

Specification

Part No.	:	MA173.A.LBI.001
Product Name	:	Monsoon 3 in 1 GNSS, LTE MIMO Low Profile Permanent Mount Antenna
Features	:	2*LTE MIMO Antenna 1*Active GNSS Antenna - GPS L1 and GLONASS L1 Permanent (Screwmount) Mounting IP67 Rated Enclosure Dims: 204 * 69 * 31 mm LTE MIMO: 3M CFD200 Cable and SMA(M)ST Connector GNSS: 3M RG-174 Cable and SMA(M)ST Connector Cables & Connectors Customizable Dimensions: 204 * 69 * 31 mm REACH & RoHS Compliant



1. Introduction

The Monsoon MA173 antenna is a low profile combination antenna. It integrates high-performing LTE MIMO antennas with an active GNSS antenna that supports both GPS L1 and GLONASS L1 bands. All antennas are enclosed in a fully IP67 waterproof housing designed for use in the most challenging of environments.

Typical applications include:

- HD Video over LTE -First Responder and Emergency Services
- Intelligent Transport Systems
- Internet of Things (IoT market)
- High Definition Video Broadcast Systems
- Wireless LTE M2M Devices
- Digital Signage

The Monsoon MA173's LTE MIMO antennas are designed for high efficiency, even without a ground plane. 4G LTE applications demand high speed data uplink and downlink and the high efficiency and gain characteristics exhibited by this antenna help to achieve the required signal to noise ratio and throughput to solve these challenges. Low loss cables are used to keep efficiency high over long cables lengths.

The GNSS antenna has been optimized to work on both GPS and GLONASS bands. Dual GPS/GLONASS systems can accelerate time to first fix, especially in challenging environments such as urban canyons or any environment where a large portion of the sky is blocked. A front-end SAW filter protects the GNSS antenna's LNA from potentially damaging out-of-band wireless transmissions, ensuring that it can be used in environments where these signals might be encountered.

All cable and connectors are customizable, contact your regional Taoglas sales office for customization and additional support.

2. Specification

GNSS Electrical			
Frequency	GPS L1: 1575.42 MHz $\pm$ 1.023 MHz GLONASS L1: 1602 MHz $\pm$ 1.023 MHz		
Bandwidth - Return Loss <-10 dB	6 MHz min		
Return loss (GPS L1 GLONASS L1)	< -10 dB		
Passive Gain at Zenith (GPS L1 and GLONASS L1)	+1.0 dBic typ.		
Polarization	RHCP		
Impedance	50 Ω		
LNA Out-band Attenuation	fo = 1575.42MHz fo $\pm$ 30 MHz 5dB Min. fo $\pm$ 50 MHz 20dB Min. fo $\pm$ 100 MHz 25dB Min.		
Input Voltage	Min:1.8V	Typ. 3.0V	Max: 5.5V
Total Gain @ Zenith	25dBic	30dBic	32dBic
Current Consumption	6mA	12mA	30mA
Noise Figure	2.7dB	3.0dB	3.7dB

LTE MIMO 1 Antenna								
Frequency (MHz)		LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600
		698~824	824~894	880~960	1710~1880	1850~1990	1920~2170	2490~2690
Efficiency (%)								
Free Space	0.3M	52.61	38.03	41.65	56.02	39.31	38.20	59.86
	1M	49.81	36.31	39.77	51.10	35.86	35.24	54.60
	2M	46.48	33.29	36.27	45.54	31.72	30.86	47.23
	3M	43.11	30.91	33.68	40.51	27.92	27.30	40.86
On 30x30cm Ground Plane	0.3M	32.24	45.06	59.51	41.93	40.70	42.55	62.35
	1M	30.47	43.03	56.82	38.25	37.13	39.26	56.84
	2M	28.44	39.35	51.82	34.09	32.80	34.35	49.18
	3M	26.40	36.62	48.16	30.32	28.89	30.44	42.55
Average Gain (dB)								
Free Space	0.3M	-2.79	-4.20	-3.80	-2.52	-4.05	-4.18	-3.01
	1M	-3.03	-4.40	-4.00	-2.92	-4.45	-4.53	-3.41
	2M	-3.33	-4.78	-4.40	-3.42	-4.99	-5.11	-4.02
	3M	-3.65	-5.10	-4.73	-3.92	-5.54	-5.64	-4.63
On 30x30cm Ground Plane	0.3M	-4.92	-3.46	-2.25	-3.77	-3.90	-3.71	-2.05
	1M	-5.16	-3.66	-2.46	-4.17	-4.30	-4.06	-2.45
	2M	-5.46	-4.05	-2.86	-4.67	-4.84	-4.64	-3.08
	3M	-5.78	-4.36	-3.17	-5.18	-5.39	-5.17	-3.71
Peak Gain (dBi)								
Free Space	0.3M	-1.68	-3.64	-2.53	-1.90	-3.11	-3.32	-1.99
	1M	-1.98	-3.84	-2.73	-2.30	-3.51	-3.62	-2.39
	2M	-2.28	-4.24	-3.13	-2.80	-4.01	-4.22	-2.99
	3M	-2.58	-4.54	-3.53	-3.30	-4.51	-4.72	-3.59
On 30x30cm Ground Plane	0.3M	-2.47	-2.19	-1.97	-3.18	-2.96	-2.75	-1.62
	1M	-2.77	-2.39	-2.17	-3.58	-3.36	-3.05	-2.02
	2M	-3.07	-2.79	-2.57	-4.08	-3.96	-3.65	-2.62
	3M	-3.37	-3.09	-2.97	-4.58	-4.46	-4.15	-3.22
Impedance	50 Ω							
Return loss	< -3 dB							
Polarization	Vertical							

LTE MIMO 2 Antenna								
Frequency (MHz)		LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600
		698~824	824~894	880~960	1710~1880	1850~1990	1920~2170	2490~2690
Efficiency (%)								
Free Space	0.3M	49.28	33.76	54.84	43.64	28.06	30.86	56.83
	1M	46.69	32.24	52.35	39.80	25.58	28.44	51.84
	2M	43.57	29.55	47.74	35.48	22.64	24.94	44.84
	3M	40.39	27.44	44.33	31.56	19.92	22.03	38.80
On 30x30cm Ground Plane	0.3M	41.55	37.55	57.10	38.85	25.51	29.51	61.72
	1M	39.31	35.86	54.51	35.43	23.27	27.21	56.27
	2M	36.69	32.82	49.71	31.58	20.59	23.86	48.66
	3M	34.03	30.53	46.16	28.10	18.12	21.07	42.10
Average Gain (dB)								
Free Space	0.3M	-3.07	-4.72	-2.61	-3.60	-5.52	-5.11	-2.45
	1M	-3.31	-4.92	-2.81	-4.00	-5.92	-5.46	-2.85
	2M	-3.61	-5.29	-3.21	-4.50	-6.45	-6.03	-3.48
	3M	-3.94	-5.62	-3.53	-5.01	-7.01	-6.57	-4.11
On 30x30cm Ground Plane	0.3M	-3.81	-4.25	-2.43	-4.11	-5.93	-5.30	-2.10
	1M	-4.05	-4.45	-2.64	-4.51	-6.33	-5.65	-2.50
	2M	-4.35	-4.84	-3.04	-5.01	-6.86	-6.22	-3.13
	3M	-4.68	-5.15	-3.36	-5.51	-7.42	-6.76	-3.76
Peak Gain (dBi)								
Free Space	0.3M	-2.33	-3.62	-1.27	-2.76	-4.25	-4.14	-2.17
	1M	-2.63	-3.82	-1.47	-3.16	-4.65	-4.54	-2.57
	2M	-2.93	-4.22	-1.87	-3.66	-5.15	-5.04	-3.17
	3M	-3.23	-4.52	-2.27	-4.16	-5.65	-5.64	-3.77
On 30x30cm Ground Plane	0.3M	-2.40	-2.88	-1.28	-3.24	-4.82	-4.42	-1.83
	1M	-2.70	-3.08	-1.48	-3.64	-5.22	-4.82	-2.23
	2M	-3.00	-3.48	-1.88	-4.14	-5.72	-5.32	-2.93
	3M	-3.30	-3.78	-2.28	-4.64	-6.22	-5.92	-3.53
Impedance	50 Ω							
Return loss	< -3 dB							
Polarization	Vertical							

Mechanical	
Dimensions	203.95 x 68.96 x 30.95 mm
Cable	LTE MIMO1/ MIMO2: 3000mm CFD200 GNSS: 3000mm RG174
Connector	LTE: SMA(M) GNSS: SMA(M)
Casing	PC+ABS
Adhesive	3M 9448HK + CR4305
Sealant	Rubber Stopper
Weight	550 g
Environmental	
Protection	IP67
Corrosion	5% NaCl for 96hrs - Nickel plated steel base and thread
Temperature Range	-40°C to +85°C
Thermal Shock	100 cycles -40°C to +85°C
Humidity	Non-condensing 65°C 95% RH
Shock (Drop Test)	1m drop on concrete 6 axes
Recommended Mounting Torque	24.5N·m
Maximum Mounting Torque	29.5N·m

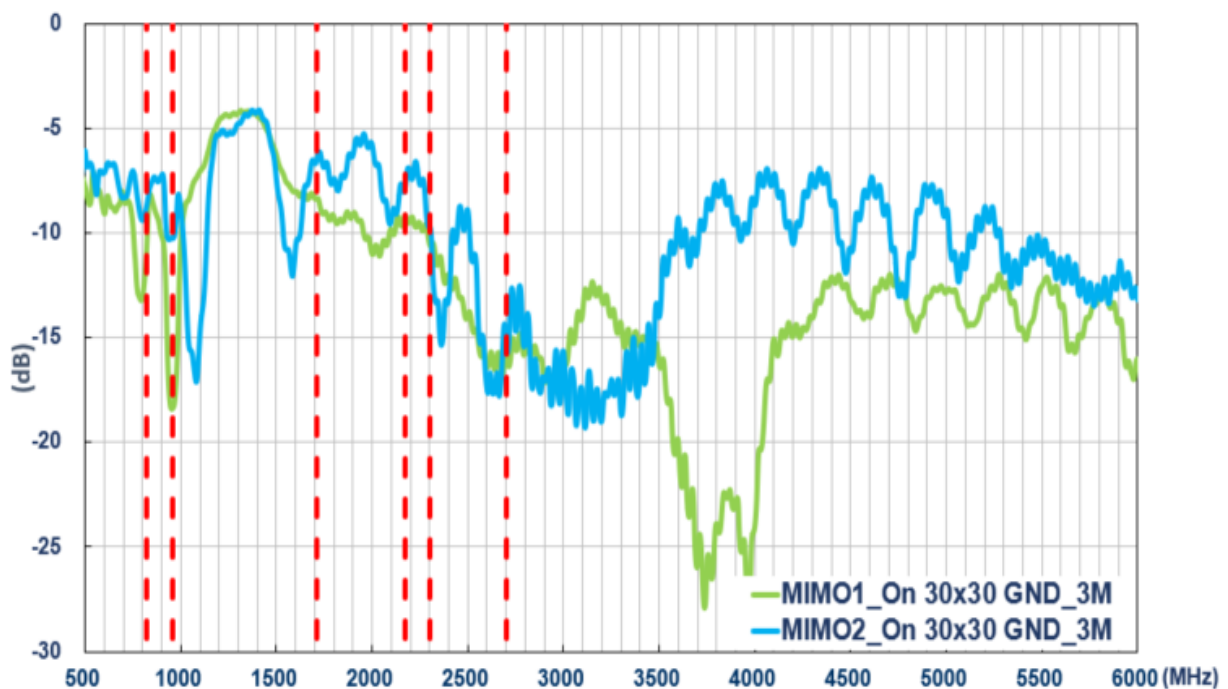
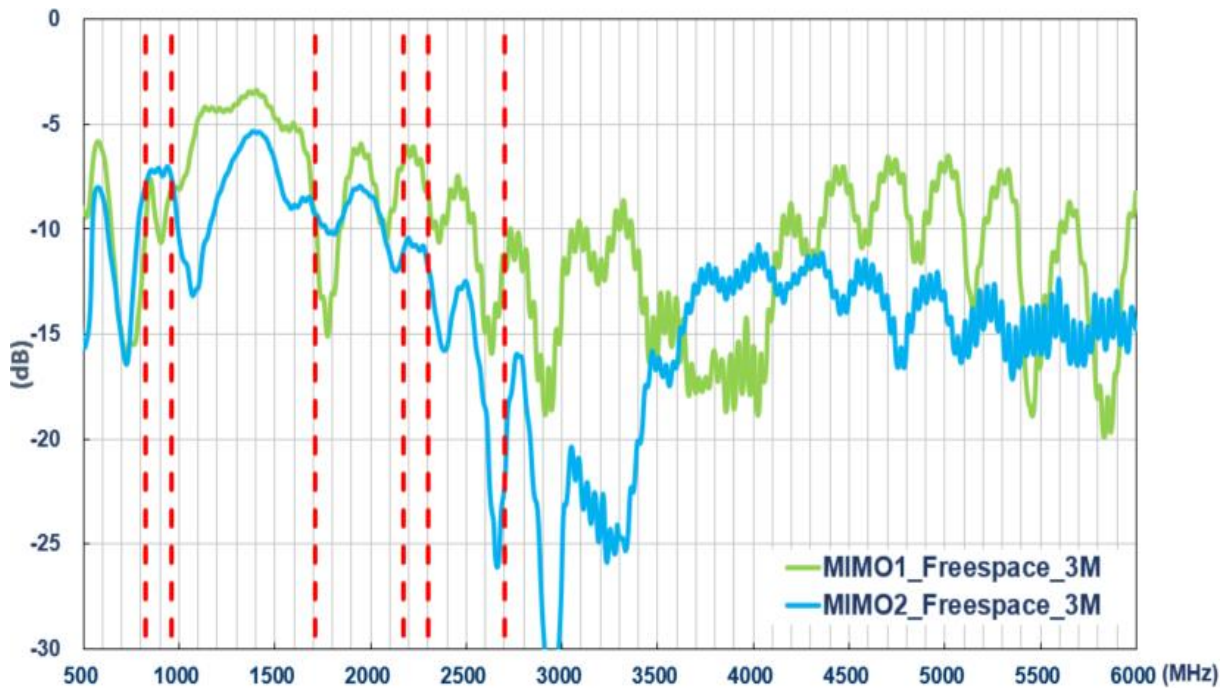
LTE BANDS IN FREE SPACE				
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA			
	Uplink	Downlink	Covered	Covered
1	UL: 1920 to 1980	DL: 2110 to 2170	✓	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓	✓
5	UL: 824 to 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 (LTE only)	✓	✓
18	UL: 815 to 830	DL: 860 to 875 (LTE only)	✓	✓
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 (LTE only)	✓	✓
24	UL: 1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✓	✓
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 (LTE only)	✓	✓
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✓	✓
29	UL: -	DL: 717 to 728 (LTE only)	✓	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✓	✓
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		✓	✓

LTE BANDS ON 30X30 GROUNDPLANE				
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA			
	Uplink	Downlink	Covered	Covered
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 (LTE only)	✓	✓
18	UL: 815 to 830	DL: 860 to 875 (LTE only)	✓	✓
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 (LTE only)	✓	✓
24	UL: 1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✓	✓
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 (LTE only)	✓	✓
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✓	✓
29	UL: -	DL: 717 to 728 (LTE only)	✓	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✓	✓
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		✓	✓

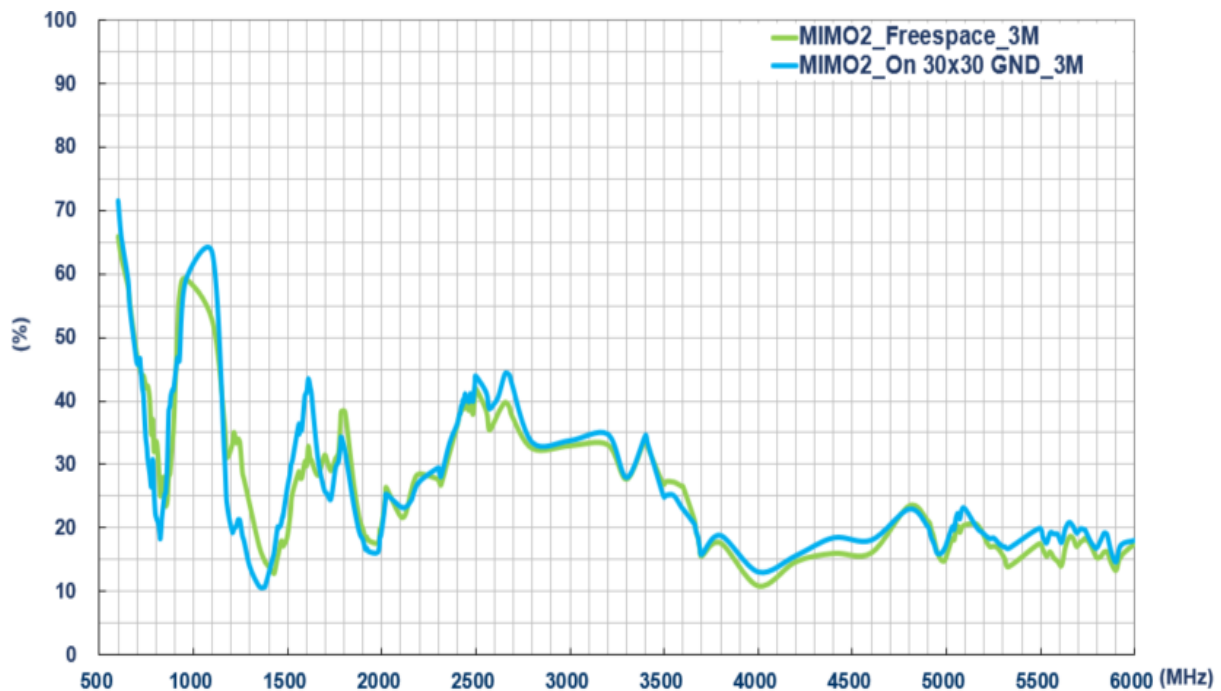
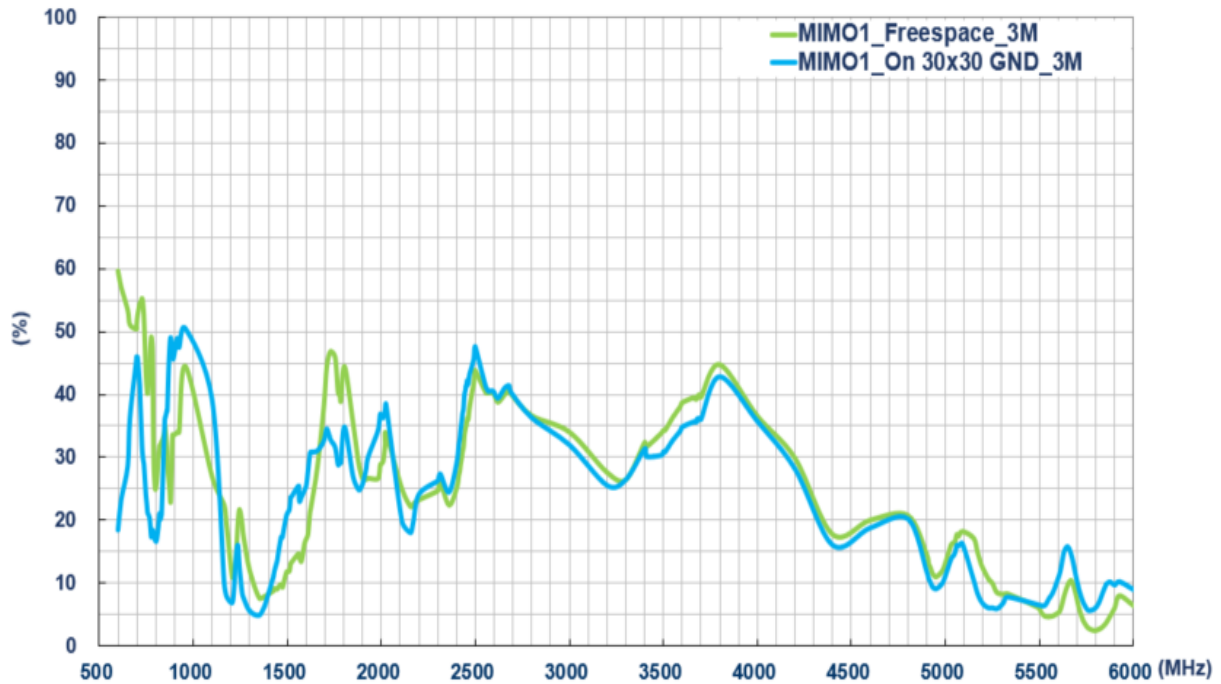
3. Antenna Characteristics

3.1. LTE MIMO1 and MIMO2 Antennas

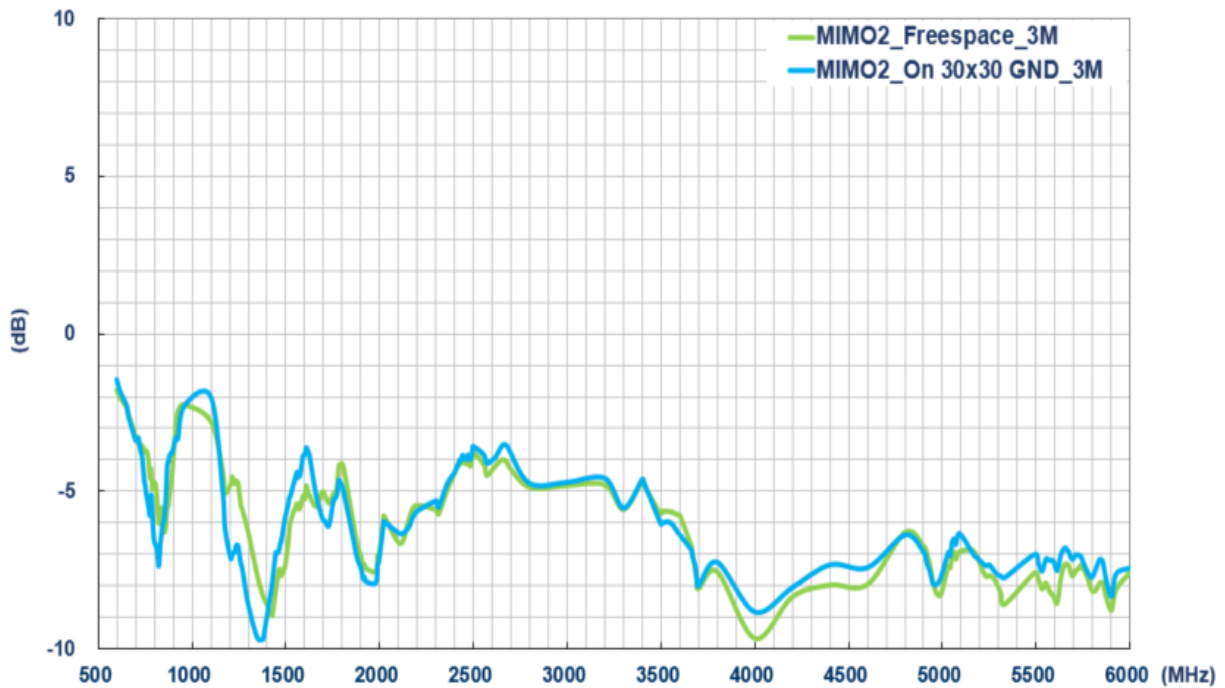
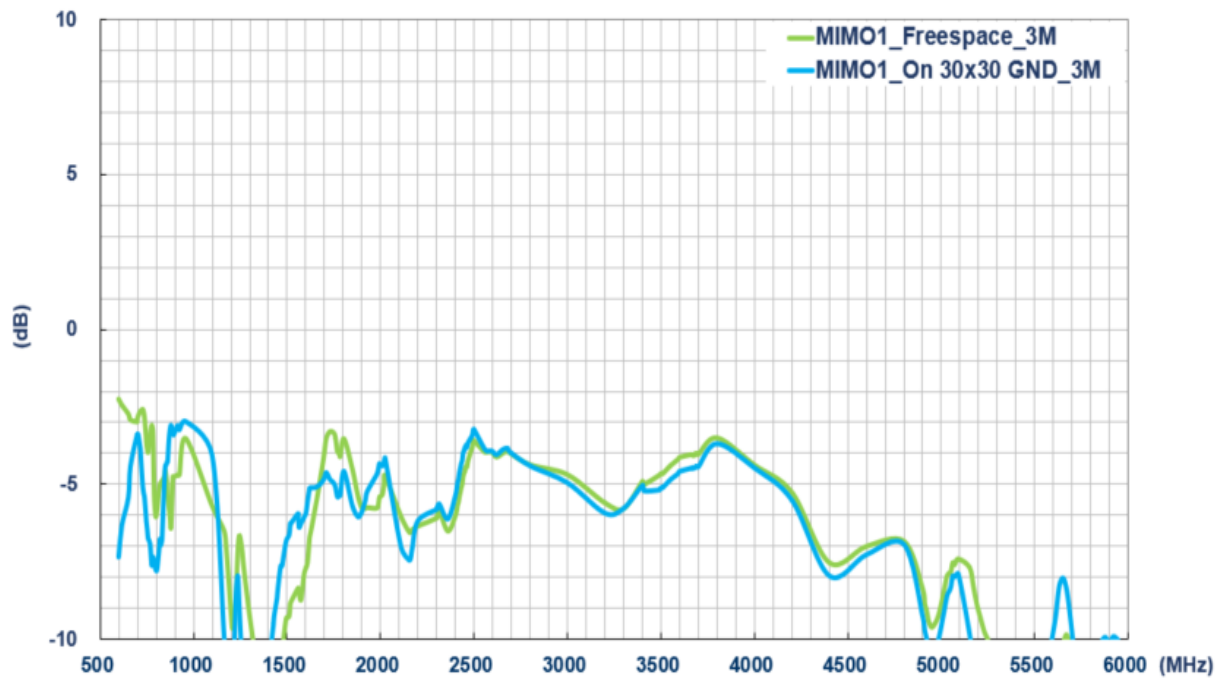
3.1.1. Return Loss – MIMO1 and MIMO2



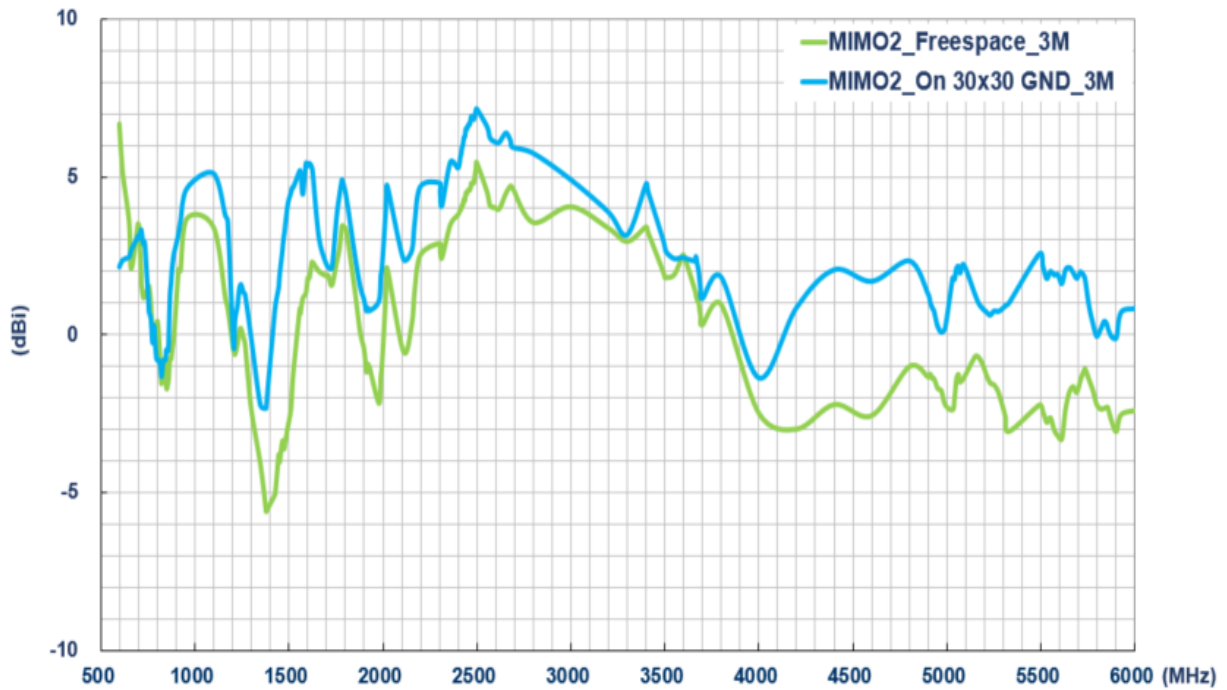
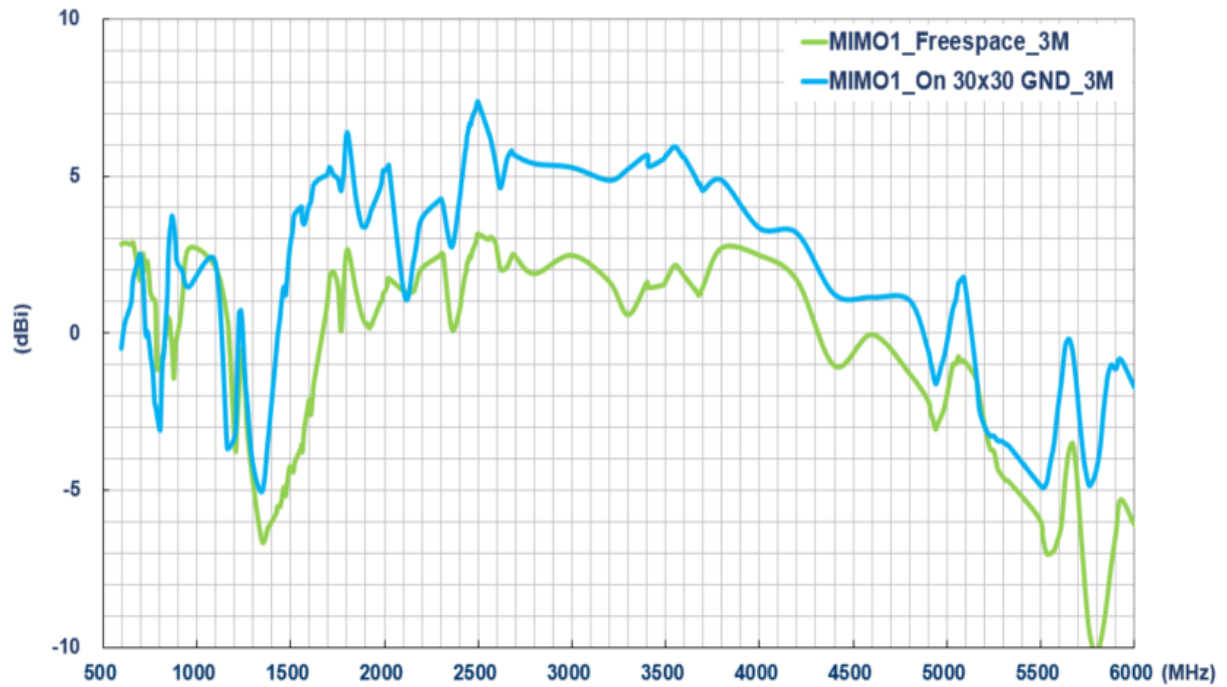
3.1.2. Efficiency – MIMO1 and MIMO2



