



# Antenna Composite Gain Test Report

Equipment	ROG Rapture Tri-Band Gaming Router
Brand Name	ASUS
Model Name	GT-AX11000 Pro
Applicant	ASUSTeK COMPUTER INC. 1F., No. 15, Lide Rd., Beitou, Taipei City 112, Taiwan
Manufacturer (1)	Compal Networking(KunShan) CO., LTD No.520,Nan Bang RD., Economic & Technical Development Zone, KunShan,JiangSu,China
Manufacturer (2)	ARCADYAN TECHNOLOGY (VIETNAM) CO., LTD. Land plot No. D4-5-6, Thang Long Industrial Park (Vinh Phuc), Thien Ke Commune, Binh Xuyen District, Vinh Phuc Province, Vietnam
Sample Received	Feb. 15, 2022
Start Test Date	Mar. 14, 2022
Final Test Date	Mar. 14, 2022



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### 1. Operation Mode and Antenna Information

Antenna Position	RF Port	Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
2G 5GL Ant1	1	PSA	RFDPA181125IMLB902	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~2A
2G 5GL Ant2	2	PSA	RFDPA181120IMLB902	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~2A
2G 5GL Ant3	3	PSA	RFDPA181105IMLB903	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~2A
2G 5GL Ant4	4	PSA	RFDPA181112IMLB902	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~2A
5GH Ant1	1	PSA	RFDPA181118IM5B902	Dipole	I-PEX	5GHz UNII 2C~4
5GH Ant2	2	PSA	RFDPA181110IM5B902	Dipole	I-PEX	5GHz UNII 2C~4
5GH Ant3	3	PSA	RFDPA181116IM5B902	Dipole	I-PEX	5GHz UNII 2C~4
5GH Ant4	4	PSA	RFDPA181121IM5B902	Dipole	I-PEX	5GHz UNII 2C~4

Note:

For WLAN 2.4GHz:

Operation Mode (4TX/4RX)

2G 5GL Ant1~ Ant4 can be used as transmitting/receiving antenna.

2G 5GL Ant1~ Ant4 could transmit/receive simultaneously.

For WLAN 5GHz:

Operation Mode (4TX/4RX)

2G 5GL Ant1~ Ant4 can be used as transmitting/receiving antenna.

2G 5GL Ant1~ Ant4 could transmit/receive simultaneously.

The 2G 5GL Ant1~Ant4 operate in UNII 1, UNII 2A.

5GH Ant1~Ant4 can be used as transmitting/receiving antenna.

5GH Ant1~ Ant4 could transmit/receive simultaneously.

The 5GH Ant1~Ant4 operate in UNII 2C, UNII 3, UNII 4.

### 2. Test Frequency

The listed frequency of each bands are selected to represent each frequency bands

Band [MHz]	Test Frequency [MHz]
2400-2483.5	2450
5150-5250	5200
5250-5350	5300
5470-5725	5600
5725-5850	5785
5850-5895	5885



### 3. Testing Location

Testing Location		
<input checked="" type="checkbox"/>	HWA YA	ADD : No.13-1 & 14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333, Taiwan R.O.C.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	05CH03-HY	Rex Liao	23.5-24.5 / 40-50	Mar. 14, 2022

Note:

