



# Antenna Composite Gain Test Report

|                  |                                                                                                                                                                                      |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC ID           | MSQ-RTAX5X00                                                                                                                                                                         |
| Equipment        | ROG Rapture AX10000 Tri-band Gaming Mesh Router                                                                                                                                      |
| Brand Name       | ASUS                                                                                                                                                                                 |
| Model Name       | GT6                                                                                                                                                                                  |
| Applicant        | ASUSTeK COMPUTER INC.<br>1F., No. 15, Lide Rd., Beitou, Taipei City 112, Taiwan                                                                                                      |
| Manufacturer (1) | Compal Networking(KunShan) CO., LTD<br>No.520,Nan Bang RD., Economic & Technical Development Zone,<br>KunShan,JiangSu,China                                                          |
| Manufacturer (2) | ARCADYAN TECHNOLOGY (VIETNAM) CO., LTD.<br>Land plot No. D4-5-6, Thang Long Industrial Park (Vinh Phuc), Thien<br>Ke Commune, Binh Xuyen District, 15000 Vinh Phuc Province, Vietnam |
| Sample Received  | Apr. 06, 2022                                                                                                                                                                        |
| Start Test Date  | May 25, 2022                                                                                                                                                                         |
| Final Test Date  | May 26, 2022                                                                                                                                                                         |

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.



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## 1. Operation Mode and Antenna Information

| Antenna Position | RF Port     |                     |                              |                              | Brand Name | Model Name                        | Ant. Type | Connector | Modes of Operation      |
|------------------|-------------|---------------------|------------------------------|------------------------------|------------|-----------------------------------|-----------|-----------|-------------------------|
|                  | WLAN 2.4GHz | WLAN 5GHz UNII 1~2A | WLAN 5GHz UNII 2C~4 (Mode 1) | WLAN 5GHz UNII 2C~4 (Mode 2) |            |                                   |           |           |                         |
| 2G5GL Ant.1      | 2           | 4                   | -                            | -                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 2.4GHz & 5GHz UNII 1~2A |
| 2G5GL Ant.2      | 1           | 3                   | -                            | -                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 2.4GHz & 5GHz UNII 1~2A |
| 2G5GL Ant.3      | -           | 2                   | -                            | -                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 1~2A          |
| 2G5GL Ant.4      | -           | 1                   | -                            | -                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 1~2A          |
| 5GH5.9G Ant.1    | -           | -                   | 4                            | 4                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 2C~4          |
| 5GH5.9G Ant.2    | -           | -                   | 1                            | 1                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 2C~4          |
| 5GH5.9G Ant.3    | -           | -                   | 3                            | 3                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 2C~4          |
| 5GH5.9G Ant.4    | -           | -                   | 2                            | -                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 2C~4          |
| 5GH5.9G Ant.5    | -           | -                   | -                            | 2                            | LYNwave    | MLX22M-121AA1-A / MLX22M-121AA1-B | Dipole    | I-PEX     | 5GHz UNII 2C~4          |

Note:

### For WLAN 2.4GHz:

Operation Mode (2TX/2RX)

2G5GL Ant.1~2 can be used as transmitting/receiving antenna.

2G5GL Ant.1~2 could transmit/receive simultaneously.

### For WLAN 5GHz:

Operation Mode (4TX/4RX)

The 2G 5GL Ant.3~4 operate in UNII 1, UNII 2A.

2G5GL Ant.1~4 can be used as transmitting/receiving antenna.

2G5GL Ant.1~4 could transmit/receive simultaneously.

5GH5.9G Ant1~5 operate in UNII 2C, UNII 3, UNII 4.

The EUT supports the "5GH5.9G Ant.4, 5" with TX/RX diversity functions.

Mode1 was 5GH5.9G Ant.1~4 and Mode 2 was 5GH5.9G Ant.1~3+Ant.5.

5GH5.9G Ant.1~4 or 5GH5.9G Ant.1~3 + 5GH5.9G Ant.5 can be used as transmitting/receiving antenna.

5GH5.9G Ant.1~4 or 5GH5.9G Ant.1~3 + 5GH5.9G Ant.5 could transmit/receive simultaneously.

5GH5.9G Ant.4~5 can be used as transmitting/receiving antenna, but only one of them will be used at one time.

