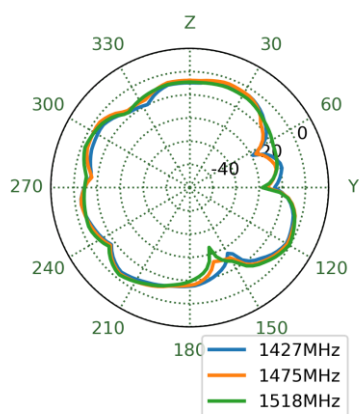
7.20 5G-4G-2 Patterns at 1475 MHz



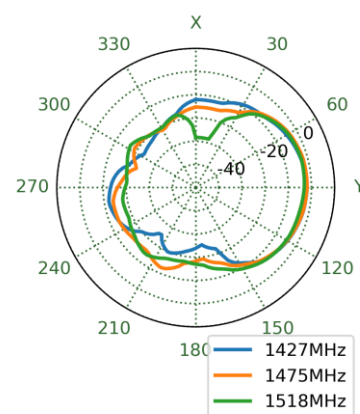
XZ Plane



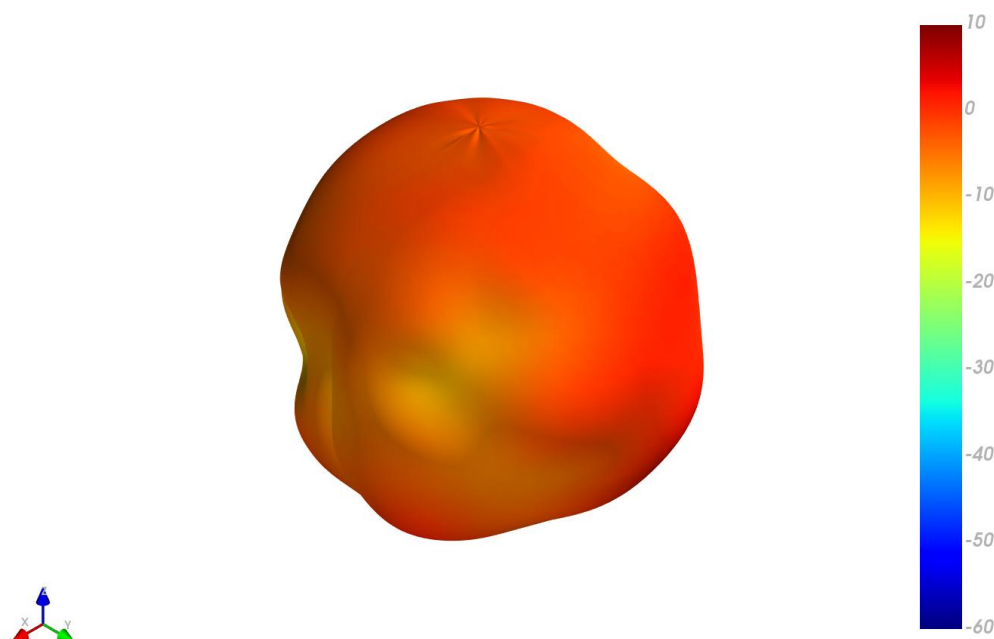
YZ Plane



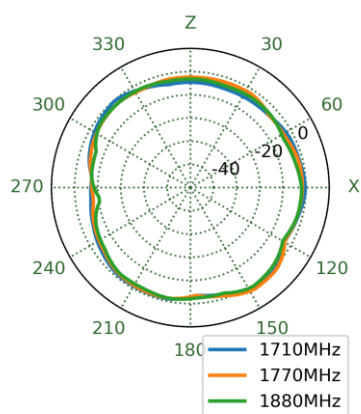
XY Plane



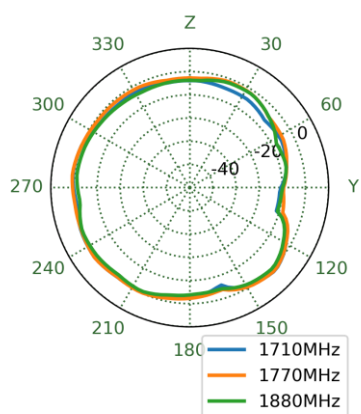
7.21 5G-4G-2 Patterns at 1770 MHz



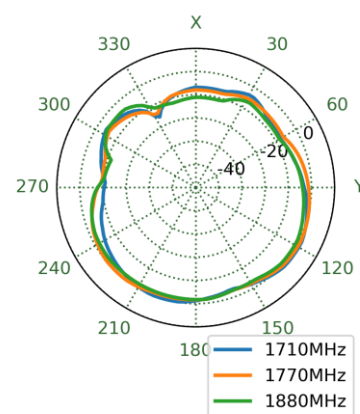
XZ Plane



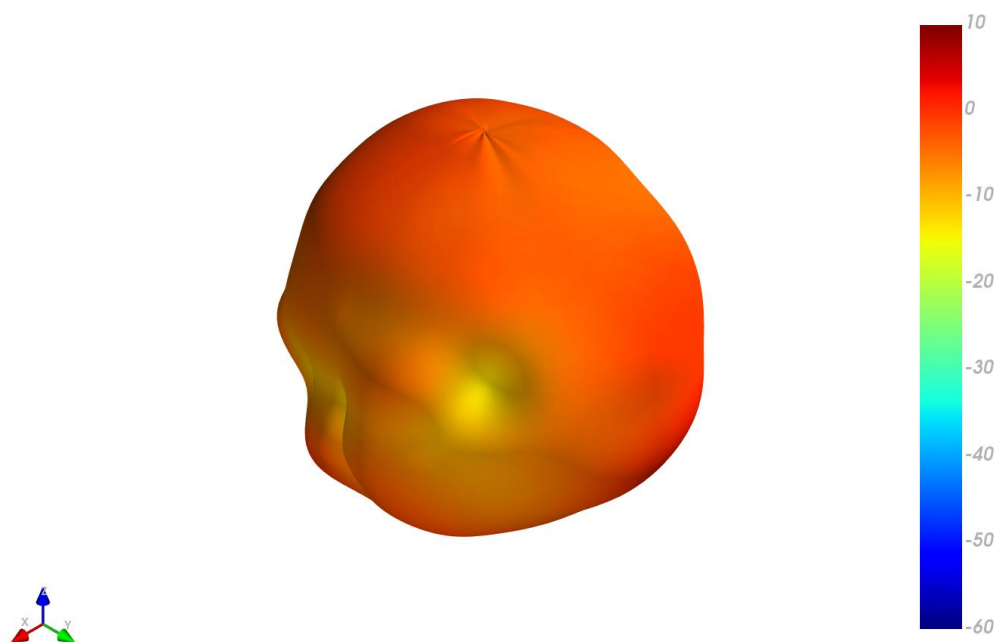
YZ Plane



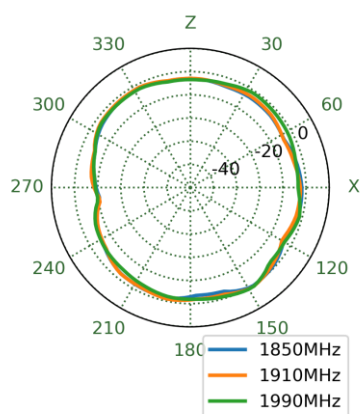
XY Plane



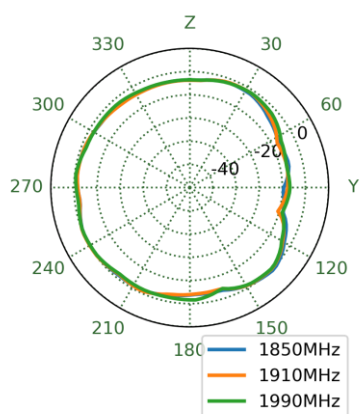
7.22 5G-4G-2 Patterns at 1910 MHz



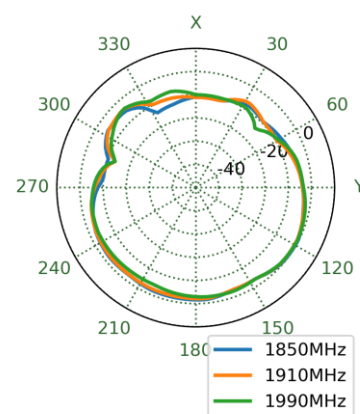
XZ Plane



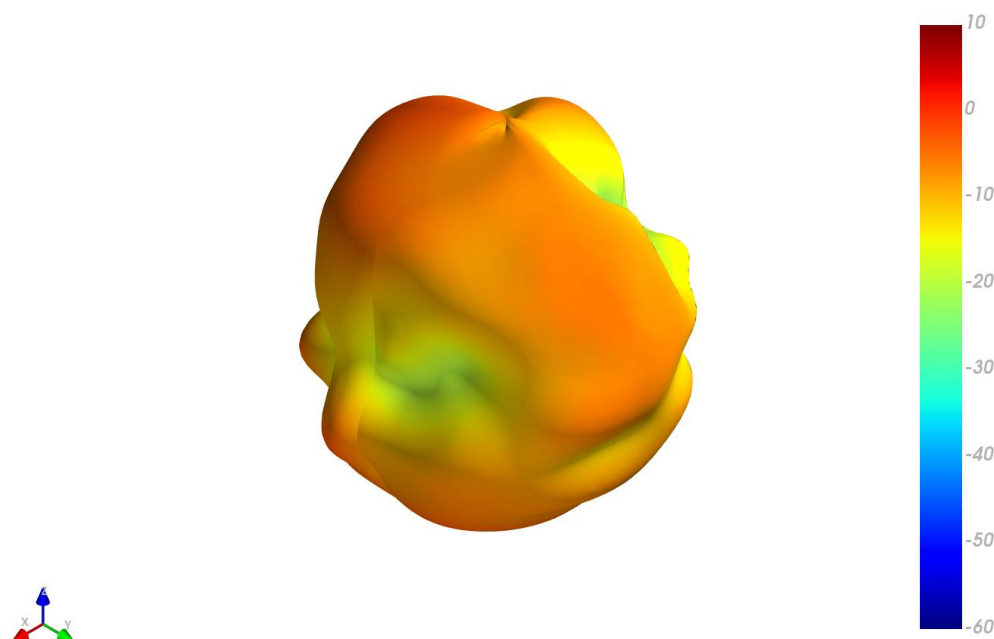
YZ Plane



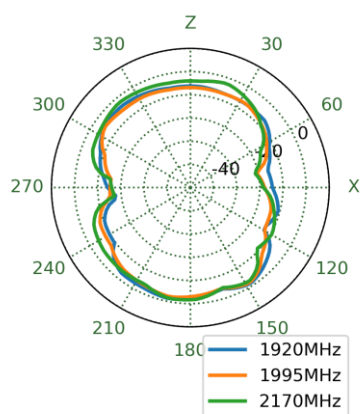
XY Plane



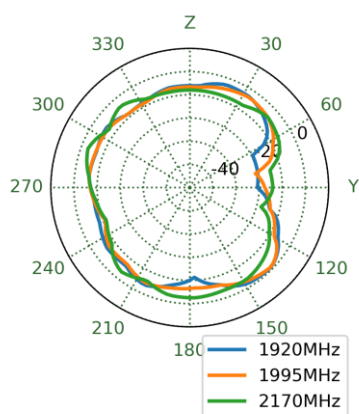
7.23 5G-4G-2 Patterns at 1995 MHz



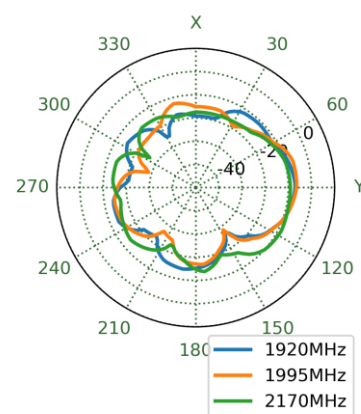
XZ Plane



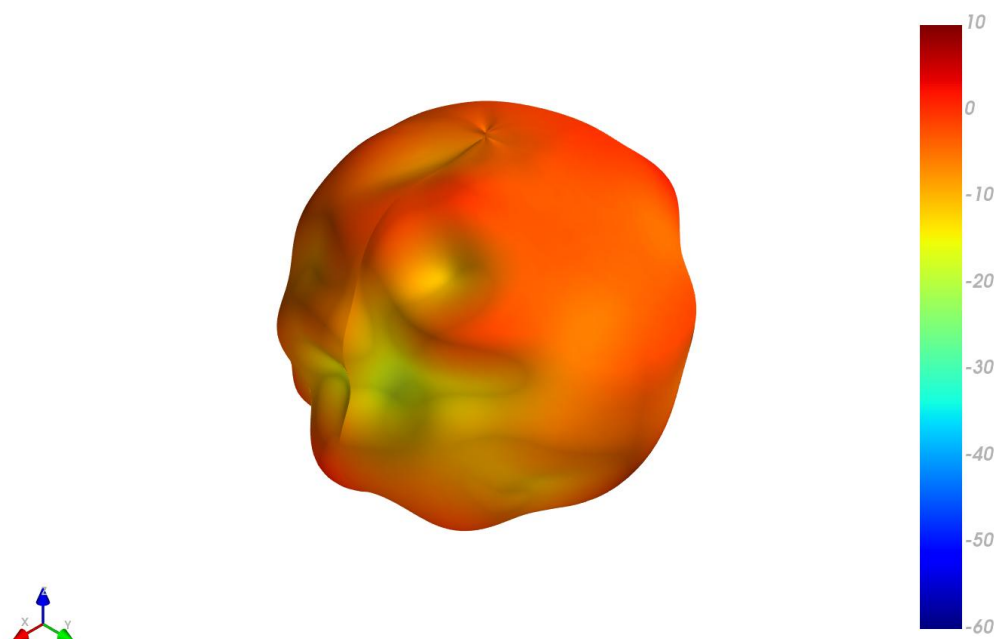
YZ Plane



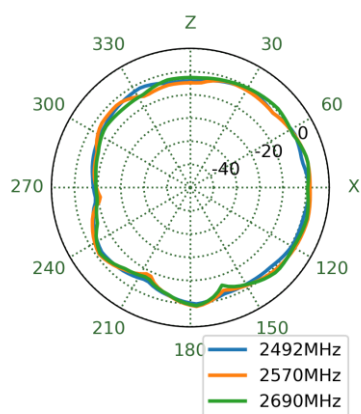
XY Plane



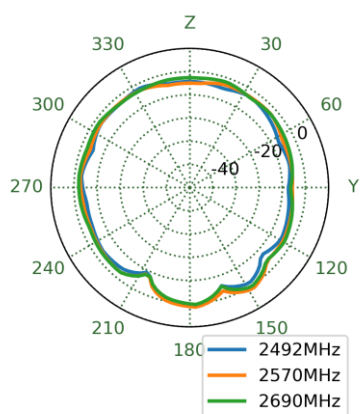
7.24 5G-4G-2 Patterns at 2570 MHz



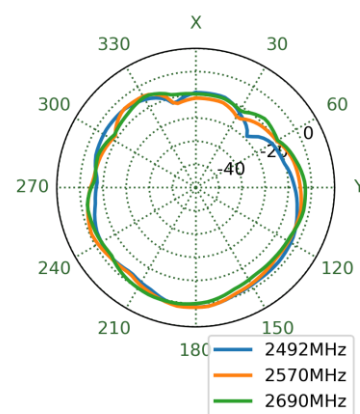
XZ Plane



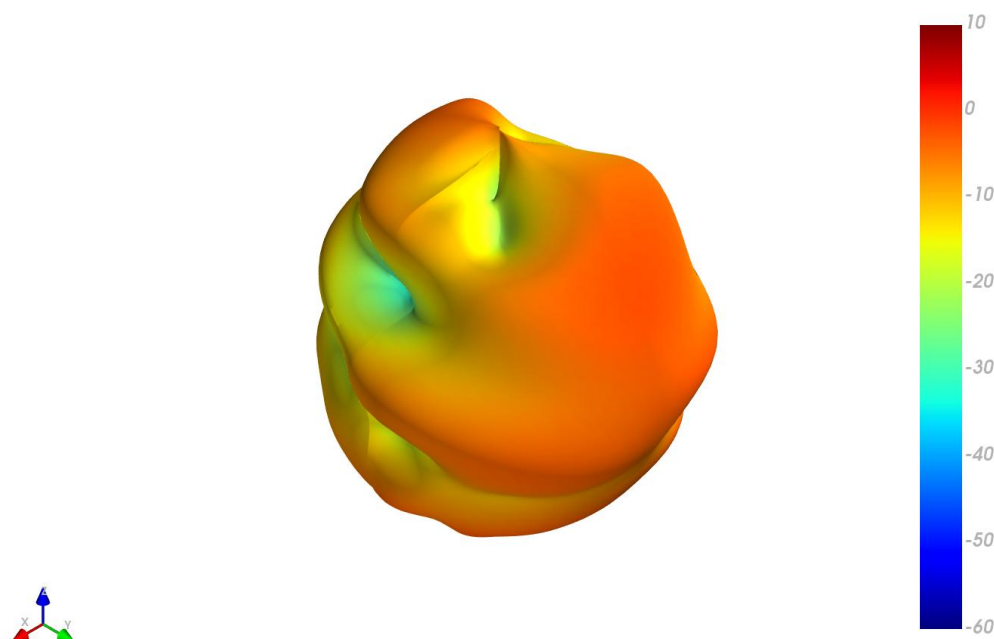
