

GALTRONICS

WHEN CONNECTIONS COUNT



SEI DirecTV Alaska Antenna Performance Report

Galtronics Project: 8190

Prepared by Junho Cha
April 29th , 2026



Test Information

Instrument	Manufacturer	Model No.	Cali. Date	Cali. Due Date
ENA Series Network Analyzer	Agilent Technologies	E5071B	1/15/2026	1/14/2027
Spherical Near-Field Scanner	Howland / Universal Shielding Corporation	7200S	1/30/2026	1/31/2027

Software	Manufacturer
Howland WTL V5_10.vi	ATDS Howland
Howland Spherical N2F V5.02.vi	ATDS Howland

Antenna Information

Antenna	Assy Number	Antenna Type	Manufacturer
DB1	02102140-08190-1	Stealth	Galtronics
DB2	02102140-08190-2	Stealth	Galtronics
BT	02102073-08190	Dipole	Galtronics
Galtronics USA, Inc : 8930 S. Beck Avenue, Suite # 103 Tempe, Arizona 85284-2891, USA			

Test Configuration

Test Engineer		Test Environment (°C / %)		Test Date	
Junho Cha		20-24 / 45-60		4/21/2026	
Freq (MHz)			Test Frequency (MHz)		
2400-2500			2400 / 2450 / 2500		
5150-5825			5150 / 5250 / 5350 / 5500 / 5725 / 5825		
Testing Location					
Galtronics		Galtronics USA, Inc : 8930 S. Beck Avenue, Suite # 103 Tempe, Arizona 85284-2891, USA			

Introduction

- » Galtronics developed an antenna solution for SEI DirecTV Alaska
- » Hardware 2.0
- » DB2 antenna was retuned.
- » There are 3 antennas
 - Two PCB Dual Band antennas (DB1 and DB2)
 - One PCB Bluetooth antenna (BT)
- » The operating frequency of the Dual Band antennas are 2.4 GHz-2.5 GHz and 5.15 GHz-5.825 GHz.
- » The operating frequency of the Bluetooth antenna is 2.4 GHz-2.5 GHz .
- » Measured return loss, isolation, peak gain, efficiency, and gain pattern of the antennas.

- » Appendix I: Uncorrelated Gain Specifications
- » Appendix II : DB2 received RL vs DB2 retuned RL

Cable lengths and Antenna Orientation

Antenna	Total Cable Length	Orientation	Cable Color
DB1	125 mm	V	Black
DB2	95 mm	V	White
BT	95 mm	H	Blue

V = vertical
H = horizontal

Cable lengths will be updated
based on cable routing

Performance Summary

Antenna	Worst Case Return Loss (dB) 2.45 GHz Band	Worst Case Return Loss (dB) 5 GHz Band	Average Efficiency 2.45 GHz Band (%)	Average Efficiency 5 GHz Band (%)	Highest Peak Gain 2.45 GHz Band (dBi)	Highest Peak Gain 5 GHz Band (dBi)	Mutual Isolation (dB) 2.45 GHz Band		Mutual Isolation (dB) 5 GHz Band	
							DB1	DB2	DB1	DB2
DB1	-11.3	-16.0	64.26	71.51	3.35	5.45				
DB2	-10.1	-17.7	64.78	71.37	3.25	5.94	-21.5		-28.9	
BT	-11.7		63.53		5.43		-20.5	-21.0	-29.8	-28.9

Antenna Group	Worst-Case Mutual Isolation in Group (dB) 2.45 GHz Band		Worst-Case Mutual Isolation in Group (dB) 5 GHz Band	
	DB1 & DB2		DB1 & DB2	
DB1 & DB2	-21.5	DB1 & DB2	-28.9	DB1 & DB2
BT	-20.5	DB1 & BT	-28.9	DB2 & BT

Operating Frequency Band	Worst Case Horizontal and Vertical Directional Gain (dBi)	
	Correlated	Uncorrelated
2.45 GHz	2.69	0.58
5 GHz	4.79	2.36

Peak Gain and Efficiency

DB1	Freq (MHz)	Peak Gain (dBi)	Directivity (dB)	Efficiency
	2400	3.02	5.00	63.40 %
	2450	3.35	5.21	65.12 %
	2500	2.83	4.75	64.26 %
	Average			64.26 %

DB2	Freq (MHz)	Peak Gain (dBi)	Directivity (dB)	Efficiency
	2400	3.20	5.10	64.48 %
	2450	3.25	5.08	65.64 %
	2500	2.85	4.77	64.23 %
	Average			64.78 %

DB1	Freq (MHz)	Peak Gain (dBi)	Directivity (dB)	Efficiency
	5150	5.16	6.69	70.31 %
	5250	5.31	6.79	71.06 %
	5350	5.45	6.93	71.19 %
	5500	4.85	6.25	72.43 %
	5725	4.75	6.14	72.50 %
	5825	4.94	6.39	71.58 %
	Average			71.51 %

DB2	Freq (MHz)	Peak Gain (dBi)	Directivity (dB)	Efficiency
	5150	4.23	5.70	71.21 %
	5250	4.10	5.53	71.95 %
	5350	4.96	6.36	72.45 %
	5500	4.38	5.83	71.54 %
	5725	5.82	7.32	70.80 %
	5825	5.94	7.48	70.27 %
	Average			71.37 %

BT	Freq (MHz)	Peak Gain (dBi)	Directivity (dB)	Efficiency
	2400	4.22	6.09	65.01 %
	2450	5.43	7.43	63.10 %
	2500	5.30	7.35	62.47 %
	Average			63.53 %

DB 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	100	11	-5.57	1.45	1.64
2450	103	310	-3.91	-0.05	1.24
2500	7	179	-0.25	-2.59	1.67

Frequency (MHz)	Degree		Gain (dBi)		Correlated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
2400	70	261	-5.37	2.63	2.53
2450	72	261	-5.48	2.89	2.68
2500	6	111	1.13	-2.06	2.69

DB 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	101	11	-5.79	1.52	-0.75
2450	103	311	-3.93	-0.04	-1.56
2500	7	182	-0.12	-2.80	-1.26

Frequency (MHz)	Degree		Gain (dBi)		UnCorrelated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
2400	61	267	-7.09	3.06	0.45
2450	61	266	-7.00	3.19	0.58
2500	62	266	-8.67	2.76	0.05

DB 5 GHz Horizontal and Vertical Correlated directional Gain

Worst Case

Frequency (MHz)	Degree		Gain (dBi)		Correlated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	
5150	158	170	-7.52	1.73	1.29
5250	158	172	-6.66	2.15	1.83
5350	158	176	-5.83	1.08	1.30
5500	8	246	-6.32	0.63	0.84
5725	6	255	-6.66	2.71	2.24
5825	154	145	-4.32	2.56	2.79

Frequency (MHz)	Degree		Gain (dBi)		Correlated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
5150	127	265	4.64	-8.25	3.40
5250	91	265	3.51	-3.08	3.84
5350	127	265	4.76	-7.01	3.74
5500	126	218	3.35	-1.55	4.25
5725	127	220	3.91	-1.41	4.66
5825	128	217	4.19	-1.57	4.79

DB 5 GHz Horizontal and Vertical Uncorrelated directional Gain

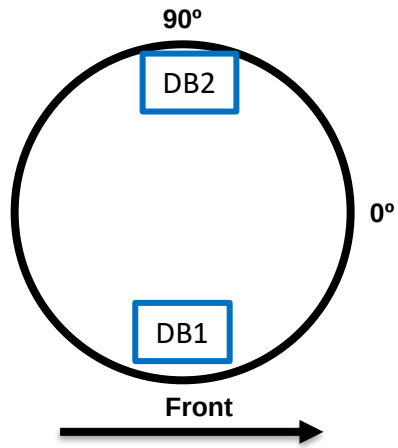
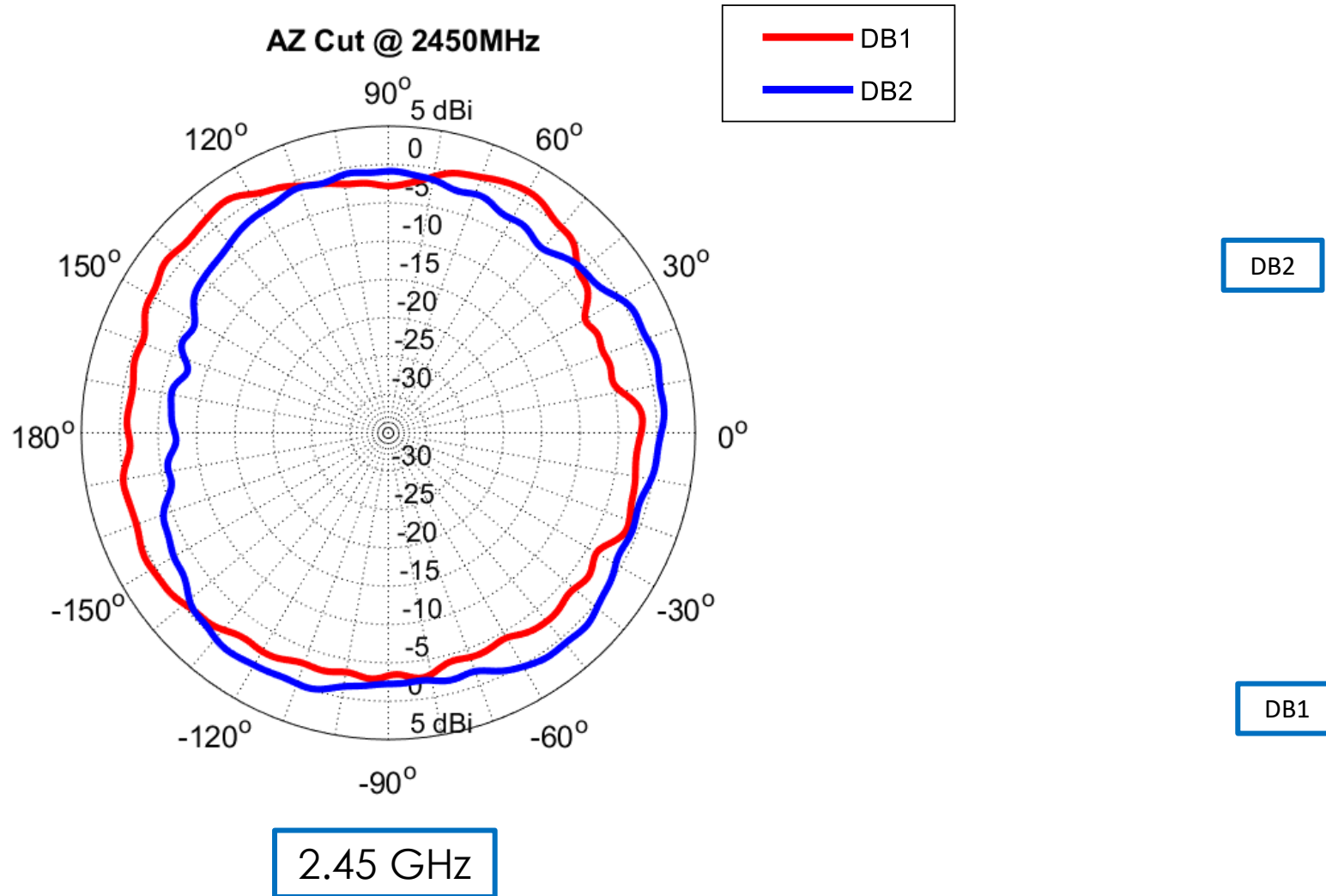
Worst Case

Frequency (MHz)	Degree		Gain (dBi)		UnCorrelated Gain (dBi) - H-Pol
	Theta	Phi	DB1	DB2	
5150	158	167	-8.14	1.85	-0.74
5250	158	170	-7.09	2.25	-0.28
5350	158	172	-6.84	1.34	-1.06
5500	9	246	-7.10	0.90	-1.47
5725	6	267	-9.23	3.14	0.37
5825	154	137	-5.44	2.86	0.45

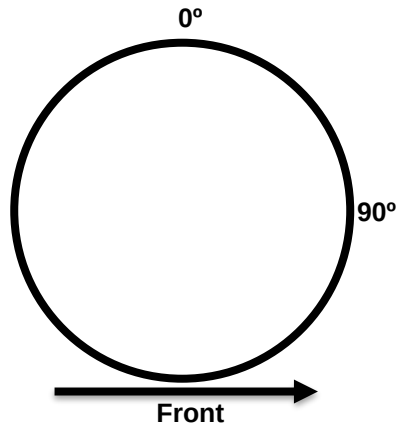
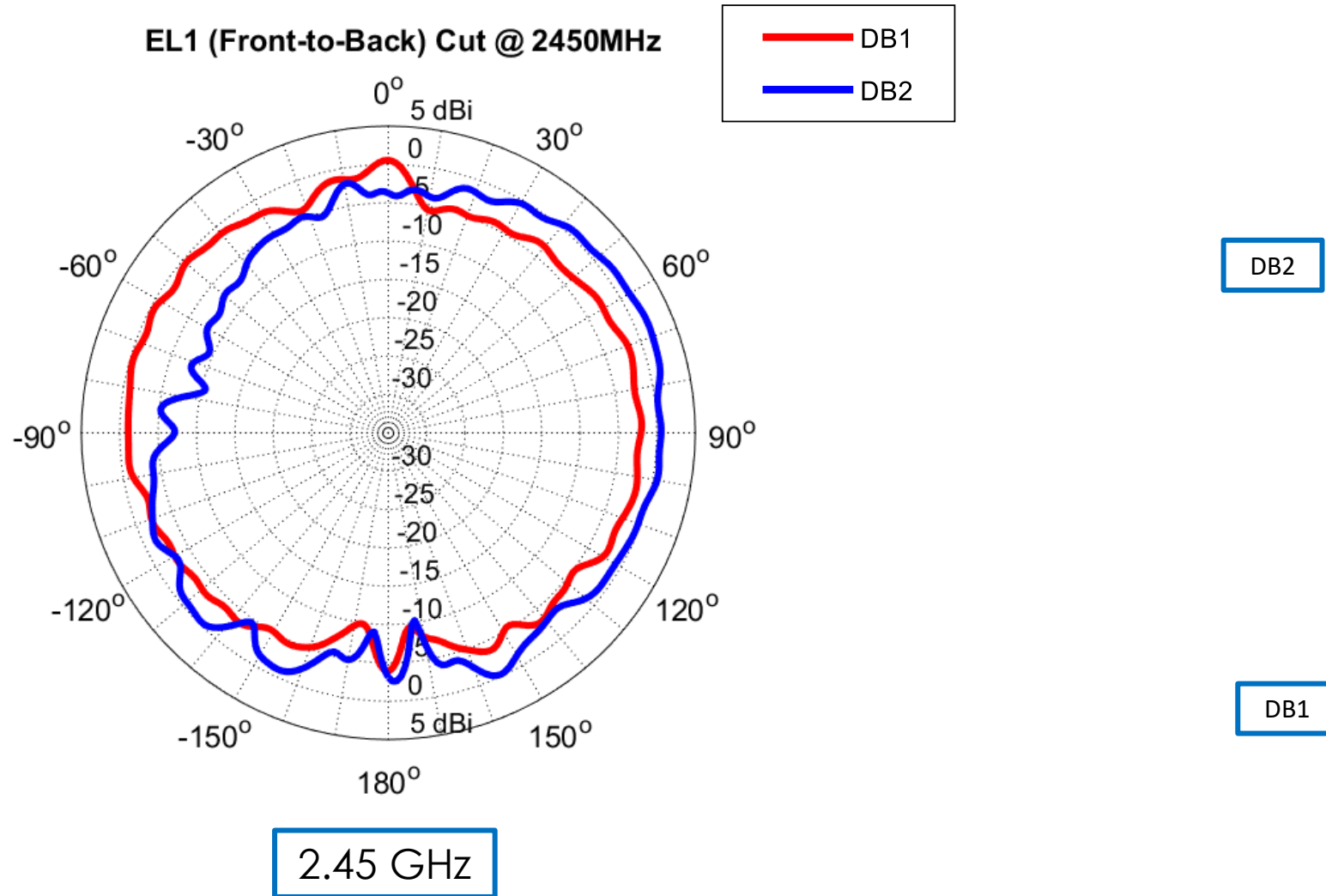
Frequency (MHz)	Degree		Gain (dBi)		UnCorrelated Gain (dBi)-V-Pol
	Theta	Phi	DB1	DB2	
5150	125	254	4.91	-12.33	1.98
5250	126	255	5.12	-11.43	2.20
5350	126	252	5.31	-13.49	2.36
5500	128	254	4.77	-7.47	2.01
5725	162	46	-18.41	5.21	2.22
5825	117	230	4.75	-3.65	2.33

Azimuth Cut - Power Sum

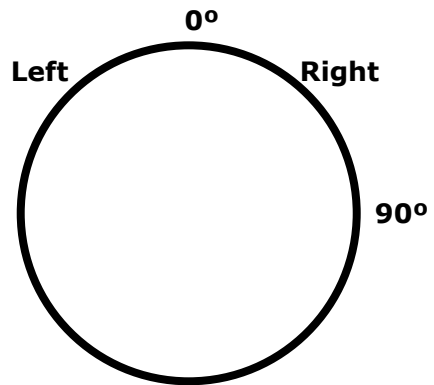
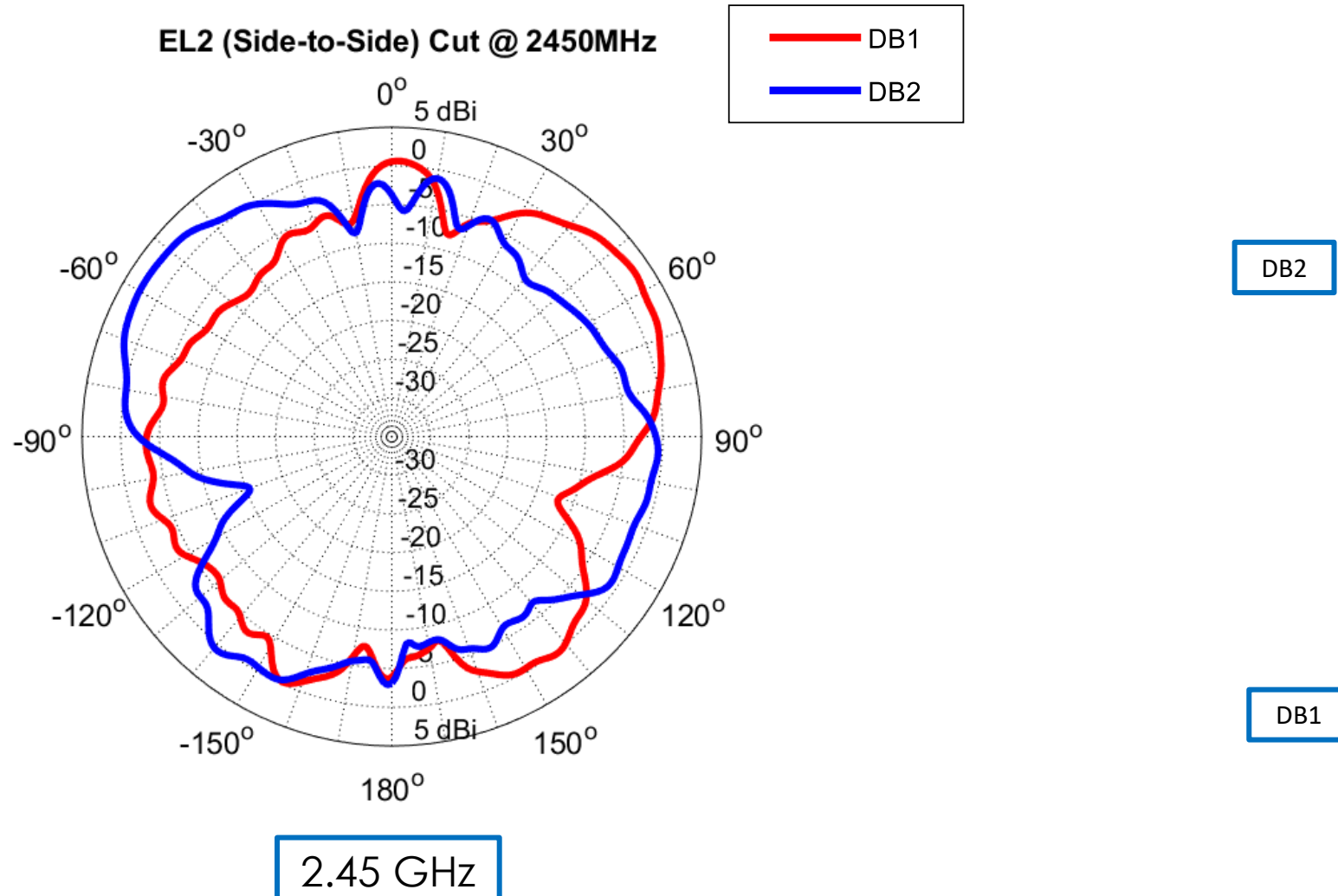
System Coverage – DB Antennas



