

Antenna Composite Gain Test Report

1. Test Information

Equipment	Campus Access Points
Brand Name	Aruba
Model Name	AP754
Applicant	Aruba
Manufacturer	Aruba

2. Testing Location

Testing Location	
WNC	ADD : 20 Park Ave. II, Hsinchu Science Park, Hsinchu 308 Taiwan

Test Condition	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	Leo Chuang	20-24 / 45-60	05.01.2024~05.13.2024

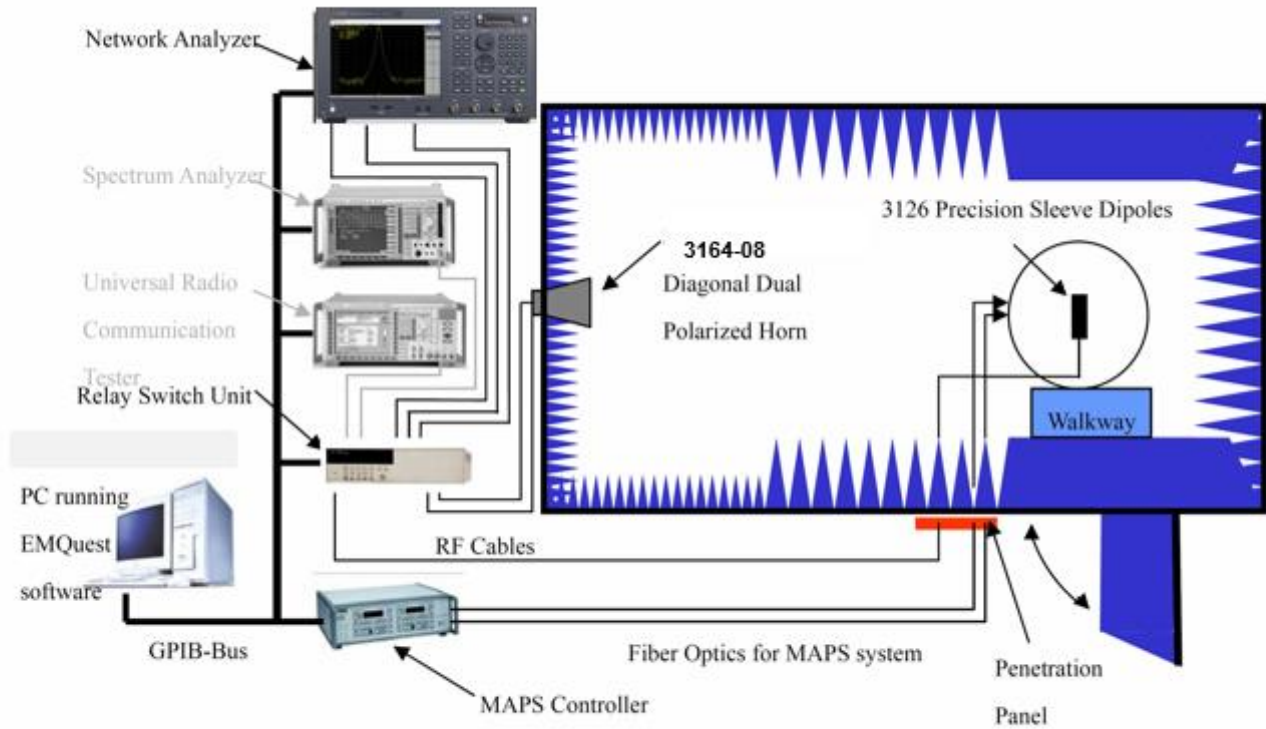
3. Test Frequency

Band (MHz)	Test Frequency (MHz)
1165-1185	1176
1560-1590	1575
2401-2423	2401
2441-2463	2452
2473-2484	2484

4. Antenna Information

Ant. Position	Brand Name	Model Name	Ant. Type	Connector
Antenna 1 (BLE)	Aruba	95XPAD15.GAG	PIFA	I-PEX
Antenna 2 (BLE)	Aruba	95XPAD15.GAH	PIFA	I-PEX
Antenna 3 (GPS)	Aruba	95XPAD15.G50	PIFA	I-PEX
Antenna 4 (BLE)	Aruba	95XPAD15.G51	Alford Loop	I-PEX

5. Test Configuration

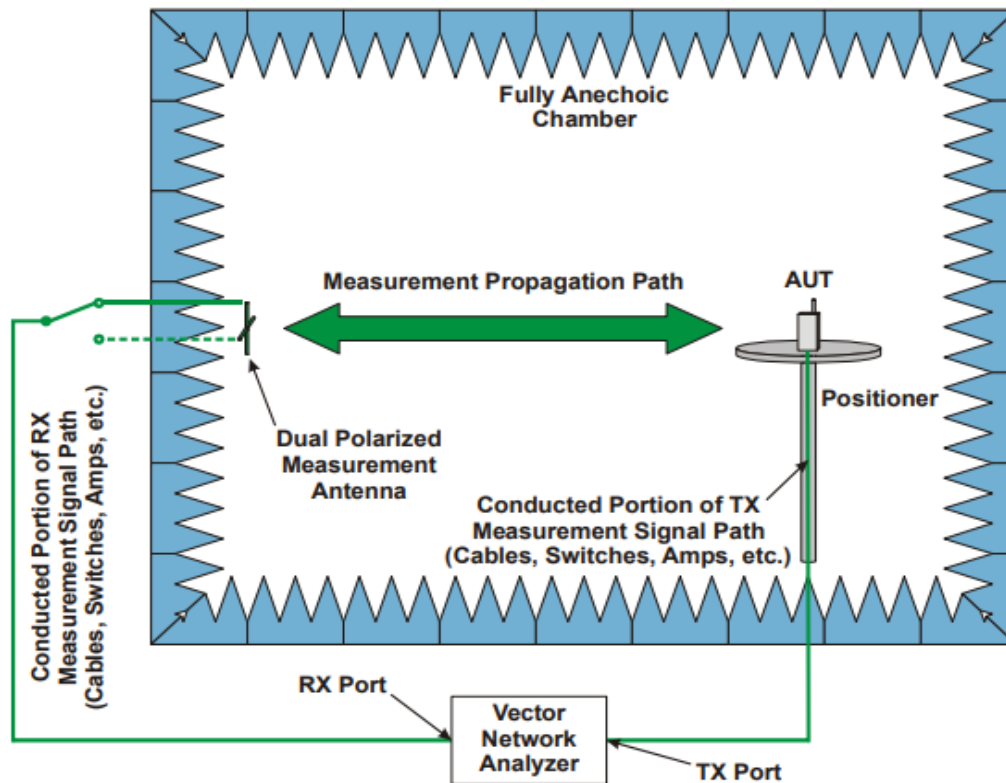


ETS-AMS 8500 System

Item	Device	Type/Model	Serial#	Manufacturer	Cal. Date	Cal. Due Date
1	Anechoic Chamber	ETS-AMS	8500	ETS-Lindgren	2024/03/09	2025/03/08
2	Turn Table	ETS		ETS-Lindgren	2024/03/09	2025/03/08
3	Multi-Device Positioning Controller	Model 2090	142407	ETS-Lindgren	2024/03/09	2025/03/08
4	Network Analyzer	E5071C	0171E5485A6J	Keysight	2023/05/31	2024/05/30
5	Horn antenna	3164-08	140264	ETS-Lindgren	2024/03/09	2025/03/08
6	Cable 7.5m 400MHz to 18GHz (H-pol)	SS402	00100A1F5A1XXS	Woken	2024/03/09	2025/03/08
7	Cable 7.5m 400MHz to 18GHz (V-pol)	SS402	00100A1F5A1XXS	Woken	2024/03/09	2025/03/08
8	Cable 14m 400MHz to 18GHz	SS402	00100A1F5A1XXS	Woken	2024/03/09	2025/03/08
9	Temperature & Humidity Meter	HTC-01		Metravi	2024/03/09	2025/03/08

6. Reference Calibration

Range Calibration Configuration (Passive)



7. Test Method

The “great circle” cut method, whereby the Measurement Antenna remains fixed and the EUT is rotated about two axes in sequential order. The radiated RF performance of the Equipment Under Test (EUT) is measured by sampling the radiated transmit power of the mobile at various locations surrounding the device. A three-dimensional characterization of the 'transmit' performance of the EUT is pieced together by analyzing the data from the spatially distributed measurements.