YZ Plane



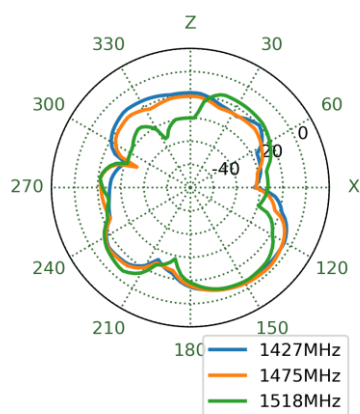
XY Plane



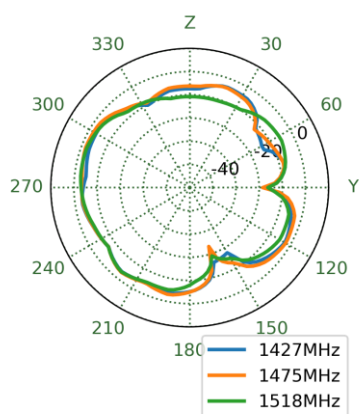
7.25 5G-4G-7 Patterns at 1475 MHz



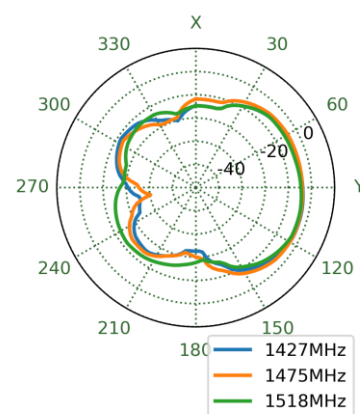
XZ Plane



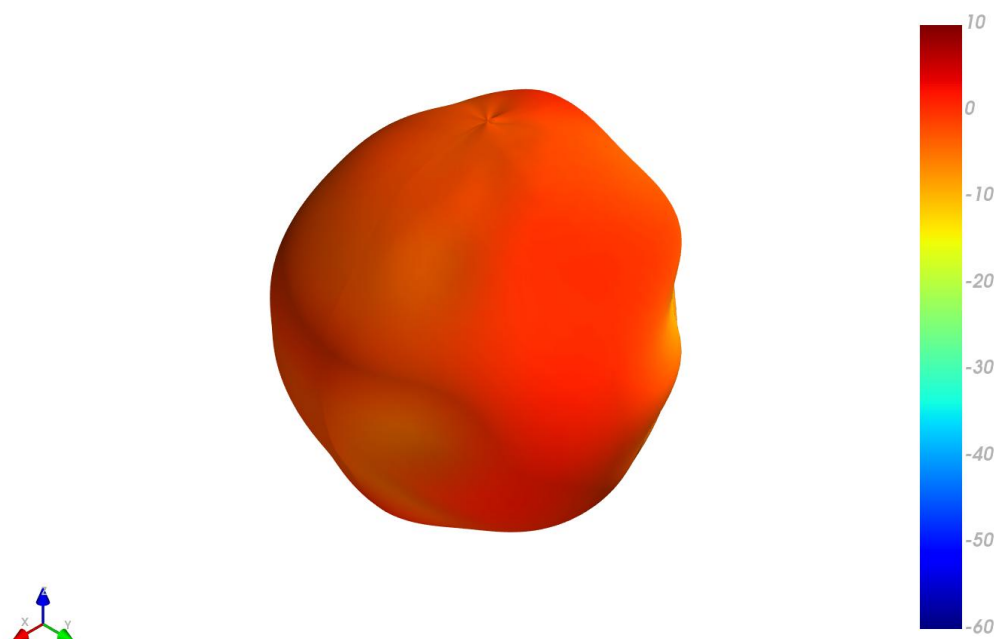
YZ Plane



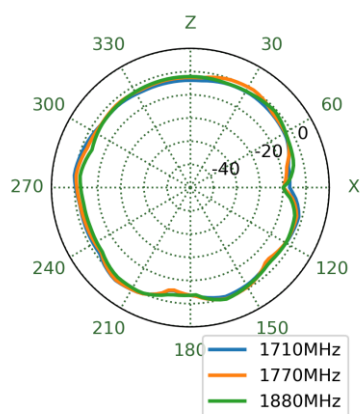
XY Plane



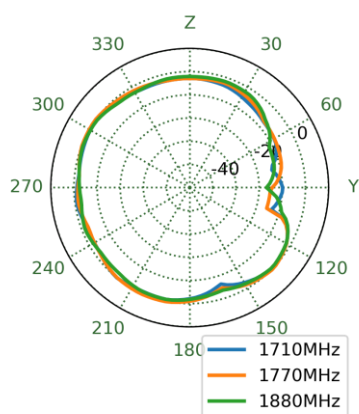
7.26 5G-4G-7 Patterns at 1770 MHz



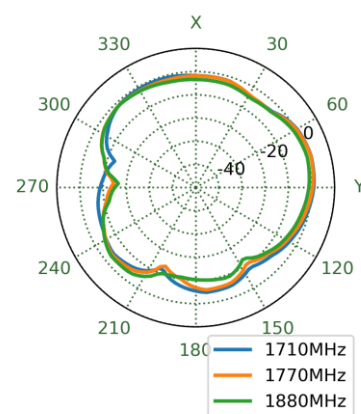
XZ Plane



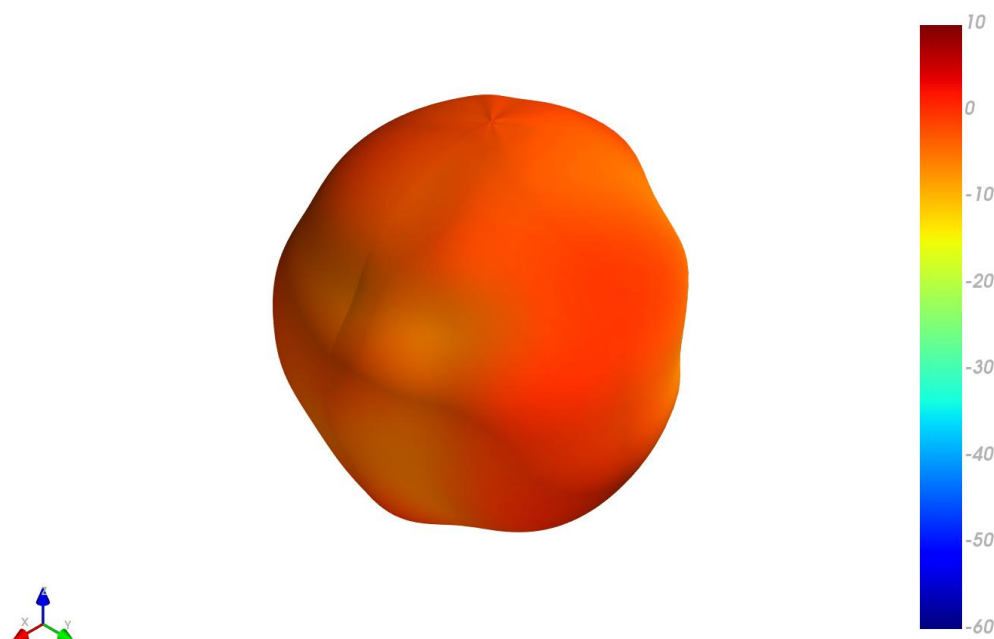
YZ Plane



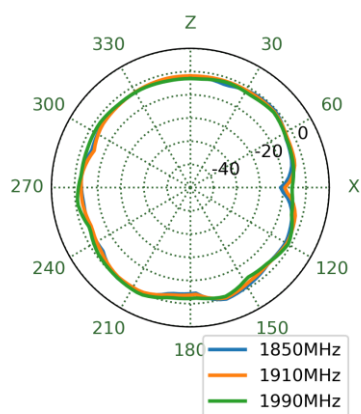
XY Plane



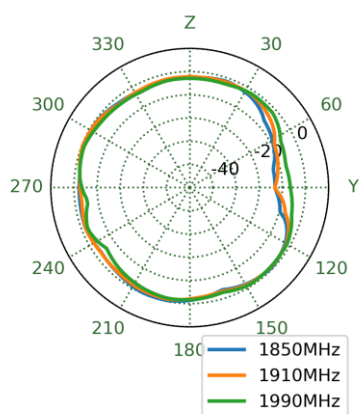
7.27 5G-4G-7 Patterns at 1910 MHz



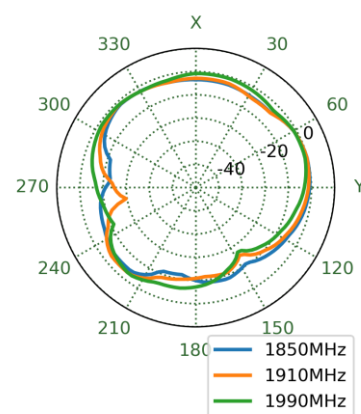
XZ Plane



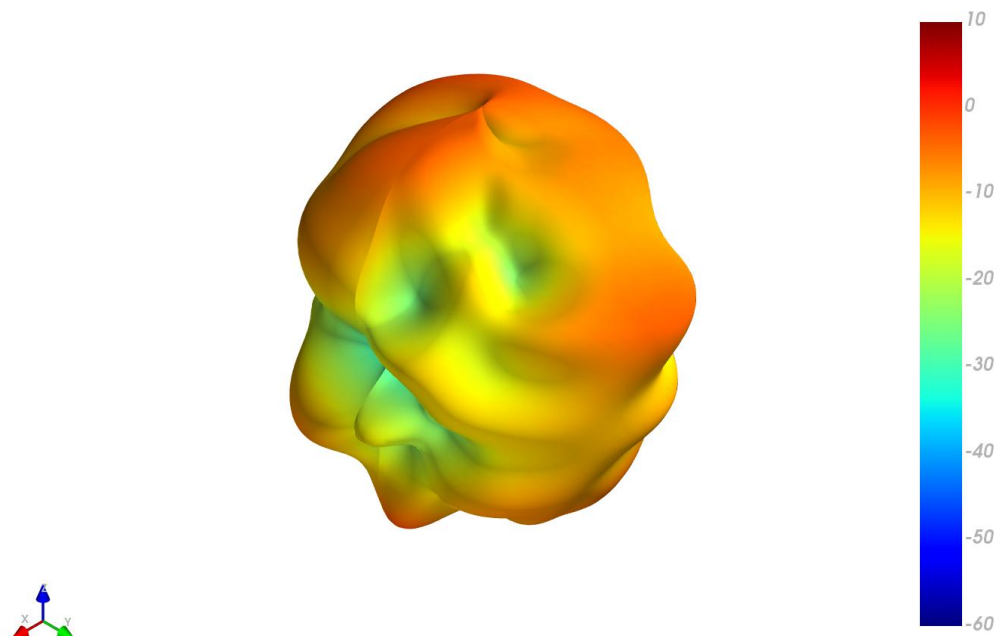
YZ Plane



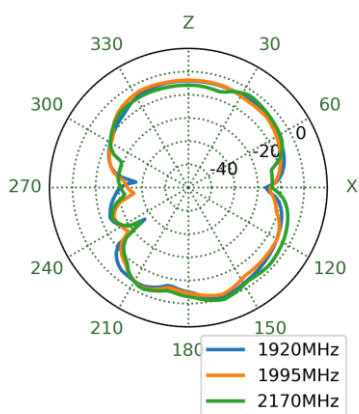
XY Plane



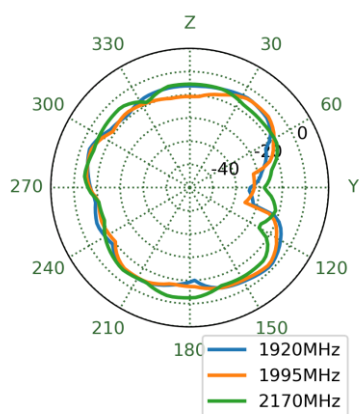
7.28 5G-4G-2 Patterns at 1995 MHz



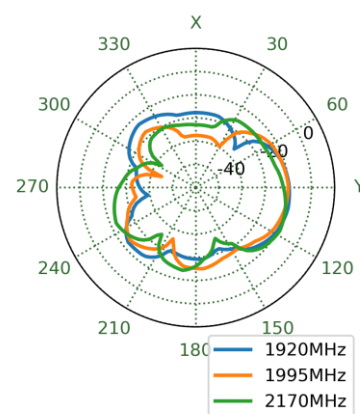
XZ Plane



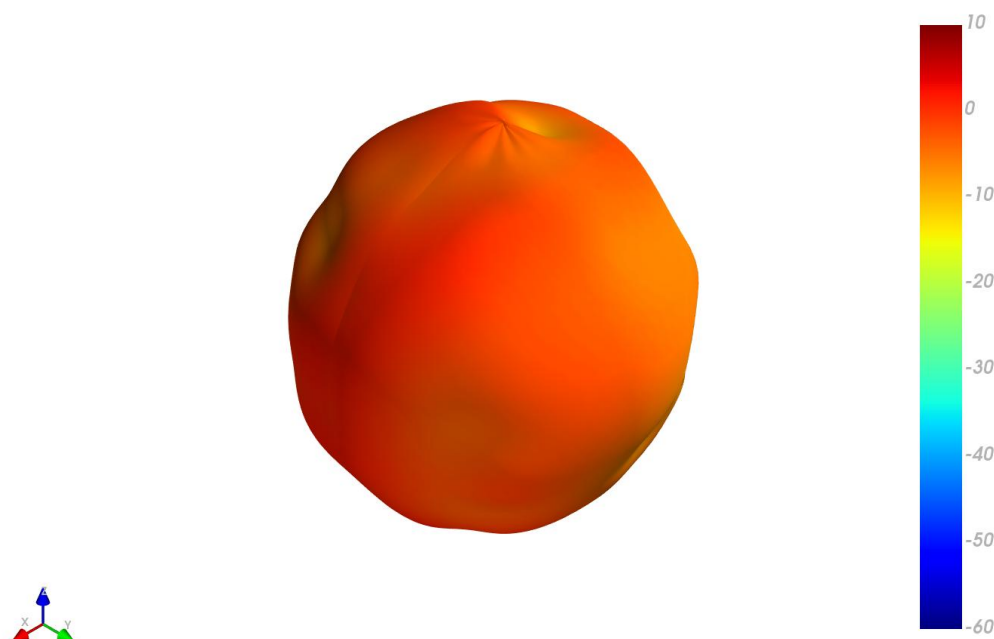
YZ Plane



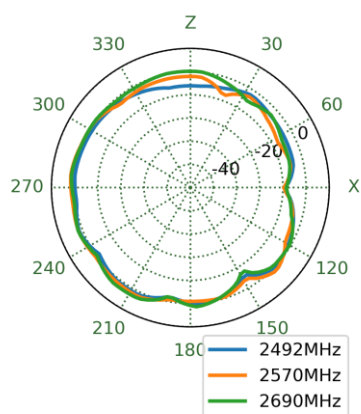
XY Plane



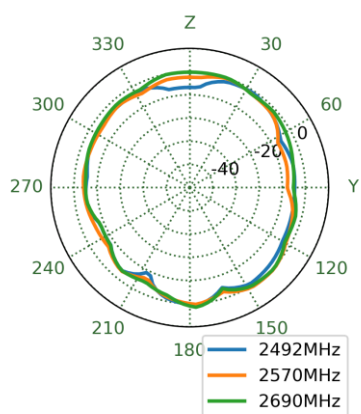
7.29 5G-4G-7 Patterns at 2570 MHz



