

GALTRONICS

WHEN CONNECTIONS COUNT



Adtran Gemtek Mount Stuart PH2 WiFi7 Mesh

Galtronics Project: 8069

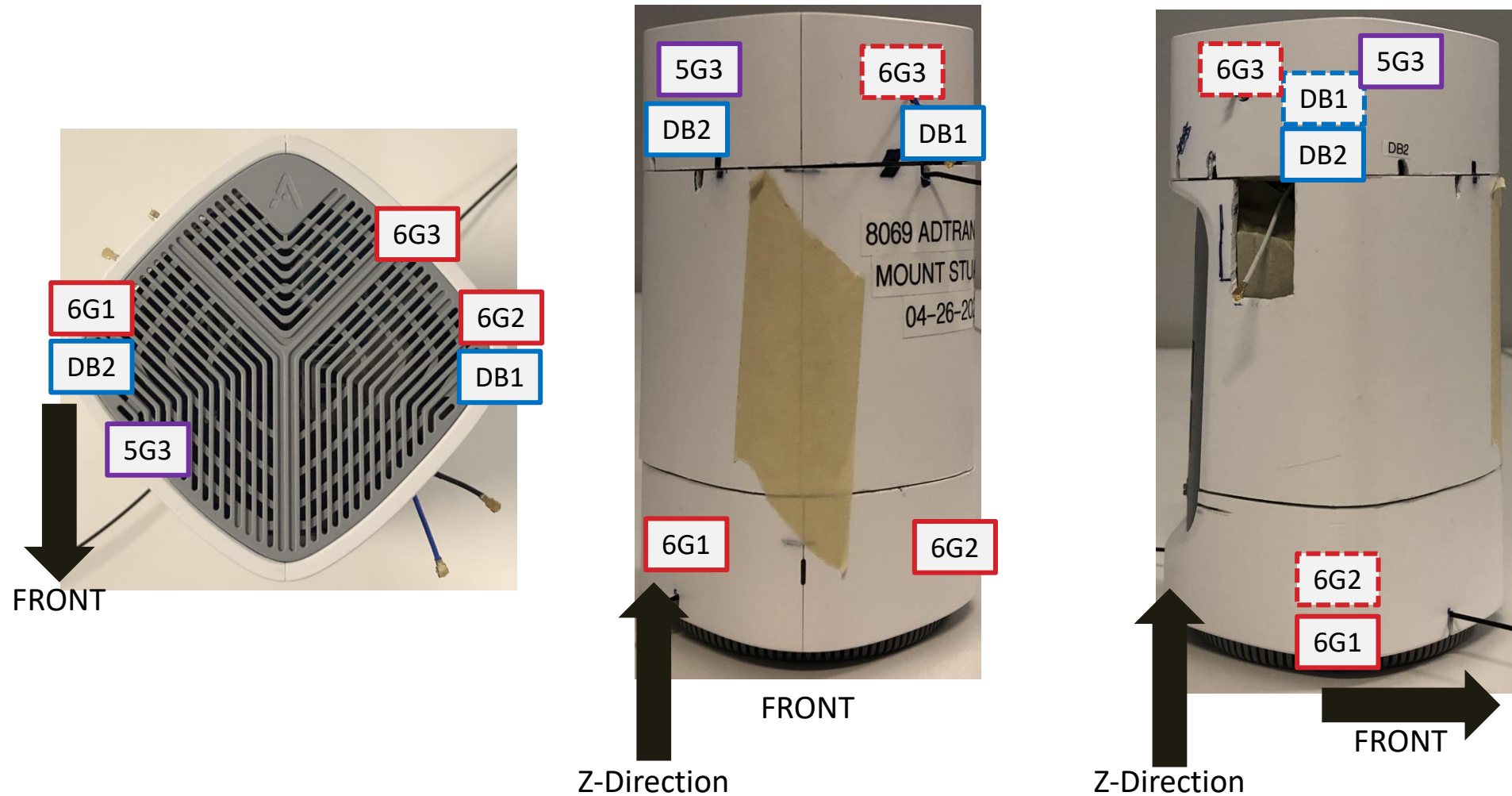
Prepared by Helena Clavin
May 14, 2024

Introduction

- » Galtronics created an antenna solution for Adtran Gemtek Mount Stuart PH2 WiFi7 Mesh
- » Galtronics received a unit on 4/26/2024
- » Galtronics tuned DB2 and 6G3 antennas and new antennas for 6G1 and 6G2.
- » We can use current frame and clips for 6G1 and 6G2
- » There are 6 antennas:
 - Two Dual Band Antennas (DB1 and DB2)
 - One 5 GHz Antenna (5G3)
 - Three 6 GHz Antennas (6G1, 6G2, and 6G3)
- » All antennas are DC-grounded antennas
- » The operating frequency of the Dual band Antennas is 2.4 GHz-2.5 GHz and 5.15 GHz-5.825 GHz.
- » The operating frequency of 5 GHz antenna is 5.15 GHz- 5.825 GHz.
- » The operating frequency of 6 GHz antennas is 5.925 GHz- 7.125 GHz.
- » Measured return loss, isolation, peak gain, efficiency, composite gain and gain pattern of the antennas

Antenna With an Enclosure

The antennas were tested in full in enclosure.



Cable Length and Orientation

Antenna	Cable Length	Orientation	Cable Color
DB1	80 mm	V	Orange
DB2	48 mm	V	White
5G3	60 mm	H-Pol Omni	Blue
6G1	180 mm	V	Yellow
6G2	225 mm	V	Green
6G3	85 mm	H-Pol Omni	Blue
H = Horizontal V = Vertical			

6G1 and 6G2 are Low Loss cables

Antenna Performance Summary

Antenna	Worst Case Return Loss (dB) 2.45 GHz Band	Worst Case Return Loss (dB) 5 GHz Band	Worst Case Return Loss (dB) 6 GHz Band	Mutual Isolation (dB) 2.45 GHz Band		Mutual Isolation (dB) 5 GHz Band			Mutual Isolation (dB) 6 GHz Band		
				DB1	DB2	DB1	DB2	5G3	6G1	6G2	6G3
DB1	-14.2	-17.4							-43.3	-37.1	-29.1
DB2	-15.9	-15.2		-23.1		-28.8			-30.0	-41.4	-36.6
5G3		-15.3		-26.2	-21.2	-37.5	-33.5		-37.7	-43.3	-25.0
6G1			-13.2	-43.9	-49.4	-45.9	-31.1	-32.7			
6G2			-13.5	-43.4	-42.4	-38.2	-44.3	-37.9	-26.5		
6G3			-13.4	-28.9	-46.0	-32.0	-35.8	-26.2	-41.1	-38.2	

Antenna	Average Efficiency 2.45 GHz Band (%)	Average Efficiency 5 GHz Band (%)	Average Efficiency 6 GHz Band (%)	Highest Peak Gain 2.45 GHz Band (dBi)	Highest Peak Gain 5 GHz Band (dBi)	Highest Peak Gain 6 GHz Band (dBi)
DB1	70.7	72.7		3.0	4.4	
DB2	67.5	71.9		3.0	3.7	
5G3		70.1			4.4	
6G1			68.9			5.3
6G2			65.1			4.0
6G3			66.5			4.3

DB and 5 GHz Antenna Peak Gain and Efficiency

DB1	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	2400	2.986	4.462	71.18 %
	2450	3.002	4.410	72.30 %
	2500	3.032	4.669	68.59 %
	Average			70.69 %

DB2	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	2400	3.005	4.564	69.85 %
	2450	2.786	4.434	68.43 %
	2500	2.703	4.627	64.22 %
	Average			67.50 %

DB1	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5150	3.956	5.355	72.46 %
	5250	4.184	5.513	73.63 %
	5350	4.182	5.597	72.19 %
	5500	4.317	5.678	73.08 %
	5725	4.245	5.640	72.52 %
	5825	4.428	5.825	72.50 %
	Average			72.73 %

DB2	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5150	3.183	4.691	70.65 %
	5250	3.182	4.569	72.67 %
	5350	3.118	4.552	71.87 %
	5500	3.065	4.491	72.01 %
	5725	3.722	5.115	72.57 %
	5825	3.514	4.965	71.59 %
	Average			71.89 %

5G3	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5150	4.193	5.759	69.73 %
	5250	4.413	5.888	71.20 %
	5350	4.250	5.844	69.28 %
	5500	4.299	5.833	70.24 %
	5725	4.418	5.942	70.40 %
	5825	4.273	5.854	69.49 %
	Average			70.06 %

6 GHz Antenna Peak Gain and Efficiency

6G1	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5925	5.270	6.927	68.29 %
	6300	4.854	6.484	68.71 %
	6500	4.187	5.750	69.77 %
	6800	3.429	5.013	69.45 %
	7125	4.020	5.664	68.48 %
	Average			68.94 %

6G2	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5925	3.968	5.734	66.58 %
	6300	2.997	4.852	65.24 %
	6500	3.746	5.720	63.48 %
	6800	3.892	5.784	64.69 %
	7125	3.426	5.275	65.33 %
	Average			65.06 %

6G3	Freq (MHz)	Peak Gain (dBi)	Directivity (dBi)	Efficiency
	5925	4.275	5.982	67.50 %
	6300	3.995	5.755	66.68 %
	6500	3.977	5.712	67.07 %
	6800	3.328	5.112	66.31 %
	7125	3.058	4.936	64.89 %
	Average			66.49 %

2.45 GHz Horizontal and Vertical Correlated directional Gain

WORST CASE

Frequency (MHz)	Degree		Gain (dBi)		Correlated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	
2400	0	156	-1.43	1.88	3.39
2450	147	314	1.01	-2.90	2.29
2500	145	314	0.93	-1.97	2.61

Frequency (MHz)	Degree		Gain (dBi)		Correlated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
2400	105	103	1.56	-0.54	3.58
2450	105	102	1.87	-0.23	3.89
2500	105	101	1.98	-0.71	3.75

2.45 GHz Horizontal and Vertical Uncorrelated directional Gain

WORST CASE

Frequency (MHz)	Degree		Gain (dBi)		UnCorrelated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	
2400	1	340	-2.00	2.20	0.59
2450	146	314	1.05	-2.96	-0.51
2500	145	313	0.95	-2.00	-0.28

Frequency (MHz)	Degree		Gain (dBi)		UnCorrelated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
2400	1	251	-1.80	2.29	0.71
2450	105	102	1.87	-0.23	0.94
2500	105	101	1.98	-0.71	0.84

5 GHz Horizontal and Vertical Correlated directional Gain

WORST CASE

Frequency (MHz)	Degree		Gain (dBi)			Correlated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	5G3	
5150	156	151	-3.31	-3.94	-1.34	1.98
5250	160	159	-3.23	-4.52	-1.72	1.69
5350	89	106	-12.44	-12.26	4.03	1.56
5500	89	104	-8.48	-13.18	4.20	2.15
5725	4	0	1.97	0.71	-7.06	4.12
5825	162	146	-2.01	-3.65	-2.77	1.99

Frequency (MHz)	Degree		Gain (dBi)			Correlated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	5G3	
5150	80	178	1.63	1.24	-8.42	3.98
5250	79	177	1.00	1.42	-8.63	3.76
5350	79	178	0.56	1.40	-8.70	3.56
5500	78	228	1.03	1.40	-10.11	3.57
5725	97	308	0.92	2.32	-9.27	4.05
5825	98	309	1.32	2.10	-9.63	4.07

5 GHz Horizontal and Vertical Uncorrelated directional Gain

WORST CASE

Frequency (MHz)	Degree		Gain (dBi)			UnCorrelated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	5G3	
5150	84	111	-11.38	-13.01	4.10	-0.47
5250	82	112	-16.56	-14.93	4.35	-0.33
5350	85	107	-17.26	-11.94	4.18	-0.46
5500	87	104	-9.45	-12.59	4.28	-0.23
5725	4	359	1.97	0.72	-7.08	-0.08
5825	85	39	-10.34	-10.44	3.72	-0.73

Frequency (MHz)	Degree		Gain (dBi)			UnCorrelated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	5G3	
5150	83	200	2.09	2.23	-17.41	0.42
5250	84	208	2.39	1.36	-20.77	0.16
5350	86	211	2.25	1.17	-23.22	-0.01
5500	87	211	1.80	1.39	-27.71	-0.16
5725	81	177	1.58	2.84	-20.72	0.51
5825	83	178	1.85	2.70	-29.21	0.54

6 GHz Horizontal and Vertical Correlated directional Gain

WORST CASE

Frequency (MHz)	Degree		Gain (dBi)			Correlated Gain (dBi) - H-Pol
	Theta	Phi	6G1	6G2	6G3	
5925	94	133	2.21	-17.47	2.12	3.85
6300	108	54	-3.10	-14.17	3.96	3.10
6500	166	168	0.73	-5.86	-1.00	3.15
6800	79	226	-5.37	-8.16	3.04	2.65
7125	37	58	-4.15	-0.64	-1.88	2.67

Frequency (MHz)	Degree		Gain (dBi)			Correlated Gain (dBi)-V-Pol
	Theta	Phi	6G1	6G2	6G3	
5925	112	328	2.00	2.68	-17.90	4.01
6300	99	148	2.98	1.46	-14.96	4.08
6500	90	227	2.65	0.14	-14.33	3.41
6800	107	230	1.78	1.59	-13.87	3.63
7125	108	227	2.76	0.41	-11.01	3.87

6 GHz Horizontal and Vertical Uncorrelated directional Gain

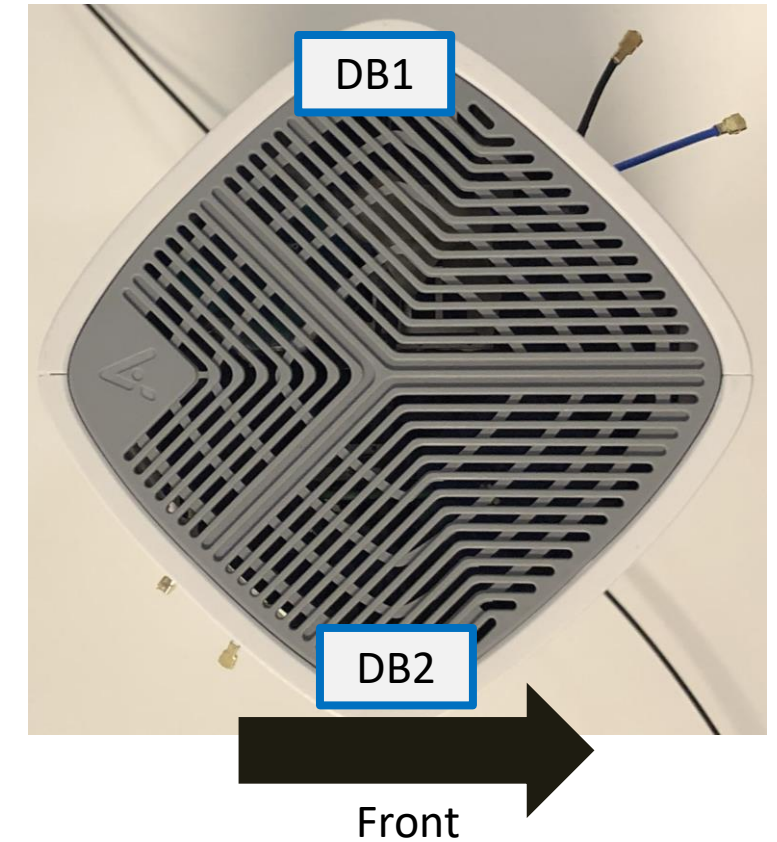
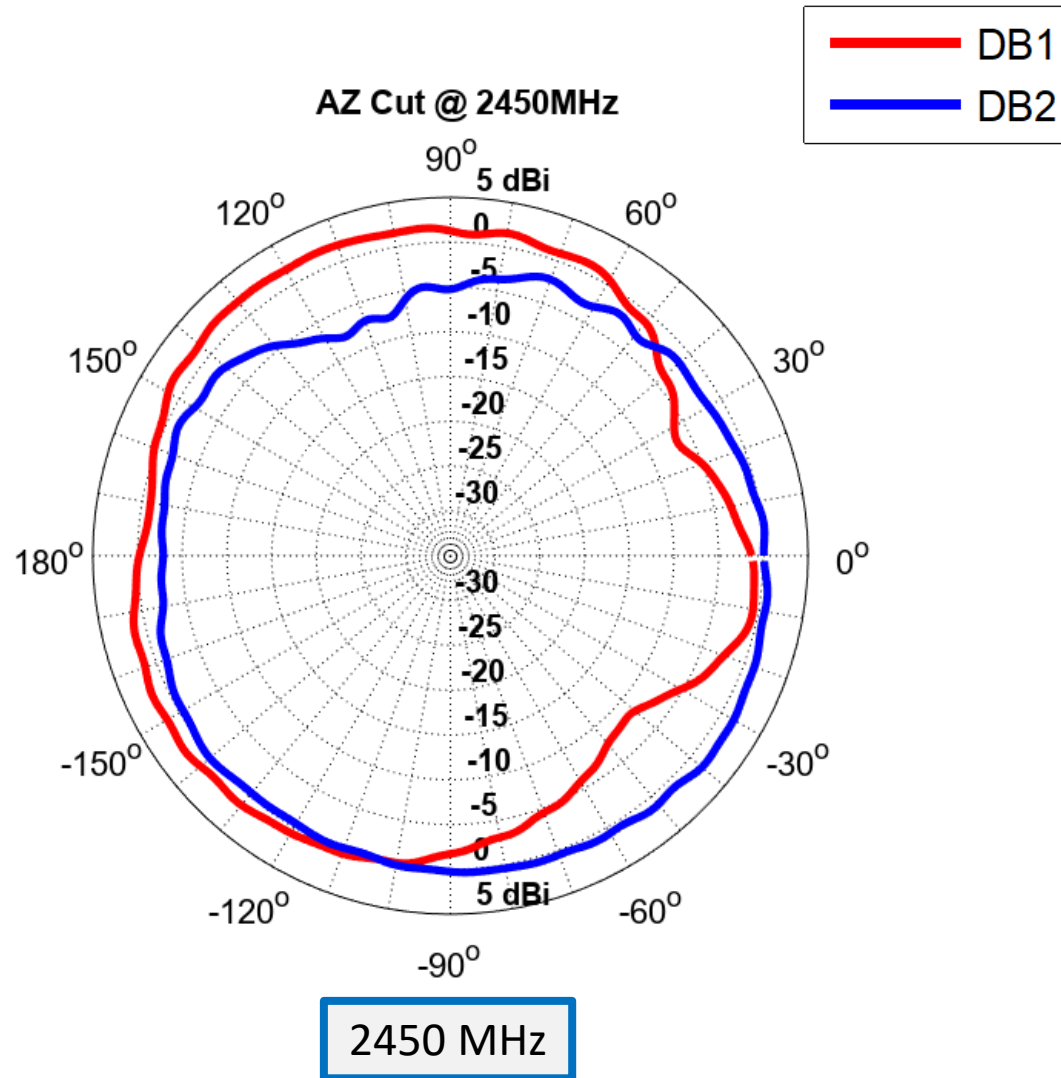
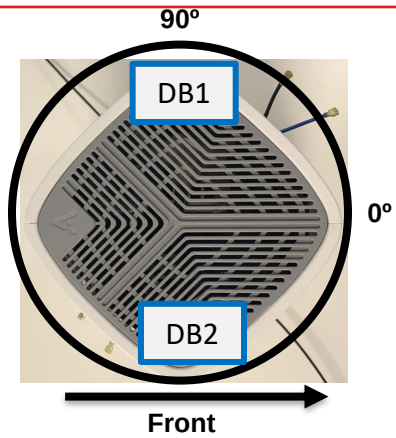
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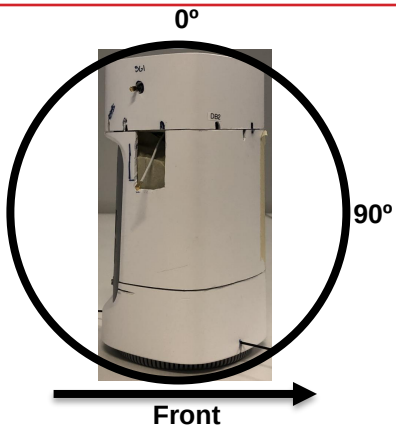
Frequency (MHz)	Degree		Gain (dBi)			UnCorrelated Gain (dBi) - H-Pol
	Theta	Phi	6G1	6G2	6G3	
5925	93	133	2.22	-18.09	2.17	0.45
6300	108	55	-2.90	-16.16	3.97	0.05
6500	109	52	-5.33	-13.00	3.76	-0.43
6800	80	226	-5.92	-7.95	3.15	-0.83
7125	85	240	-6.65	-5.18	2.08	-1.48

Frequency (MHz)	Degree		Gain (dBi)			UnCorrelated Gain (dBi)-V-Pol
	Theta	Phi	6G1	6G2	6G3	
5925	111	329	1.95	2.80	-19.30	0.65
6300	97	147	2.92	1.68	-16.92	0.61
6500	99	64	-0.36	3.42	-18.56	0.19
6800	88	221	2.58	1.06	-16.86	0.15
7125	107	227	2.84	0.39	-11.98	0.11