Note: Antennas' Model Name: MLX22M-121AA1-A are for EUT 1 use and MLX22M-121AA1-B are for EUT 2 use. They're same type of antennas.

## 2. Table for EUT Information

| EUT   | PCB board Version | Color of outer case |       |
|-------|-------------------|---------------------|-------|
|       |                   | Black               | White |
| EUT 1 | R1.20             | V                   | V     |
| EUT 2 | R2.00             | V                   | V     |

Note: The above information was declared by manufacturer.

## 3. Table for Permissive Change

This product is an extension of original one reported under Sporton project number: AP221807AA.

Below is the table for the change of the product with respect to the original one.

| Modifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Performance Checking                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 1. Upgrading the PCB version of EUT to R2.00 from R1.20. The difference is listed below:<br>(1) Mainboard: Adding common mode filter to TX path of USB3.0 (Location: FL1).<br>(2) I/O board: Adding common mode filter to RX path of USB3.0 (Location: FL3).<br>2. Revising the black and white housing to the final version.<br>3. Adding Zero wait function for DFS.<br>4. Adding a set antennas (Model Name: MLX22M-121AA1-B) which is almost same as the original antenna but the grey color. The new antennas is available for the white housing only.. | After evaluation,<br>the test results don't be affected. |

Note: All test results are based on original test report.

## 4. 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                 |

## 5. 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<br>(°C / %) | Test Date                     |
|----------------|---------------|---------------|------------------------------|-------------------------------|
| Radiated       | 05CH03-HY     | Rex Liao      | 21-22 / 50-55                | May 25, 2022~<br>May 26, 2022 |

Note:

Testing Site Information

Brand Name: TDK

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

Characteristic: Fully Anechoic Chamber

## 6. Test Facility and Configuration

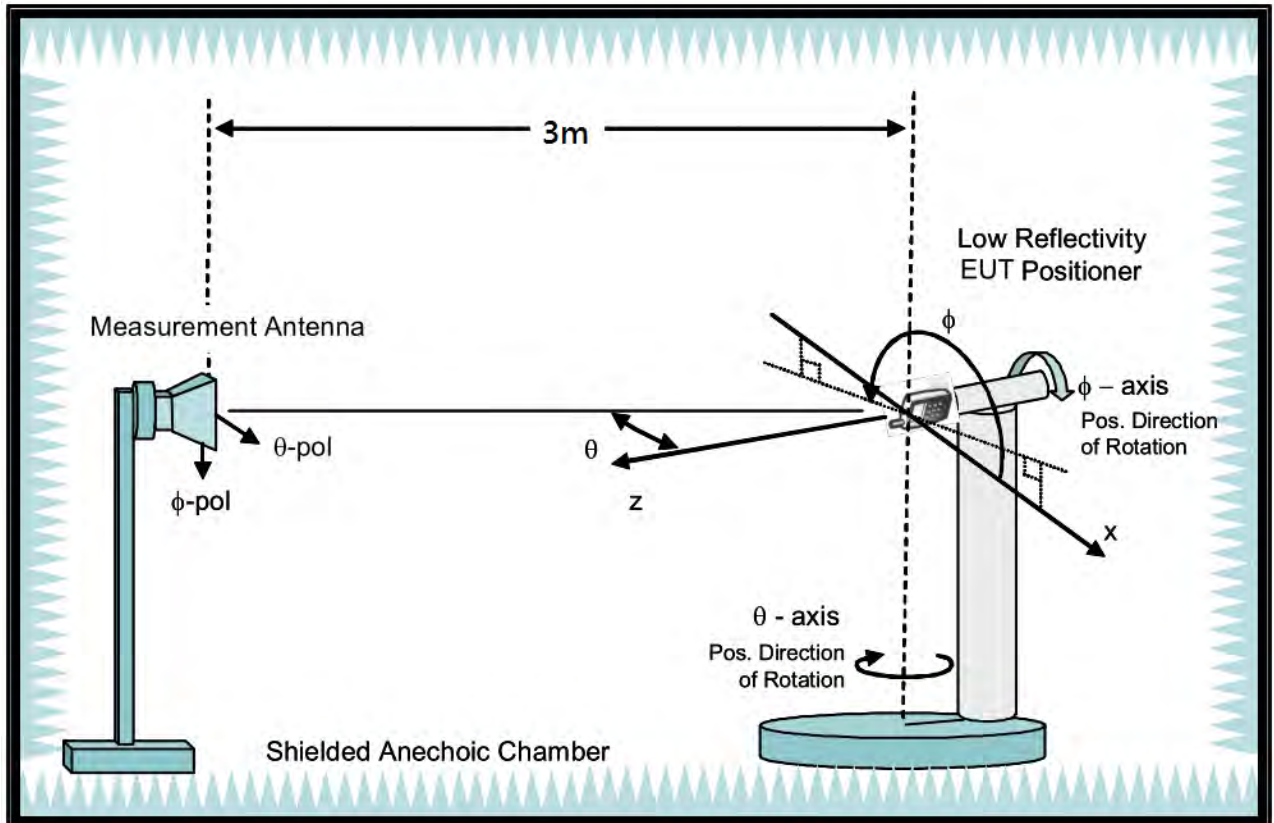
Test configuration: Reference to CITA OTA distributed-axes system configuration.