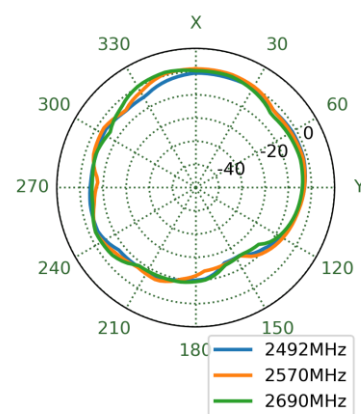
XZ Plane



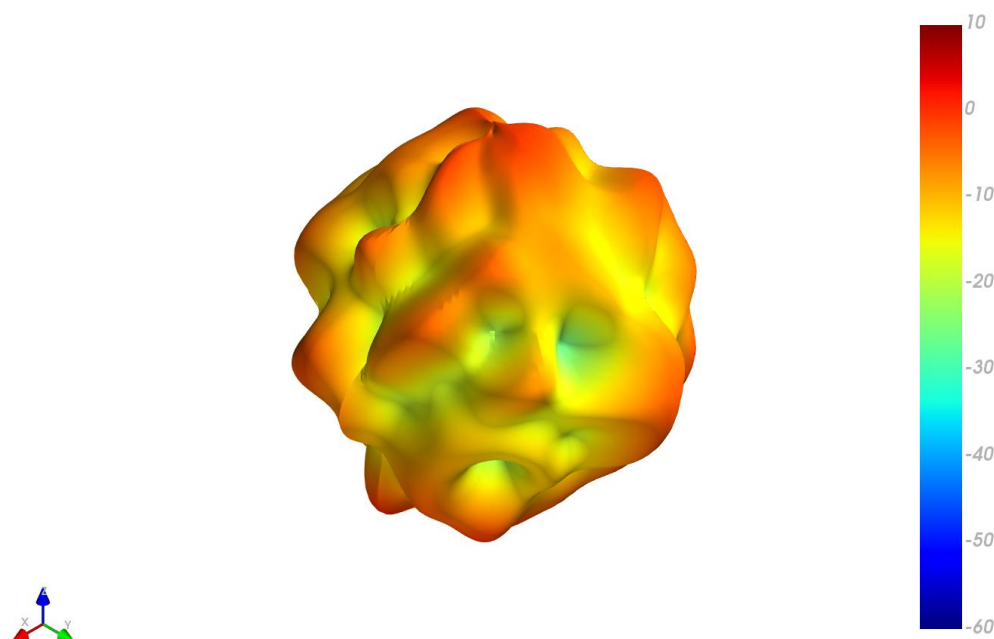
YZ Plane



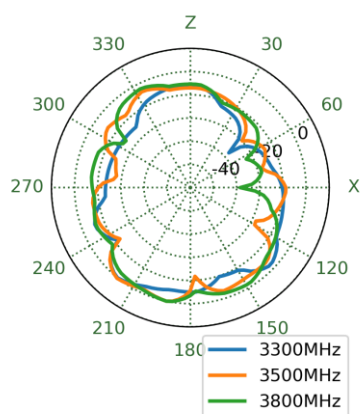
XY Plane



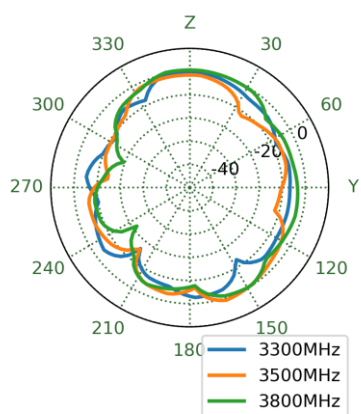
7.30 5G-4G-3 Patterns at 3500 MHz



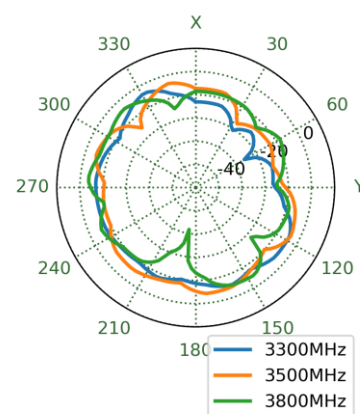
XZ Plane



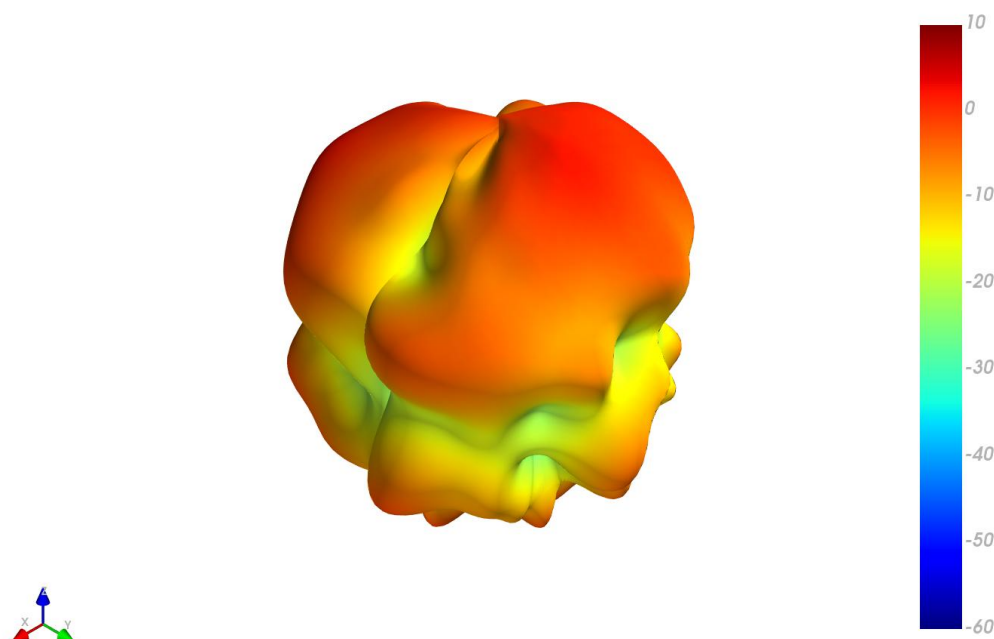
YZ Plane



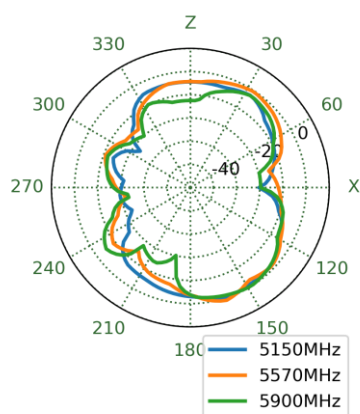
XY Plane



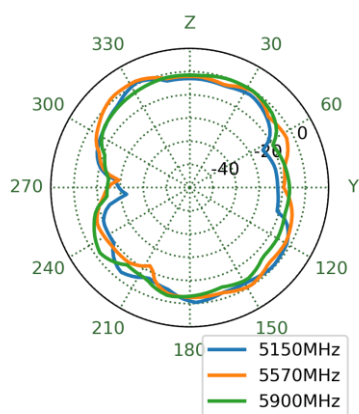
7.31 5G-4G-3 Patterns at 5570 MHz



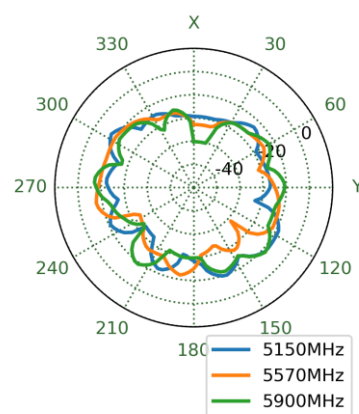
XZ Plane



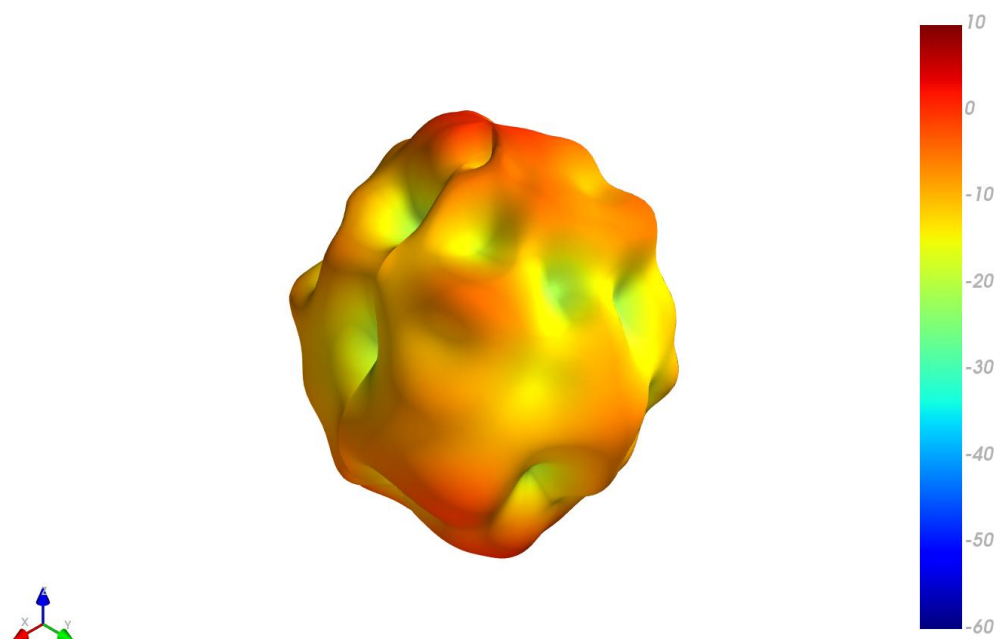
YZ Plane



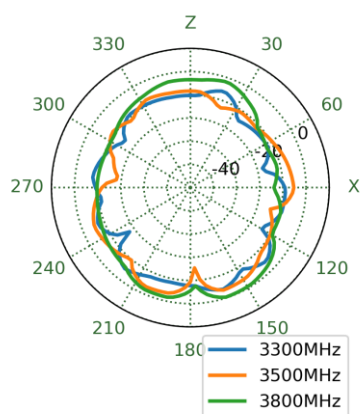
XY Plane



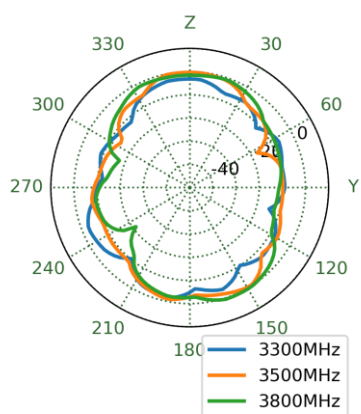
7.32 5G-4G-6 Patterns at 3500 MHz



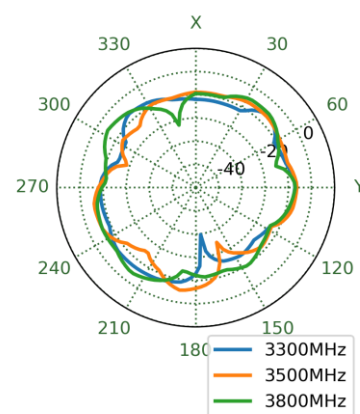
XZ Plane



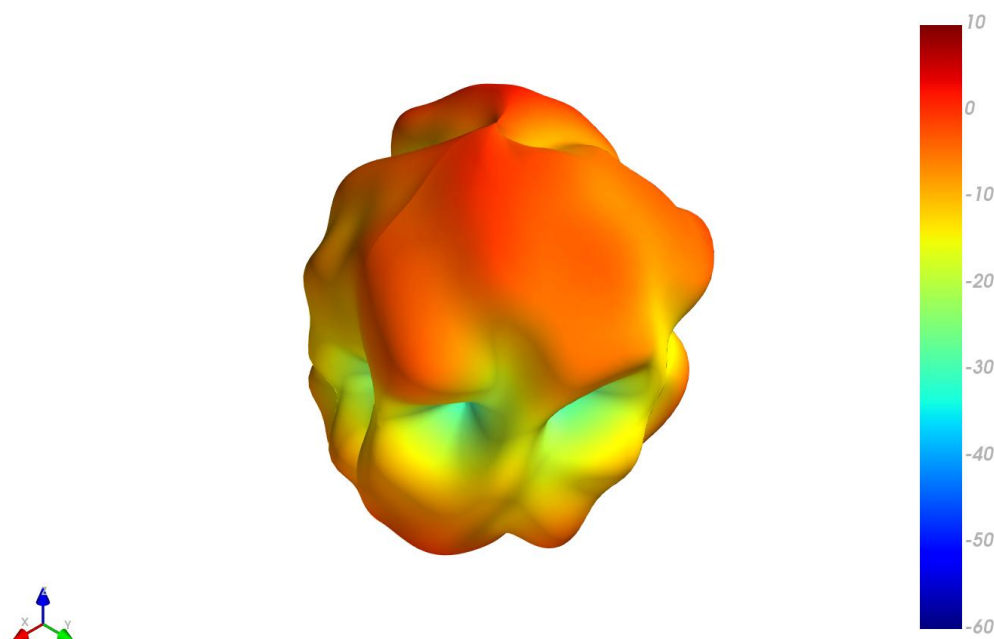
YZ Plane



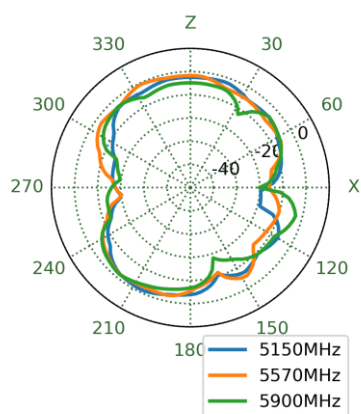
XY Plane



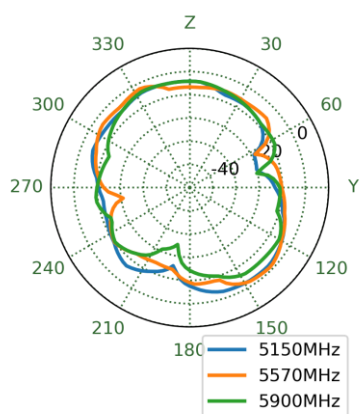
7.33 5G-4G-6 Patterns at 5570 MHz



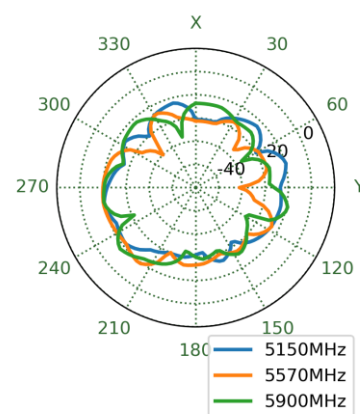
XZ Plane



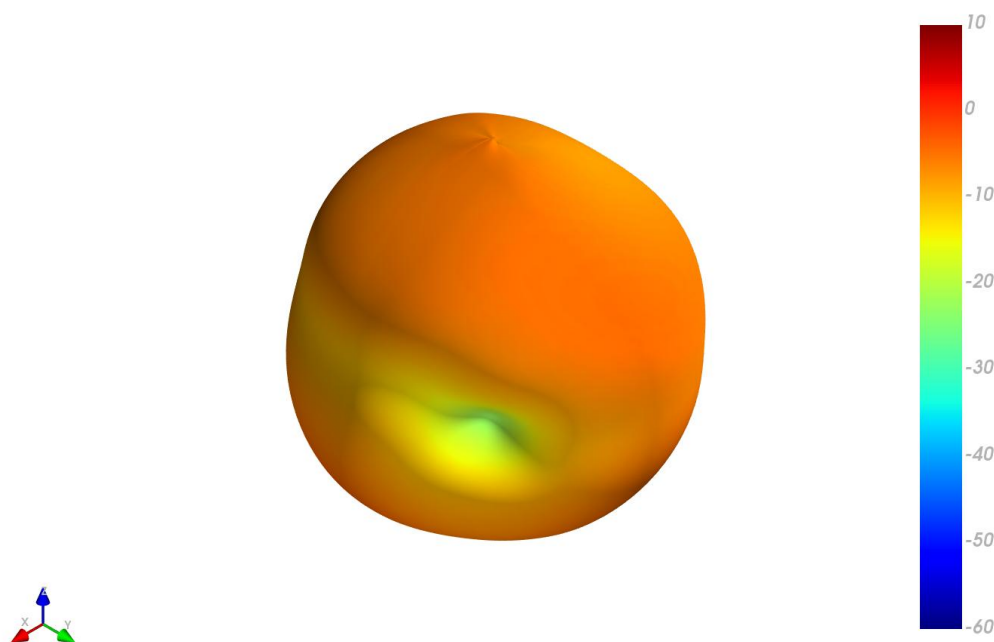
YZ Plane



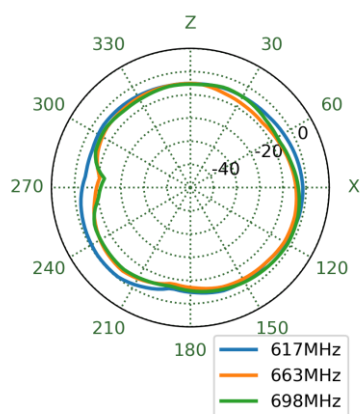
XY Plane