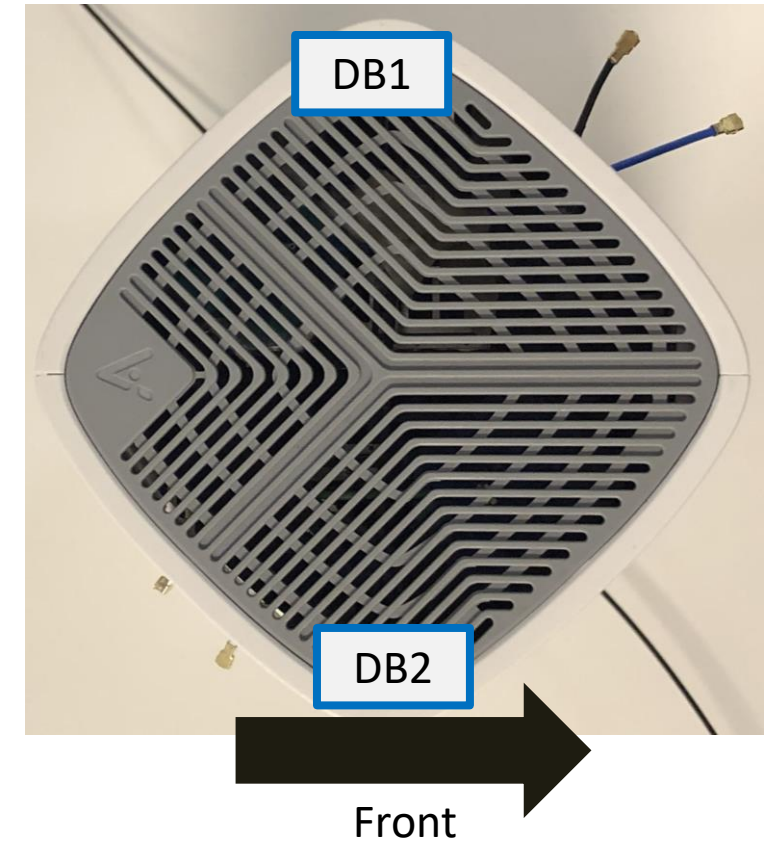
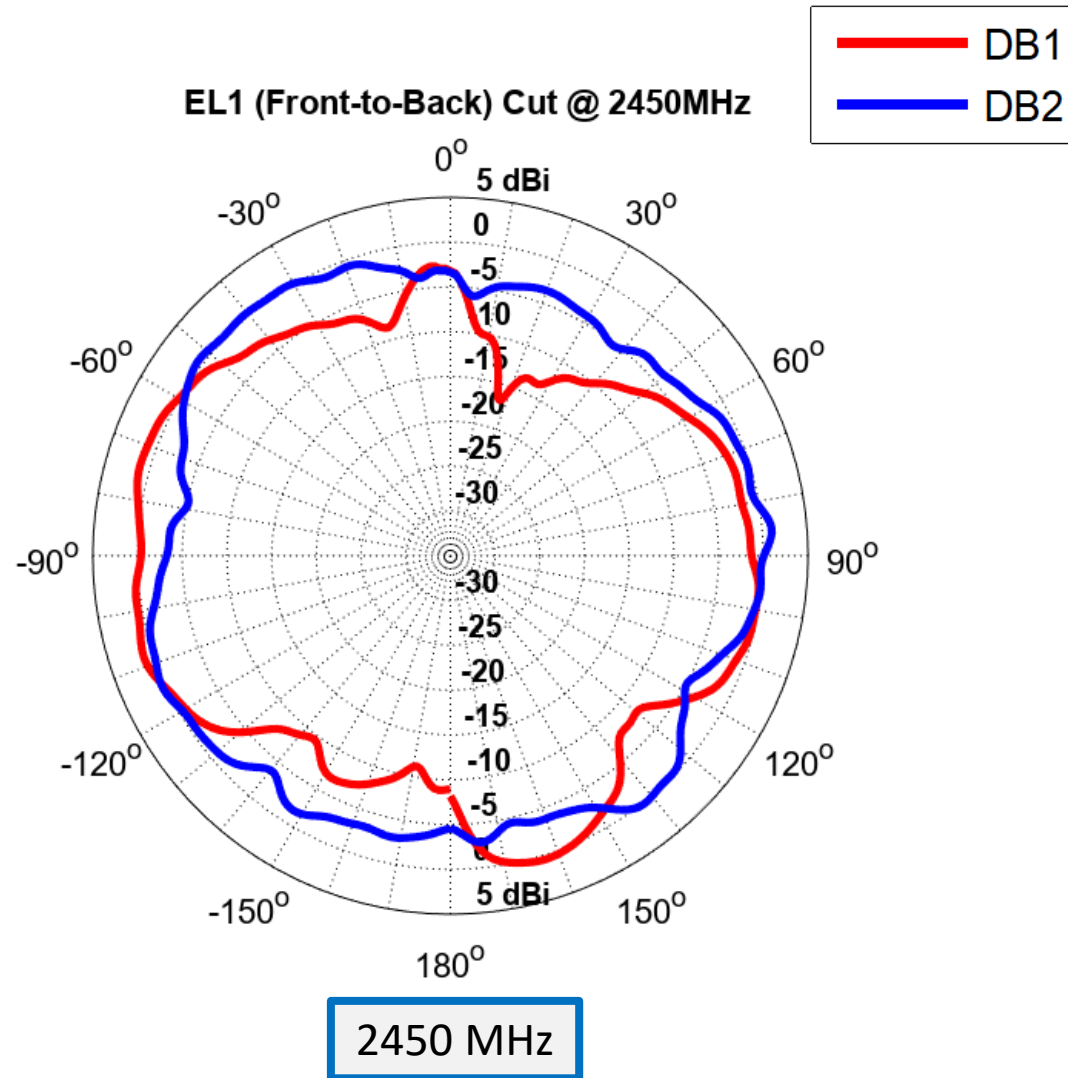
Azimuth Cut – Power Sum

System Coverage – 2.45 GHz Band

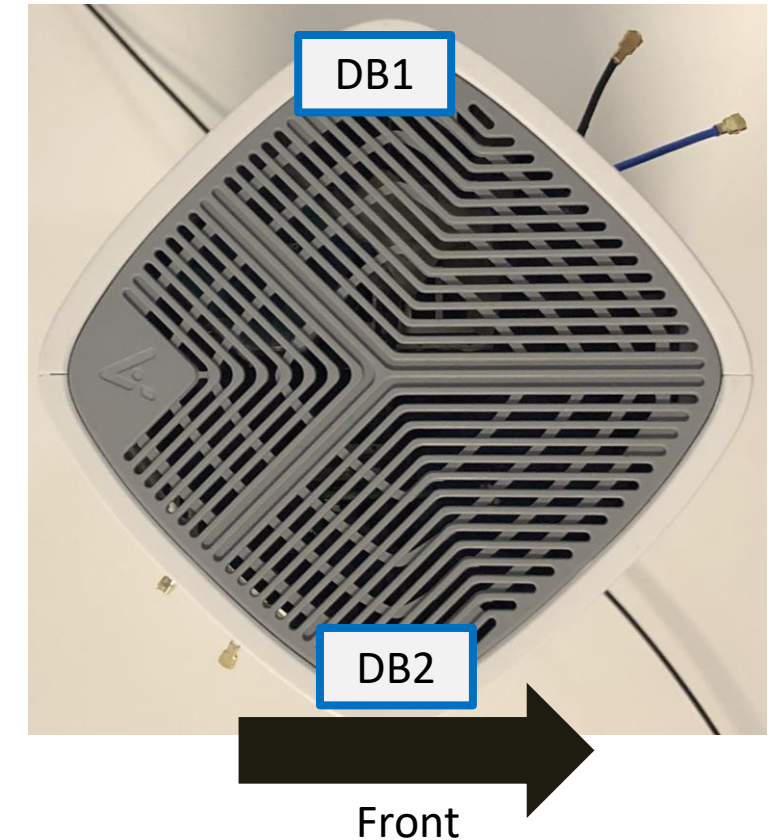
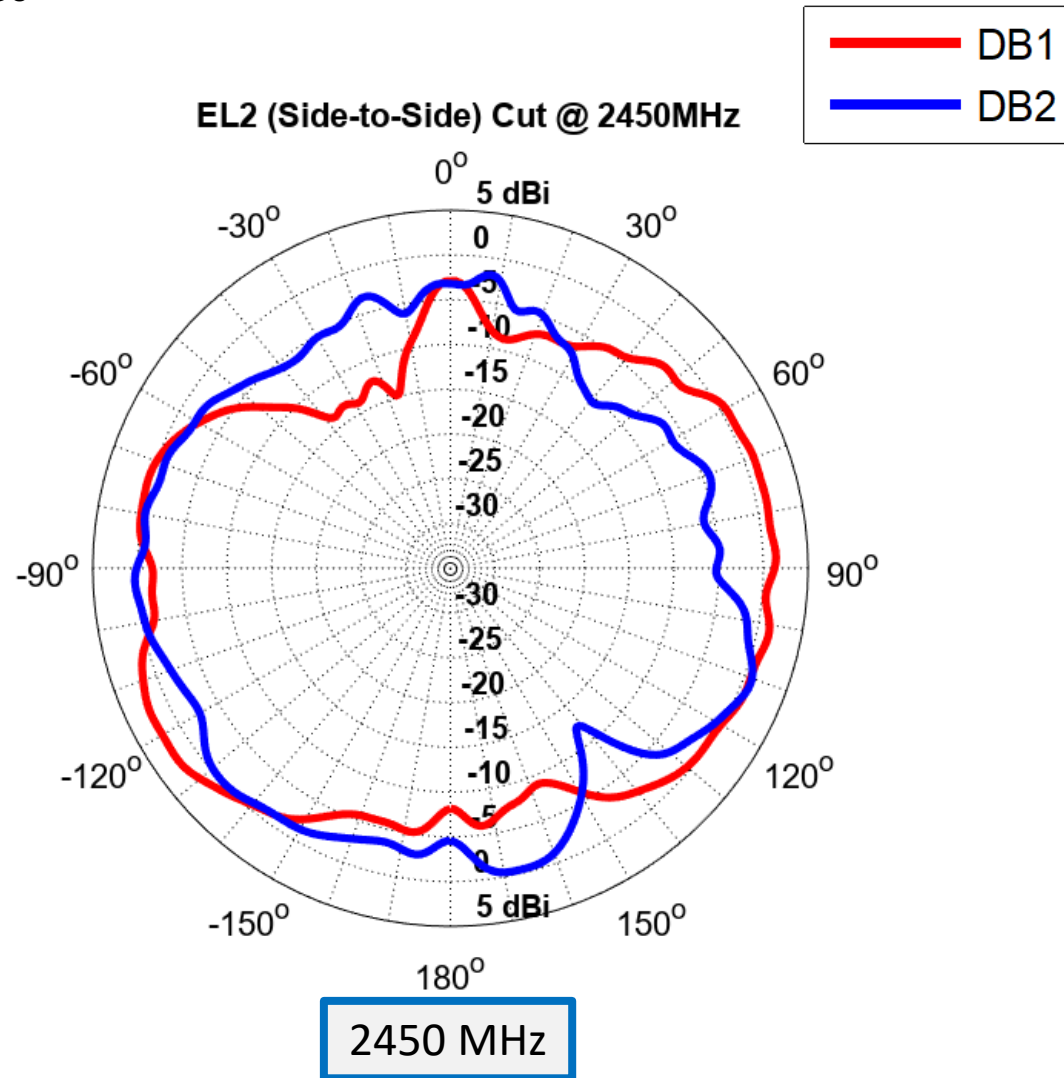
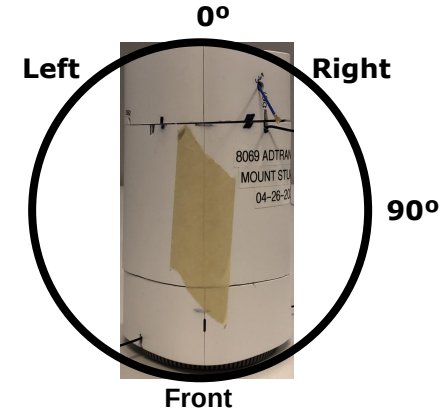




Elevation (Front to Back) Cut – Power Sum System Coverage – 2.45 GHz Band

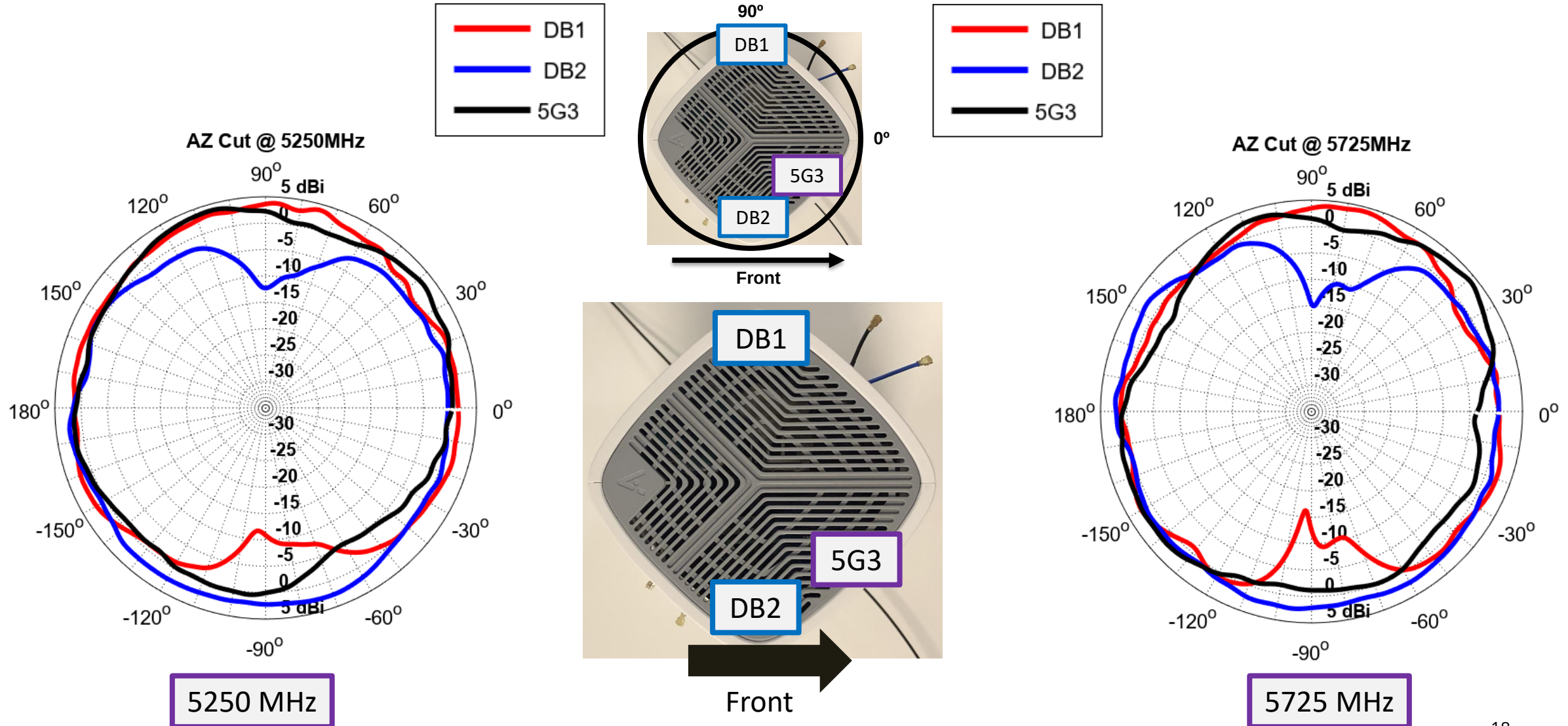


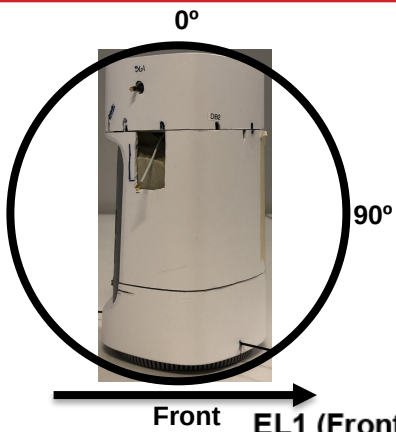
Elevation (Side to Side) Cut – Power Sum System Coverage – 2.45 GHz Band



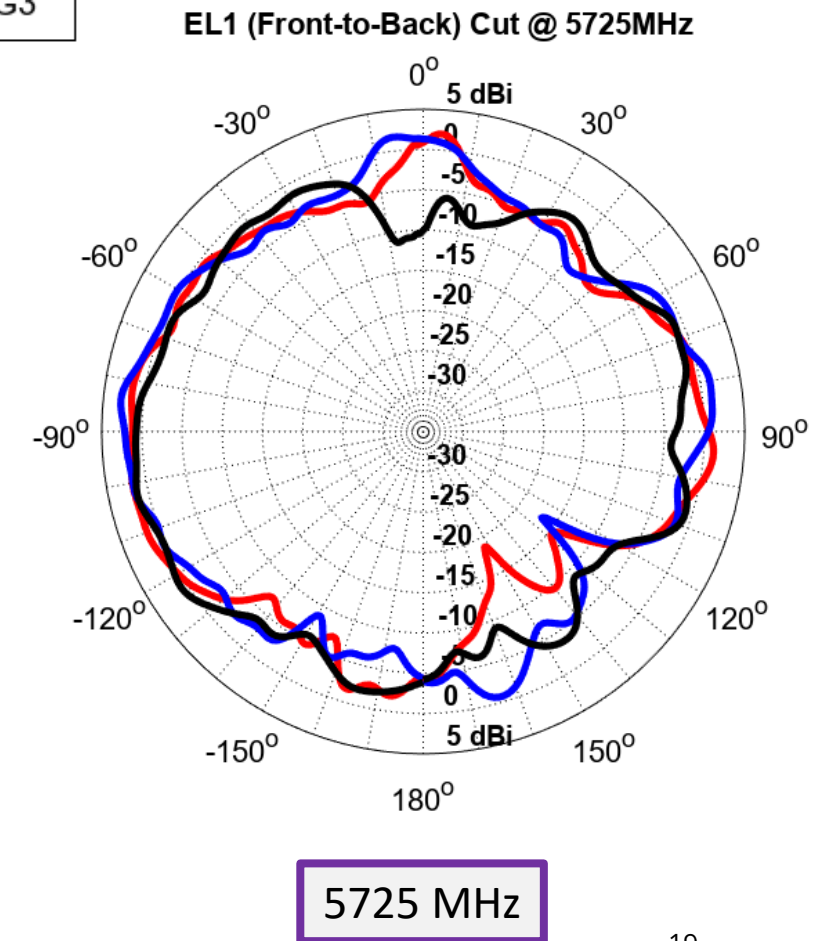
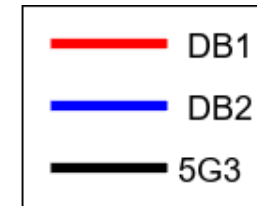
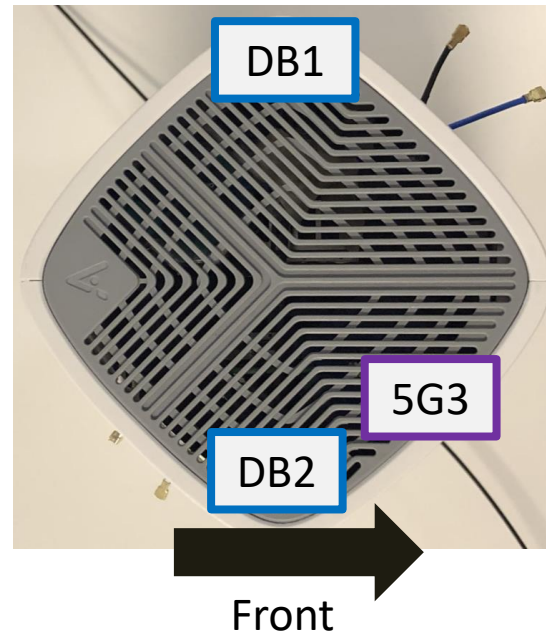
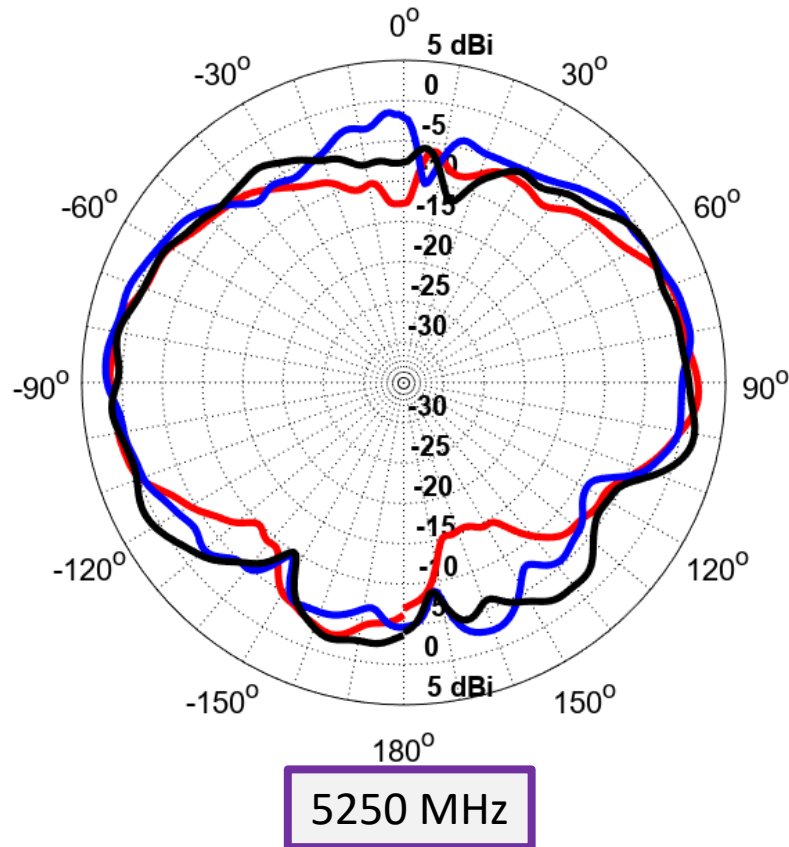
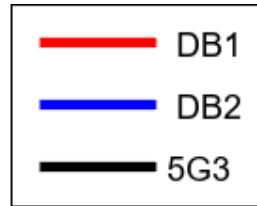
Azimuth Cut - Power Sum