Elevation (Front to Back) Cut - Power Sum System Coverage – DB Antennas

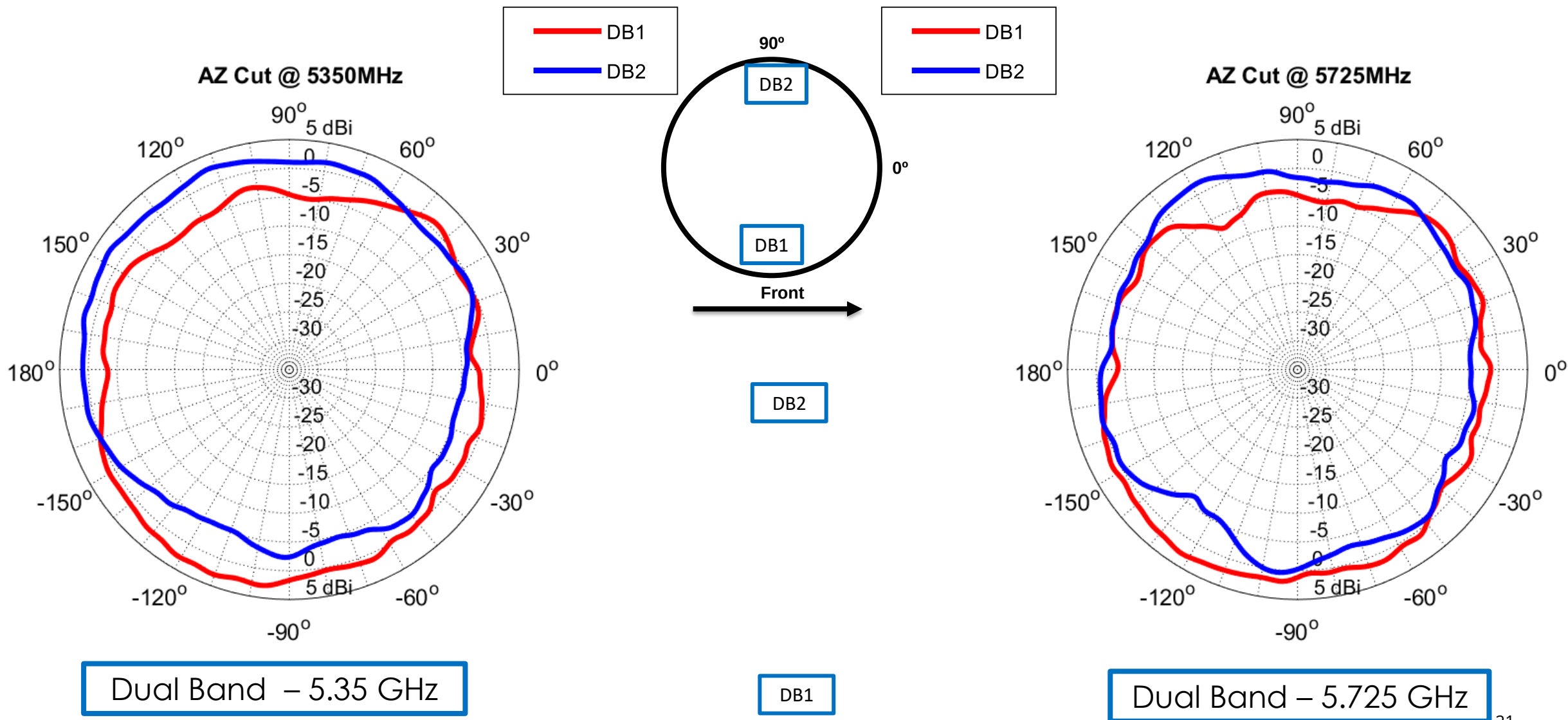


Elevation (Side to Side) Cut - Power Sum System Coverage – DB Antennas

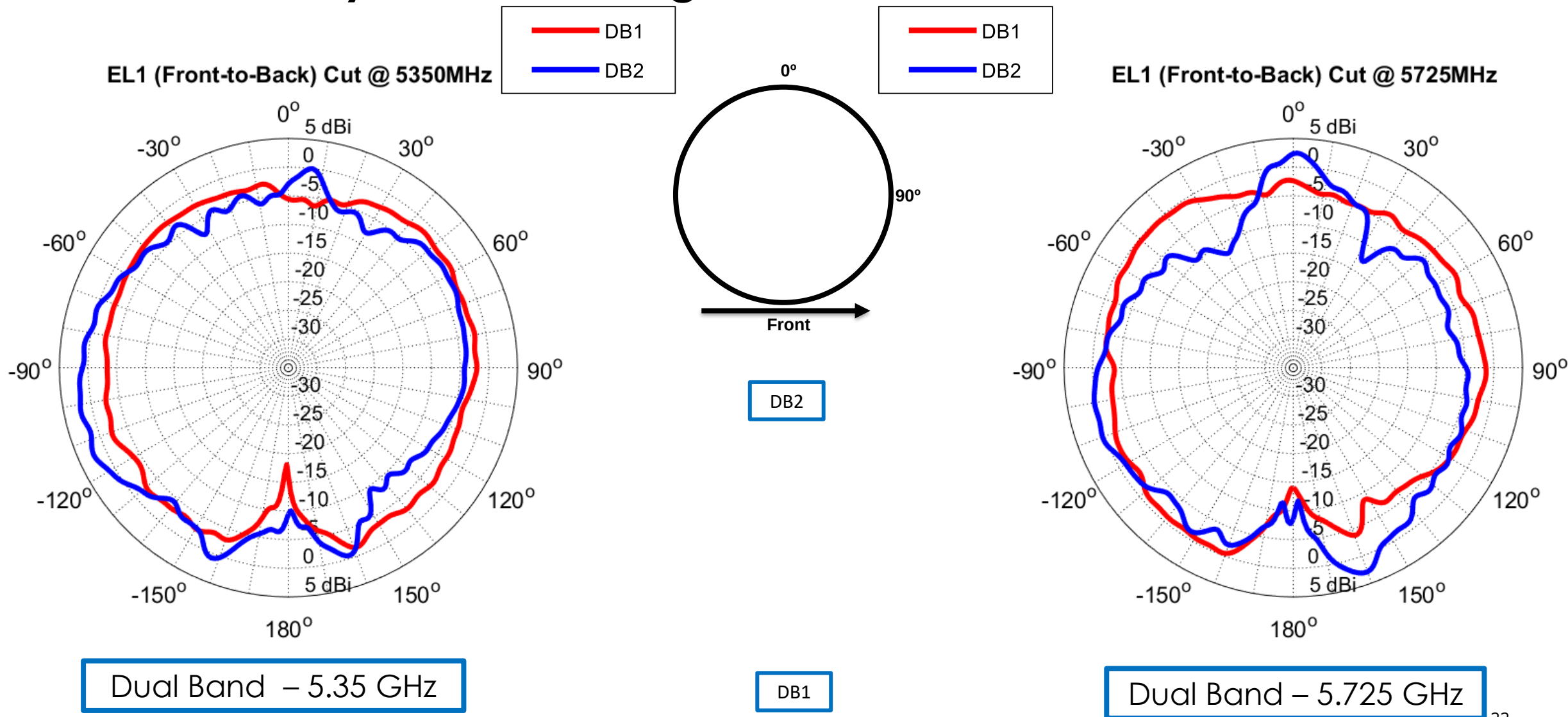


Azimuth Cut - Power Sum

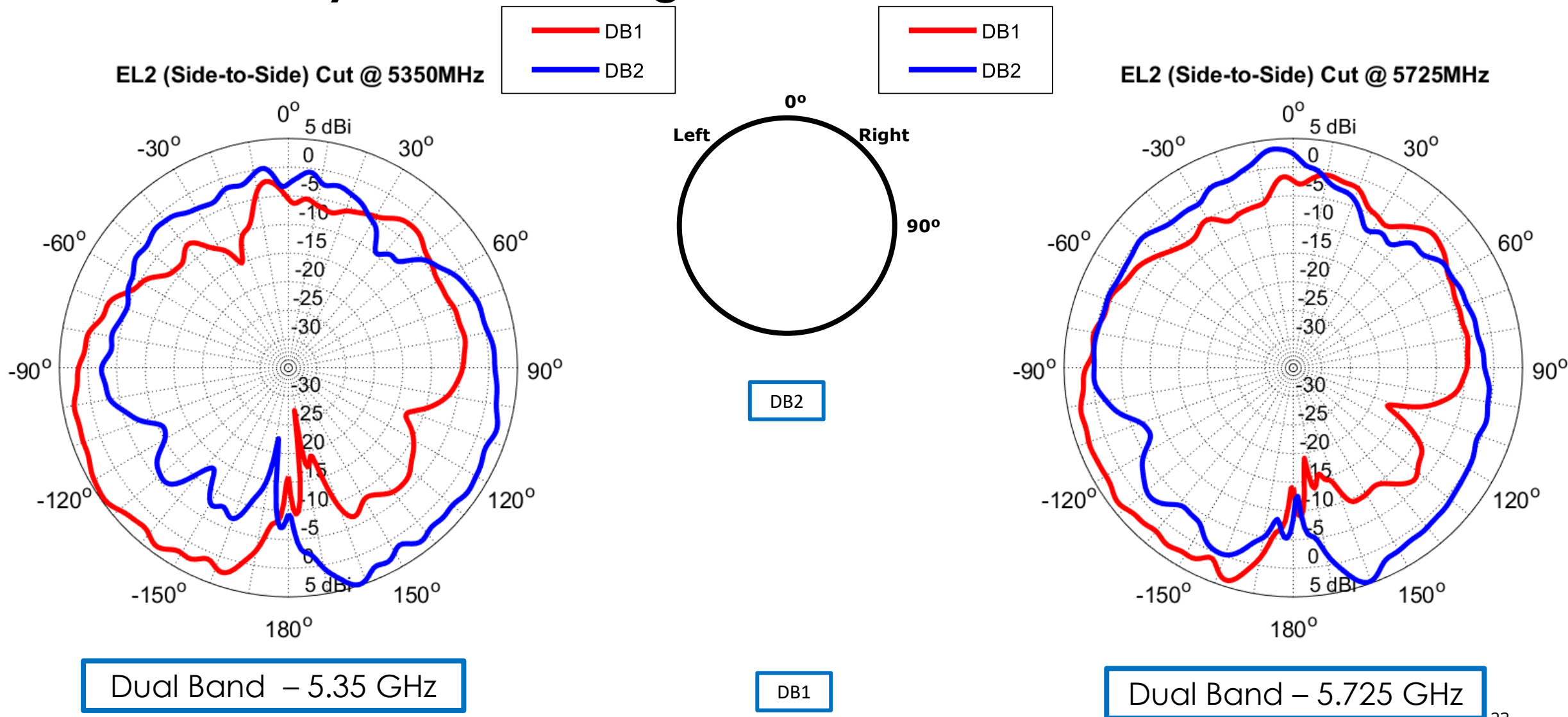
System Coverage – DB Antennas



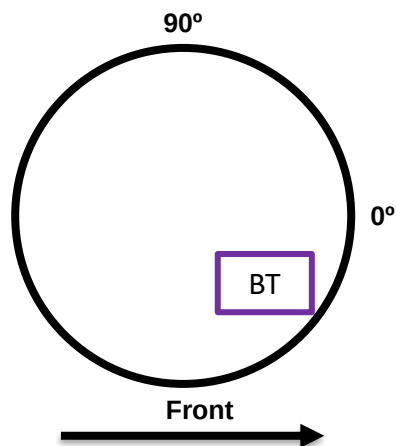
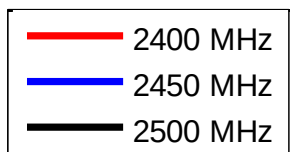
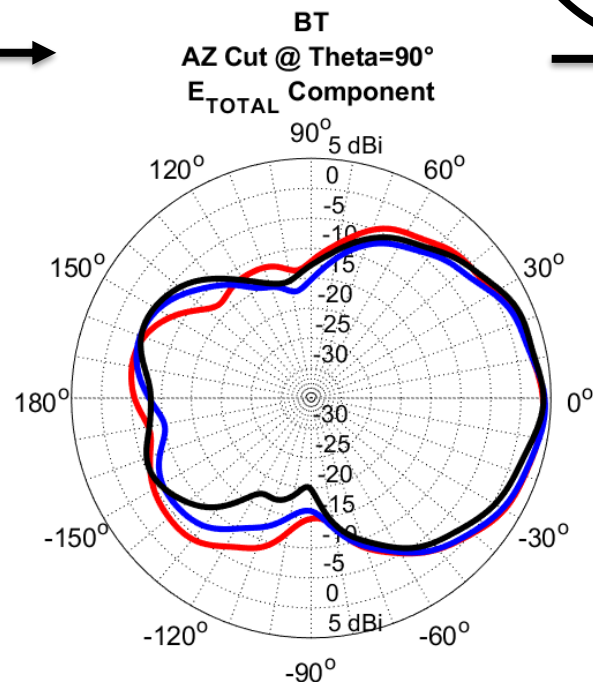
Elevation (Front to Back) Cut - Power Sum System Coverage – DB Antennas



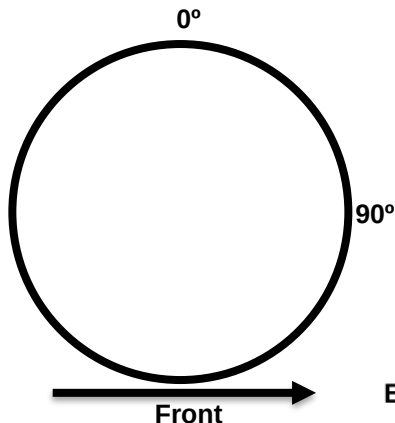
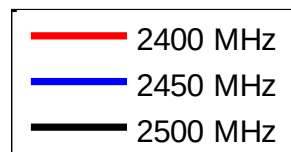
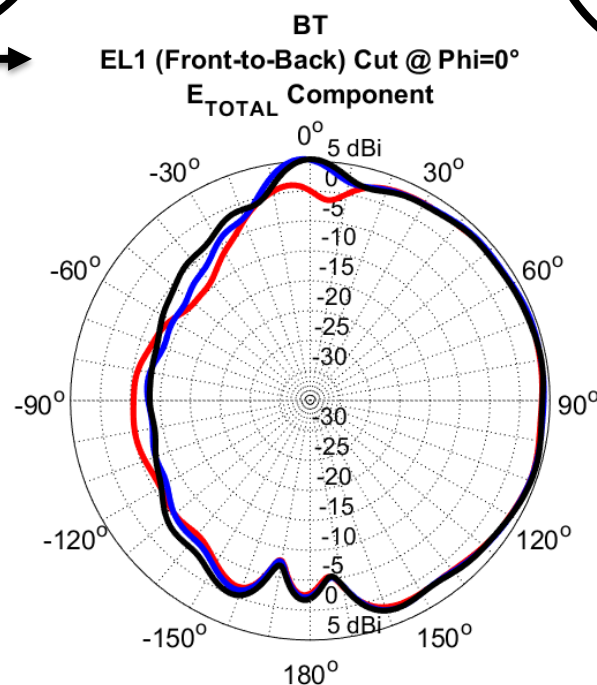
Elevation (Side to Side) Cut - Power Sum System Coverage – DB Antennas



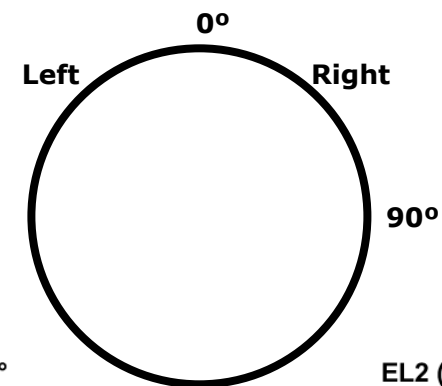
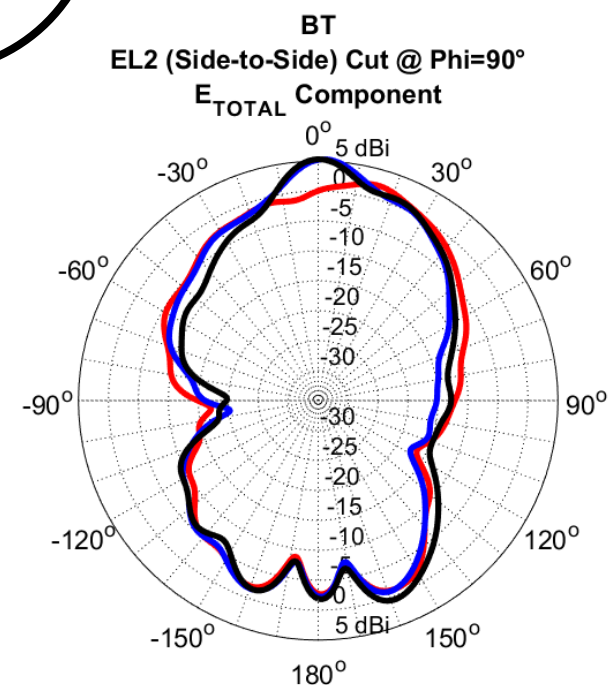
BT Antenna Power Sum Gain Patterns