Testing Site Information

Brand Name: TDK

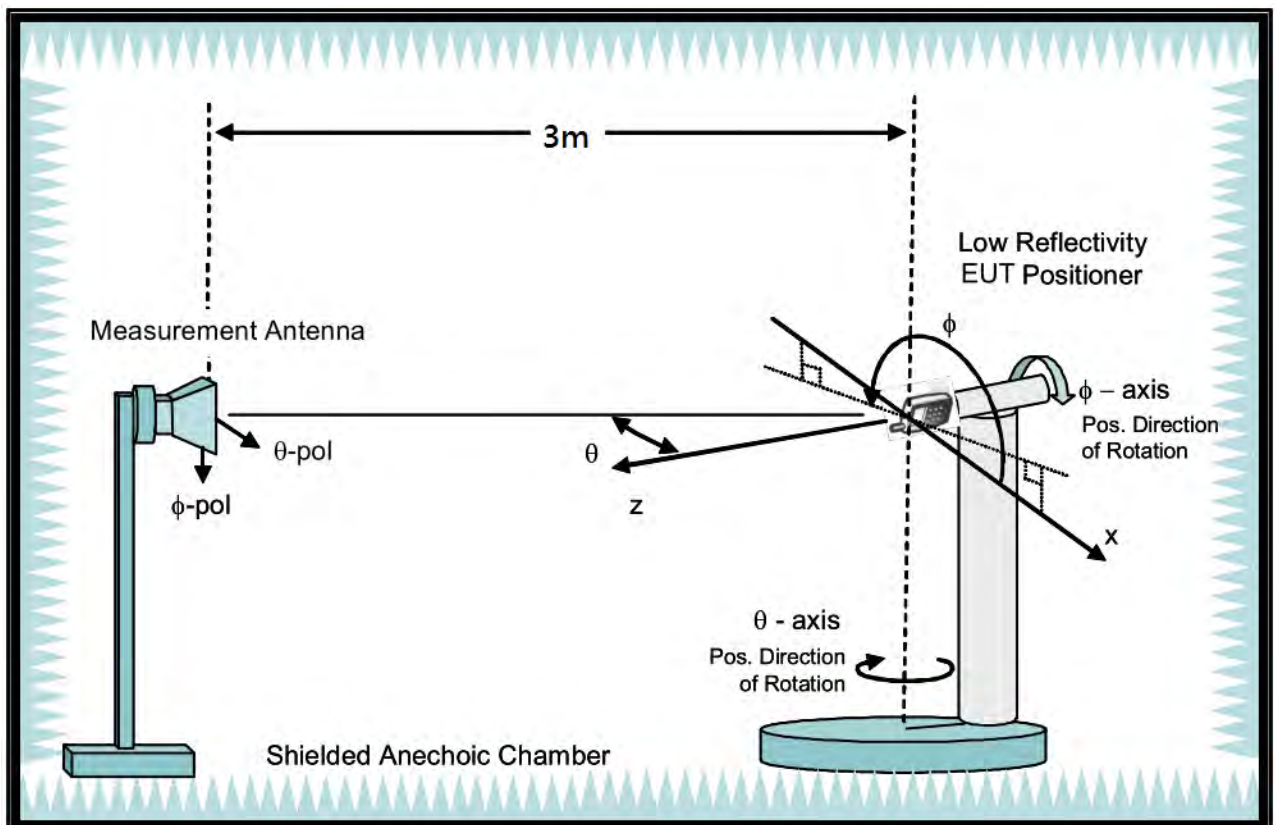
Dimension: 11m\*6m\*6m

Characteristic: Fully Anechoic Chamber

#### 4. Test Facility and Configuration

Test configuration: Reference to CITA OTA distributed-axes system configuration.  
 Chamber: Fully Anechoic Chamber.  
 Measurement antenna: Single Polarization Horn antenna calibrated according to ANSI C63.5.  
 Turntable: Multi-axis positioner (Theta and Phi angle).

#Reference to CTIA “ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1”



#### 5. Test Method

EUT set on multi-axis positioner and adjust EUT’s physical center to measurement reference center. Measurement antenna set at phi polarization and 1.5 meter height. Port 1 of Network analyzer connect to antenna 1 of EUT. Record S21 value every 15 degree from 0 to 345 degree on Phi angle and 0 to 180 on theta angle of multi-axis positioner. Then set measurement antenna to theta polarization and repeat process. Repeat process to each antenna of EUT.

DG steps:

1. Each Phi and Theta polarization antenna gain are measured for all test angles.
2. Composite Phi and Theta antenna gain are computed, using formula in KDB662911 D01 d) (i) and (ii), for all angles.
3. Composite antenna gain are examined for all angles to determine max gain and Phi/Theta position.

## 6. Summary of Test Result

For 2G 5GL:

Freq(Hz)	2.45G	5.2G	5.3G
Ant. 1 Max Gain (dBi)	2.85	2.75	3.44
Ant. 2 Max Gain (dBi)	1.57	2	1.89
Ant. 3 Max Gain (dBi)	3.93	2.48	2.45
Ant. 4 Max Gain (dBi)	1.86	3.61	3.56
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/60/180	Theta/90/210	Theta/90/165
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/225	Theta/90/30	Theta/75/180
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/75	Theta/90/135	Theta/90/150
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/60/330	Theta/90/15	Theta/90/270
Max Gain (dBi)	3.93	3.61	3.56
DG [1SS] (dBi)	7.6	6.89	6.99
DG [2SS] (dBi)	4.6	3.89	3.99
DG [4SS] (dBi)	1.77	1.03	1.12

Note:

1. Each antenna max gain is the max value of measurement S21 of theta and phi through all measurement angles.
2. The max gain is the max value of all antennas.
3. Directional Gain (2SS) = Directional Gain (1SS) – 3dB. If directional gain is less than max gain, use max gain as directional gain.