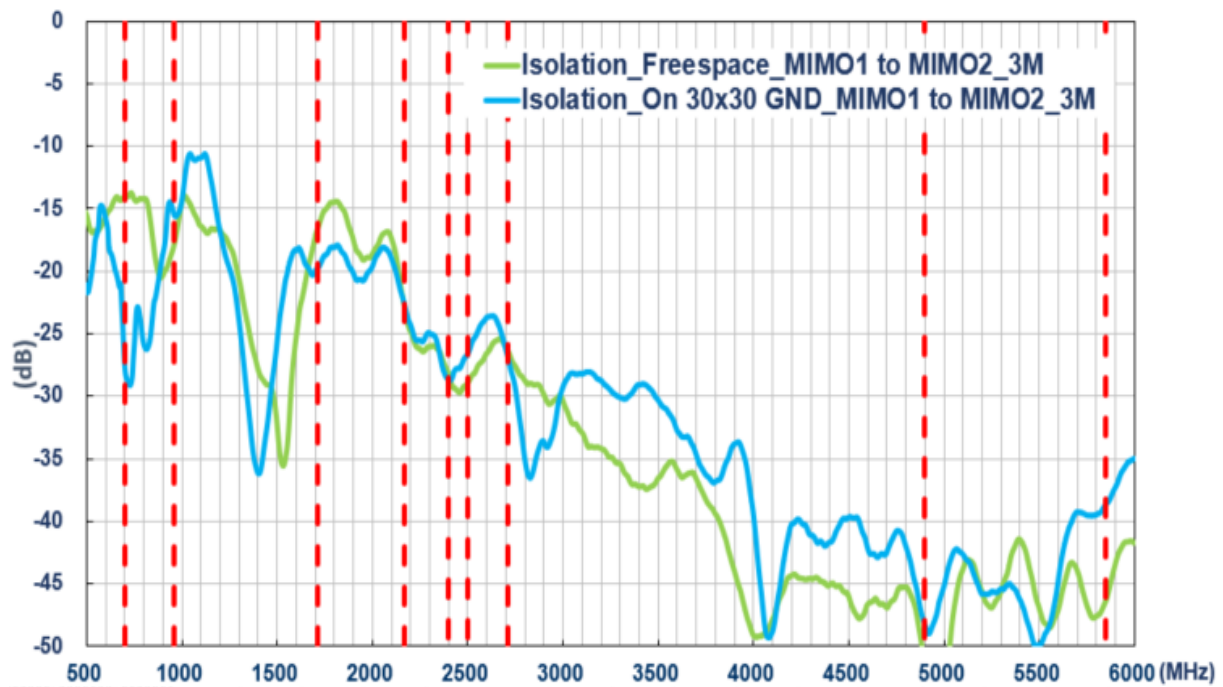
3.1.3. Average Gain – MIMO1 and MIMO2



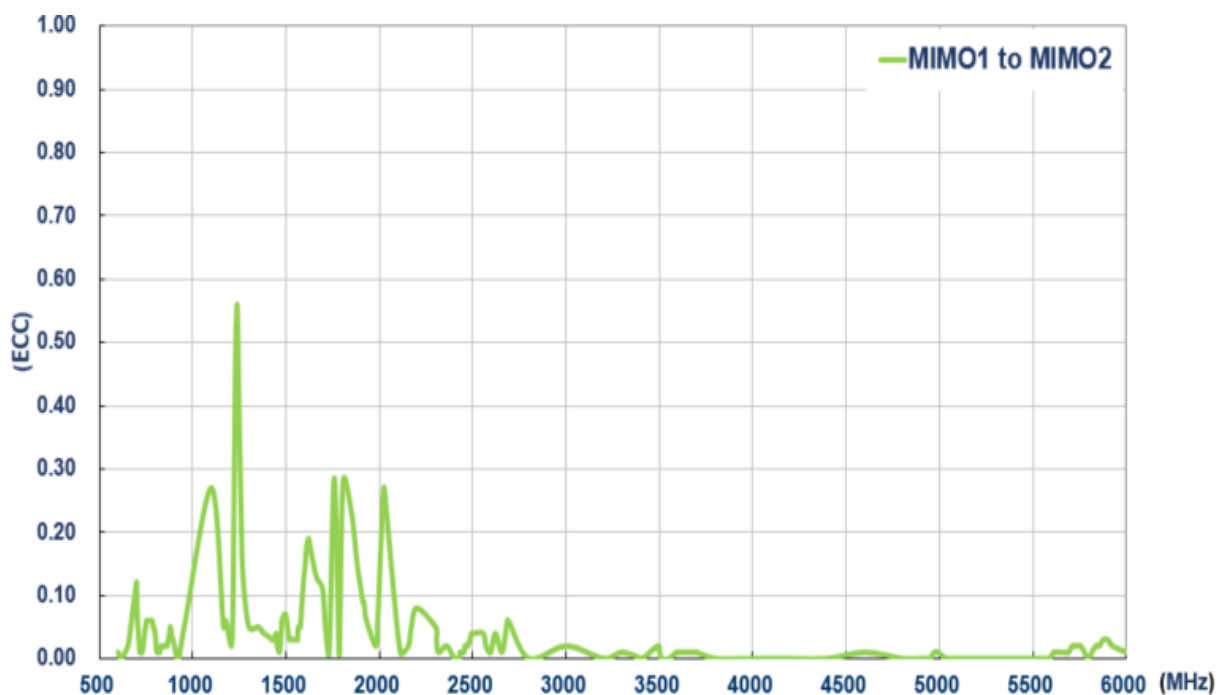
3.1.4. Peak Gain – MIMO1 and MIMO2



3.1.5. Isolation – MIMO1 and MIMO2

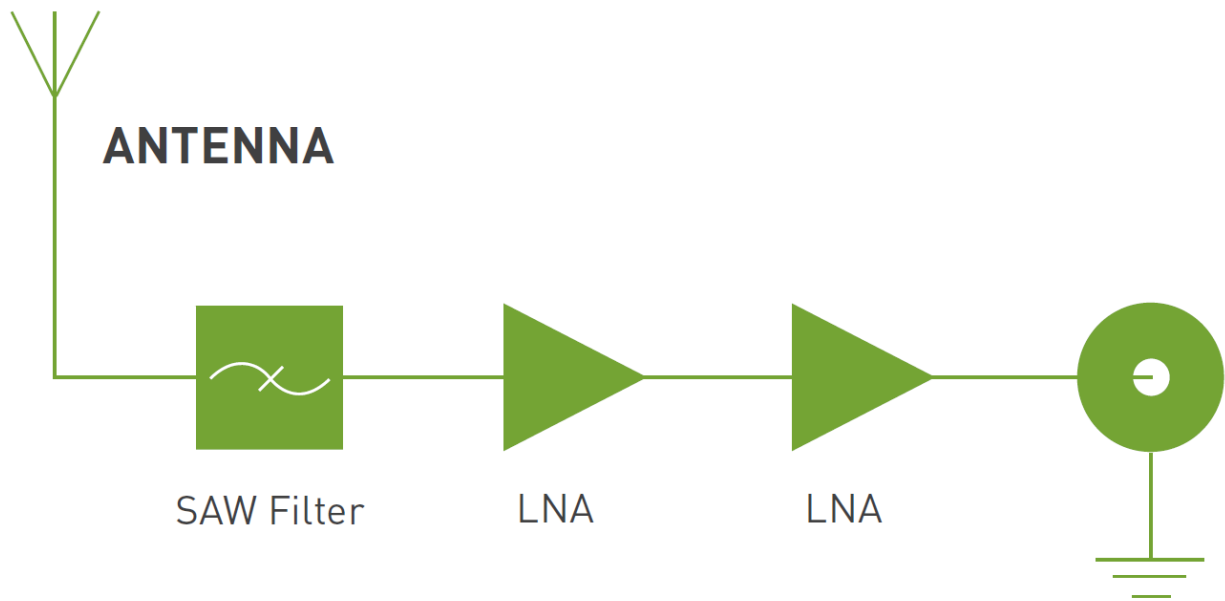


3.1.6. ECC – MIMO1 and MIMO2

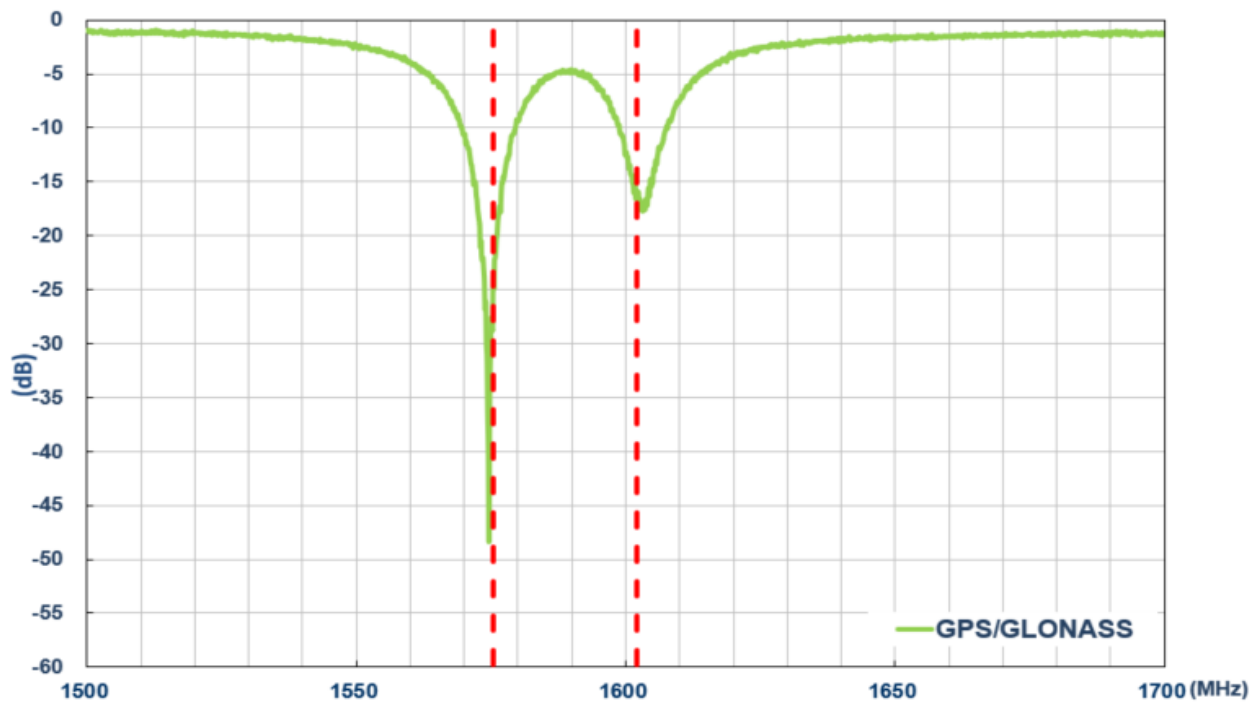


3.2. GNSS Antenna

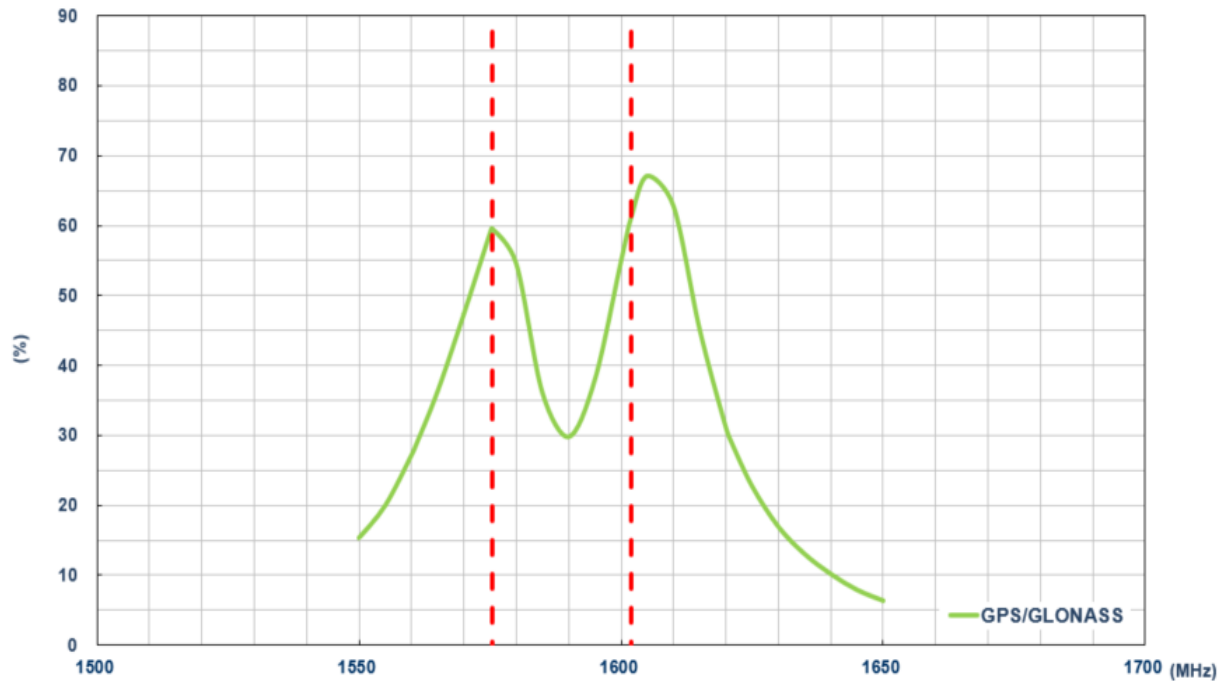
3.2.1. Block Diagram (Active antenna)



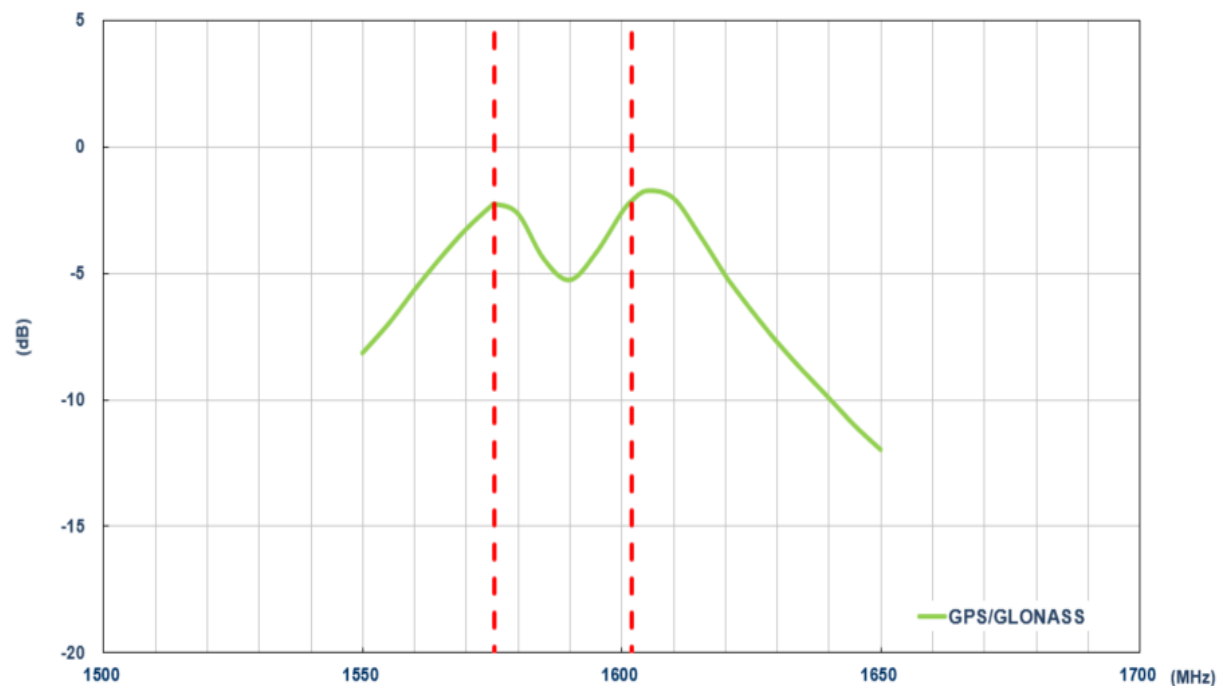
3.2.2. Return Loss – GNSS Antenna



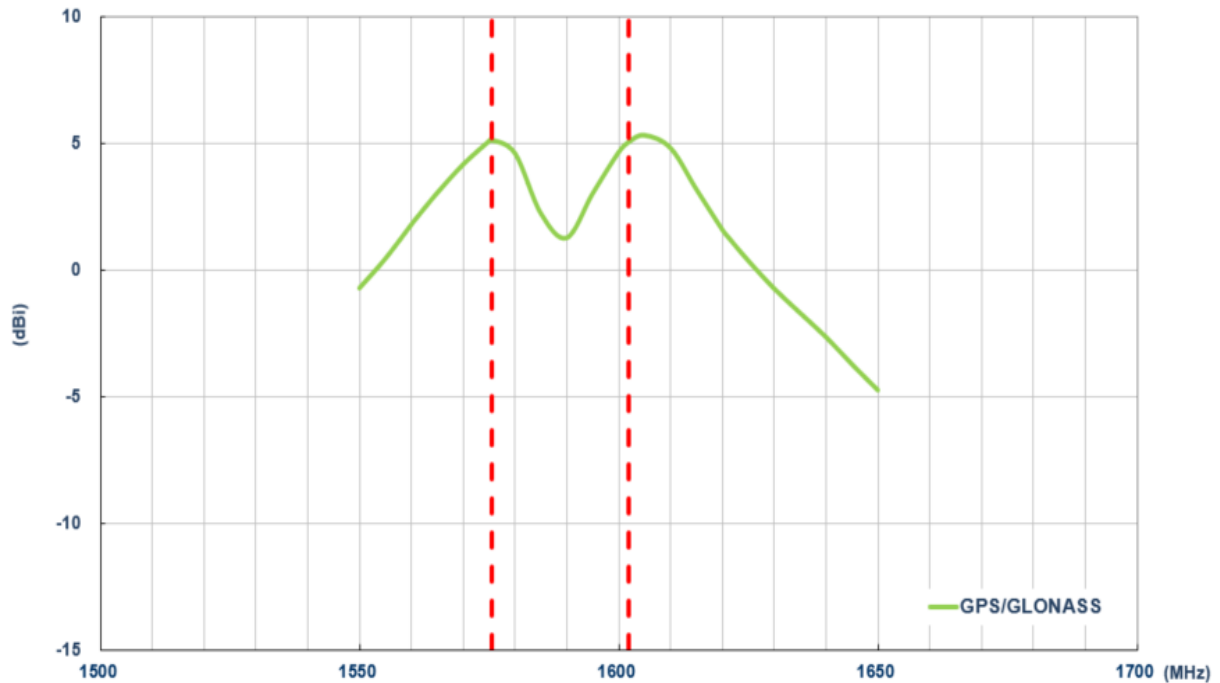
3.2.3. Efficiency – GNSS Antenna (passive measurement)



3.2.4. Average Gain – GNSS Antenna (passive measurement)

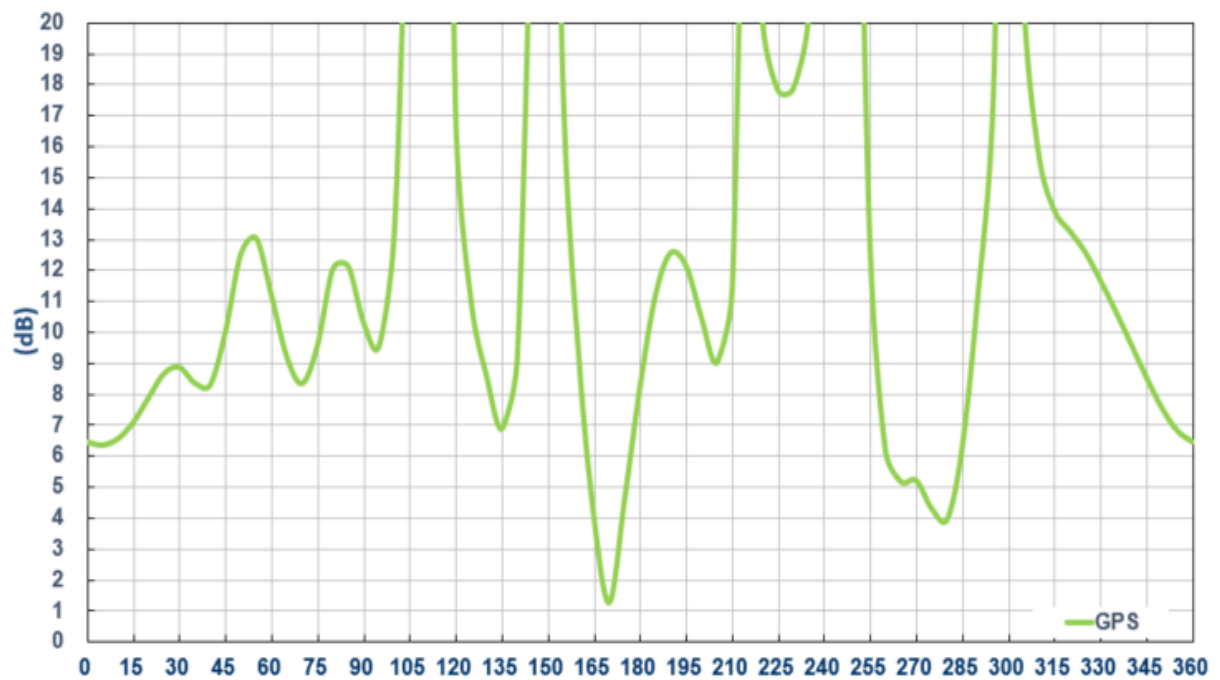


3.2.5. Peak Gain – GNSS Antenna (passive measurement)

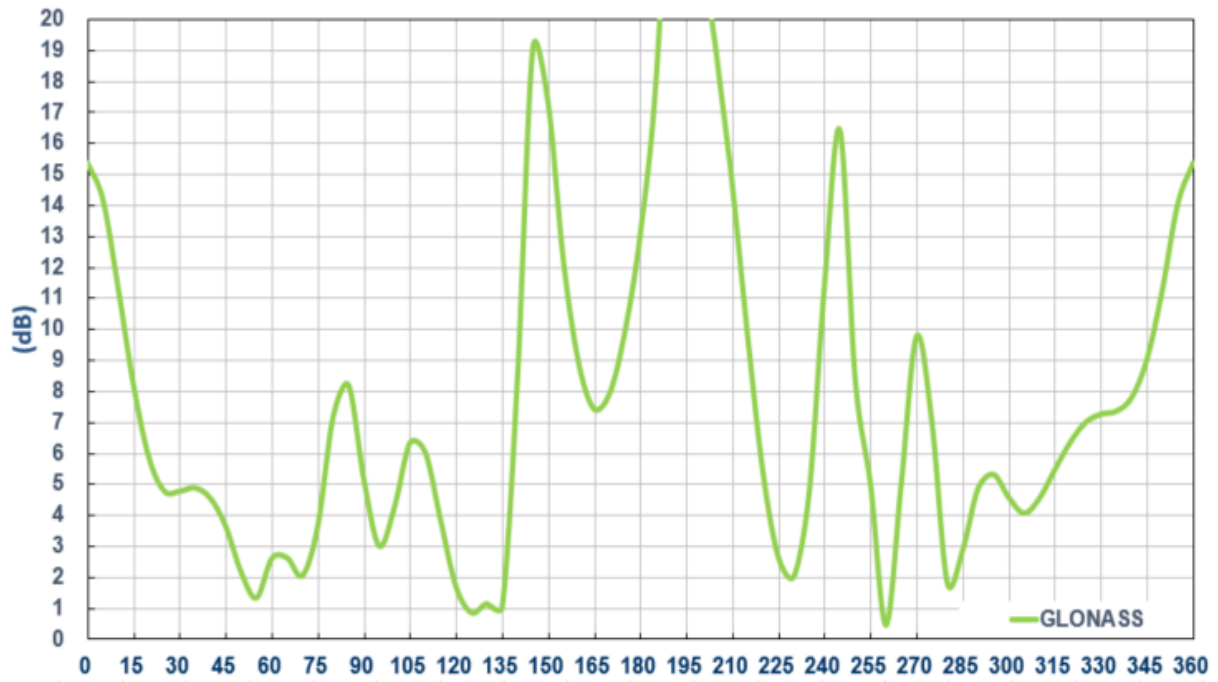


3.2.6. Axial Ratio – GNSS Antenna (Zenith is at 0°)

Axial Ratio at GPS L1 (1575.42 MHz)

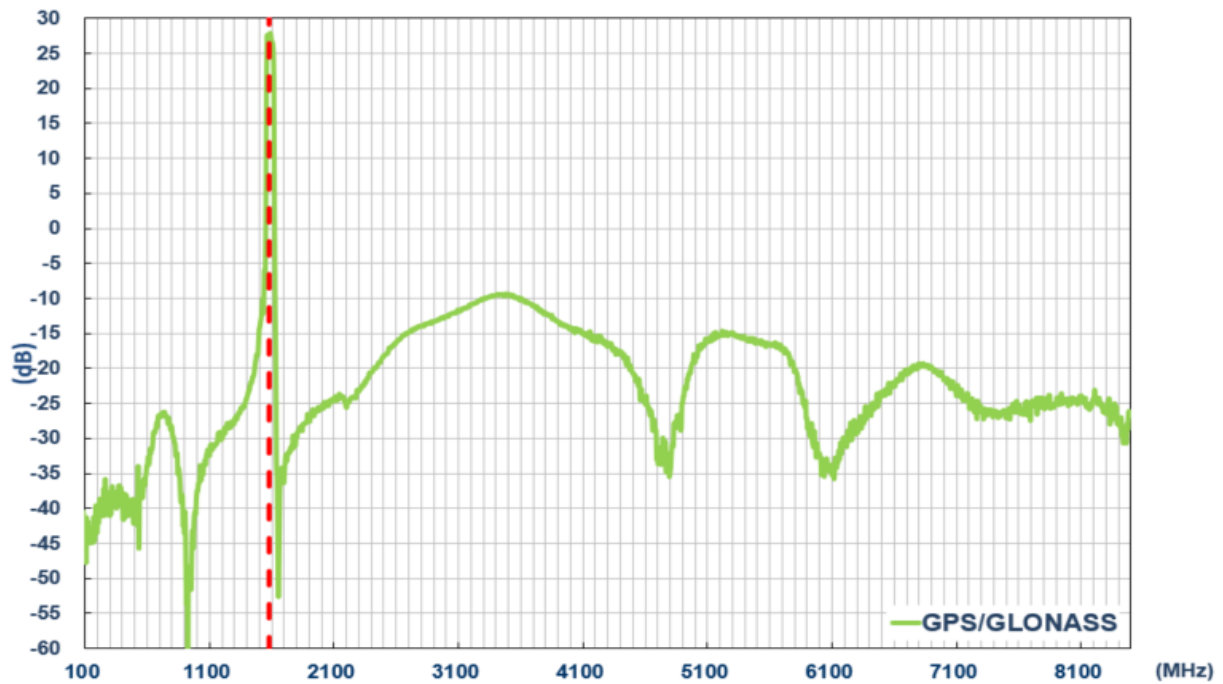


Axial Ratio at GLONASS L1 (1602 MHz)

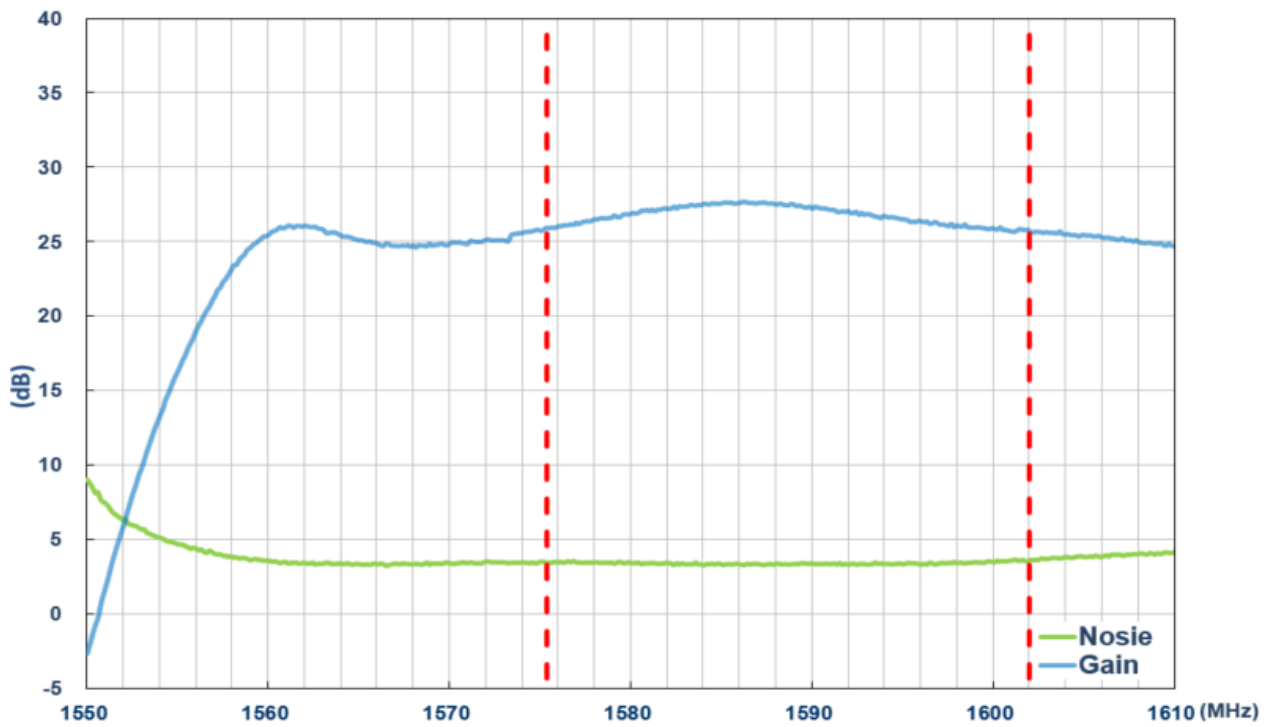


3.2.7. GNSS Antenna Active Measurements

LNA Gain @ 3.0V



LNA Gain and Noise Figure @ 3.0V



4. Antenna Radiation Patterns

4.1 Antenna Setup

Free Space



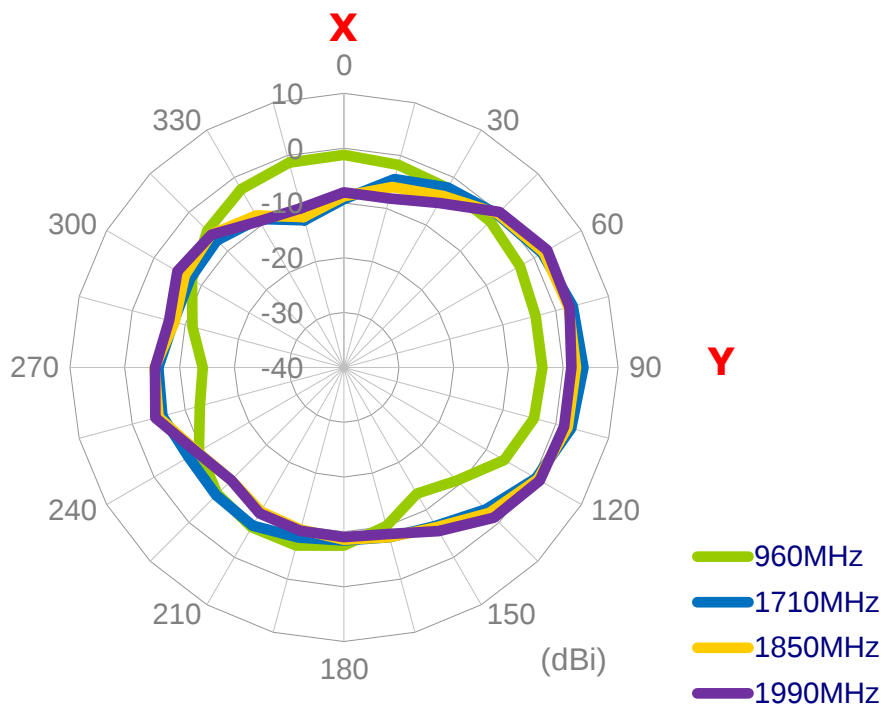
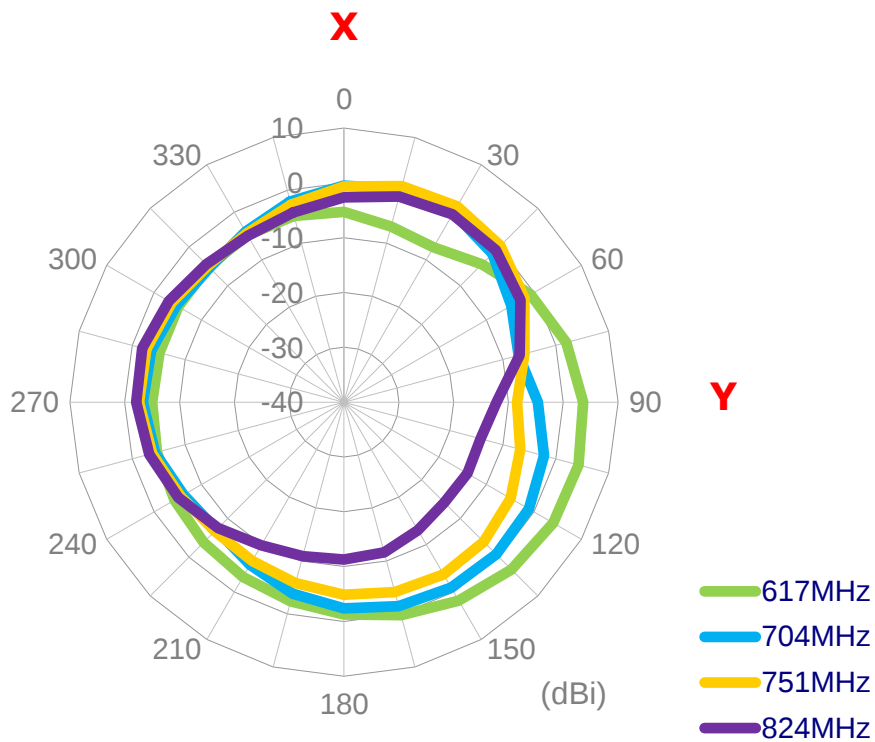
On 30*30cm GND

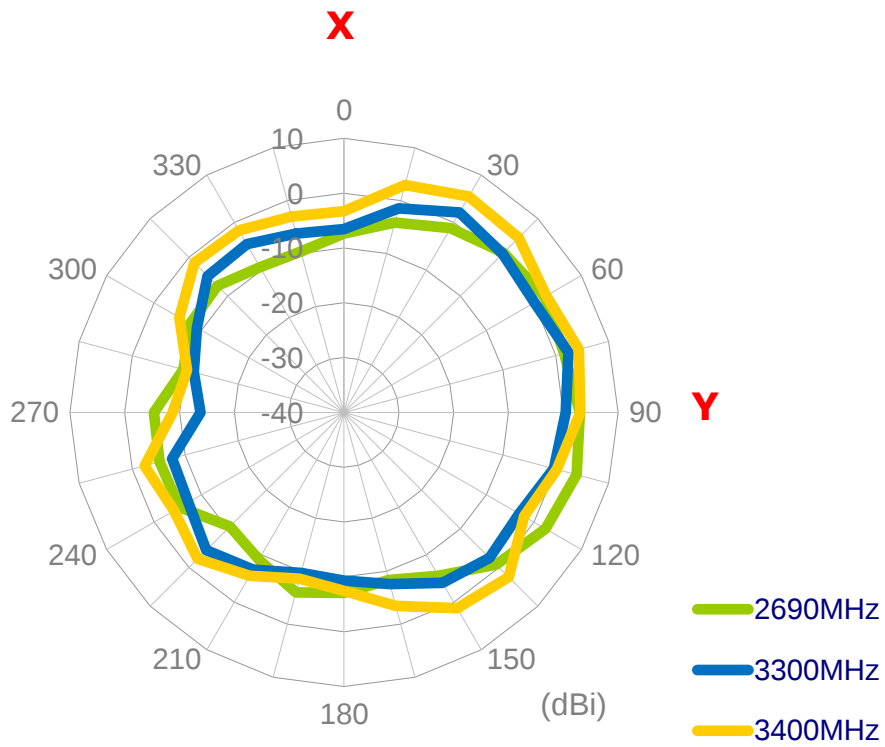
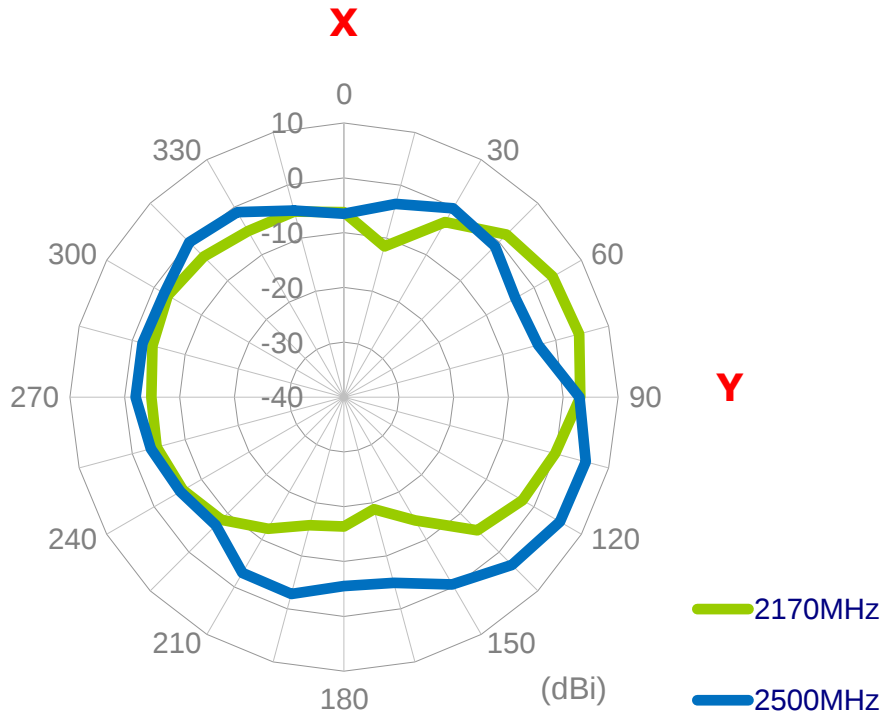


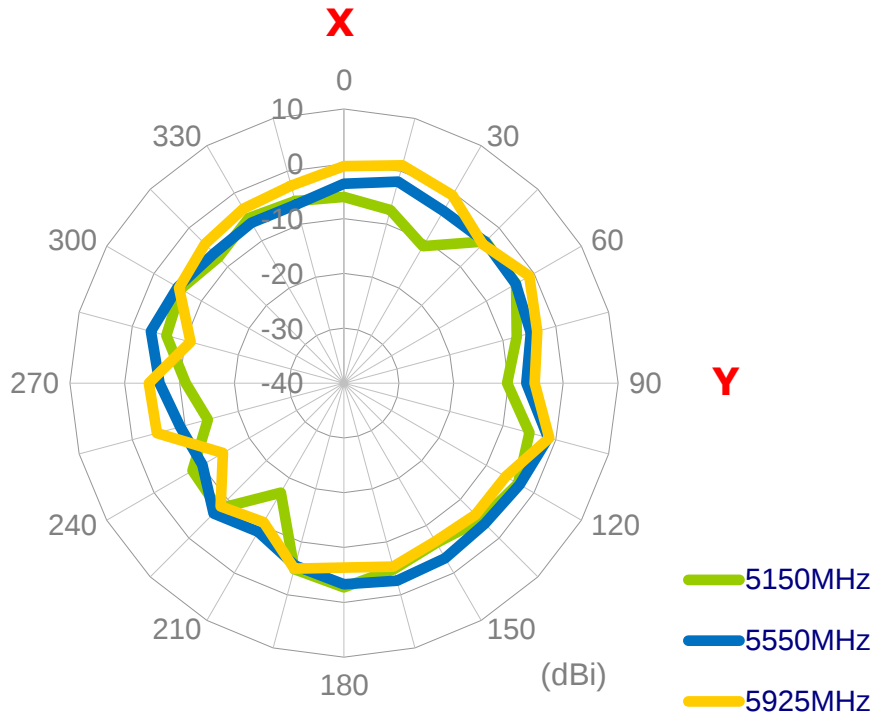
4.2 2D Radiation Patterns

4.2.1 MIMO1_Free Space

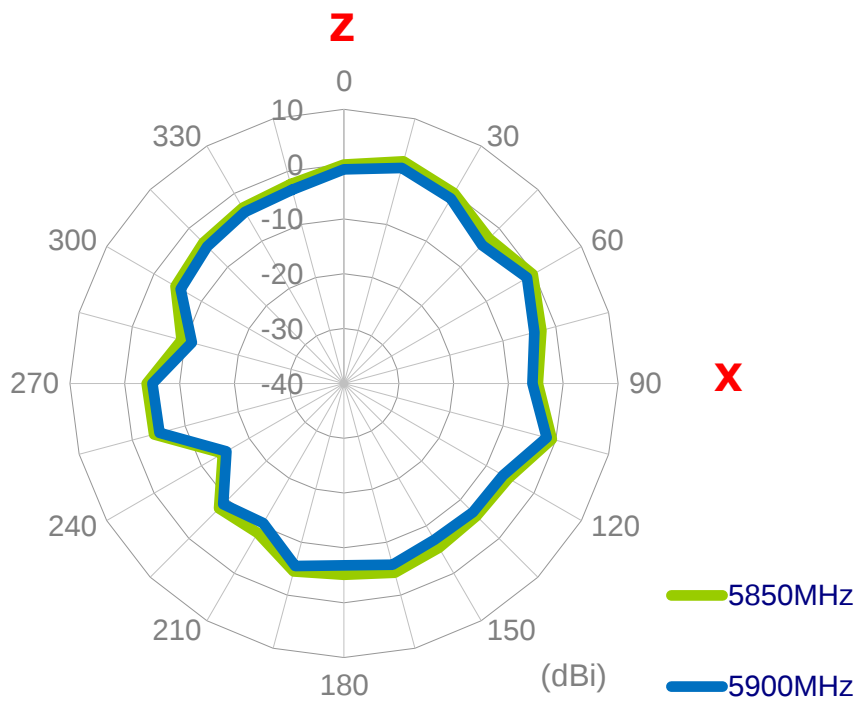
XY Plane

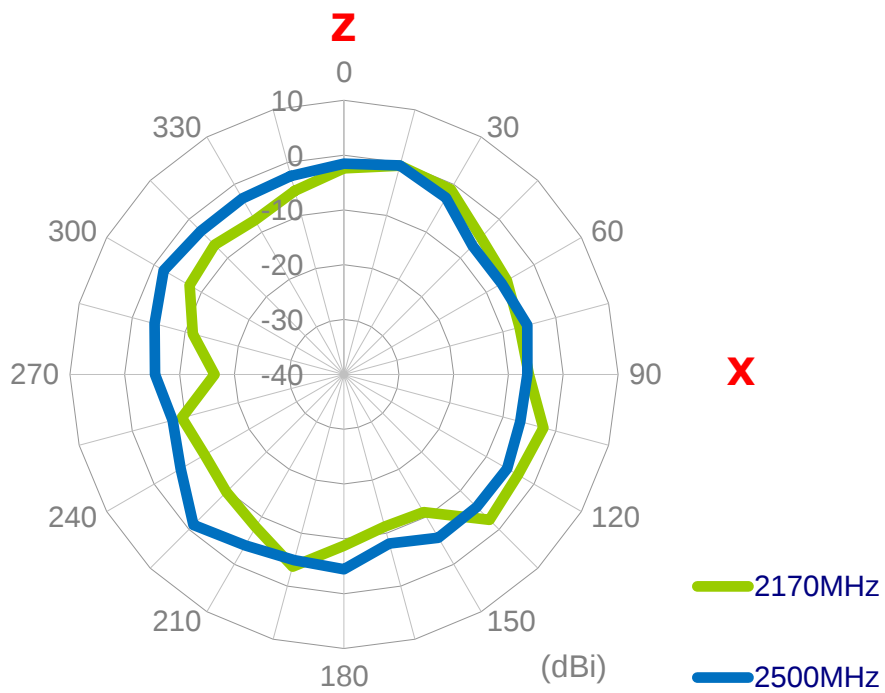
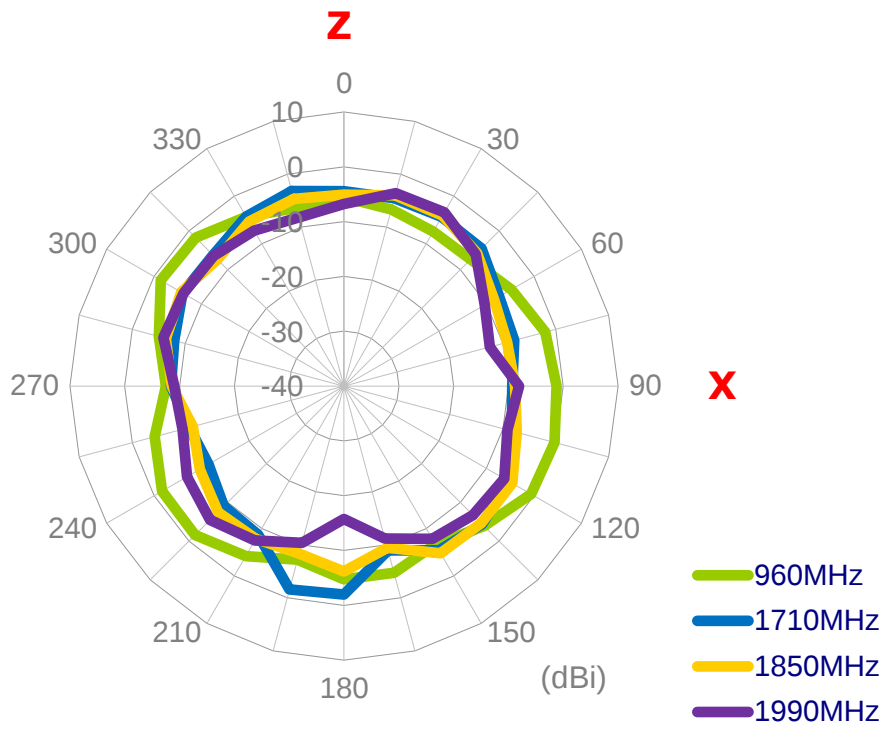