Chamber: Fully Anechoic Chamber.

Measurement antenna: Dual Polarization Horn antenna

Turntable: Multi-axis positioner (Theta and Phi angle).

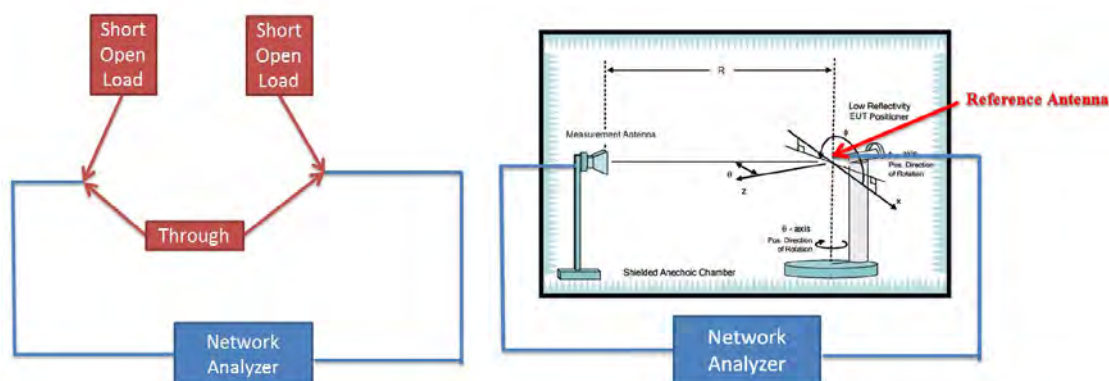
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



## 7. Reference Calibration

Connected cables to VNA calibration kit and use network analyzer internal function to do calibration. Do short, open and load to each side. Then connect through to both side and calibrate G values. The cable loss is calibrated and set inside the network analyzer.

Measurement Antenna is connected to port1 of Network analyzer and reference antenna connected to port 2 of Network Analyzer. Record G values and used with reference antenna gain to calculate gain factor.



| Frequency (MHz)      | 2400  | 2450  | 2500  | 5150  | 5200  | 5300  | 5600  | 5750  | 5800  | 5900  | 6000  | 6500  | 7000  | 7500  |
|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| G reading (dB)       | -31.4 | -31.4 | -31.3 | -31.3 | -31   | -30.7 | -30.1 | -30.5 | -30.5 | -30.8 | -31.3 | -32.8 | -34.4 | -35.4 |
| Reference gain (dBi) | 10.2  | 10.4  | 10.6  | 12.4  | 12.8  | 13.4  | 13.4  | 13.3  | 13.3  | 13.1  | 13.2  | 12.3  | 11.7  | 11.1  |
| Factor (dB)          | 41.34 | 41.55 | 41.68 | 43.24 | 43.56 | 43.68 | 43.79 | 43.91 | 43.99 | 44.43 | 44.49 | 45.24 | 46.12 | 46.31 |

Note:

$$G \text{ reading (dB)} = 20 \cdot \log(V_2/V_1) = 10 \cdot \log(P_2/P_1)$$

V2 is the voltage of VNA port2 is measured, V1 is the voltage of VNA port1 is the reference source.