System Coverage – 5 GHz Band

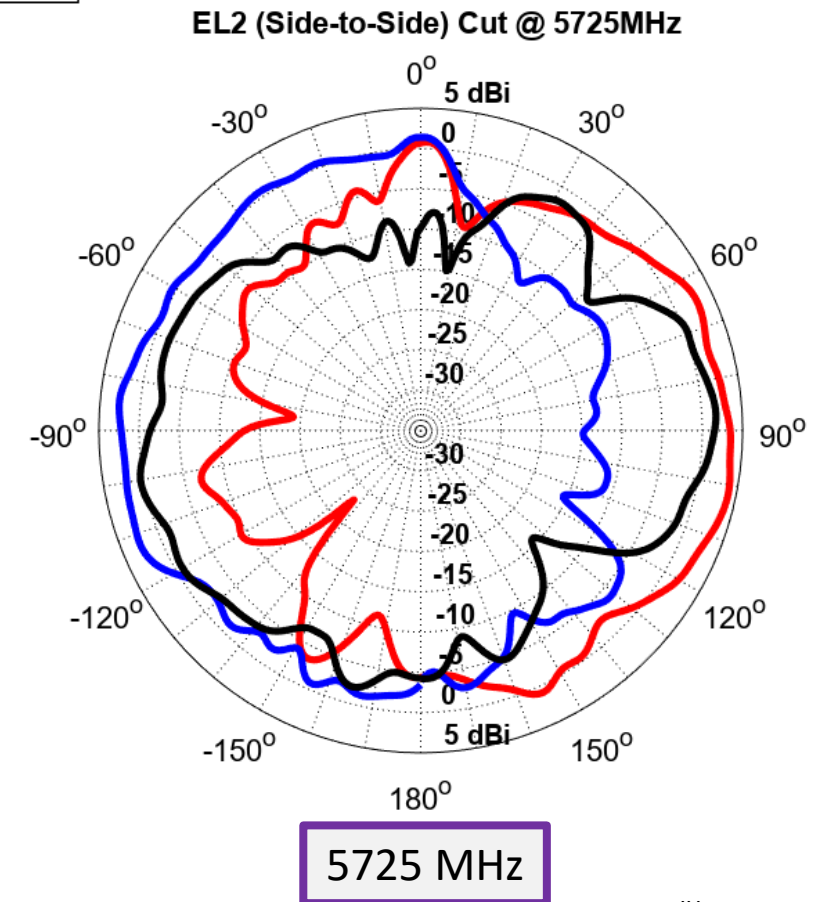
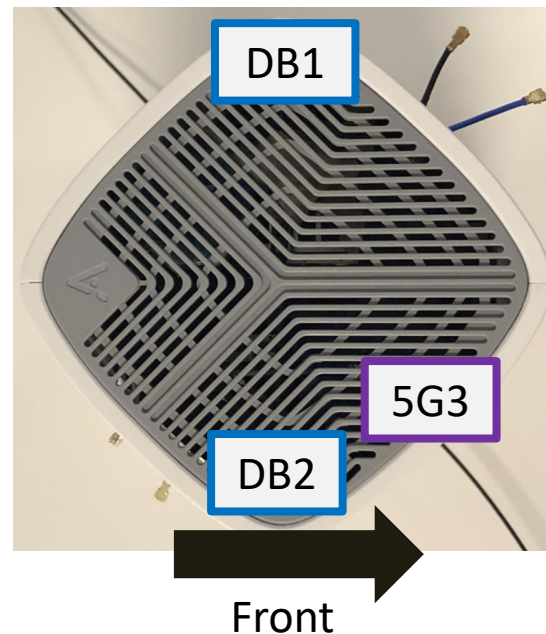
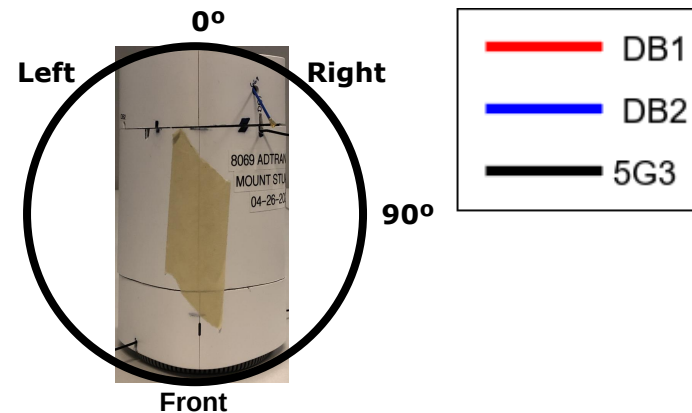
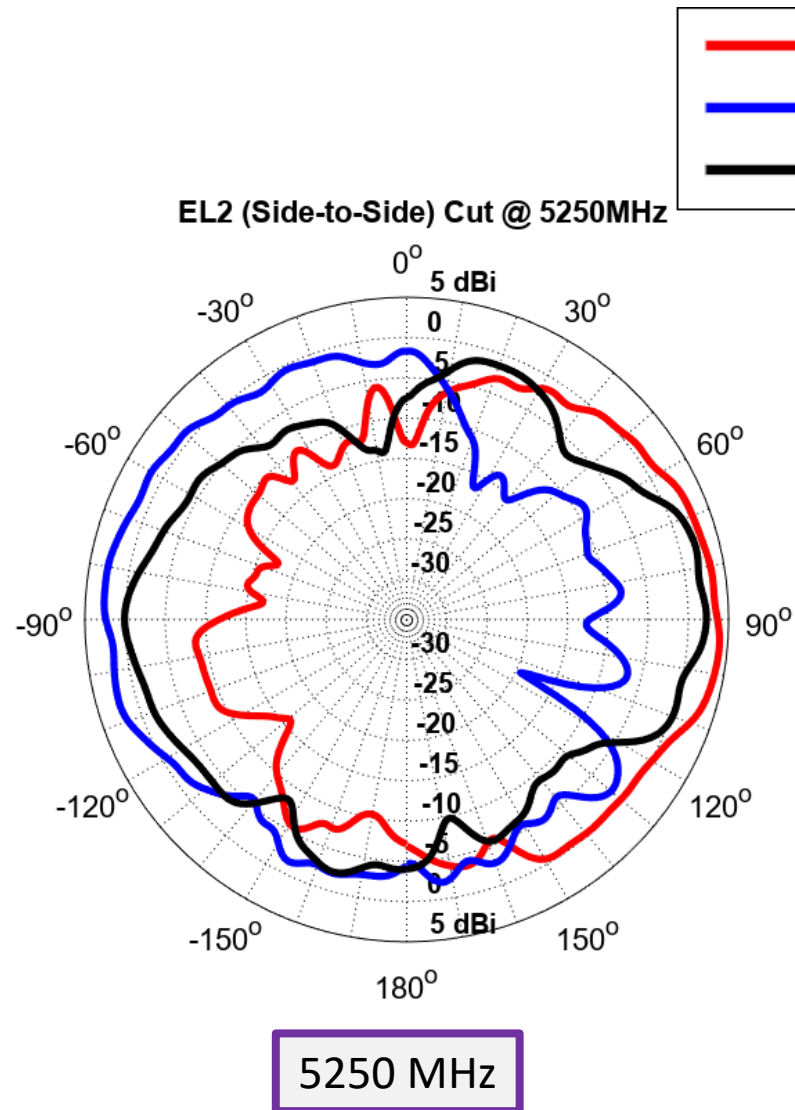




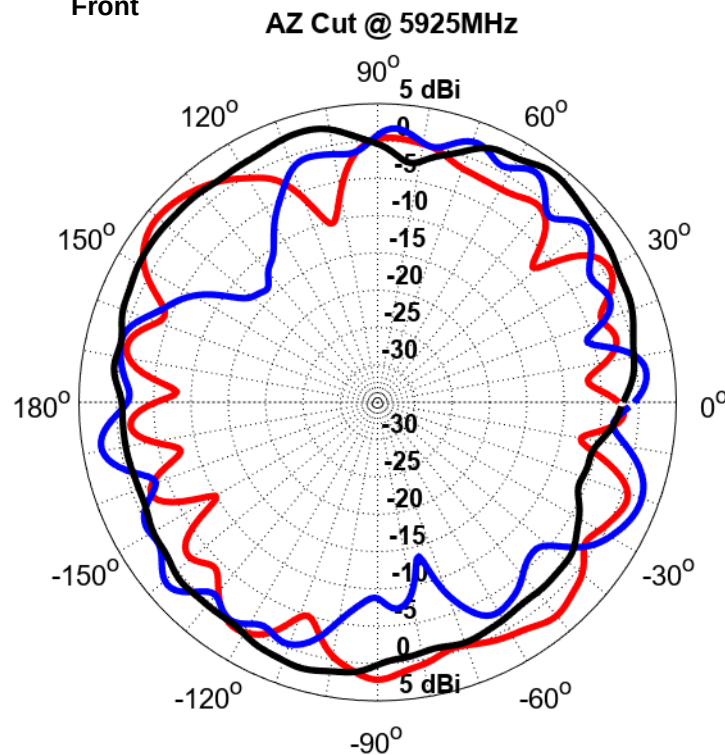
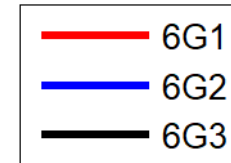
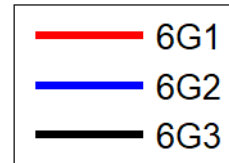
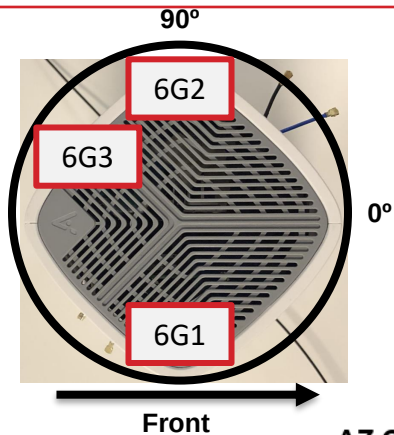
Elevation (Front to Back) Cut - Power Sum System Coverage – 5 GHz Band



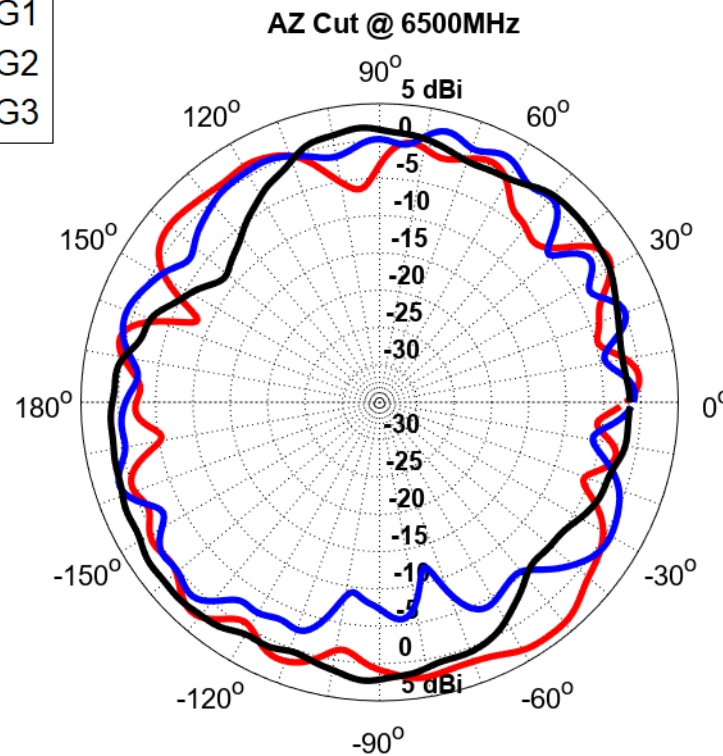
Elevation (Side to Side) Cut - Power Sum System Coverage – 5 GHz Band



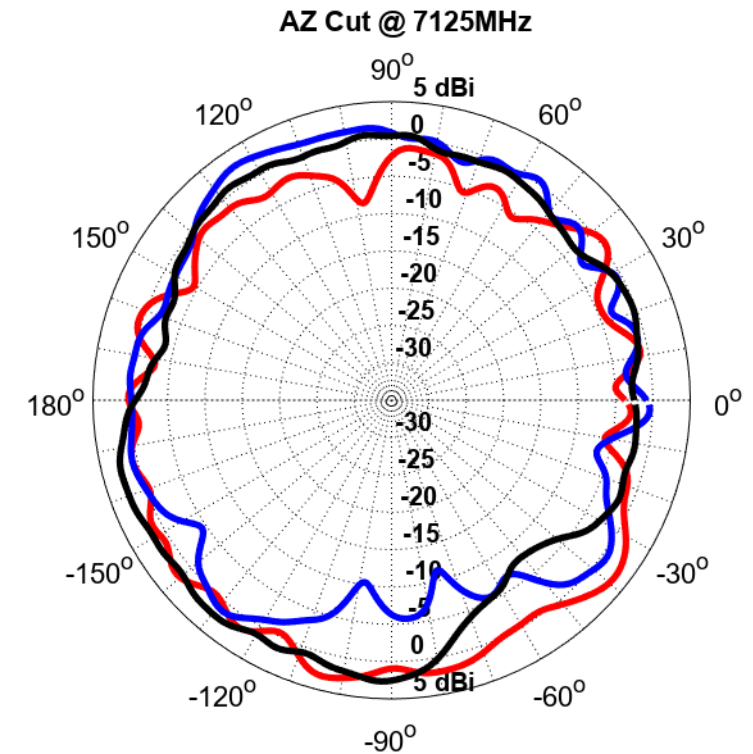
Azimuth Cut - Power Sum System Coverage – 6 GHz Band



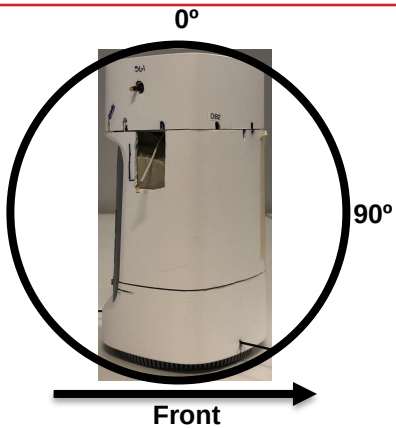
5925 MHz



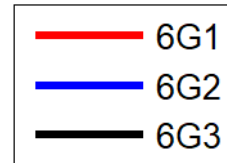
6500 MHz



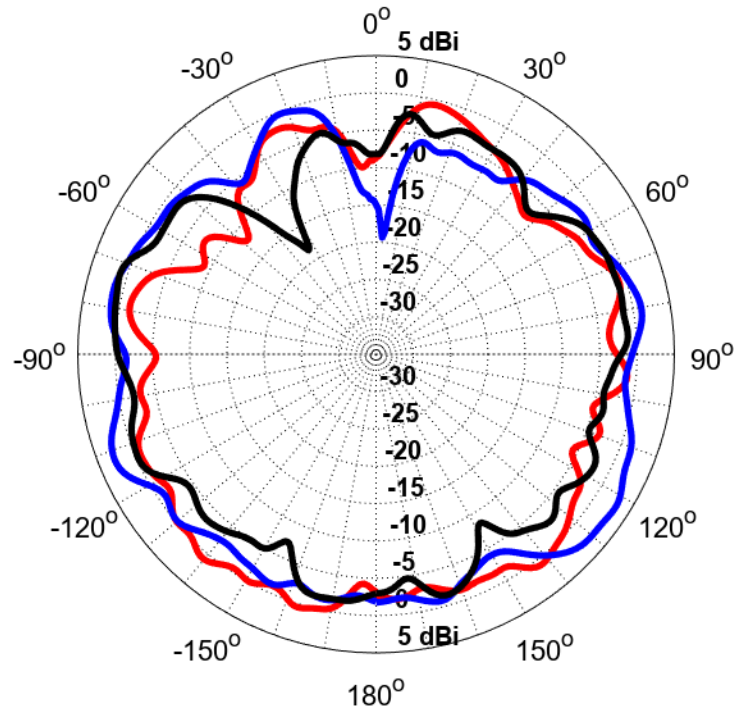
7125 MHz



Elevation (Front to Back) Cut - Power Sum System Coverage – 6 GHz Band

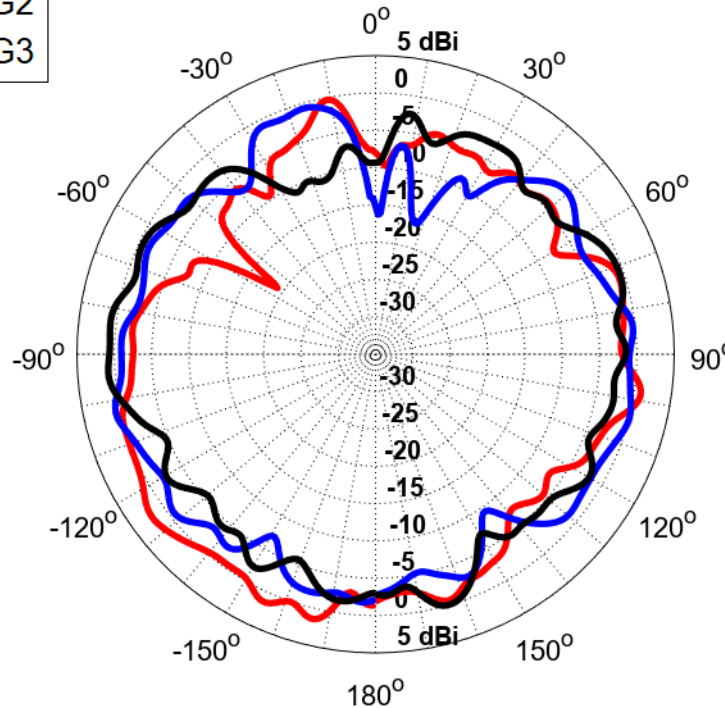


EL1 (Front-to-Back) Cut @ 5925MHz

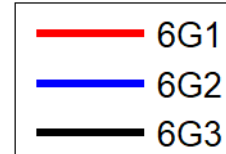


5925 MHz

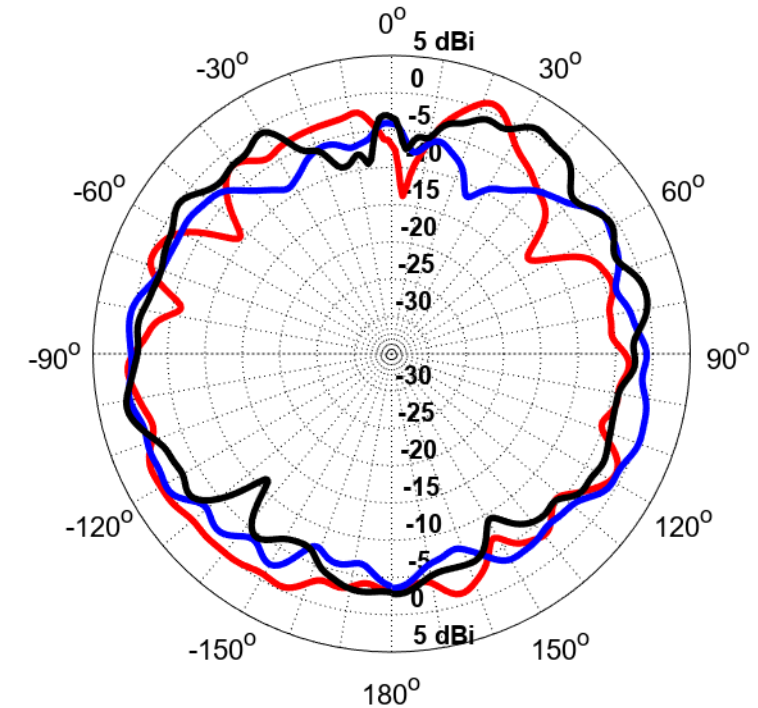
EL1 (Front-to-Back) Cut @ 6500MHz



6500 MHz

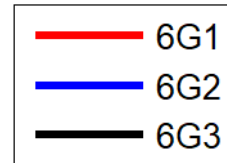
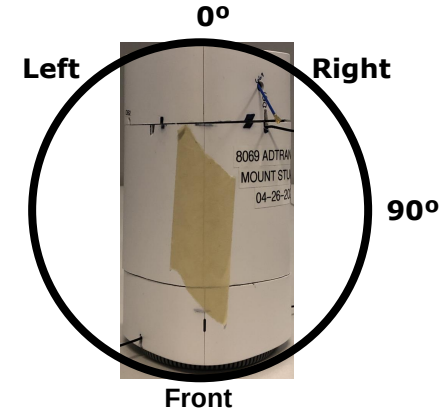