For 5GH:

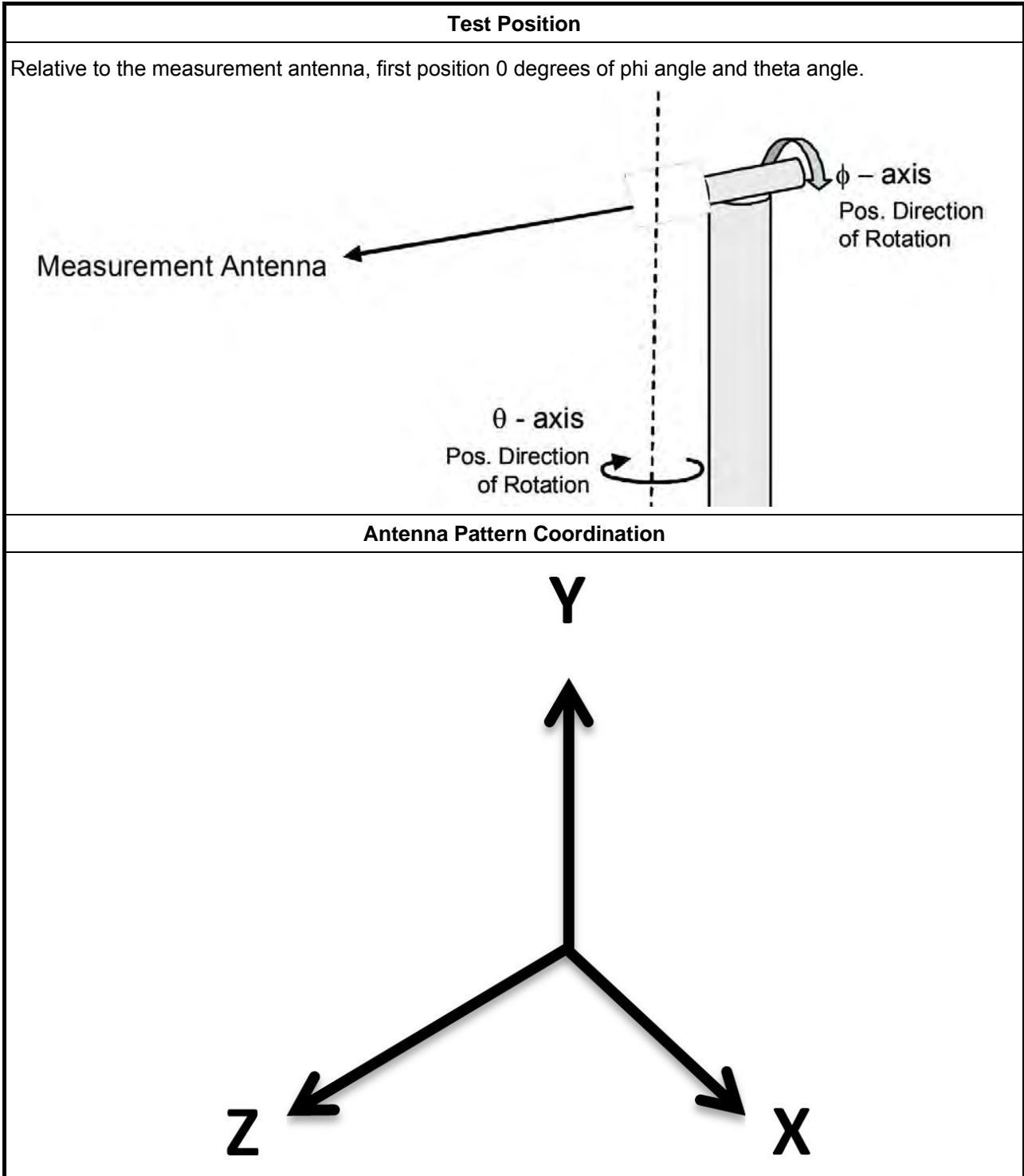
Freq(Hz)	5.6G	5.785G	5.885G
Ant. 1 Max Gain (dBi)	3.67	3.02	3.98
Ant. 2 Max Gain (dBi)	2.68	2.31	1.93
Ant. 3 Max Gain (dBi)	2.74	1.84	1.99
Ant. 4 Max Gain (dBi)	3.61	2.51	3.44
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/240	Theta/90/240	Theta/90/240
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/105	Theta/75/105	Theta/75/90
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/120	Theta/90/105	Theta/105/105
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/315	Theta/105/270	Theta/90/315
Max Gain (dBi)	3.67	3.02	3.98
DG [1SS] (dBi)	6.61	5.94	6.25
DG [2SS] (dBi)	3.67	3.02	3.98
DG [4SS] (dBi)	0.88	0.23	0.57

