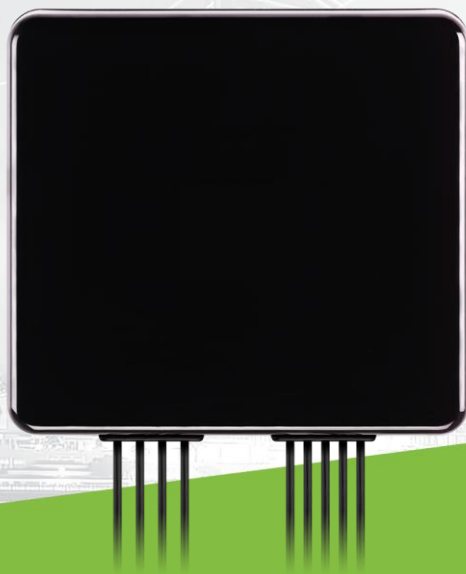




TAOGLAS®



Datasheet

9-in-1 Guardian

Part No:
MA990.A.001

Description:

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

Features:

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

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1. Introduction



The Taoglas MA990 Guardian has been designed to be the smallest 9-in-1 combination antenna in the world. The MA990 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 MA990 combines all 9 antenna elements in one low-profile heavy-duty, IP67 rated waterproof, adhesive mount external enclosure.

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

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

Typical applications include:

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

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

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

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

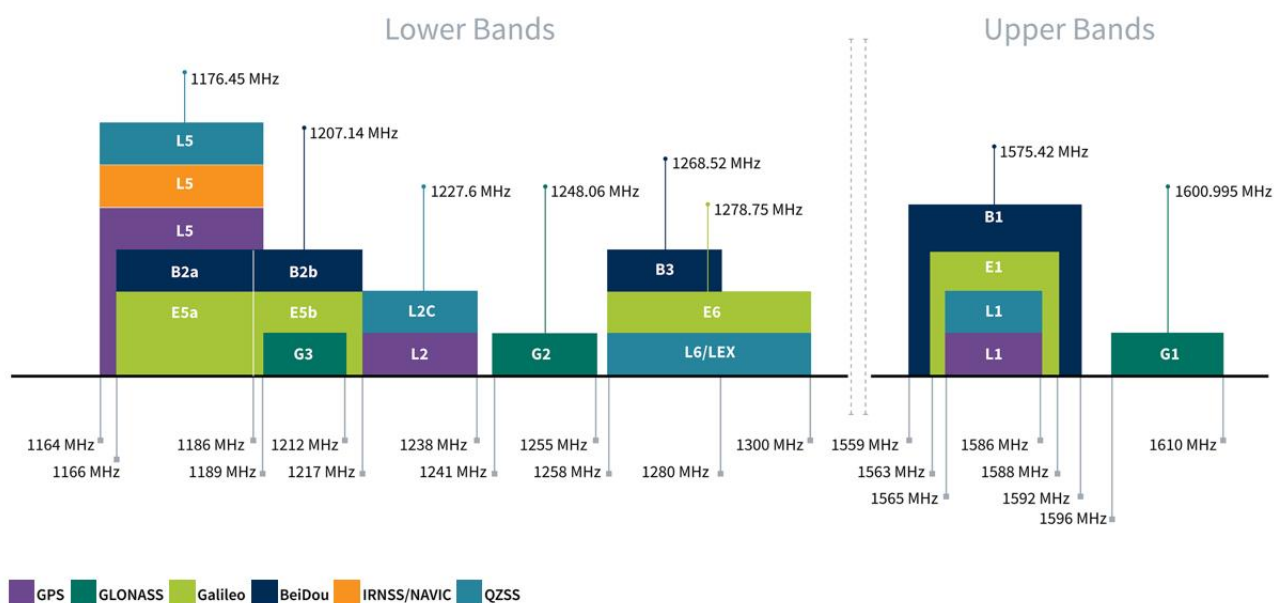
Cable type and length, and connector types are fully customizable and the Guardian can also be customized for any variation of antennas below 9-in-1 and the addition of Wi-Fi/Single Band GNSS is also possible. Contact your regional Taoglas customer support team for more information.

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 Bands Covered. □ GNSS Frequency Bands Not Covered.

*SBAS systems: WASS(L1/L5), EGNOS(E1/E5a), SDCM(G1/G2/G3), SNAS(B1,B2a), GAGAN(L1/L5), QZSS(L1/L5), KAZZ(L1/L5).



GNSS Bands and Constellations

GPS L1 & L2 Antenna						
Frequency	GPS_L2 1207-1239	GLONASS_G2 1241-1248	BeiDou_B1 1559-1563	Galileo_E1 1563-1587	GPS_L1 1564-1587	GLONASS 1593-1610
Average Gain (dB)	-2	-3.2	-4.4	-1.6	-1.6	-4.4
Efficiency (%)	63.2	47.5	36.3	69.1	69.1	36.1
Peak Gain (dBi)	4.2	3.2	0.9	3.7	3.7	0.8
Axial Ratio at Zenith	13.7	22.2	17.4	8.6	6.6	19.1
Impedance	50 Ω					
Polarization	RHCP					
LNA and Filter Electrical Properties						
		3V (Typ.)				
LNA Gain	L2	19.6				
	L1	22.6				
Noise Figure	L1	3.8				
	L2	2.4				
Current Consumption		16.8mA				
Outer Band Attenuation (dB)		30 @ Fc +/-100MHz 40 @ Fc +/-200MHz				
Output Impedance		50 Ohm				
Return loss (dB)		<-10 dB				
Input Voltage (V)		+ 1.8 to 5.5				

5G/4G MIMO								
Band	Frequency (MHz)		Efficiency (%)	Average Gain (dB)	Peak Gain (dBi)	VSWR	Impedance	Polarization
5GNR/4G Band 5,8,12,13,14,17,18,20, 26,27,28, 29,71	617~960	MIMO 1	N/A	N/A	N/A	3 Max	50 Ω	Linear
		MIMO 2	N/A	N/A	N/A			
		MIMO 3	N/A	N/A	N/A			
		MIMO 4	43.6	-3.6	1.5			
		MIMO 5	43.8	-3.6	2.1			
		MIMO 6	N/A	N/A	N/A			
		MIMO 7	N/A	N/A	N/A			
		MIMO 8	N/A	N/A	N/A			
5GNR/4G Band 21,32,74,75,76	1427~1518	MIMO 1	N/A	N/A	N/A	3 Max	50 Ω	Linear
		MIMO 2	36.2	-4.4	2.2			
		MIMO 3	N/A	N/A	N/A			
		MIMO 4	37.4	-4.3	-0.1			
		MIMO 5	41.8	-3.8	0.1			
		MIMO 6	N/A	N/A	N/A			
		MIMO 7	39	-4.1	1.6			
		MIMO 8	N/A	N/A	N/A			

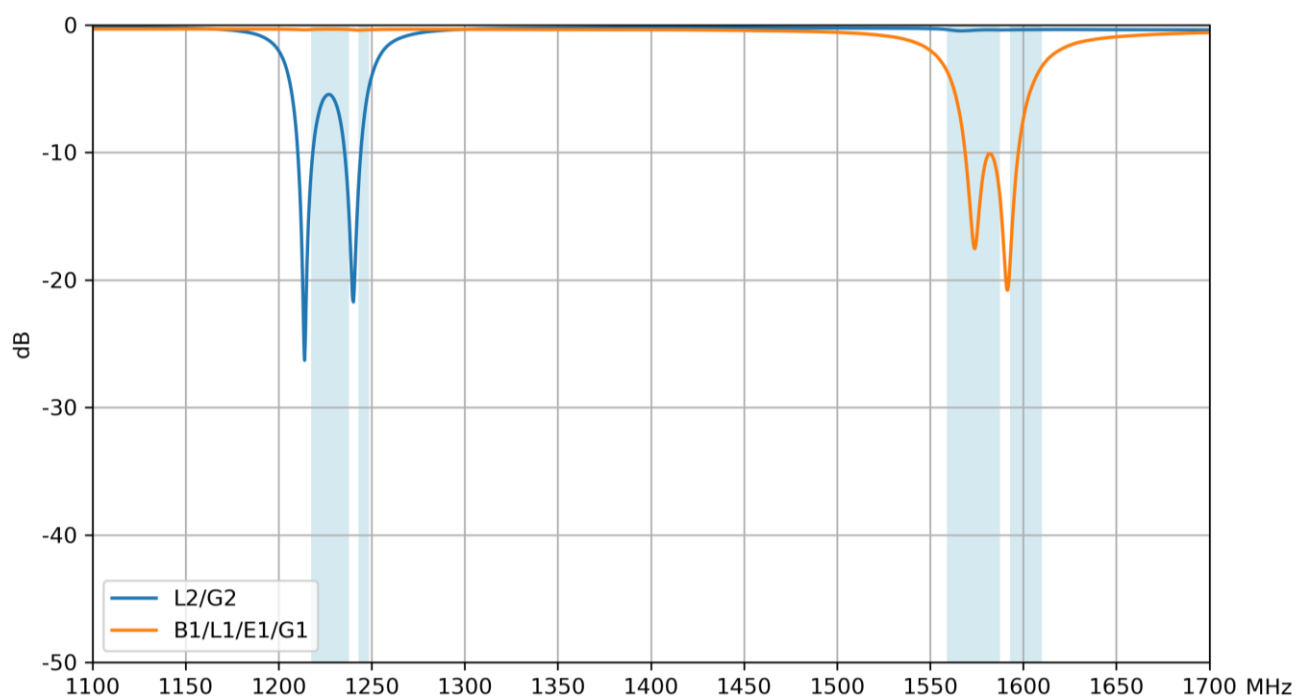
4G/3G Band 1,2,3,4,9,23,25,35,39,66	1710~2200	MIMO 1	53.2	-2.7	4			
		MIMO 2	53	-2.8	2.2			
		MIMO 3	N/A	N/A	N/A			
		MIMO 4	45.7	-3.4	3.5			
		MIMO 5	51.4	-2.9	3.25			
		MIMO 6	N/A	N/A	N/A			
		MIMO 7	39	-2.8	2.4			
		MIMO 8	52.7	-2.8	3.6			
4G/3G Band 7,30,38,40,41	2390~2690	MIMO 1	49	-3.1	3.3			
		MIMO 2	48	-3.2	1.9			
		MIMO 3	N/A	N/A	N/A			
		MIMO 4	47	-3.3	3.3			
		MIMO 5	44.5	-3.5	2.6			
		MIMO 6	N/A	N/A	N/A			
		MIMO 7	45	-3.5	2.8			
		MIMO 8	47.1	-3.3	4.5			
5GNR/4G Band 22,42,43,48,77,78,79	3300~5000	MIMO 1	51.5	-2.9	5.4			
		MIMO 2	N/A	N/A	N/A			
		MIMO 3	41	-3.9	4			
		MIMO 4	45.2	-3.5	2.9			
		MIMO 5	47.7	-3.2	2.5			
		MIMO 6	38	-4.2	4.2			
		MIMO 7	N/A	N/A	N/A			
		MIMO 8	52	-2.8	5.1			
LTE5200/ Wi-Fi 5800	5150~5925	MIMO 1	50.1	-2.9	5.2			
		MIMO 2	N/A	N/A	N/A			
		MIMO 3	54	-2.7	5.3			
		MIMO 4	45	-3.5	7.1			
		MIMO 5	42	-3.8	6.6	3 Max	50Ω	Linear
		MIMO 6	46.3	-3.3	4.2			
		MIMO 7	N/A	N/A	N/A			
		MIMO 8	51.5	-2.9	4.8			

Mechanical	
Height	20.5mm
Planner Dimension	146 x 134mm
Housing Material	ASA
Adhesive	CR4305 + 3M 9448HK
Cable	1m TGC-1.5DS for 5G/4G – Fully Customizable 1m RG174 for GNSS – Fully Customizable
Connector	5G/4G: SMA Male Straight – Fully Customizable GNSS: SMA Male Straight – Fully Customizable
Weight	800g
Environmental	
Protection	IP67
Temperature Range	-40°C to 85°C
Humidity	Non-condensing 65°C 95% RH

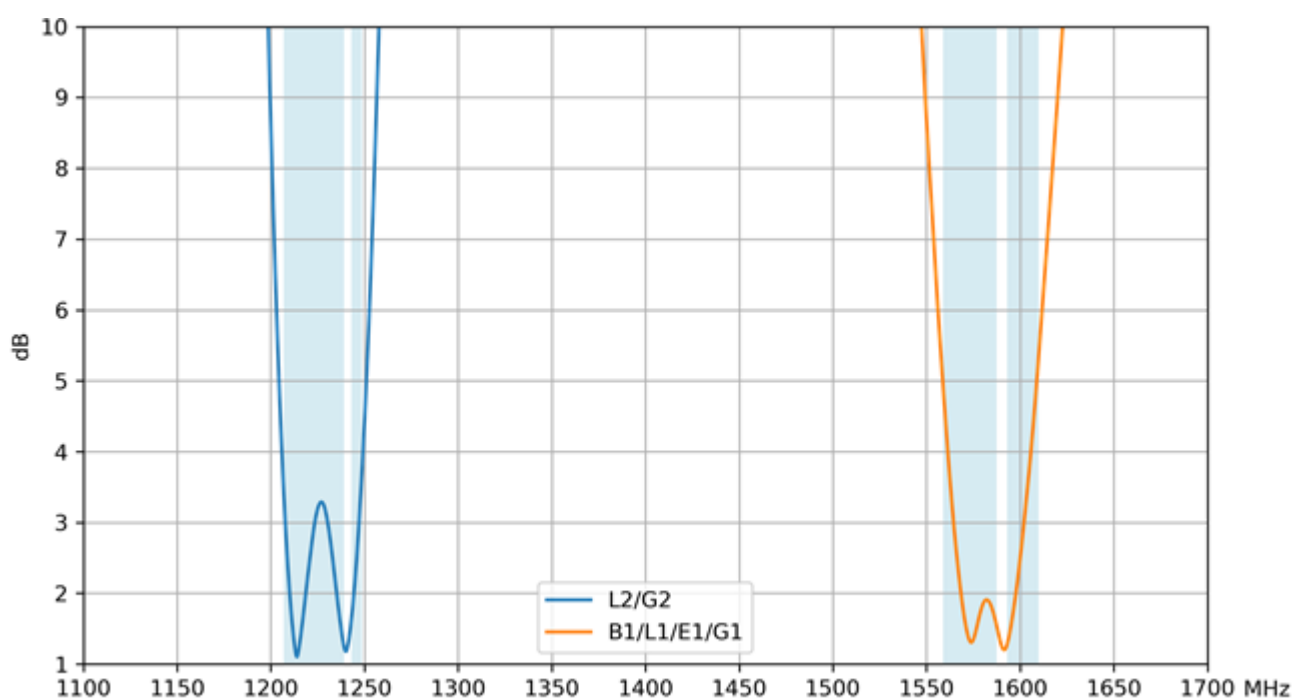
5G/4G Bands						
Band Number	5G NR / FR1 / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA					
	Uplink	Downlink	Covered (4G/5G-1&8)	Covered (4G/5G-2&7)	Covered (4G/5G-3&6)	Covered (4G/5G-4&5)
1	UL: 1920 to 1980	DL: 2110 to 2170	✓	✓	✗	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓	✓	✗	✓
3	UL: 1710 to 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 - 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: 1710-1780	DL: 2110-2200	✓	✓	✗	✓
71	617 to 698		✗	✗	✗	✓
74/75/76	1427 to 1518		✗	✓	✗	✓
77/78/79	3300 to 3800		✓	✓	✓	✓
WiFi 5800	5150 to 5925		✓	✓	✓	✓