P2 is the power of VNA port2 is measured, P1 is the power of VNA port1 is the reference source.

$$\text{Factor} = \text{gain factor} + \text{power gain conversion} = (\text{Reference antenna gain}) - (G \text{ reading})$$

## 8. 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 G value every 10 degree from 0 to 350 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 e) (ii), for all angles.
3. Composite antenna gain are examined for all angles to determine max gain and Phi/Theta position. Max gain and phi/theta position are listed in section 9 tables.

Note: Antenna gain = G reading + factor, The factor of chapter five includes reference antenna gain factor and power gain conversion.

## 9. Measured Values and Calculation of Maximum Gain Positions

For 2G 5GL

DG\_1SS max value position

| Frequency (Hz)     | 2.45G | 5.2G  | 5.3G  |
|--------------------|-------|-------|-------|
| Ant. 1 (dBi)       | 2.65  | -0.07 | 3.14  |
| Ant. 2 (dBi)       | 3.34  | 0.79  | 3.5   |
| Ant. 3 (dBi)       | -     | 2.32  | -2.73 |
| Ant. 4 (dBi)       | -     | -3    | -5.47 |
| DG [1SS] (dBi)     | 6.01  | 6.24  | 6.43  |
| Polarization       | Theta | Theta | Theta |
| $\Theta(^{\circ})$ | 70    | 60    | 80    |
| $\Phi(^{\circ})$   | 90    | 200   | 150   |

Note: The DG 1SS max value position is the maximum value of section 13 table DG 1SS Result.

DG\_1SS max value position calculation

| Frequency (Hz)                            | 2.45G            | 5.2G              | 5.3G              |
|-------------------------------------------|------------------|-------------------|-------------------|
| Ant. 1 [ $10^{(G/20)}$ ]                  | $10^{(2.65/20)}$ | $10^{(-0.07/20)}$ | $10^{(3.14/20)}$  |
| Ant. 2 [ $10^{(G/20)}$ ]                  | $10^{(3.34/20)}$ | $10^{(0.79/20)}$  | $10^{(3.5/20)}$   |
| Ant. 3 [ $10^{(G/20)}$ ]                  |                  | $10^{(2.32/20)}$  | $10^{(-2.73/20)}$ |
| Ant. 4 [ $10^{(G/20)}$ ]                  |                  | $10^{(-3/20)}$    | $10^{(-5.47/20)}$ |
| Ant. 1 [ $10^{(G/20)}$ ] value            | 1.357            | 0.992             | 1.435             |
| Ant. 2 [ $10^{(G/20)}$ ] value            | 1.469            | 1.095             | 1.496             |
| Ant. 3 [ $10^{(G/20)}$ ] value            |                  | 1.306             | 0.73              |
| Ant. 4 [ $10^{(G/20)}$ ] value            |                  | 0.708             | 0.533             |
| Sum All Antenna [Amax]                    | 2.826            | 4.101             | 4.195             |
| DG [ $10 \cdot \log(A_{max}^2/N_{ant})$ ] | 6.01             | 6.24              | 6.43              |

Note:

Directional Gain (1SS) is the max value of every look angle. Each position value is calculated by KDB662911 D01 d) (i).

Directional gain (1SS) =  $10 \cdot \log(10^{(G_{ant1}/20)} + 10^{(G_{ant2}/20)} + 10^{(G_{ant3}/20)} + 10^{(G_{ant4}/20)} + \dots)^{2/N_{ant}}$

For 5GH

Mode 1: 5GH5.9G Ant.1~4

DG\_1SS max value position

| Frequency (Hz)     | 5.6G  | 5.785G | 5.885G |
|--------------------|-------|--------|--------|
| Ant. 1 (dBi)       | -1.42 | 1.29   | 2.17   |
| Ant. 2 (dBi)       | -1.98 | -1.91  | -1.69  |
| Ant. 3 (dBi)       | 2.8   | 2.47   | 1.01   |
| Ant. 4 (dBi)       | 0.2   | 2.32   | 1.03   |
| DG [1SS] (dBi)     | 6.13  | 7.23   | 6.76   |
| Polarization       | Theta | Theta  | Theta  |
| $\Theta(^{\circ})$ | 90    | 90     | 90     |
| $\Phi(^{\circ})$   | 0     | 330    | 330    |

Note: The DG 1SS max value position is the maximum value of section 13 table DG 1SS Result.