Note:

1. Each antenna max gain is the max value of measurement S21 of theta and phi through all measurement angles.
2. The max gain is the max value of all antennas.
3. Directional Gain (2SS) = Directional Gain (1SS) – 3dB. If directional gain is less than max gain, use max gain as directional gain.



### 7. Test Setup



Note:

Photos of Test Position: Please refer to the test photos in the appendix.



### 8. Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1292	1GHz~18GHz	Aug. 04, 2021	Aug. 03, 2022
ENA Series Network Analyzer	AGILENT	E5071C	MY46419201	100kHz~8.5GHz	Feb. 21, 2022	Feb. 20, 2023
Test Software	SPORTON	SENSE-RDG	V1.0.6	-	N.C.R.	N.C.R.

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



## **9. Test Results**

Please refer to the appendix.

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Freq(Hz)	2.45G	5.2G	5.3G
Ant. 1 Max Gain (dBi)	2.85	2.75	3.44
Ant. 2 Max Gain (dBi)	1.57	2	1.89
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Ant. 4 Max Gain (dBi)	1.86	3.61	3.56
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/60/180	Theta/90/210	Theta/90/165
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/225	Theta/90/30	Theta/75/180
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/75	Theta/90/135	Theta/90/150
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/60/330	Theta/90/15	Theta/90/270
Max Gain (dBi)	3.93	3.61	3.56
DG [1SS] (dBi)	7.6	6.89	6.99
DG [2SS] (dBi)	4.6	3.89	3.99
DG [4SS] (dBi)	1.77	1.03	1.12



DG 1SS Result

Table with columns for Freq(Hz), DG(dB), and various Phi angles (0 to 345 degrees) for 2.45G and 5.2G frequencies. Includes sub-sections for Theta and Phi for each frequency.



**Radiated Composite Gain of 2.4GHz and 5GHz UNII1, UNII 2A**

**Appendix A**

$\Theta(180^\circ)$	-3.23	-4.15	-4.75	-3.16	-2.65	-5.96	-5.17	-6.08	-7.39	-7.37	-6.39	-5.2	-3.83	-4.13	-4.45	-5.58	-6.91	-6.85	-9.37	-9.39	-6.88	-7.31	-7.46	-4.92
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Radiated Composite Gain of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix A

Gain Result

Table with columns for Freq(Hz), Gain, Pol, Phi, Ant. 1, and various Phi angles (0 to 345 degrees) for frequencies 2.45G, 5.2G, and 5.3G.



Radiated Composite Gain of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix A

Table with columns for frequency (2.45G, 5.2G, 5.3G), polarization (Pol), and various antenna angles (Theta, Phi) from 0 to 180 degrees. It contains gain values for multiple antenna configurations (Ant. 2, Ant. 3).





Radiated Composite Gain of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix A

Table with columns for frequency (5.2G, 5.3G, 2.45G, 2.45G), polarization (Pol.), phase (Phi), antenna (Ant. 3, Ant. 4), and gain (Phi(0) to Phi(345)). Rows show gain values for various angles (Theta) and phases.



Radiated Composite Gain of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix A

Table with columns for frequency (5.2G, 5.3G), polarization (Pol.), angle (Theta, Phi), antenna number (Ant. 4), and gain values for various azimuthal angles (0 to 345 degrees).



Freq(Hz)	5.6G	5.785G	5.885G
Ant. 1 Max Gain (dBi)	3.67	3.02	3.98
Ant. 2 Max Gain (dBi)	2.68	2.31	1.93
Ant. 3 Max Gain (dBi)	2.74	1.84	1.99
Ant. 4 Max Gain (dBi)	3.61	2.51	3.44
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/240	Theta/90/240	Theta/90/240
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/105	Theta/75/105	Theta/75/90
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/120	Theta/90/105	Theta/105/105
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/90/315	Theta/105/270	Theta/90/315
Max Gain (dBi)	3.67	3.02	3.98
DG [1SS] (dBi)	6.61	5.94	6.25
DG [2SS] (dBi)	3.67	3.02	3.98
DG [4SS] (dBi)	0.88	0.23	0.57



Radiated Composite Gain of 5GHz UNII 2C, UNII 3, UNII 4

Appendix B

DG 1SS Result

Table with columns for Freq(Hz), Pol., Phi, and DG(dBi) for various angles (0 to 180 degrees) across multiple frequency bands (5.6G, 5.785G, 5.885G).



