
AP-725 Antenna Test report

Date: 2024/12/30

Author: Hennry



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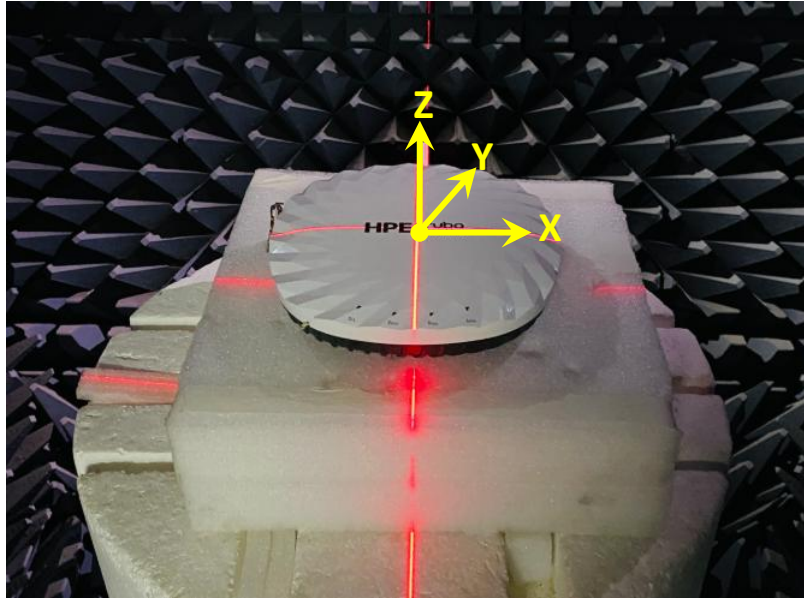
Revision History

Released Date	Version	Record
2024/12/30	Rev 01	Initial Solution

Test Information

Item	Description
Brand Name	HPE Aruba
DUT Equipment	Wi-Fi 6E 11ax Triple Band Access Point
Test Location	Beijing
Test Condition	RayZone 2800
Test Engineer	Yanzhengsen
Test Environment	Microwave chamber
Test Date	2024/12/30

Test Setup for Radiation Pattern Measurement



Test Configuration



Test System

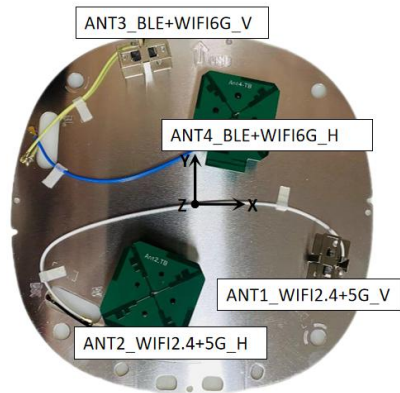
Test Equipment & Calibration

Network analyzer and reference antennas are used for calibration. Path loss and cable loss for different frequency bands can be checked.

Instrument	Brand	Characteristics	Model No.	Serial No.	Calibration Date
Electric dipole sleeve antenna	GTS	600 MHz ~ 700 MHz	RA-L0607DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	700 MHz ~ 800 MHz	RA-L0708DP	19011001	Dec.12, 2024
Electric dipole sleeve antenna	GTS	800 MHz ~ 1000 MHz	RA-L0810DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	1100 MHz ~ 1300 MHz	RA-L1113DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	1400 MHz ~ 1700 MHz	RA-L1417DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	1700 MHz ~ 1900 MHz	RA-L1719DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	1900 MHz ~ 2300 MHz	RA-L1923DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	2300 MHz ~ 2900 MHz	RA-L2329DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	2900 MHz ~ 3200 MHz	RA-L2932DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	3200 MHz ~ 3800 MHz	RA-L3238DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	3800 MHz ~ 4400 MHz	RA-L3844DP	19011002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	4400 MHz ~ 4900 MHz	RA-L4449DP	202011003	Dec.12, 2024
Electric dipole sleeve antenna	GTS	4900 MHz ~ 5900 MHz	RA-L4959DP	202101002	Dec.12, 2024
Electric dipole sleeve antenna	GTS	5900 MHz ~ 6900 MHz	RA-L5969DP	202011003	Dec.12, 2024
Electric dipole sleeve antenna	GTS	6900 MHz ~ 8000 MHz	RA-L6980DP	202101002	Dec.12, 2024
MaxSign Libra	GTS	Control chamber System	RayZone2800C_Z		Non-Calibration Required

Antenna Details

Antenna Placement



Ant No.	Part Number	Operating Band	Type	Size(L*W*H)	Cable Length(mm)	Polarization type	Cable type	Material
A1	ANT1-725-Dual	WIFI 2+5G	PIFA	27*19*13	180	Vertical	1.37 normal	Steel
A2	ANT2-725-Dual	WIFI 2+5G	Dipole	42*42*1	108	Horizontal	1.37 normal	GF300
A3	ANT3-725-Dual	BLE + WIFI 6G	PIFA	27*19*13	89	Vertical	1.37 normal	Steel
A4	ANT4-725-Dual	BLE + WIFI 6G	Dipole	40*47*1	139	Horizontal	1.37 normal	GF300

Result Summary-----Wifi 2.4G

Results summary for 2.4GHz

Antenna	Detail Spec	Spec	Ant1-Dual Band			Ant2-Dual Band		
Frequency	2.4~2.48GHz	-	2.4GHz	2.44GHz	2.48GHz	2.4GHz	2.44GHz	2.48GHz
Efficiency	>70%	-	81.49	81.19	82.38	78.09	88.80	79.64
Peak Gain for 3D	3dBi< Peak<5dBi		3.69	3.61	3.59	5.06	4.88	4.90
Horizontal cut Average Gain	60°	<10dB	1.30	1.44	1.51	2.69	3.72	3.26
	70°	<10dB	0.95	0.97	1.05	0.87	1.64	1.28
	80°	<10dB	0.33	0.23	0.29	-1.23	-0.72	-1.05
	90°	<10dB	-0.46	-0.61	-0.57	-3.28	-2.95	-3.34
Horizontal cut Flatness	60°	<10dB	5.42	4.74	4.31	3.96	2.03	1.46
	70°	<10dB	4.71	4.62	4.79	4.95	3.81	2.72
	80°	<10dB	6.27	6.39	6.47	5.85	6.00	5.14
	90°	<10dB	7.82	7.52	7.50	7.31	7.53	7.34

Result Summary-----Wifi 5G

Results summary for 5GHz

Antenna	Detail Spec	Spec	Ant1-Dual Band			Ant2-Dual Band		
Frequency	5.15~5.895GHz	-	5.15GHz	5.49GHz	5.895GHz	5.15GHz	5.49GHz	5.895GHz
Efficiency	>70%	-	87.06	83.14	74.05	87.70	86.15	79.81
Peak Gain for 3D	3dBi< Peak<5dBi		5.43	5.39	5.33	5.33	5.21	4.58
Horizontal cut Average Gain	60°	<10dB	1.92	1.51	0.92	4.69	3.31	2.53
	70°	<10dB	2.15	1.71	1.50	3.38	2.65	2.47
	80°	<10dB	1.54	0.93	0.91	1.24	0.96	1.20
	90°	<10dB	0.22	-0.67	-0.88	-1.39	-1.53	-1.24
Horizontal cut Flatness	60°	<10dB	5.61	5.40	6.10	1.52	4.37	5.14
	70°	<10dB	6.66	6.21	5.89	2.84	5.62	5.30
	80°	<10dB	7.51	6.86	6.66	3.92	5.43	5.48
	90°	<10dB	7.92	7.24	7.58	4.70	5.86	6.19