Azimuth Cut

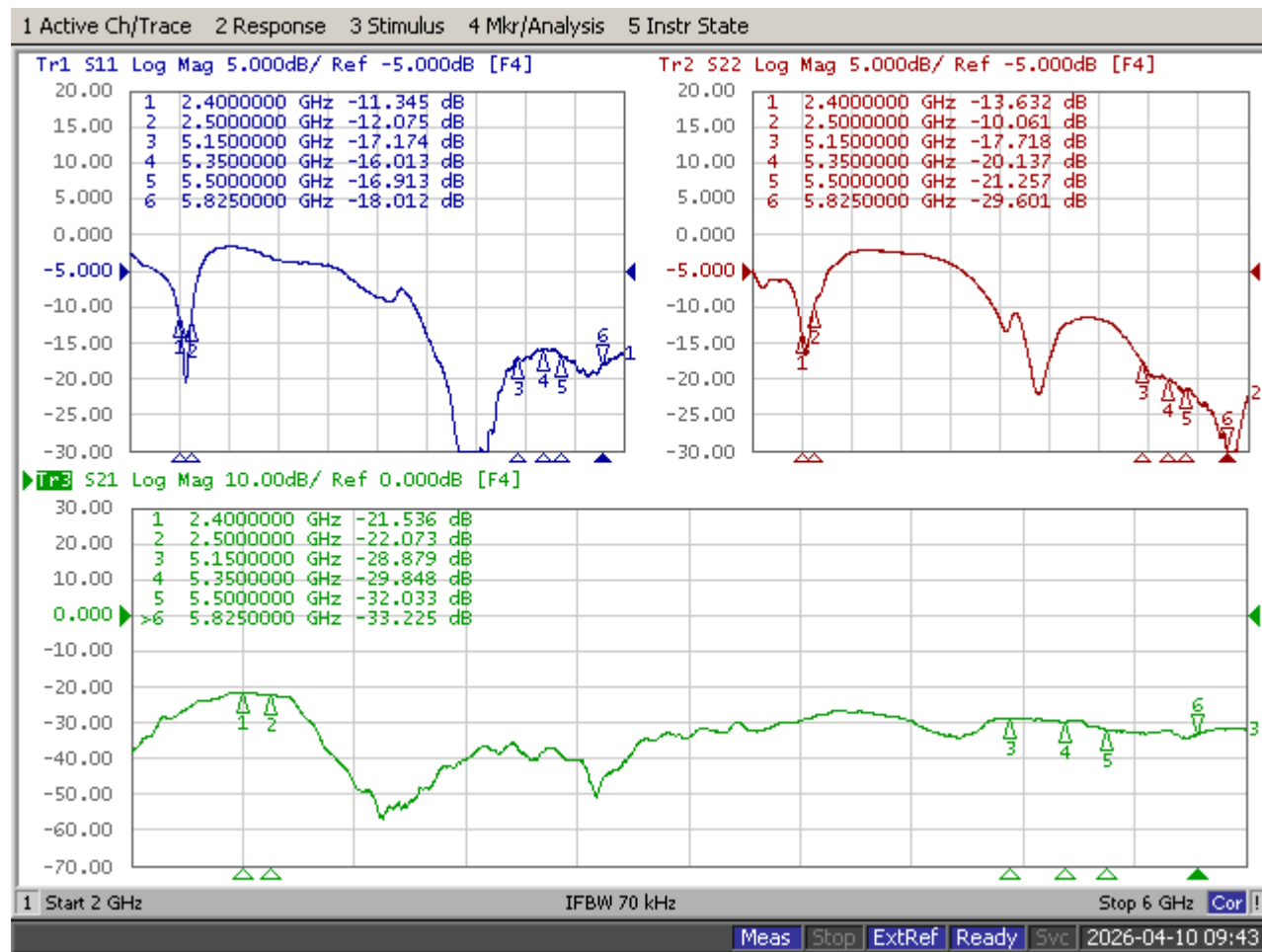


Elevation
(Front to Back) Cut



Elevation
(Side to Side) Cut

Return Loss and Isolation of DB Antennas

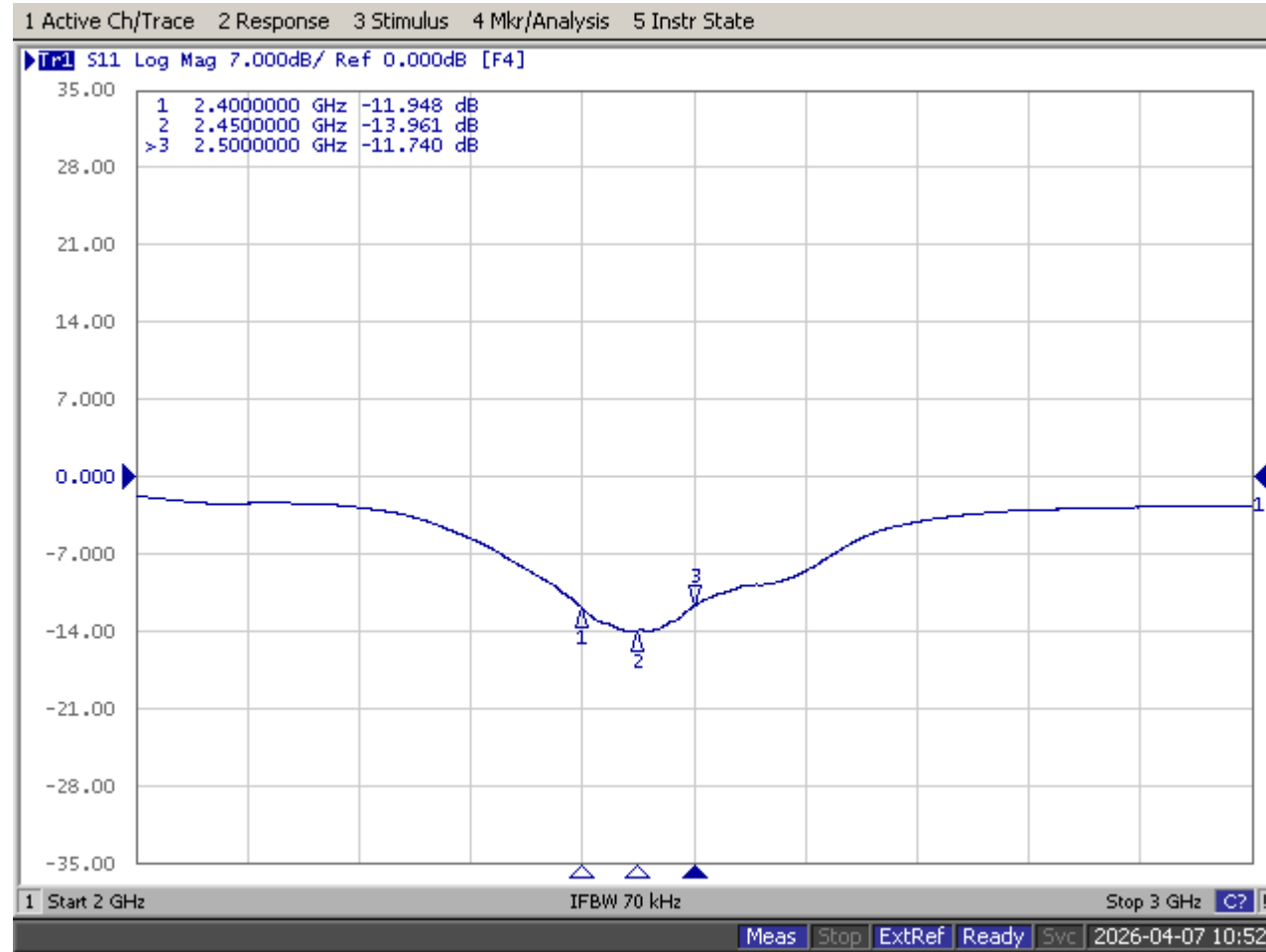


Port 1 = DB1 Port 2 = DB2

DB2

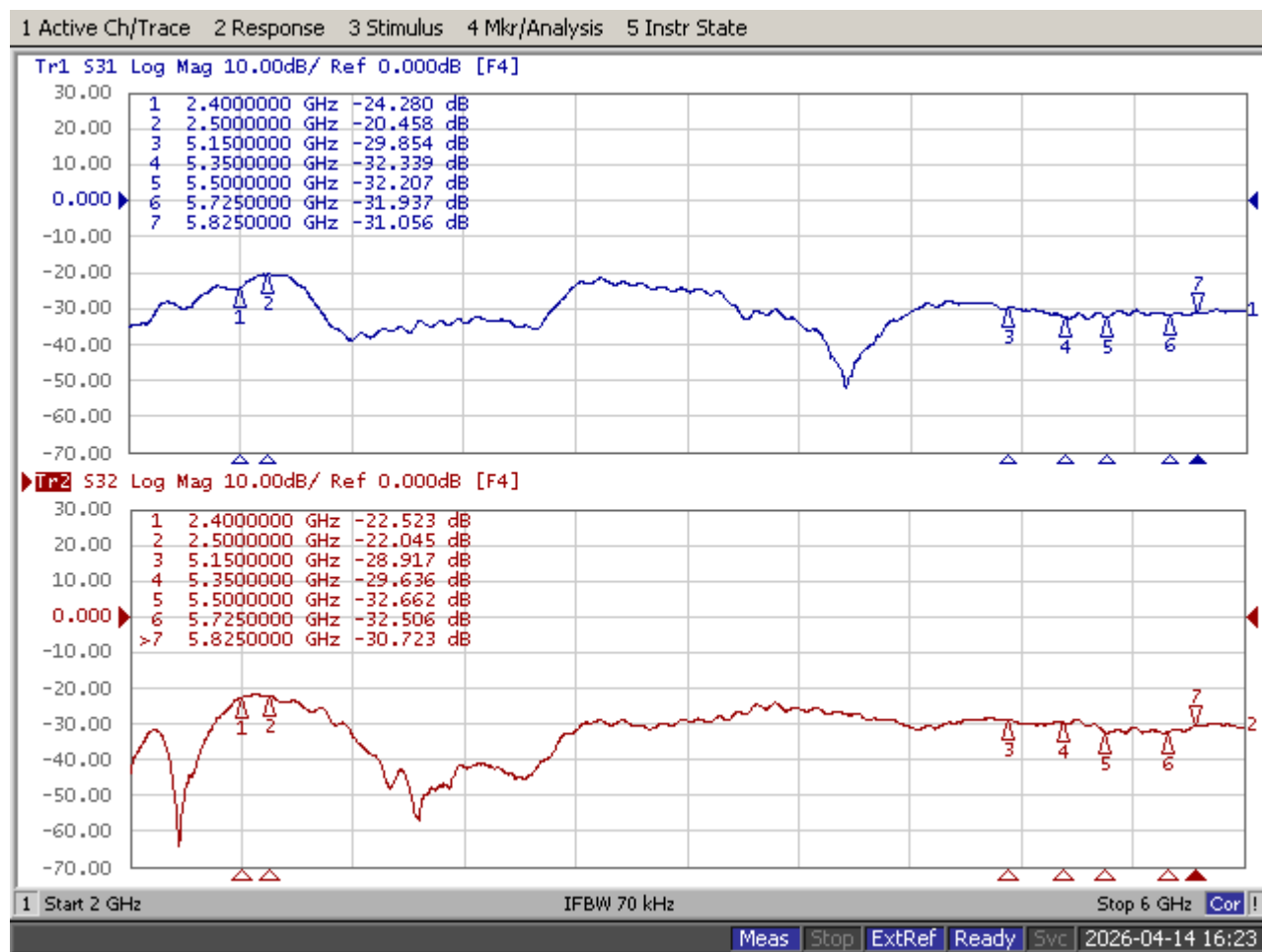
DB1

Return Loss of BT Antenna



BT

Isolation Between DB and BT Antennas



Port 1 = DB1

Port 2 = DB2

Port 3 = BT

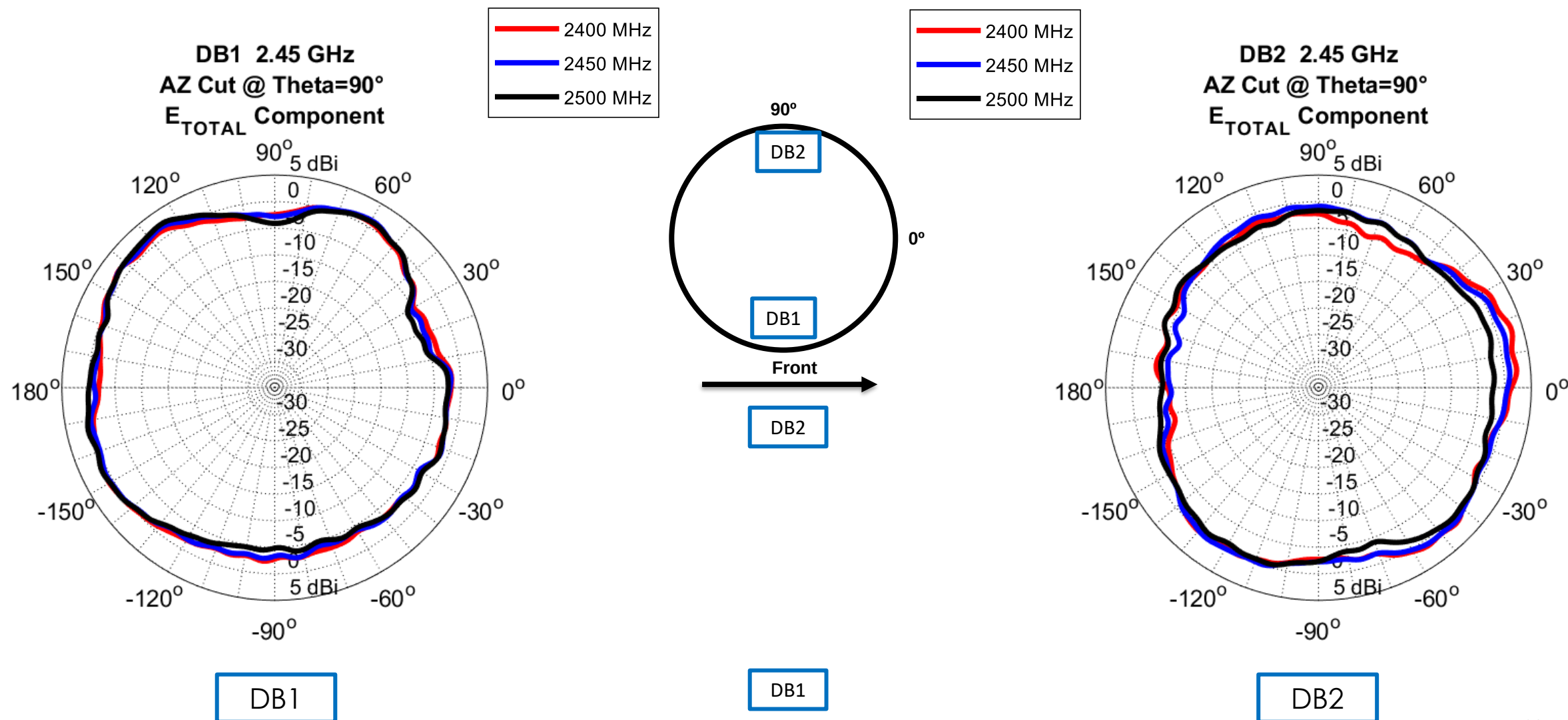
DB2

BT

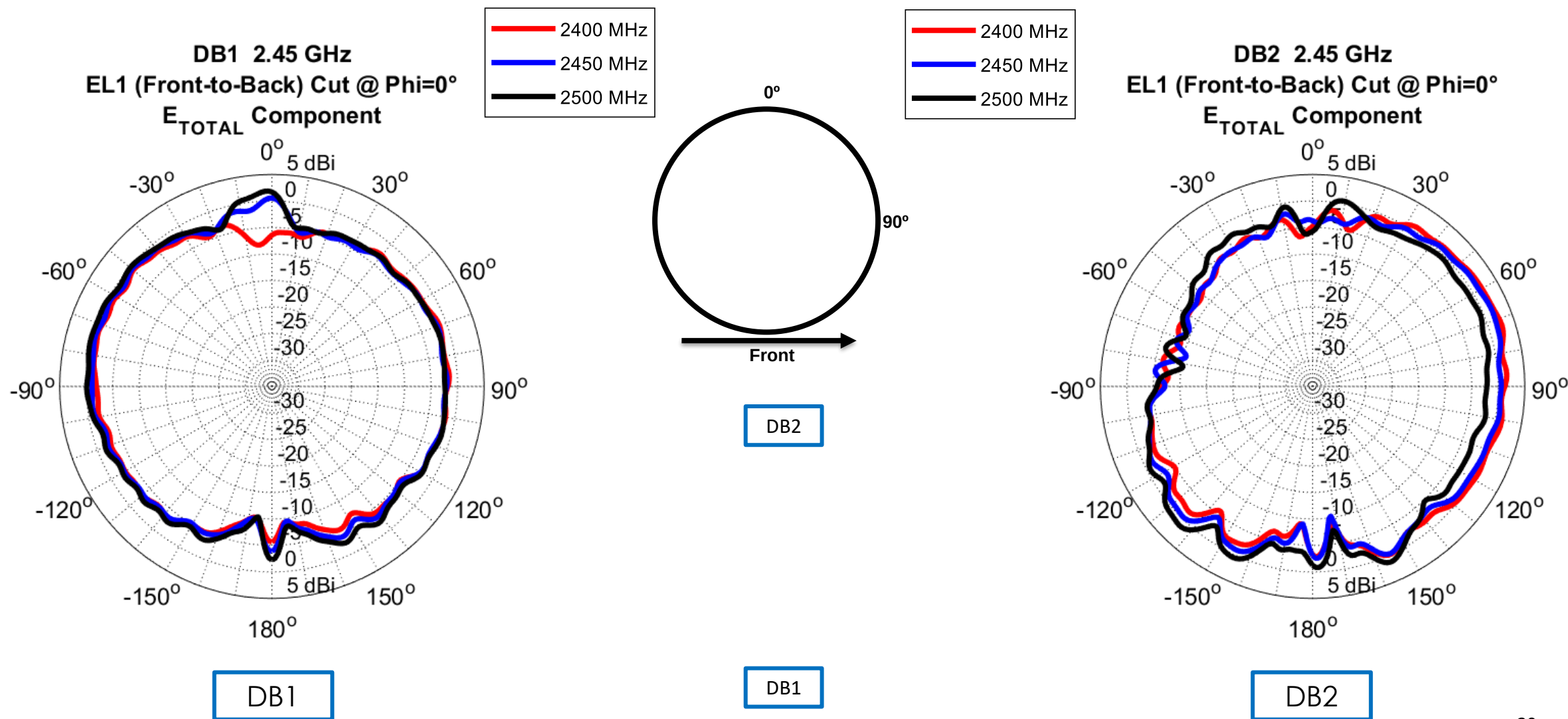
DB1

Azimuth Cut – Power Sum

DB Antennas

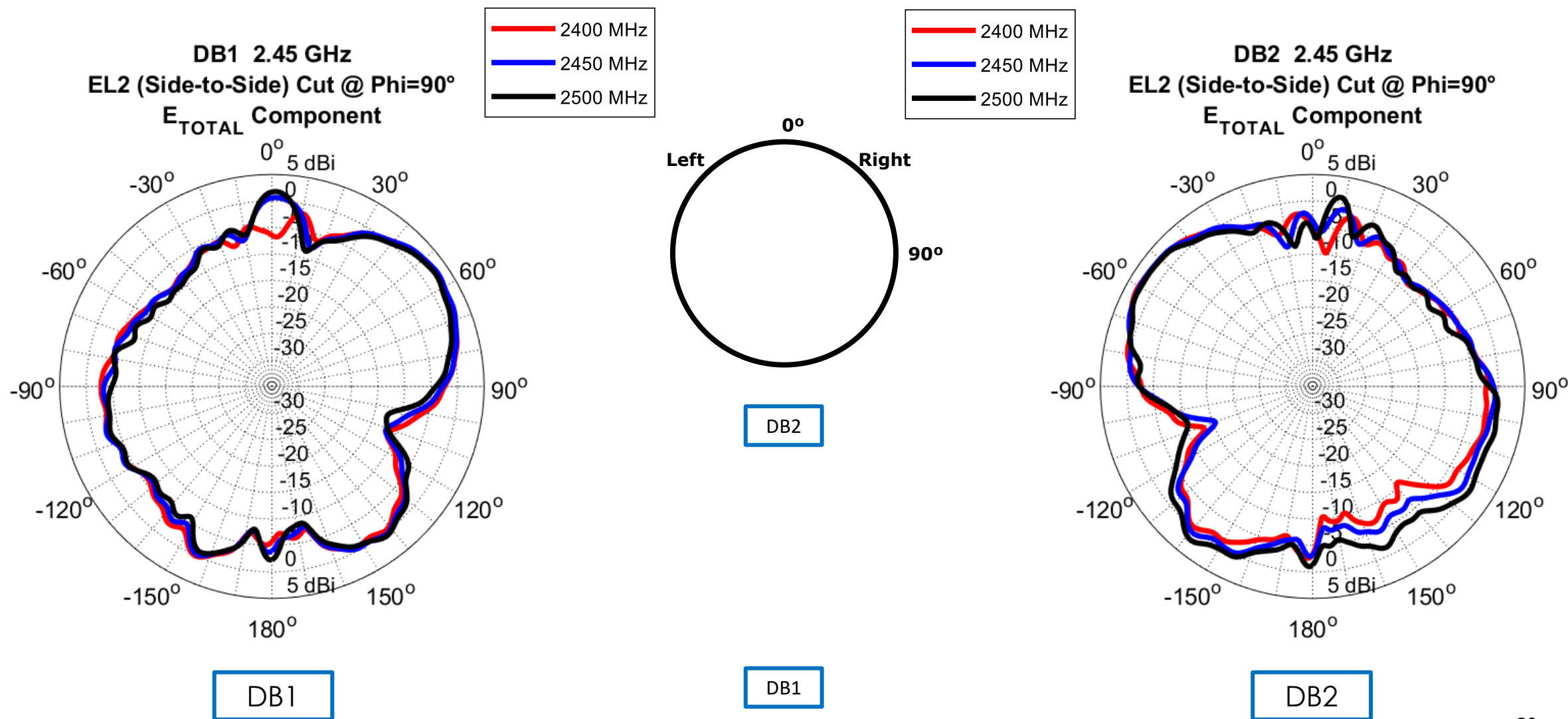


Elevation (Front to Back) Cut – Power Sum DB Antennas



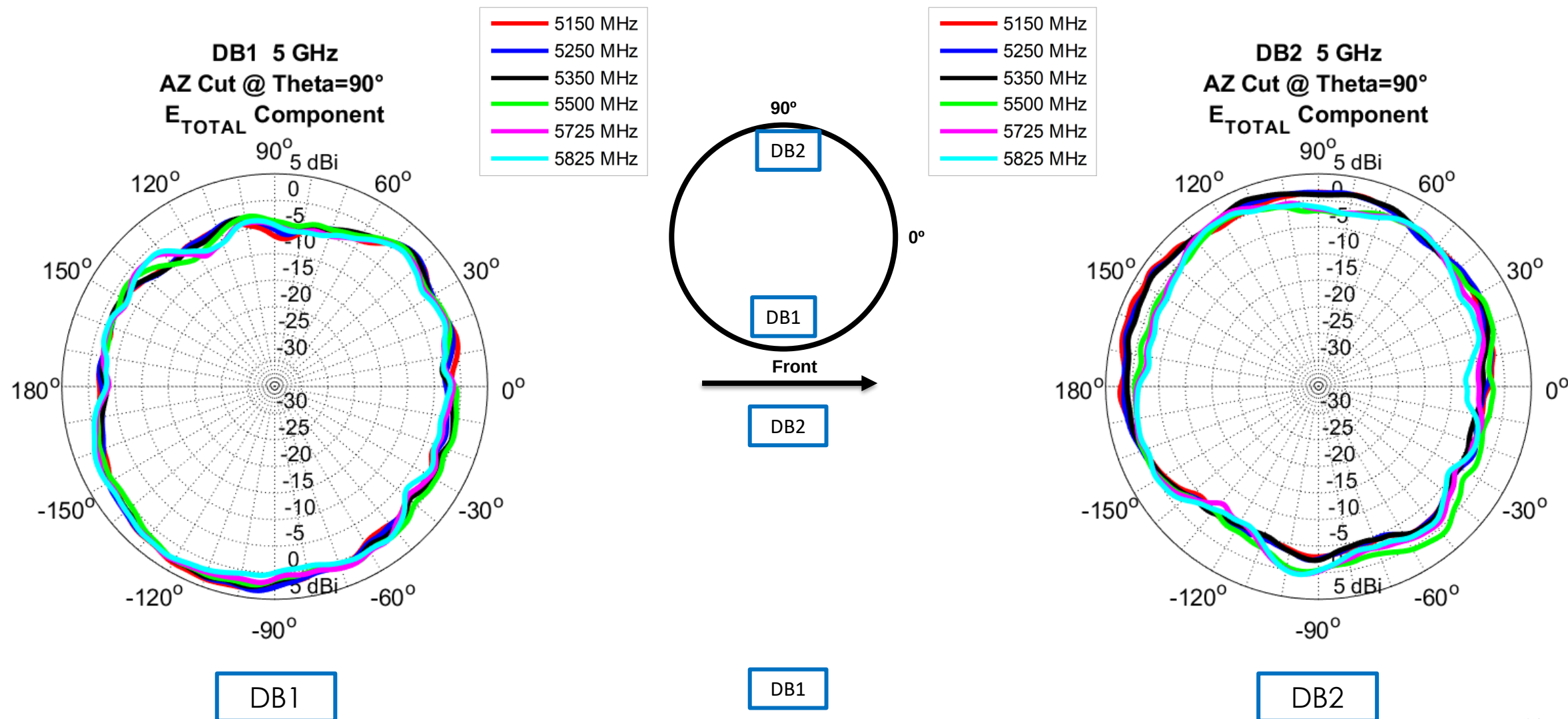
Elevation (Side to Side) Cut – Power Sum

DB Antennas

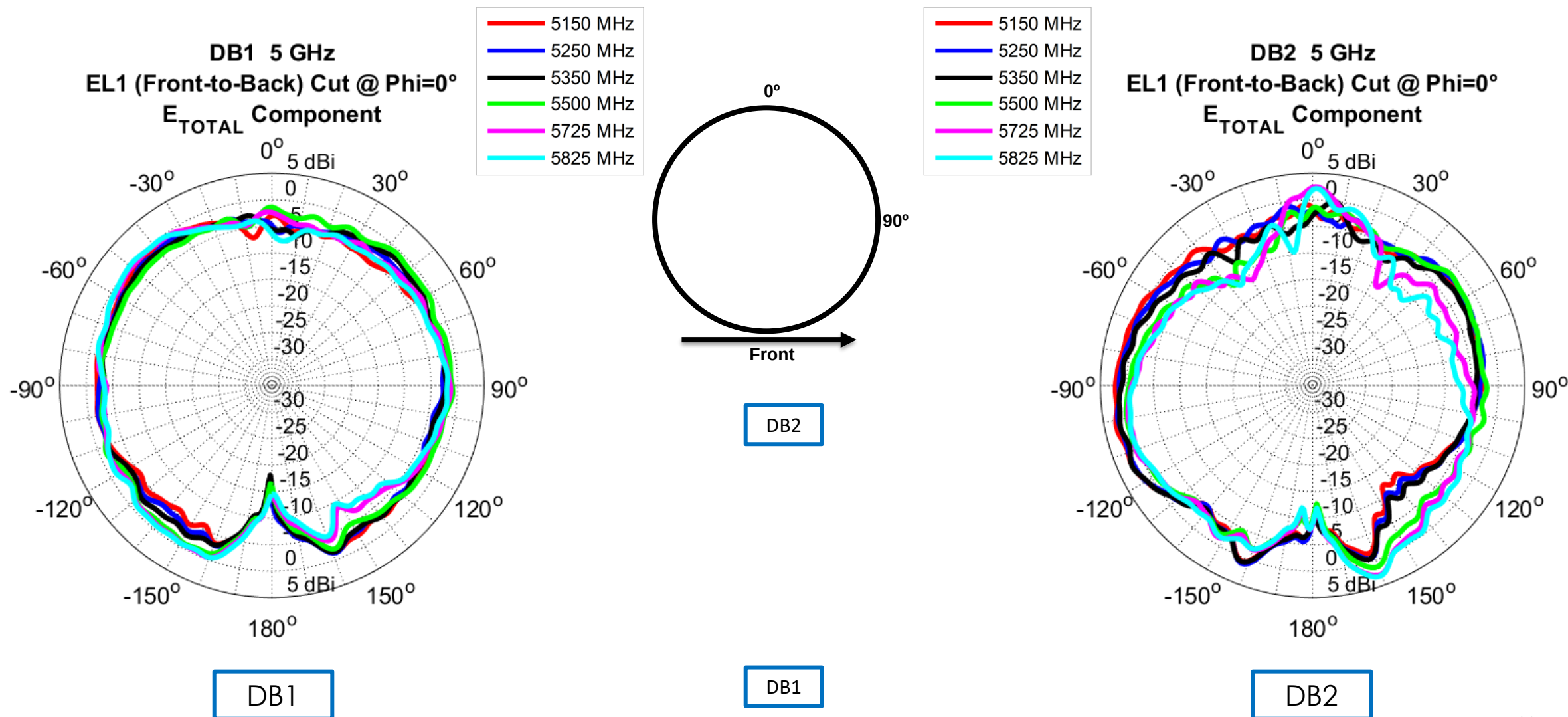


Azimuth Cut – Power Sum

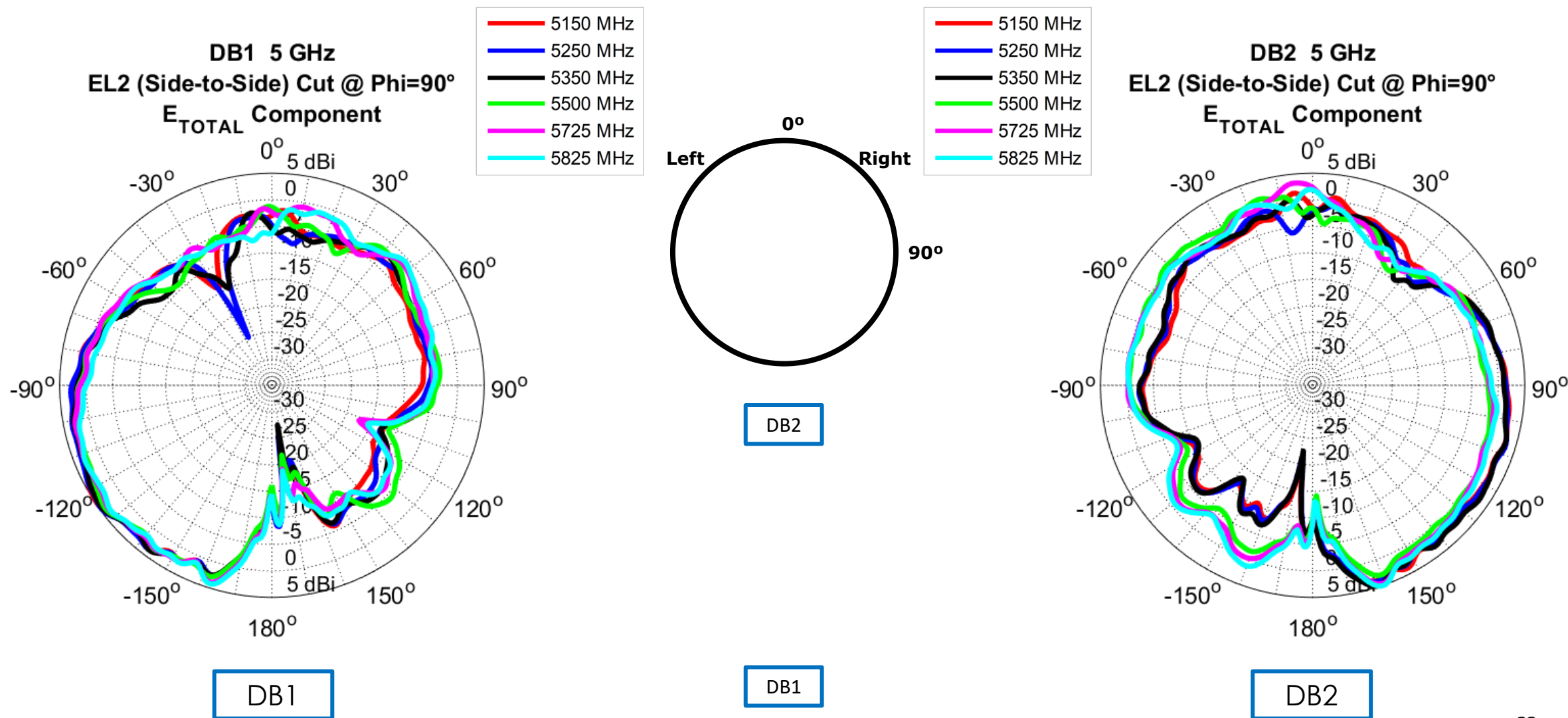
DB Antennas



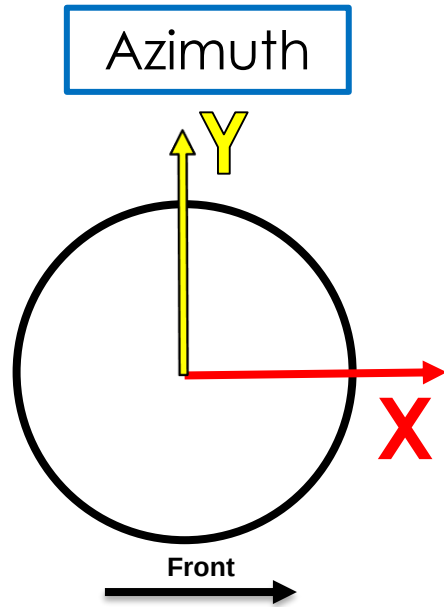
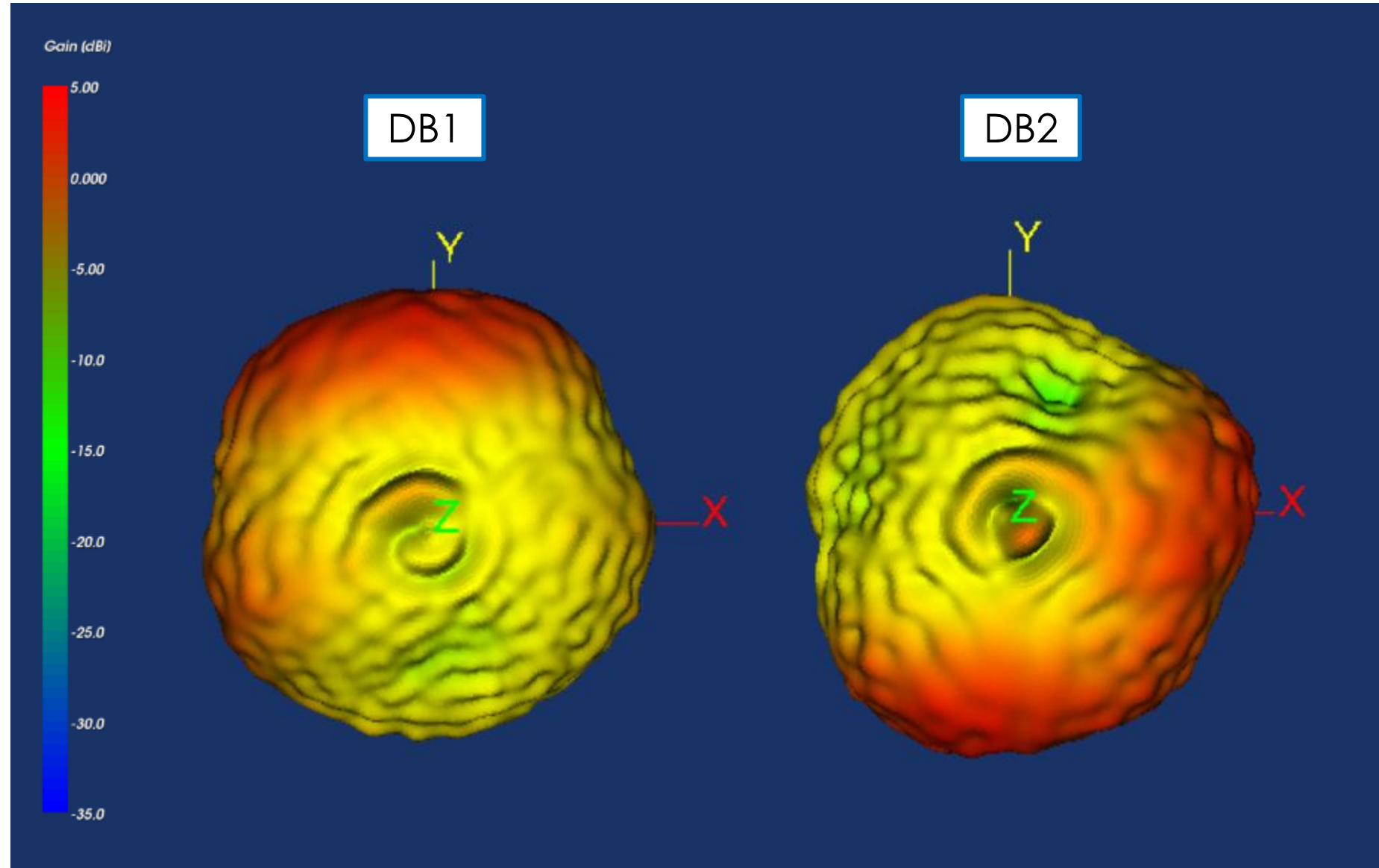
Elevation (Front to Back) Cut – Power Sum DB Antennas



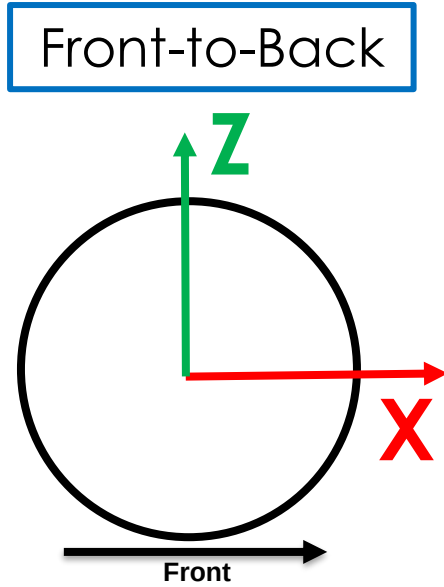
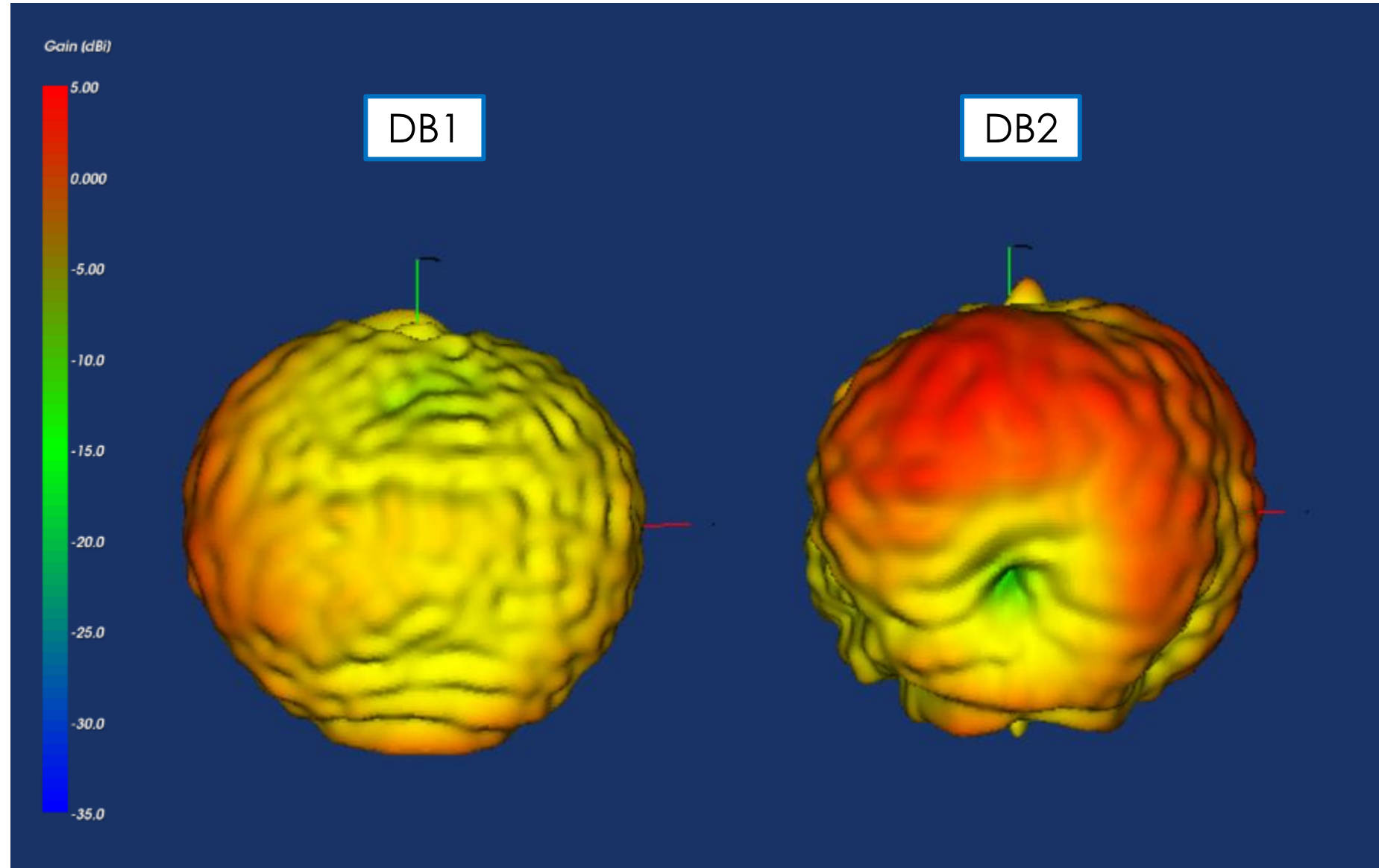
Elevation (Side to Side) Cut – Power Sum DB Antennas