Data points taken every 15 degrees in the theta and in the phi axes are deemed sufficient to fully characterize the EUT's Far-Field radiation pattern and total radiated power. All of the measured power values will be integrated.

8. Measured Values and Calculation of Correlated / Uncorrelated Gains

Antenna Peak Gain Table (Ant. Position : GPS Ant.3)

Band (MHz)	1165-1185	1560-1590
Frequency (MHz)	1176	1575
Ant.3 Max Gain (dBi)	2.8	3.0

Antenna Peak Gain Table (Ant. Position : BLE Ant.1~2, 4)

Band (MHz)	2401-2423	2441-2463	2473-2484
Frequency (MHz)	2401	2452	2484
Ant.1 Max Gain (dBi)	2.3	4.5	5.6
Ant.2 Max Gain (dBi)	2.8	3.3	3.2
Ant.4 Max Gain (dBi)	4.8	5.0	4.7
Max Gain (dBi)	4.8	5.0	5.6

Antenna Correlated / Uncorrelated Gain Table (Ant. Position : BLE Ant.1, 4)

Frequency (MHz)	Correlated Gain (dBi)	Uncorrelated Gain (dBi)
2401	5.4	2.4
2452	6.6	3.6
2484	7.0	4.2

Antenna Correlated / Uncorrelated Gain Table (Ant. Position : BLE Ant.1~2)

Frequency (MHz)	Correlated Gain (dBi)	Uncorrelated Gain (dBi)
2401	5.3	2.3
2452	6.1	3.1
2484	7.1	4.2

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

The uncorrelated and correlated gains were calculated for each point in the spatial data, and the highest values reported.

Note :

KDB 662911 D01, F(2)(d)(i)

$$\text{Correlated Gain} = 10 \log \left[\left(10^{\frac{G_1}{20}} + 10^{\frac{G_2}{20}} + \dots + 10^{\frac{G_n}{20}} \right)^2 / N_{Ant.} \right] \text{ dBi}$$

KDB 662911 D01, F(2)(d)(ii)

$$\text{Uncorrelated Gain} = 10 \log \left[\left(10^{\frac{G_1}{10}} + 10^{\frac{G_2}{10}} + \dots + 10^{\frac{G_n}{10}} \right) / N_{Ant.} \right] \text{ dBi}$$

$N_{Ant.}$: Number of antenna

G_n : Gain of antenna

Maximum Correlated / Uncorrelated Gain Calculation (Ant. Position : BLE Ant.1, 4)

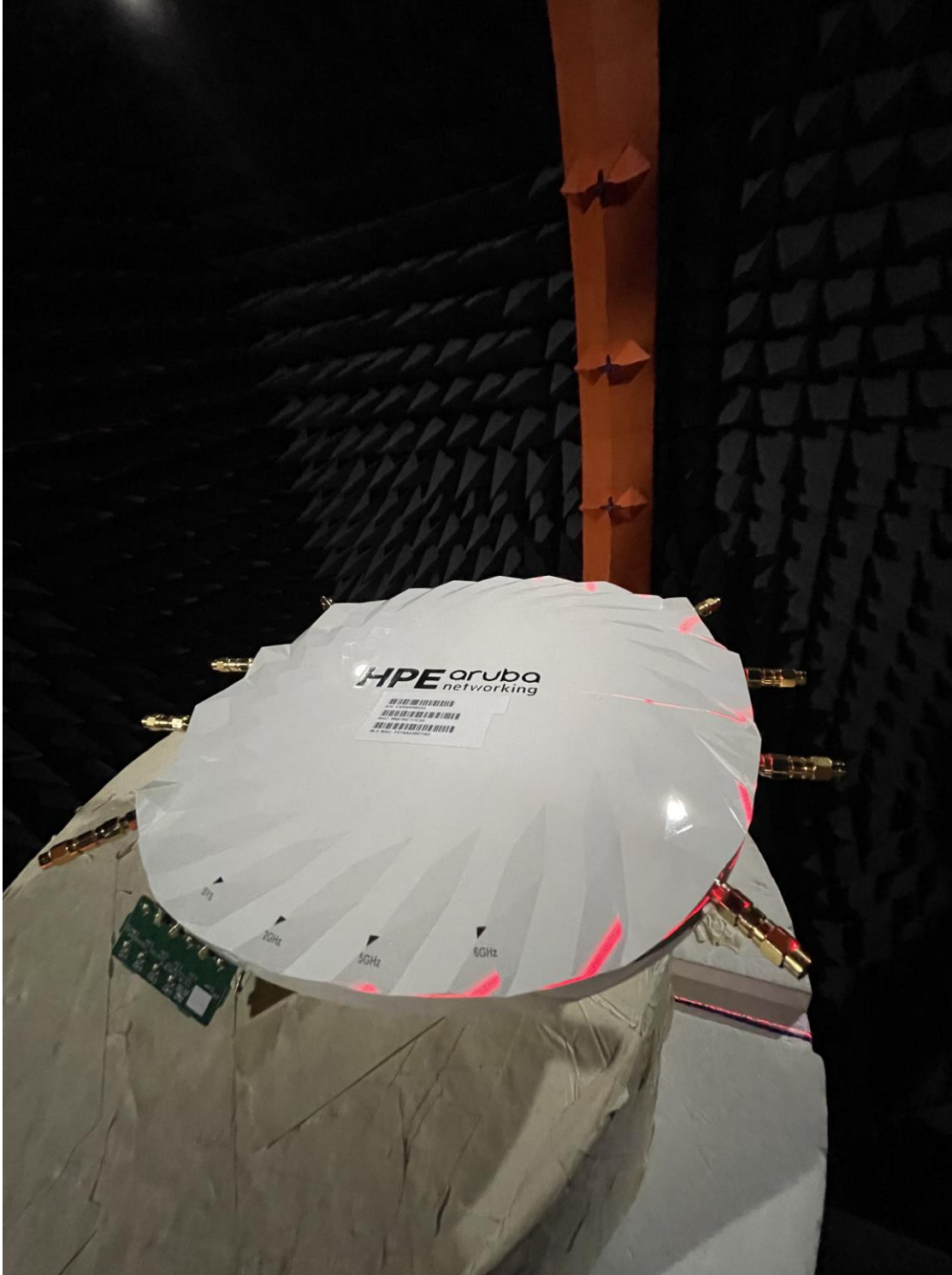
Frequency (MHz)	2484
Ant.1 Gain (dBi)	5.59
Ant.4 Gain (dBi)	2.09
Phi (°)	150
Theta (°)	55
Corr. Ant. Gain (dBi) $[10^{(G_1/20)}+10^{(G_2/20)}]^2/N_{ANT.}$	5.04
Uncor. Ant. Gain (dBi) $[10^{(G_1/10)}+10^{(G_2/10)}]/N_{ANT.}$	2.62
Corr. Gain (dBi) $10 \cdot \log(\text{Corr. Ant. Gain})$	7.0
Uncor. Gain (dBi) $10 \cdot \log(\text{Uncor. Ant. Gain})$	4.2

(Ant. Position : BLE Ant.1~2)

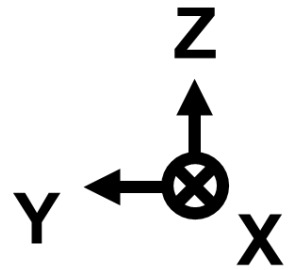
Frequency (MHz)	2484
Ant.1 Gain (dBi)	5.38
Ant.4 Gain (dBi)	2.51
Phi (°)	155
Theta (°)	55
Corr. Ant. Gain (dBi) $[10^{(G_1/20)}+10^{(G_2/20)}]^2/N_{ANT.}$	5.09
Uncor. Ant. Gain (dBi) $[10^{(G_1/10)}+10^{(G_2/10)}]/N_{ANT.}$	2.61
Corr. Gain (dBi) $10 \cdot \log(\text{Corr. Ant. Gain})$	7.1
Uncor. Gain (dBi) $10 \cdot \log(\text{Uncor. Ant. Gain})$	4.2

Note : Antenna gain is the correlated / uncorrelated gain position in the appendix gain table.