Result Summary-----Wifi 6G

Results summary for 6GHz

Antenna	Detail Spec	Spec	Ant3-Dual Band			Ant4-Dual Band		
Frequency	5.925~7.125GHz	-	5.925GHz	6.525GHz	7.125GHz	5.925GHz	6.525GHz	7.125GHz
Efficiency	>70%	-	78.53	85.44	74.69	78.47	85.58	73.83
Peak Gain for 3D	3dBi< Peak<5dBi		3.97	5.42	5.08	4.13	4.89	4.53
Horizontal cut Average Gain	60°	<10dB	-0.36	1.36	0.32	1.83	2.67	0.74
	70°	<10dB	0.82	2.15	1.19	1.94	2.46	0.29
	80°	<10dB	0.93	1.98	0.92	0.77	1.45	-0.71
	90°	<10dB	-0.03	0.89	-0.55	-1.81	-0.57	-2.48
Horizontal cut Flatness	60°	<10dB	9.51	5.37	5.63	6.85	4.53	7.18
	70°	<10dB	6.24	5.81	5.98	6.82	6.63	7.40
	80°	<10dB	5.38	7.35	7.04	5.97	7.51	8.53
	90°	<10dB	5.29	7.12	7.30	4.86	8.12	7.68

Result Summary-----BLE

Results summary for BLE

Antenna	Detail Spec	Spec	Ant3-Dual Band			Ant4-Dual Band		
Frequency	2.4~2.48GHz	-	2.4GHz	2.44GHz	2.48GHz	2.4GHz	2.44GHz	2.48GHz
Efficiency	>70%	-	83.39	83.74	85.22	79.36	86.45	82.83
Peak Gain for 3D	3dBi< Peak<5dBi		3.11	3.19	3.58	4.78	4.93	4.95
Horizontal cut Average Gain	60°	<10dB	0.88	1.09	1.22	2.74	3.34	2.73
	70°	<10dB	0.54	0.65	0.82	0.76	1.22	0.74
	80°	<10dB	0.17	0.20	0.33	-1.53	-1.04	-1.41
	90°	<10dB	-0.15	-0.17	-0.12	-3.78	-3.13	-3.47
Horizontal cut Flatness	60°	<10dB	8.75	8.25	8.76	4.01	4.02	5.39
	70°	<10dB	9.17	8.95	9.31	4.47	5.33	6.66
	80°	<10dB	7.86	7.93	8.22	4.87	6.16	7.73
	90°	<10dB	5.35	5.46	6.06	6.30	7.76	9.42

Result Summary - Uncorrelated Gain & Correlated Gain

	Frequency (MHz)	Uncorrelated Gain (dBi)	Ants included
2.4G Wi-Fi	2400	3.36	A1&A2
	2440	3.81	A1&A2
	2480	3.44	A1&A2
5GHz Wi-Fi	5150	4.66	A1&A2
	5490	4.64	A1&A2
	5895	4.27	A1&A2
6GHz Wi-Fi	5925	3.71	A3&A4
	6525	4.84	A3&A4
	7125	3.31	A3&A4

Calculations

Because the antennas are fixed in location within the device the directional antenna gain for MIMO is calculated over a sphere using the raw spatial data taken at 2 degree steps of theta and phi for each antenna using the equations from KDB 662911 D01. The raw antenna data is located in the appendix of this report.

The uncorrelated antenna gain was calculated using KDB 662911 D01, F(2)(d)(ii)

The uncorrelated gain was calculated for each point in the spatial data, and the highest value reported.

2.4GHz uncorrelated calculation:

Maximum uncorrelated gain: 3.81dBi

$$= 10 \cdot \log(((10^{(G0/10)}) + (10^{(G1/10)})) / 2)$$

$$= 10 \cdot \log(((10^{(3.8/10)}) + (10^{(3.89/10)})) / 2)$$

This occurs at: 2440MHz, phi 114/theta 54

5GHz uncorrelated calculation:

Maximum uncorrelated gain: 4.66dBi

$$= 10 \cdot \log(((10^{(G0/10)}) + (10^{(G1/10)})) / 2)$$

$$= 10 \cdot \log(((10^{(4.29/10)}) + (10^{(3.86/10)})) / 2)$$

This occurs at: 5150MHz, phi 162/theta 62

6GHz uncorrelated calculation:

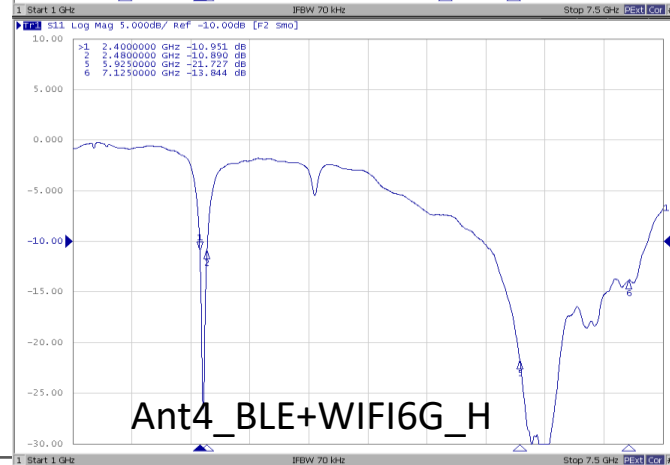
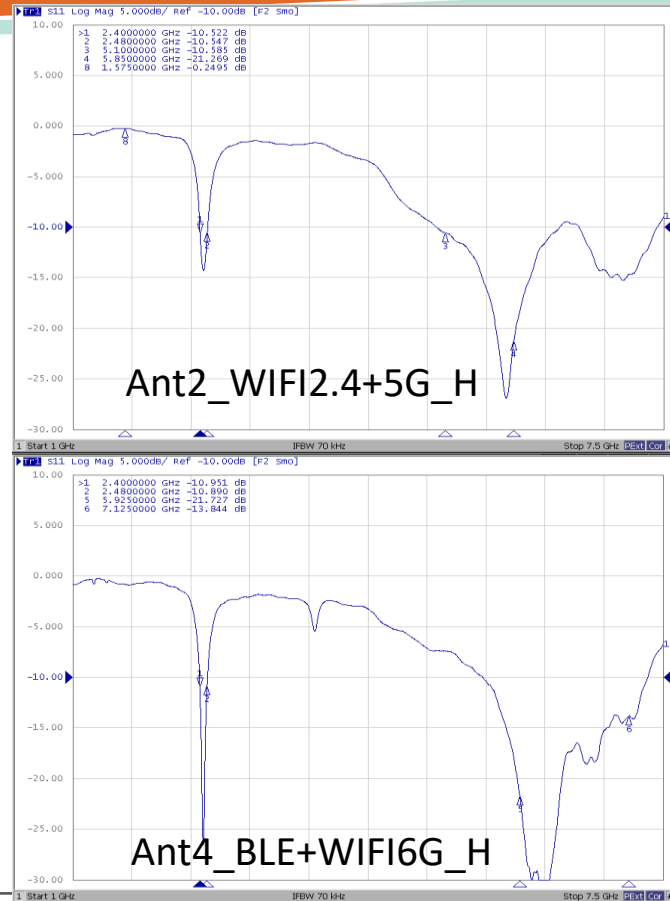
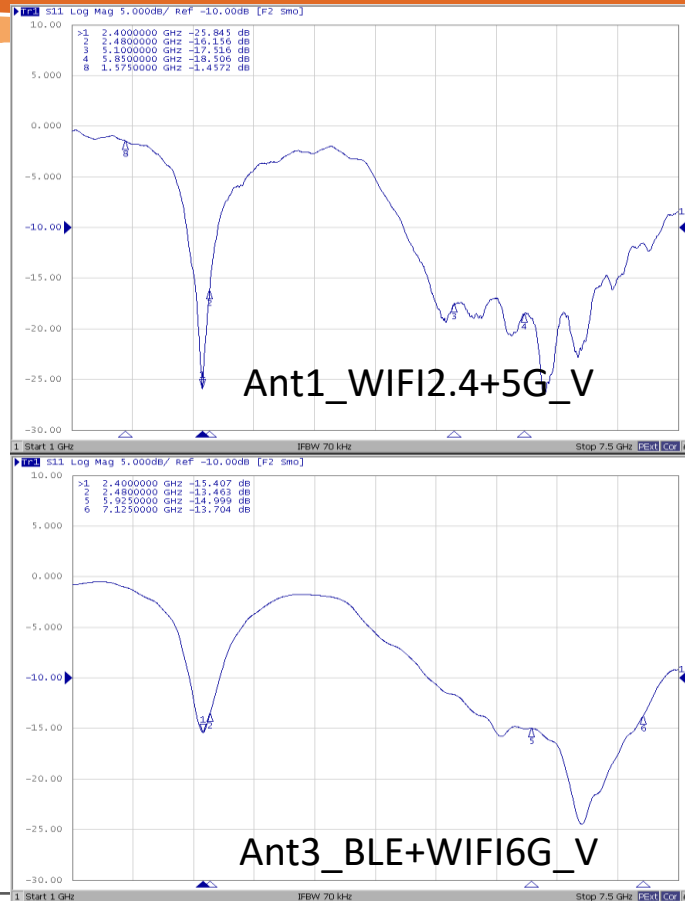
Maximum uncorrelated gain: 4.84dBi

$$= 10 \cdot \log(((10^{(G0/10)}) + (10^{(G1/10)})) / 2)$$

$$= 10 \cdot \log(((10^{(2.33/10)}) + (10^{(4.96/10)})) / 2)$$

This occurs at: 6525MHz, phi 104/theta 282

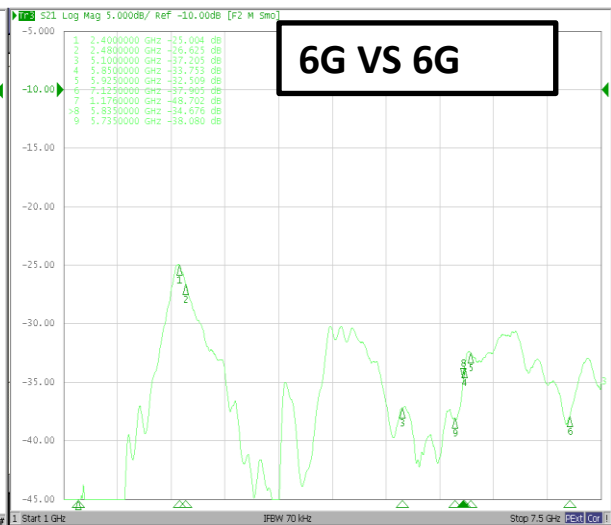
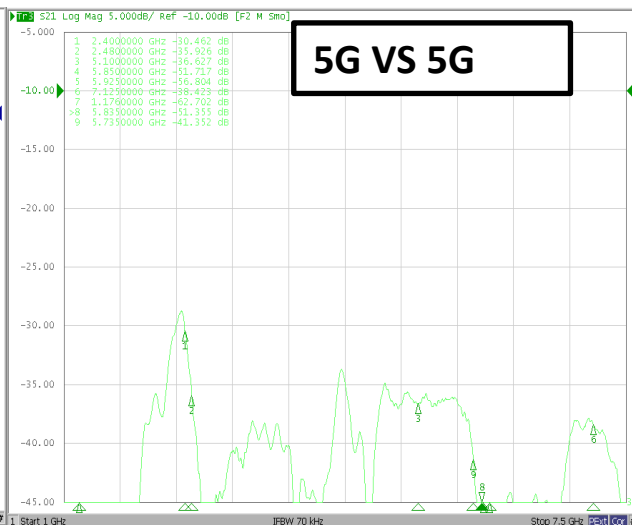
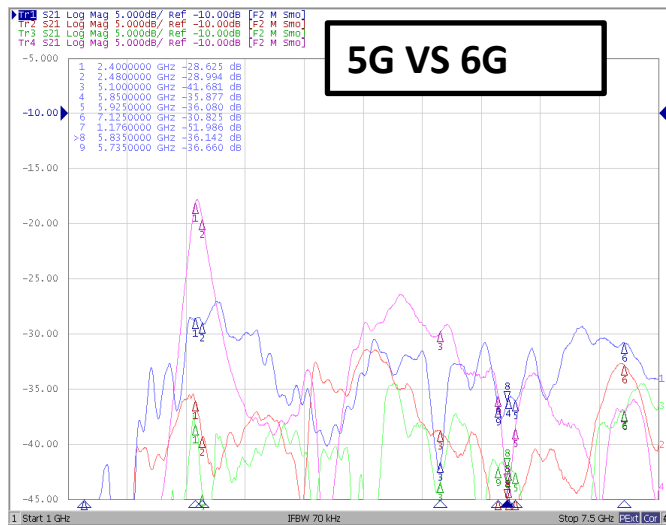
Measurement Data-----Return Loss



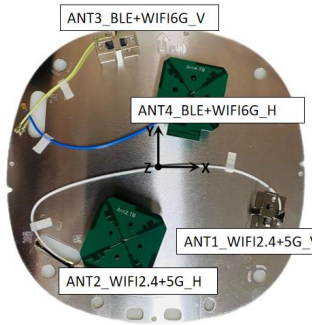
Measurement Data-----Return Loss

Return Loss	Frequency (MHz)	ANT1	ANT2	ANT3	ANT4
2.4G Wi-Fi&BLE	2440	-25.8	-10.5	-15.4	-10.9
	2440	-19.1	-14.3	-14.3	-25.8
	2480	-16.1	-10.5	-13.4	-10.8
5GHz Wi-Fi	5150	-17.5	-10.5	--	--
	5490	-18.3	-17.4	--	--
	5895	-18.5	-21.2	--	--
6GHz Wi-Fi	5925	--	--	-14.9	-21.7
	6525	--	--	-23.3	-18.5
	7125	--	--	-13.7	-13.8