3D Gain Plot – DB Antennas – 2.4 GHz

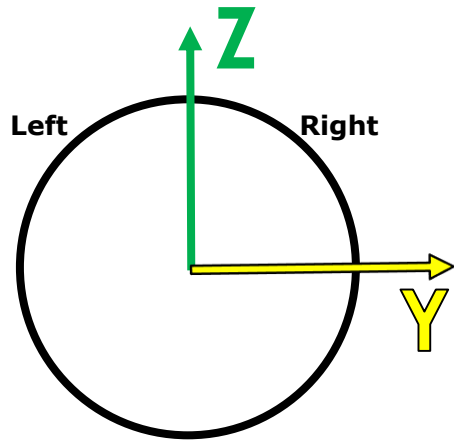
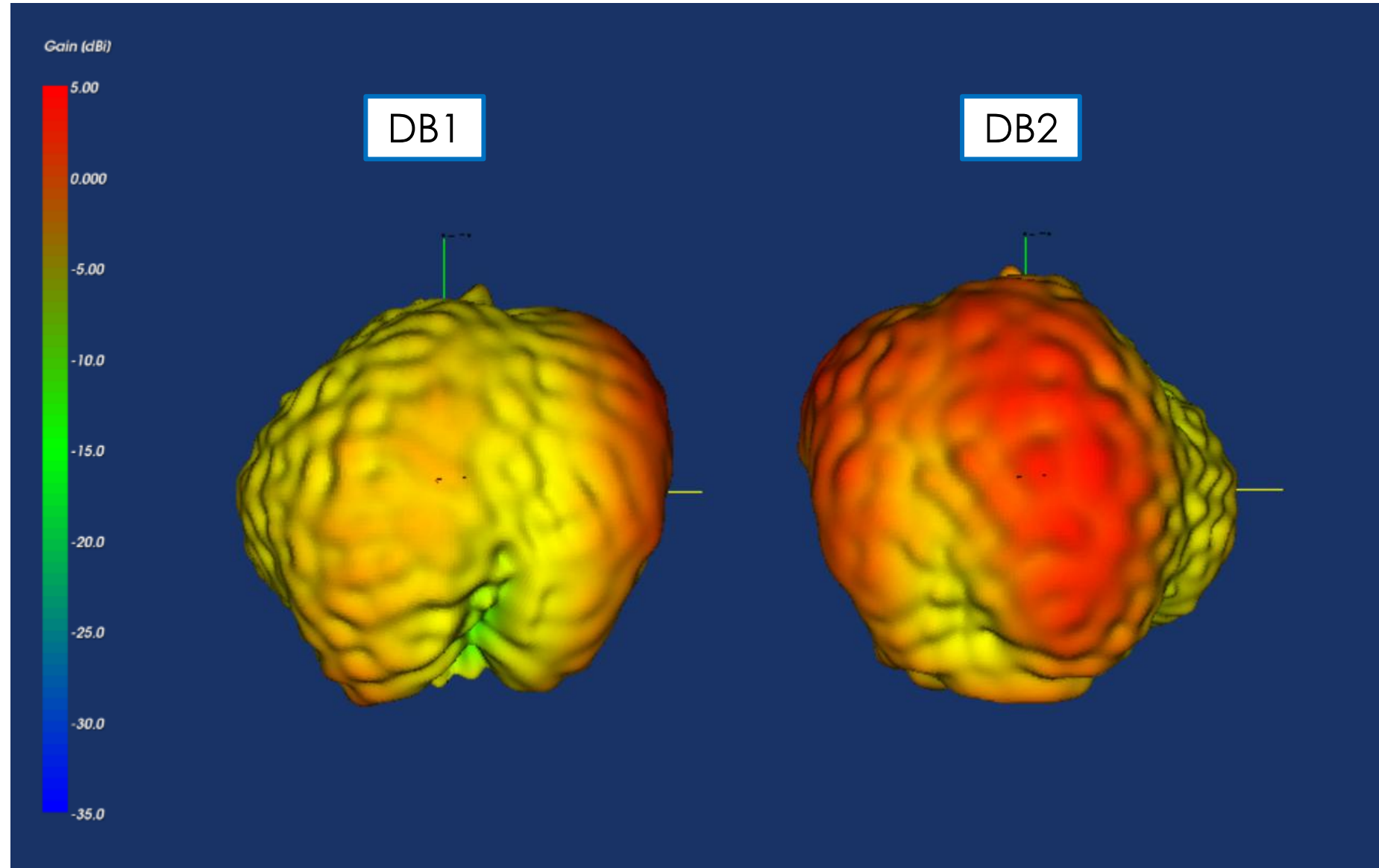


3D Gain Plot – DB Antennas – 2.4 GHz

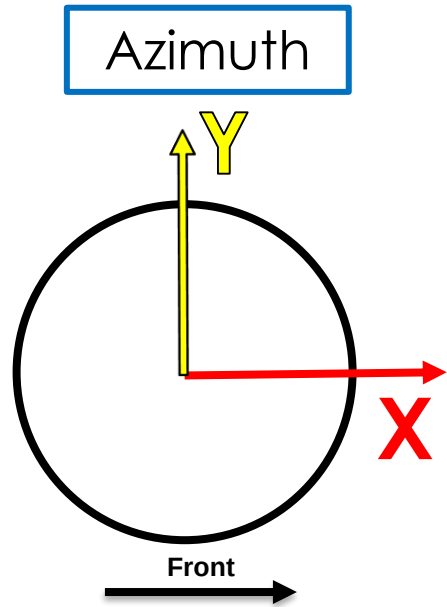
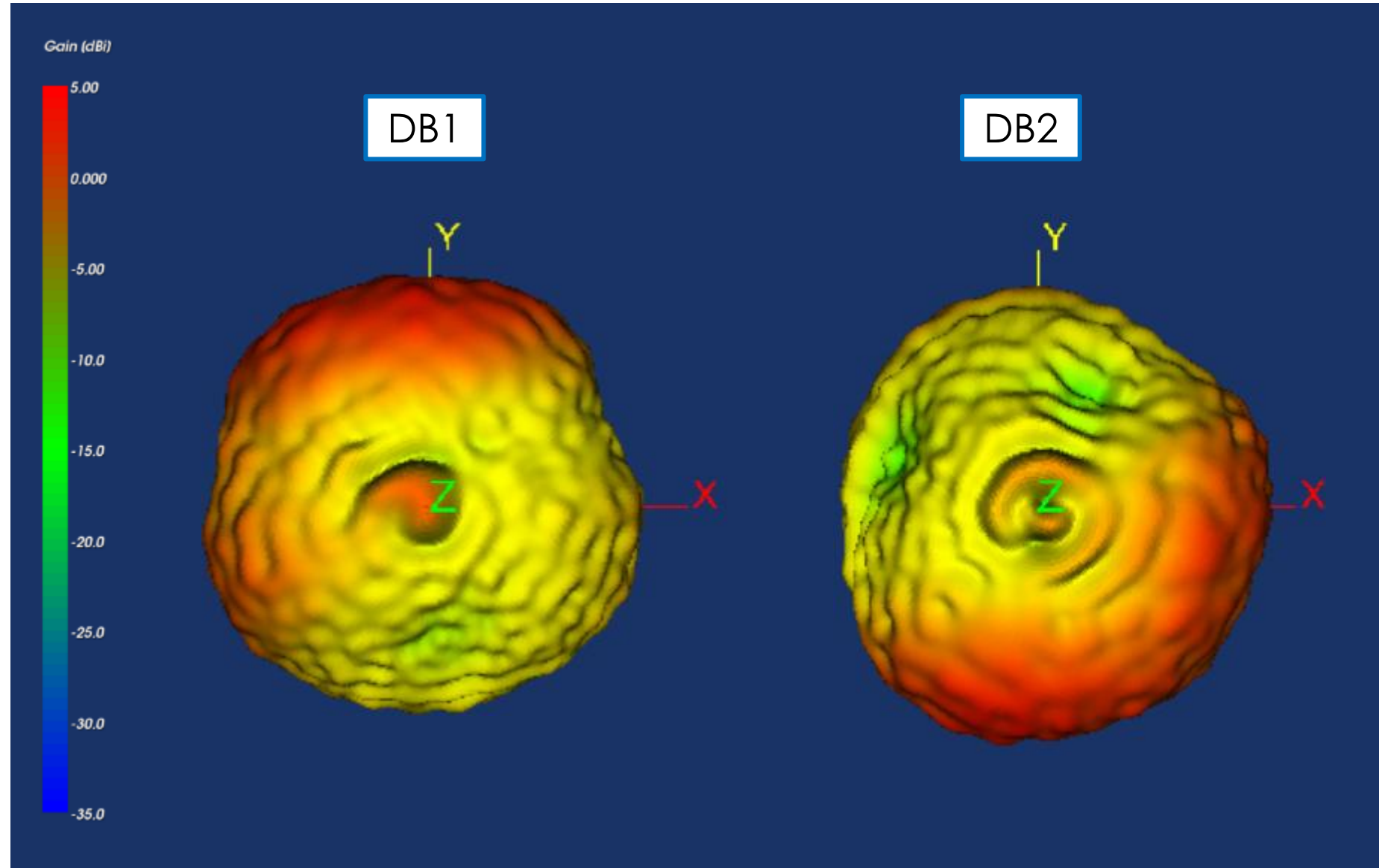


3D Gain Plot – DB Antennas – 2.4 GHz

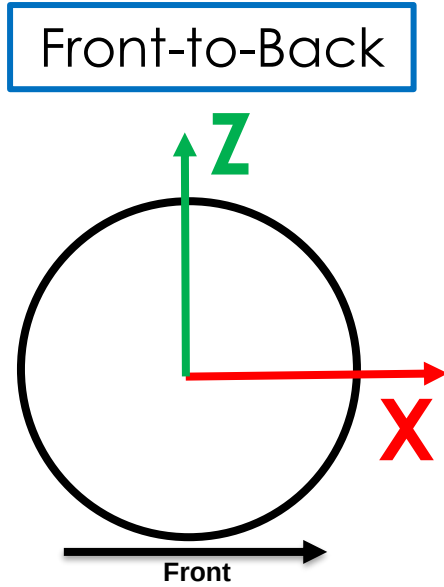
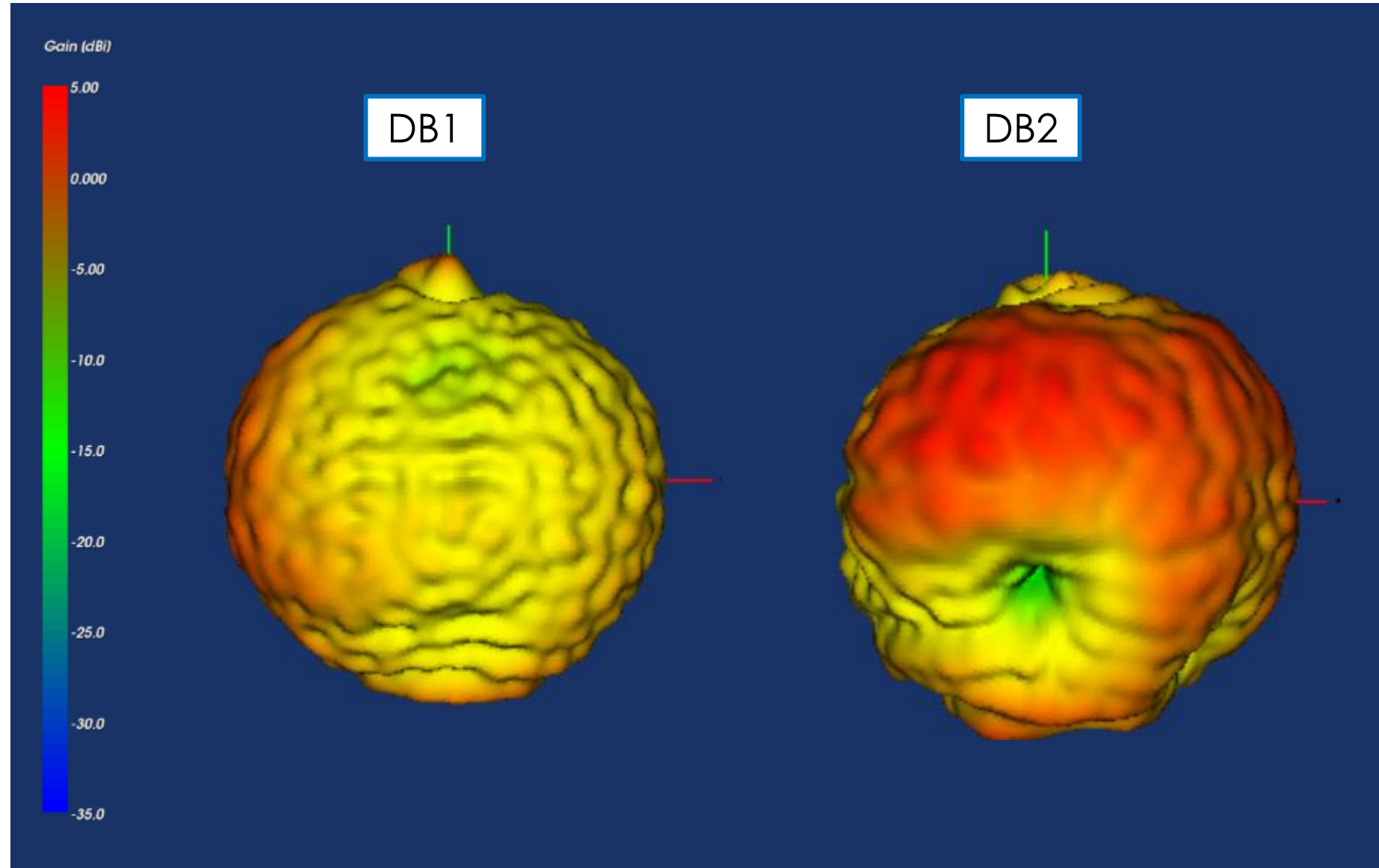
Side-to-Side



3D Gain Plot – DB Antennas – 2.45 GHz

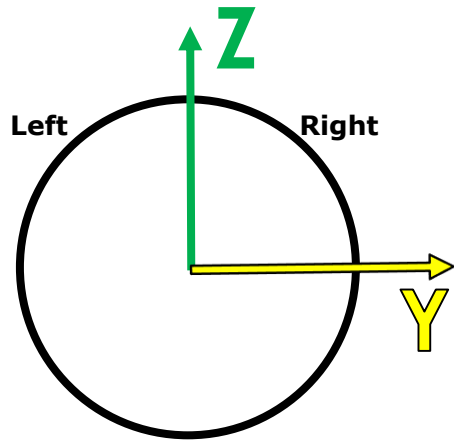
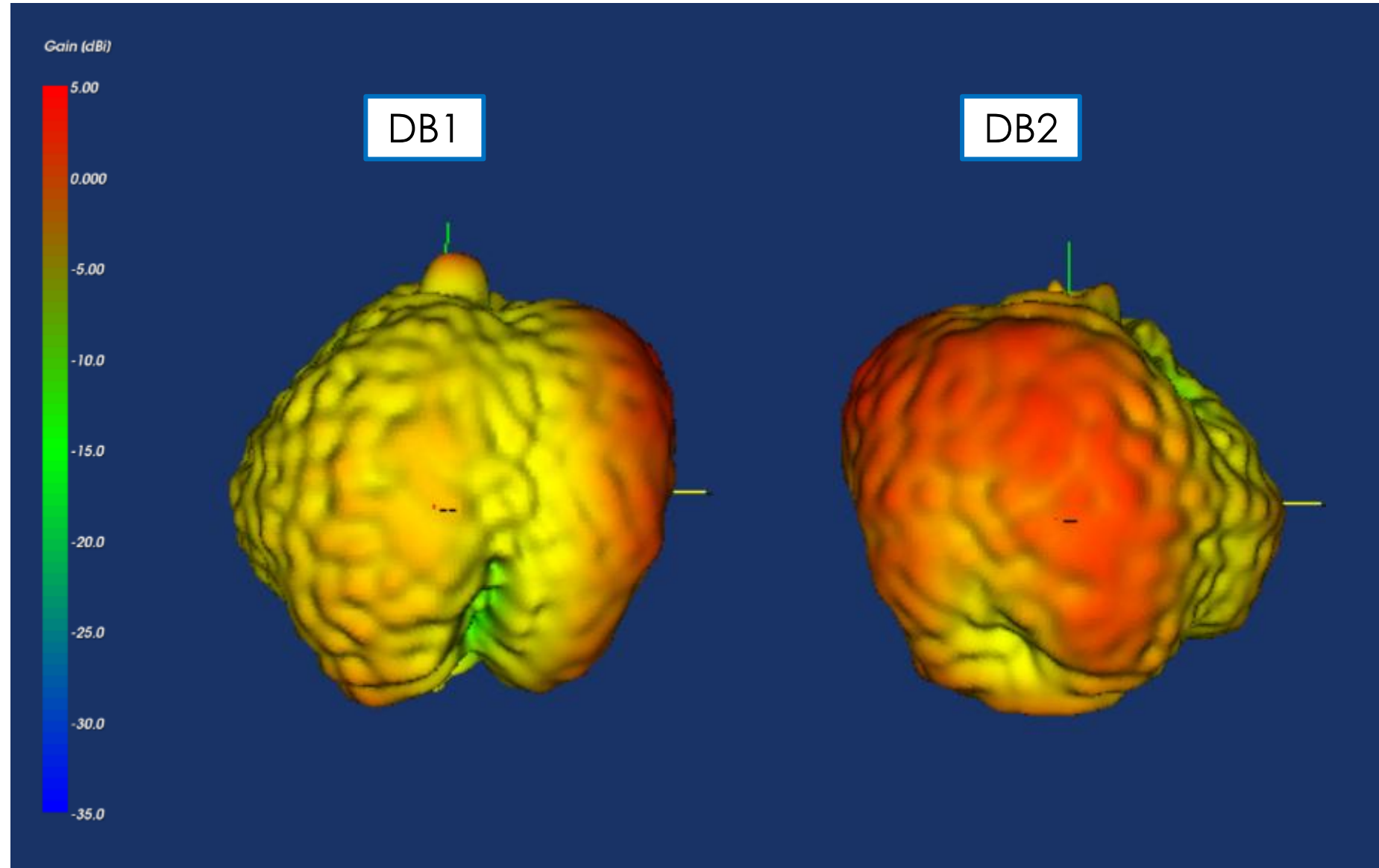


3D Gain Plot – DB Antennas – 2.45 GHz

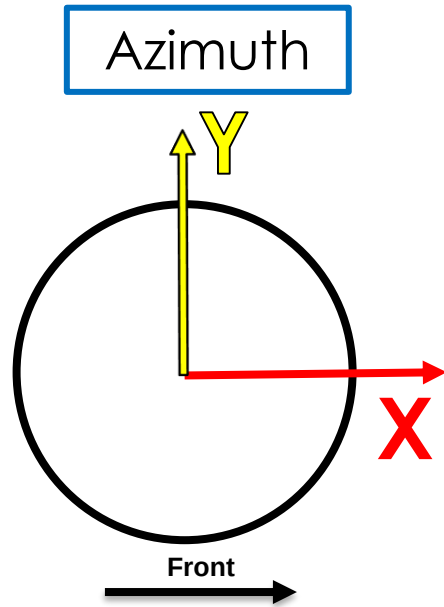
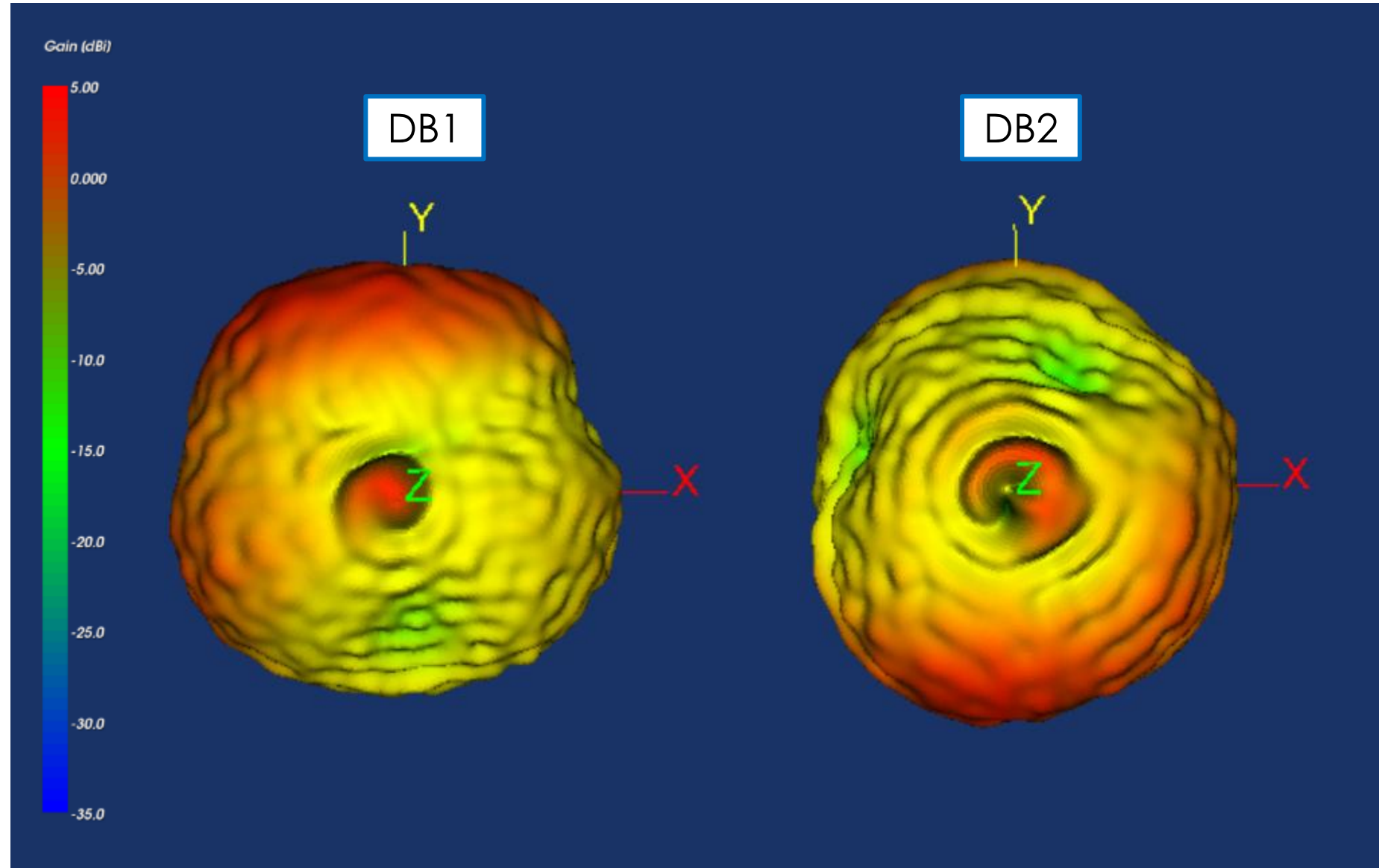


3D Gain Plot – DB Antennas – 2.45 GHz

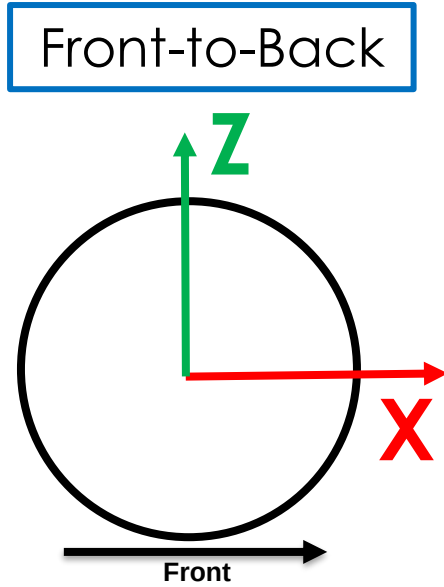
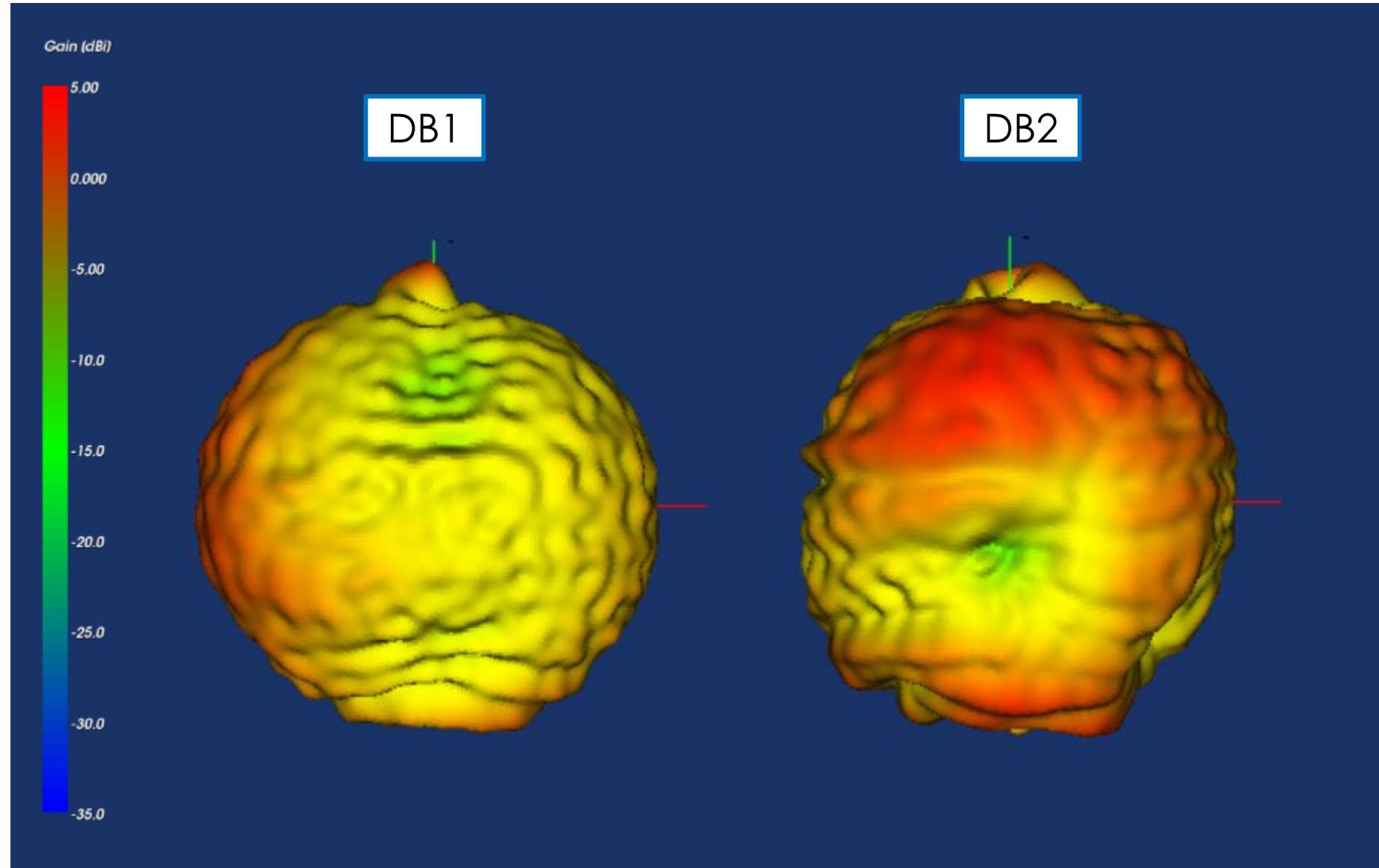
Side-to-Side