9. Test Setup



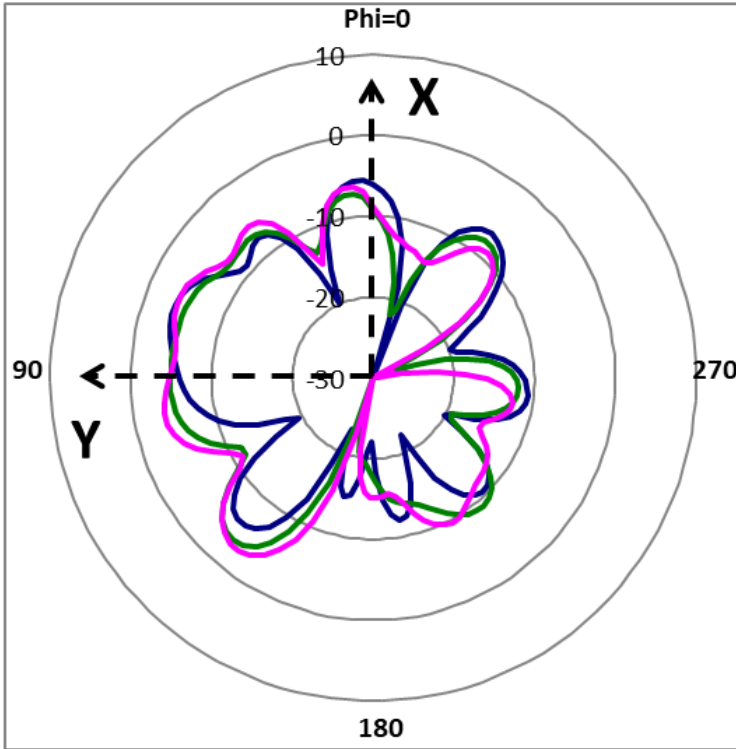
Note :
Top cover toward +Z direction



10. Radiation Pattern

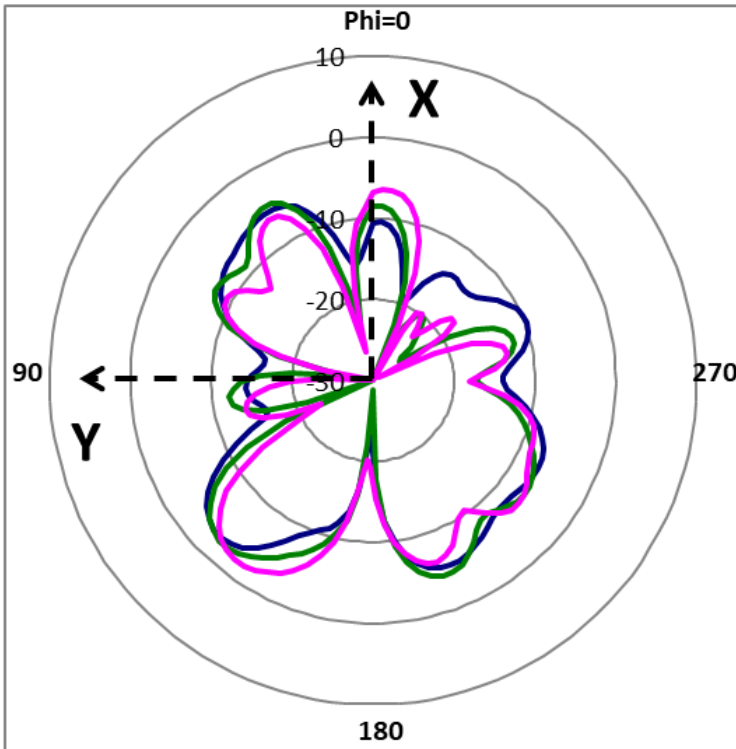
Ant. Position : BLE Ant.1~2, 4

XY_Pol._Phi_Ant.1



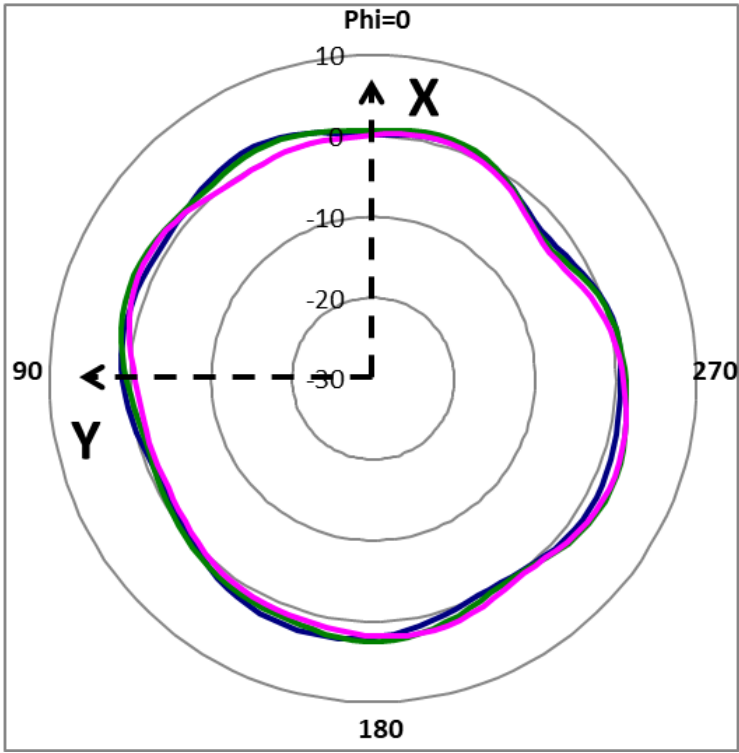
- 2401MHz_Gain_-3.85
- 2452MHz_Gain_-3.47
- 2484MHz_Gain_-2.87

XY_Pol._Phi_Ant.2



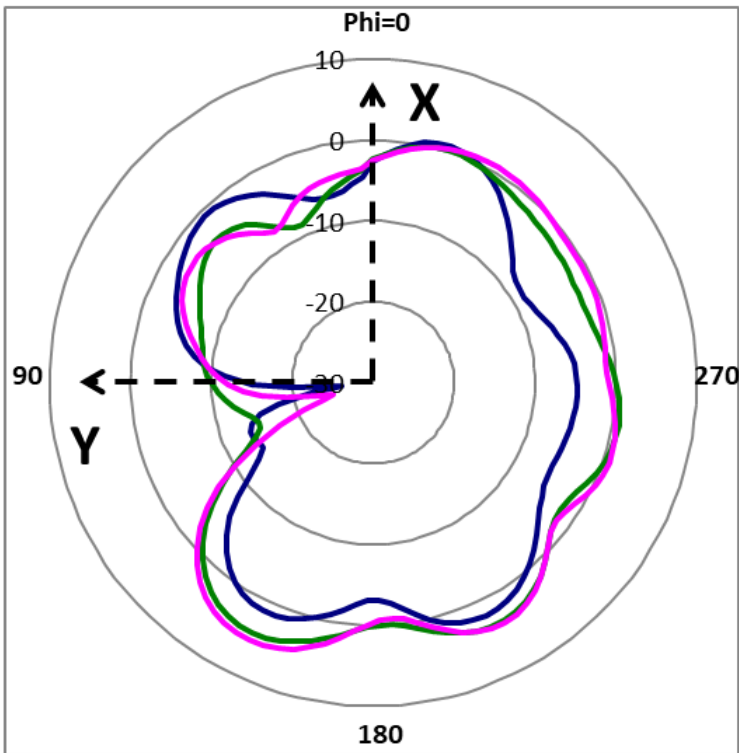
- 2401MHz_Gain_-2.99
- 2452MHz_Gain_-2.57
- 2484MHz_Gain_-2.08

