



Comcast / ES1 Antenna Test Report

May. 19, 2023

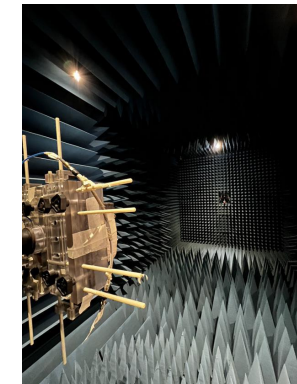
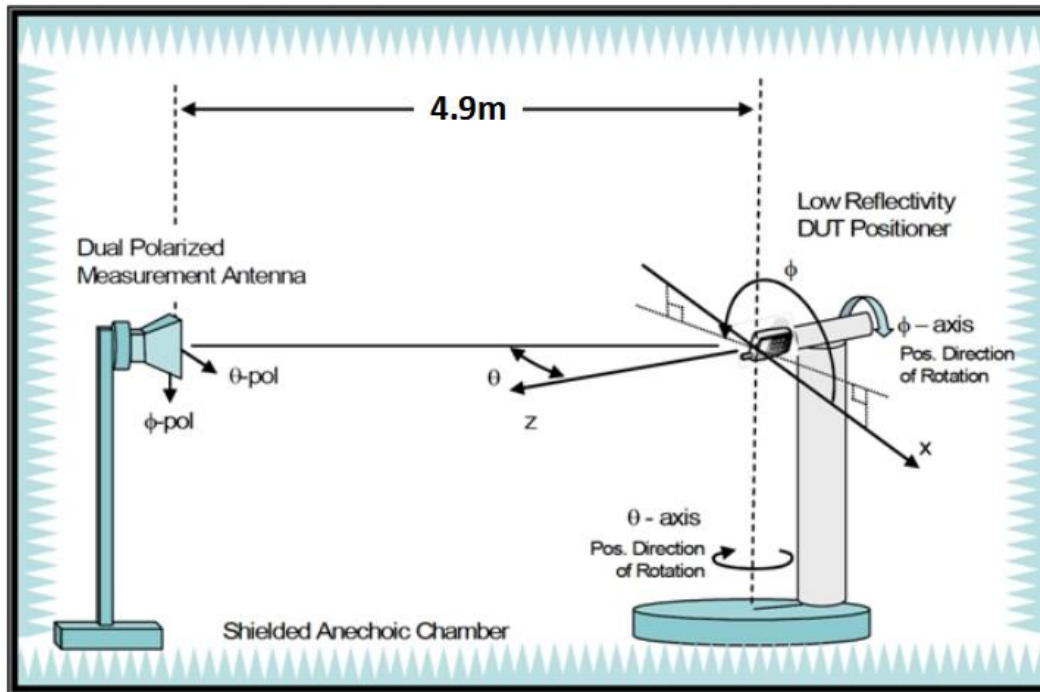
Prepared by Larry Jiang

Outline

- Information of Test Setup
- Antenna Structure & Placement
- Return Loss & Isolation
- Peak Gain & Efficiency
- 2D Radiation Pattern
 - Each Antenna
 - System Coverage
- 3D Radiation Pattern And Heatmap For Each Antenna
- Uncorrelated Gain
 - 2D Radiation Pattern
 - Gain Table
- Correlated Gain
 - 2D Radiation Pattern
 - Gain Table

Test Configuration

ETS AMS-8500 antenna measurement system with a size of $7.32(L) \times 3.66(W) \times 3.66(H)$ m³ is used for antenna performance test, which is based on the great-circle test method defined by CTIA. The multi-axis positioning system (MAPS) rotates the DUT around two orthogonal axes for full spherical coverage.

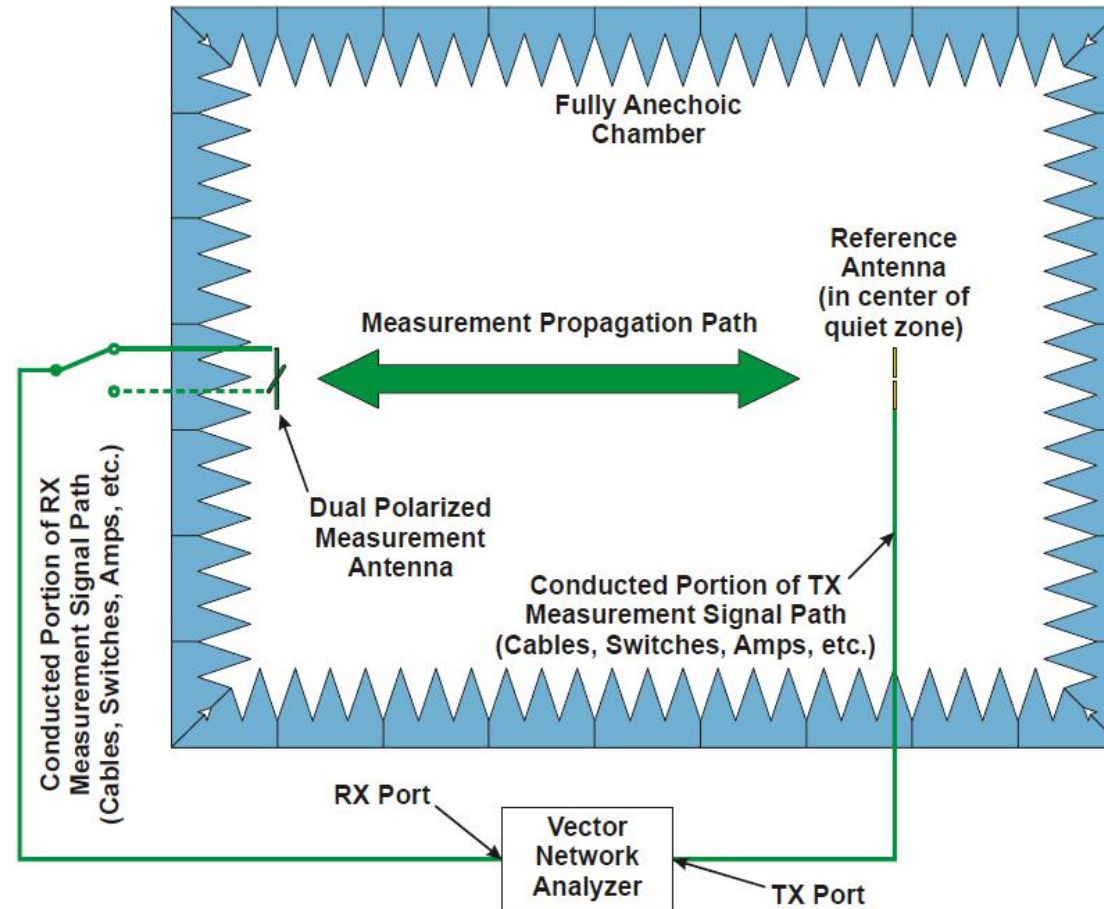


Test Setup & Procedure

1. Fix the DUT on the dielectric support structure and connect the feeding cable to the antenna used for test
2. Set measurement parameters such as frequency range and sampling angle
3. Perform 3D test and then get far-field data (radiation pattern, gain, efficiency)

Test Equipment & Calibration

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



Test Information

Item	Description
Brand Name	Comcast
Equipment	Wi-Fi
Test Location	8F, No. 3-1, YuanQu St. Taipei, Taiwan 115 R.O.C.
Test Condition	Radiation
Test Engineer	Larry Jiang
Test Environment	ETS-8500 Antenna Measurement Chamber
Test Date	May. 15, 2023 ~ May. 19, 2023

Equipment Used Information

Instrument	Brand	Characteristics	Model No.	Serial No.	Calibration Due Date
Precision Sleeve Dipole	ETS-Lindgren	700 MHz ~ 900 MHz	3126-700	00169715	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	900 MHz ~ 1000 MHz	3126-900	00169592	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	1400 MHz ~ 1700 MHz	3126-1550	00164599	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	1700 MHz ~ 2000 MHz	3126-1850	00169588	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	2000 MHz ~ 2300 MHz	3126-2150	00169593	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	2300 MHz ~ 2700 MHz	3126-2500	00169597	Feb 13, 2024
Precision Sleeve Dipole	ETS-Lindgren	5000 MHz ~ 6000 MHz	3126-5500	00169728	Feb 13, 2024
Horn Antenna	SCHWARZBECK	1 GHz ~ 18 GHz	BBHA 9120D	BBHA 9120D-1294	Feb 13, 2024
EMQuest Antenna Measurement Software	ETS-Lindgren	Control chamber system	EMQ-100	1437	Non-Calibration Required

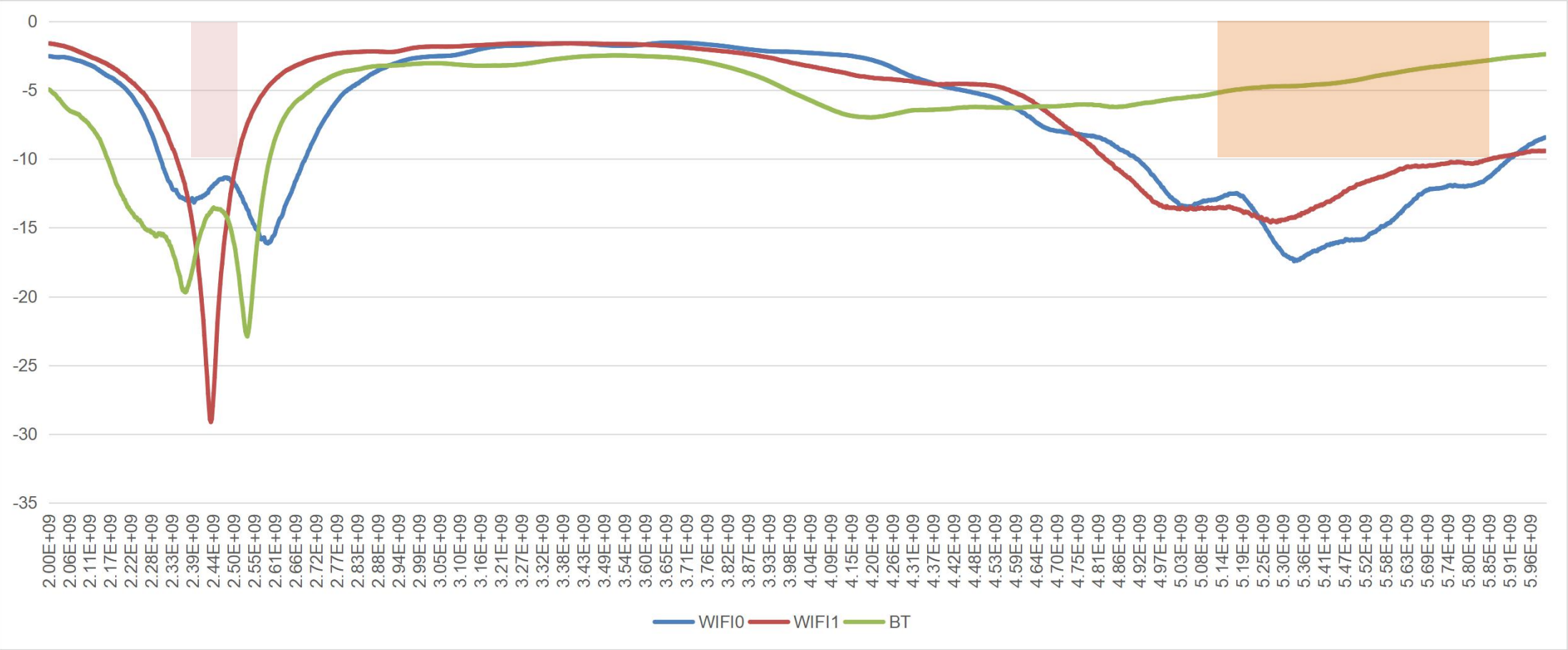
Antenna Specification

Antenna Specification	Comply	Note
Return Loss: > 10dB (WiFi & BLE)	Yes	
Isolation : > 15dB (WiFi & BLE)	Yes	
Efficiency : > 50% (WiFi & BLE)	Yes	