3D Gain Plot – DB Antennas – 2.5 GHz

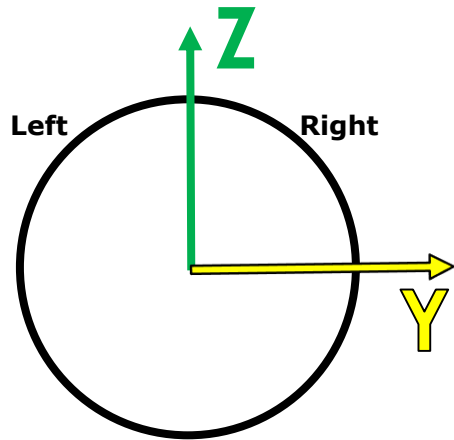
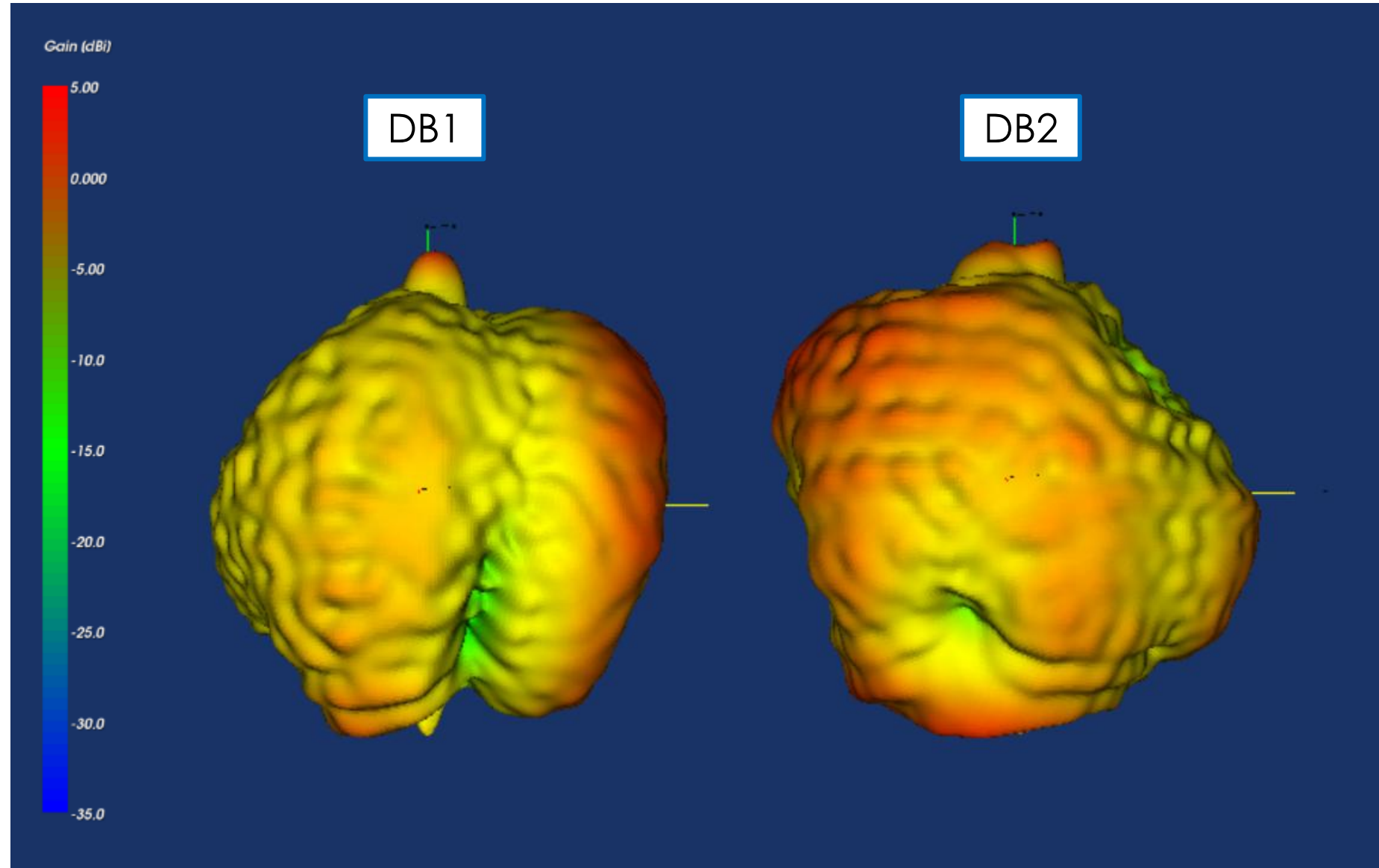


3D Gain Plot – DB Antennas – 2.5 GHz

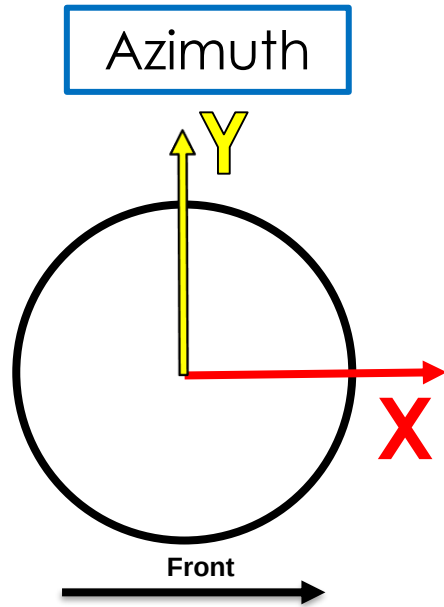
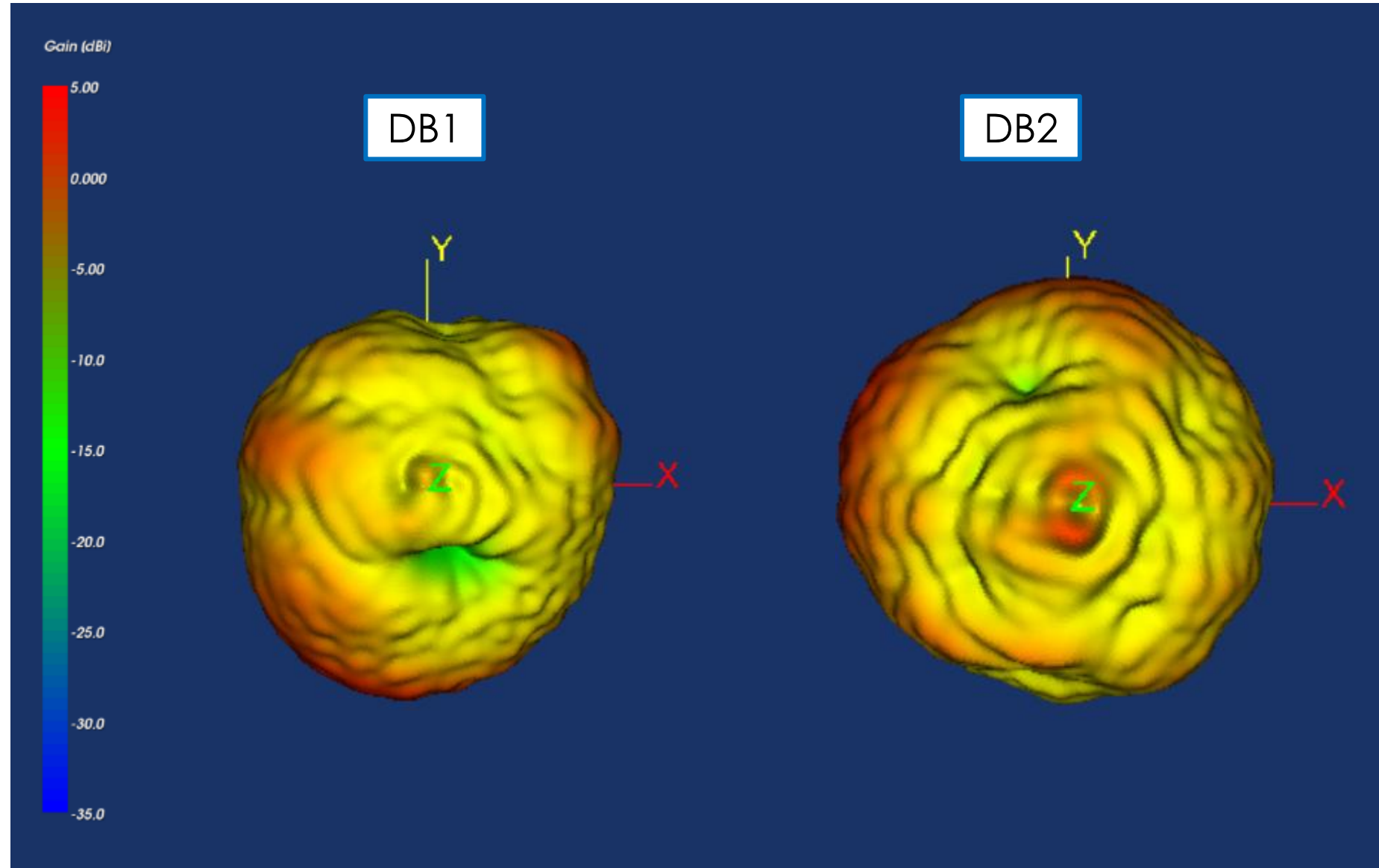


3D Gain Plot – DB Antennas – 2.5 GHz

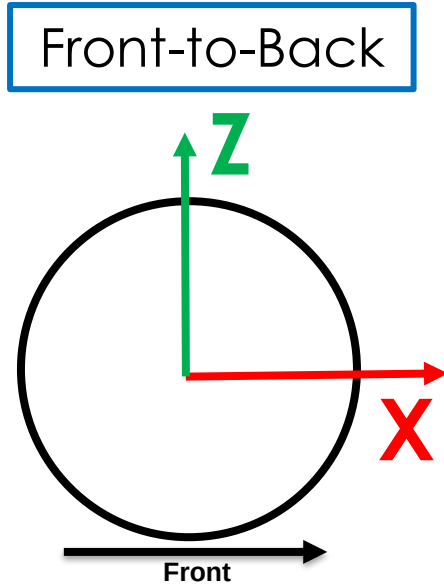
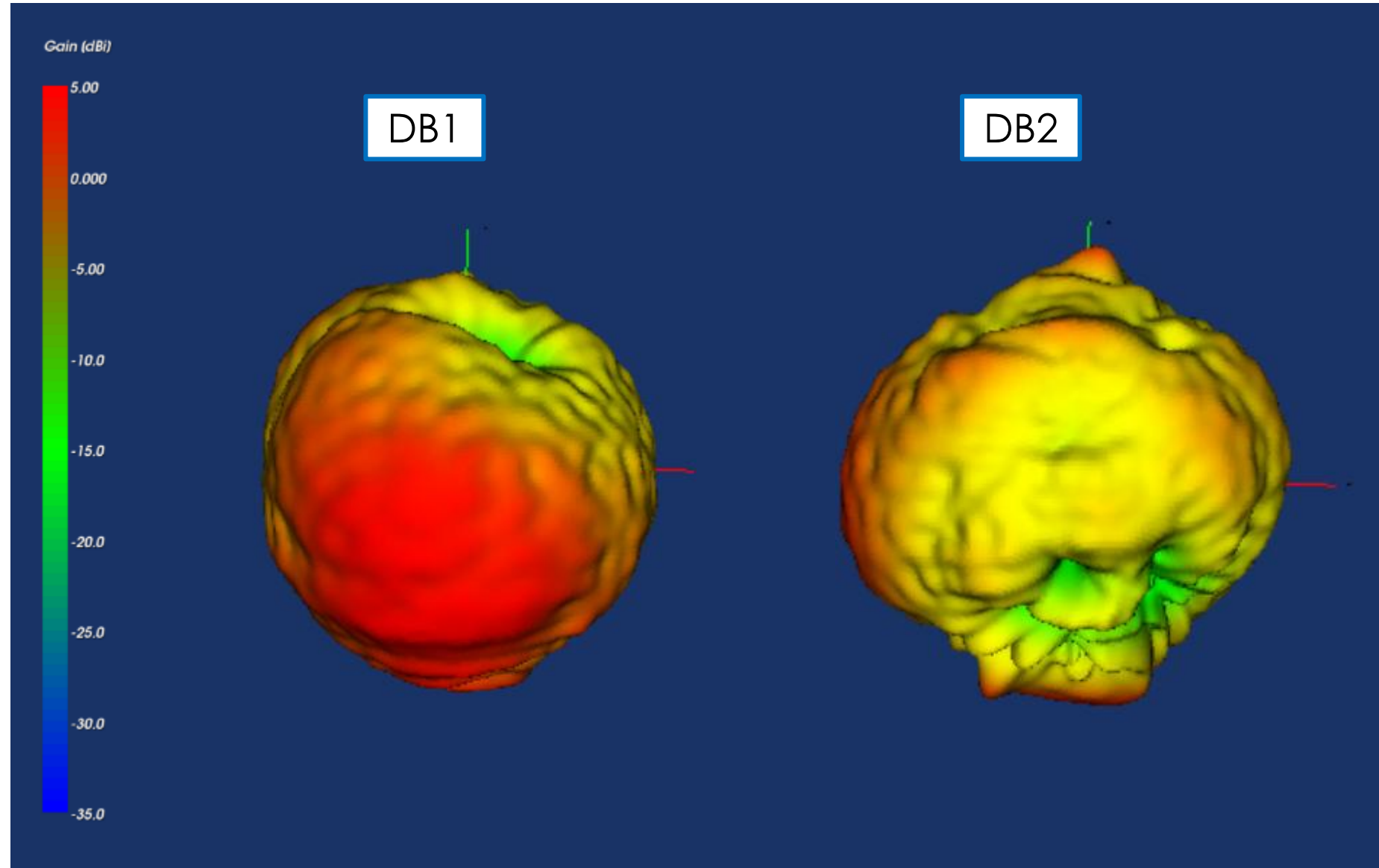
Side-to-Side



3D Gain Plot – DB Antennas – 5.15 GHz

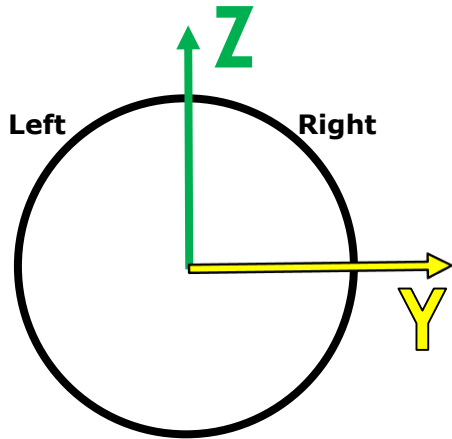
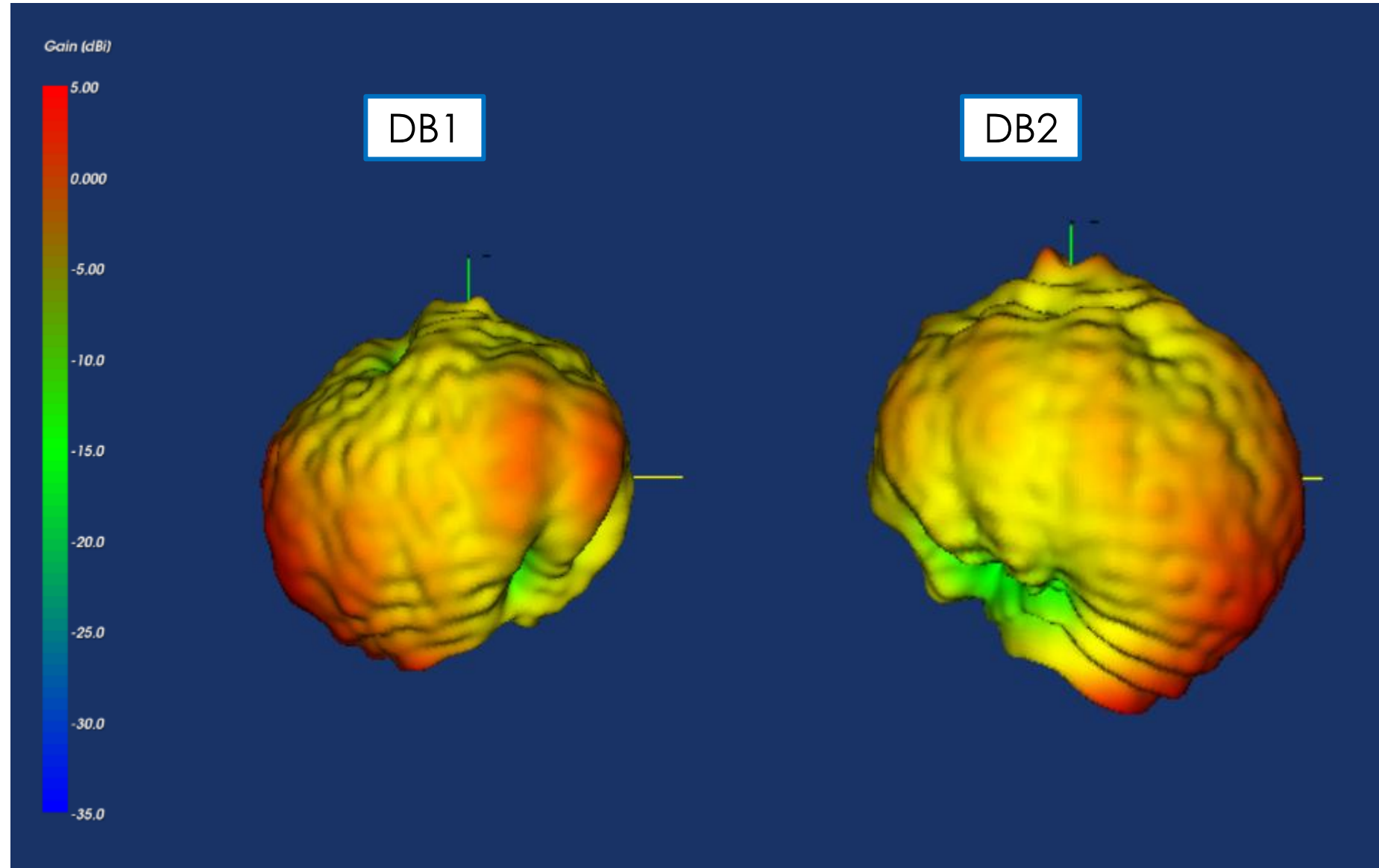


3D Gain Plot – DB Antennas – 5.15 GHz

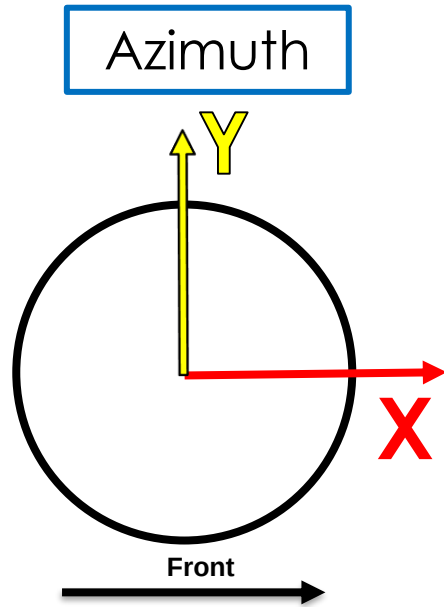
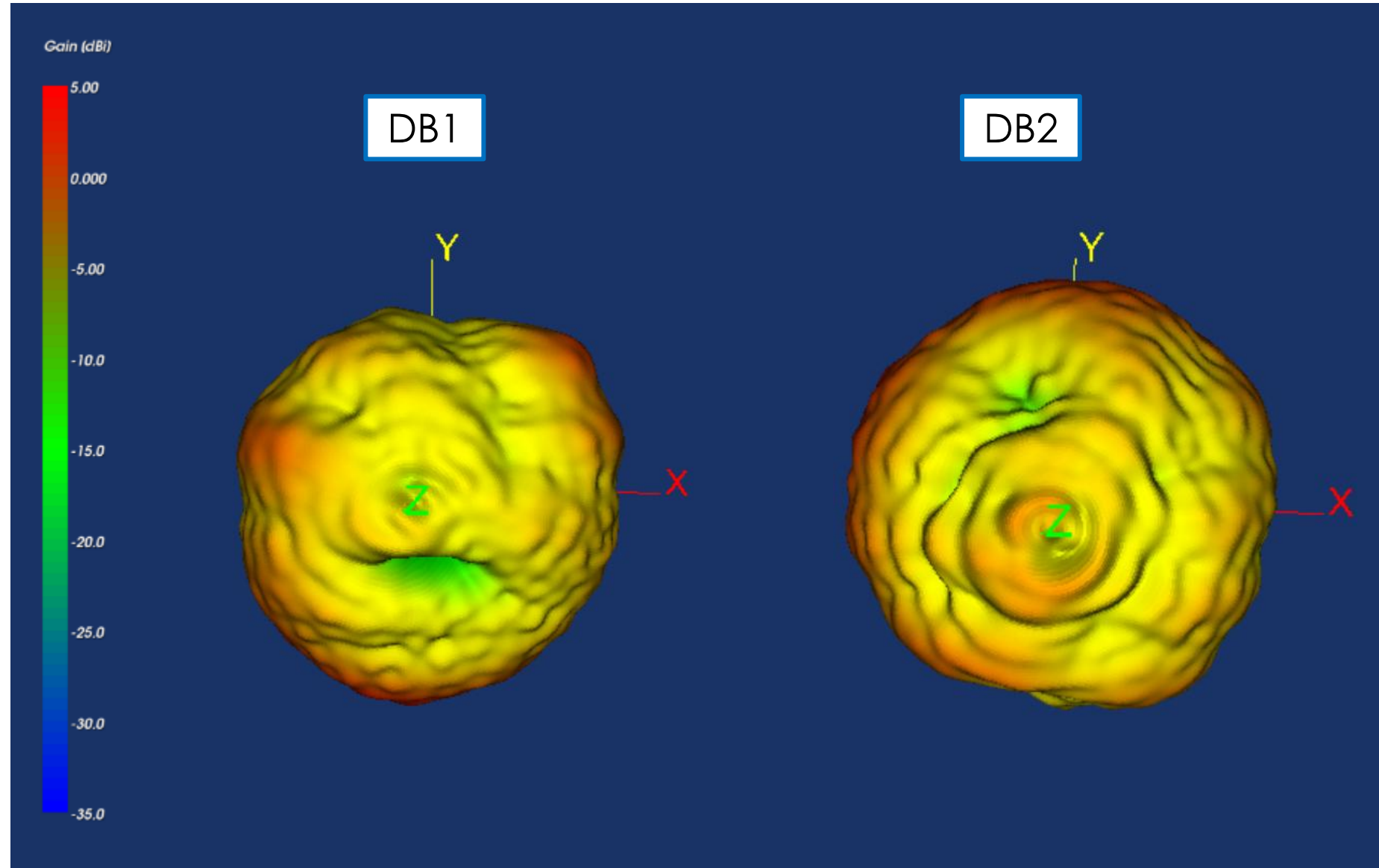


3D Gain Plot – DB Antennas – 5.15 GHz

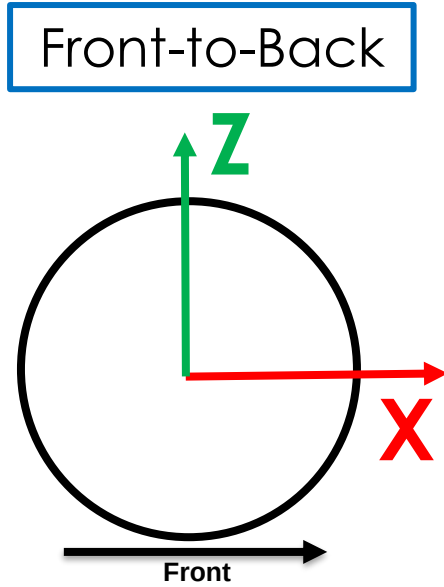
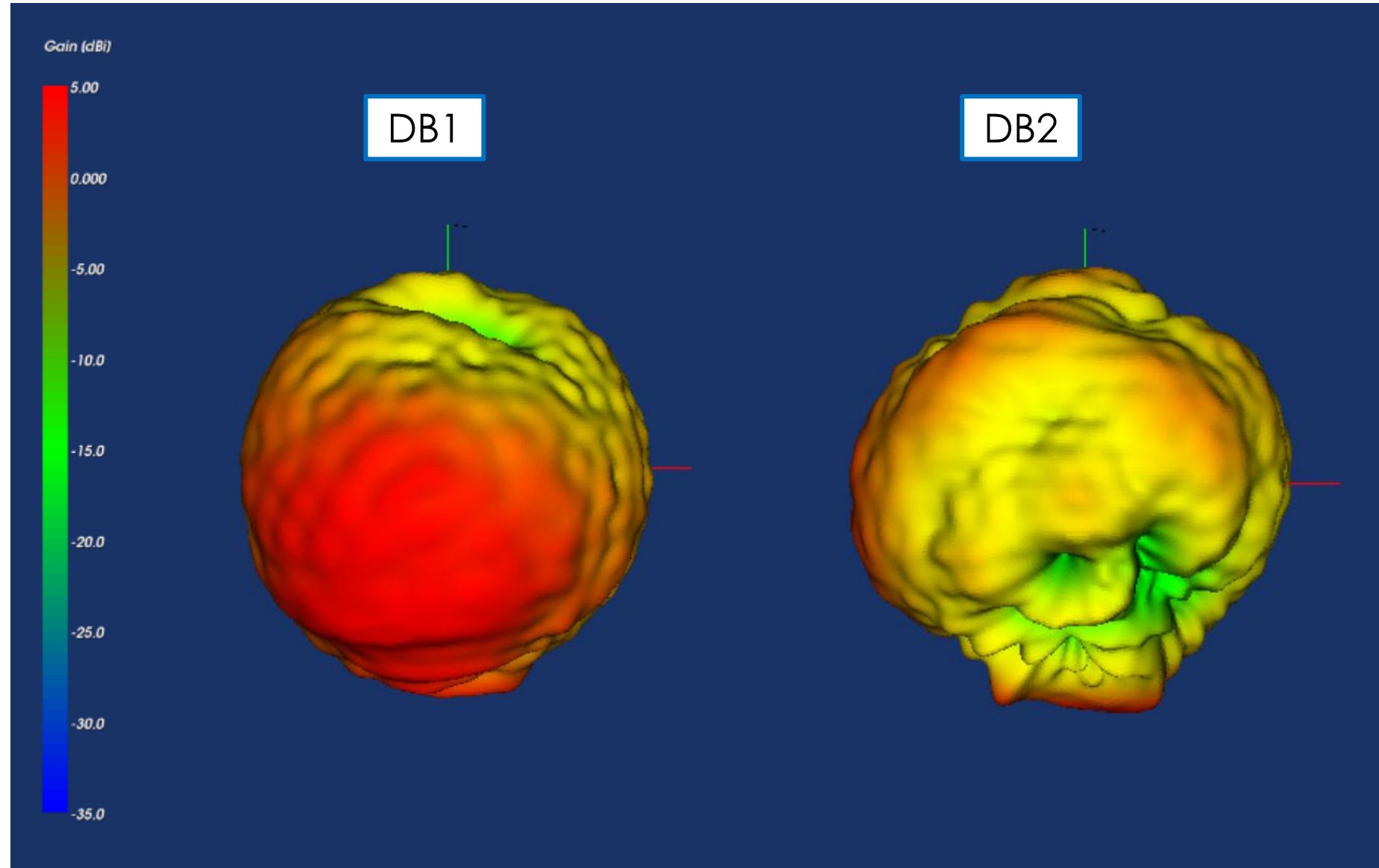
Side-to-Side