XY_Pol._Phi_Ant.4



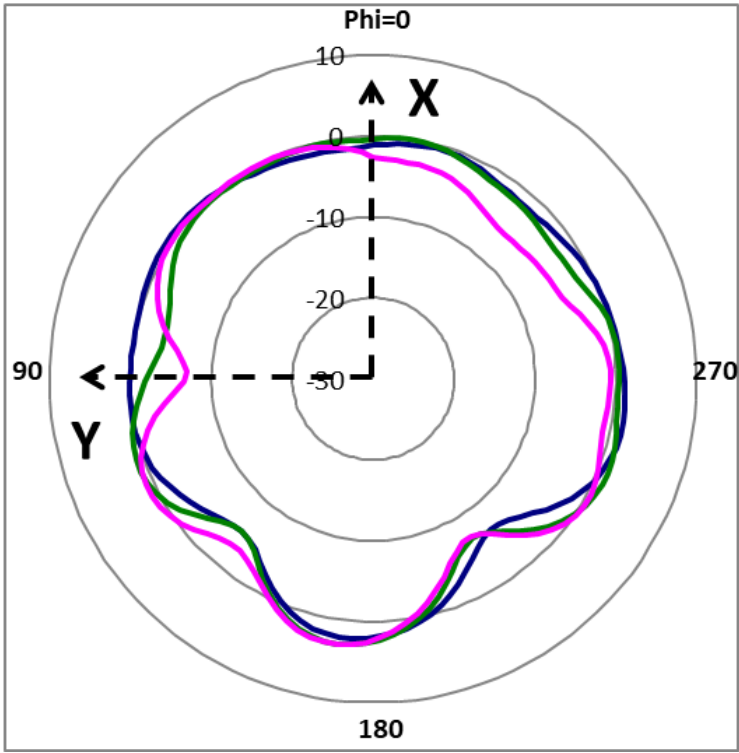
- 2401MHz_Gain_2.44
- 2452MHz_Gain_2.43
- 2484MHz_Gain_2.19

XY_Pol._Theta_Ant.1



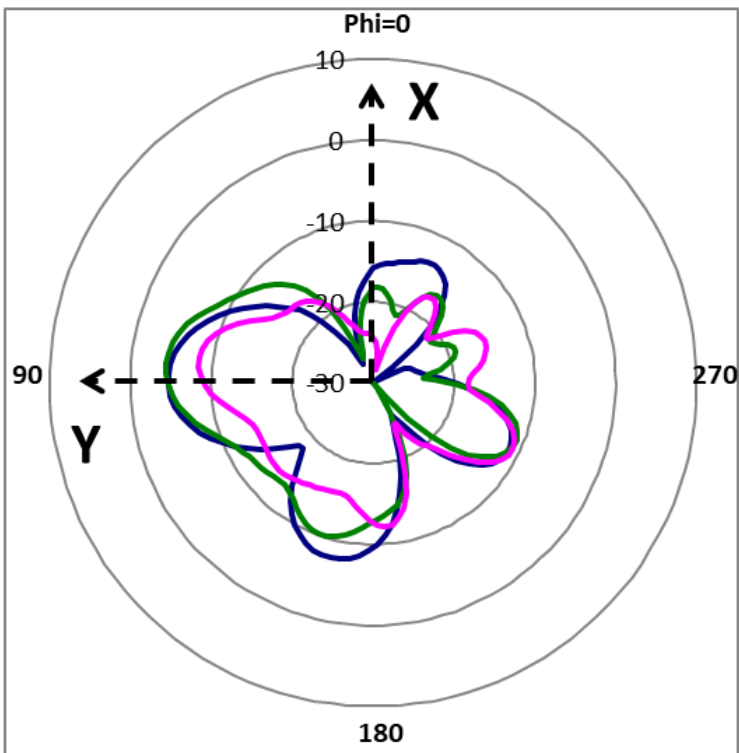
- 2401MHz_Gain_2.03
- 2452MHz_Gain_4.38
- 2484MHz_Gain_5.39

XY_Pol._Theta_Ant.2



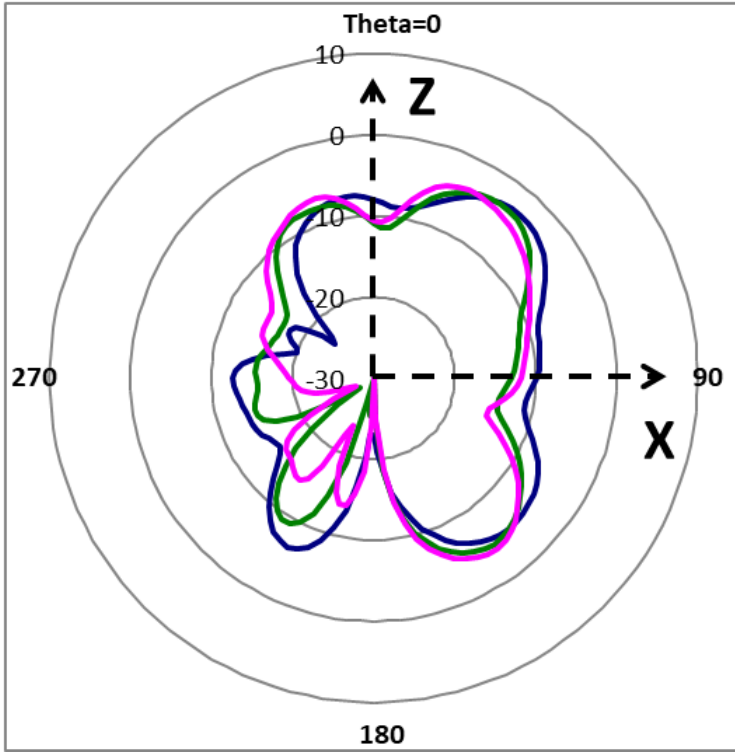
- 2401MHz_Gain_2.20
- 2452MHz_Gain_3.02
- 2484MHz_Gain_3.11