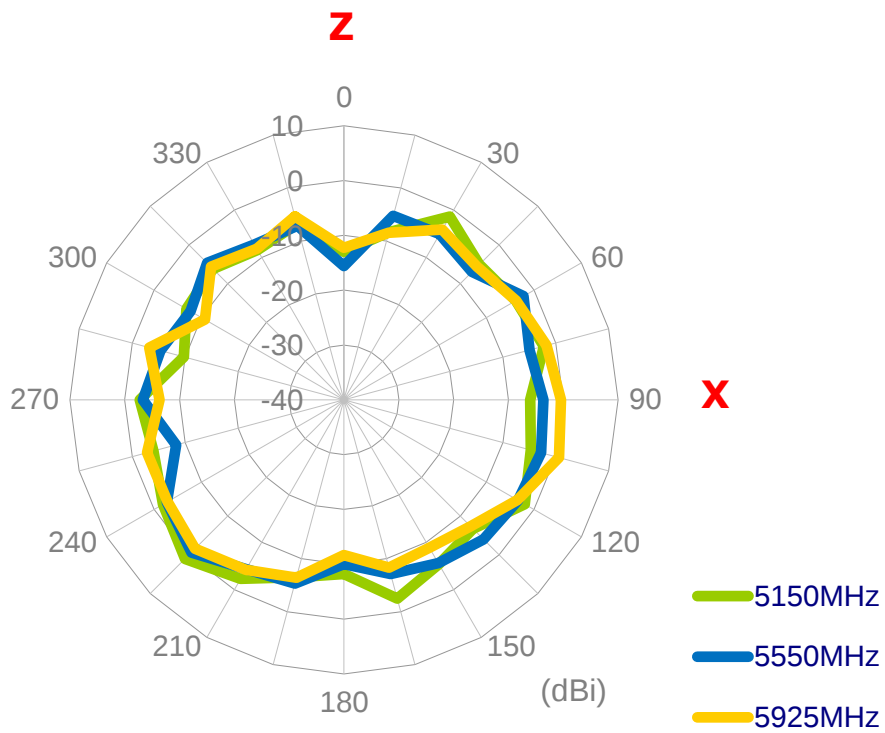
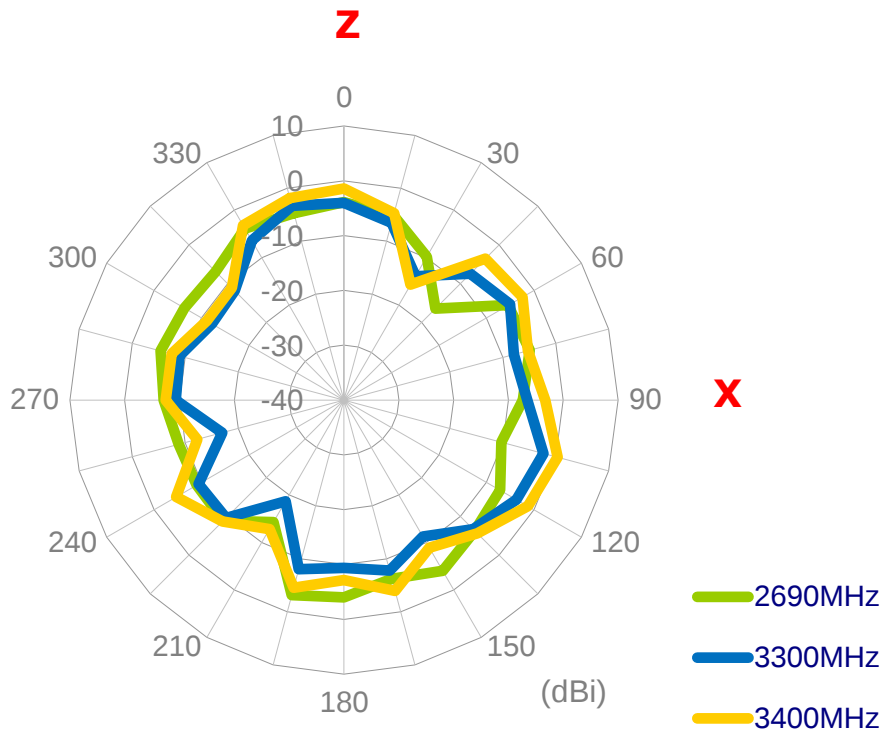




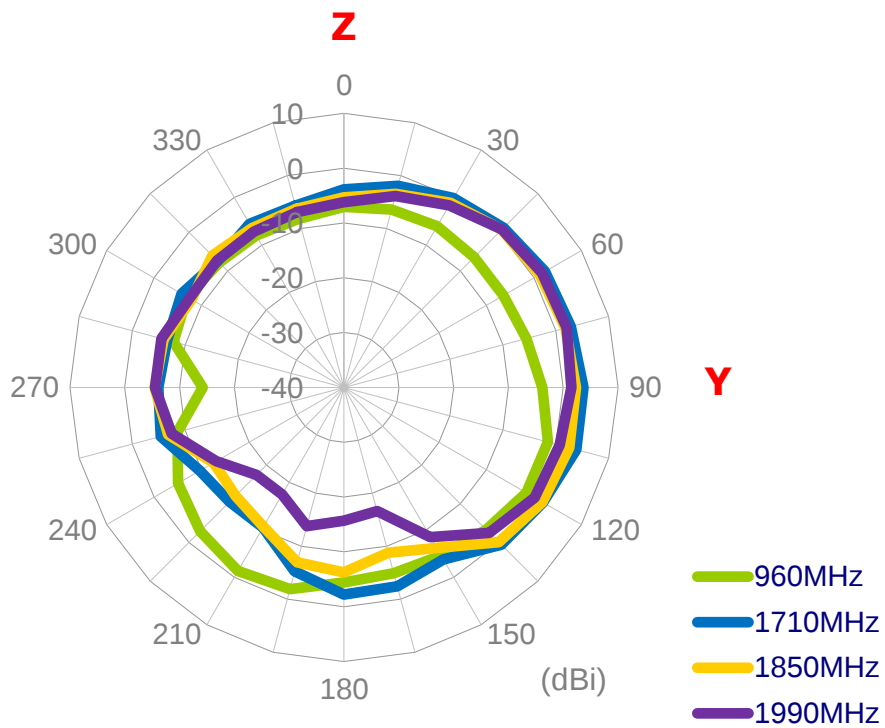
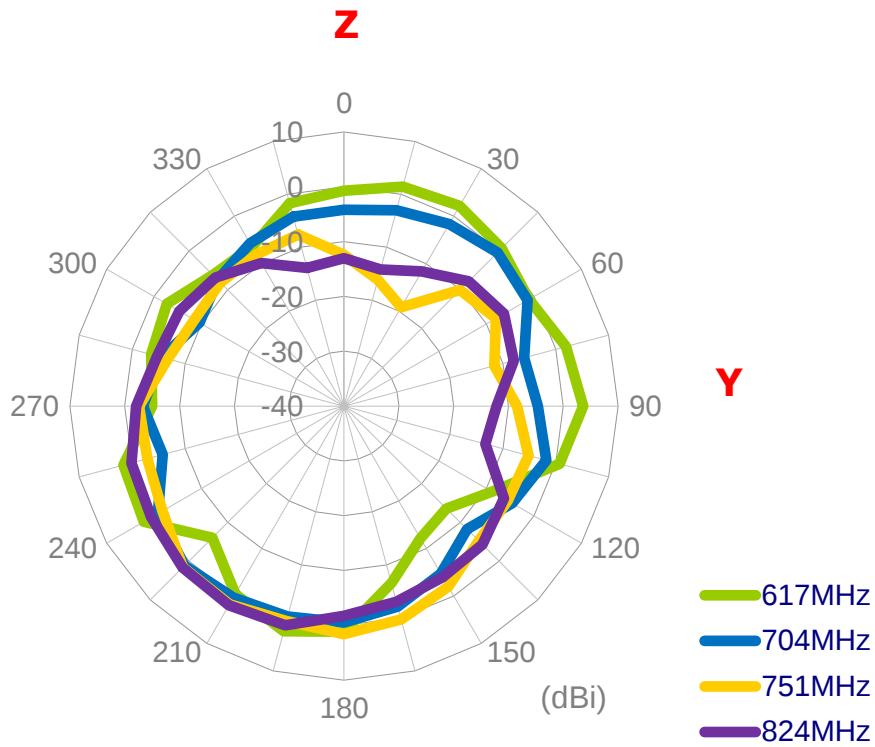
XZ Plane

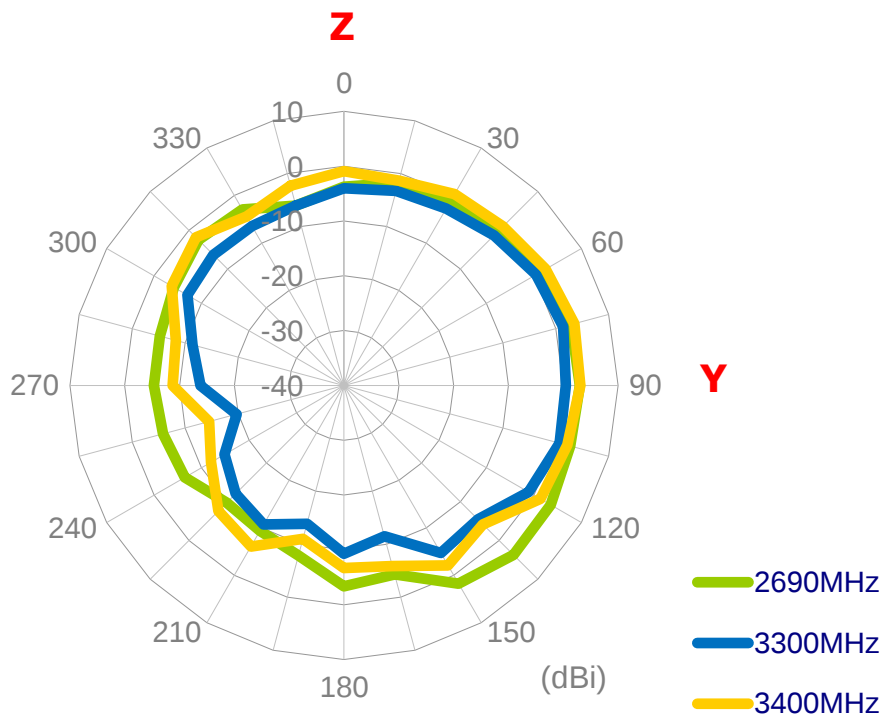
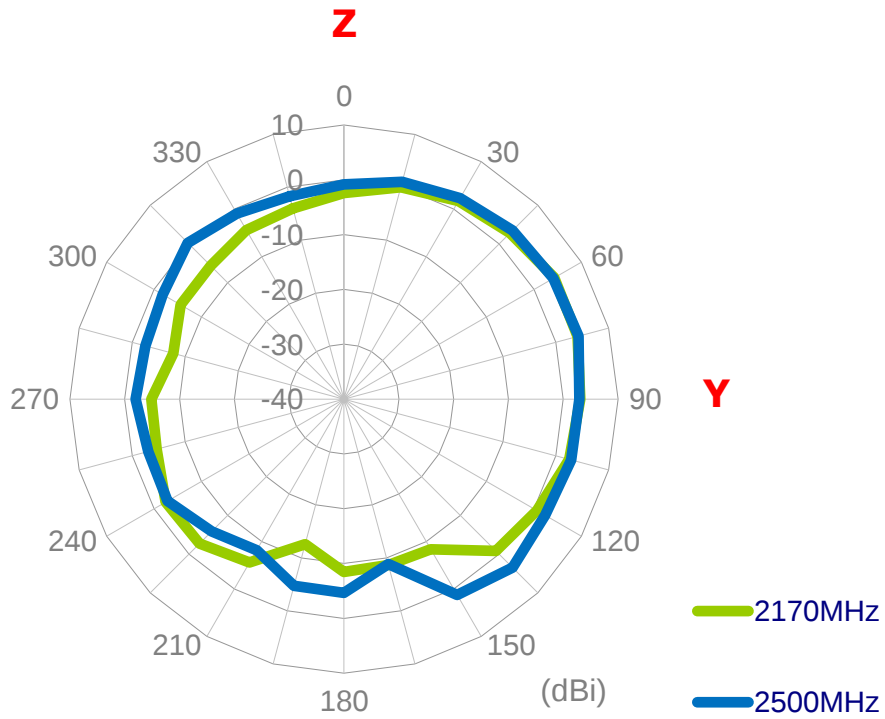


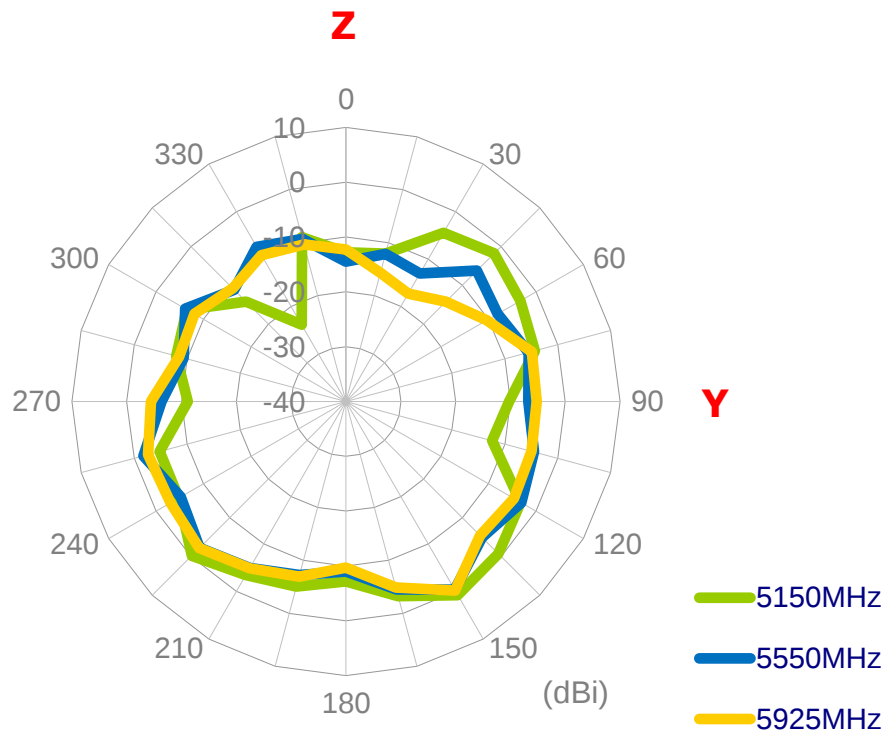




YZ Plane

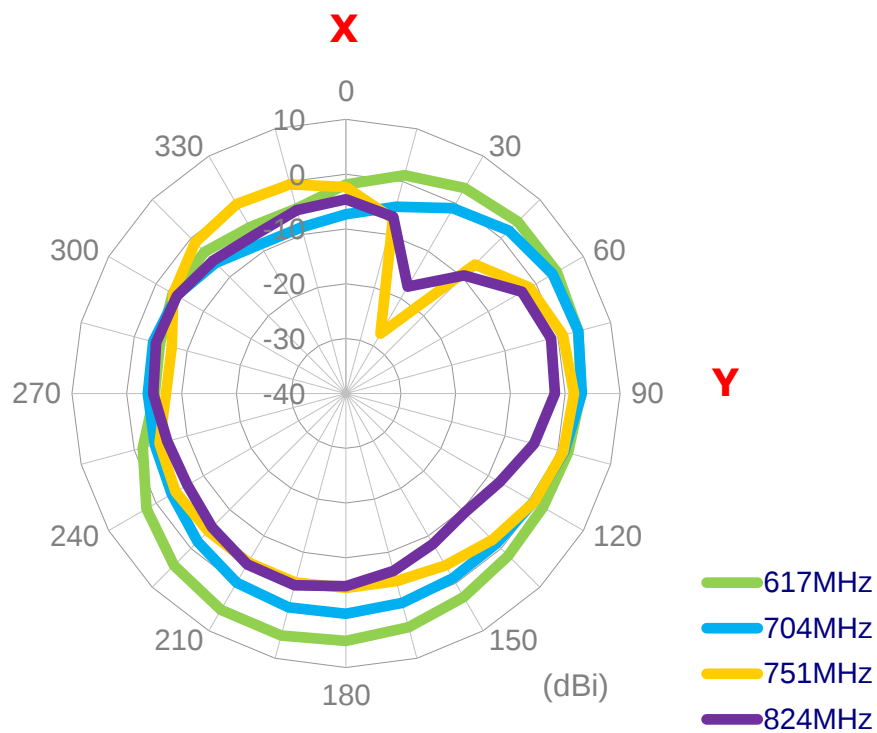


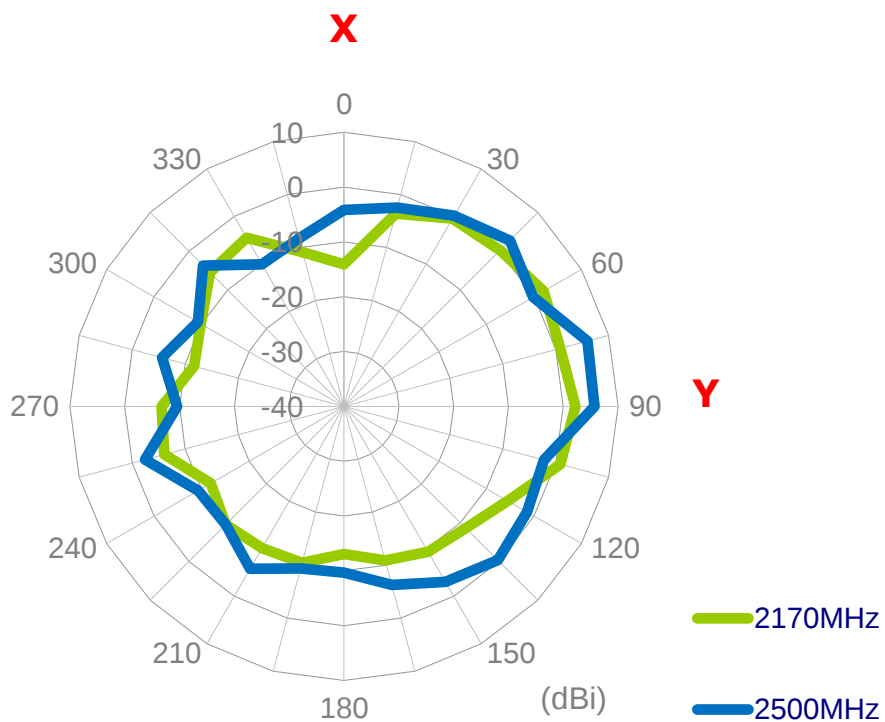
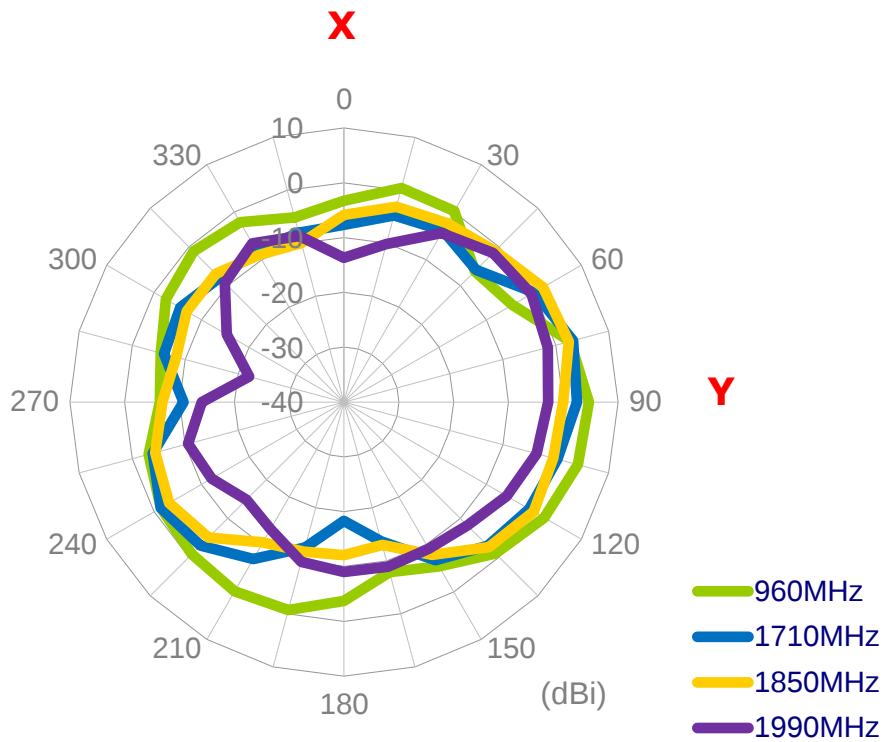


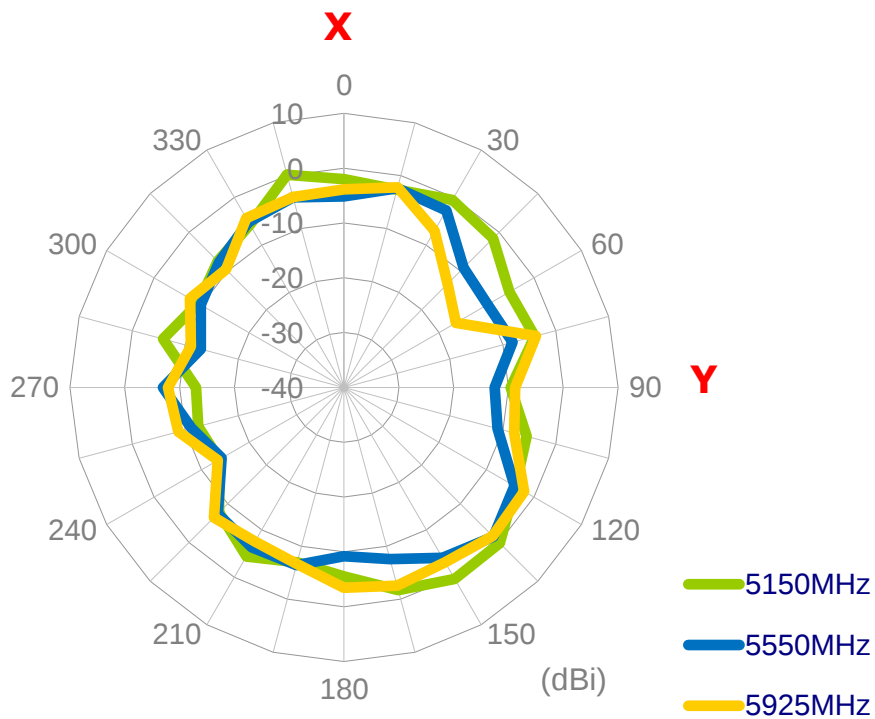
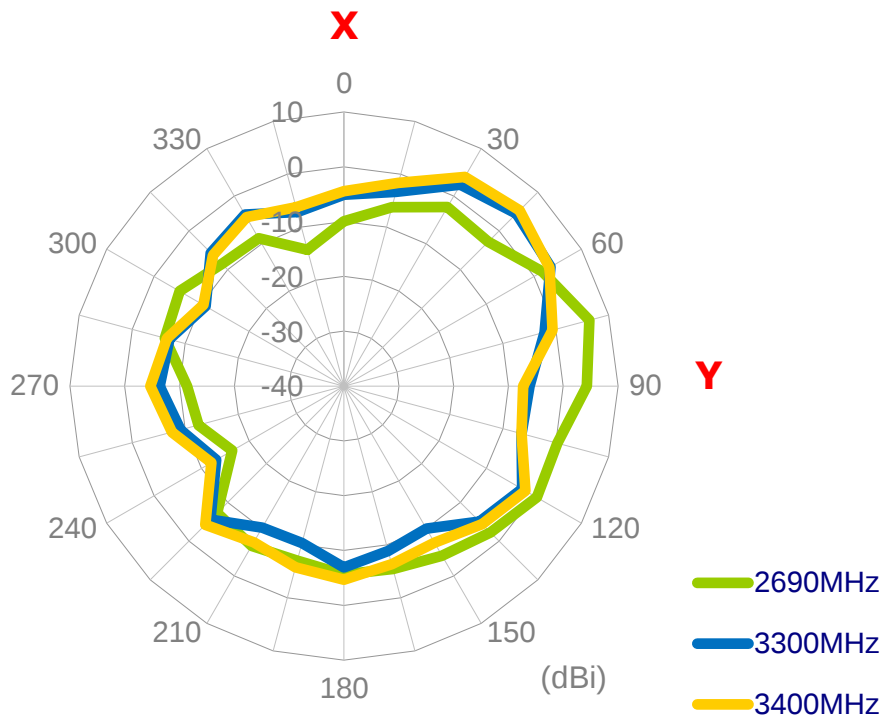


4.2.2 MIMO2_Free Space

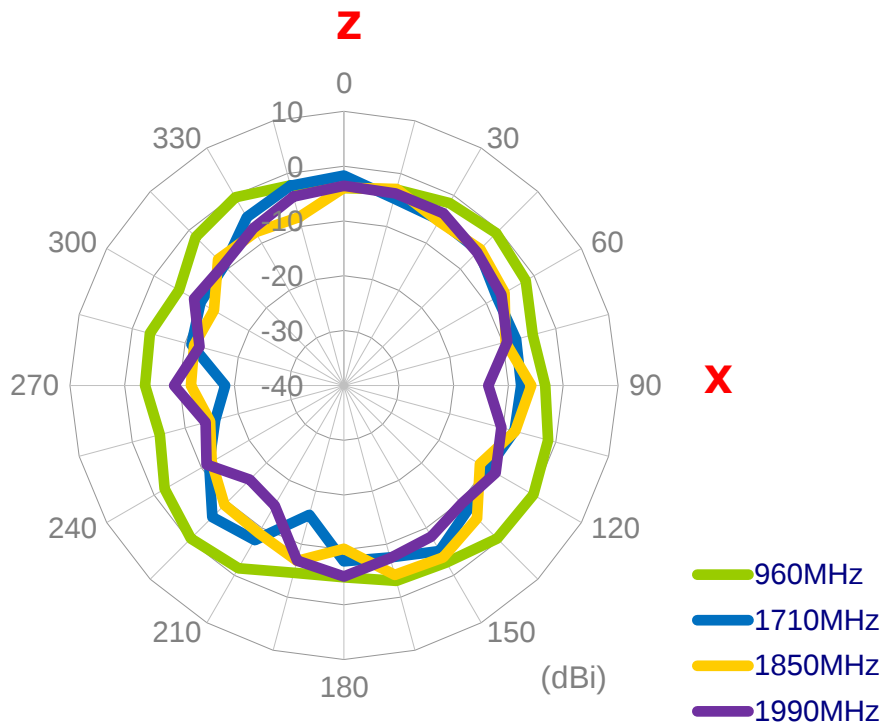
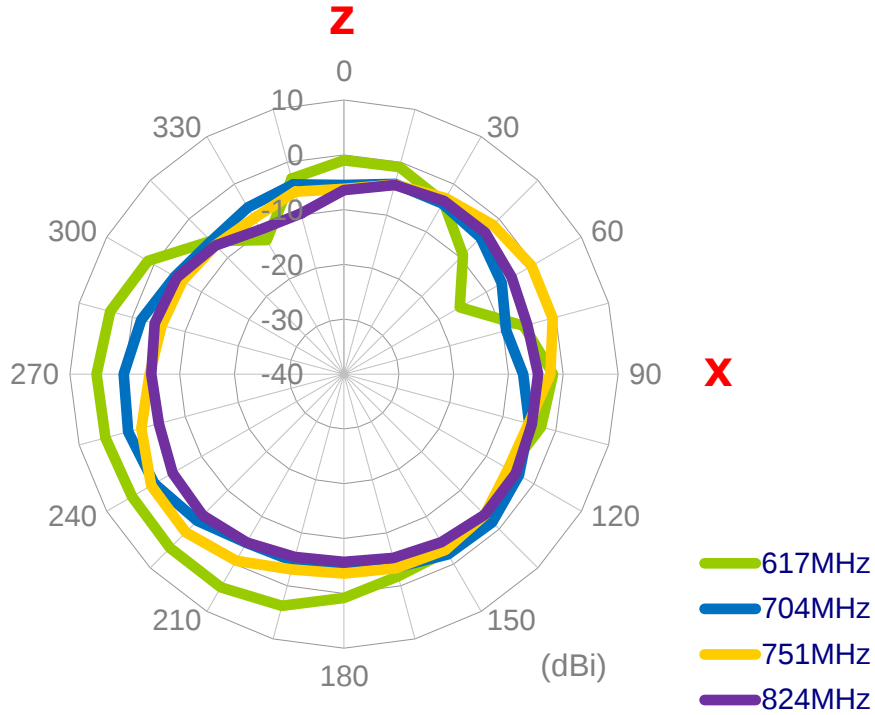
XY Plane

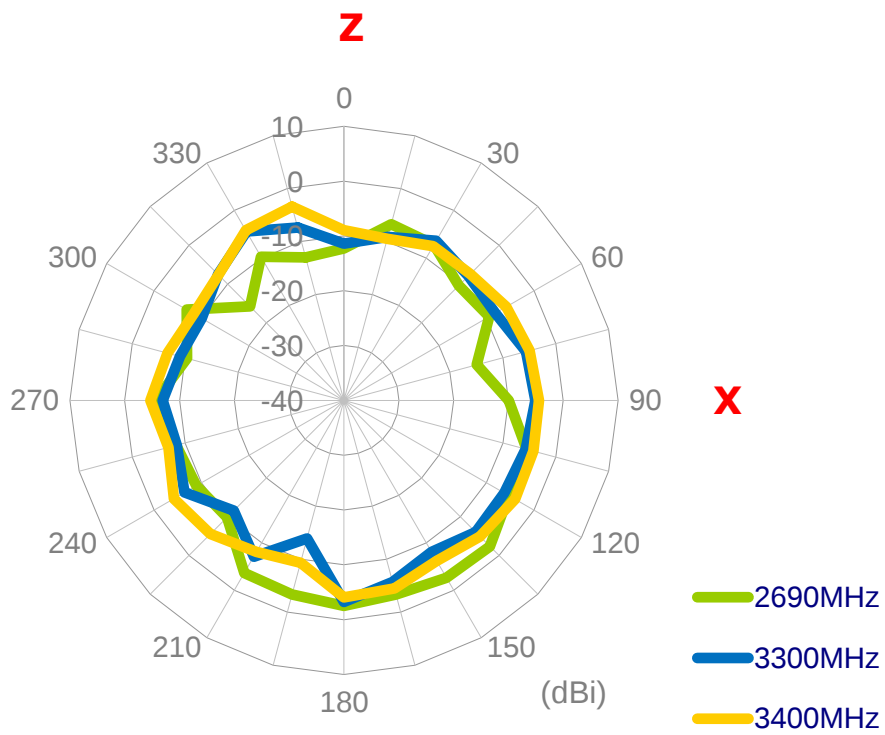
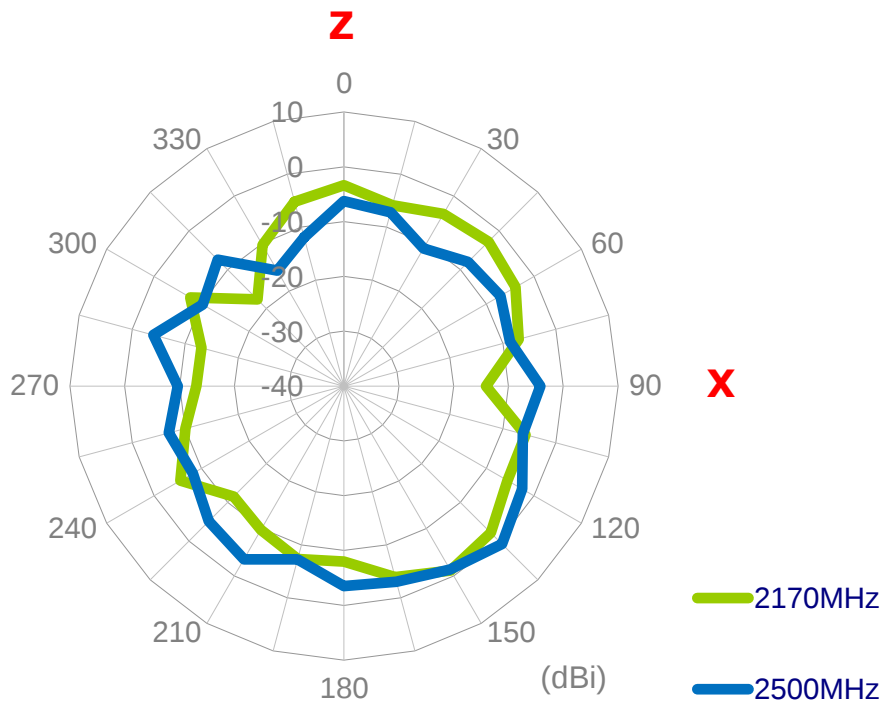