EL1 (Front-to-Back) Cut @ 7125MHz

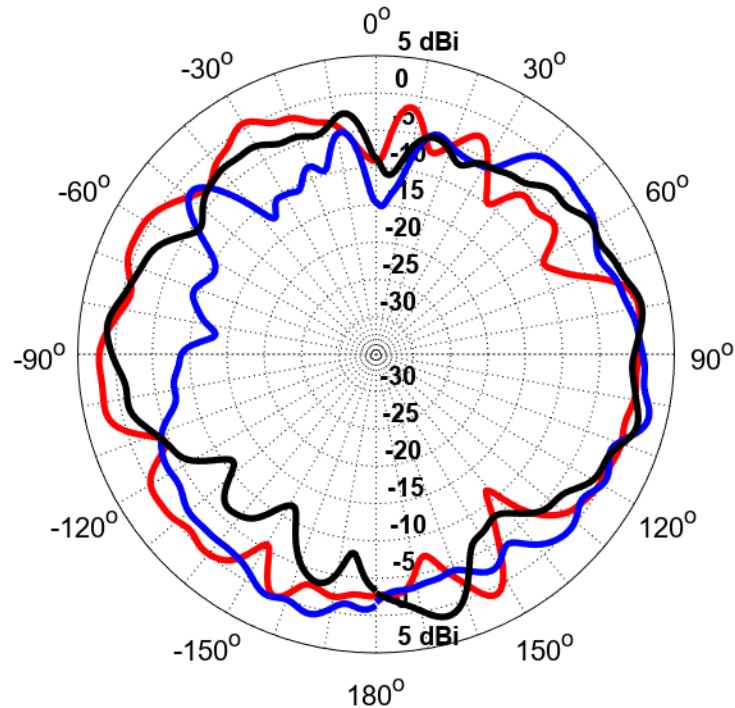


7125 MHz

Elevation (Side to Side) Cut - Power Sum System Coverage – 6 GHz Band

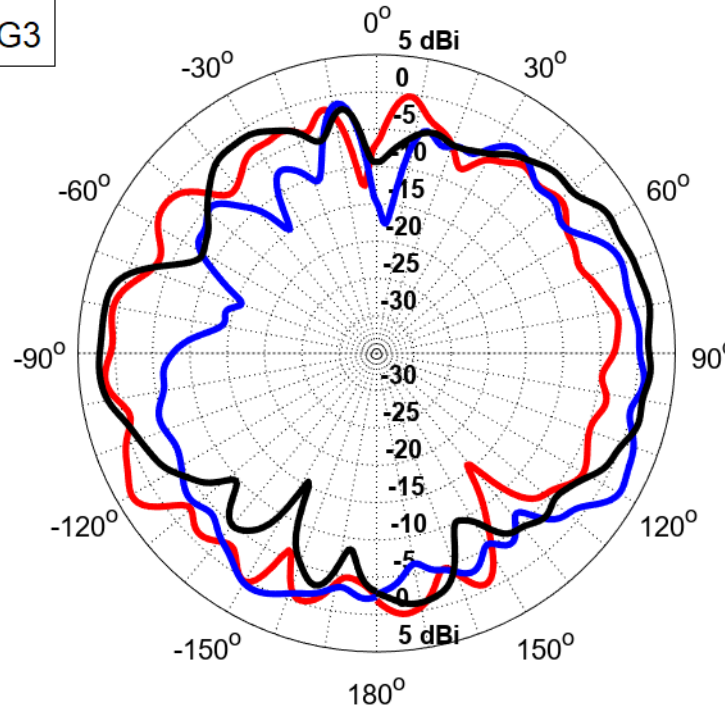


EL2 (Side-to-Side) Cut @ 5925MHz

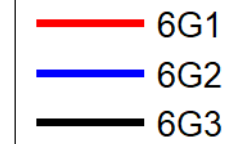


5925 MHz

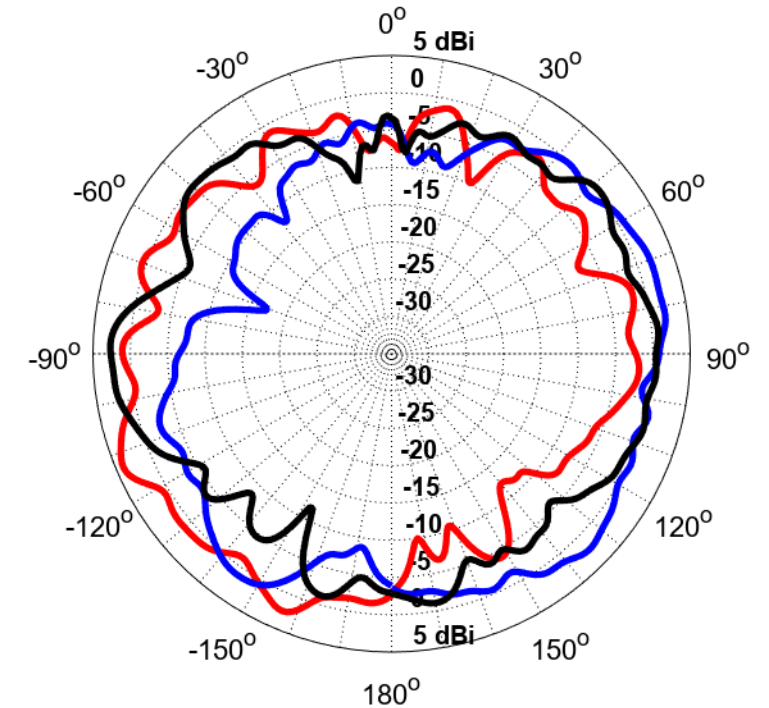
EL2 (Side-to-Side) Cut @ 6500MHz



6500 MHz

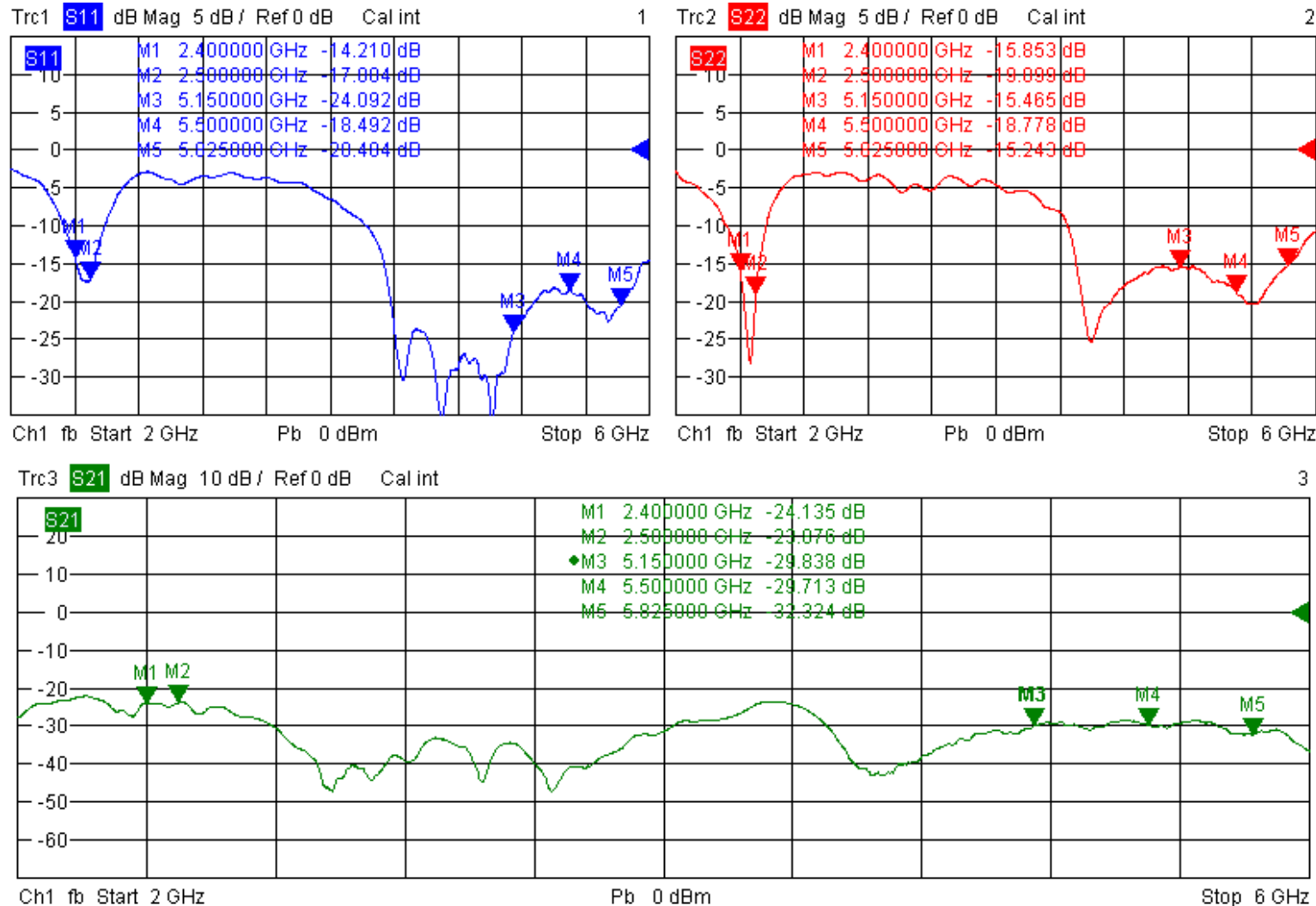


EL2 (Side-to-Side) Cut @ 7125MHz



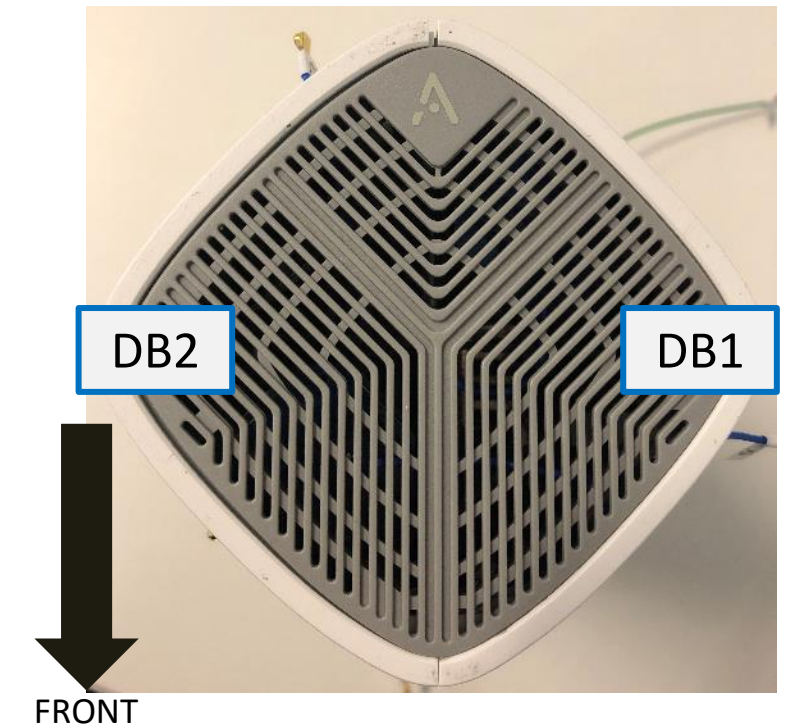
7125 MHz

Antenna Return Loss and Isolation of the DB Antennas



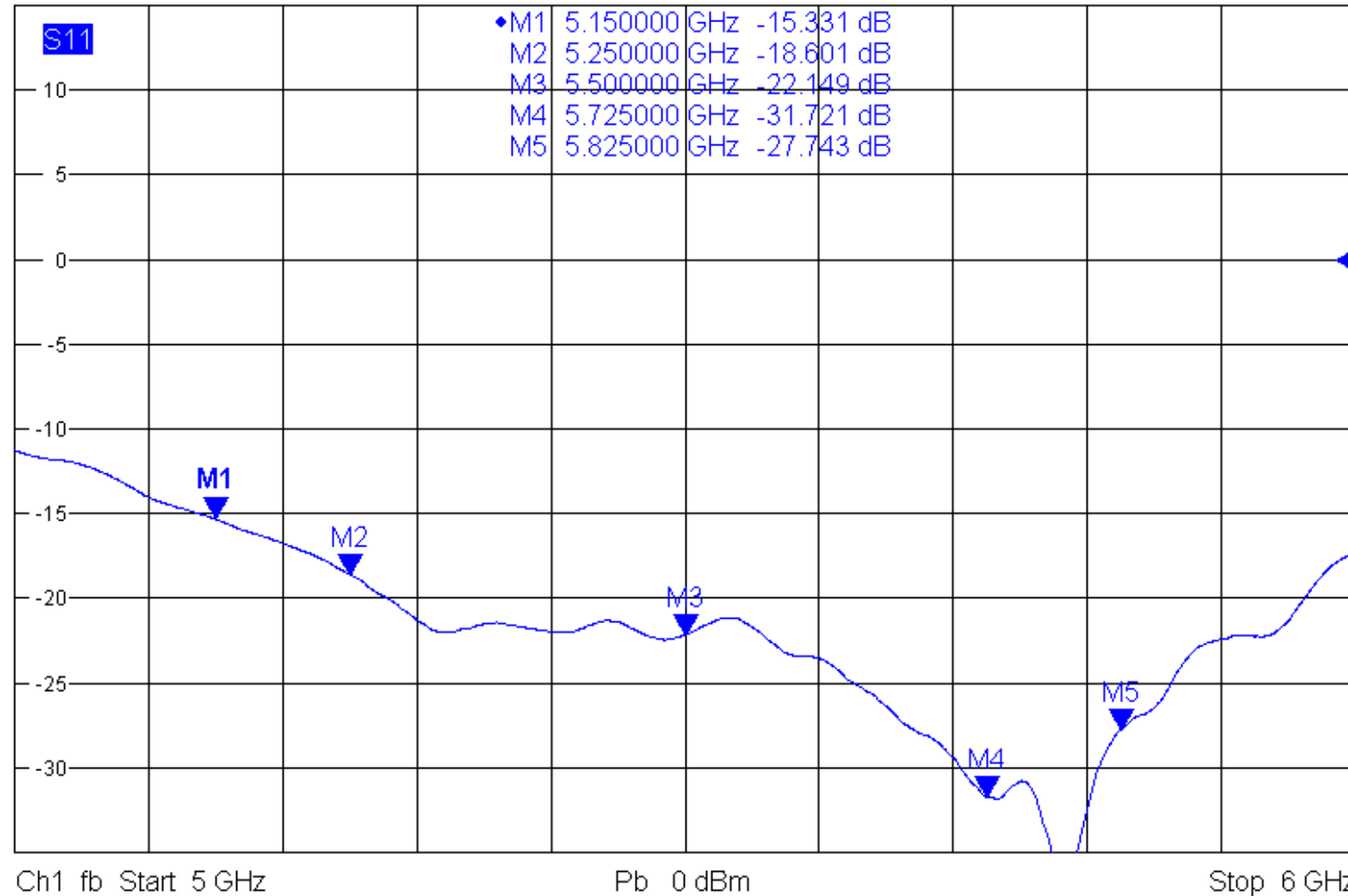
Port1= DB1

Port2 DB2

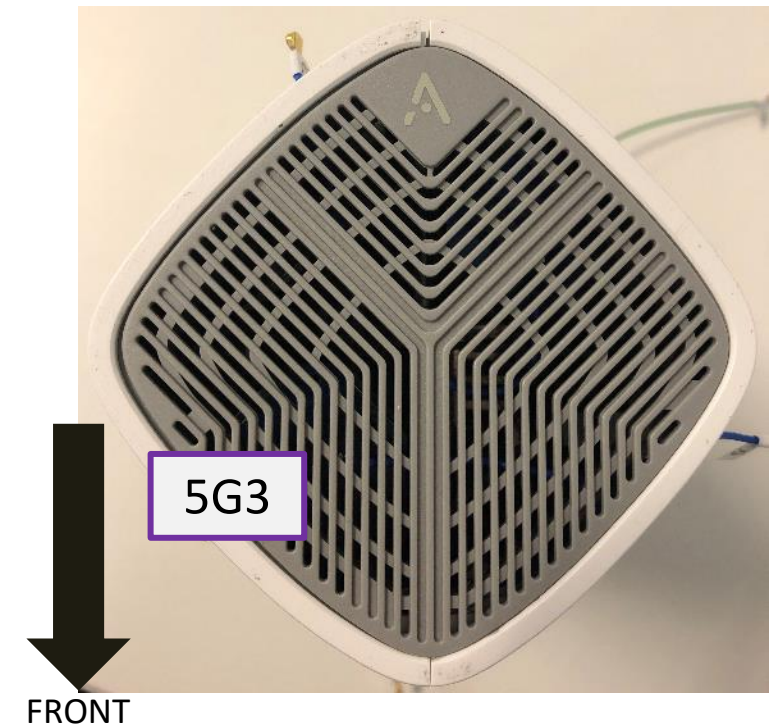


Antenna Return Loss of the 5 GHz Antenna

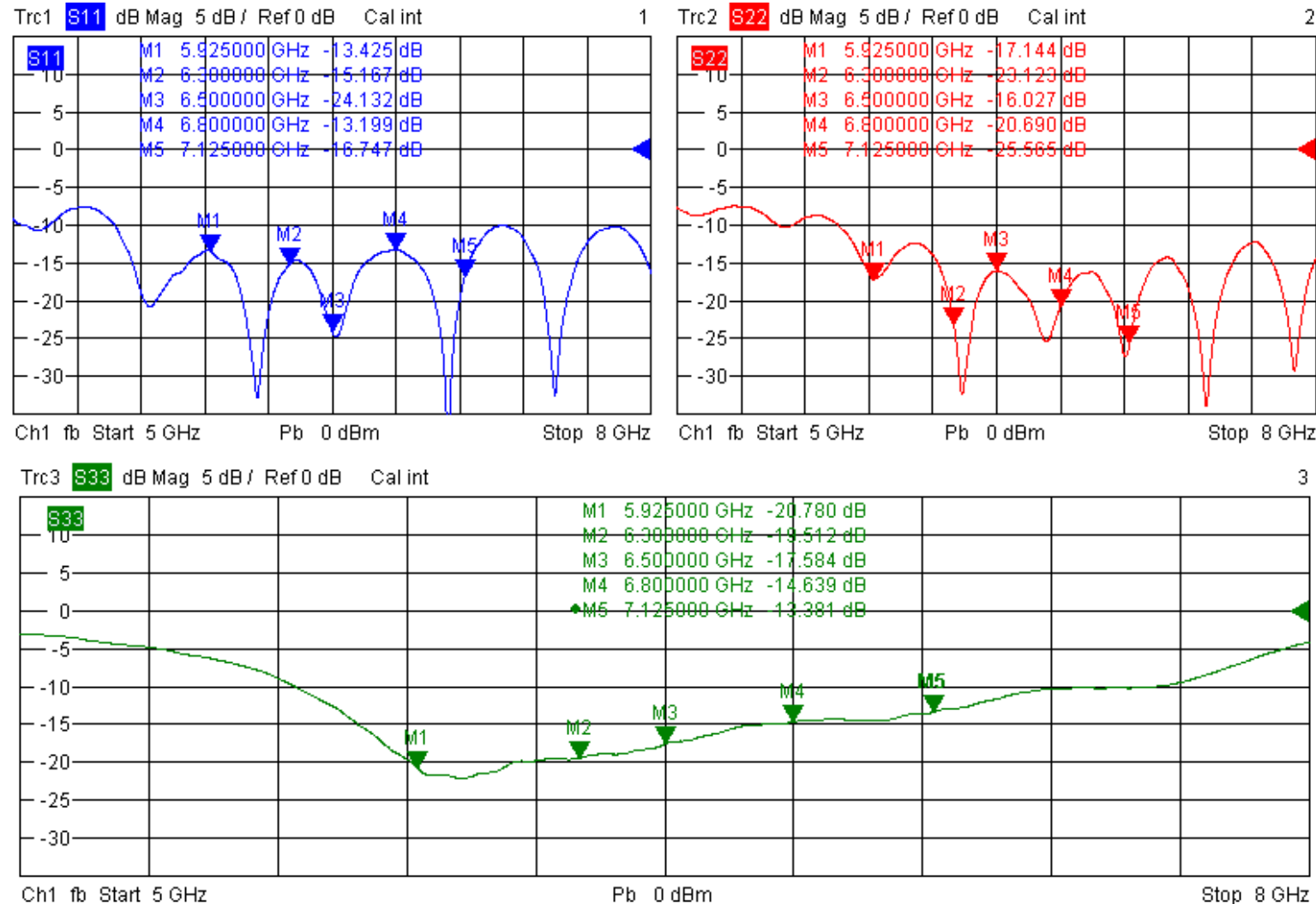
Trc1 S11 dB Mag 5 dB / Ref 0 dB Cal int



Port1 = 5G3