DG\_1SS max value position calculation

| Frequency (Hz)                            | 5.6G              | 5.785G            | 5.885G            |
|-------------------------------------------|-------------------|-------------------|-------------------|
| Ant. 1 [ $10^{(G/20)}$ ]                  | $10^{(-1.42/20)}$ | $10^{(1.29/20)}$  | $10^{(2.17/20)}$  |
| Ant. 2 [ $10^{(G/20)}$ ]                  | $10^{(-1.98/20)}$ | $10^{(-1.91/20)}$ | $10^{(-1.69/20)}$ |
| Ant. 3 [ $10^{(G/20)}$ ]                  | $10^{(2.8/20)}$   | $10^{(2.47/20)}$  | $10^{(1.01/20)}$  |
| Ant. 4 [ $10^{(G/20)}$ ]                  | $10^{(0.2/20)}$   | $10^{(2.32/20)}$  | $10^{(1.03/20)}$  |
| Ant. 1 [ $10^{(G/20)}$ ] value            | 0.849             | 1.16              | 1.284             |
| Ant. 2 [ $10^{(G/20)}$ ] value            | 0.796             | 0.803             | 0.823             |
| Ant. 3 [ $10^{(G/20)}$ ] value            | 1.38              | 1.329             | 1.123             |
| Ant. 4 [ $10^{(G/20)}$ ] value            | 1.023             | 1.306             | 1.126             |
| Sum All Antenna [Amax]                    | 4.049             | 4.598             | 4.356             |
| DG [ $10 \cdot \log(A_{max}^2/N_{ant})$ ] | 6.13              | 7.23              | 6.76              |

Note:

Directional Gain (1SS) is the max value of every look angle. Each position value is calculated by KDB662911 D01 d) (i).

Directional gain (1SS) =  $10 \cdot \log(10^{(G_{ant1}/20)} + 10^{(G_{ant2}/20)} + 10^{(G_{ant3}/20)} + 10^{(G_{ant4}/20)} + \dots)^{2/N_{ant}}$

For 5GH

Mode 2: 5GH5.9G Ant.1~3 + 5GH5.9G Ant.5

DG\_1SS max value position

| Frequency (Hz)     | 5.6G  | 5.785G | 5.885G |
|--------------------|-------|--------|--------|
| Ant. 1 (dBi)       | 0.84  | 1.8    | -0.48  |
| Ant. 2 (dBi)       | -1.59 | -0.84  | 0.02   |
| Ant. 3 (dBi)       | 0.34  | 1.3    | 1.7    |
| Ant. 5 (dBi)       | -5.81 | -8.89  | -8.63  |
| DG [1SS] (dBi)     | 4.83  | 5.25   | 4.95   |
| Polarization       | Theta | Theta  | Theta  |
| $\Theta(^{\circ})$ | 90    | 90     | 100    |
| $\Phi(^{\circ})$   | 340   | 340    | 330    |

Note: The DG 1SS max value position is the maximum value of section 13 table DG 1SS Result.

DG\_1SS max value position calculation

| Frequency (Hz)                            | 5.6G              | 5.785G            | 5.885G            |
|-------------------------------------------|-------------------|-------------------|-------------------|
| Ant. 1 [ $10^{(G/20)}$ ]                  | $10^{(0.84/20)}$  | $10^{(1.8/20)}$   | $10^{(-0.48/20)}$ |
| Ant. 2 [ $10^{(G/20)}$ ]                  | $10^{(-1.59/20)}$ | $10^{(-0.84/20)}$ | $10^{(0.02/20)}$  |
| Ant. 3 [ $10^{(G/20)}$ ]                  | $10^{(0.34/20)}$  | $10^{(1.3/20)}$   | $10^{(1.7/20)}$   |
| Ant. 5 [ $10^{(G/20)}$ ]                  | $10^{(-5.81/20)}$ | $10^{(-8.89/20)}$ | $10^{(-8.63/20)}$ |
| Ant. 1 [ $10^{(G/20)}$ ] value            | 1.102             | 1.23              | 0.946             |
| Ant. 2 [ $10^{(G/20)}$ ] value            | 0.833             | 0.908             | 1.002             |
| Ant. 3 [ $10^{(G/20)}$ ] value            | 1.04              | 1.161             | 1.216             |
| Ant. 5 [ $10^{(G/20)}$ ] value            | 0.512             | 0.359             | 0.37              |
| Sum All Antenna [Amax]                    | 3.486             | 3.659             | 3.535             |
| DG [ $10 \cdot \log(A_{max}^2/N_{ant})$ ] | 4.83              | 5.25              | 4.95              |

Note:

Directional Gain (1SS) is the max value of every look angle. Each position value is calculated by KDB662911 D01 d) (i).

