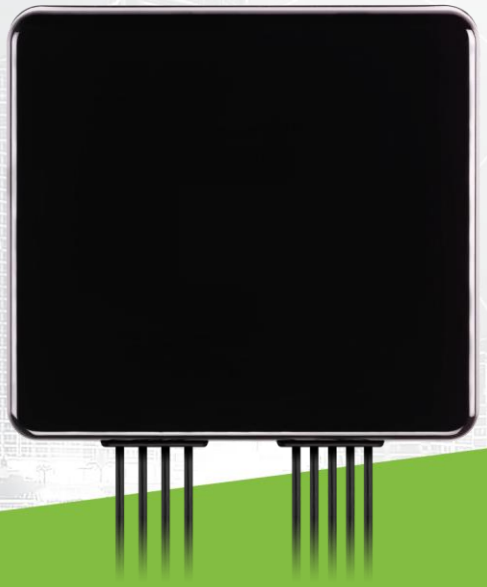
TAOGLAS



Datasheet

9- in – 1 Guardian

Part No:
MA995.A.001

Description:

9in1 Guardian - 1*GNSS L1/L5 1m RG-174 SMA(M) 8*5G/4G MIMO 1m TGC-1.5DS with SMA(M)

Features:

Low-profile IP67 Rated Housing

8*5G/4G MIMO

1*GNSS – GPS/GLONASS/BeiDou/Galileo L1/L5

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 MA995 Guardian has been designed to be the smallest 9-in-1 combination antenna in the world. The MA995 Guardian 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 MA995 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/L5 coverage, 8* 5G/4G Cellular MIMO. The MA995 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 MA995 Guardian 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.

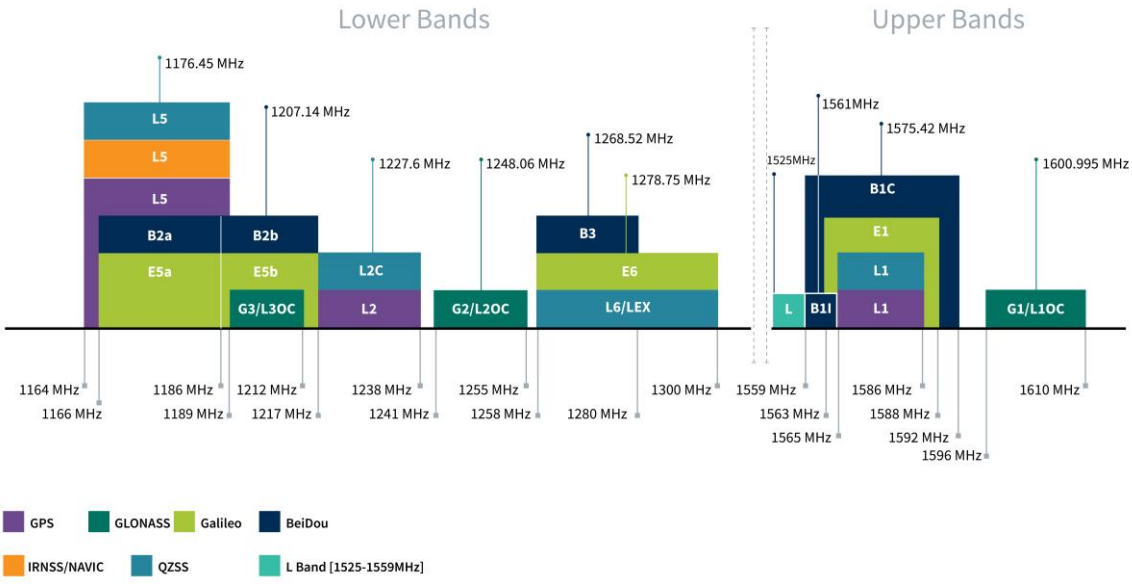
5G/4G applications demand high-speed data uplink and downlink. High efficiency and high gain MIMO antennas are necessary to achieve the required signal to noise ratio and throughput required to solve these challenges. Taoglas also takes care to ensure high isolation between the MIMO antennas to prevent selfinterference. 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 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. Specifications

GNSS Frequency Bands Covered						
GPS	L1	L2	L5			
	■	□	■			
GLONASS	G1	G2	G3			
	■	□	□			
Galileo	E1	E5a	E5b	E6		
	□	■	□	□		
BeiDou	B1	B2a	B2b	B3		
	■	■	□	□		
QZSS (Regional)	L1	L2C	L5	L6		
	■	□	■	□		
IRNSS (Regional)	L5					
	■					
SBAS	L1/E1/B1	L5/B2a/E5a	G1	G2	G3	
	■	□	■	□	□	

■GNSS Frequency Band Covered. □GNSS Frequency Band Not Covered.



GNSS				
Frequency (MHz)	GPS_L1	GPS_L5	BeiDou_B1	GLONASS_G1
	1565-1586	1164-1189	1559-1592	1596-1610
Average Gain (dB)	-1.77	-2.95	-2.00	-2.62
Efficiency (%)	66.5	50.7	63.0	54.7
Peak Gain (dBi)	3.93	2.49	3.93	3.38
Axial Ratio at Zenith	11.7	5	4.8	13.1
Impedance	50 Ω			
Polarization	RHCP			

LNA and Filter Electrical Properties		
		3V(Type.)
LNA Gain	L1	22.3
	L5	15.15
Noise Figure	L1	2.22
	L5	5.72
Current Consumption		16.8mA
Outer Band Attenuation(dB)	At 500 ~1000 MHz	60 dB
	At 2000 ~2690MHz	50 dB
	At 3300~6000MHz	50 dB
Output Impedance		50 ohm
Return Loss(dB)		< -10dB
Input Voltage(V)		+1.8 to 5.5

4G/5G-1 & 8										
Frequency (MHz)	5GNR N74-N76	DCS	PCS	UMTS1	LTE B40-B41	5GNR N77	5GNR N78	5GNR N79	LTE B46-B47	WiFi 2.4
	1427-1518	1710-1880	1850-1990	1920-2170	2300-2690	3300-4200	3300-3800	4400-5000	5150-5925	2400-2500
Efficiency (%)										
4G/5G-1	40.1	60.1	56.4	56.0	53.9	58.9	58.3	60.8	59.6	52.2
4G/5G-8	42.9	58.6	55.5	56.6	51.9	59.7	58.9	61.2	60.3	49.4
Average Gain (dB)										
4G/5G-1	-3.97	-2.21	-2.49	-2.52	-2.68	-2.30	-2.35	-2.16	-2.25	-2.82
4G/5G-8	-3.67	-2.32	-2.56	-2.47	-2.85	-2.24	-2.30	-2.13	-2.20	-3.06
Peak Gain (dBi)										
4G/5G-1	1.55	4.35	3.51	3.74	3.70	6.89	5.95	5.64	5.88	3.44
4G/5G-8	1.40	3.41	3.35	3.93	4.92	6.45	5.64	6.30	5.53	4.92
Impedance	50 Ω									
Polarization	Linear									
Radiation Pattern	Omni									

4G/5G-2 & 7										
Frequency (MHz)	5GNR N74-N76	DCS	PCS	UMTS1	LTE B40-B41	5GNR N77	5GNR N78	5GNR N79	LTE B46-B47	WiFi 2.4
	1427-1518	1710-1880	1850-1990	1920-2170	2300-2690	3300-4200	3300-3800	4400-5000	5150-5925	2400-2500
Efficiency (%)										
4G/5G-2	38.6	59.6	54.3	57.1	52.8	36.2	36.8	38.9	48.3	51.7
4G/5G-7	41.7	58.6	55.7	56.2	49.5	34.4	35.3	39.2	45.4	47.5
Average Gain (dB)										
4G/5G-2	-4.13	-2.25	-2.65	-2.43	-2.78	-4.42	-4.35	-4.10	-3.16	-2.87
4G/5G-7	-3.80	-2.32	-2.54	-2.50	-3.05	-4.64	-4.53	-4.07	-3.43	-3.23
Peak Gain (dBi)										
4G/5G-2	2.48	2.56	1.46	1.46	2.29	3.34	2.33	2.28	5.14	1.92
4G/5G-7	1.90	2.64	2.37	2.86	3.17	1.06	1.06	1.64	3.72	2.16
Impedance	50 Ω									
Polarization	Linear									
Radiation Pattern	Omni									

4G/5G-3 & 6				
Frequency (MHz)	5GNR N77	5GNR N78	5GNR N79	LTE B46-B47
	3300-4200	3300-3800	4400-5000	5150-5925
Efficiency (%)				
4G/5G-3	45.4	46.3	47.2	62.8
4G/5G-6	42.0	42.9	32.5	54.2
Average Gain (dB)				
4G/5G-3	-3.43	-3.34	-3.26	-2.02
4G/5G-6	-3.77	-3.68	-4.87	-2.66
Peak Gain (dBi)				
4G/5G-3	4.44	4.44	4.48	6.04
4G/5G-6	4.77	4.77	4.14	4.94
Impedance	50 Ω			
Polarization	Linear			
Radiation Pattern	Omni			

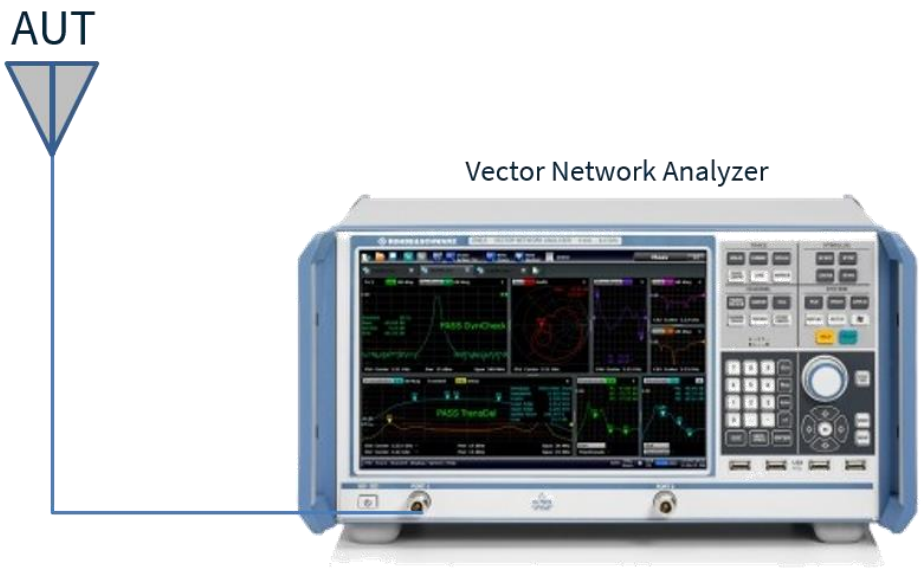
4G/5G-4 & 5														
Frequency (MHz)	LTE B71	LTE B12-B17	LTE B20	GSM 850/900	5GNR N74-N76	DCS	PCS	UMTS1	LTE B40-B41	5GNR N77	5GNR N78	5GNR N79	LTE B46-B47	WiFi 2.4
	617-698	698-798	791-862	824-960	1427-1518	1710-1880	1850-1990	1920-2170	2300-2690	3300-4200	3300-3800	4400-5000	5150-5925	2400-2500
Efficiency (%)														
4G/5G-4	41.7	44.0	47.9	51.6	39.9	48.9	47.1	51.4	51.7	51.5	51.1	50.5	52.8	51.7
4G/5G-5	38.5	46.0	49.9	53.6	44.7	59.5	54.7	52.8	49.0	53.6	54.0	49.9	49.0	48.2
Average Gain (dB)														
4G/5G-4	-3.79	-3.57	-3.20	-2.87	-3.99	-3.11	-3.27	-2.89	-2.86	-2.88	-2.92	-2.97	-2.77	-2.86
4G/5G-5	-4.14	-3.37	-3.02	-2.71	-3.50	-2.25	-2.62	-2.77	-3.09	-2.71	-2.68	-3.02	-3.10	-3.17
Peak Gain (dBi)														
4G/5G-4	0.66	1.30	3.15	3.15	0.16	3.49	2.84	3.95	3.73	5.31	3.36	2.99	7.77	3.18
4G/5G-5	0.28	2.45	4.07	4.07	0.42	3.60	2.15	2.48	3.02	3.02	3.02	3.66	7.32	2.10
Impedance	50 Ω													
Polarization	Linear													
Radiation Pattern	Omni													

Mechanical	
Dimensions	146*134*20mm
Weight	640g (including cable)
Material	ASA
Connector	SMA
Cable	TGC 1.5DS
Environmental	
Waterproof Rating	IPx7
Temperature Range	-40°C to + 85°C
Humidity	Non-condensing 65°C 95% RH

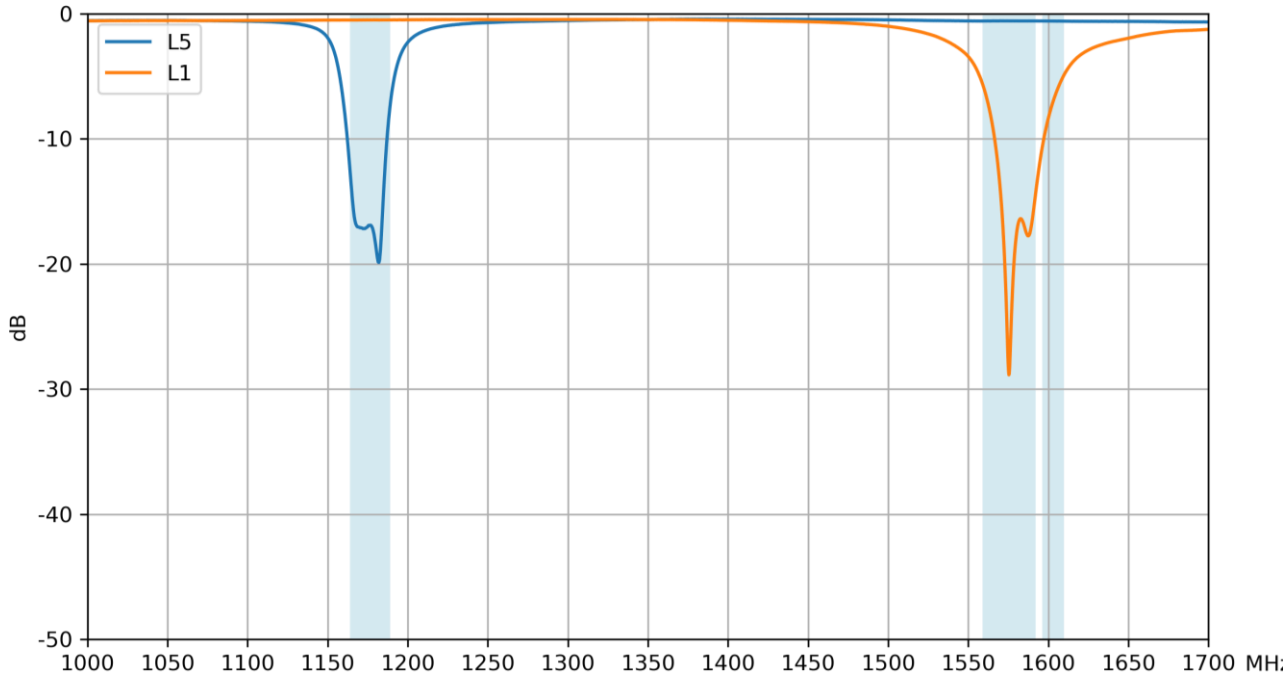
5G/4G Band						
Band Number	5GNR / FR1 / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA					
	Uplink	**Downlink**	**Covered (4G/5G-1&8)**	**Covered (4G/5G-2&7)**	**Covered (4G/5G-3&6)**	**Covered (4G/5G-4&5)**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓	✓	✗	✓
2	UL: 1850 to1910	DL: 1930 to 1990	✓	✓	✗	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓	✓	✗	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓	✓	✗	✓
5	UL: 824 to 849	DL: 869 to 894	✗	✗	✗	✓
7	UL: 2500 to 2570	DL: 2620 to 2690	✓	✓	✓	✓
8	UL: 880 to 915	DL: 925 to 960	✗	✗	✗	✓
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓	✓	✗	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✓	✓	✗	✓
12	UL: 699 to 716	DL: 729 to 746	✗	✗	✗	✓
13	UL: 777 to 787	DL: 746 to 756	✗	✗	✗	✓
14	UL: 788 to 798	DL: 758 to 768	✗	✗	✗	✓
17	UL: 704 to 716	DL: 734 to 746	✗	✗	✗	✓
18	UL: 815 to 830	DL: 860 to 875	✗	✗	✗	✓
19	UL: 830 to 845	DL: 875 to 890	✗	✗	✗	✓
20	UL: 832 to 862	DL: 791 to 821	✗	✗	✗	✓
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✓	✓	✗	✓
22	UL: 3410 to 3490	DL: 3510 to 3590	✓	✓	✗	✓
23	UL: 2000 to 2020	DL: 2180 to 2200	✓	✓	✗	✓
24	UL: 1625.5 to 1660.5	DL: 1525 to 1559	✗	✓	✗	✓
25	UL: 1850 to 1915	DL: 1930 to 1995	✓	✓	✗	✓
26	UL: 814 to 849	DL: 859 to 894	✗	✗	✗	✓
27	UL: 807 to 824	DL: 852 to 869	✗	✗	✗	✓
28	UL: 703 to 748	DL: 758 to 803	✗	✗	✗	✓
29	UL: -	DL: 717 to 728	✗	✗	✗	✓
30	UL: 2305 to 2315	DL: 2350 to 2360	✓	✓	✗	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5	✗	✗	✗	✓
32	UL: -	DL: 1452 to 1496	✗	✓	✗	✓
35	1850 to 1910		✓	✓	✗	✓
38	2570 to 2620		✓	✓	✗	✓
39	1880 to 1920		✓	✓	✗	✓
40	2300 to 2400		✓	✓	✗	✓
41	2496 to 2690		✓	✓	✗	✓
42	3400 to 3600		✓	✗	✓	✓
43	3600 to 3800		✓	✗	✓	✓
48	3550 to 3700		✓	✗	✓	✓
66	UL: 1710 to 1780	DL: 2110 to 2200	✓	✓	✗	✓
71	617 to 698		✗	✗	✗	✓
74/75/76	1427 to 1518		✗	✓	✗	✓
77/78/79	3300 to 3800		✓	✓	✓	✓
WiFi 2450	2400 to 2500		✓	✓	✗	✓
WiFi 5800	5150 to 5925		✓	✓	✓	✓