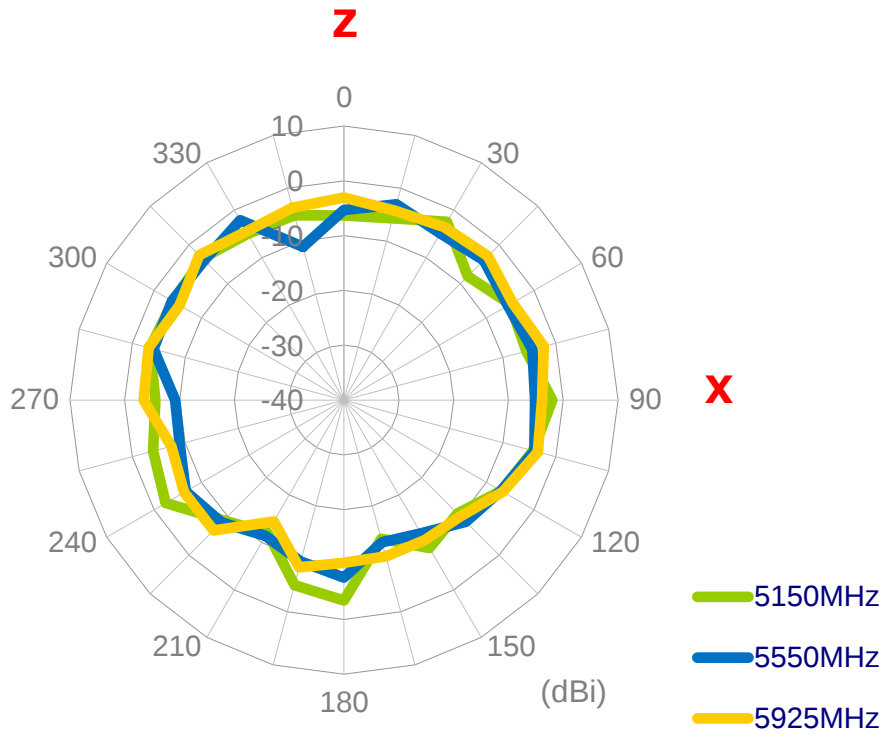




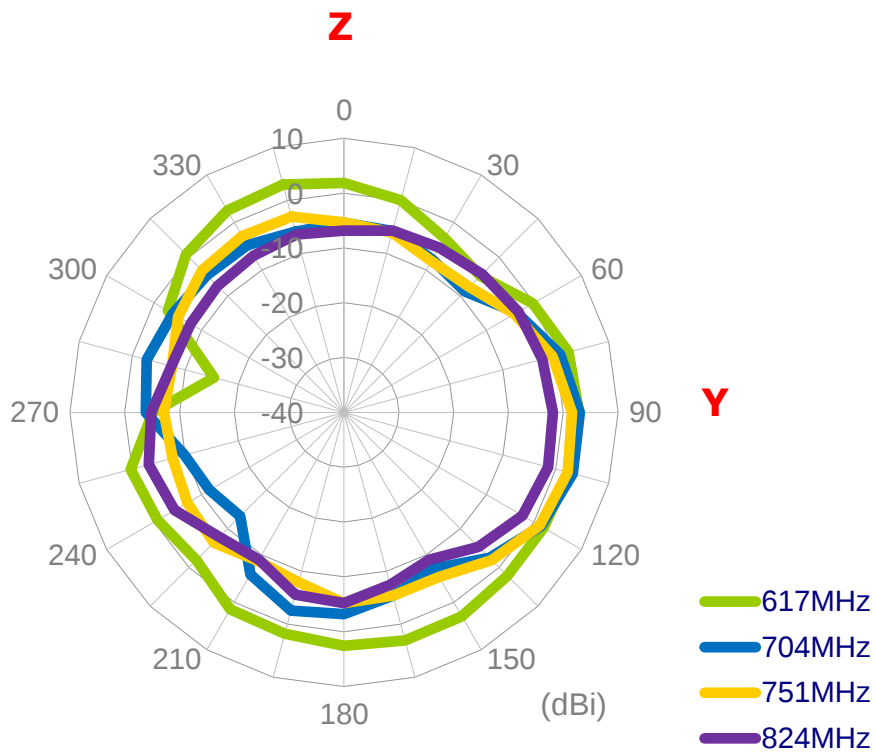
XZ Plane

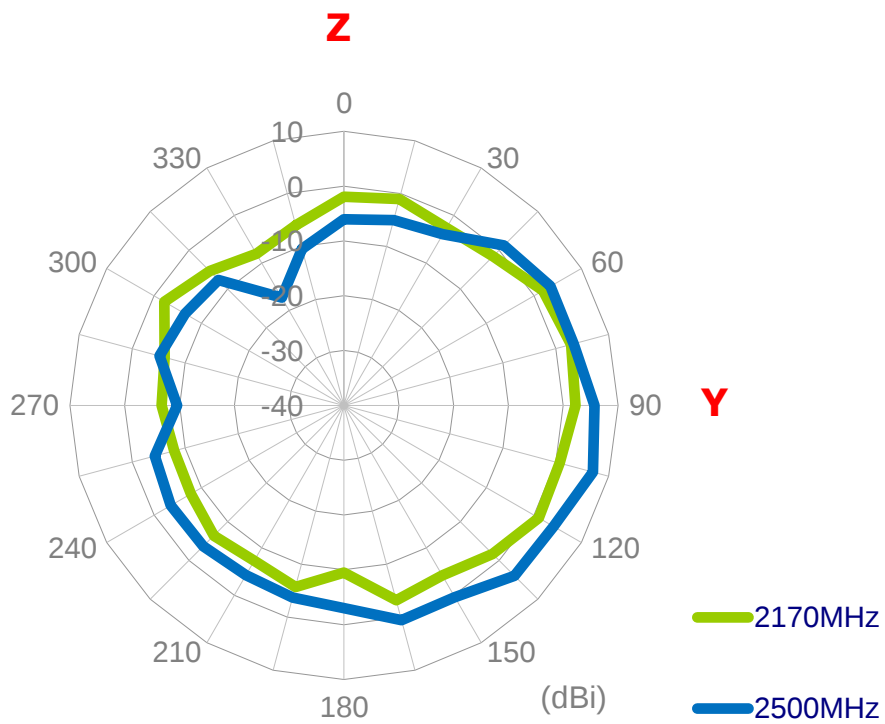
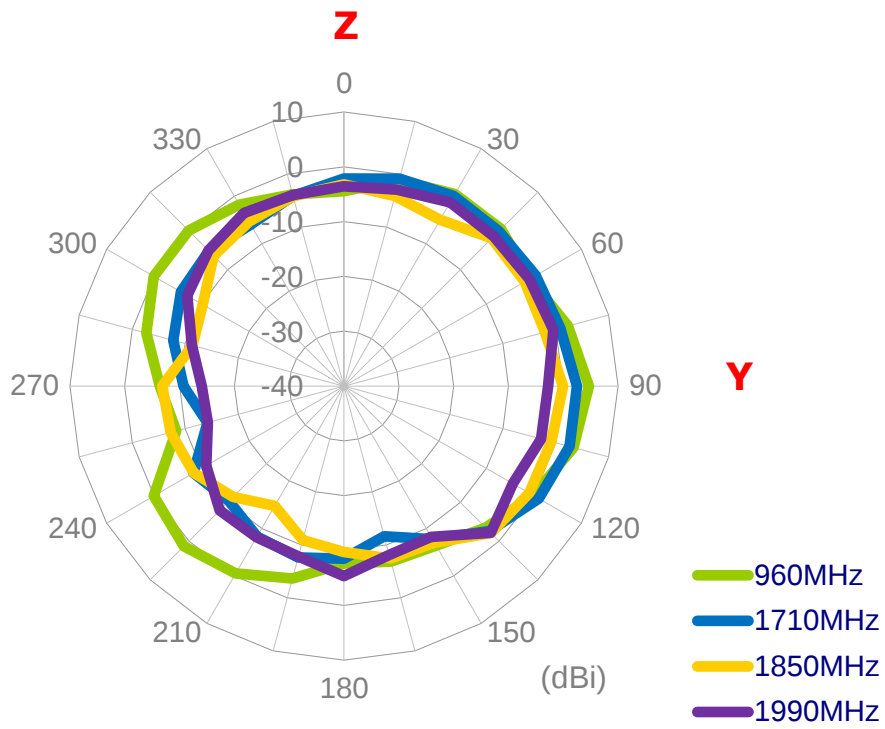


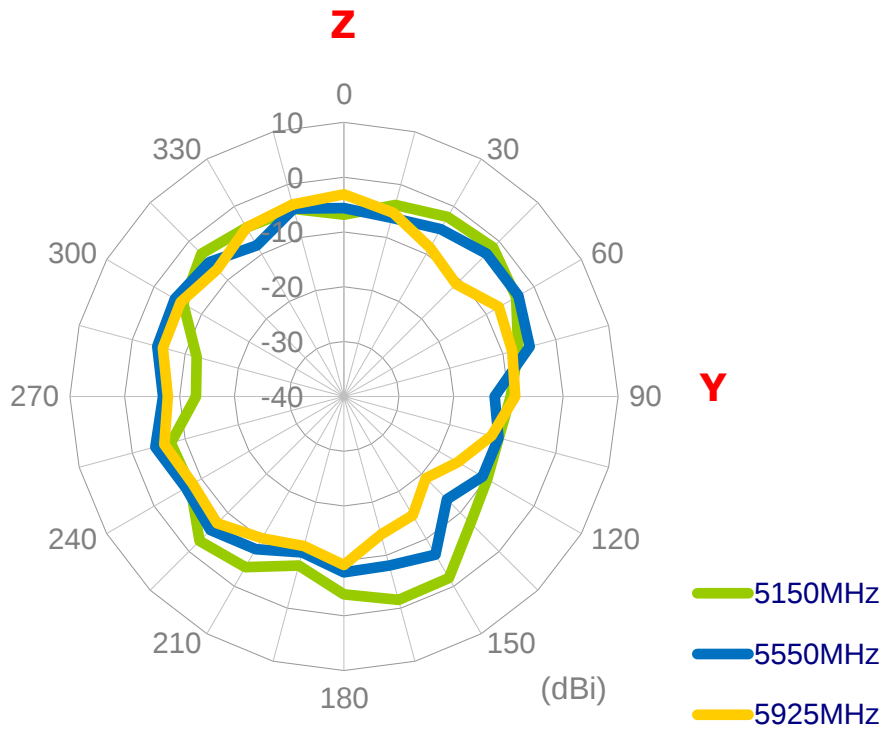
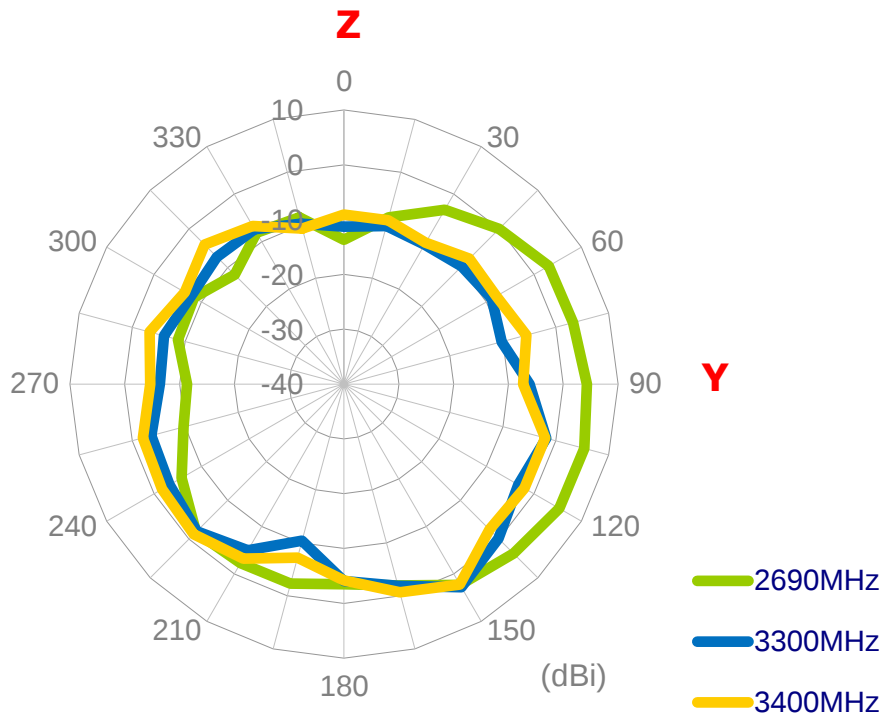




YZ Plane

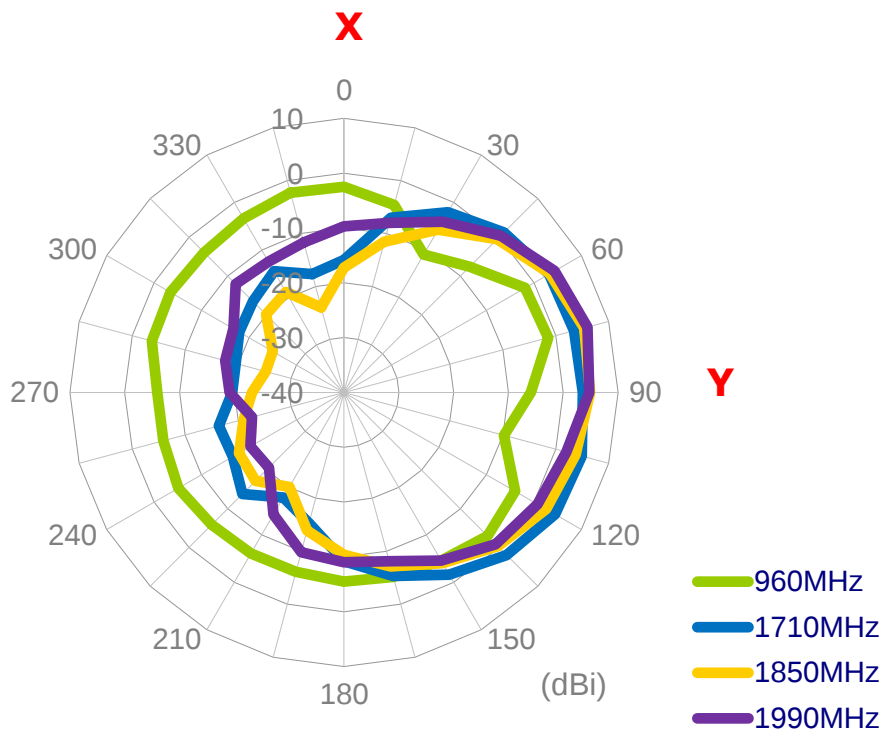
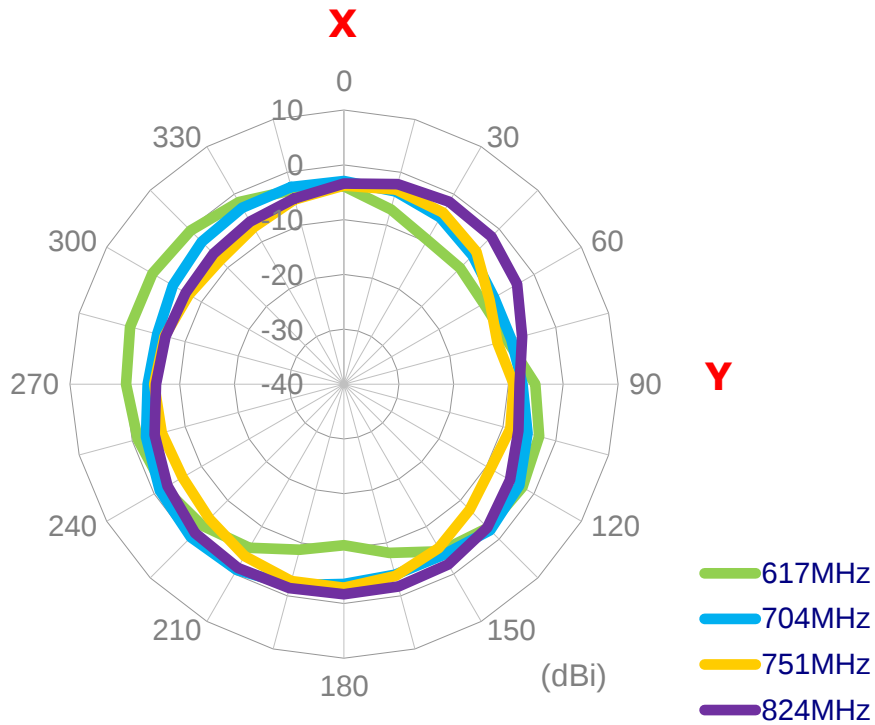


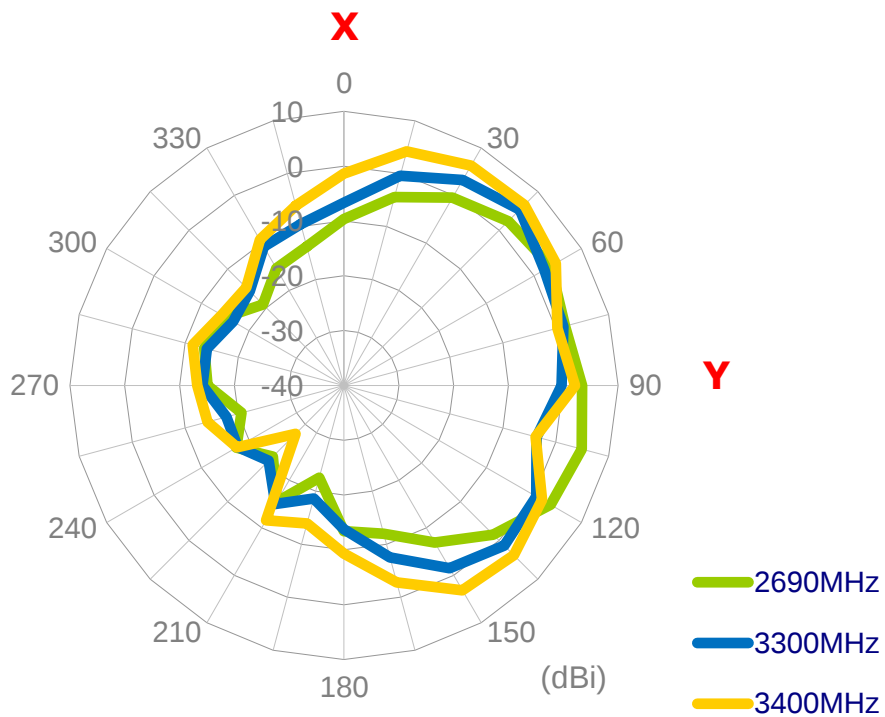
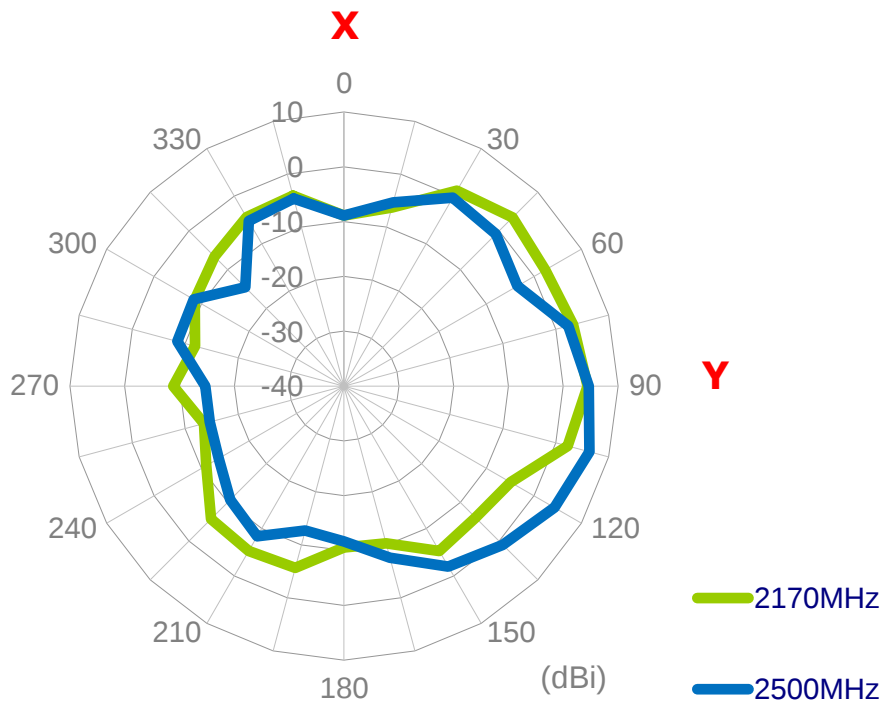


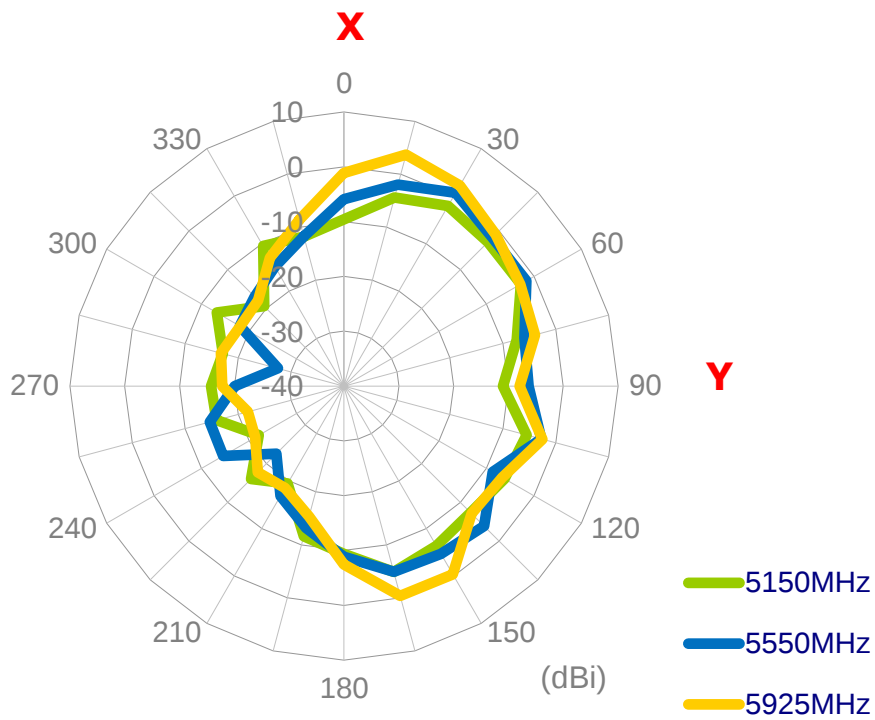


4.2.3 MIMO1_On 30x30cm GND

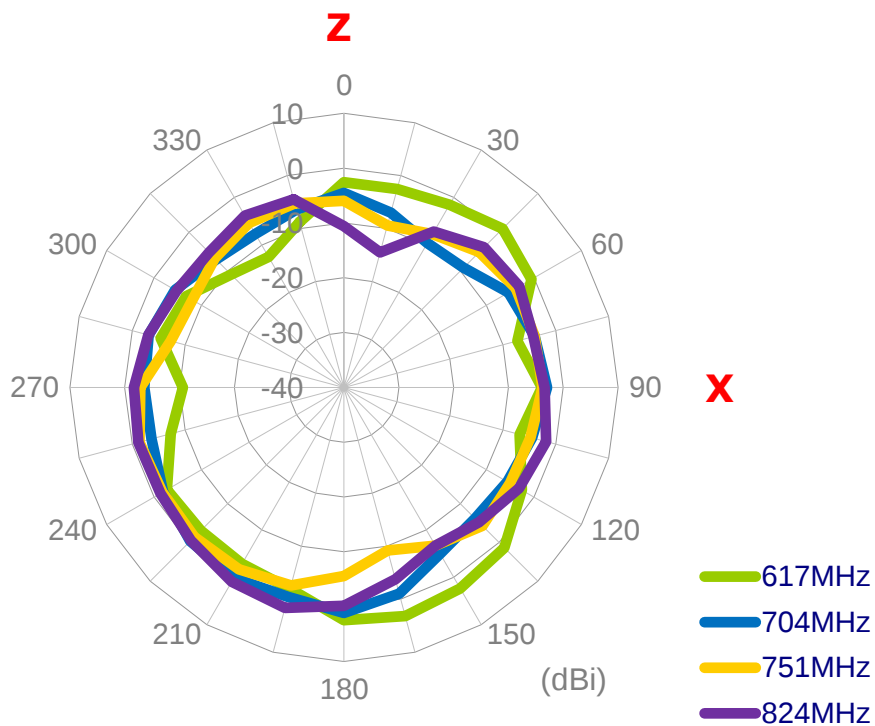
XY Plane

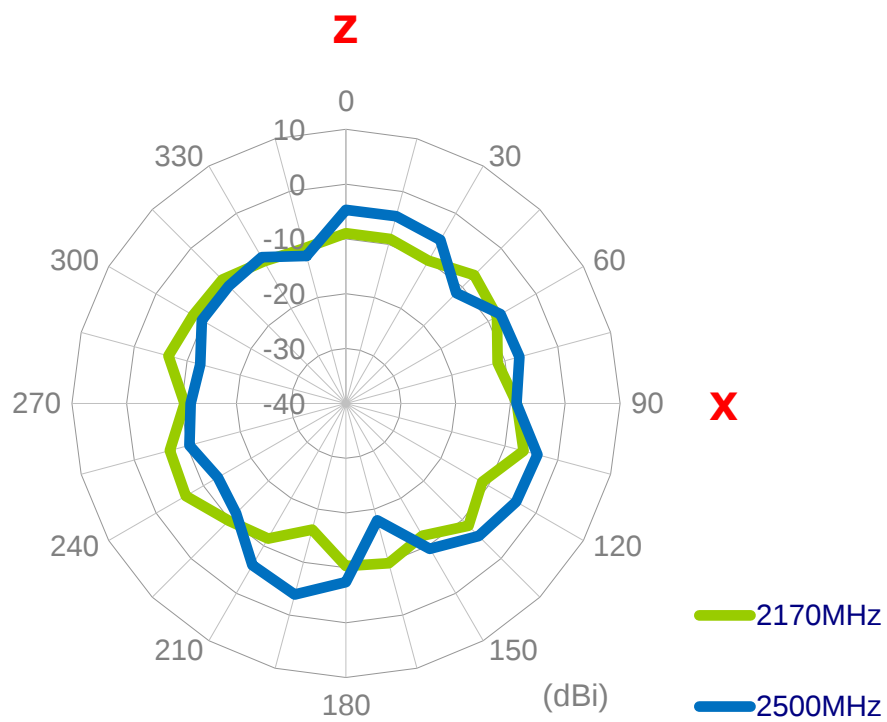
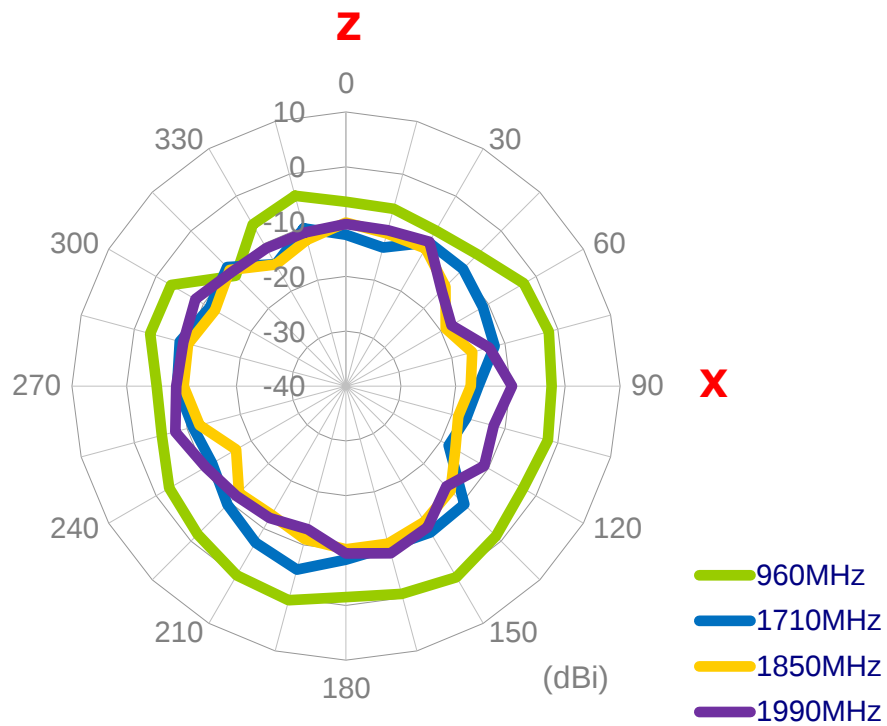


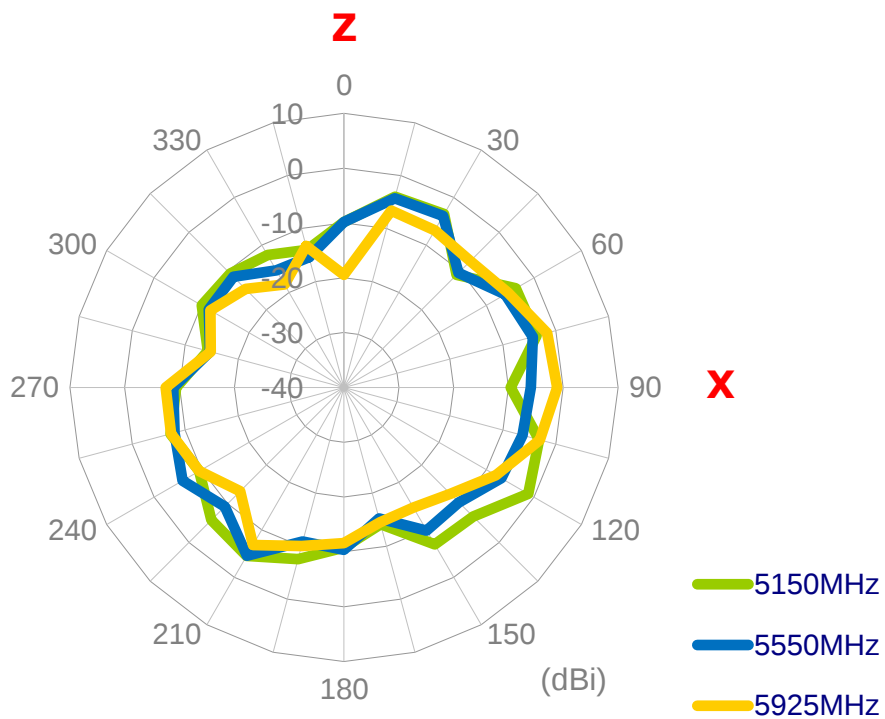
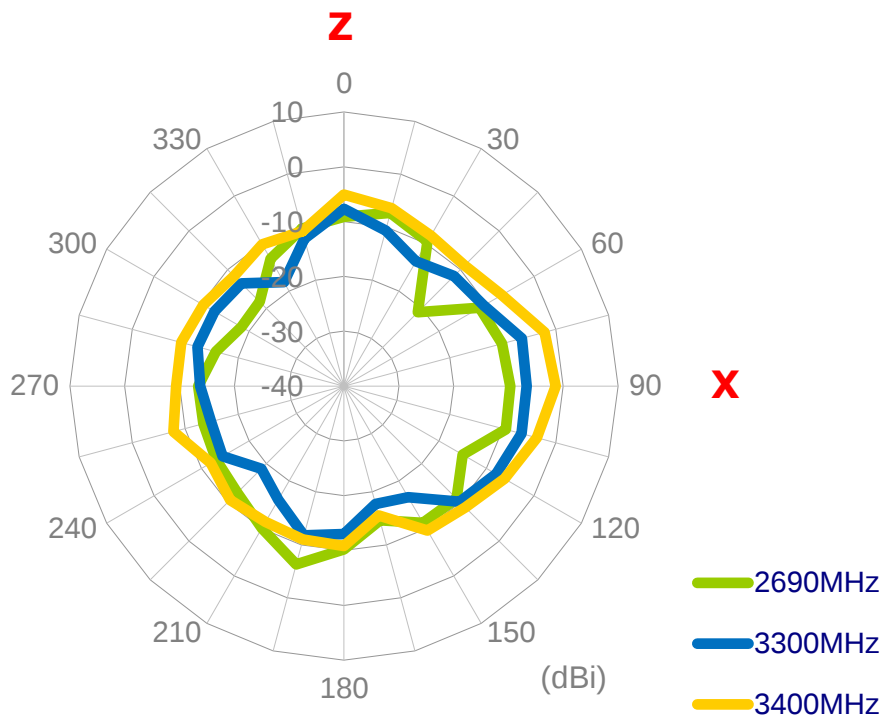




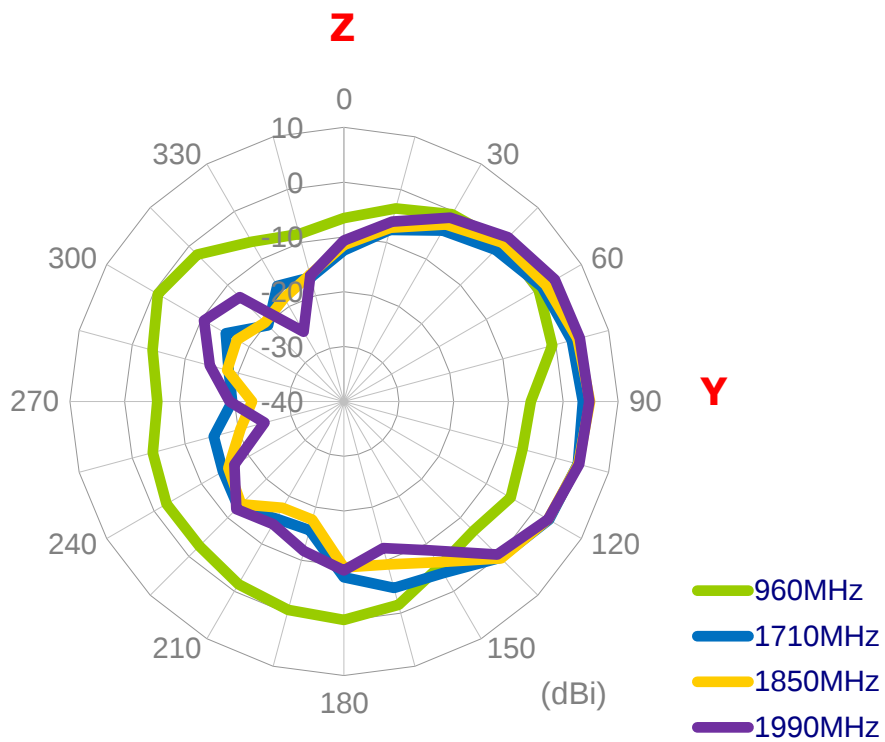
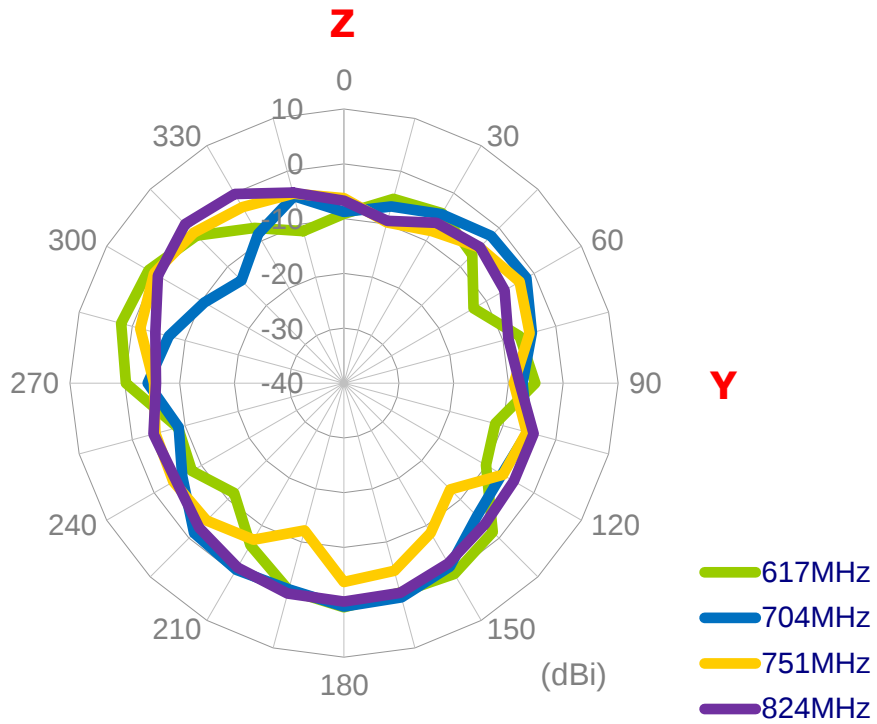
XZ Plane

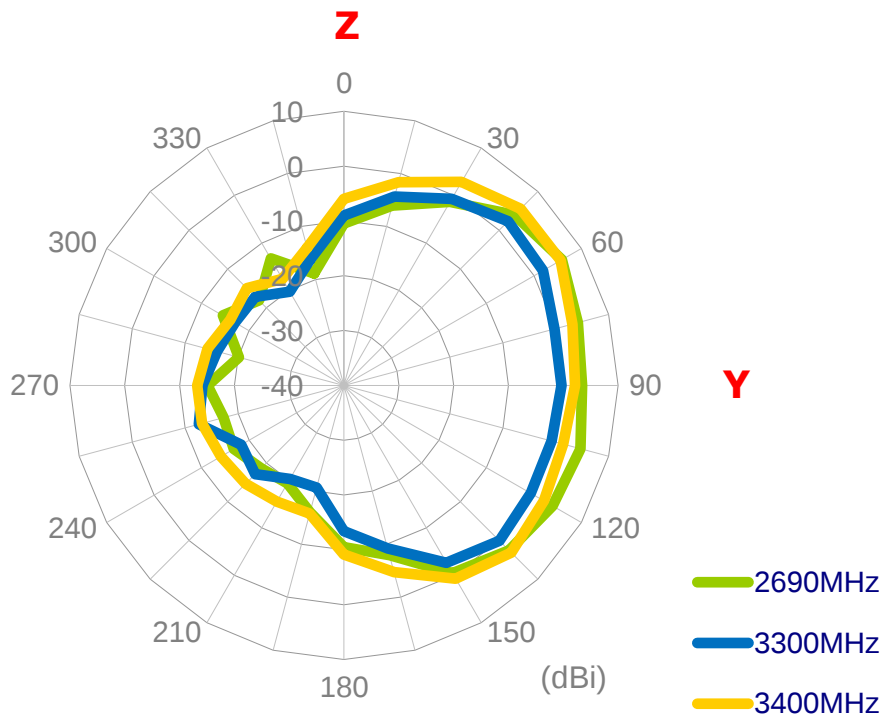
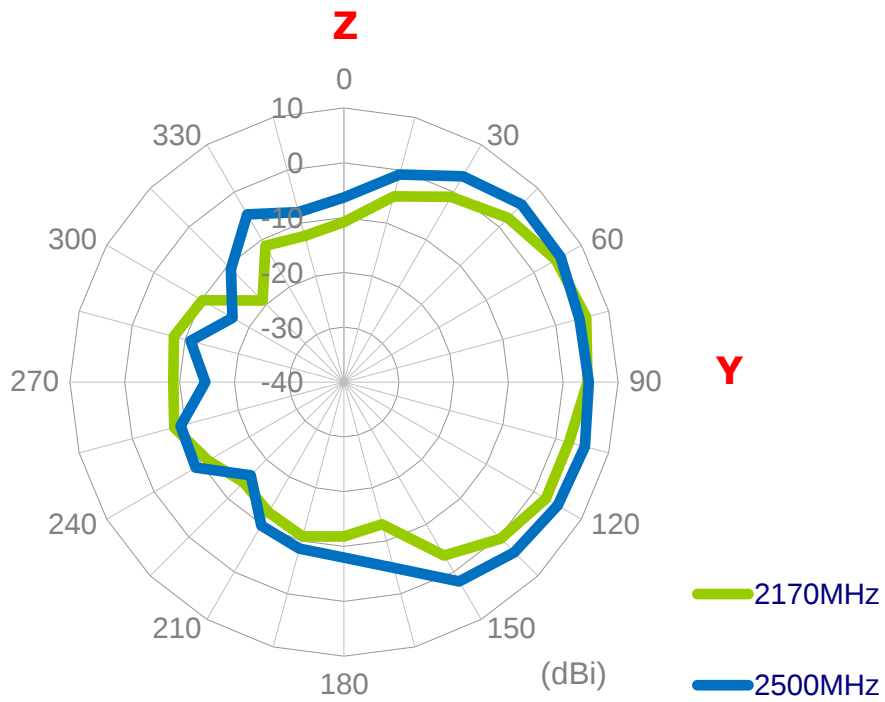