Directional gain (1SS) =  $10 \cdot \log(10^{(G_{ant1}/20)} + 10^{(G_{ant2}/20)} + 10^{(G_{ant3}/20)} + 10^{(G_{ant4}/20)} + \dots)^{2/N_{ant}}$

## 10. Summary of Test Result

For 2G 5GL

| Freq(Hz)                                               | 2.45G        | 5.2G         | 5.3G         |
|--------------------------------------------------------|--------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 4.1          | 3.53         | 3.81         |
| Ant. 2 Max Gain (dBi)                                  | 3.39         | 3.26         | 4.32         |
| Ant. 3 Max Gain (dBi)                                  | -            | 2.32         | 2.96         |
| Ant. 4 Max Gain (dBi)                                  | -            | 2.31         | 2.44         |
| Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/90/130 | Theta/90/250 | Theta/80/80  |
| Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/80/90  | Theta/70/140 | Theta/80/140 |
| Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | -            | Theta/60/200 | Theta/50/200 |
| Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | -            | Theta/50/330 | Theta/50/330 |
| Max Gain (dBi)                                         | 4.1          | 3.53         | 4.32         |
| DG [1SS] (dBi)                                         | 6.01         | 6.24         | 6.43         |
| DG [2SS] (dBi)                                         | 4.1          | 3.53         | 4.32         |
| DG [4SS] (dBi)                                         | -            | 3.53         | 4.32         |

Note:

1. Antenna max gain is the max value of each individual antenna through all measurement angles. Each antenna max gain is the max value of measurement G 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.
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain.

## For 5GH

### Mode 1: 5GH5.9G Ant.1~4

| Freq(Hz)                                               | 5.6G          | 5.785G       | 5.885G       |
|--------------------------------------------------------|---------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 1.43          | 2.08         | 2.5          |
| Ant. 2 Max Gain (dBi)                                  | 1.66          | 1.91         | 2.89         |
| Ant. 3 Max Gain (dBi)                                  | 2.8           | 3.51         | 3.79         |
| Ant. 4 Max Gain (dBi)                                  | 2.55          | 3.36         | 3.65         |
| Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/120/180 | Theta/70/0   | Theta/80/0   |
| Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/50/180  | Theta/50/190 | Theta/50/190 |
| Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/90/0    | Theta/90/0   | Theta/90/0   |
| Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/90/280  | Theta/90/180 | Theta/90/180 |
| Max Gain (dBi)                                         | 2.8           | 3.51         | 3.79         |
| DG [1SS] (dBi)                                         | 6.13          | 7.23         | 6.76         |
| DG [2SS] (dBi)                                         | 3.13          | 4.23         | 3.79         |
| DG [4SS] (dBi)                                         | 2.8           | 3.51         | 3.79         |

#### Note:

1. Antenna max gain is the max value of each individual antenna through all measurement angles. Each antenna max gain is the max value of measurement G 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.
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain.