Measurement Data----Isolation

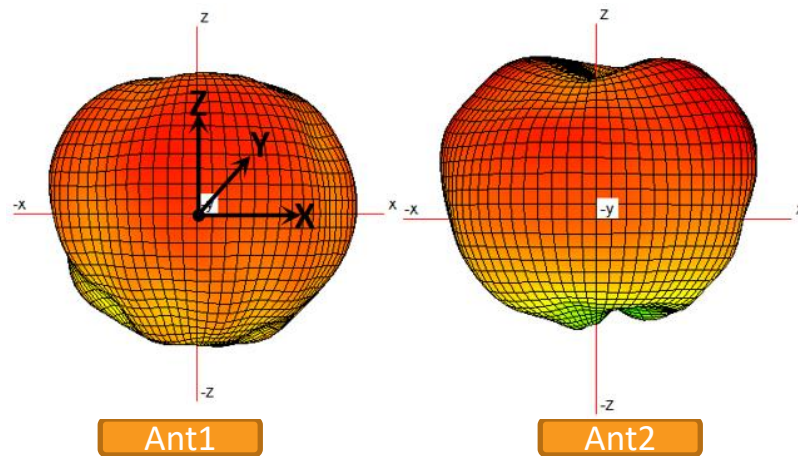


Measurement Data----Isolation

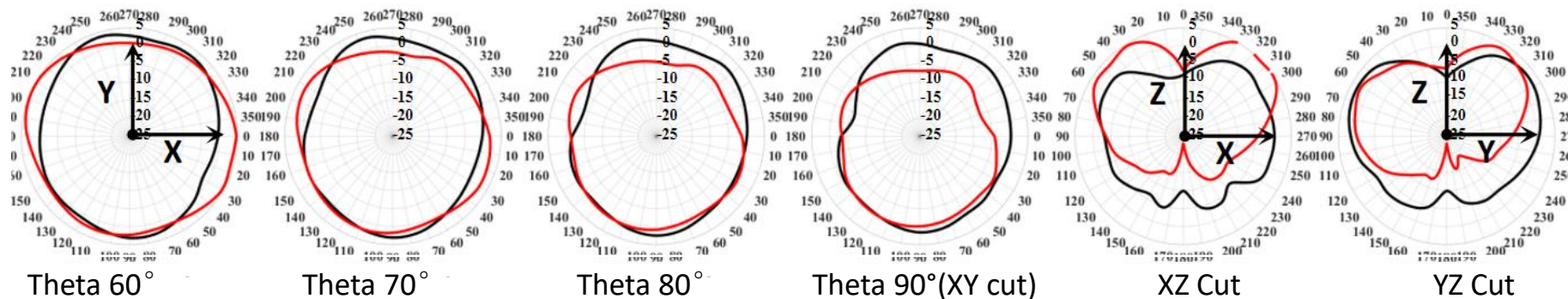
Isol(dB)	ANT1		ANT2		ANT3
ANT1	-		-		
ANT2	2.4G: 25/30 5G↔5G: 25/36		-		
ANT3	2.4G↔BLE: 20/28 5G: 5735~5835:35/36 5535~5735:30/31 5150~5535:25/31	6G: 5945~6025:30/32 6025~7125:25/28	2.4G↔BLE: 25/36 5G: 5735~5835:35/40 5535~5735:30/40 5150~5535:25/37	6G: 5945~6025:30/42 6025~7125:25/37	
ANT4	2.4G↔BLE: 20/36 5G: 5735~5835:35/42 5535~5735:30/38 5150~5535:25/37	6G: 5945~6025:30/40 6025~7125:25/32	2.4G↔BLE: 20/18 5G: 5735~5835:35/36 5535~5735:30/32 5150~5535:25/28	6G: 5945~6025:30/33 6025~7125:25/36	BLE↔BLE: 25/25 5G↔5G: 25/31