XY_Pol._Theta_Ant.4

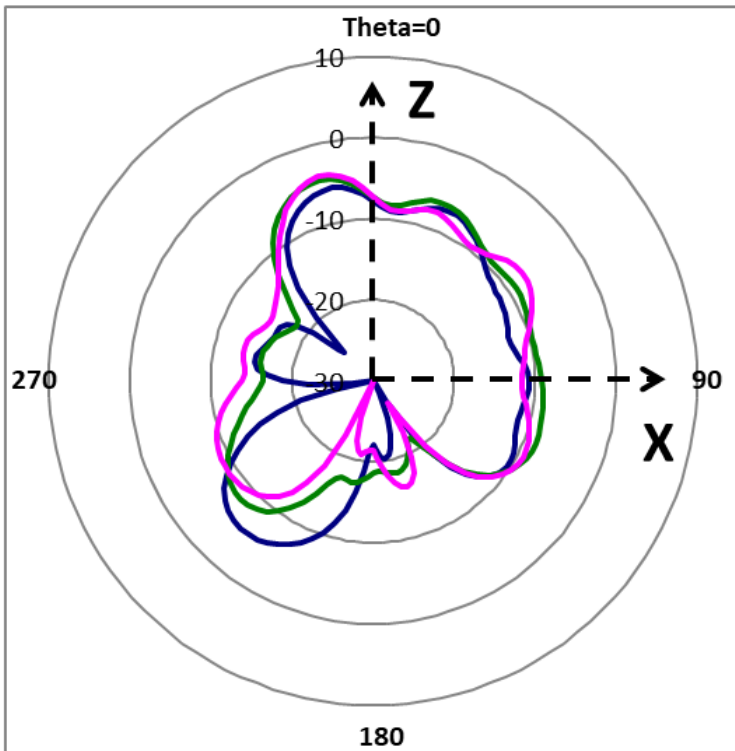


- 2401MHz_Gain_-4.69
- 2452MHz_Gain_-4.32
- 2484MHz_Gain_-8.26

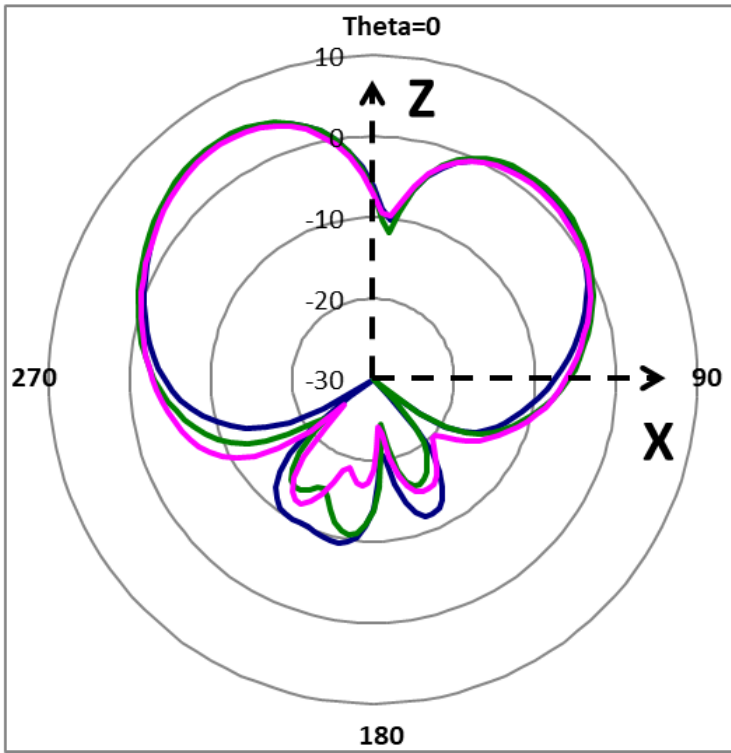
XZ_Pol._Phi_Ant.1



XZ_Pol._Phi_Ant.2

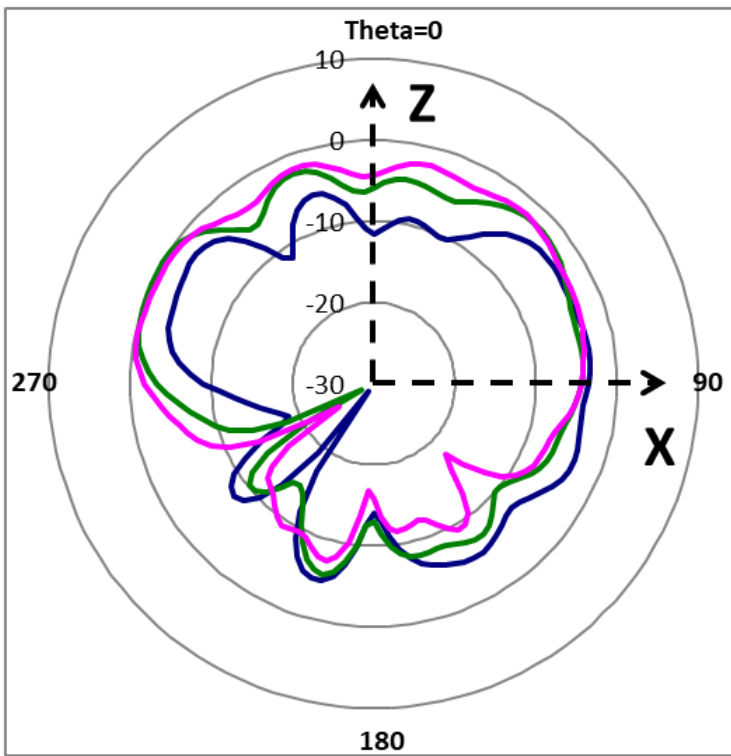


XZ_Pol._Phi_Ant.4



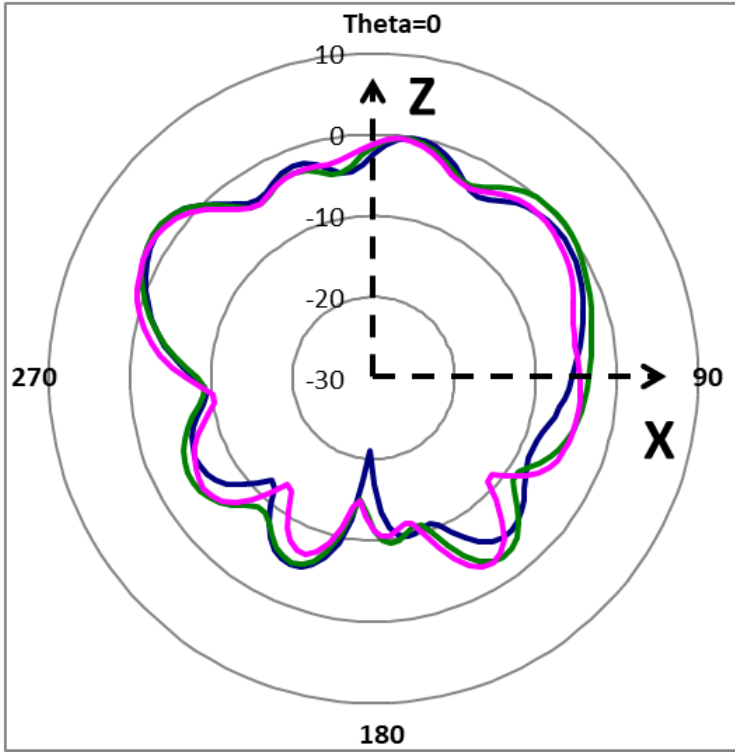
- 2401MHz_Gain_4.92
- 2452MHz_Gain_5.12
- 2484MHz_Gain_4.61

XZ_Pol._Theta_Ant.1



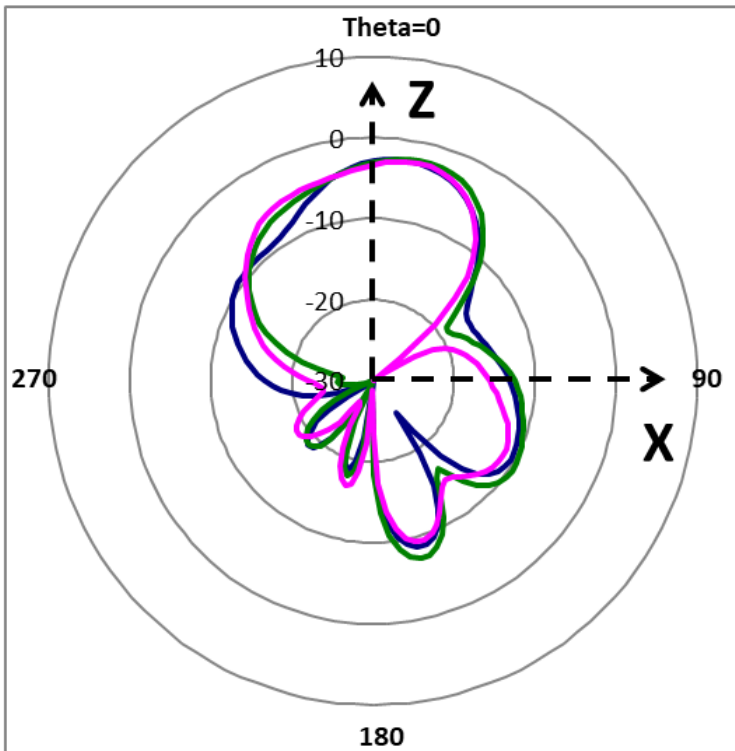
- 2401MHz_Gain_-2.88
- 2452MHz_Gain_0.03
- 2484MHz_Gain_-0.23