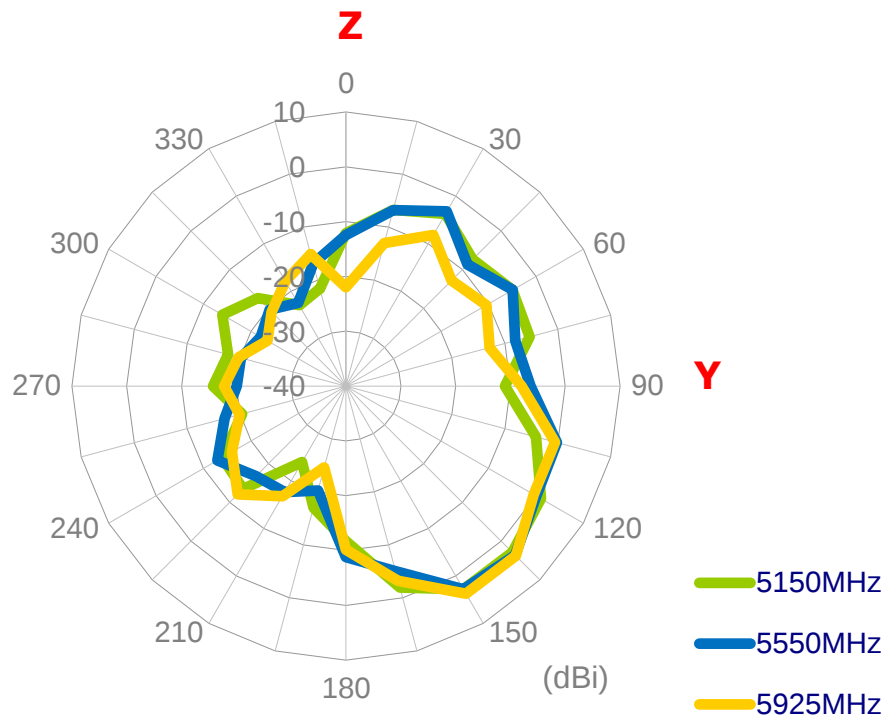




YZ Plane

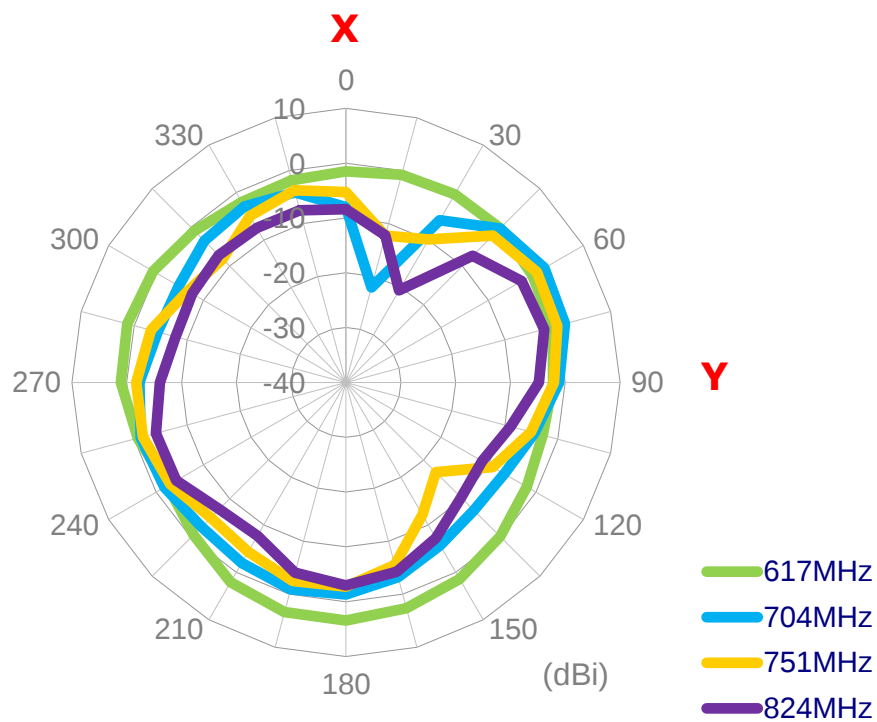


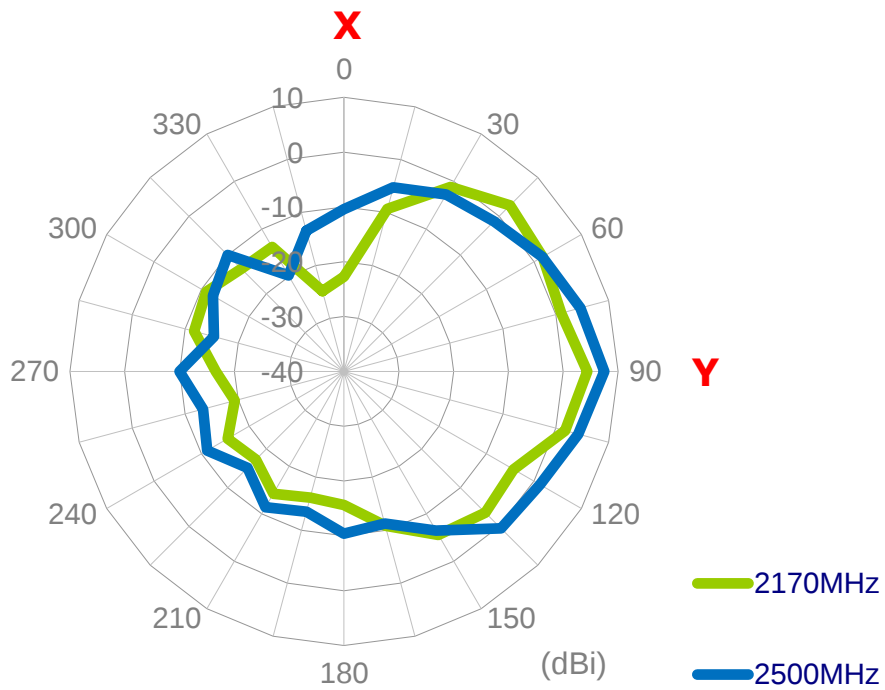
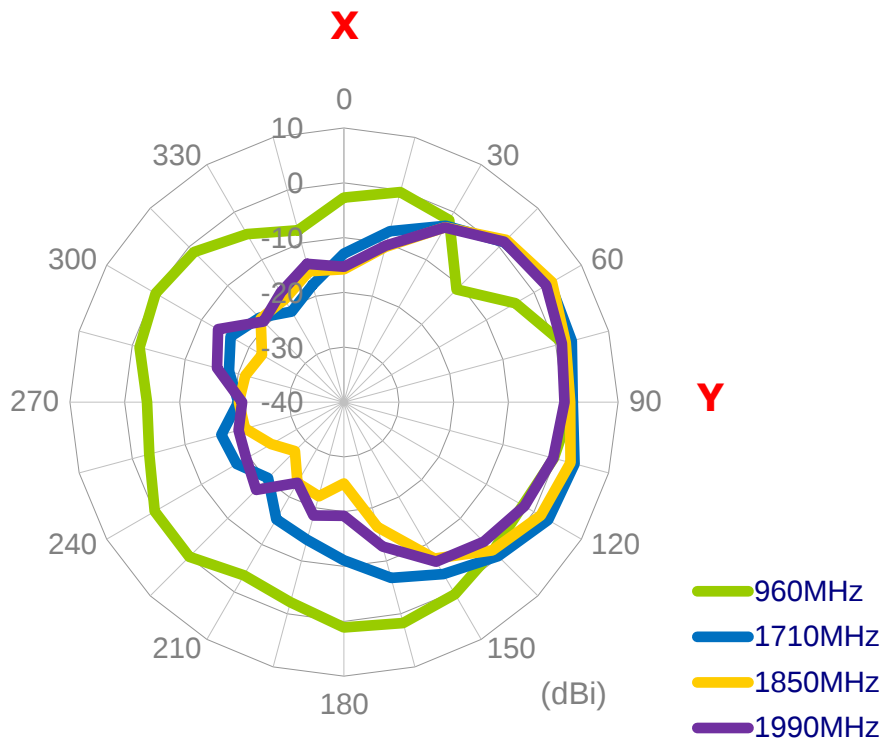


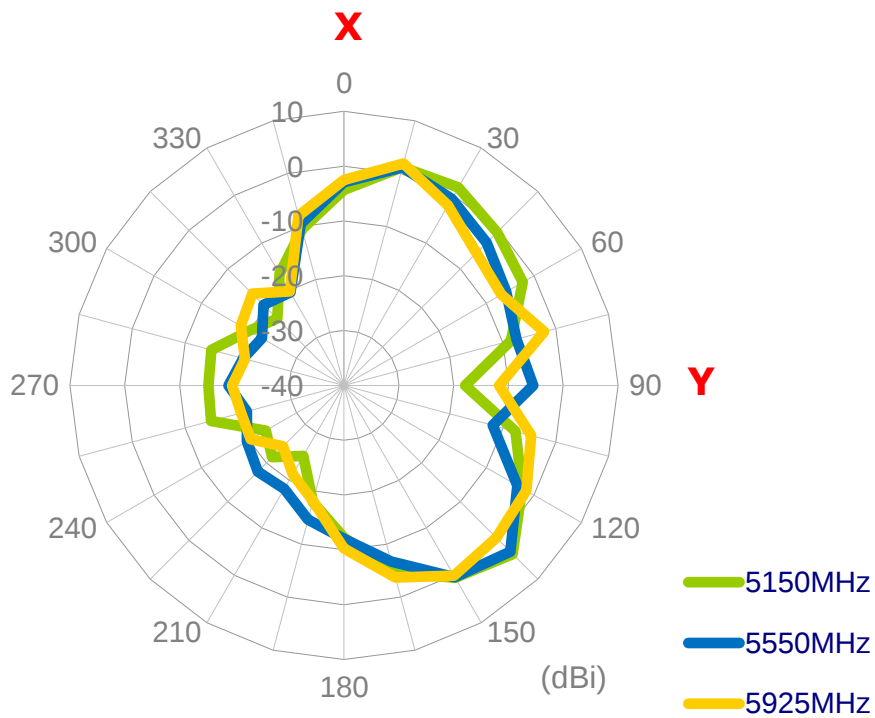
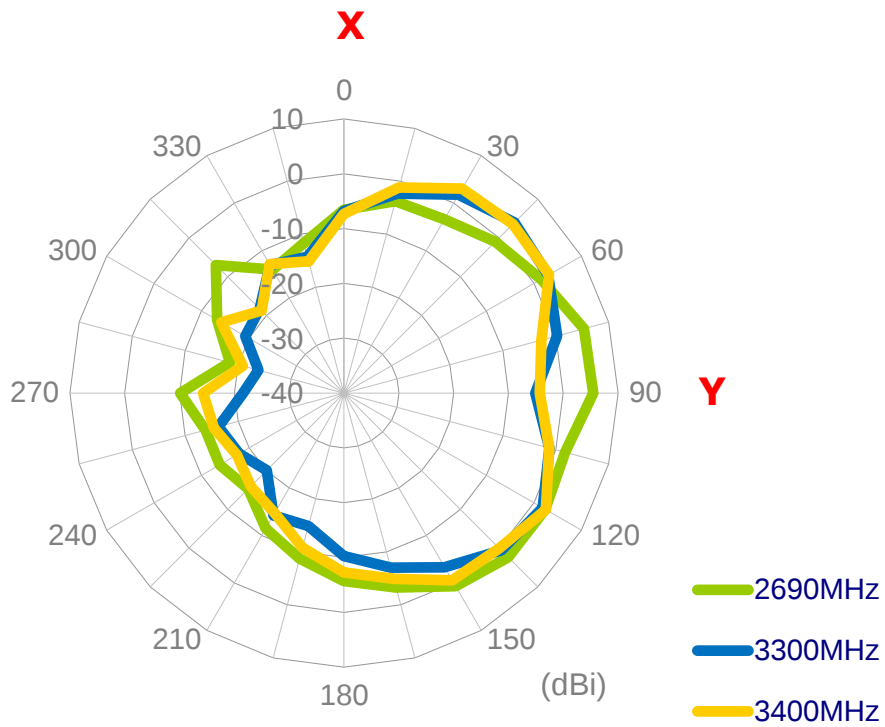


4.2.4 MIMO2_On 30x30cm GND

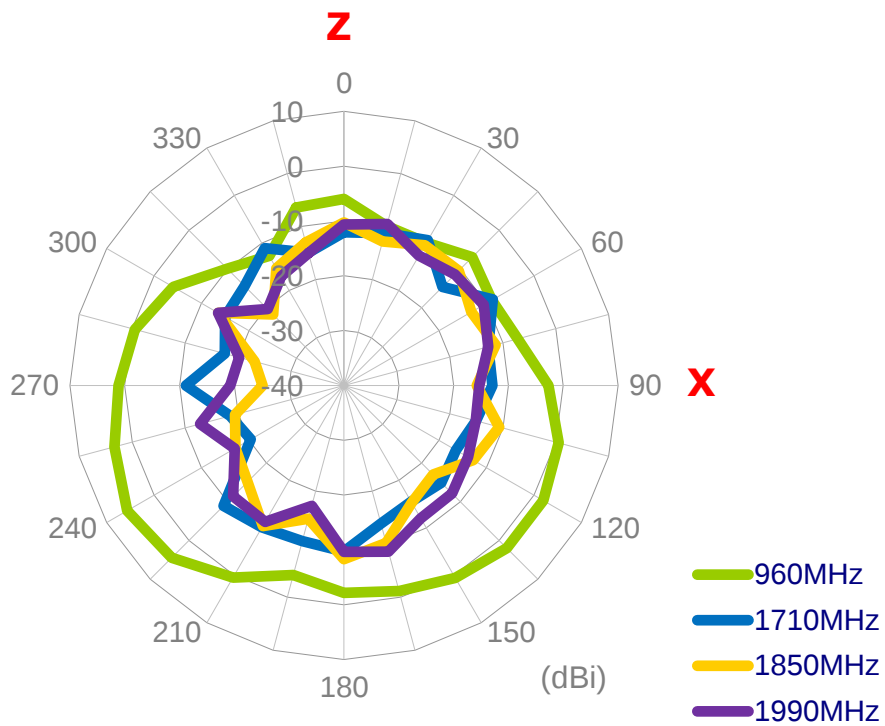
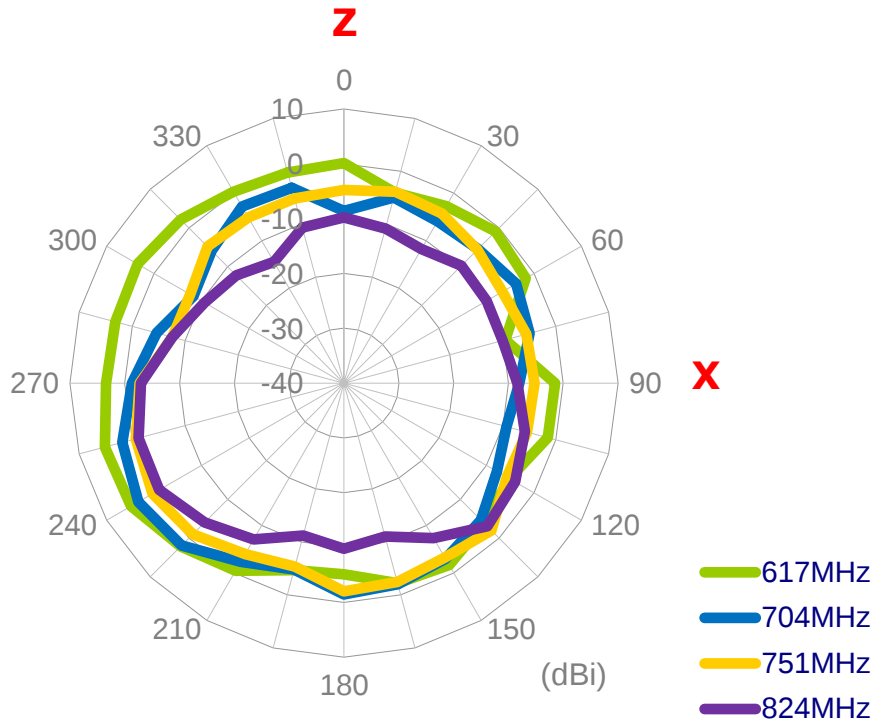
XY Plane

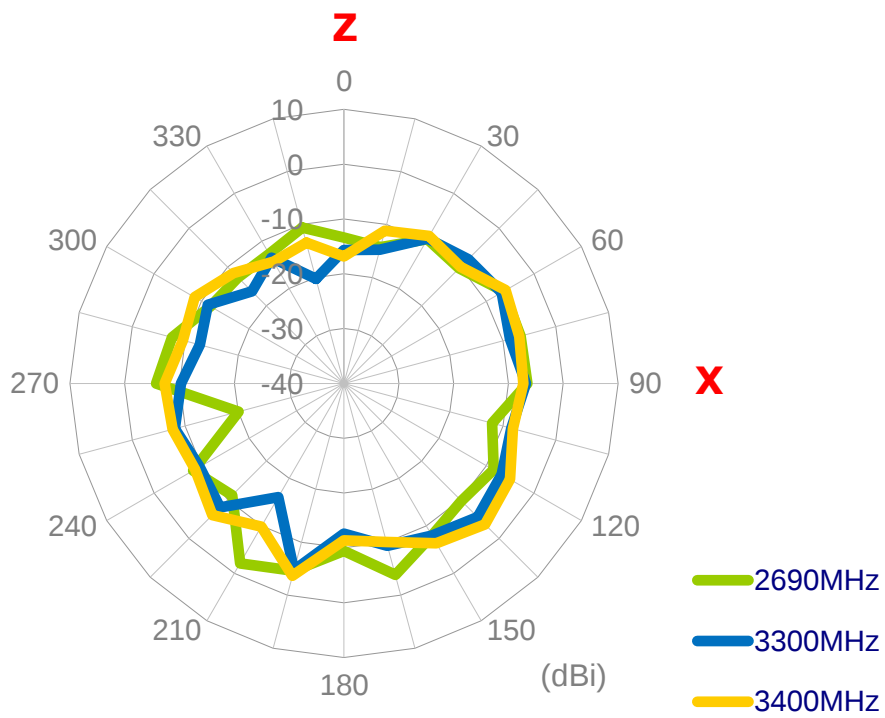
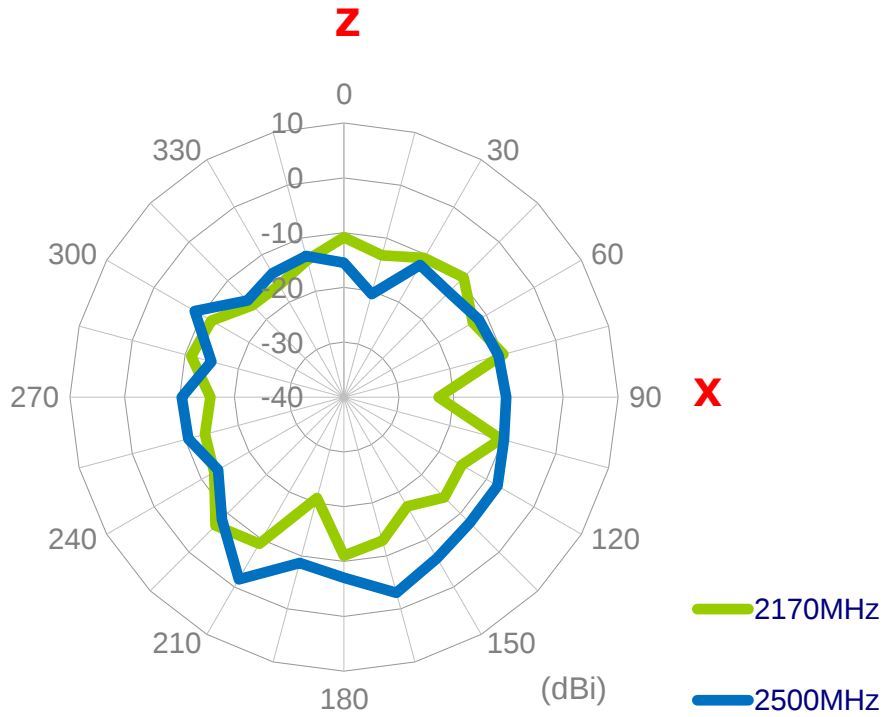


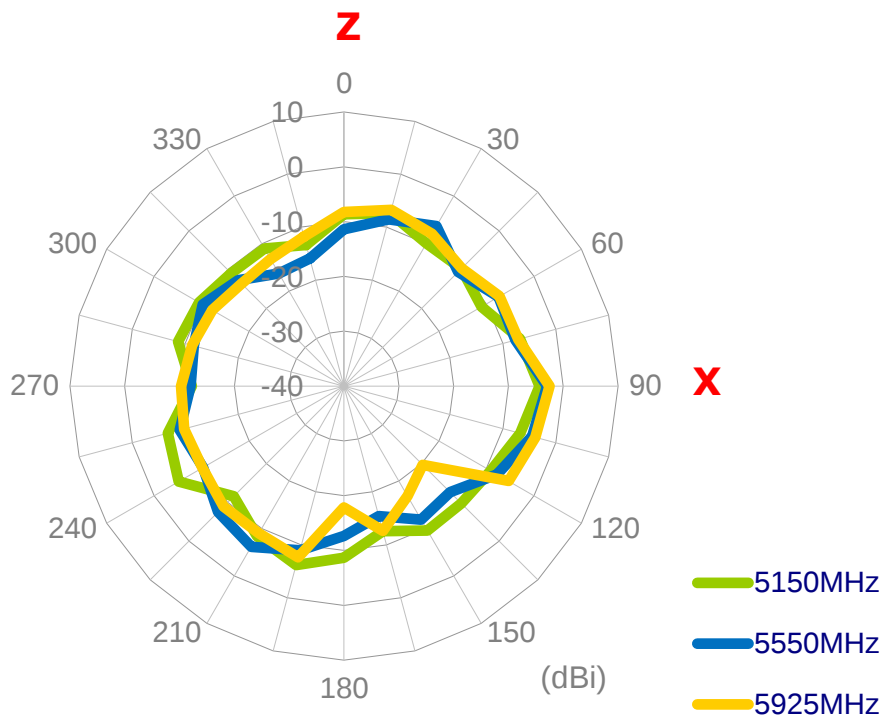




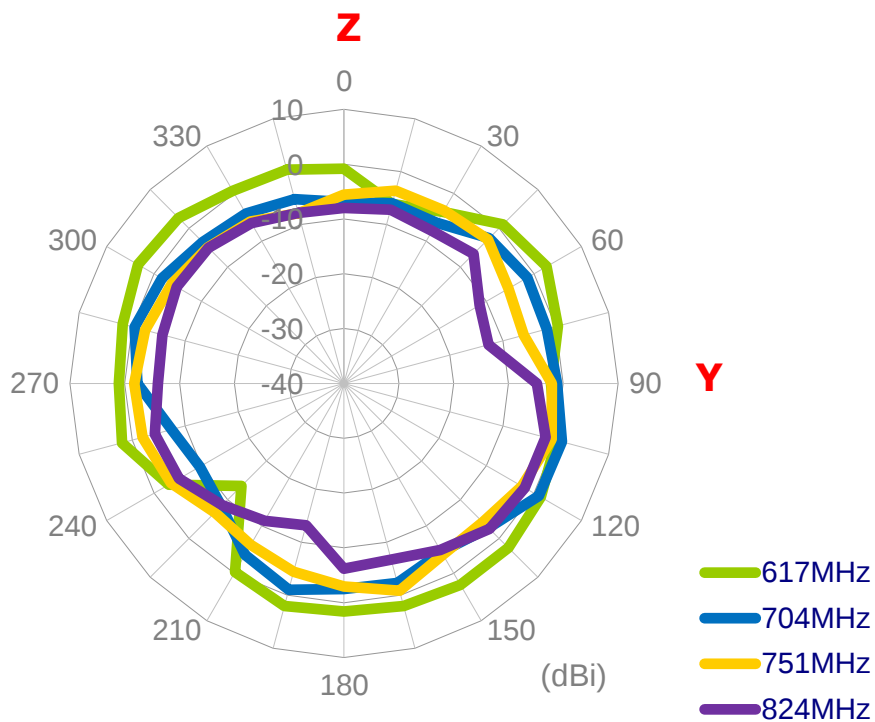
XZ Plane

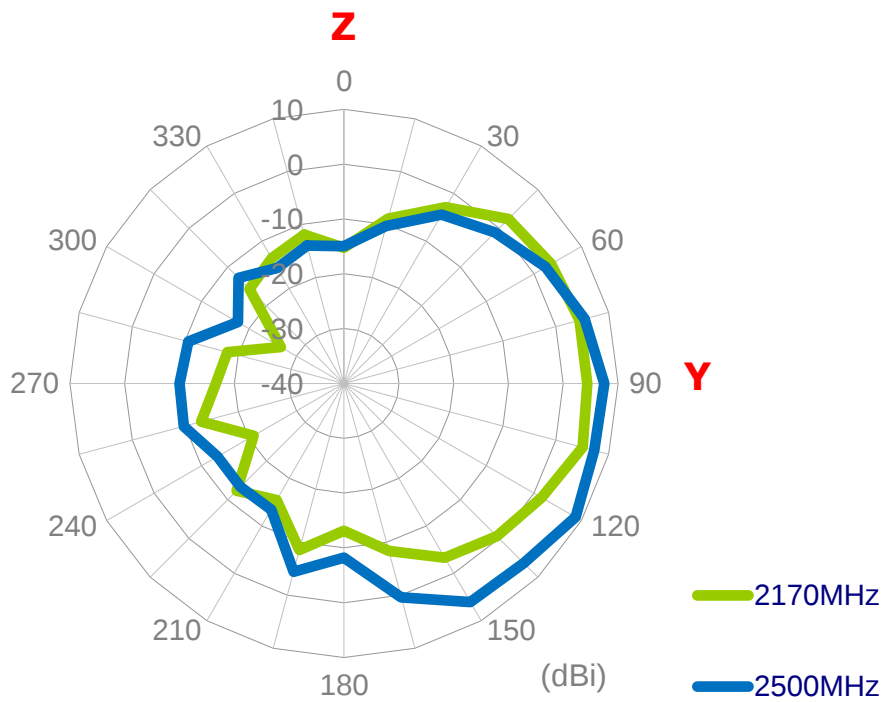
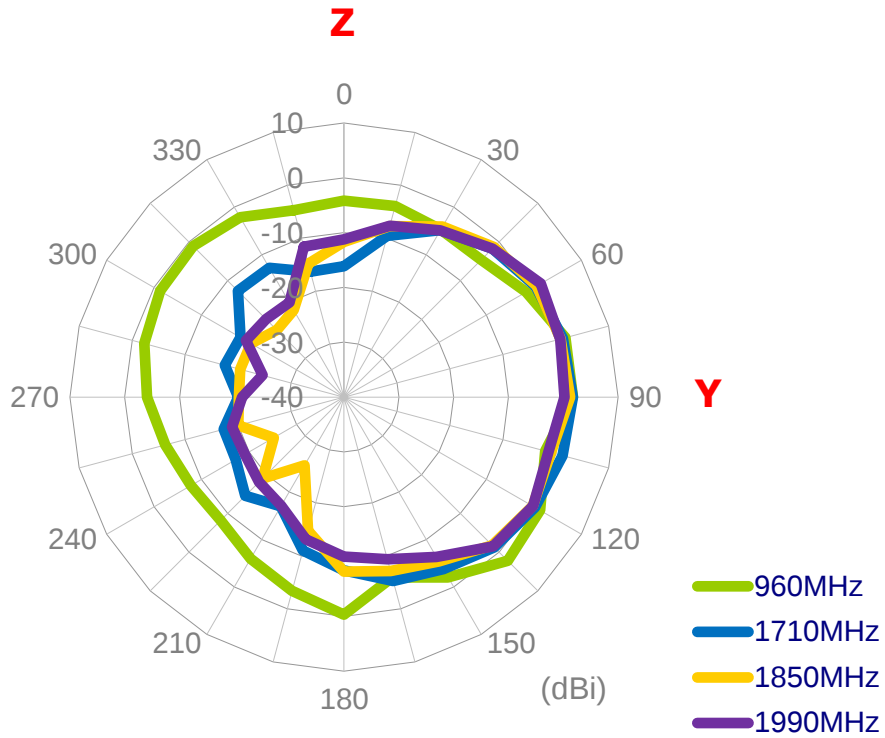


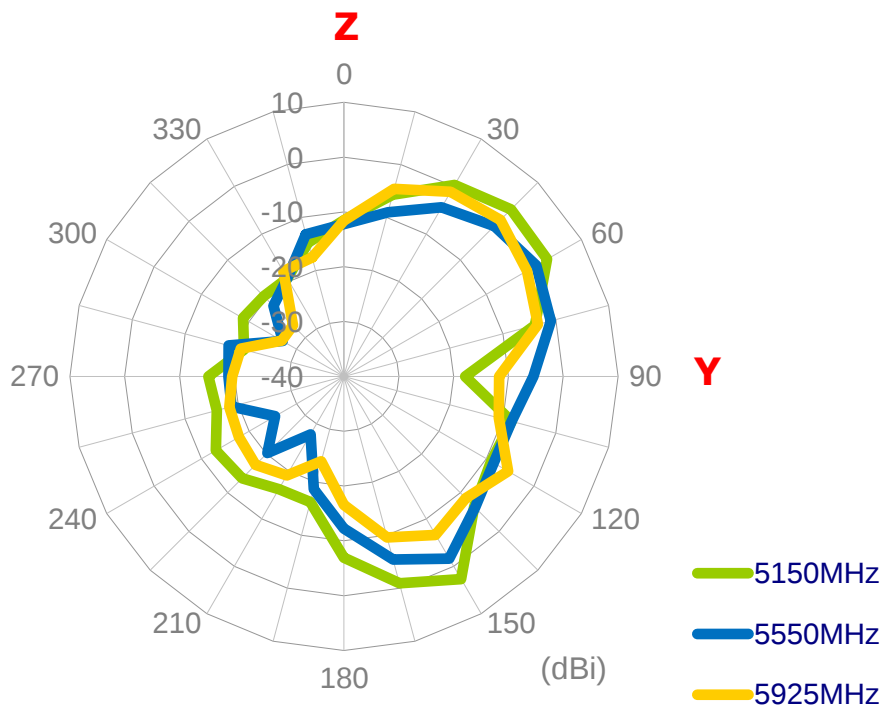
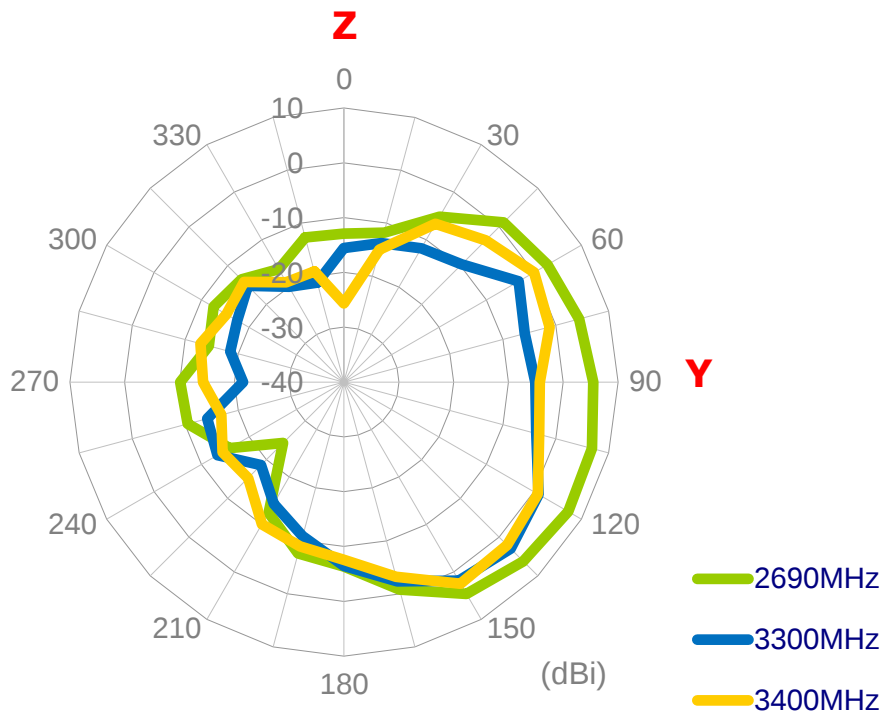




YZ Plane

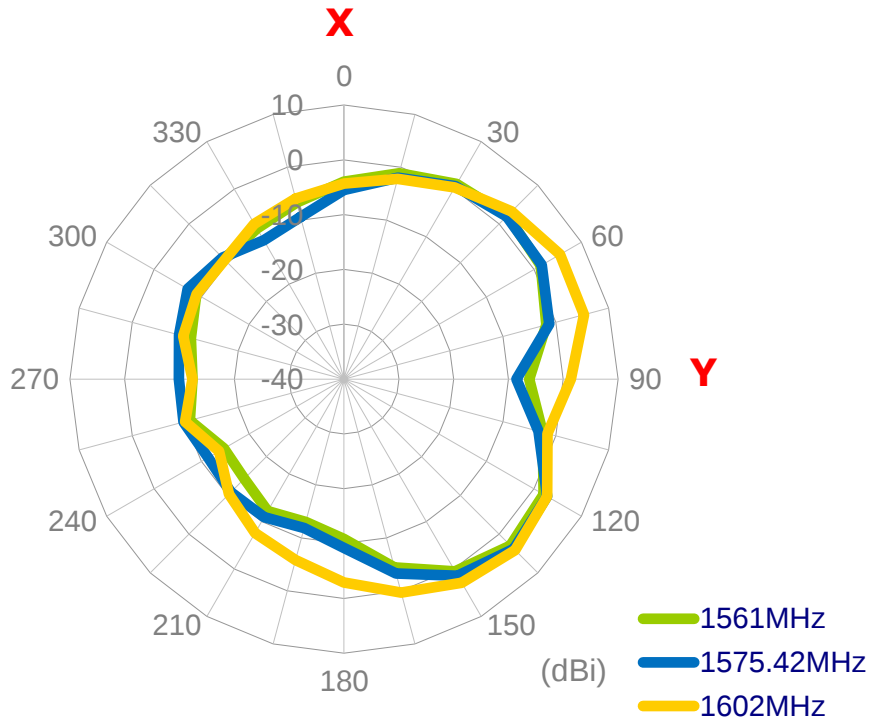




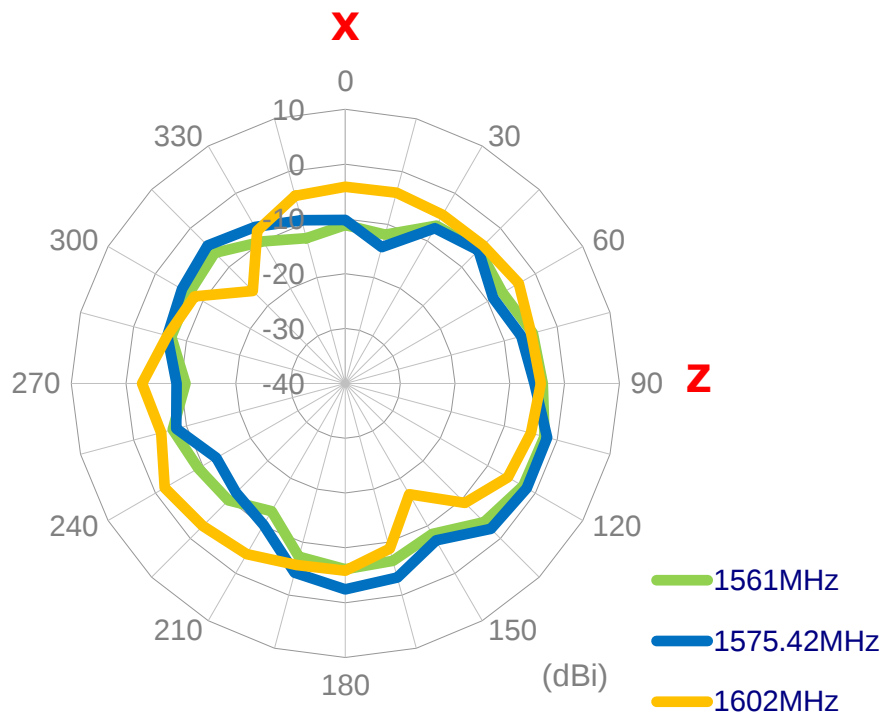


4.2.5 GNSS

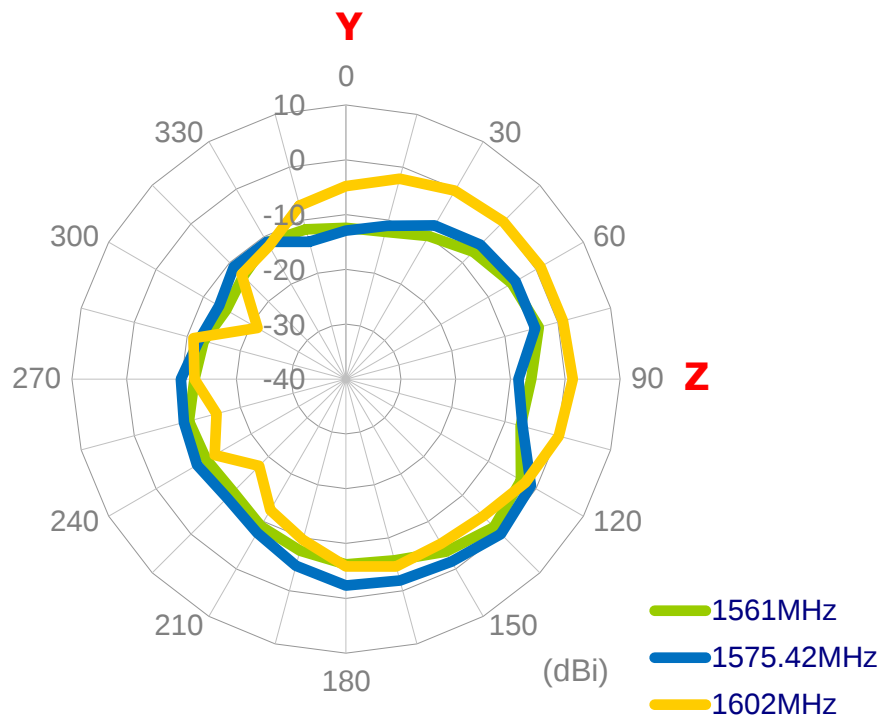
XY Plane



XZ Plane

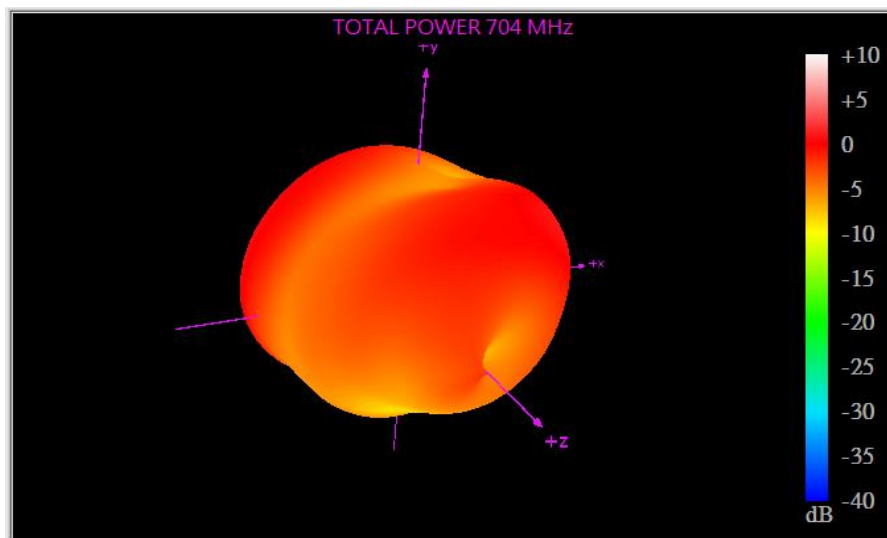
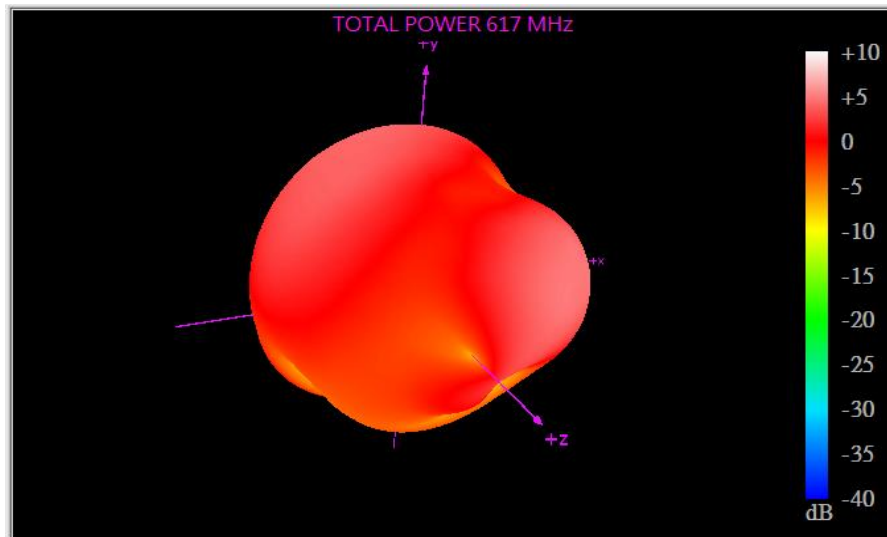