Antenna Structure & Placement

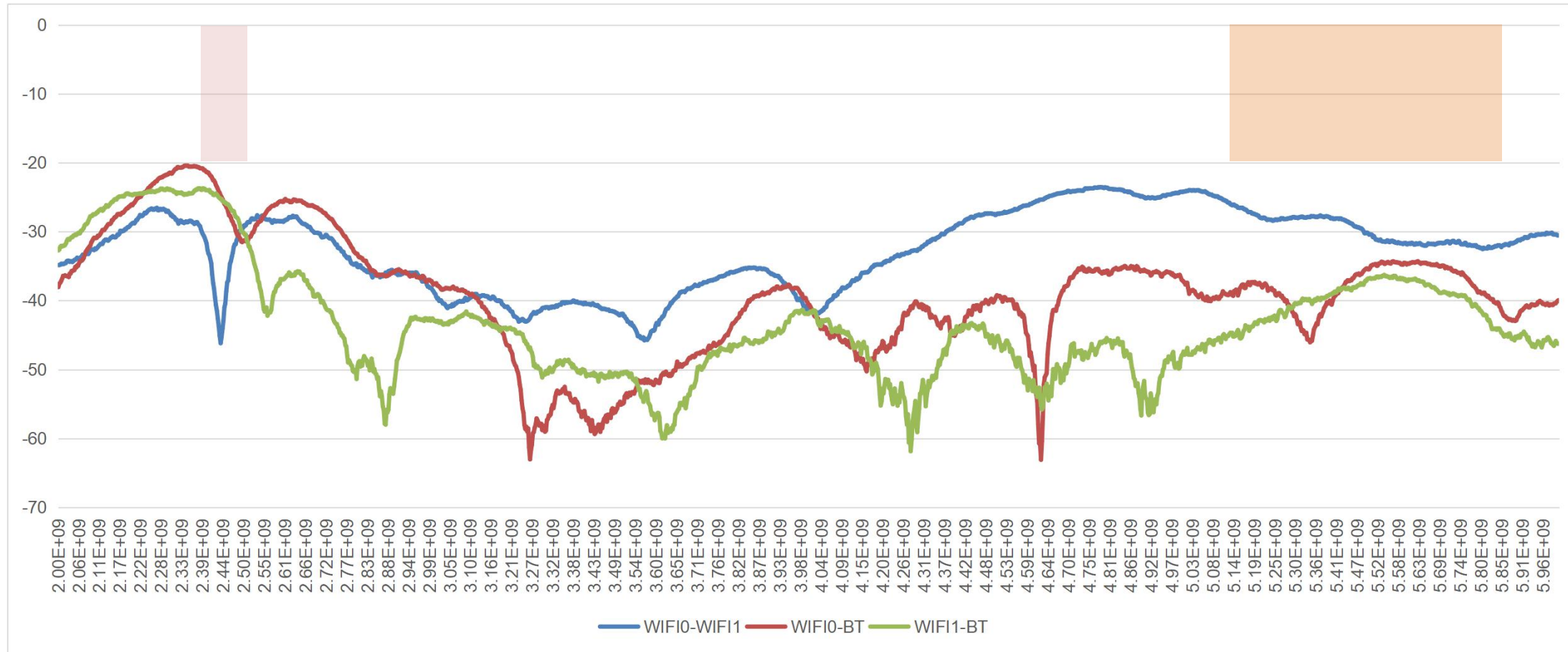
Ant No.	Function	Operating Band	Type	Material	Feeding	Dimension
WIFI0	WiFi 2G/5G	2400MHz ~ 2500MHz 5150MHz ~ 5850MHz	PIFA	FPC	Cable (35mm)	25(L) x 23.6(W) mm ²
WIFI1	WiFi 2G/5G	2400MHz ~ 2500MHz 5150MHz ~ 5850MHz	PIFA	FPC	Cable (95mm)	25(L) x 23.6(W) mm ²
BT	BT	2400MHz ~ 2500MHz	PIFA	Printing	Trace	24(L) x 10(W) mm ²

Return Loss



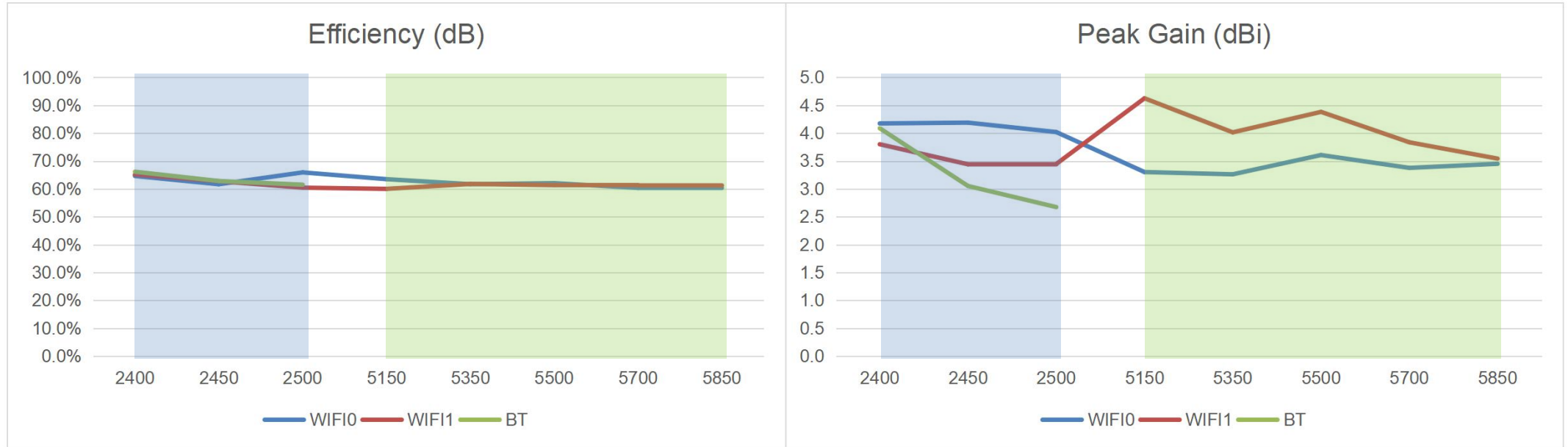
Worst Returnloss (dB)	WIFI0	WIFI1	BT
2.4~2.5GHz	-11.3	-11.0	-13.5
5.15~5.85GHz	-11.4	-10.1	

Isolation



Worst Isolation (dB)	WIFI0 - WIFI1	WIFI0 - BT	WIFI1 - BT
2.4~2.5GHz	-29.1	-20.0	-23.9
5.15~5.85GHz	-26.5	-33.3	-36.3

Peak Gain & Efficiency

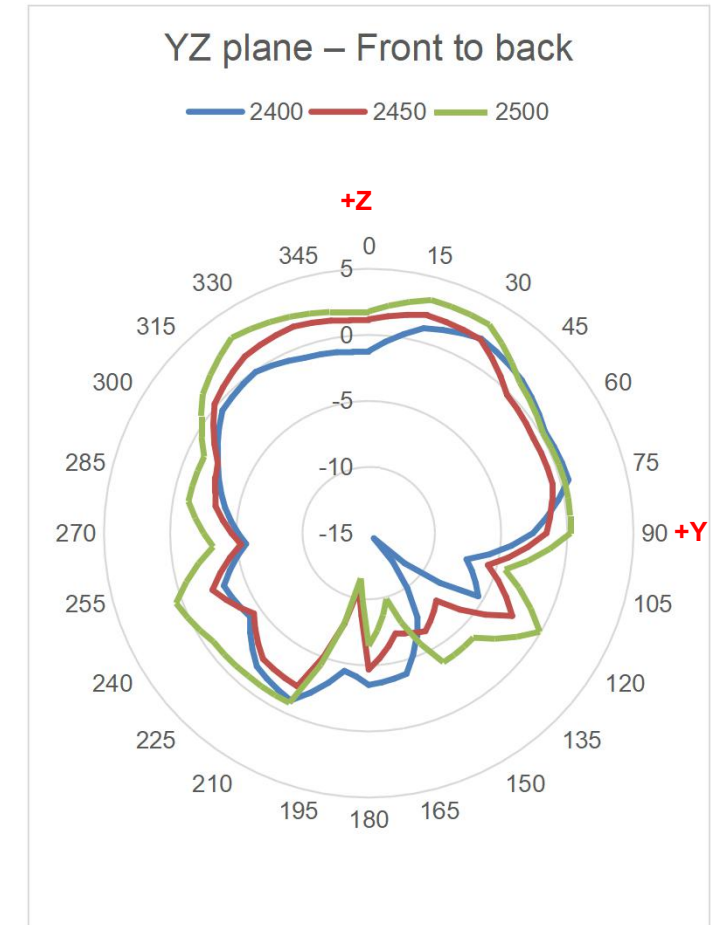
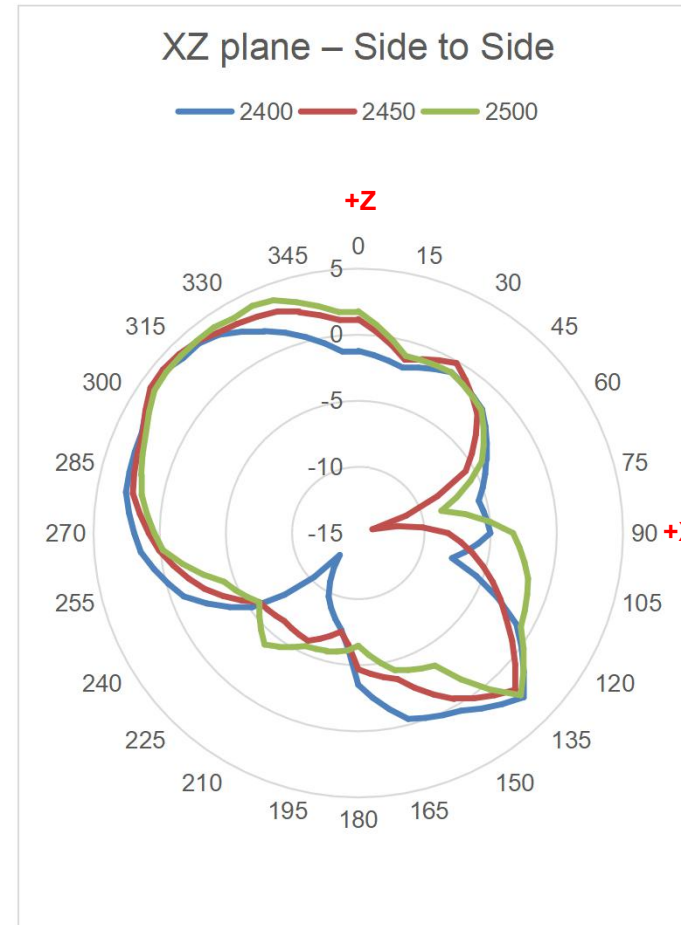
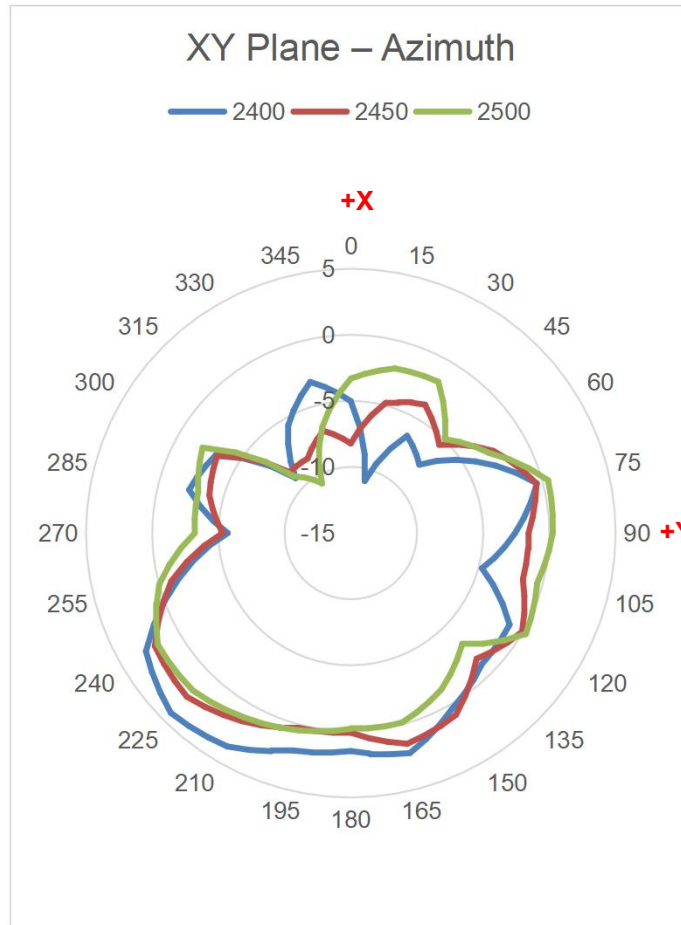


Performance						
Frequency (MHz)	WIFI0		WIFI1		BT	
	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)
2400	64.6%	4.2	65.1%	3.8	66%	4.1
2450	61.7%	4.2	62.8%	3.4	63%	3.1
2500	65.9%	4.0	60.4%	3.4	62%	2.7
5150	63.5%	3.3	60.0%	4.6		
5500	62.1%	3.6	61.4%	4.4		
5850	60.5%	3.5	61.4%	3.5		