Gain Result

Table with columns: Freq(Hz), Gain, and various Phi angles (0 to 345 degrees) for frequencies 5.6G, 5.785G, and 5.885G. The table contains multiple sub-tables for each frequency, showing gain values for different antenna configurations and orientations.





Radiated Composite Gain of 5GHz UNII 2C, UNII 3, UNII 4

Appendix B

Table with columns for frequency (5.6G, 5.785G, 5.885G), gain, and various angles (Theta, Phi) for antennas 2, 3, and 4. Values range from -19.09 to -13.54 dB.



Radiated Composite Gain of 5GHz UNII 2C, UNII 3, UNII 4

Appendix B

Table with columns for Frequency (5.785G, 5.885G, 5.6G), Gain, and various Phi angles (0 to 345 degrees). It contains multiple data blocks for different antenna configurations.



Radiated Composite Gain of 5GHz UNII 2C, UNII 3, UNII 4

Appendix B

Table with columns for Gain (Phi(0) to Phi(345)) and rows for various angles (Theta) and frequencies (5.785G, 5.885G). Includes numerical data and highlighted values like -7.78 and 2.51.





Antenna Pattern of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix C

Total Gain Data

Table with columns for Freq(Hz), Gain, and various Azimuth (Az) and Elevation (El) angles. It contains data for 2.45G, 5.2G, and 5.3G frequencies across multiple antenna configurations.

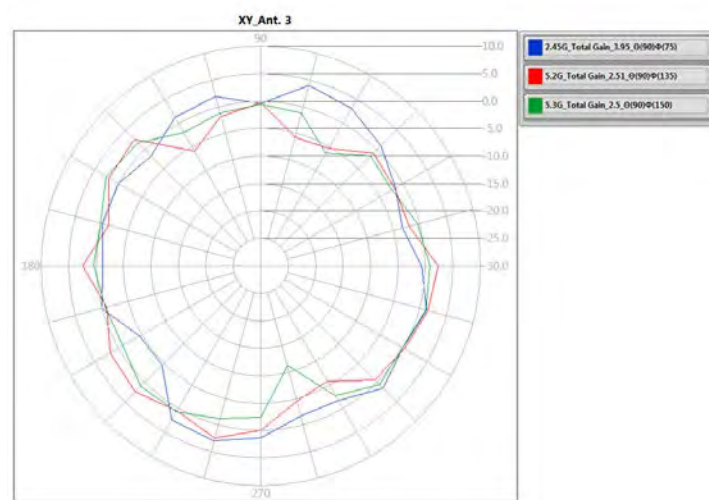
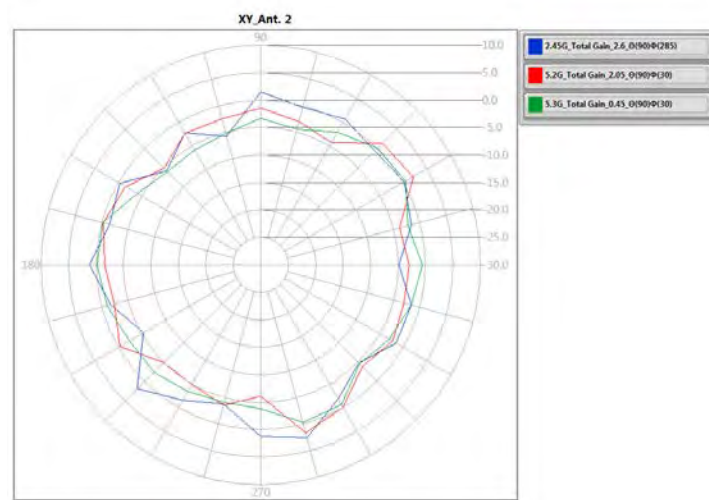
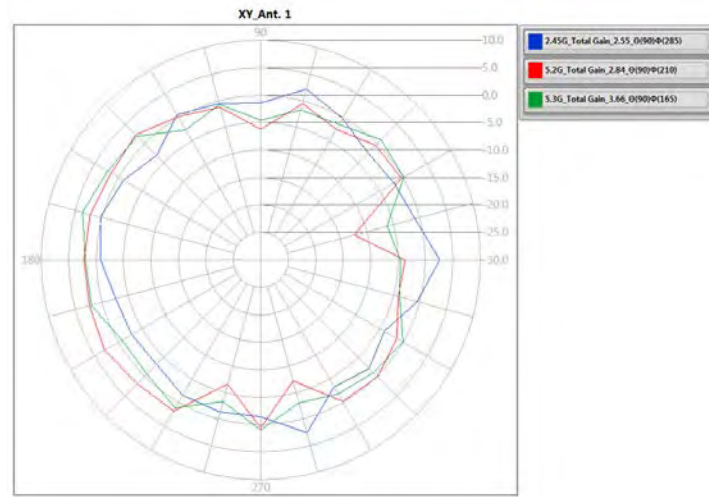