3. Antenna Characteristics

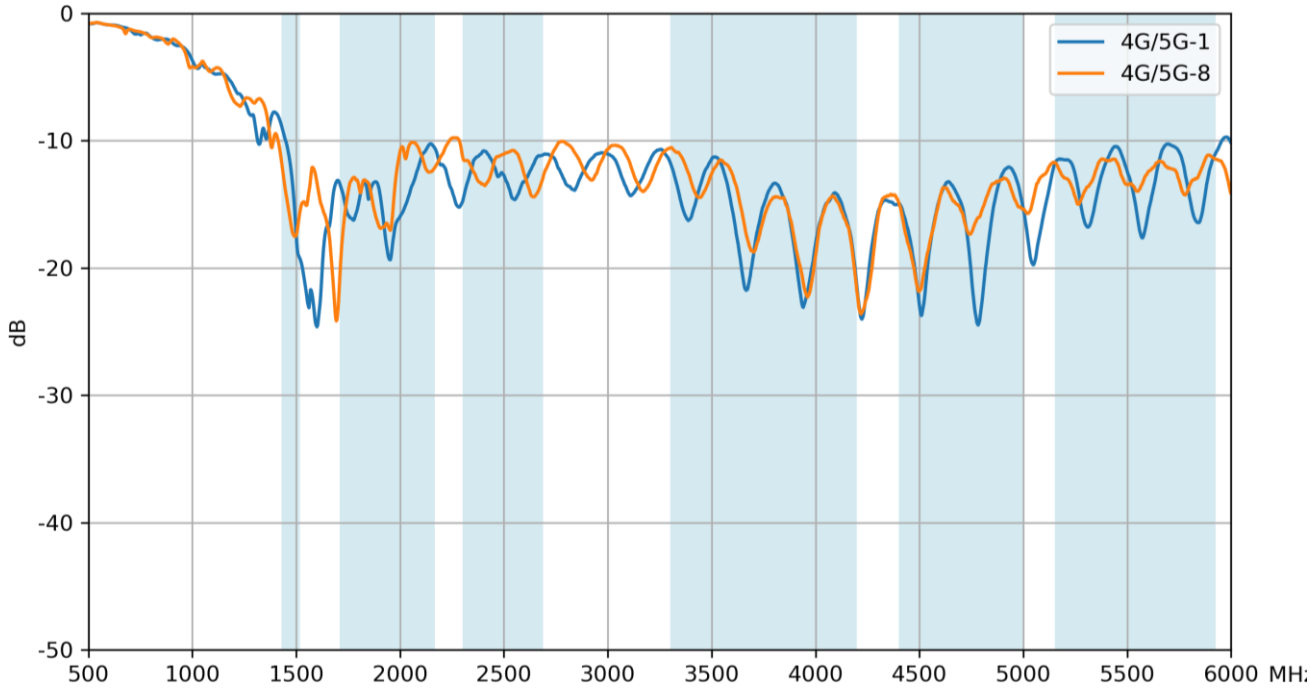
3.1 Test Setup



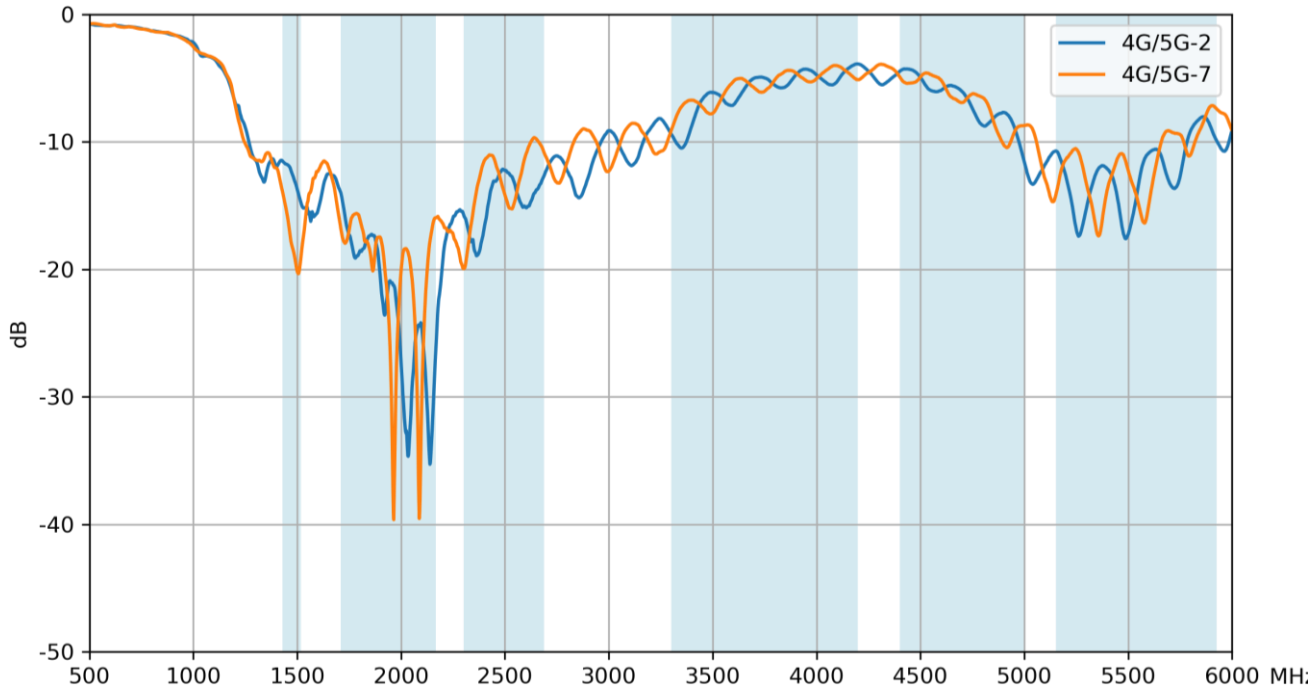
3.2 Return Loss - GPS



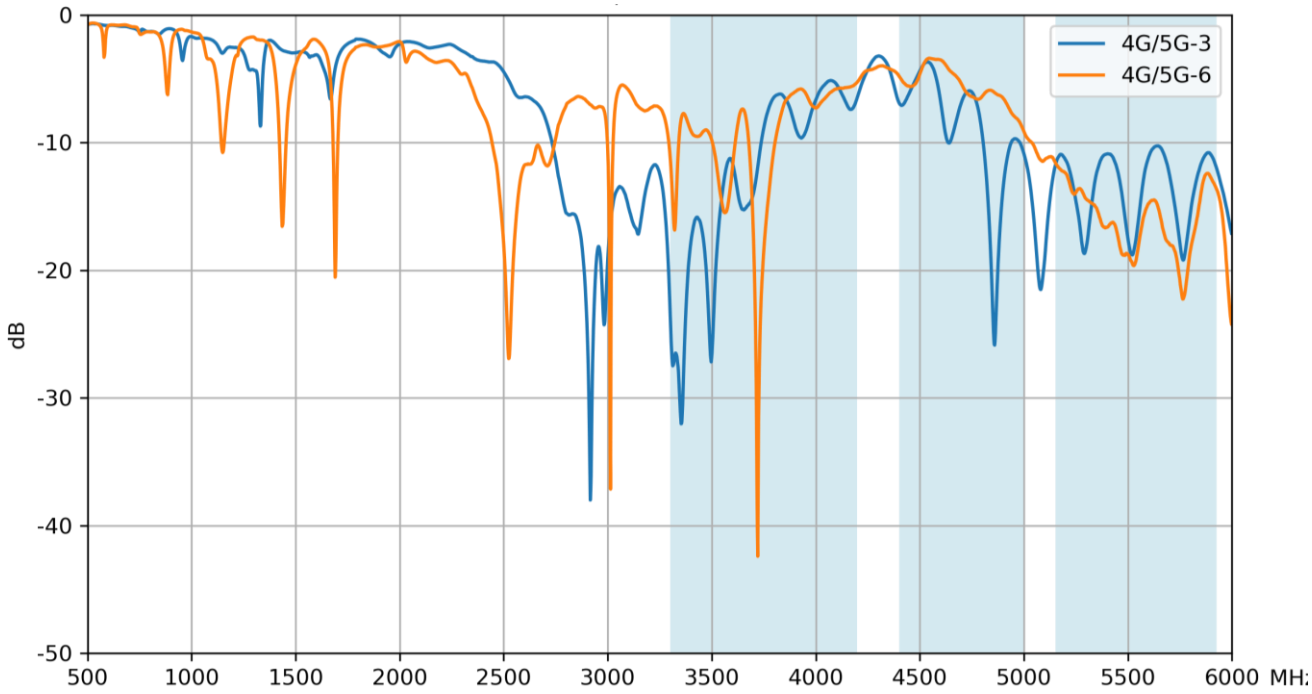
3.3 Return Loss – 4G/5G – 1 & 8



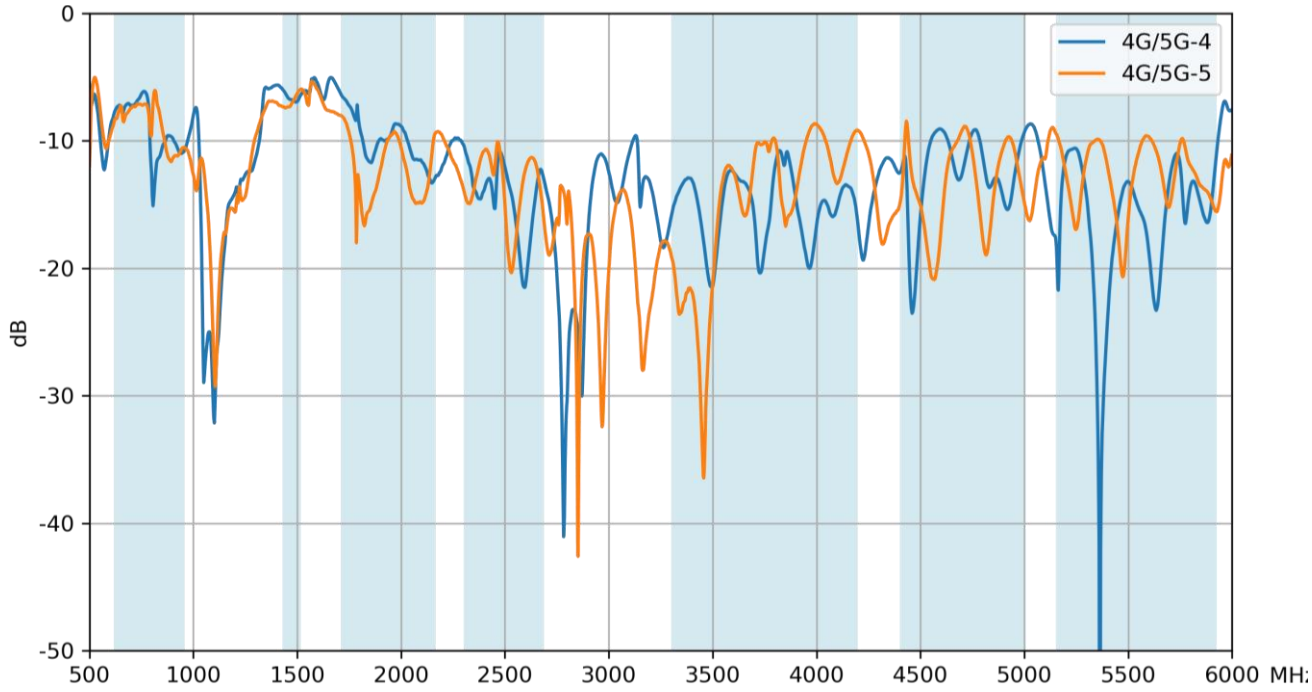
3.4 Return Loss – 4G/5G – 2 & 7



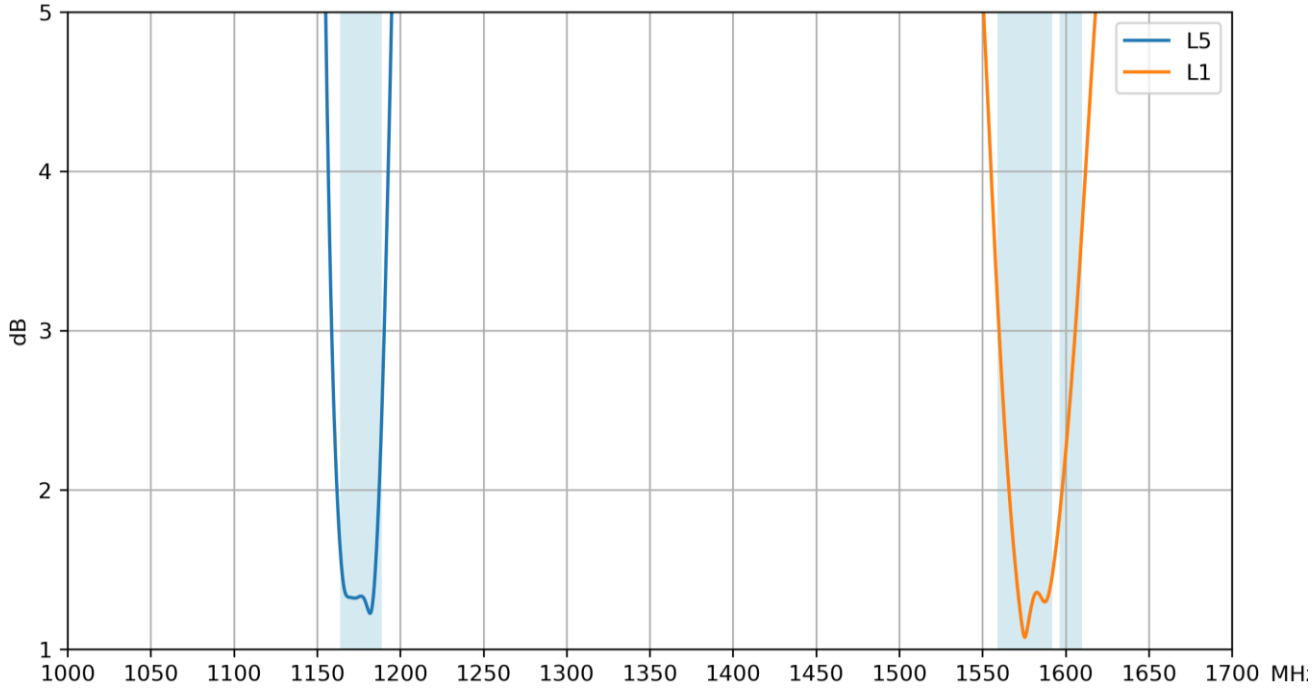
3.5 Return Loss – 4G/5G – 3 & 6



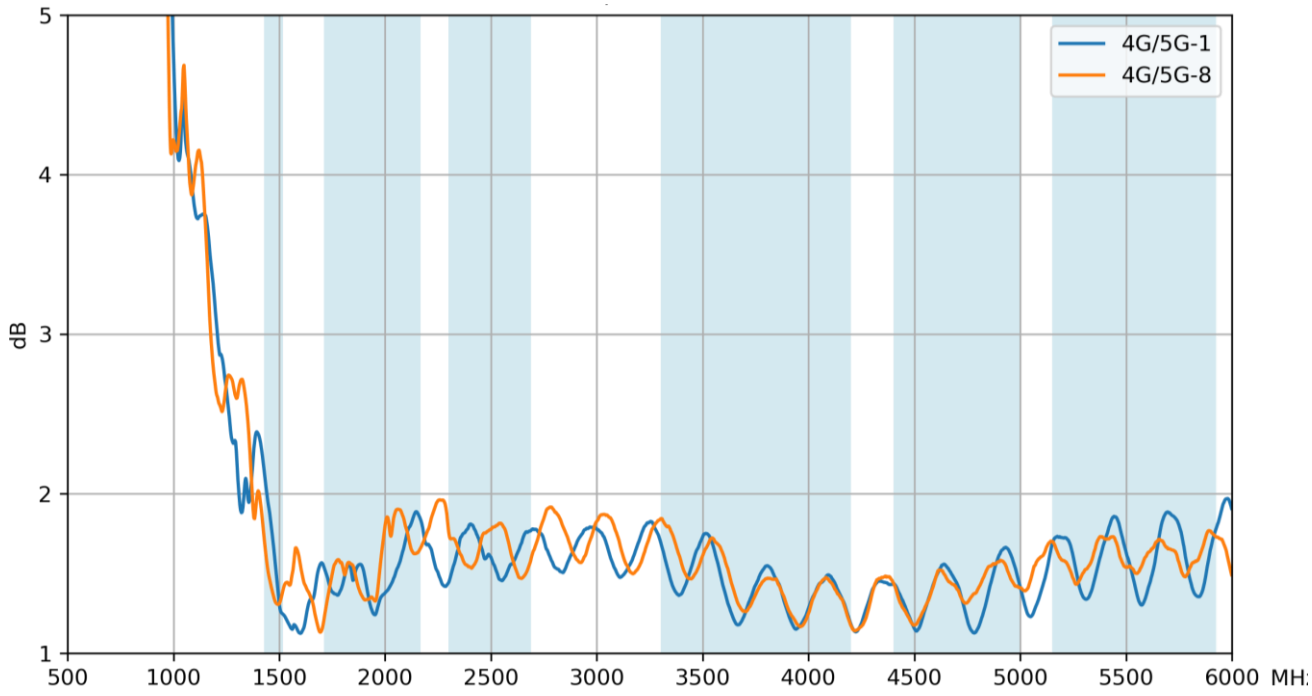
3.6 Return Loss – 4G/5G – 4 & 5



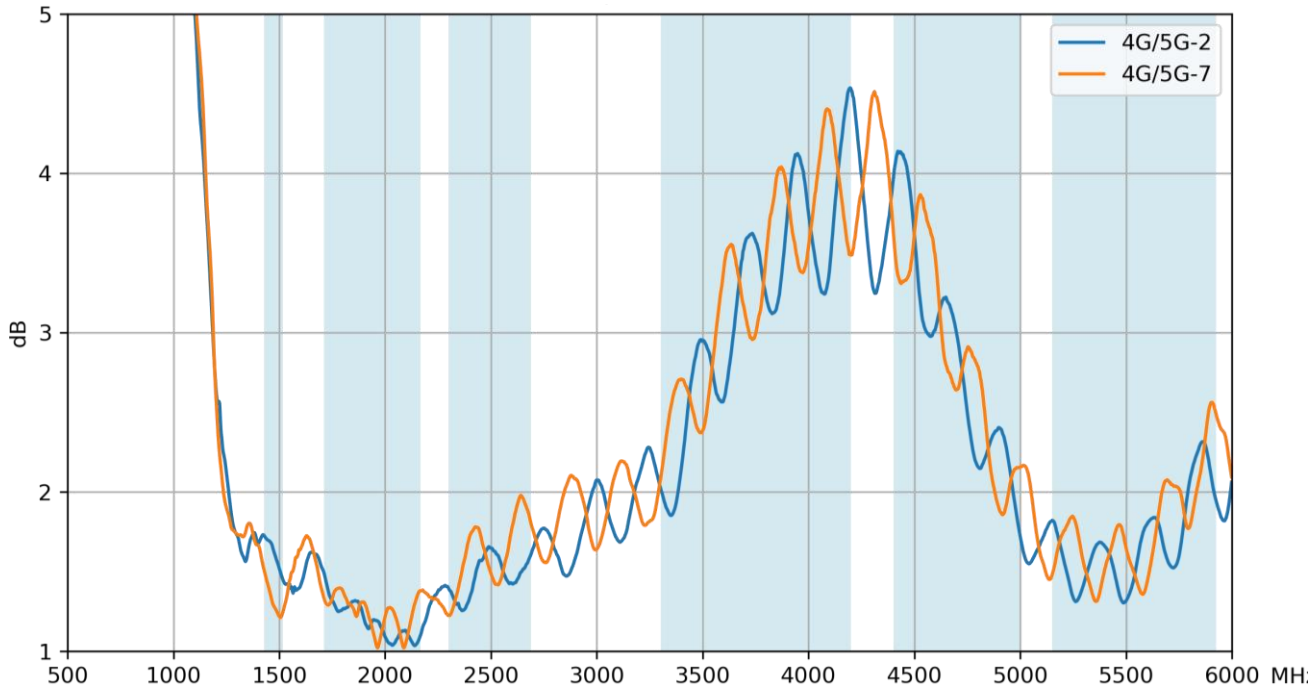
3.7 VSWR - GPS



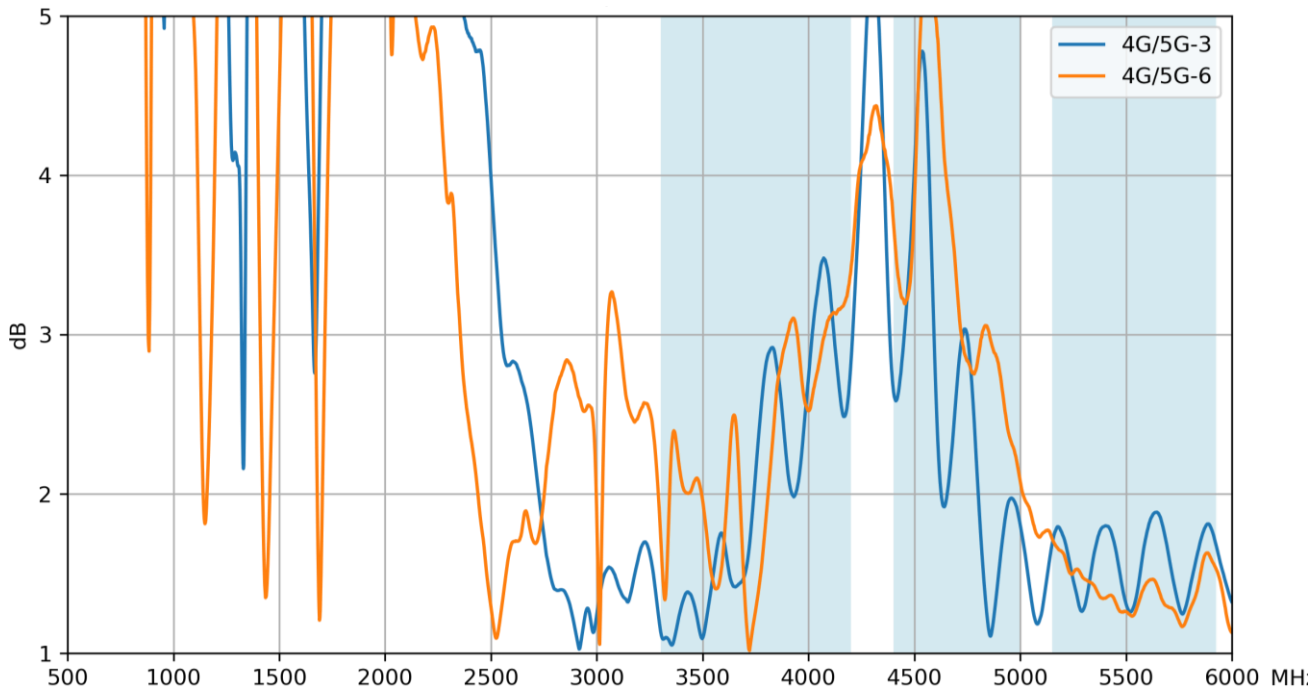
3.8 VSWR – 4G/5G – 1 & 8



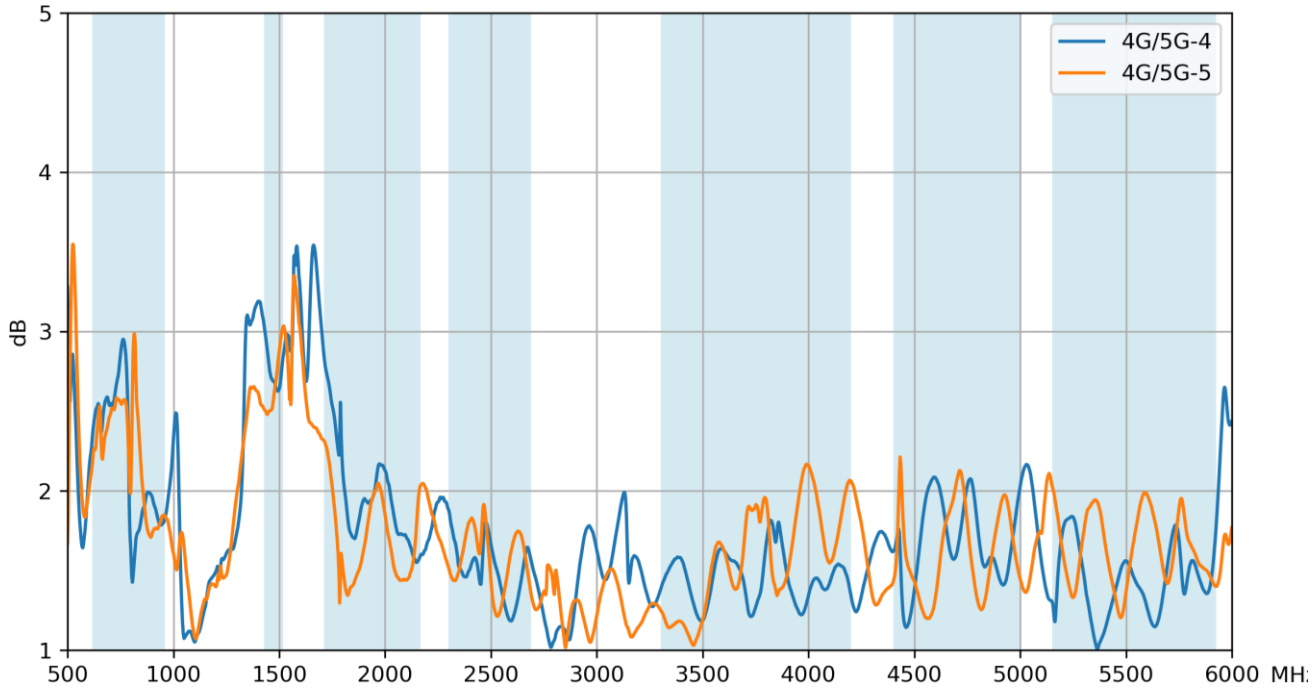
3.9 VSWR - 4G/5G – 2 & 7



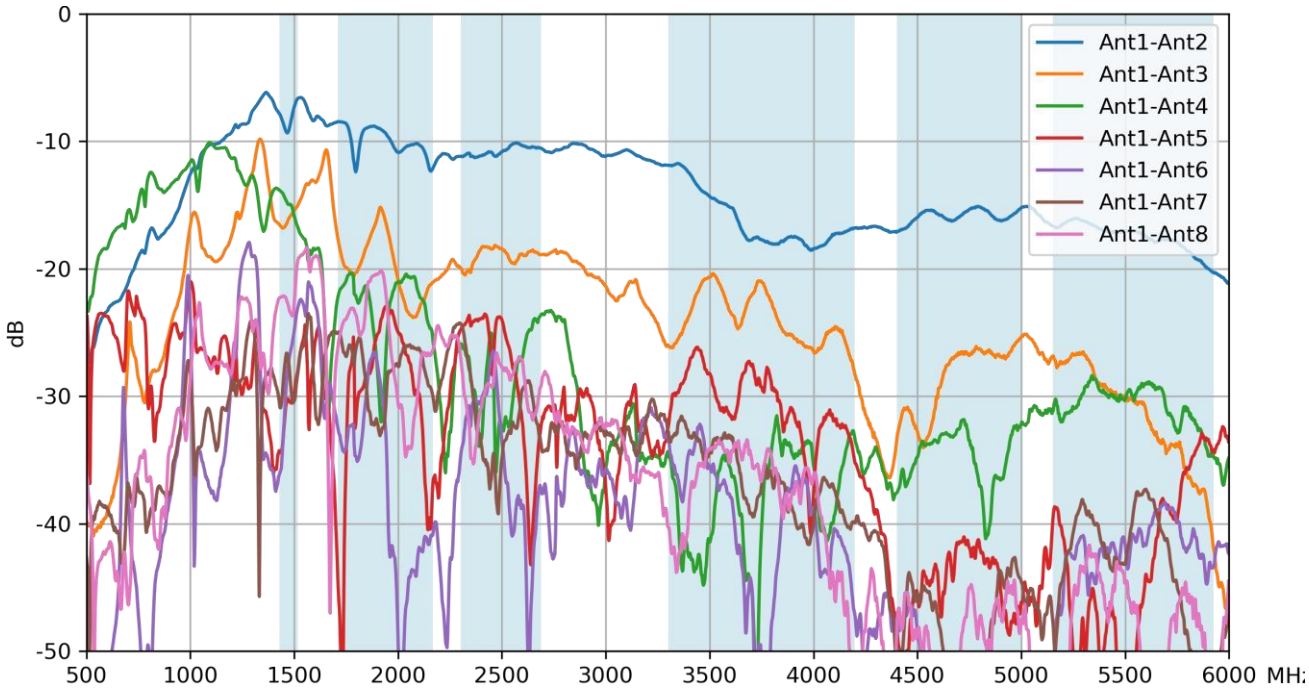
3.10 VSWR – 4G/5G – 3 & 6



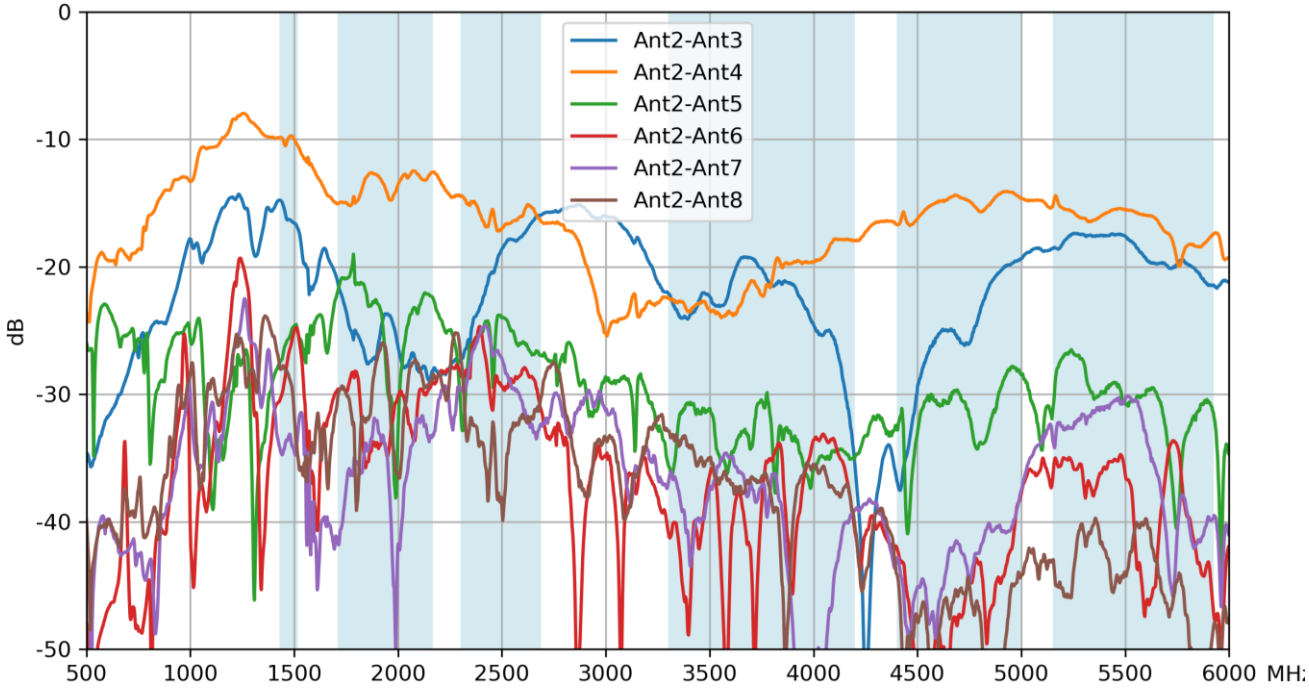
3.11 VSWR – 4G/5G – 4 & 5



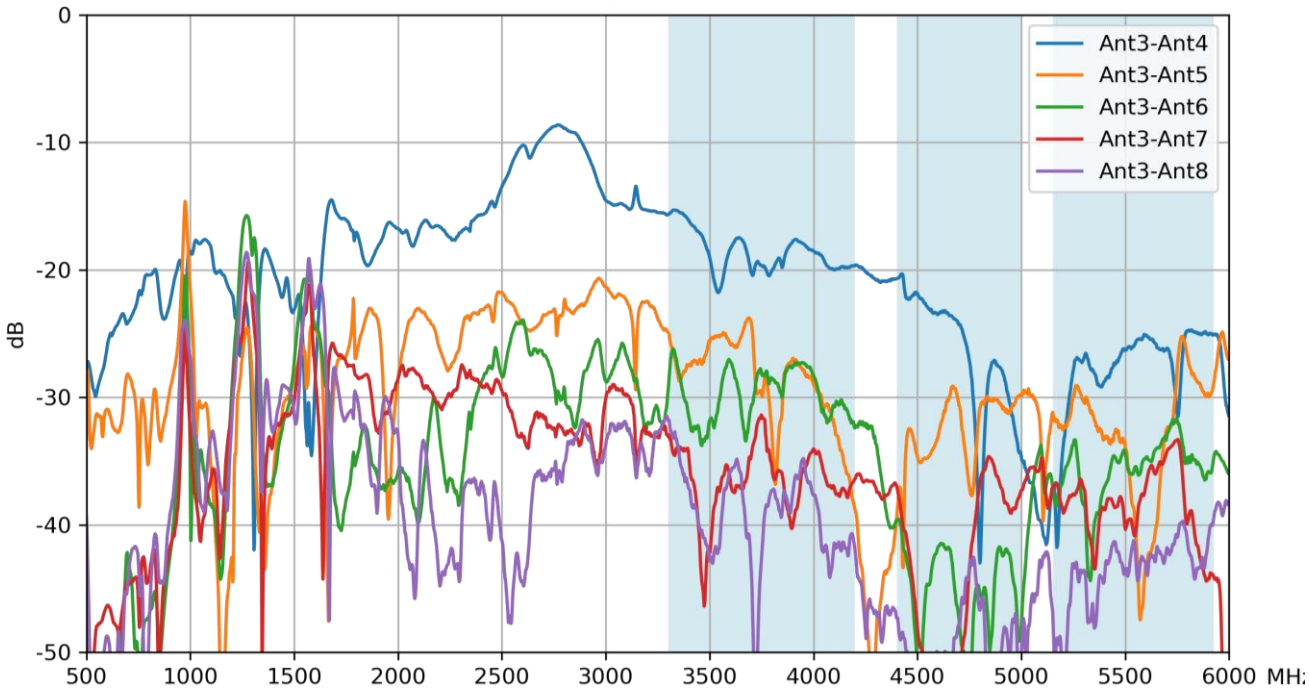
3.12 Isolation Ant1



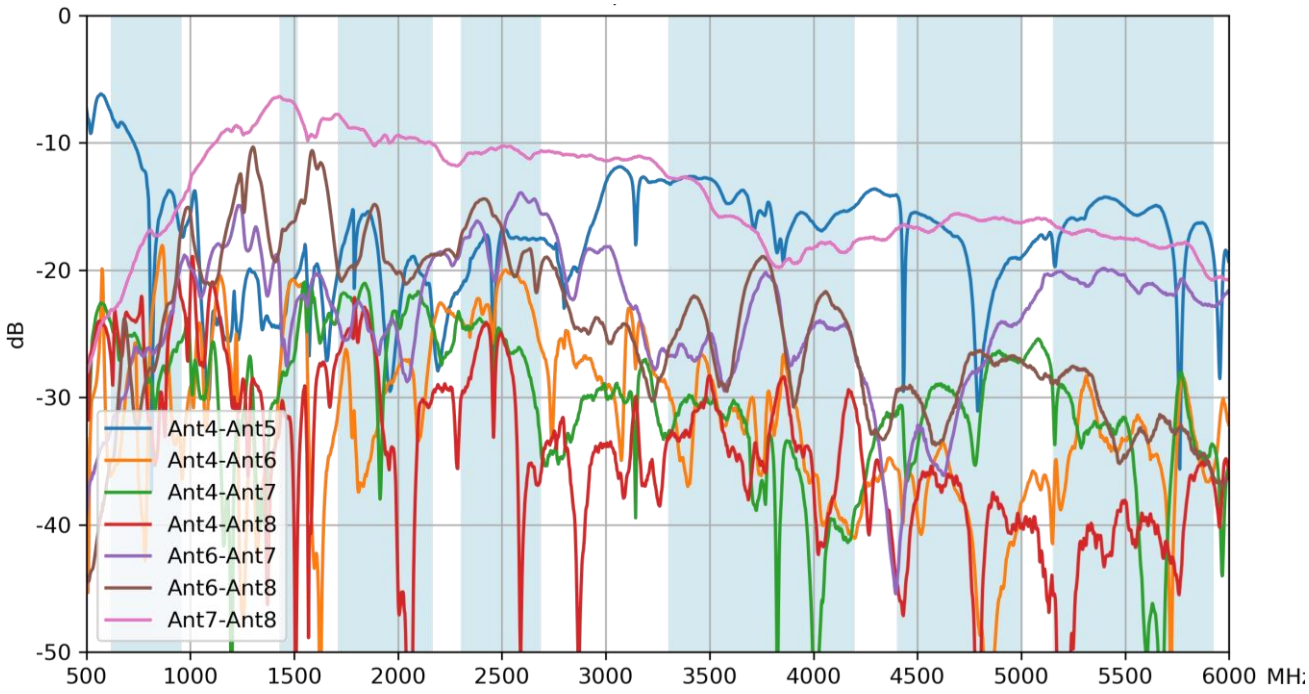
3.13 Isolation – Ant2



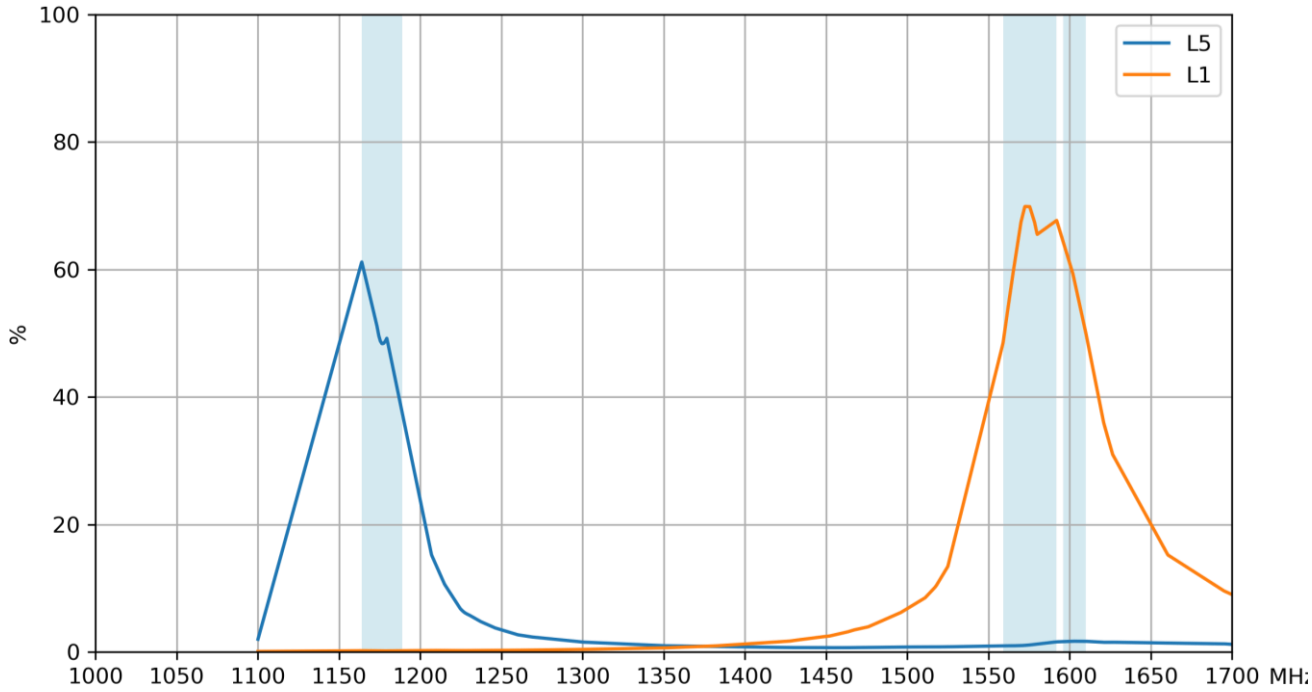
3.14 Isolation – Ant3



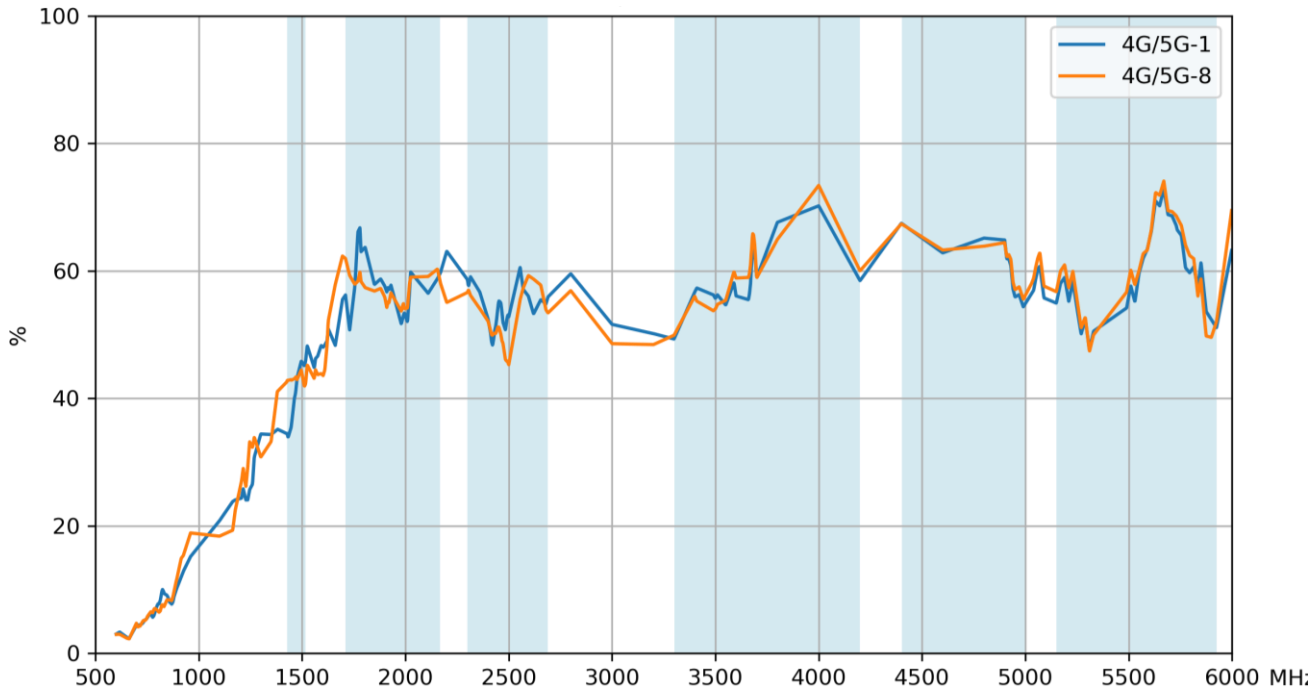
3.15 Isolation – Ant4



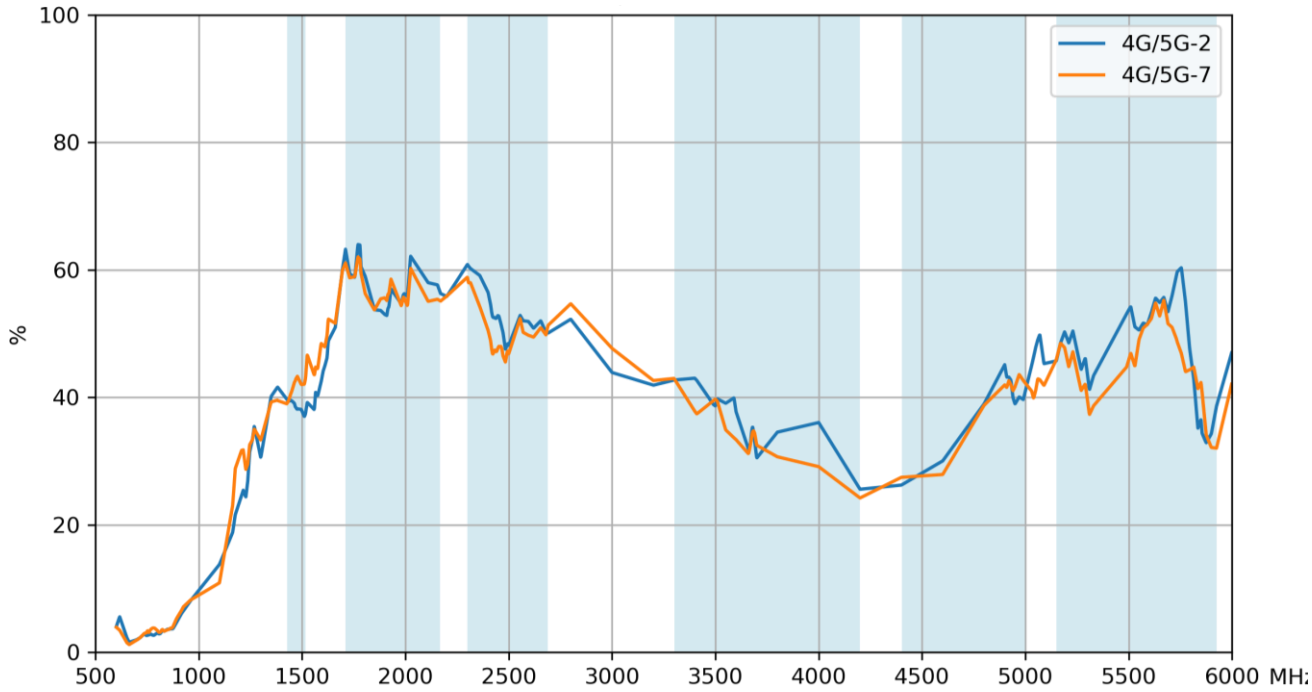
3.16 Efficiency - GPS



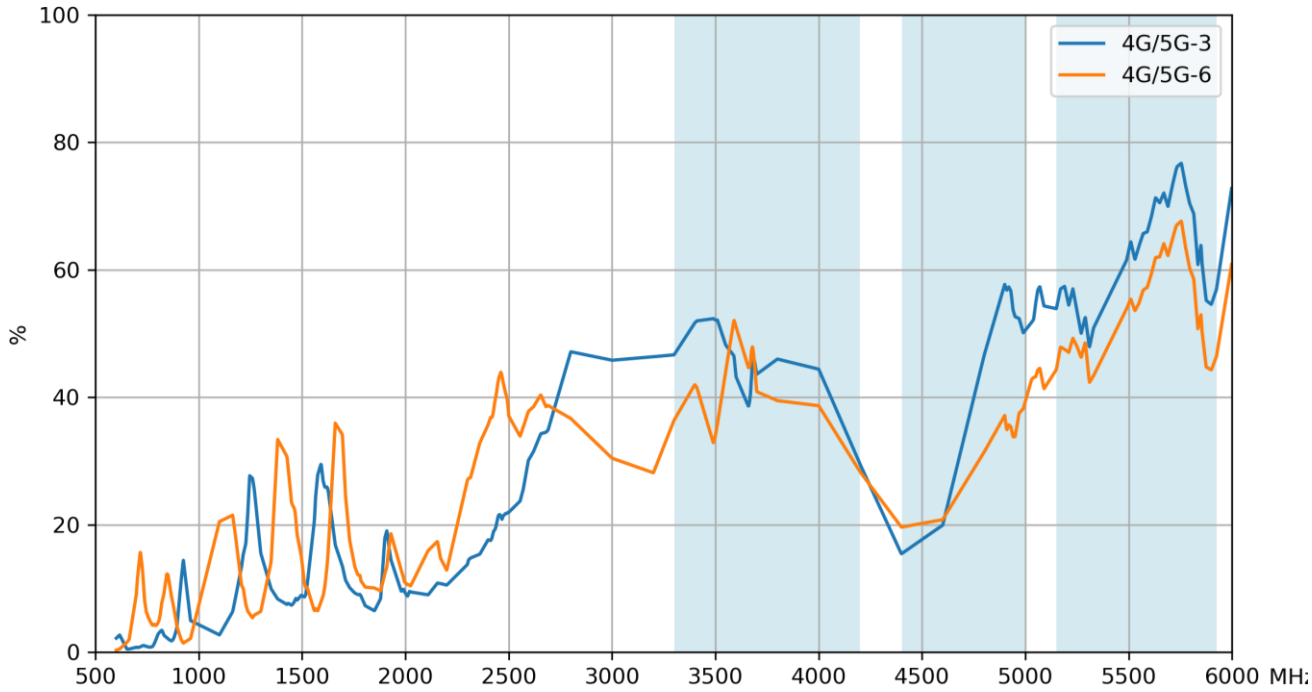
3.17 Efficiency – 4G/5G – 1 & 8



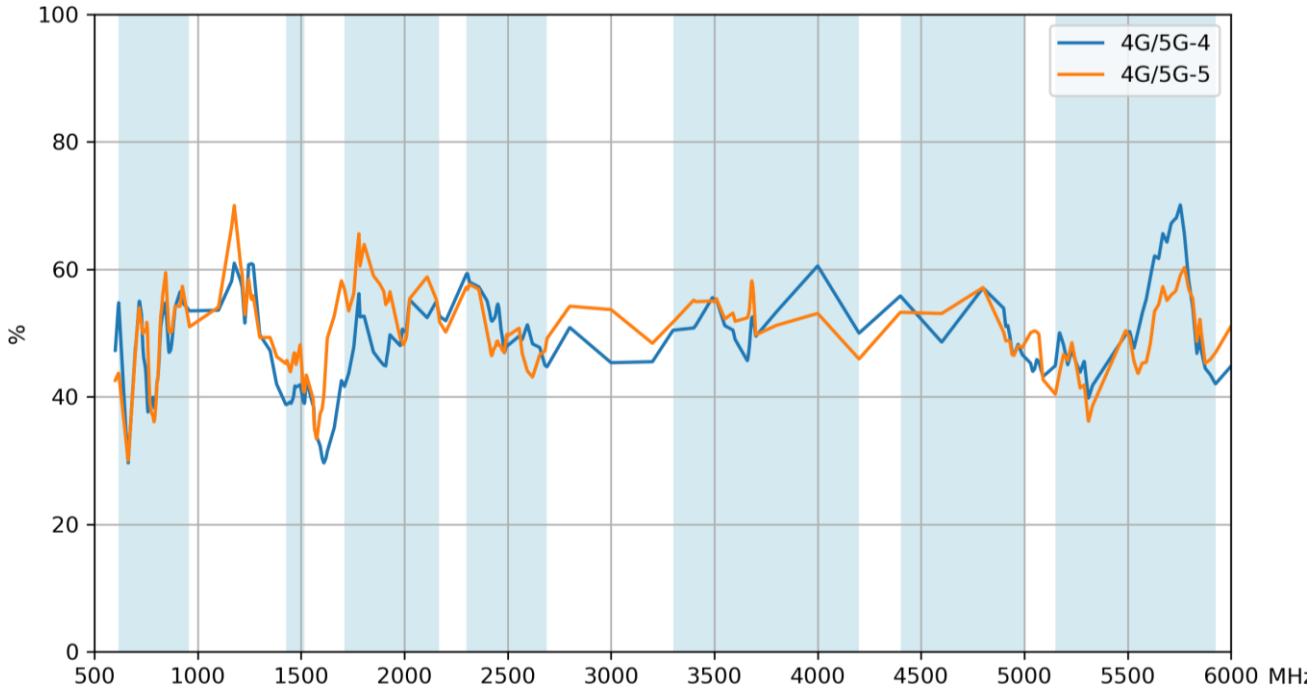
3.18 Efficiency - 4G/5G – 2 & 7



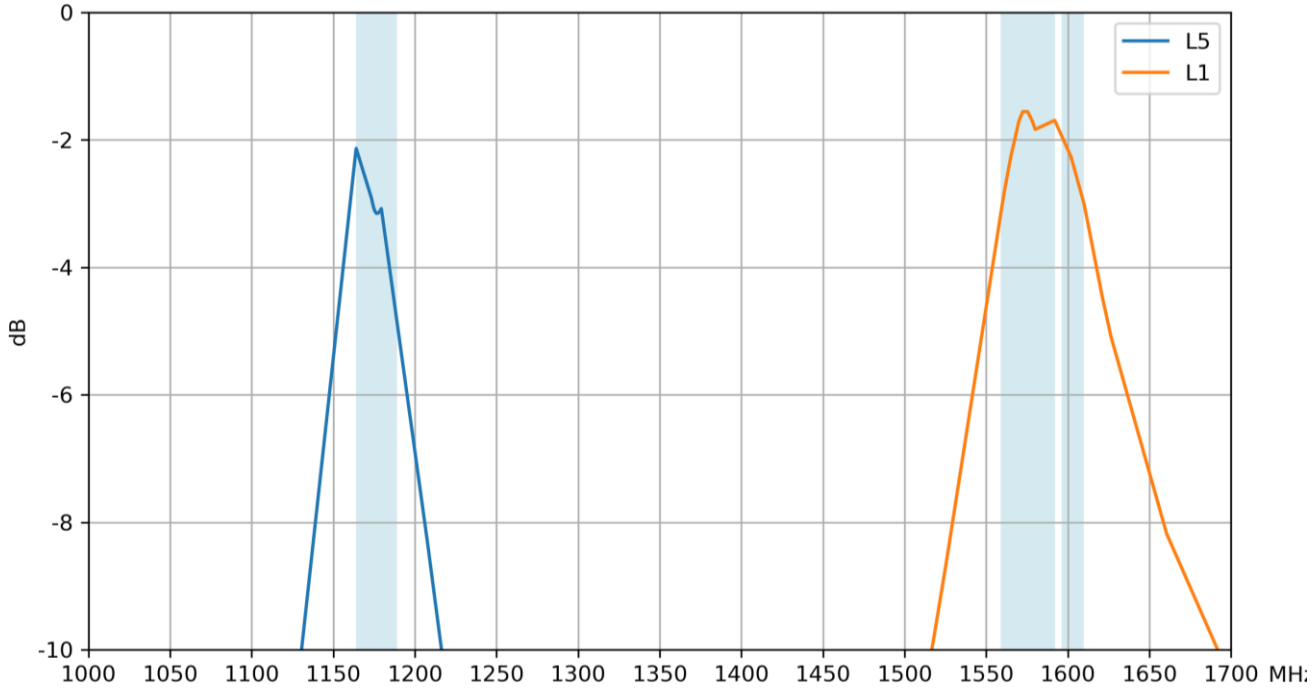
3.19 Efficiency – 4G/5G – 3 & 6



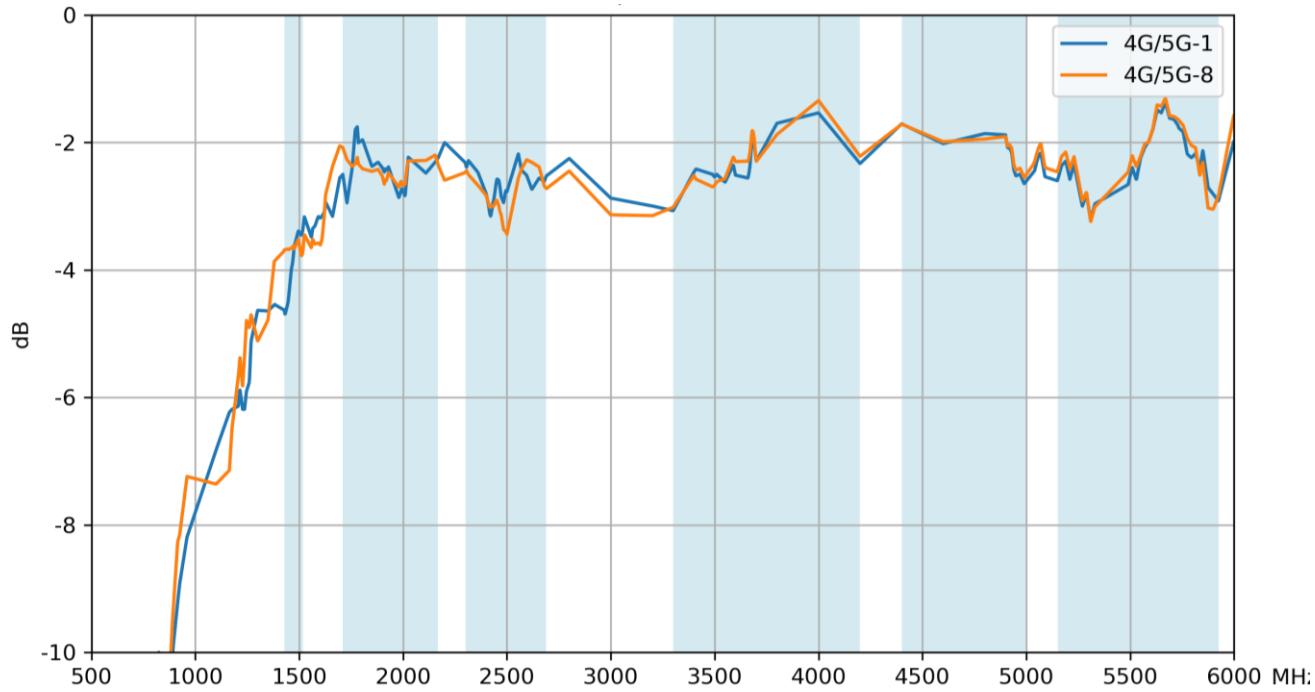
3.20 Efficiency - 4G/5G – 4 & 5



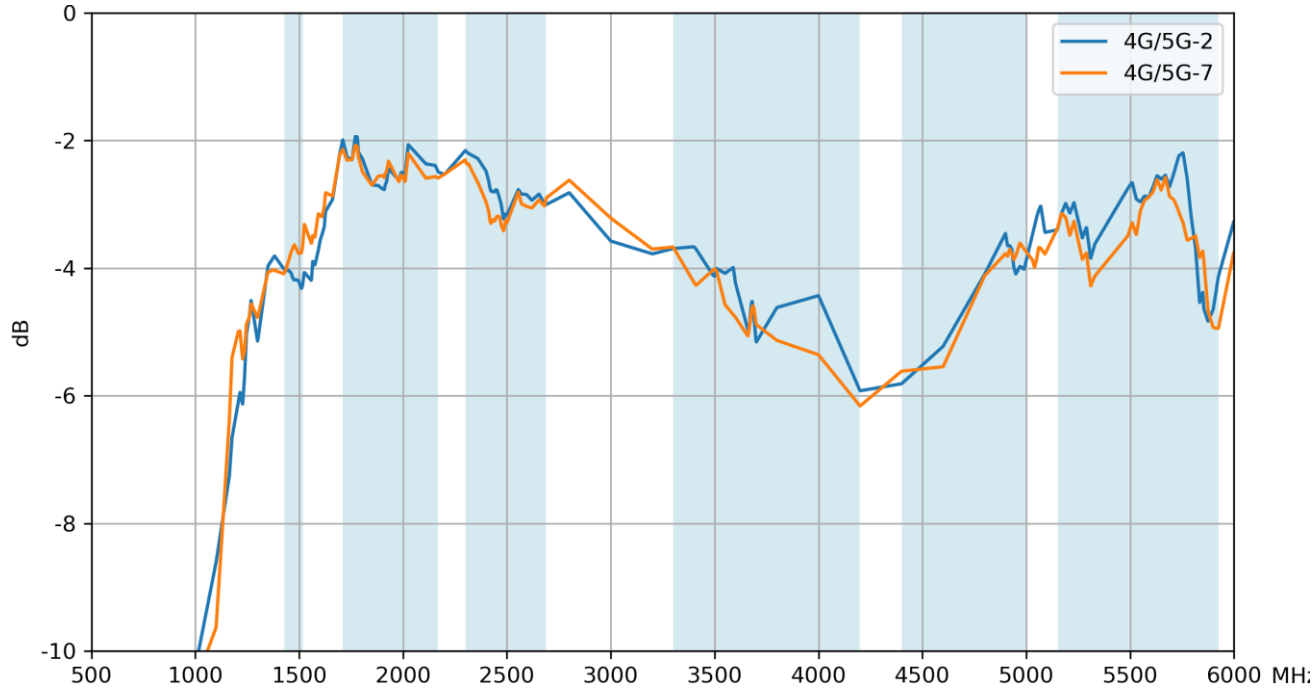