3D Gain Plot – DB Antennas – 5.25 GHz

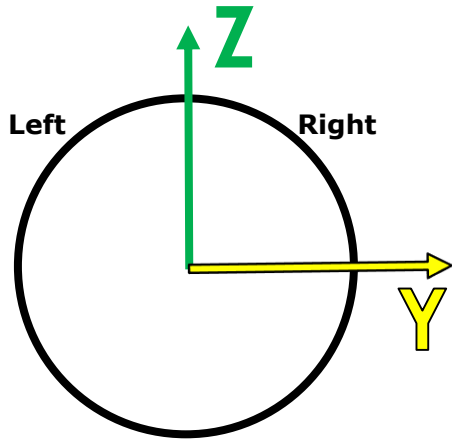
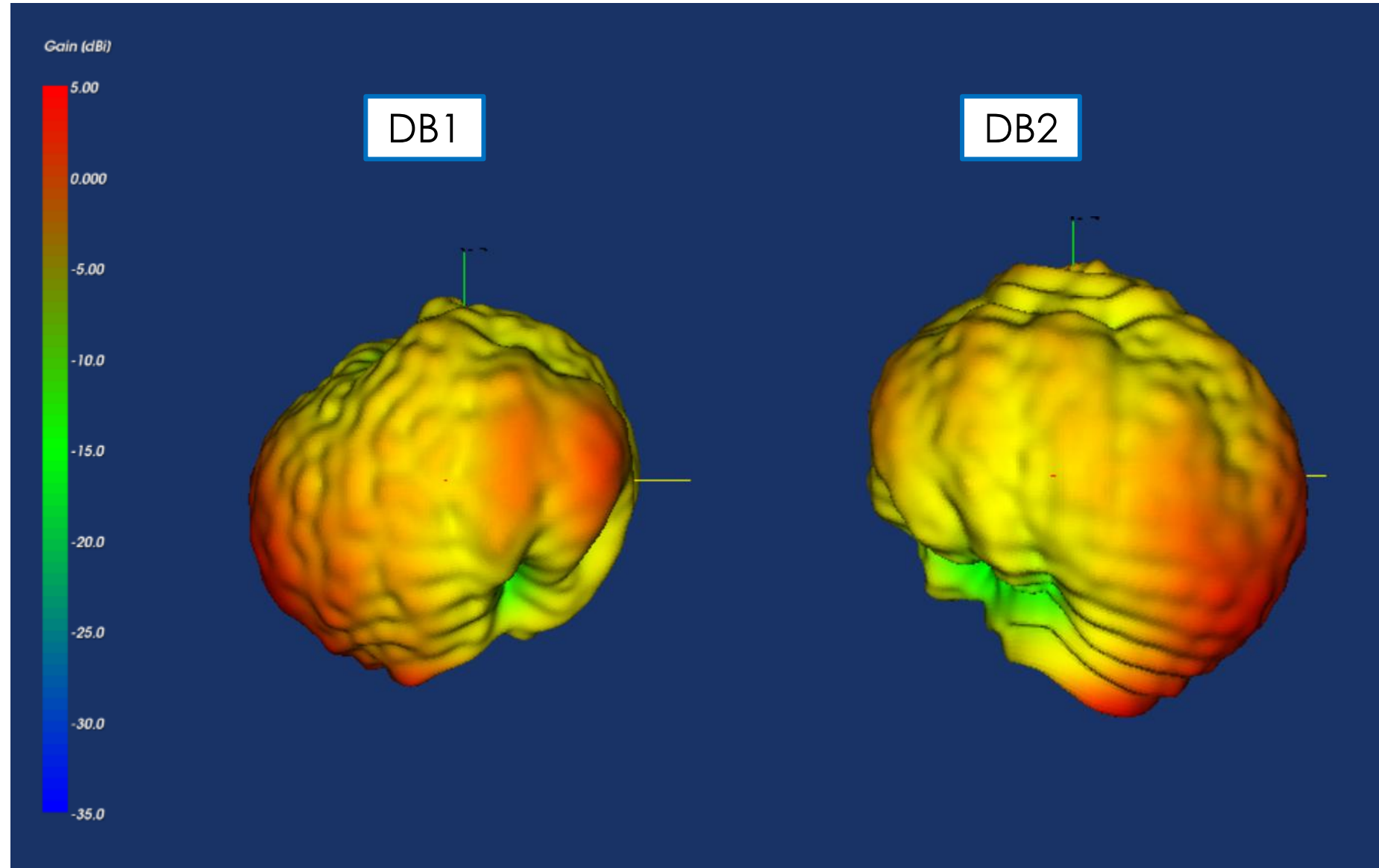


3D Gain Plot – DB Antennas – 5.25 GHz

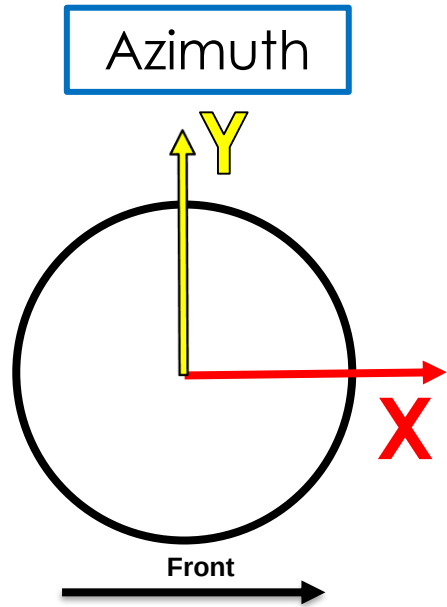
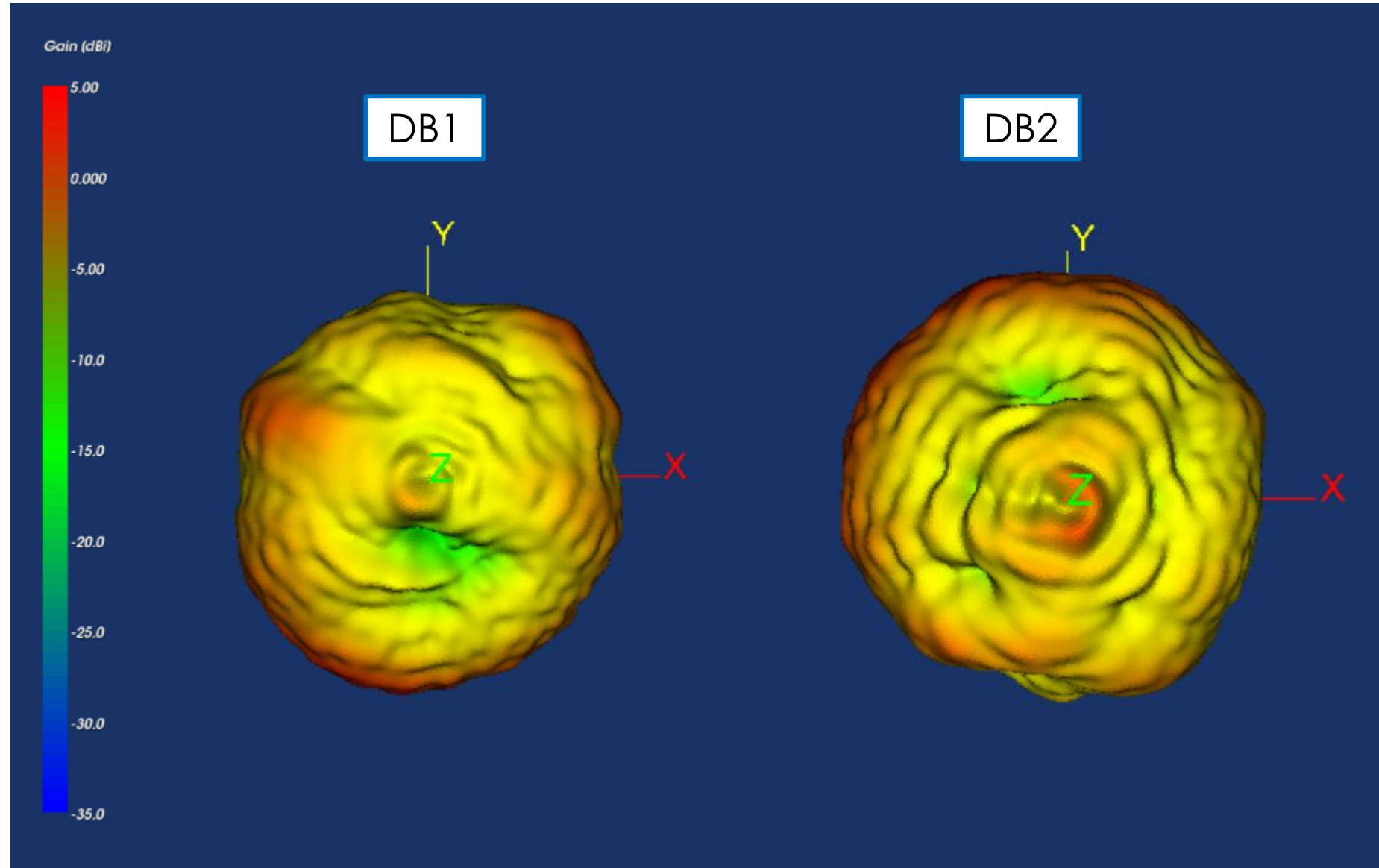


3D Gain Plot – DB Antennas – 5.25 GHz

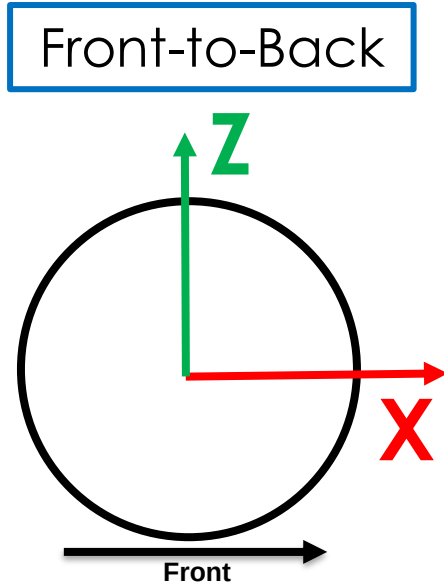
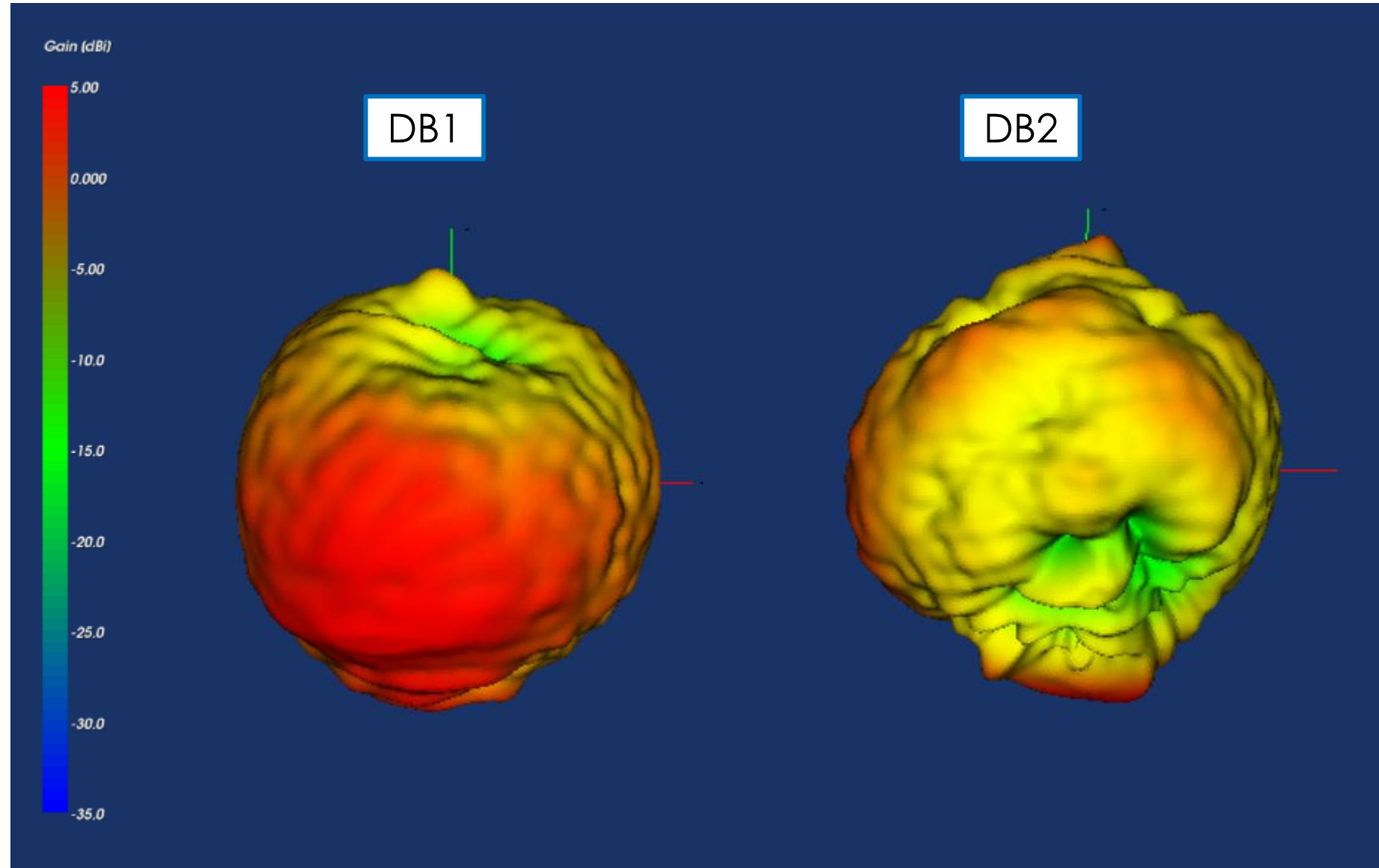
Side-to-Side



3D Gain Plot – DB Antennas – 5.35 GHz

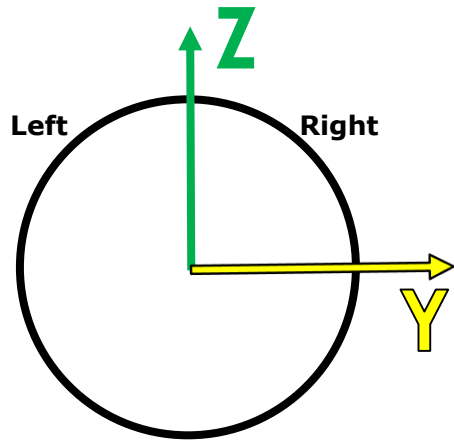
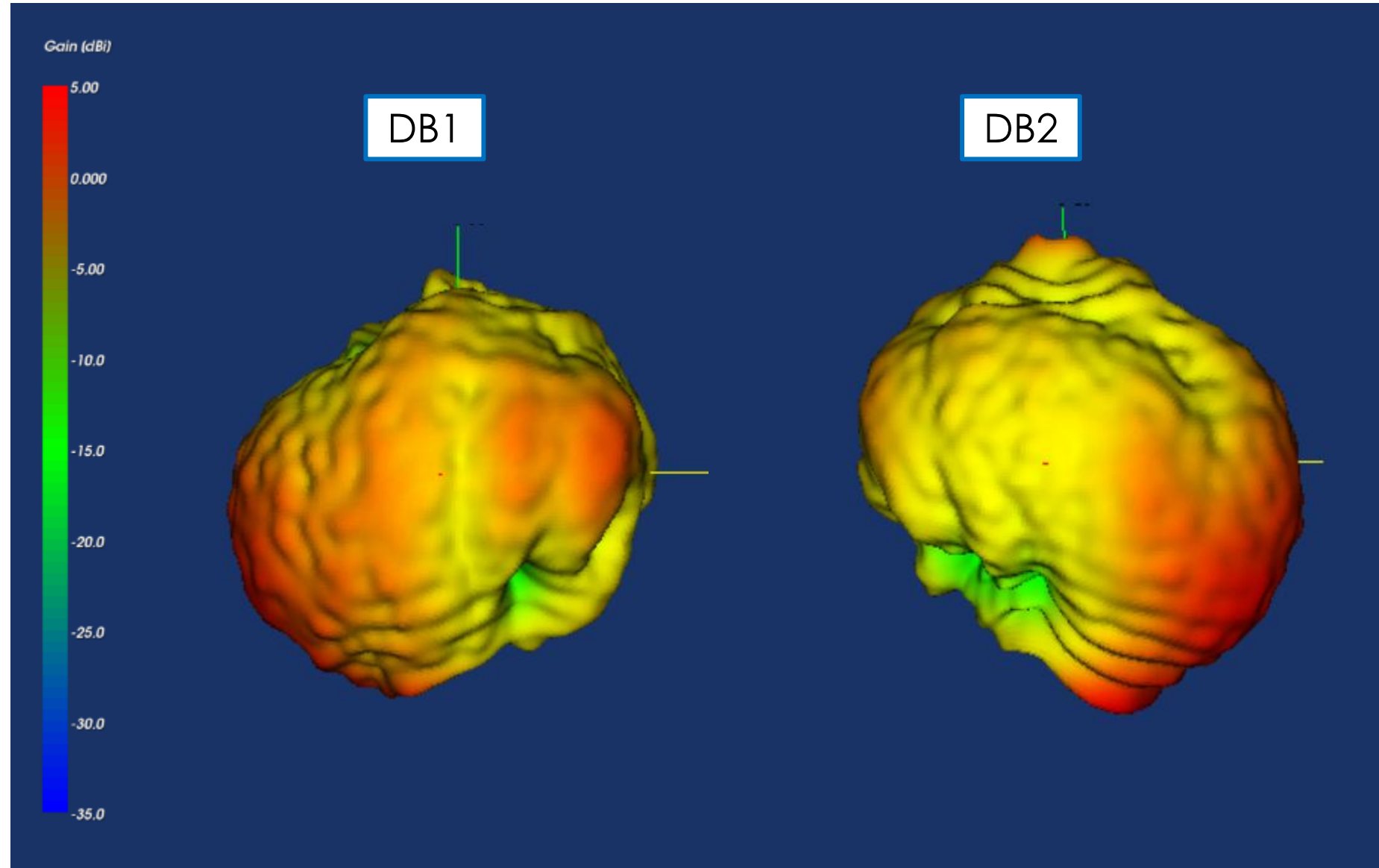


3D Gain Plot – DB Antennas – 5.35 GHz

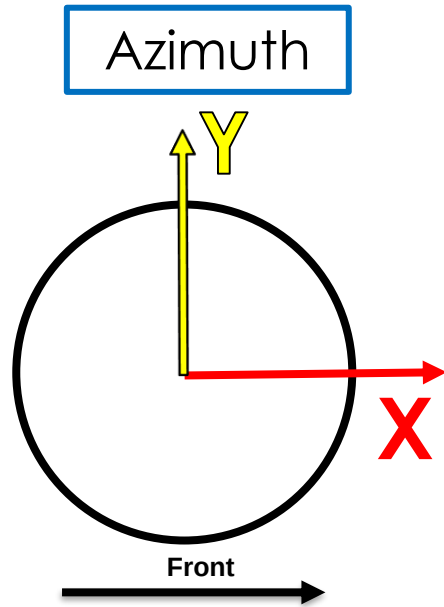
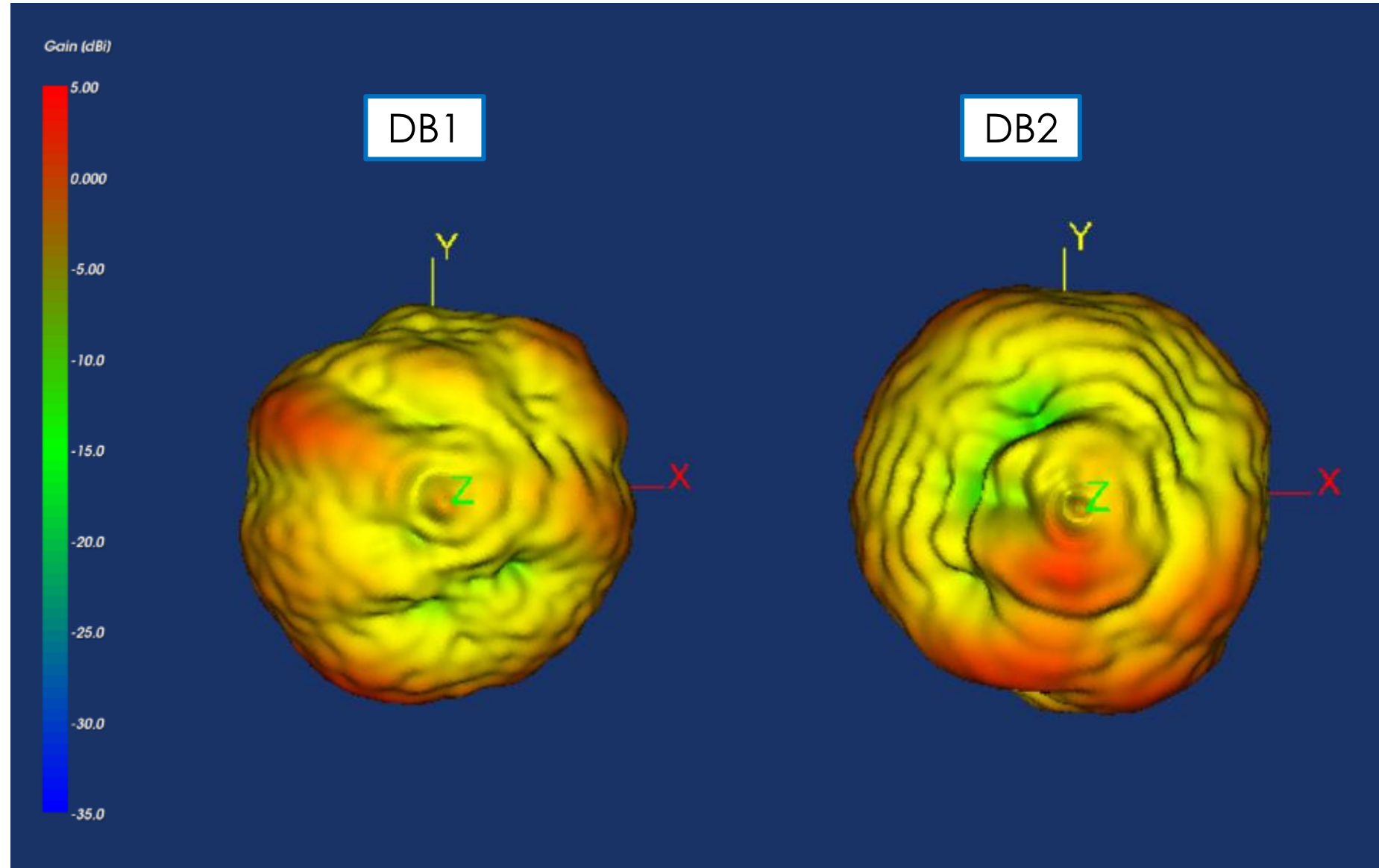


3D Gain Plot – DB Antennas – 5.35 GHz

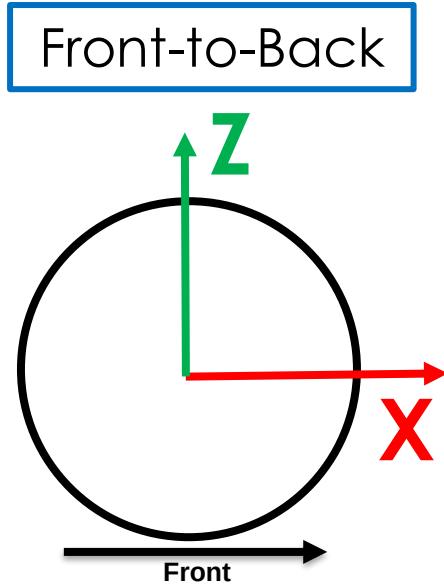
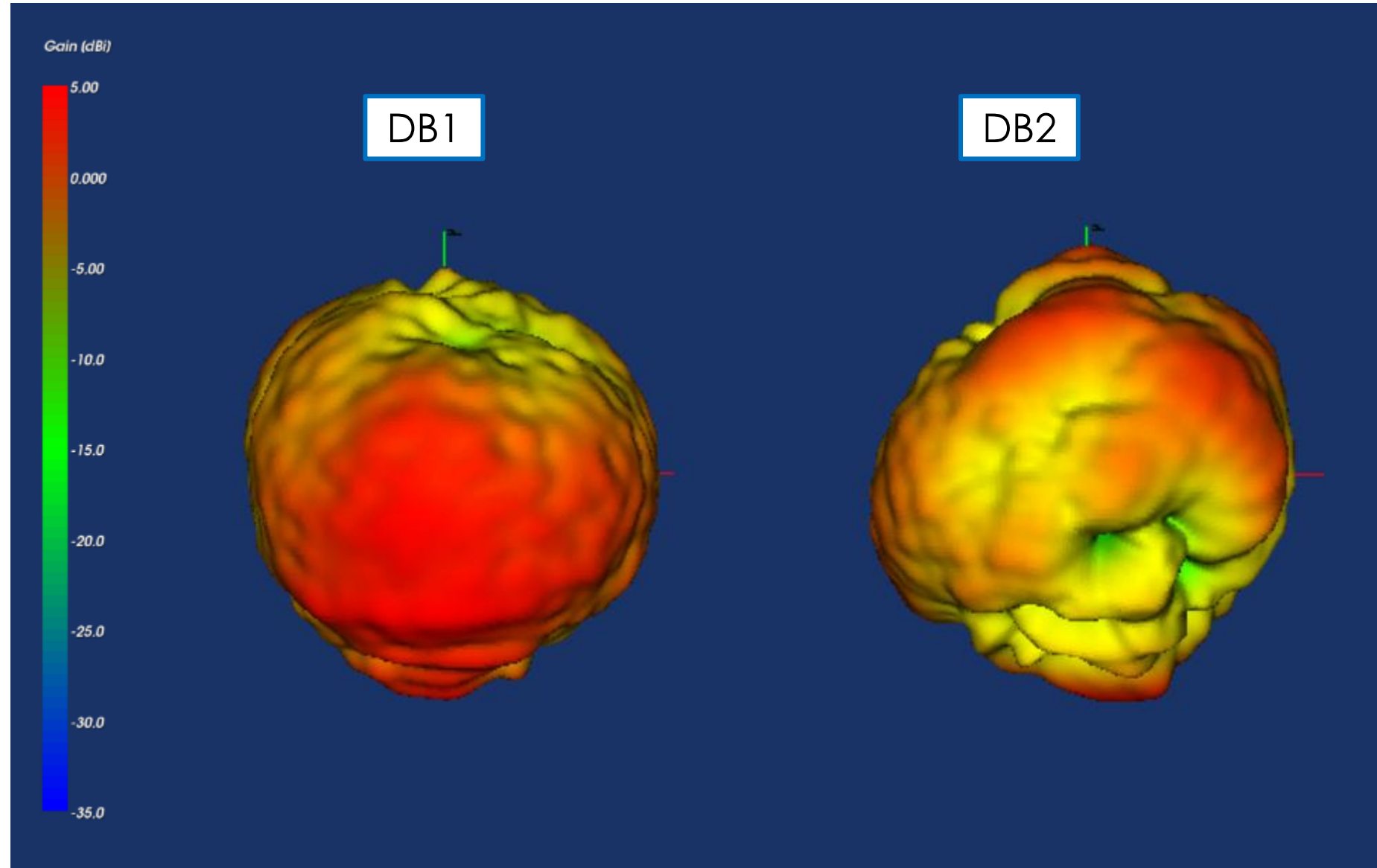
Side-to-Side