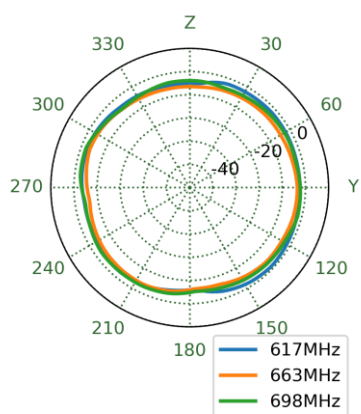
7.34 5G-4G-4 Patterns at 663 MHz



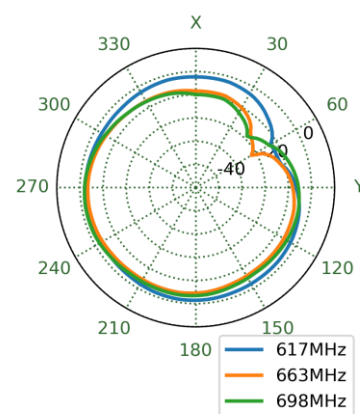
XZ Plane



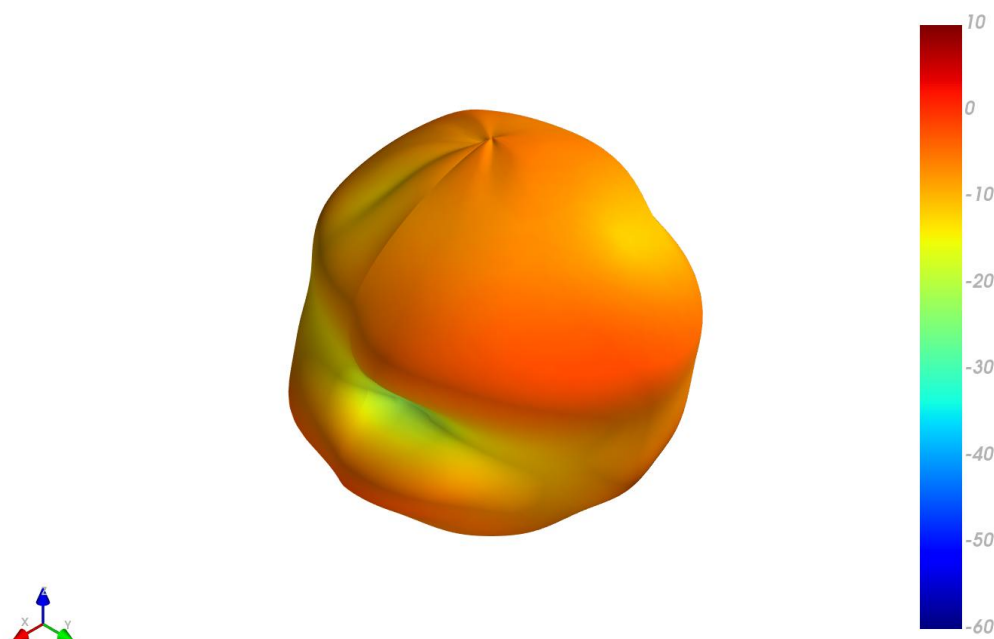
YZ Plane



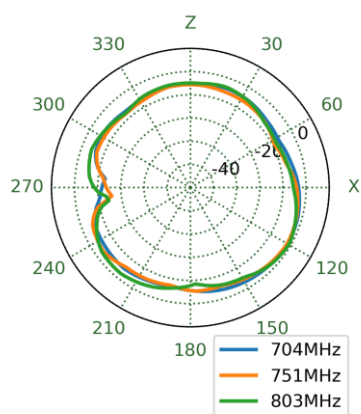
XY Plane



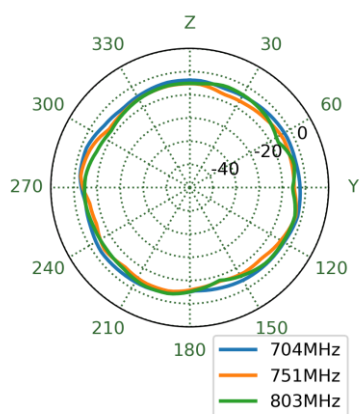
7.35 5G-4G-4 Patterns at 751 MHz



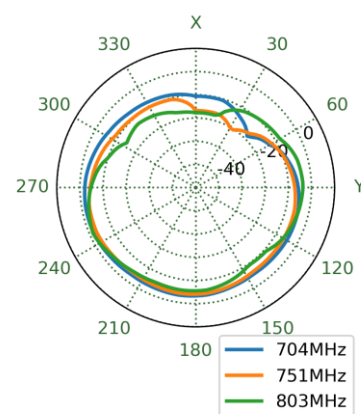
XZ Plane



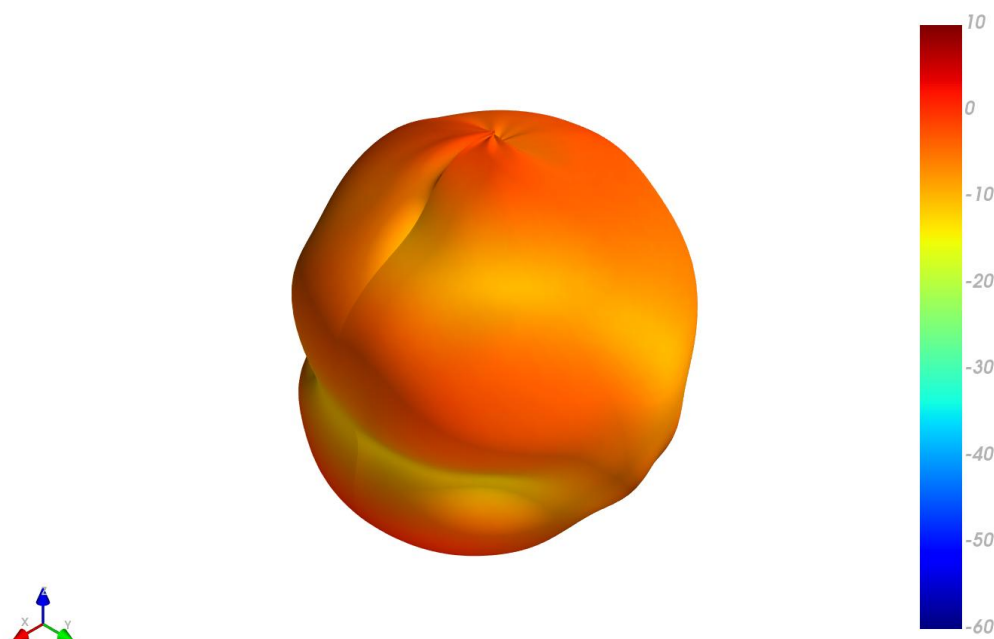
YZ Plane



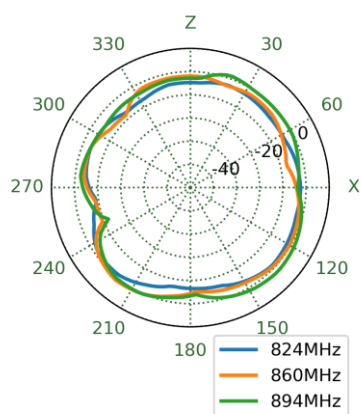
XY Plane



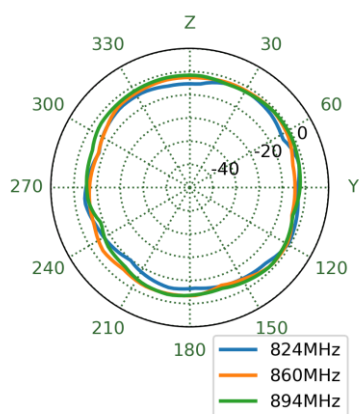
7.36 5G-4G-4 Patterns at 860 MHz



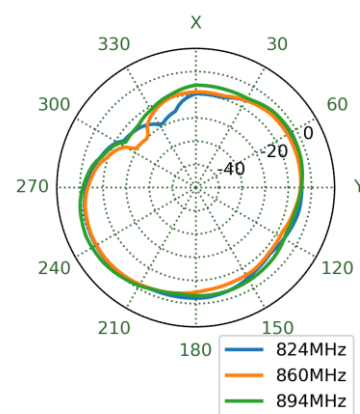
XZ Plane



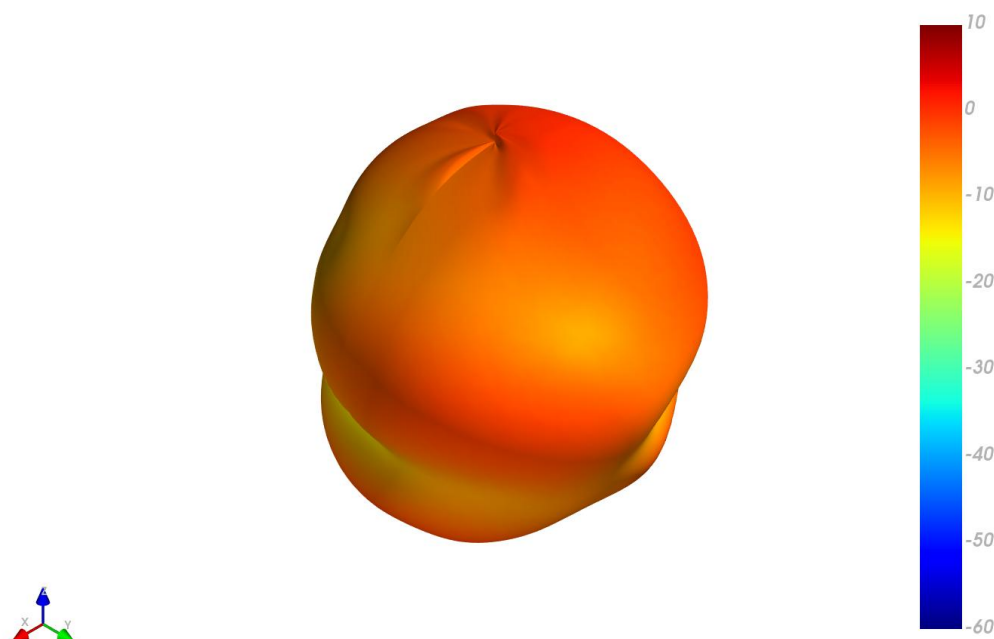
YZ Plane



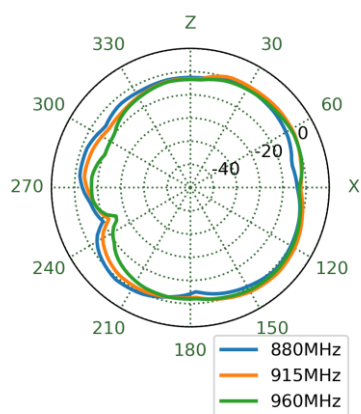
XY Plane



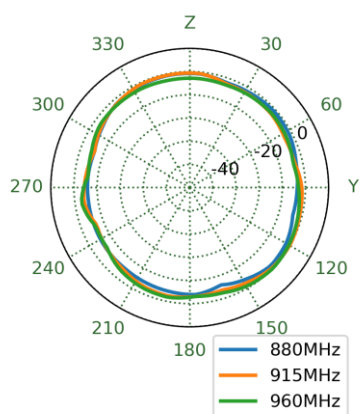
7.37 5G-4G-4 Patterns at 915 MHz



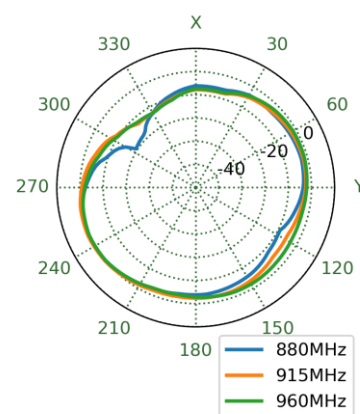
XZ Plane



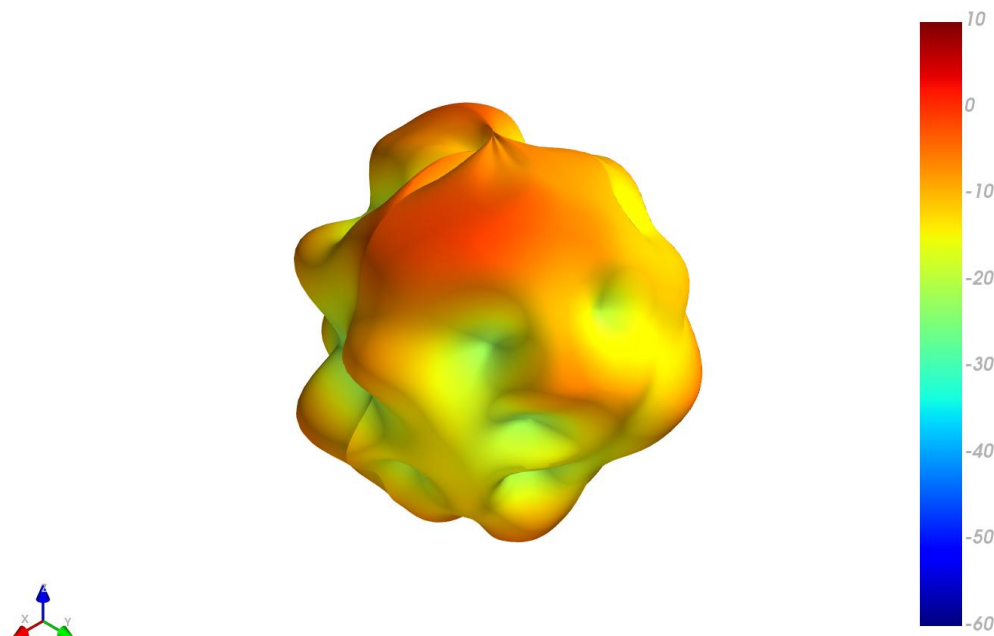
YZ Plane



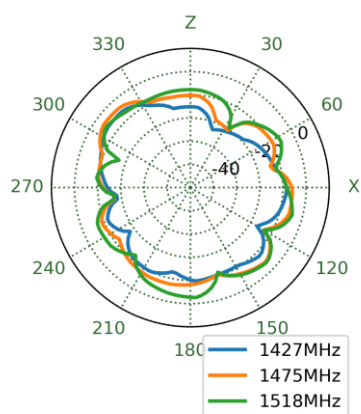
XY Plane



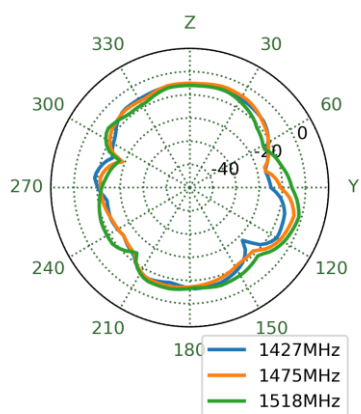
7.38 5G-4G-4 Patterns at 1475 MHz



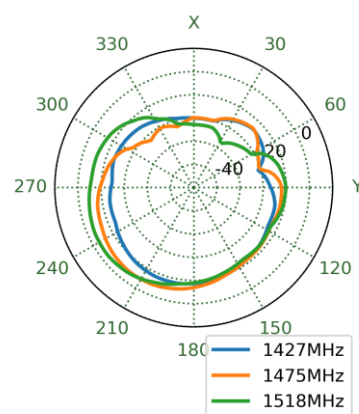
XZ Plane



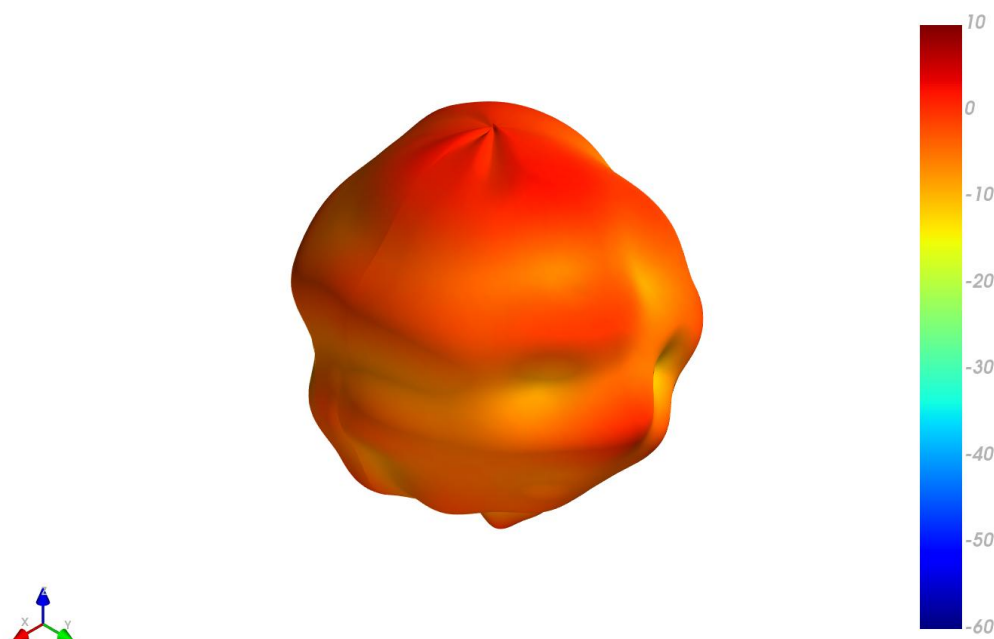