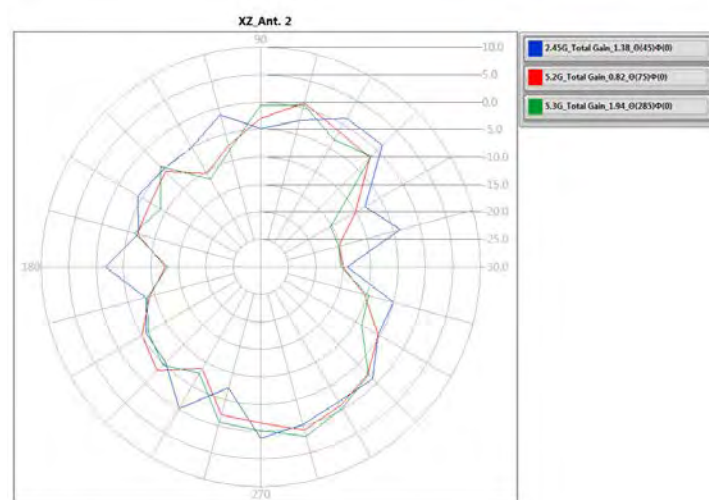
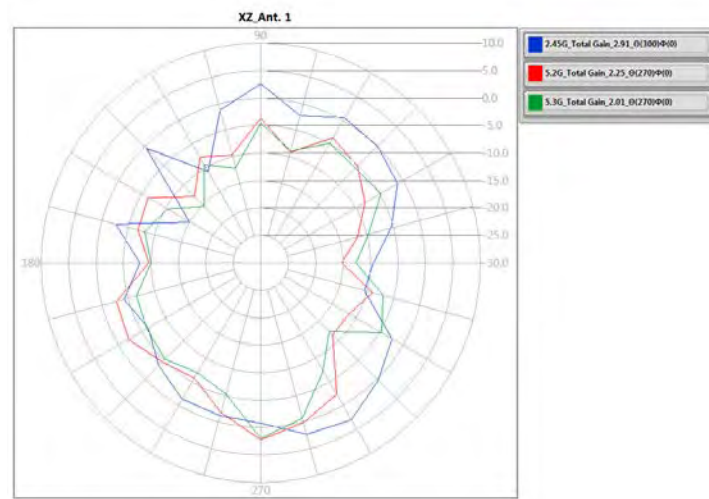
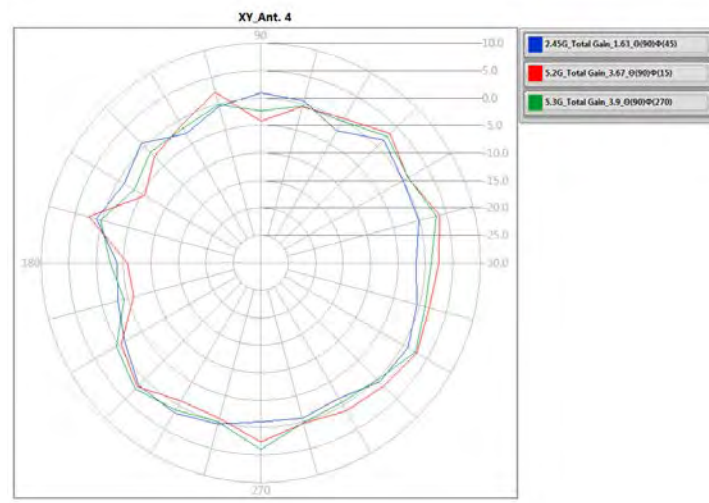
Antenna Pattern of 2.4GHz and 5GHz UNII1, UNII 2A