Appendix

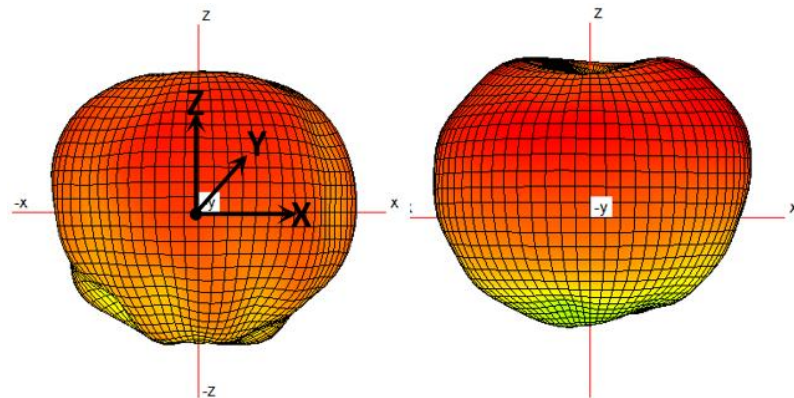
Radiation Pattern- WiFi @ 2.4GHz



— ANT1_2400
— ANT2_2400



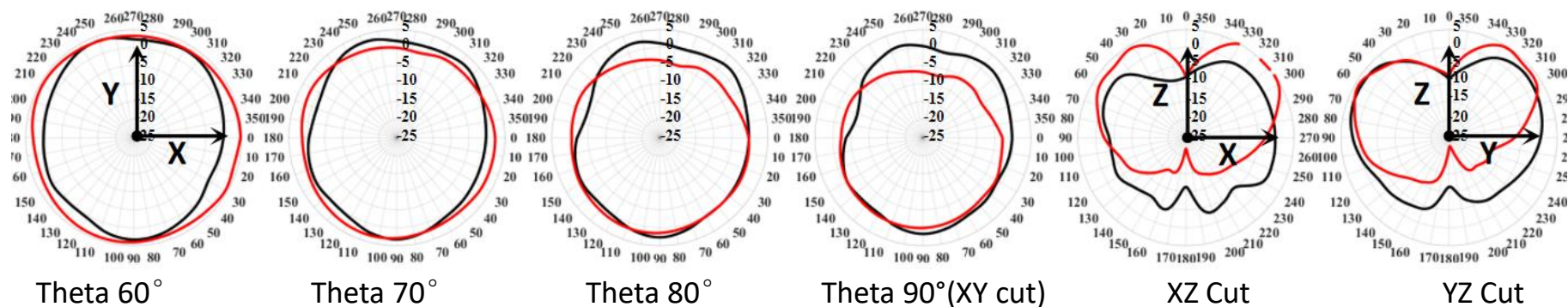
Radiation Pattern- WiFi @ 2.44GHz



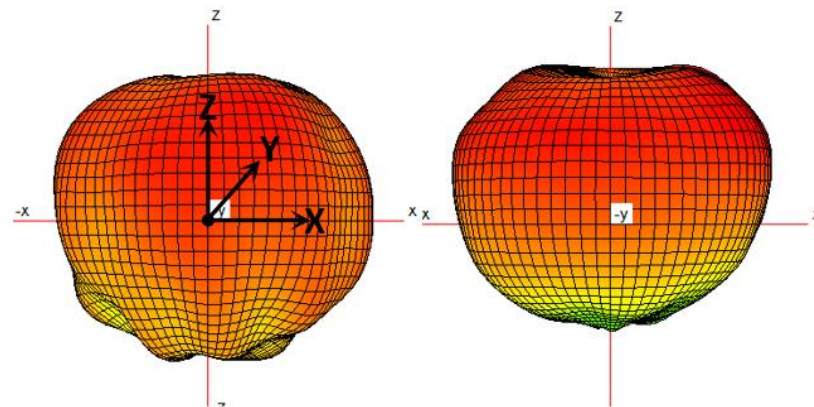
Ant1

Ant2

— ANT1_2440
— ANT2_2440



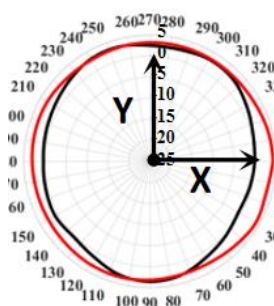
Radiation Pattern- WiFi @ 2.48GHz



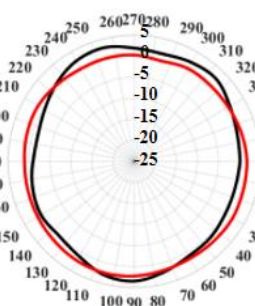
Ant1

Ant2

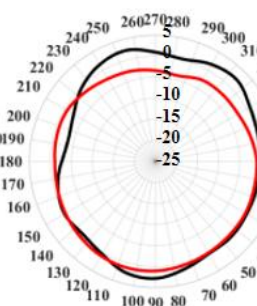
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— ANT2_2480



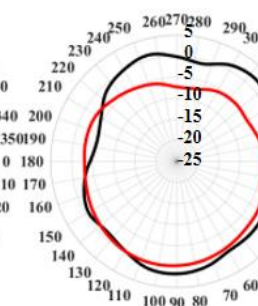
Theta 60°



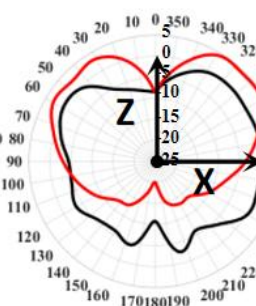
Theta 70°



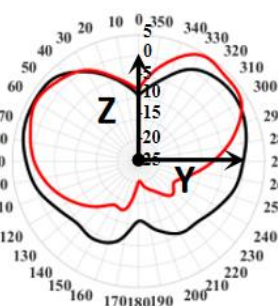
Theta 80°



Theta 90°(XY cut)

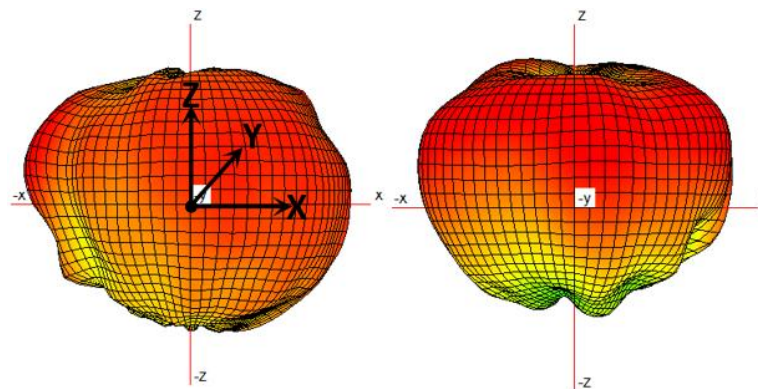


XZ Cut



YZ Cut

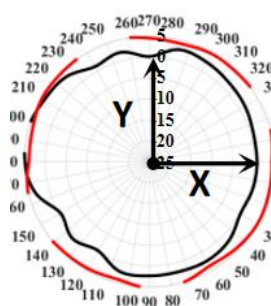
Radiation Pattern- WiFi @ 5.15GHz



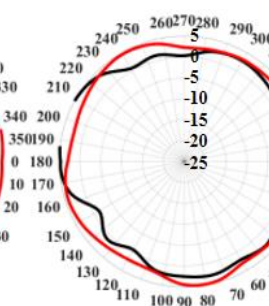
Ant1

Ant2

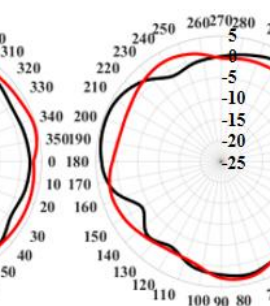
— ANT1_5150
— ANT2_5150



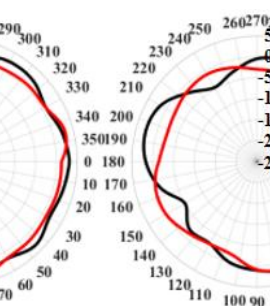
Theta 60°



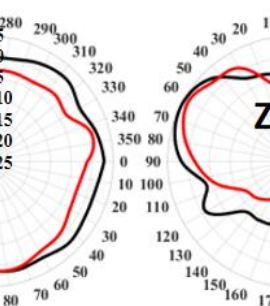
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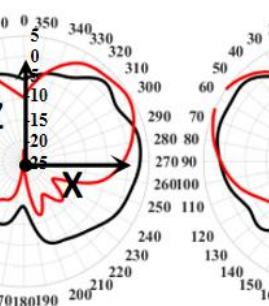
Theta 80°



Theta 90° (XY cut)