YZ Plane



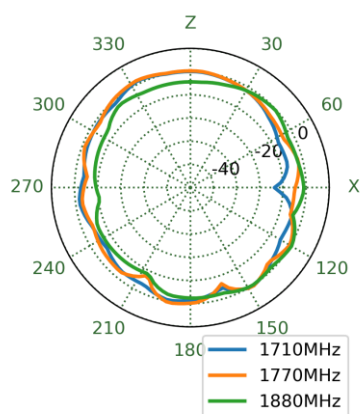
XY Plane



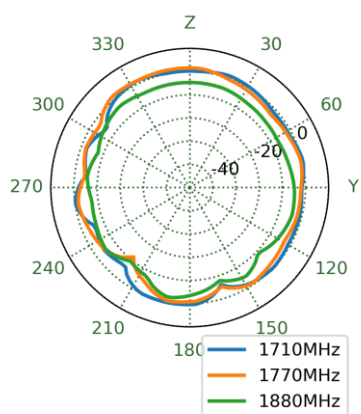
7.39 5G-4G-4 Patterns at 1770 MHz



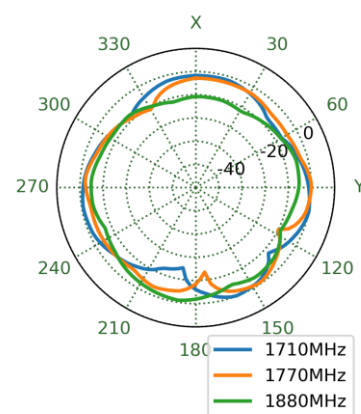
XZ Plane



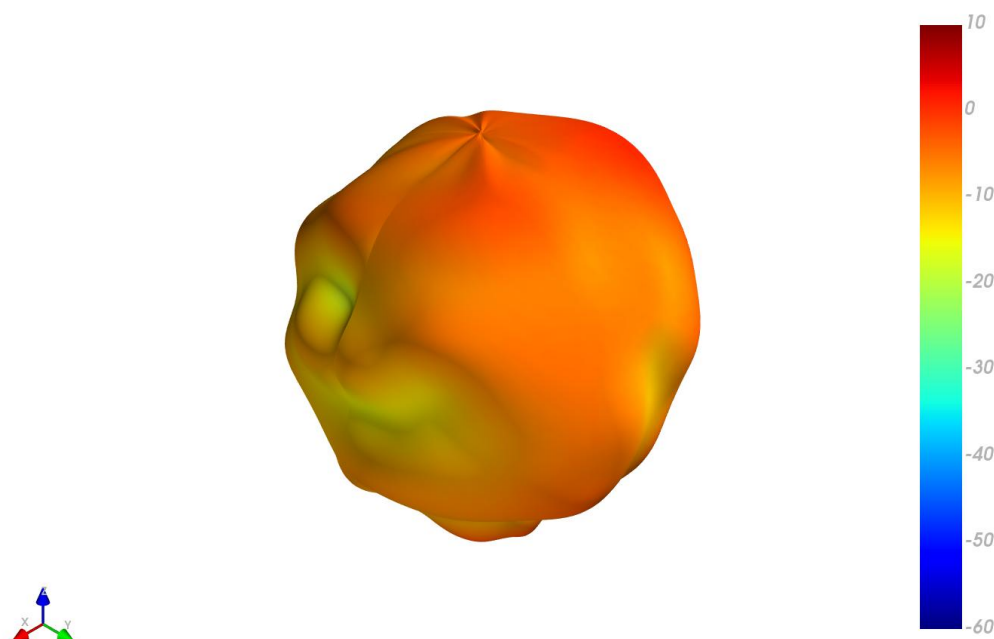
YZ Plane



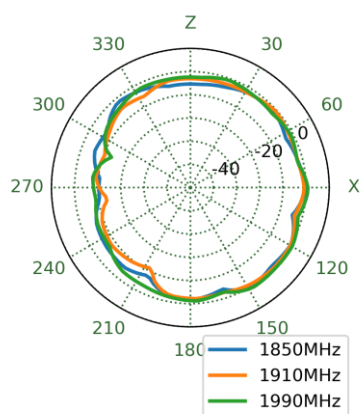
XY Plane



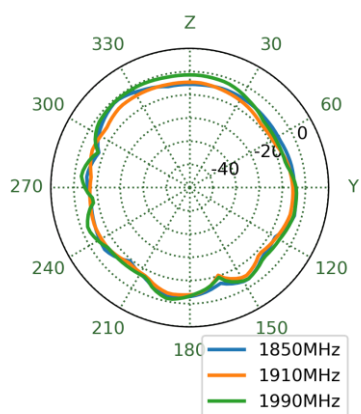
7.40 5G-4G-4 Patterns at 1910 MHz



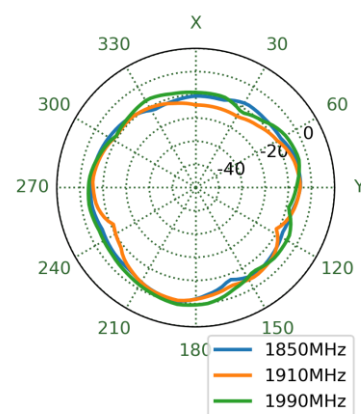
XZ Plane



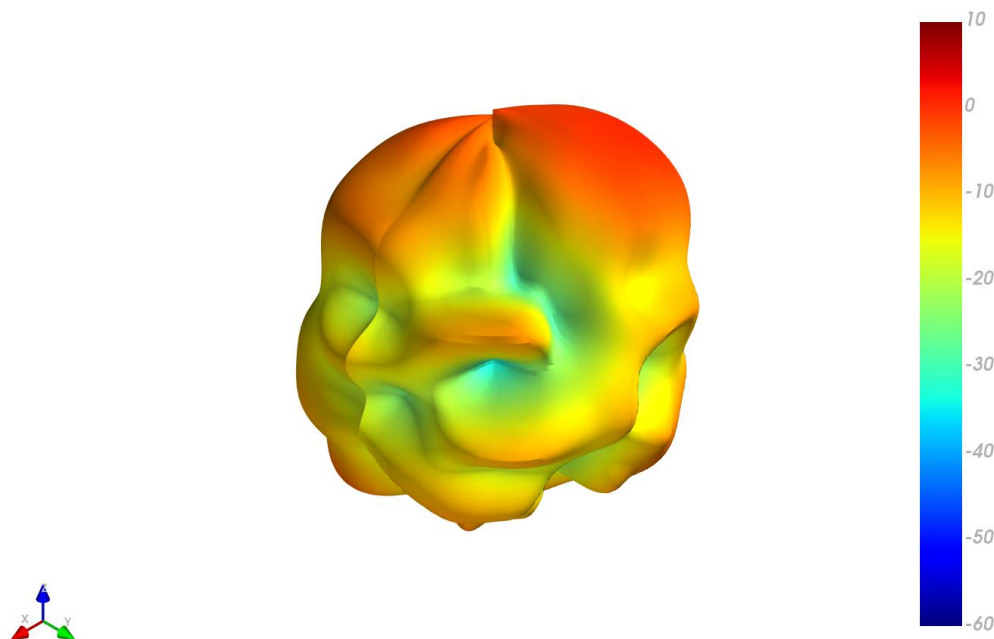
YZ Plane



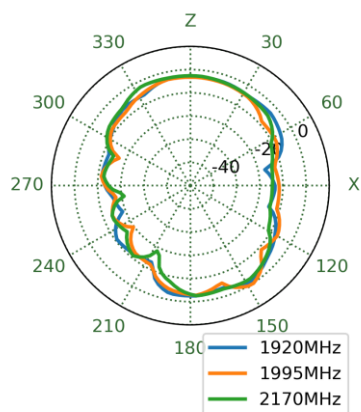
XY Plane



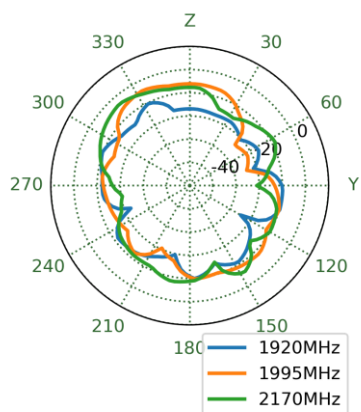
7.41 5G-4G-4 Patterns at 1995 MHz



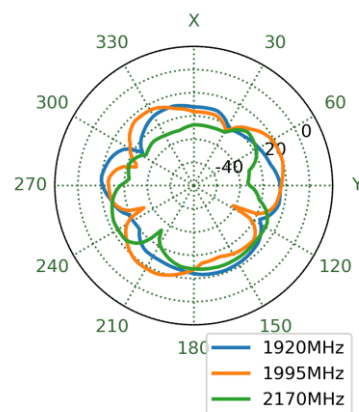
XZ Plane



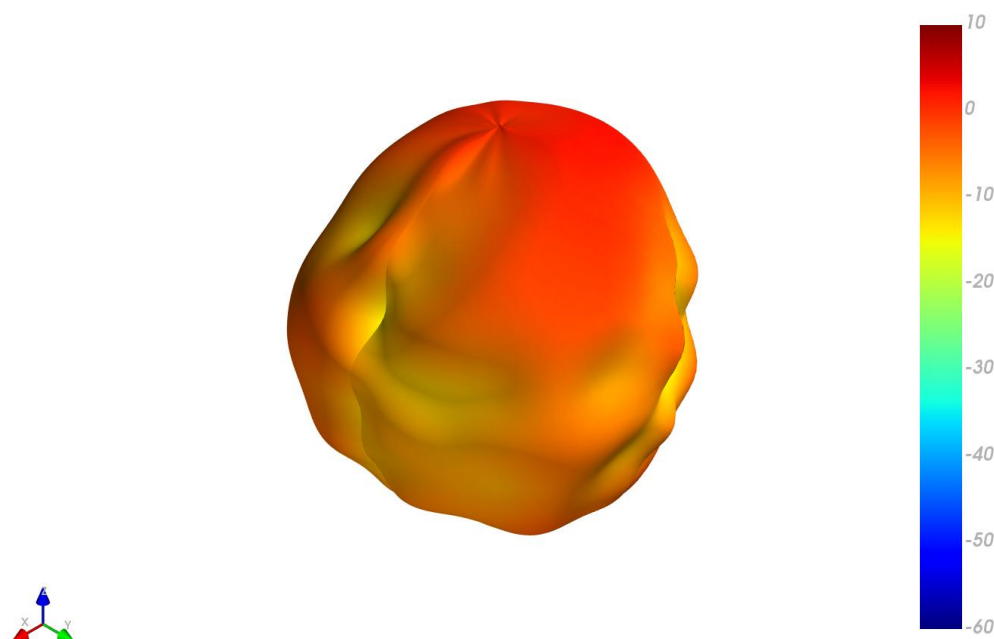
YZ Plane



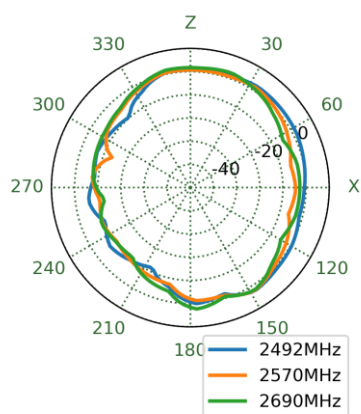
XY Plane



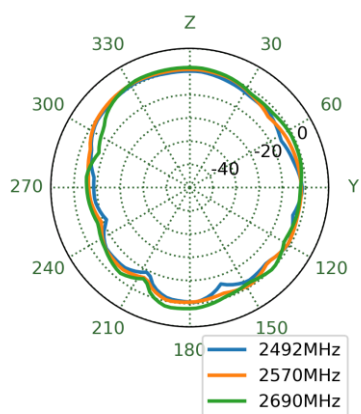
7.42 5G-4G-4 Patterns at 2570 MHz



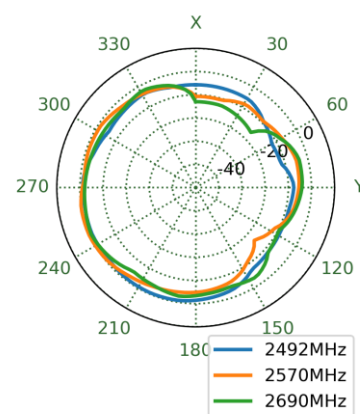
XZ Plane



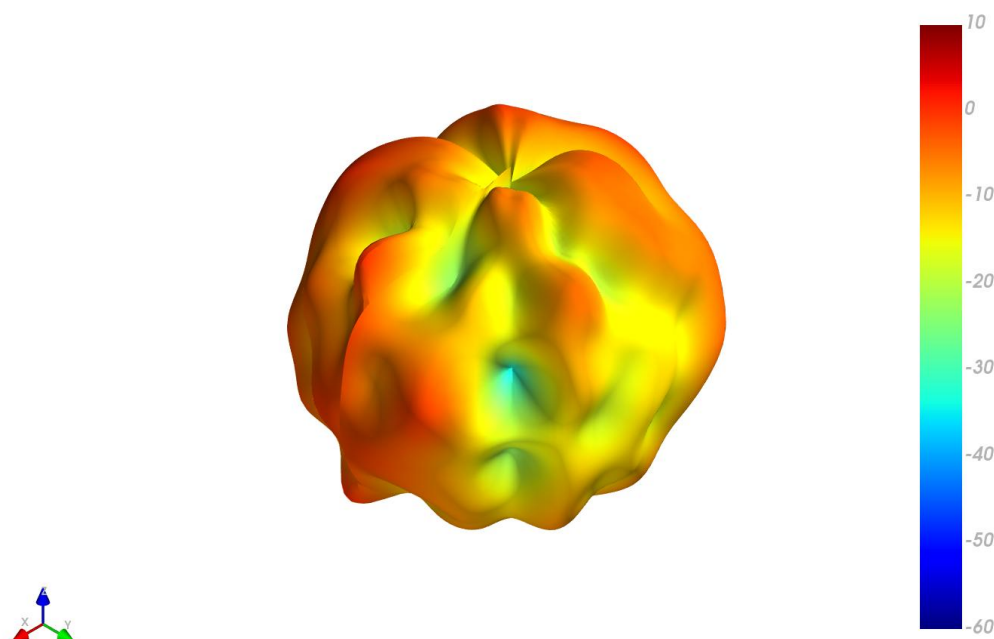
YZ Plane



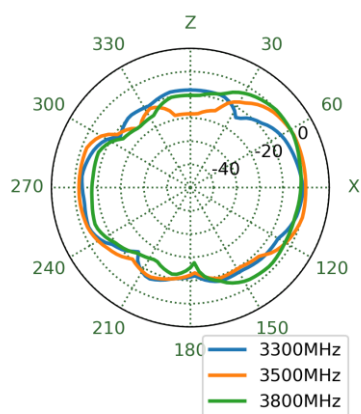
XY Plane



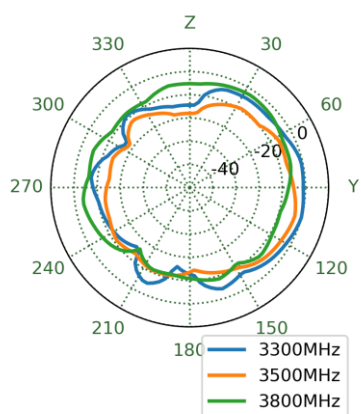
7.43 5G-4G-4 Patterns at 3500 MHz