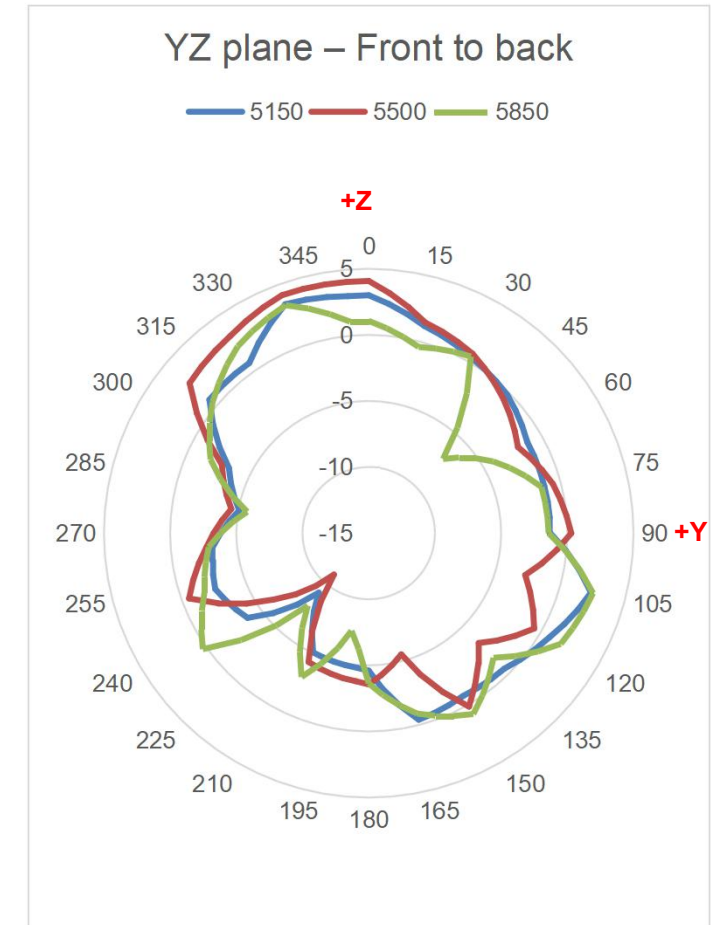
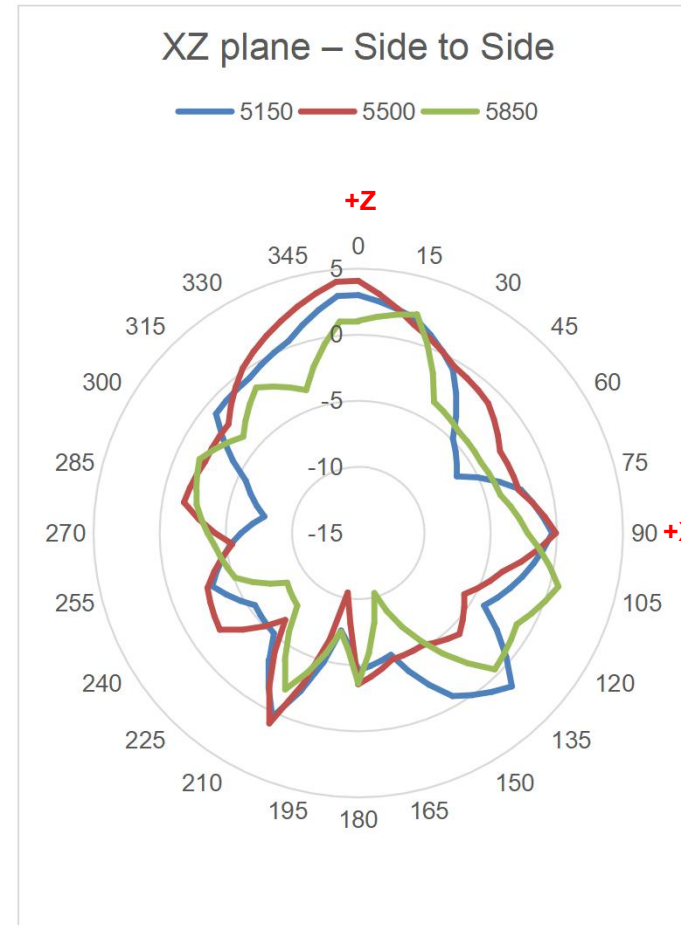
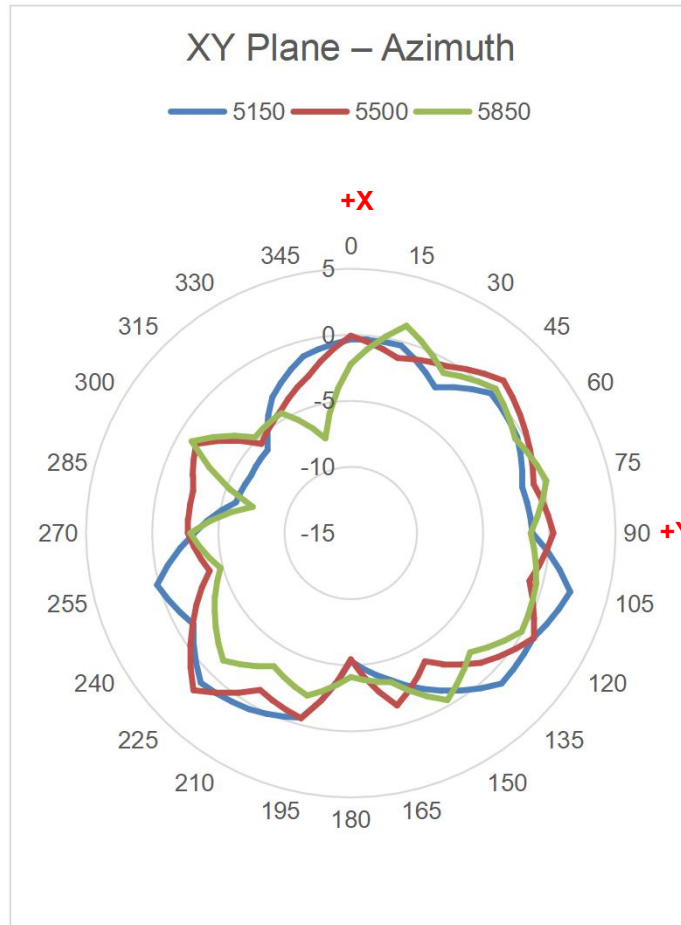
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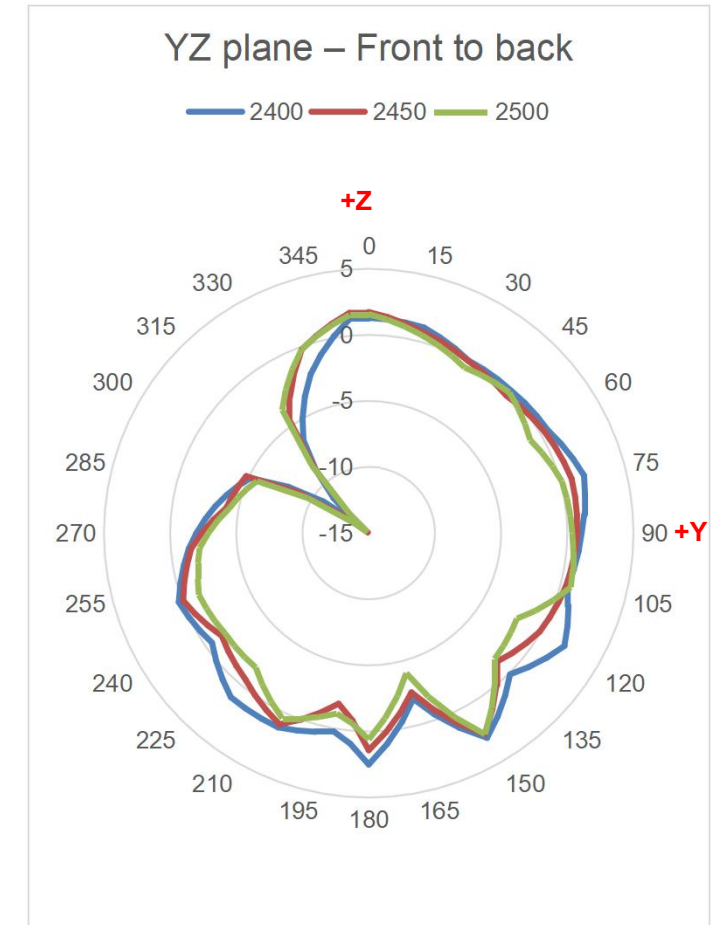
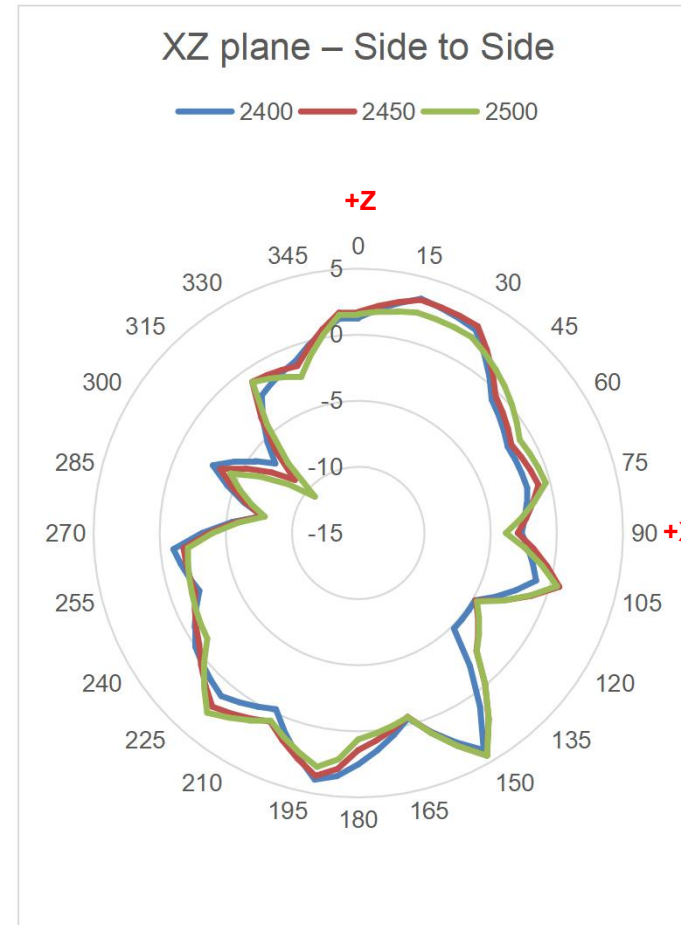
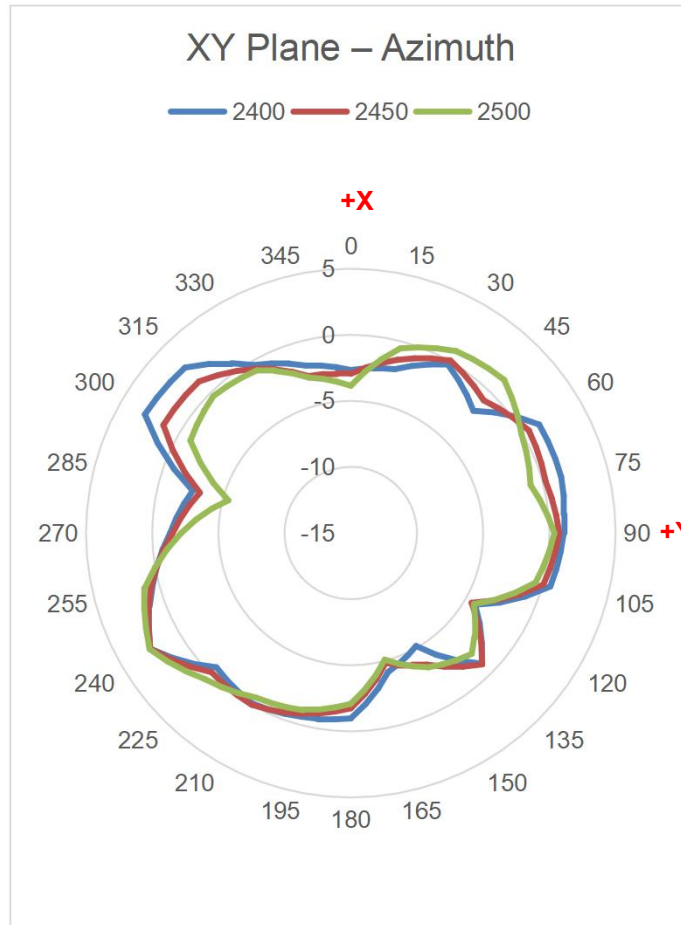
2D Radiation Pattern _ WiFi0@2.4G