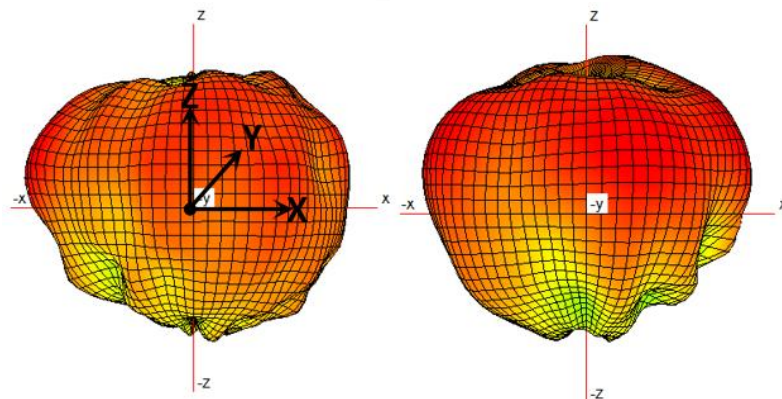


XZ Cut



YZ Cut

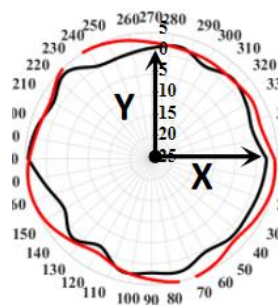
Radiation Pattern- WiFi @ 5.49GHz



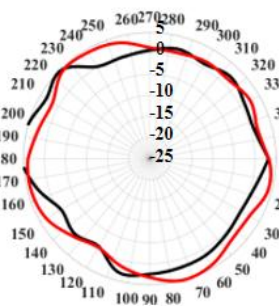
Ant1

Ant2

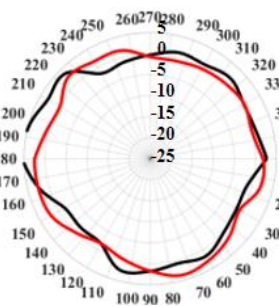
— ANT1_5490
— ANT2_5490



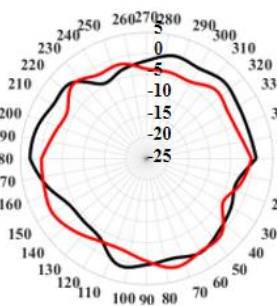
Theta 60°



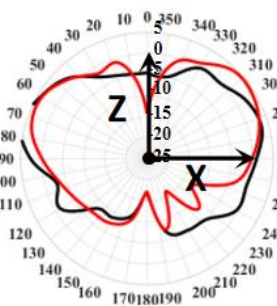
Theta 70°



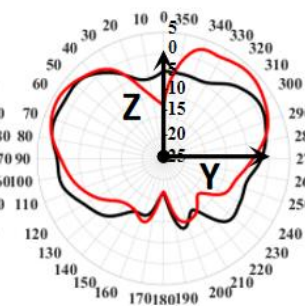
Theta 80°



Theta 90°(XY cut)

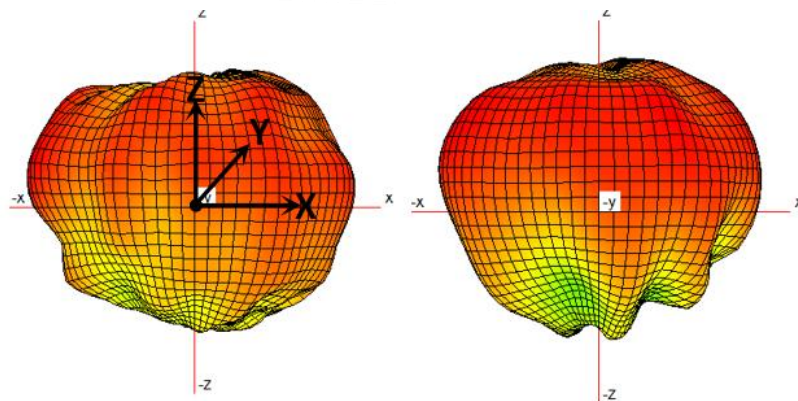


XZ Cut



YZ Cut

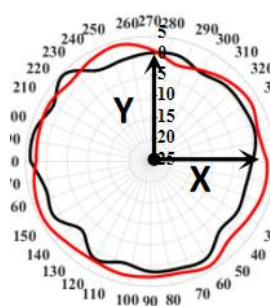
Radiation Pattern- WiFi @ 5.895GHz



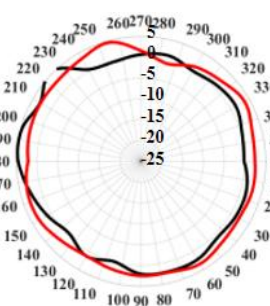
Ant1

Ant2

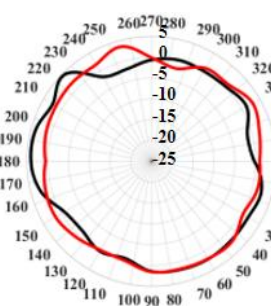
— ANT1_5895
— ANT2_5895



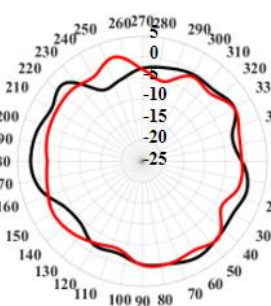
Theta 60°



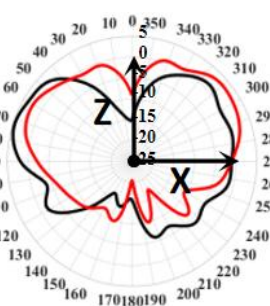
Theta 70°



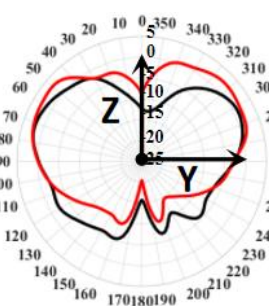
Theta 80°



Theta 90°(XY cut)