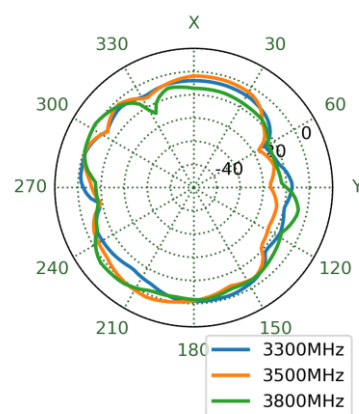
XZ Plane



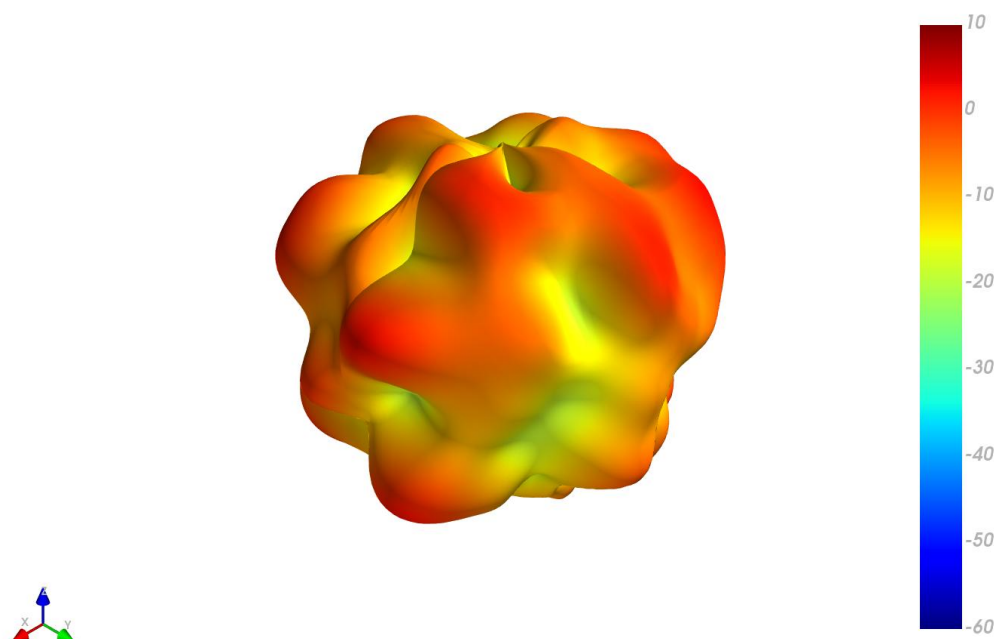
YZ Plane



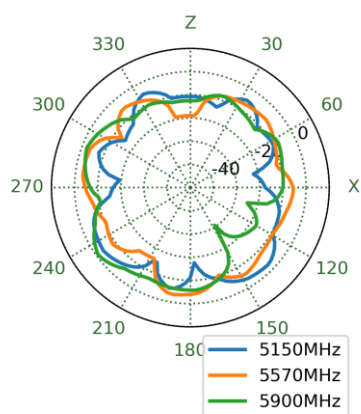
XY Plane



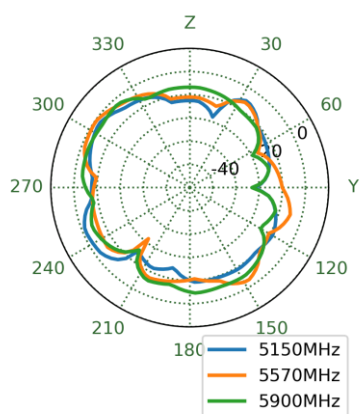
7.44 5G-4G-4 Patterns at 5570 MHz



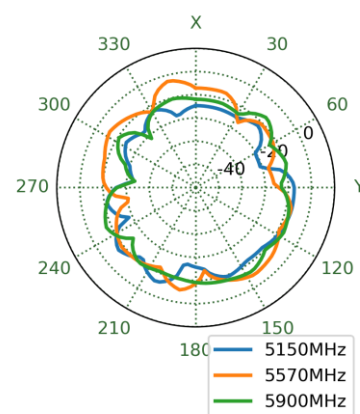
XZ Plane



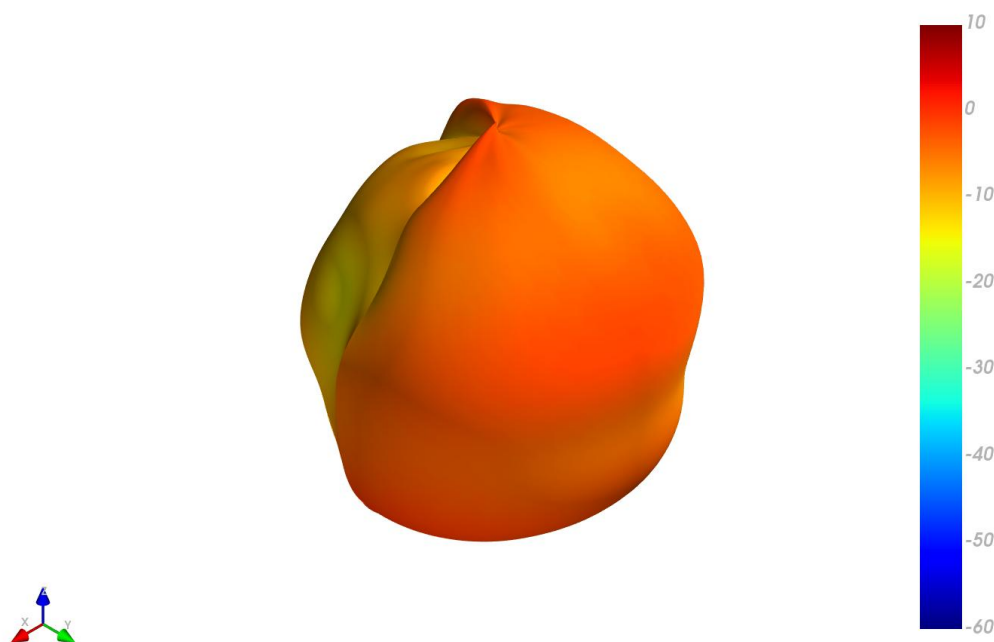
YZ Plane



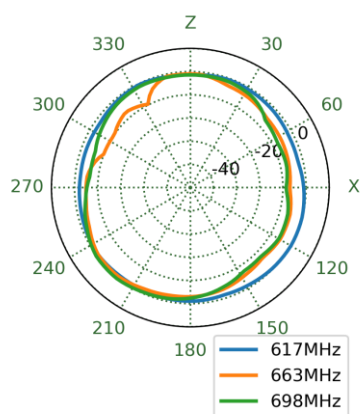
XY Plane



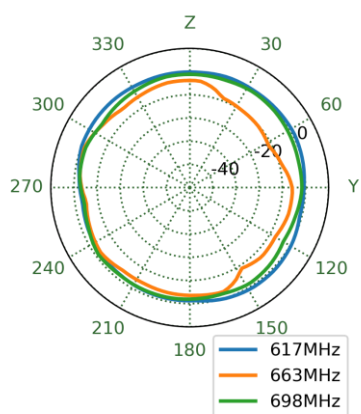
7.45 5G-4G-5 Patterns at 663 MHz



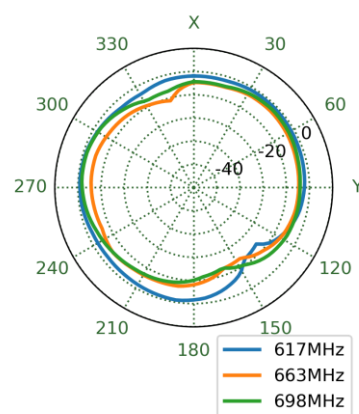
XZ Plane



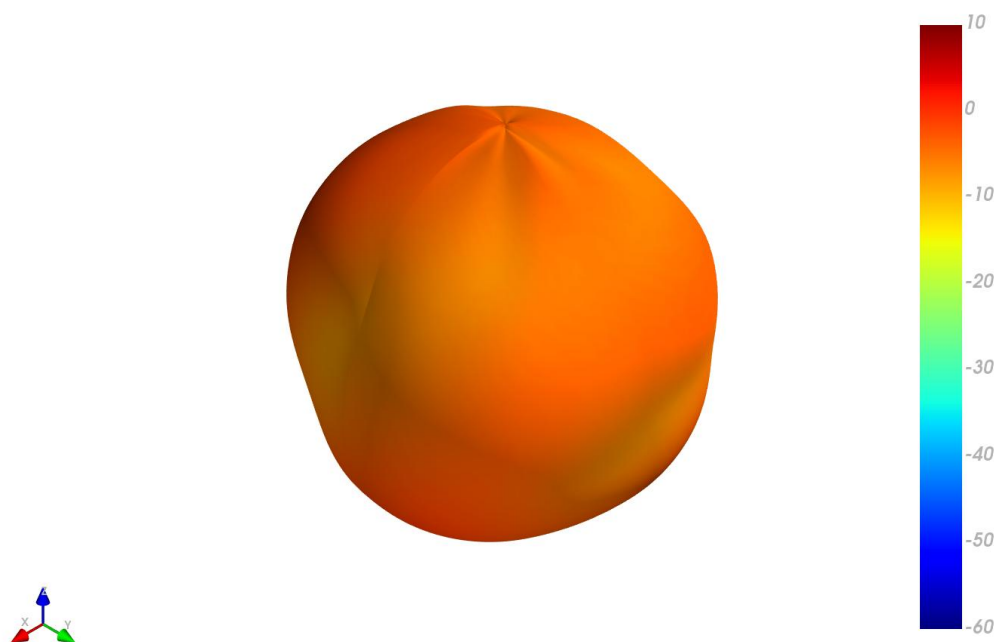
YZ Plane



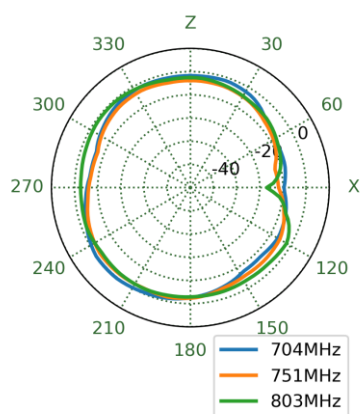
XY Plane



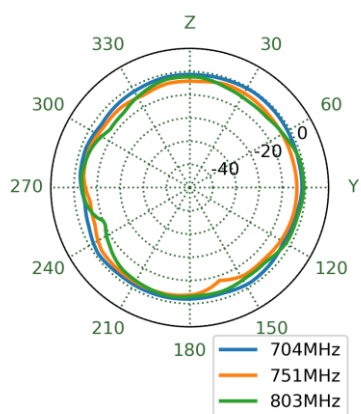
7.46 5G-4G-5 Patterns at 751 MHz



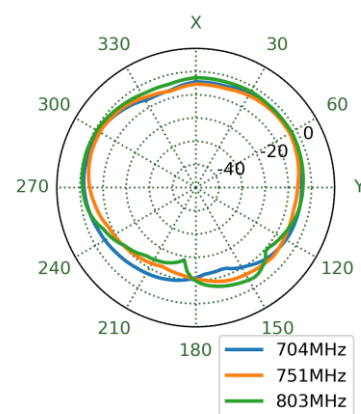
XZ Plane



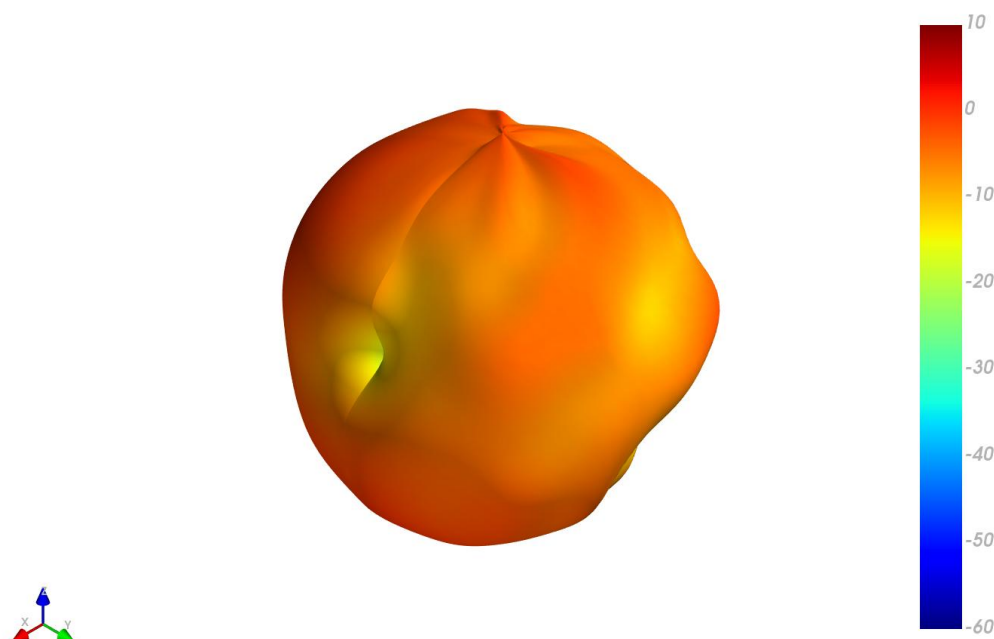
YZ Plane



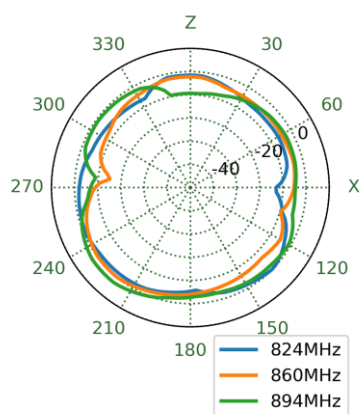
XY Plane



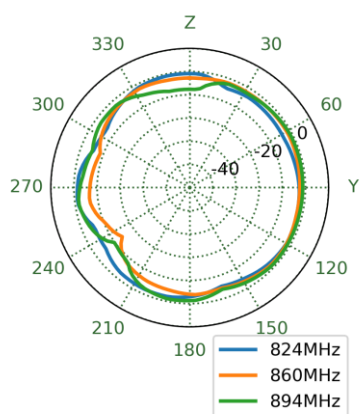
7.47 5G-4G-5 Patterns at 860 MHz



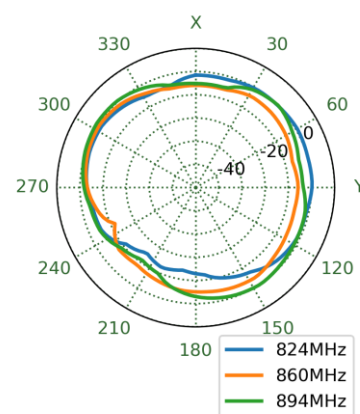
XZ Plane



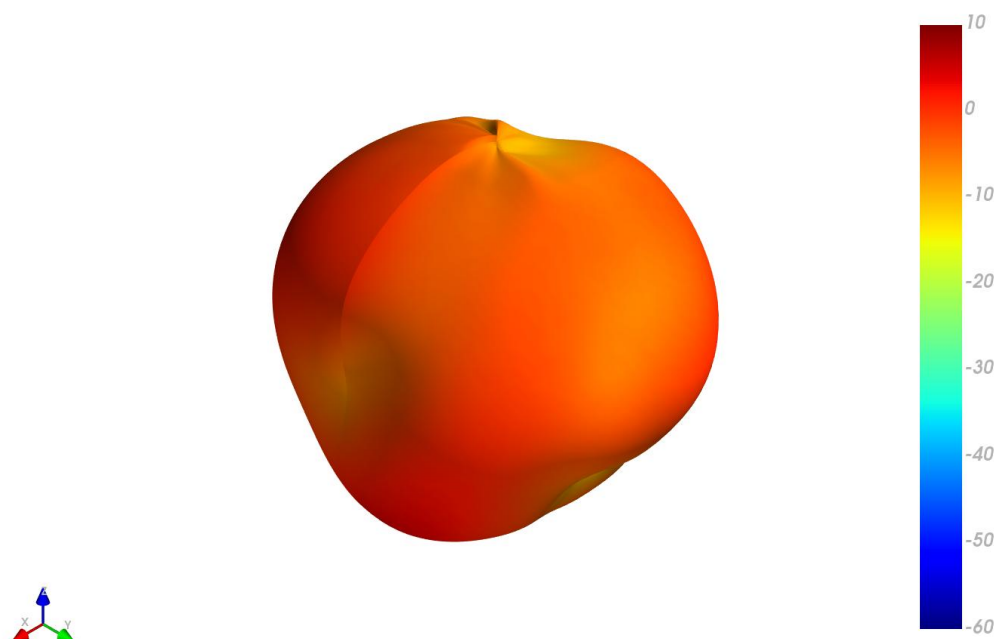
YZ Plane



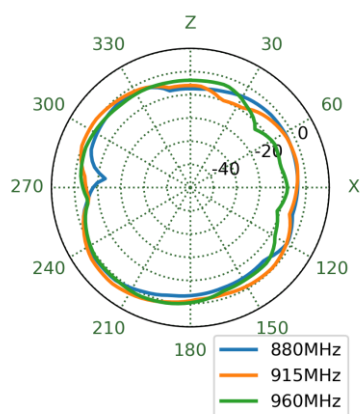
XY Plane