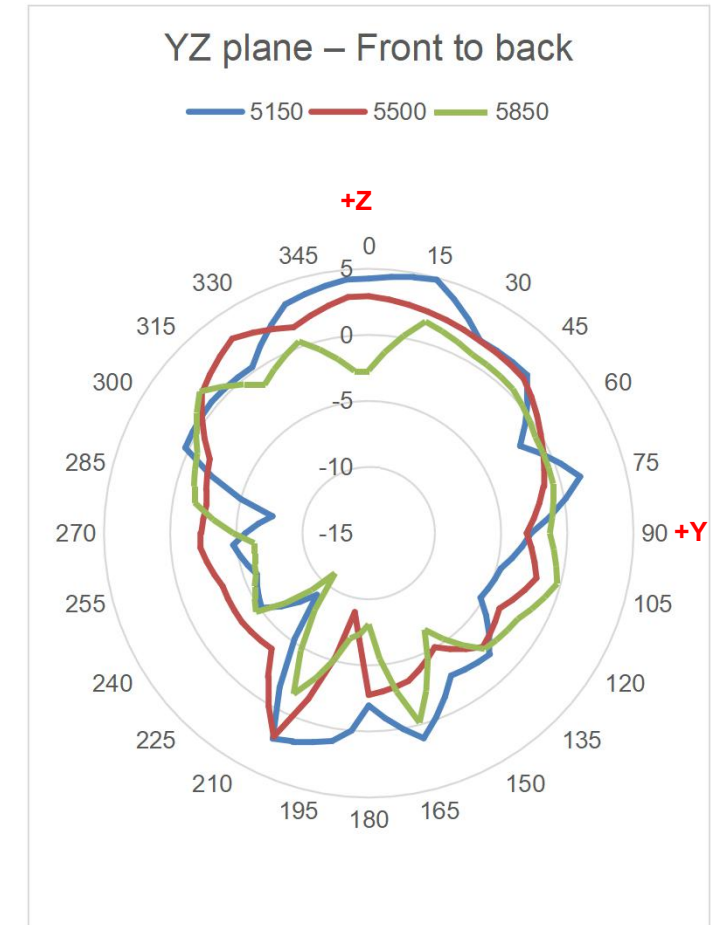
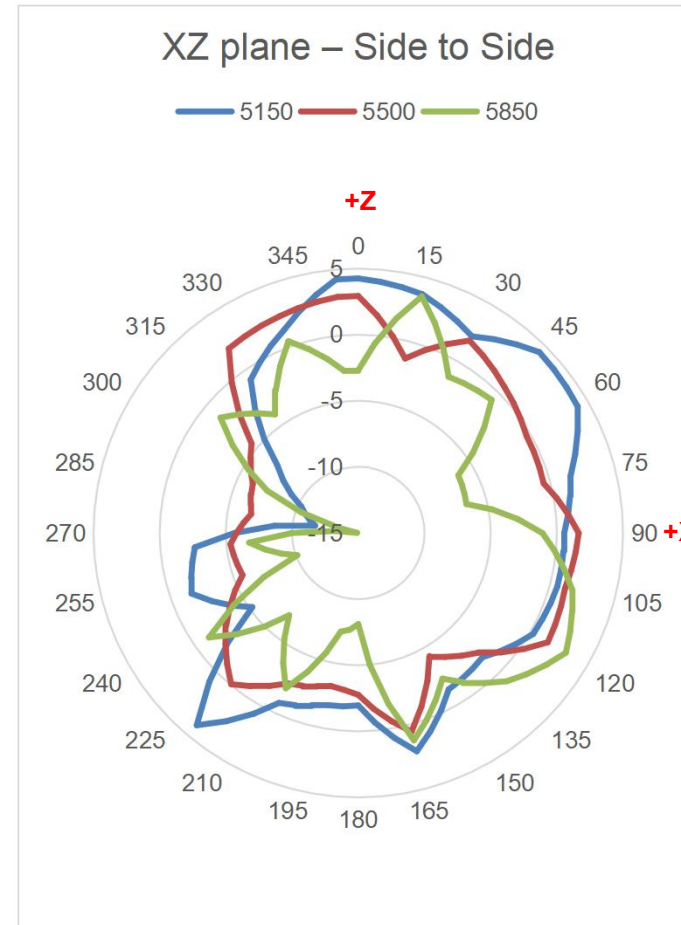
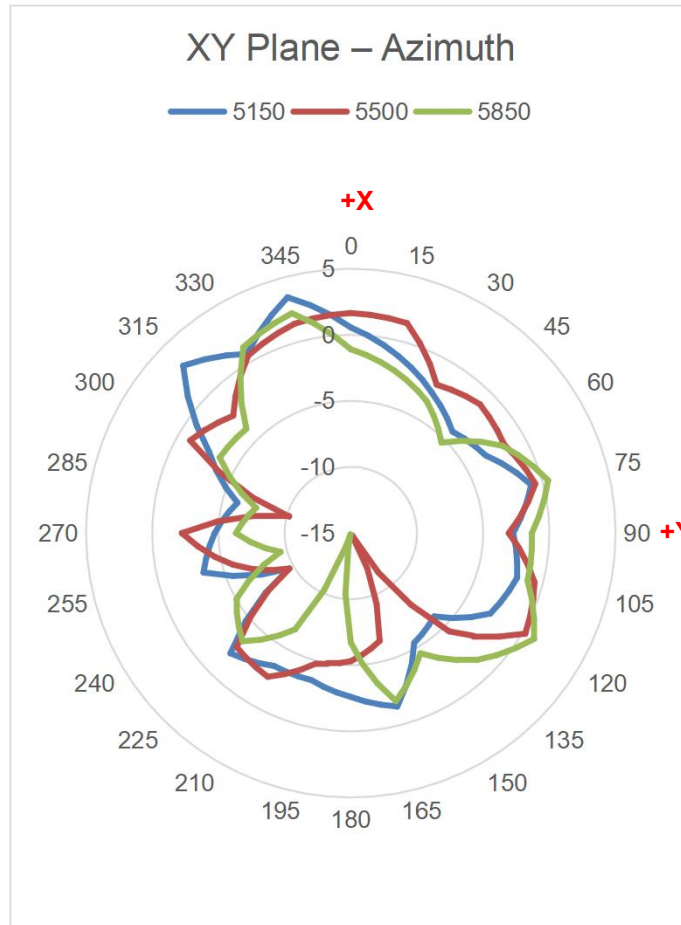
2D Radiation Pattern _ WiFi0@5G



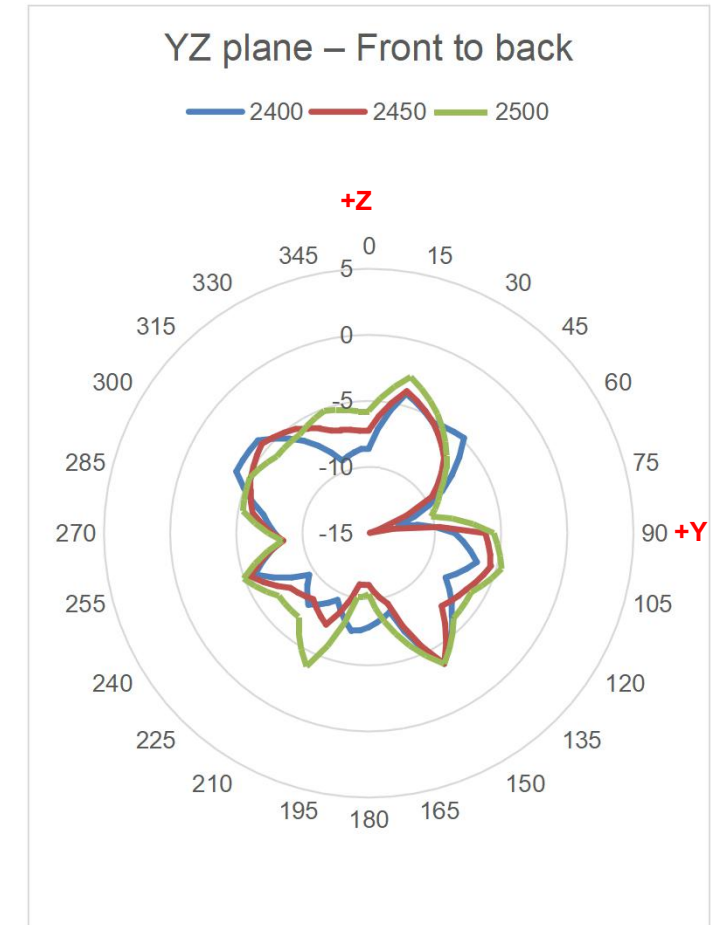
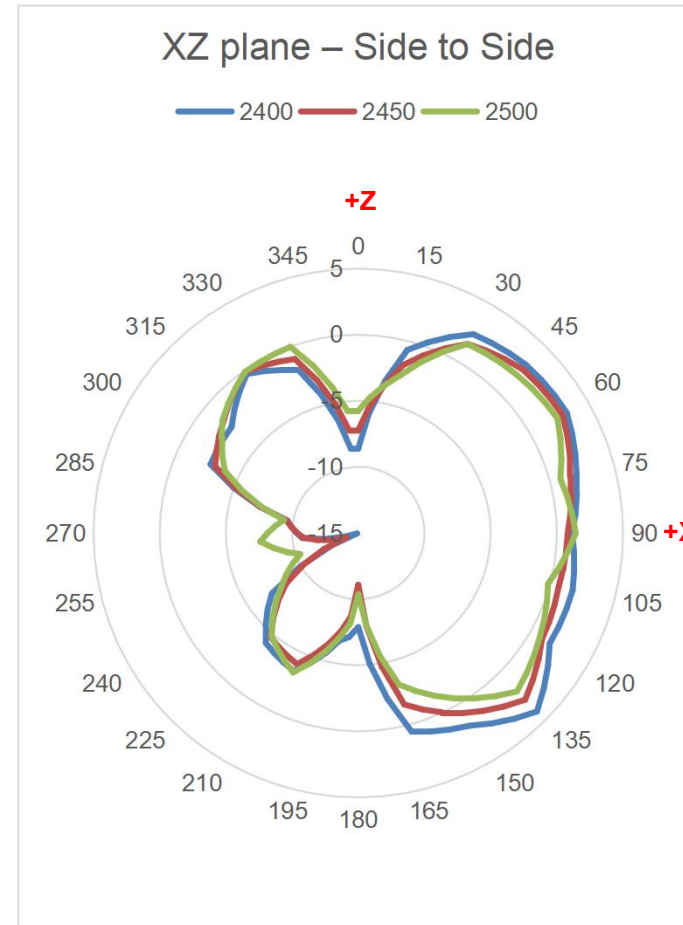
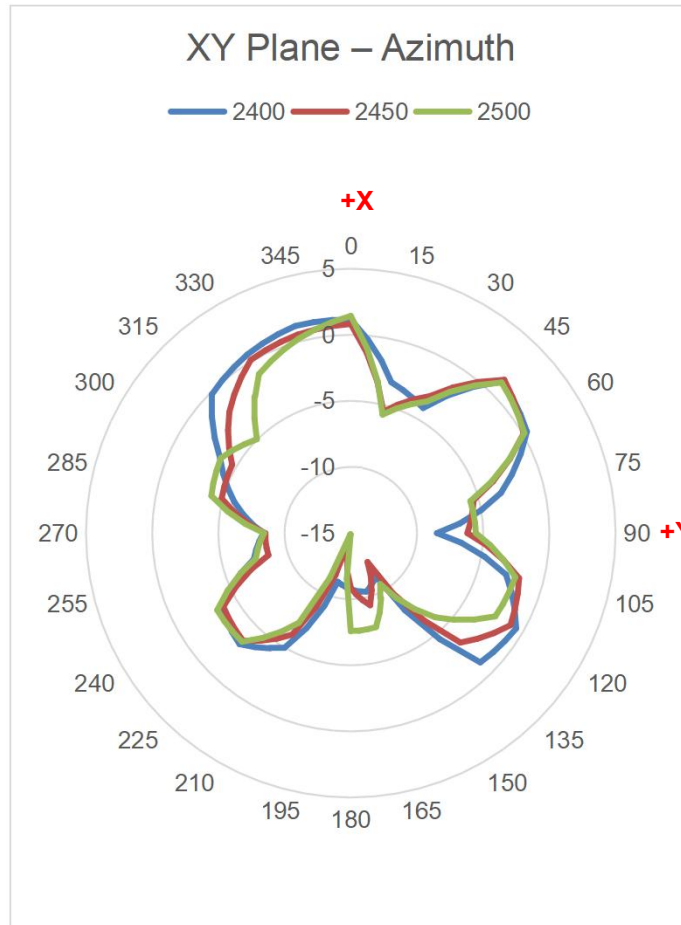
2D Radiation Pattern _ WiFi1@2.4G