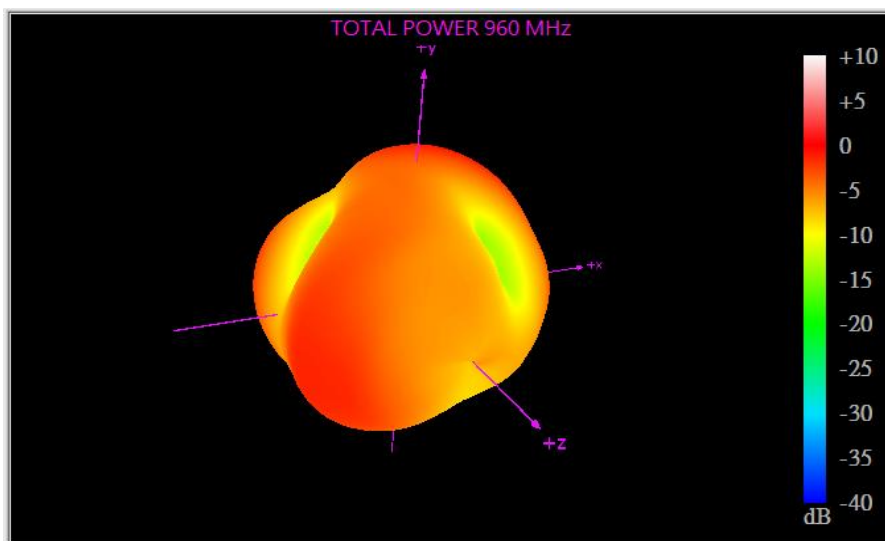
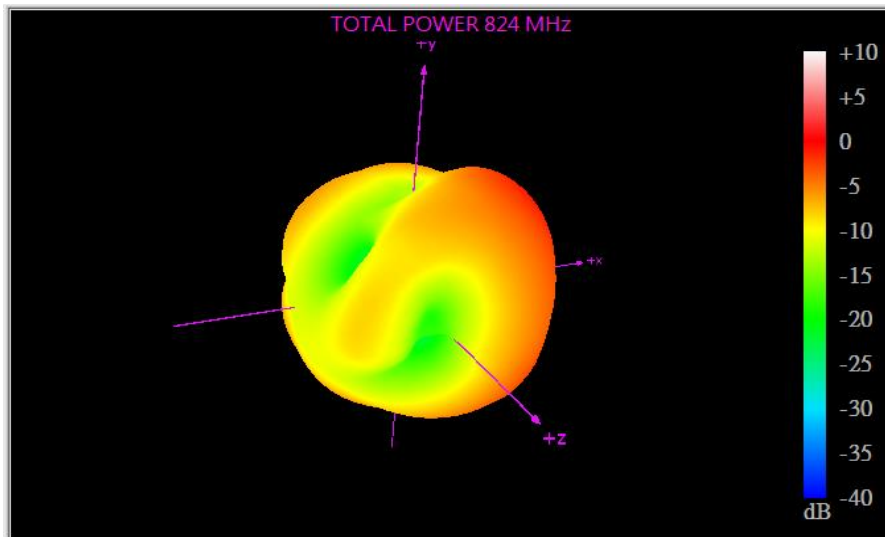
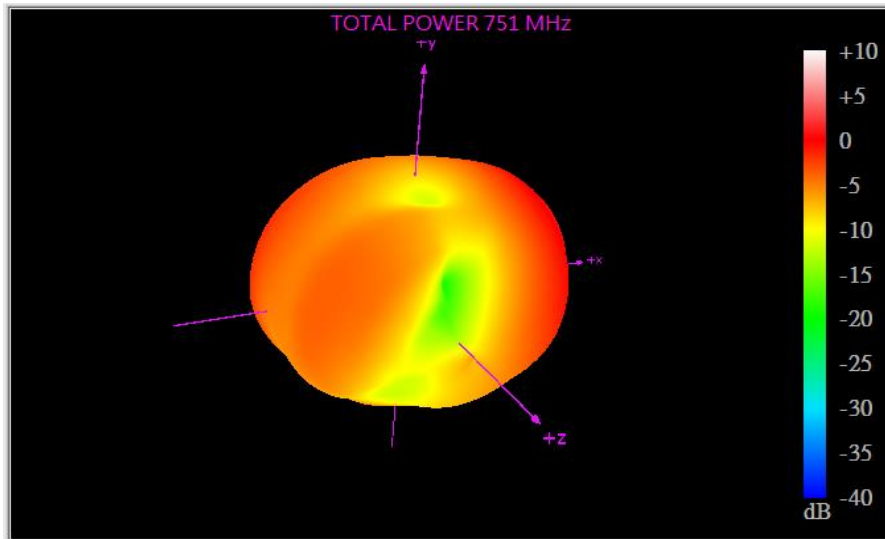
YZ Plane

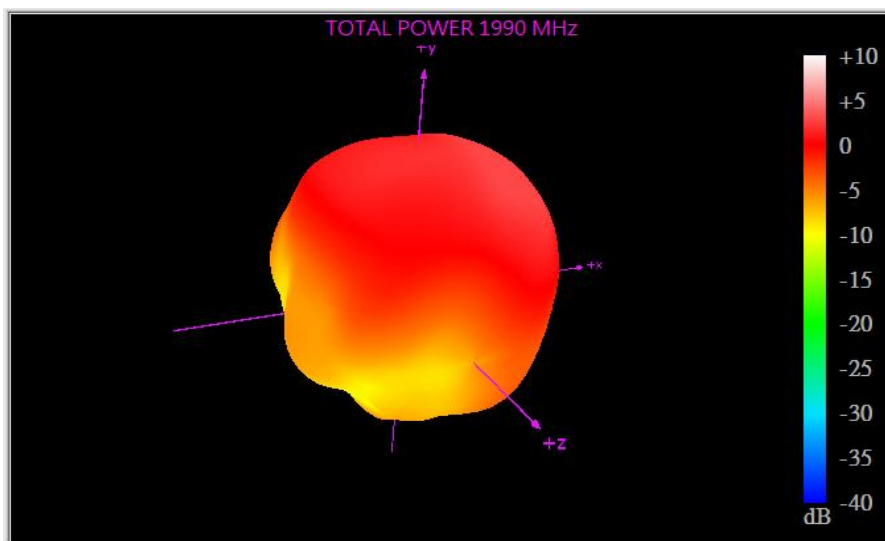
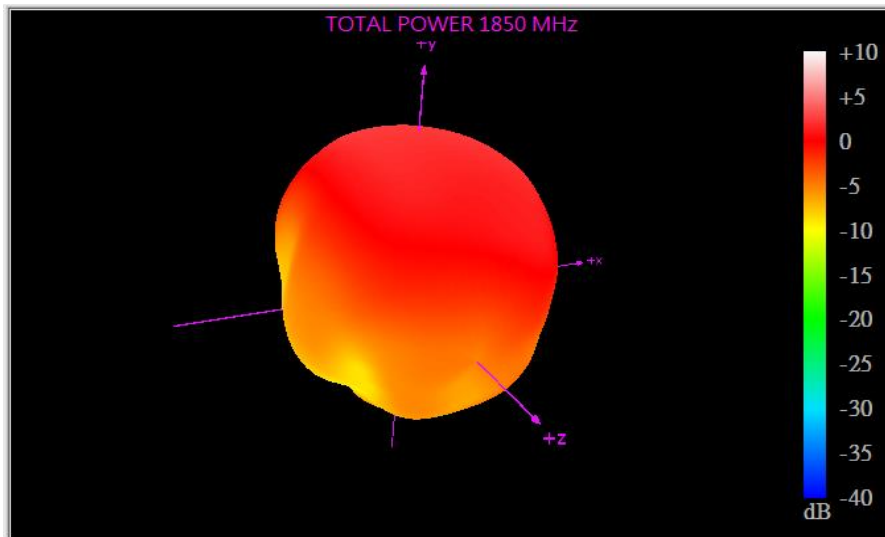
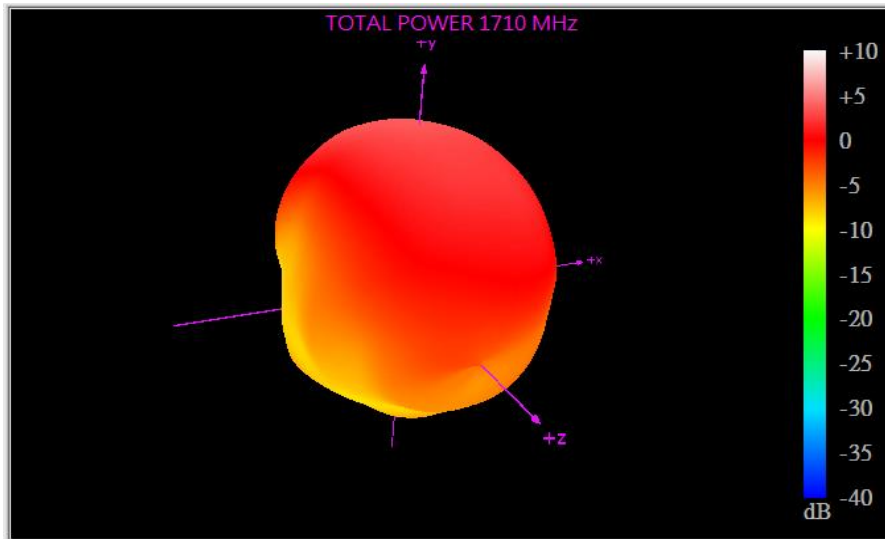


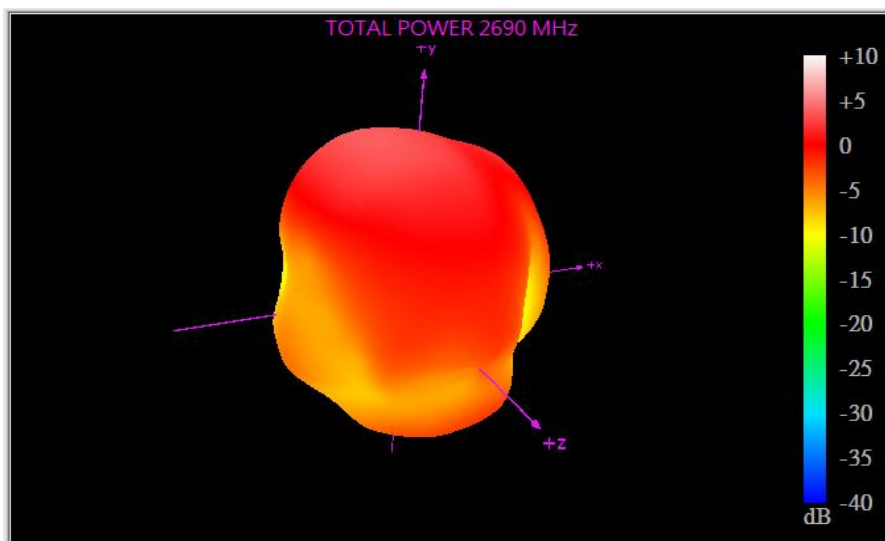
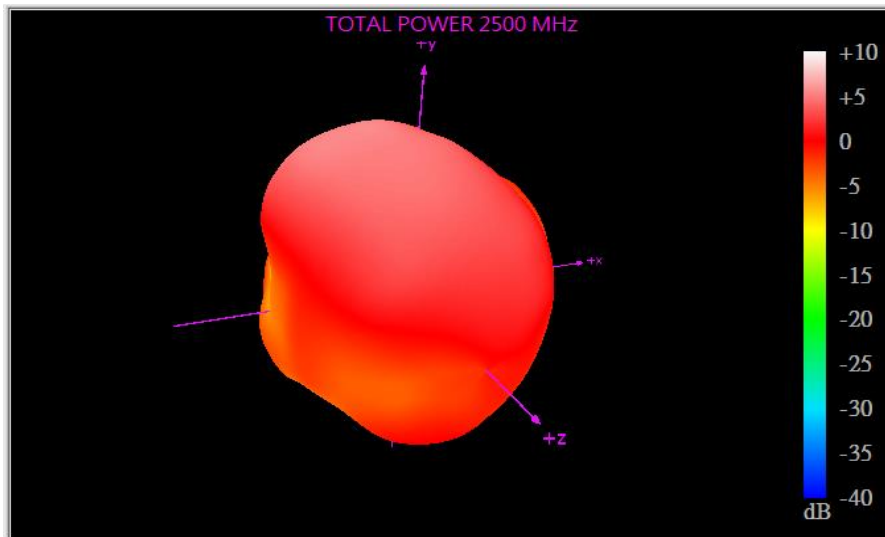
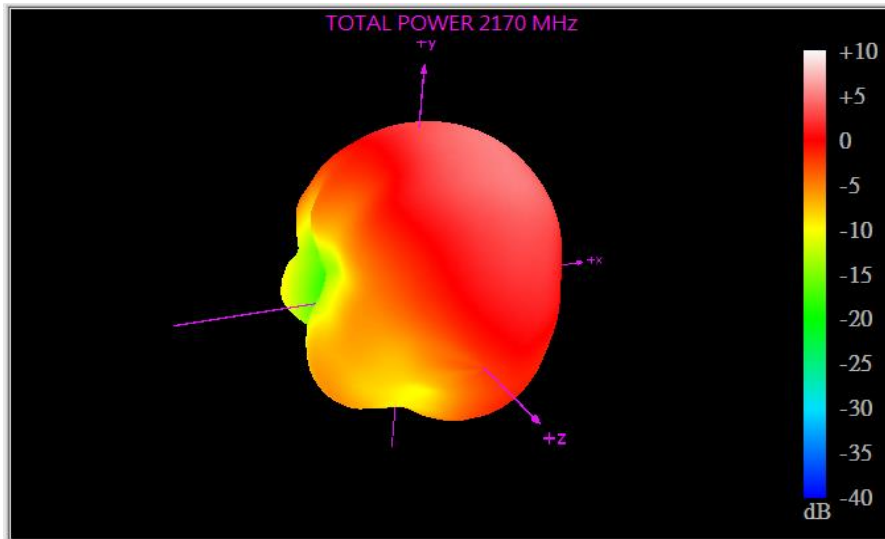
3D Radiation Patterns

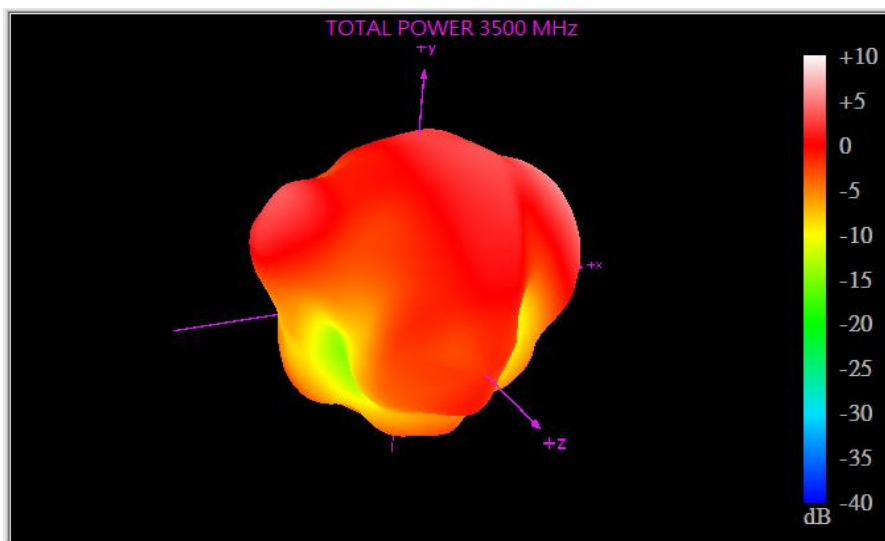
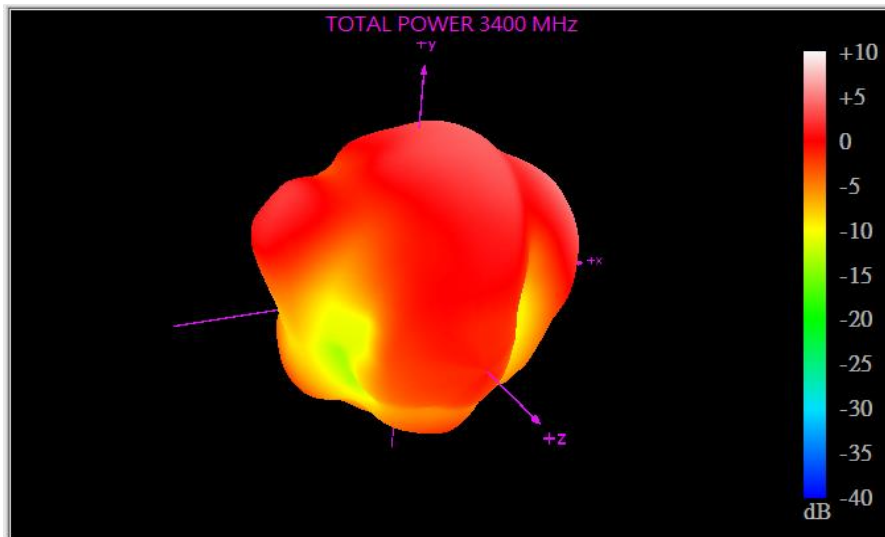
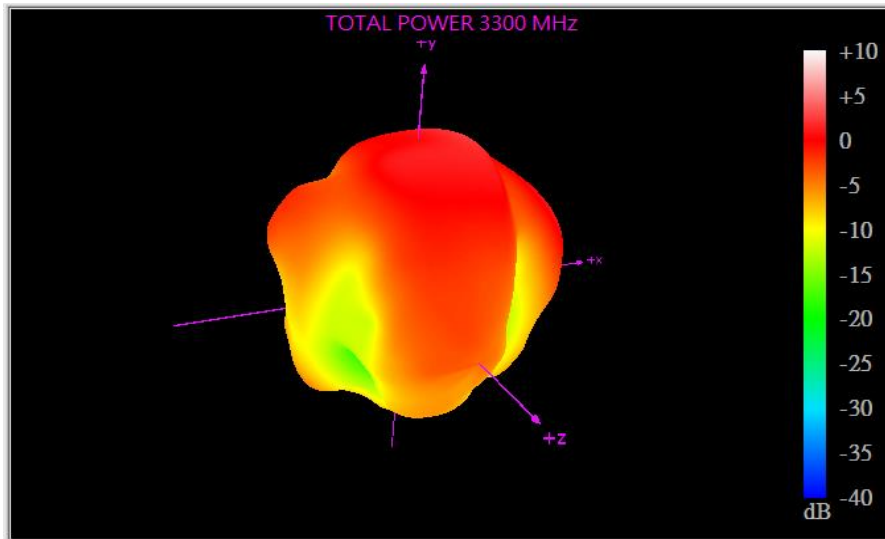
4.2.6 MIMO1

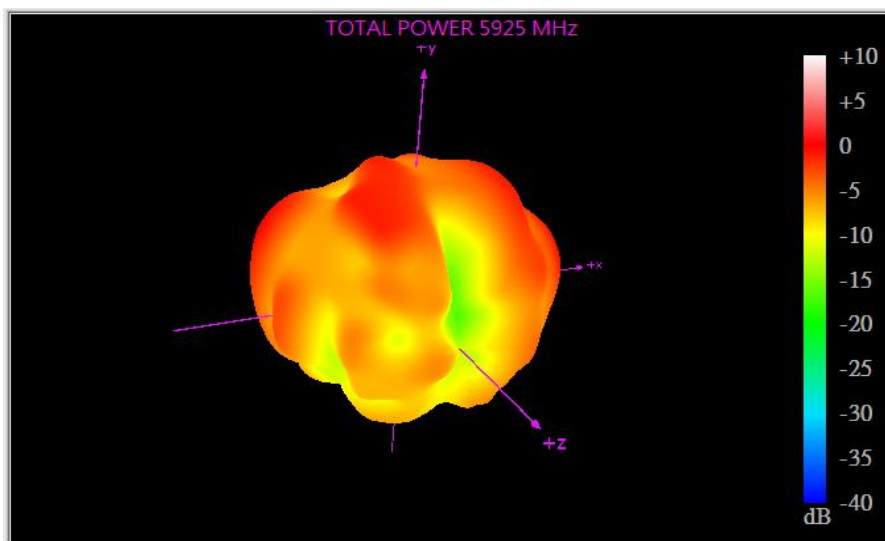
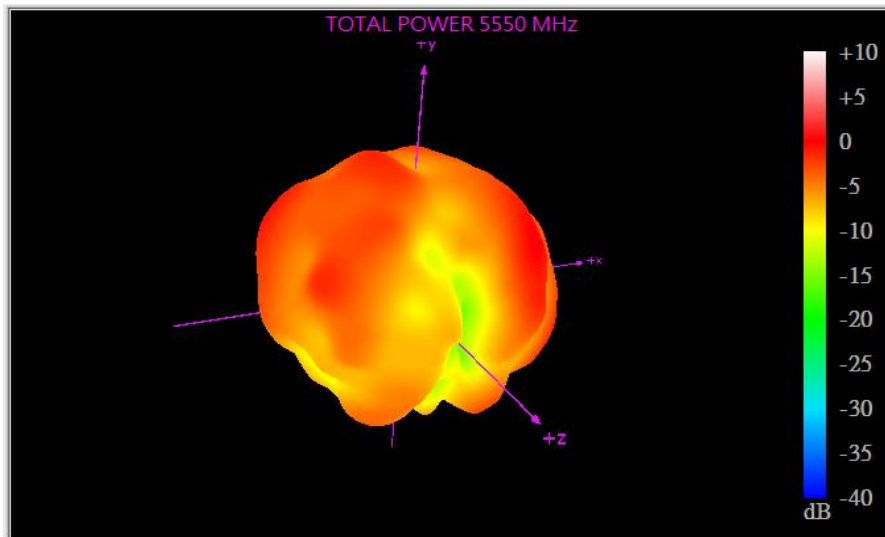
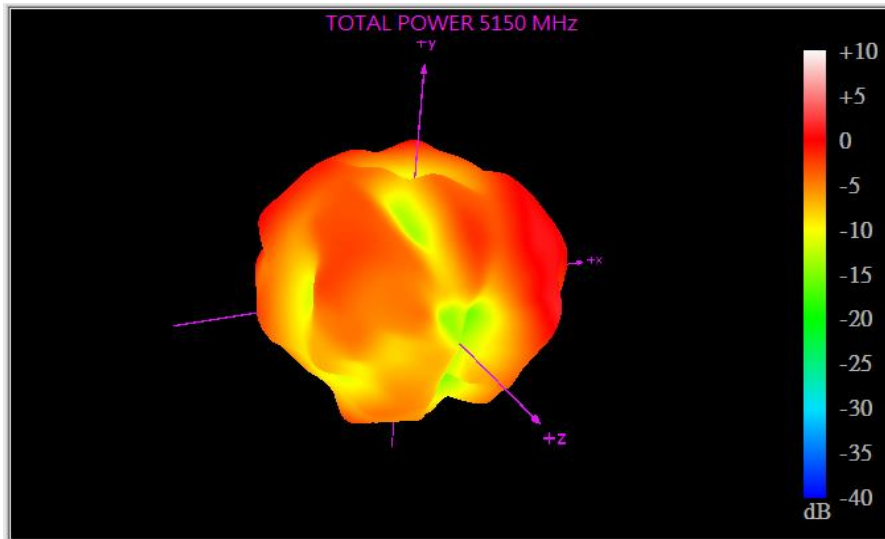




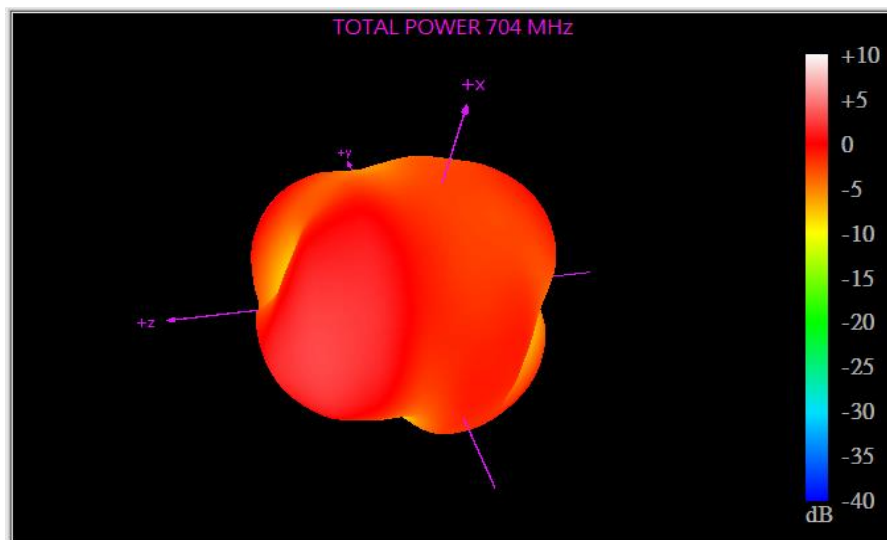
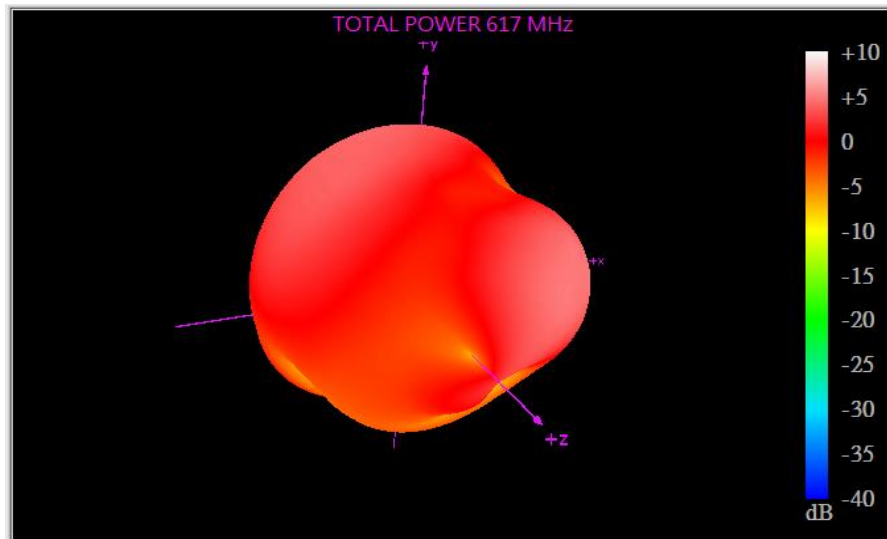


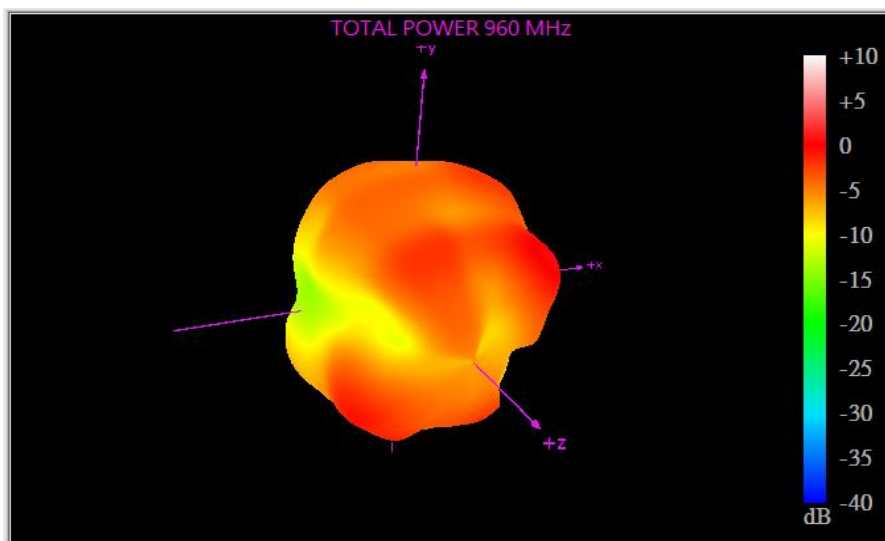
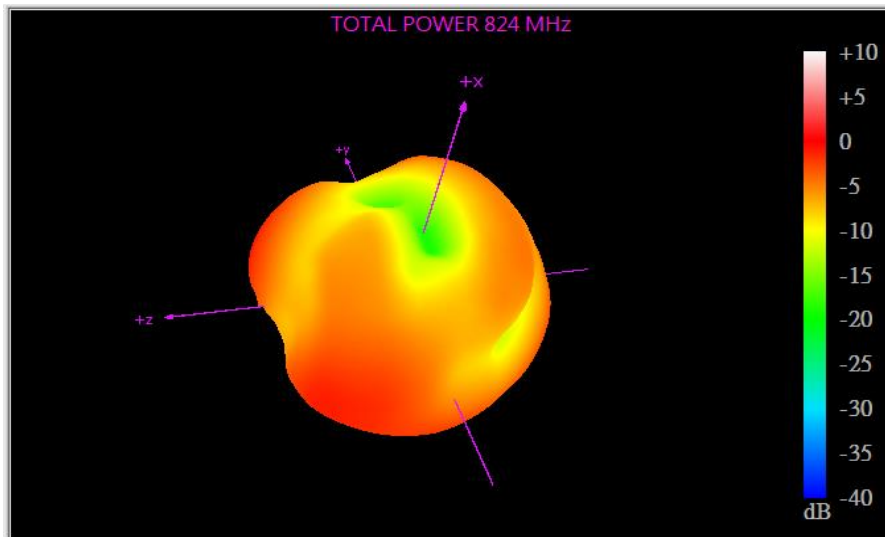
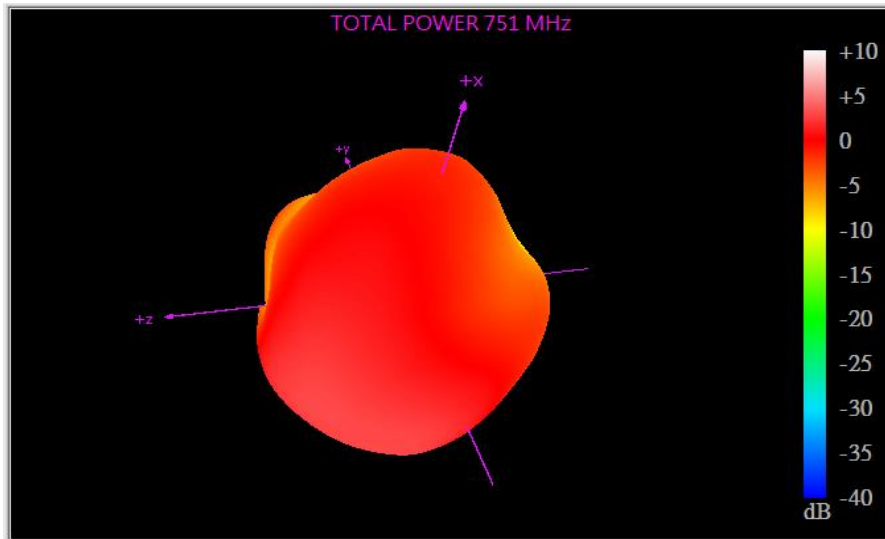


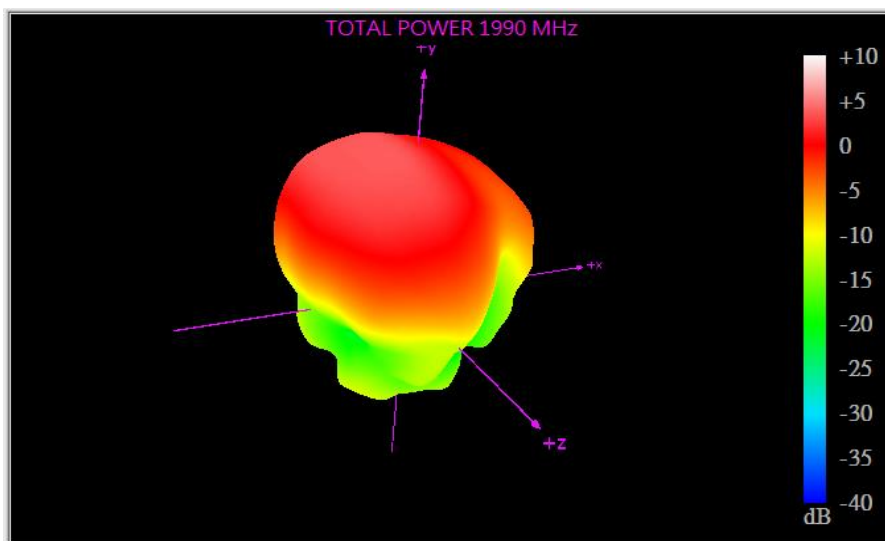
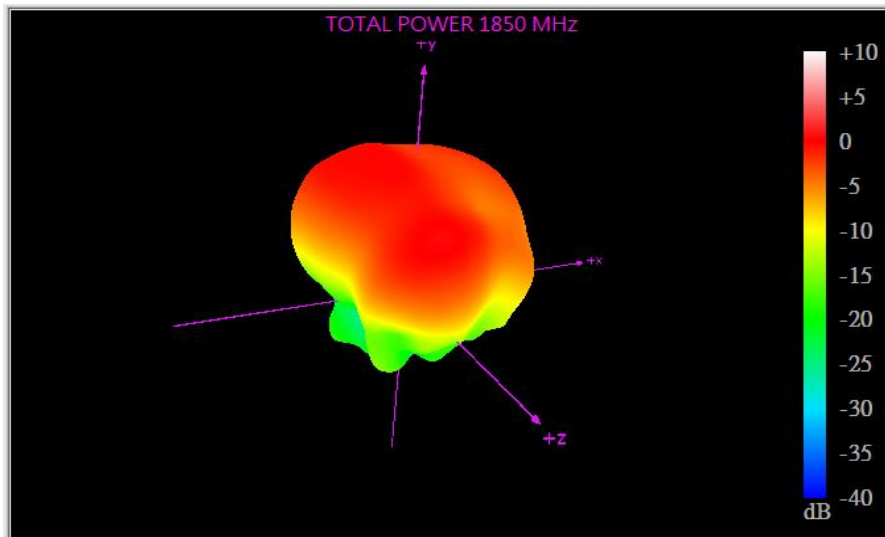
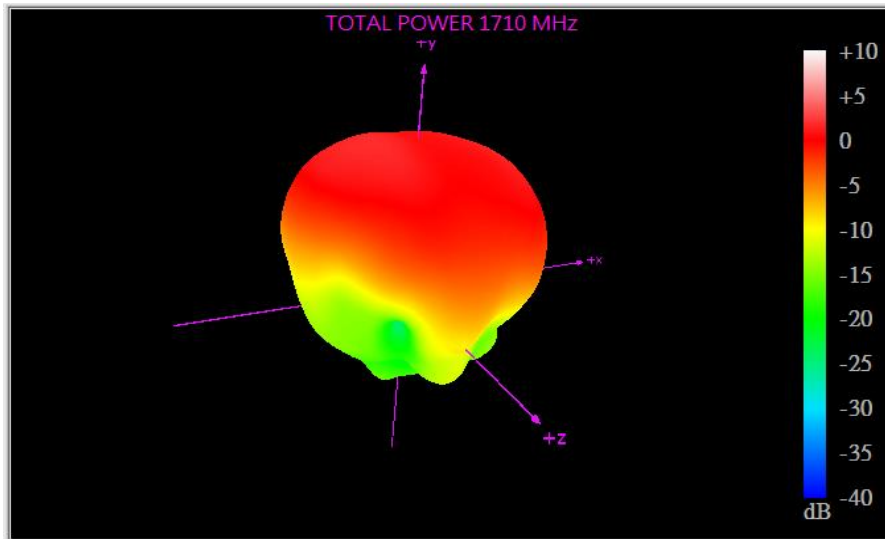