3.21 Average Gain – GPS



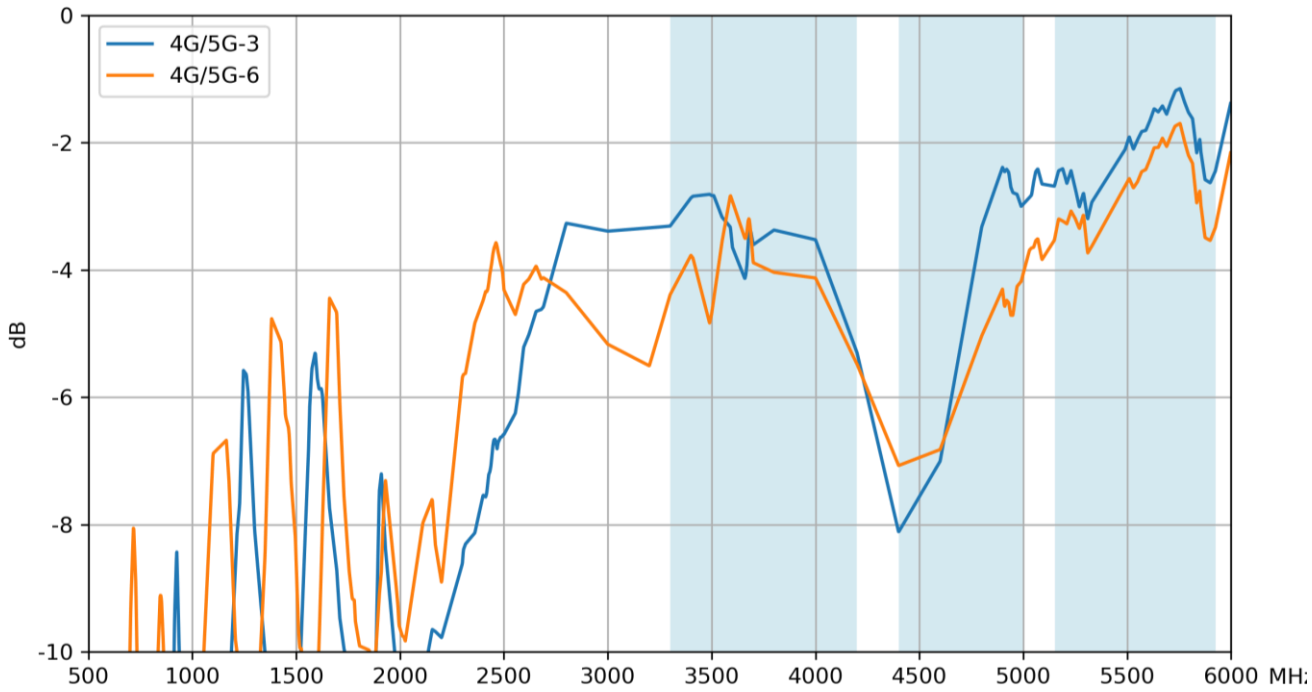
3.22 Average Gain - 4G/5G – 1 & 8



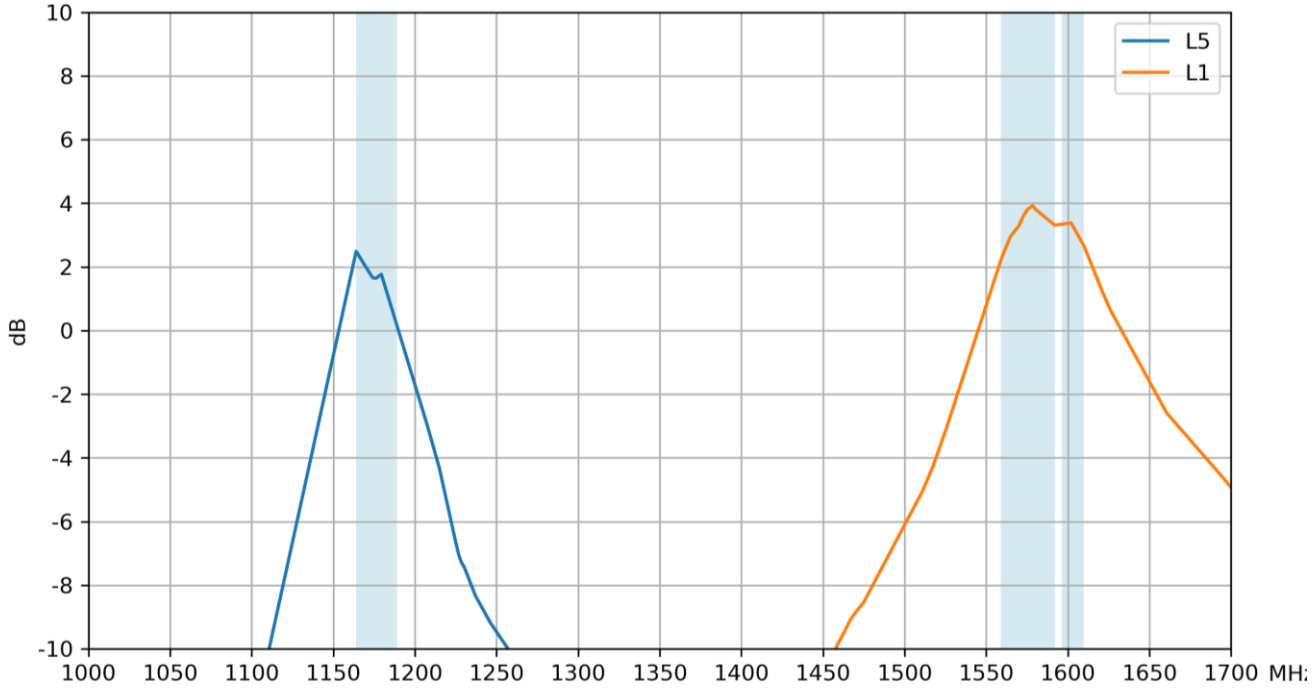
3.23 Average Gain – 4G/5G – 2 & 7



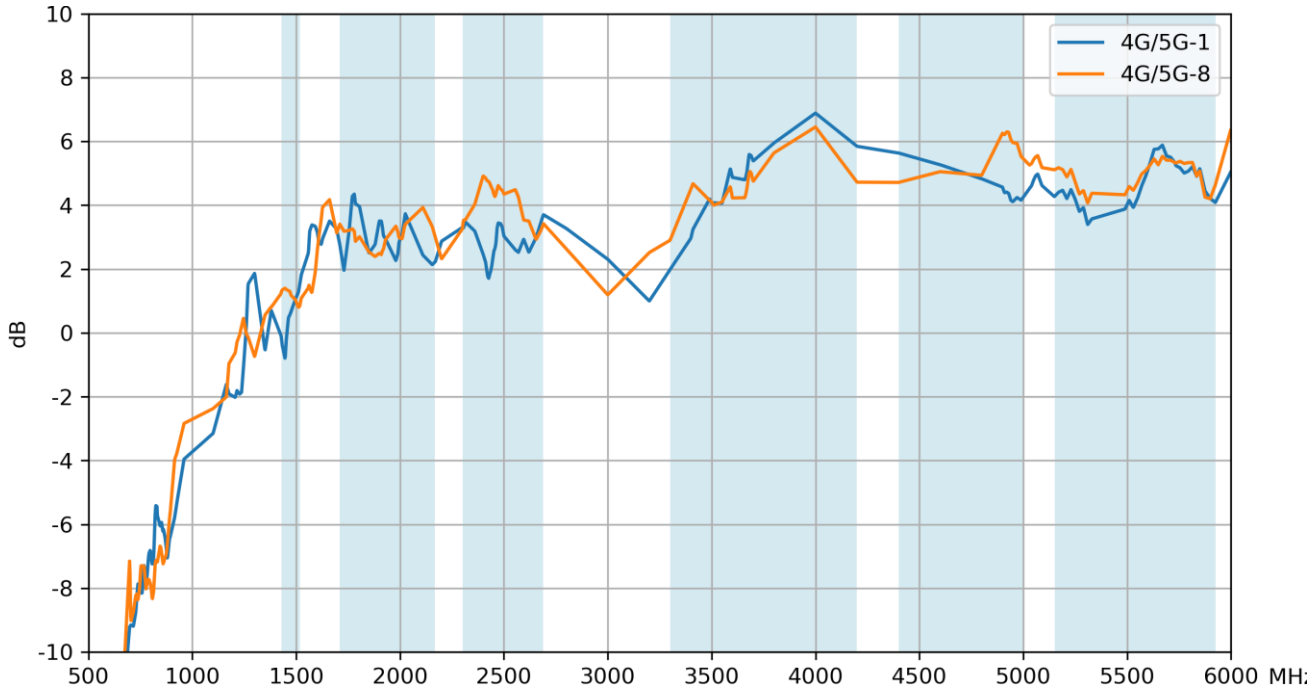
3.24 Average Gain - 4G/5G – 3 & 6



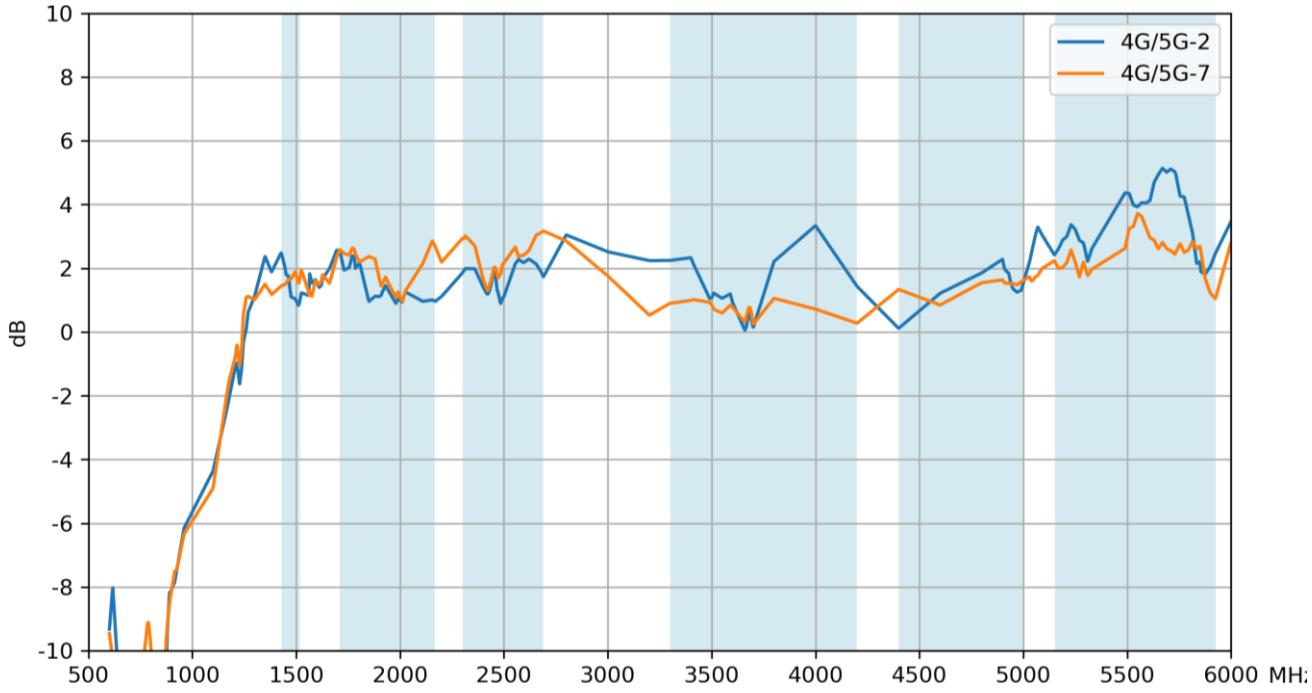
3.25 Peak Gain – GPS



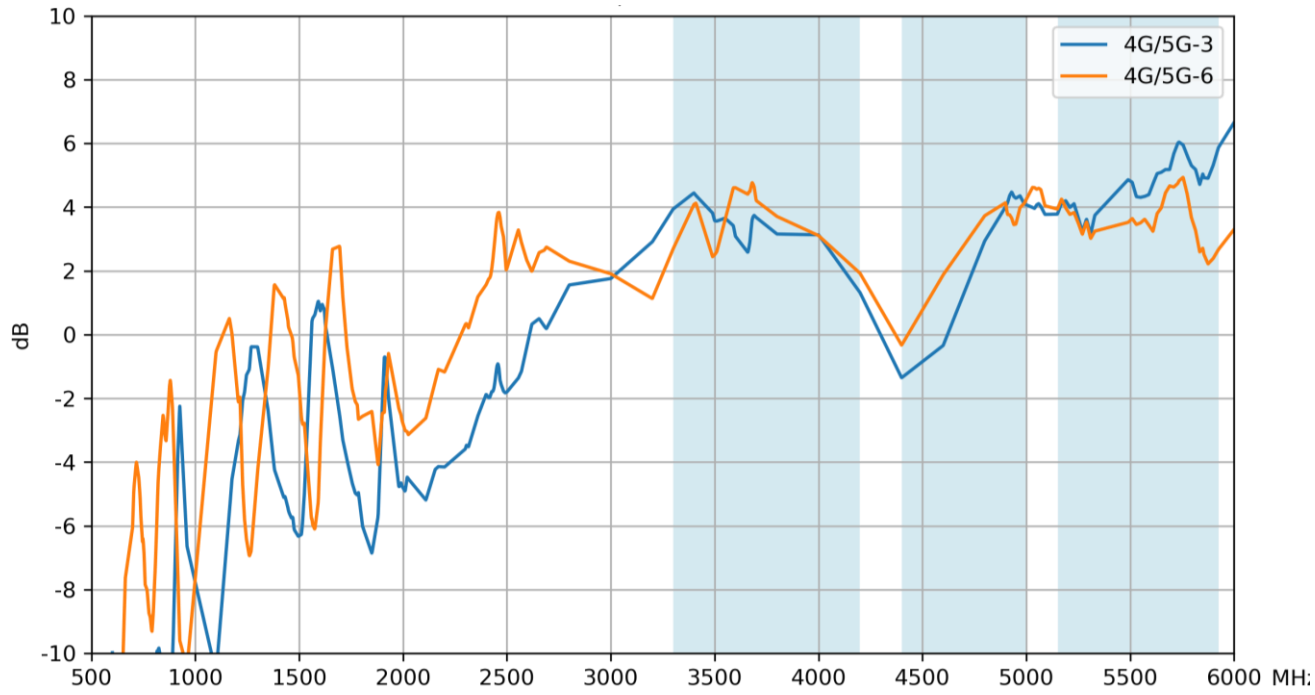
3.26 Peak Gain - 4G/5G – 1 & 8



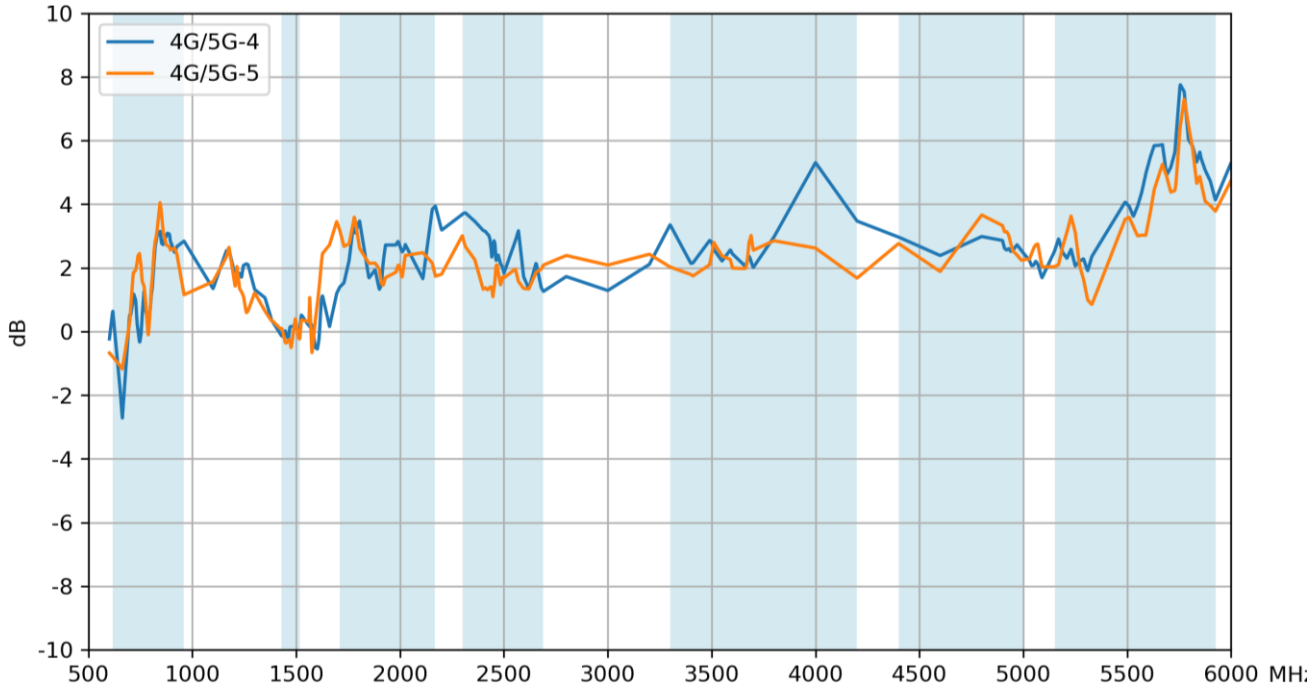
3.27 Peak Gain – 4G/5G – 2 & 7



3.28 Peak Gain - 4G/5G – 3 & 6

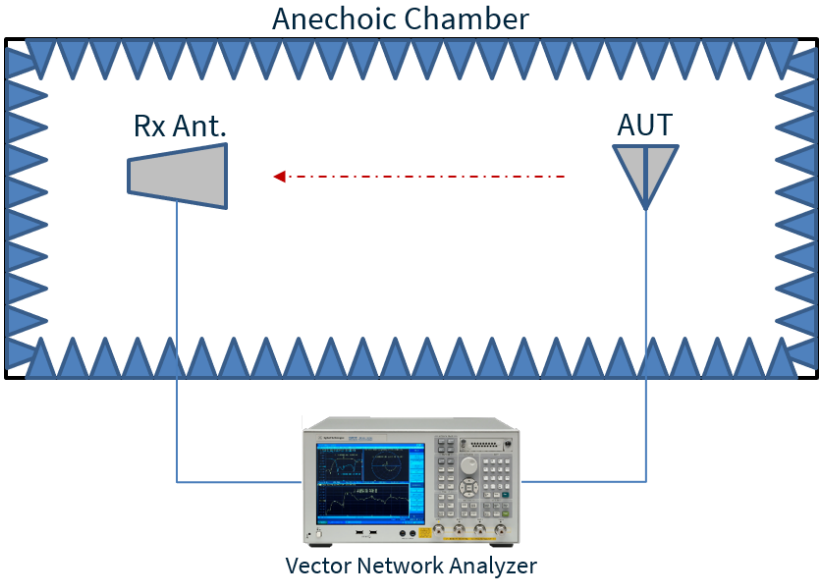


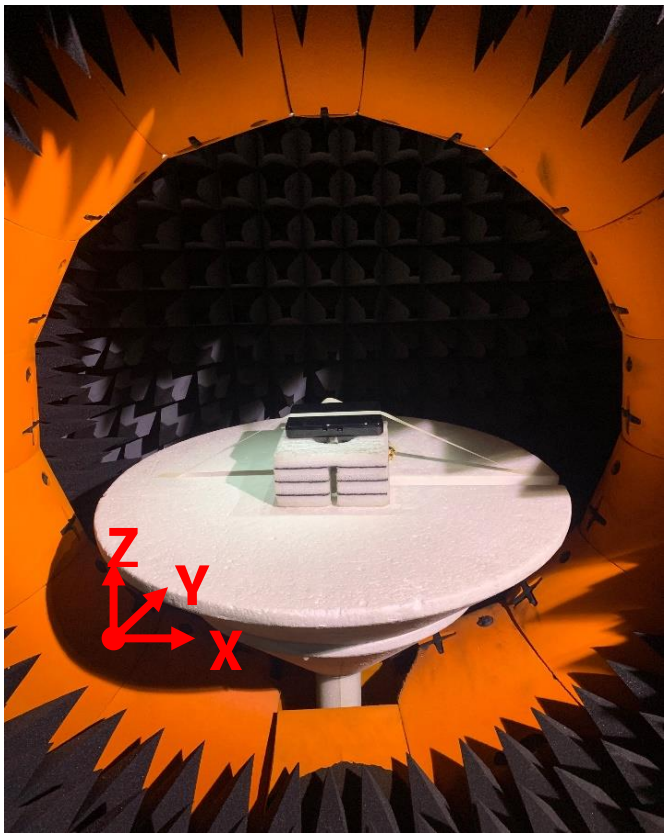
3.29 Peak Gain – 4G/5G – 4 & 5



4. Radiation Patterns

4.1 Test Setup

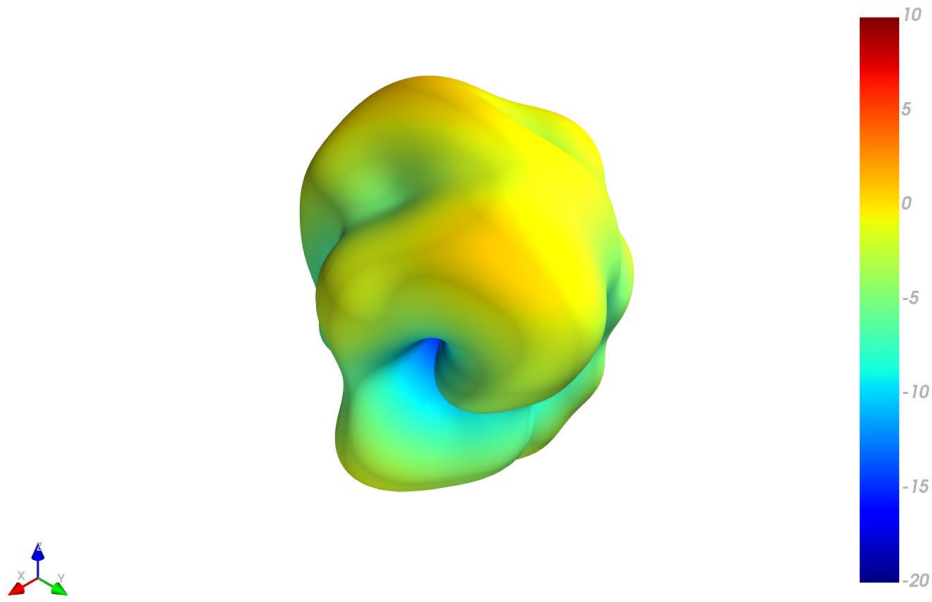


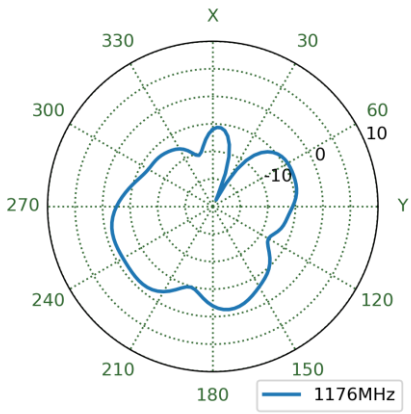
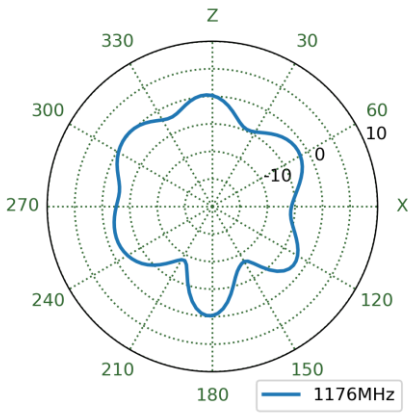
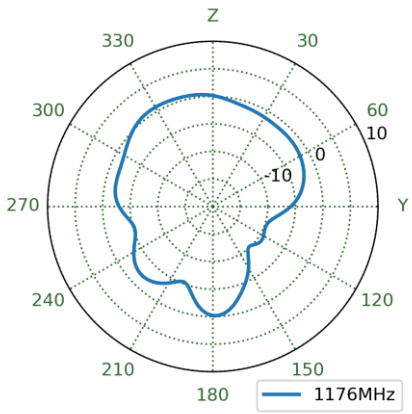


Free space

4.2 GPS - L5 3D and 2D Radiation Patterns

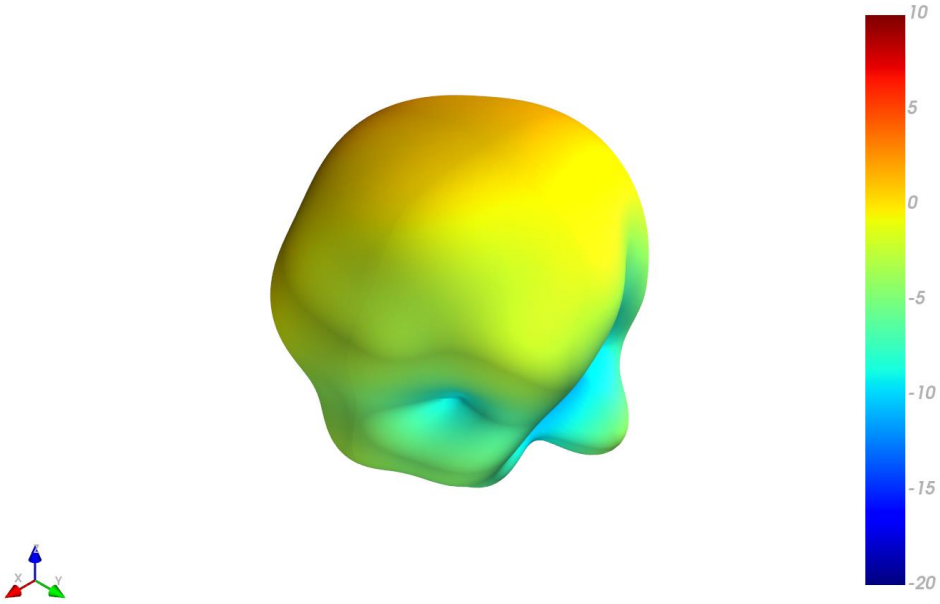
1176MHz

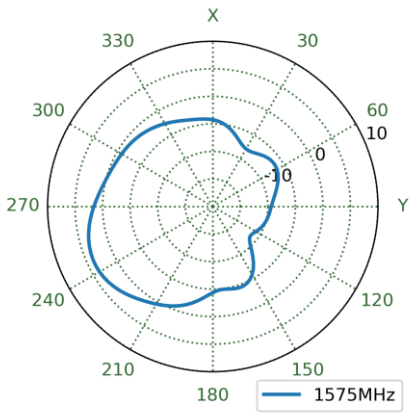
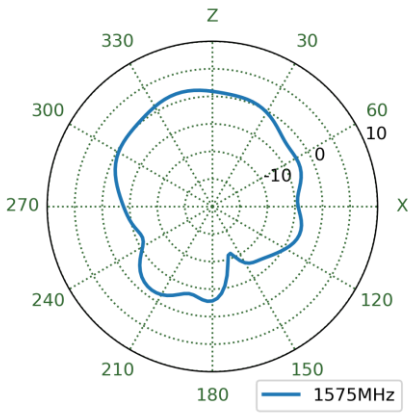
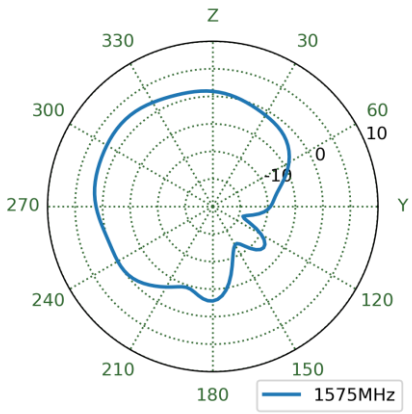


XY Plane	XZ Plane	YZ Plane
		

4.3 GPS - L1 3D and 2D Radiation Patterns

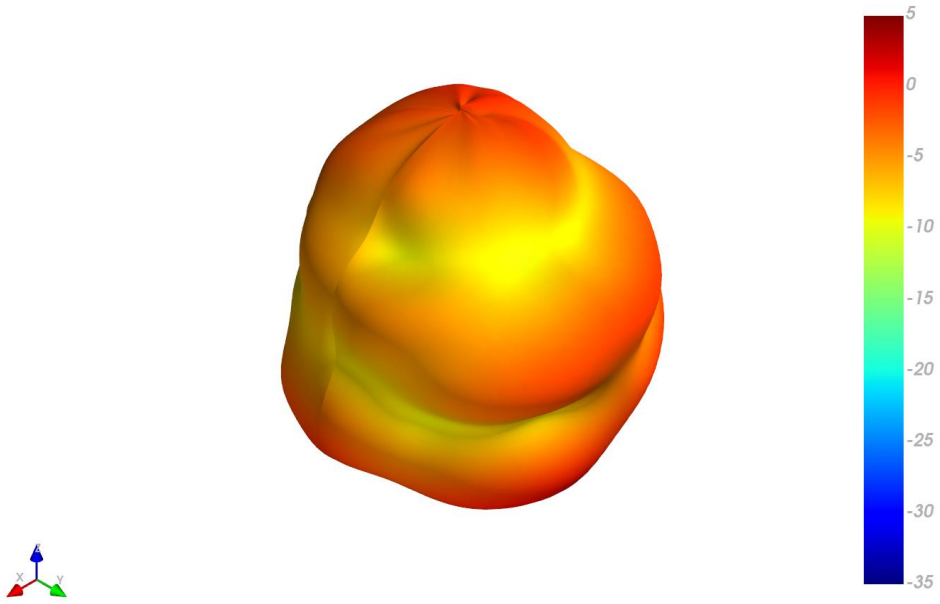
1575MHz

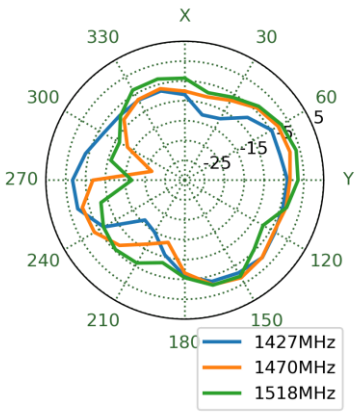
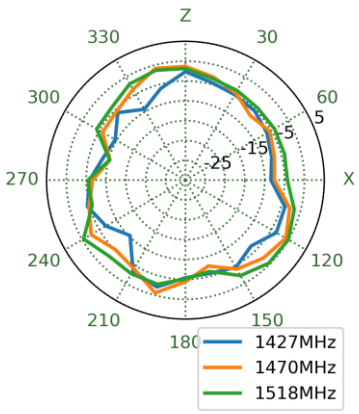
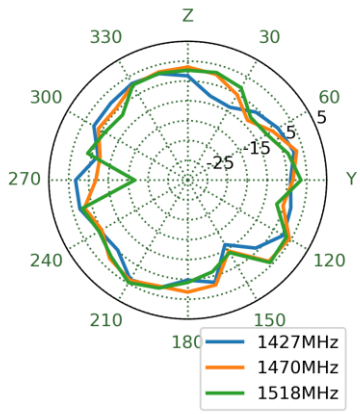


XY Plane	XZ Plane	YZ Plane
		

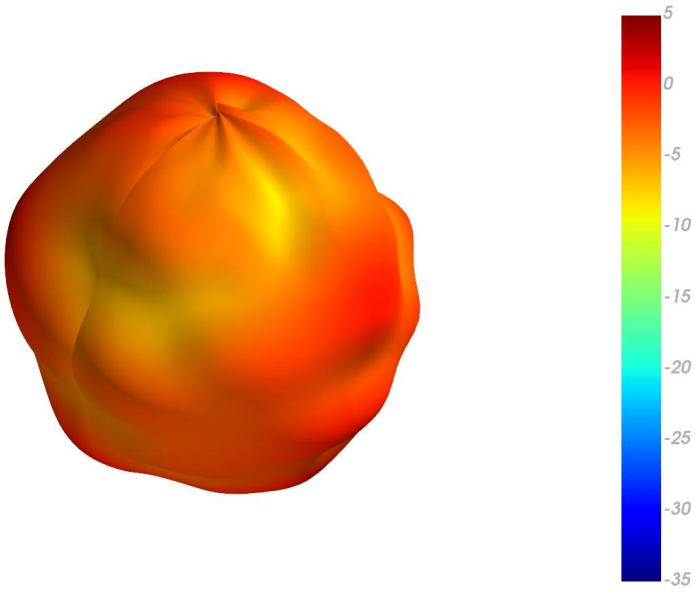
4.4 4G/5G – Ant1 3D and 2D Radiation Patterns