XZ_Pol._Theta_Ant.2



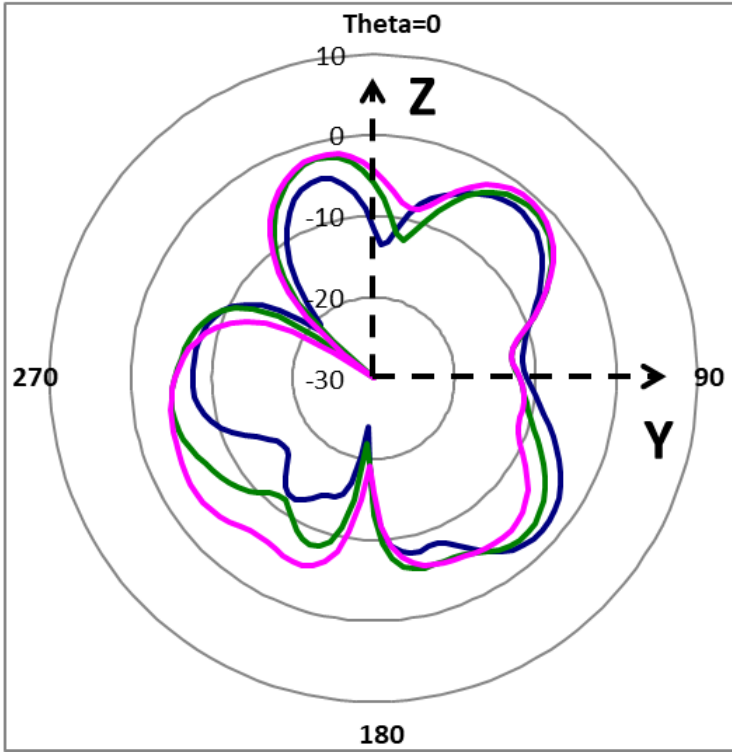
- 2401MHz_Gain_2.10
- 2452MHz_Gain_2.43
- 2484MHz_Gain_2.03

XZ_Pol._Theta_Ant.4



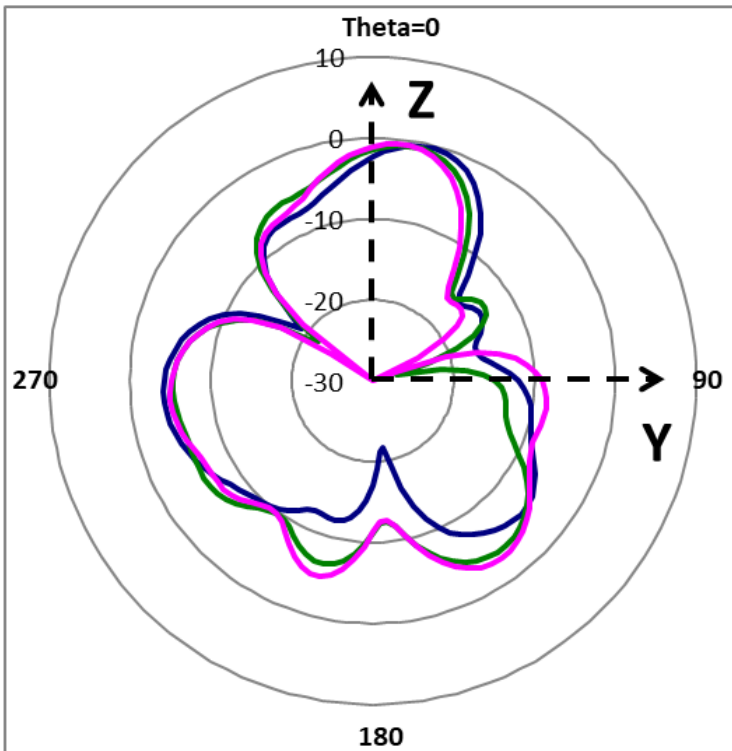
- 2401MHz_Gain_-2.50
- 2452MHz_Gain_-2.21
- 2484MHz_Gain_-2.58

YZ_Pol._Phi_Ant.1



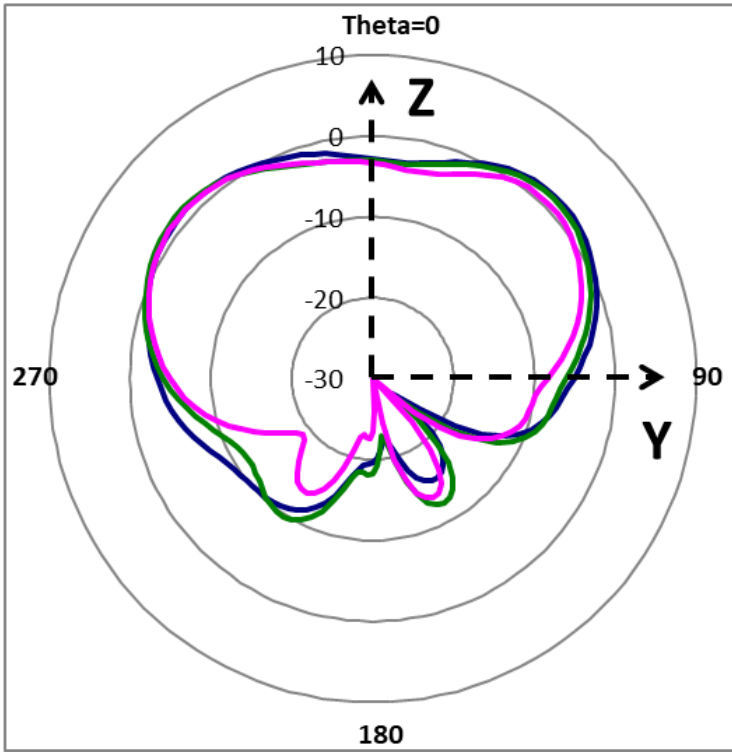
- 2401MHz_Gain_-1.89
- 2452MHz_Gain_-1.36
- 2484MHz_Gain_-0.71

YZ_Pol._Phi_Ant.2



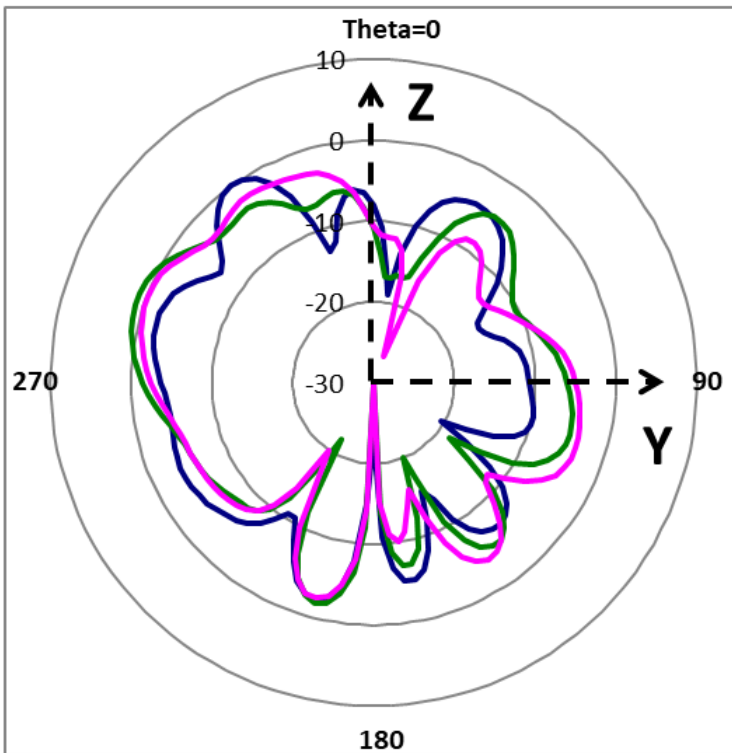
- 2401MHz_Gain_-0.31
- 2452MHz_Gain_-0.67
- 2484MHz_Gain_-0.61