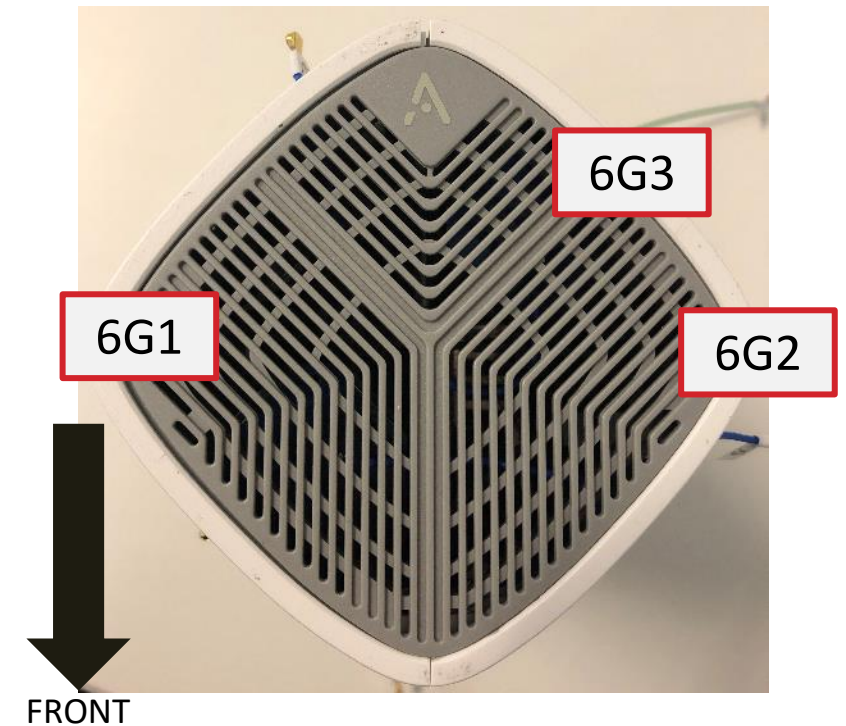


Antenna Return Loss of 6 GHz Antennas

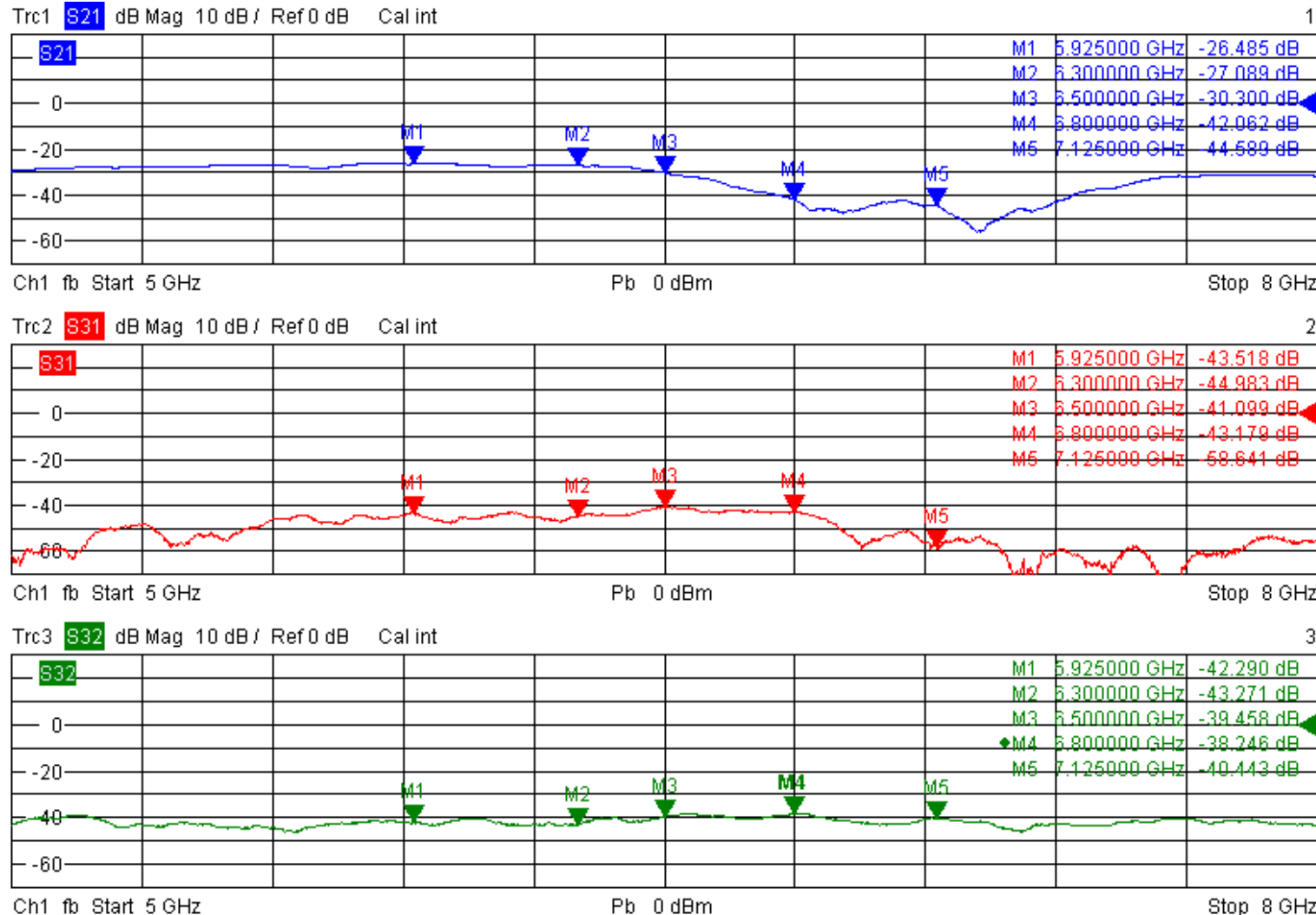


Port1= 6G1 Port2= 6G2

Port3= 6G3

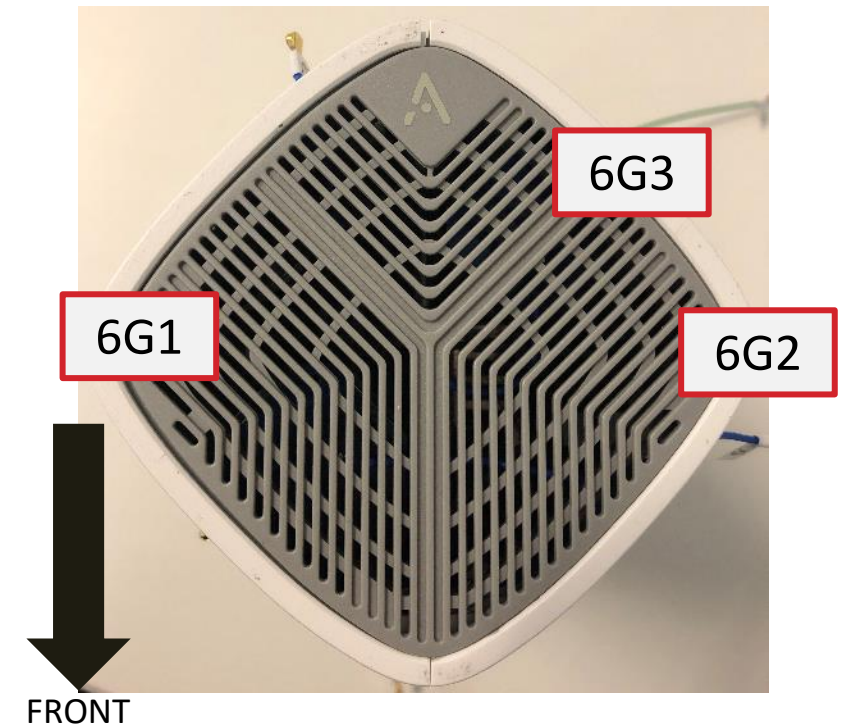


Antenna Isolation of 6 GHz Antennas



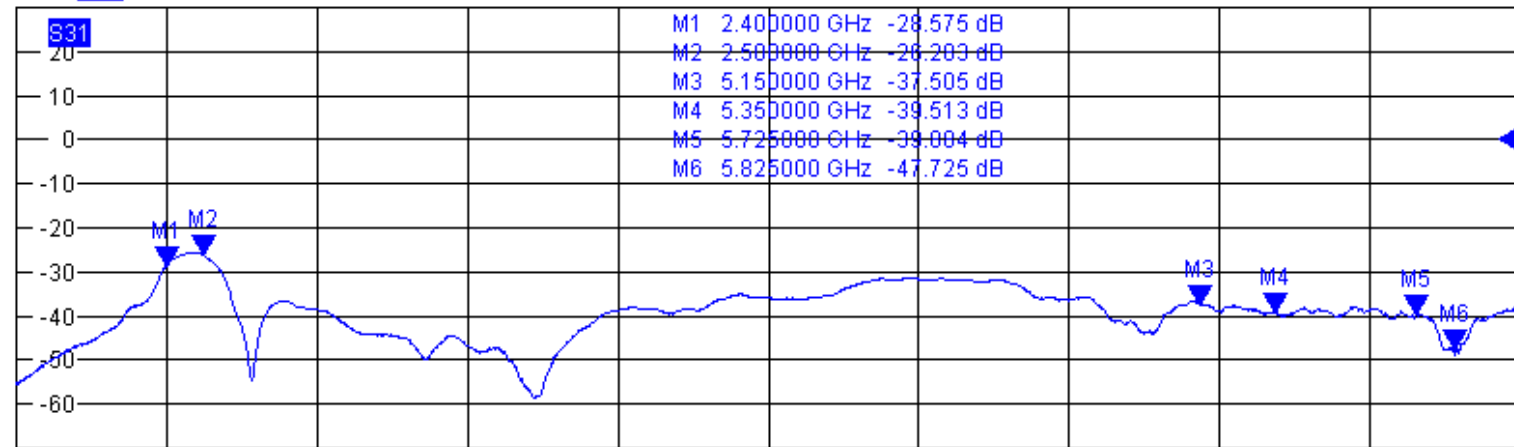
Port1= 6G1 Port2= 6G2

Port3= 6G3



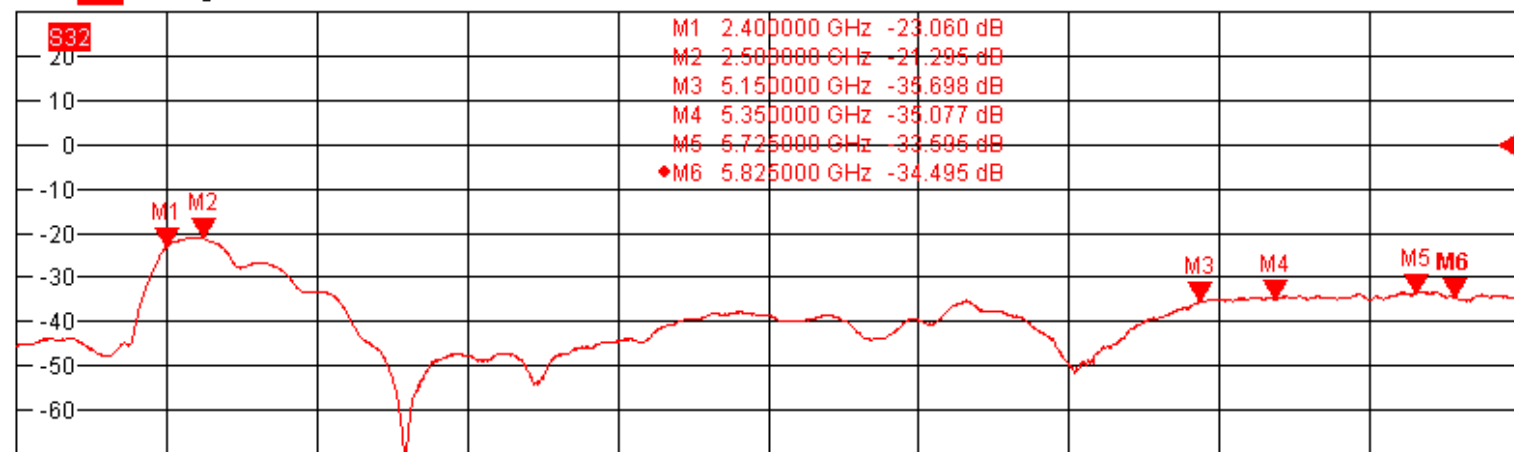
Antenna Isolation of DB and 5 GHz Antennas

Trc1 S31 dB Mag 10 dB / Ref 0 dB Cal int



Ch1 fb Start 2 GHz Pb 0 dBm Stop 6 GHz

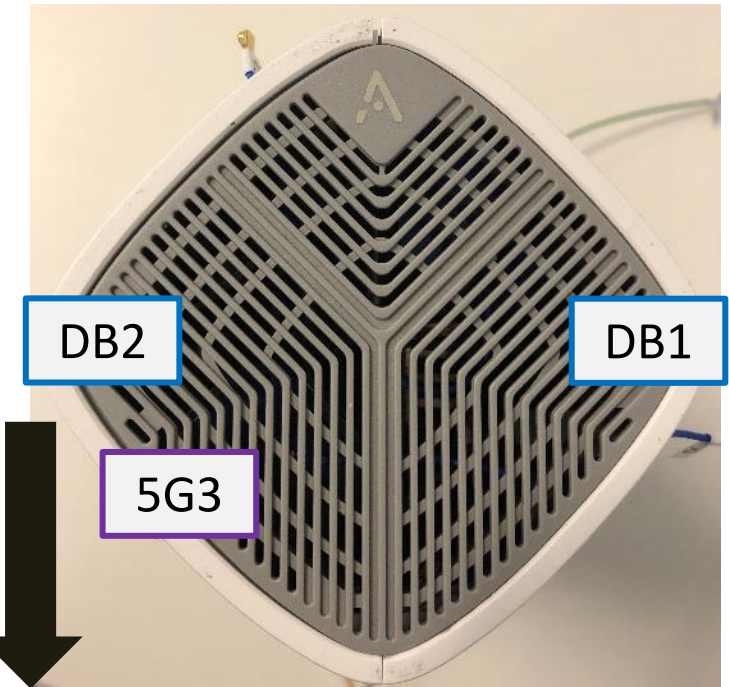
Trc2 S32 dB Mag 10 dB / Ref 0 dB Cal int



Ch1 fb Start 2 GHz Pb 0 dBm Stop 6 GHz

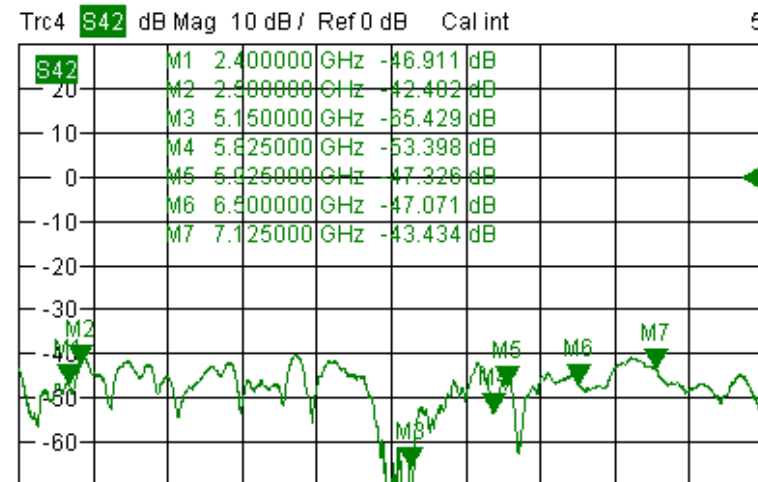
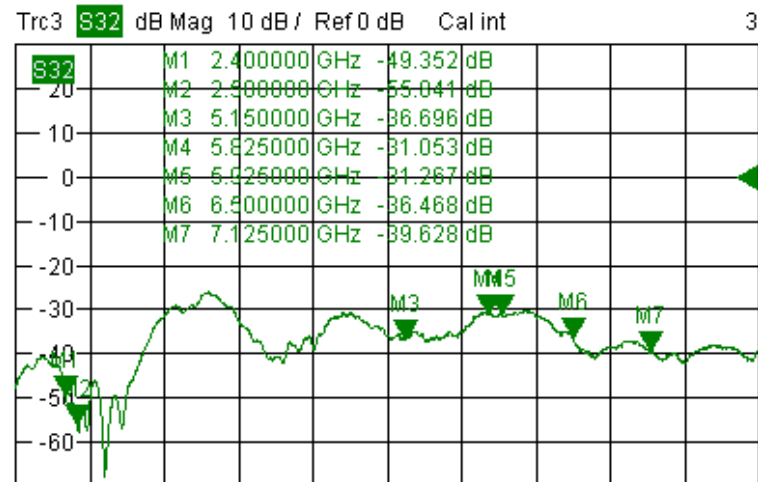
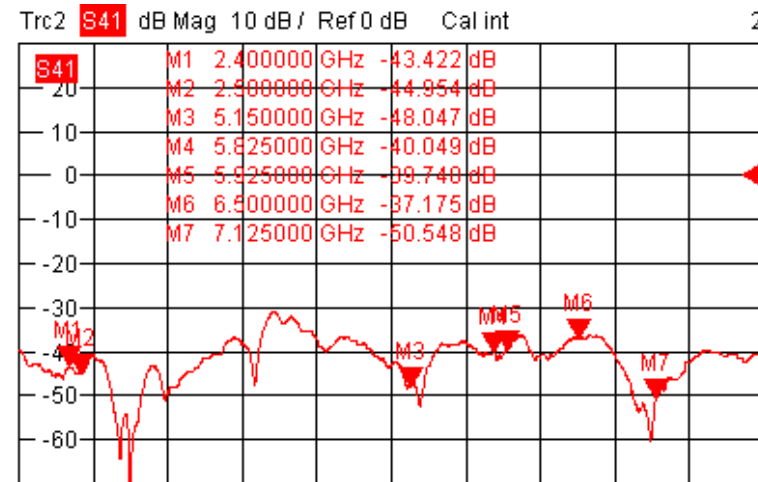
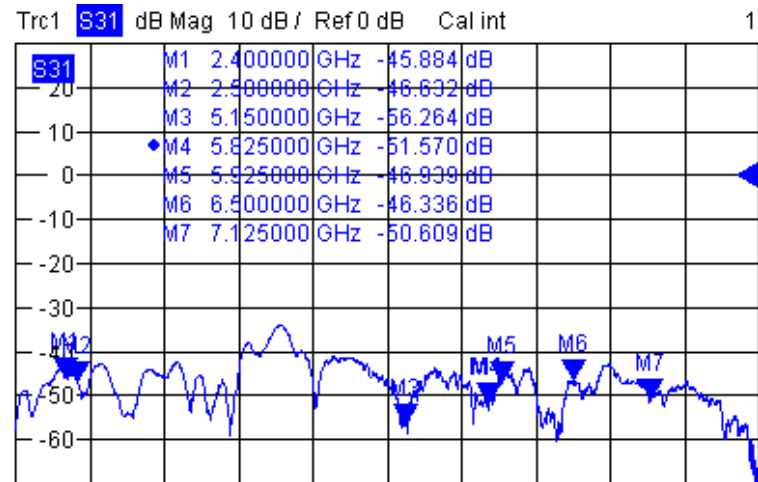
Port1= DB1 Port2 DB2