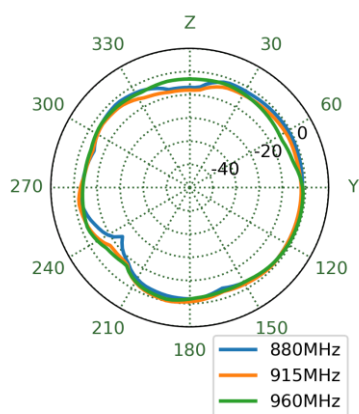
7.48 5G-4G-5 Patterns at 915 MHz



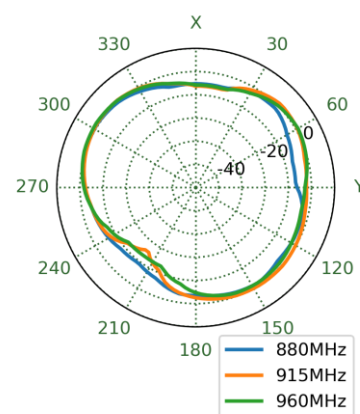
XZ Plane



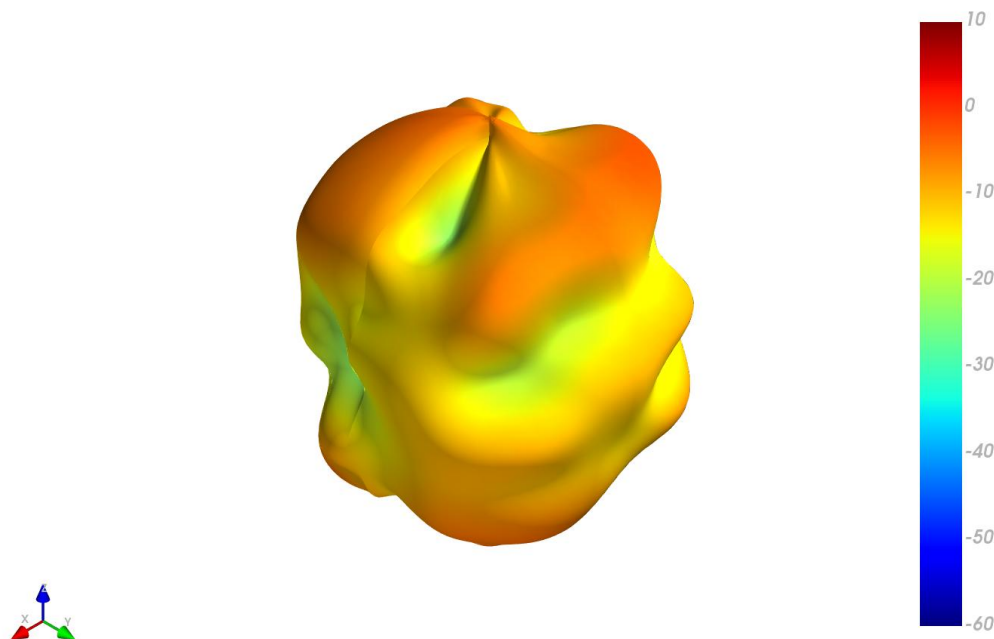
YZ Plane



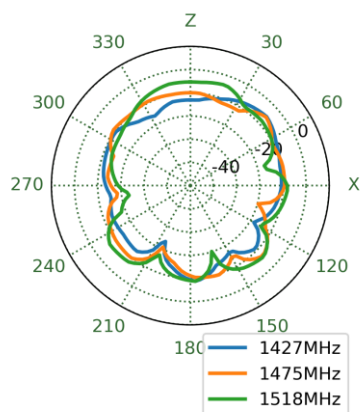
XY Plane



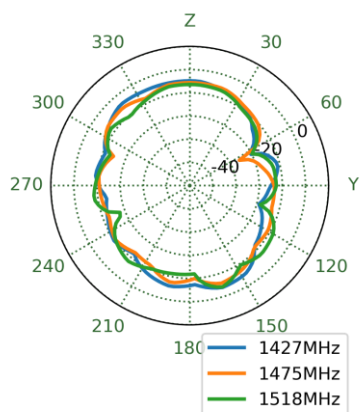
7.49 5G-4G-5 Patterns at 1475 MHz



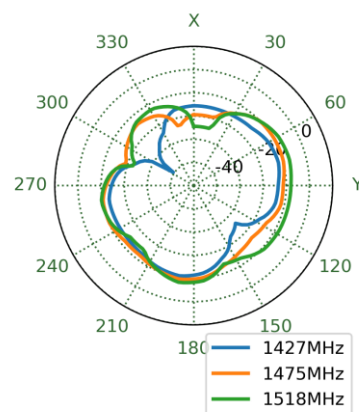
XZ Plane



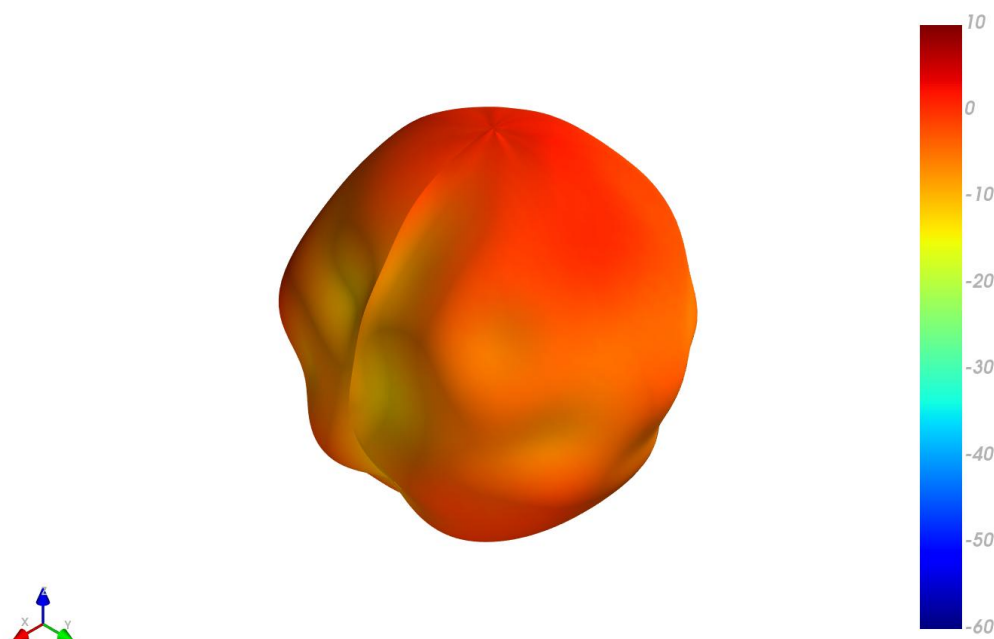
YZ Plane



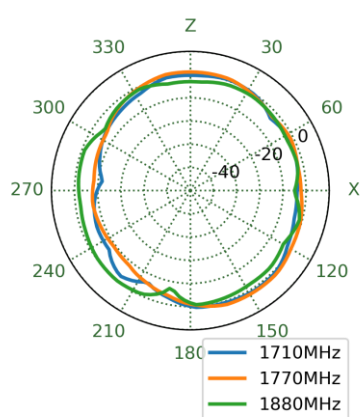
XY Plane



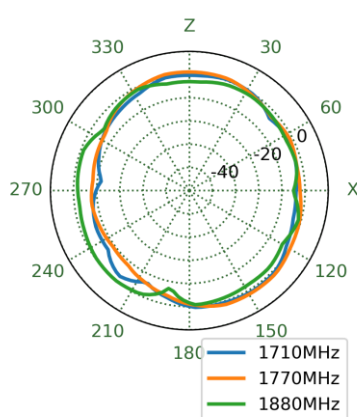
7.50 5G-4G-5 Patterns at 1770 MHz



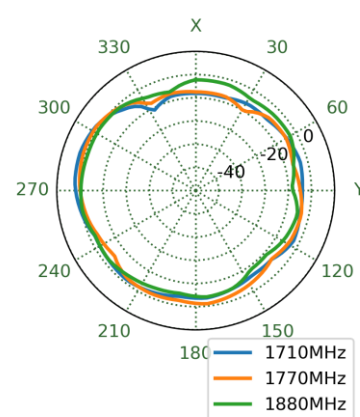
XZ Plane



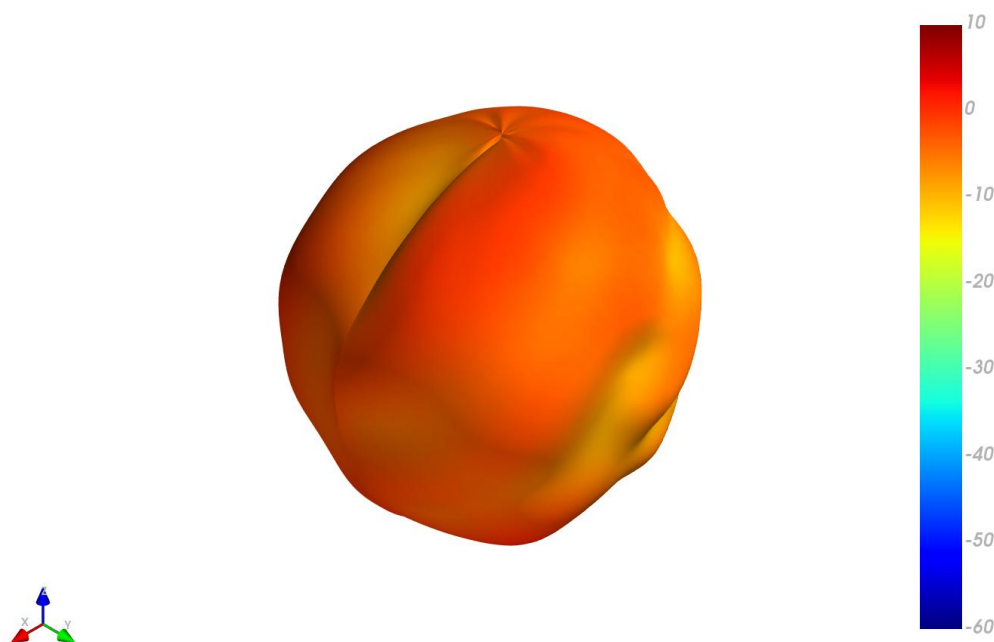
YZ Plane



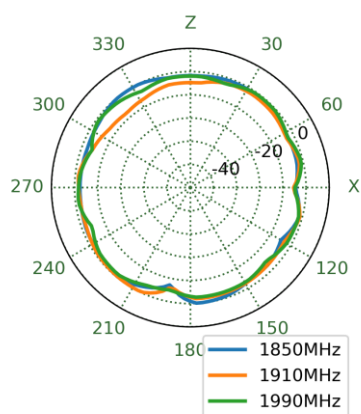
XY Plane



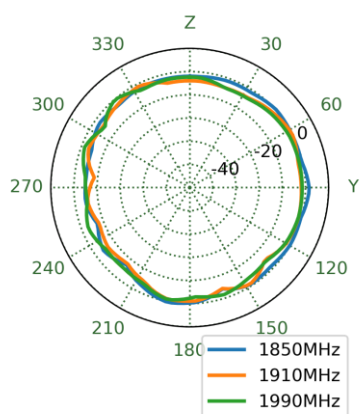
7.51 5G-4G-5 Patterns at 1910 MHz



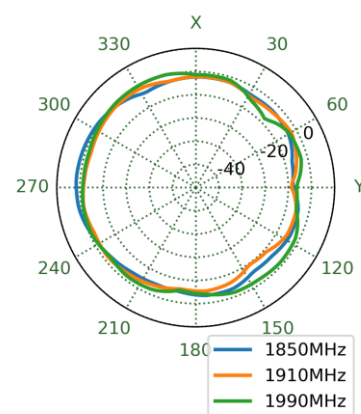
XZ Plane



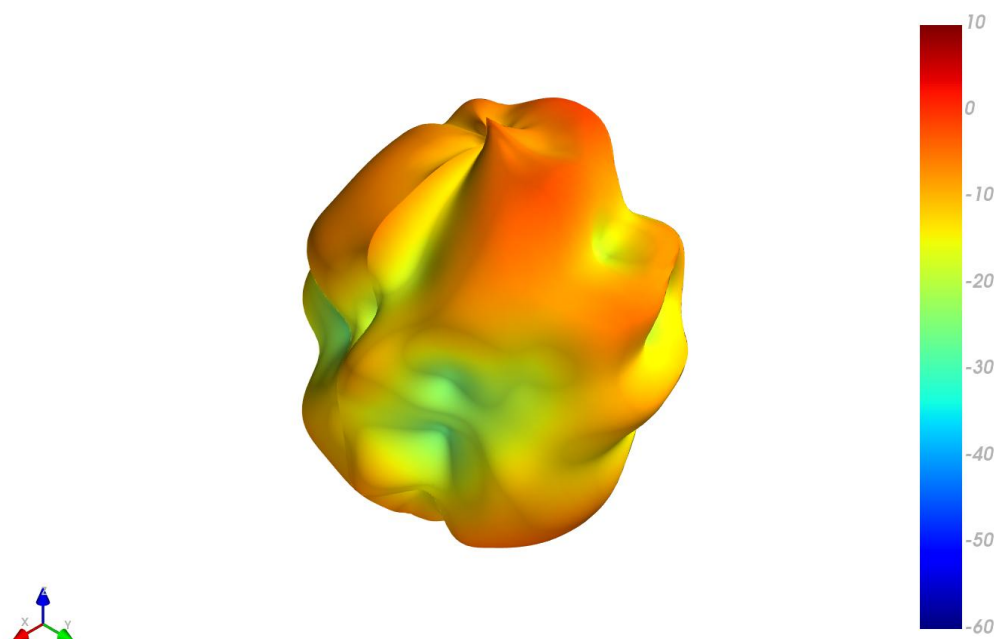
YZ Plane



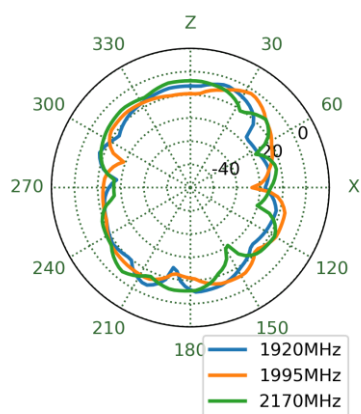
XY Plane



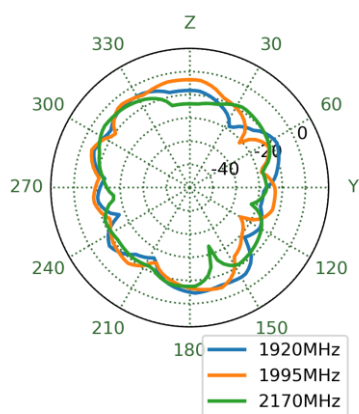
7.52 5G-4G-5 Patterns at 1995 MHz



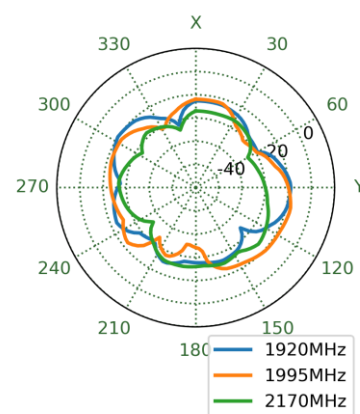
XZ Plane



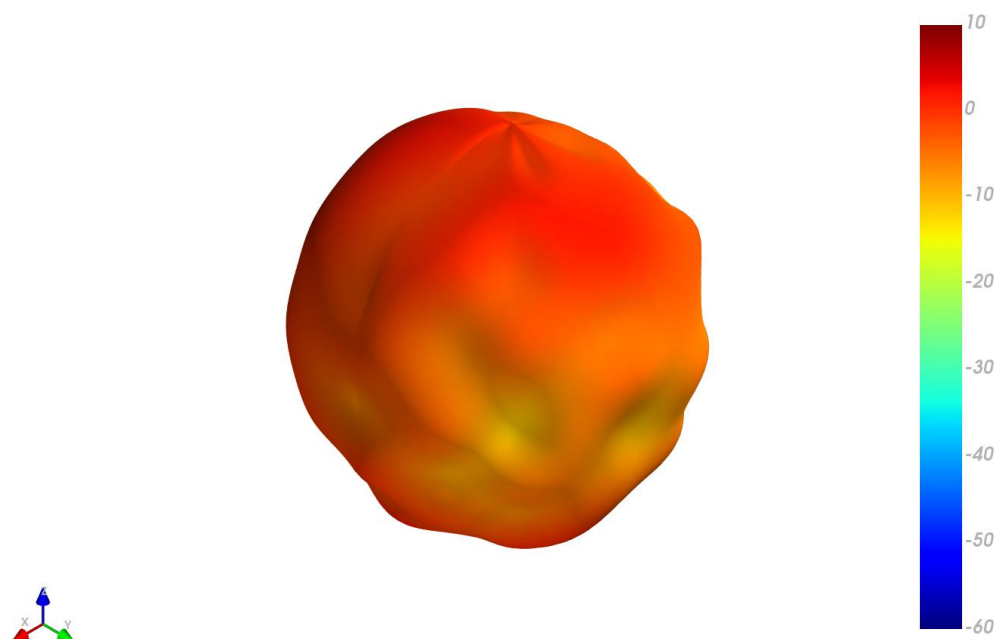