YZ_Pol._Phi_Ant.4



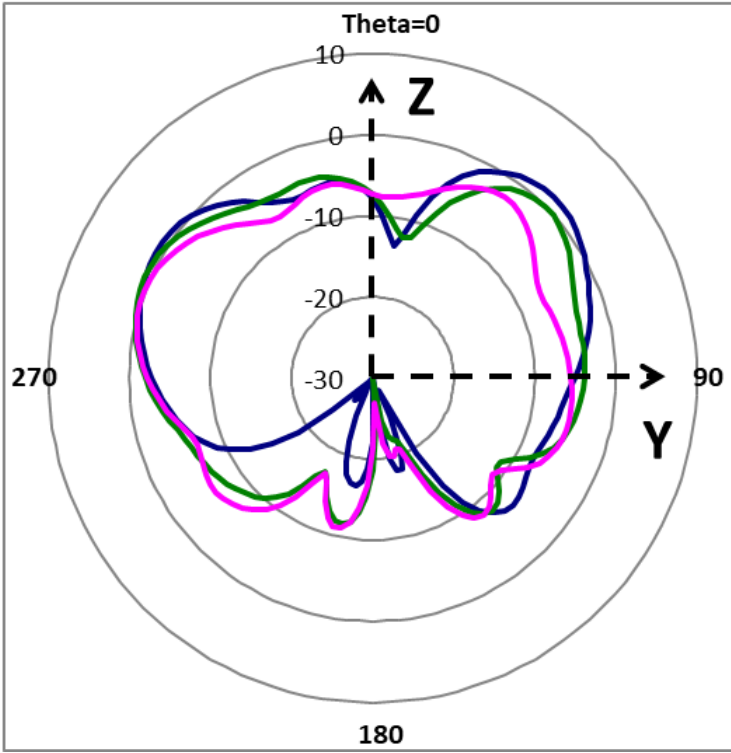
- 2401MHz_Gain_1.88
- 2452MHz_Gain_1.56
- 2484MHz_Gain_1.20

YZ_Pol._Theta_Ant.1

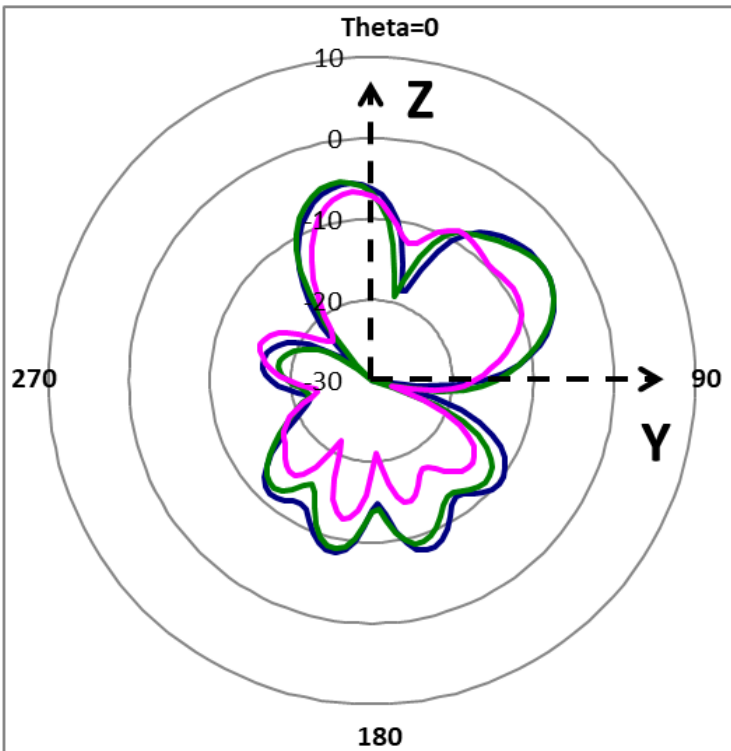


- 2401MHz_Gain_0.12
- 2452MHz_Gain_0.99
- 2484MHz_Gain_-0.11

YZ_Pol._Theta_Ant.2

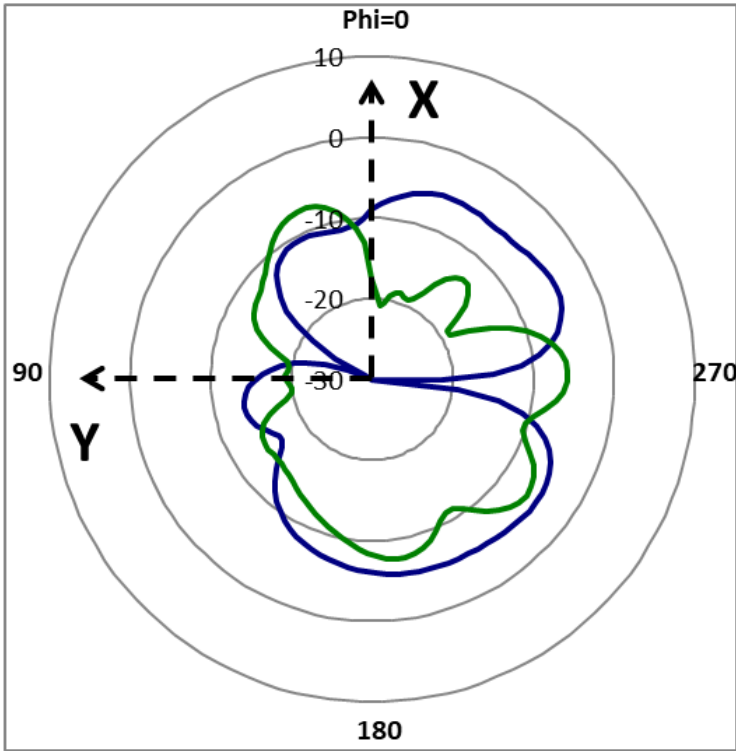


YZ_Pol._Theta_Ant.4



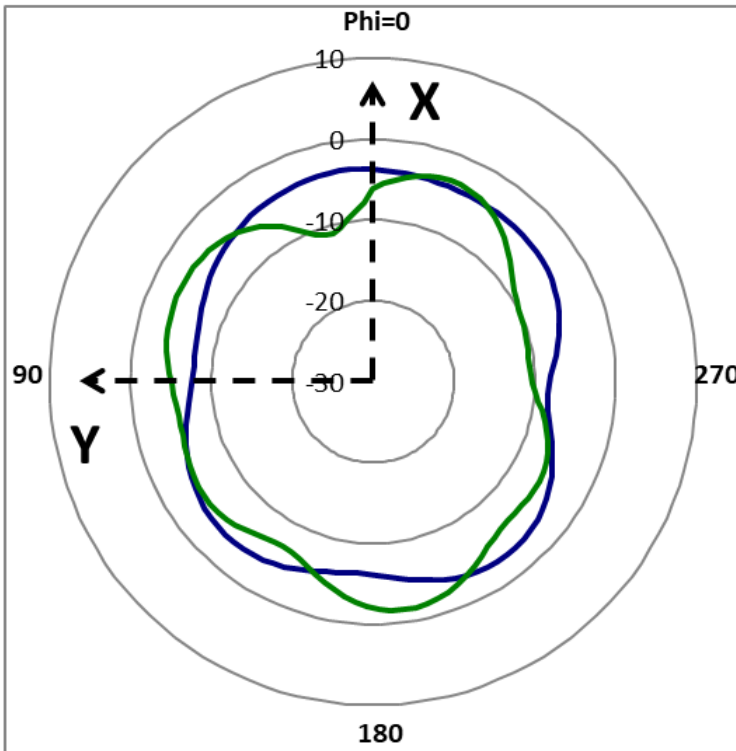
Ant. Position : GPS Ant.3

XY_Pol._Phi_Ant.3



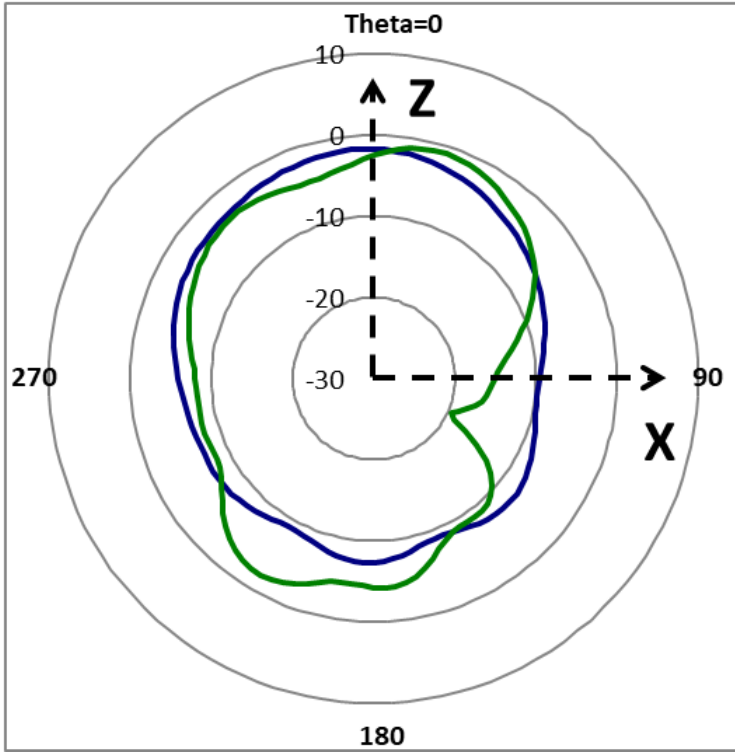
— 1176MHz_Gain_-4.53
— 1575MHz_Gain_-5.71