1470MHz

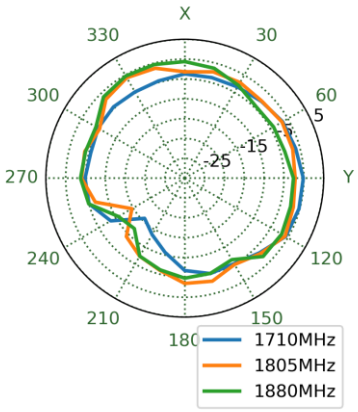


XY Plane	XZ Plane	YZ Plane
		

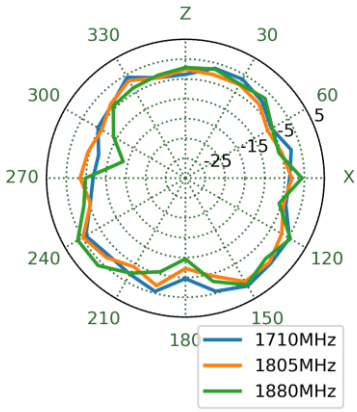
1805MHz



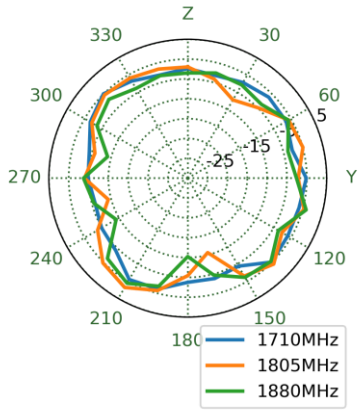
XY Plane



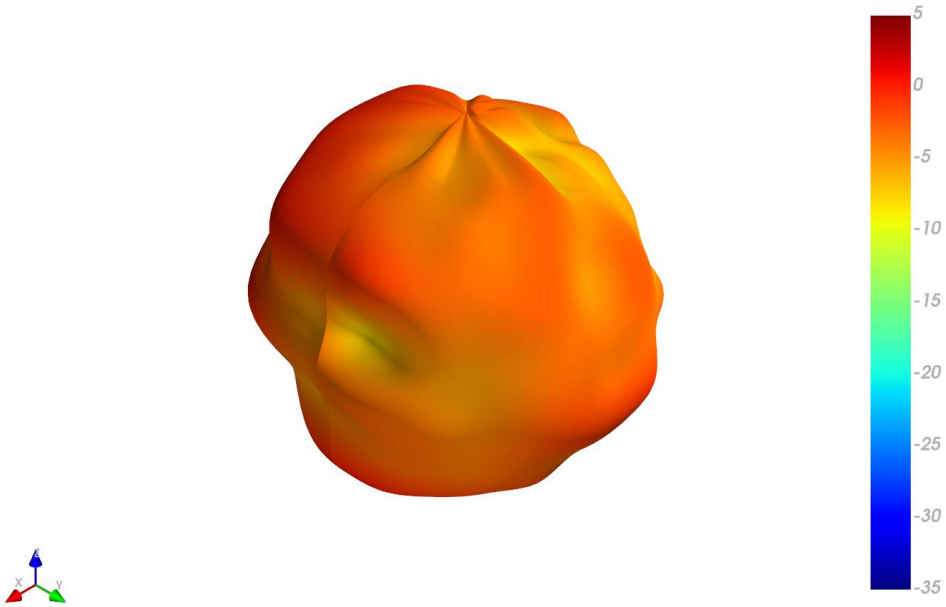
XZ Plane



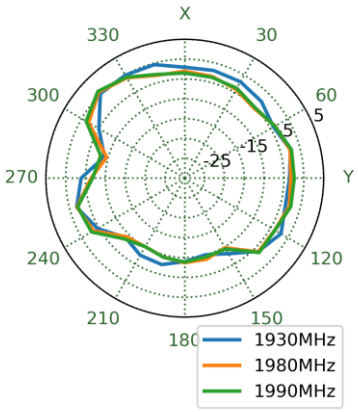
YZ Plane

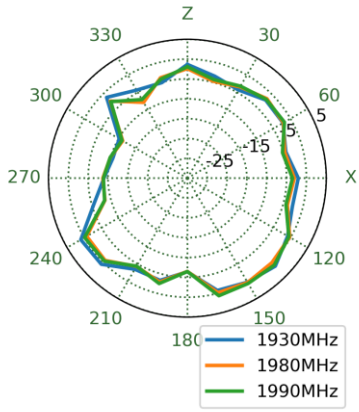


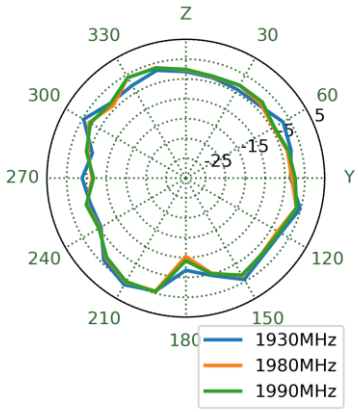
1980MHz



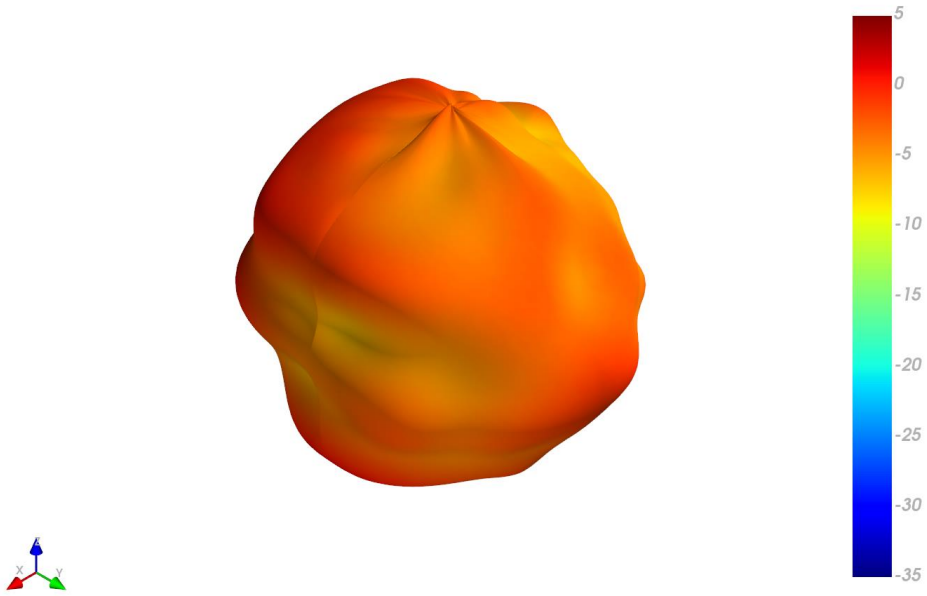
XY Plane	XZ Plane	YZ Plane



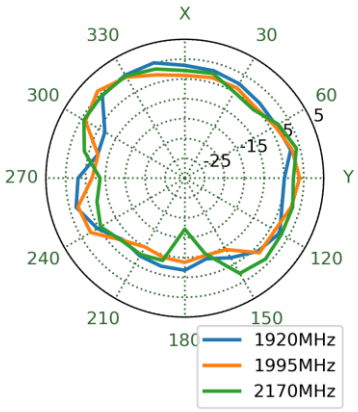




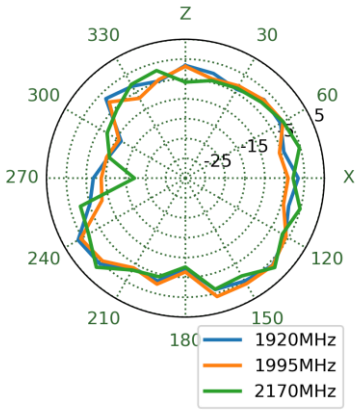
1995MHz



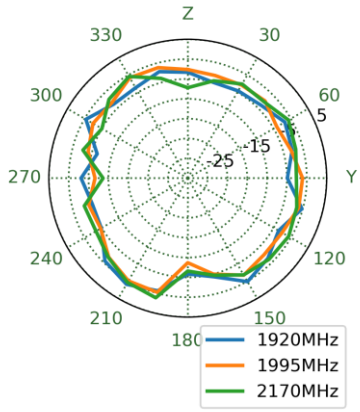
XY Plane



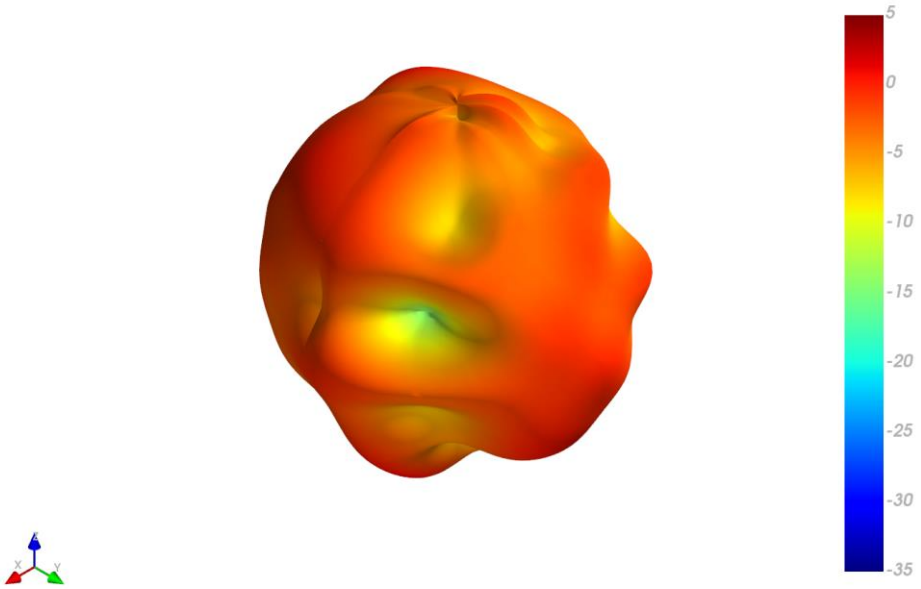
XZ Plane



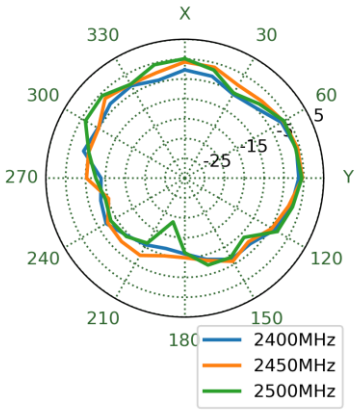
YZ Plane

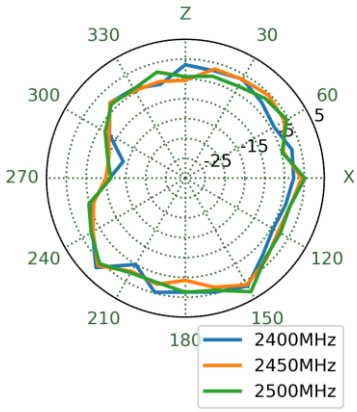


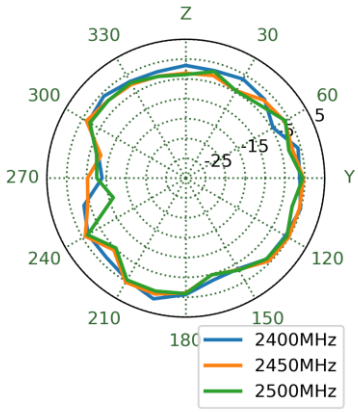
2450MHz



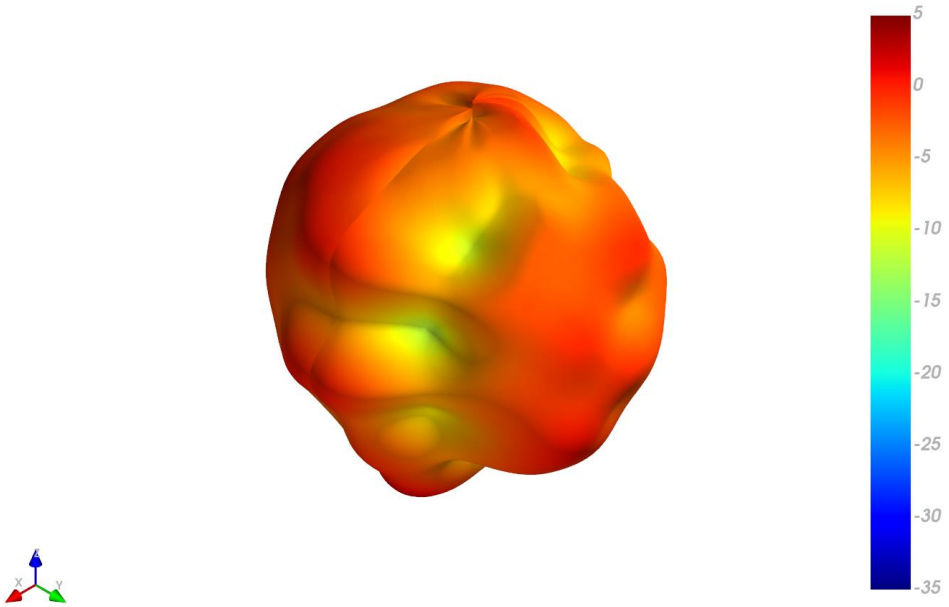
XY Plane	XZ Plane	YZ Plane



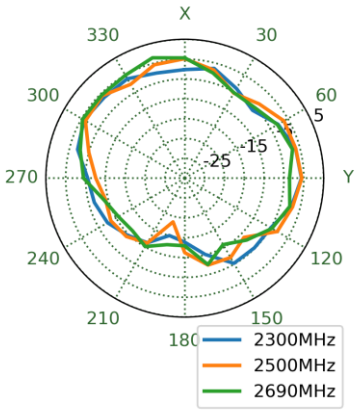


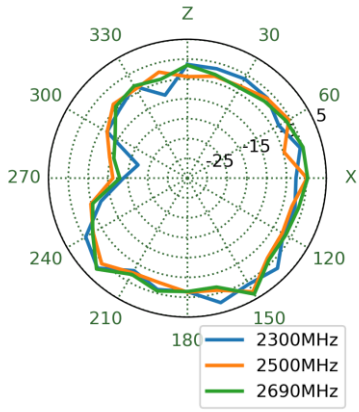


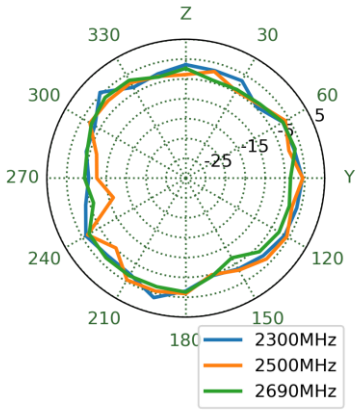
2500MHz



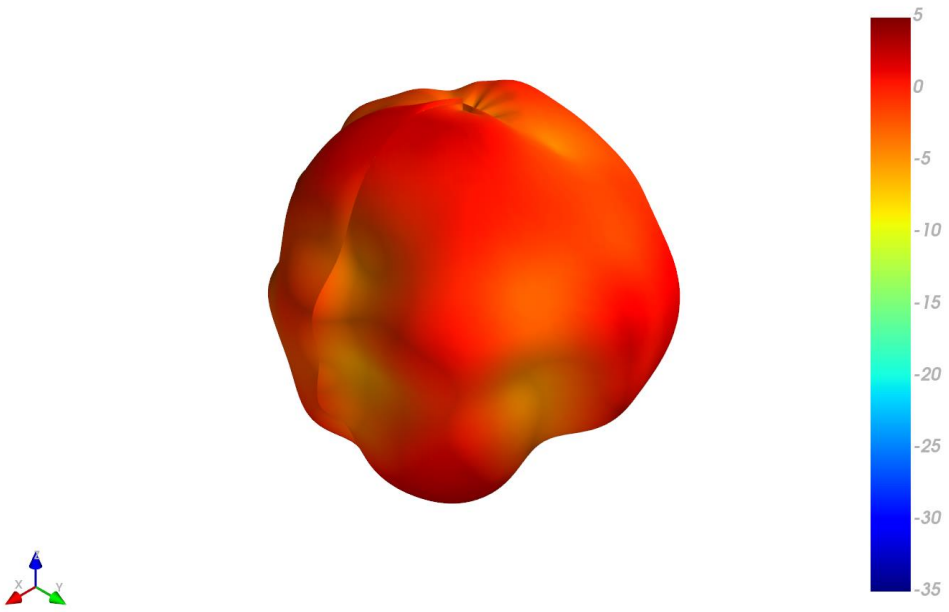
XY Plane	XZ Plane	YZ Plane



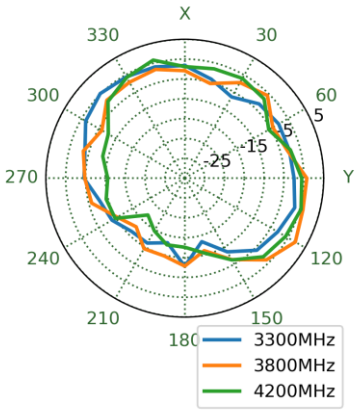


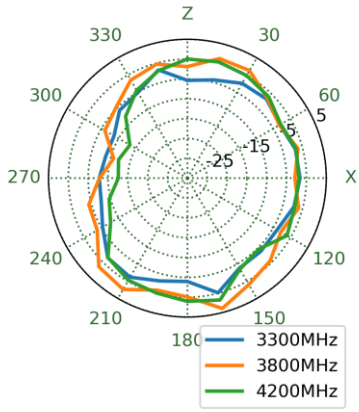


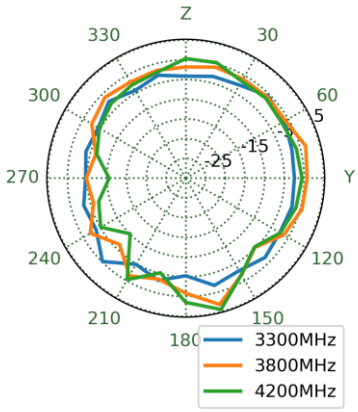
3800MHz



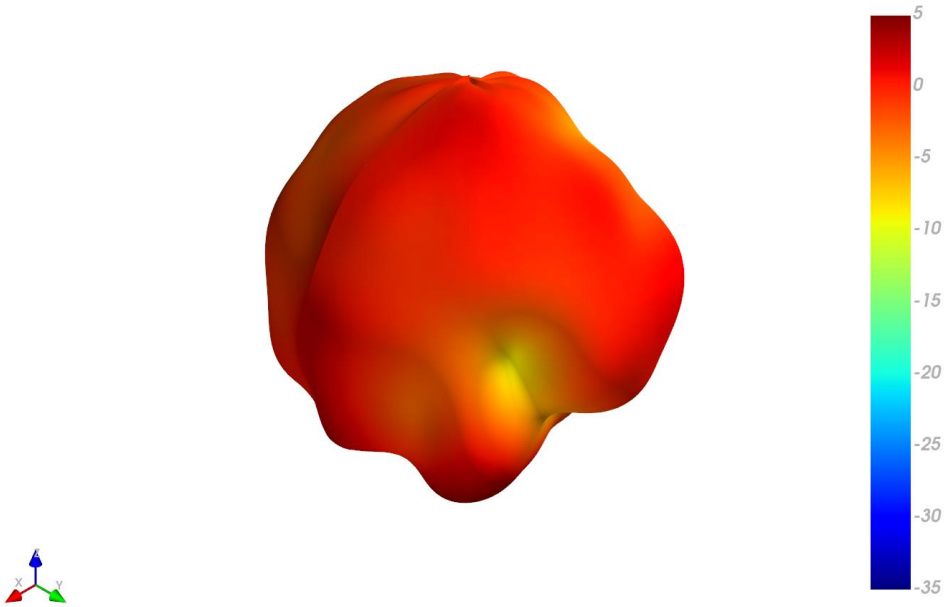
XY Plane	XZ Plane	YZ Plane



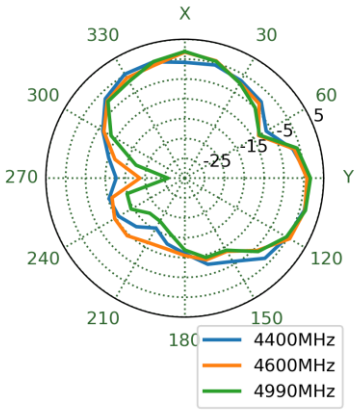


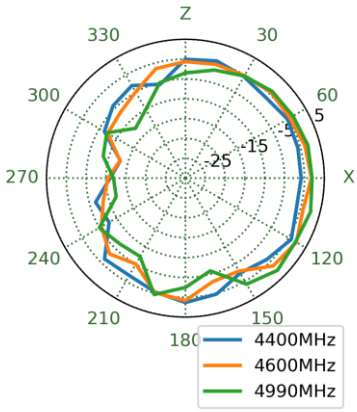


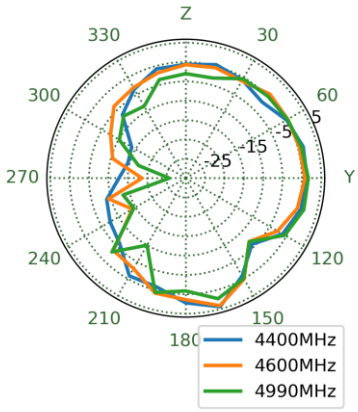
4600MHz



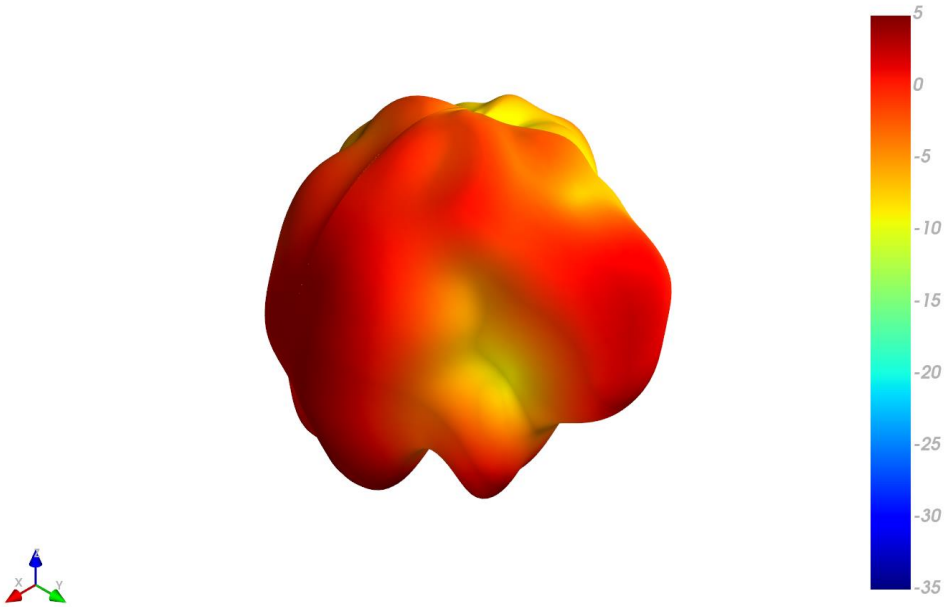
XY Plane	XZ Plane	YZ Plane



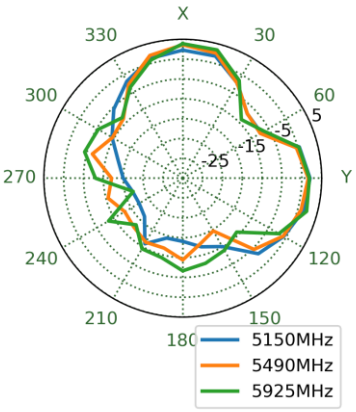




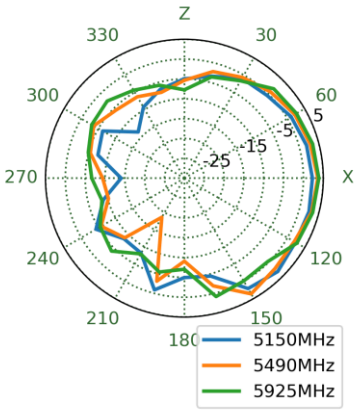
5490MHz



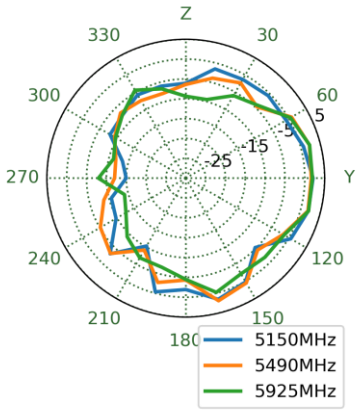
XY Plane



XZ Plane

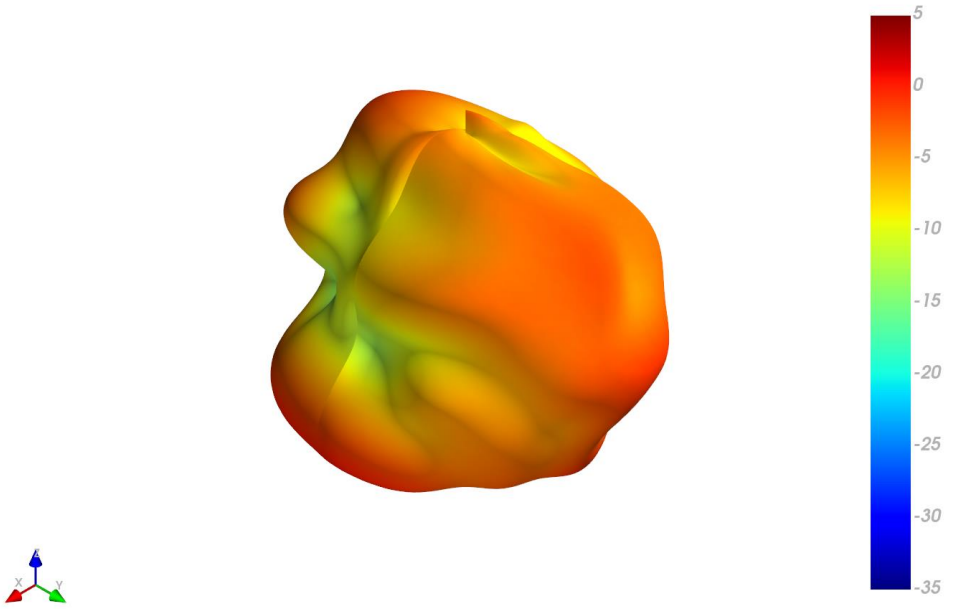


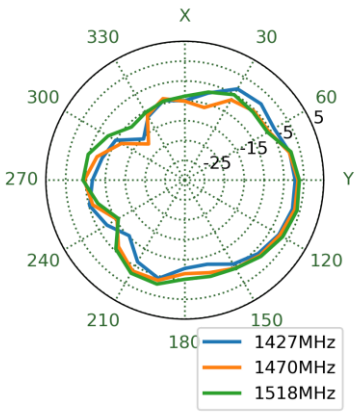
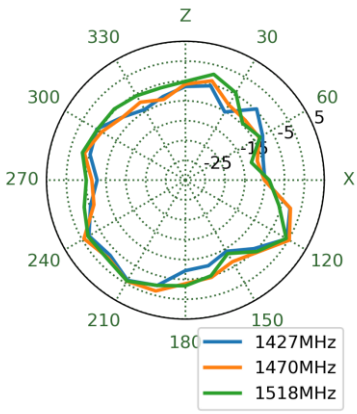
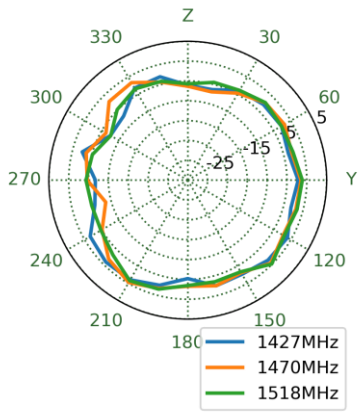
YZ Plane



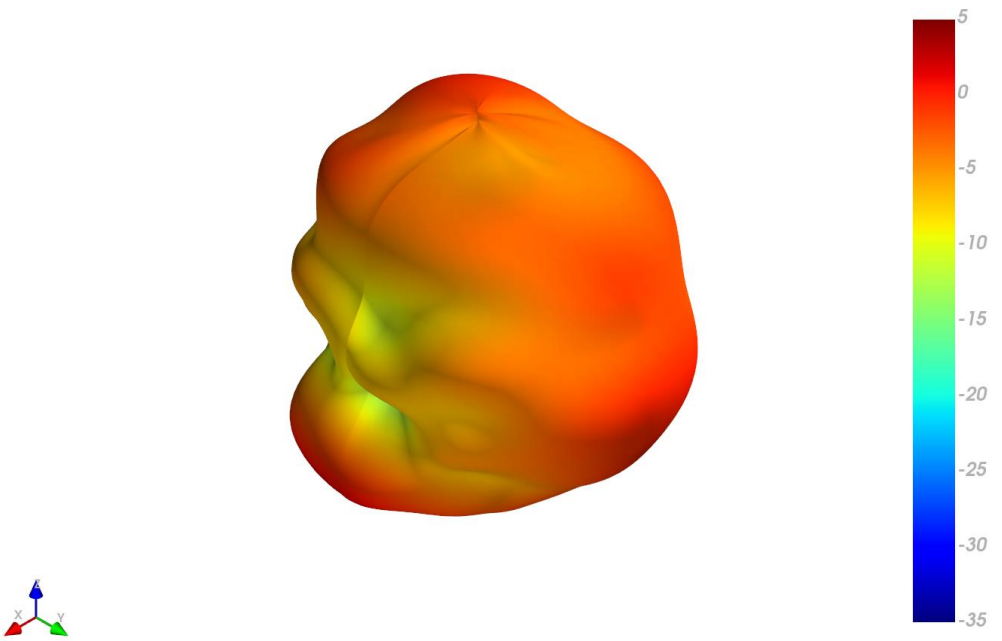
4.5 4G/5G – Ant8 3D and 2D Radiation Patterns

1470MHz

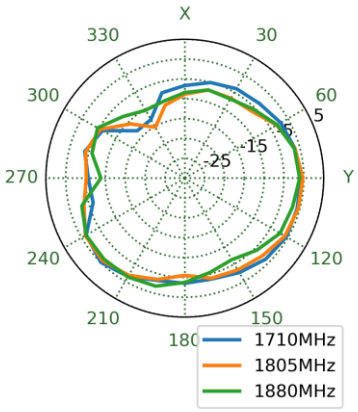


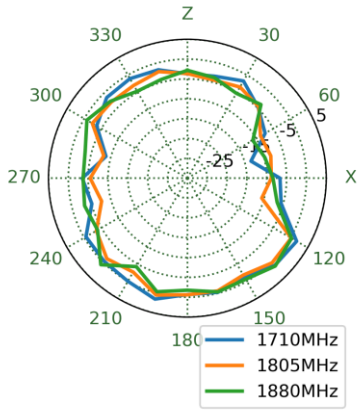
XY Plane	XZ Plane	YZ Plane
		

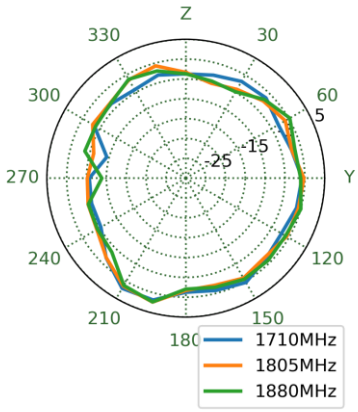
1805MHz



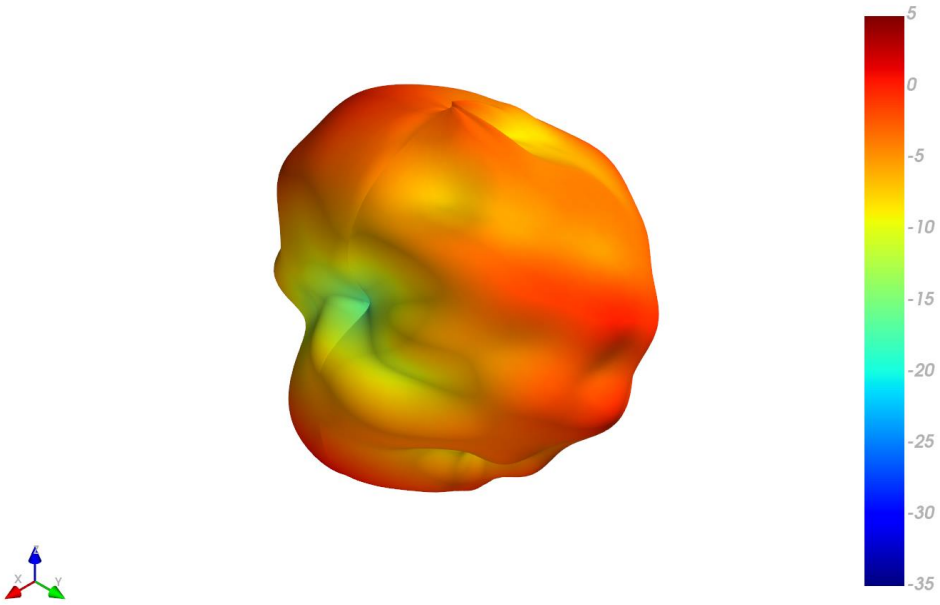
XY Plane	XZ Plane	YZ Plane



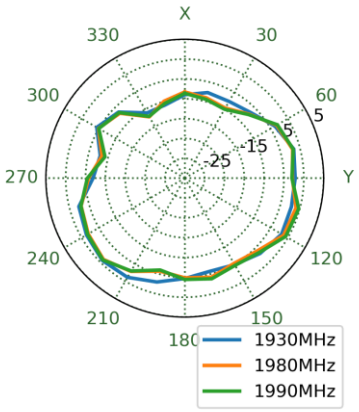




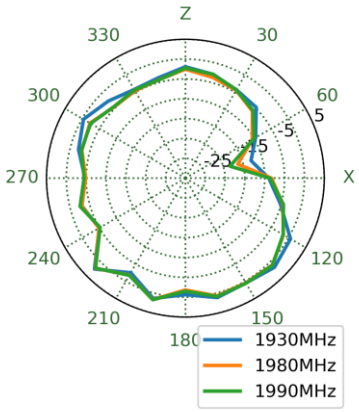
1980MHz



XY Plane



XZ Plane



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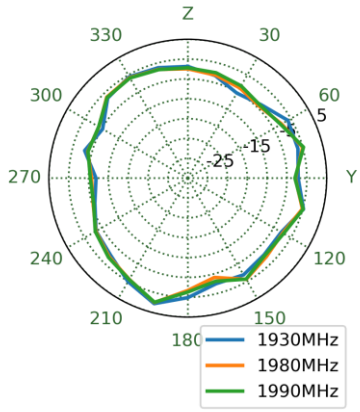
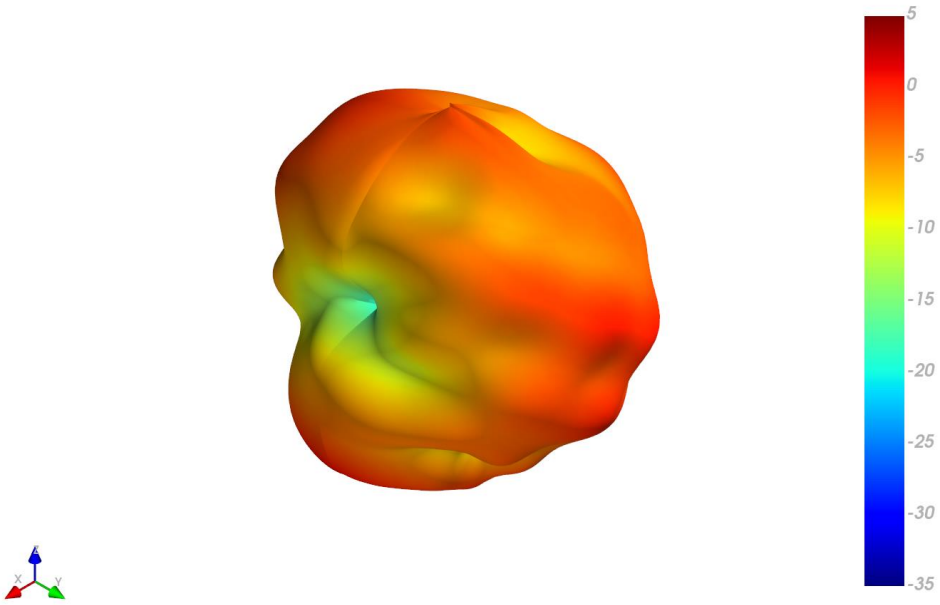
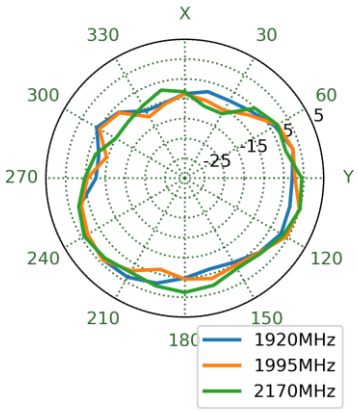


1995MHz



XY Plane



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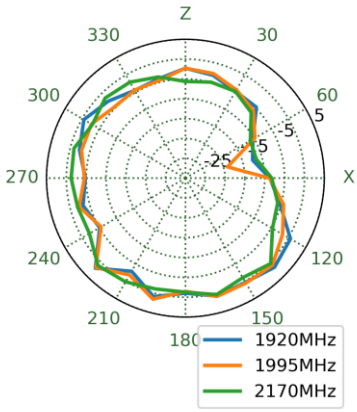

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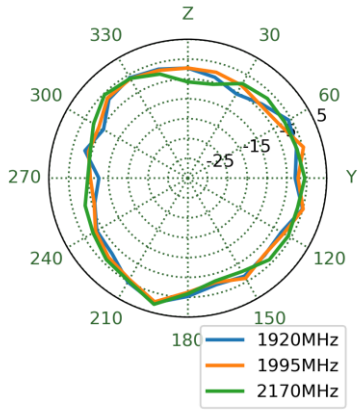
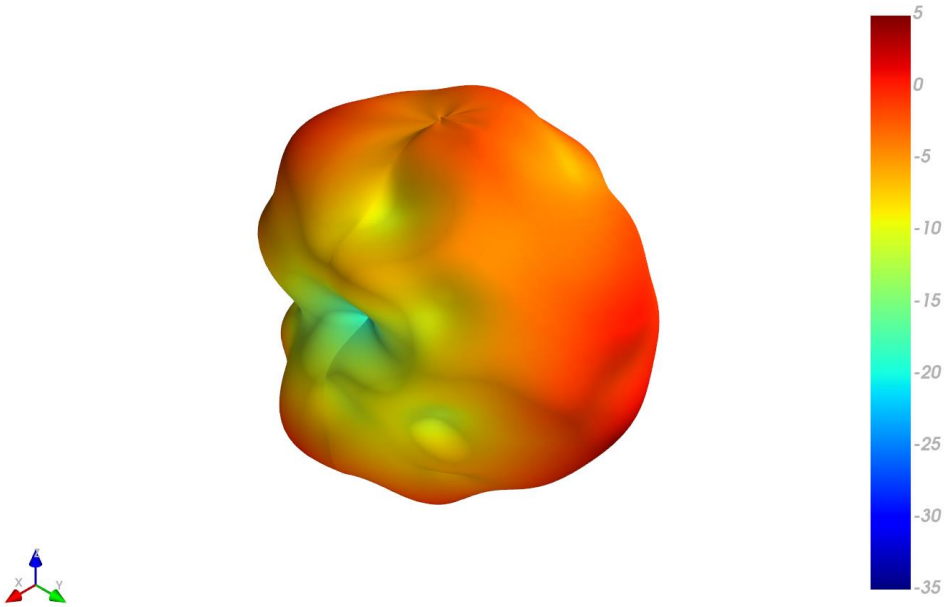
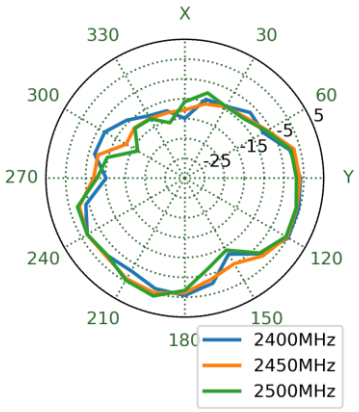
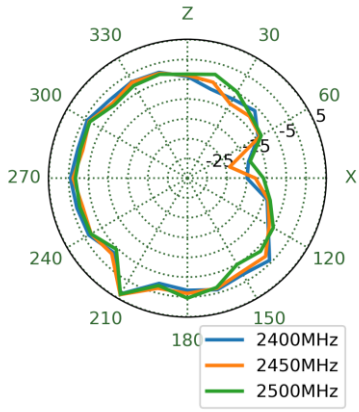


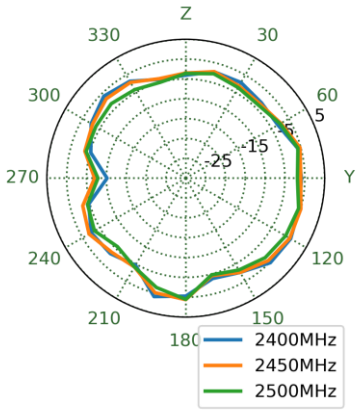
2450MHz



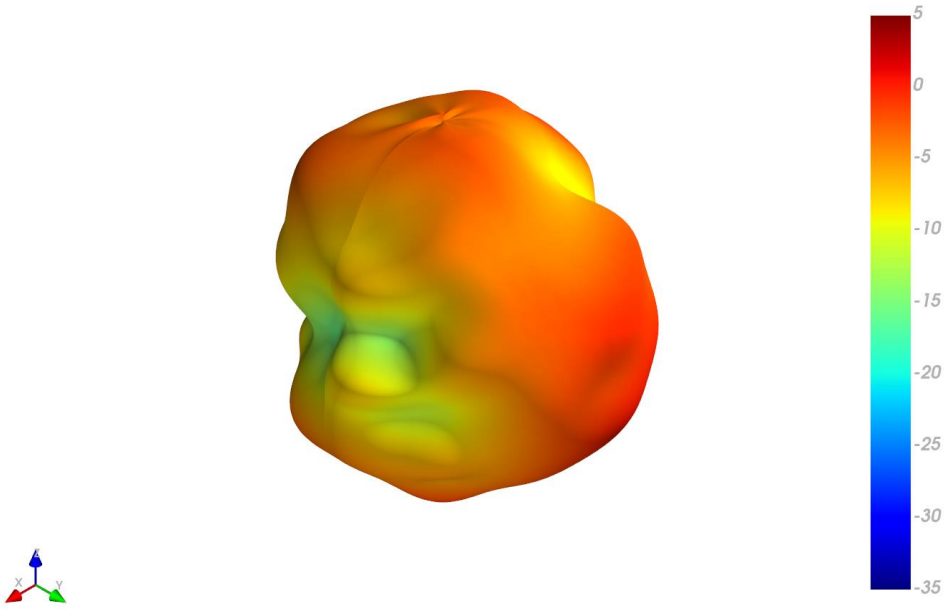
XY Plane	XZ Plane	YZ Plane



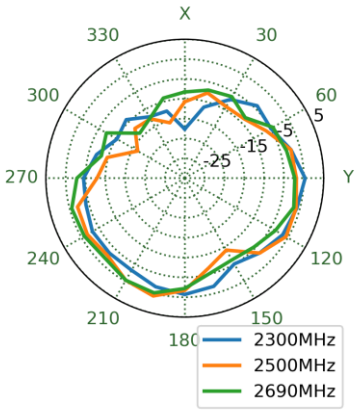


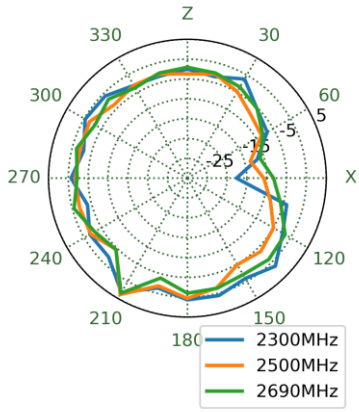


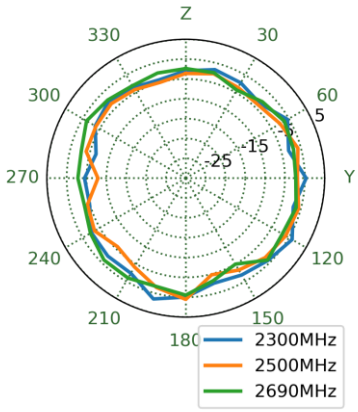
2500MHz



XY Plane	XZ Plane	YZ Plane







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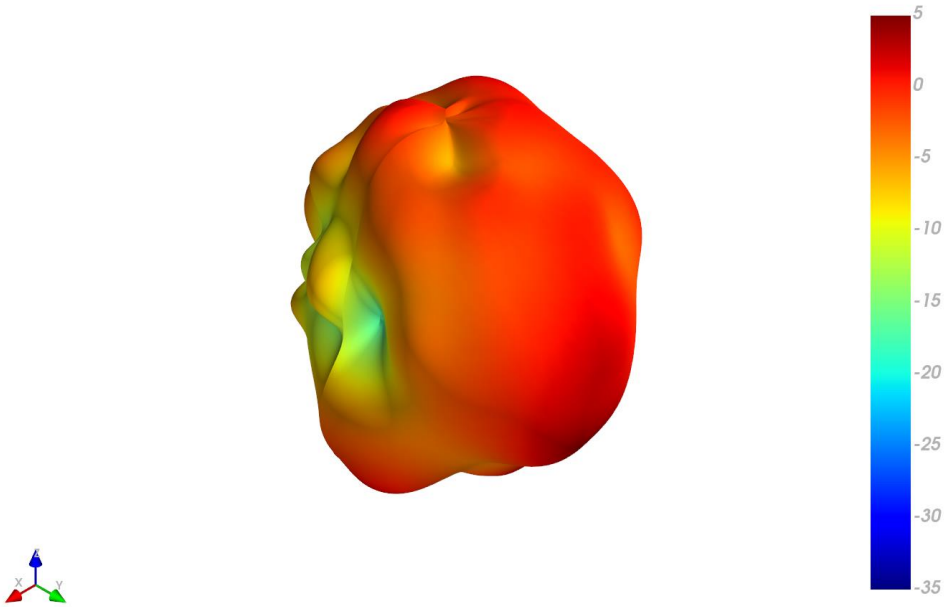
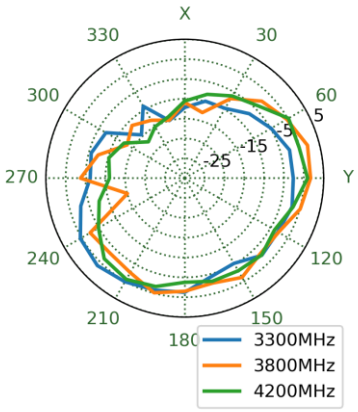
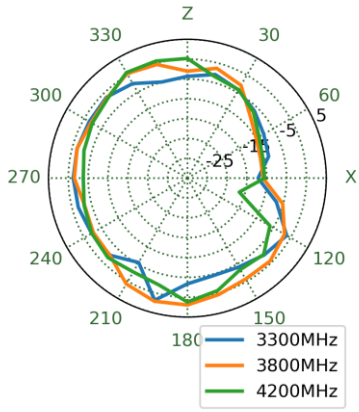
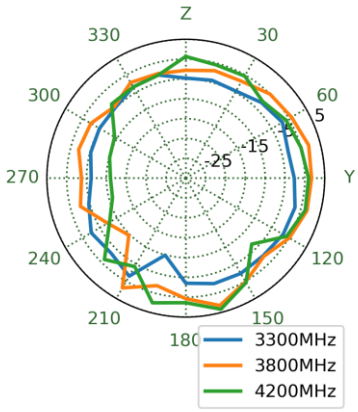


XY Plane	XZ Plane	YZ Plane







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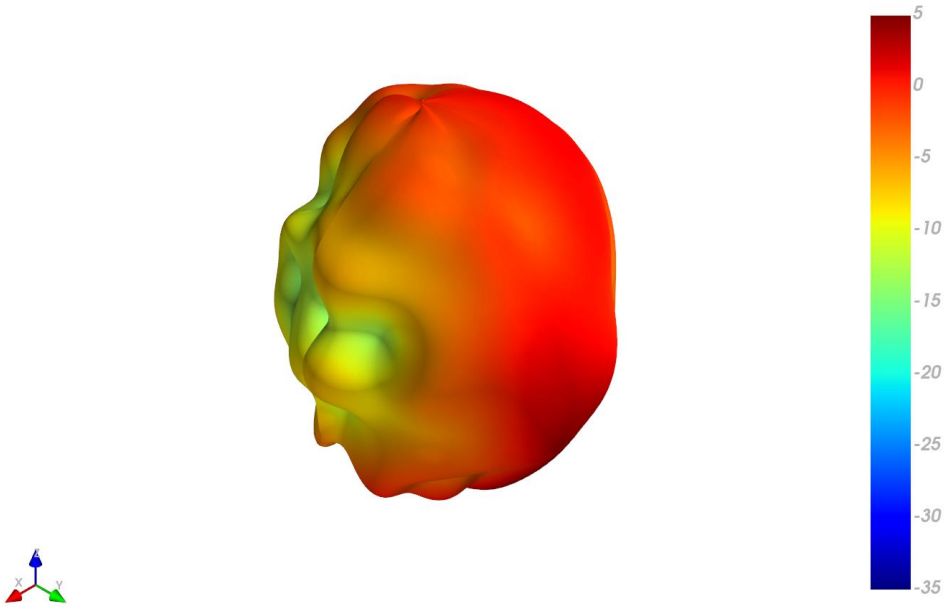
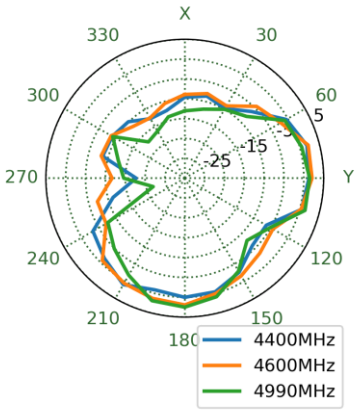
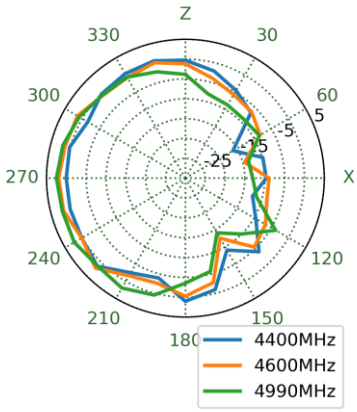


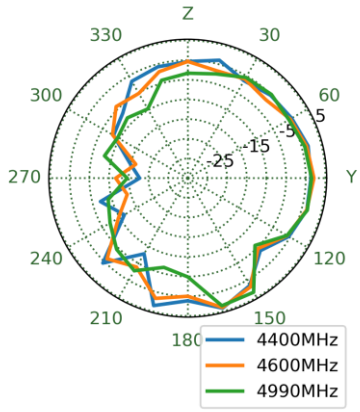
XY Plane



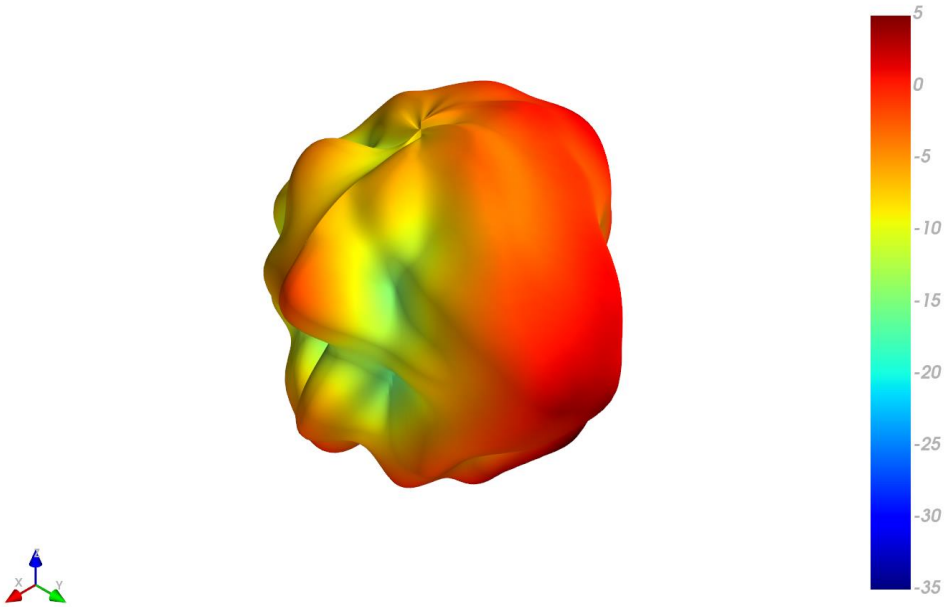
XZ Plane



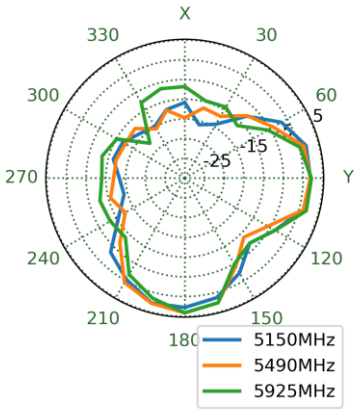
YZ Plane

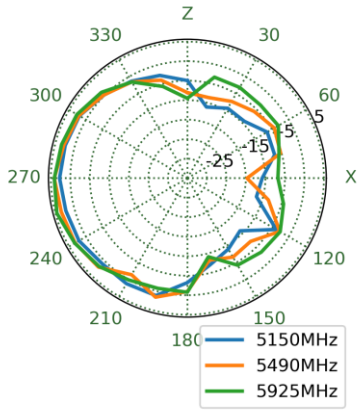


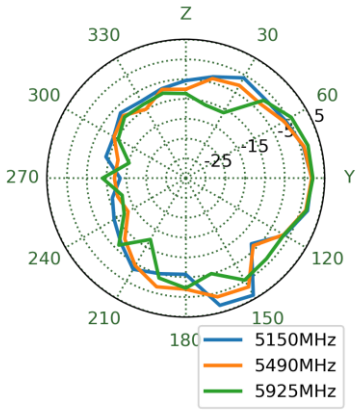
5490MHz



XY Plane	XZ Plane	YZ Plane

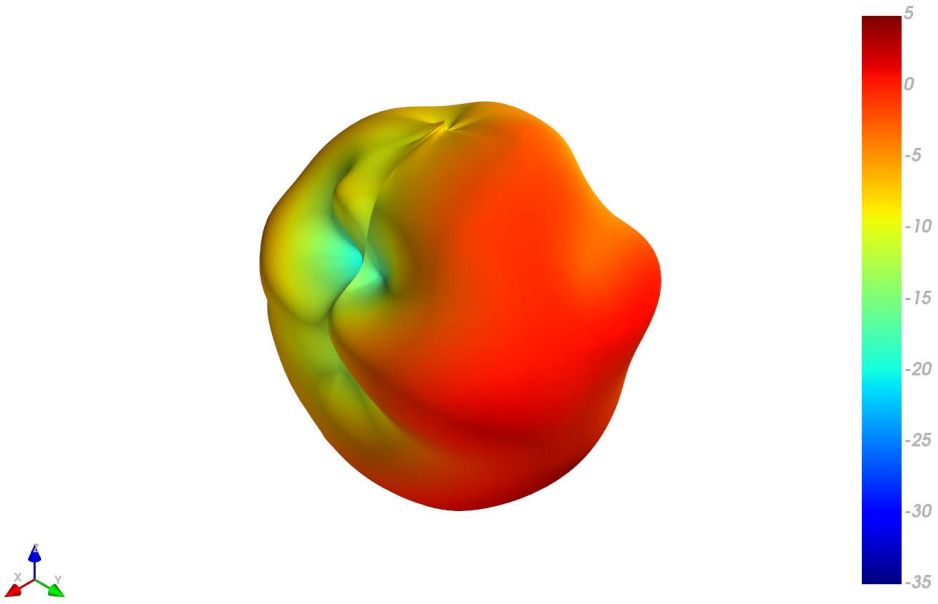




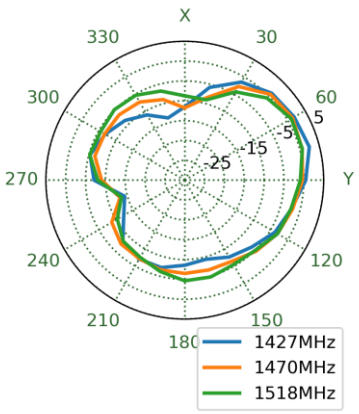


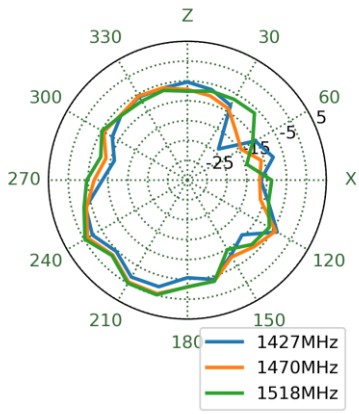
4.6 4G/5G – Ant2 3D and 2D Radiation Patterns