3. Antenna Characteristics

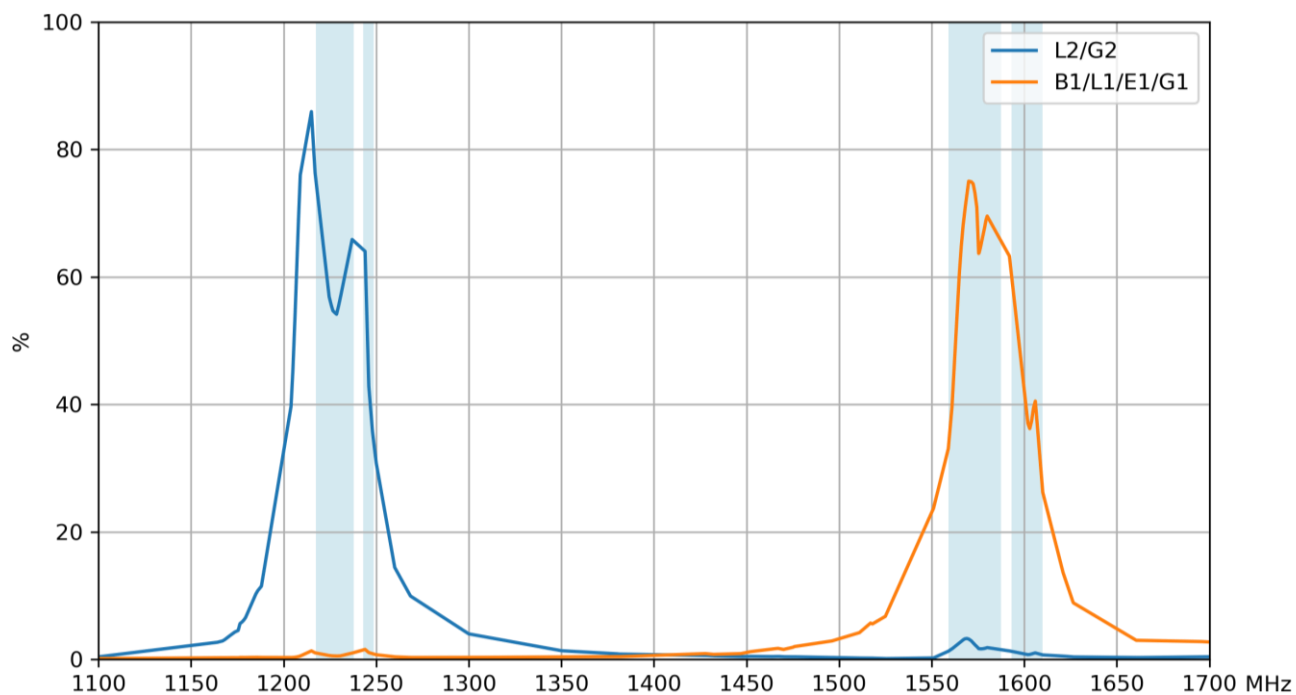
3.1 Return Loss - GNSS



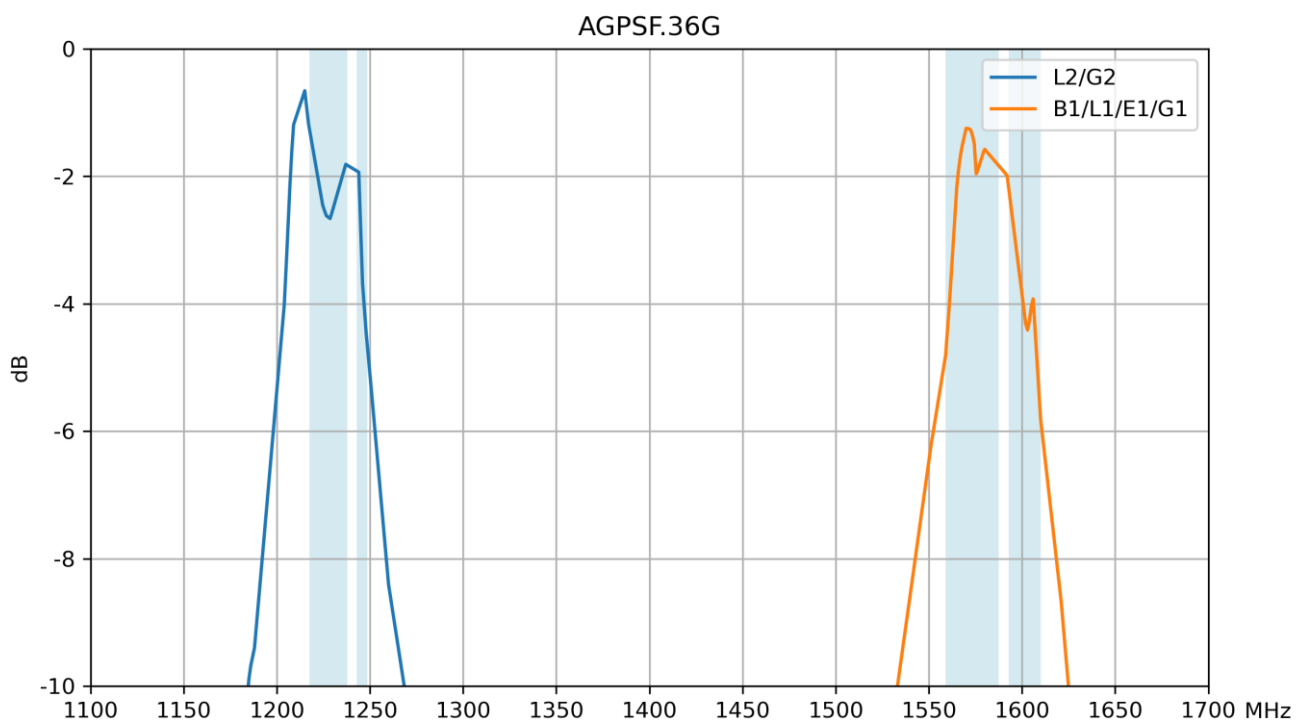
3.2 VSWR – GNSS



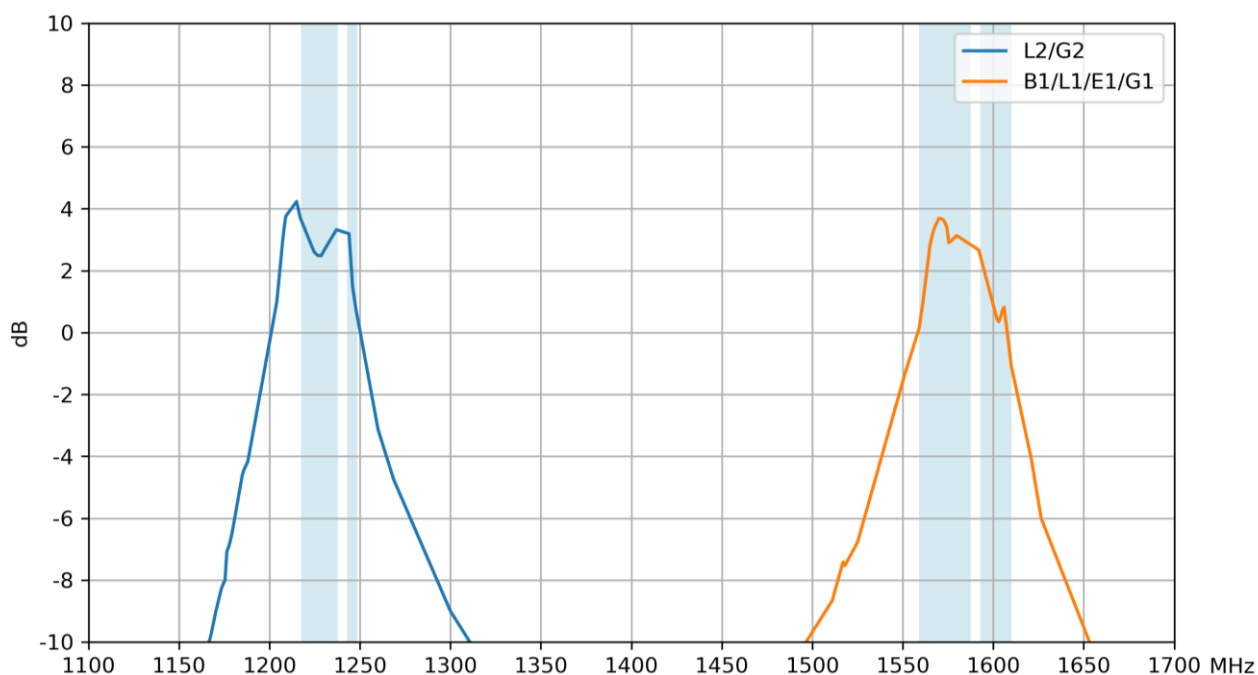
3.3 Efficiency – GNSS



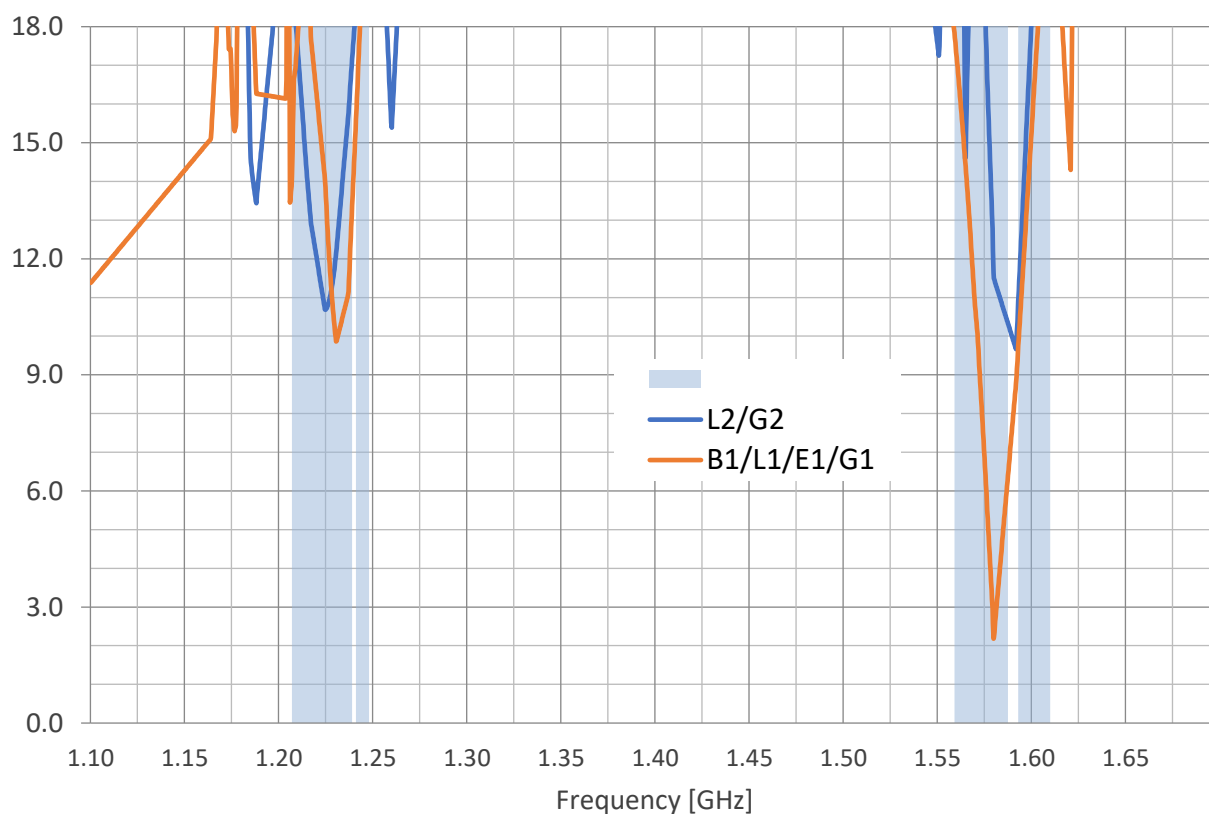
3.4 Average Gain - GNSS



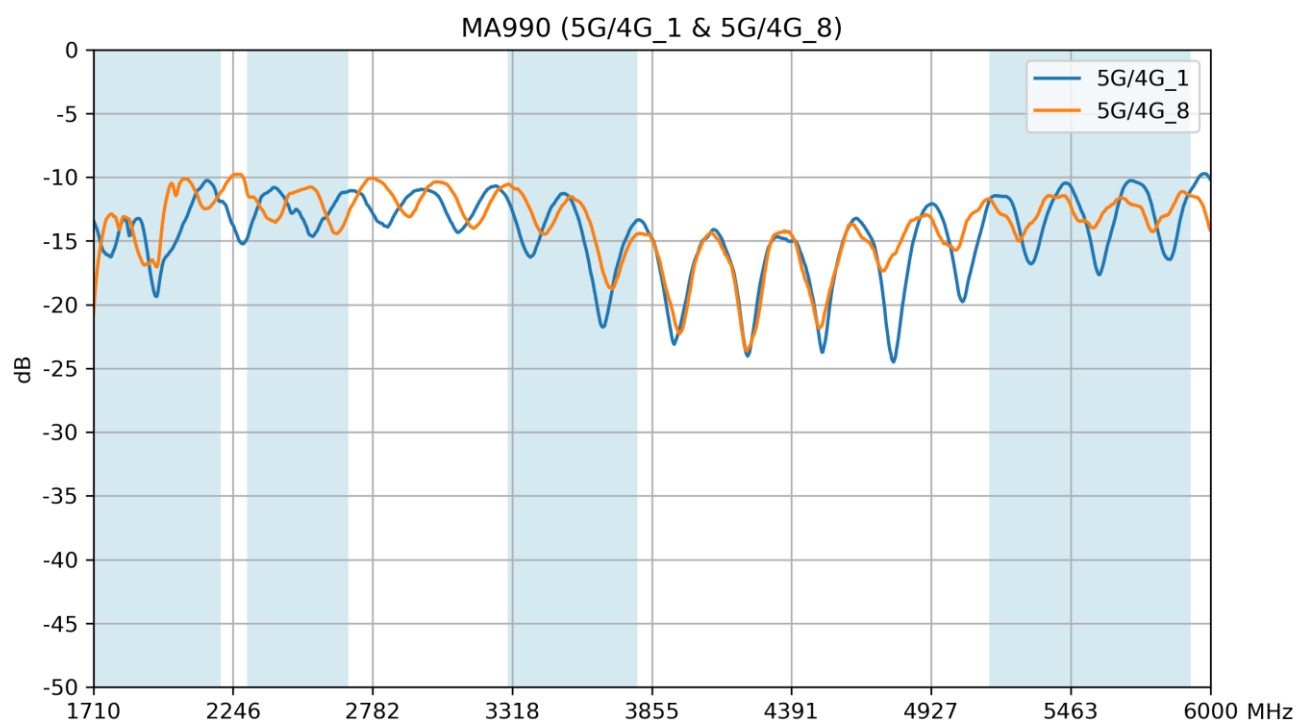
3.5 Peak Gain – GNSS



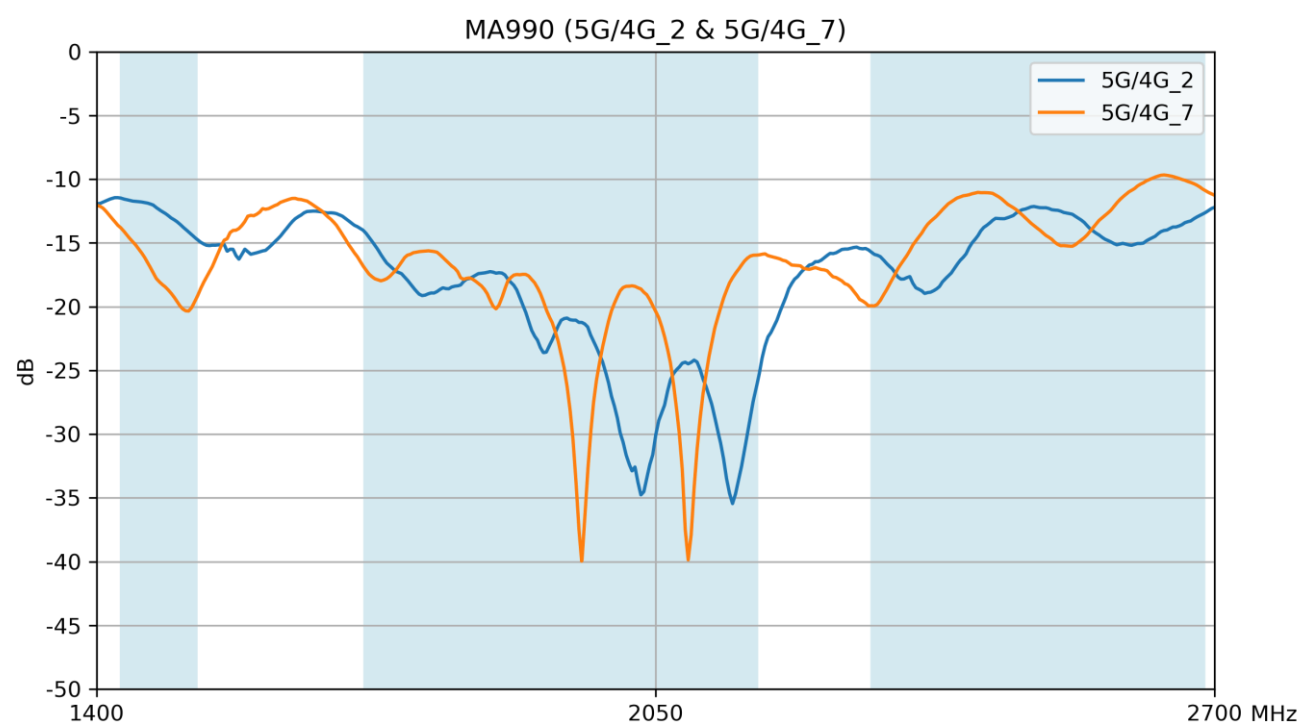
3.6 Axial Ratio – GNSS



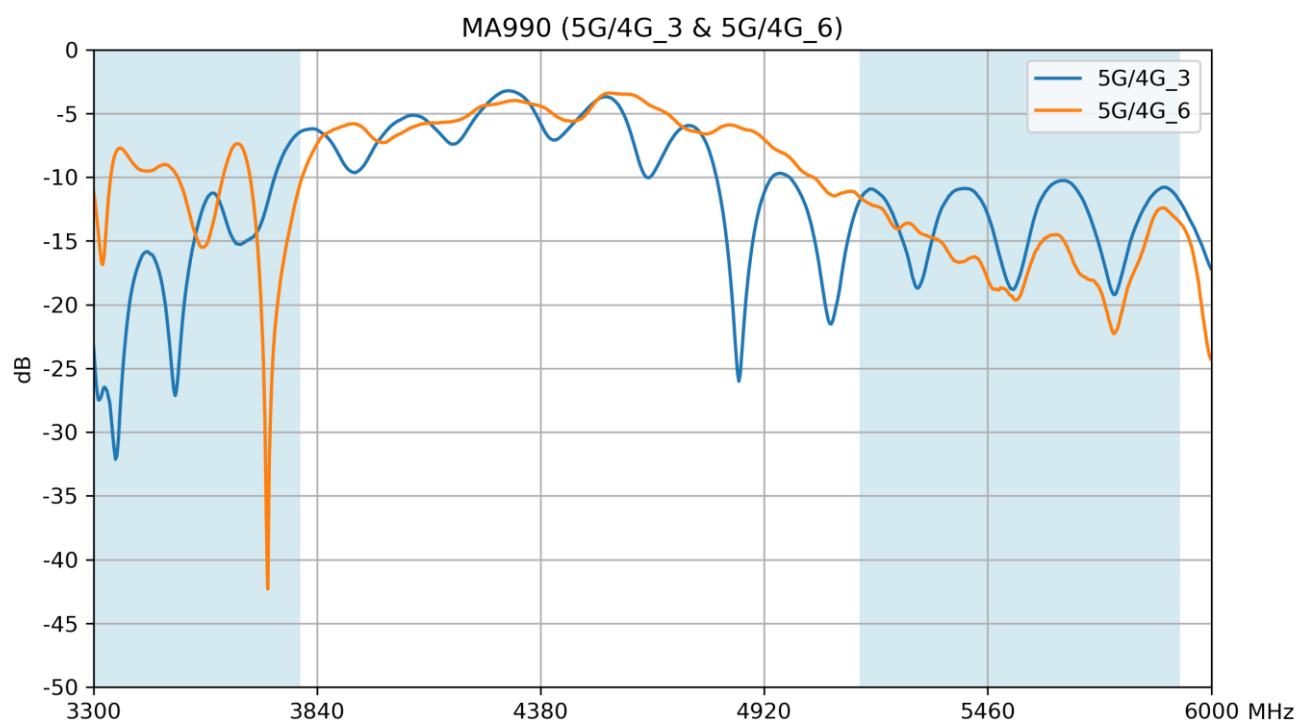
3.7 Return Loss - 5G/4G 1 & 8



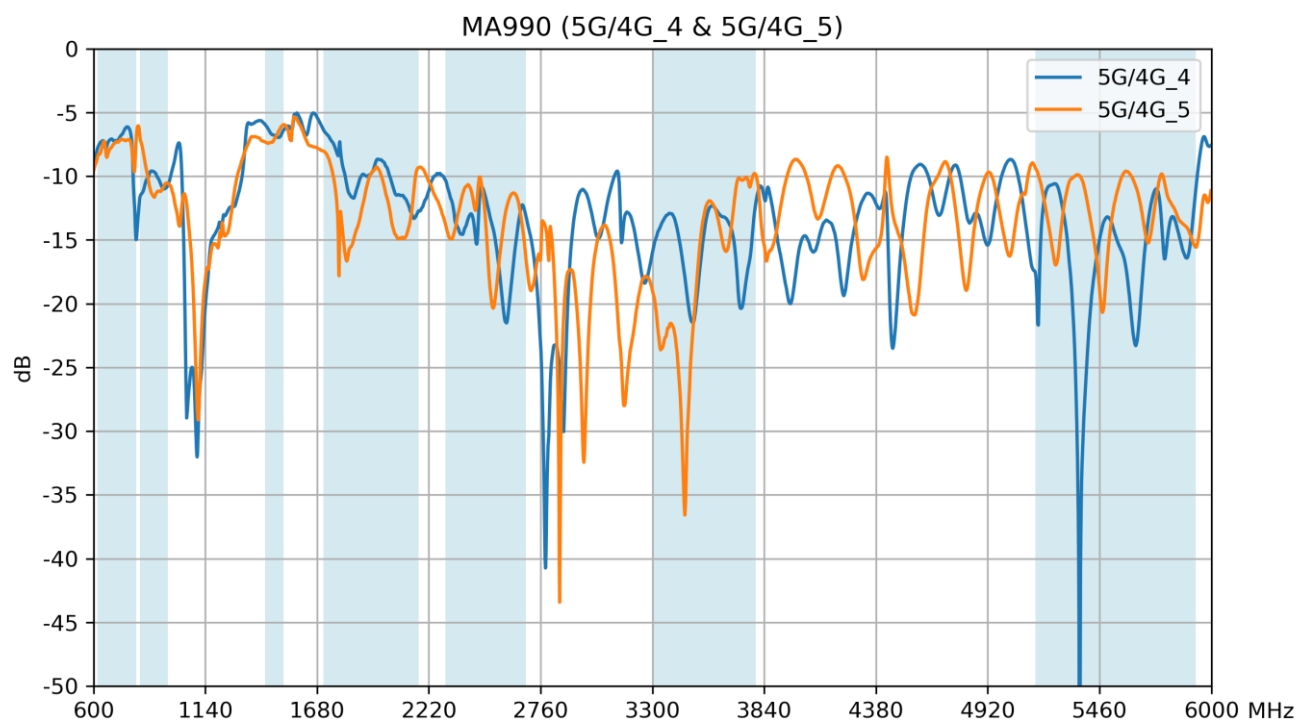
3.8 Return Loss - 5G/4G 2 & 7



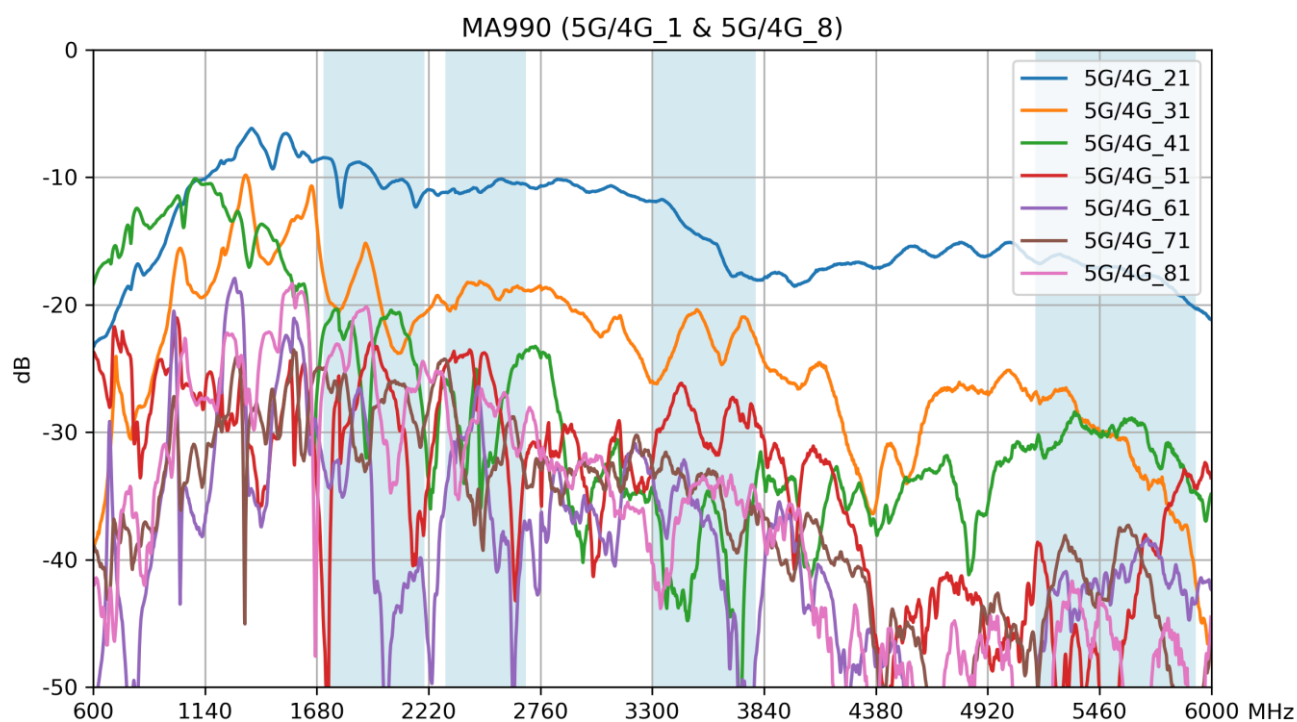
3.9 Return Loss - 5G/4G 3 & 6



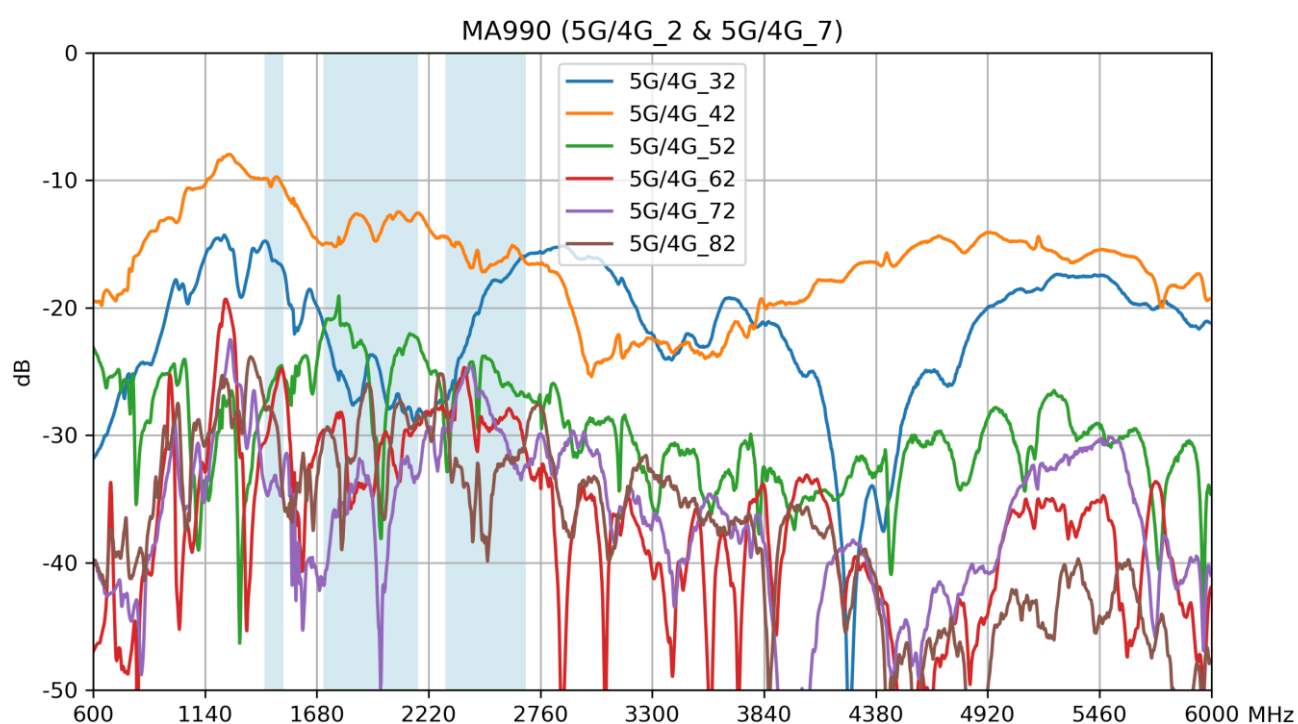
3.10 Return Loss - 5G/4G 4 & 5



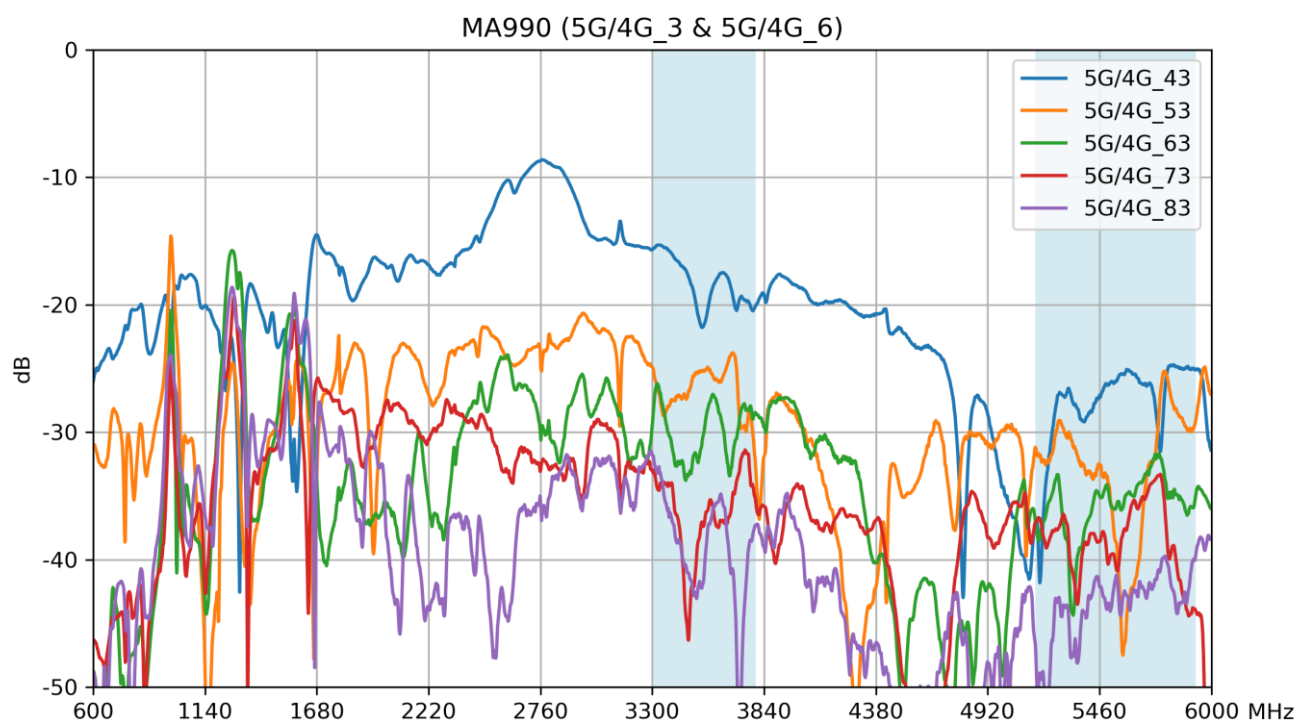
3.11 Isolation – 5G/4G 1 & 8



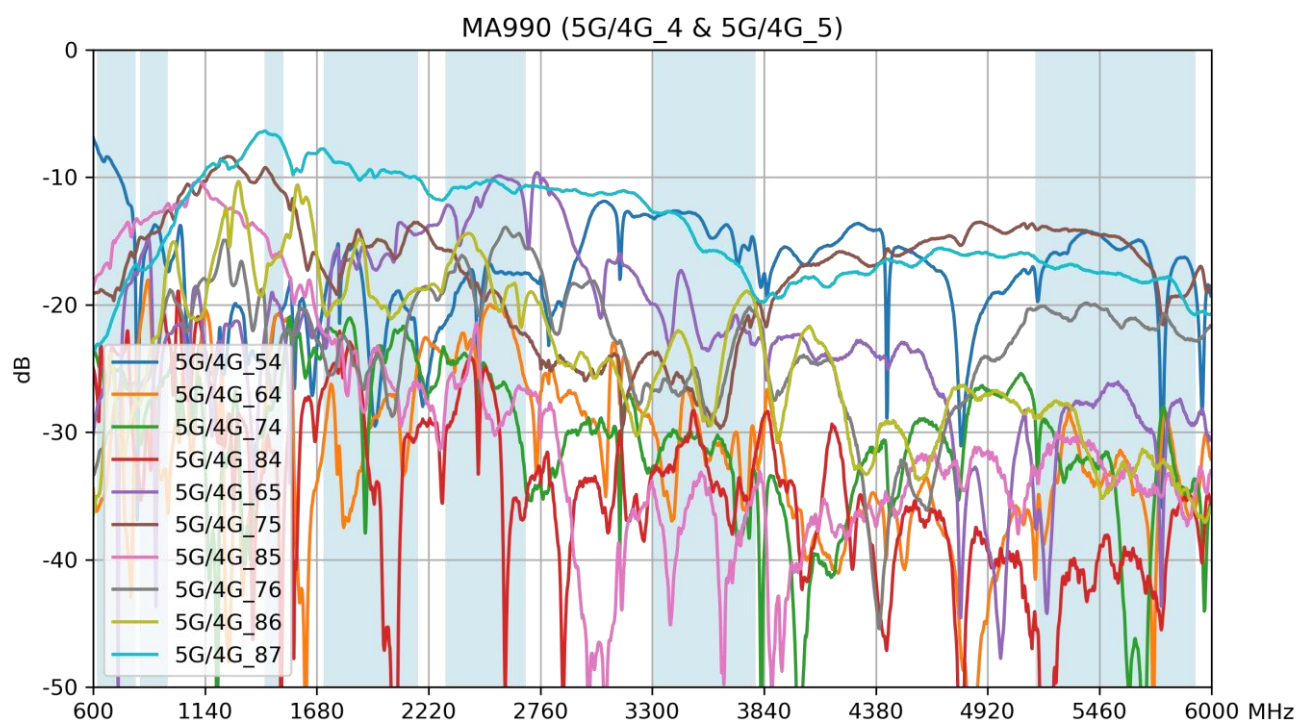
3.12 Isolation – 5G/4G 2 & 7



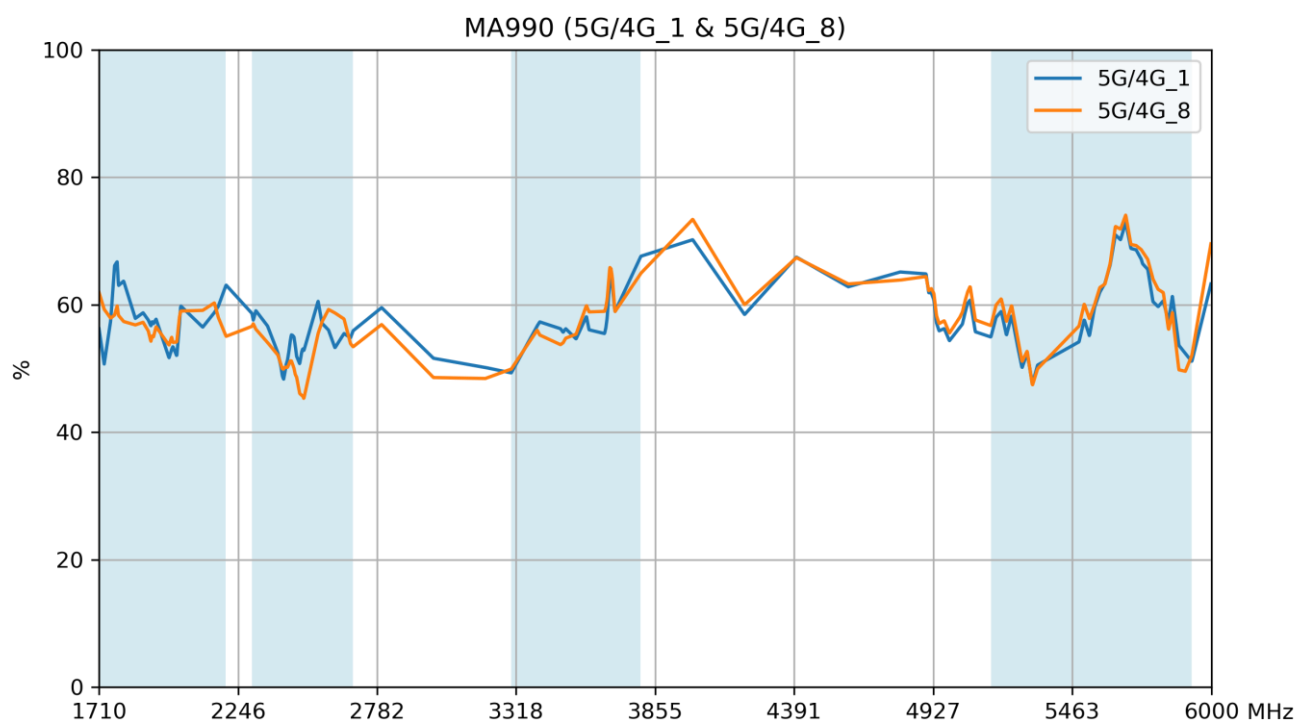
3.13 Isolation – 5G/4G 3 & 6



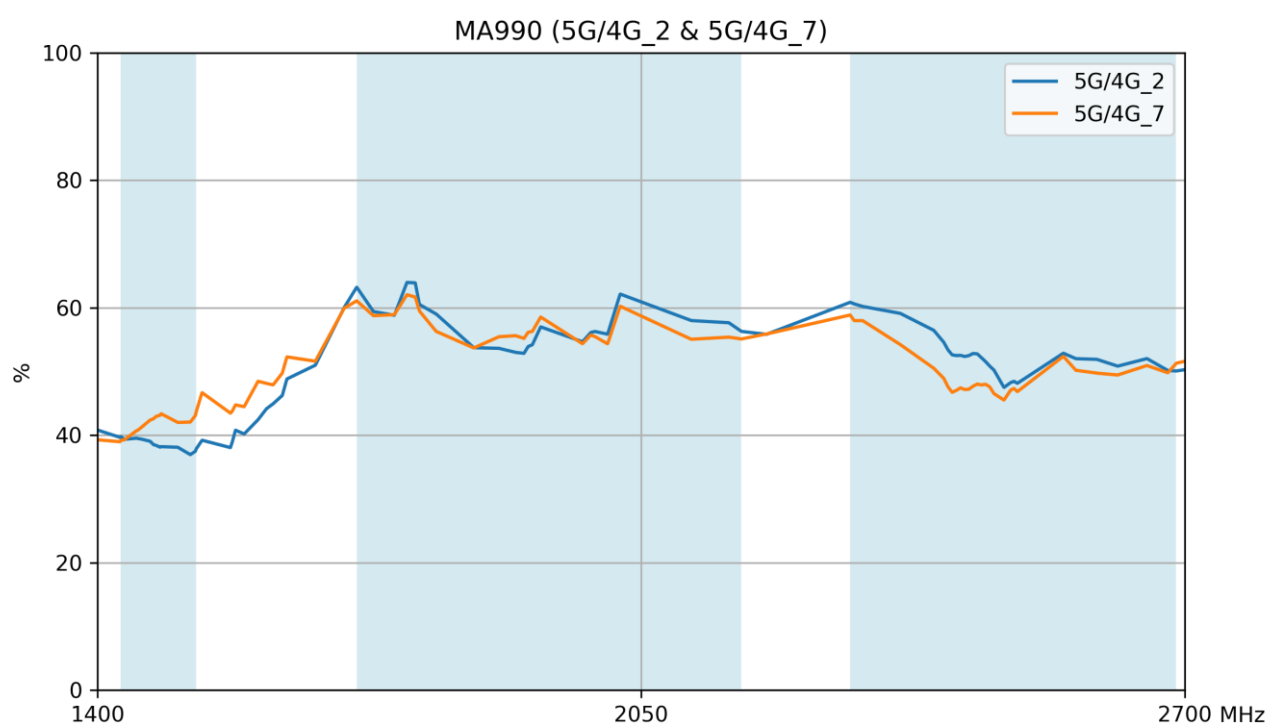
3.14 Isolation – 5G/4G 4 & 5



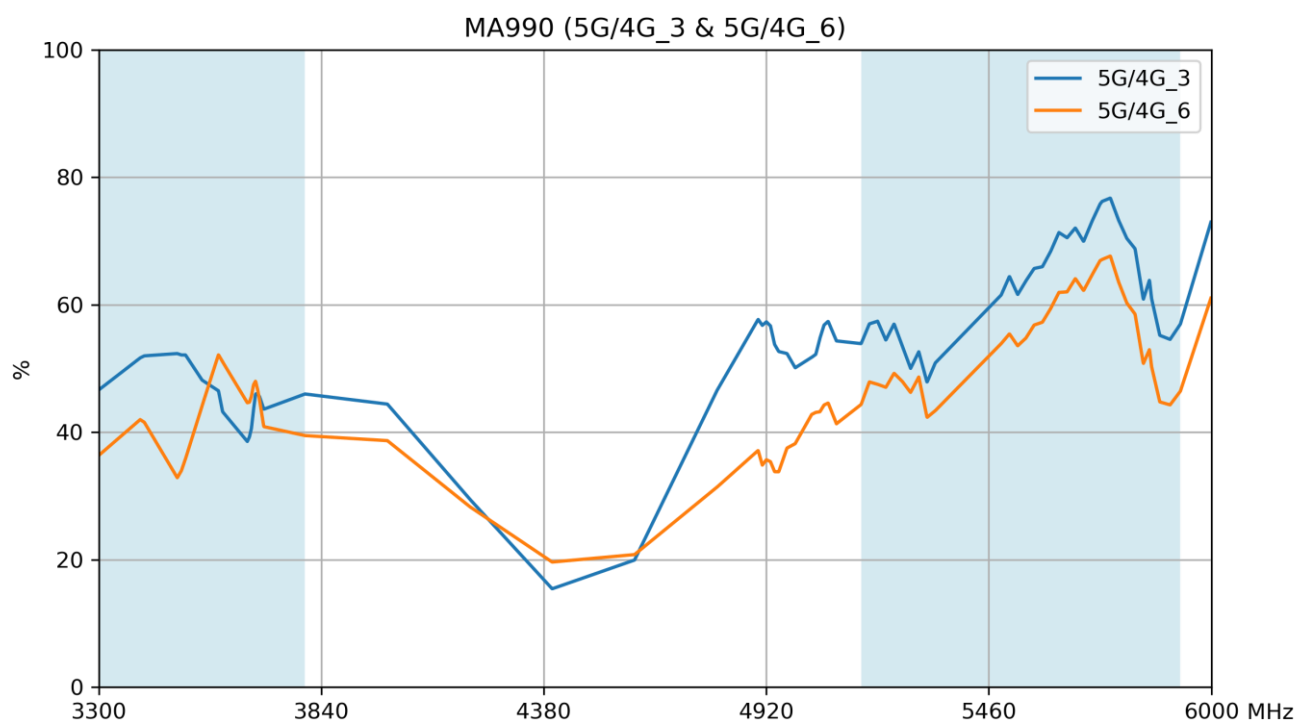
3.15 Efficiency – 5G/4G 1 & 8



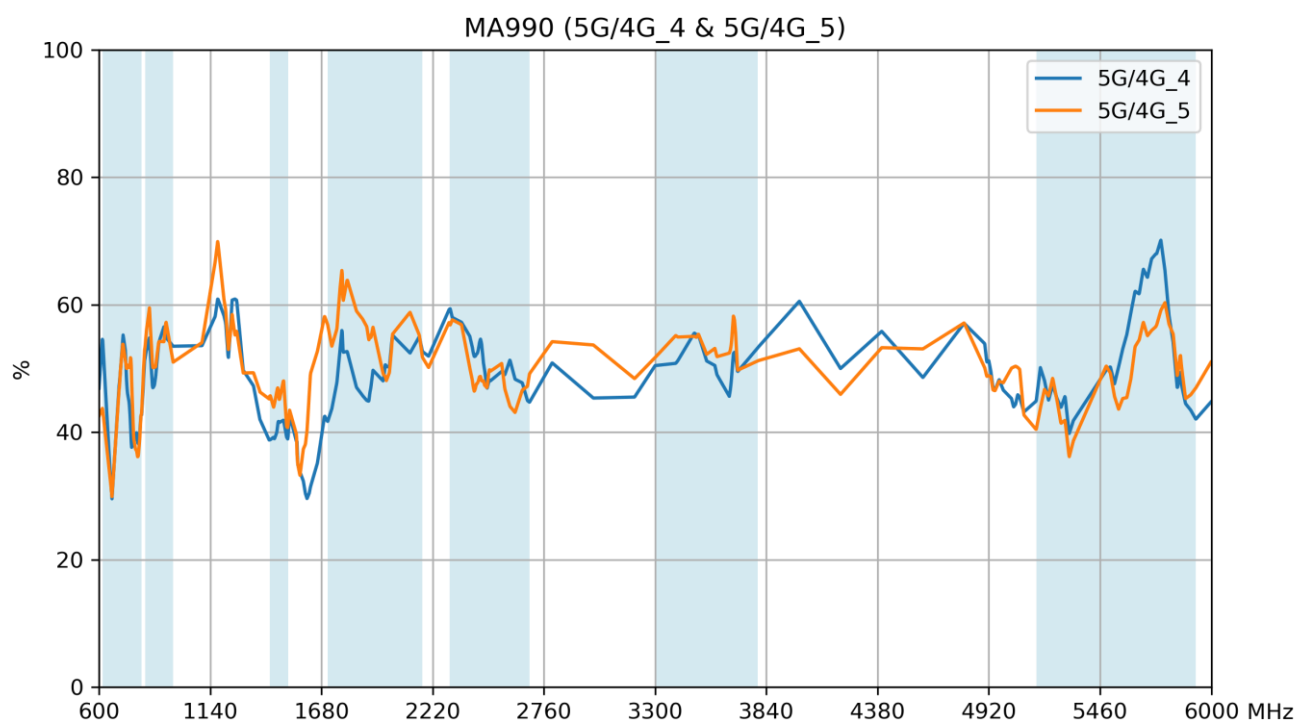
3.16 Efficiency – 5G/4G 2 & 7



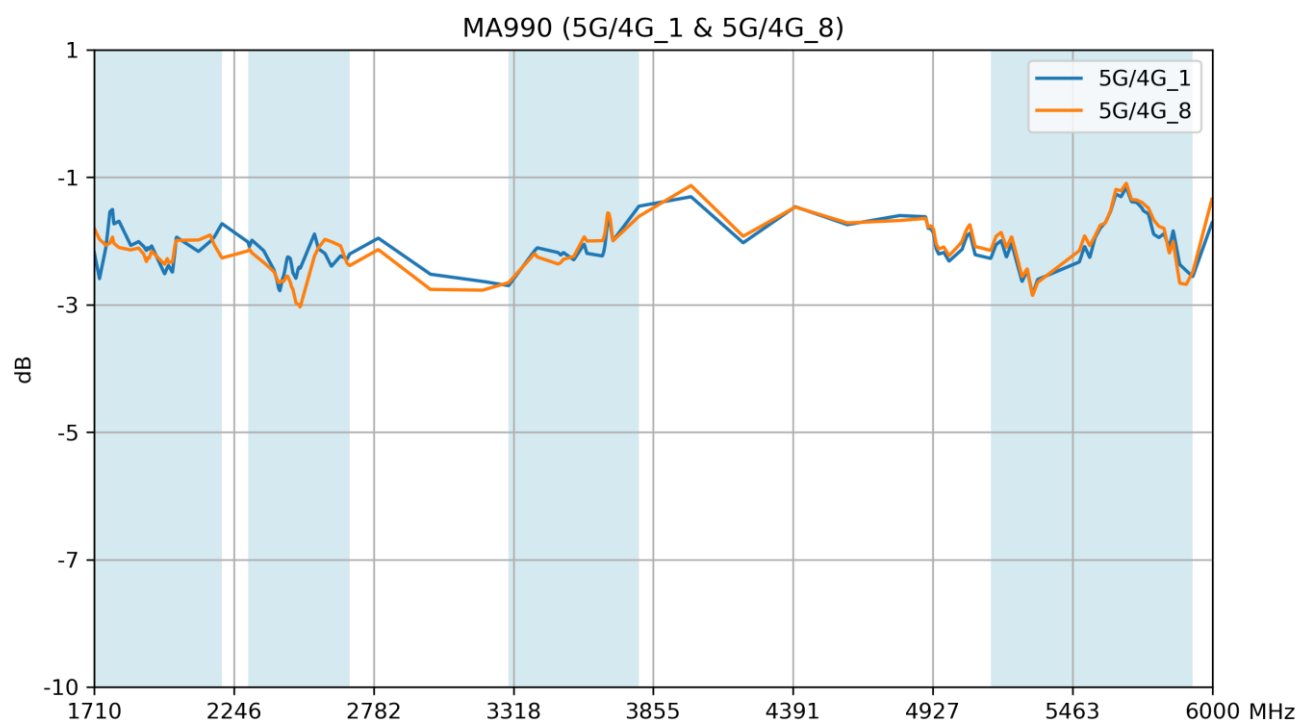