XY_Pol._Theta_Ant.3



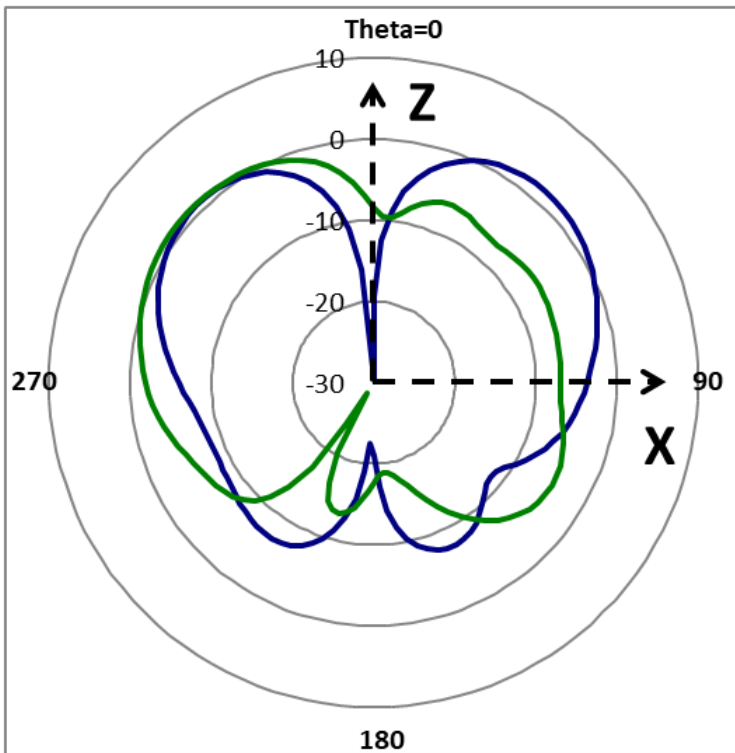
— 1176MHz_Gain_-2.92
— 1575MHz_Gain_-1.56

XZ_Pol._Phi_Ant.3



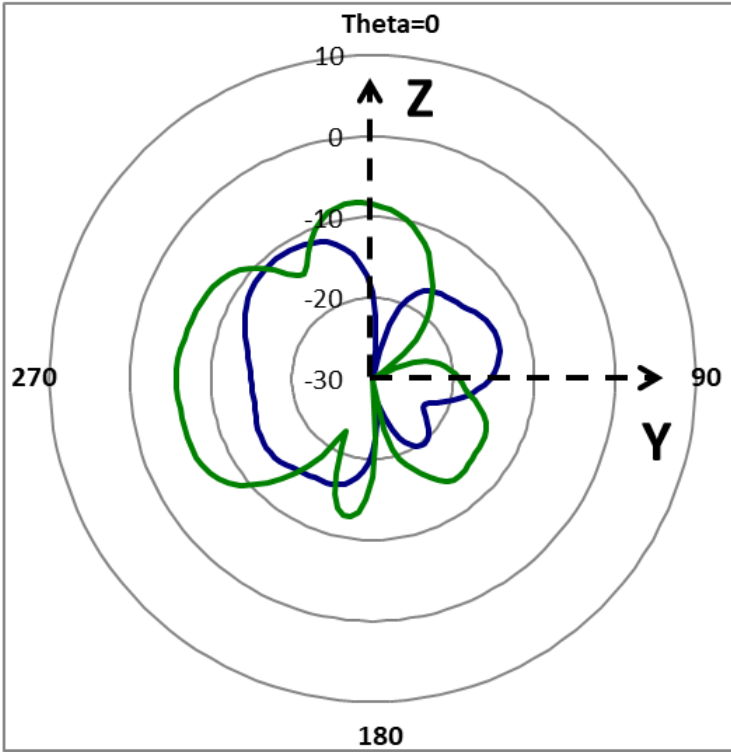
— 1176MHz_Gain_-1.67
— 1575MHz_Gain_-0.88

XZ_Pol._Theta_Ant.3



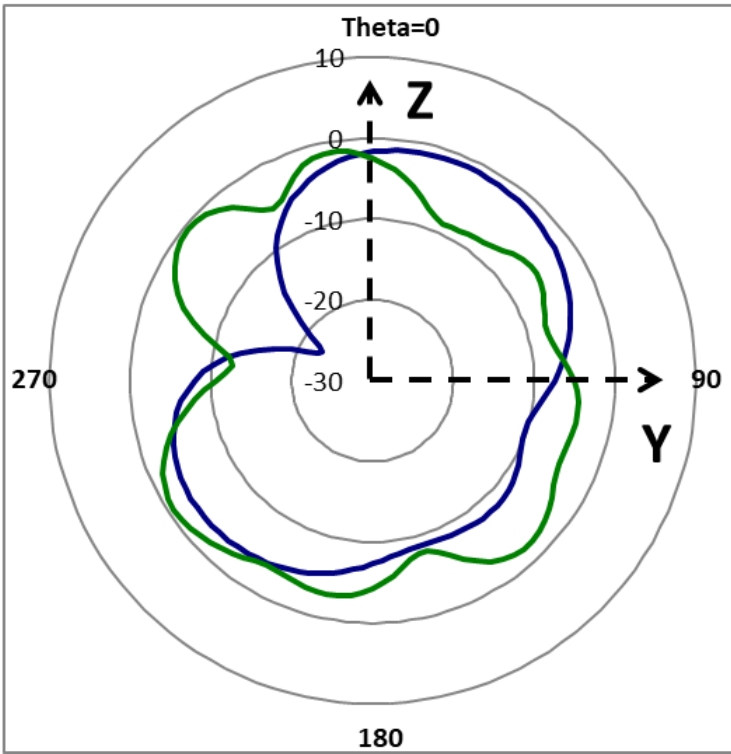
— 1176MHz_Gain_1.68
— 1575MHz_Gain_1.14

YZ_Pol._Phi_Ant.3



— 1176MHz_Gain_-11.00
— 1575MHz_Gain_-5.71

YZ_Pol._Theta_Ant.3



— 1176MHz_Gain_-1.08
— 1575MHz_Gain_-0.48

Table with 180 columns (2460 MHz to 180) and multiple rows of numerical data. The table contains various numerical values and headers for each column.

Ant. Position : BLE Ant.2

Table with columns for Frequency (MHz), Azimuth (0-180), and Elevation (0-180). It contains a dense grid of numerical data points representing signal characteristics across various frequencies and angles.

Table with 178 columns (2400 MHz Azimuth 0 to 180) and 178 rows (0 to 177). Each cell contains numerical data representing signal strength or quality at specific angles.

Ant. Position : GPS Ant.3

Table with 178 columns (1175 MHz Azimuth 0 to 180) and 178 rows (0 to 177). Each cell contains numerical data representing signal strength or quality at specific angles.

Doc.No.:3.8.05 Rev

Table with columns: 1575 MHz Azim, 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180. Rows contain numerical data representing signal strength or quality metrics.

Ant. Position : BLE Ant.4

Table with columns: 2400 MHz Azim, 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180. Rows contain numerical data representing signal strength or quality metrics.

Regulatory WiFi Antenna Information

Table with 160 columns (2460 Thea Area 0 to 160) and 160 rows (0 to 160). Each cell contains numerical data representing antenna information for a specific area and row.

Table with 160 columns (2460 Thea Area 0 to 160) and 160 rows (0 to 160). This section continues the data from the previous table, providing a complete grid of antenna information.