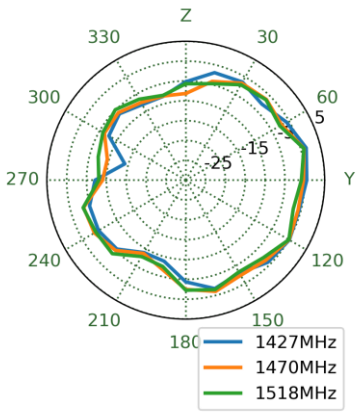
1470MHz



XY Plane	XZ Plane	YZ Plane







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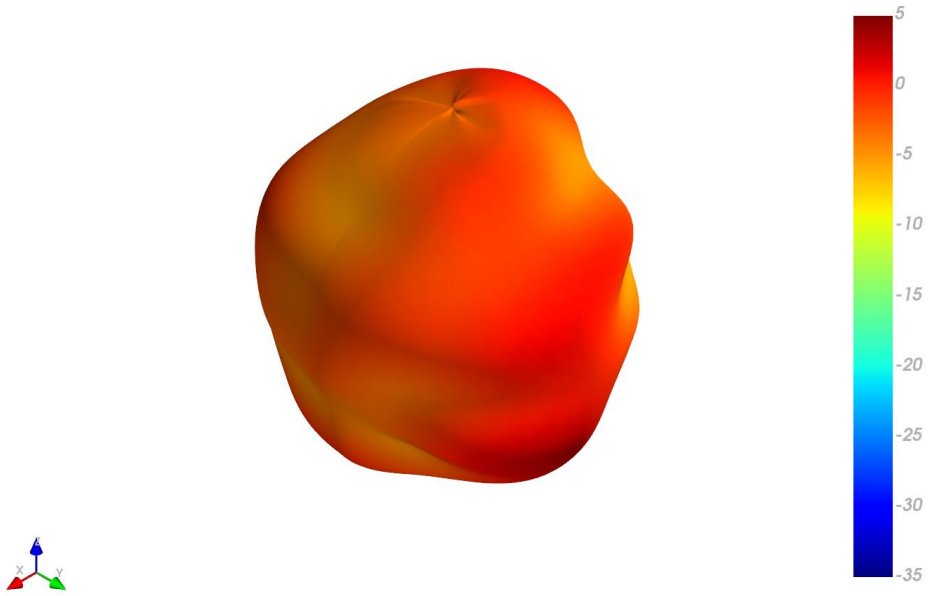
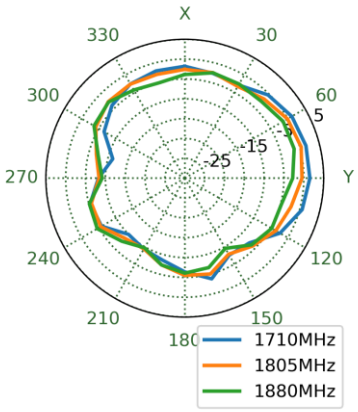
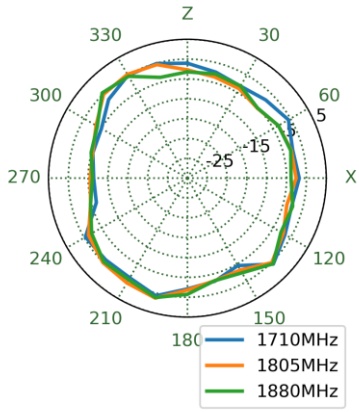
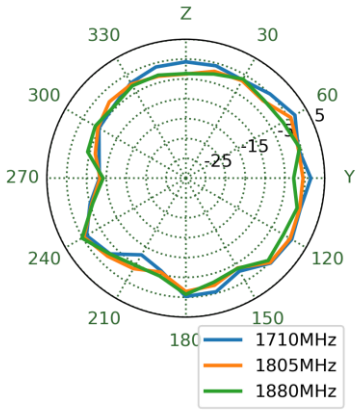


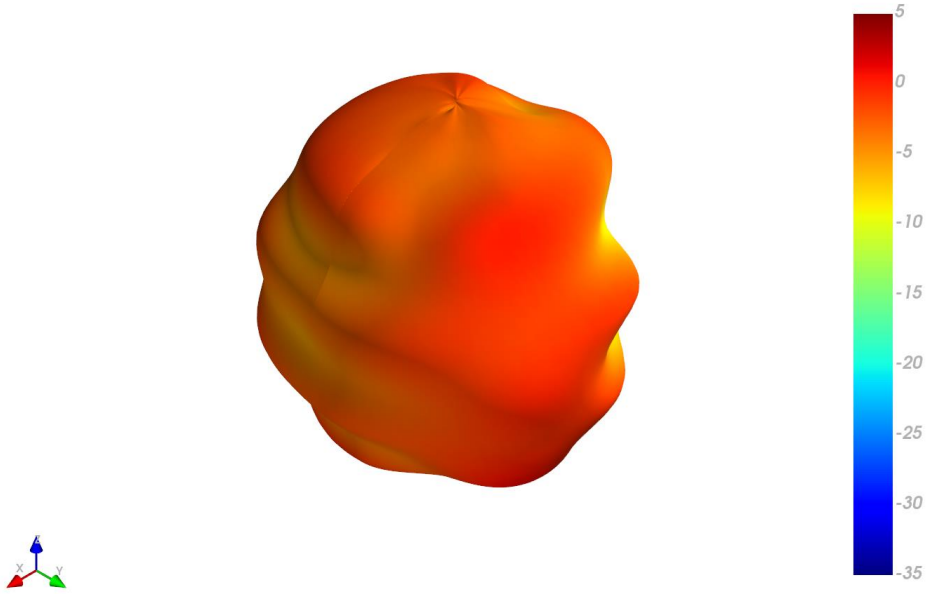
XY Plane	XZ Plane	YZ Plane



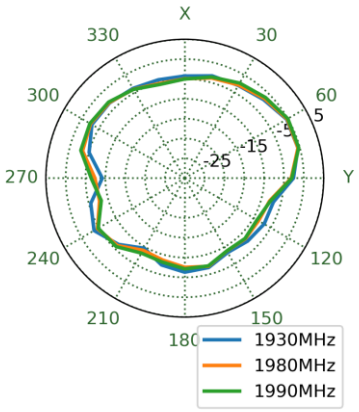




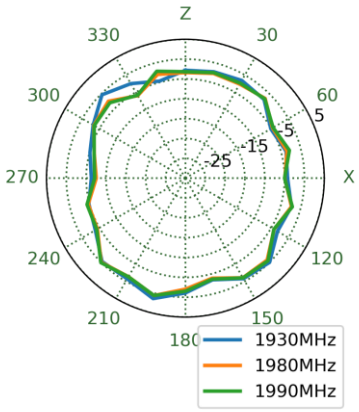
1980MHz



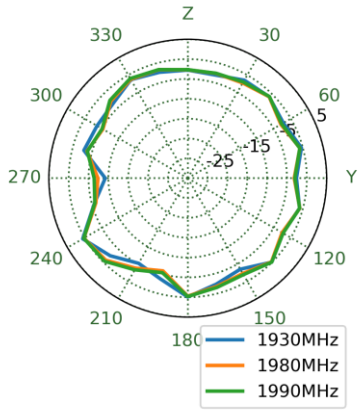
XY Plane



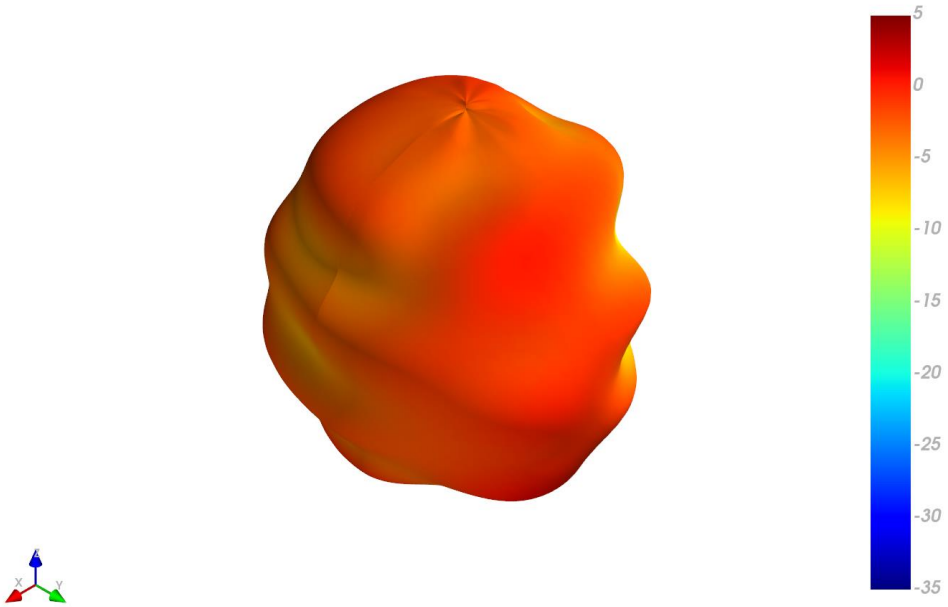
XZ Plane



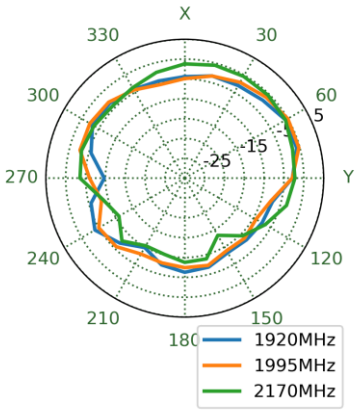
YZ Plane



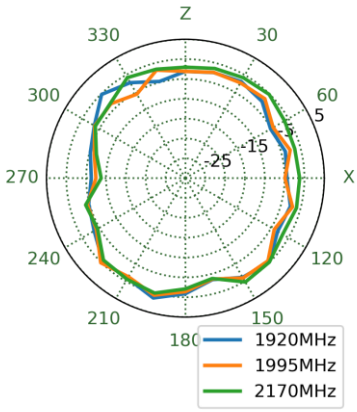
1995MHz



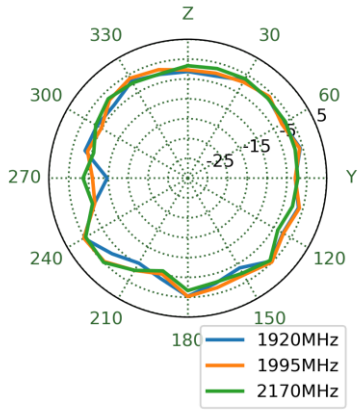
XY Plane



XZ Plane



YZ Plane



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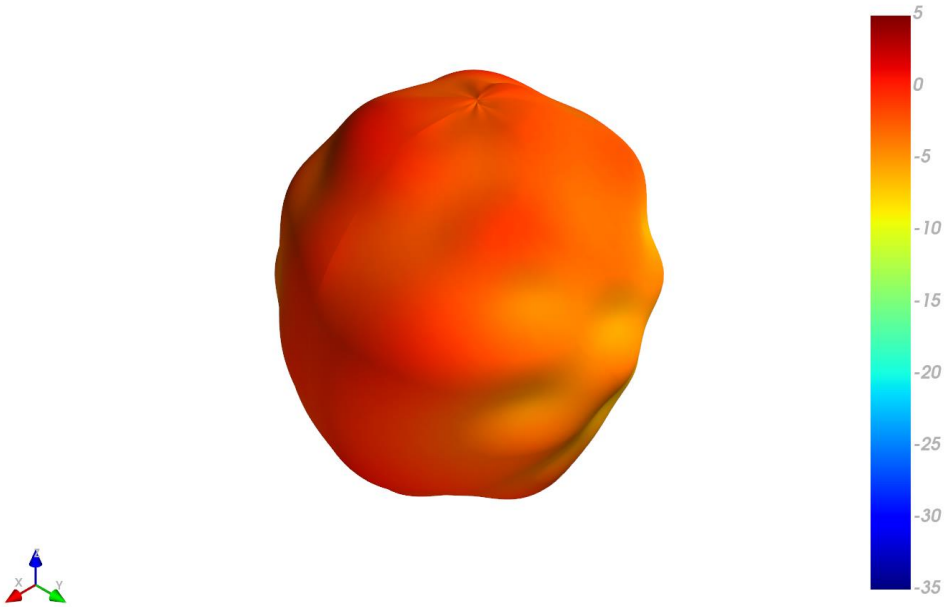
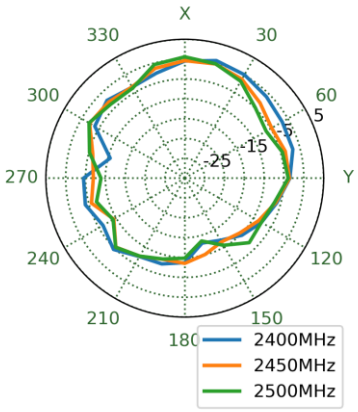
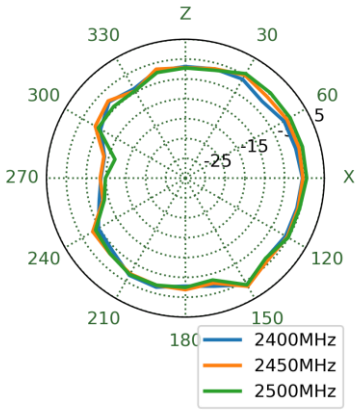
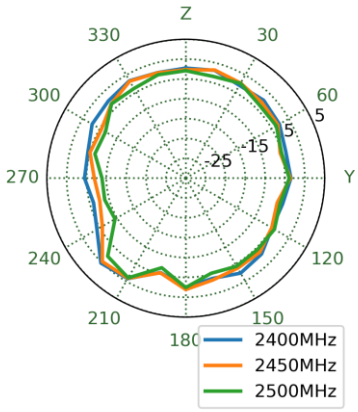


XY Plane	XZ Plane	YZ Plane







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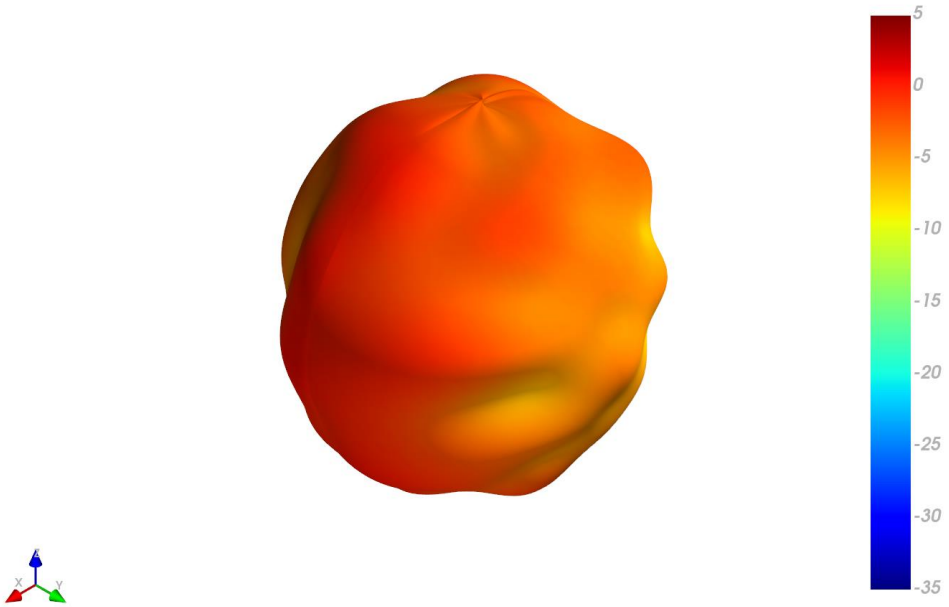
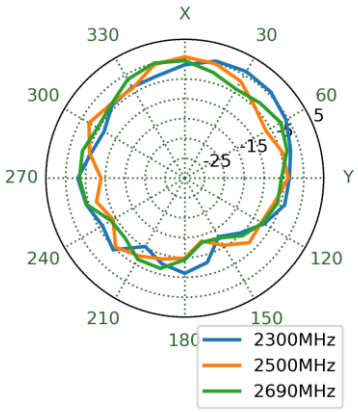
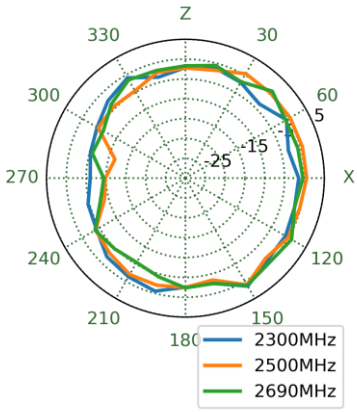
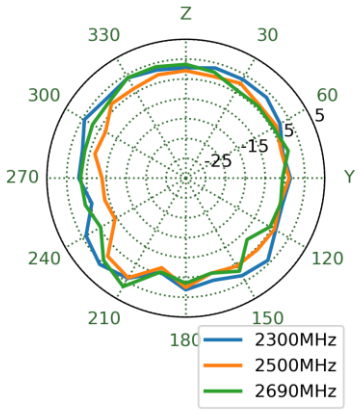


XY Plane	XZ Plane	YZ Plane







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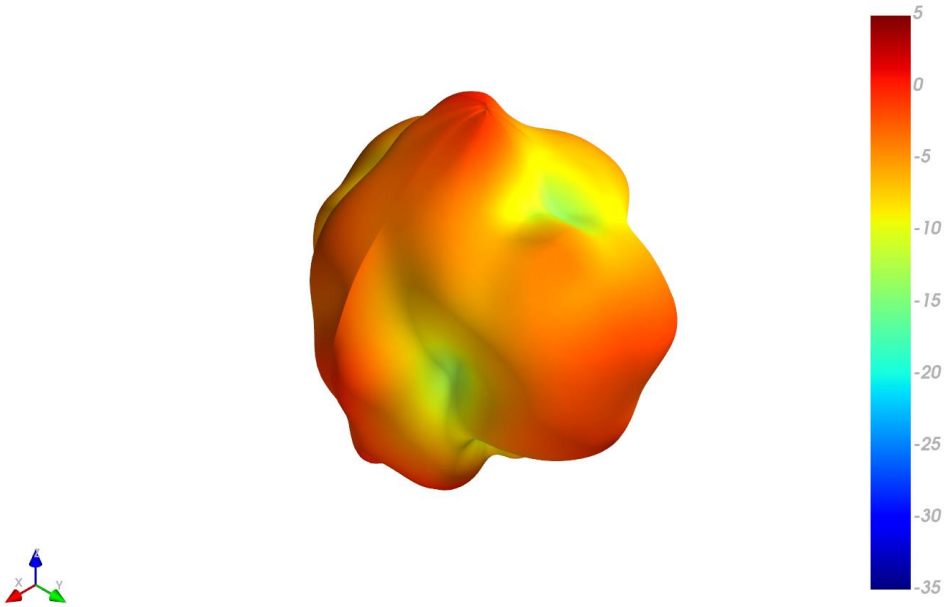
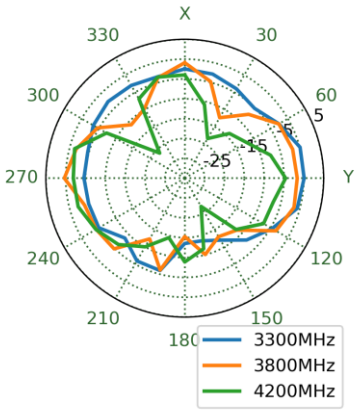
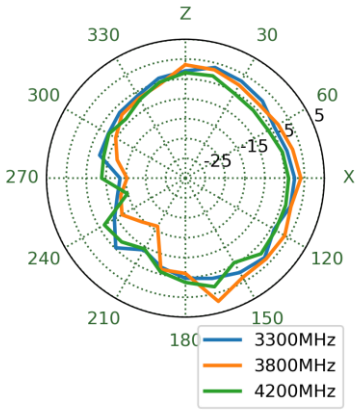
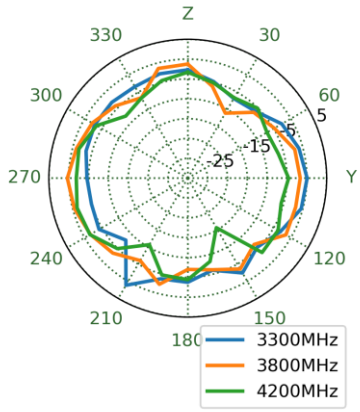


XY Plane	XZ Plane	YZ Plane
		

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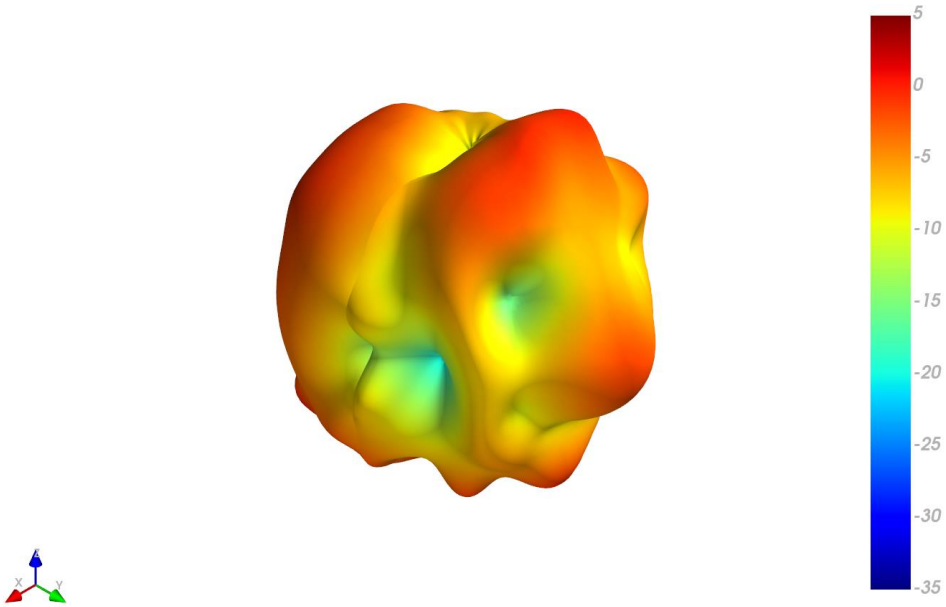
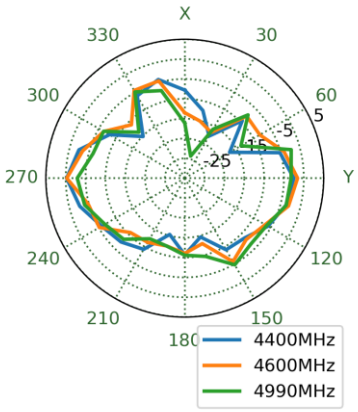
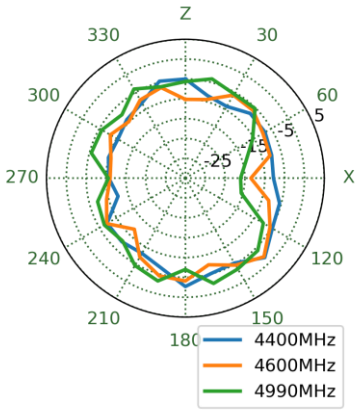


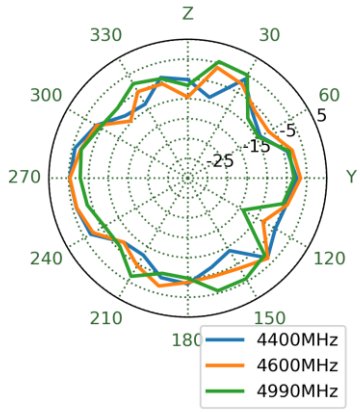
XY Plane



XZ Plane



YZ Plane



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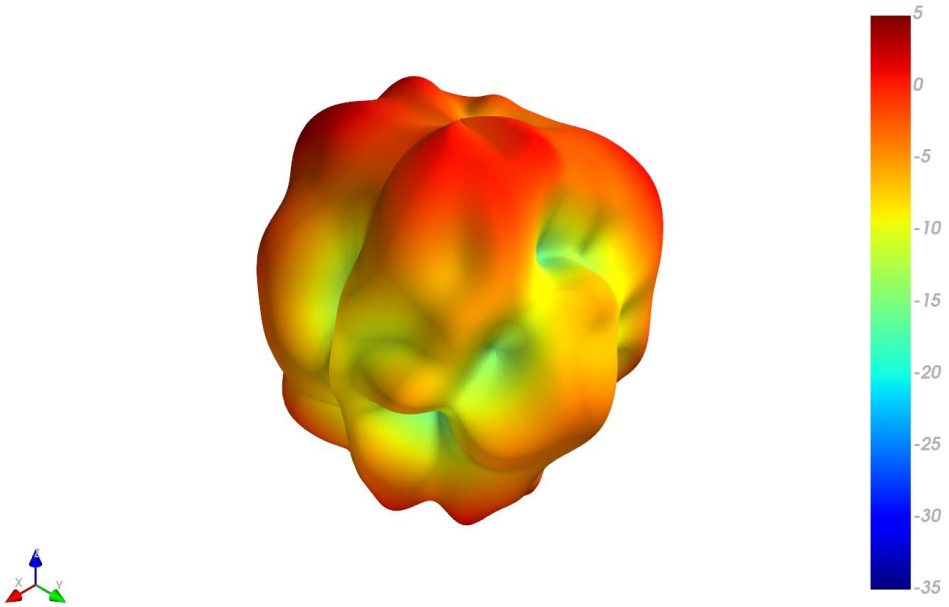
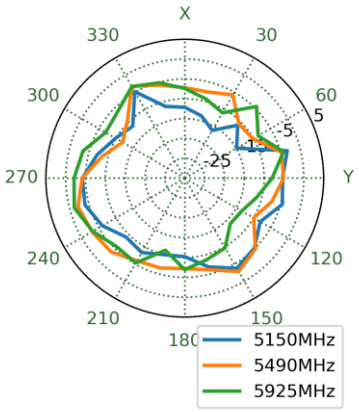
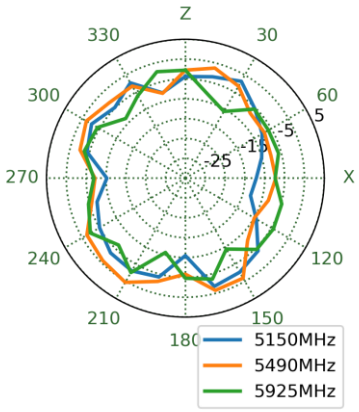
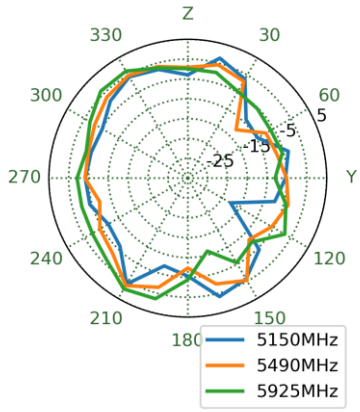
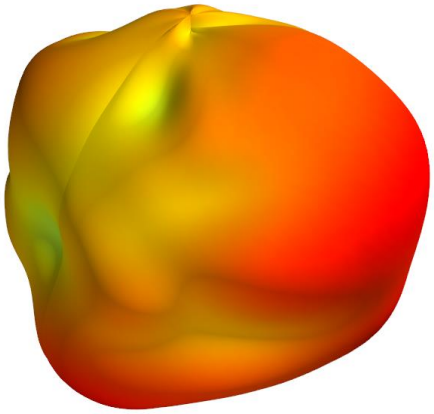


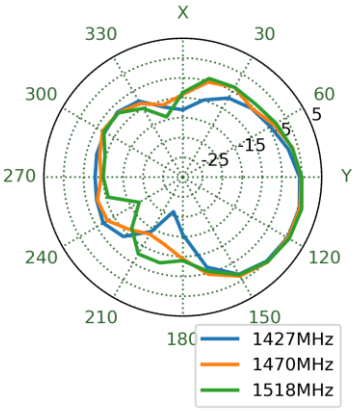
XY Plane	XZ Plane	YZ Plane
		

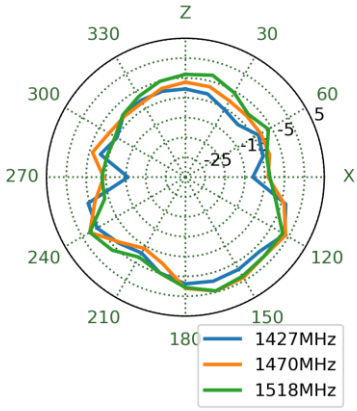
4.7 4G/5G – Ant7 3D and 2D Radiation Patterns

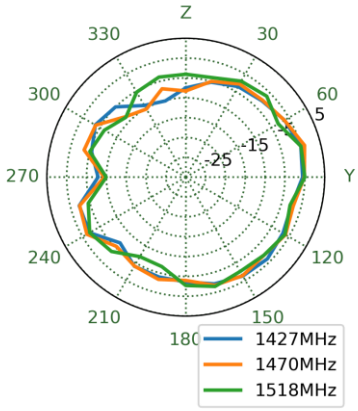
1470MHz



XY Plane	XZ Plane	YZ Plane







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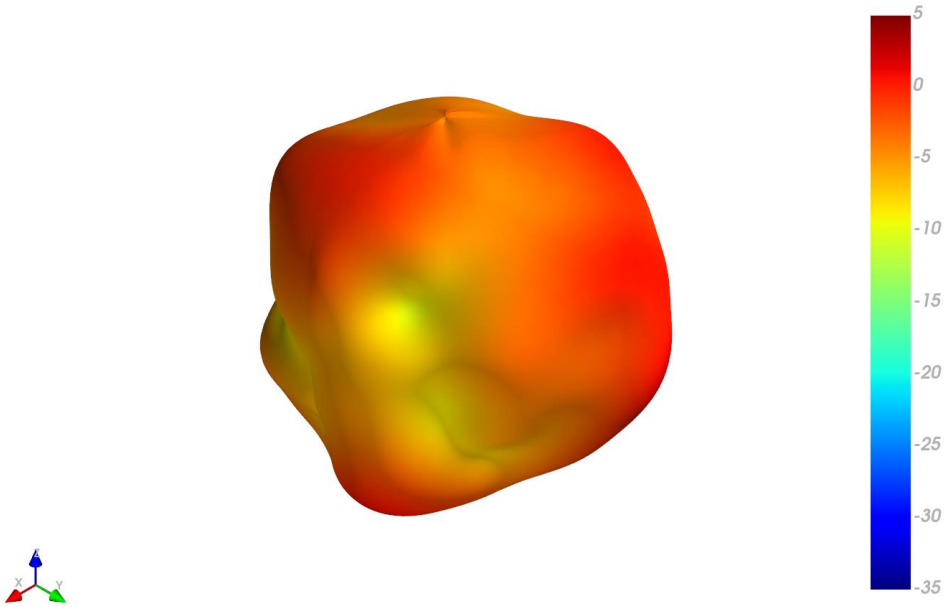
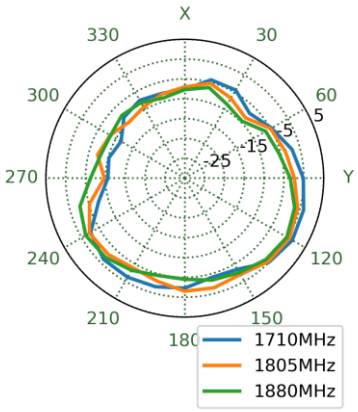
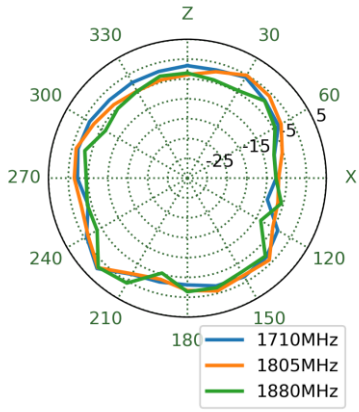
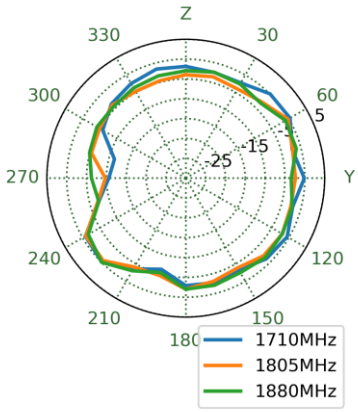


XY Plane	XZ Plane	YZ Plane







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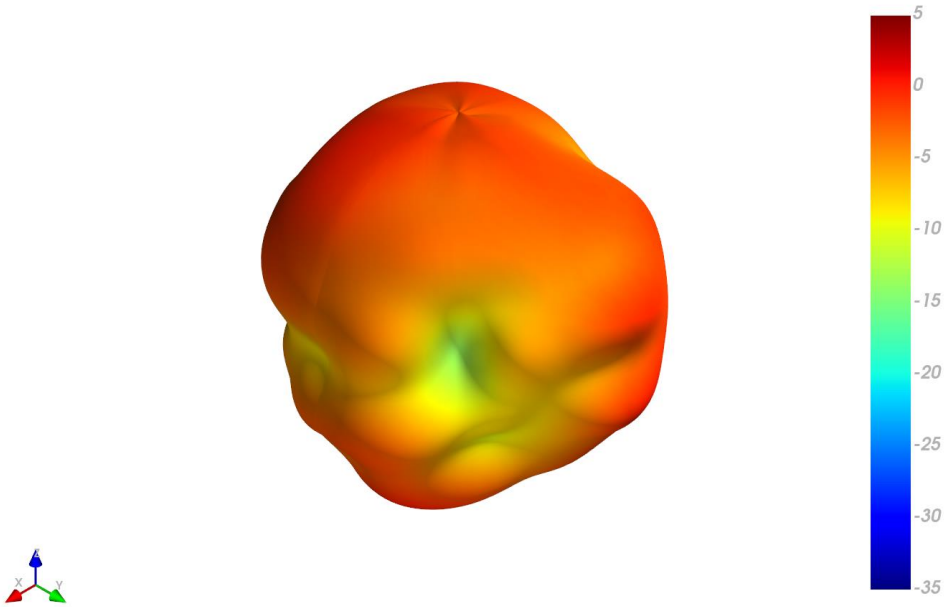
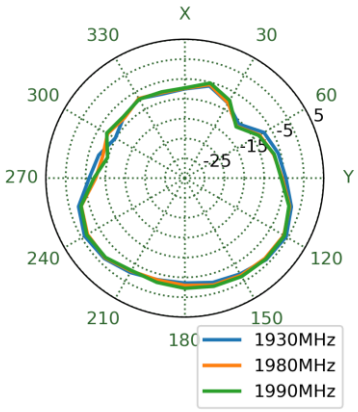
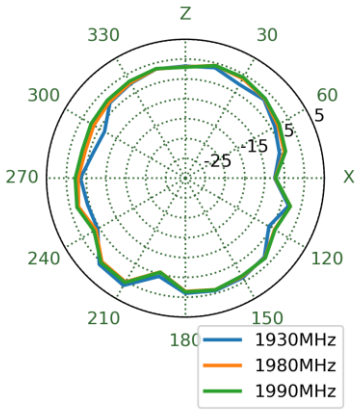
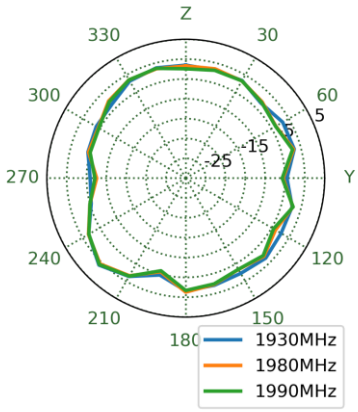


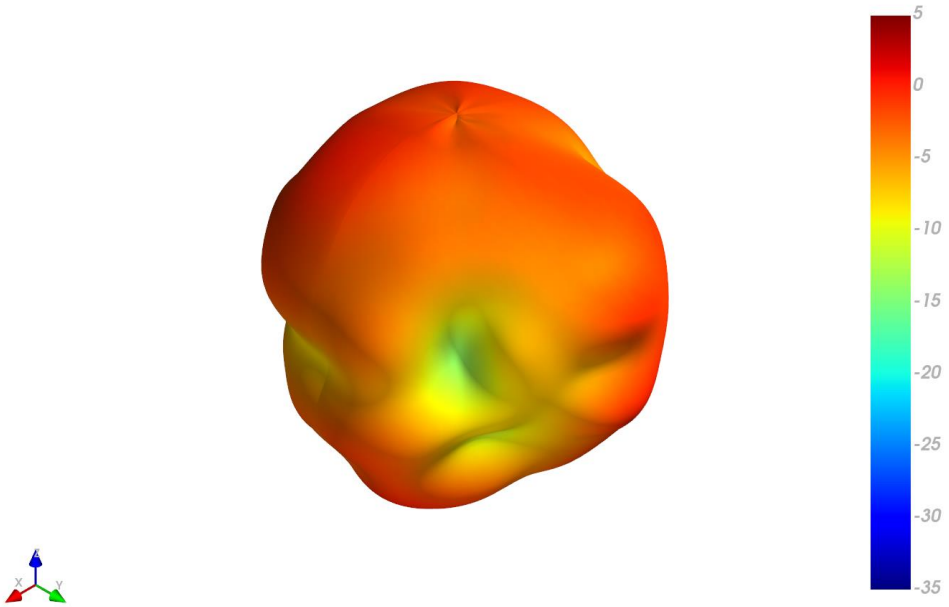
XY Plane	XZ Plane	YZ Plane



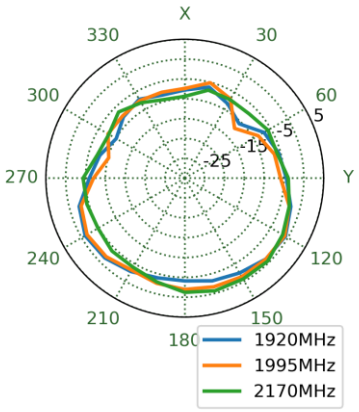




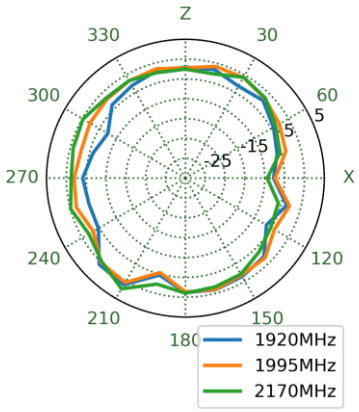
1995MHz



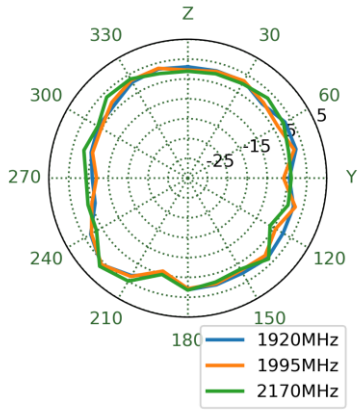
XY Plane



XZ Plane



YZ Plane



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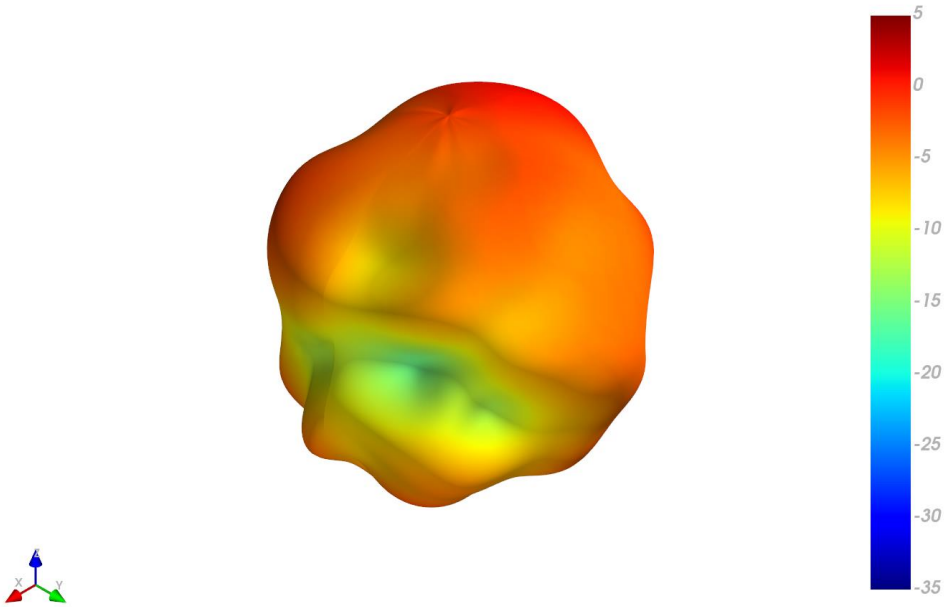
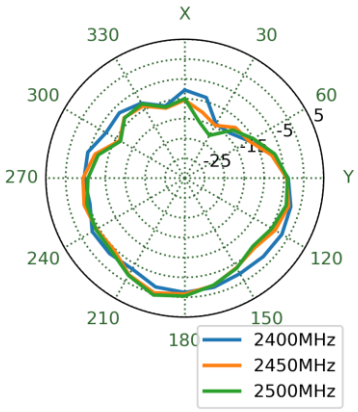
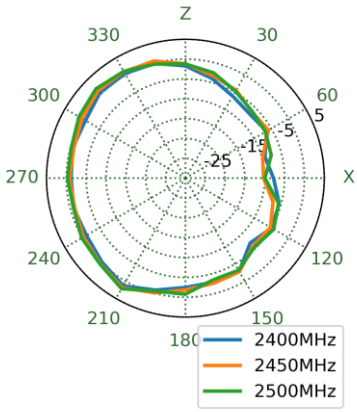
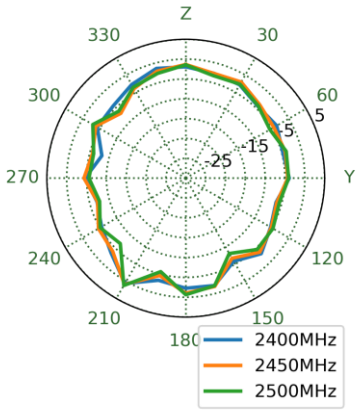