3.17 Efficiency – 5G/4G 3 & 6



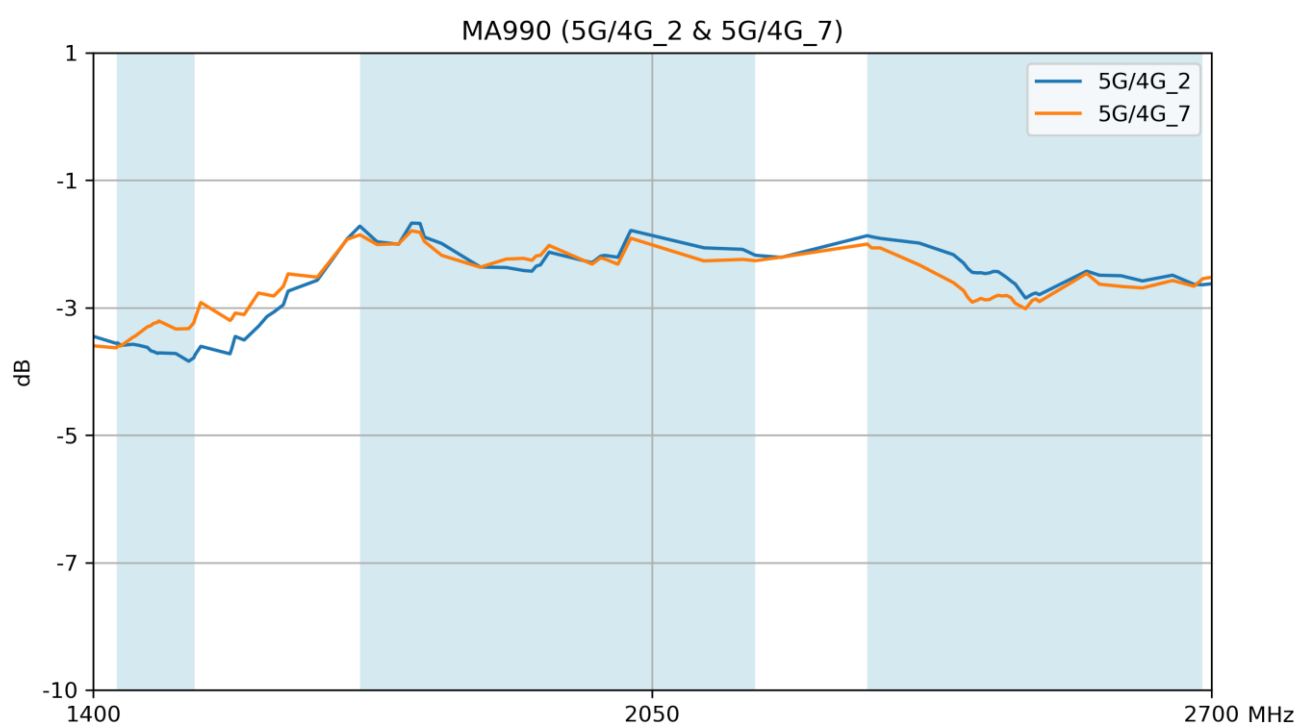
3.18 Efficiency – 5G/4G 4 & 5



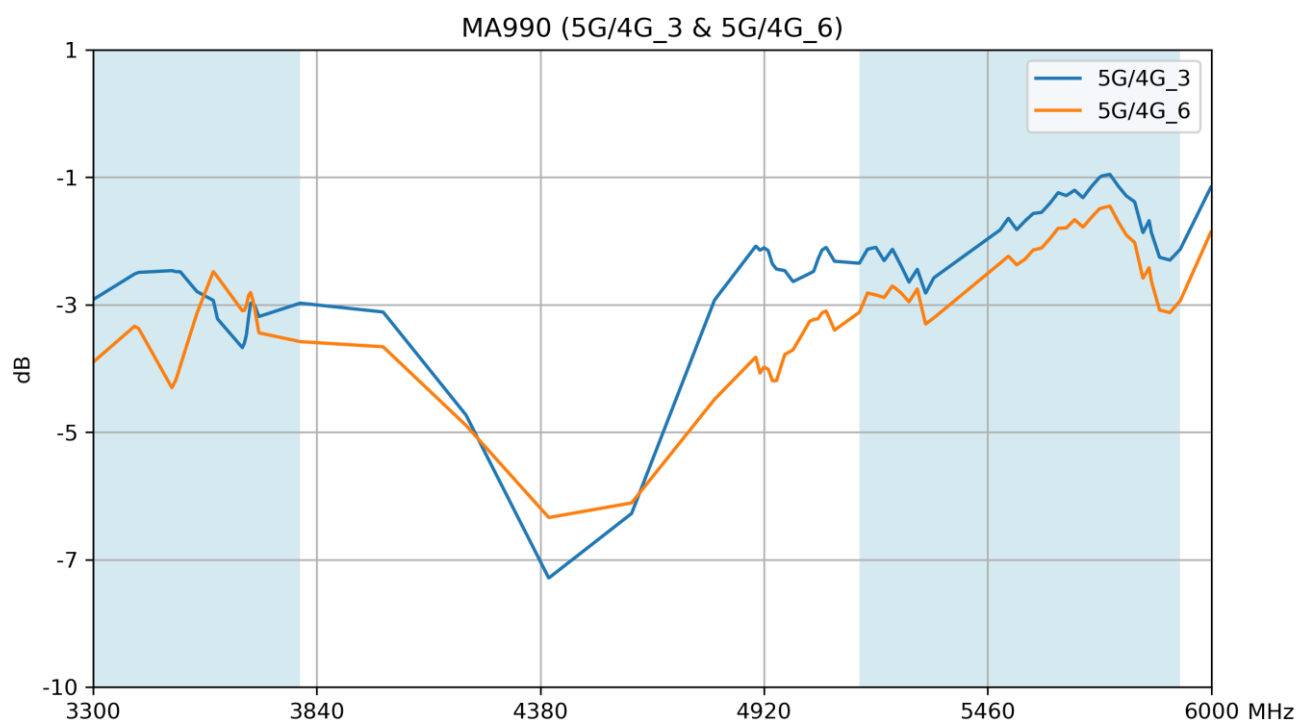
3.19 Average Gain – 5G/4G 1 & 8



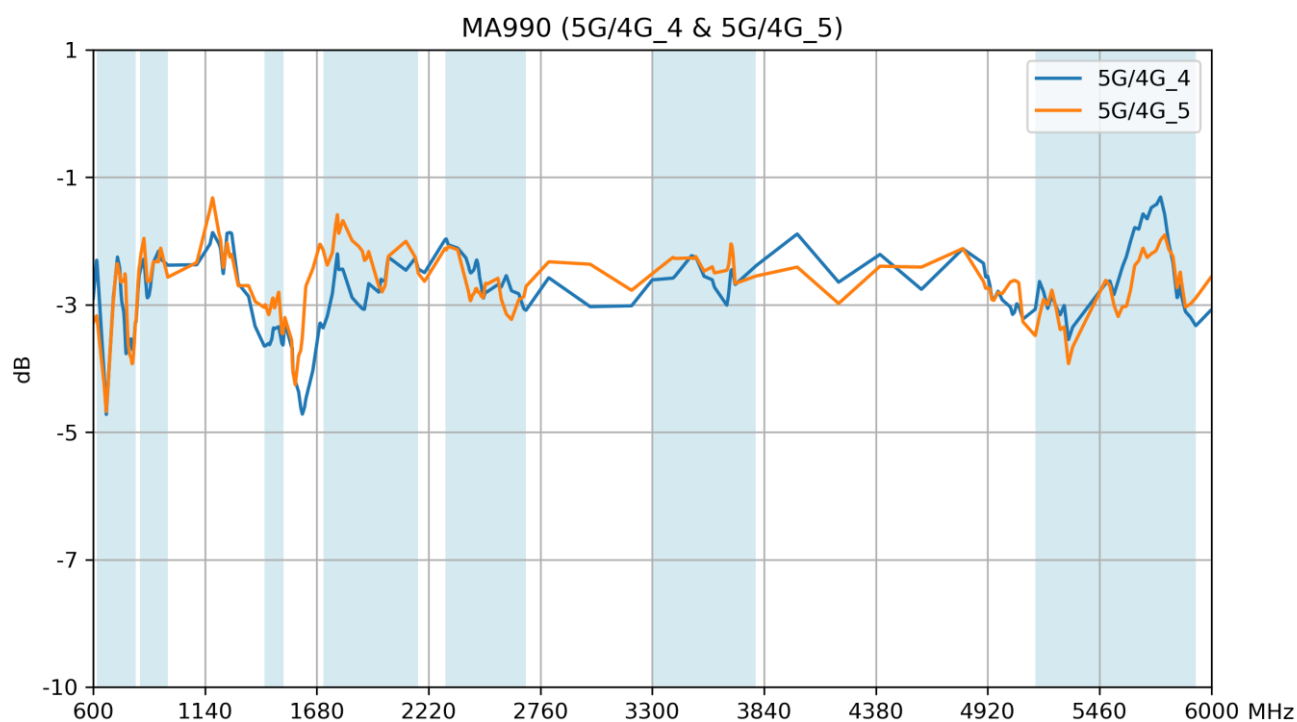
3.20 Average Gain – 5G/4G 2 & 7



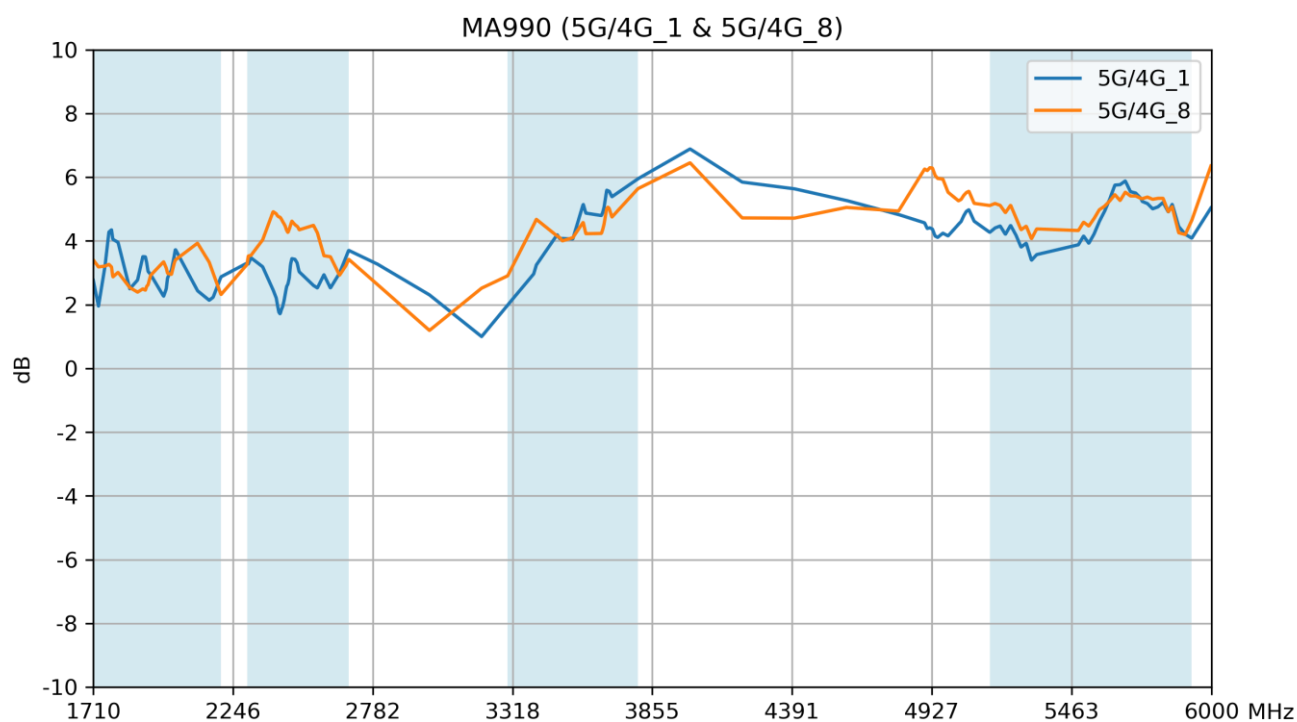
3.21 Average Gain – 5G/4G 3 & 6



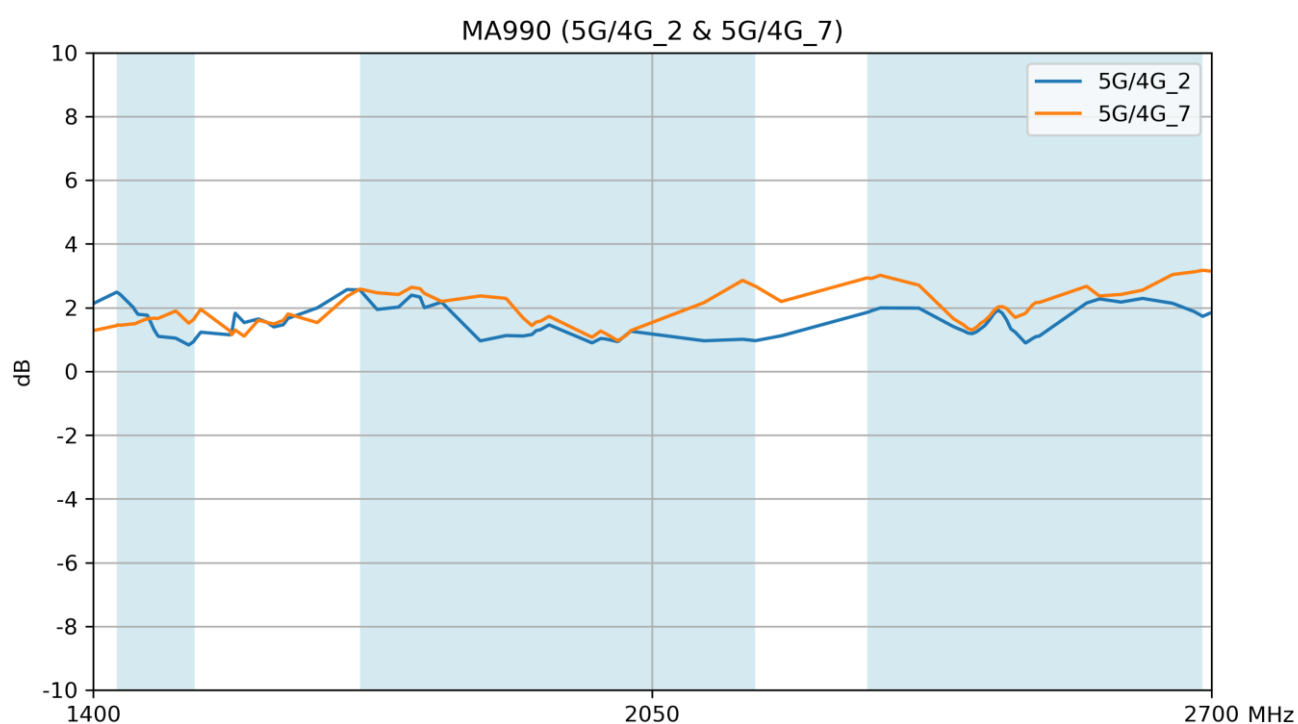
3.22 Average Gain – 5G/4G 4 & 5



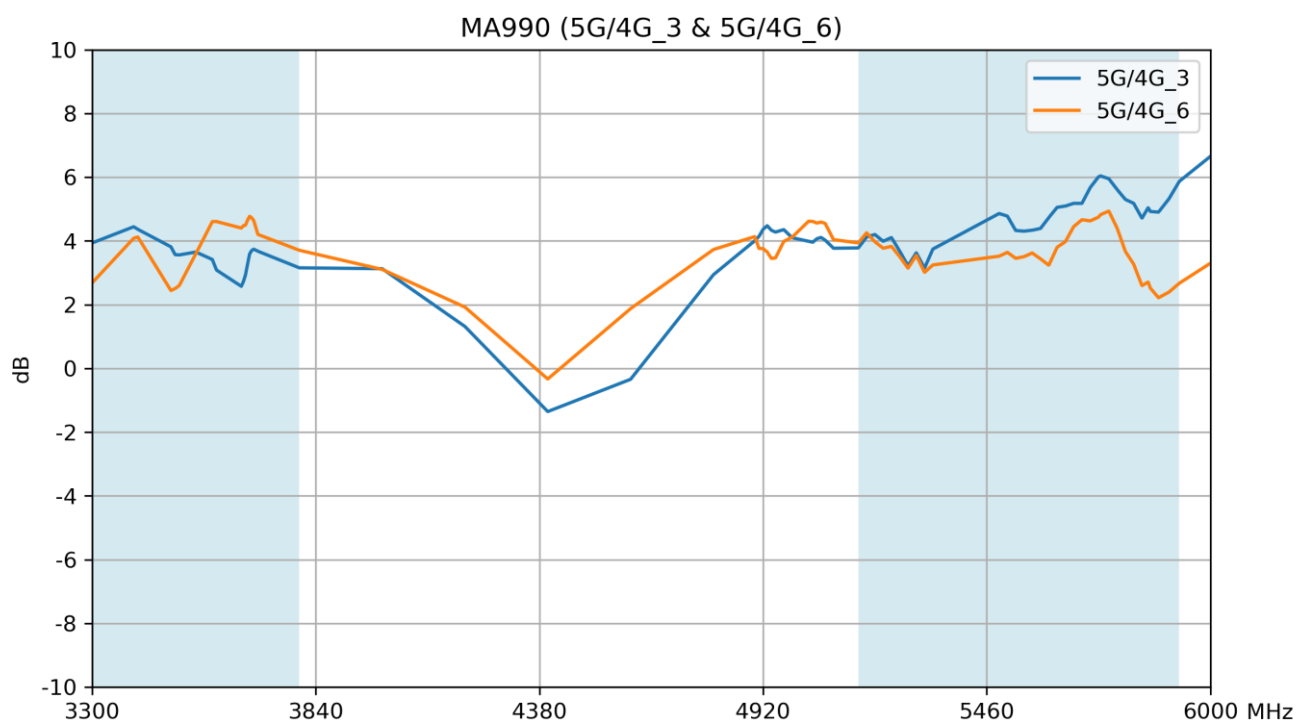
3.23 Peak Gain – 5G/4G 1 & 8



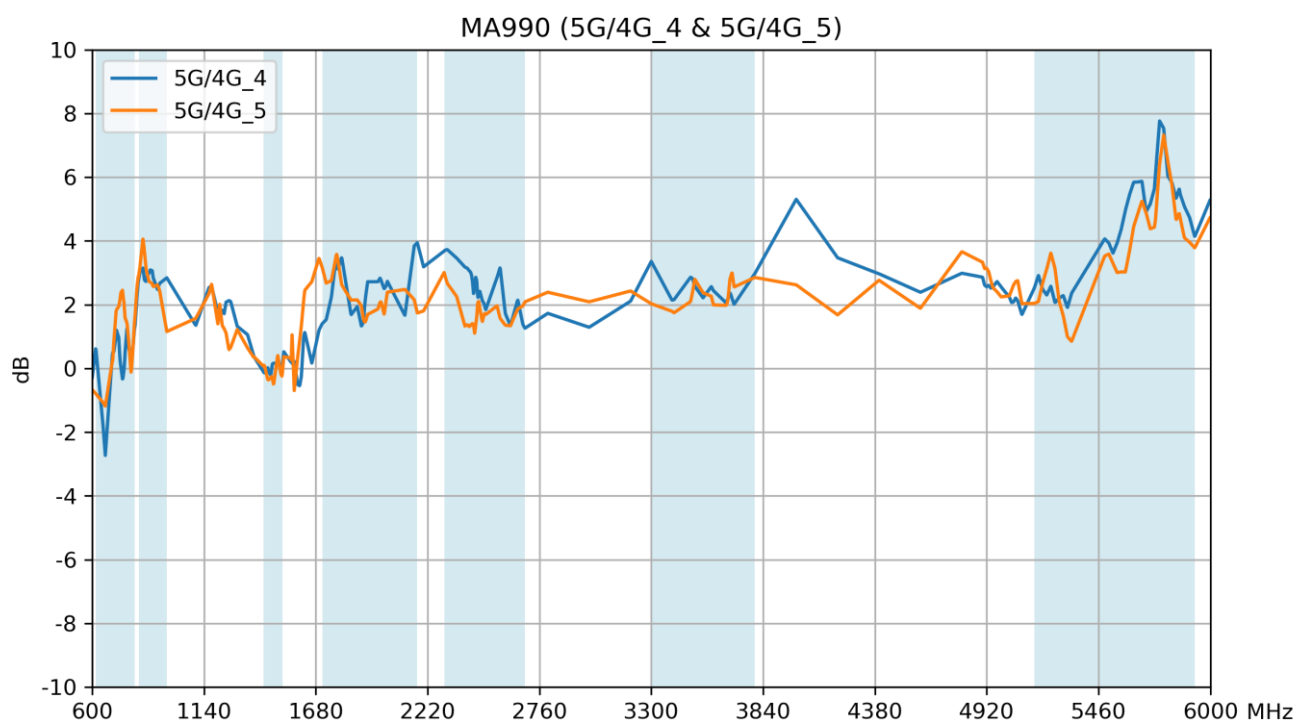
3.24 Peak Gain – 5G/4G 2 & 7



3.25 Peak Gain – 5G/4G 3 & 6

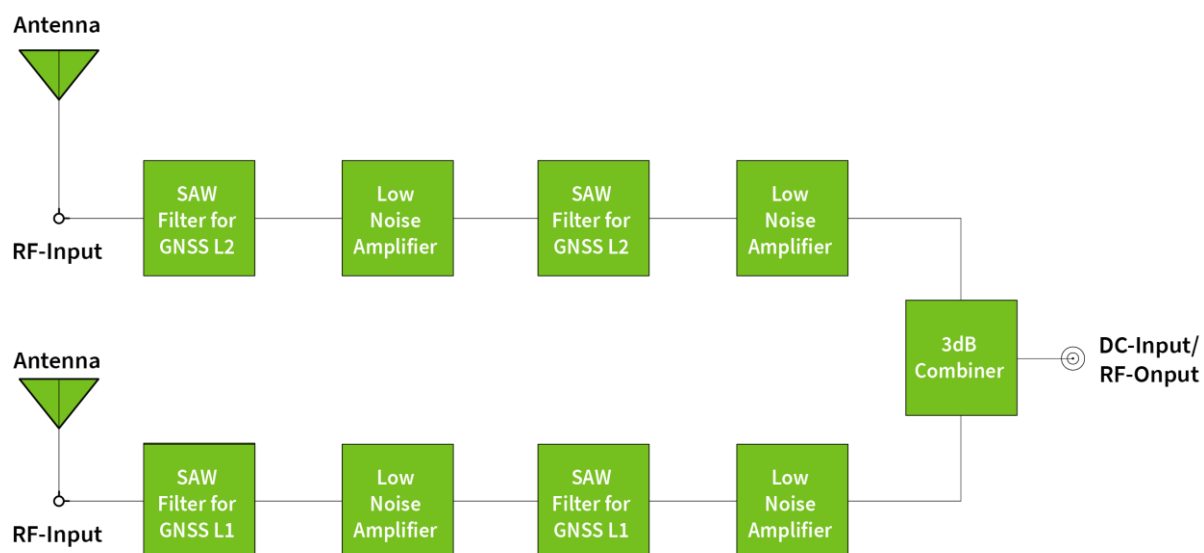


3.26 Peak Gain – 5G/4G 4 & 5



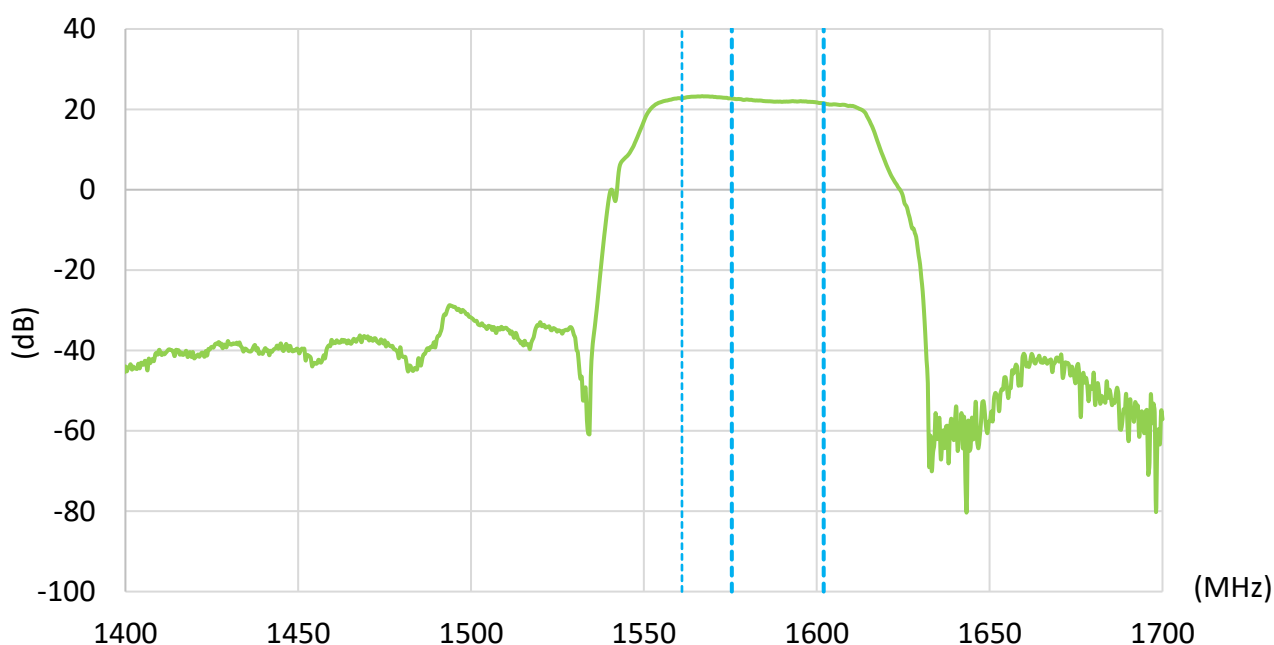
4. Active Antenna Characteristics

4.1 Block Diagram

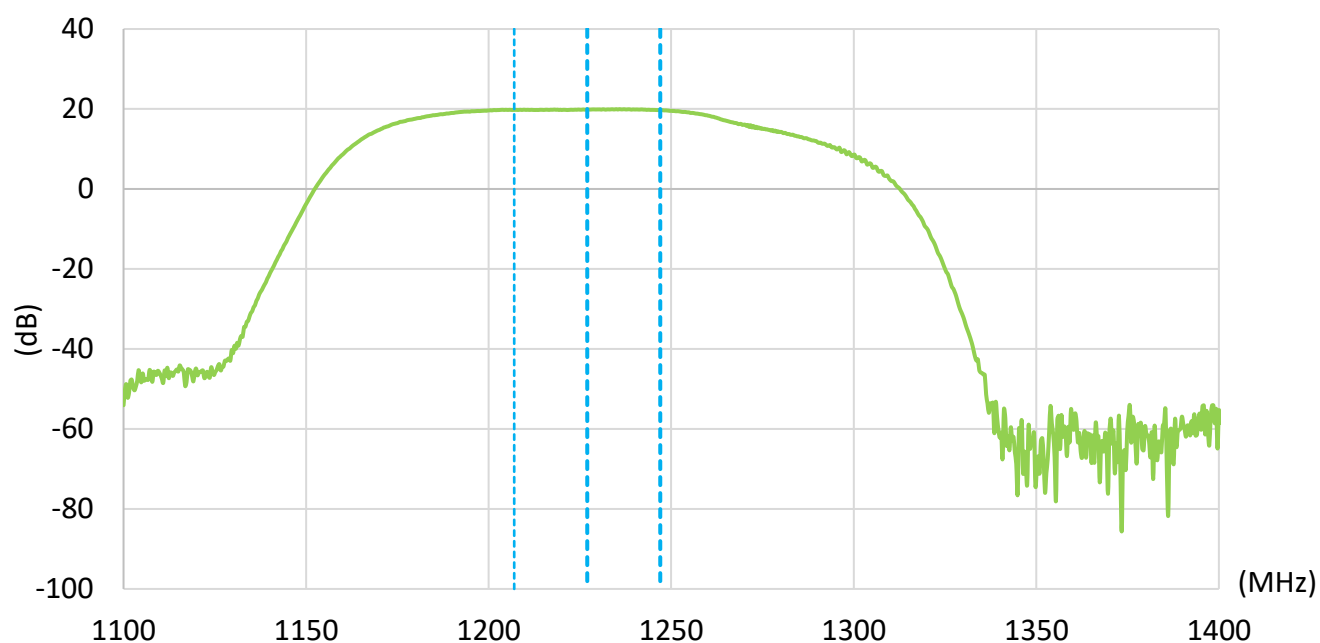


4.2 LNA Gain @3.0V

GNSS L1

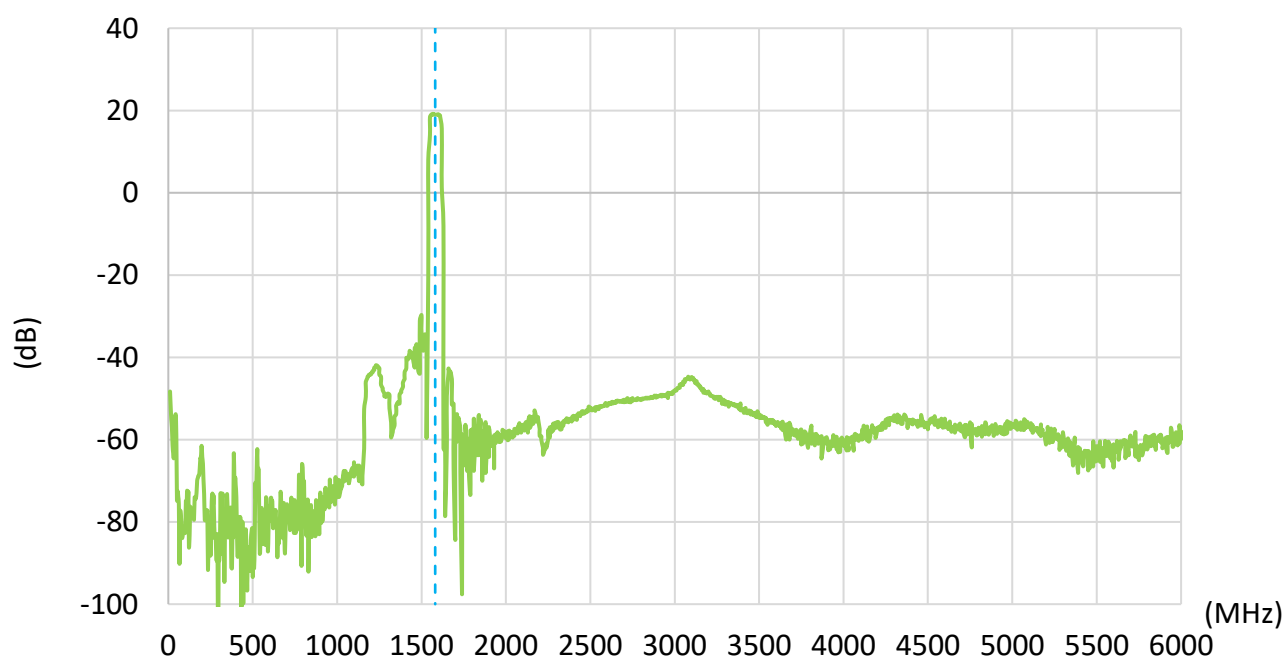


GNSS L2

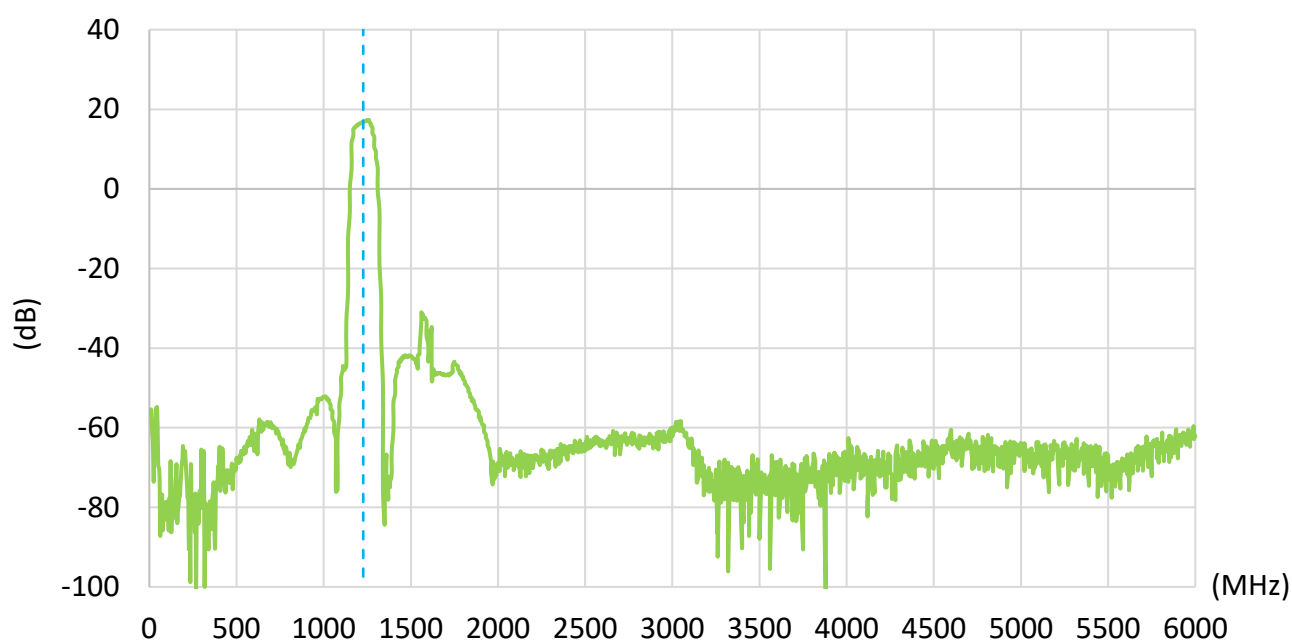


4.3 Out of Band Rejection

GNSS L1

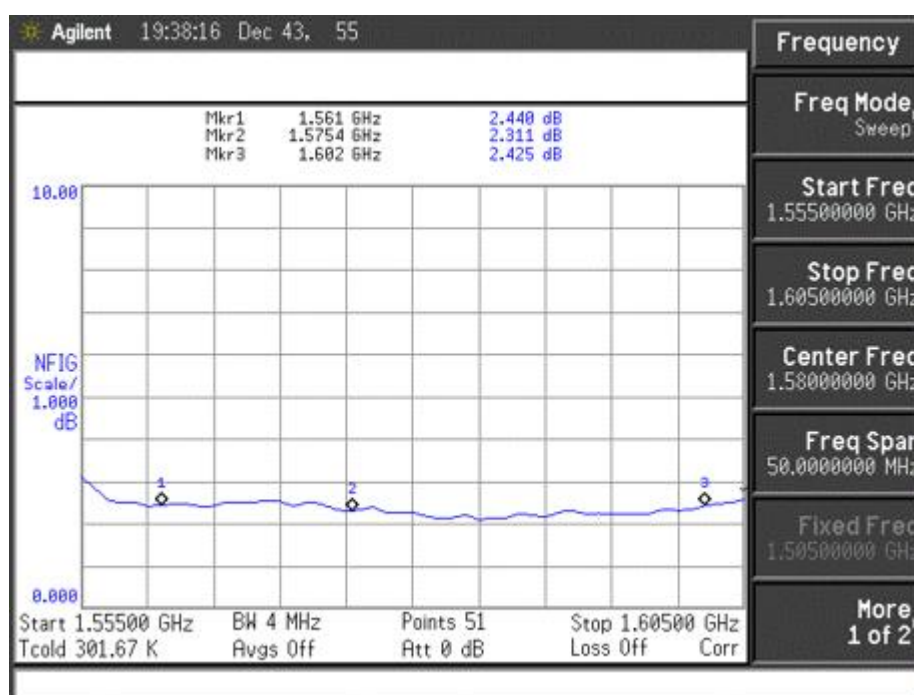


GNSS L2

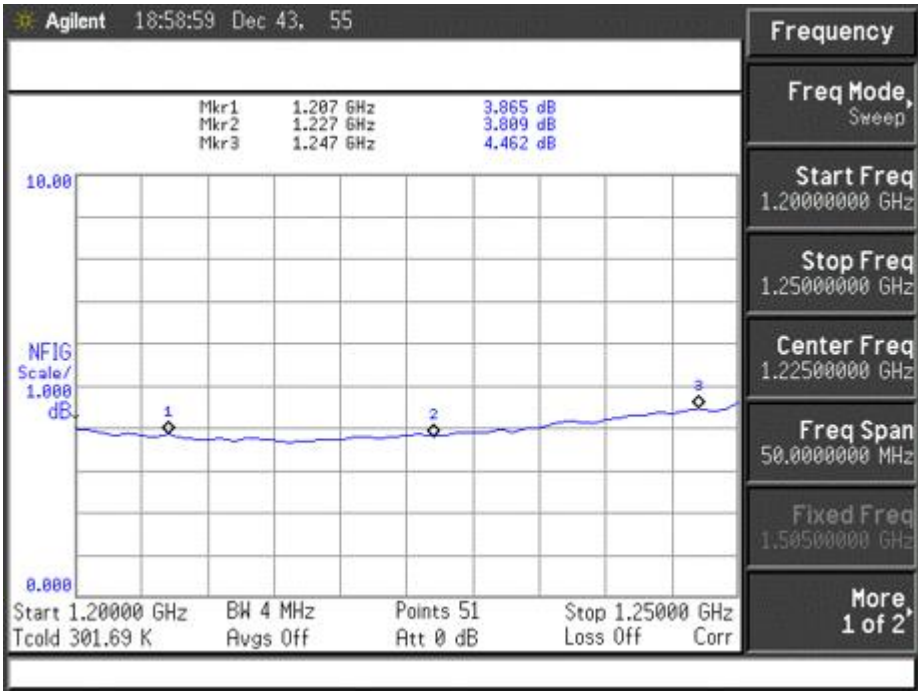


3.11 Noise Figure

GNSS L1



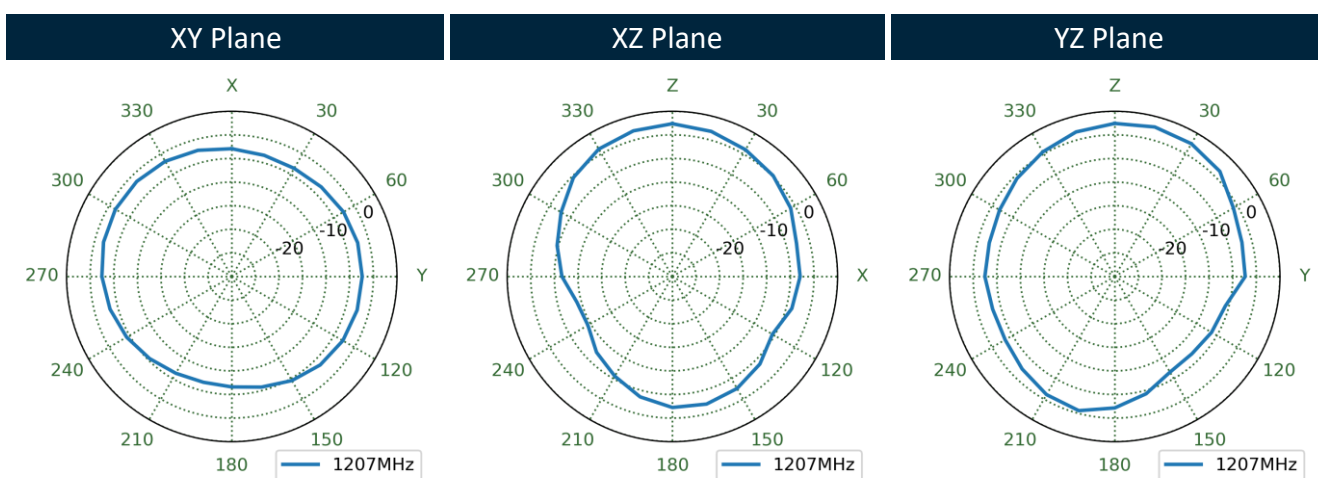
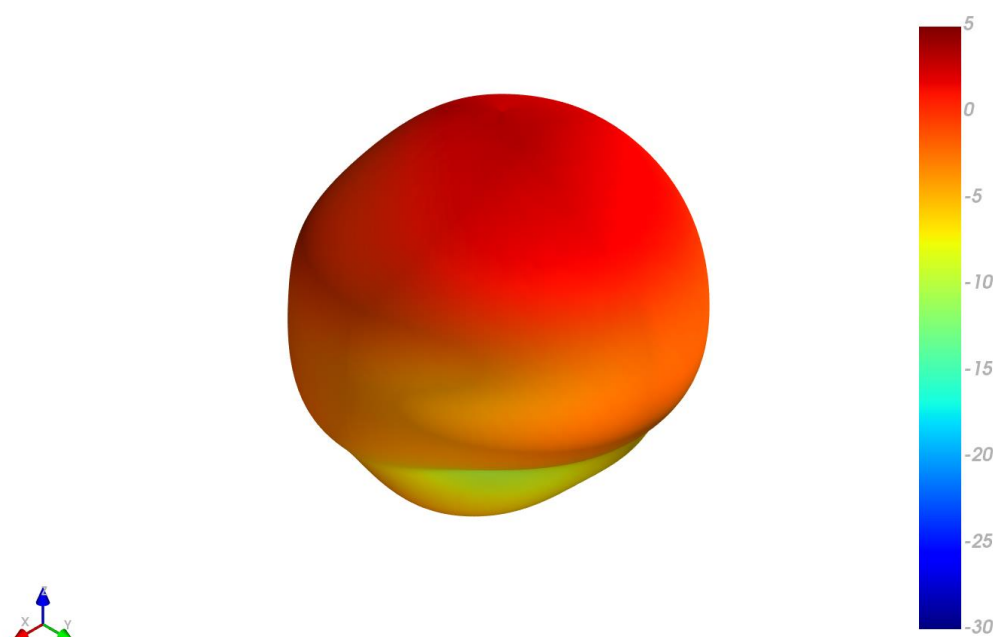
GNSS L2