Appendix C

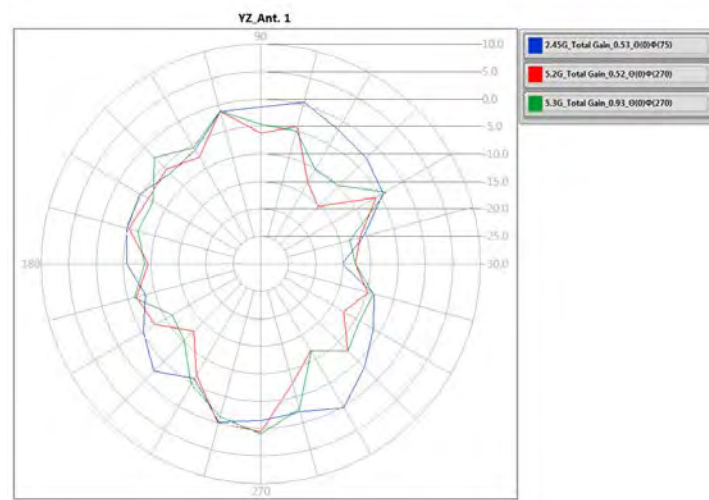
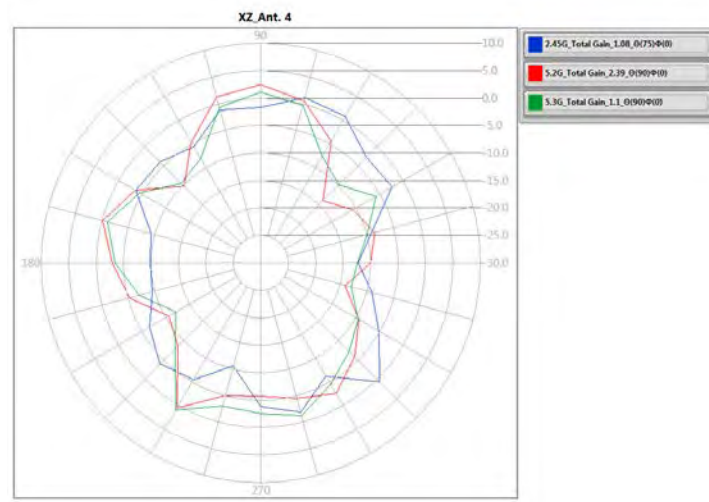
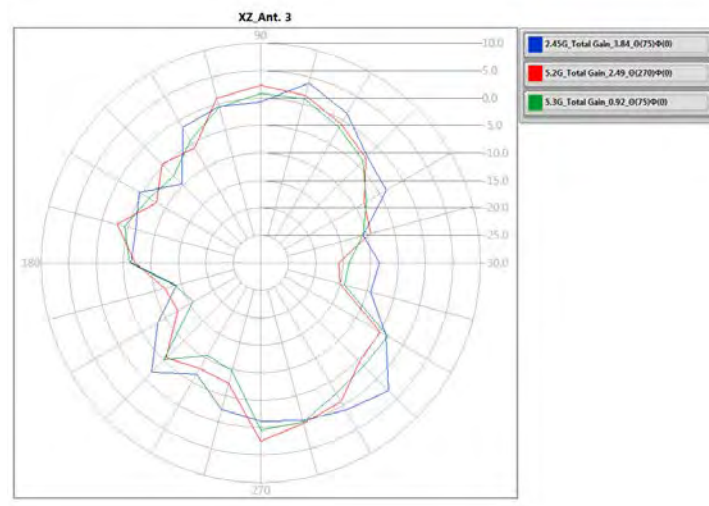
Table with columns for frequency (5.2G, 5.3G, 2.45G), polarization (Pol.), total gain, and azimuth/elevation angles (Ant. 3, Ant. 4). Rows list gain values for various angles from 0 to 180 degrees.