## For 5GH

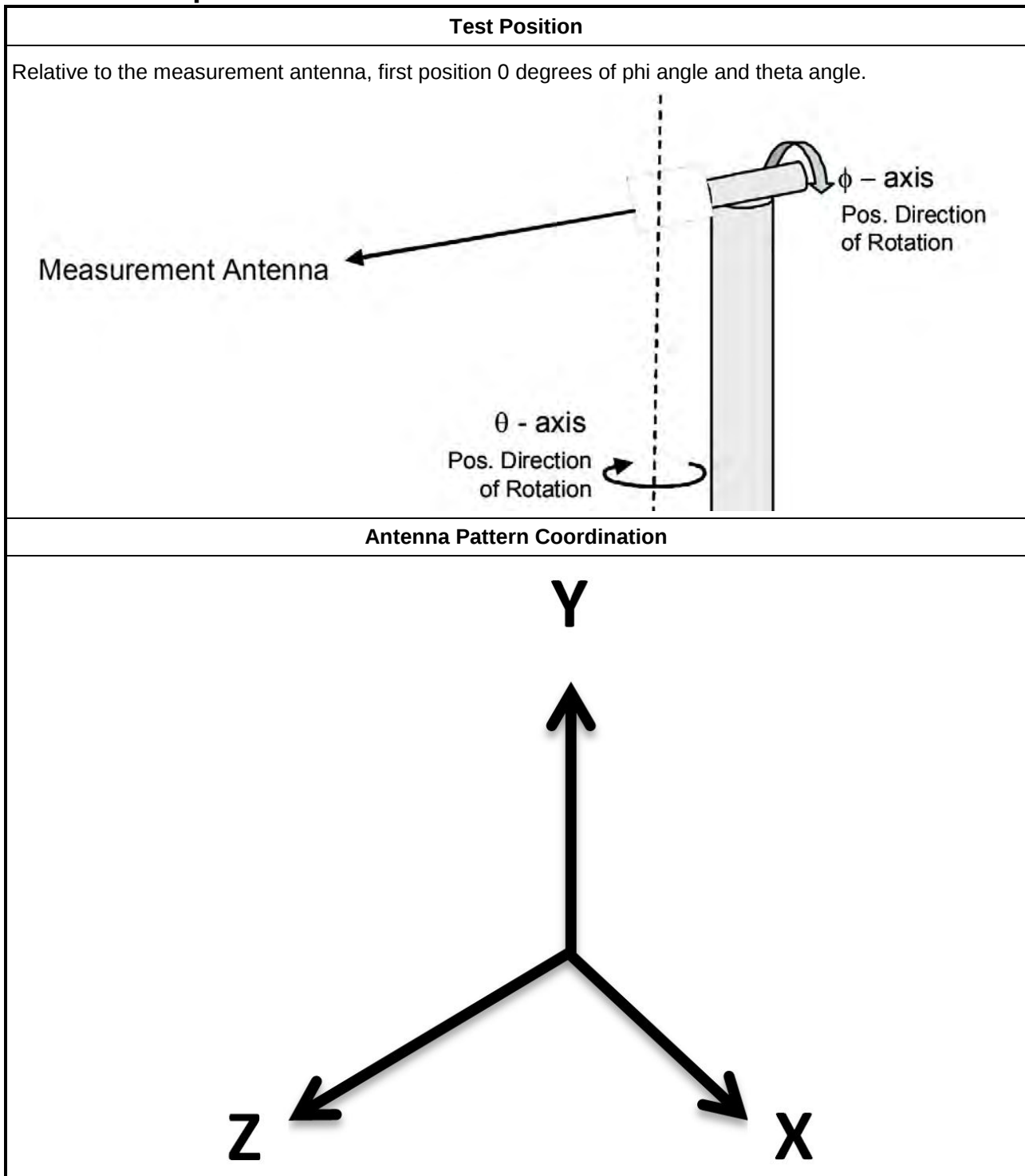
### Mode 2: 5GH5.9G Ant.1~3 + 5GH5.9G Ant.5

| Freq(Hz)                                               | 5.6G          | 5.785G       | 5.885G       |
|--------------------------------------------------------|---------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 1.43          | 2.08         | 2.5          |
| Ant. 2 Max Gain (dBi)                                  | 1.66          | 1.91         | 2.89         |
| Ant. 3 Max Gain (dBi)                                  | 2.8           | 3.51         | 3.79         |
| Ant. 5 Max Gain (dBi)                                  | 3.64          | 3.64         | 3.29         |
| Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/120/180 | Theta/70/0   | Theta/80/0   |
| Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/50/180  | Theta/50/190 | Theta/50/190 |
| Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/90/0    | Theta/90/0   | Theta/90/0   |
| Ant. 5 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$ | Theta/20/20   | Theta/0/180  | Phi/80/290   |
| Max Gain (dBi)                                         | 3.64          | 3.64         | 3.79         |
| DG [1SS] (dBi)                                         | 4.83          | 5.25         | 4.95         |
| DG [2SS] (dBi)                                         | 3.64          | 3.64         | 3.79         |
| DG [4SS] (dBi)                                         | 3.64          | 3.64         | 3.79         |

#### Note:

1. Antenna max gain is the max value of each individual antenna through all measurement angles. Each antenna max gain is the max value of measurement G 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.
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain.