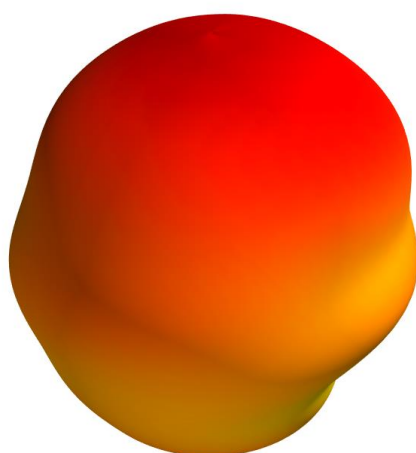
5. Radiation Patterns

5.1 GNSS 3D and 2D Radiation Patterns

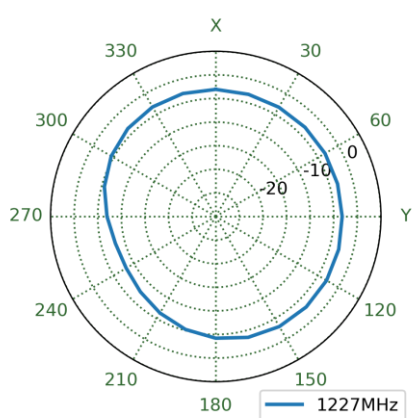
1207MHz



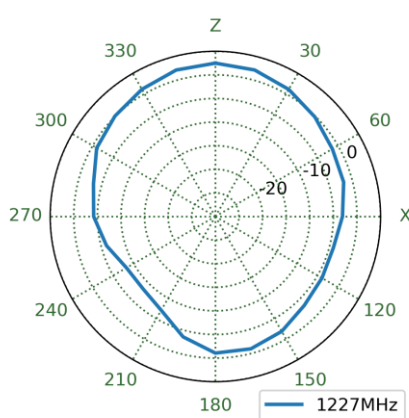
1227MHz



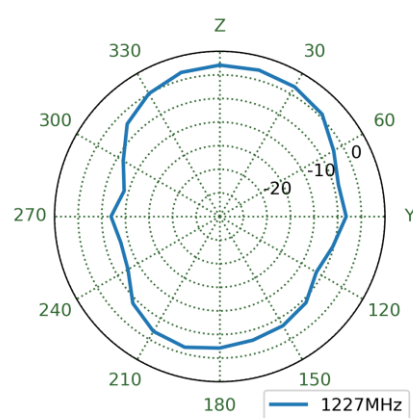
XY Plane



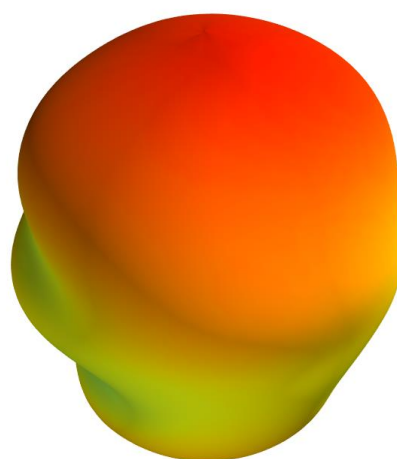
XZ Plane



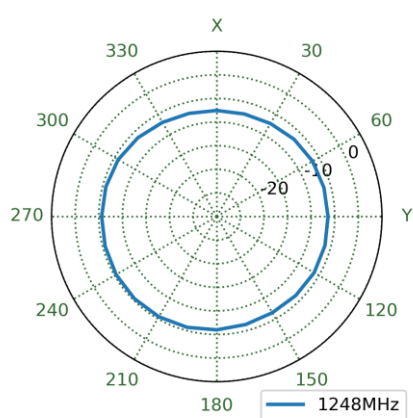
YZ Plane



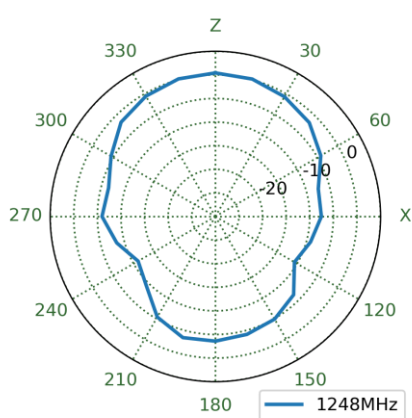
1248MHz



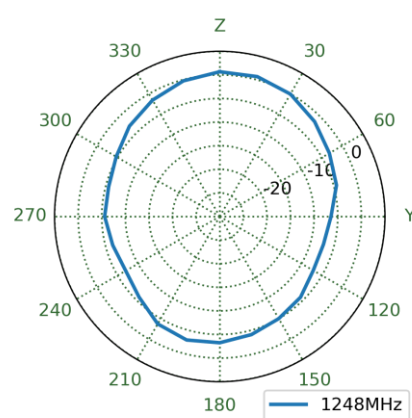
XY Plane



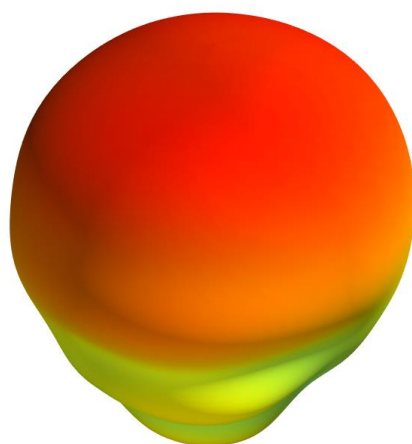
XZ Plane



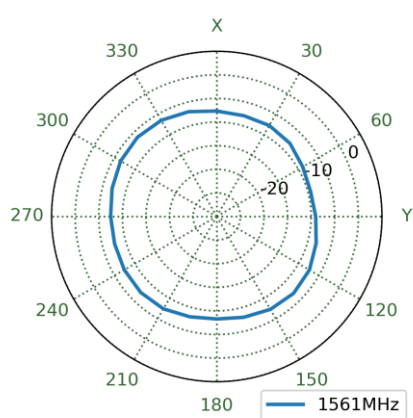
YZ Plane



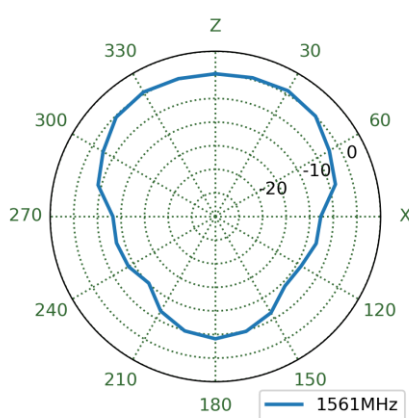
1561MHz



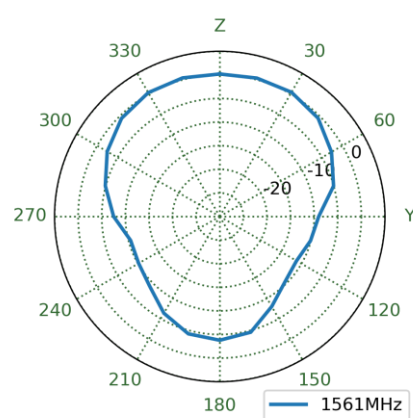
XY Plane



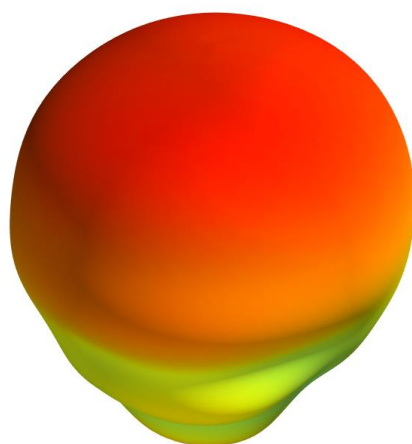
XZ Plane



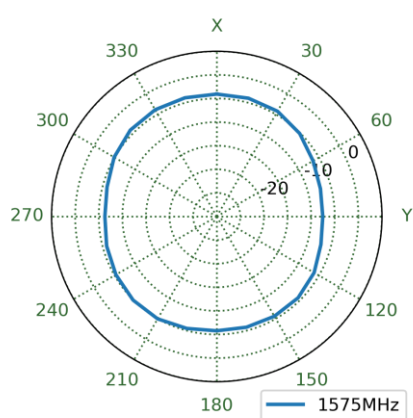
YZ Plane



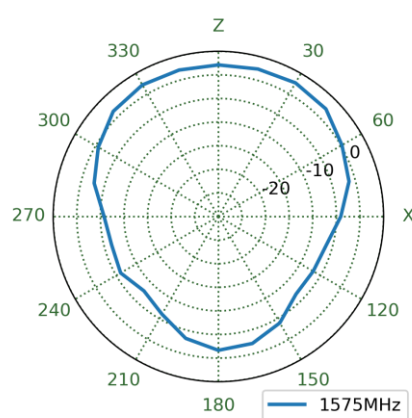
1575MHz



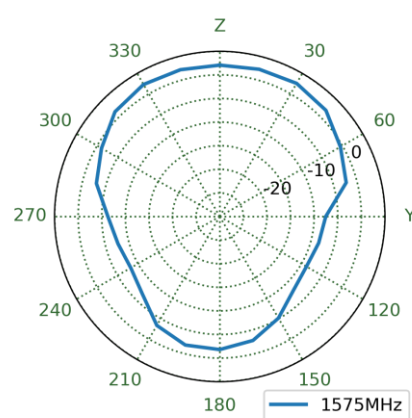
XY Plane



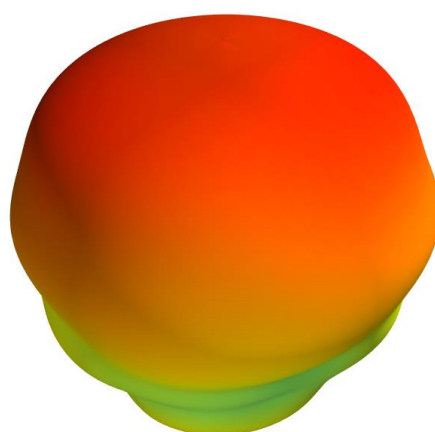
XZ Plane



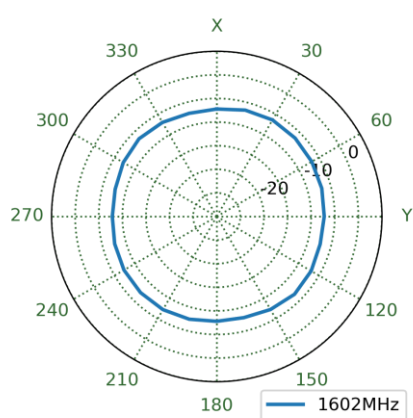
YZ Plane



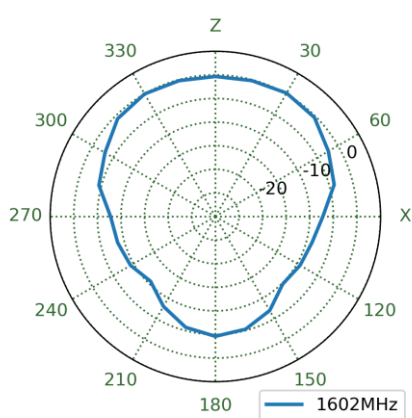
1602MHz



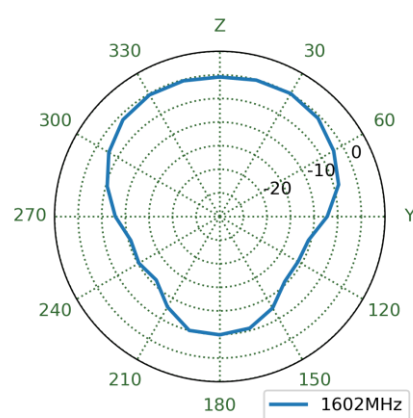
XY Plane



XZ Plane

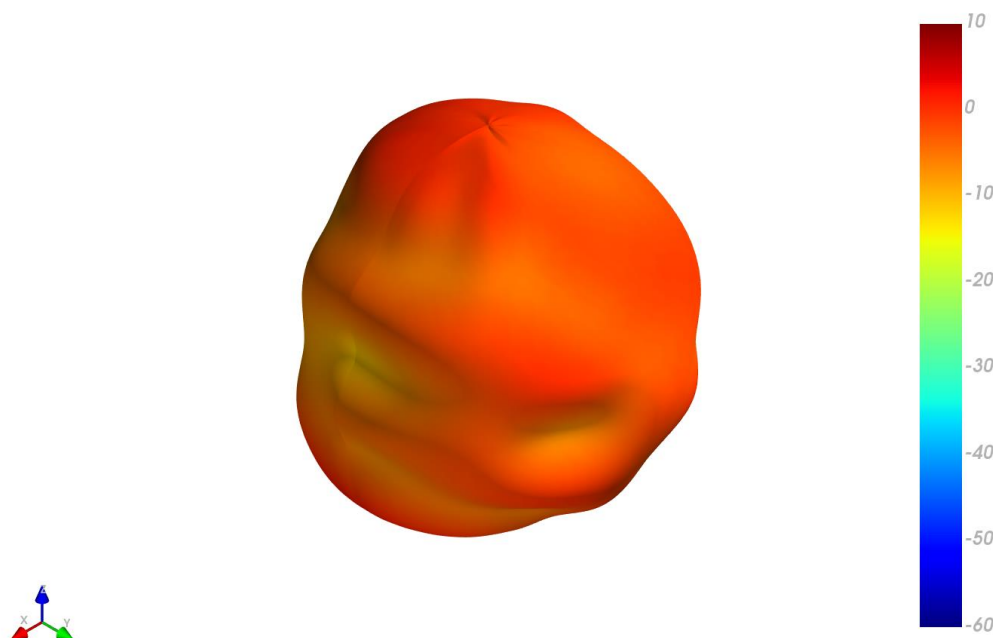


YZ Plane

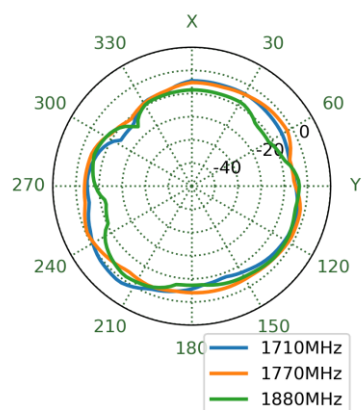


5.2 5G/4G 1 3D and 2D Radiation Patterns

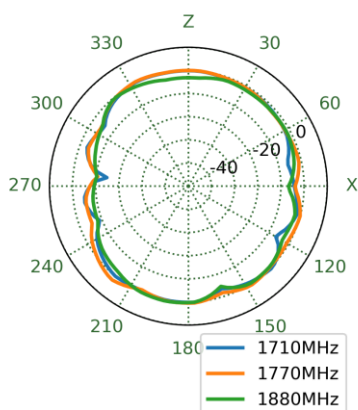
1710MHz



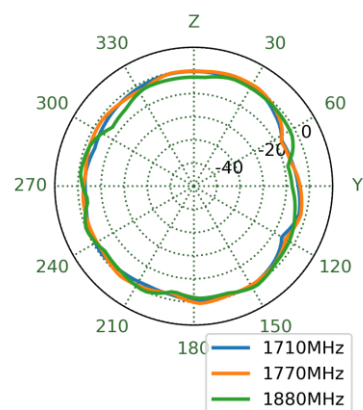
XY Plane



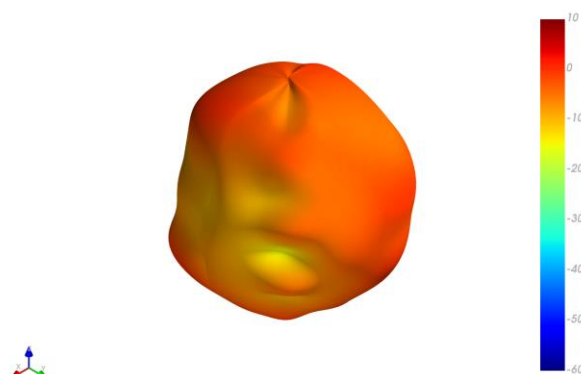
XZ Plane



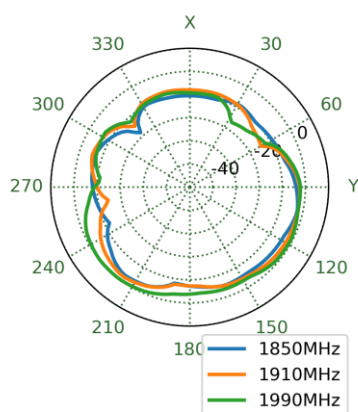
YZ Plane



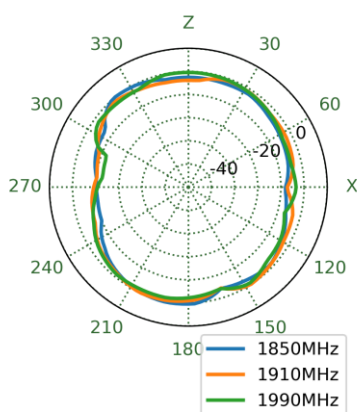
1910MHz



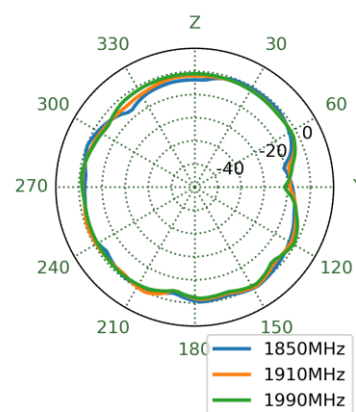
XY Plane



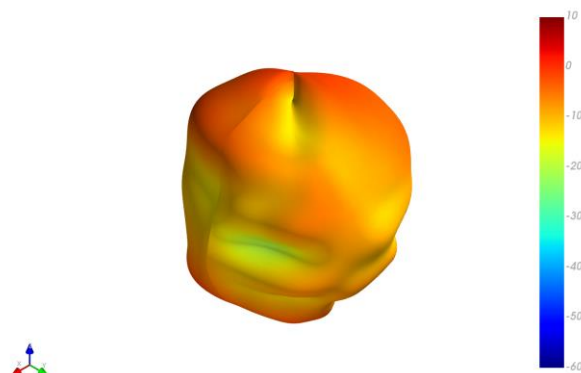
XZ Plane



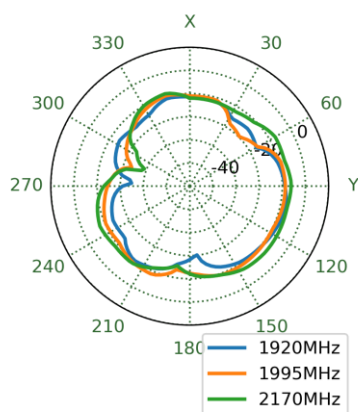
YZ Plane



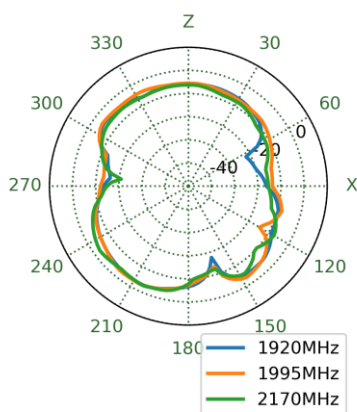
1995MHz



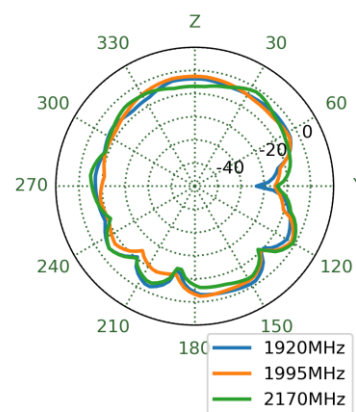
XY Plane



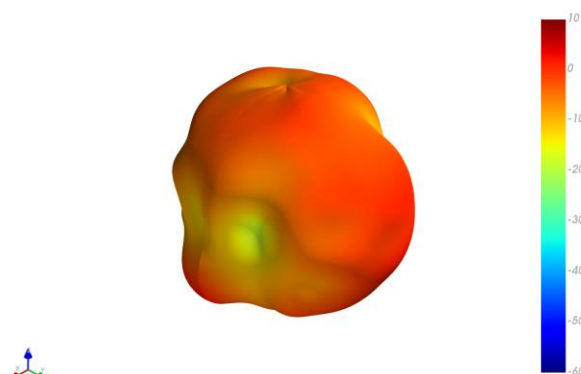
XZ Plane



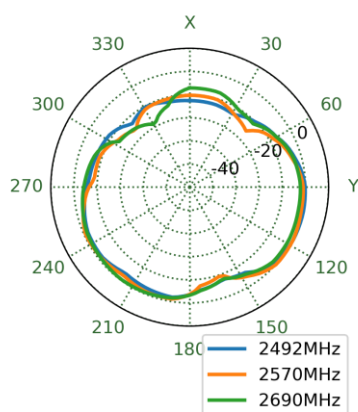
YZ Plane



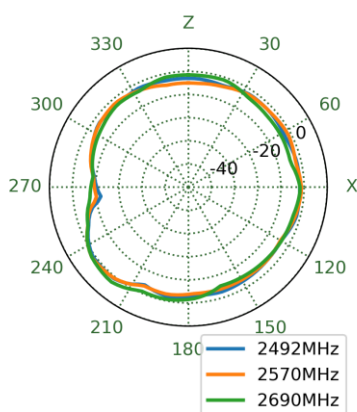
2570MHz



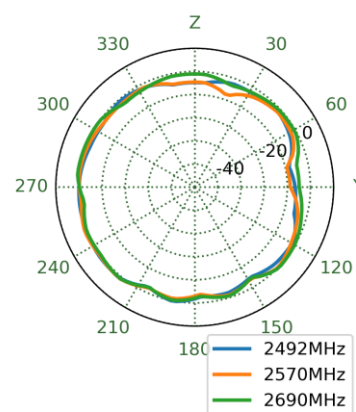
XY Plane



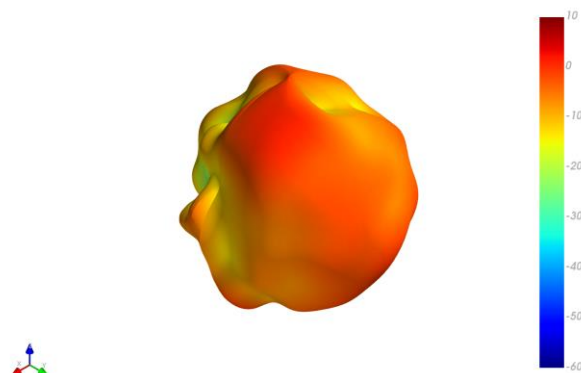
XZ Plane



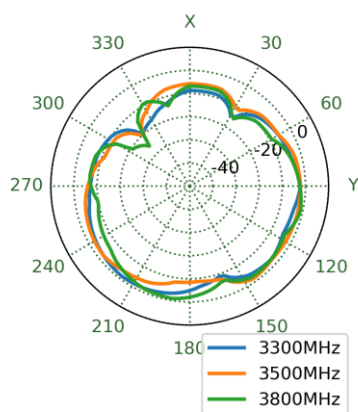
YZ Plane



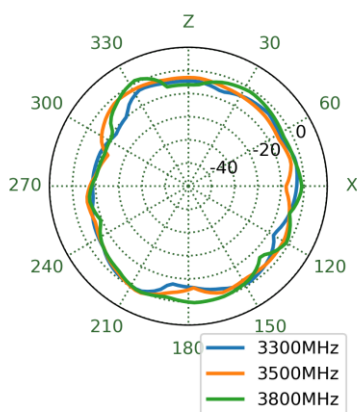
3500MHz



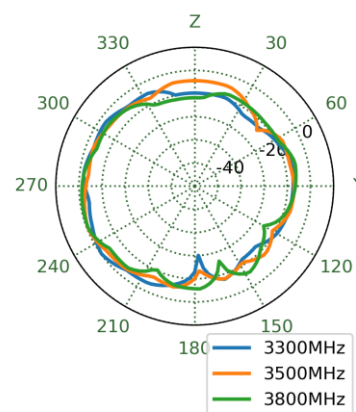
XY Plane



XZ Plane

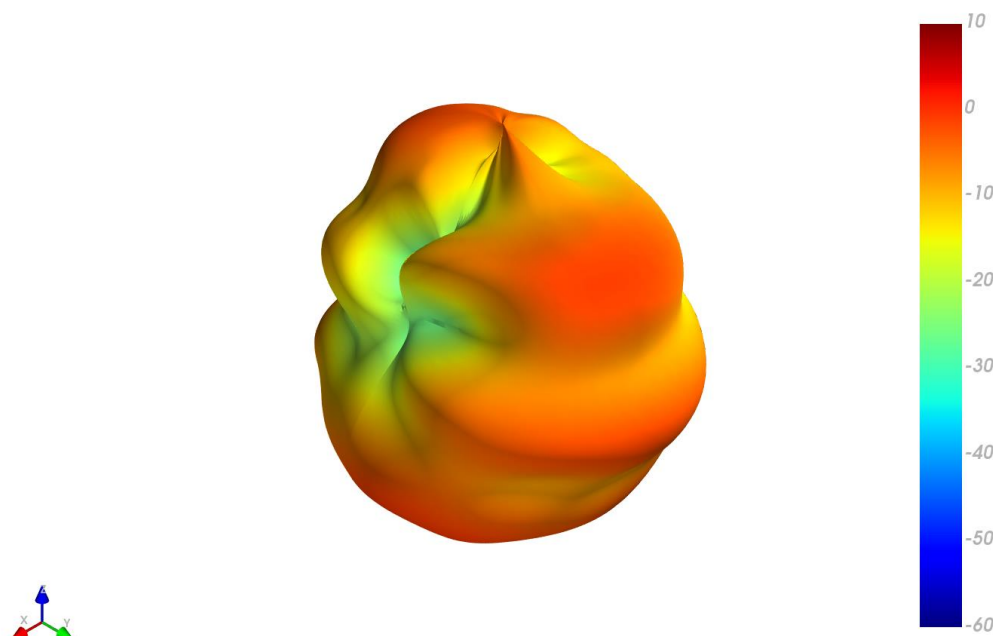


YZ Plane

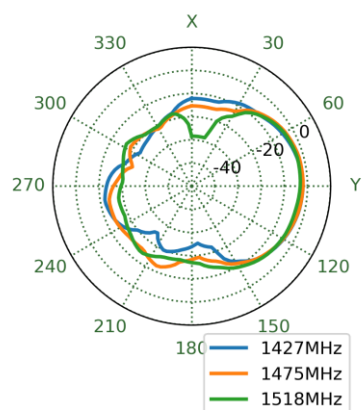


5.3 5G/4G 2 3D and 2D Radiation Patterns

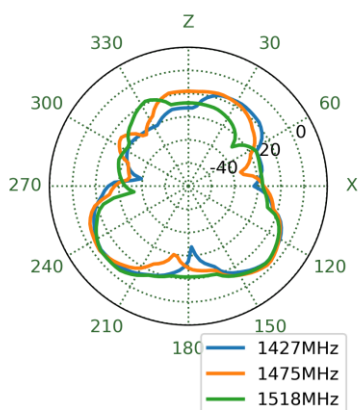
1475MHz



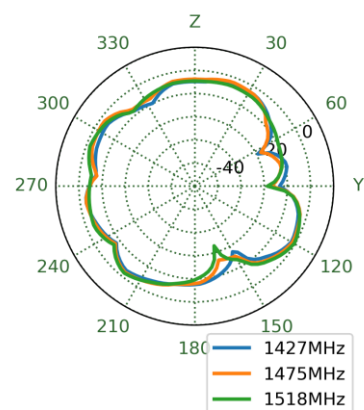
XY Plane



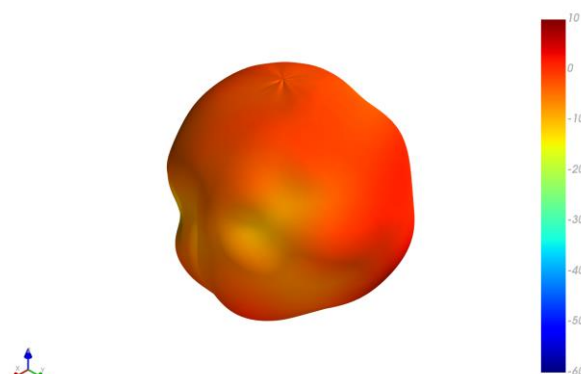
XZ Plane



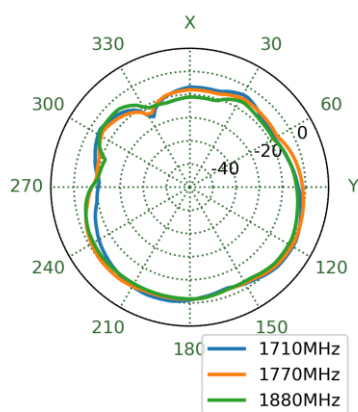
YZ Plane



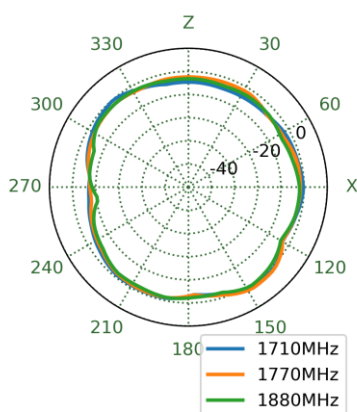
1770MHz



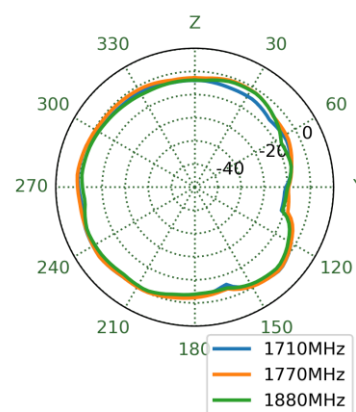
XY Plane



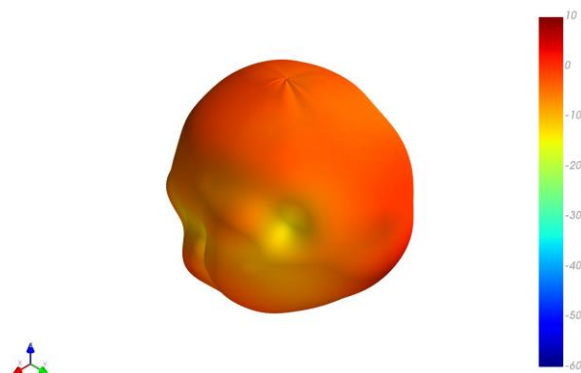
XZ Plane



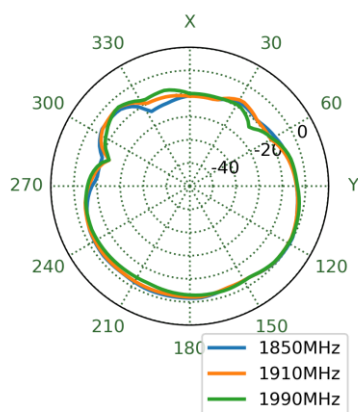
YZ Plane



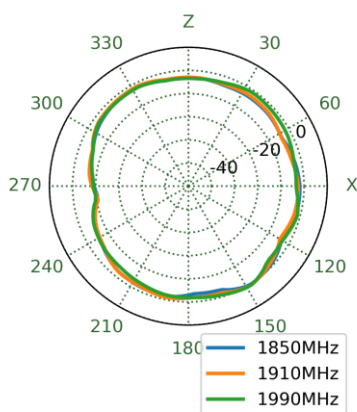
1910MHz



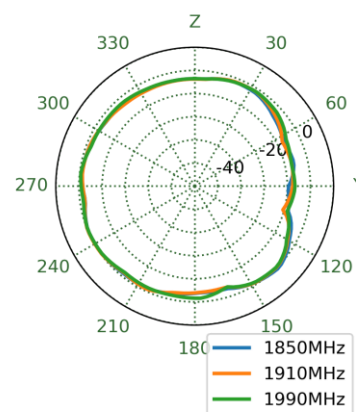
XY Plane



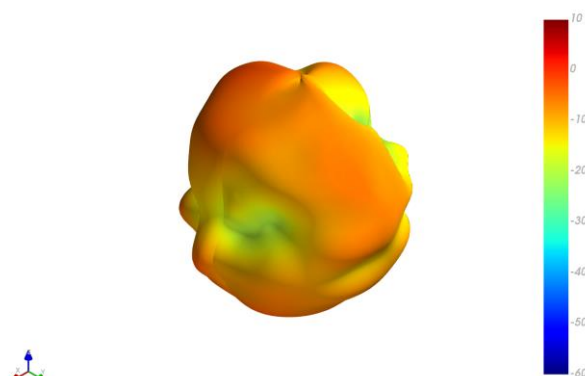
XZ Plane



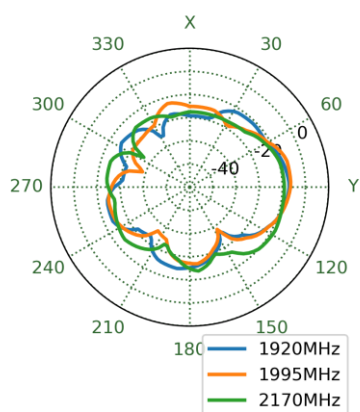
YZ Plane



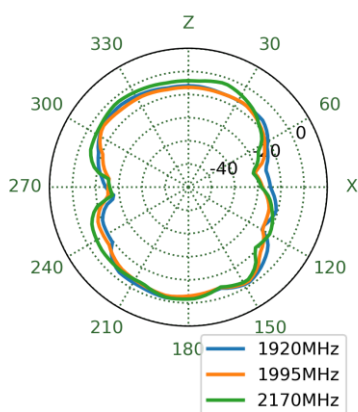
1995MHz



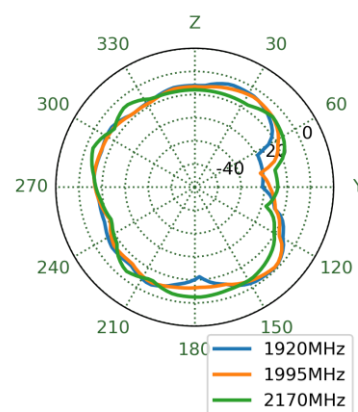
XY Plane



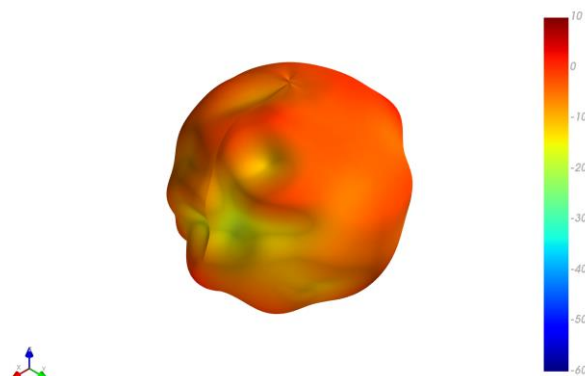
XZ Plane



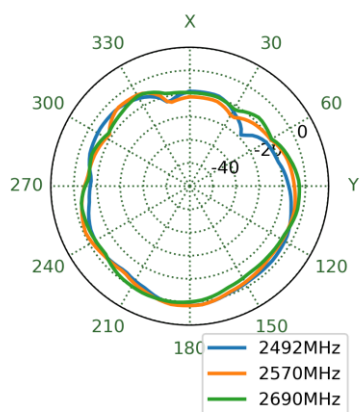
YZ Plane



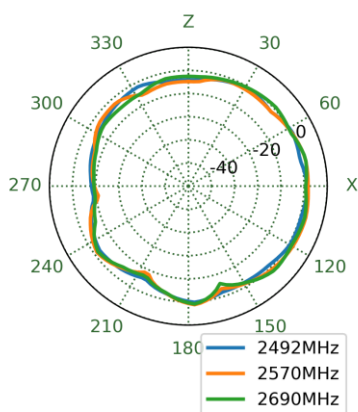
2570MHz



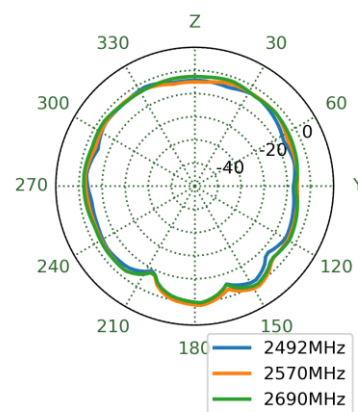
XY Plane



XZ Plane

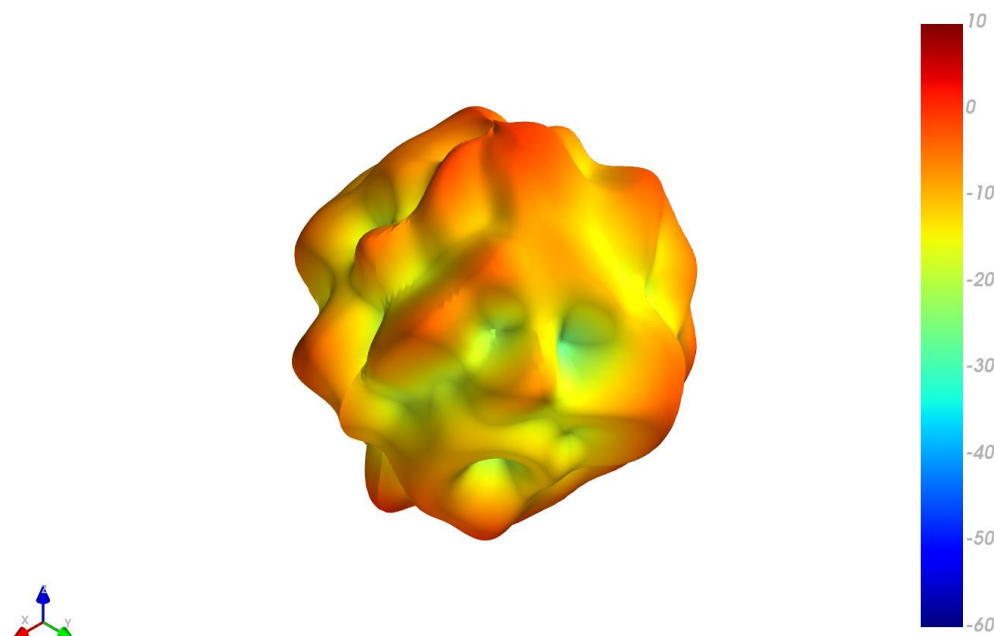


YZ Plane

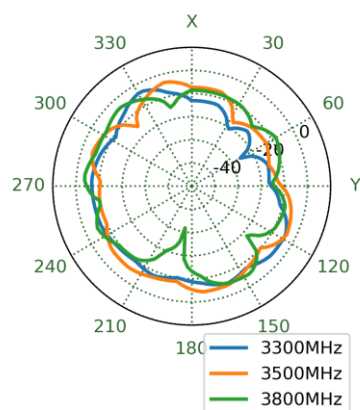


5.4 5G/4G 3 3D and 2D Radiation Patterns

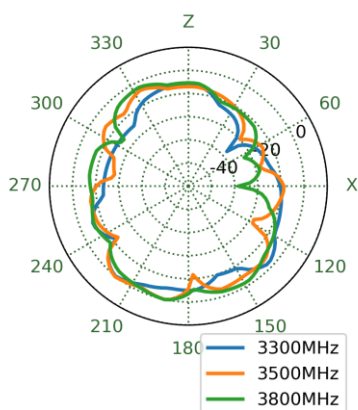
3500MHz



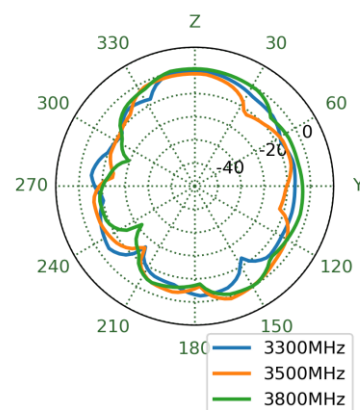
XY Plane



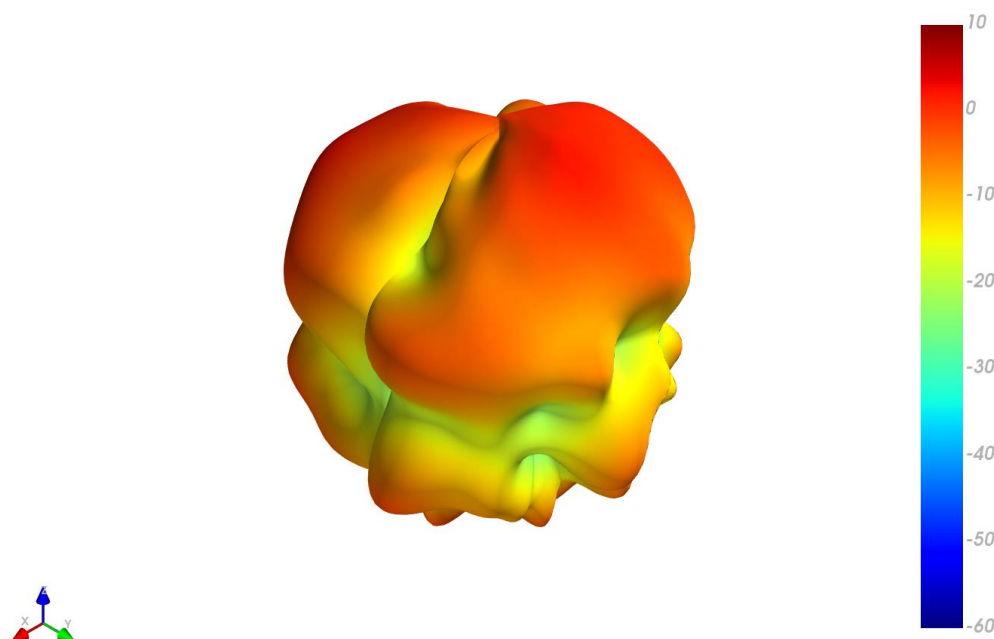
XZ Plane



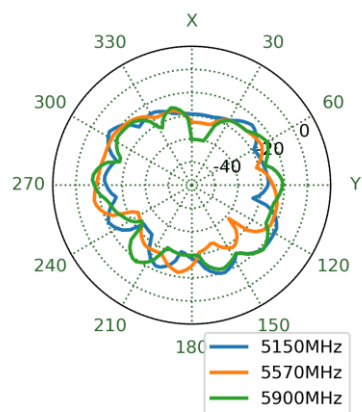
YZ Plane



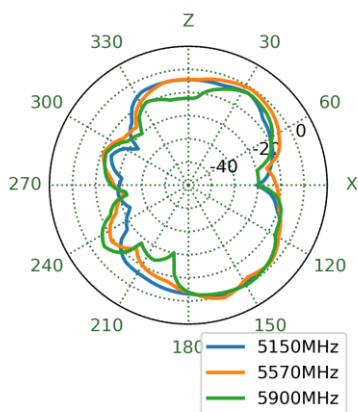
5570MHz



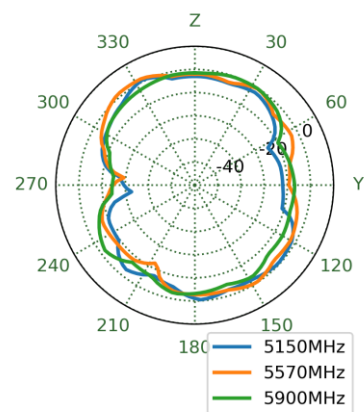
XY Plane



XZ Plane

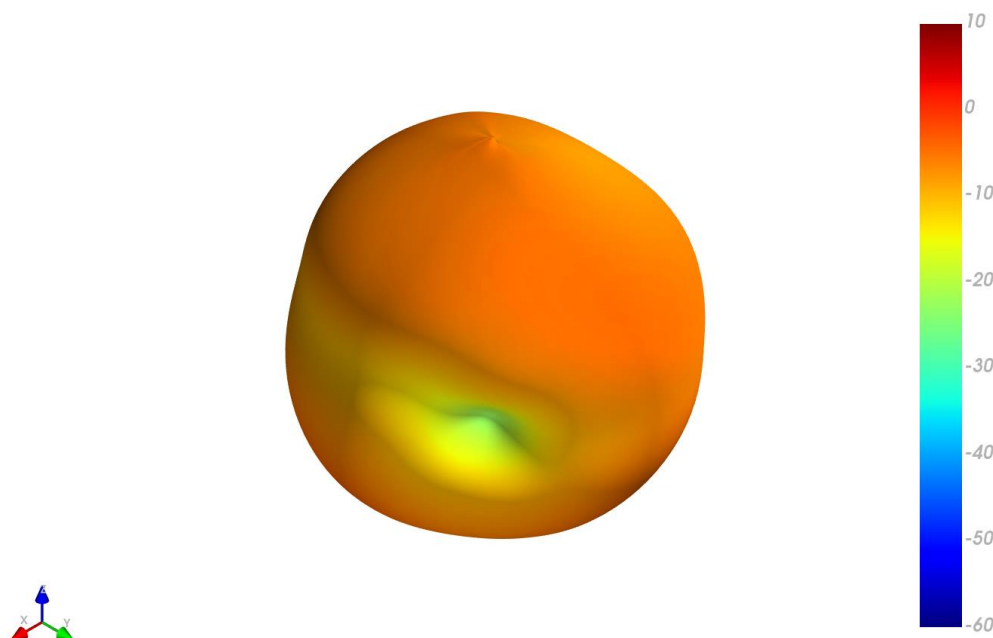


YZ Plane

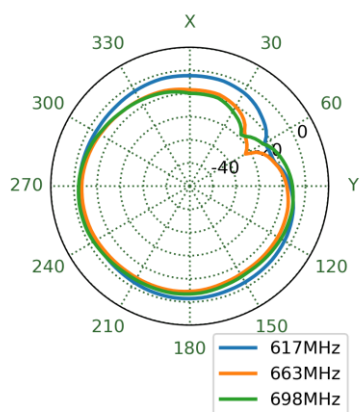


5.5 5G/4G 4 3D and 2D Radiation Patterns

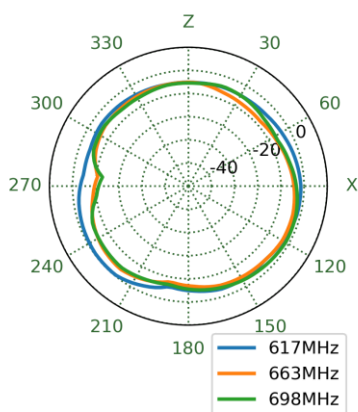
663MHz



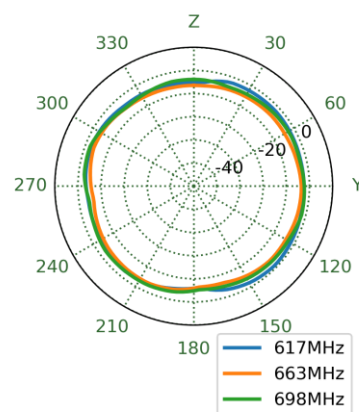
XY Plane



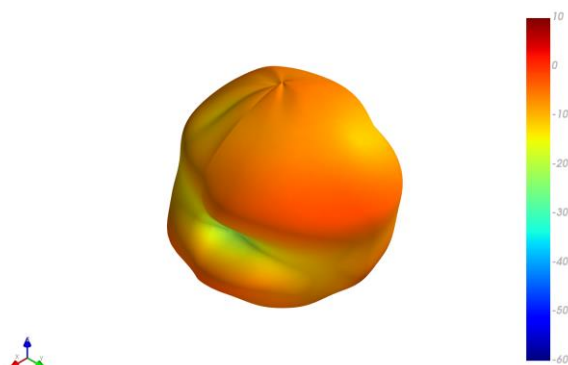
XZ Plane



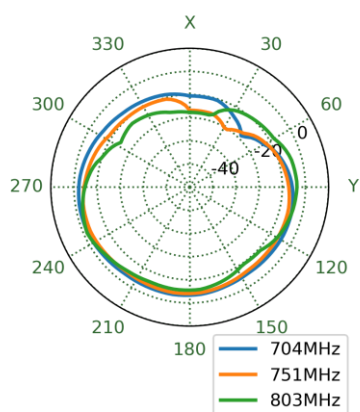
YZ Plane



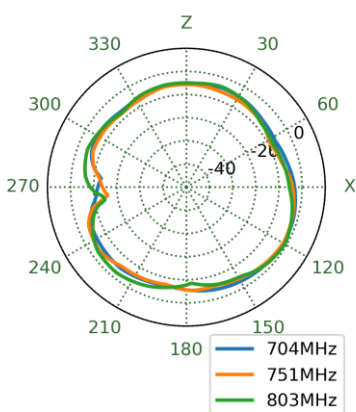
751MHz