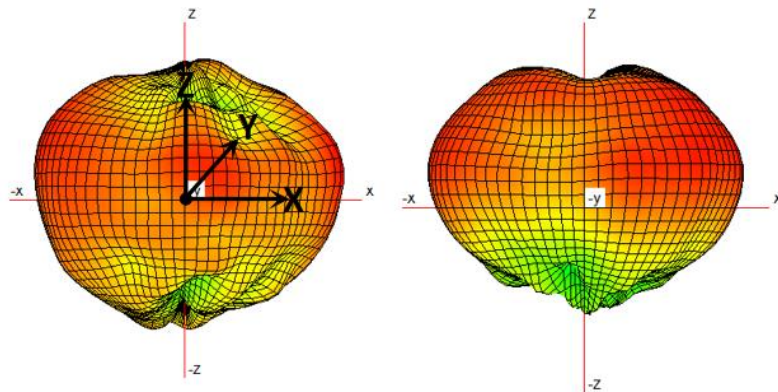


XZ Cut



YZ Cut

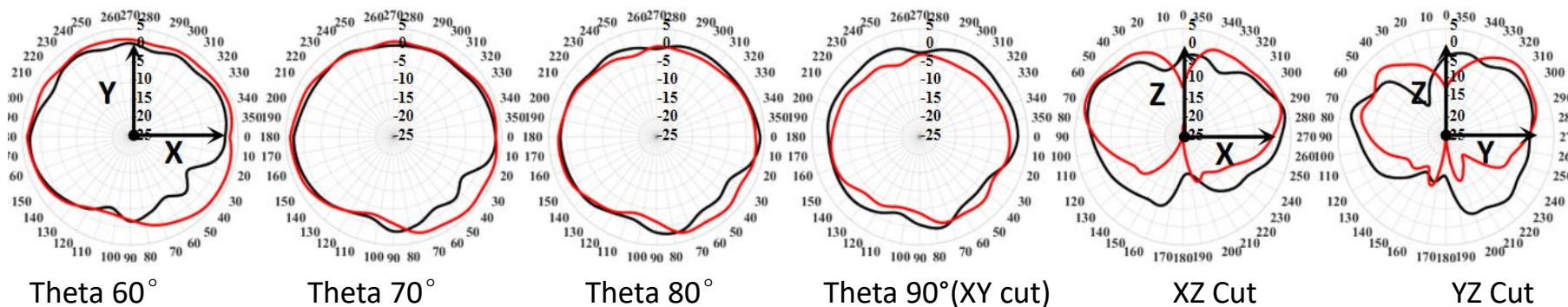
Radiation Pattern- WiFi @ 5.925GHz



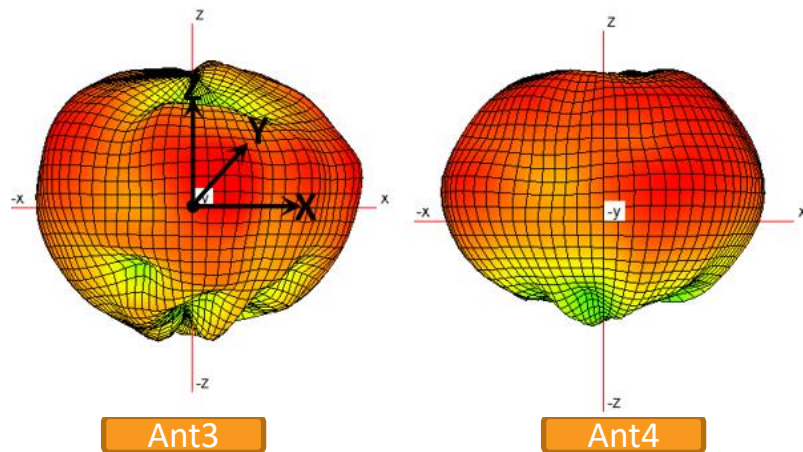
Ant3

Ant4

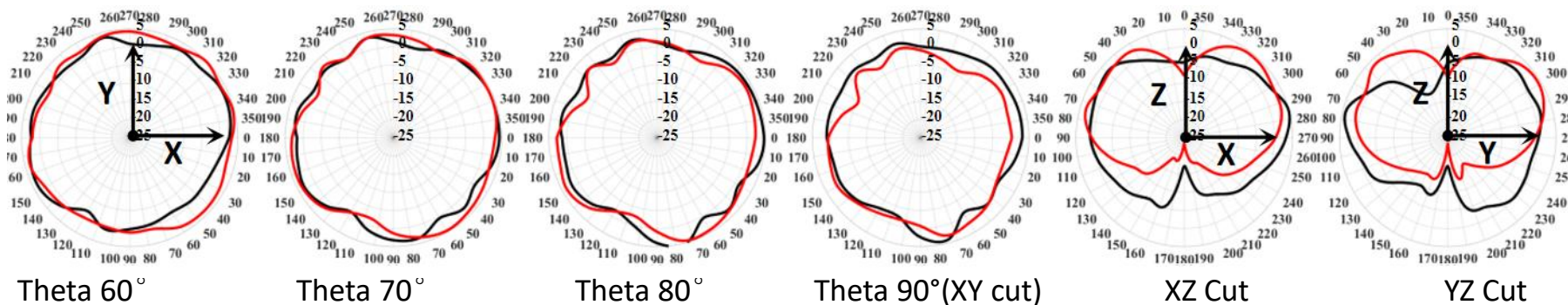
— ANT1_5925
— ANT2_5925



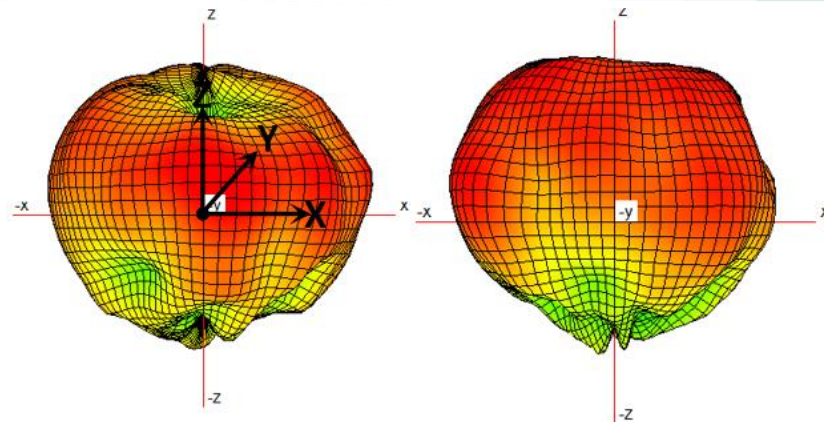
Radiation Pattern- WiFi @ 6.525GHz



— ANT1_6525
— ANT2_6525



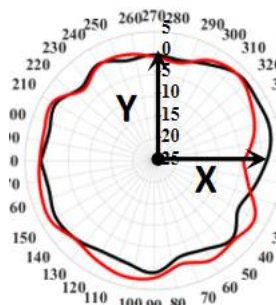
Radiation Pattern- WiFi @ 7.125GHz



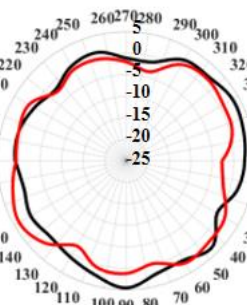
Ant3

Ant4

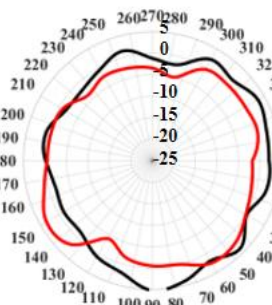
— ANT1_7125
— ANT2_7125



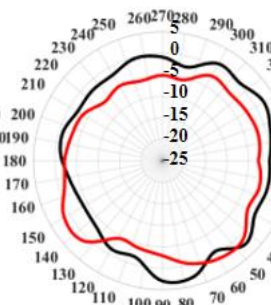
Theta 60°



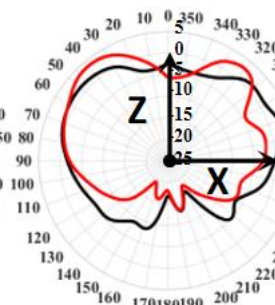
Theta 70°



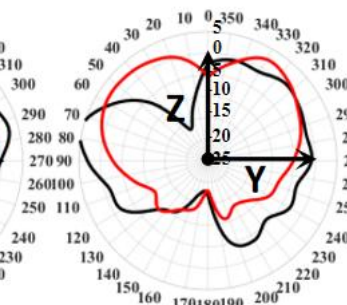
Theta 80°



Theta 90° (XY cut)