2D Radiation Pattern _ WiFi1@5G



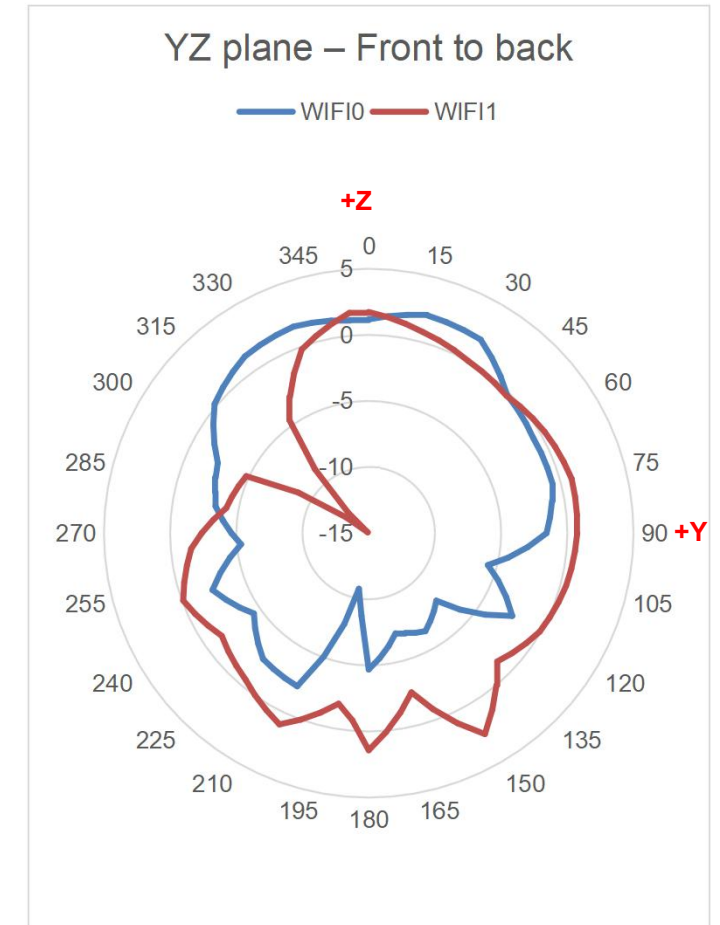
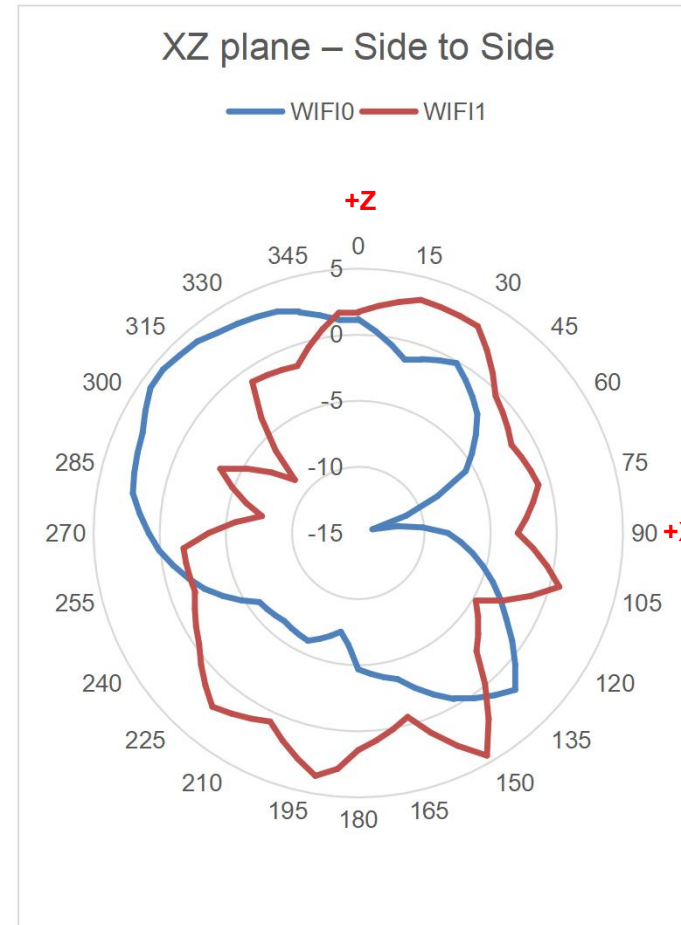
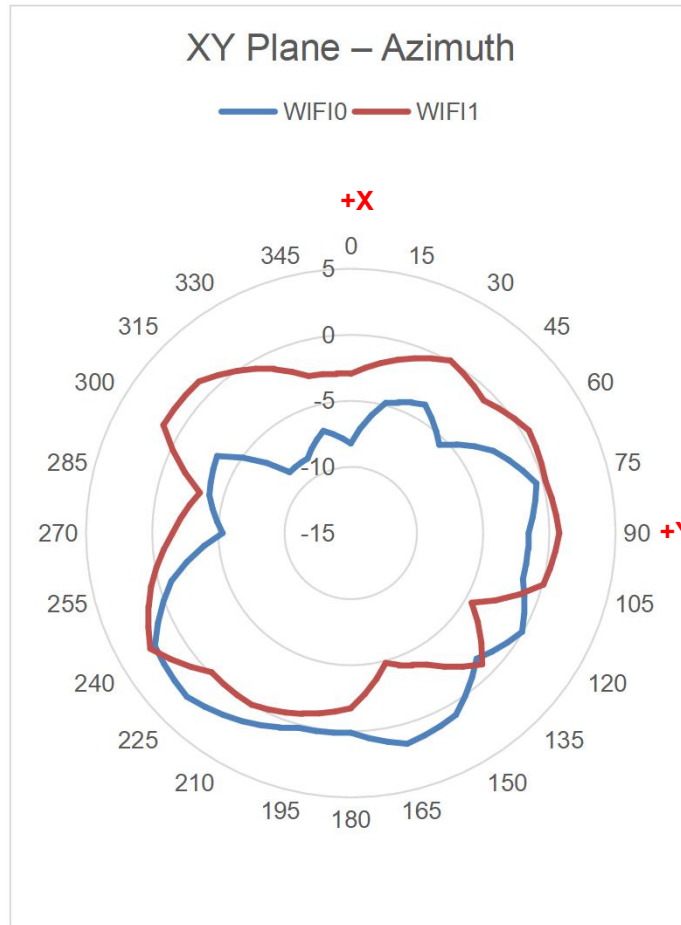
2D Radiation Pattern _ BT



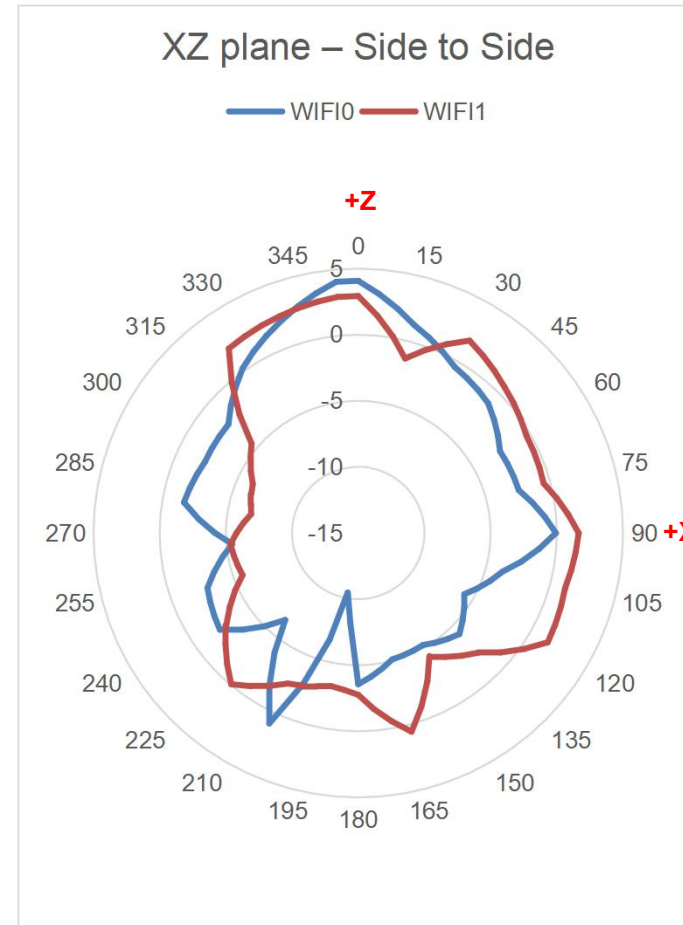
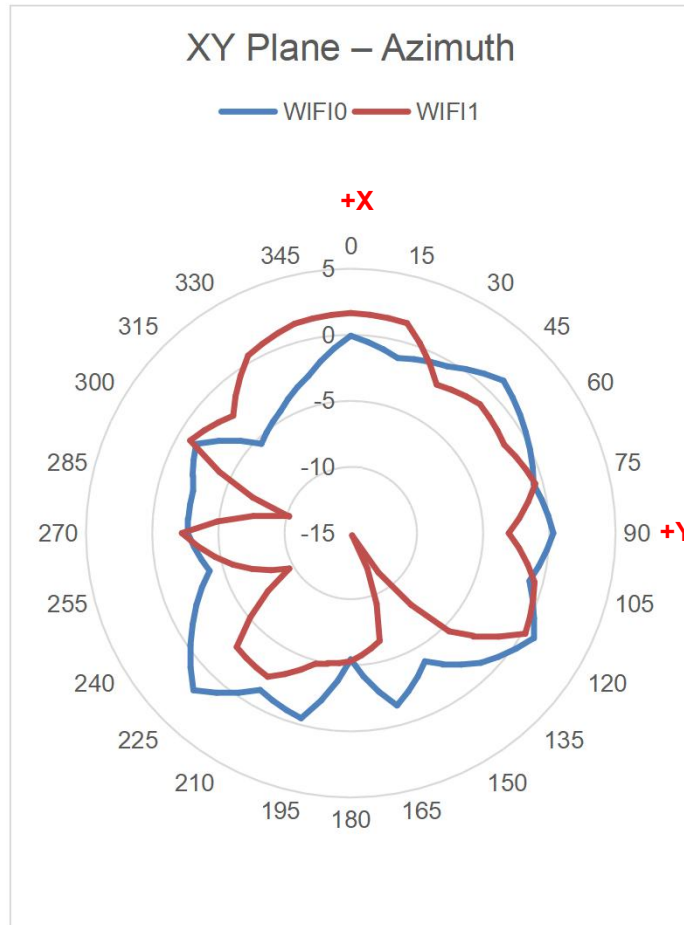
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System Coverage_ WiFi 2.4G



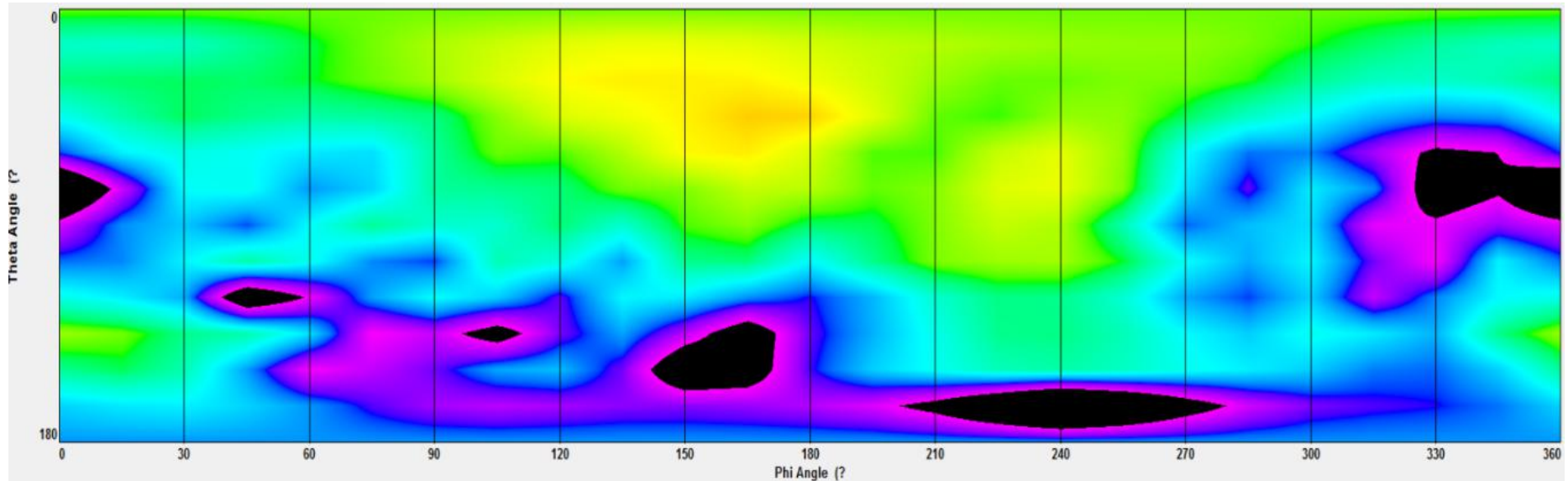
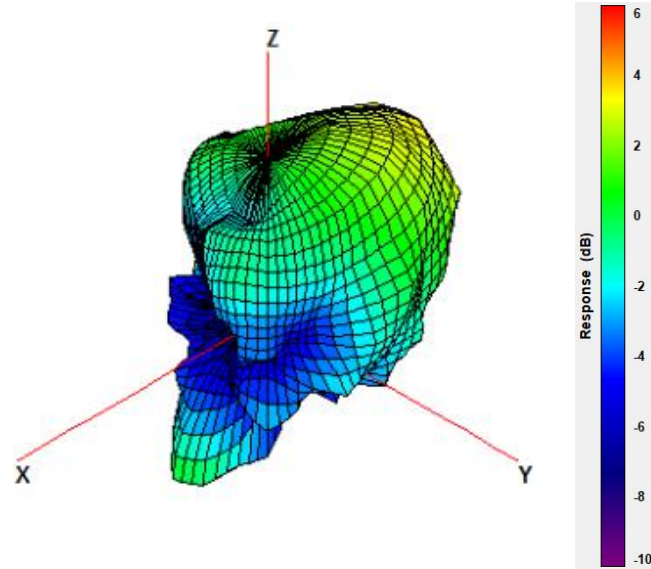
System Coverage_ WiFi 5G