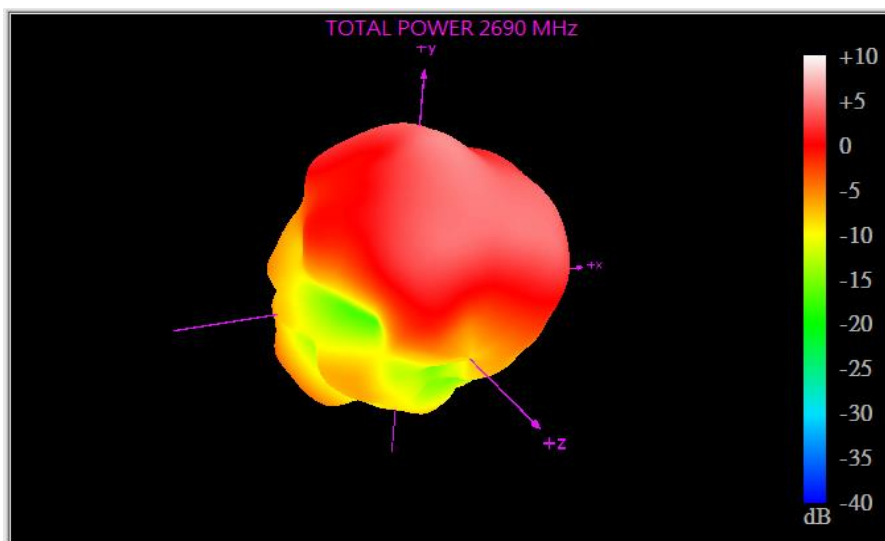
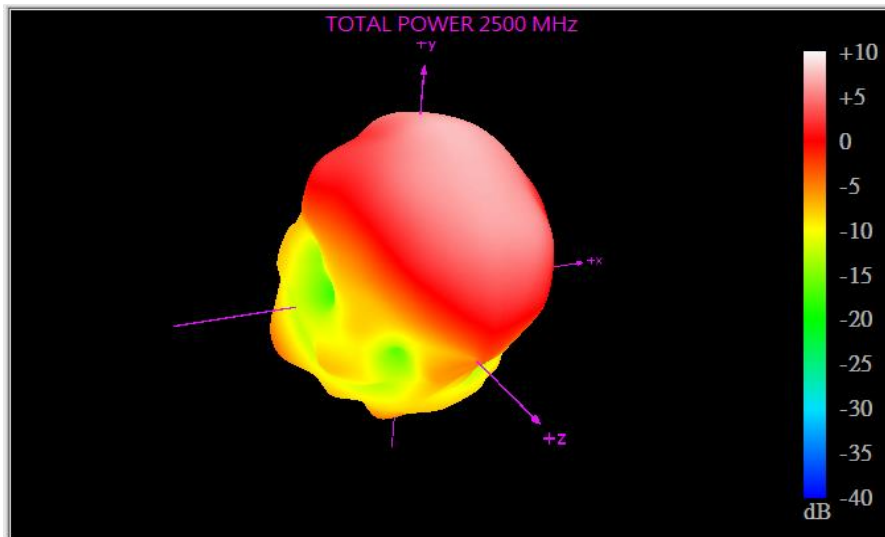
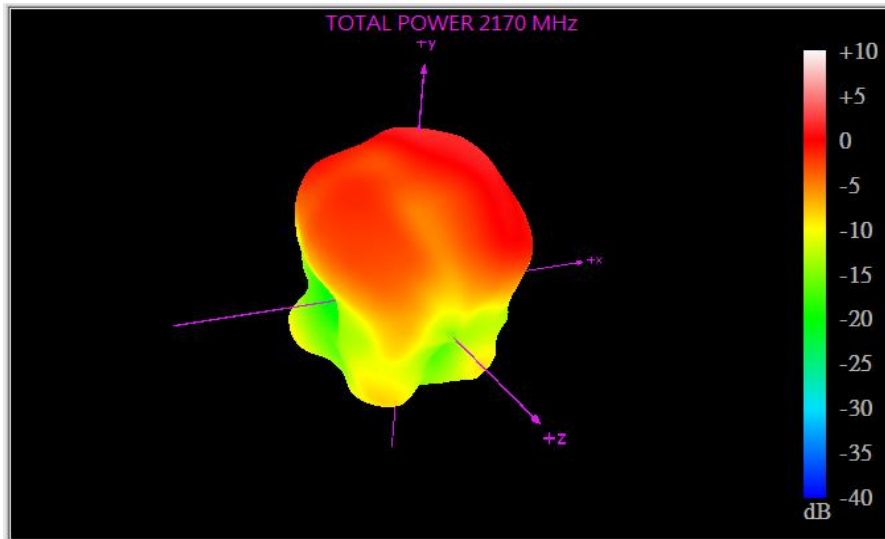


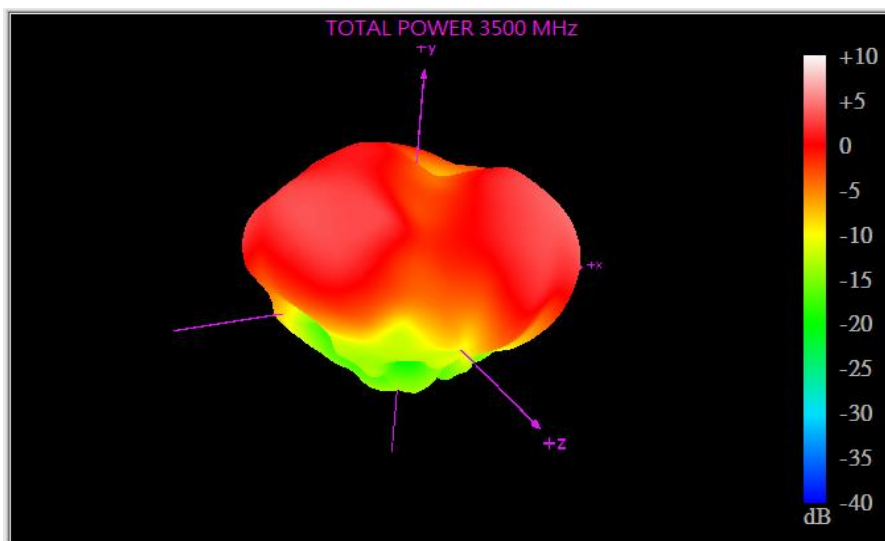
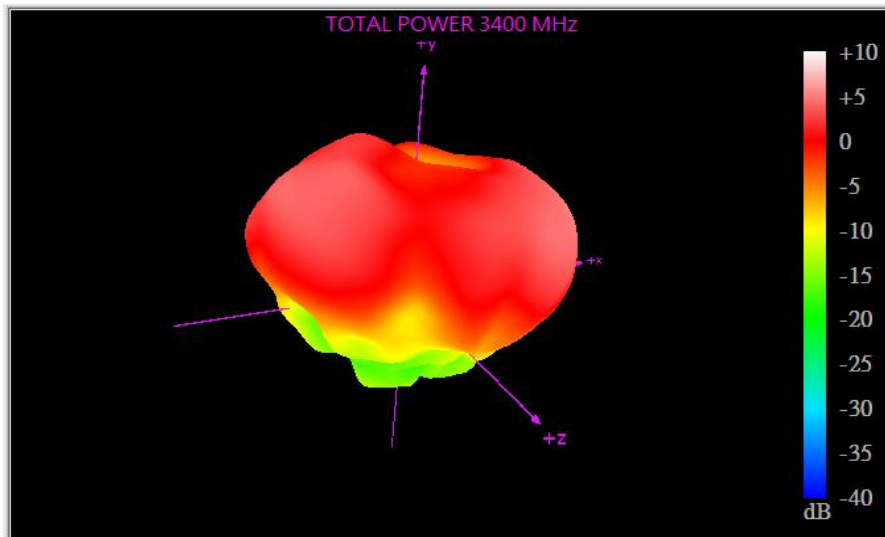
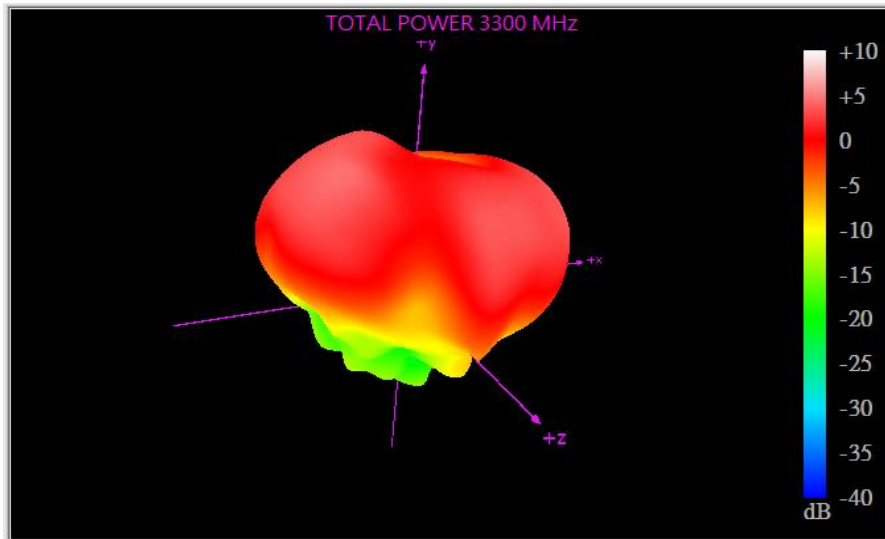
4.2.7 MIMO2

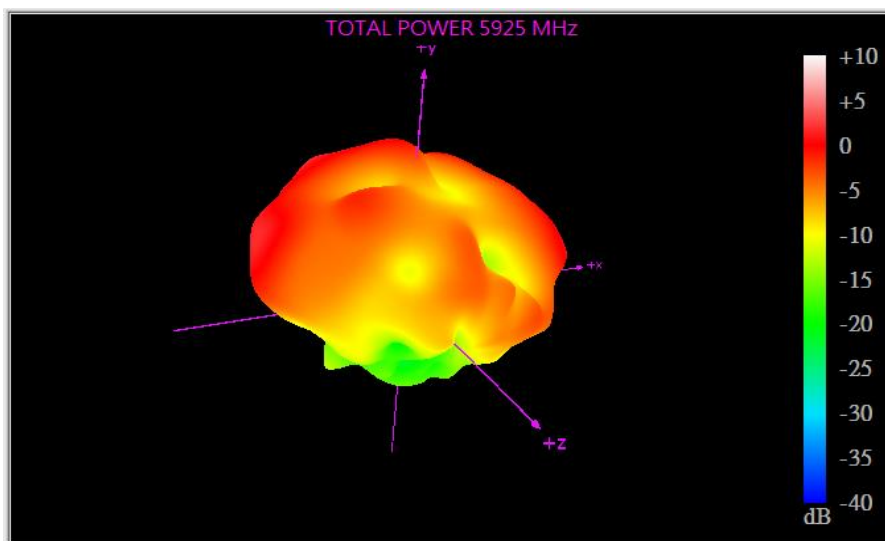
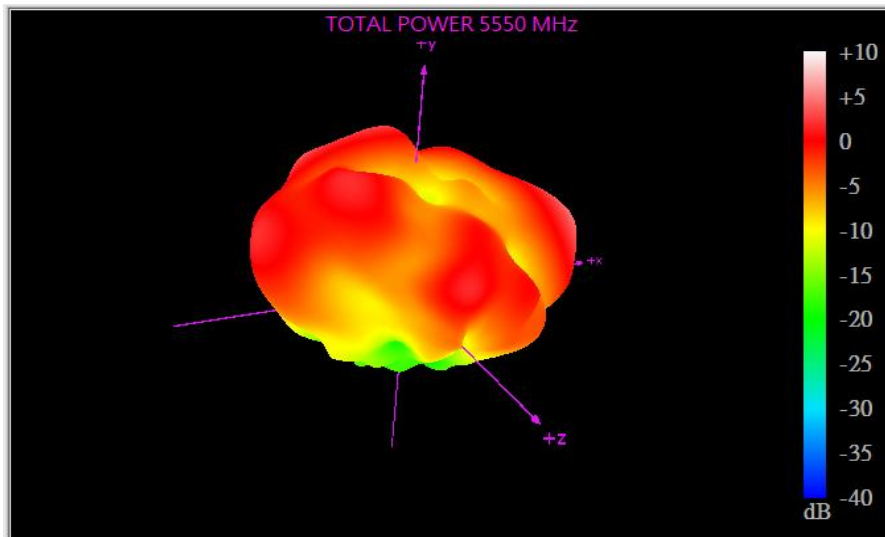
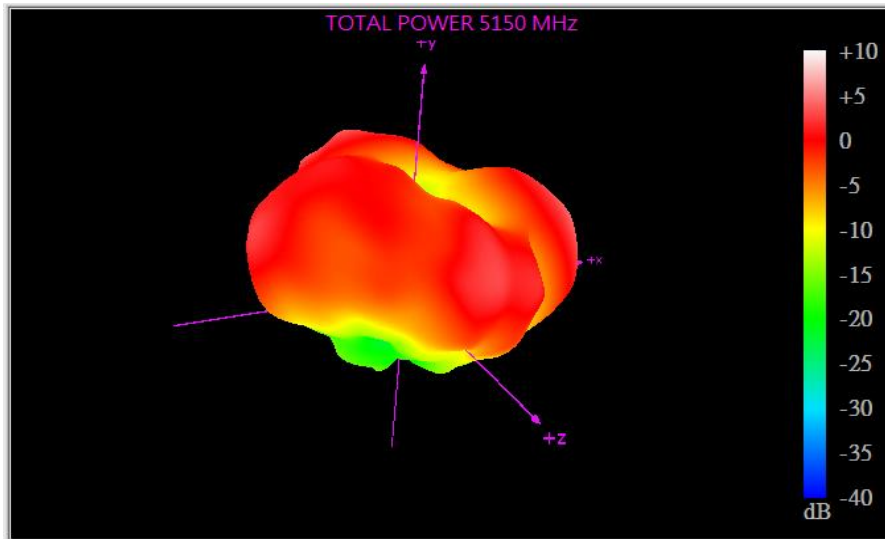




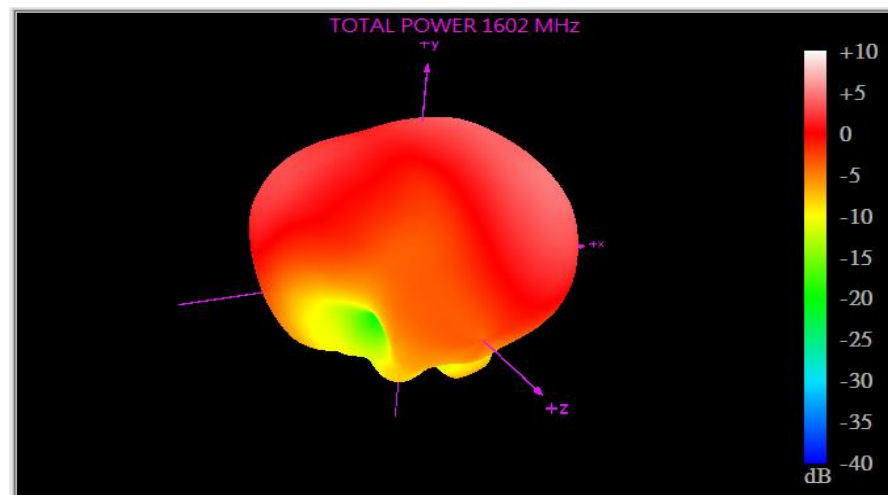
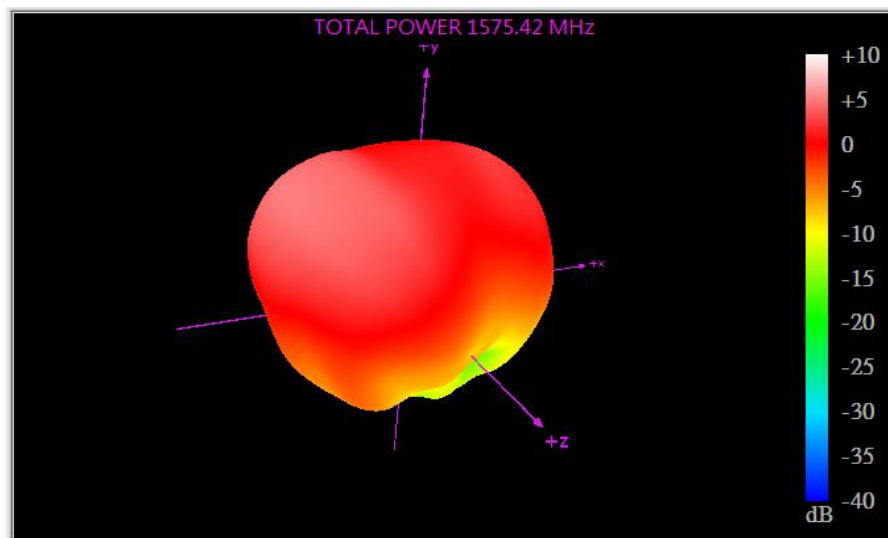
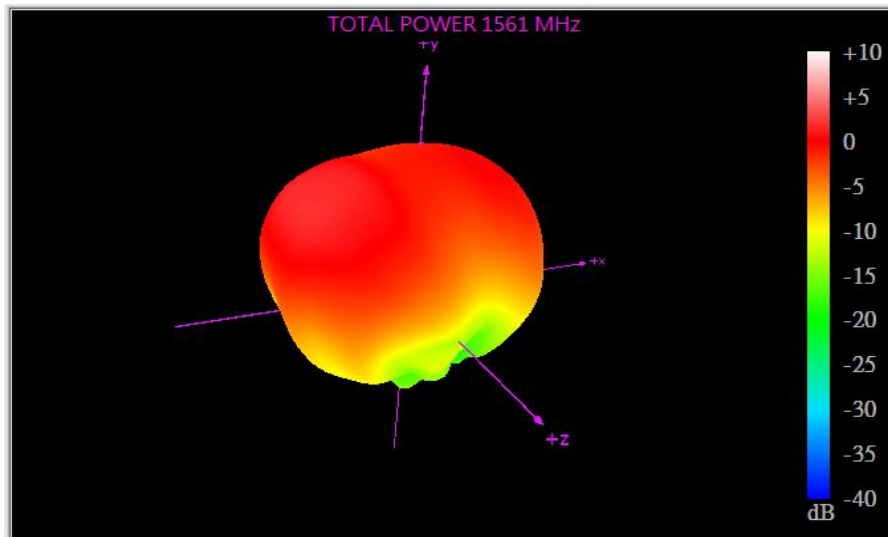






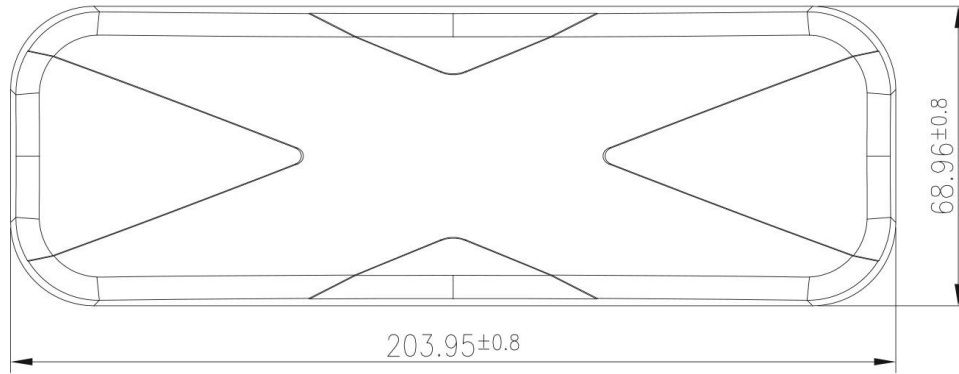


4.1.1 GNSS

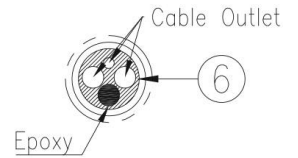


5. Mechanical Drawing (Unit: mm)

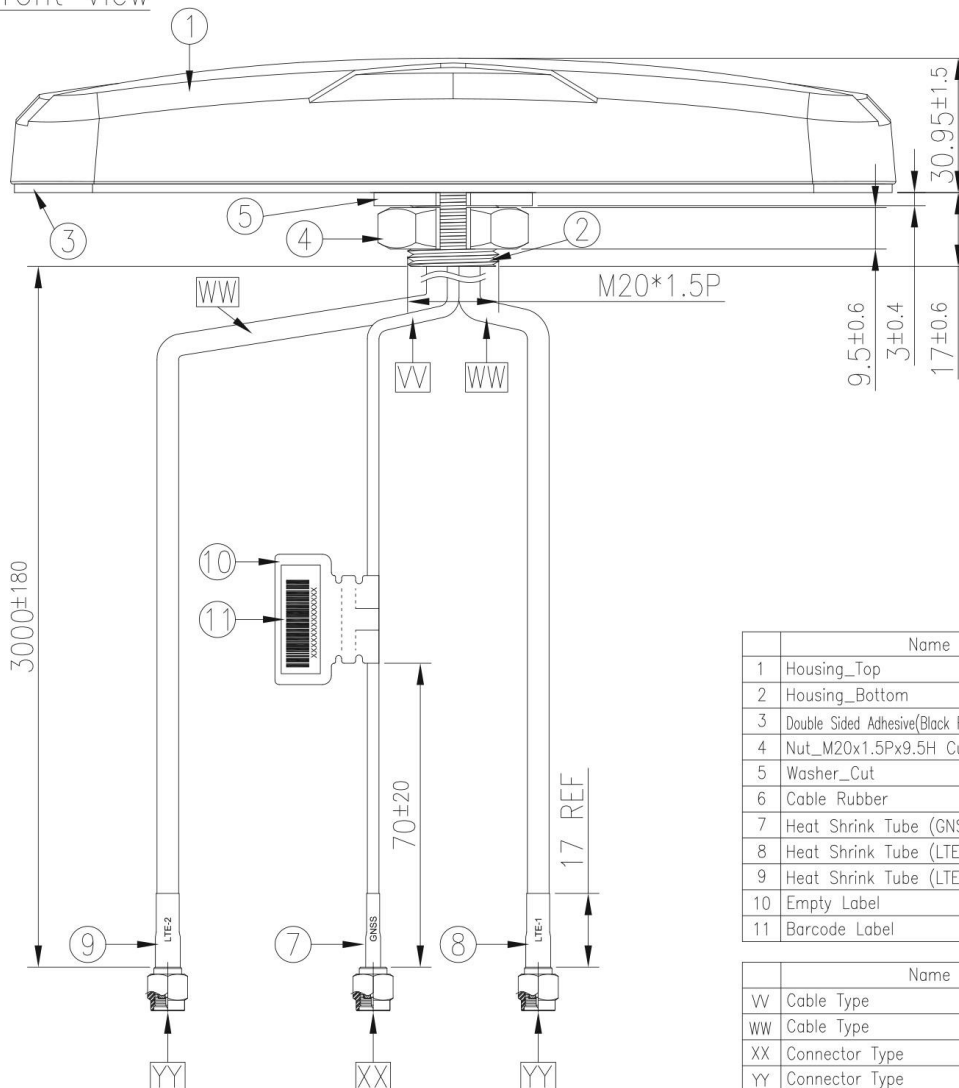
Top View



Bottom Thread View



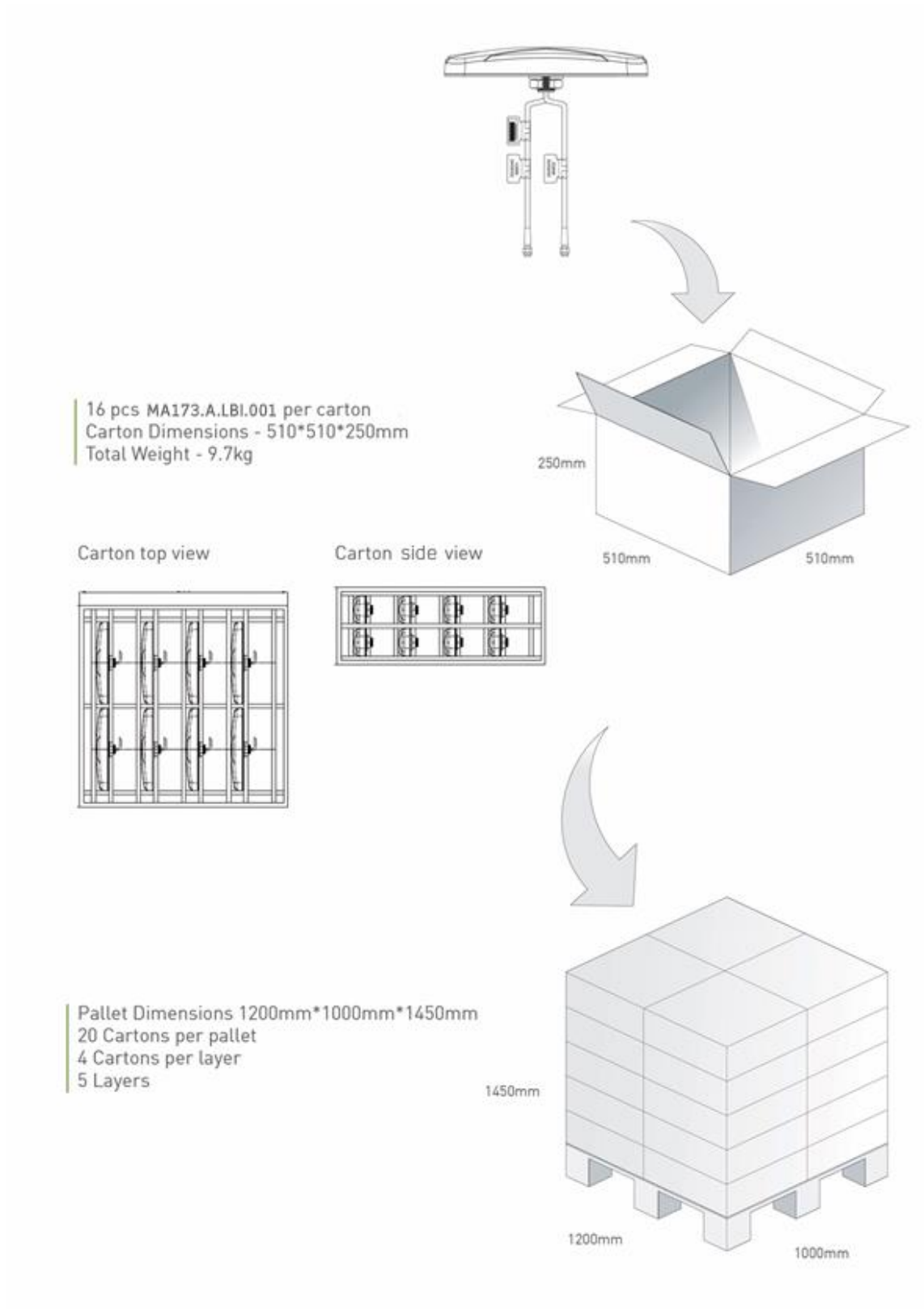
Front View



	Name	Material	Finish	QTY
1	Housing_Top	ABS+PC	Black	1
2	Housing_Bottom	ABS+PC	Black	1
3	Double Sided Adhesive(Black Foam)	3M 9448HK+CR4305	White Liner	1
4	Nut_M20x1.5Px9.5H Cut	Steel	Ni-Zn Plated	1
5	Washer_Cut	Steel	Ni-Zn Plated	1
6	Cable Rubber	Silicone Rubber	Black	1
7	Heat Shrink Tube (GNSS)	PE	Blue Tube/White Text	1
8	Heat Shrink Tube (LTE-1)	PE	Red Tube/White Text	1
9	Heat Shrink Tube (LTE-2)	PE	Red Tube/White Text	1
10	Empty Label	PEPA	White	1
11	Barcode Label	PET	White	1

	Name	SPEC	Finish	QTY
W	Cable Type	RG174	Black	1
WW	Cable Type	CFD200	Black	2
XX	Connector Type	SMA(M)ST	Au Plated	1
YY	Connector Type	SMA(M)ST	Au Plated	2

6. Packaging

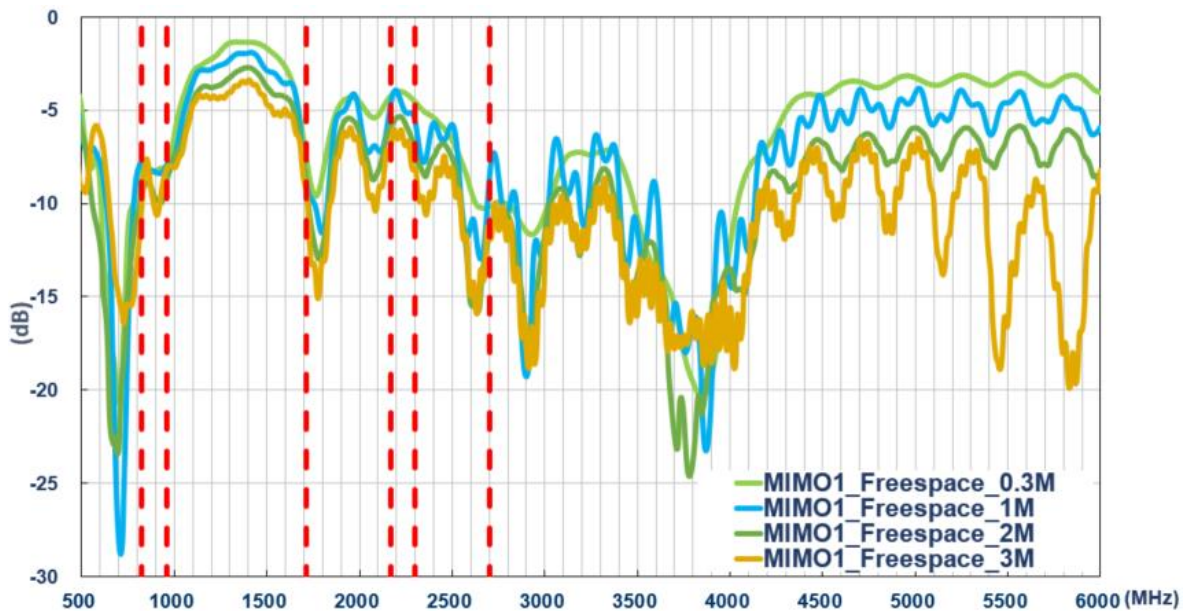


7. Application Note

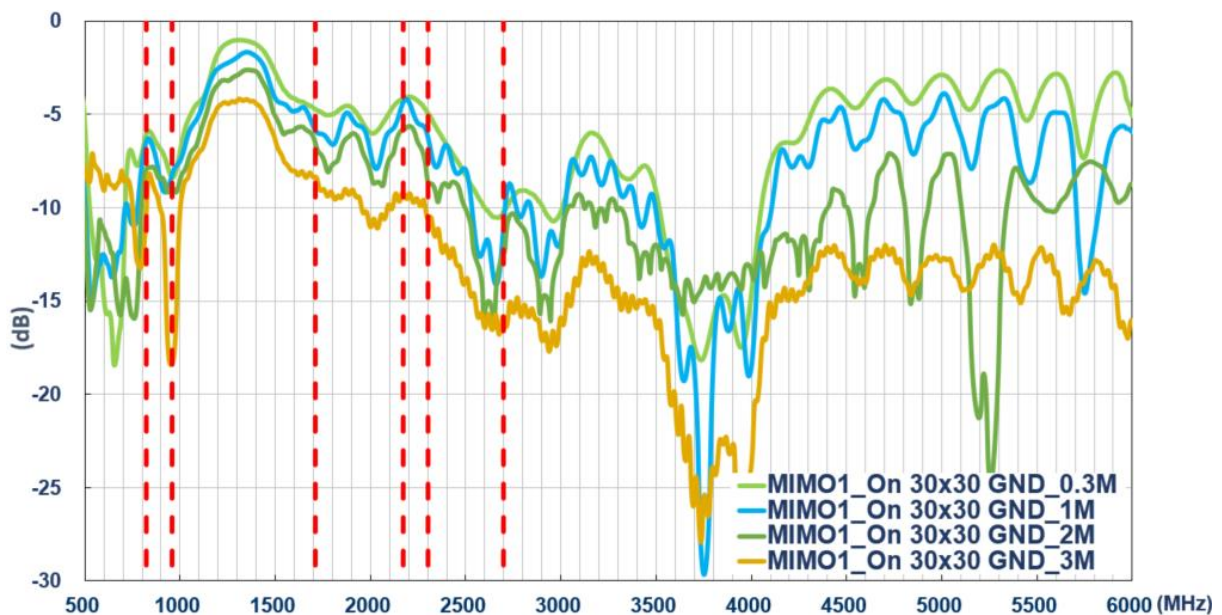
The MA173.A.LBI.001 antenna performance with different cable lengths is shown below.