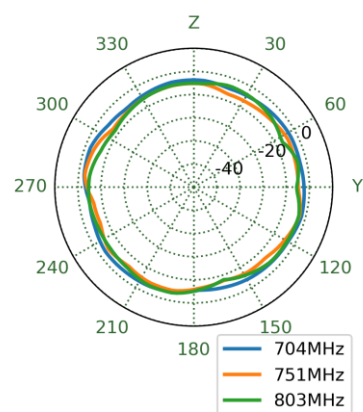
XY Plane



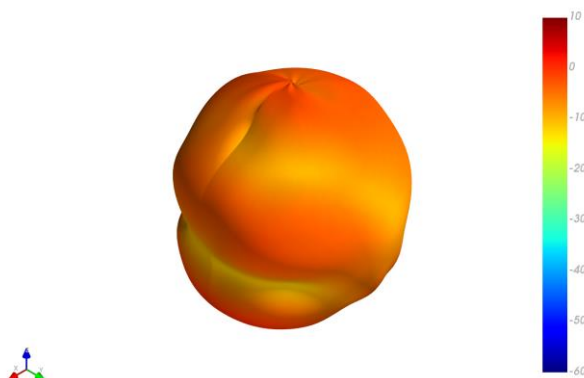
XZ Plane



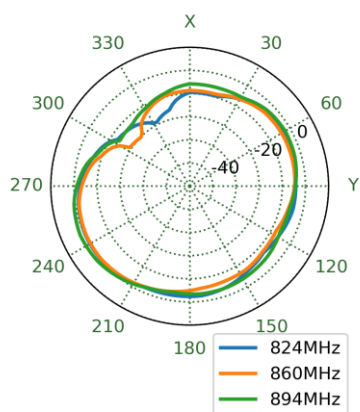
YZ Plane



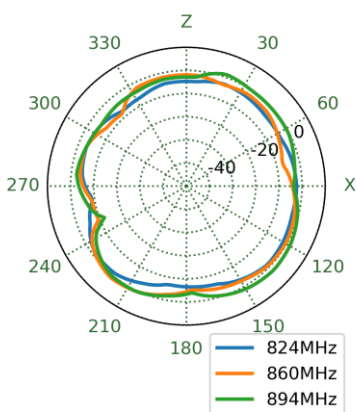
860MHz



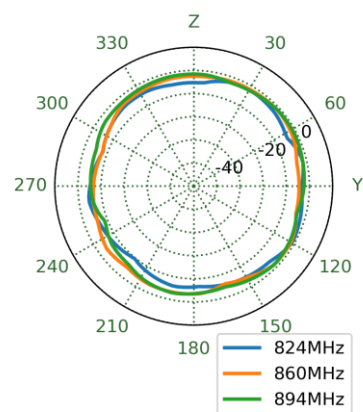
XY Plane



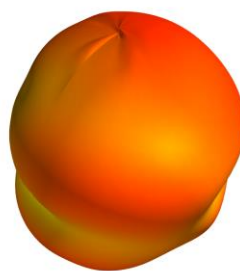
XZ Plane



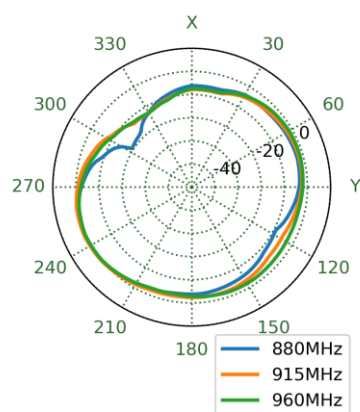
YZ Plane



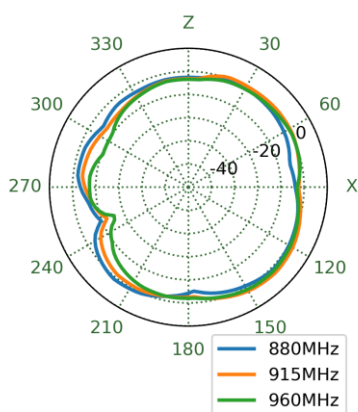
915MHz



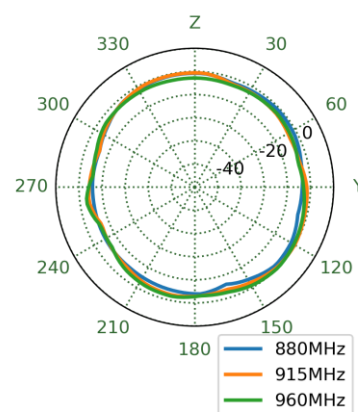
XY Plane



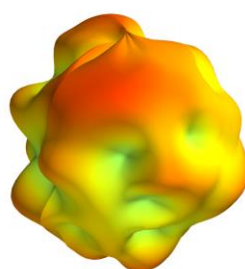
XZ Plane



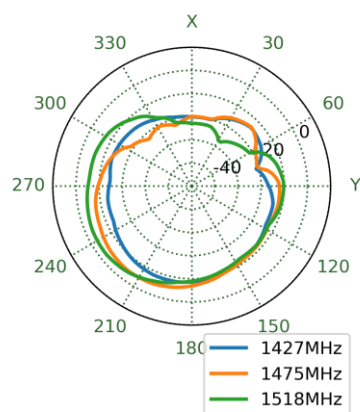
YZ Plane



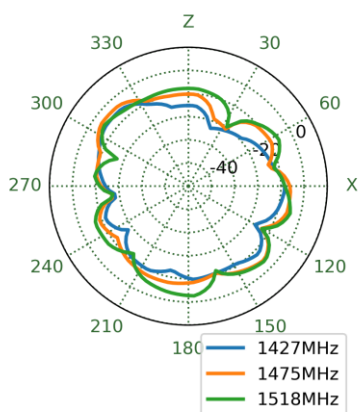
1475MHz



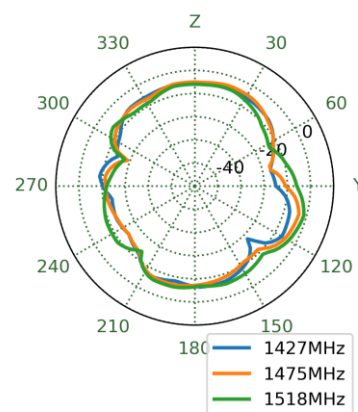
XY Plane



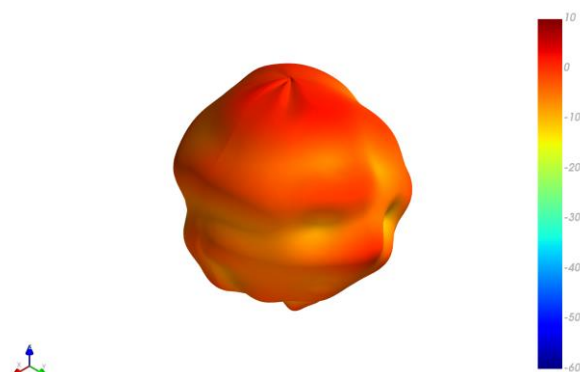
XZ Plane



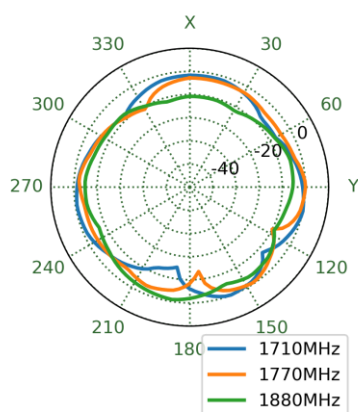
YZ Plane



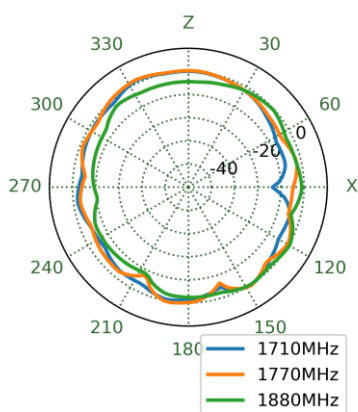
1770MHz



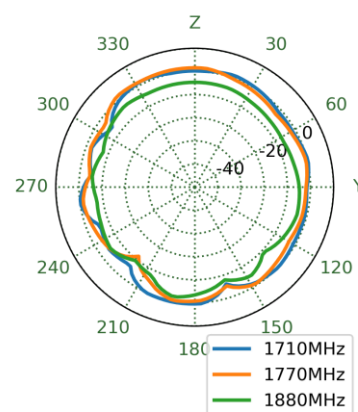
XY Plane



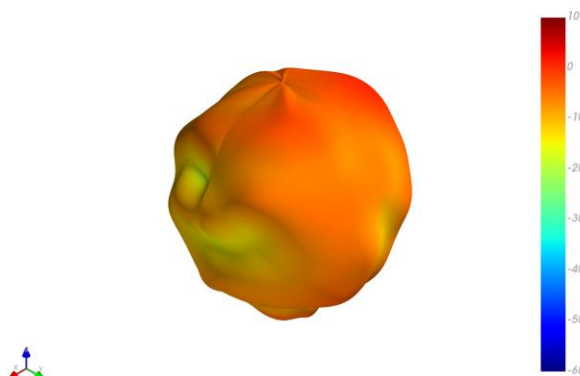
XZ Plane



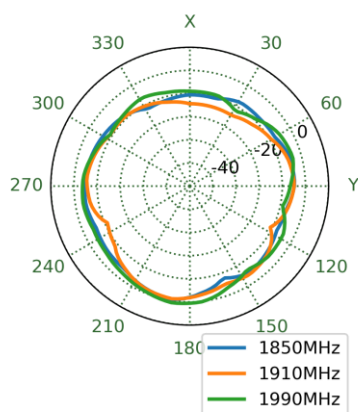
YZ Plane



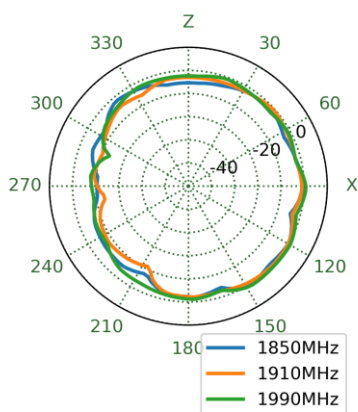
1910MHz



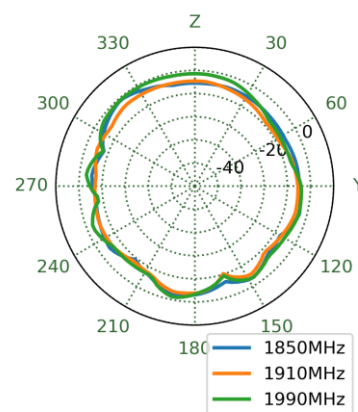
XY Plane



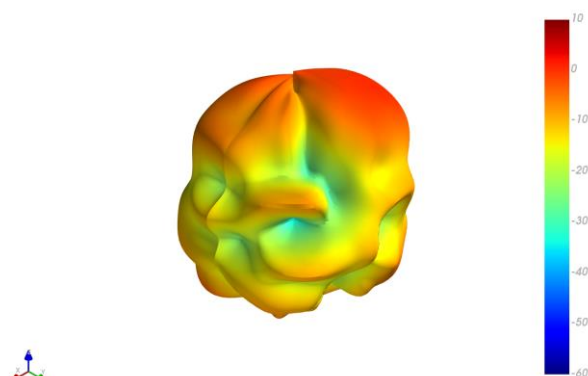
XZ Plane



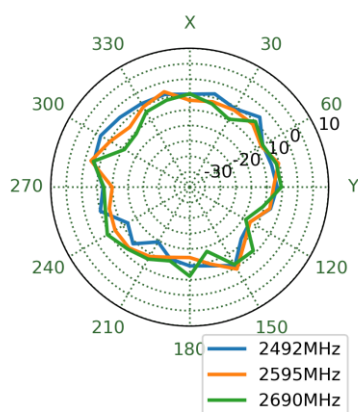
YZ Plane



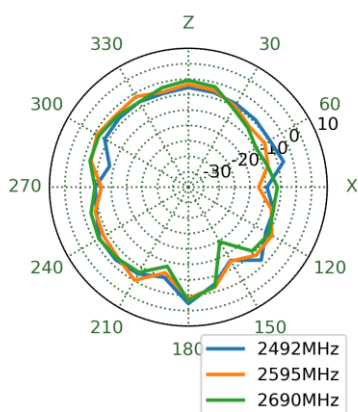
1995MHz



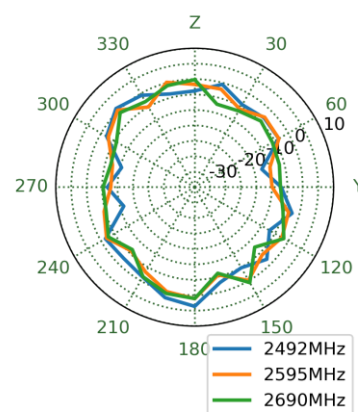
XY Plane



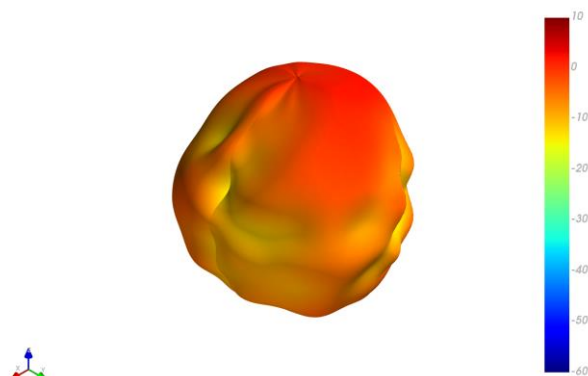
XZ Plane



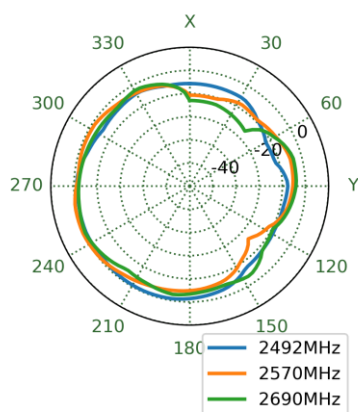
YZ Plane



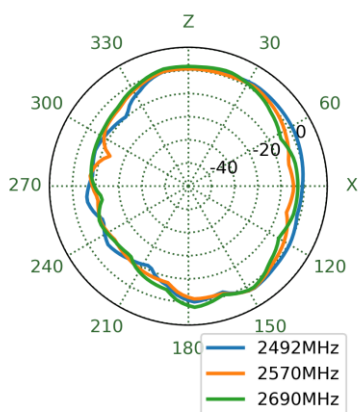
2570MHz



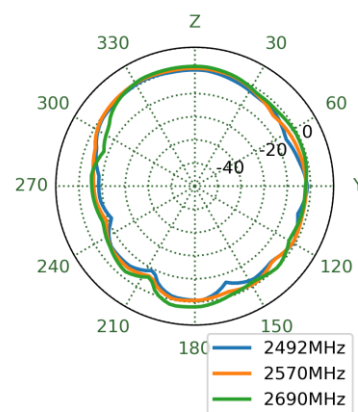
XY Plane



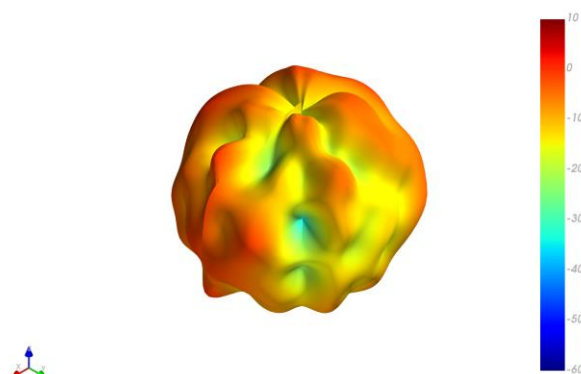
XZ Plane



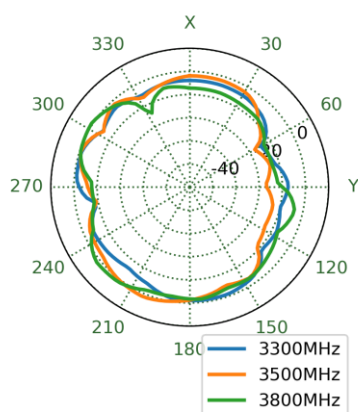
YZ Plane



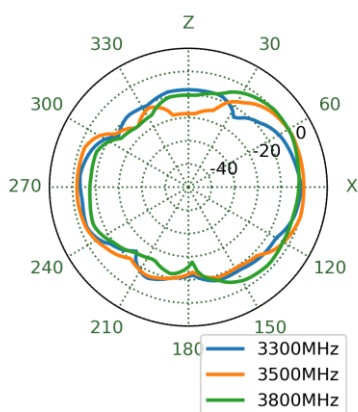
3500MHz



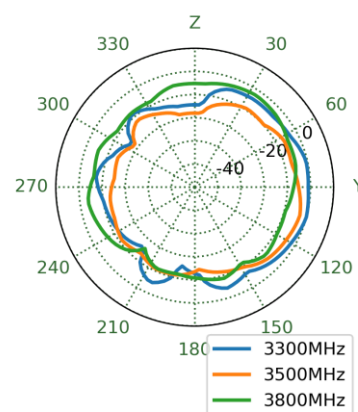
XY Plane



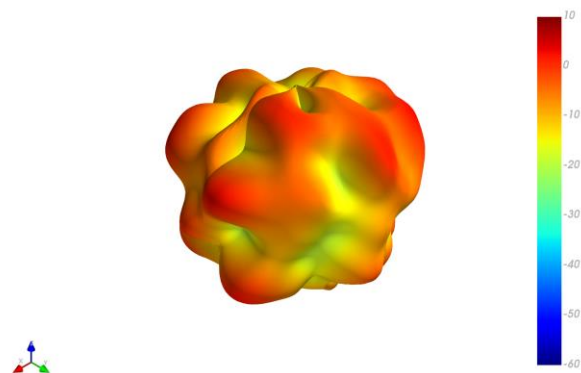
XZ Plane



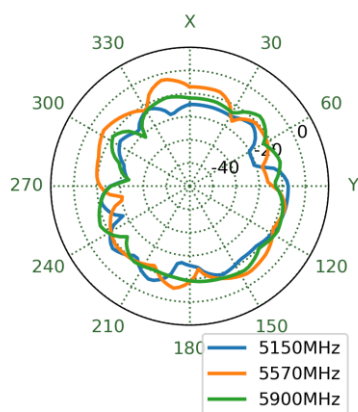
YZ Plane



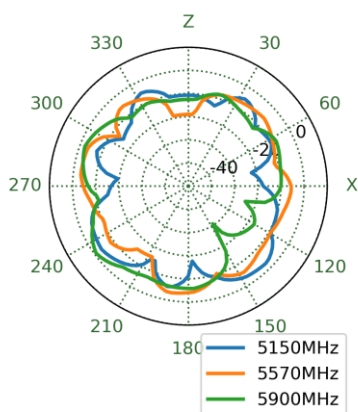
5570MHz



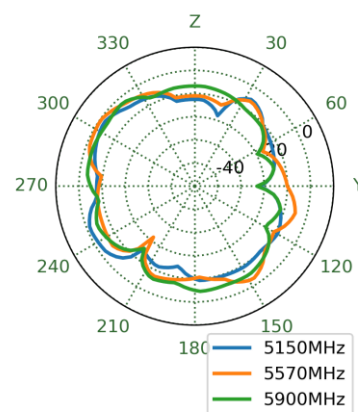
XY Plane



XZ Plane

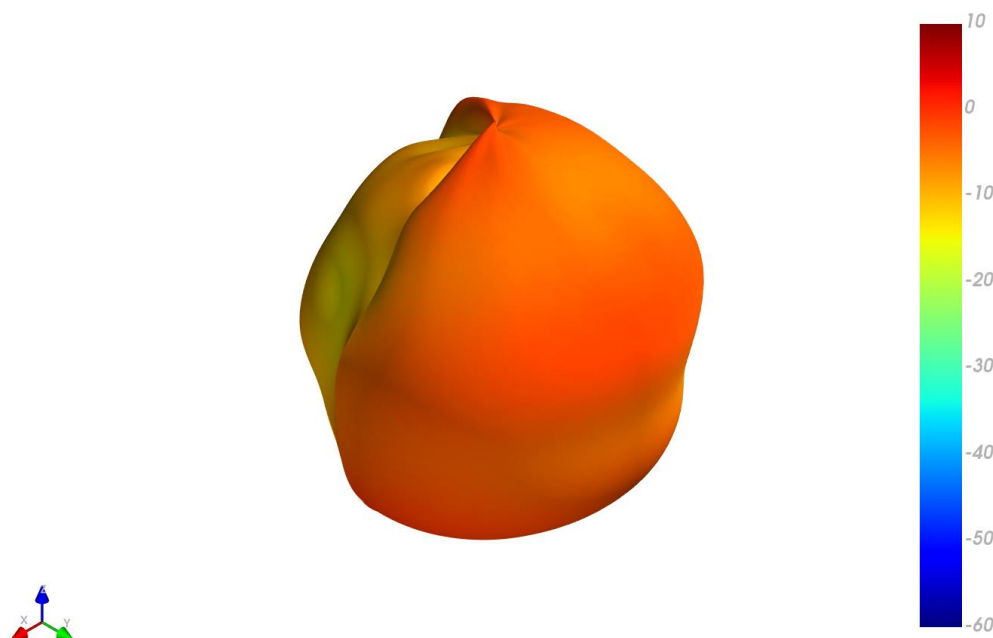


YZ Plane

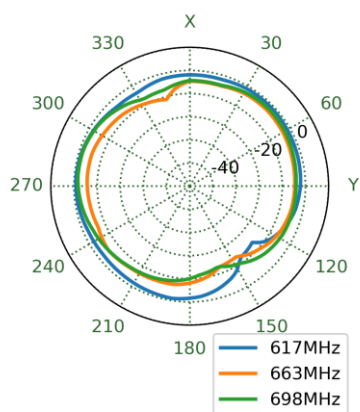


5.6 5G/4G 5 3D and 2D Radiation Patterns

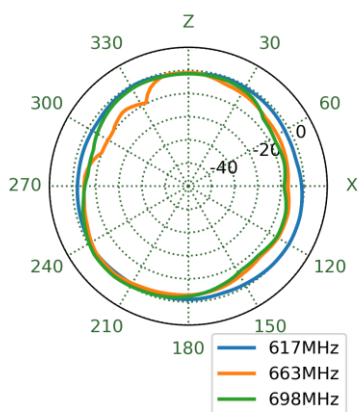
663MHz



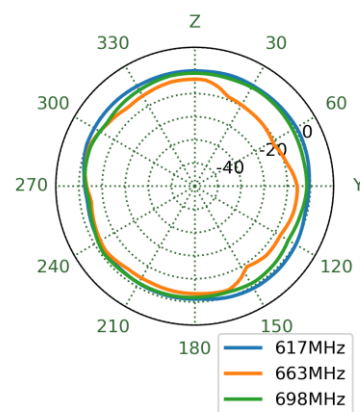
XY Plane



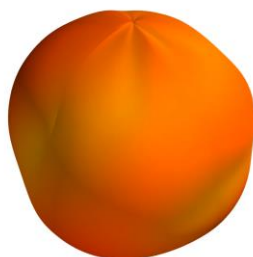
XZ Plane



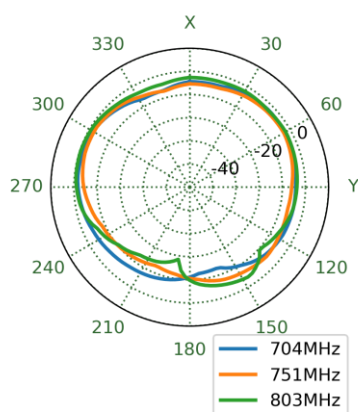
YZ Plane



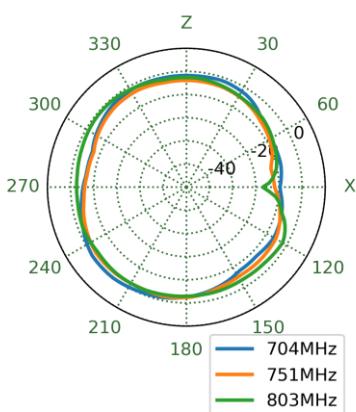
751MHz



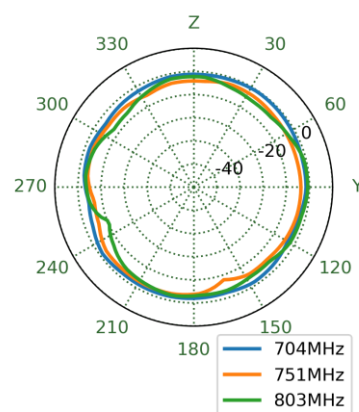
XY Plane



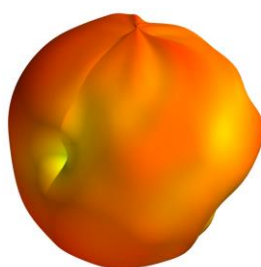
XZ Plane



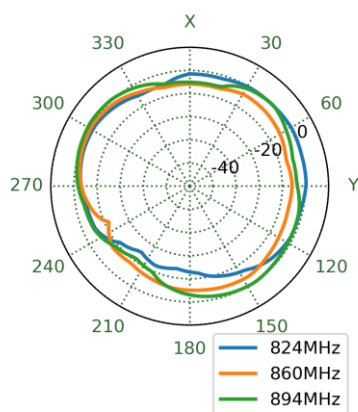
YZ Plane



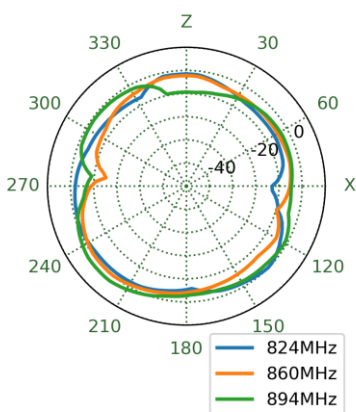
860MHz



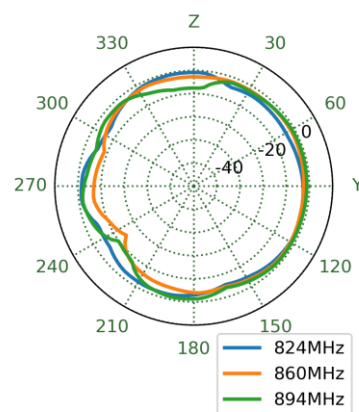
XY Plane



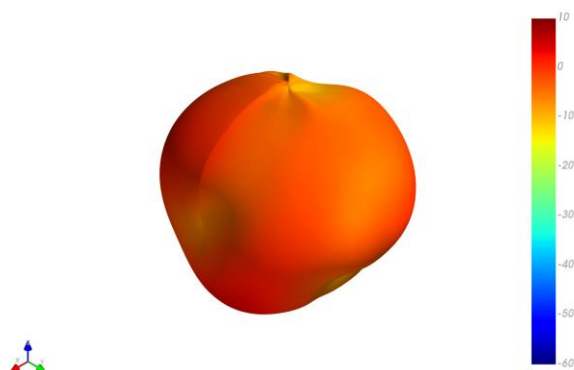
XZ Plane



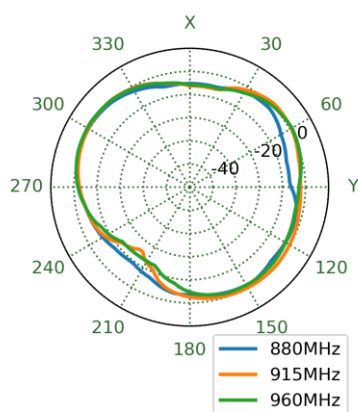
YZ Plane



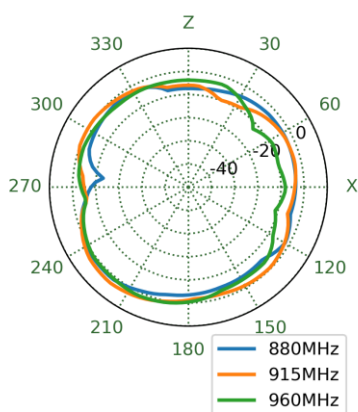
915MHz



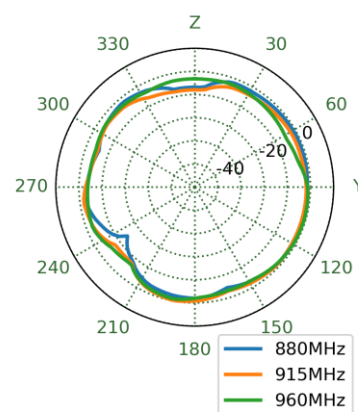
XY Plane



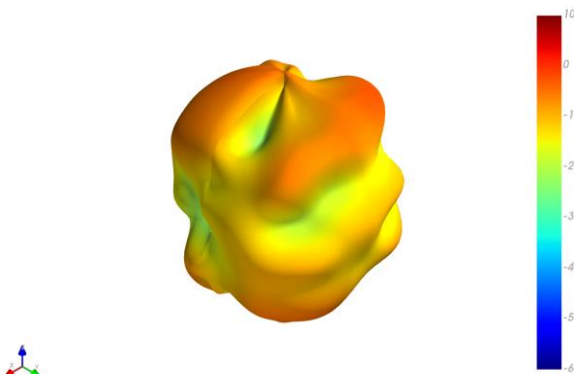
XZ Plane



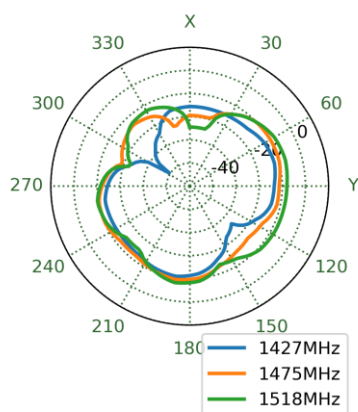
YZ Plane



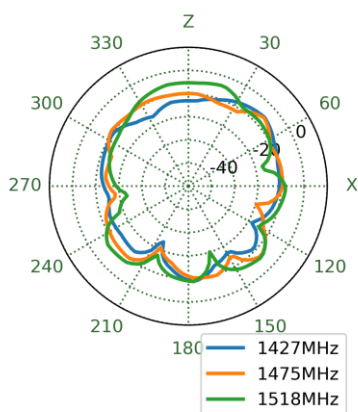
1475MHz



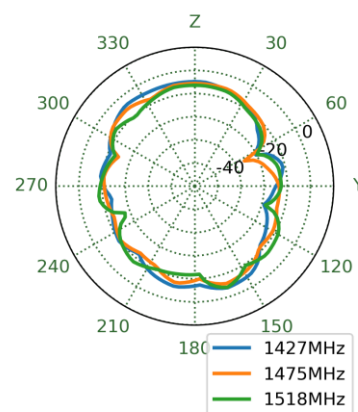
XY Plane



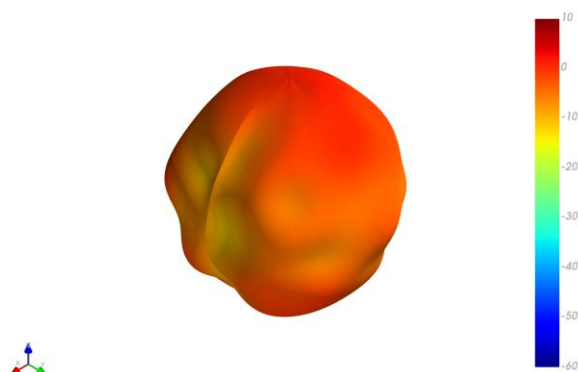
XZ Plane



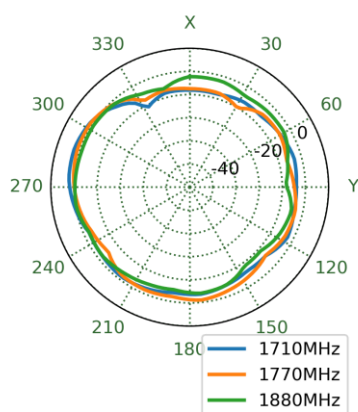
YZ Plane



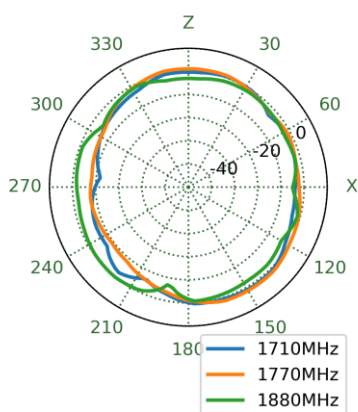
1770MHz



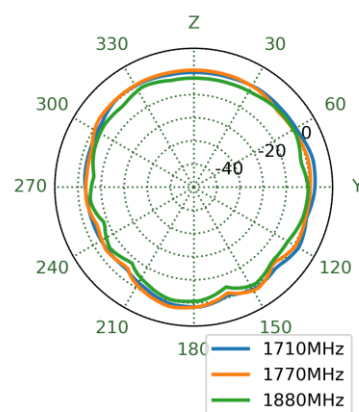
XY Plane



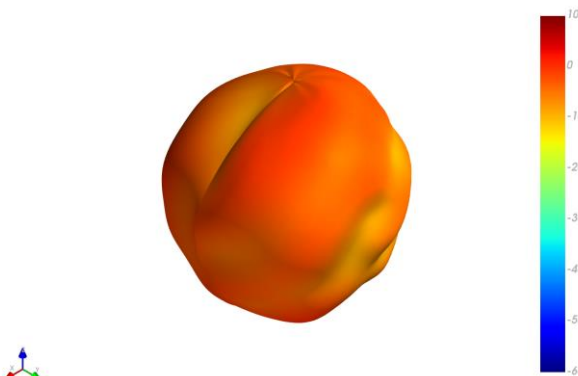
XZ Plane



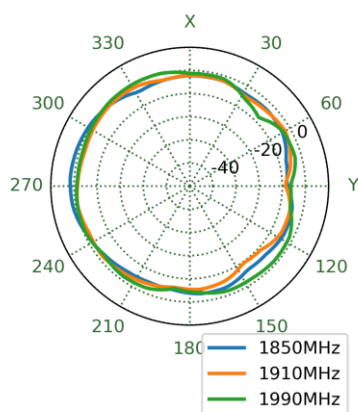
YZ Plane



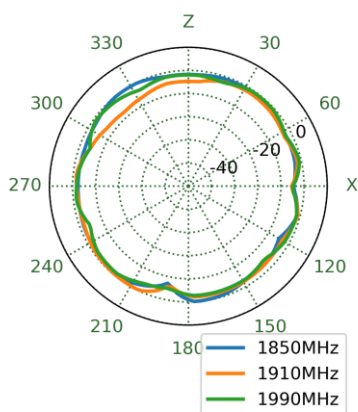
1910MHz



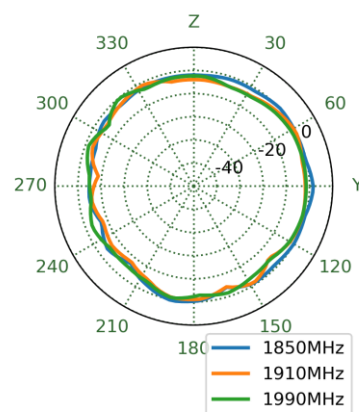
XY Plane



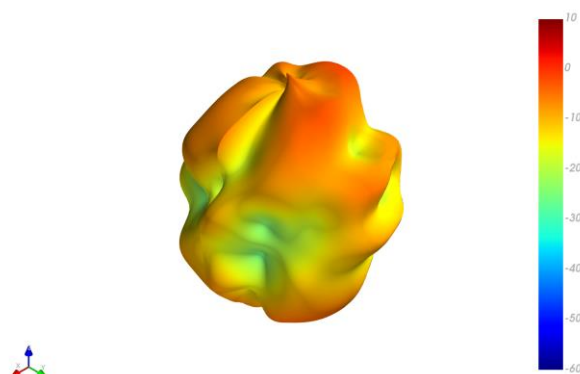
XZ Plane



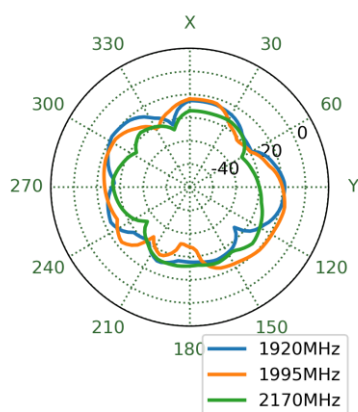
YZ Plane



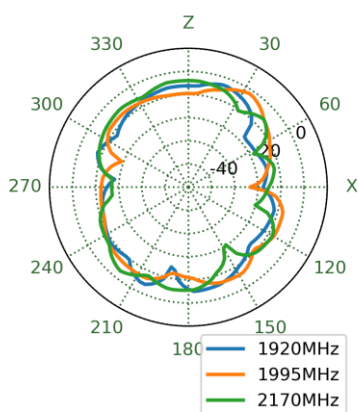
1995MHz



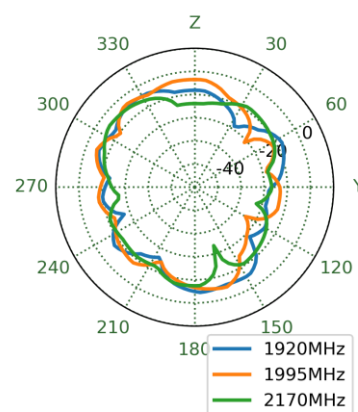
XY Plane



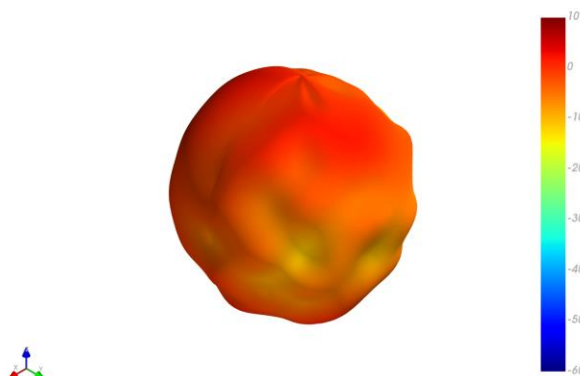
XZ Plane



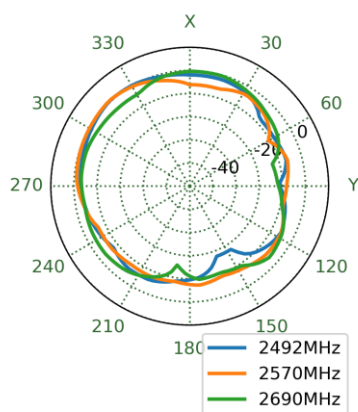
YZ Plane



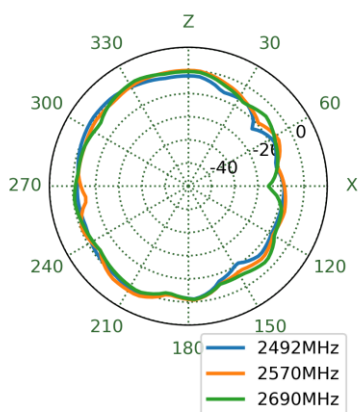
2570MHz



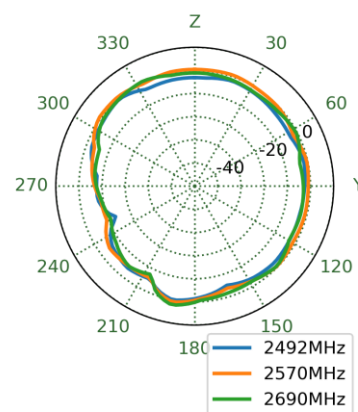
XY Plane



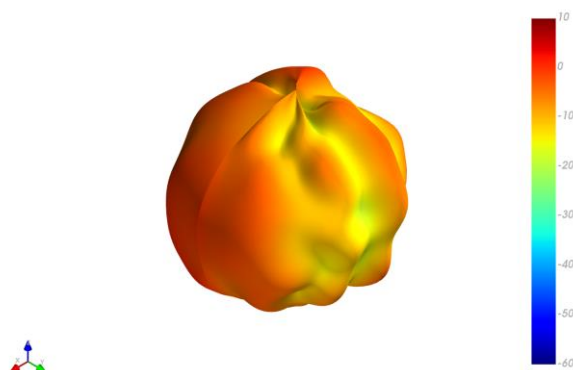
XZ Plane



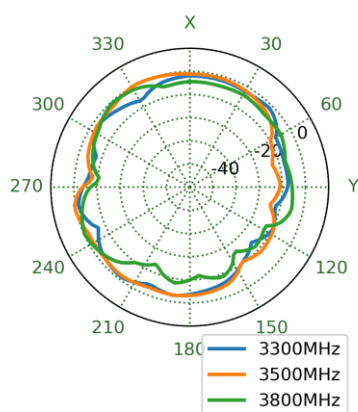
YZ Plane



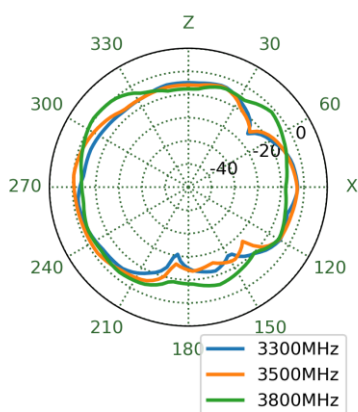
3500MHz



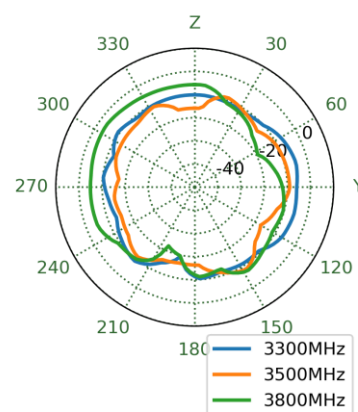
XY Plane



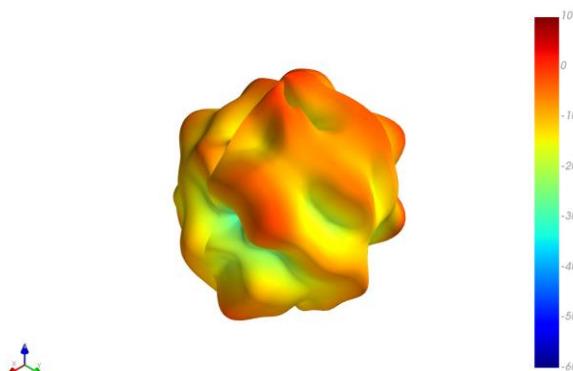
XZ Plane



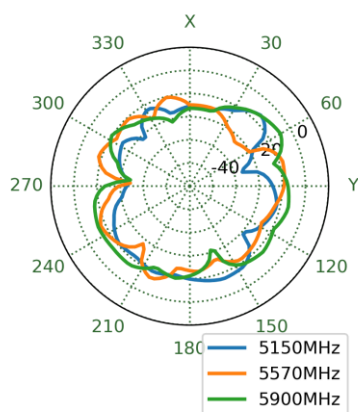
YZ Plane