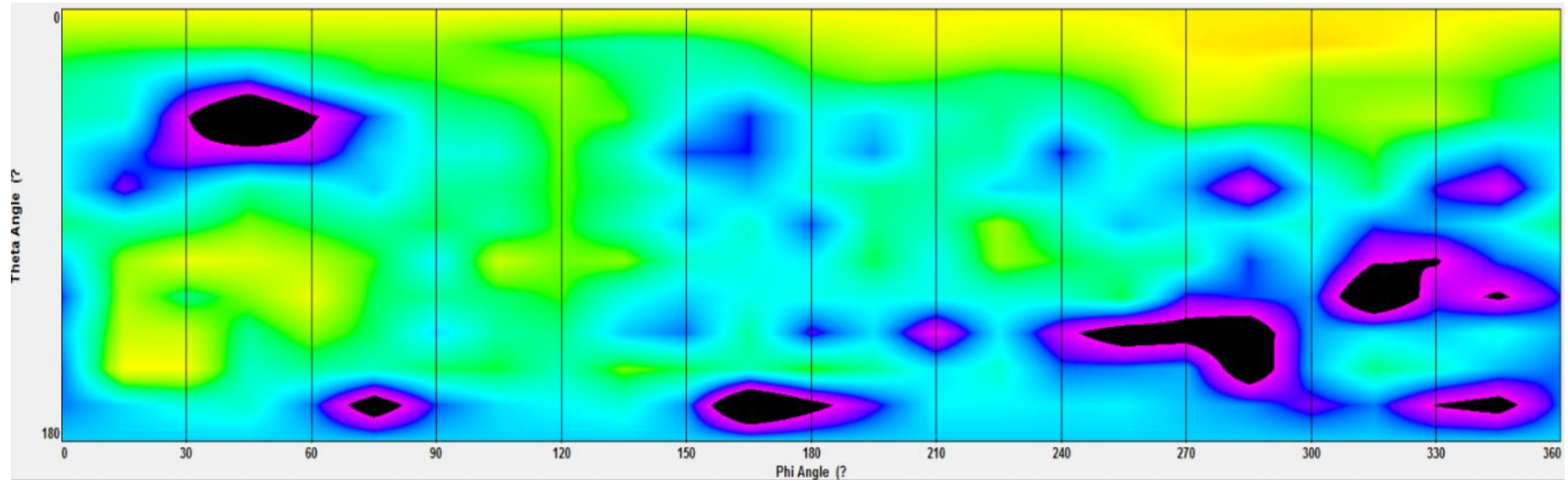
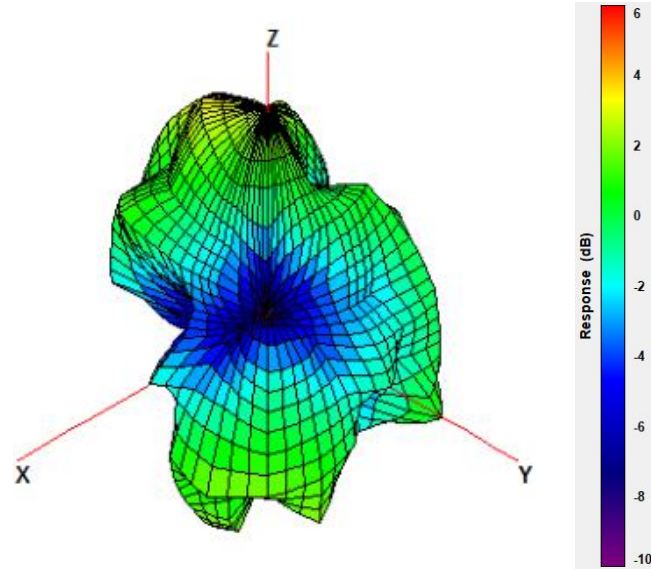
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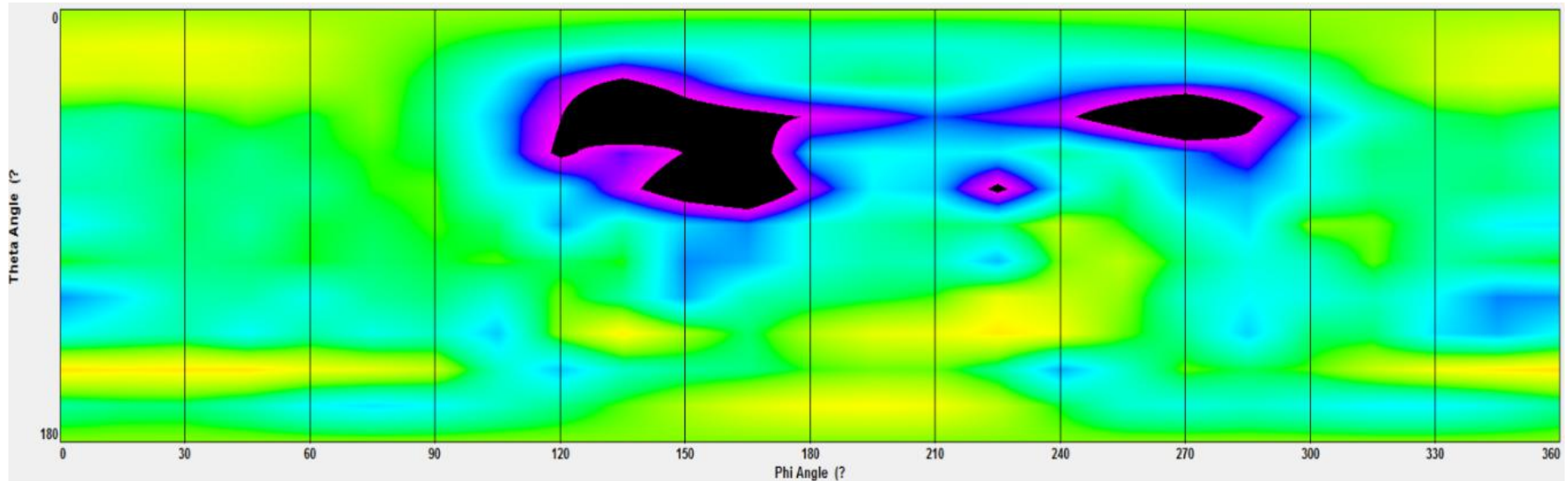
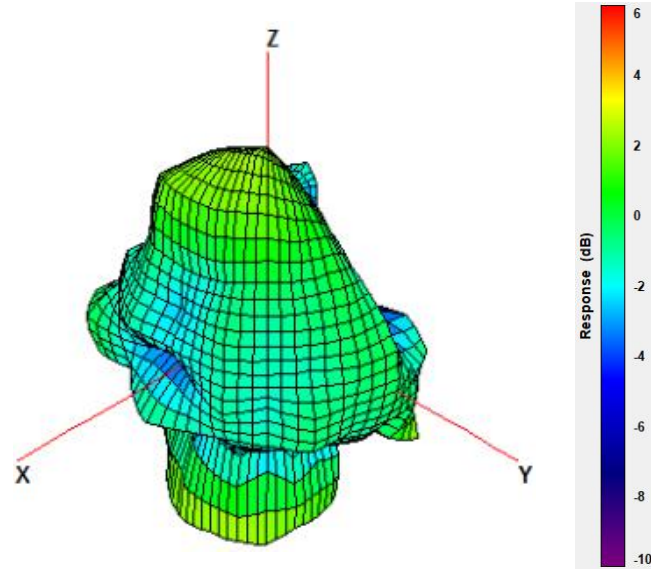
3D Radiation Pattern – WIFI0 @2.45GHz



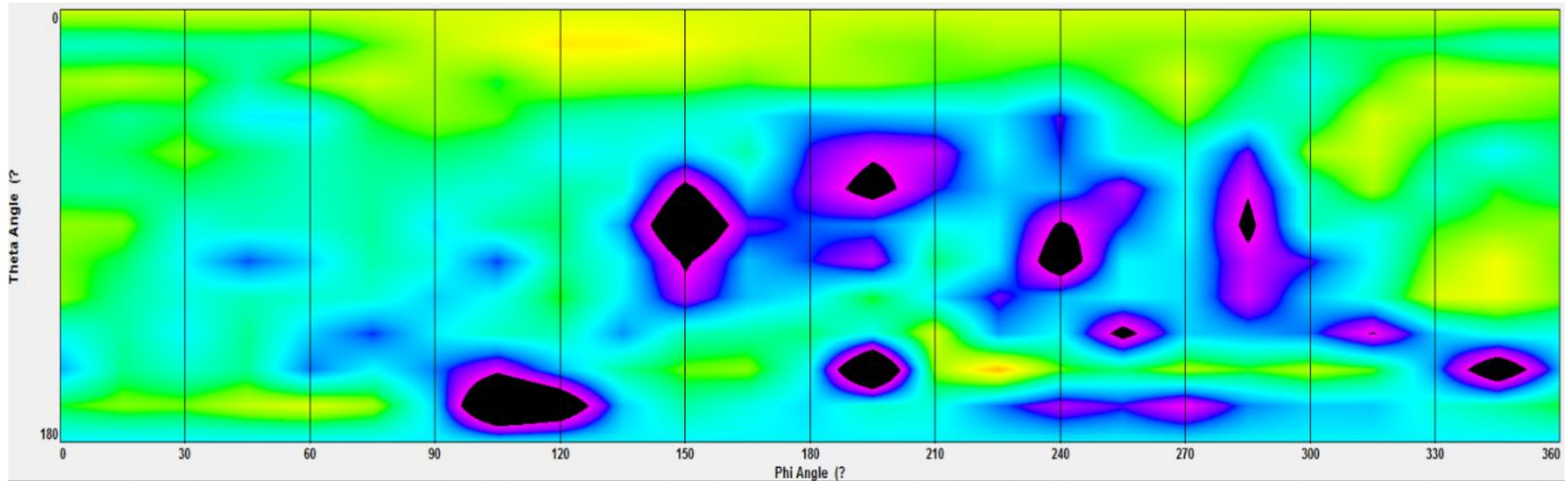
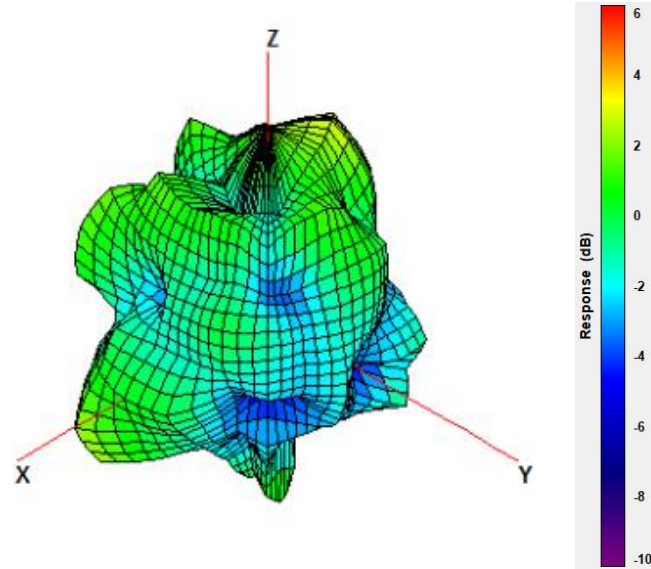
3D Radiation Pattern – WIFI0 @5.5GHz



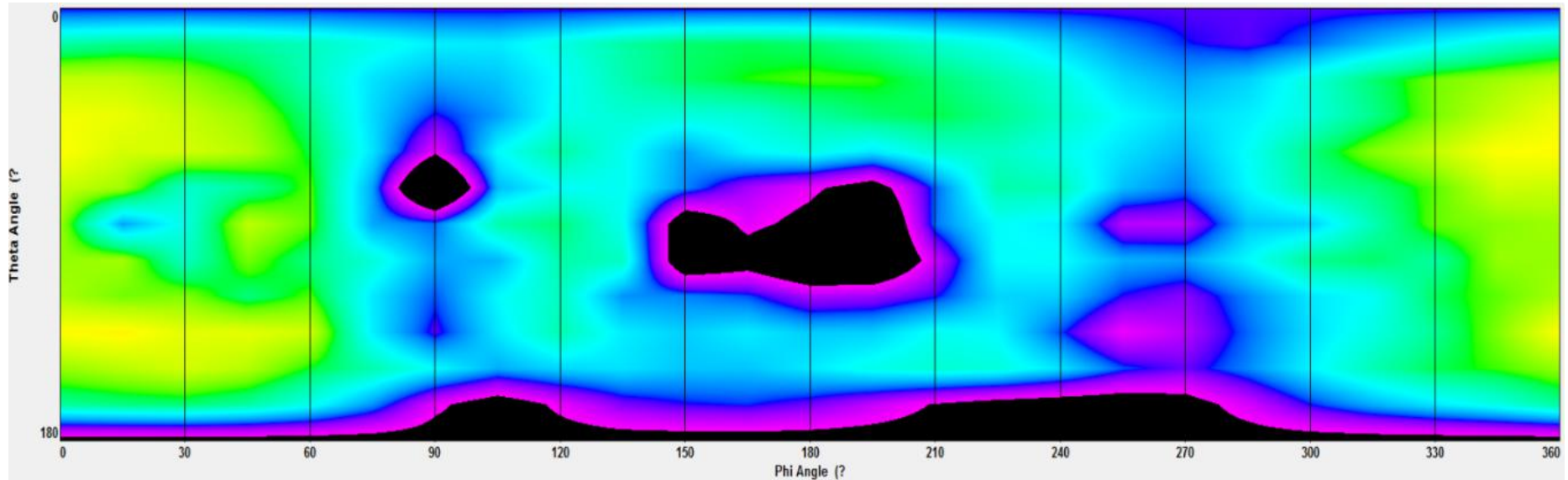
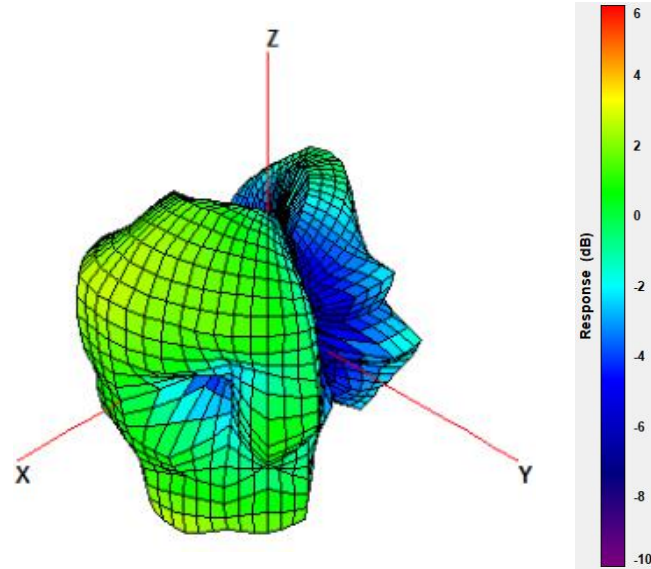
3D Radiation Pattern – WIFI1 @2.45GHz