XY Plane	XZ Plane	YZ Plane







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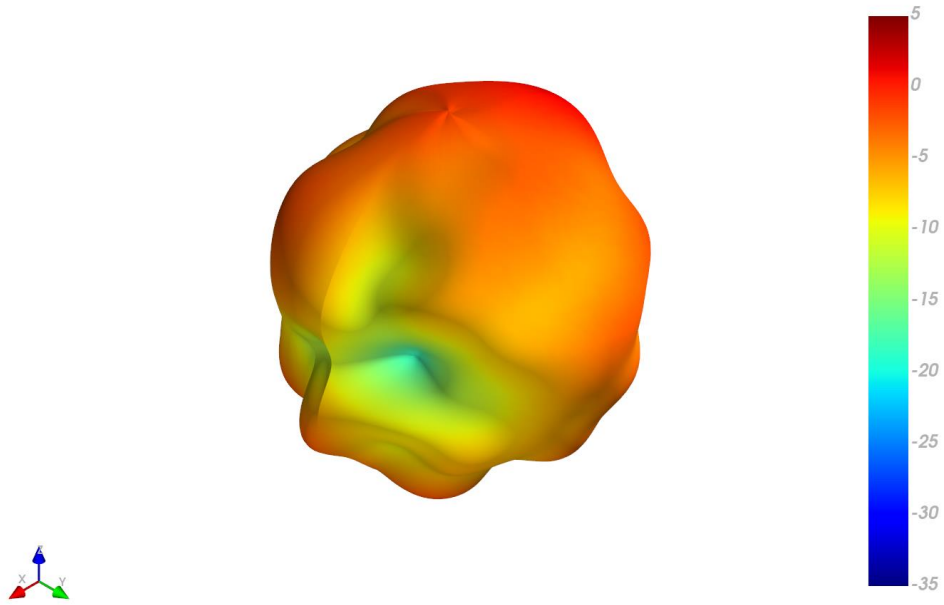
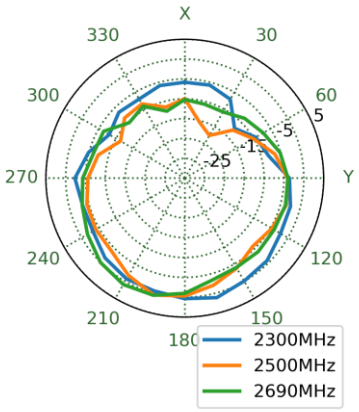
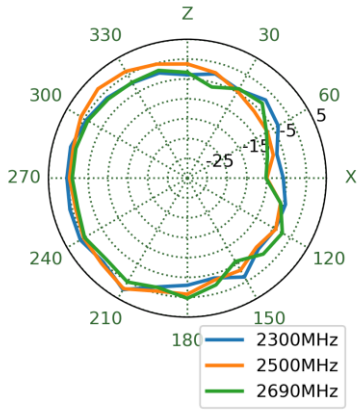
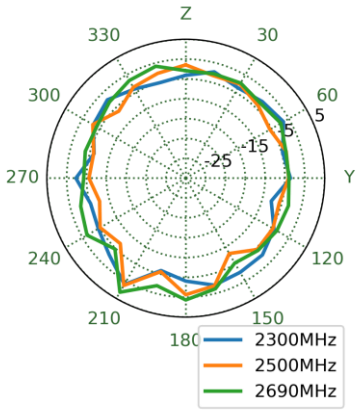


XY Plane	XZ Plane	YZ Plane







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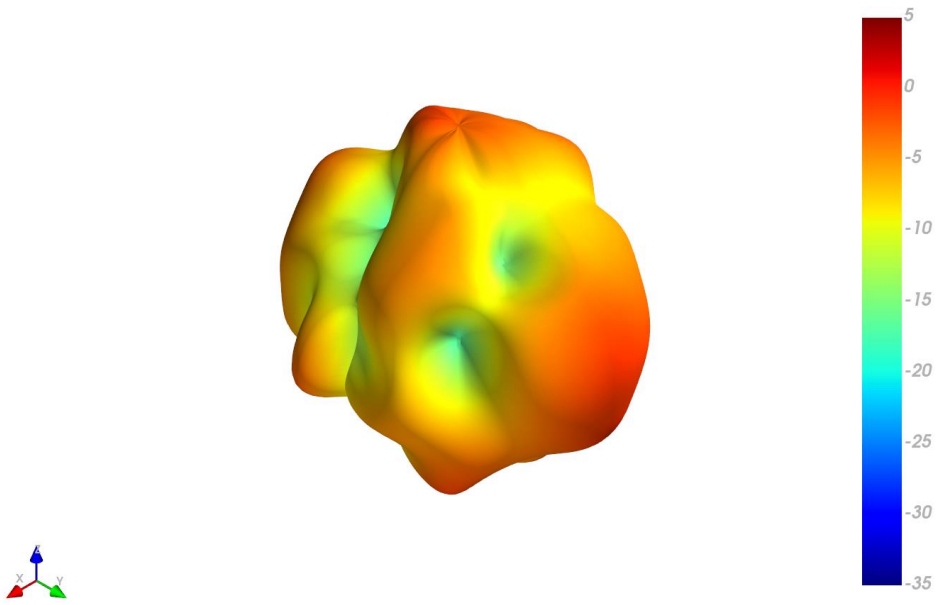
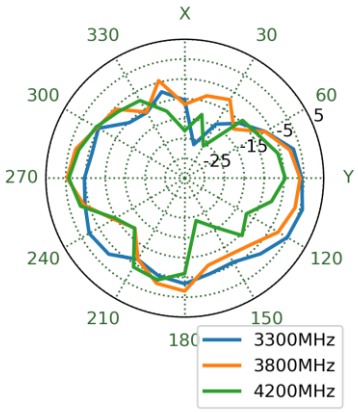
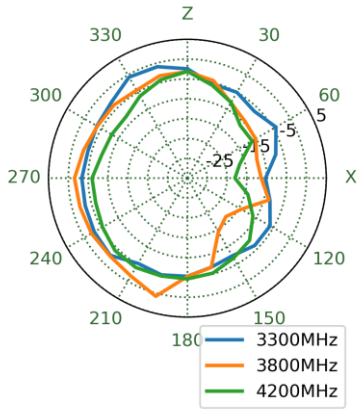
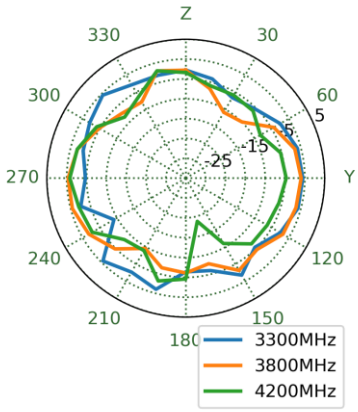


XY Plane	XZ Plane	YZ Plane







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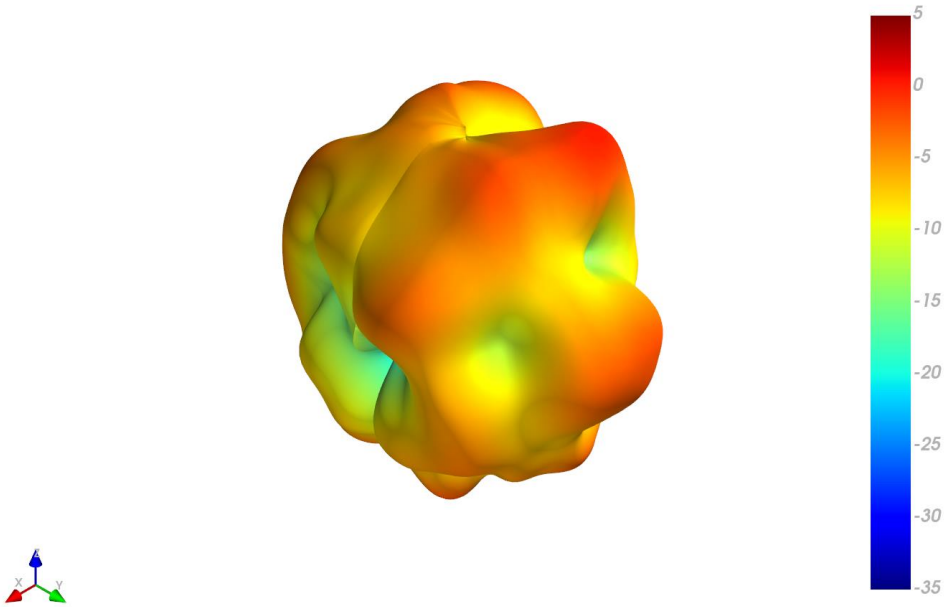

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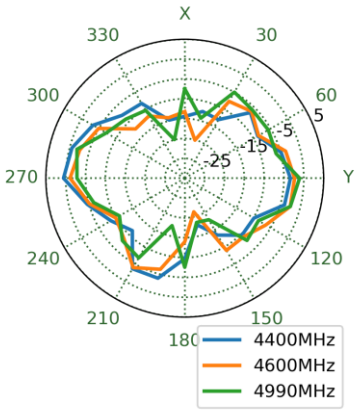

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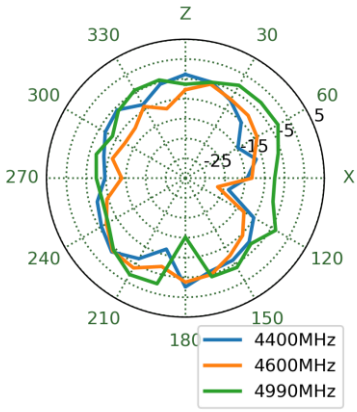
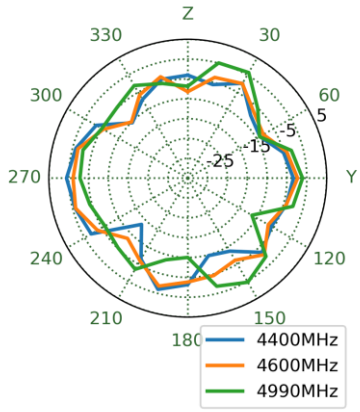


YZ Plane



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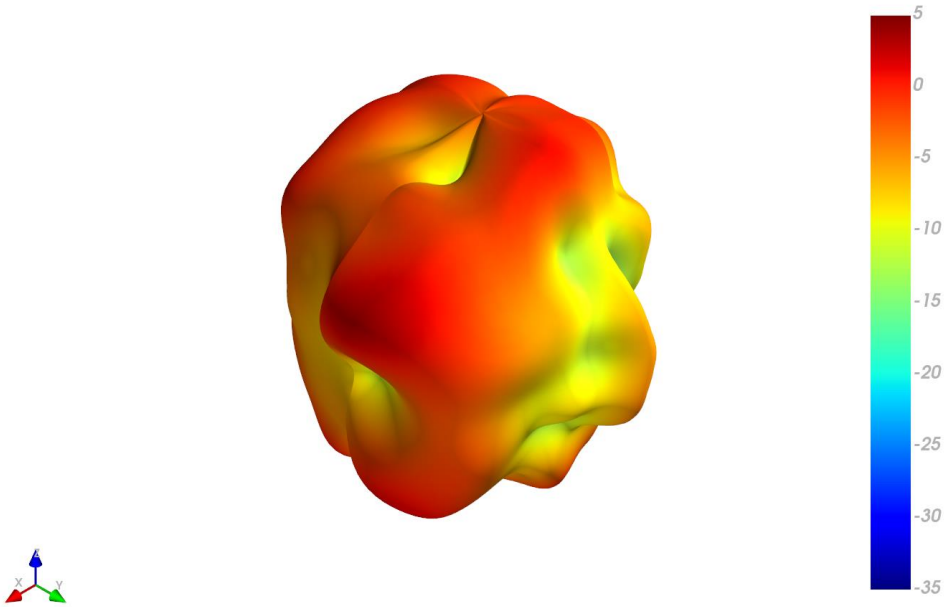
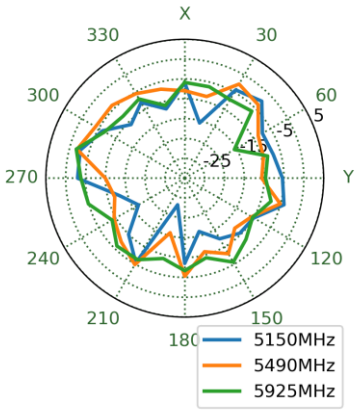
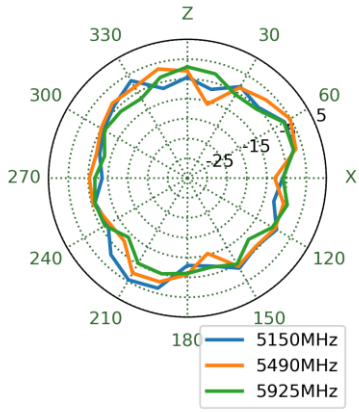
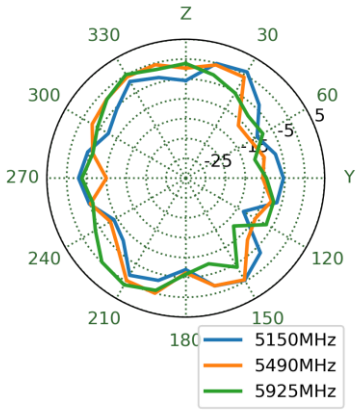


XY Plane	XZ Plane	YZ Plane

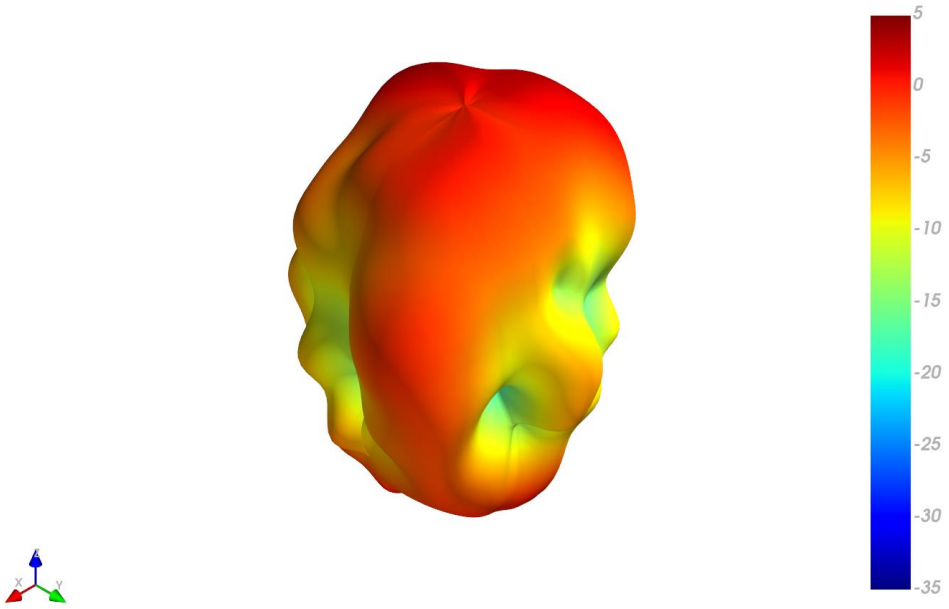




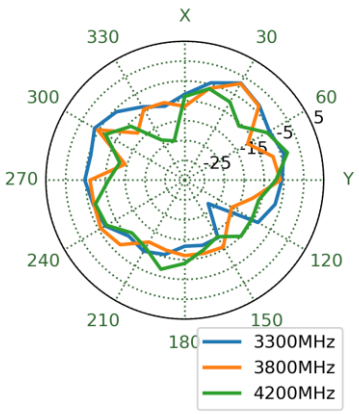


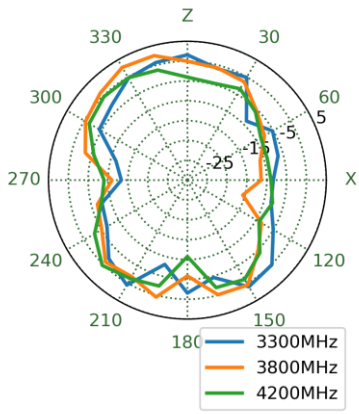
4.8 4G/5G – Ant3 3D and 2D Radiation Patterns

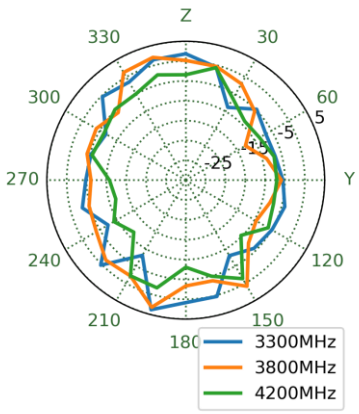
3800MHz



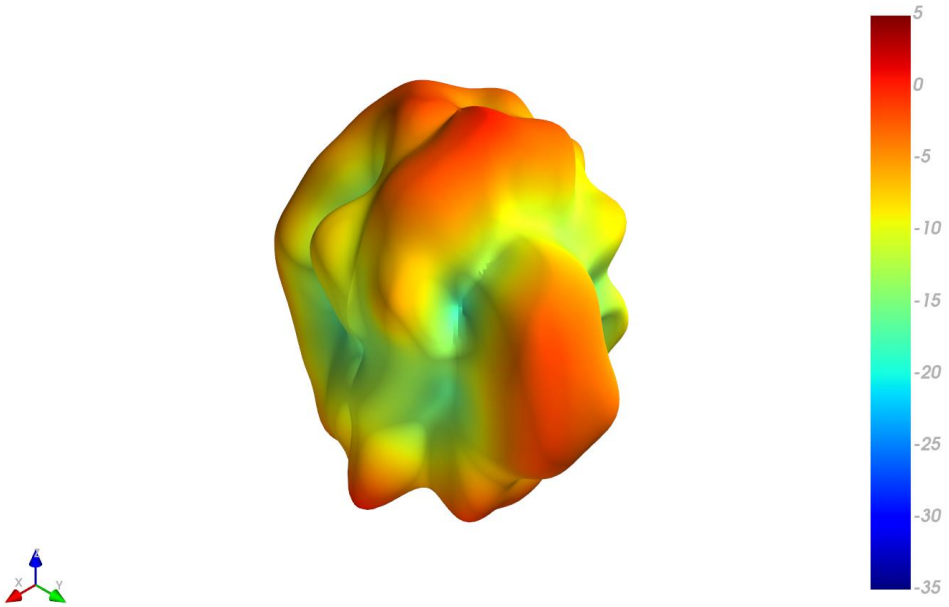
XY Plane	XZ Plane	YZ Plane



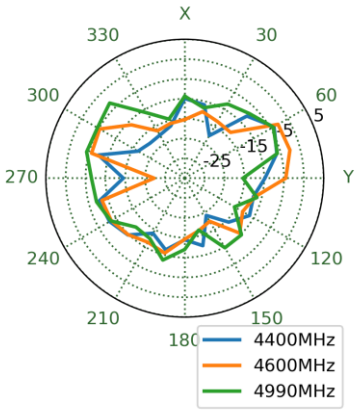




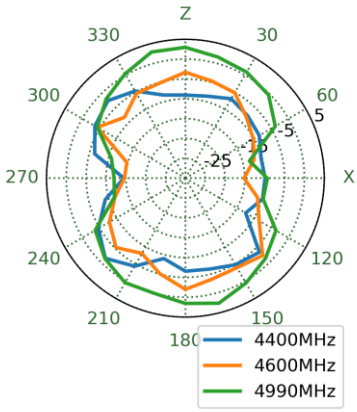
4600MHz



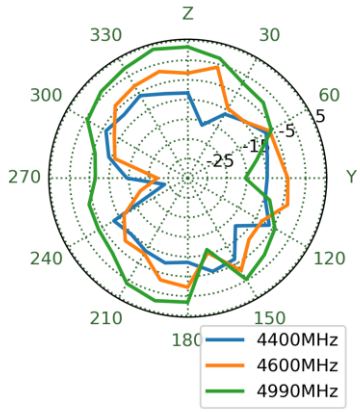
XY Plane



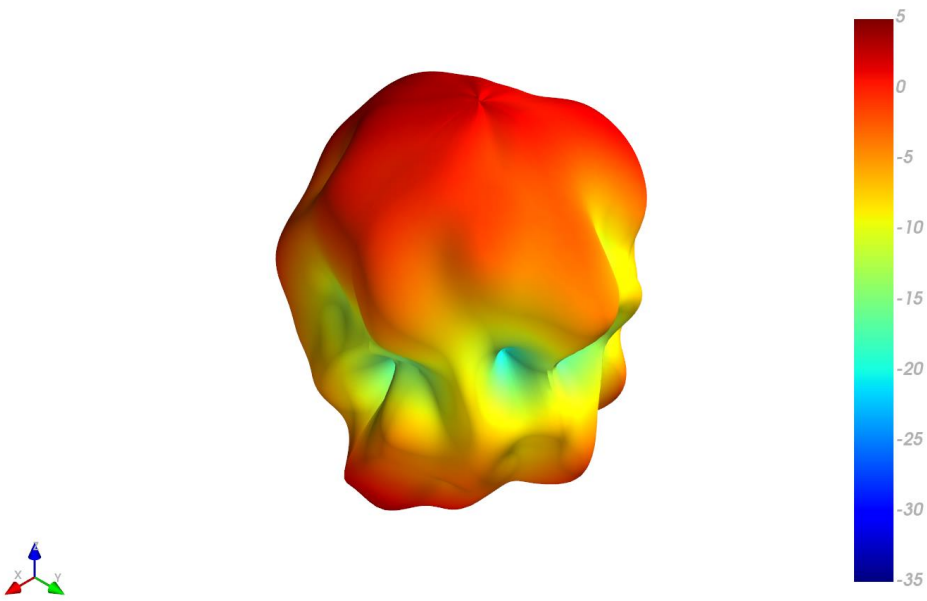
XZ Plane



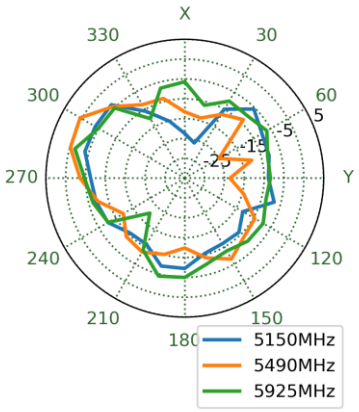
YZ Plane

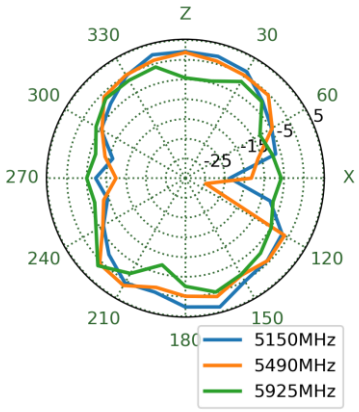


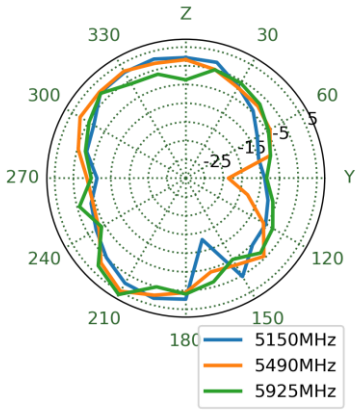
5490MHz



XY Plane	XZ Plane	YZ Plane

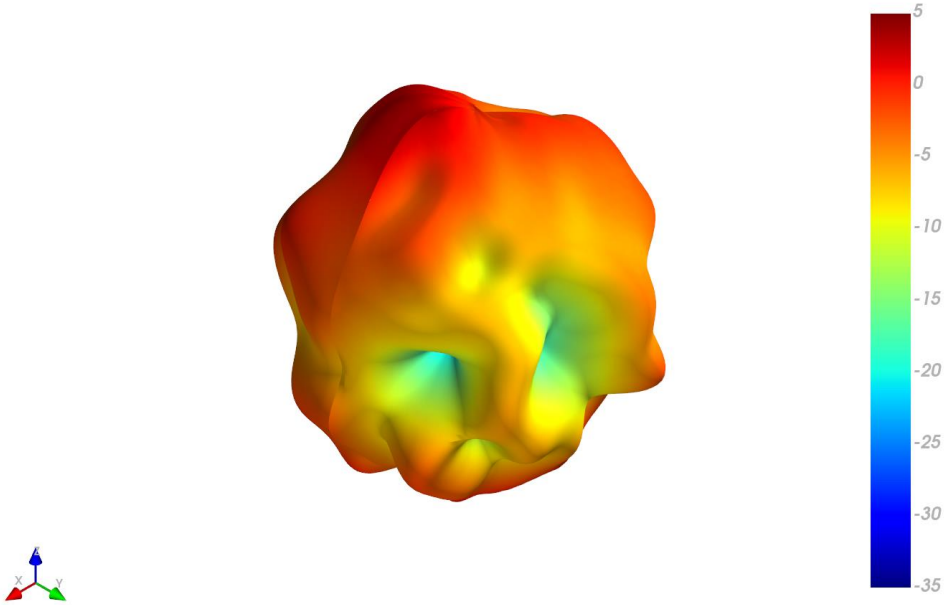




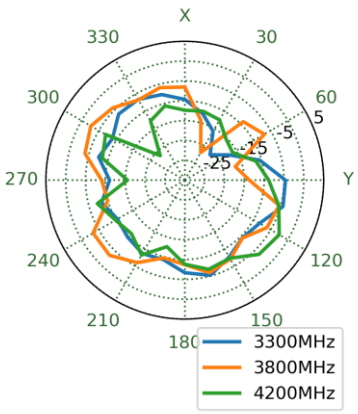


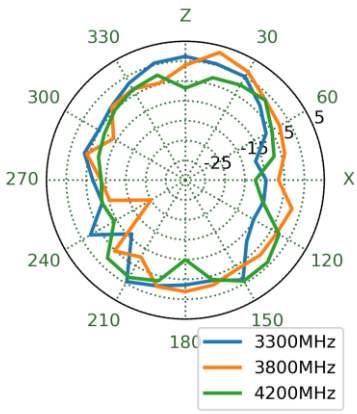
4.9 4G/5G – Ant6 3D and 2D Radiation Patterns

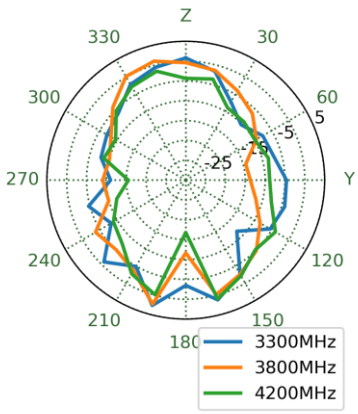
3800MHz



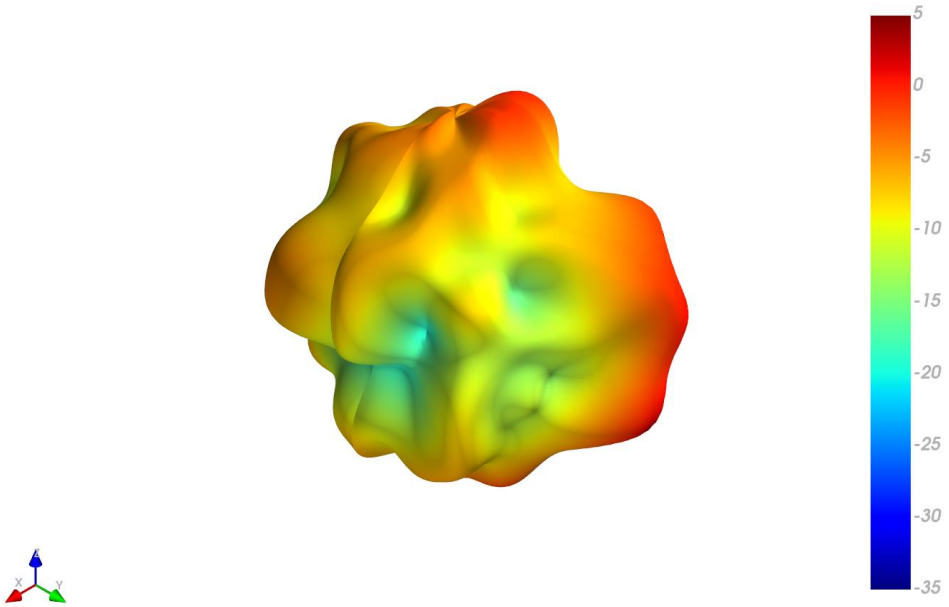
XY Plane	XZ Plane	YZ Plane



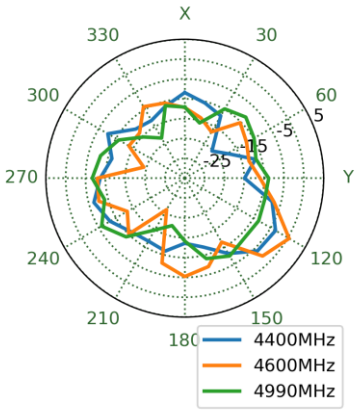




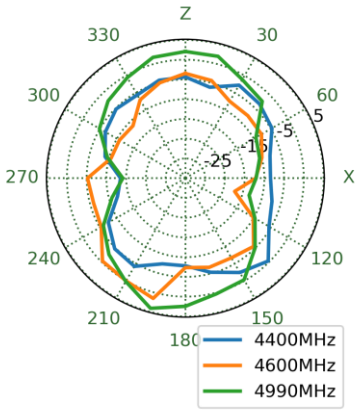
4600MHz



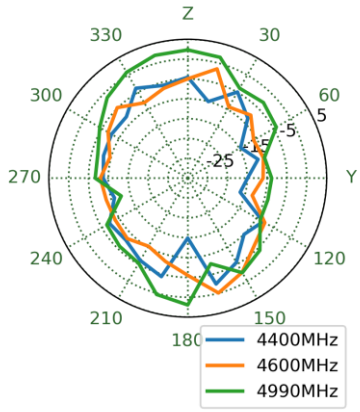
XY Plane



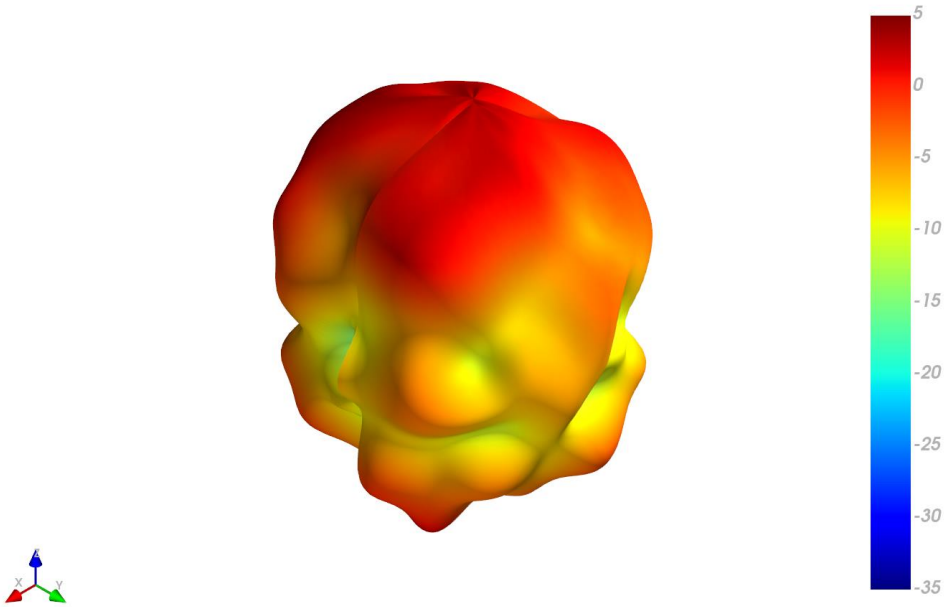
XZ Plane



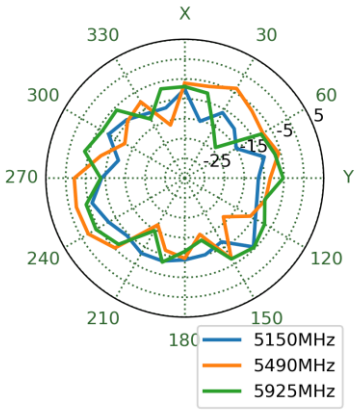
YZ Plane

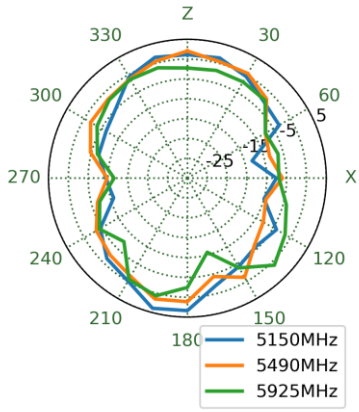


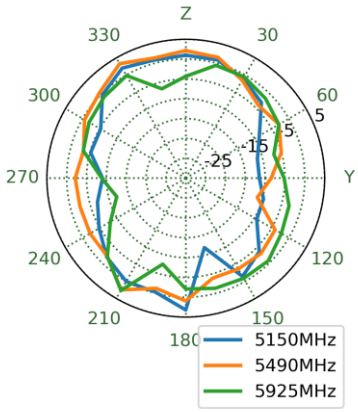
5490MHz



XY Plane	XZ Plane	YZ Plane

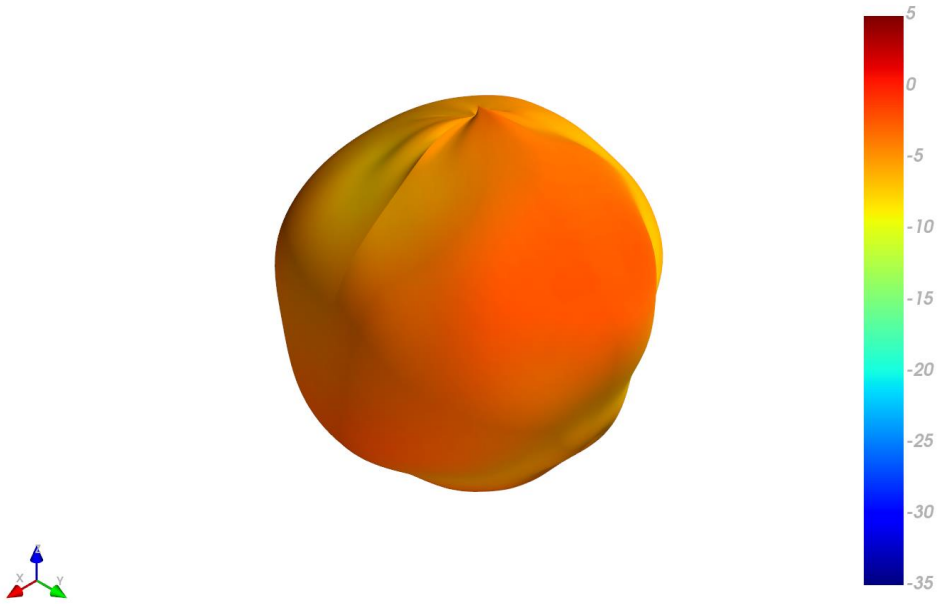


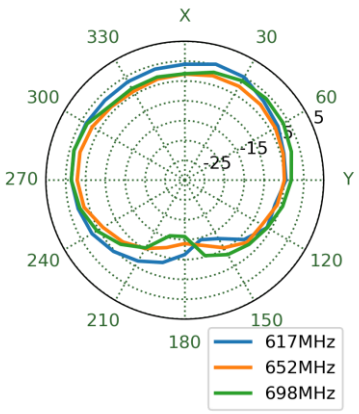
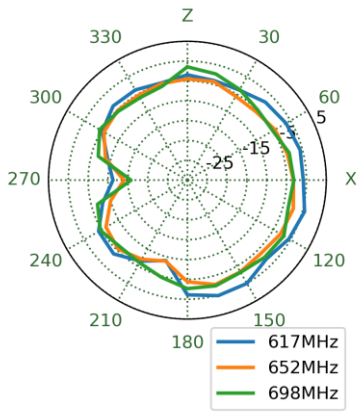
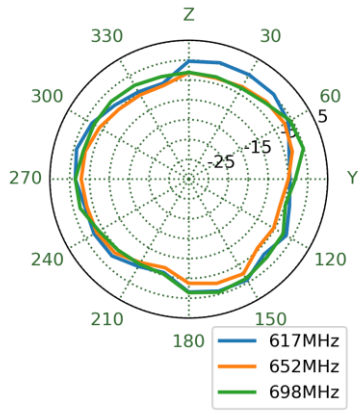




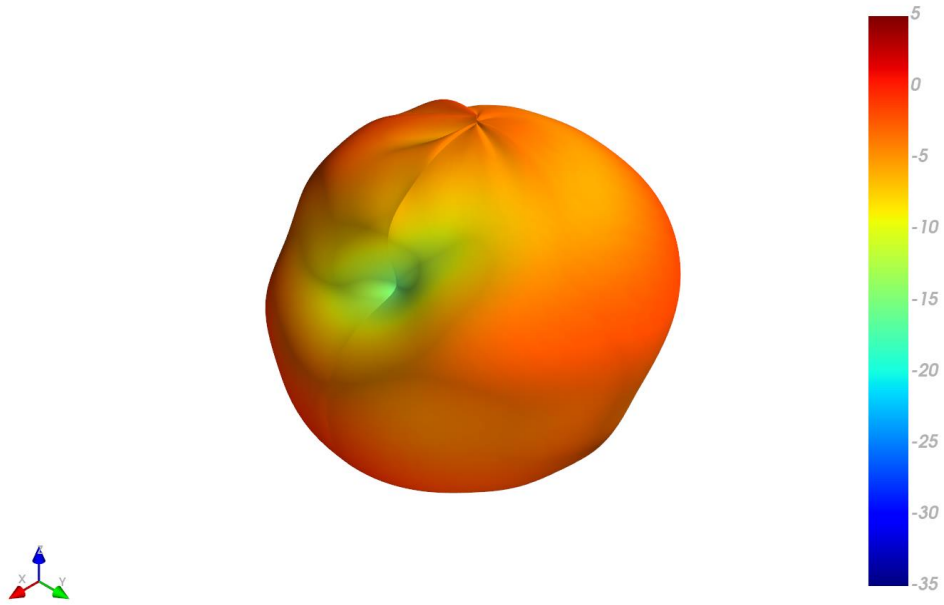
4.10 4G/5G – Ant4 3D and 2D Radiation Patterns