YZ Plane



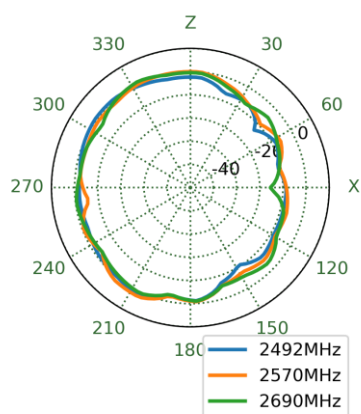
XY Plane



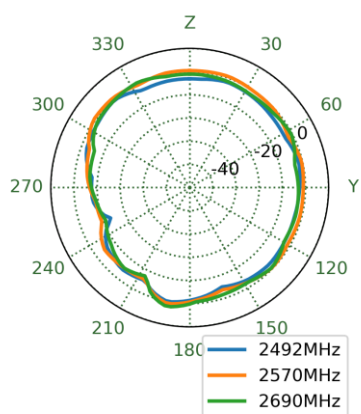
7.53 5G-4G-5 Patterns at 2570 MHz



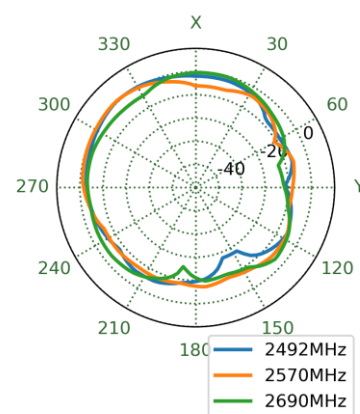
XZ Plane



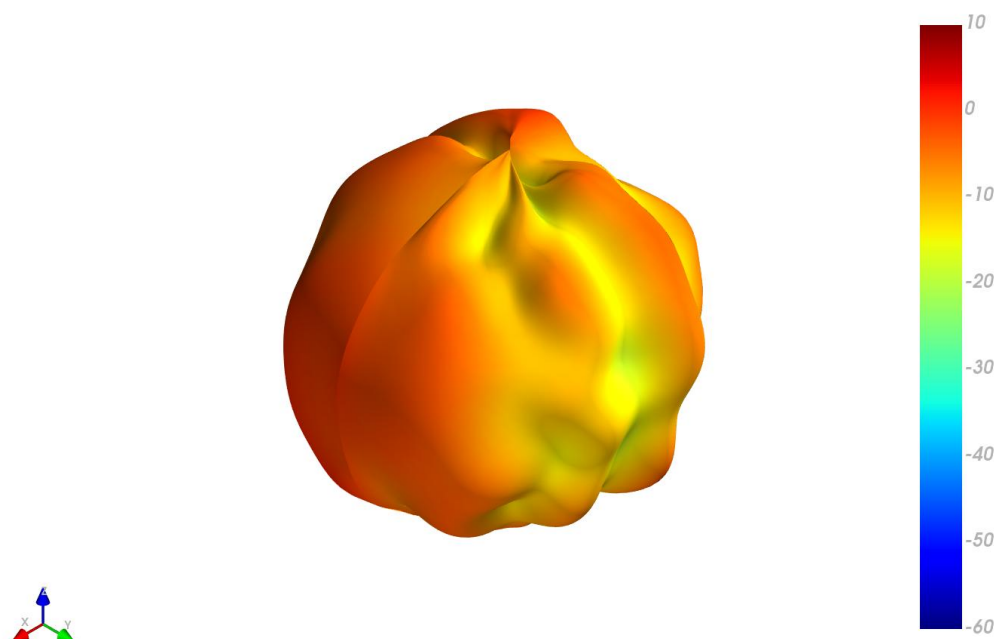
YZ Plane



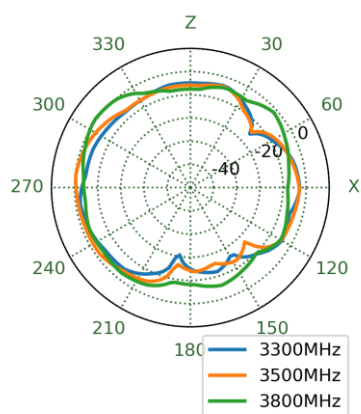
XY Plane



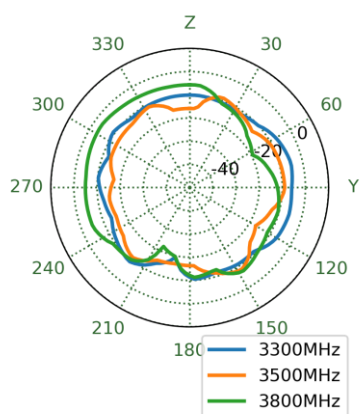
7.54 5G-4G-5 Patterns at 3500 MHz



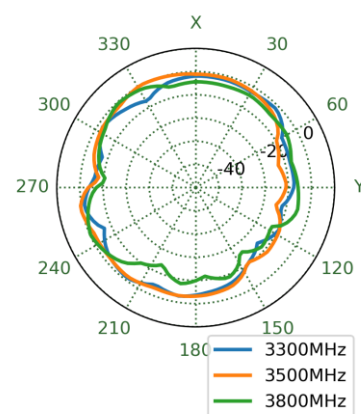
XZ Plane



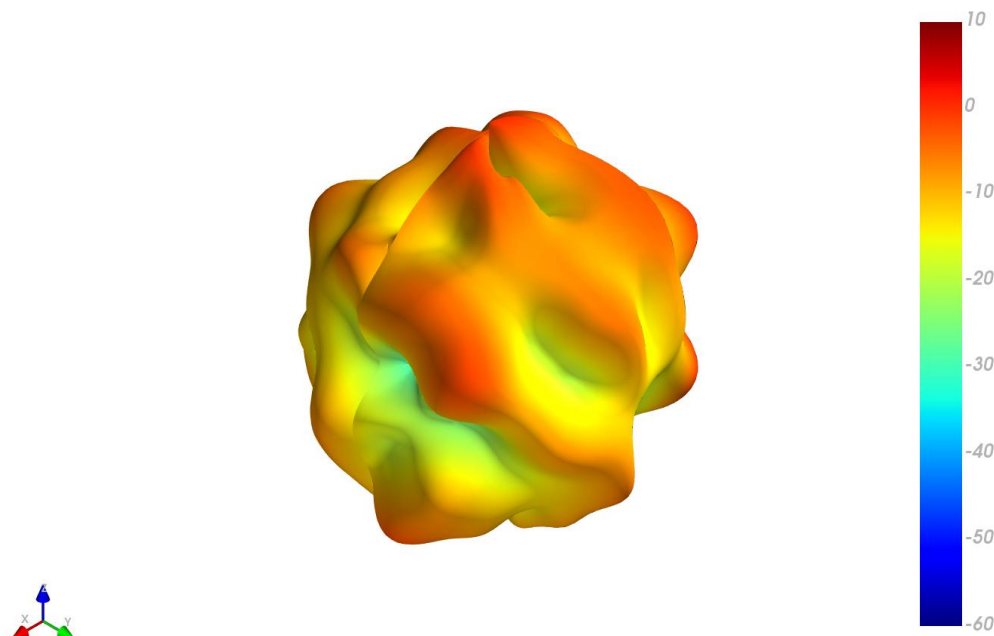
YZ Plane



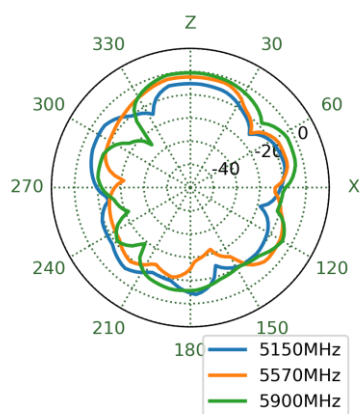
XY Plane



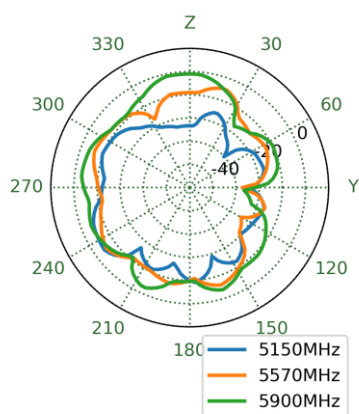
7.55 5G-4G-5 Patterns at 5570 MHz



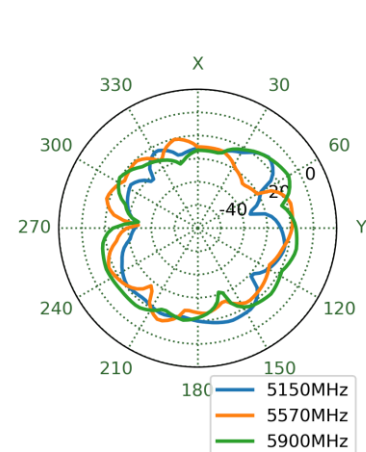
XZ Plane



YZ Plane



XY Plane



Changelog for the datasheet

SPE-22-8-017 – MA990.A.001

Revision: C (Current Release)	
Date:	2025-11-14
Changes:	Updated test setup photos
Changes Made by:	Gary West

Previous Revisions

Revision: B	
Date:	2025-04-16
Changes:	Full Datasheet Update
Changes Made by:	Gary West

Revision: A (Original First Release)	
Date:	2022-02-03
Notes:	
Author:	Jack Conroy



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