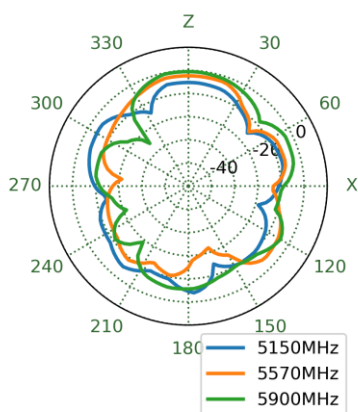
5570MHz



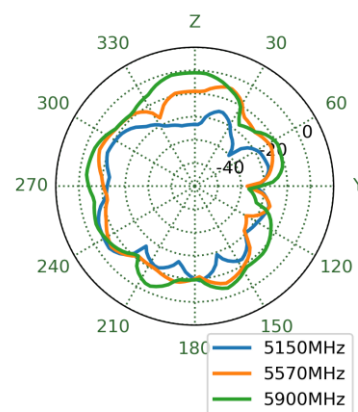
XY Plane



XZ Plane

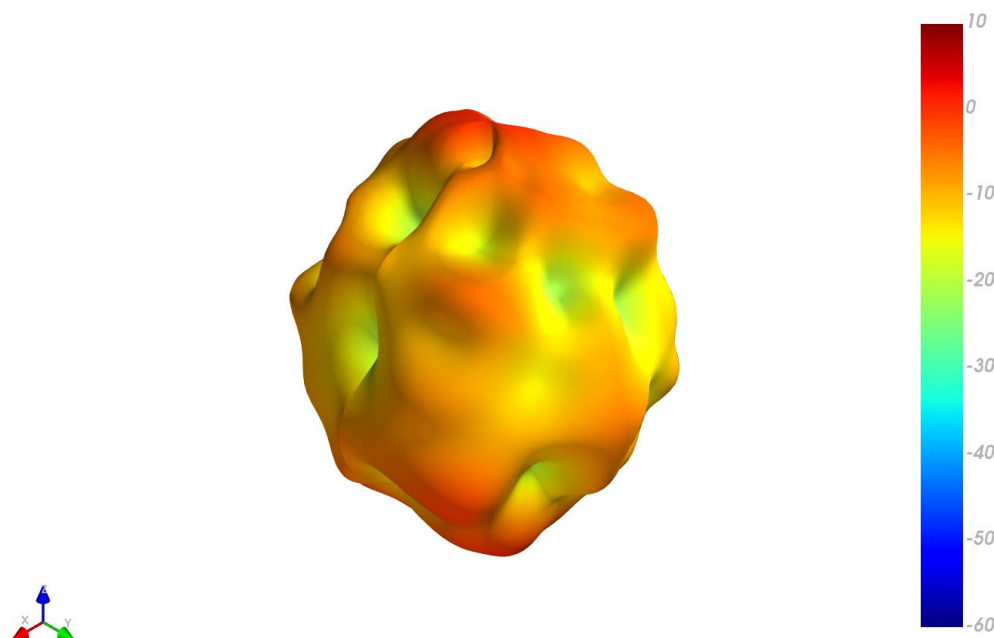


YZ Plane

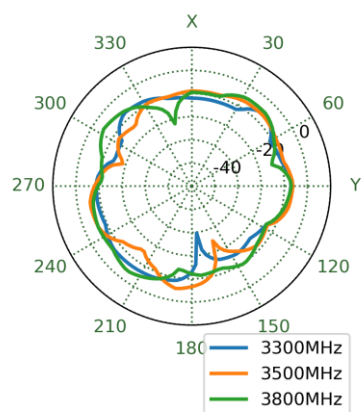


5.7 5G/4G 6 3D and 2D Radiation Patterns

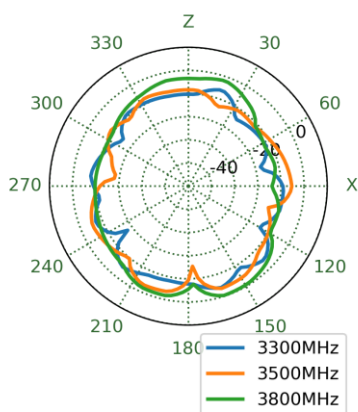
3500MHz



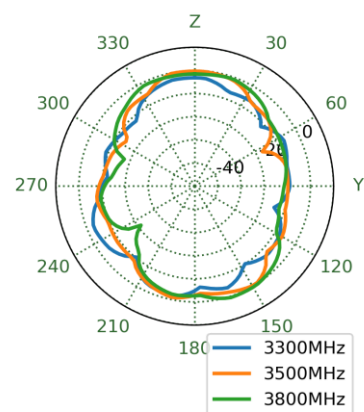
XY Plane



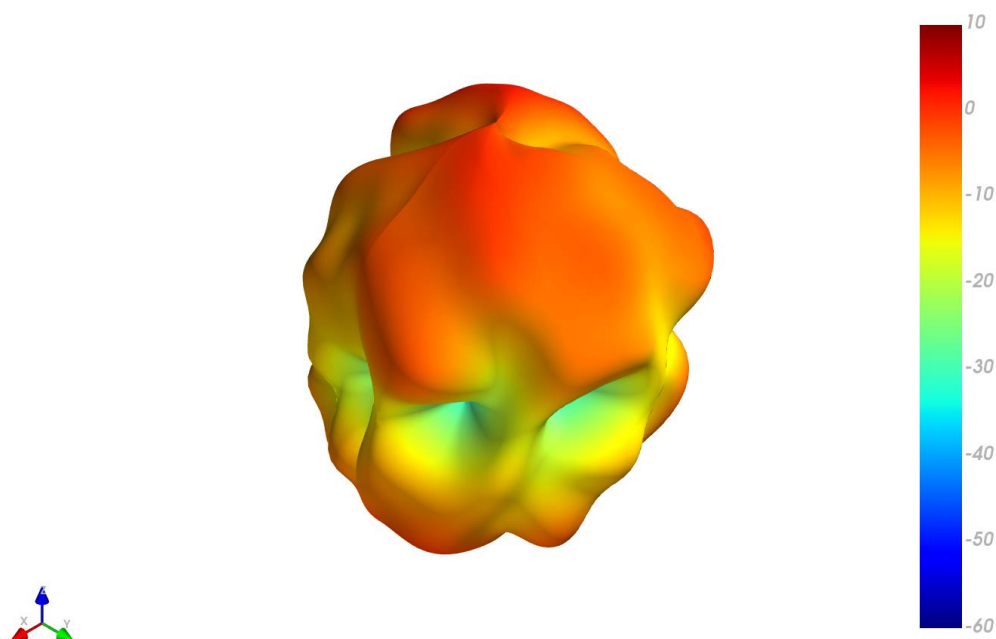
XZ Plane



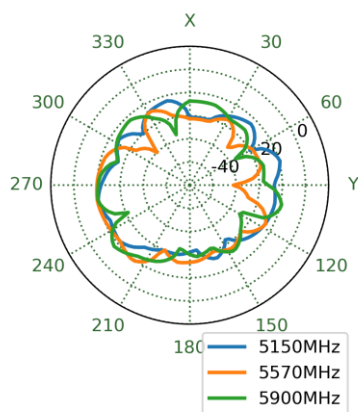
YZ Plane



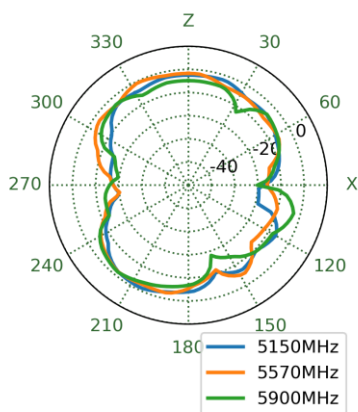
5570MHz



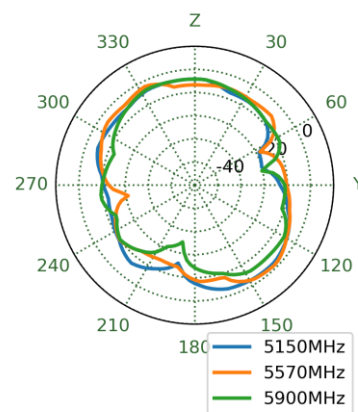
XY Plane



XZ Plane

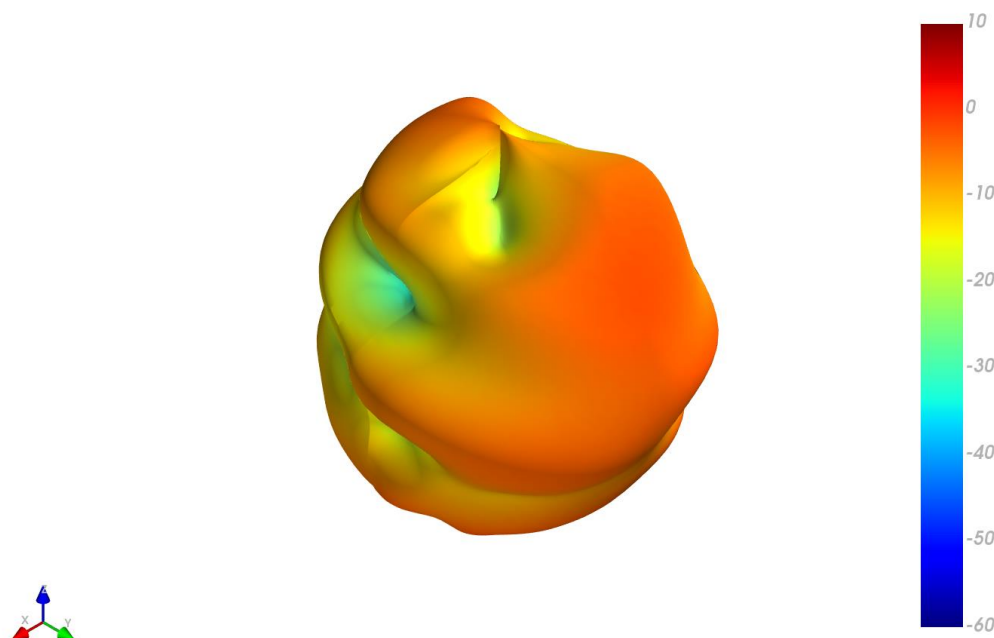


YZ Plane

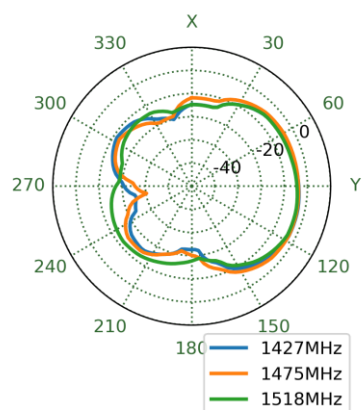


5.8 5G/4G 7 3D and 2D Radiation Patterns

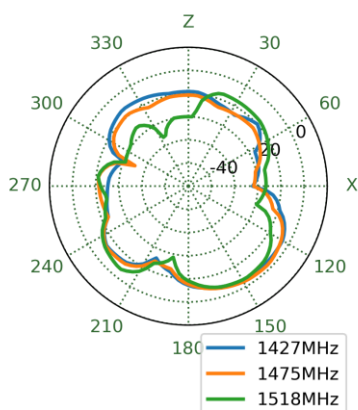
1475MHz



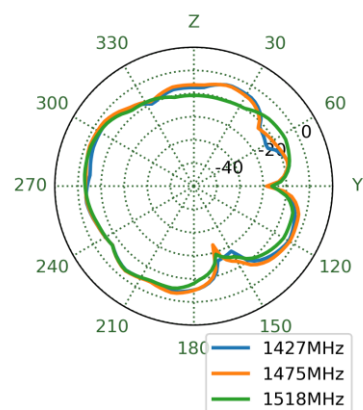
XY Plane



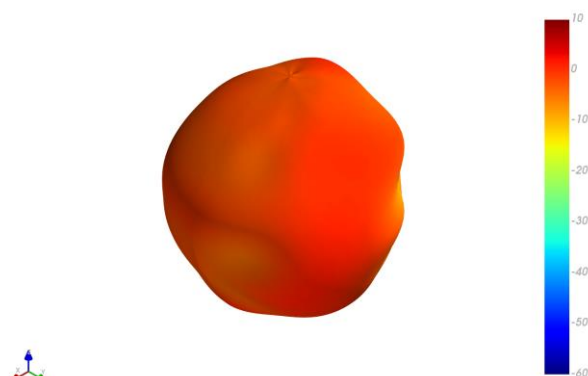
XZ Plane



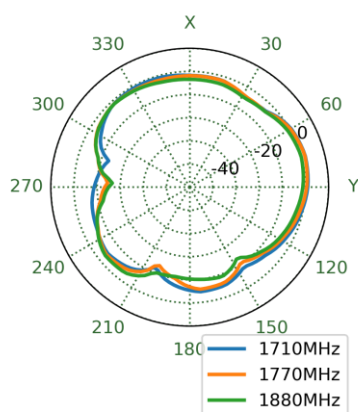
YZ Plane



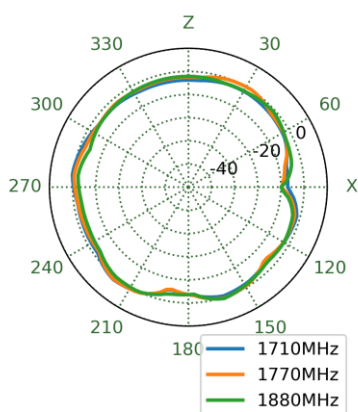
1770MHz



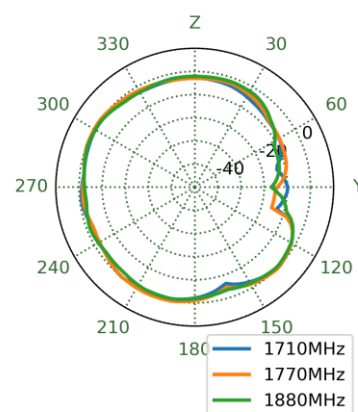
XY Plane



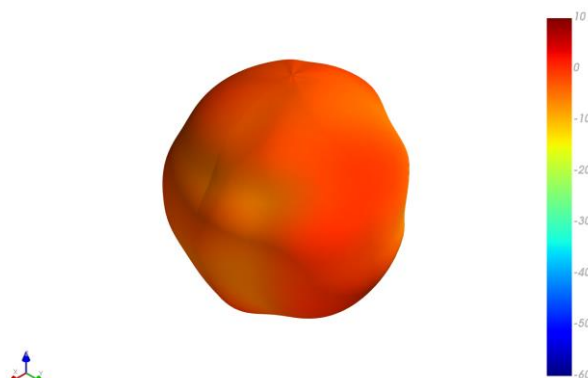
XZ Plane



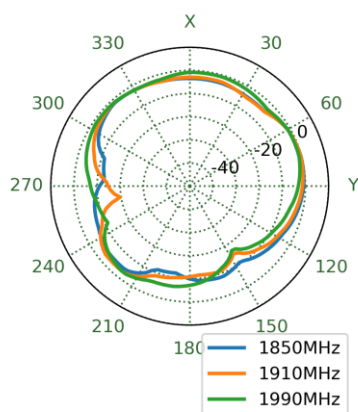
YZ Plane



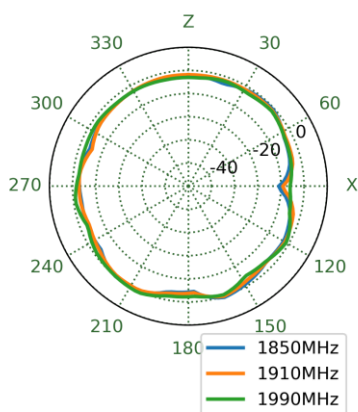
1910MHz



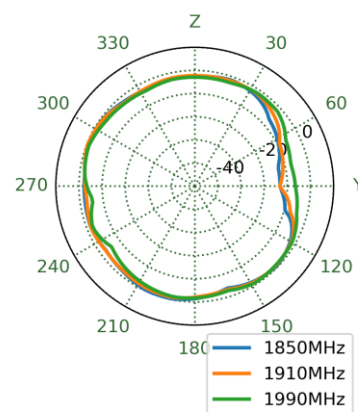
XY Plane



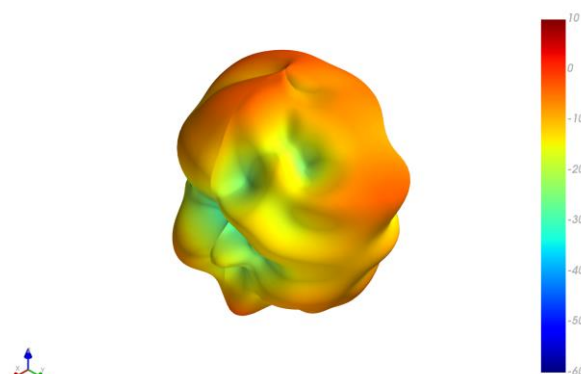
XZ Plane



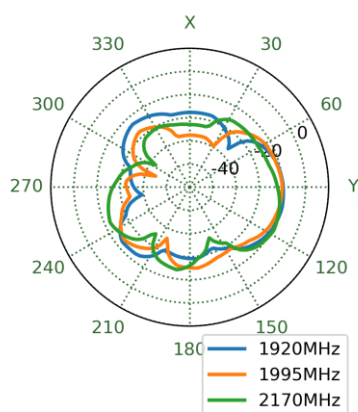
YZ Plane



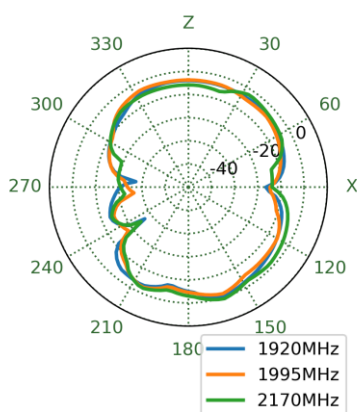
1995MHz



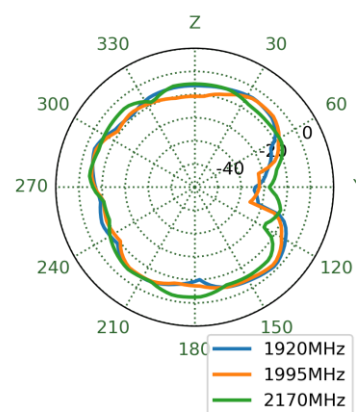
XY Plane



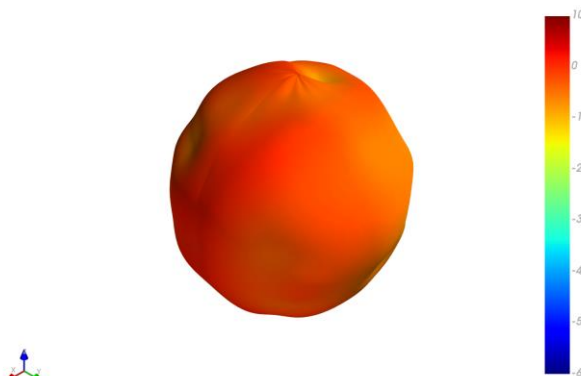
XZ Plane



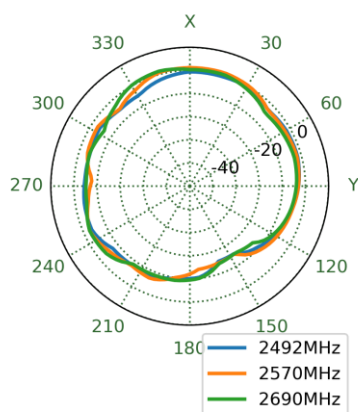
YZ Plane



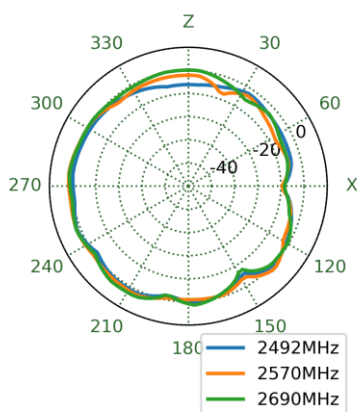
2570MHz



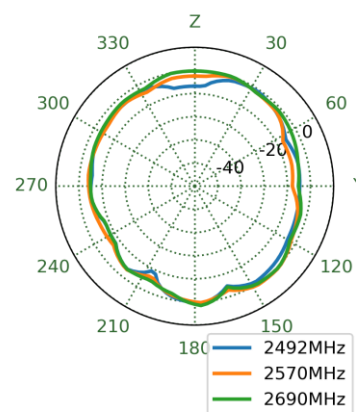
XY Plane



XZ Plane

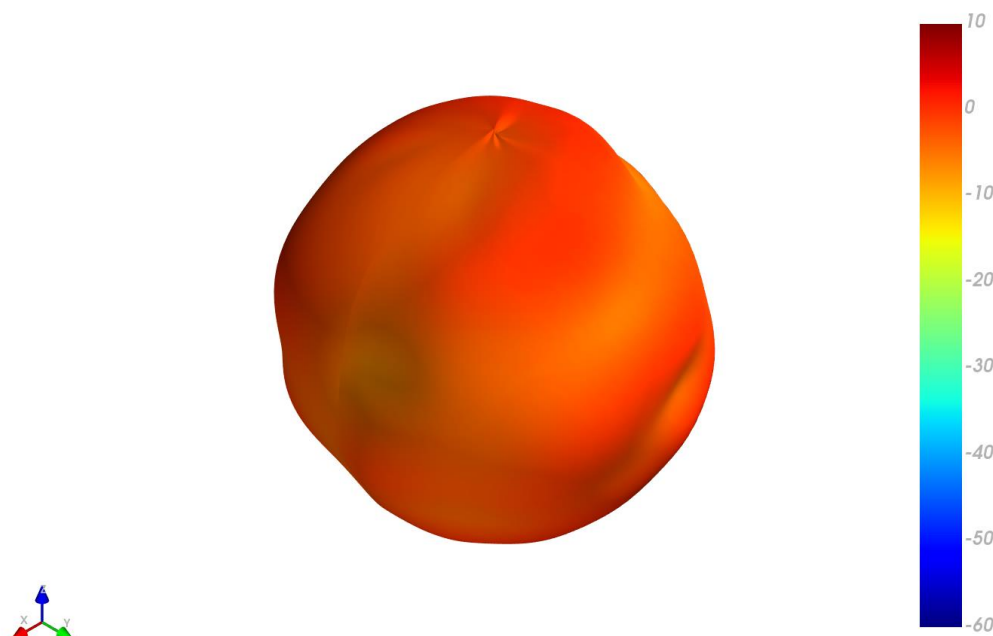


YZ Plane

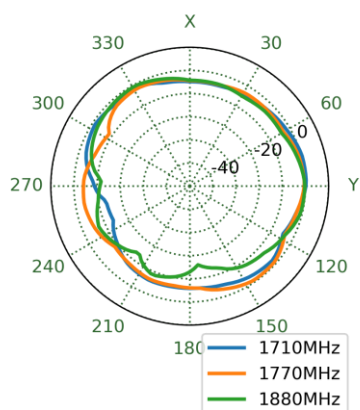


5.9 5G/4G 8 3D and 2D Radiation Patterns

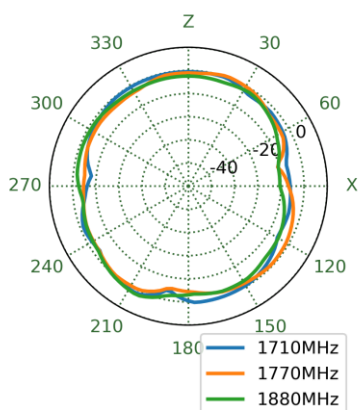
1770MHz



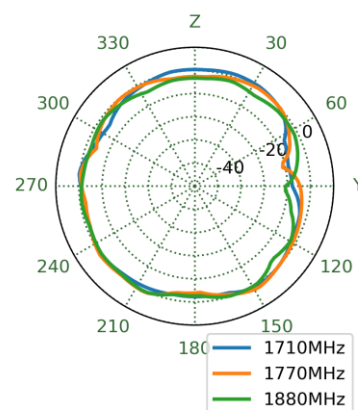
XY Plane



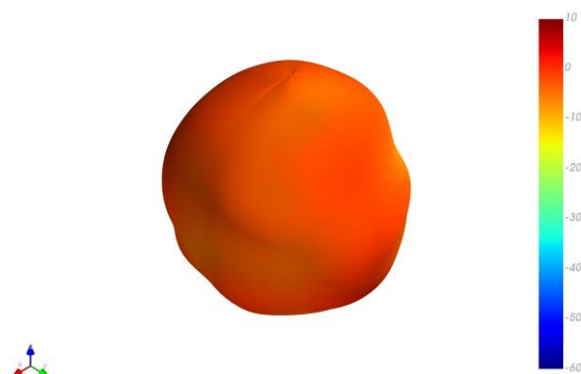
XZ Plane



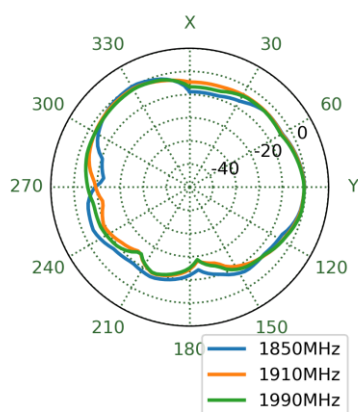
YZ Plane



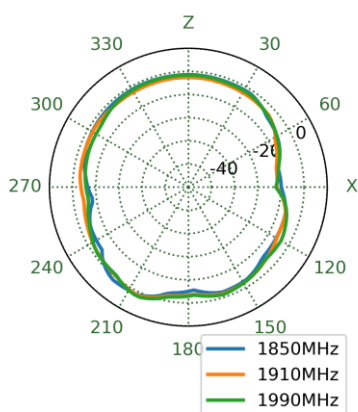
1910MHz



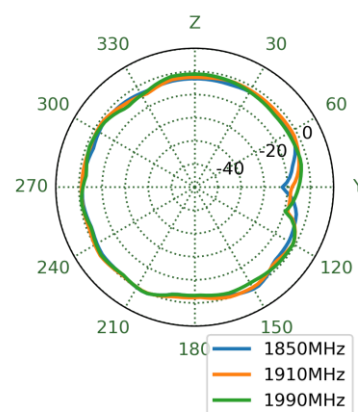
XY Plane



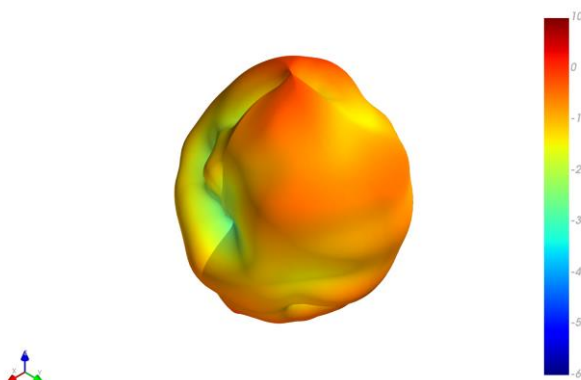
XZ Plane



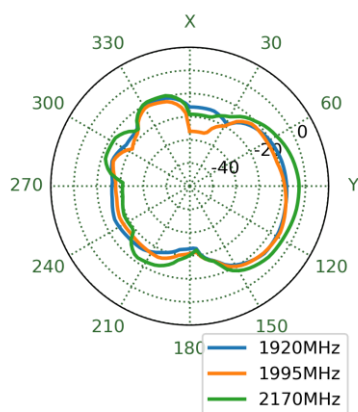
YZ Plane



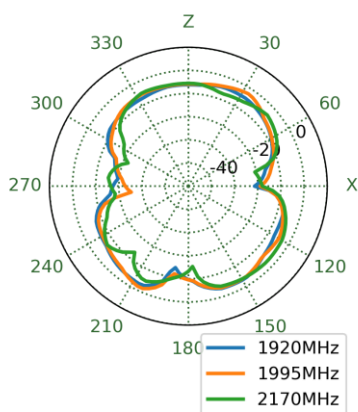
1995MHz



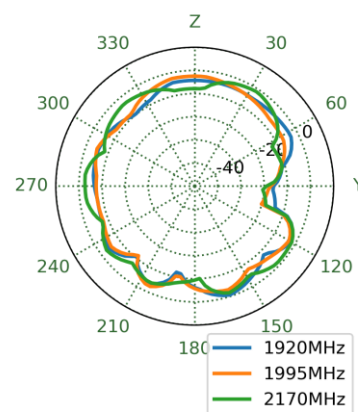
XY Plane



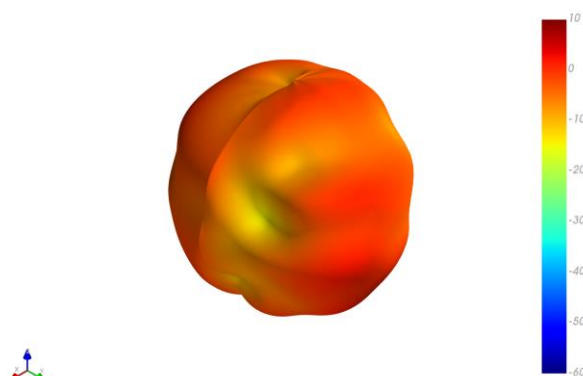
XZ Plane



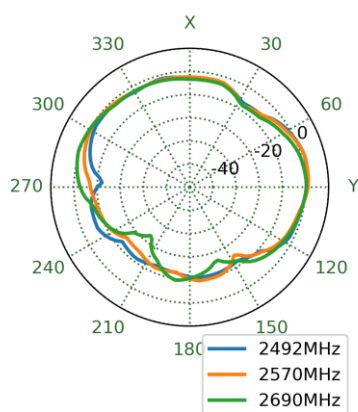
YZ Plane



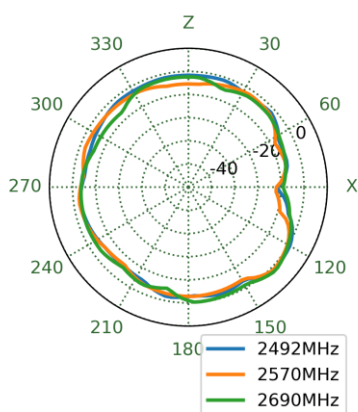
2570MHz



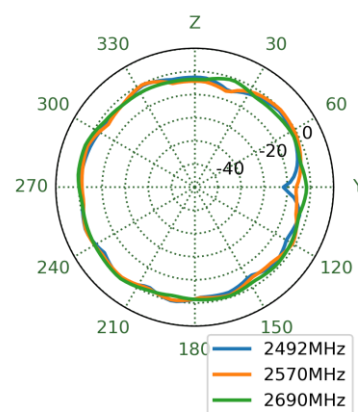
XY Plane



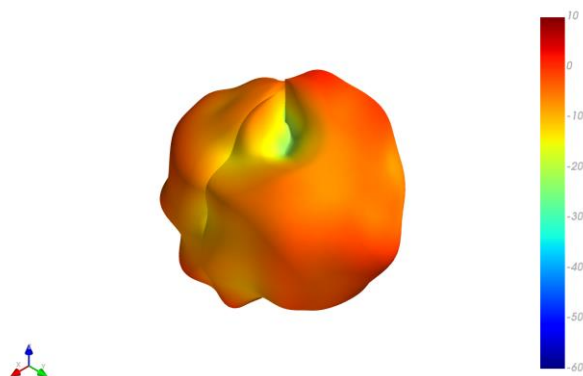
XZ Plane



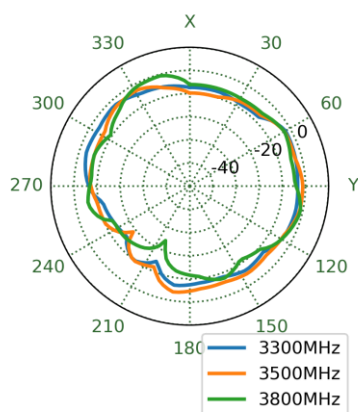
YZ Plane



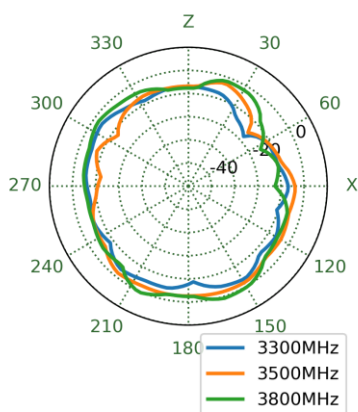
3500MHz



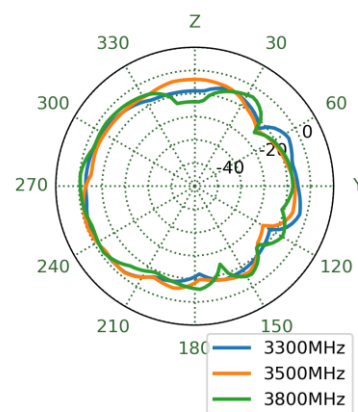
XY Plane



XZ Plane

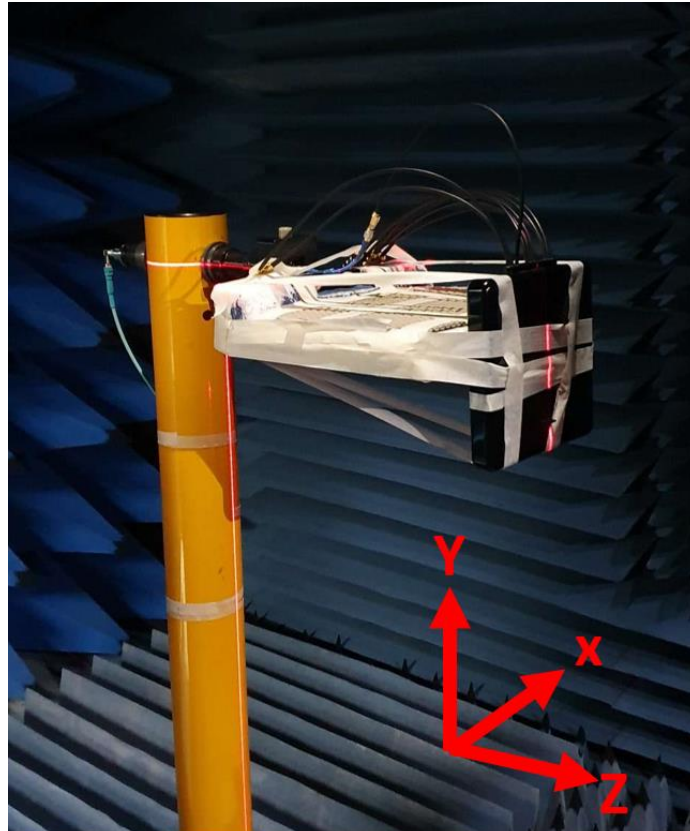


YZ Plane



5.10 5G/4G 8 3D and 2D Radiation Patterns

Test Setup



6. Mechanical Drawing (Units: mm)

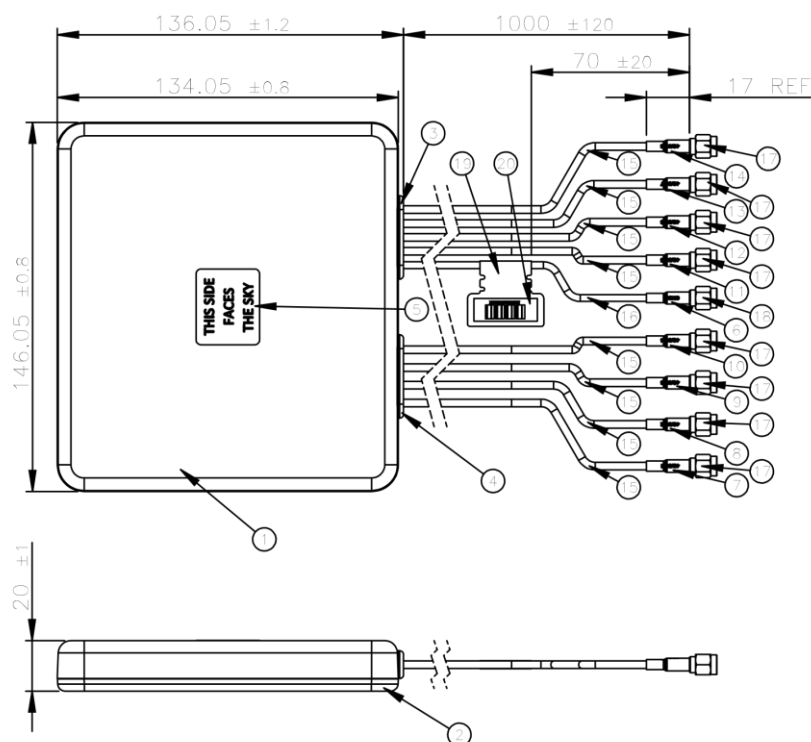
ISO NO.: EDW-21-8-0361

STATE: Release

NOTES:

1. All material must be RoHS compliant.
2. Color Codes: PANTONE Black / Plastics Color Q728-1-1.
3. Finish: Mirror Polish / SPI A-2.
4. Deburring: Less than 0.02mm.
5. No gate, parting line and any other tooling marks on appearance of product.
6. Once product have any crack/break/thread damage or any structural tooling issue, molding supplier need to correct the issue unconditionally.
7. Use this drawing together with the corresponding 3D CAD database file to fully describe the part.
8. The connector orientation has a fixed position to the antenna as per drawing.
9. Double Sided Adhesive Area : 

REV	ZONE	DESCRIPTION	ENG	APPROVED	DATE
D01	All	Initial design	Aaron Yan	Chazen	2021/08/17

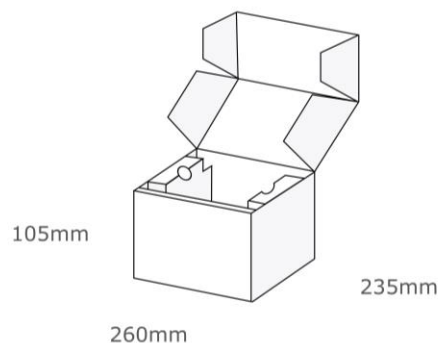


	Name	P/N	Material	Finish	QTY
1	Top housing	000116B000000A	ASA(PW-978B)	Black	1
2	Bottom housing	000116B010000A	ASA(PW-978B)	Black	1
3	Rubber (5 Holes)	000721A070000A	Silicone Rubber	Black	1
4	Rubber (4 Holes)	000721B000000A	Silicone Rubber	Black	1
5	Clear Label	001015H040000A	PET	Transparent	1
6	Heat 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 TGC 1.5DS	200221E000021A	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