652MHz

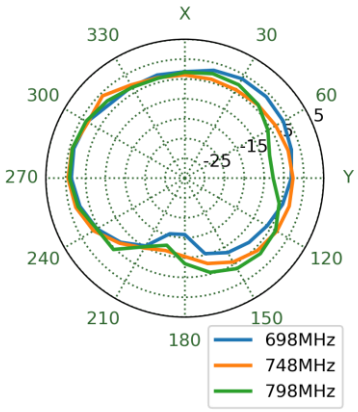


XY Plane	XZ Plane	YZ Plane
		

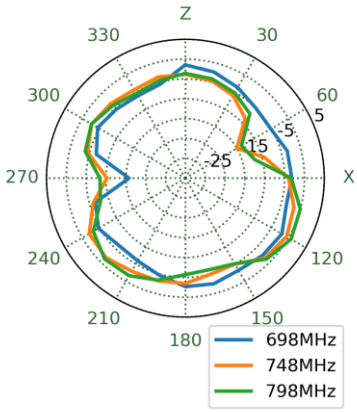
748MHz



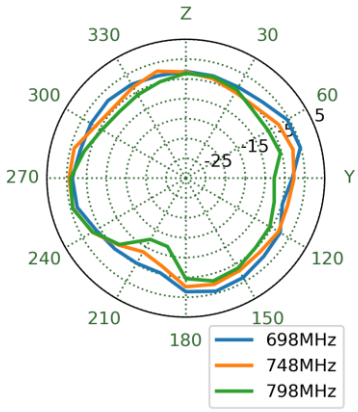
XY Plane



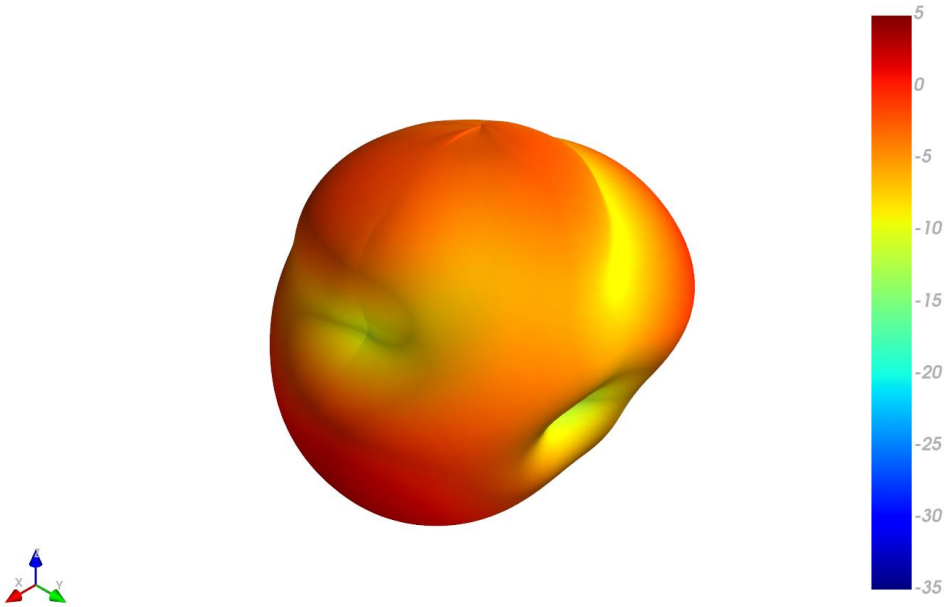
XZ Plane



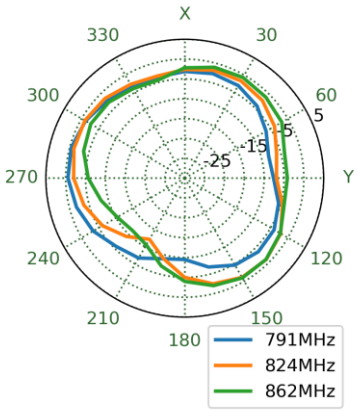
YZ Plane



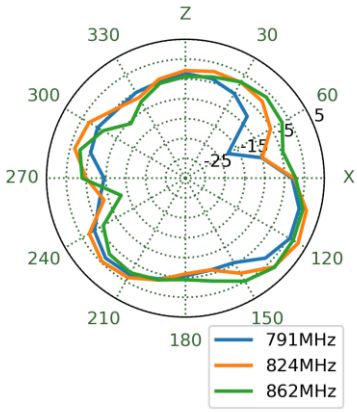
824MHz



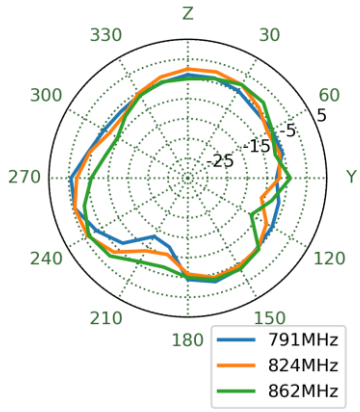
XY Plane



XZ Plane



YZ Plane



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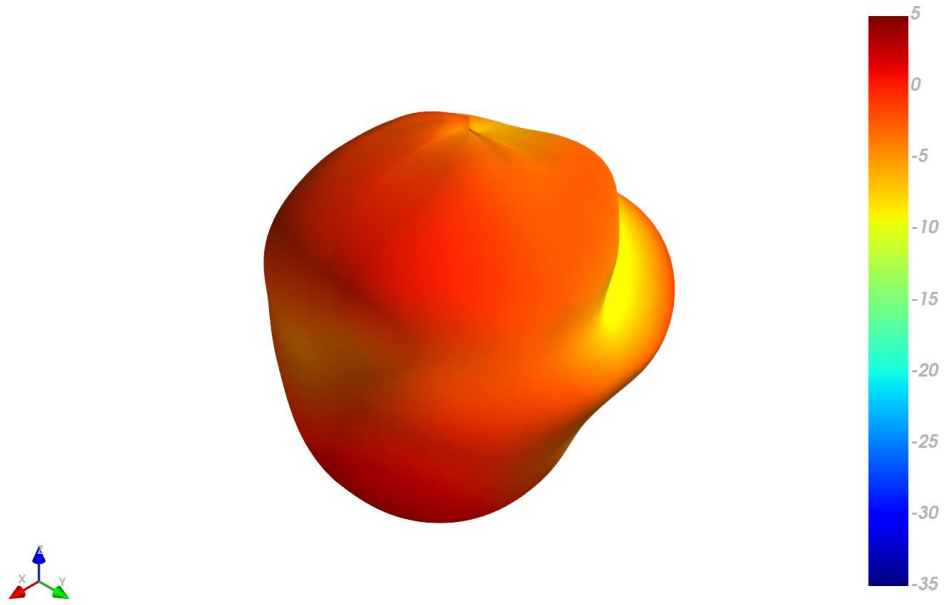
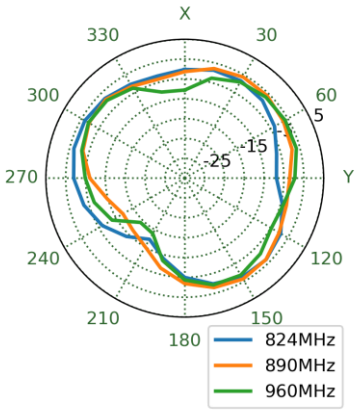
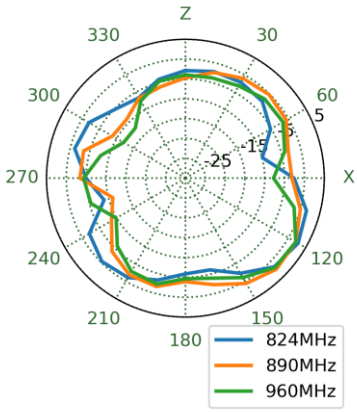


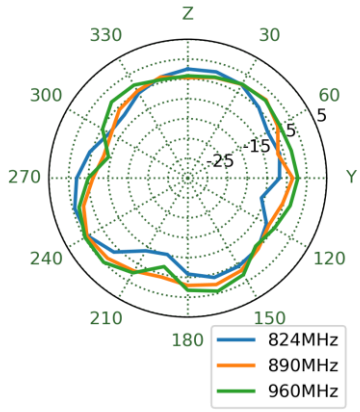
XY Plane



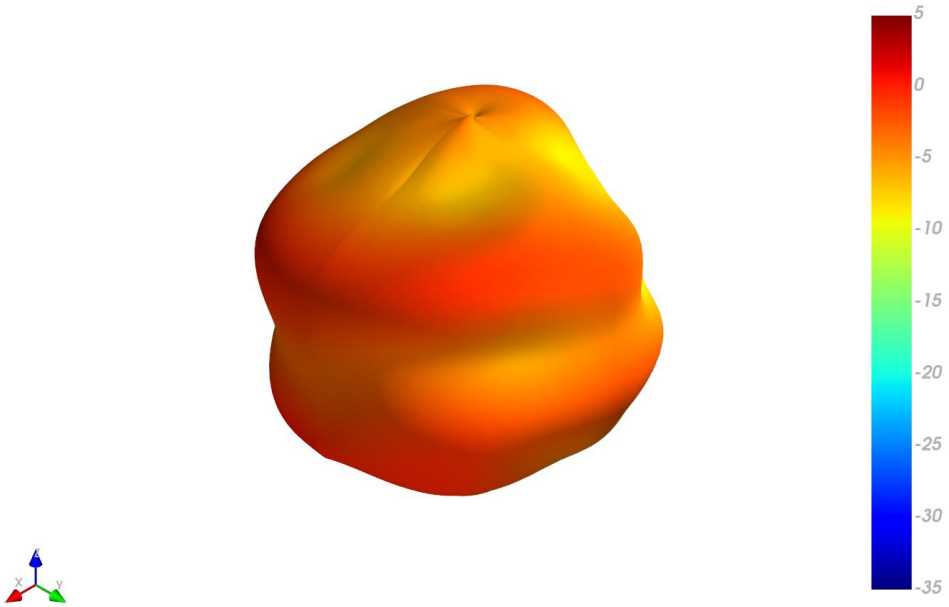
XZ Plane



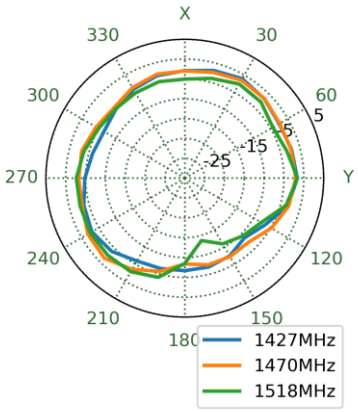
YZ Plane



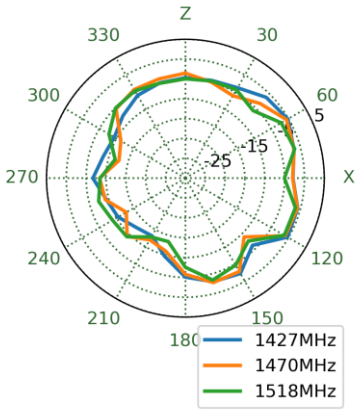
1470MHz



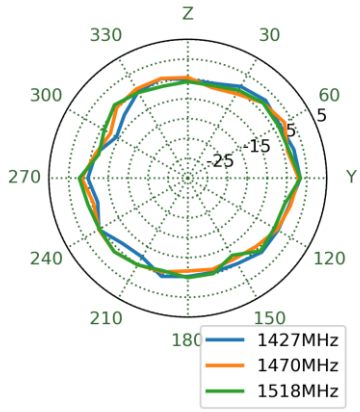
XY Plane



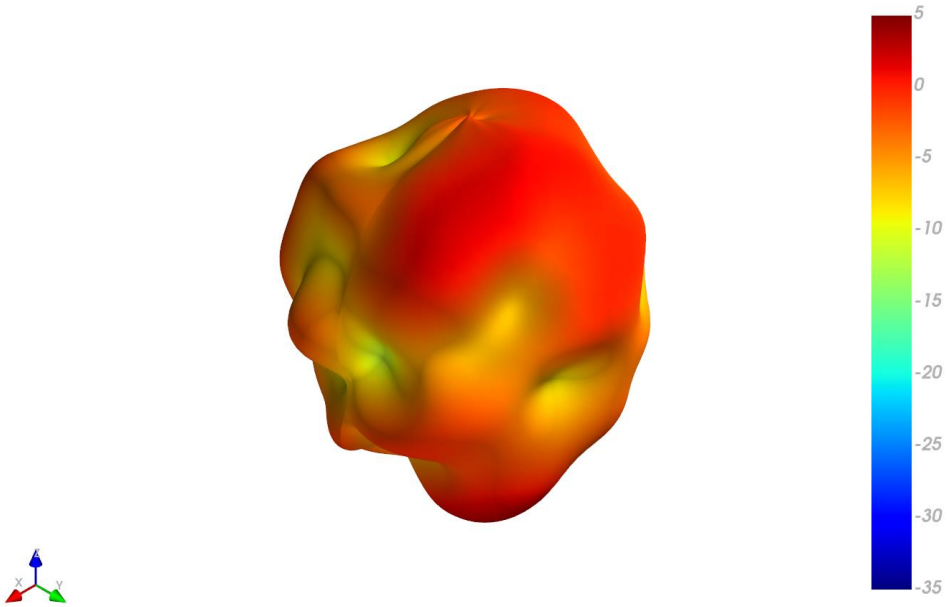
XZ Plane



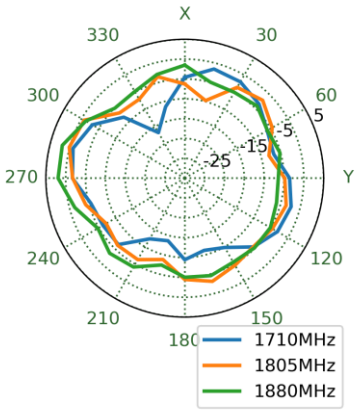
YZ Plane

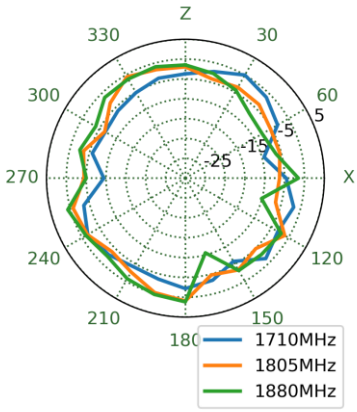


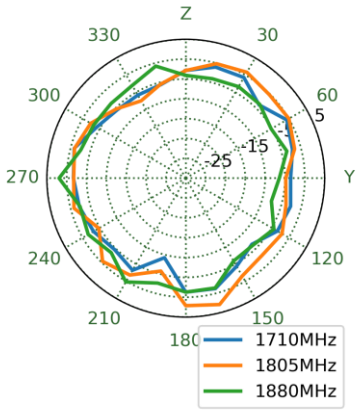
1805MHz



XY Plane	XZ Plane	YZ Plane







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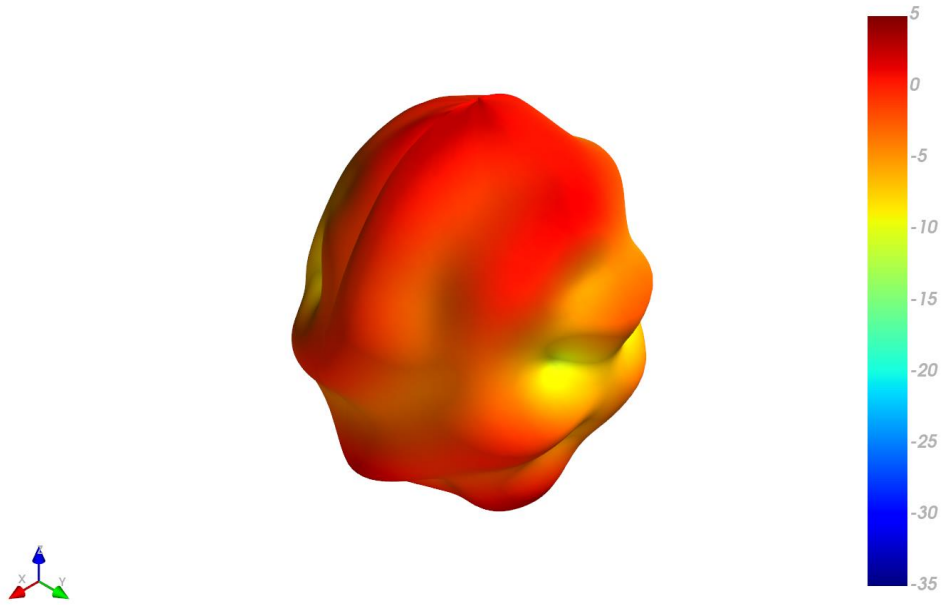
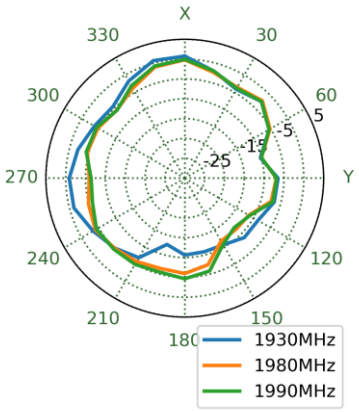


XY Plane



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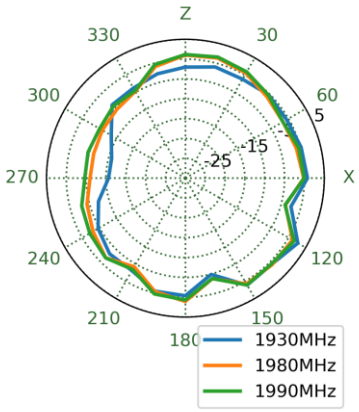
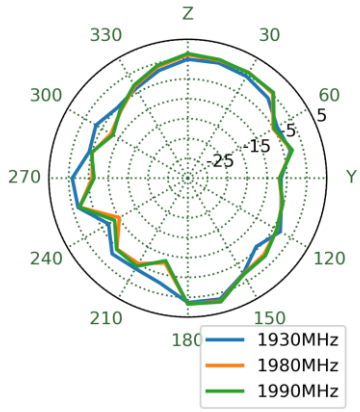
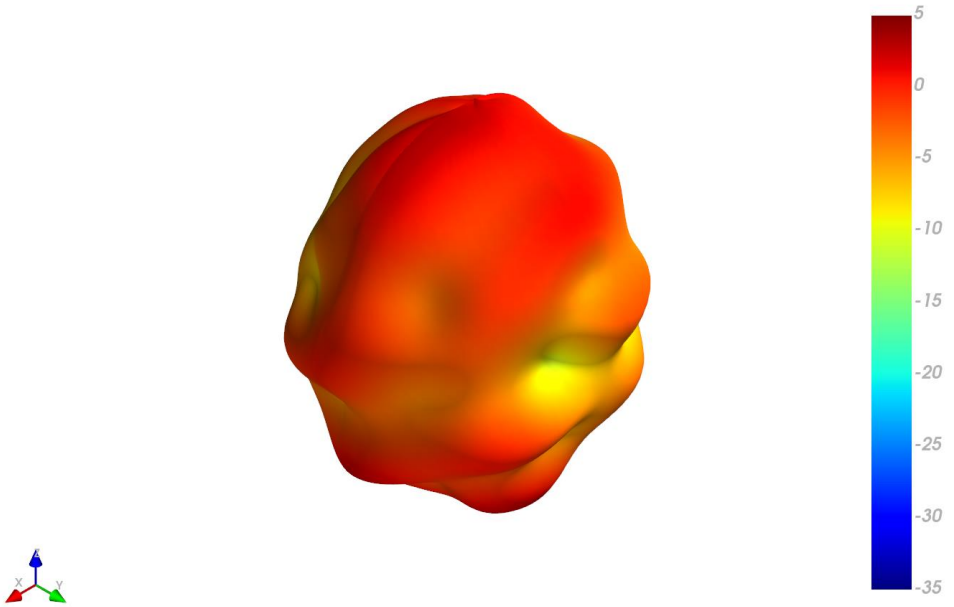


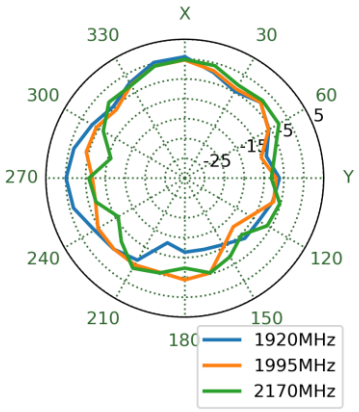
YZ Plane



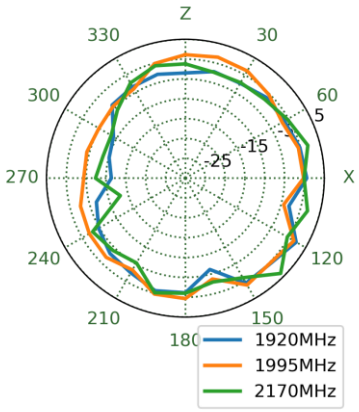
1995MHz



XY Plane



XZ Plane



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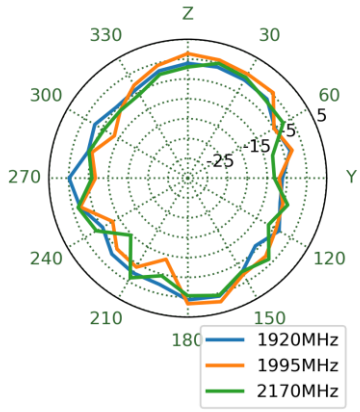

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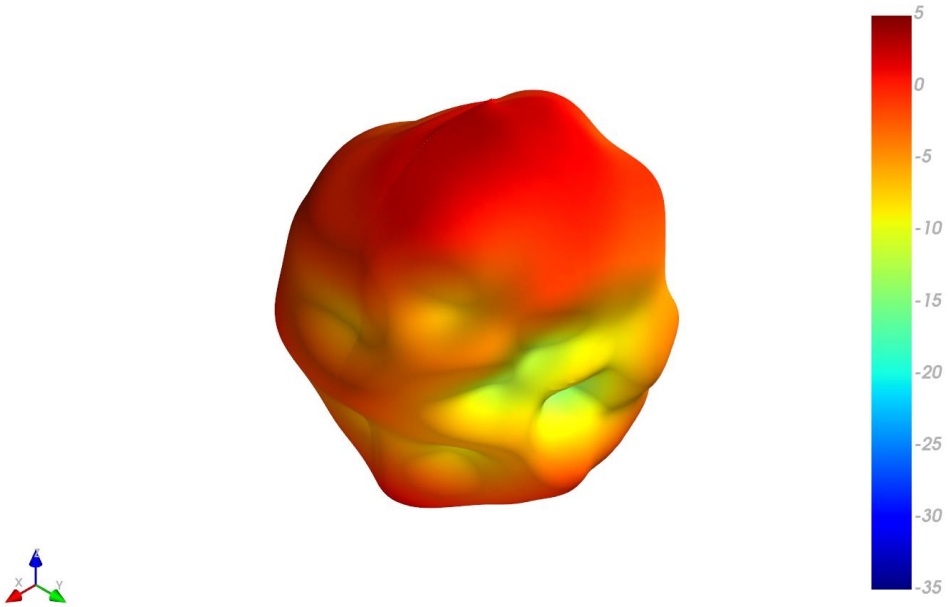
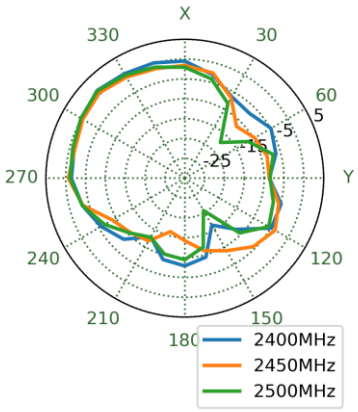
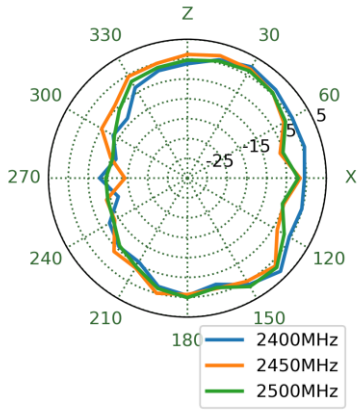
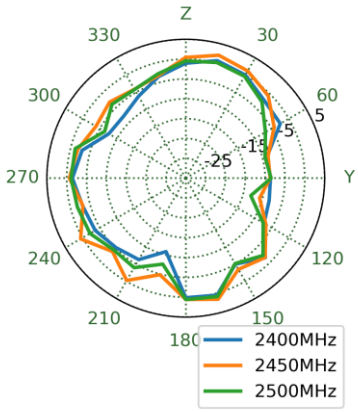


XY Plane	XZ Plane	YZ Plane







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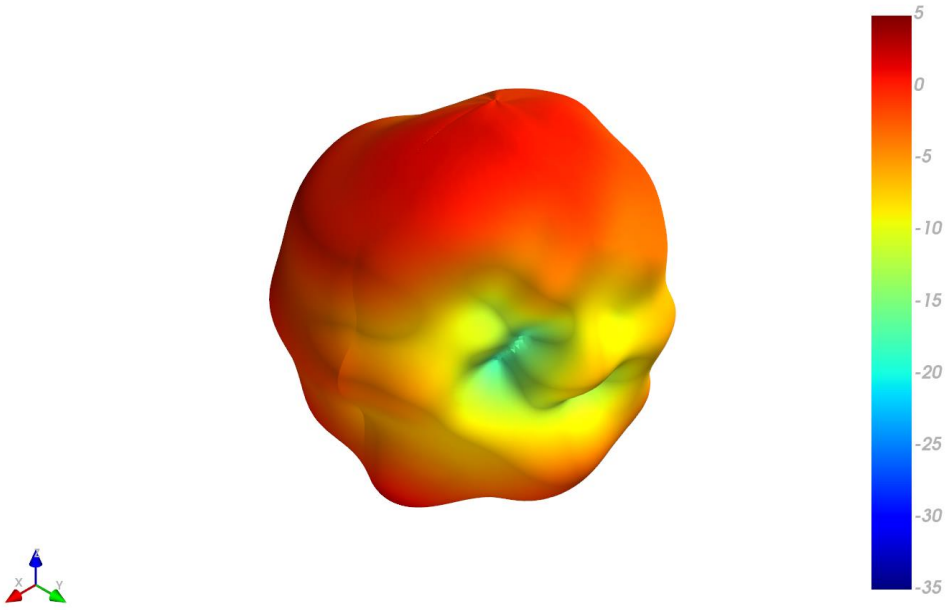
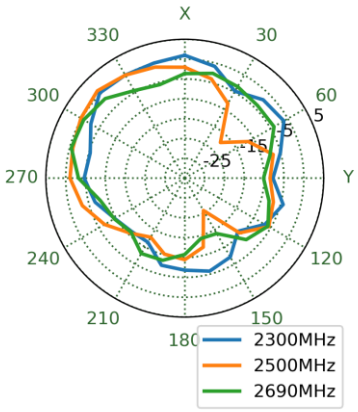
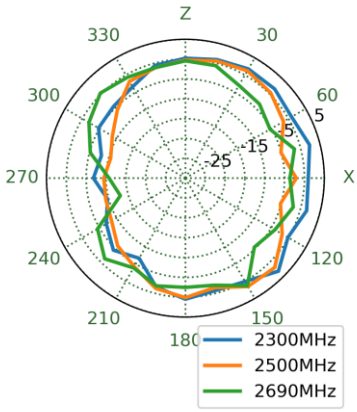
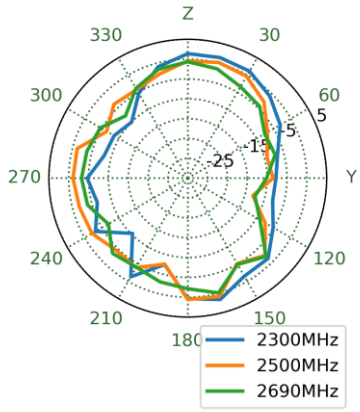


XY Plane	XZ Plane	YZ Plane
		

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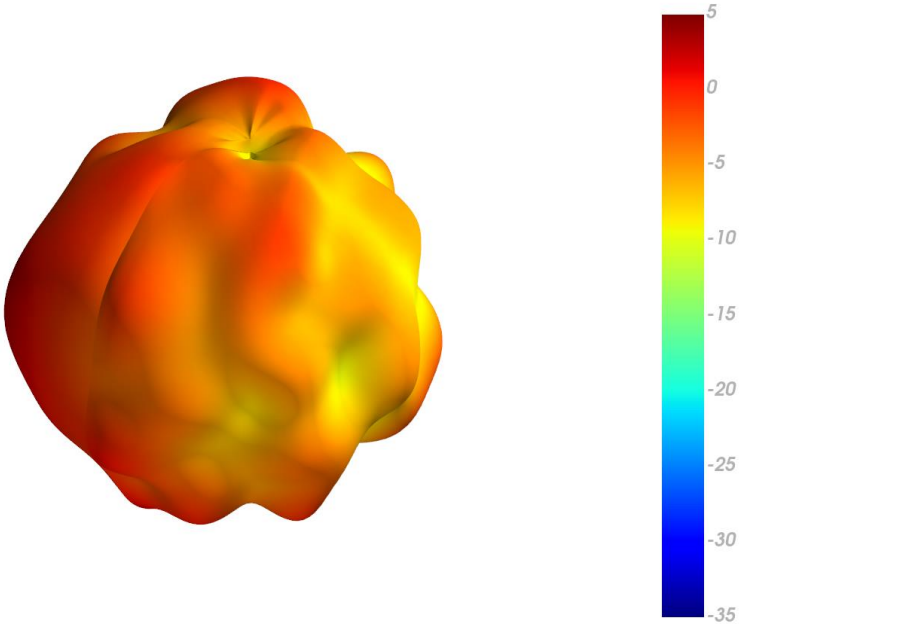
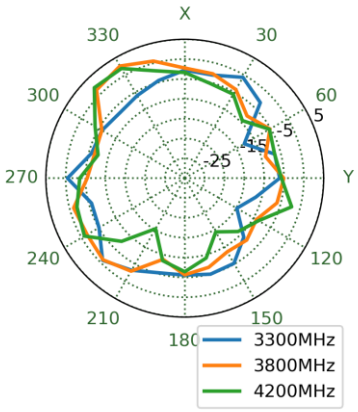
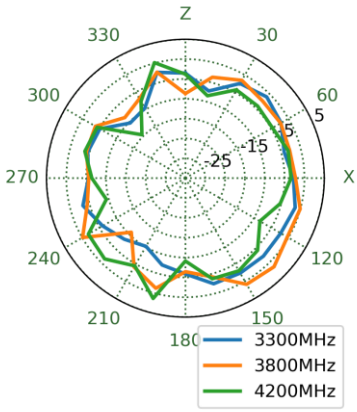
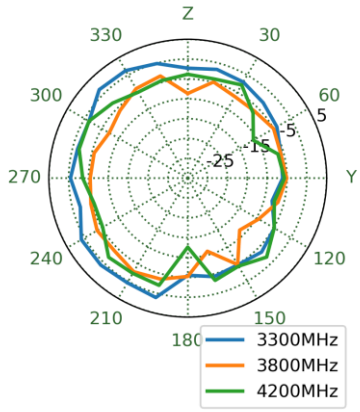


XY Plane	XZ Plane	YZ Plane
		

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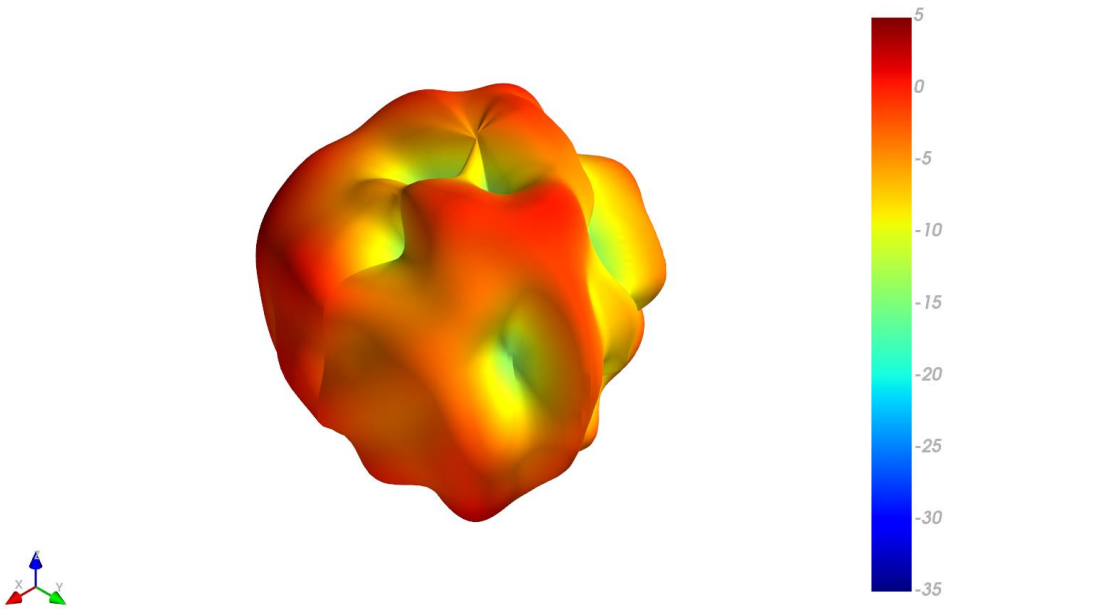
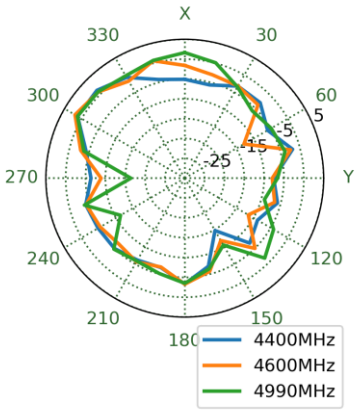
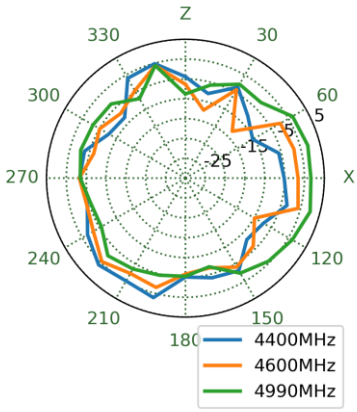
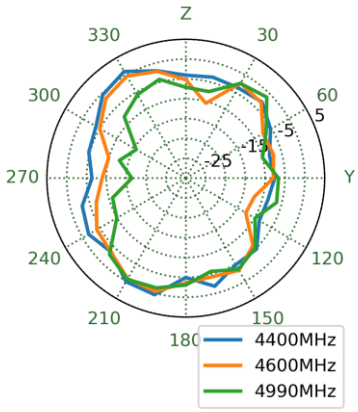


XY Plane	XZ Plane	YZ Plane







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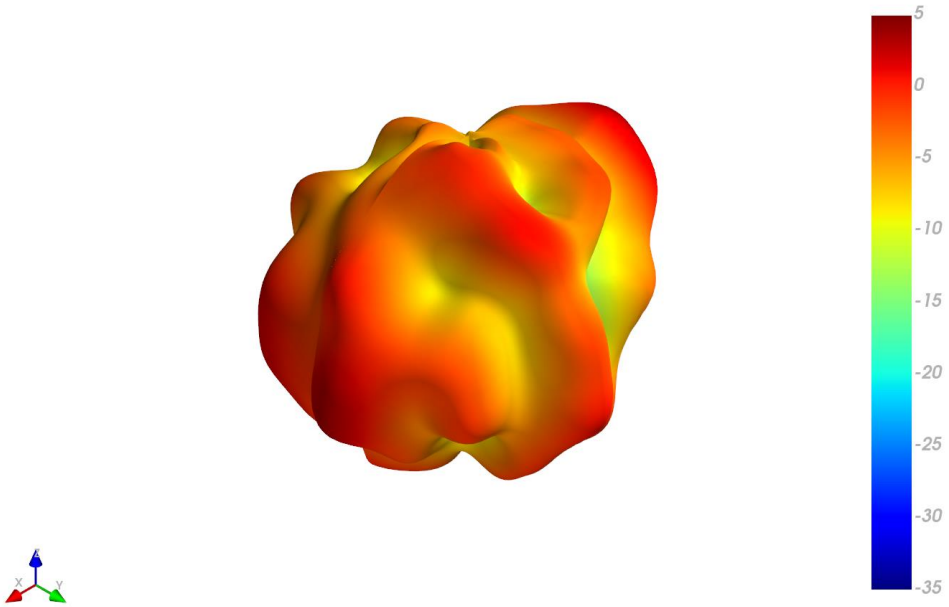
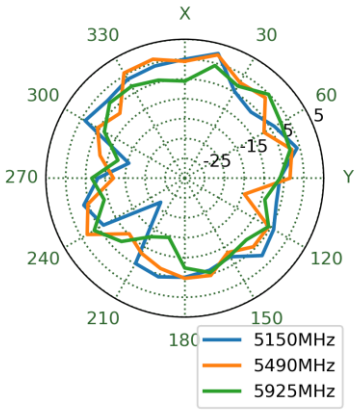
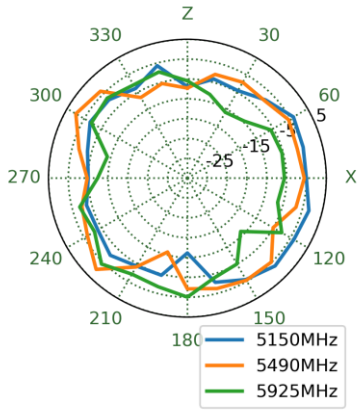
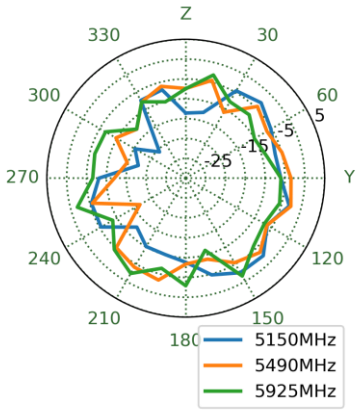


XY Plane	XZ Plane	YZ Plane

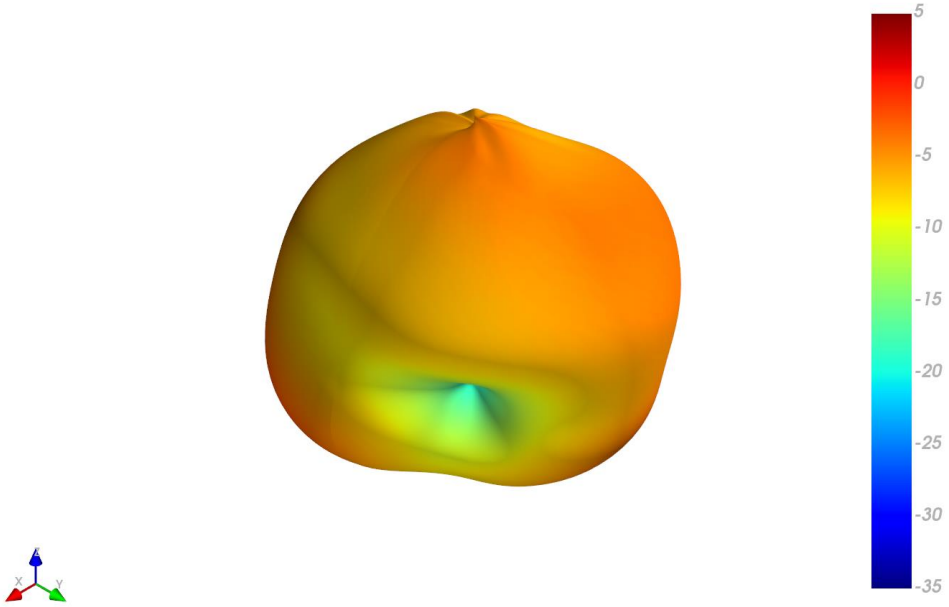




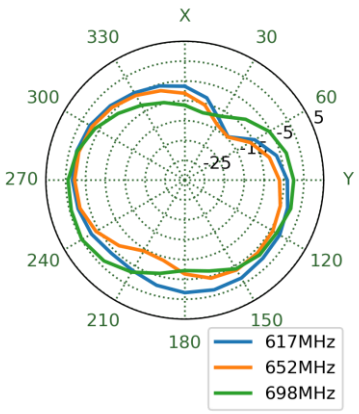


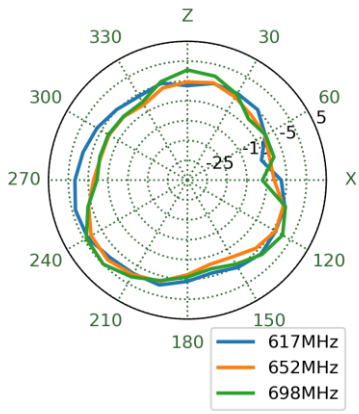
4.11 4G/5G – Ant5 3D and 2D Radiation Patterns

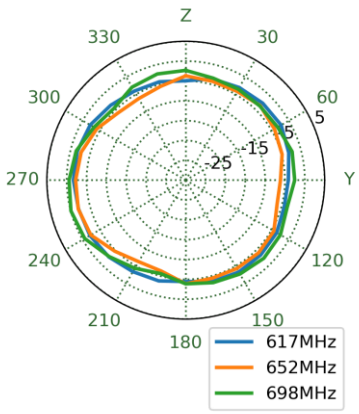
652MHz



XY Plane	XZ Plane	YZ Plane







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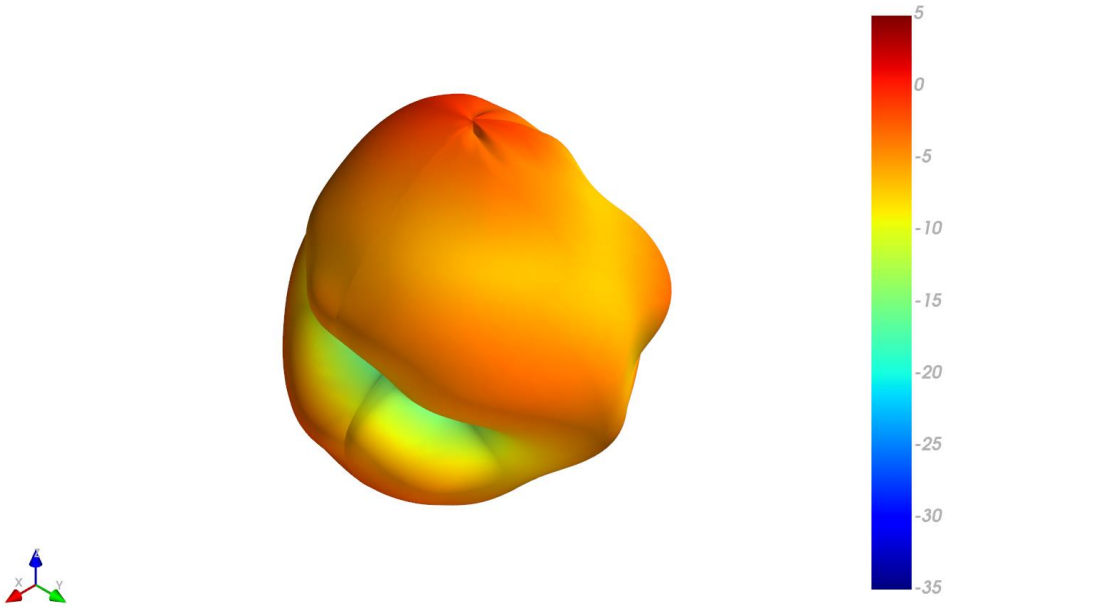
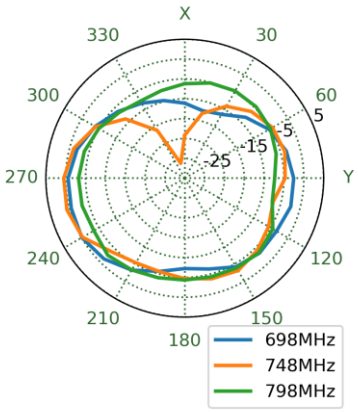
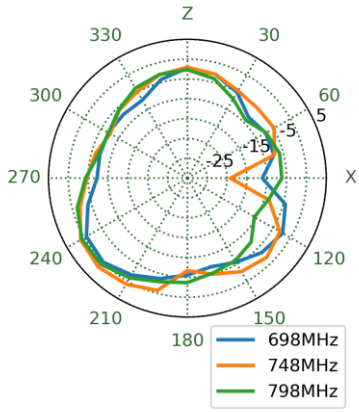
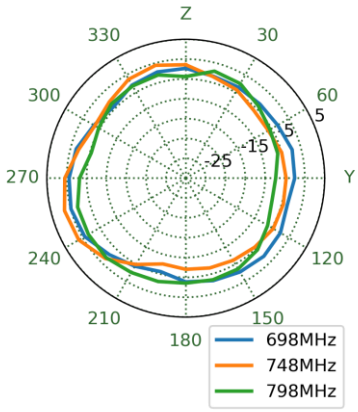