3D Radiation Pattern – WIFI1 @5.5GHz



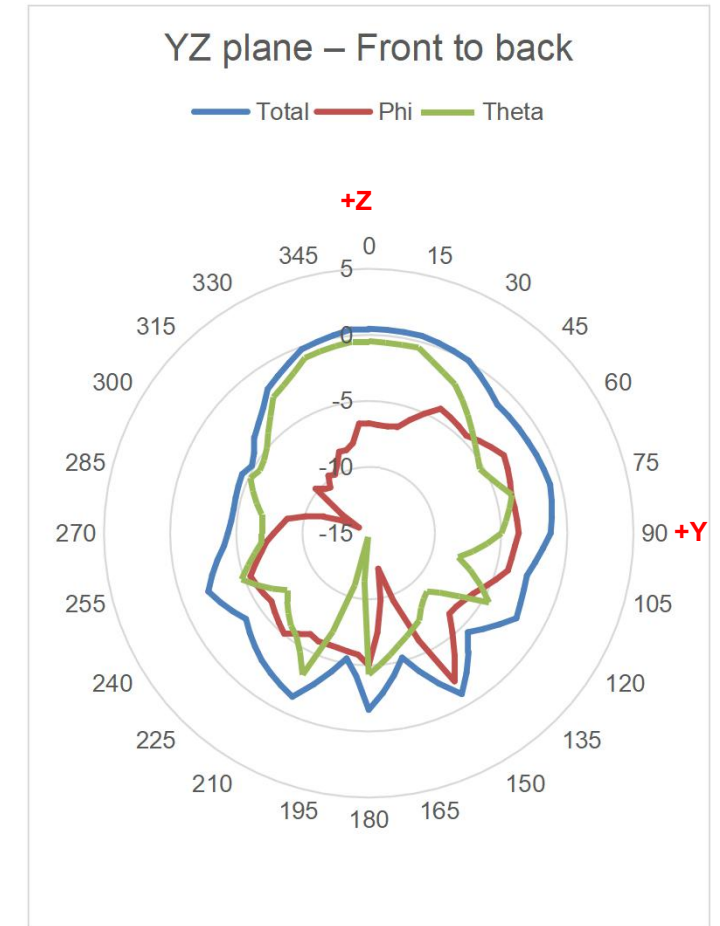
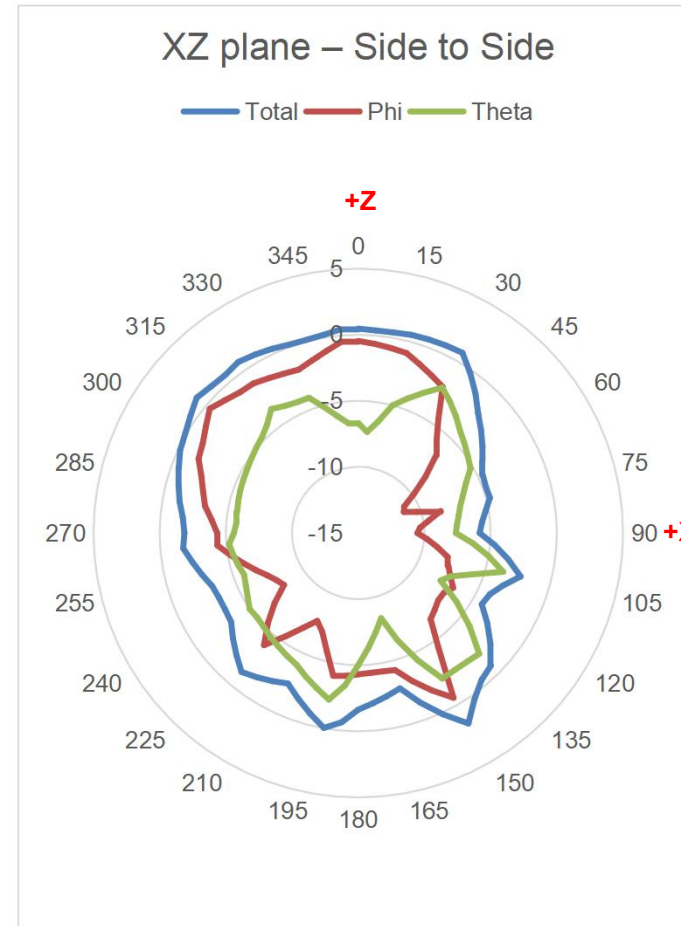
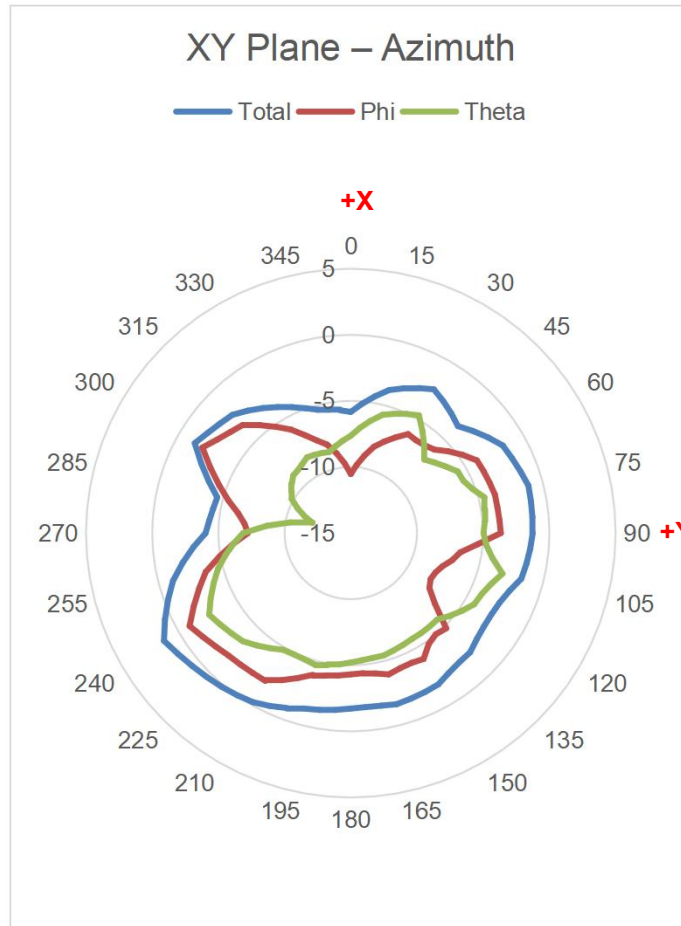
3D Radiation Pattern – BT



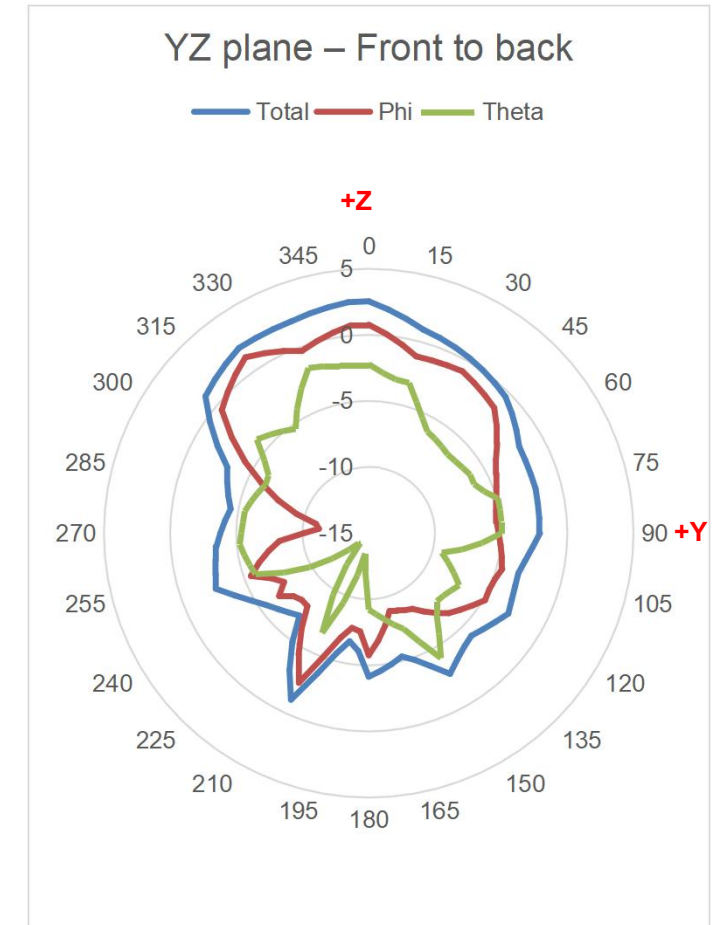
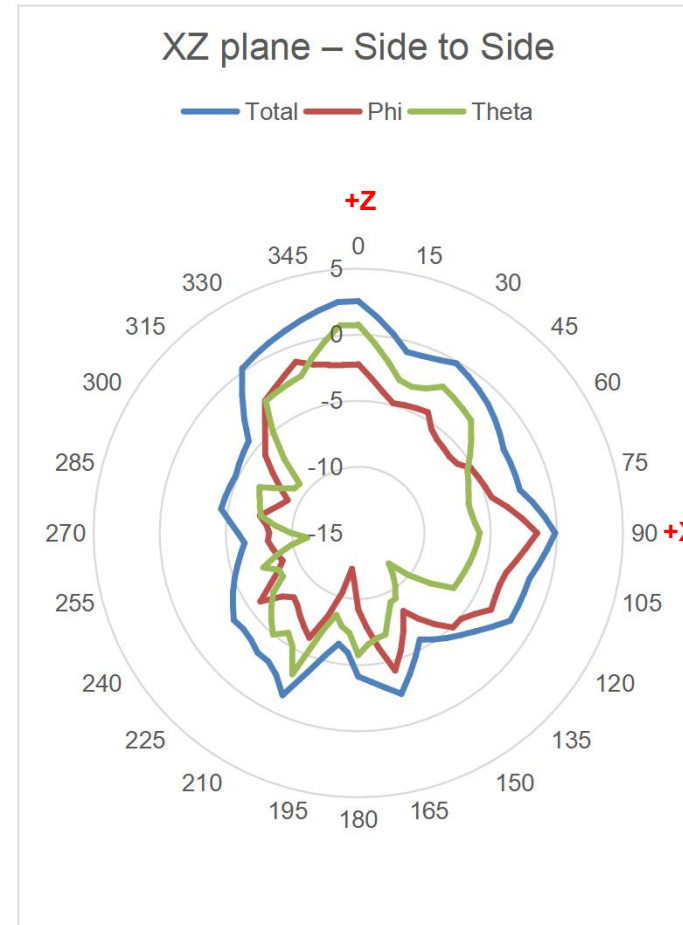
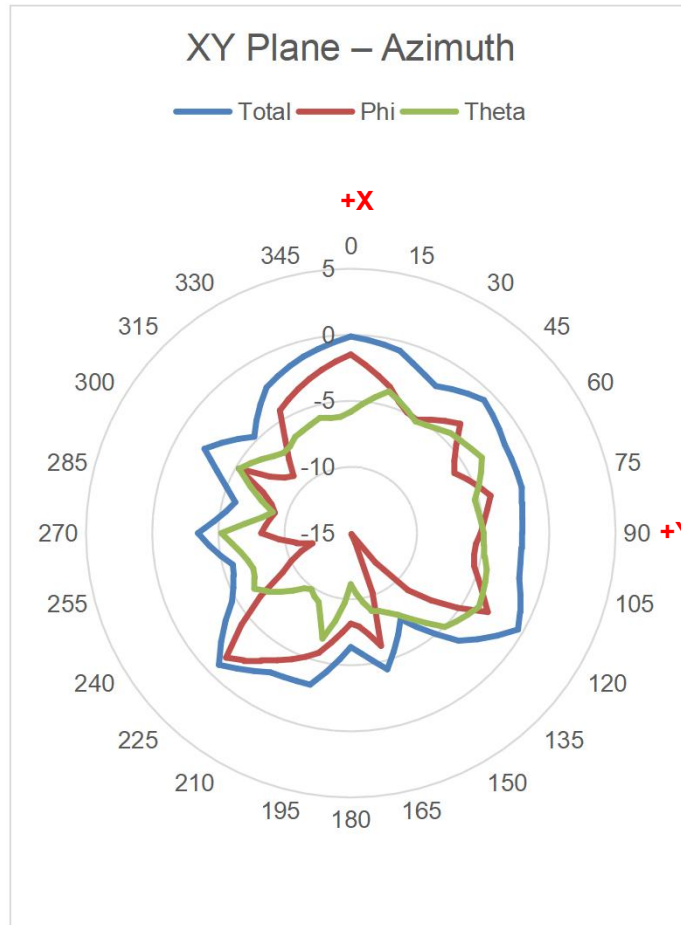
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Uncorrelated Gain@WiFi 2.4G