Port3= 5G3



FRONT

Antenna Isolation of DB and 6 GHz Antennas

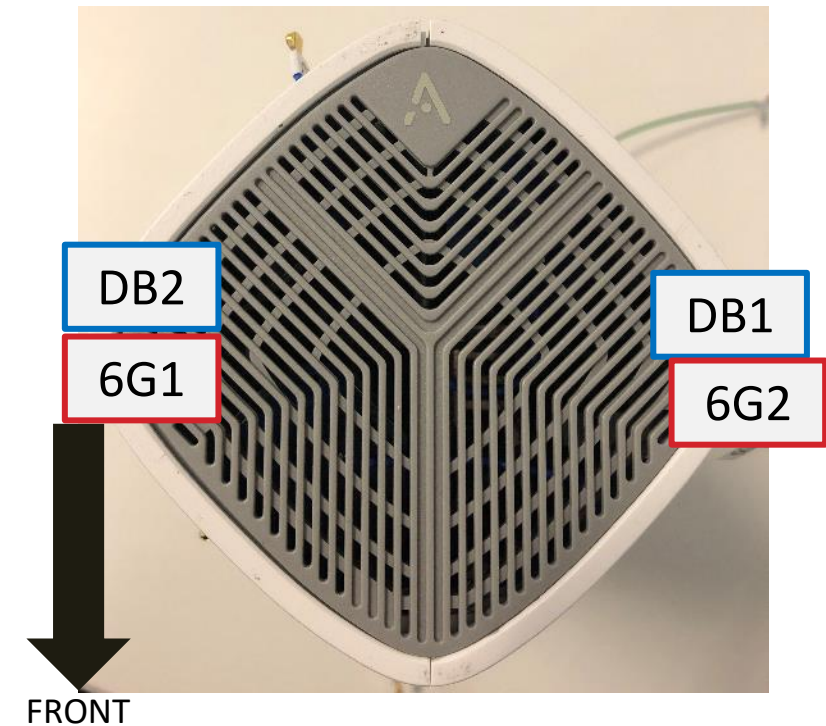


Port1= DB1

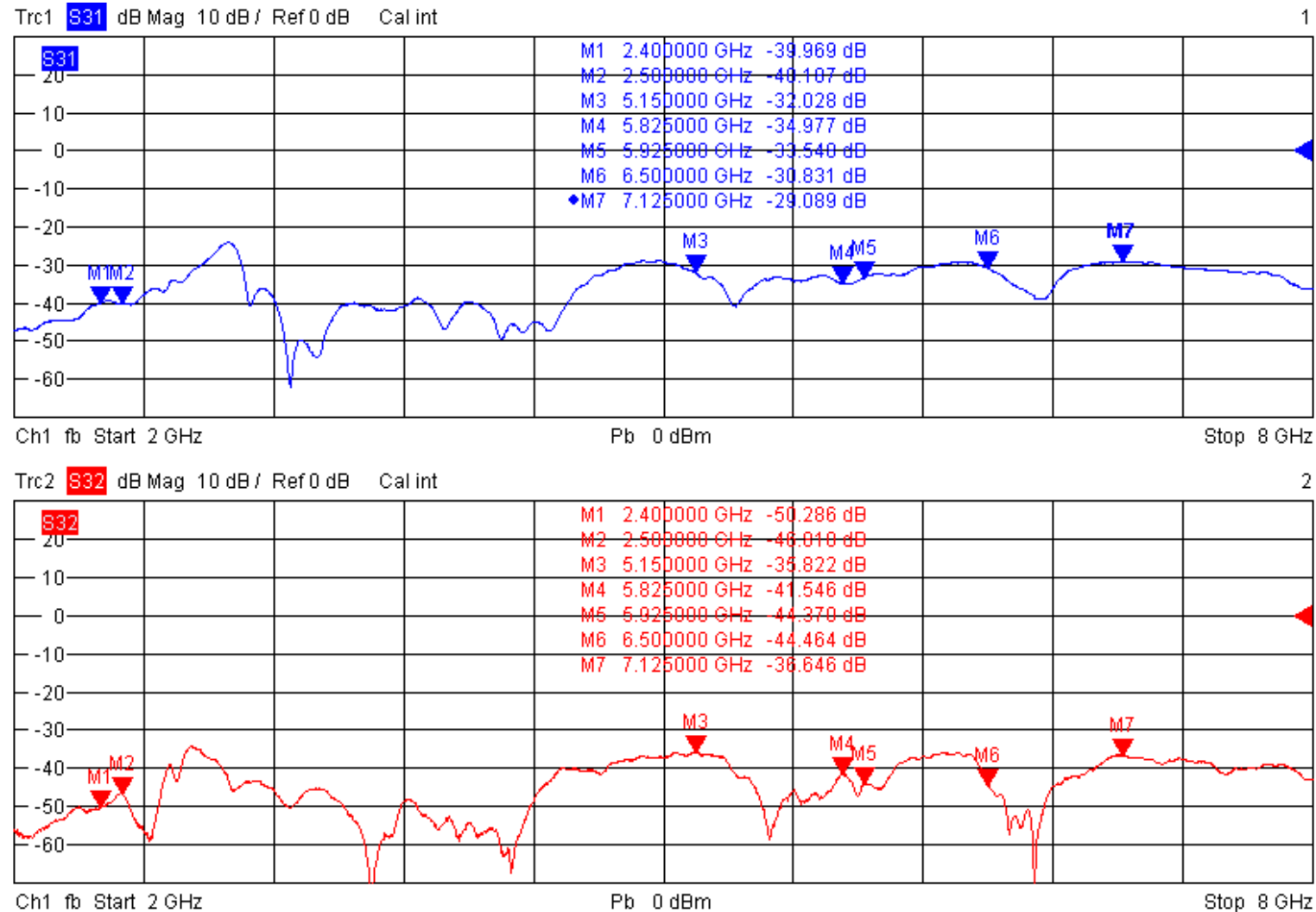
Port2= DB2

Port3= 6G1

Port4= 6G2

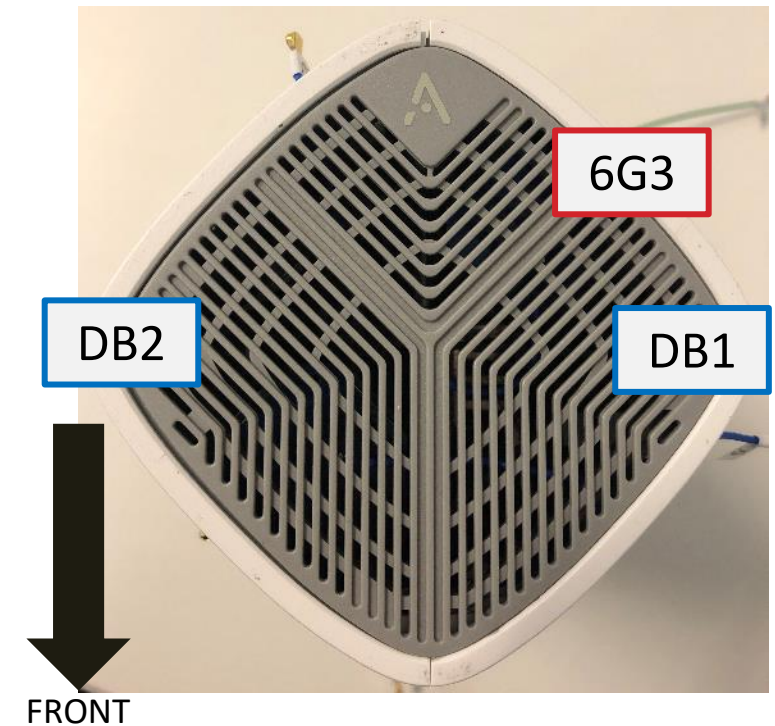


Antenna Isolation of DB and 6 GHz Antennas

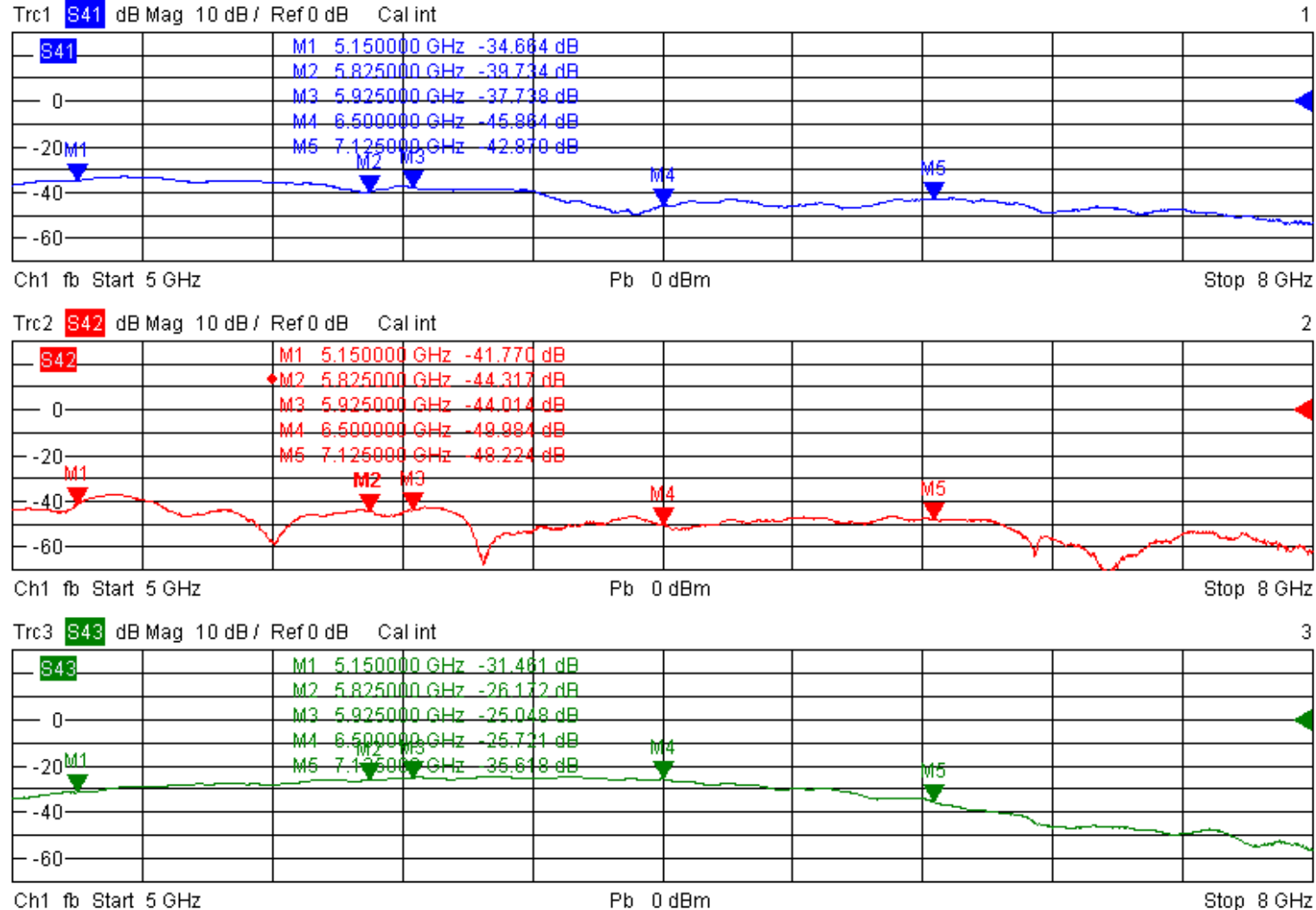


Port1= DB1 Port2 DB2

Port3= 6G3



Antenna Isolation of 5 GHz and 6 GHz Antennas

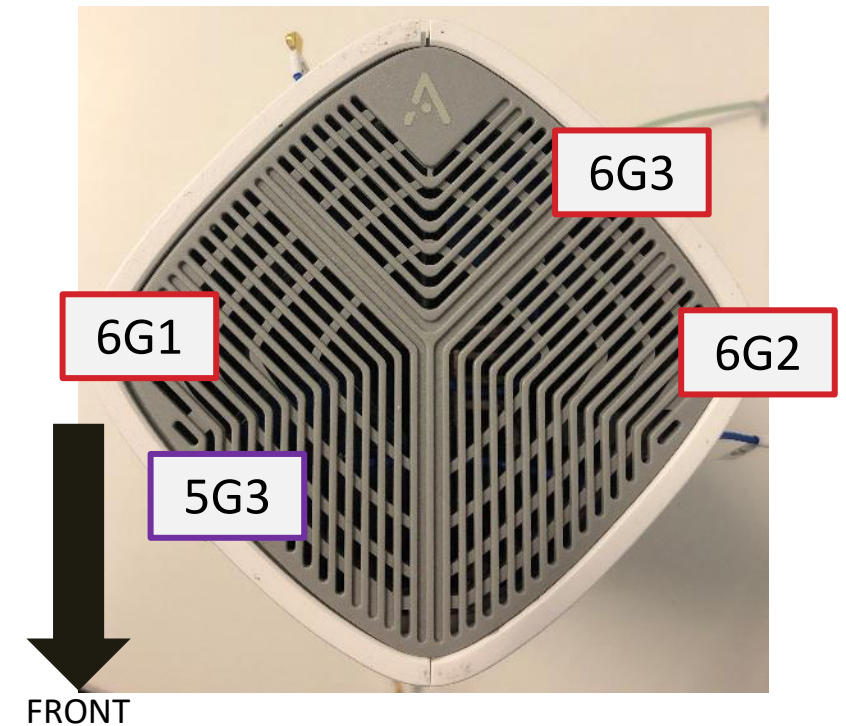


Port1 = 6G1

Port2 = 6G2

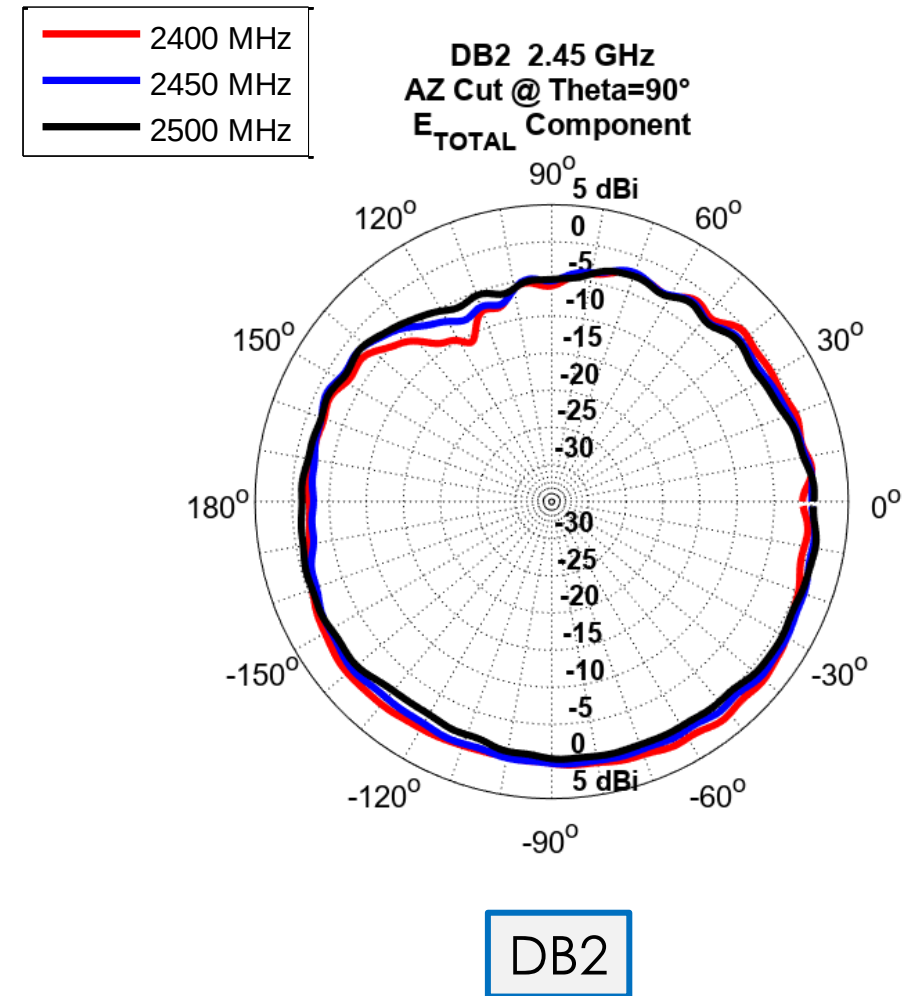
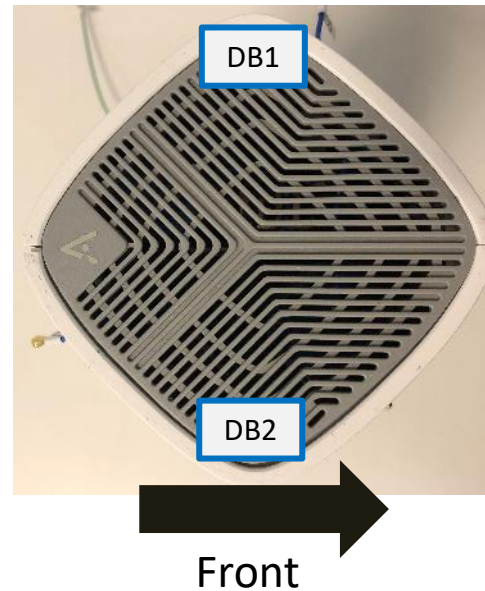
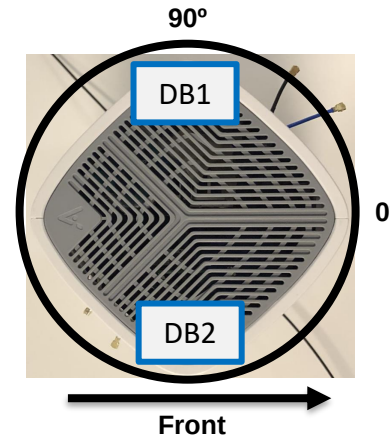
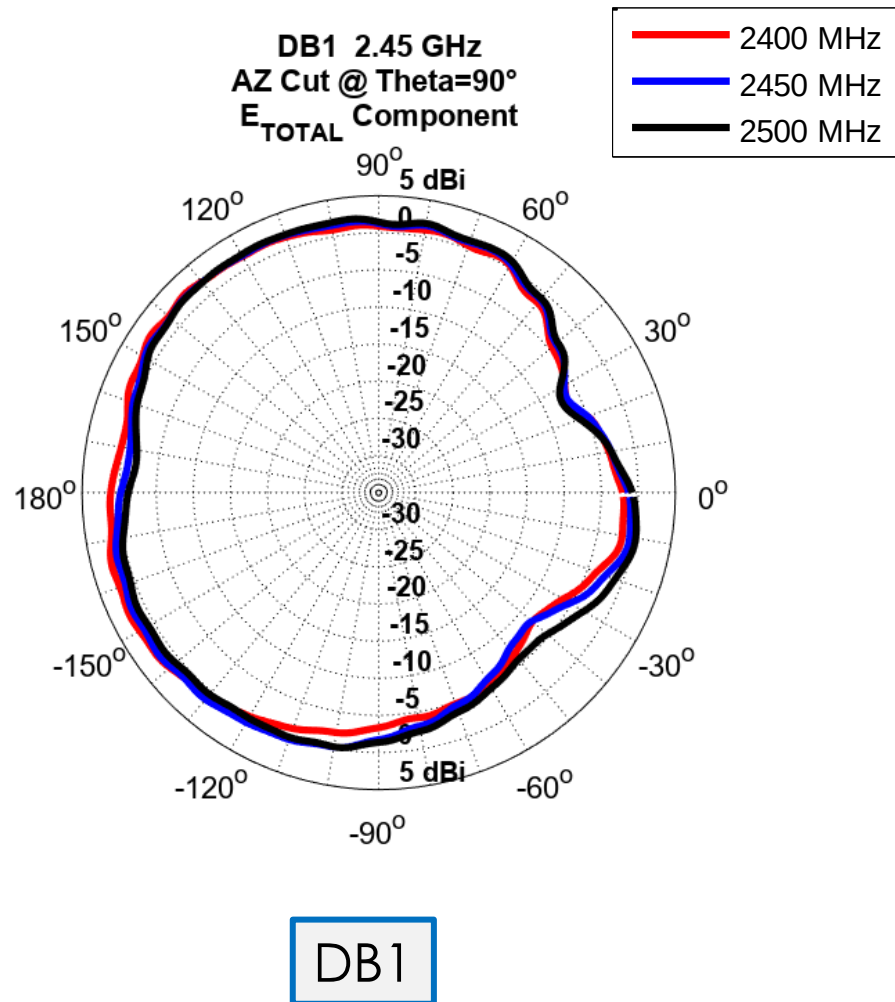
Port3 = 6G3

Port4 = 5G3



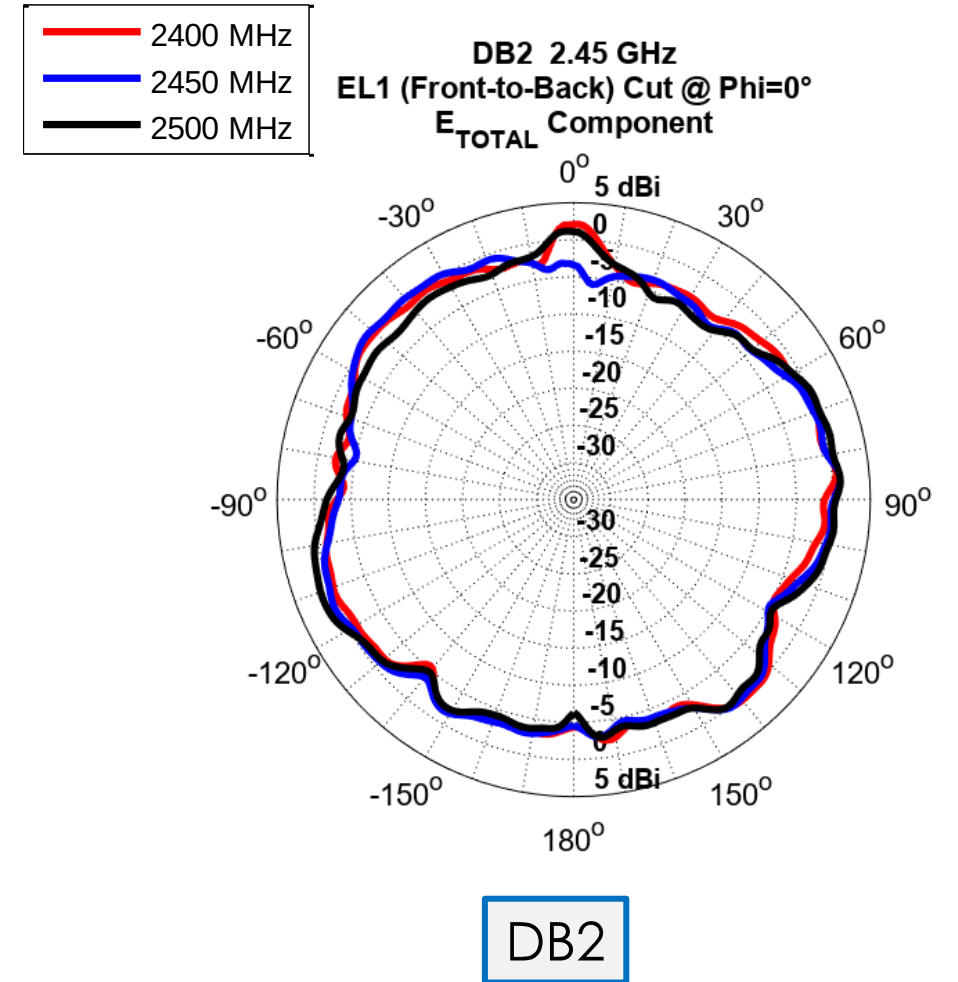
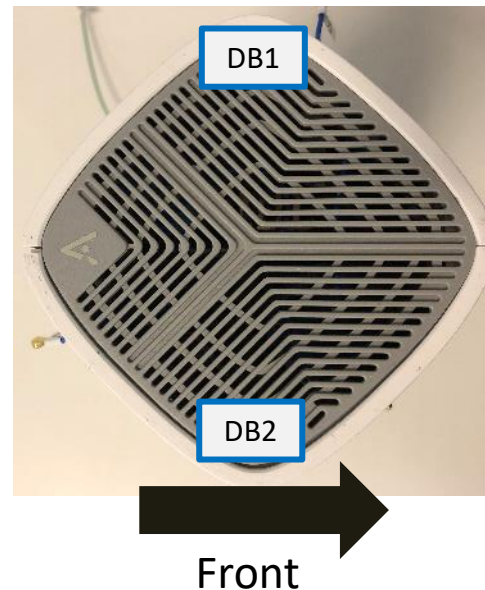
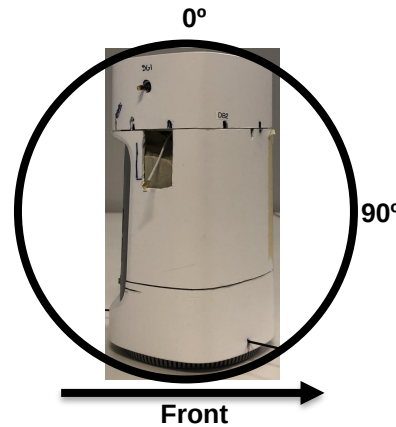
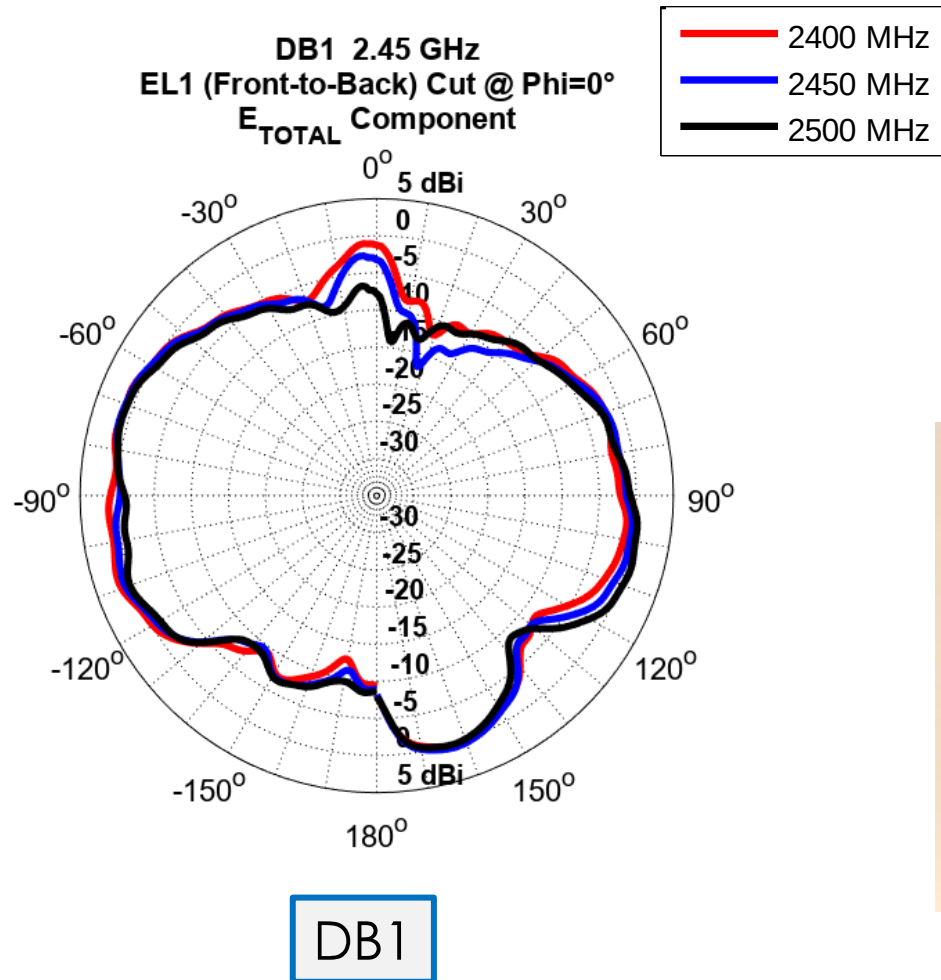
Azimuth Cut - Power Sum