3D Gain Plot – DB Antennas – 5.50 GHz

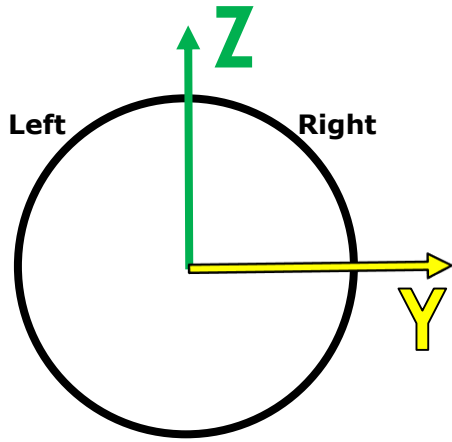
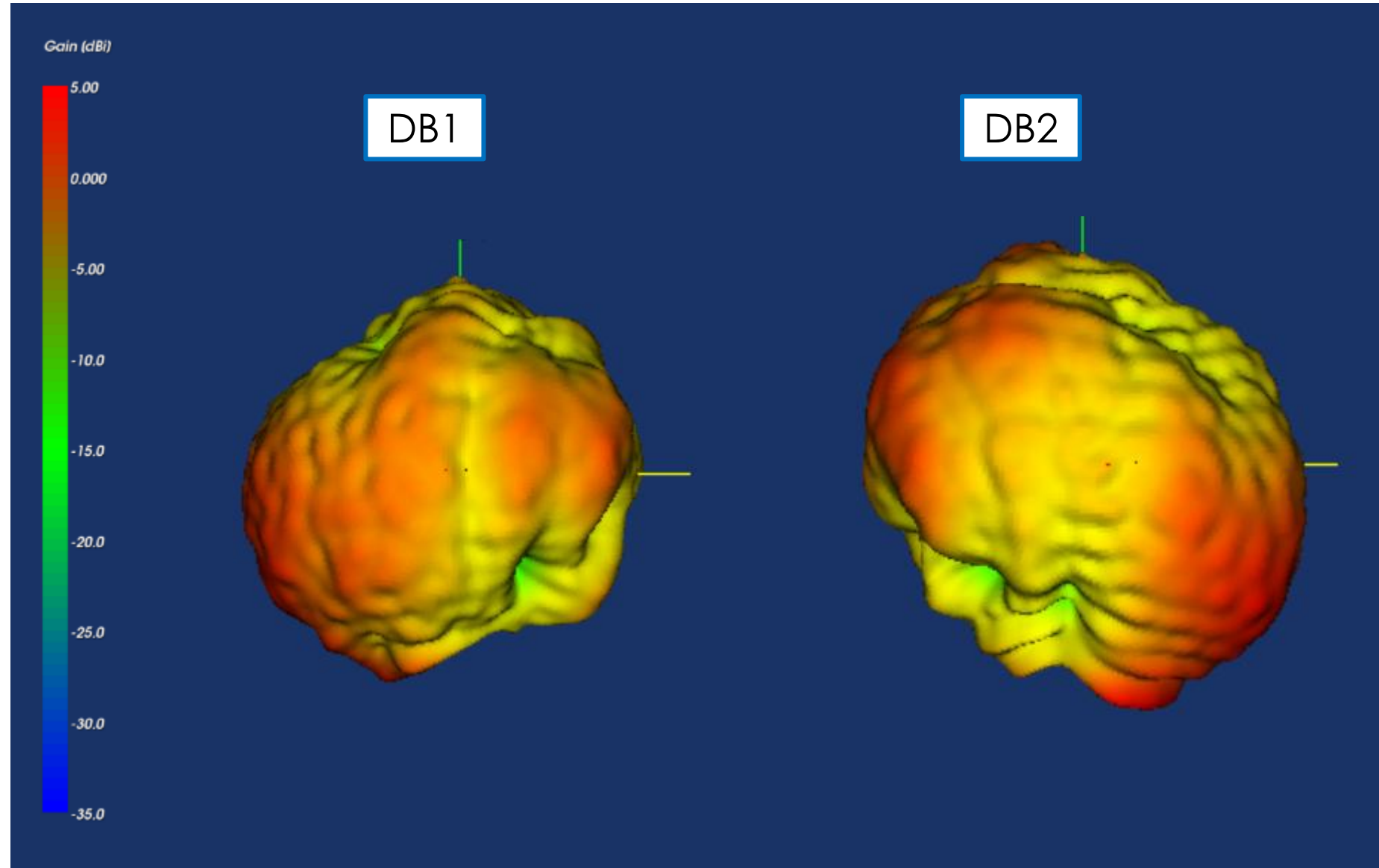


3D Gain Plot – DB Antennas – 5.50 GHz

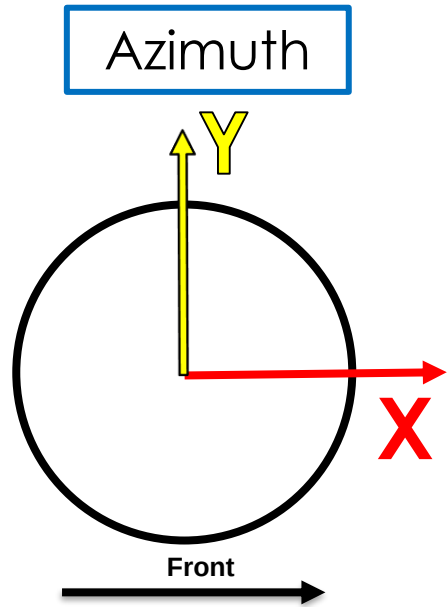
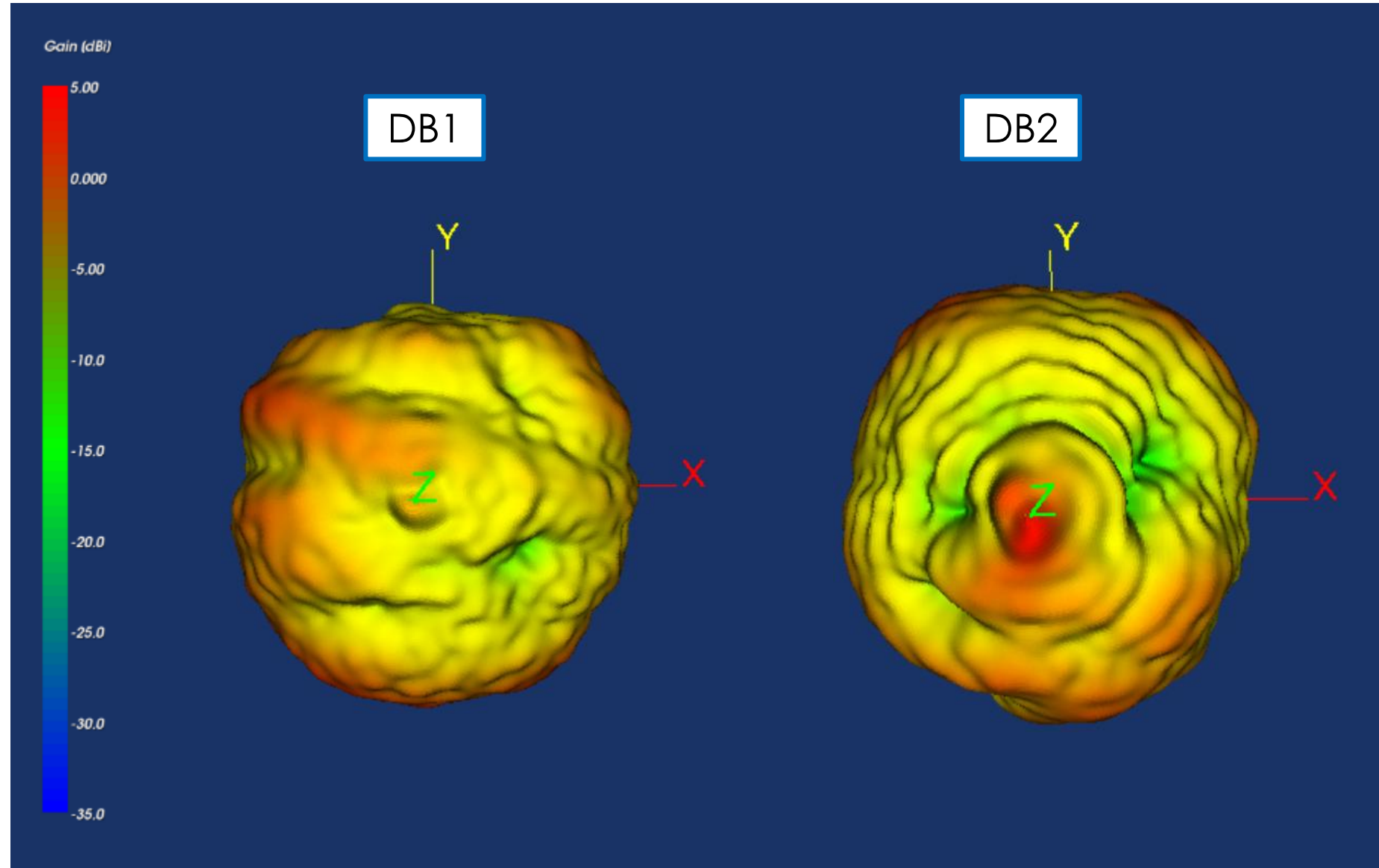


3D Gain Plot – DB Antennas – 5.50 GHz

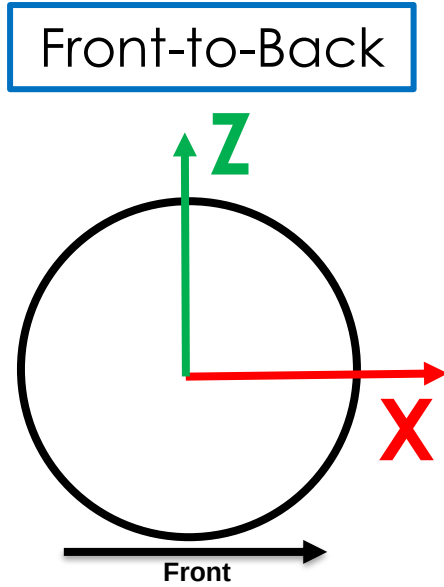
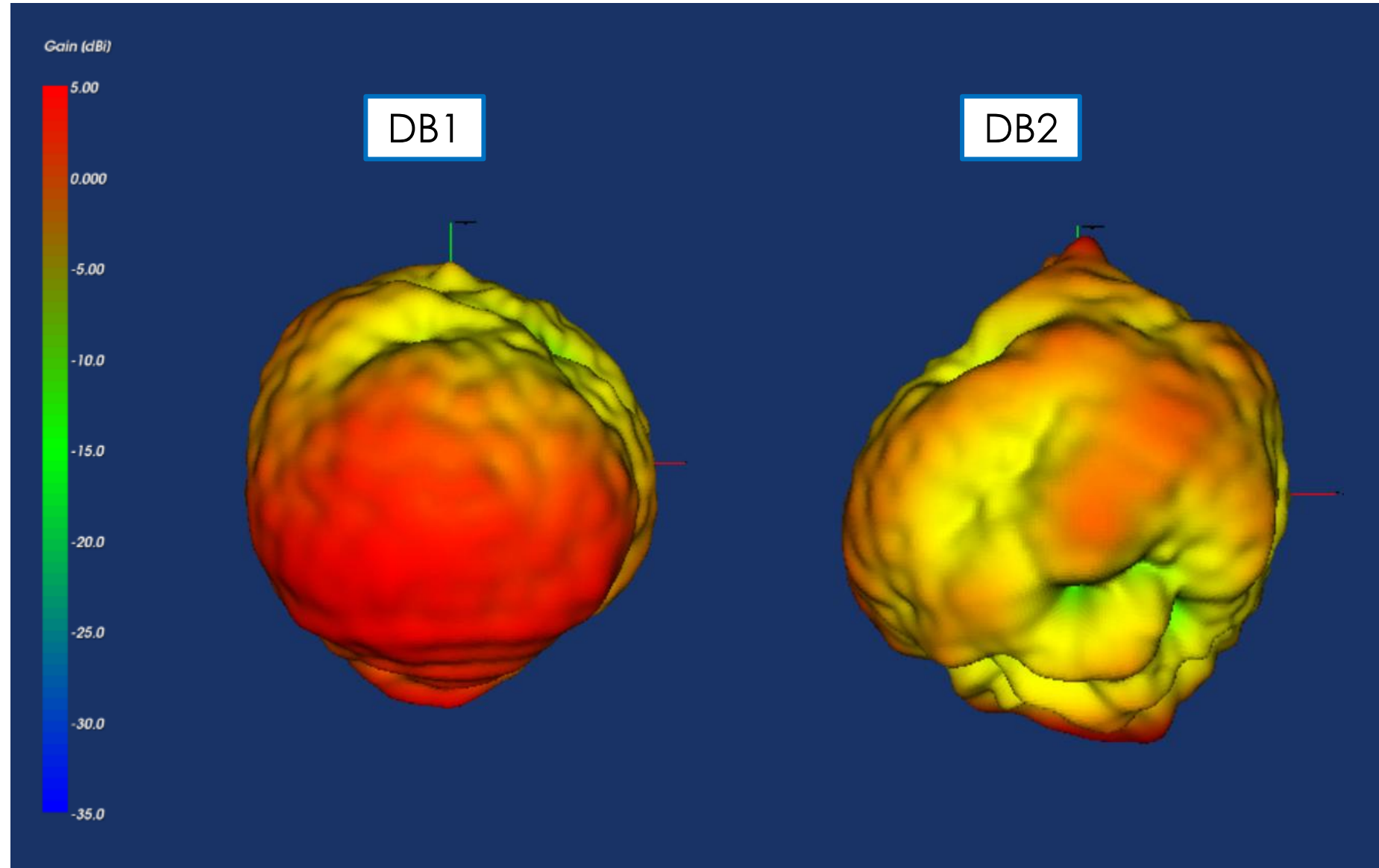
Side-to-Side



3D Gain Plot – DB Antennas – 5.725 GHz

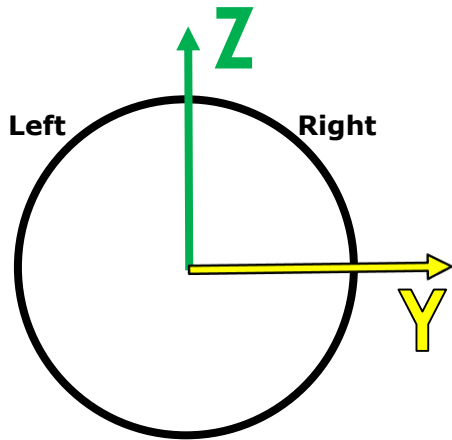
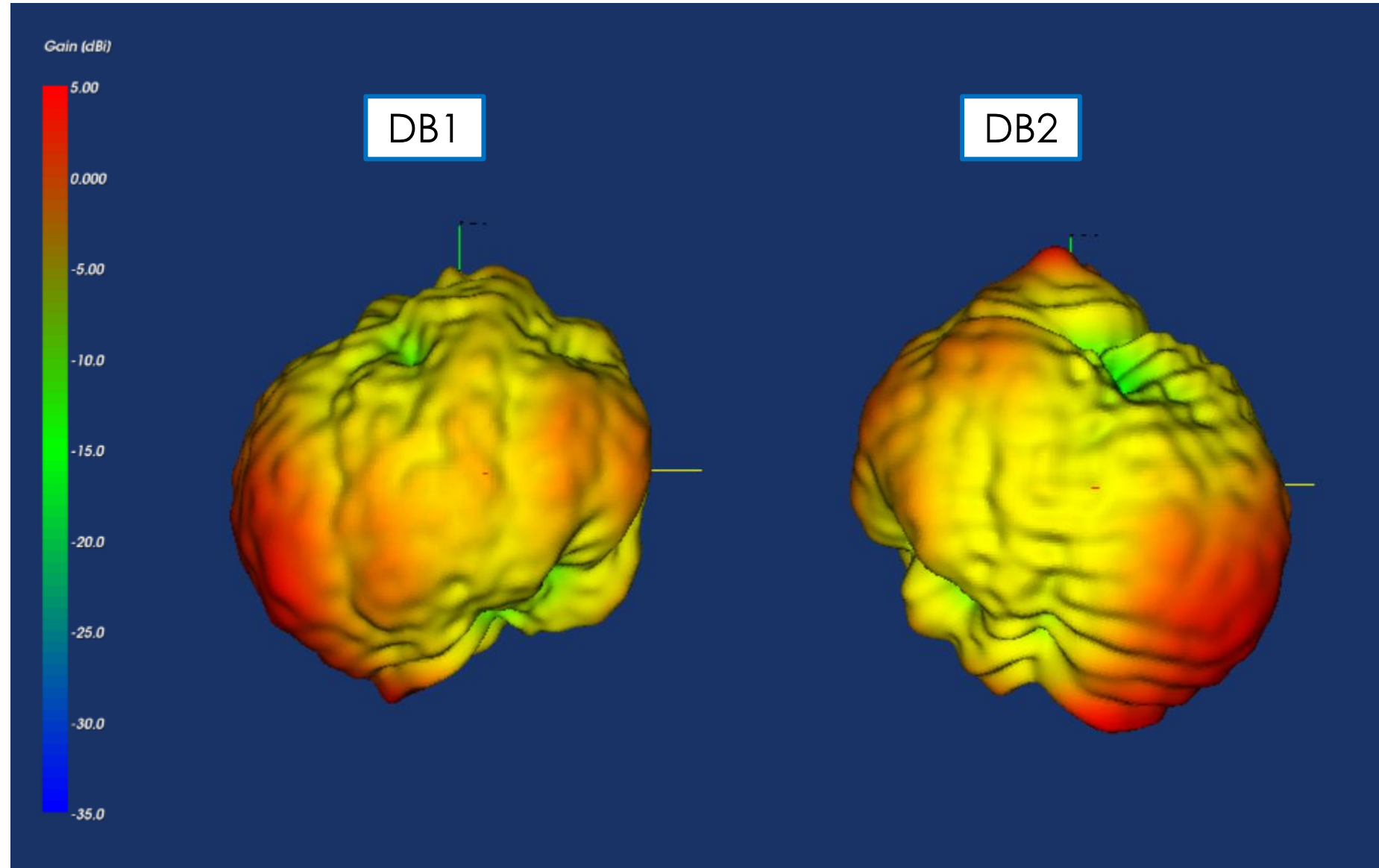


3D Gain Plot – DB Antennas – 5.725 GHz

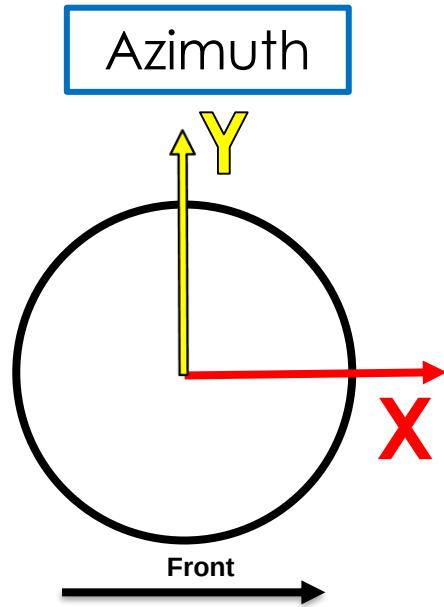
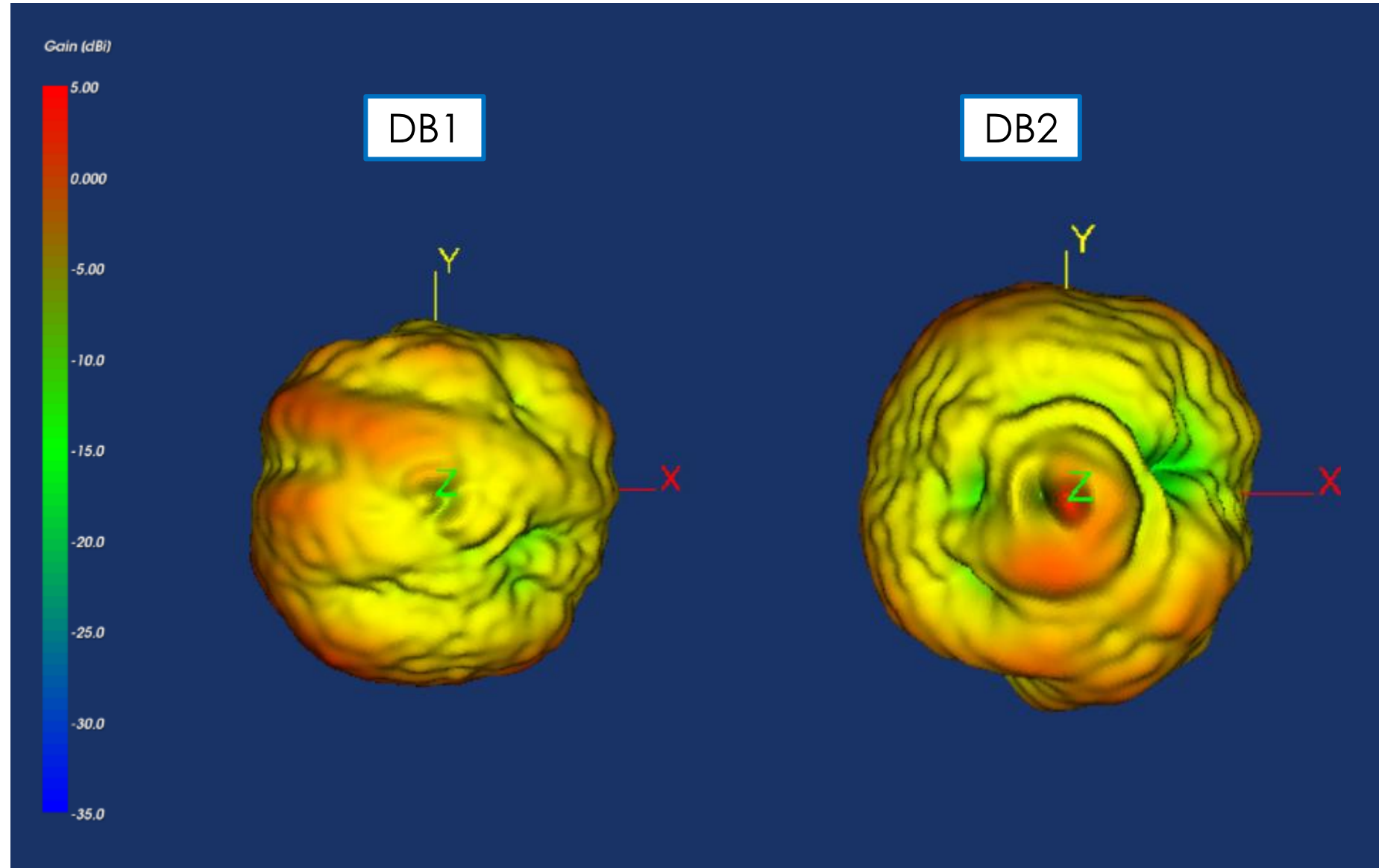


3D Gain Plot – DB Antennas – 5.725 GHz

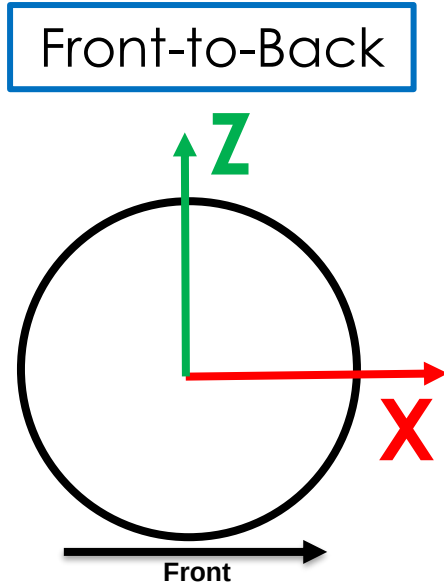
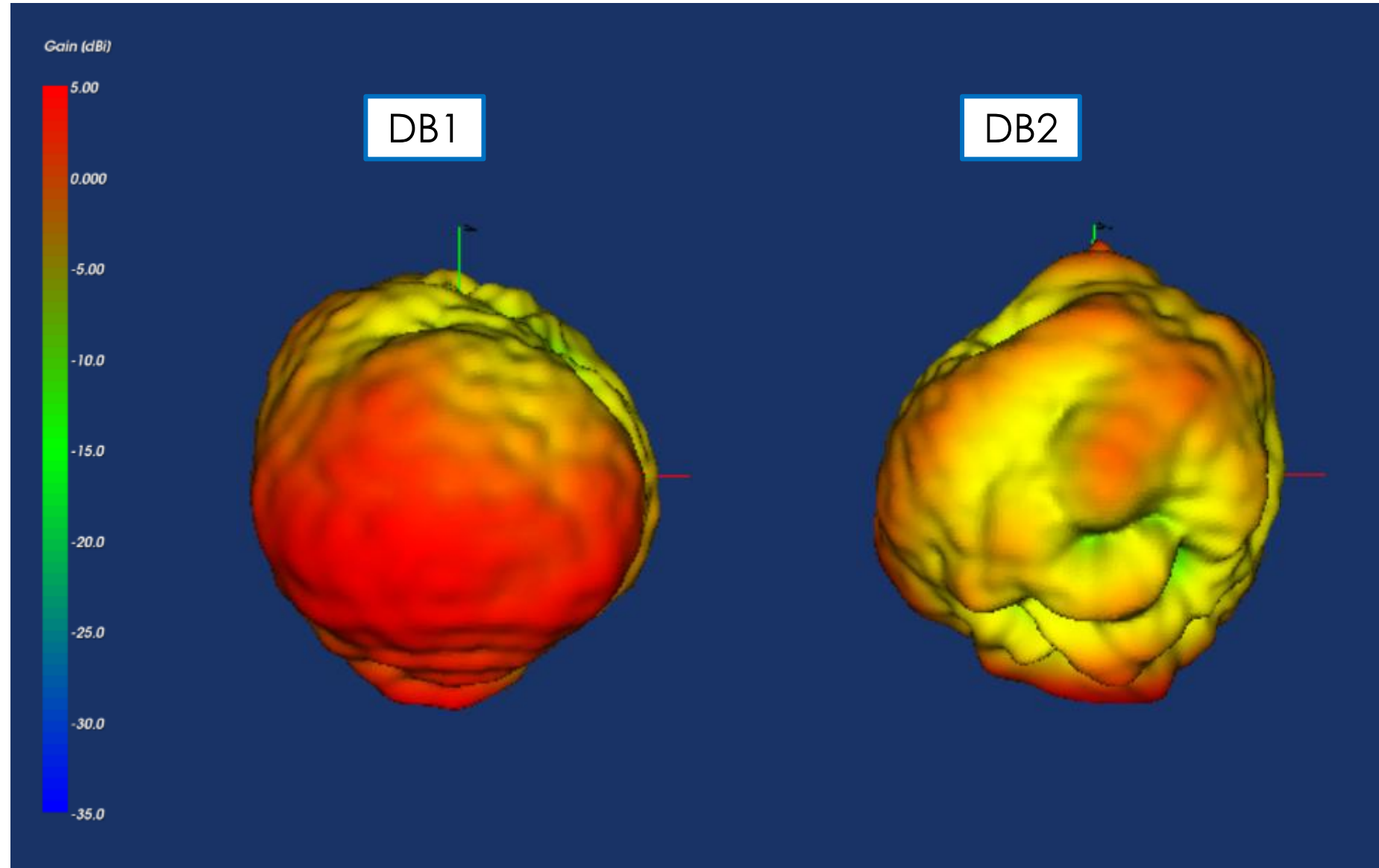
Side-to-Side