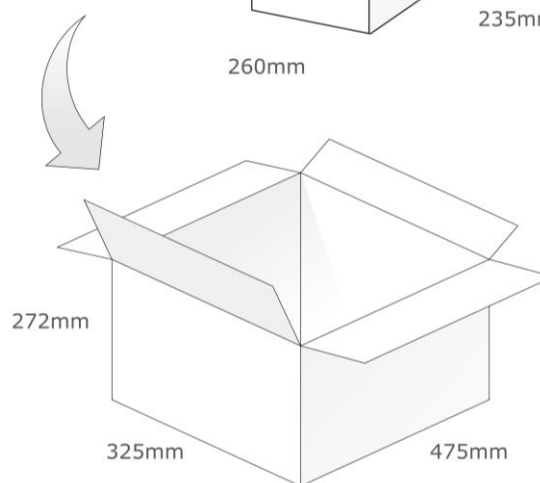
APPROVED BY: Chazen	 TW Design Centre This drawing and its inherent design concepts are property of Taoglas. Not to be copied or given to third parties without the written consent of Taoglas.
CHECK BY: Aaron	
DRAWN BY: Aaron Yan	
DATE: 2021/8/17	
UNLESS OTHERWISE SPECIFIED TOLERANCES ON:	XX ±0.5 XX ±0.3 XX ±0.2 XX ±0.1 XXX ±0.05
THIRD ANGLE PROJECTION	TITLE: 9in1 Guardian - 1*GNSS and 8*5G/4G MIMO 1m TGC-1.5DS with SMA(M) PART NO.: MA990.A.001 UNIT: mm SCALE: 1:2.5 PAGES: 1/1 REV: D01

7. Packaging

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



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

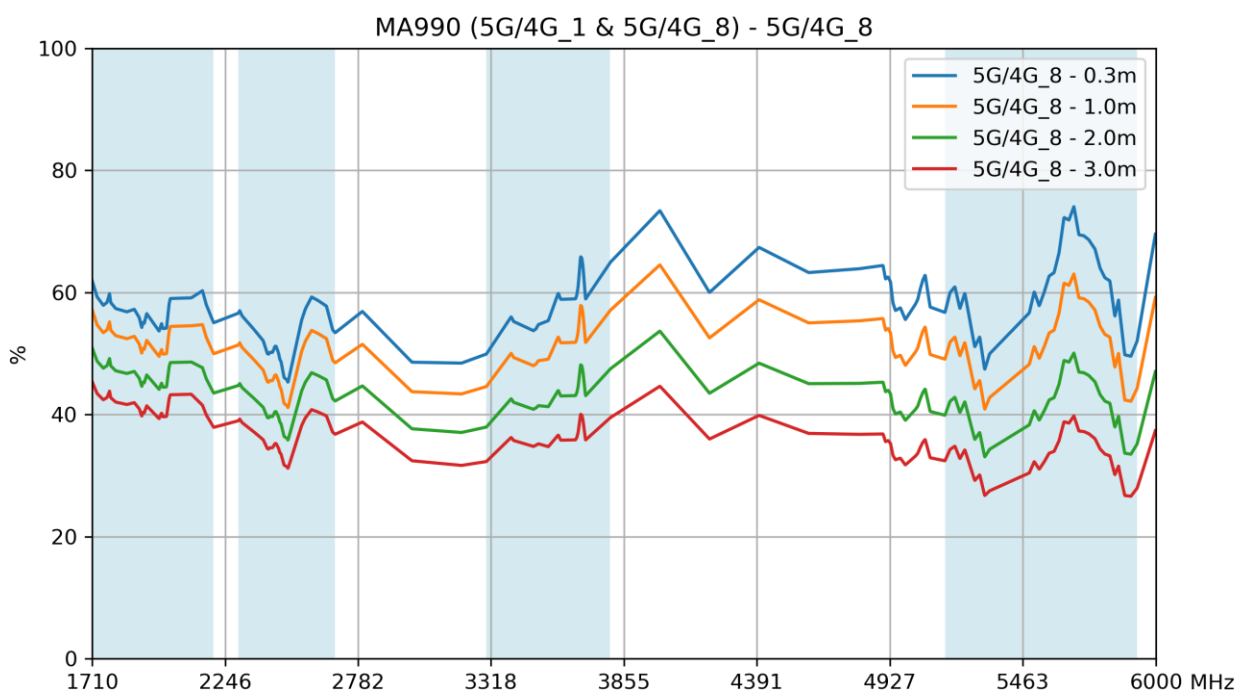
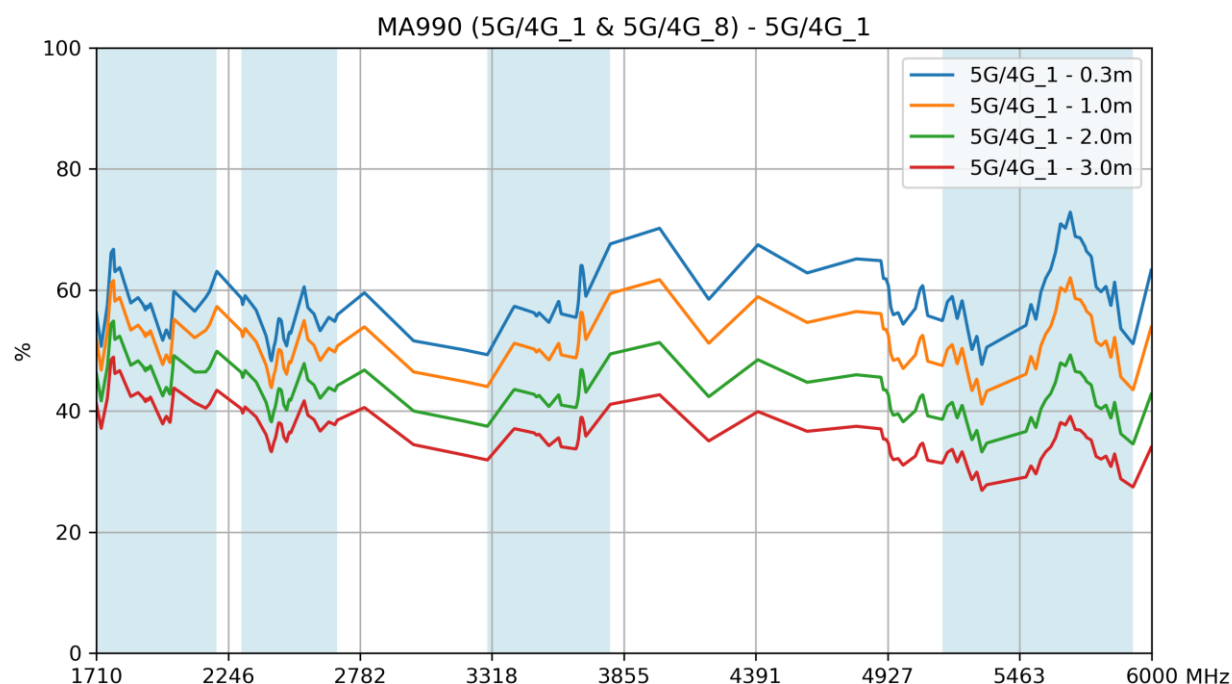


8. Application Note

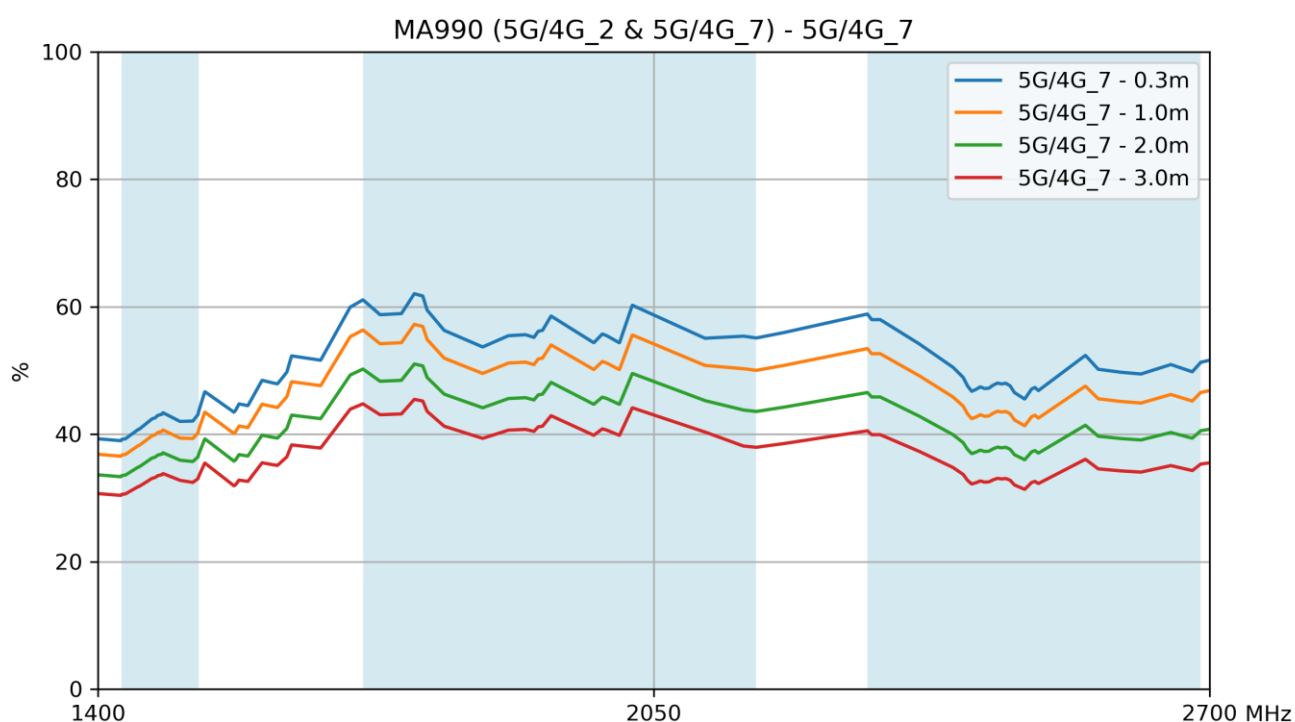
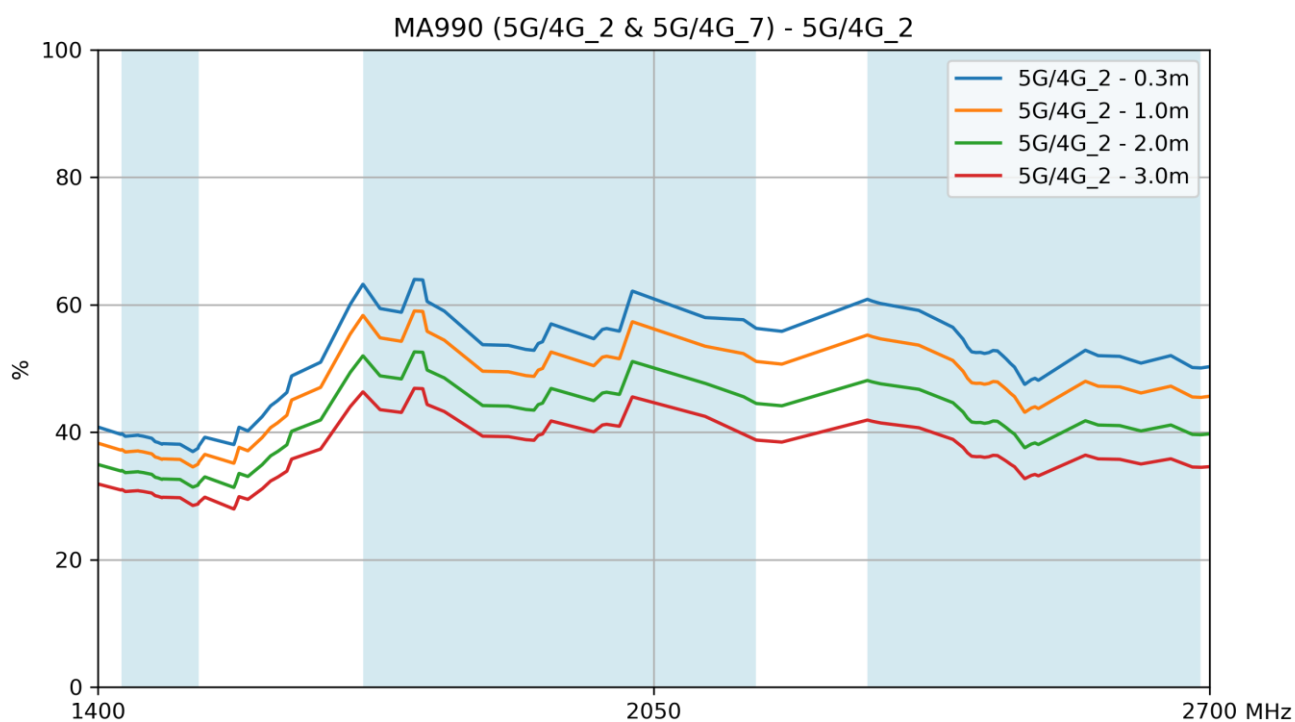
The MA990.A.001 performance is affected by different cable lengths, in this section the performance is shown with different cable lengths.

8.1 Efficiency – 5G/4G MIMO

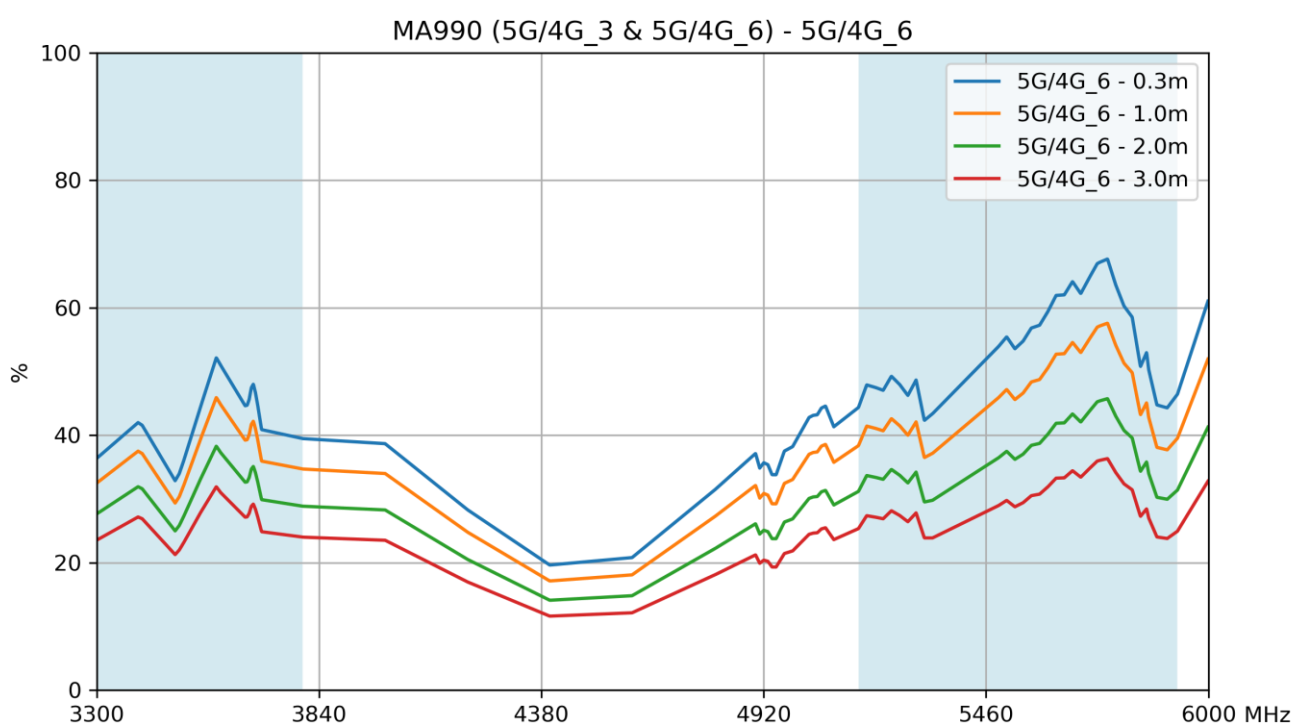
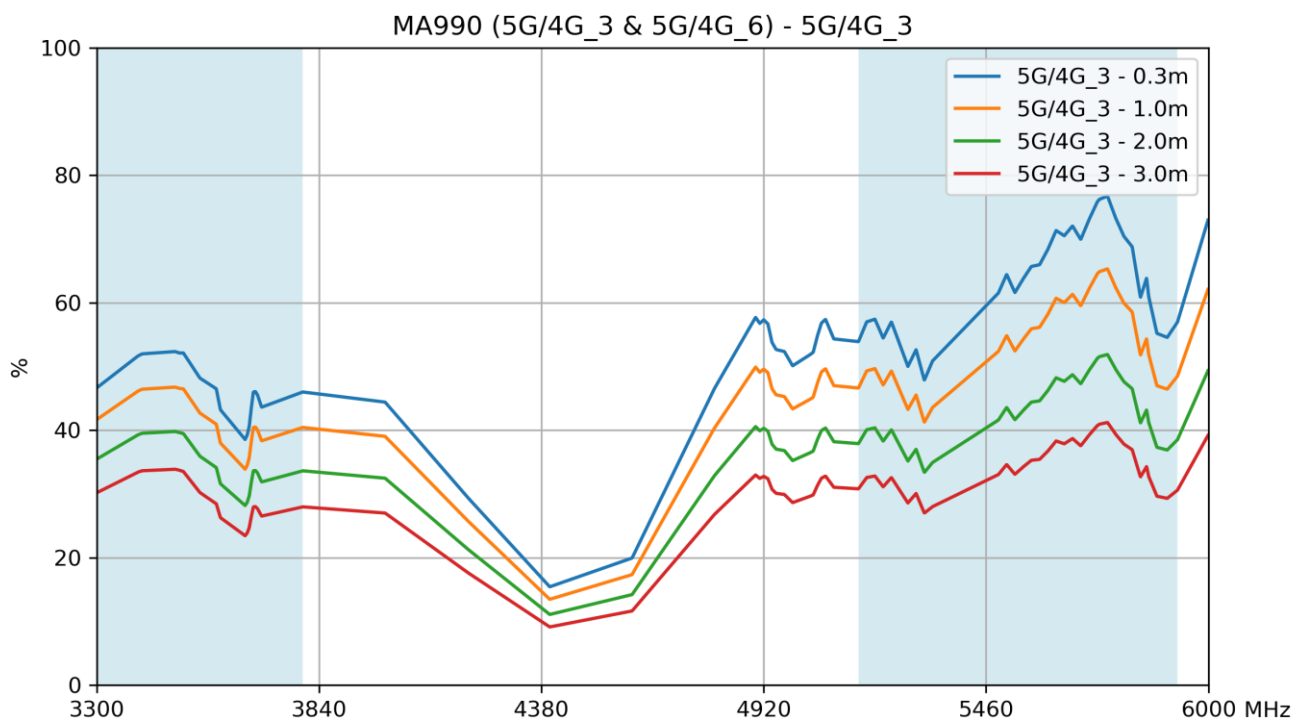
5G/4G MIMO 1 & 8



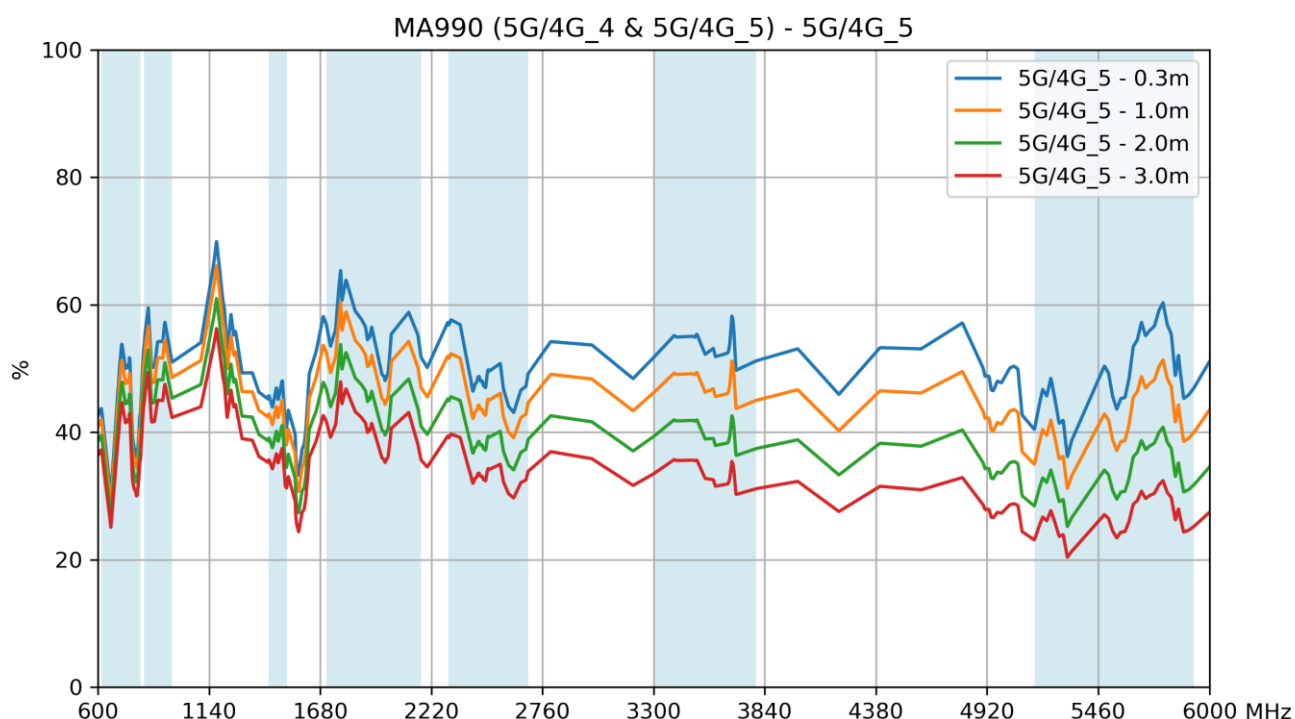
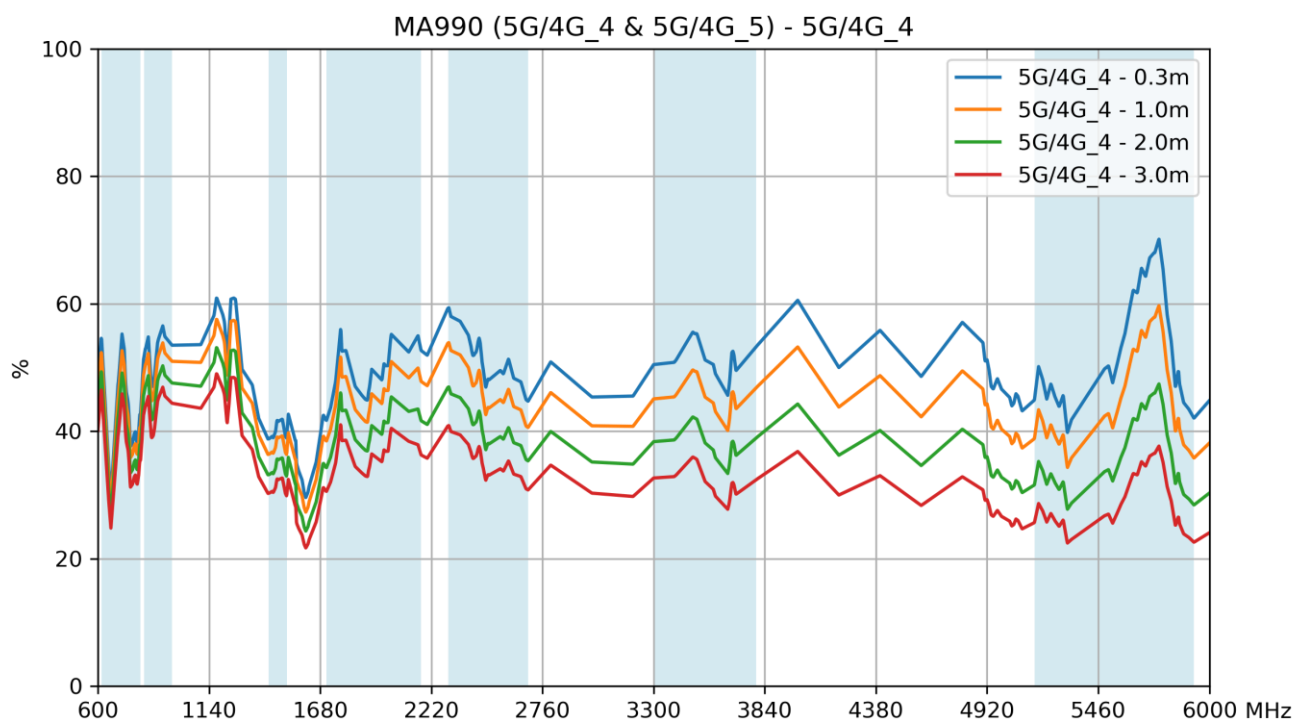
5G/4G MIMO 2 & 7



5G/4G MIMO 3 & 6

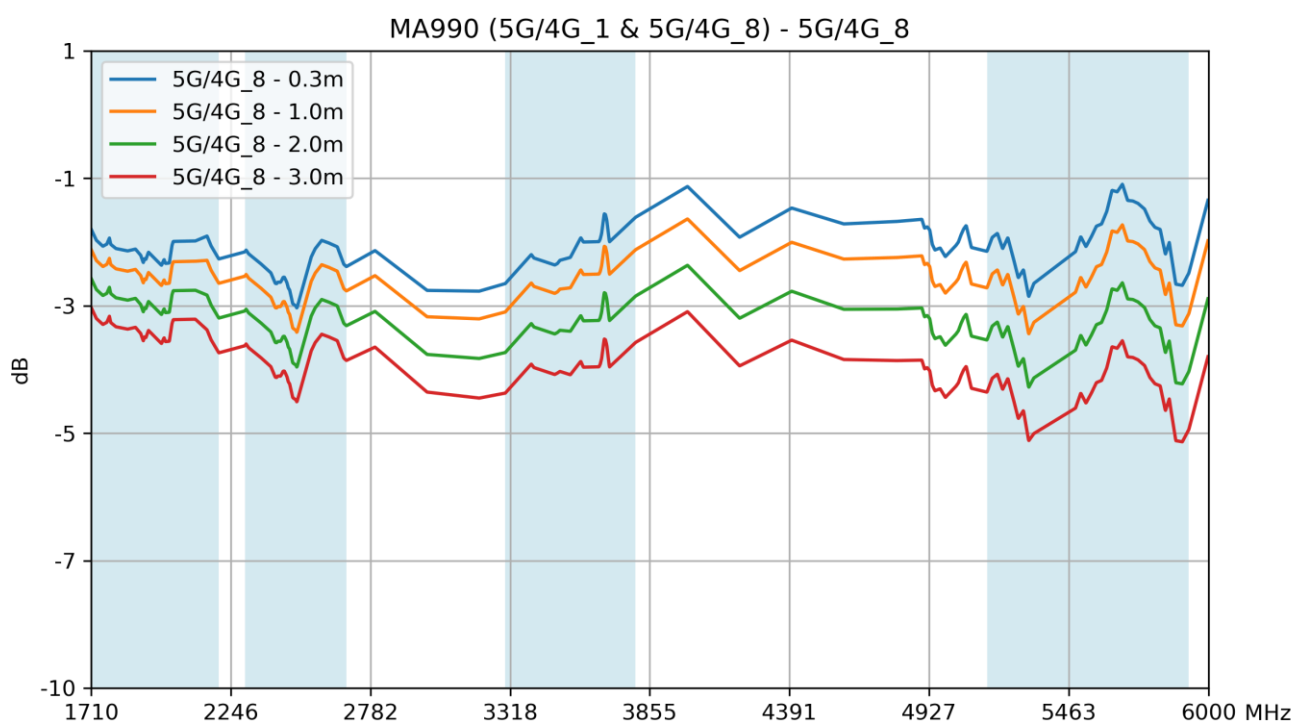
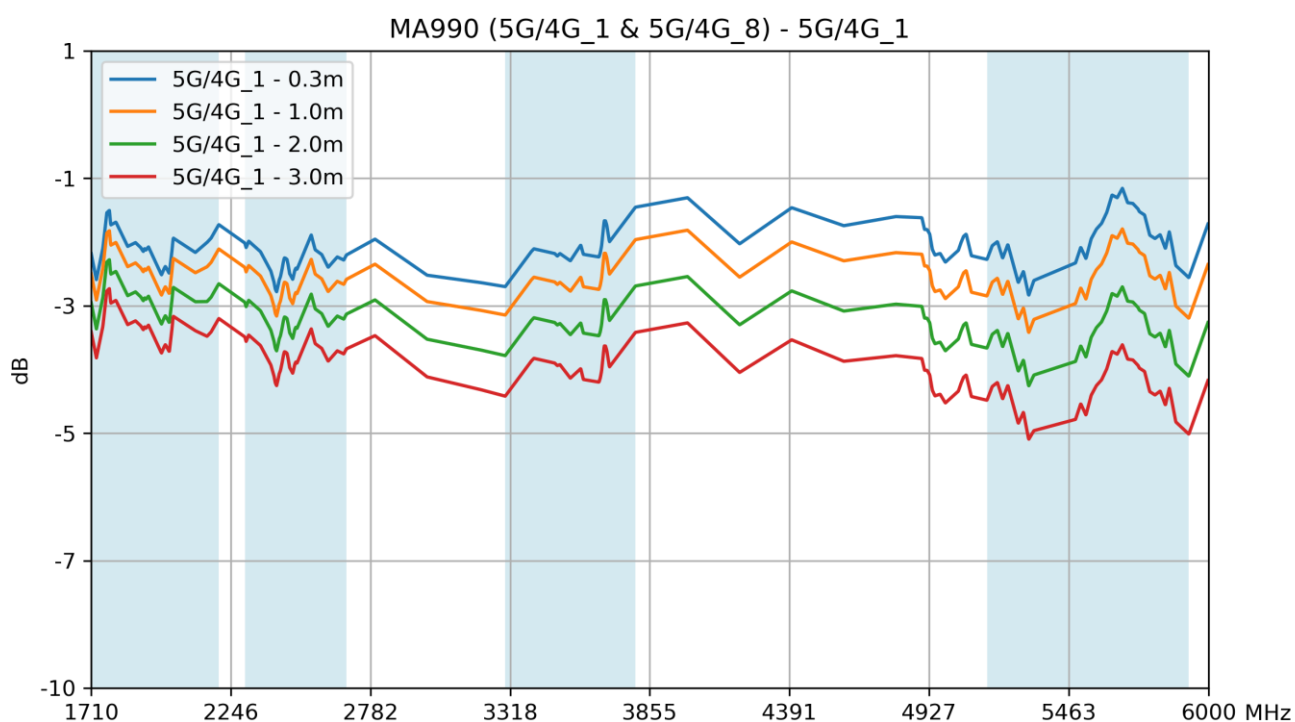


5G/4G MIMO 4 & 5

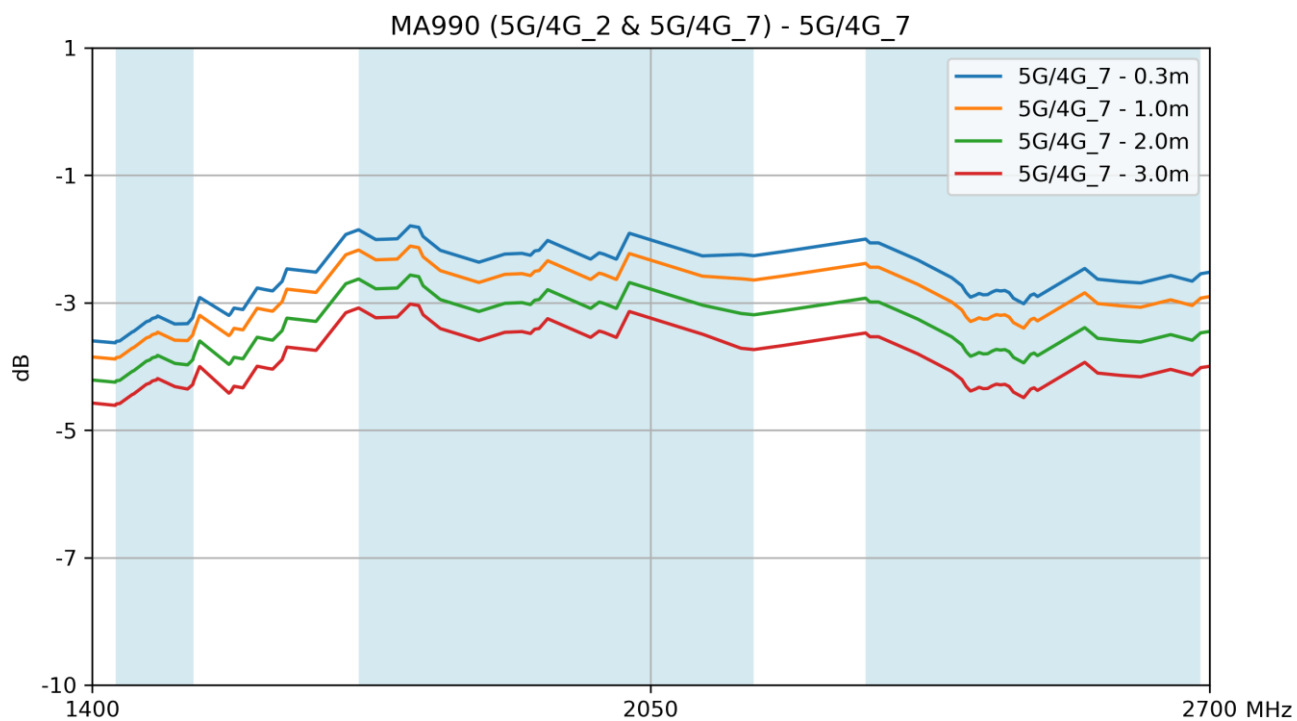
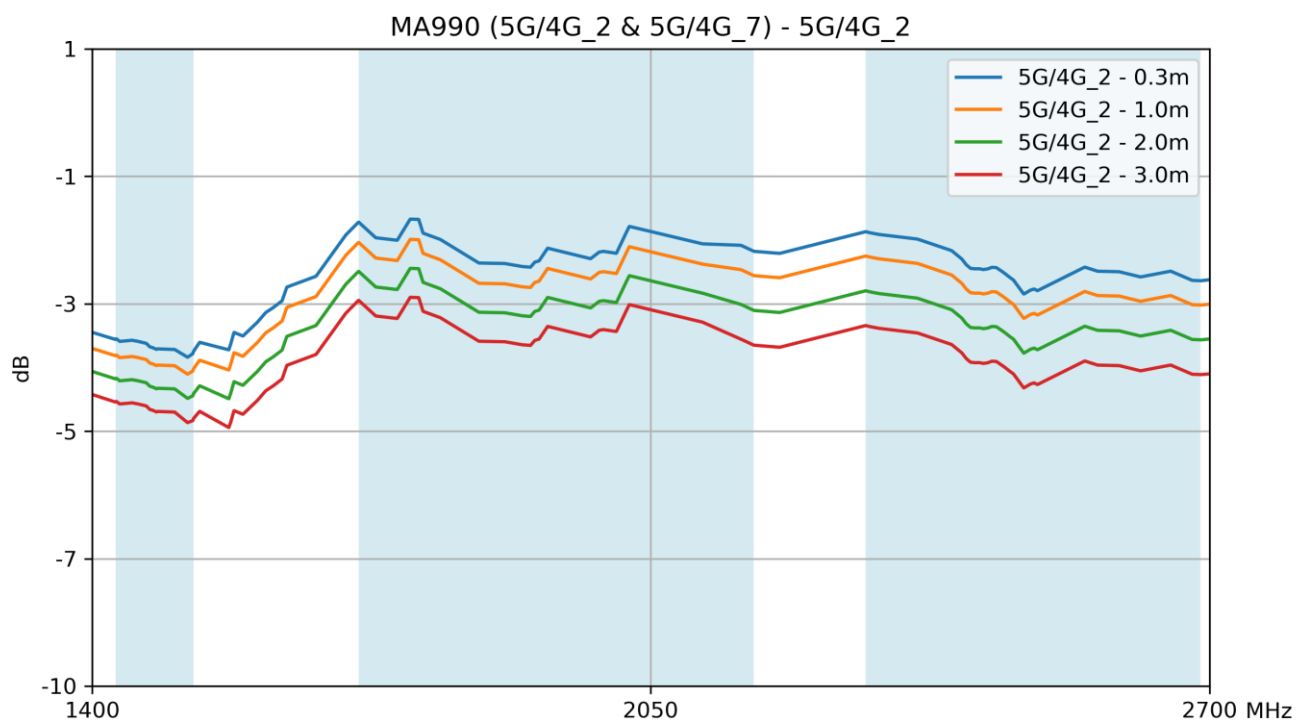


8.2 Average Gain – 5G/4G MIMO

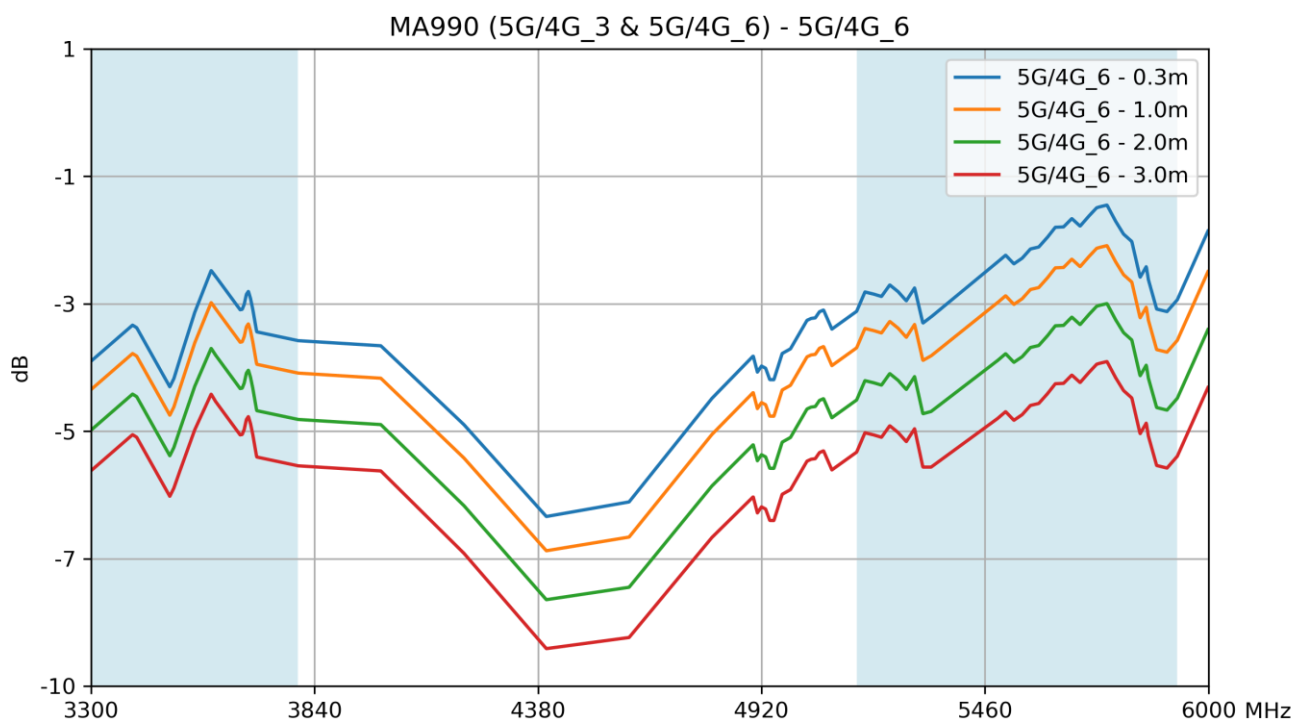
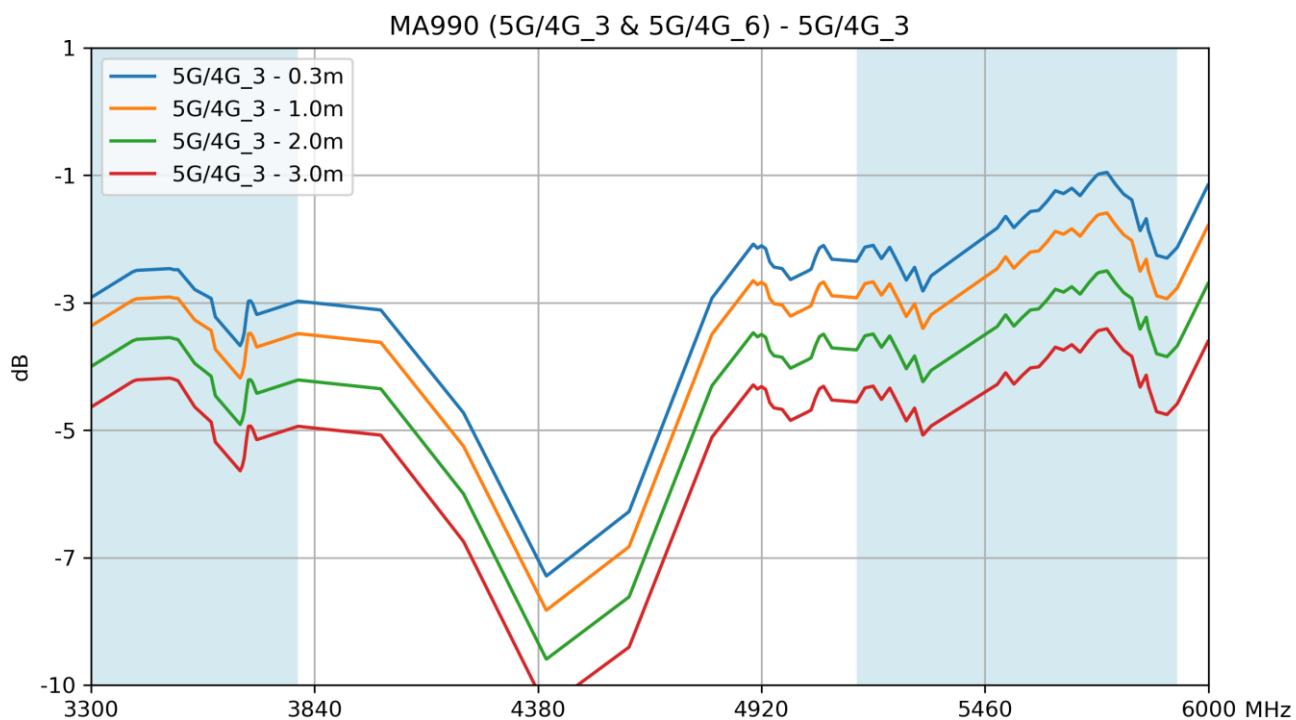
5G/4G MIMO 1 & 8