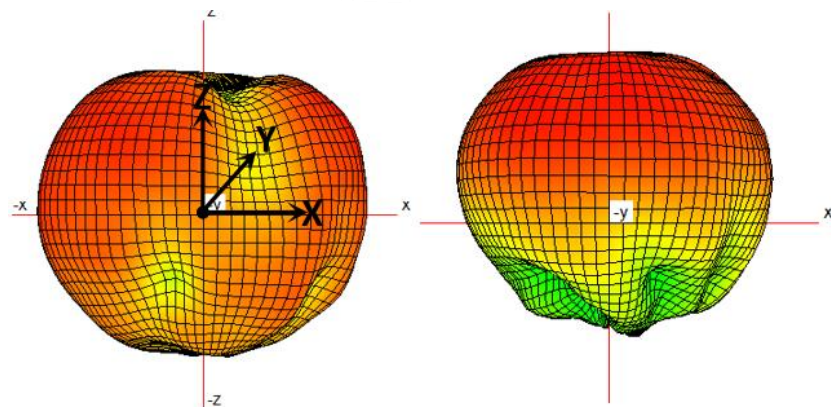


XZ Cut



YZ Cut

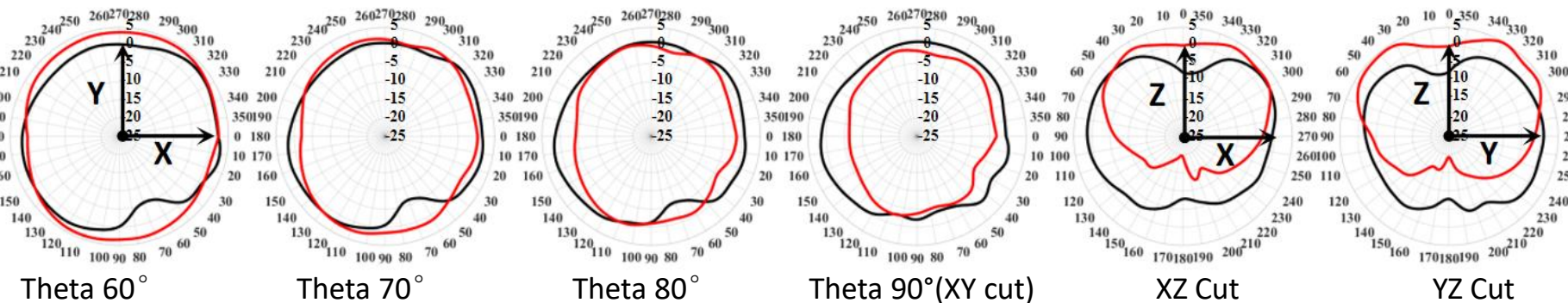
Radiation Pattern- WiFi @ BLE 2.4GHz



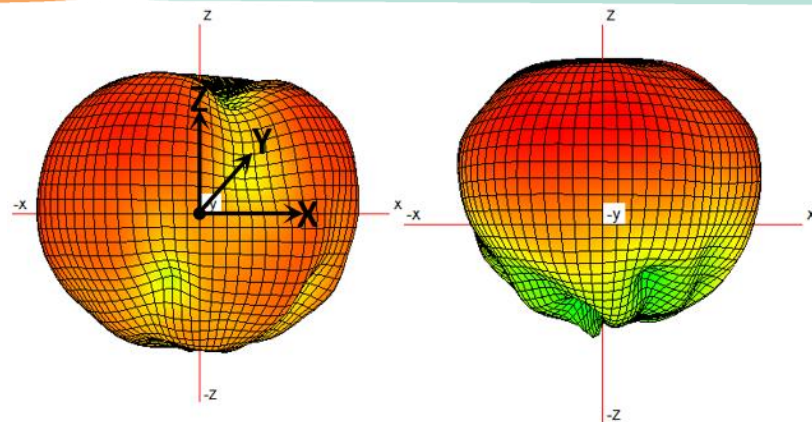
Ant3

Ant4

— ANT3_2400
— ANT4_2400



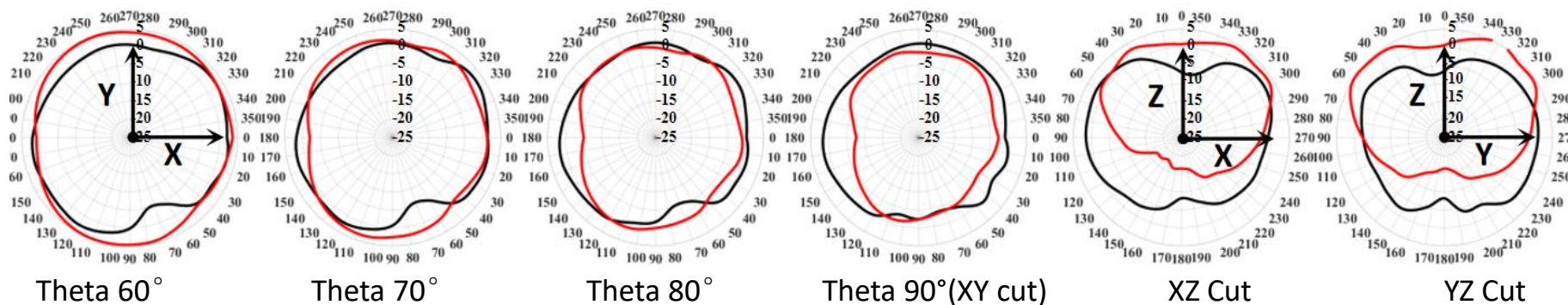
Radiation Pattern- WiFi @ BLE 2.44GHz



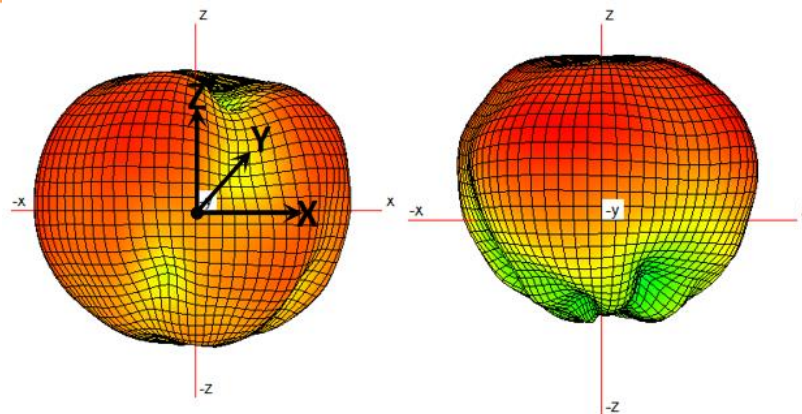
Ant3

Ant4

— ANT3_2440
— ANT4_2440



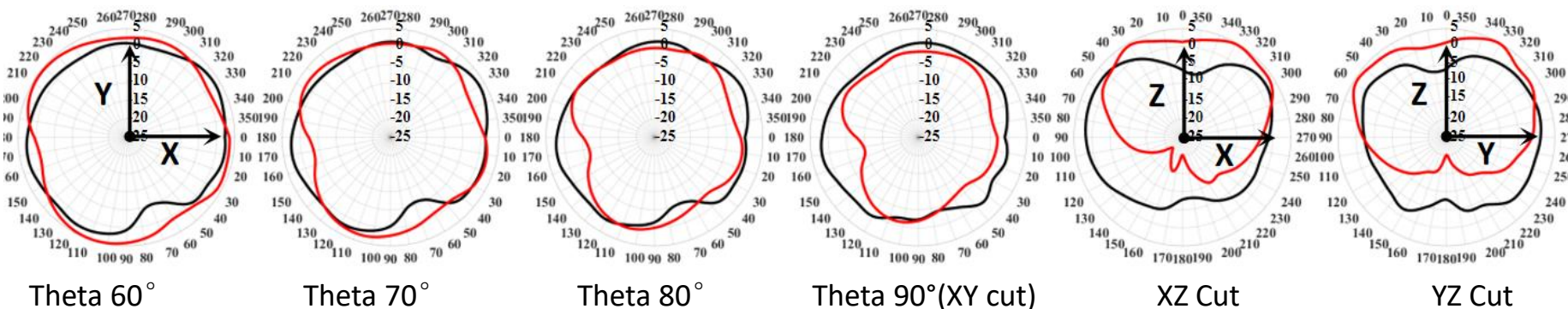
Radiation Pattern- WiFi @ BLE 2.48GHz



Ant3

Ant4

— ANT3_2480
— ANT4_2480



THANK YOU