2.45 GHz Band Antennas



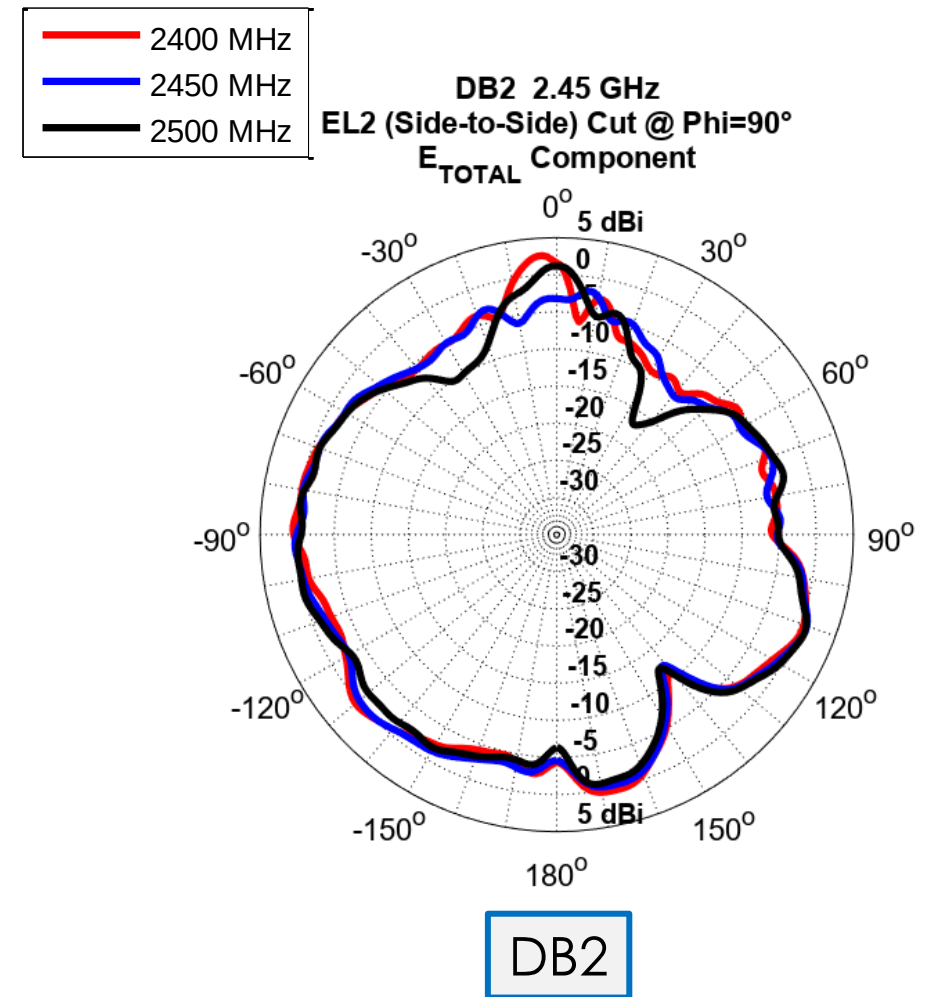
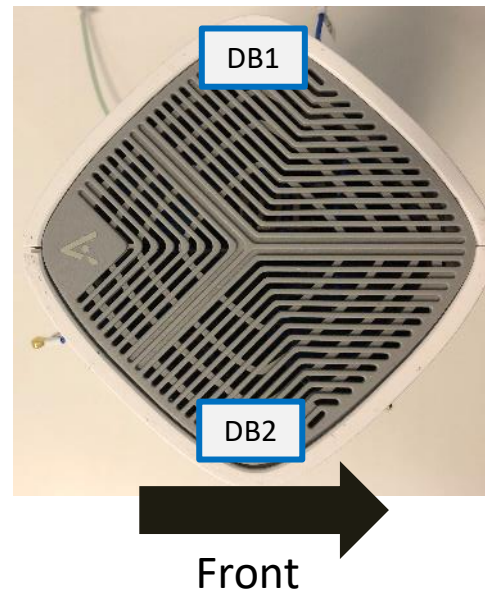
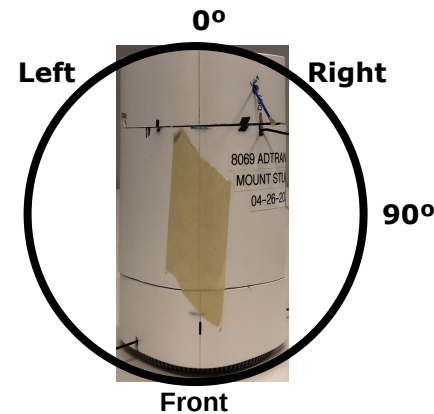
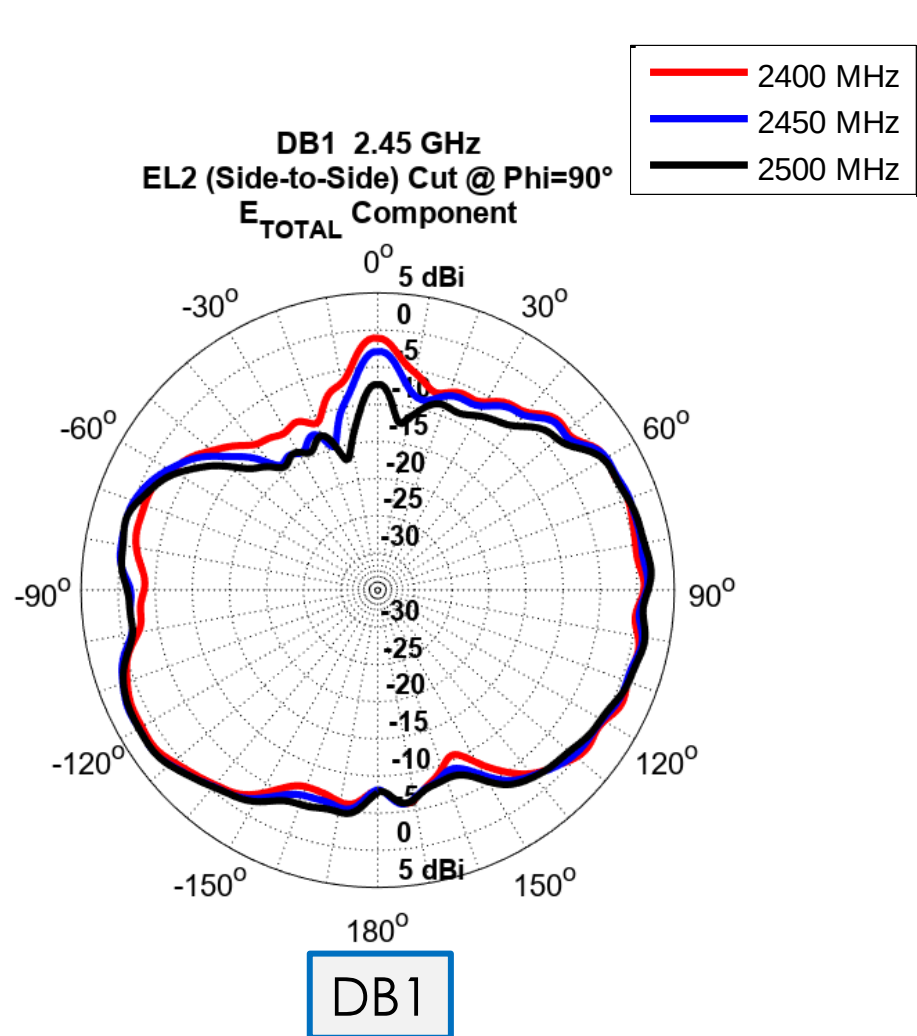
Elevation (Front to Back) Cut - Power Sum

2.45 GHz Band Antennas



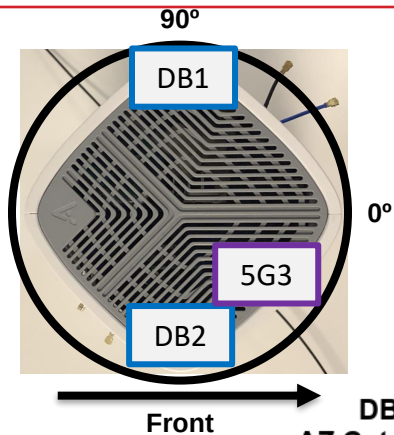
Elevation (Side to Side) Cut - Power Sum

2.45 GHz Band Antennas

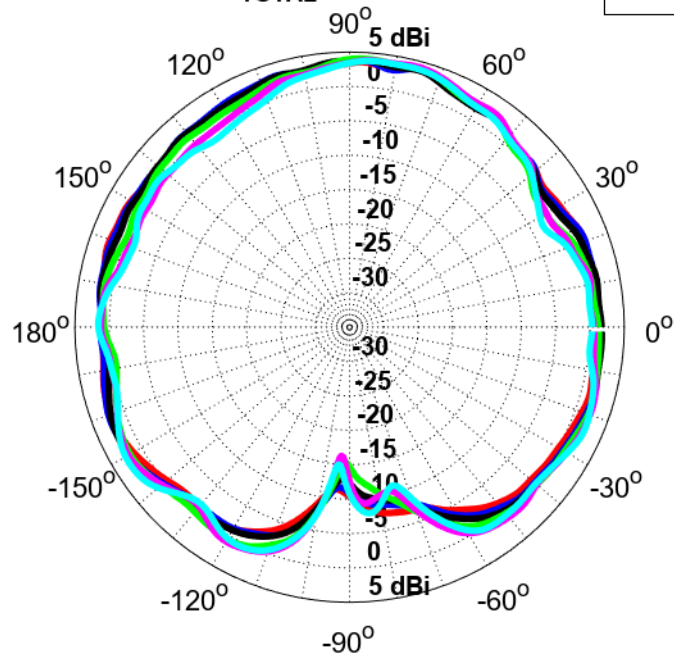


Azimuth Cut - Power Sum

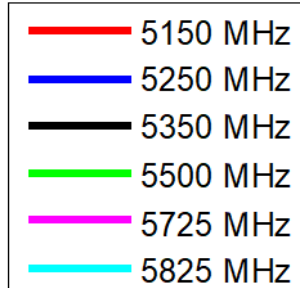
5 GHz Band Antennas



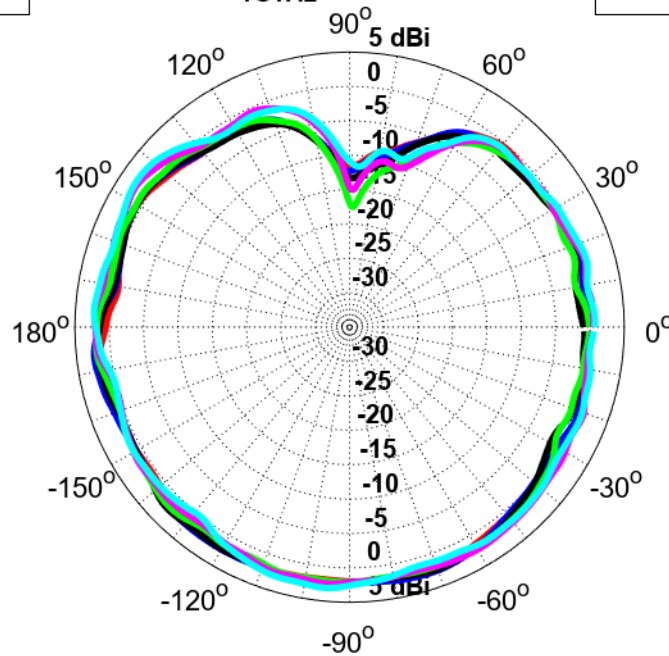
DB1 5 GHz
AZ Cut @ Theta=90°
E_{TOTAL} Component



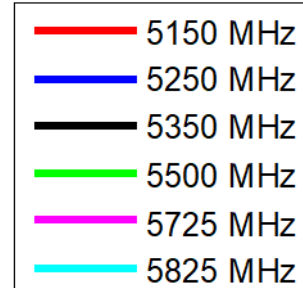
DB1



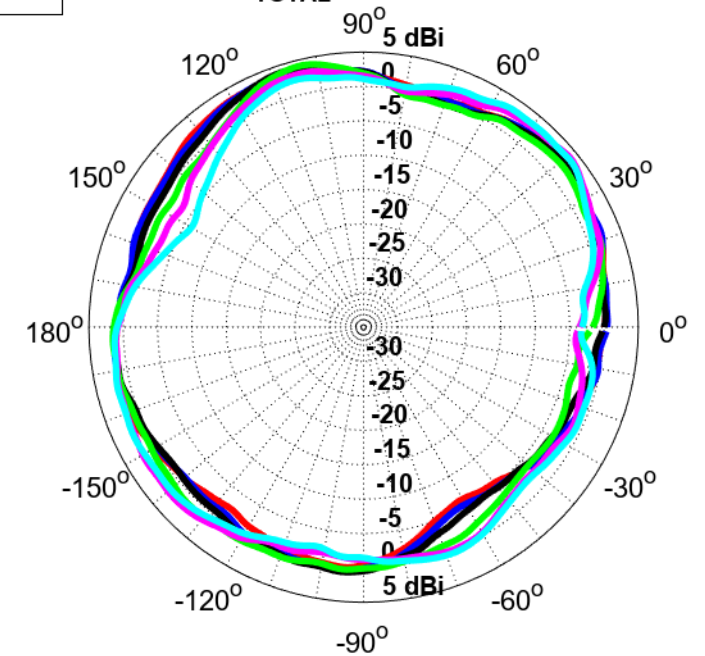
DB2 5 GHz
AZ Cut @ Theta=90°
E_{TOTAL} Component



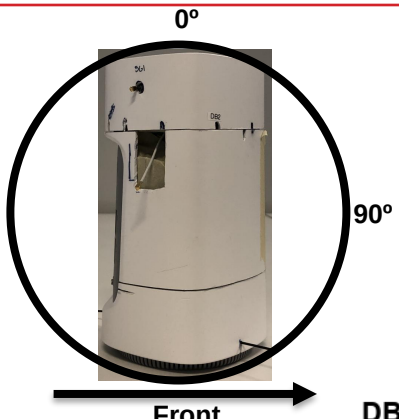
DB2



5G3 5 GHz
AZ Cut @ Theta=90°
E_{TOTAL} Component

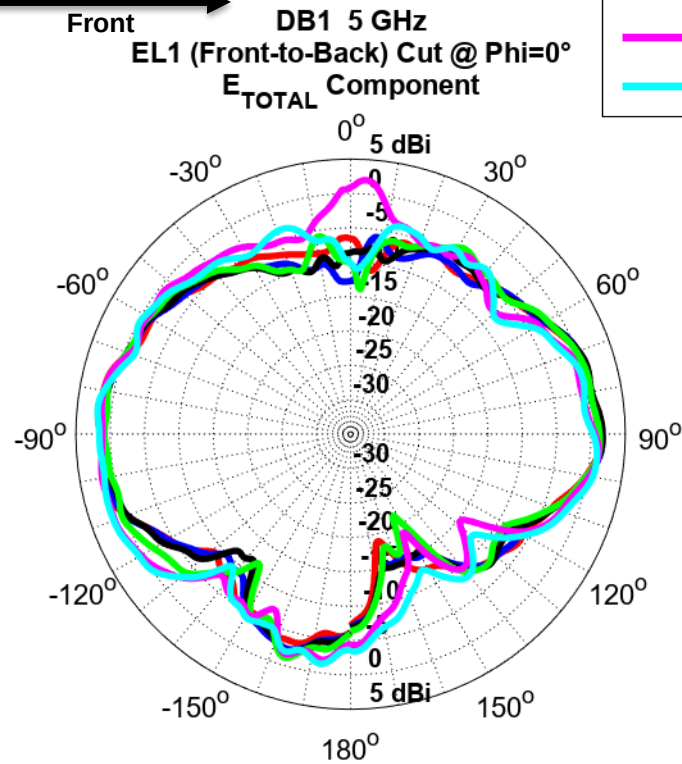
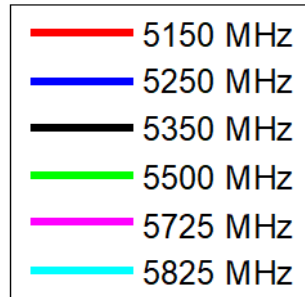


5G3



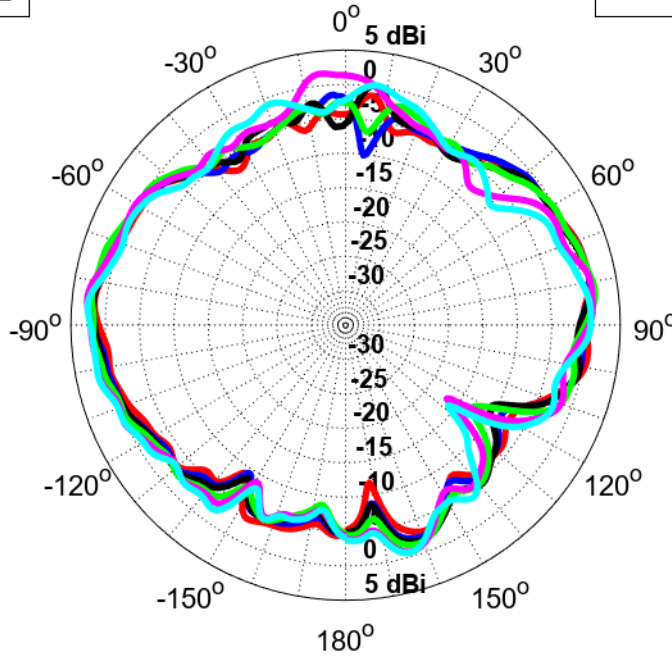
Elevation (Front to Back) Cut - Power Sum

5 GHz Band Antennas

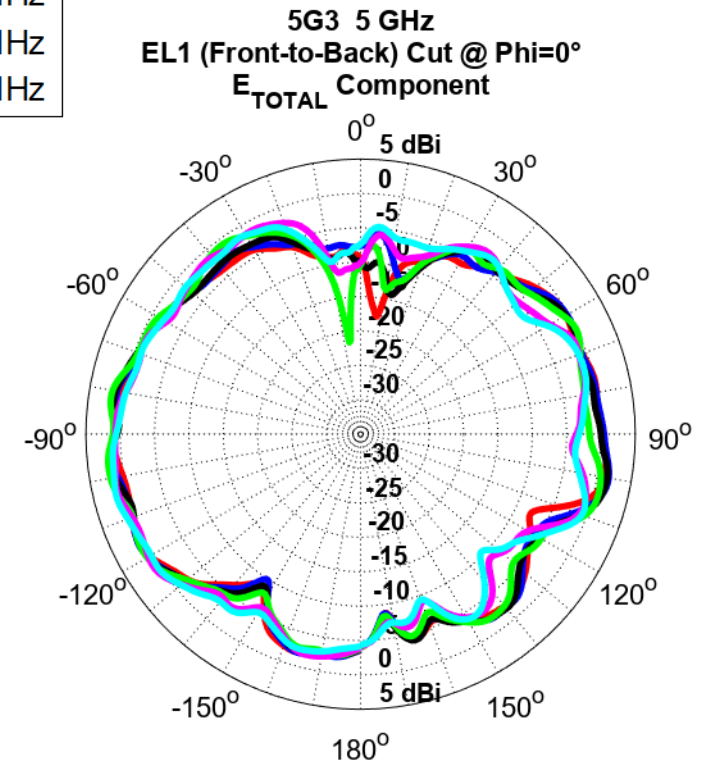
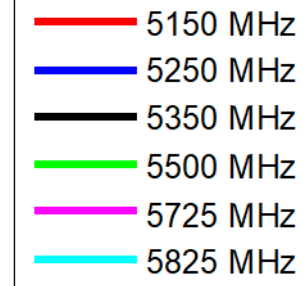


DB1

DB2 5 GHz
EL1 (Front-to-Back) Cut @ $\Phi=0^\circ$
 E_{TOTAL} Component



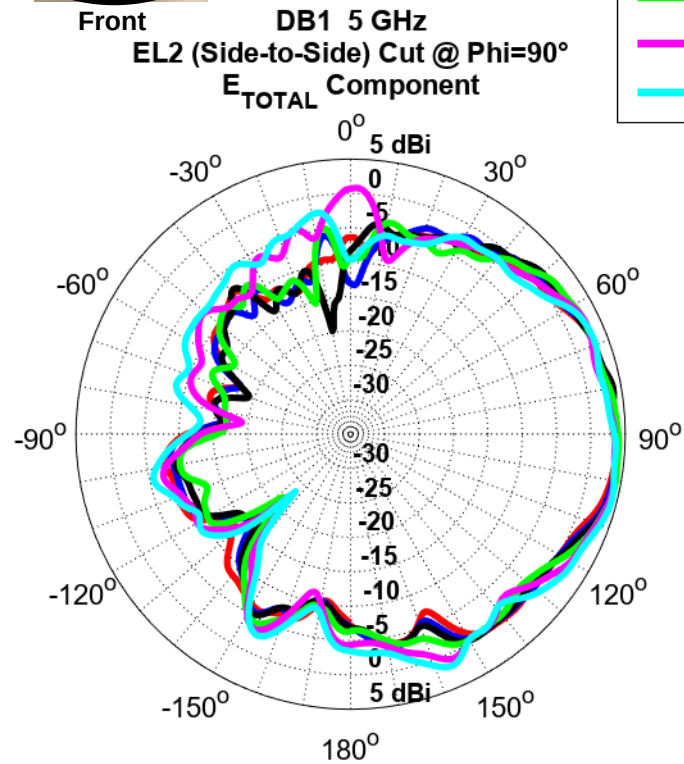
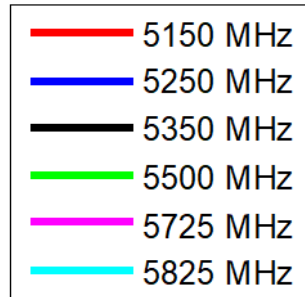
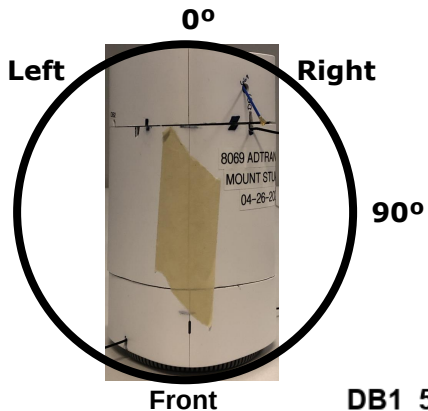
DB2