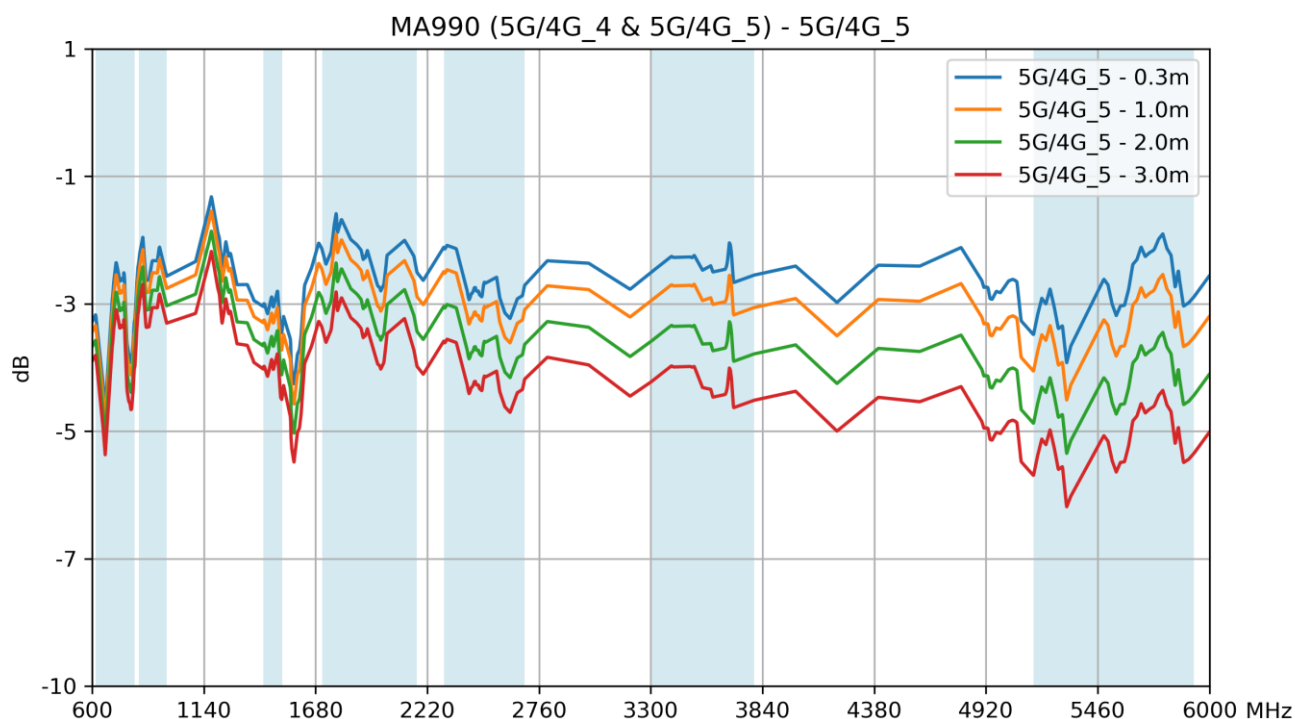
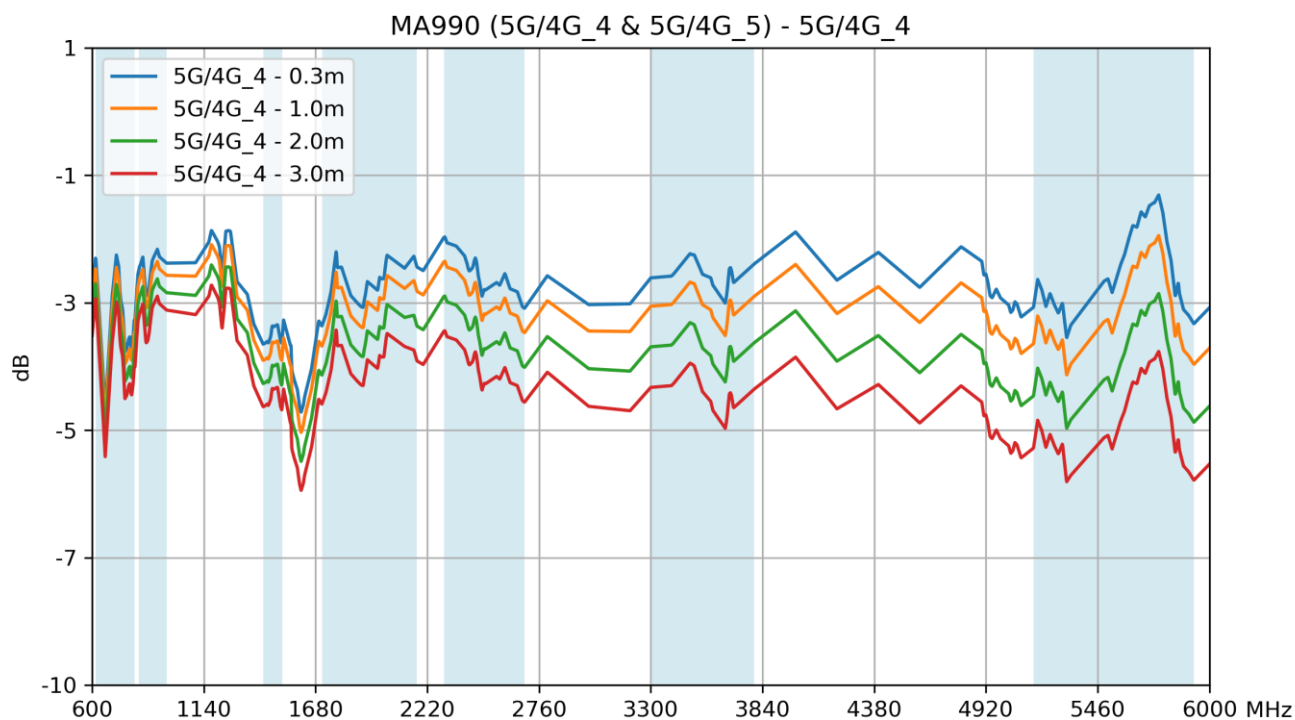
5G/4G MIMO 2 & 7



5G/4G MIMO 3 & 6

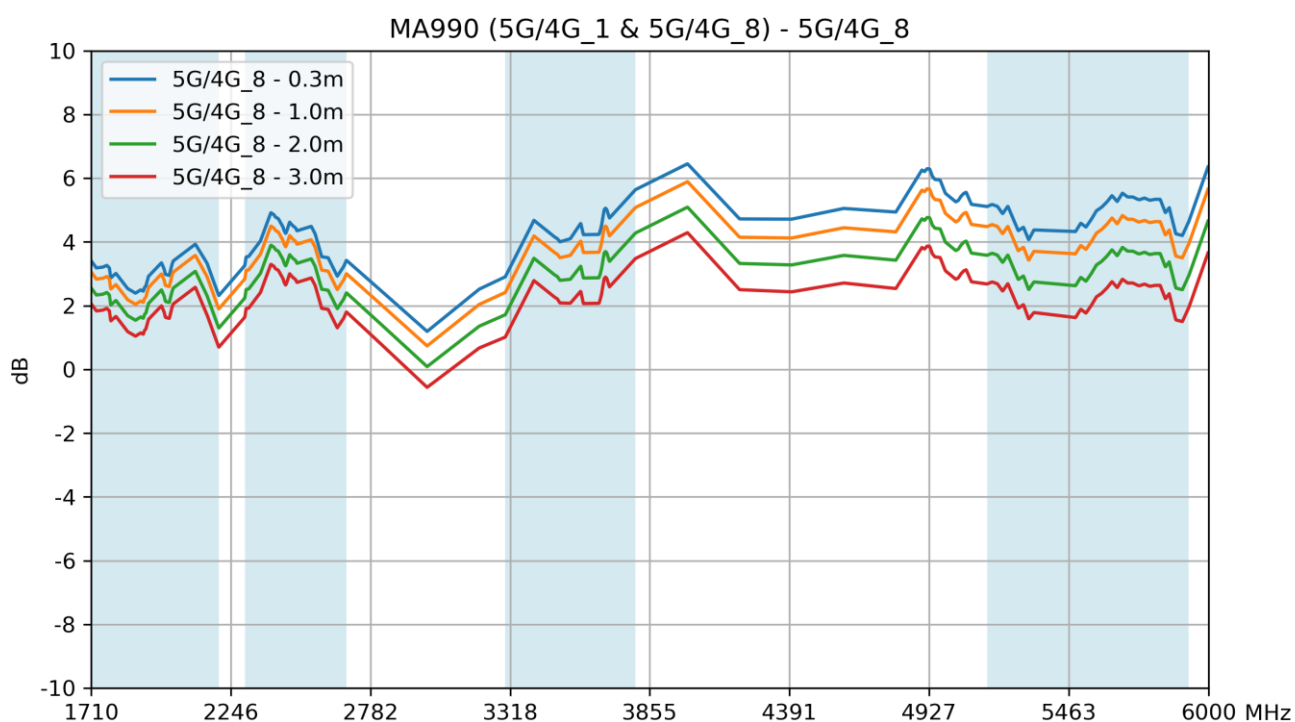
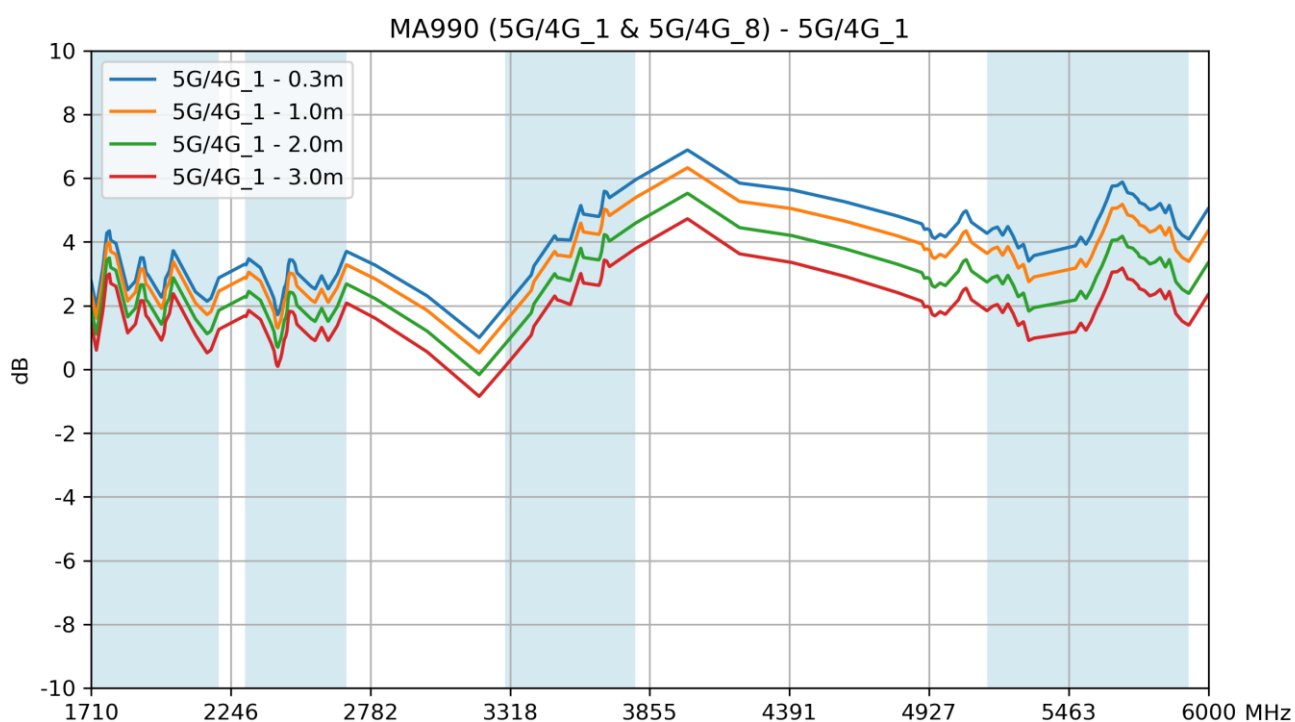


5G/4G MIMO 4 & 5

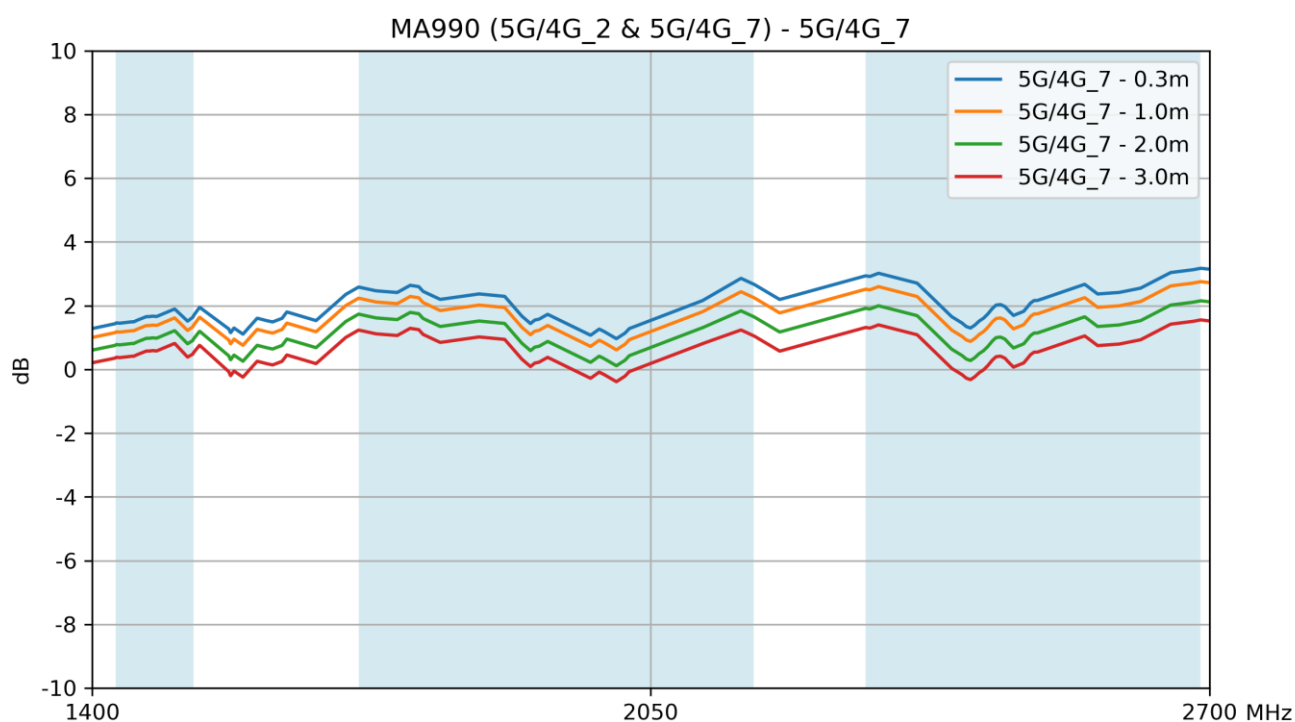
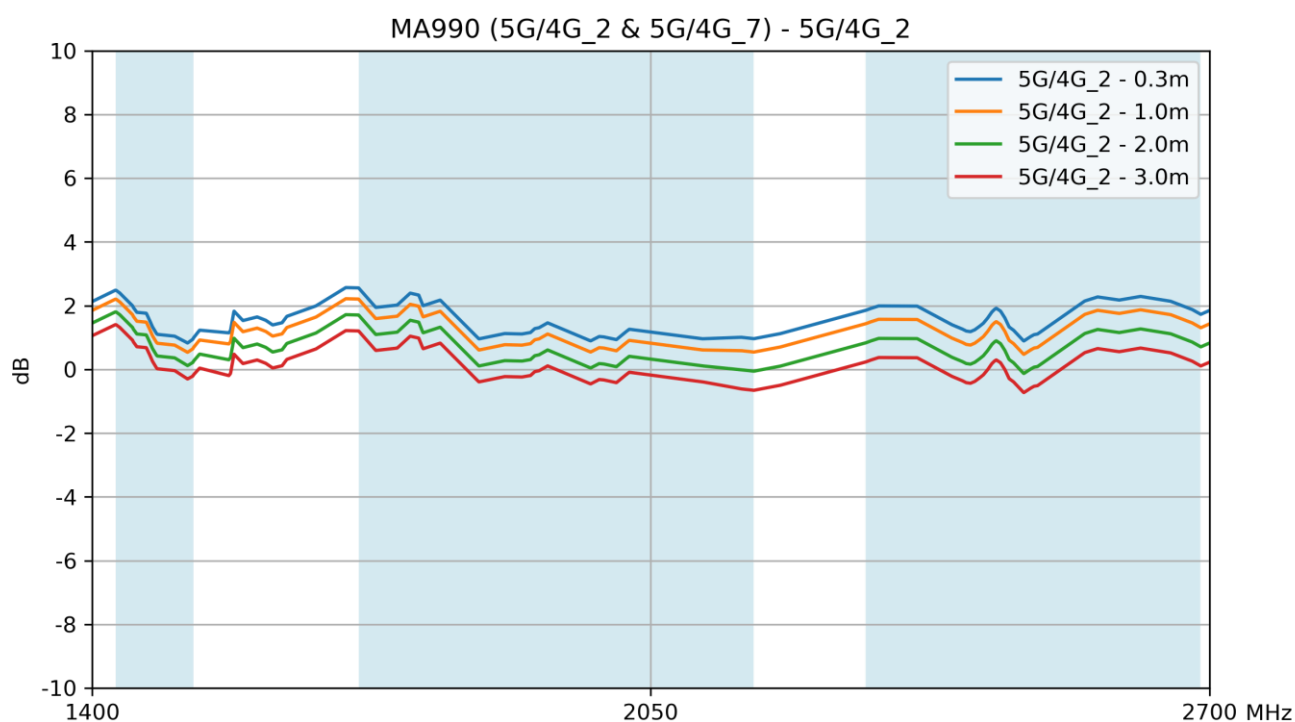


8.3 Peak Gain – 5G/4G MIMO

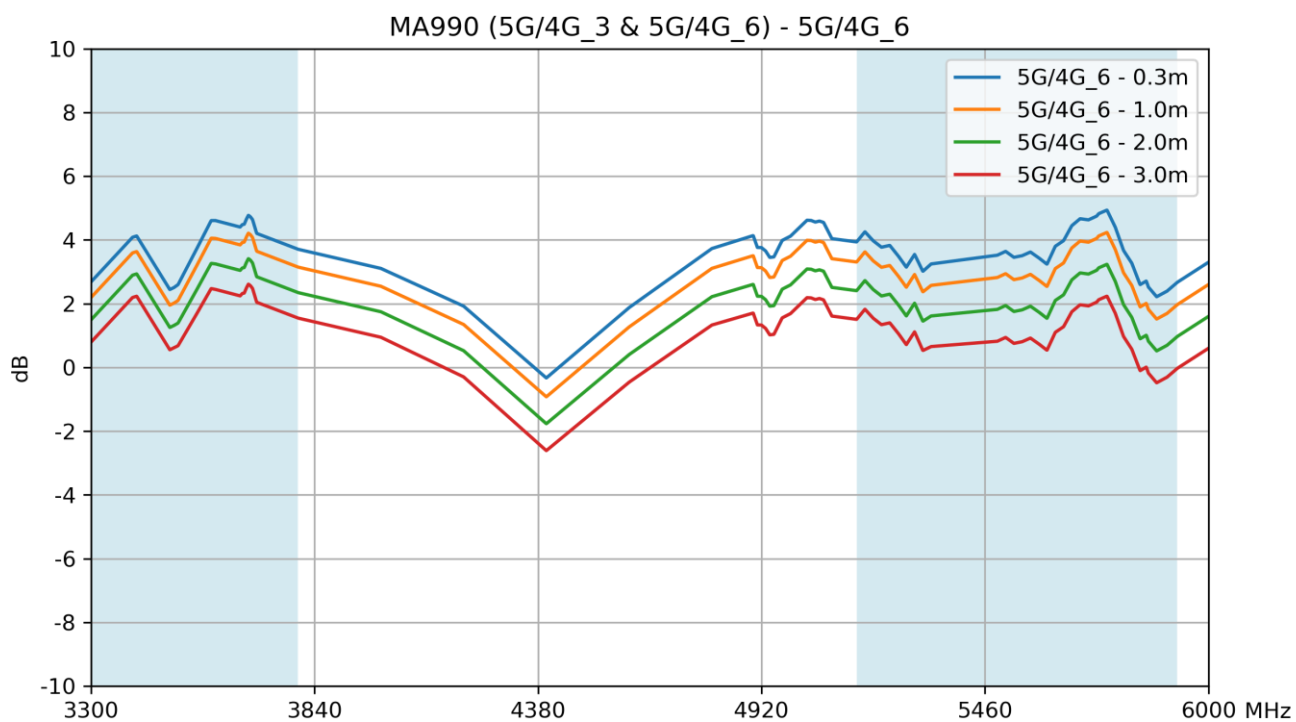
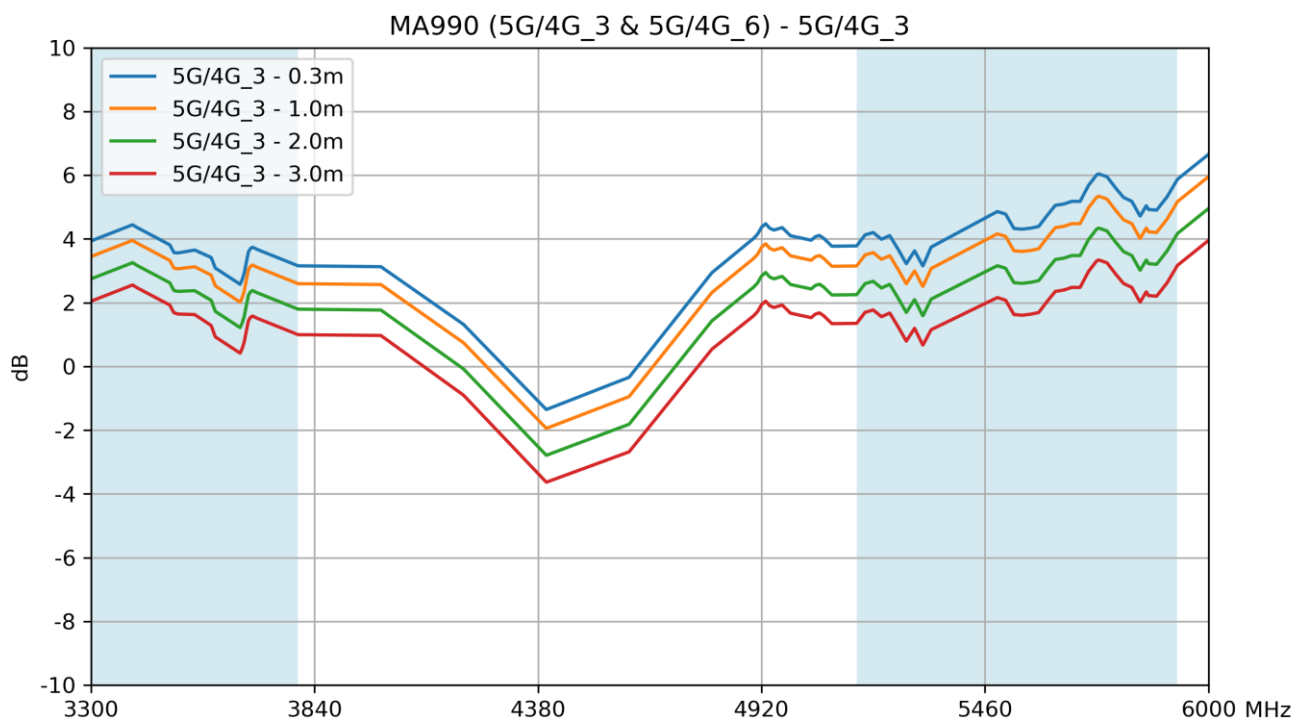
5G/4G MIMO 1 & 8



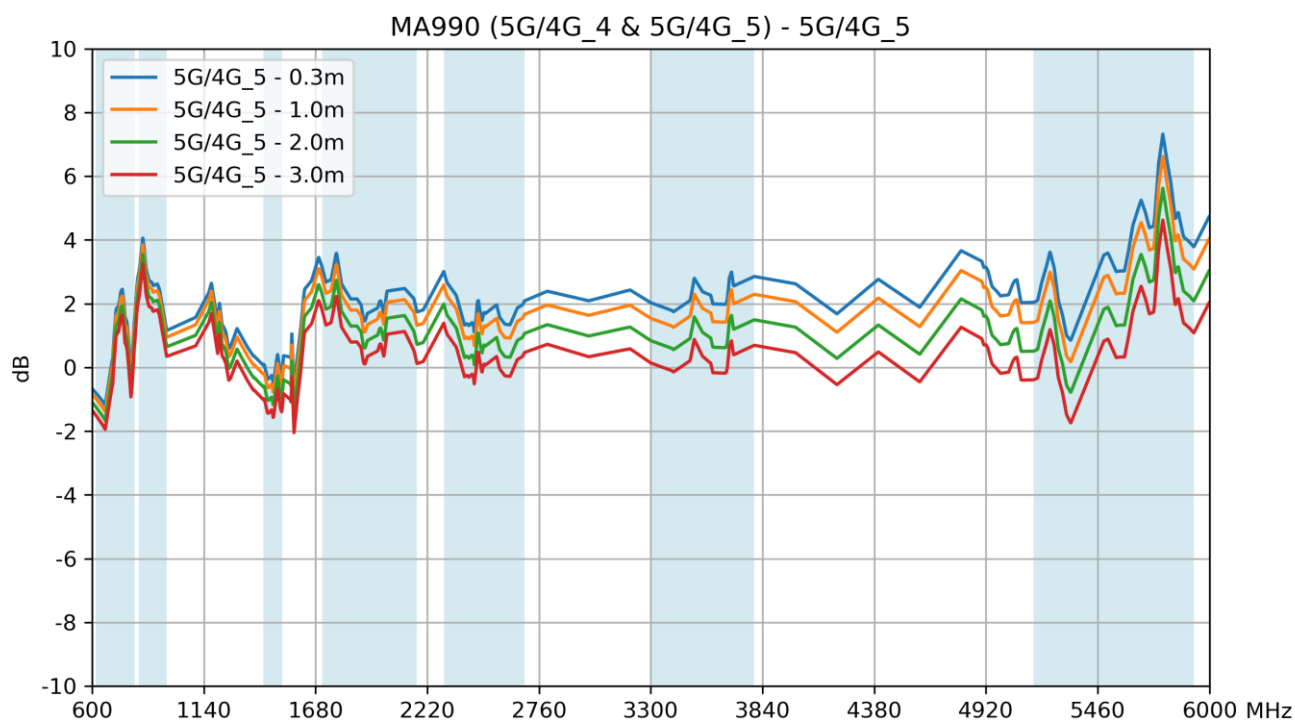
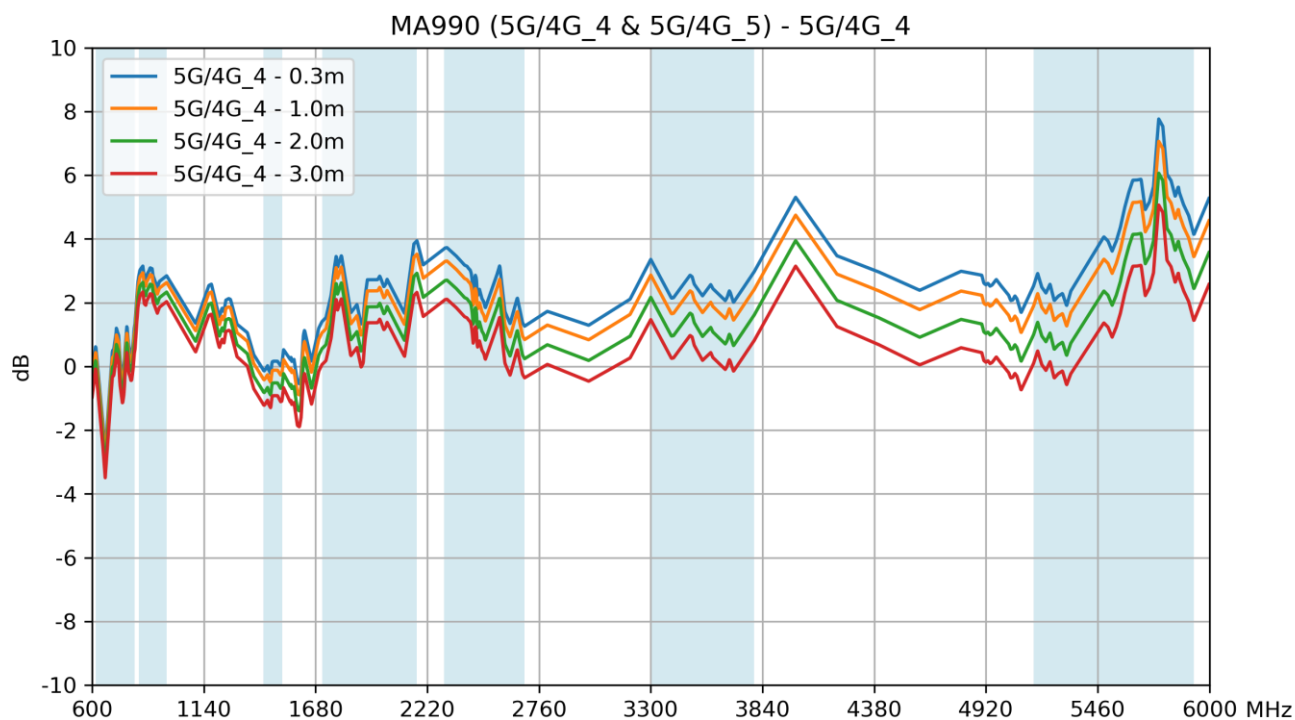
5G/4G MIMO 2 & 7



5G/4G MIMO 3 & 6



5G/4G MIMO 4 & 5



8.7 Comparison Tables

MA990 (5G/4G_1 & 5G/4G_8)					
Frequency (MHz)		5G NR n66	LTE 2600	5G NR n78	LTE 5200
		1710-2170	2300-2690	3300-3800	5150-5925
Efficiency (%)					
HGJMCKI	ицлм	нпчр	нлчс	нрчл	нсчф
	йцлм	нлчс	мсчл	нйчл	ничс
	кцлм	млчл	мкчф	млчс	мичл
	лцлм	мкчй	лпчй	лочс	лкчл
HGJMCKP	ицлм	нпчс	нйчс	нрчс	оичл
	йцлм	нкчл	млчй	нкчл	нйчл
	кцлм	мочр	мйчй	млчф	мйчс
	лцлм	мйчл	лнчр	лочф	лкчс
Average Gain (dB)					
HGJMCKI	ицлм	Жцлр	Жчрр	Жцлн	Жчкн
	йцлм	Жцлм	Жчйи	Жчрр	Жчсл
	кцлм	Жчкн	Жчлп	Жчрн	Жчсл
	лцлм	Жцло	Жчди	Жчмй	Жчрр
HGJMCKP	ицлм	Жчлп	Жчрн	Жчди	Жчки
	йцлм	Жцлр	Жчкп	Жчрм	Жчрр
	кцлм	Жчкс	Жчрп	Жчфи	Жчрн
	лцлм	Жчфи	Жчмп	Жчлп	Жчрл
Peak Gain (dBi)					
HGJMCKI	ицлм	мчлн	лчлп	нчкн	нчрр
	йцлм	мчйи	лчлр	нчлс	нчйр
	кцлм	лчлп	кчлр	мчлс	мчйр
	лцлм	лчлп	кчлр	лчлс	лчйр
HGJMCKP	ицлм	лчсл	мчск	нчрм	нчлл
	йцлм	лчлр	мчйи	нчлр	мчрл
	кцлм	лчлр	лчлп	мчлр	лчрл
	лцлм	кчлр	лчлп	лчлр	кчрл

MA990 (5G/4G_2 & 5G/4G_7)				
Frequency (MHz)		5GNR 1500	5GNR n66	LTE 2600
		1427-1518	1710-2170	2300-2690
Efficiency (%)				
HGJMГкк	ицїт	лрѳ	нпѳ	нкѳ
	йѳїт	лоѳ	нлѳ	мпѳ
	кѳїт	ллѳ	мпѳ	мїѳ
	лѳїт	лиѳ	мкѳ	лоѳ
HGJMГкп	ицїт	мїѳ	нпѳ	мсѳ
	йѳїт	лсѳ	нкѳ	мнѳ
	кѳїт	лнѳ	моѳ	лсѳ
	лѳїт	лкѳ	мїѳ	лмѳ
Average Gain (dB)				
HGJMГкк	ицїт	Жѳїл	Жѳми	Жѳпр
	йѳїт	Жѳмй	Жѳпн	Жѳки
	кѳїт	Жѳрк	Жѳко	Жѳри
	лѳїт	Жѳкк	Жѳпп	Жѳми
HGJMГкп	ицїт	Жѳри	Жѳмм	Жѳин
	йѳїт	Жѳпр	Жѳпс	Жѳип
	кѳїт	Жѳмс	Жѳди	Жѳип
	лѳїт	Жѳрс	Жѳрй	Жѳрп
Peak Gain (dBi)				
HGJMГкк	ицїт	кѳр	кѳо	кѳс
	йѳїт	кѳки	кѳй	йѳрп
	кѳїт	йѳри	йѳй	йѳп
	лѳїт	йѳми	йѳй	иѳрп
HGJMГкп	ицїт	йѳки	кѳро	лѳїп
	йѳїт	йѳрк	кѳмм	кѳпн
	кѳїт	йѳкк	йѳрм	кѳїн
	лѳїт	иѳрк	йѳс	йѳин

MA990 (5G/4G_3 & 5G/4G_6)			
Frequency (MHz)		5GNR n78	LTE 5200
		3300-3800	5150-5925
Efficiency (%)			
HGMMGкл	иқит	моқд	оқчр
	йқит	мйқи	нлқи
	кқит	лмм	мкчс
	лқит	крс	лмқс
HGMMGко	иқит	мкчс	нмқс
	йқит	лпс	моқд
	кқит	лйр	лпқи
	лқит	кочр	ксчр
Average Gain (dB)			
HGMMGкл	иқит	Жқдм	Жқик
	йқит	Жрп	Жқи
	кқит	Жфл	Жчр
	лқит	Ждс	Жфн
HGMMGко	иқит	Жчр	Жро
	йқит	Жқй	Ждм
	кқит	Жср	Ждик
	лқит	Жпн	Жқс
Peak Gain (dBi)			
HGMMGкл	иқит	мм	оқим
	йқит	лсн	нқдм
	кқит	лқн	мқдм
	лқит	кқн	лқдм
HGMMGко	иқит	мқп	мс
	йқит	мқй	мқс
	кқит	лқй	лқс
	лқит	кқй	кқс

MA990 (5G/4G_4 & 5G/4G_5)									
Frequency (MHz)	5G NR B71	LTE 700	LTE 800/900	5G NR 1500	5G NR n66	LTE 2600	5G NR n78	LTE 5200	
	617-698	698-806	824-960	1427-1518	1710-2170	2300-2690	3300-3800	5150-5925	
Efficiency (%)									
HGJMГKM	ичтм	мйчп	млчф	нйчф	лсчф	мсчф	нйчп	нйчй	нкчф
	йчтм	лсчф	мйчф	мсчй	лпчм	мнчп	мпчй	мнчф	мнчй
	кчтм	лпчм	лсчй	мнчф	лмчй	мичф	мичф	лпчф	лочй
	лчтм	лнчй	лочм	мкчф	лйчй	лочф	лнчф	лйчф	крчф
HGJMГKH	ичтм	лрчй	мнчф	нлчф	ммчп	ннчф	мсчй	нмчй	мсчй
	йчтм	лочф	млчп	нйчй	мйчф	нйчм	ммчй	мпчп	мйчф
	кчтм	лмчй	мичф	мпчп	лрчй	мнчп	лрчф	мичй	ллчй
	лчтм	лкчм	лрчй	ммчй	лмчп	мичп	ллчф	ллчф	кочп
Average Gain (dB)									
HGJMГKM	ичтм	Жчтс	Жчтп	Жчтп	Жчсс	Жчм	Жчро	Жчск	Жчп
	йчтм	Жчсс	Жчтп	Жчтп	Жчп	Жчм	Жчр	Жчн	Жчю
	кчтм	Жчп	Жчтп	Жчтп	Жчф	Жчй	Жчр	Жчй	Жчл
	лчтм	Жчн	Жчтп	Жчтп	Жчтп	Жчк	Жчр	Жчп	Жчй
HGJMГKH	ичтм	Жчй	Жчтп	Жчтп	Жчм	Жчм	Жчс	Жчр	Жчй
	йчтм	Жчм	Жчс	Жчск	Жчтп	Жчс	Жчй	Жчй	Жчтп
	кчтм	Жчр	Жчс	Жчк	Жчй	Жчм	Жчй	Жчп	Жчн
	лчтм	Жчс	Жчй	Жчк	Жчс	Жчй	Жчй	Жчм	Жчл
Peak Gain (dBi)									
HGJMГKM	ичтм	ичро	йчй	лчн	ичй	лчн	лчл	лчй	пчп
	йчтм	ичр	йчс	кчм	Жчй	лчл	лчй	кчп	пчп
	кчтм	ичк	ичс	кчм	Жчк	кчл	кчй	кчп	очп
	лчтм	Жчм	ичс	кчм	Жчк	кчл	кчй	йчп	нчп
HGJMГKH	ичтм	ичр	кчн	мчп	ичк	лчй	лчк	лчк	пчк
	йчтм	ичп	кчм	лчро	ичй	лчн	кчй	кчю	очк
	кчтм	Жчл	йчс	лчю	Жчк	кчн	кчй	йчро	нчк
	лчтм	Жчл	йчс	лчк	Жчро	кчн	йчй	ичс	мчк

Changelog for the datasheet

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Previous Revisions



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