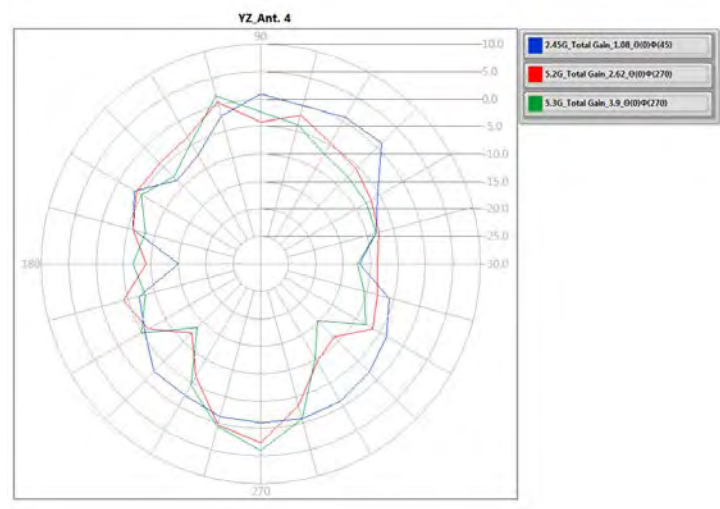
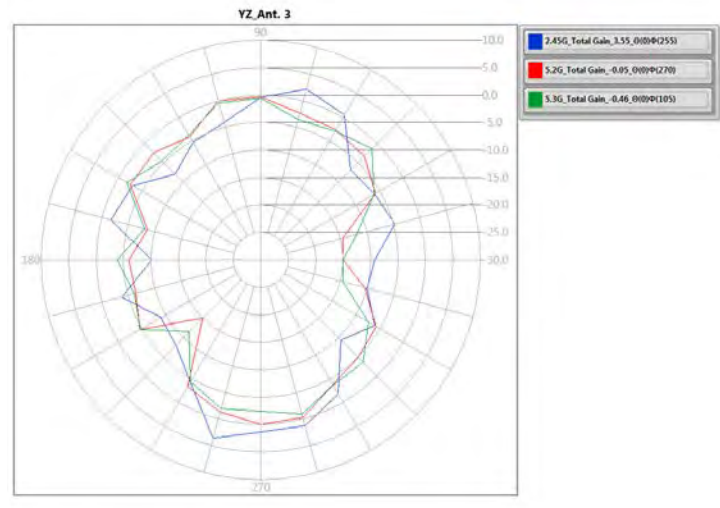
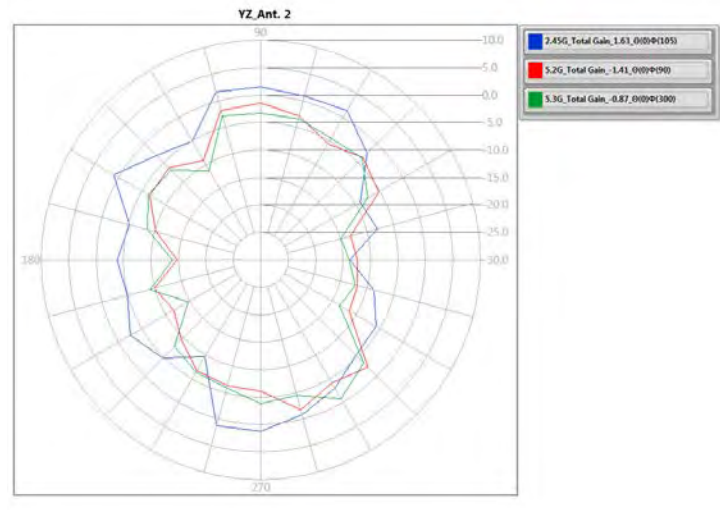
E1(XY plane) –  $\Theta(90)\Phi(0-360)$   
 E2(XZ plane) –  $\Theta(0-180)\Phi(0)$  and  $\Theta(0-180)\Phi(180)$   
 E3(YZ plane) –  $\Theta(0-180)\Phi(90)$  and  $\Theta(0-180)\Phi(270)$













Antenna Pattern of 5GHz UNII 2C, UNII 3, UNII 4

Appendix D

Total Gain Data

Table with columns for Freq(Hz), Pol., Total, and Ant. 1-4, and rows for Gain at various angles (0°, 15°, 30°, 45°, 60°, 75°, 90°, 105°, 120°, 135°, 150°, 165°, 180°) for frequencies 5.6G, 5.785G, and 5.885G.



Antenna Pattern of 5GHz UNII 2C, UNII 3, UNII 4

Appendix D

Table with columns for Azimuth (Theta), Elevation (Phi), Frequency (5.785G, 5.885G, 5.6G), and Gain. Rows represent different antenna configurations and elevation angles from 0 to 180 degrees.



E1(XY plane) –  $\Theta(90)\Phi(0-360)$   
 E2(XZ plane) –  $\Theta(0-180)\Phi(0)$  and  $\Theta(0-180)\Phi(180)$   
 E3(YZ plane) –  $\Theta(0-180)\Phi(90)$  and  $\Theta(0-180)\Phi(270)$