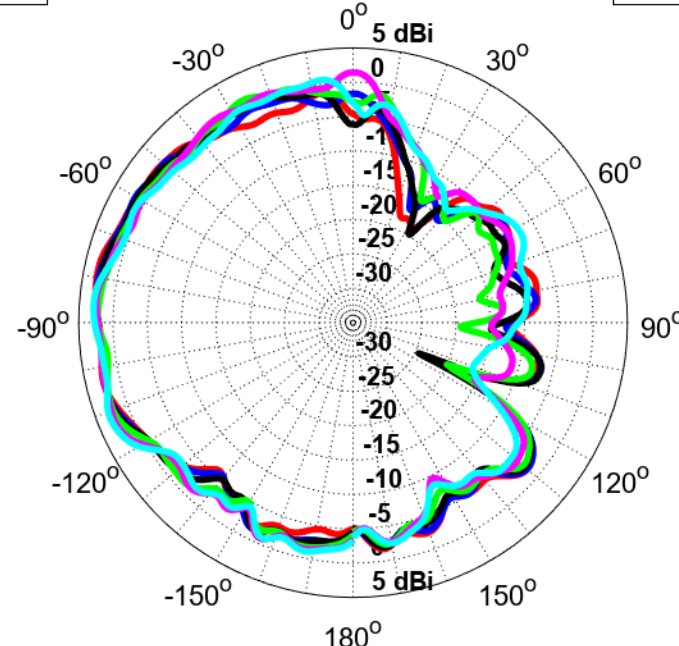
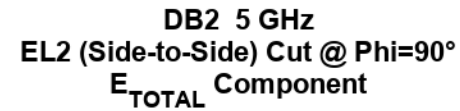
5G3

Elevation (Side to Side) Cut - Power Sum

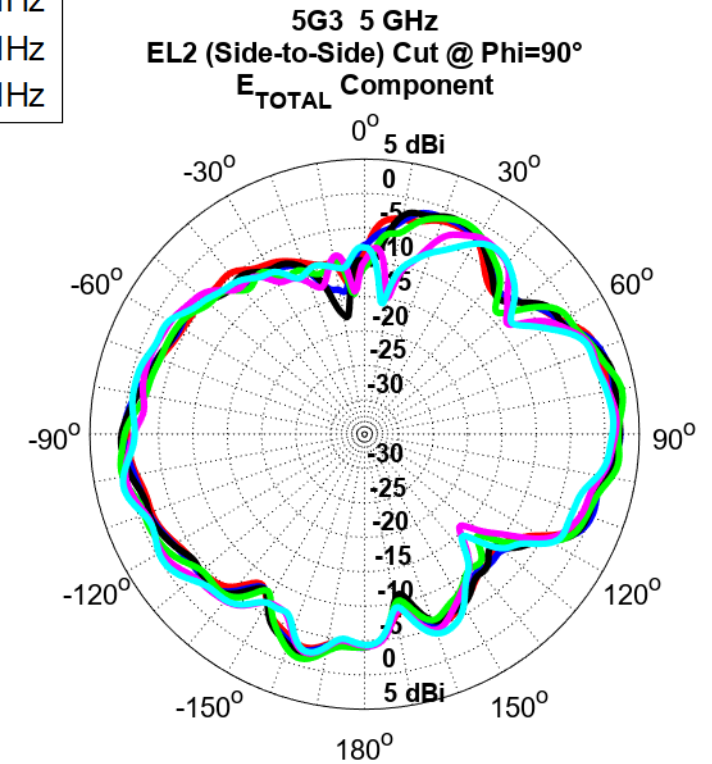
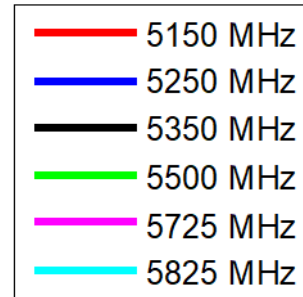
5 GHz Band Antennas



DB1



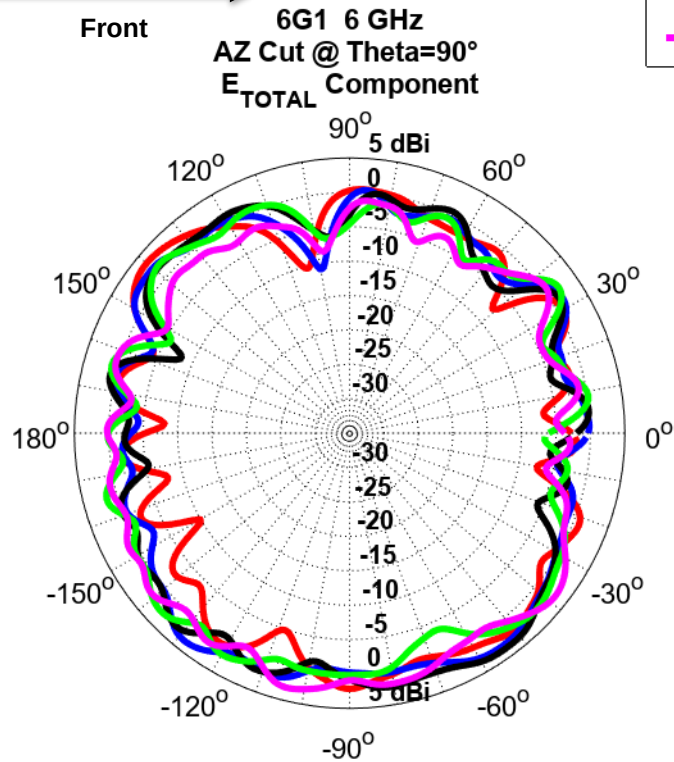
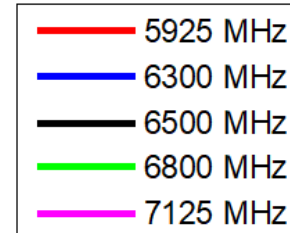
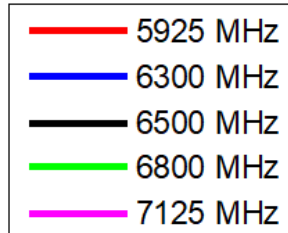
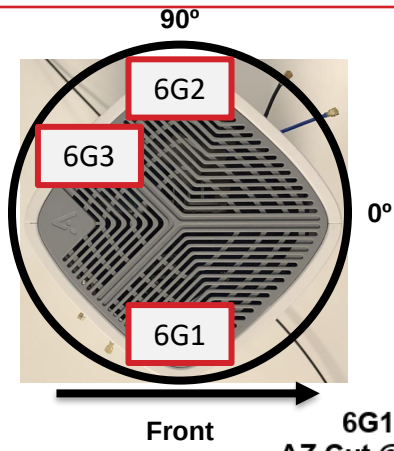
DB2



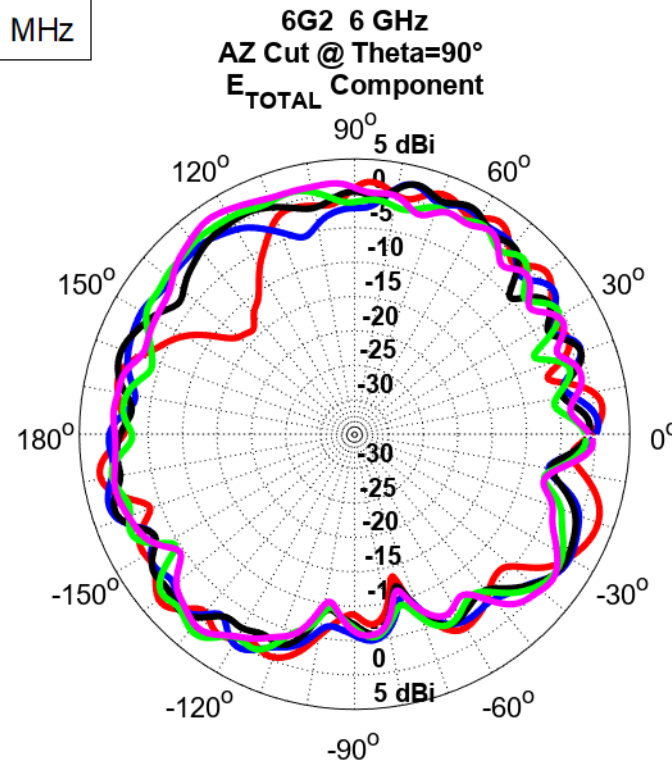
5G3

Azimuth Cut - Power Sum

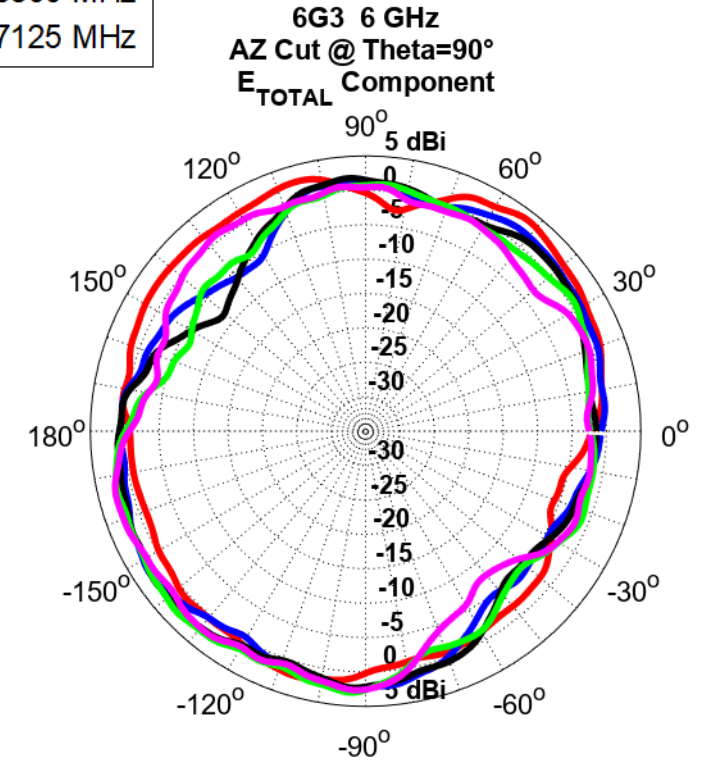
6 GHz Band Antennas



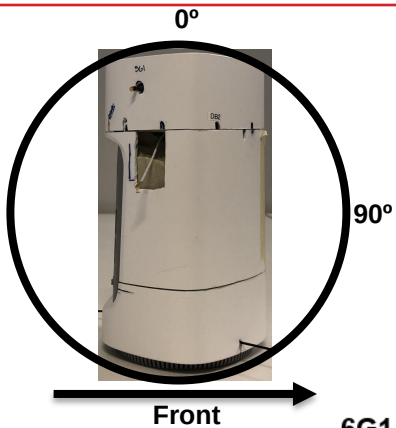
6G1



6G2

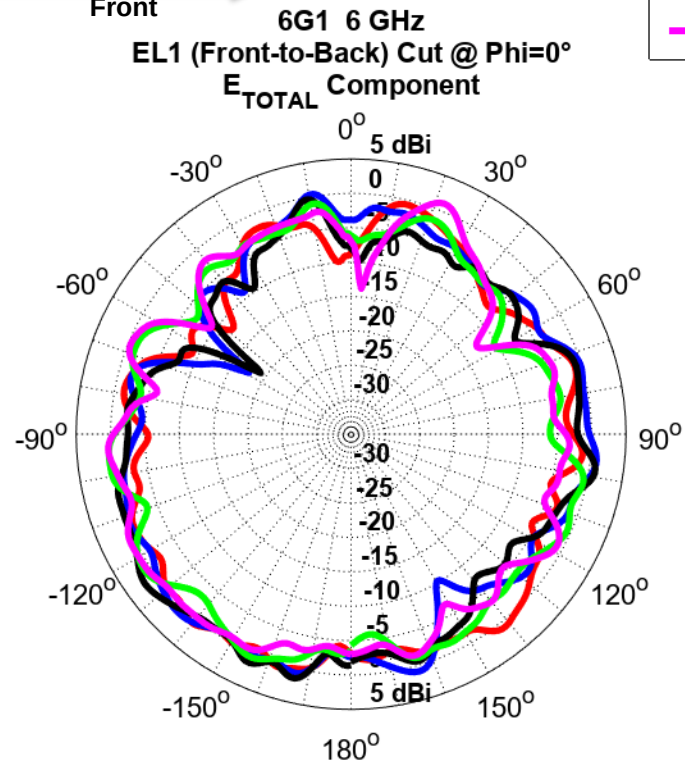
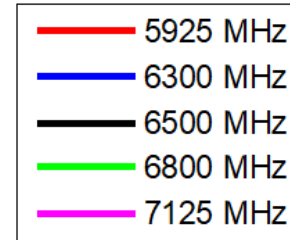
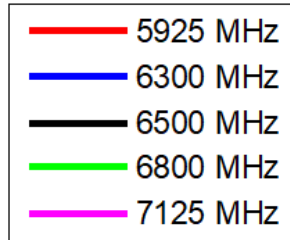


6G3

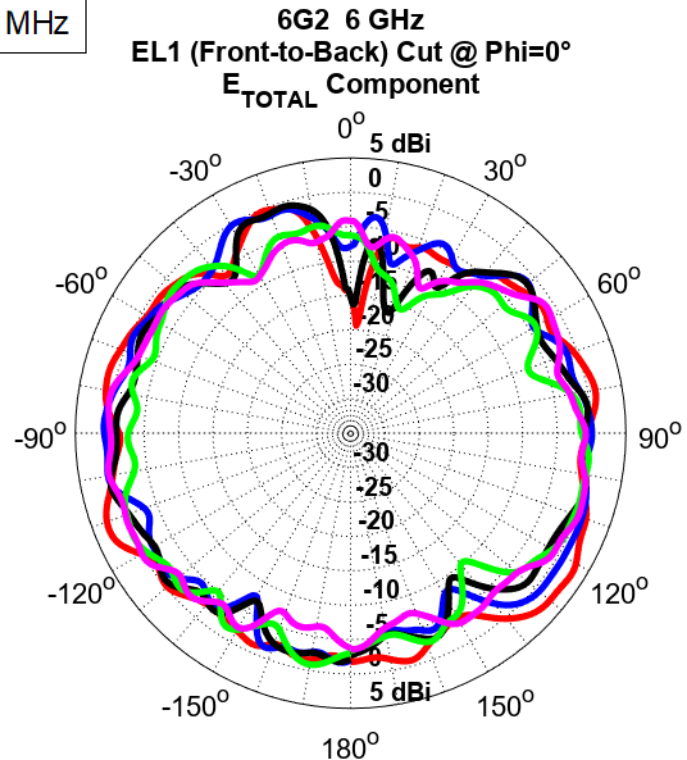


Elevation (Front to Back) Cut - Power Sum

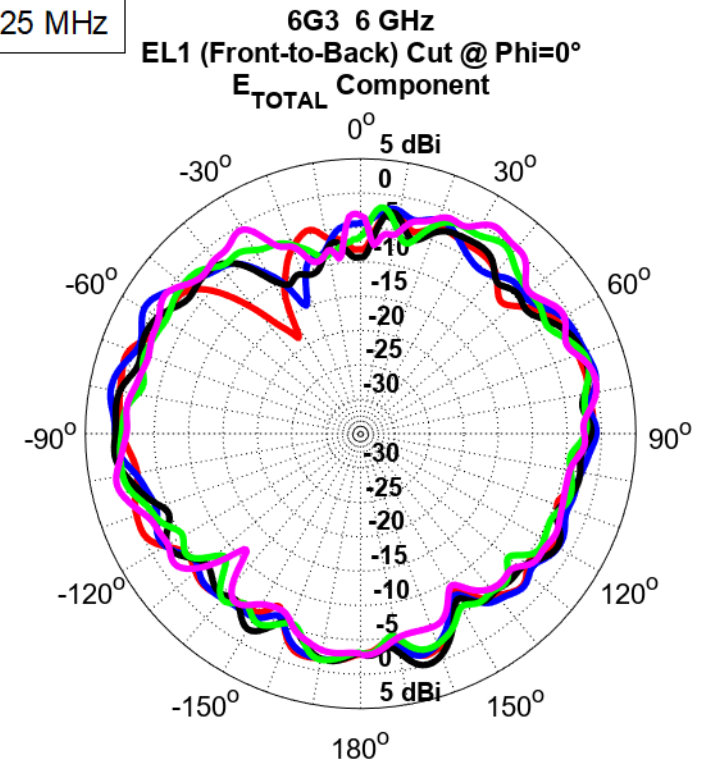
6 GHz Band Antennas



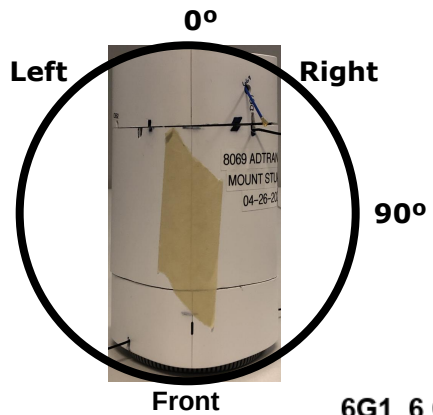
6G1



6G2

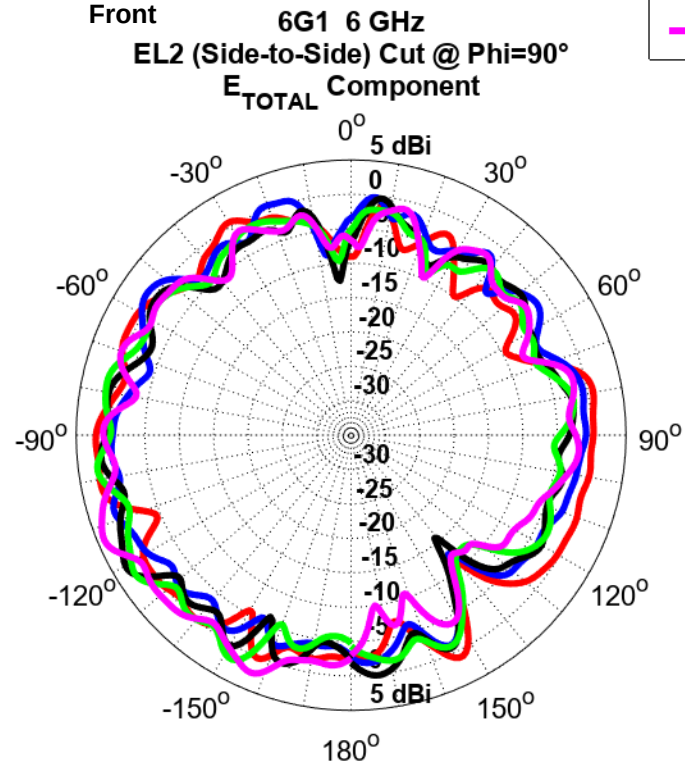
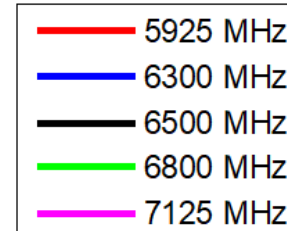
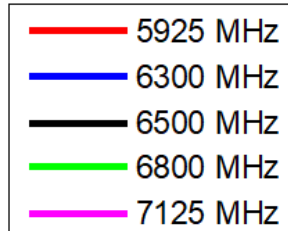
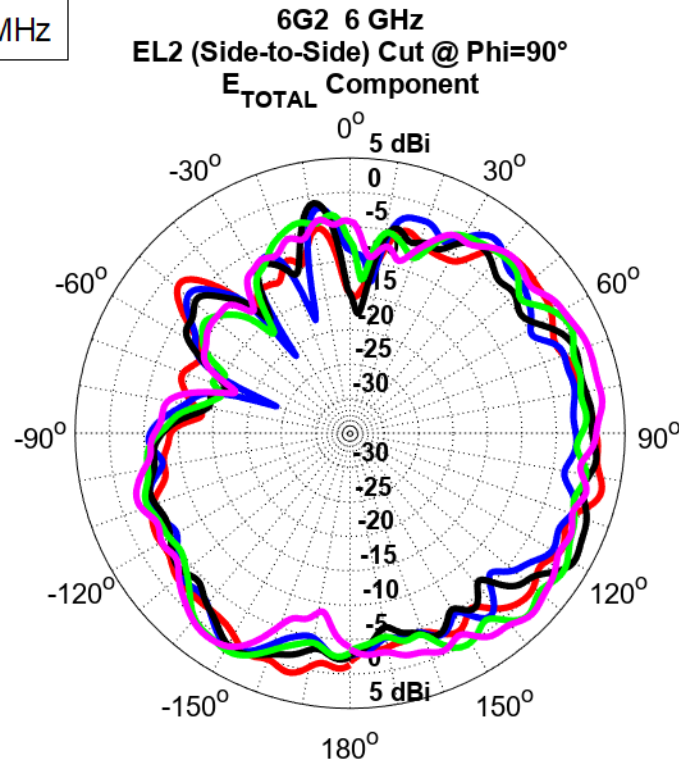
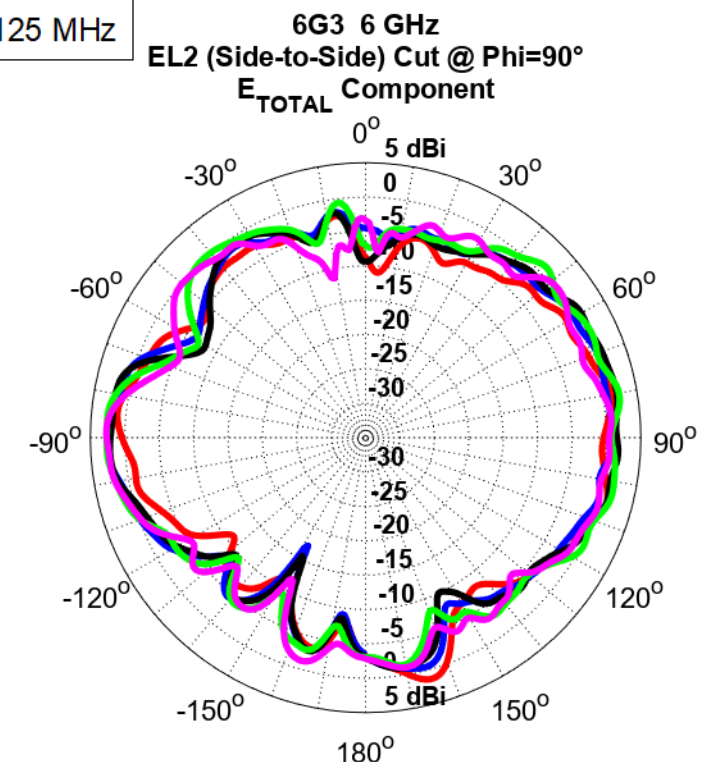


6G3



Elevation (Side to Side) Cut - Power Sum

6 GHz Band Antennas

**6G1****6G2****6G3**

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Thank You!

We Look Forward To Working Together