3D Gain Plot – DB Antennas – 5.825 GHz

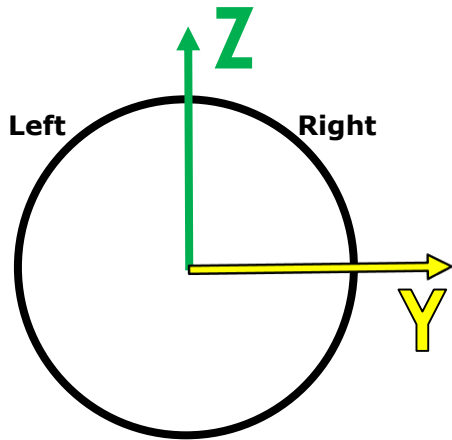
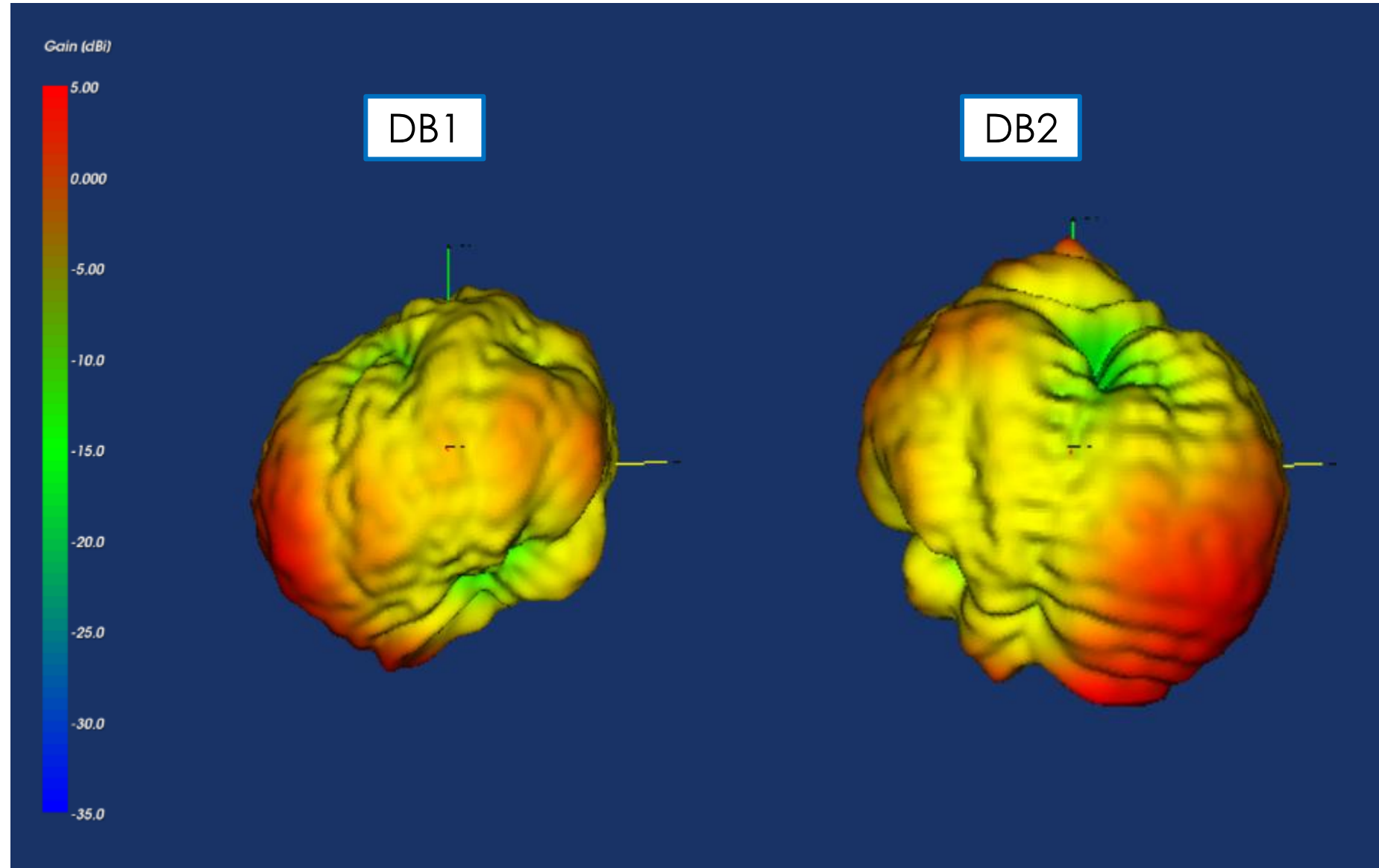


3D Gain Plot – DB Antennas – 5.825 GHz

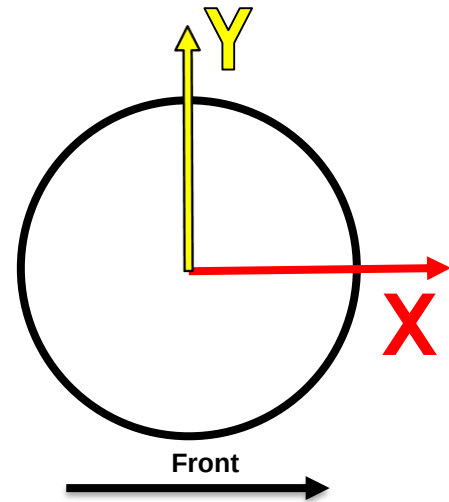
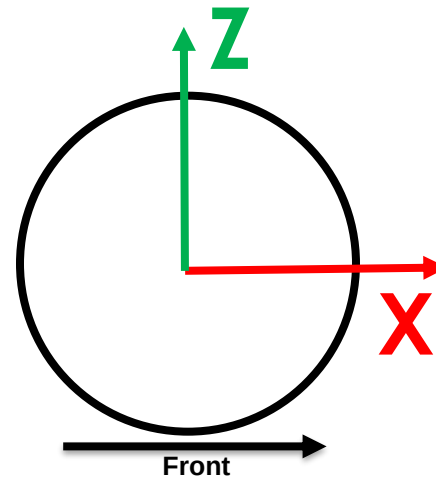
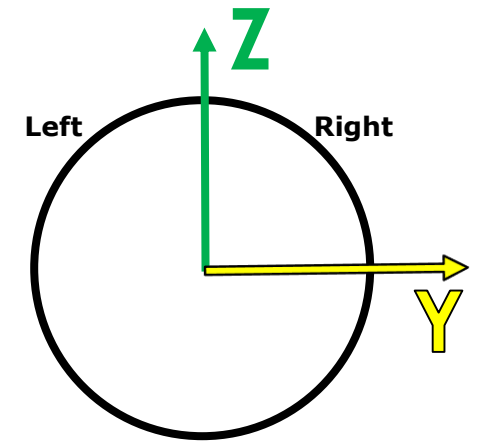
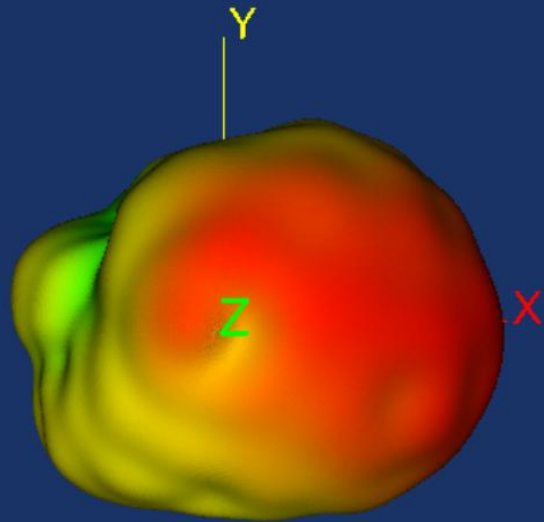


3D Gain Plot – DB Antennas – 5.825 GHz

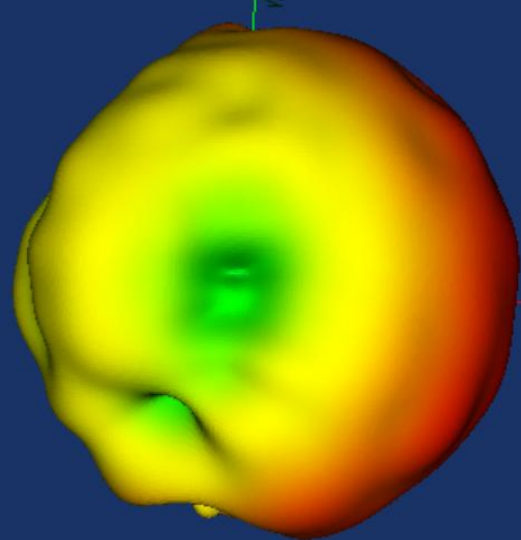
Side-to-Side



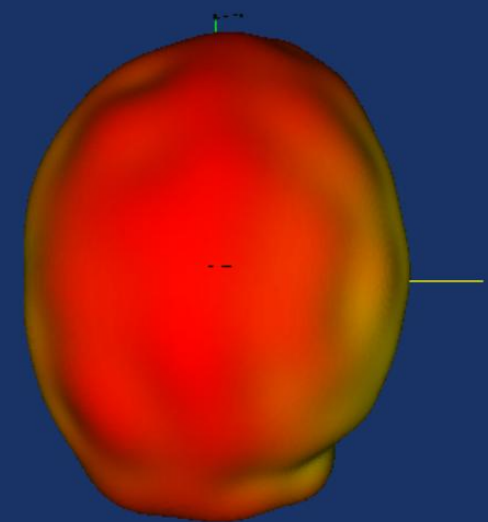
3D Gain Plot – BT Antenna – 2.4 GHz



Azimuth

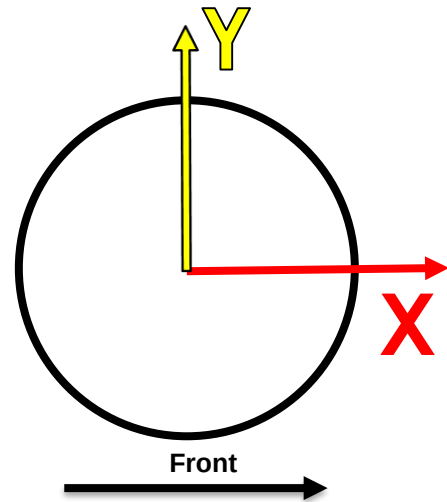
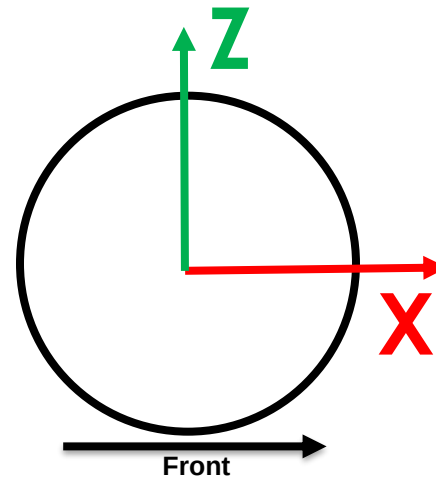
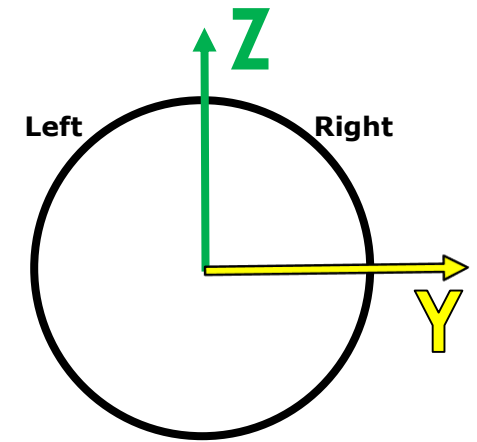
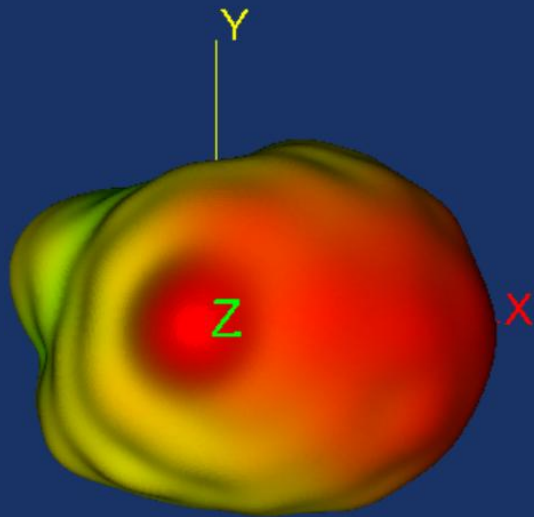


Front-to-Back

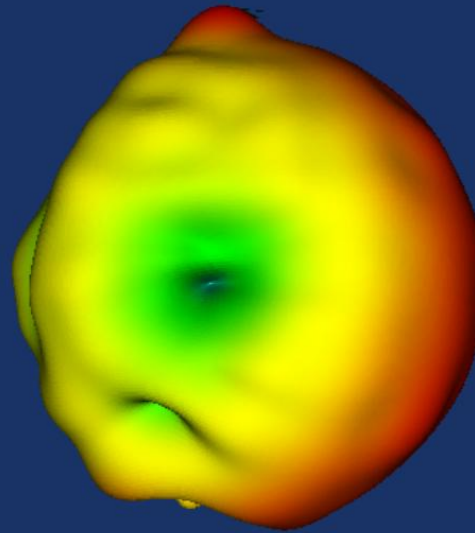


Side-to-Side

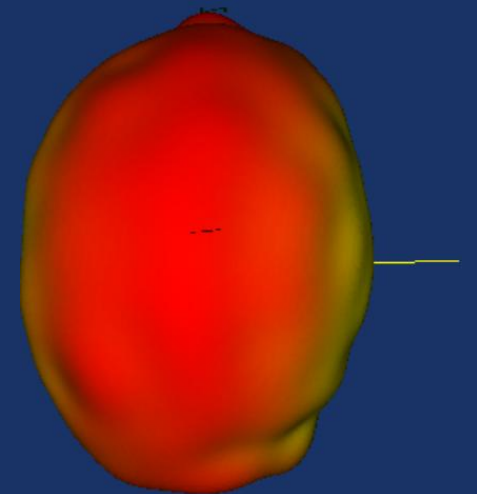
3D Gain Plot – BT Antenna – 2.45 GHz



Azimuth

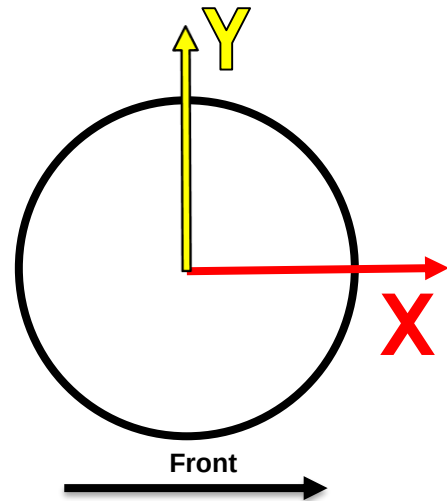
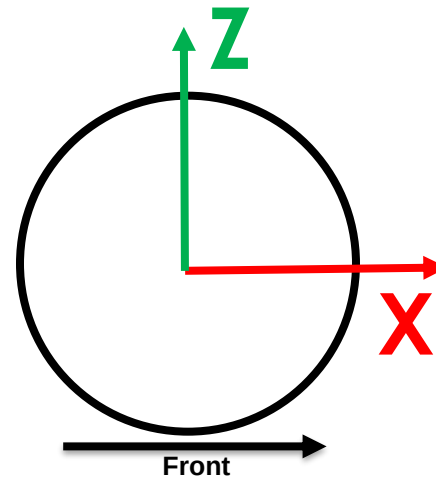
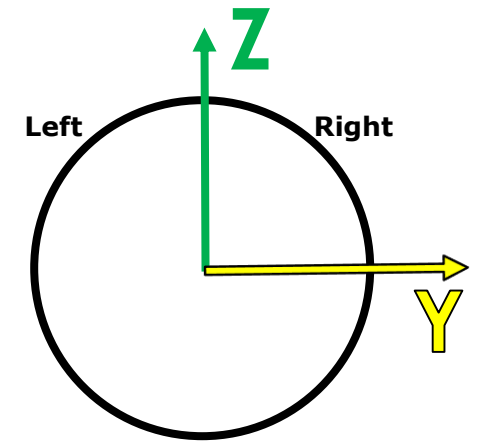
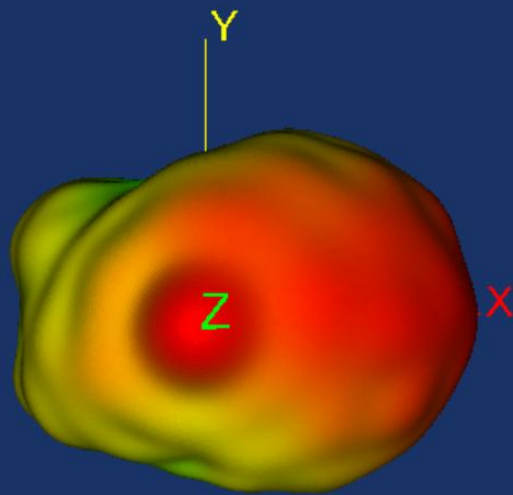


Front-to-Back

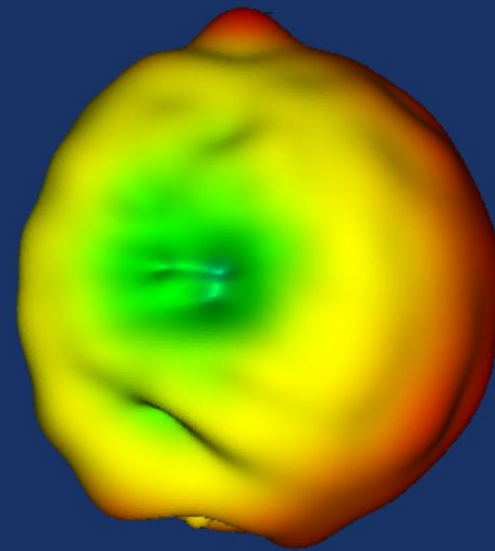


Side-to-Side

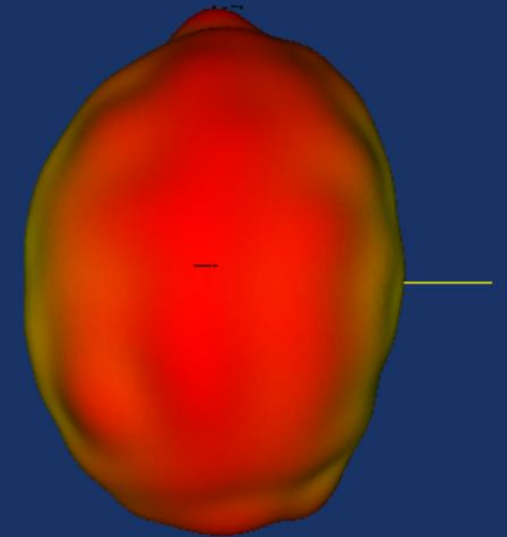
3D Gain Plot – BT Antenna – 2.5 GHz



Azimuth



Front-to-Back



Side-to-Side

Appendix I

Uncorrelated Gain Specifications

Uncorrelated Gain Specifications given by DIRECTV

- » The **uncorrelated** composite antenna gain shall be greater than -1dBi averaged over azimuth plane.
- » The **uncorrelated** composite antenna gain shall be greater than -3dBi averaged over full spherical surface.
- » The **uncorrelated** composite antenna gain shall be less than 2dBi over full spherical surface.
- » The **uncorrelated** composite antenna gain shall be greater than -7dBi over 90% of spherical surface.

DB 2.45 GHz Uncorrelated Directional Gain Data

NOT Passing DIRECTV
Specification

DIRECTV Specifications

Freq(MHz)	AZ Cut Total Uncorrelated Gain Average (dBi)	Front-to-Back Cut Total Uncorrelated Gain Average (dBi)	Side-to-Side Cut Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Max (dBi)	H-Pol Uncorrelated Gain Max (dBi)	V-Pol Uncorrelated Gain Max (dBi)	Percent of Total Uncorrelated Gain Above -7dBi (%)
All Frequencies	> -1	N/A	N/A	> -3	< 2	N/A	N/A	>90%

2.45 GHz Uncorrelated Gain Data

Freq(MHz)	AZ Cut Total Uncorrelated Gain Average (dBi)	Front-to-Back Cut Total Uncorrelated Gain Average (dBi)	Side-to-Side Cut Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Max (dBi)	H-Pol Uncorrelated Gain Max (dBi)	V-Pol Uncorrelated Gain Max (dBi)	Percent of Total Uncorrelated Gain Above -7dBi (%)
2400	-1.34	-2.48	-2.76	-1.94	1.04	-0.75	0.45	98.77%
2450	-1.32	-2.37	-2.41	-1.85	0.81	-1.56	0.58	99.04%
2500	-1.73	-2.20	-2.32	-1.92	1.23	-1.26	0.05	99.67%

DB 5 GHz Uncorrelated Directional Gain Data

NOT Passing DIRECTV
Specification

DIRECTV Specifications

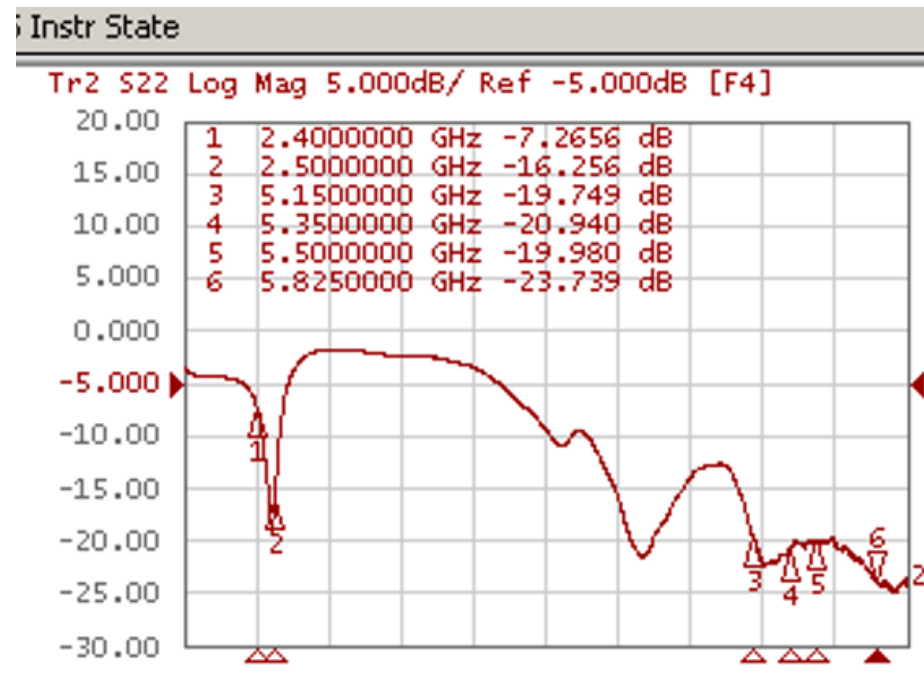
Freq(MHz)	AZ Cut Total Uncorrelated Gain Average (dBi)	Front-to-Back Cut Total Uncorrelated Gain Average (dBi)	Side-to-Side Cut Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Max (dBi)	H-Pol Uncorrelated Gain Max (dBi)	V-Pol Uncorrelated Gain Max (dBi)	Percent of Total Uncorrelated Gain Above -7dBi (%)
All Frequencies	> -1	N/A	N/A	> -3	< 2	N/A	N/A	>90%

5 GHz Uncorrelated Gain Data

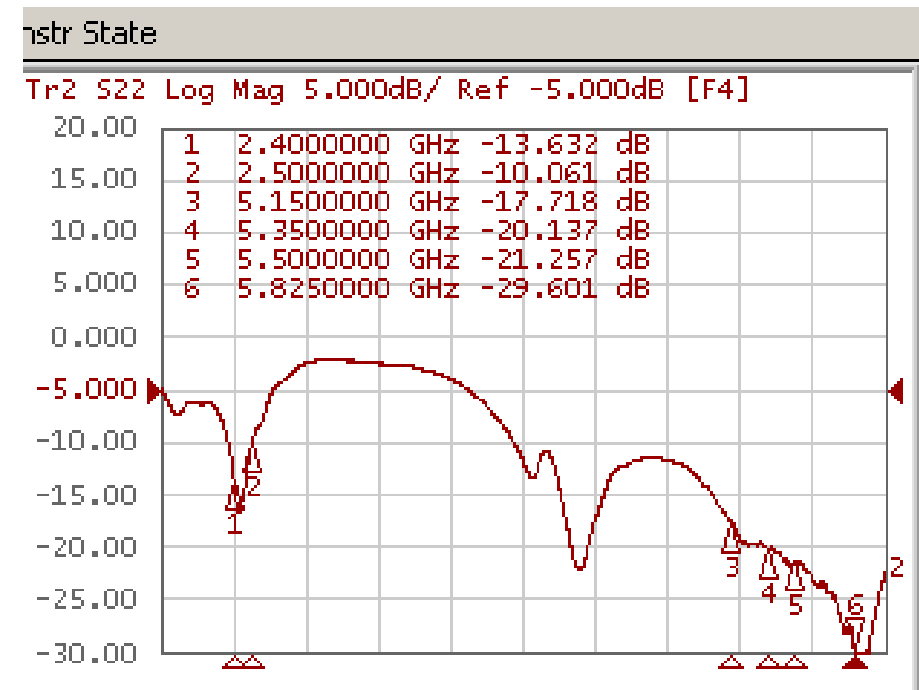
Freq(MHz)	AZ Cut Total Uncorrelated Gain Average (dBi)	Front-to-Back Cut Total Uncorrelated Gain Average (dBi)	Side-to-Side Cut Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Average (dBi)	Total Uncorrelated Gain Max (dBi)	H-Pol Uncorrelated Gain Max (dBi)	V-Pol Uncorrelated Gain Max (dBi)	Percent of Total Uncorrelated Gain Above -7dBi (%)
5150	-0.50	-2.62	-1.43	-1.50	2.28	-0.74	1.98	98.94%
5250	-0.50	-2.67	-1.49	-1.46	2.49	-0.28	2.20	99.13%
5350	-0.57	-2.87	-1.46	-1.44	2.63	-1.06	2.36	99.25%
5500	-0.77	-2.72	-1.67	-1.43	2.37	-1.47	2.01	99.00%
5725	-1.10	-2.89	-1.26	-1.45	2.87	0.37	2.22	98.77%
5825	-1.37	-3.08	-1.33	-1.49	3.06	0.45	2.33	98.62%

Appendix II

DB2 Received RL Vs. DB2 Retuned RL



HW 2.0 (DB2)
Received



HW 2.0 (DB2)
Retuned

Our Contact

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