Uncorrelated Gain@WiFi 5G



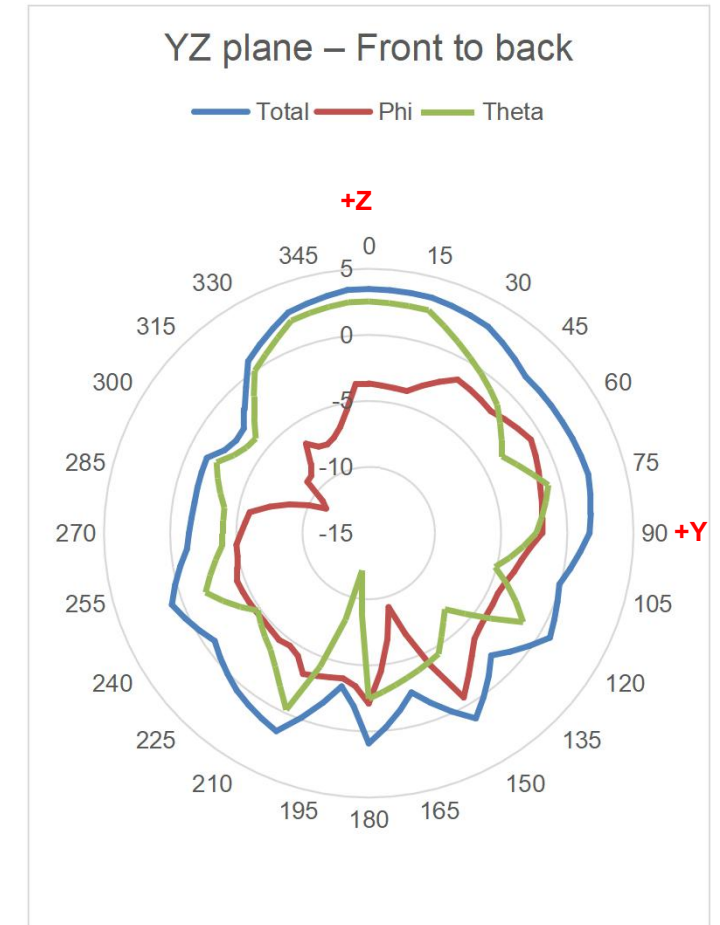
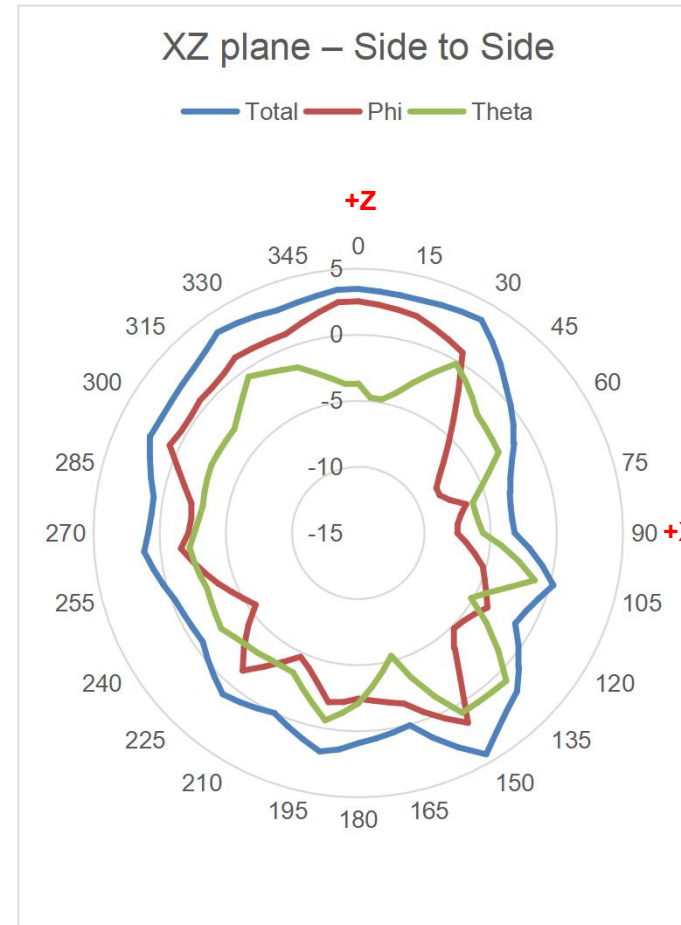
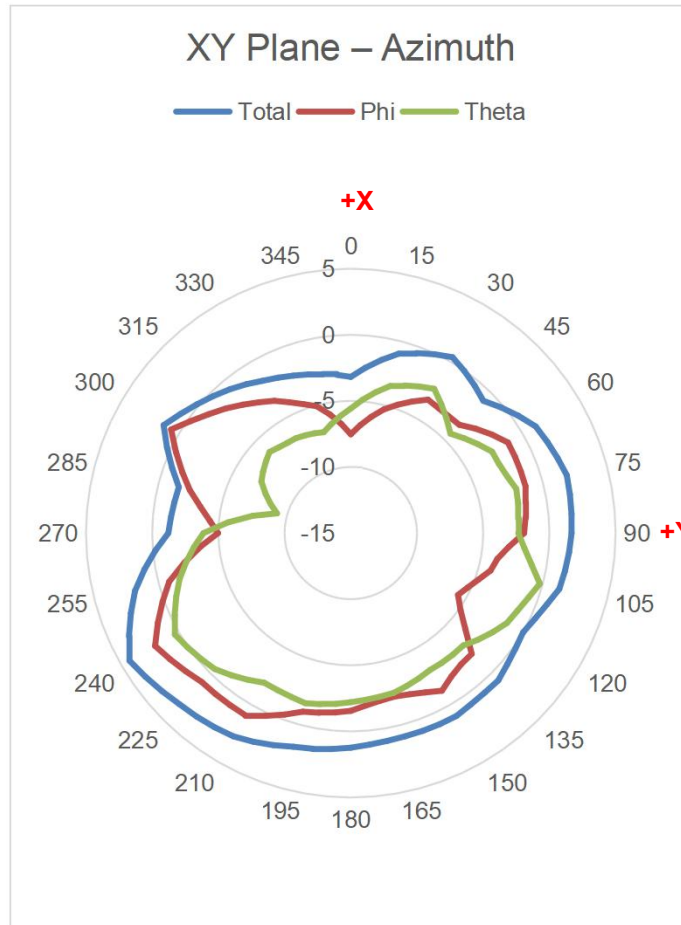
Uncorrelated Gain Table

Frquency(GHz)	Uncorrelated Total Gain	Uncorrelated Phi Gain	Uncorrelated Theta Gain
2400	2.25	0.60	-0.01
2450	1.64	0.43	0.43
2500	1.47	0.66	0.71
5150	3.25	2.21	2.21
5350	3.02	1.64	1.64
5500	2.54	2.18	2.18
5700	1.84	1.08	1.03
5850	2.11	1.05	0.39

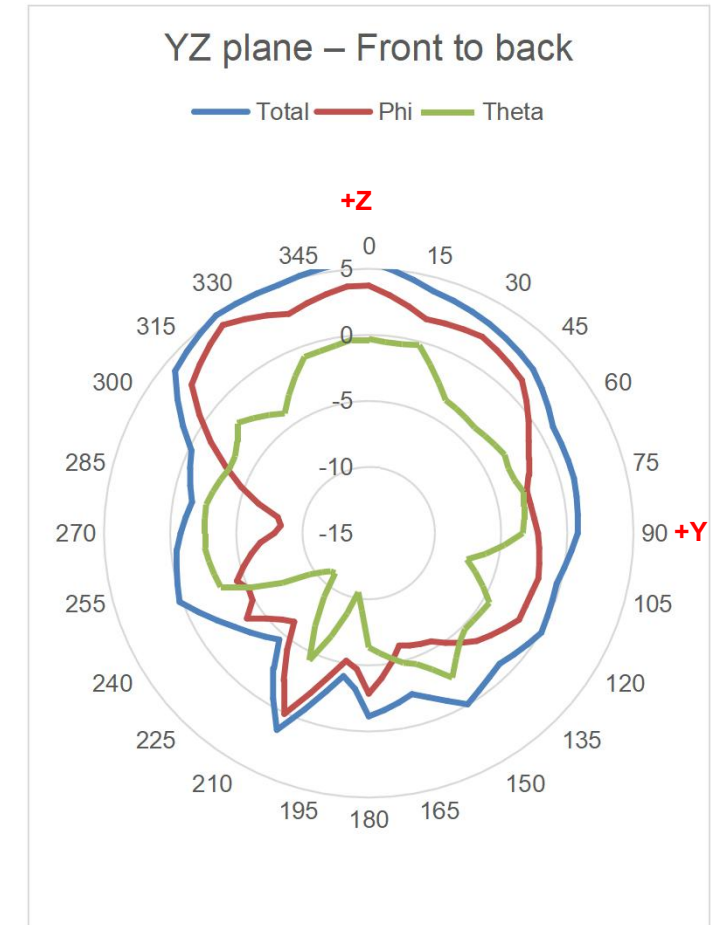
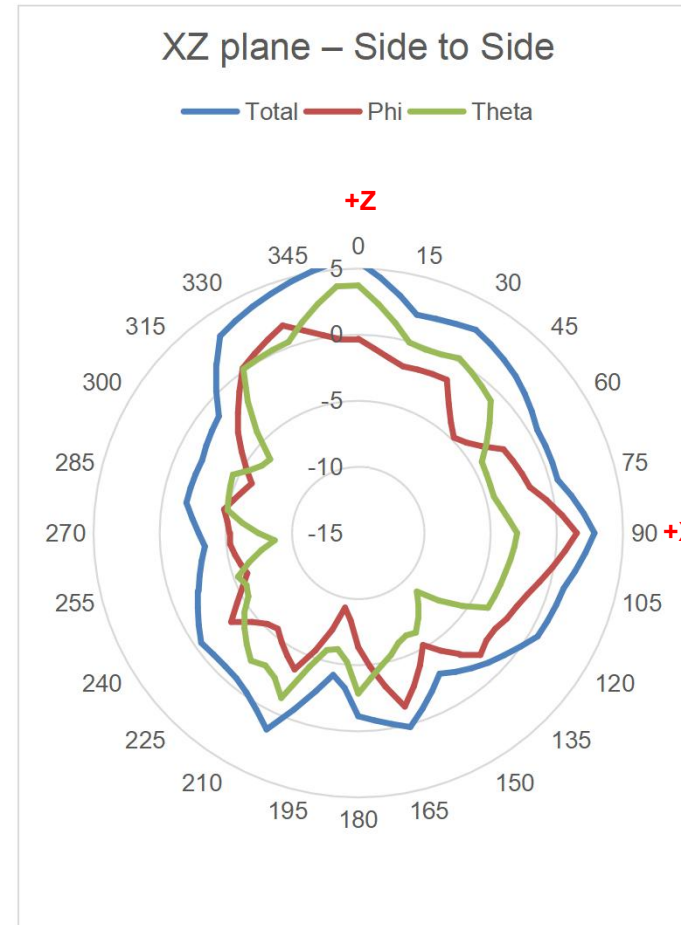
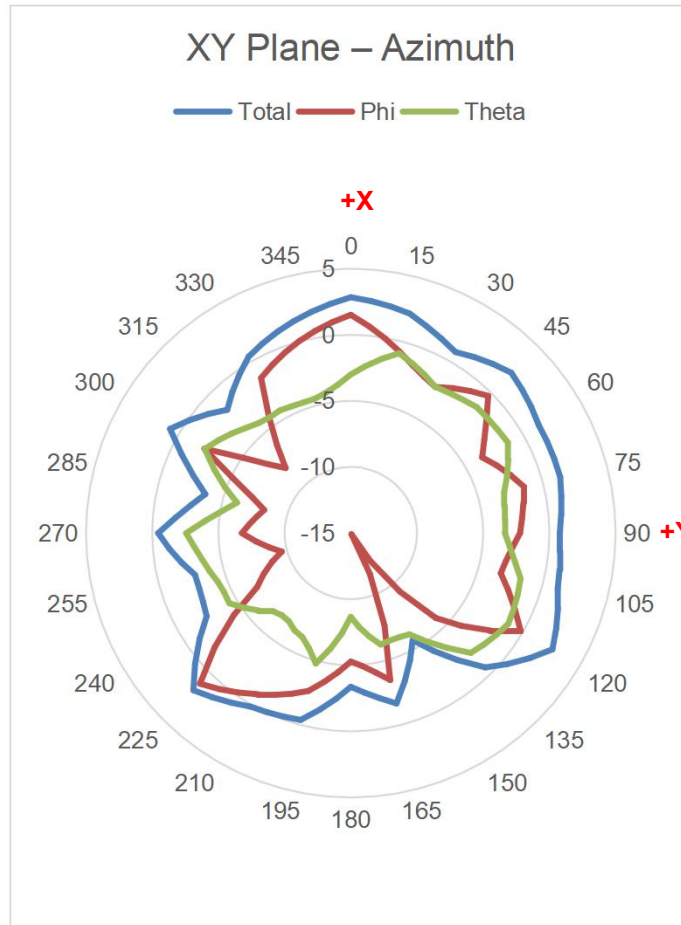
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Correlated Gain@WiFi 2.4G



Correlated Gain@WiFi 5G



Correlated Gain Table

Frquency(GHz)	Correlated Total Gain	Correlated Phi Gain	Correlated Theta Gain
2400	5.04	3.02	2.99
2450	4.43	3.44	3.44
2500	4.21	3.67	3.67
5150	5.66	5.17	5.17
5350	6.03	4.60	4.60
5500	5.53	5.17	5.17
5700	4.84	4.04	4.04
5850	5.11	3.95	3.12

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