7.1. Return Loss

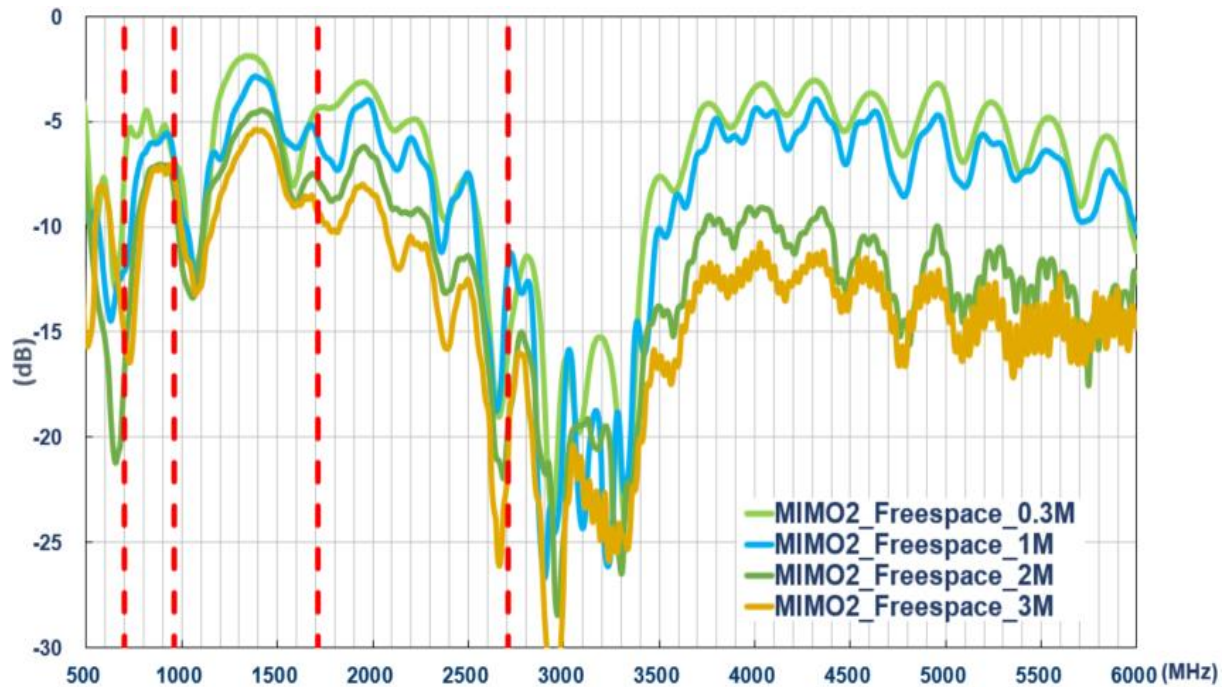
Return Loss – MIMO1 Antenna (Free Space)



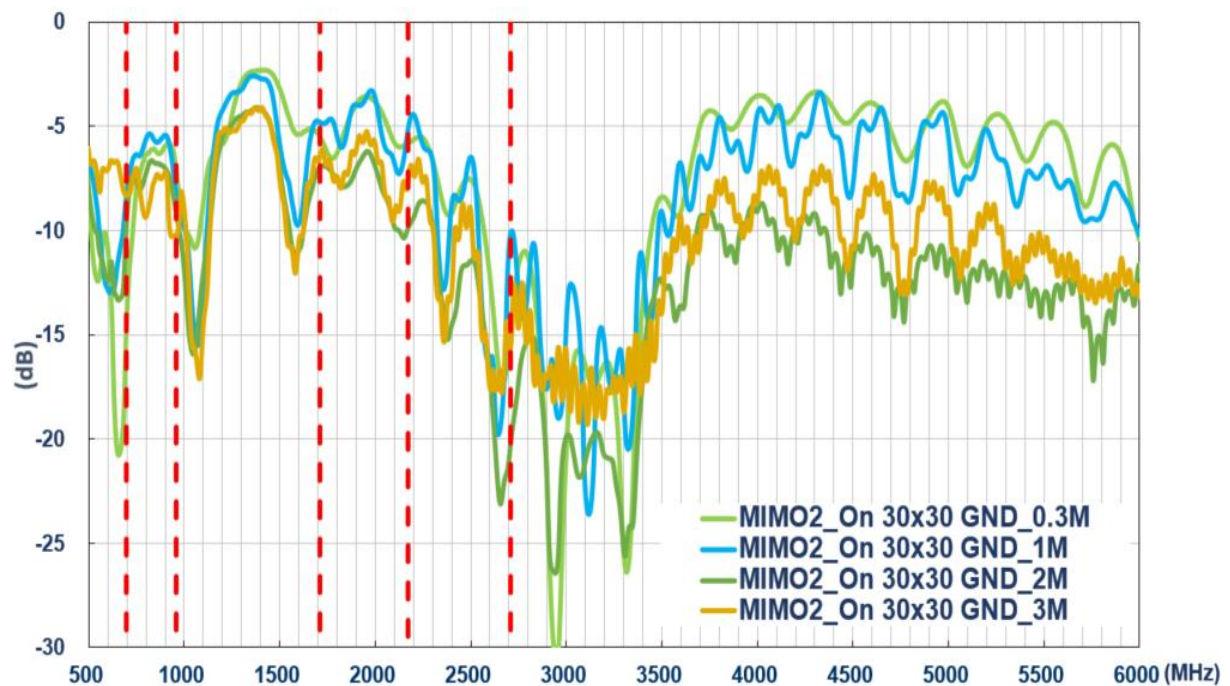
Return Loss – MIMO1 Antenna (On 30*30cm GND)



Return Loss - MIMO2 Antenna (Free Space)

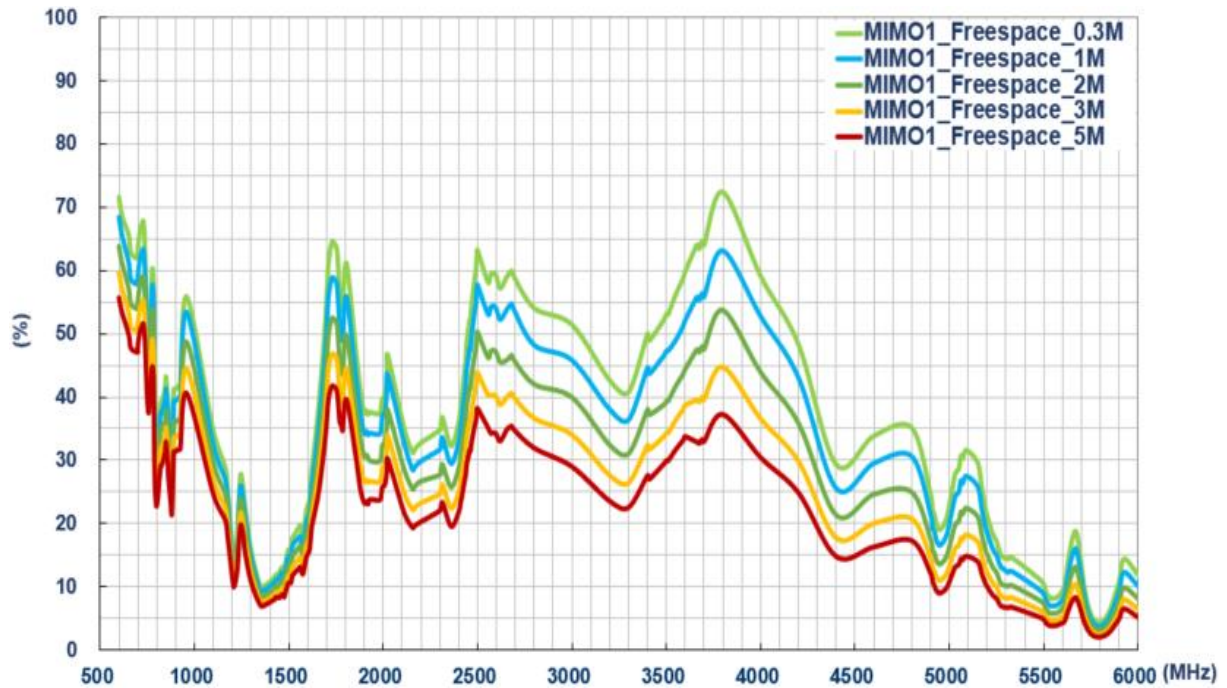


Return Loss - MIMO2 Antenna (On 30*30cm GND)

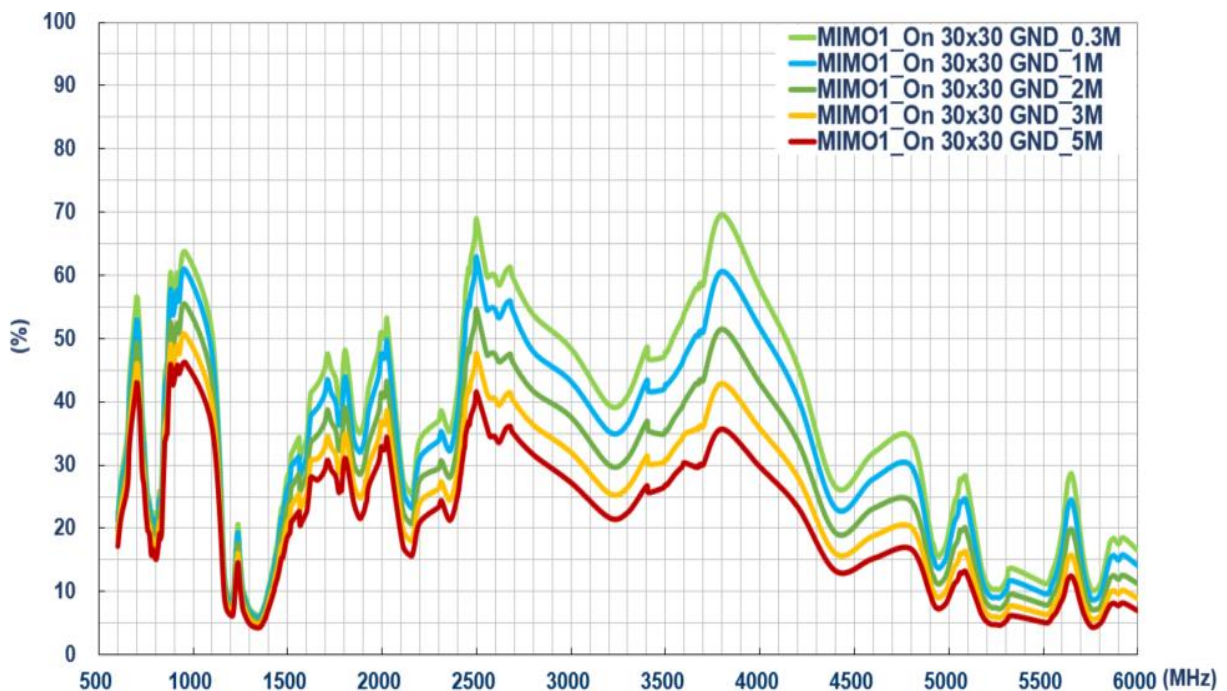


7.2. Efficiency

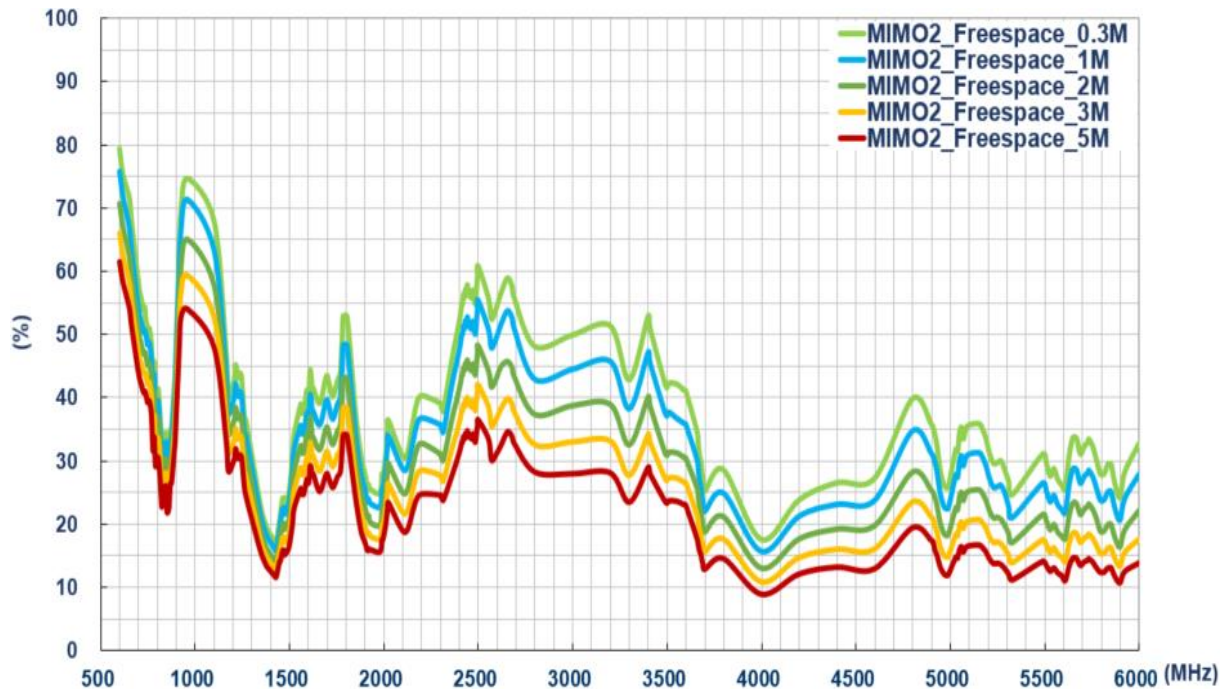
Efficiency – MIMO1 Antenna (Free Space)



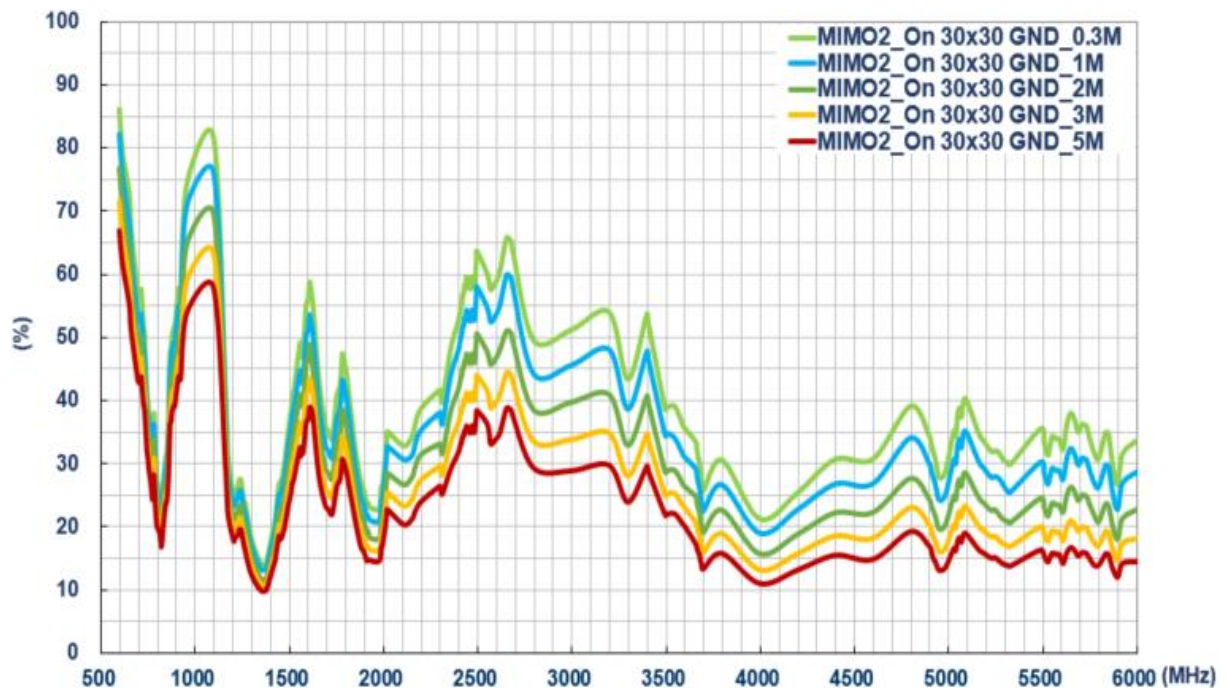
Efficiency – MIMO1 Antenna (On 30*30 GND)



Efficiency – MIMO2 Antenna (Free Space)

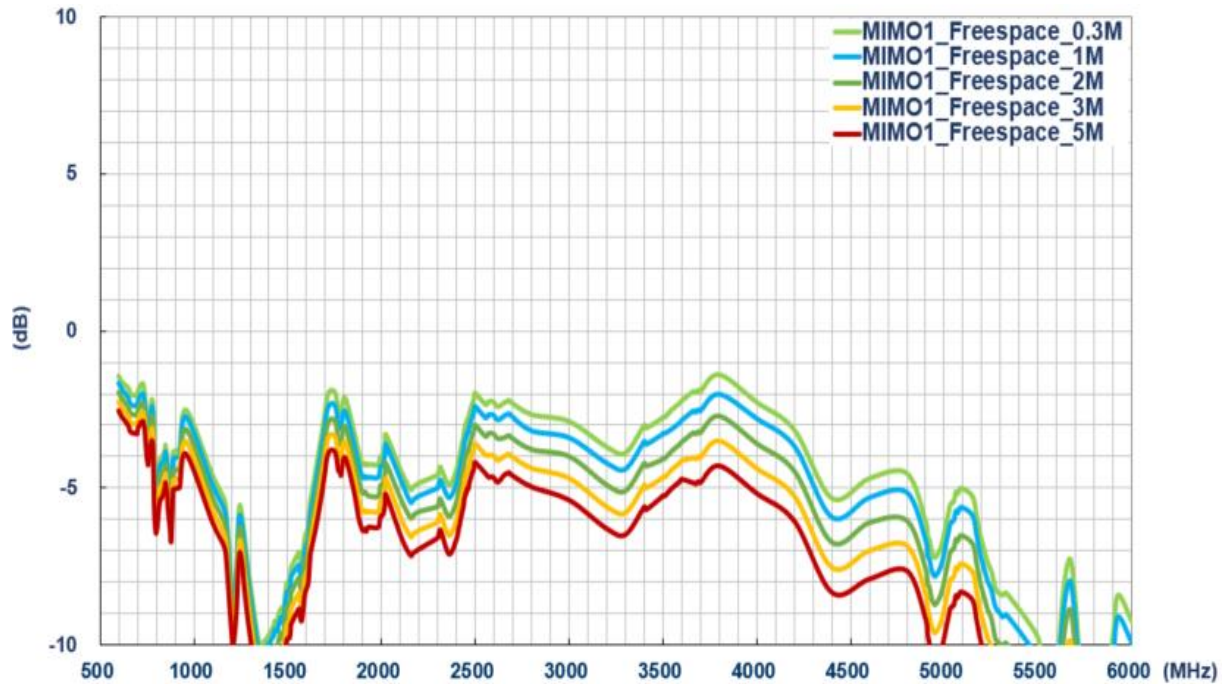


Efficiency – MIMO2 Antenna (On 30*30cm GND)

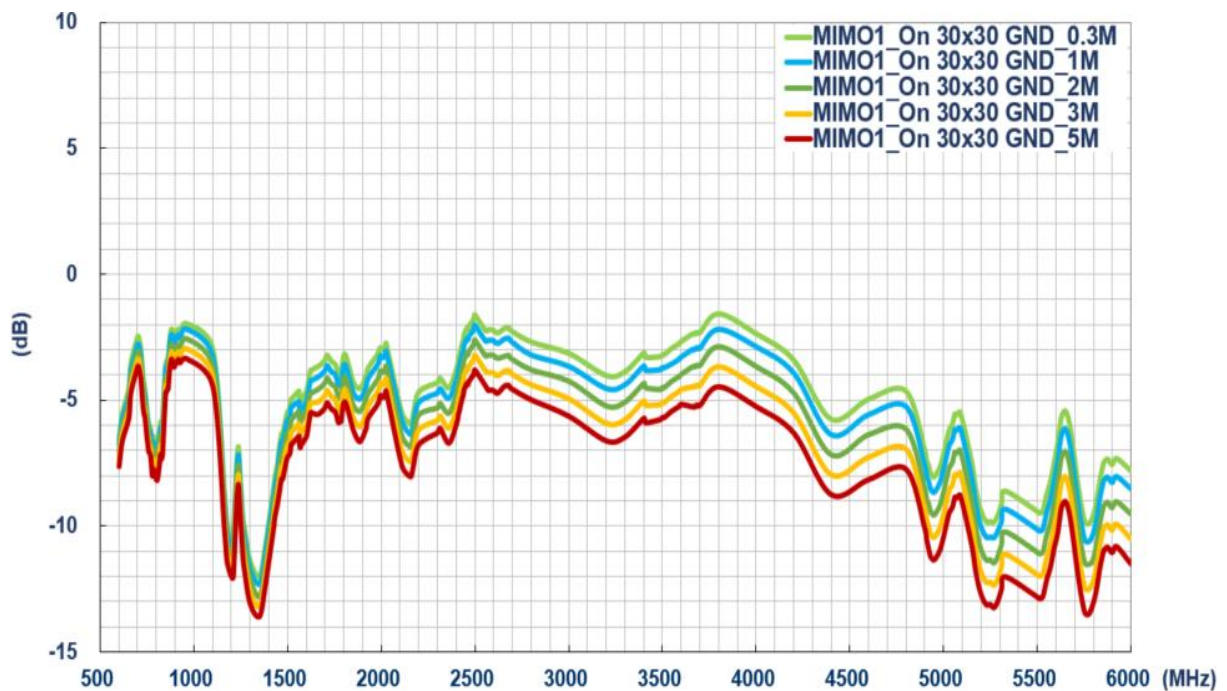


7.3. Average Gain

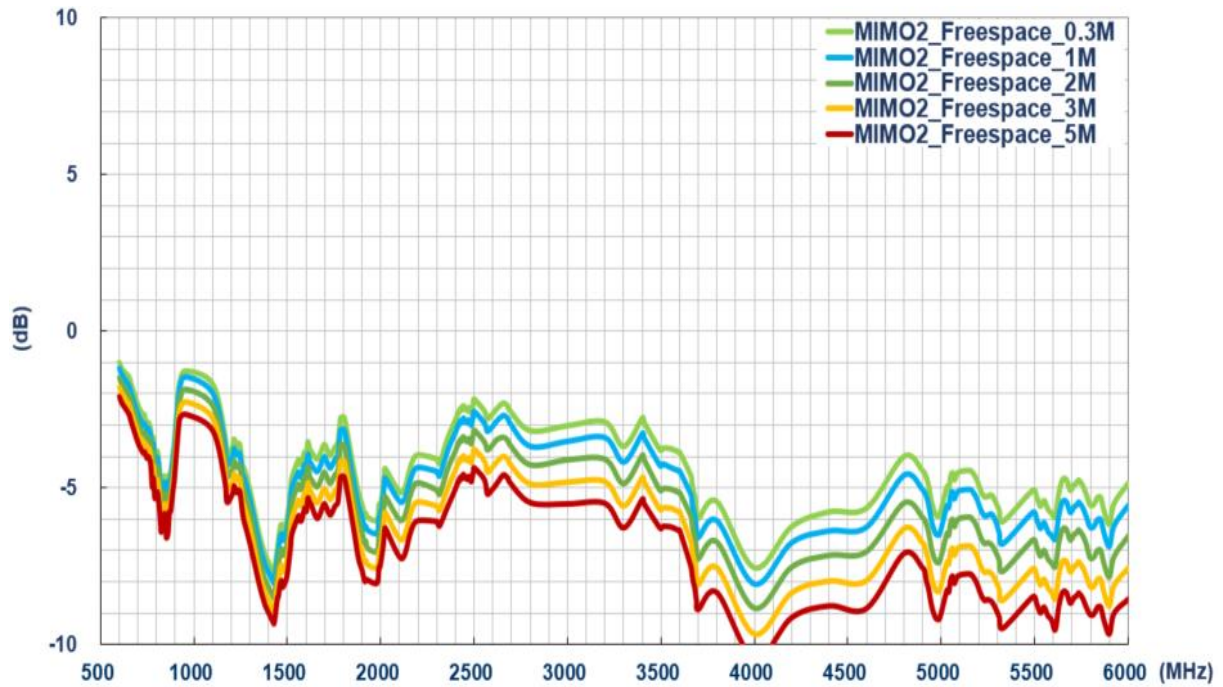
Average Gain – MIMO1 Antenna (Free Space)



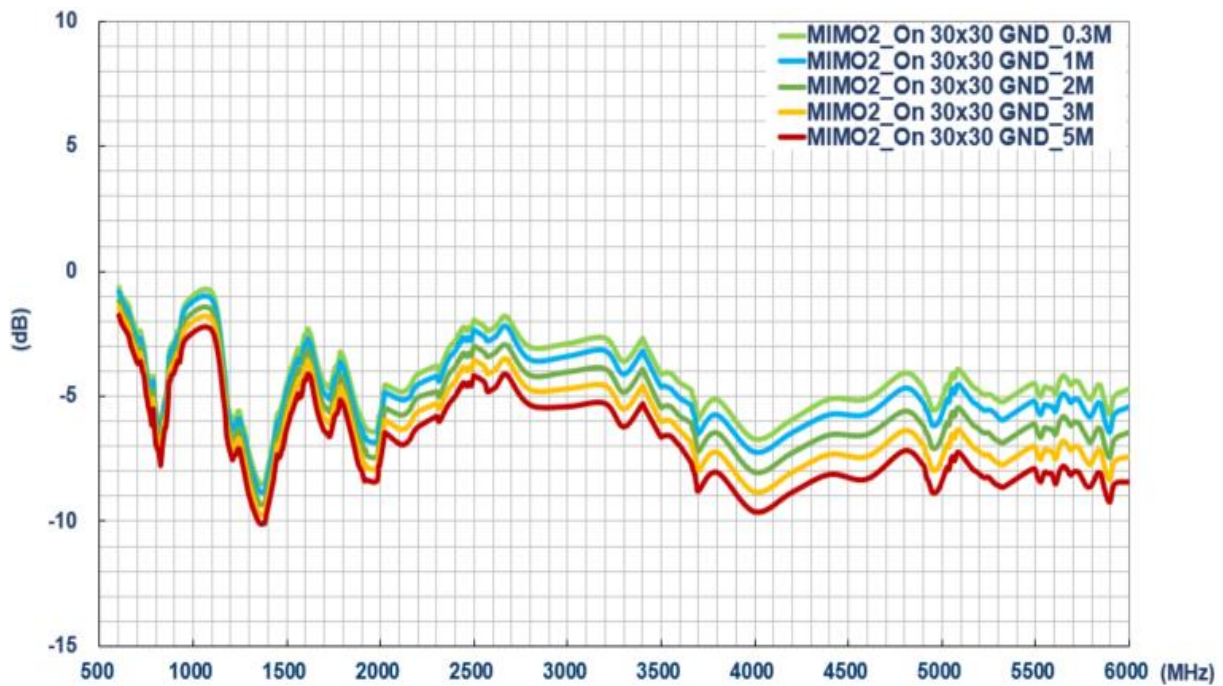
Average Gain – MIMO1 Antenna (On 30*30cm GND)



Average Gain –MIMO2 Antenna (Free Space)

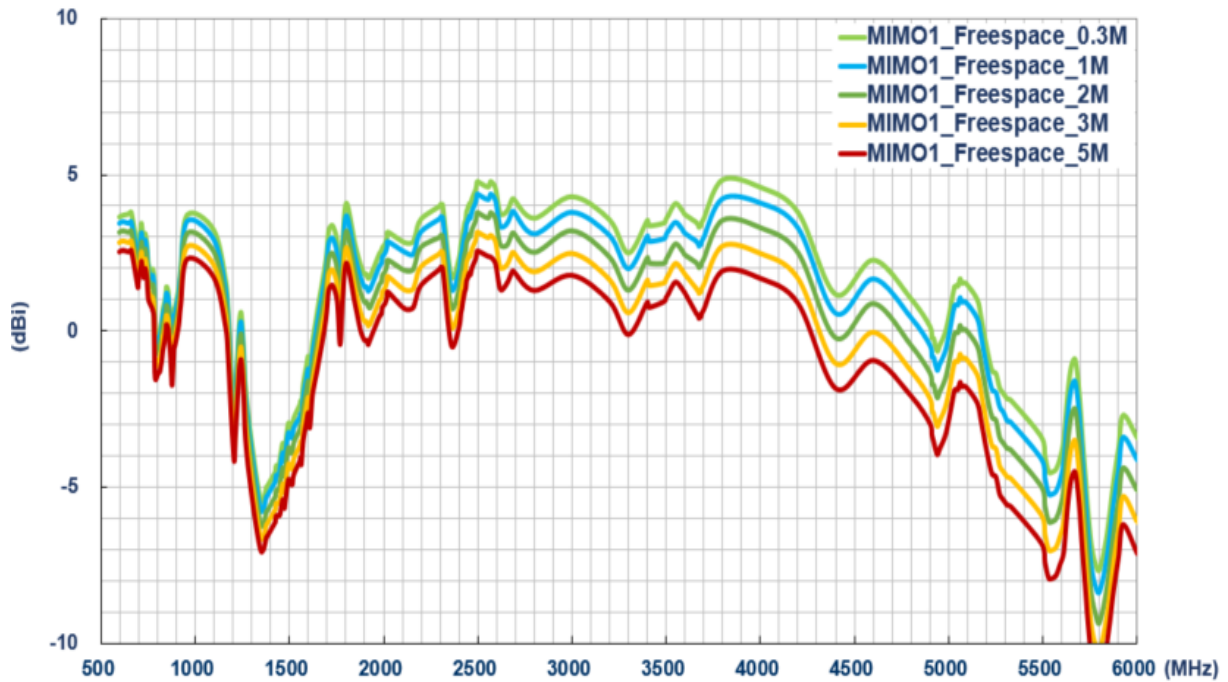


Average Gain – MIMO2 Antenna (30*30cm GND)

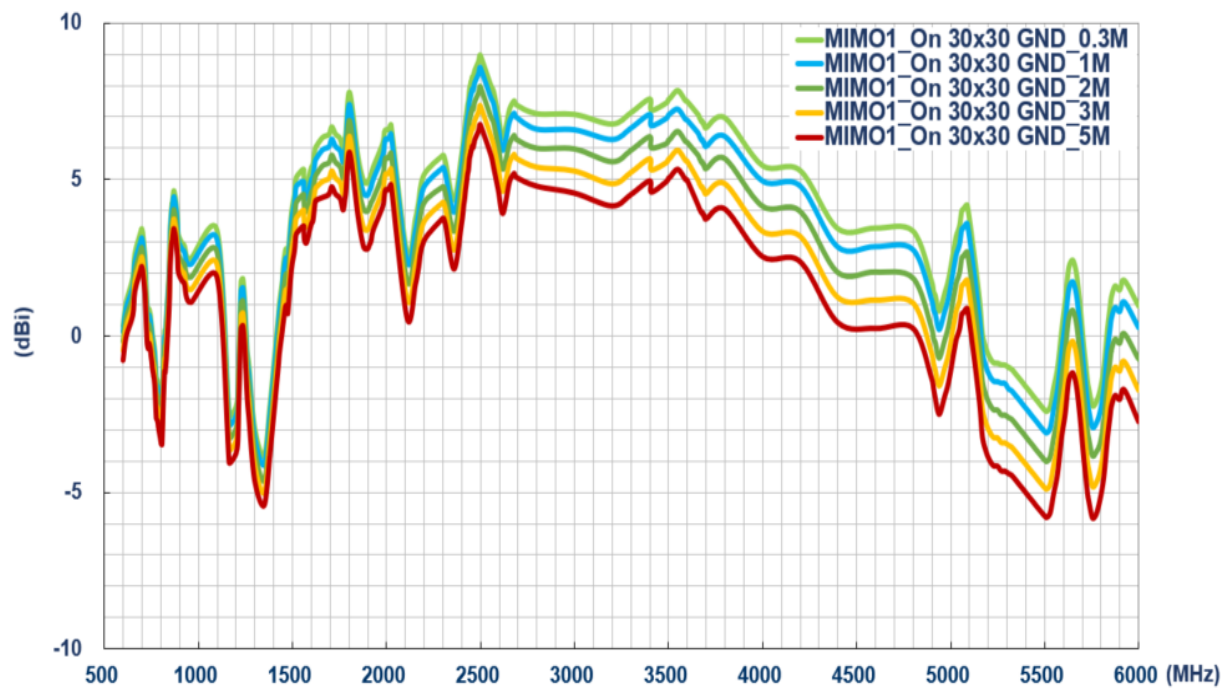


7.4. Peak Gain

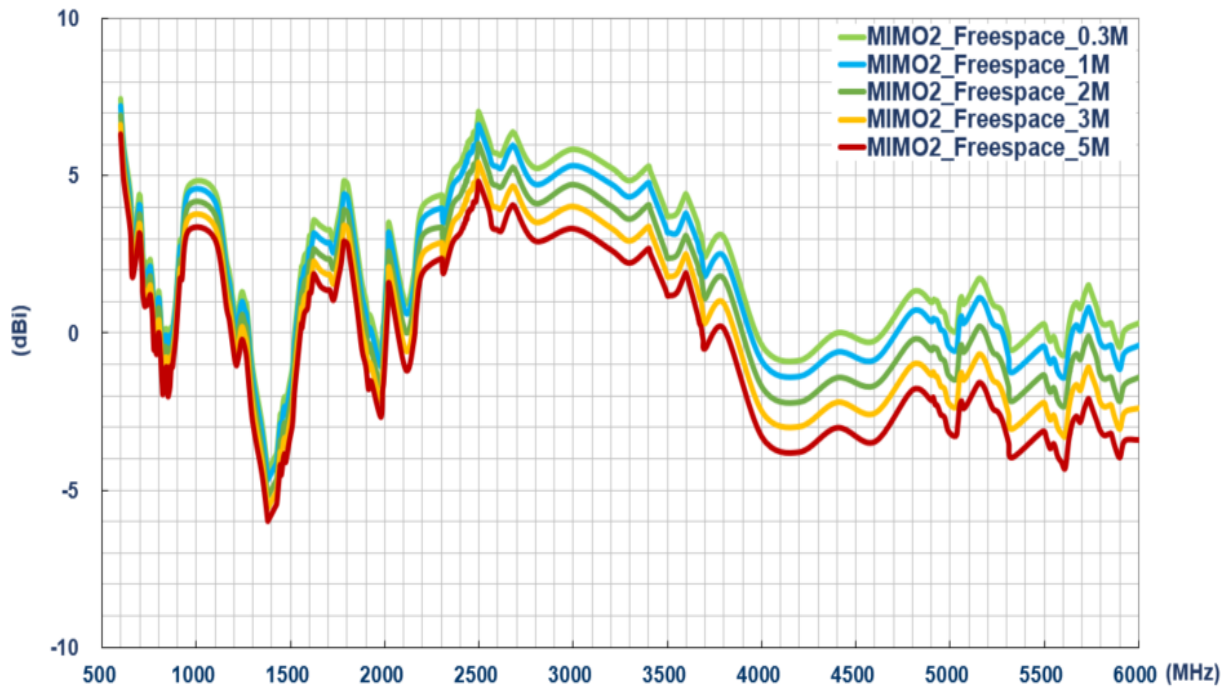
Peak Gain – MIMO1 Antenna (Free Space)



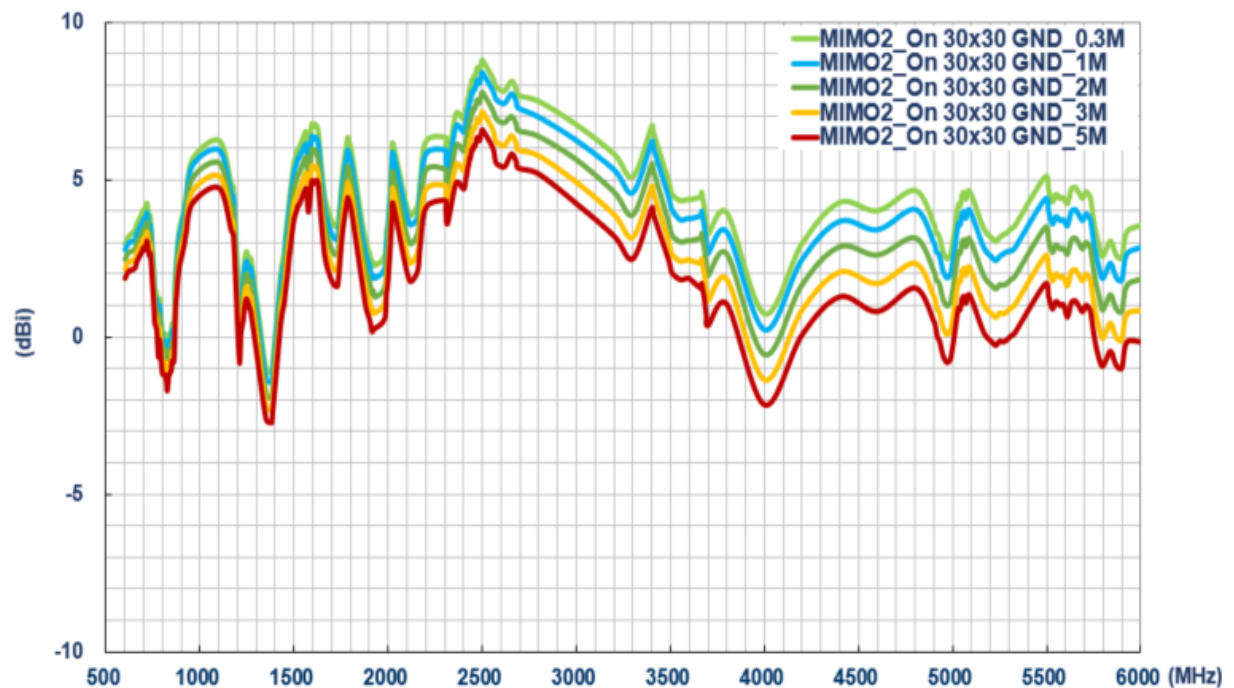
Peak Gain – MIMO1 Antenna (On 30*30cm GND)



Peak Gain – MIMO2 Antenna (Free Space)

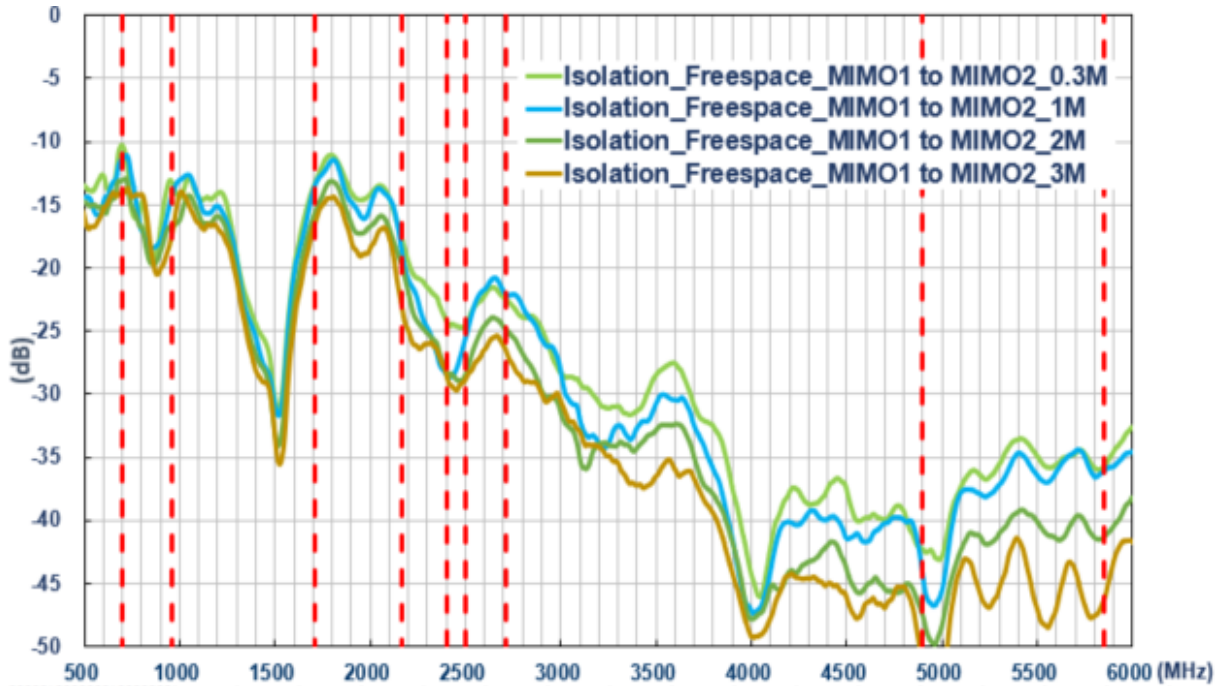


Peak Gain – MIMO2 Antenna (On 30*30cm GND)

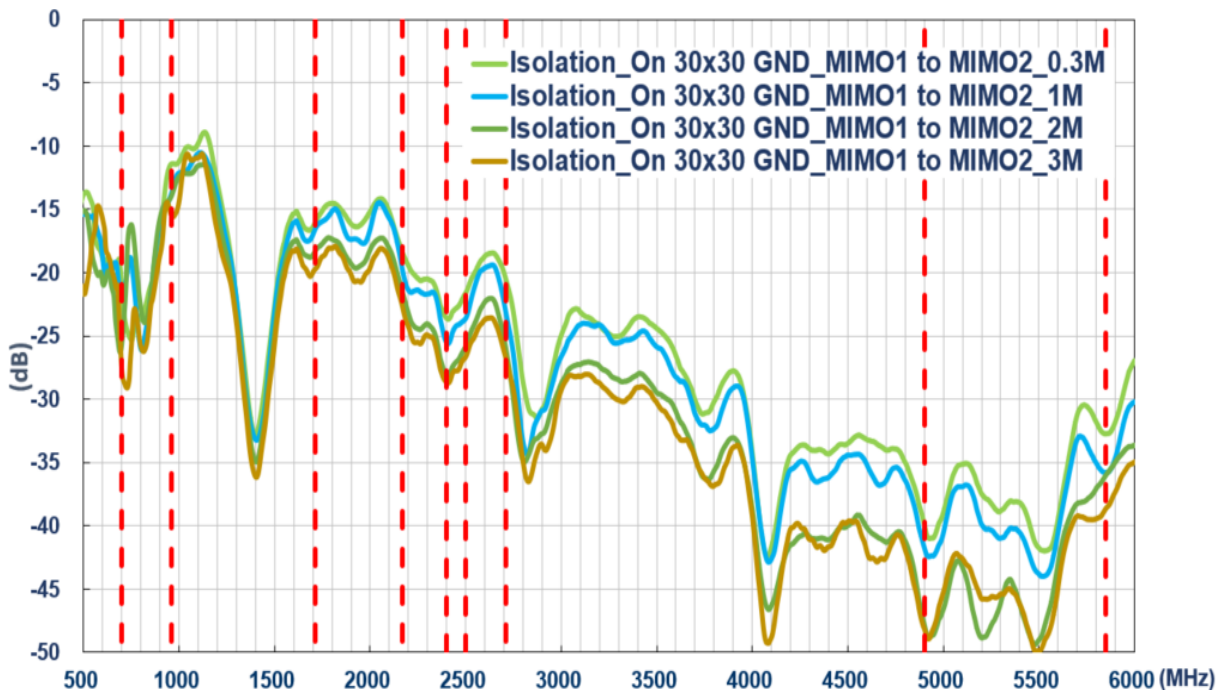


7.5. Isolation

Isolation - MIMO1 to MIMO2 (Free Space)



Isolation - MIMO1 to MIMO2 (On 30*30 cm GND)



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