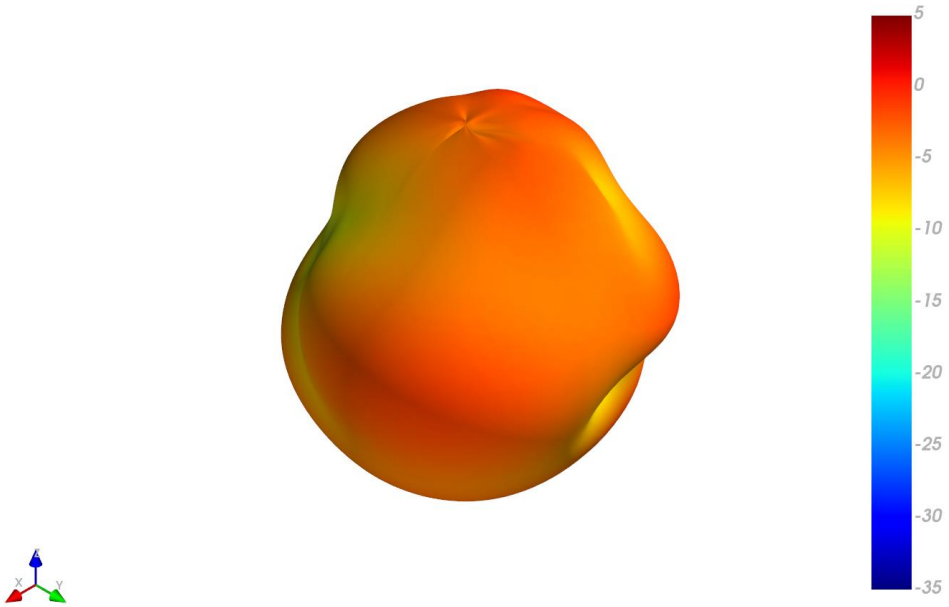
XY Plane	XZ Plane	YZ Plane

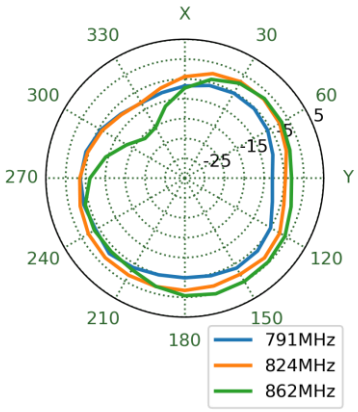
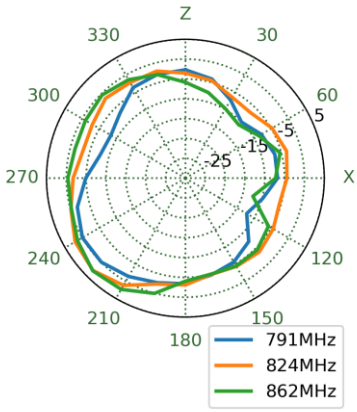
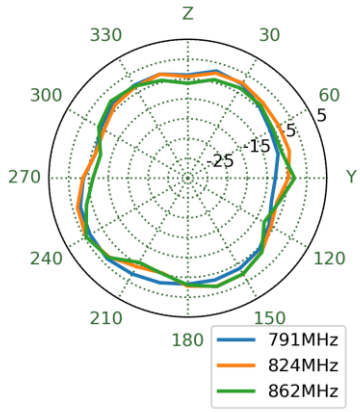






824MHz



XY Plane	XZ Plane	YZ Plane
		

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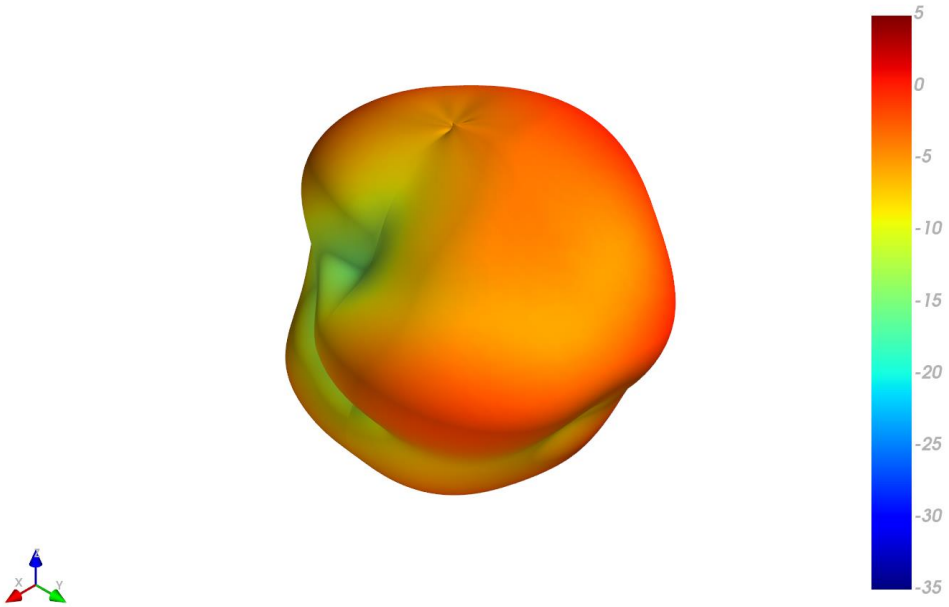
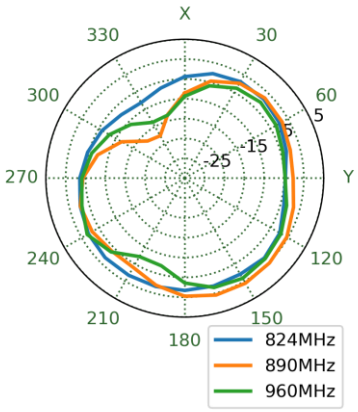


XY Plane



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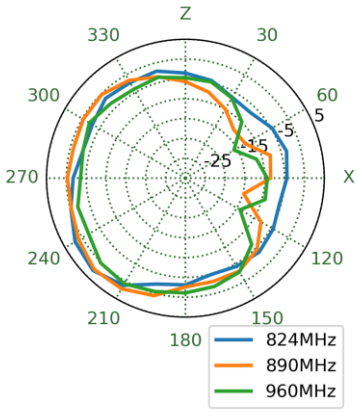
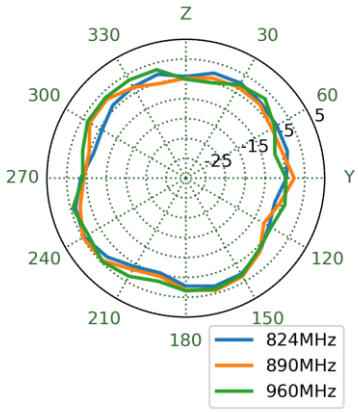


YZ Plane



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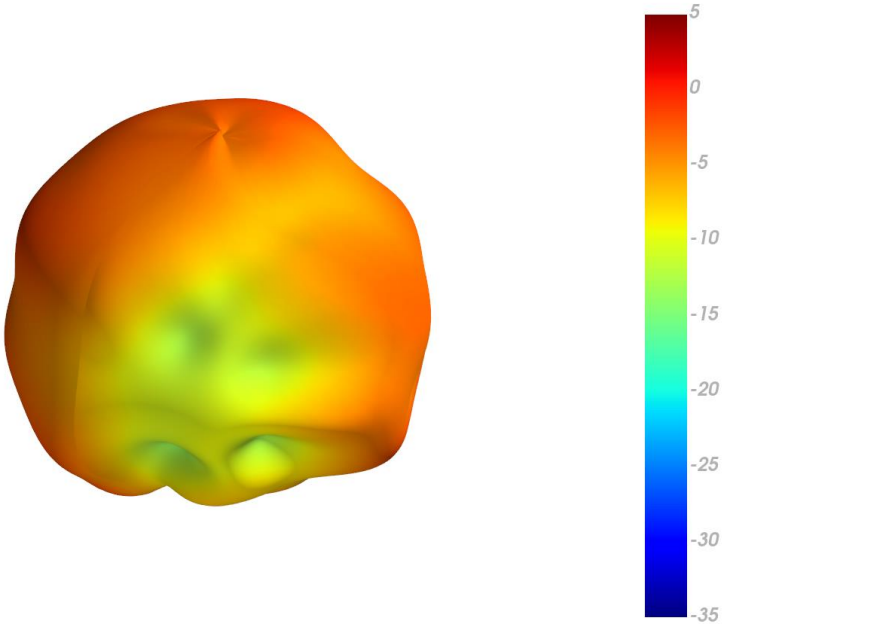
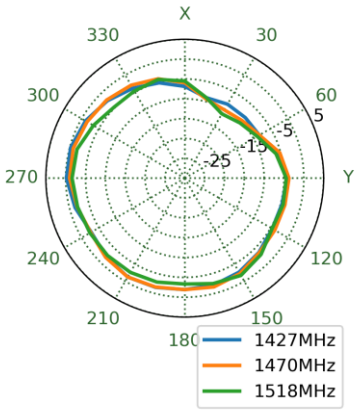
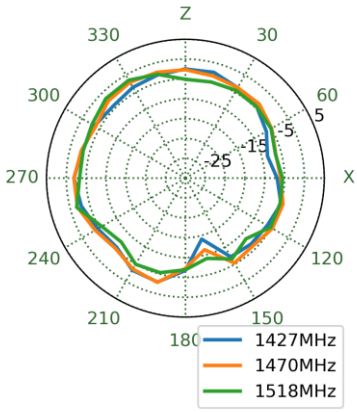
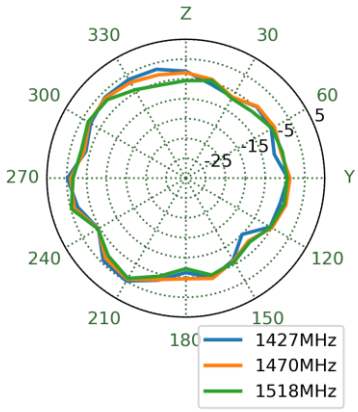


XY Plane	XZ Plane	YZ Plane







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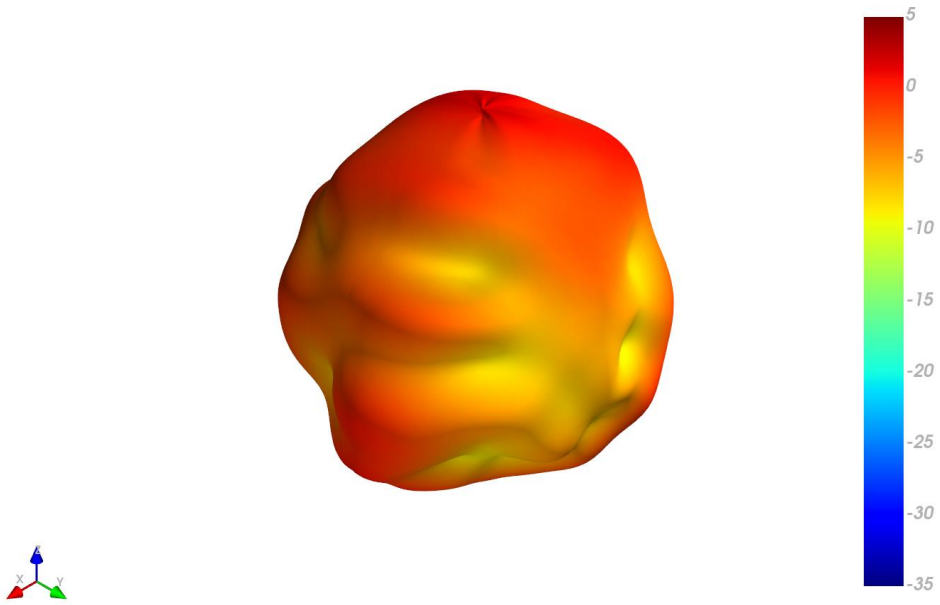
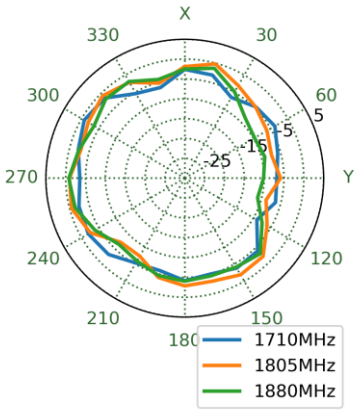
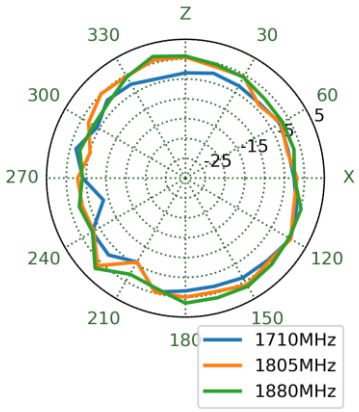


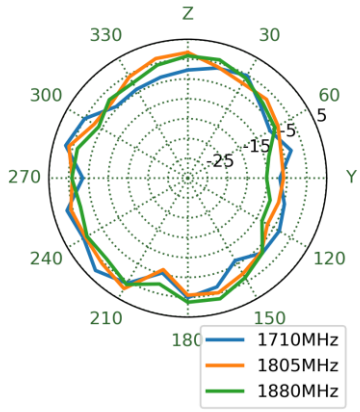
XY Plane



XZ Plane



YZ Plane



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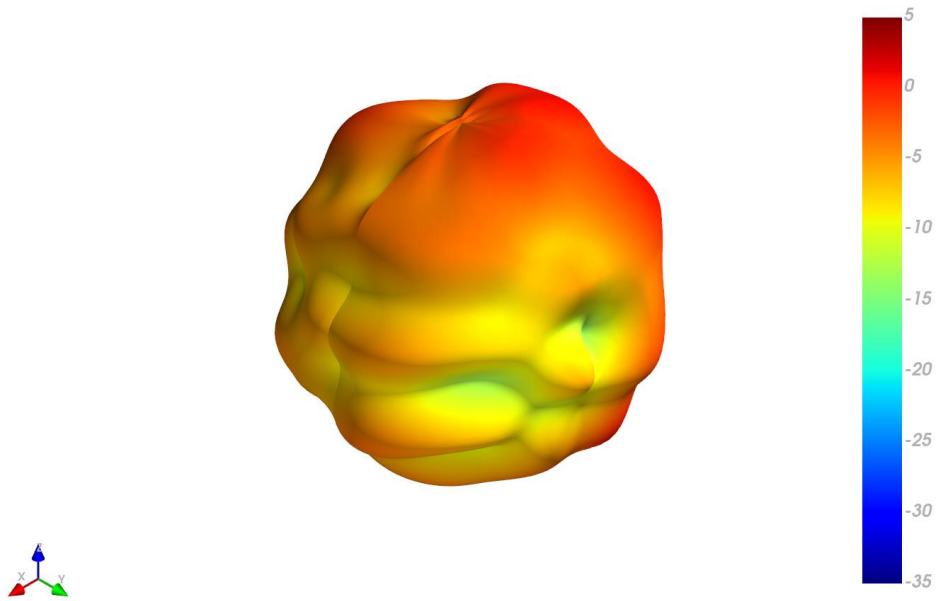

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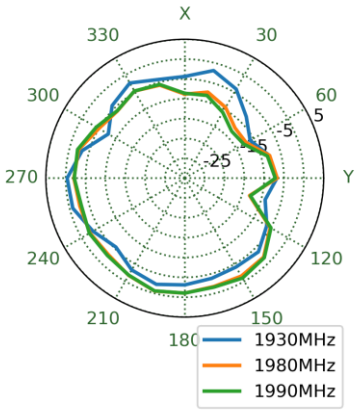

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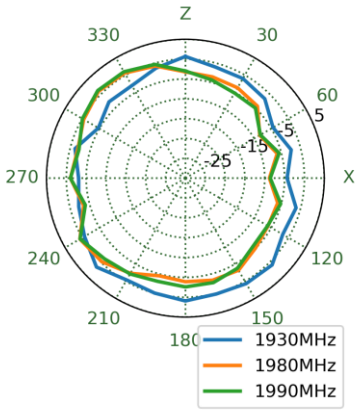

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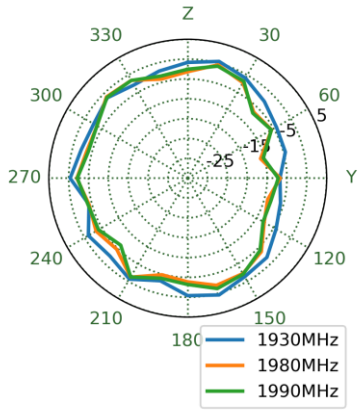

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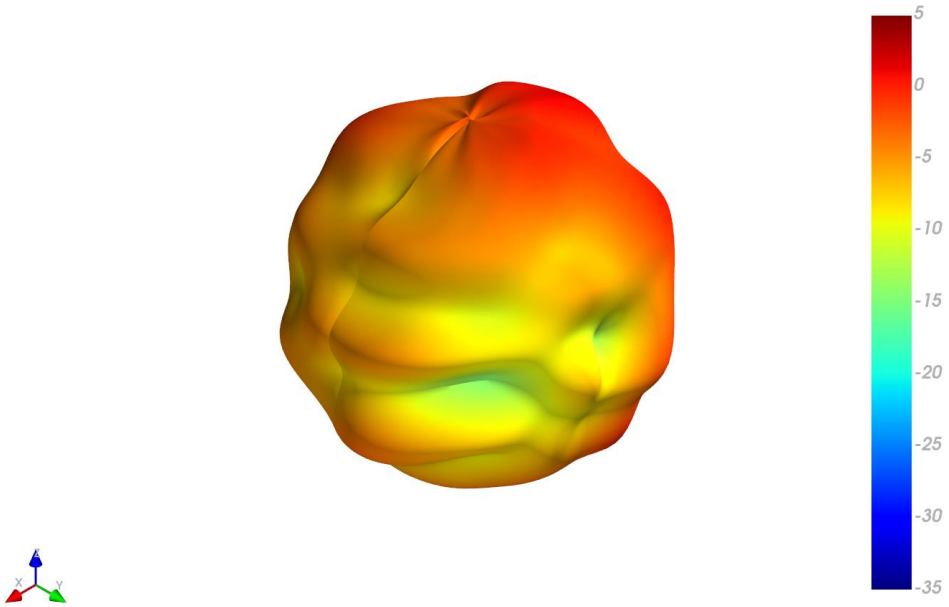

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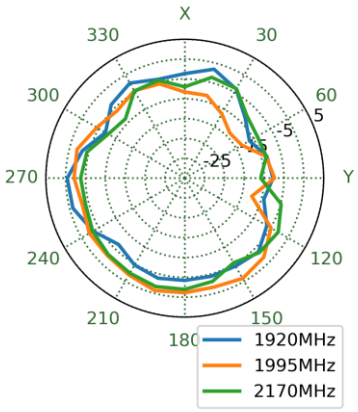
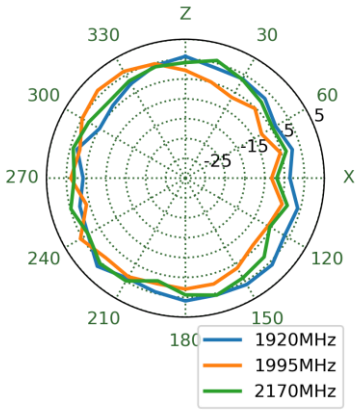
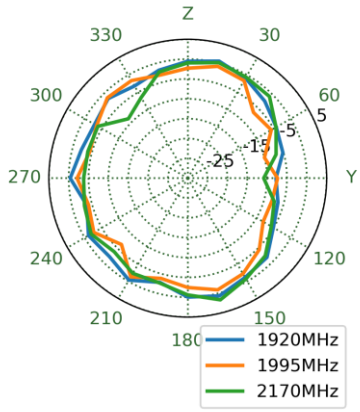


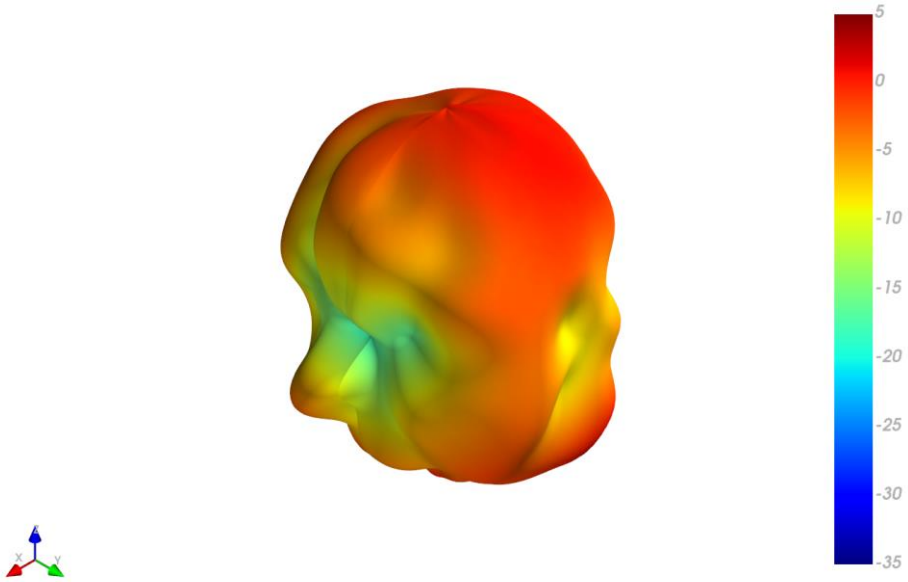
XZ Plane



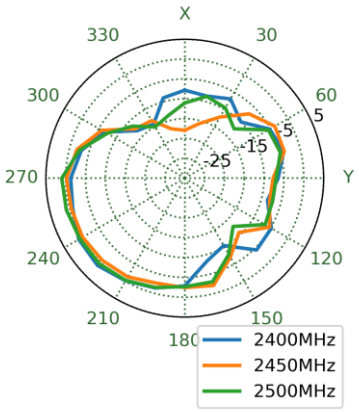
YZ Plane



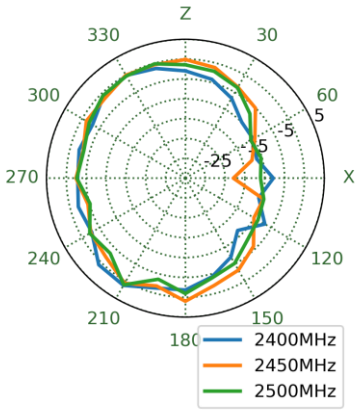
2450MHz



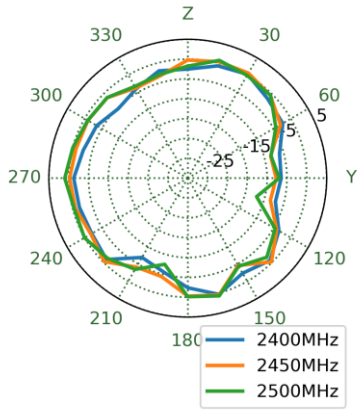
XY Plane



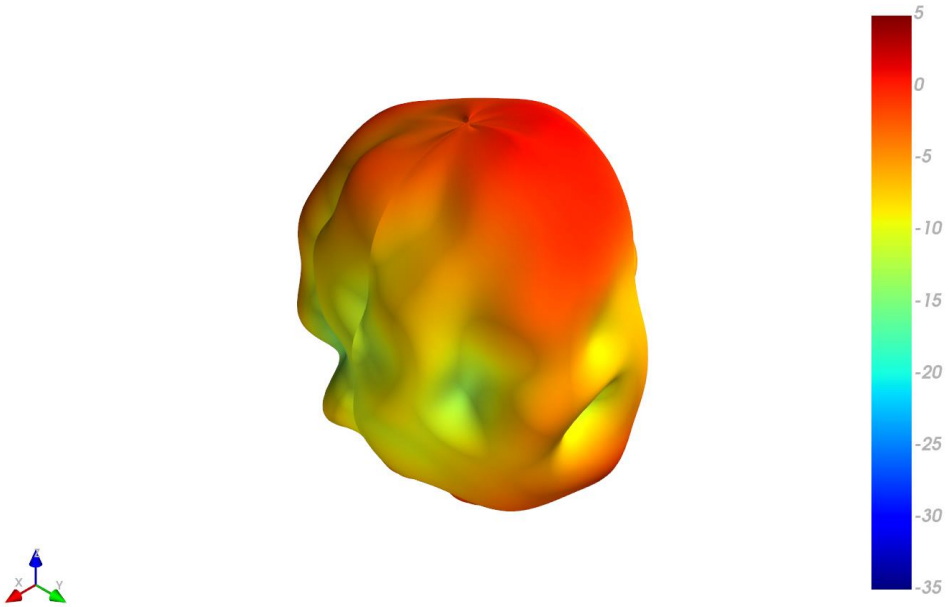
XZ Plane



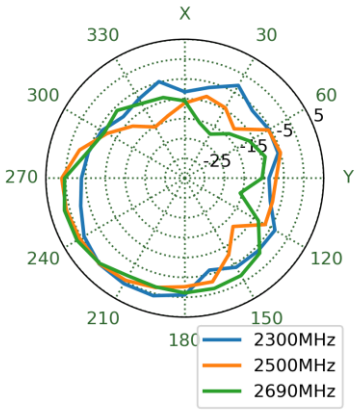
YZ Plane

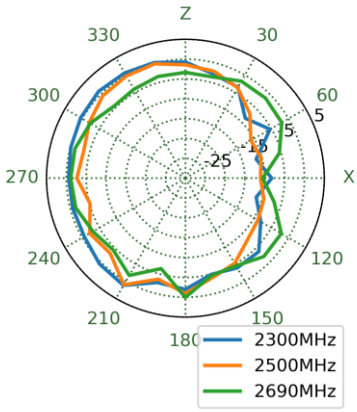


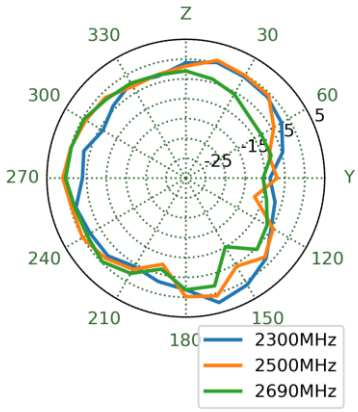
2500MHz



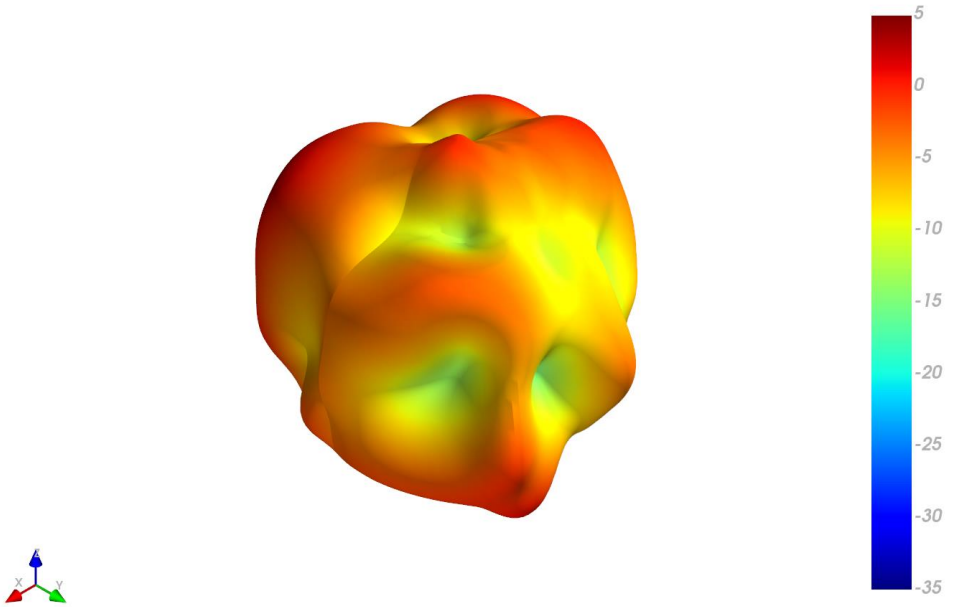
XY Plane	XZ Plane	YZ Plane



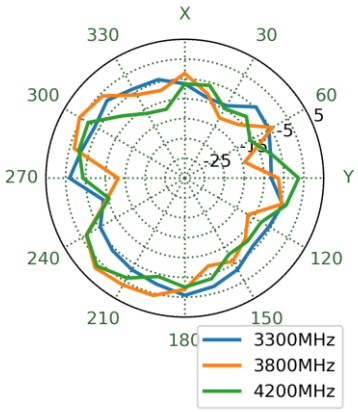


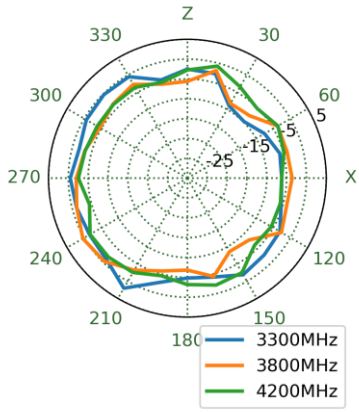


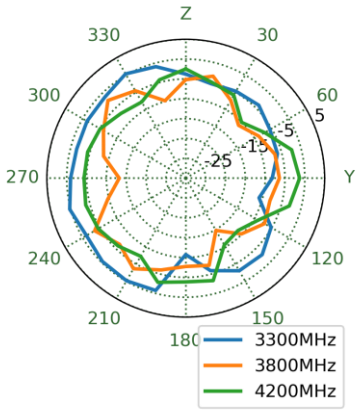
3800MHz



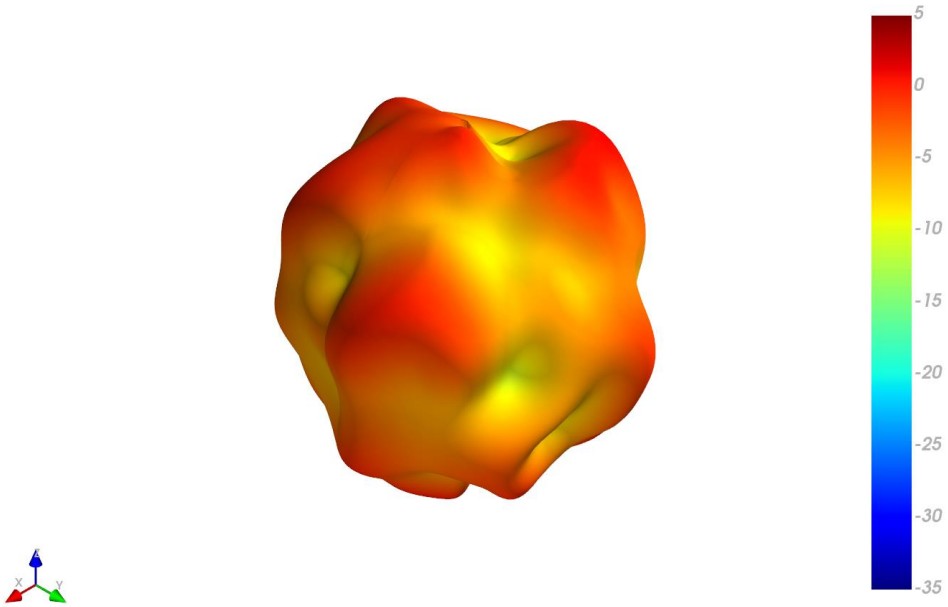
XY Plane	XZ Plane	YZ Plane



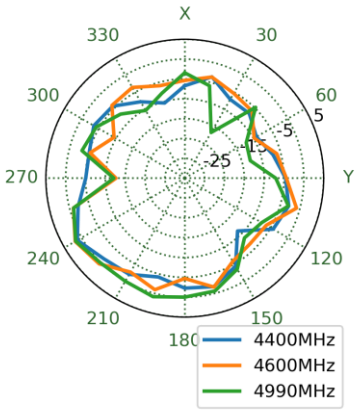




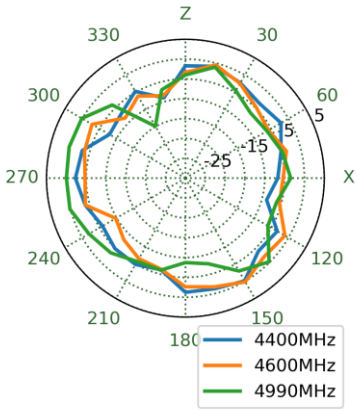
4600MHz



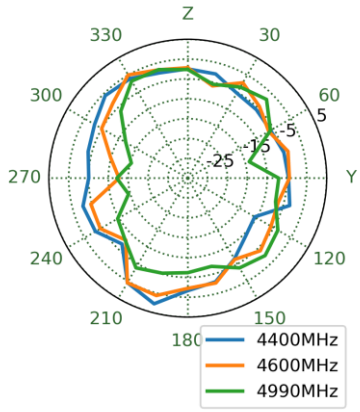
XY Plane



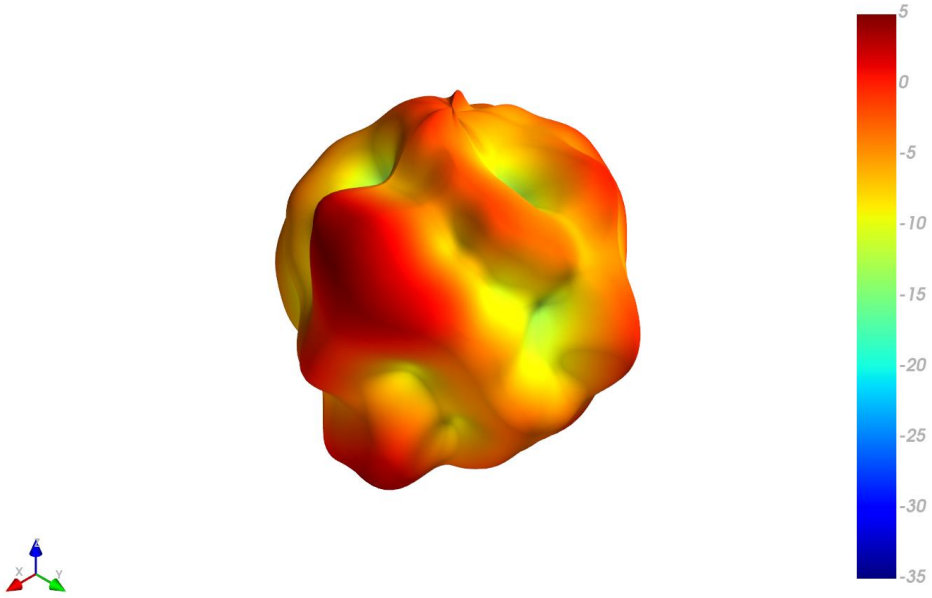
XZ Plane

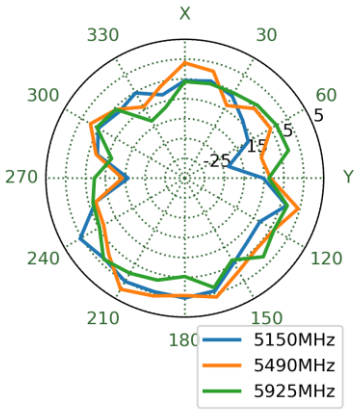
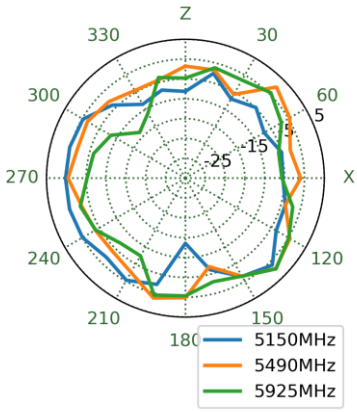
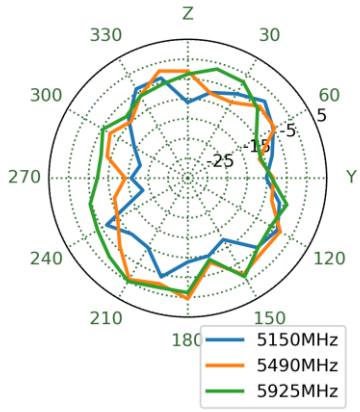


YZ Plane

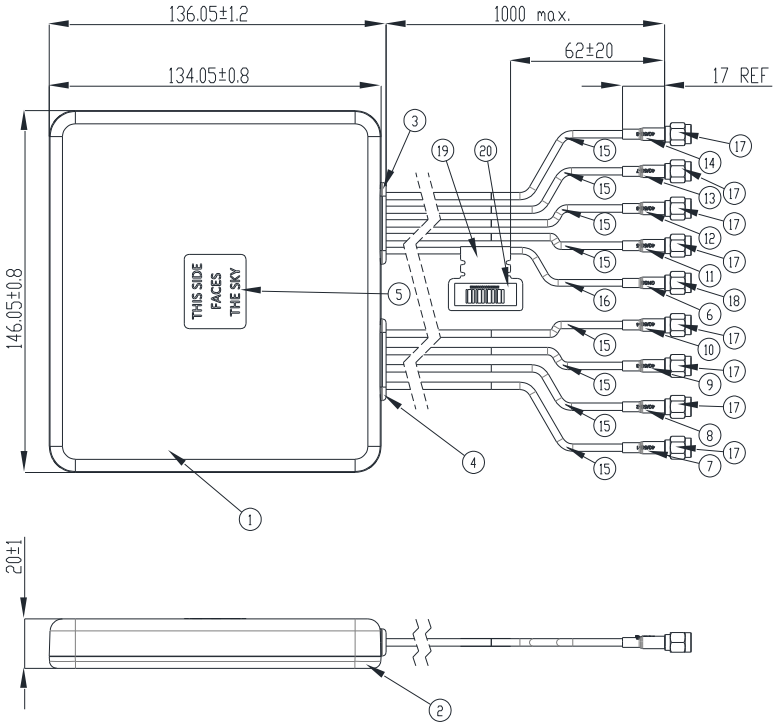


5490MHz

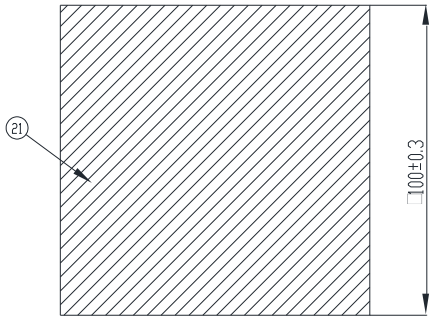


XY Plane	XZ Plane	YZ Plane
		

5. Mechanical Drawing (Units: mm)

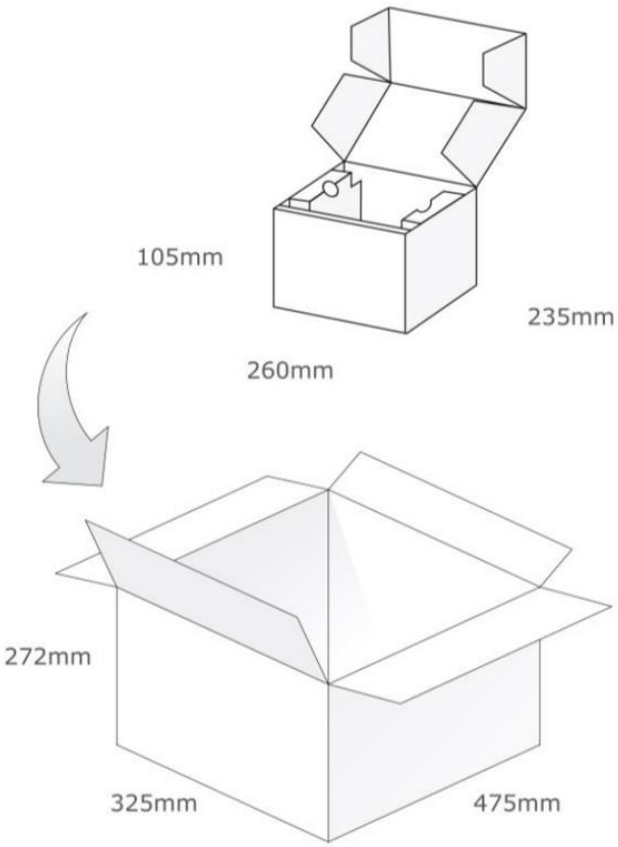


	Name	P/N	Material	Finish	QTY
1	Top housing	000116B000000A	ASA(PW-978B)	Black	1
2	Bottom housing	000116B010000A	ASA(PW-978B)	Black	1
3	Rubber (5 Holes)	000721A070000A	Silicone Rubber	Black	1
4	Rubber (4 Holes)	000721B000000A	Silicone Rubber	Black	1
5	Clear Label	001015H040000A	PET	Transparent	1
6	Heat Shrink Tube(GNSS)	001316C000000A	PE	Blue Tube/White Text	1
7	Heat Shrink Tube(4G/5G-1)	001319G000000A	PE	Red Tube/White Text	1
8	Heat Shrink Tube(4G/5G-2)	001319G010000A	PE	Red Tube/White Text	1
9	Heat Shrink Tube(4G/5G-3)	001319G020000A	PE	Red Tube/White Text	1
10	Heat Shrink Tube(4G/5G-4)	001319G030000A	PE	Red Tube/White Text	1
11	Heat Shrink Tube(4G/5G-5)	001319G040000A	PE	Red Tube/White Text	1
12	Heat Shrink Tube(4G/5G-6)	001319G110000A	PE	Red Tube/White Text	1
13	Heat Shrink Tube(4G/5G-7)	001321A000000A	PE	Red Tube/White Text	1
14	Heat Shrink Tube(4G/5G-8)	001321A010000A	PE	Red Tube/White Text	1
15	TGC-1.5DS Cable	301319I010000A	PE	Black	8
16	RG174 Cable	301315C000000A	PVC	Black	1
17	SMA(M) ST_TCG_1.5DS	200221E00002IA	Brass	Au Plated	8
18	SMA(M) ST_RG174	200220C04001GA	Brass	Au Plated	1
19	Empty Label	001015G000000A	PEPA	White	1
20	Barcode Label	001015G010000A	PET	White	1
21	Double Sided Adhesive(Black Foam)	001019C010000A	CR4305+3M9448HK	White Liner	1



6. Packaging

1 No MA995.A.001 Per Small Box
Box Dimensions – 260*235*105mm
Weight – 1.16Kg



1 Outer Carton
Carton Dimensions – 540*490*240mm
8pcs MA995.A.001 Per Carton
Weight – 9.9Kg

Changelog for the datasheet

SPE-22-8-165 – MA995.A.001

Revision: A (Current Version)	
Date:	2023-07-25
Notes:	Updated GNSS Bands graph
Author:	Cesar Sousa

Previous Revisions

Revision: A (Original First Release)	
Date:	2022-10-19
Notes:	New Datasheet
Author:	Gary West

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