## 11. Test Setup



Note:

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

**12. 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        |
| Dual Polarization<br>Horn Antenna | Sporton     | S0209DP    | S0209DP-001     | 2GHz~9GHz        | N.C.R.           | N.C.R.               |
| ENA Series Network<br>Analyzer    | AGILENT     | E5071C     | MY46419201      | 100kHz~8.5GHz    | Feb. 21, 2022    | Feb. 20, 2023        |
| VNA Calibration Kit               | TS RF       | TS85033E-F | -               | DC~9GHz          | N.C.R.           | N.C.R.               |
| Multi-axis positioner             | Sporton     | MAPS01     | MAPS01-001      | Theta / Phi axis | N.C.R.           | N.C.R.               |
| 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.



## **13. Test Results**

Please refer to the appendix.

|                                                                         |         |
|-------------------------------------------------------------------------|---------|
| Appendix A – Radiated Composite Gain of 2.4GHz and 5GHz UNII 1, 2A..... | Page 18 |
| Appendix B – Radiated Composite Gain of 5GHz UNII 2C~4 Mode 1.....      | Page 26 |
| Appendix C – Radiated Composite Gain of 5GHz UNII 2C~4 Mode 2.....      | Page 34 |
| Appendix D – Antenna Pattern of 2.4GHz and 5GHz UNII 1, 2A.....         | Page 42 |
| Appendix E – Antenna Pattern of 5GHz UNII 2C~4.....                     | Page 46 |
| Appendix F – Test Photos.....                                           | Page 50 |



| Freq(Hz)                                               | 2.45G        | 5.2G         | 5.3G         |
|--------------------------------------------------------|--------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 4.1          | 3.53         | 3.81         |
| Ant. 2 Max Gain (dBi)                                  | 3.39         | 3.26         | 4.32         |
| Ant. 3 Max Gain (dBi)                                  |              | 2.32         | 2.96         |
| Ant. 4 Max Gain (dBi)                                  |              | 2.31         | 2.44         |
| Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$ | Theta/90/130 | Theta/90/250 | Theta/80/80  |
| Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$ | Theta/80/90  | Theta/70/140 | Theta/80/140 |
| Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$ |              | Theta/60/200 | Theta/50/200 |
| Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$ |              | Theta/50/330 | Theta/50/330 |
| Max Gain (dBi)                                         | 4.1          | 3.53         | 4.32         |
| DG [1SS] (dBi)                                         | 6.01         | 6.24         | 6.43         |
| DG [2SS] (dBi)                                         | 4.1          | 3.53         | 4.32         |
| DG [4SS] (dBi)                                         |              | 3.53         | 4.32         |





Radiated Composite Gain Data of 2.4GHz and 5GHz UNII 1, 2A

Appendix A

|          |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Θ (60°)  | 4.48/4.71   | 3.75/2.85   | 2.4/2.43    | 1.67/0.88   | 1.63/1.92   | 1.91/1.95   | 2.67/4.01   | 5.51/5.33   | 5.1/4.7     | 4.57/5.01   | 5.67/4.67   | 2.43/1.19   | 0.23/-1.64  | -2.07/-1.41 | -1.37/1.64  | 2.58/1.33   | 1.17/2.47   | 2.76/3.06   |
| Θ (70°)  | 3.45/4.2    | 4.57/4.78   | 4.01/3.12   | 3.04/3.05   | 4.35/3.74   | 3.71/4.48   | 3.95/4.71   | 5.73/5.89   | 5.47/4.58   | 4.08/4.6    | 5.52/5.44   | 4.22/3.49   | 1.44/1.43   | -1.13/-1.69 | 0.58/1.12   | 2.28/2.85   | 2.69/3.36   | 3.81/3.36   |
| Θ (80°)  | 3.16/3.71   | 4.91/5.15   | 3.78/2.86   | 3.73/4.46   | 5.68/5.29   | 5.3/4.98    | 4.79/5.16   | 5.99/6.43   | 6.14/5.1    | 3.82/4.25   | 5.55/6.17   | 4.78/3.52   | 3.18/4.24   | 3.07/2.66   | 3.38/2.99   | 2.02/2.74   | 3.18/4.57   | 5.04/4.7    |
| Θ (90°)  | 4.43/4.23   | 4.44/4.31   | 3.95/3.82   | 3.92/4.26   | 5.92/4.23   | 4.19/5.03   | 4.91/4.33   | 5.02/3.77   | 4.66/4.31   | 5.01/3.66   | 3.98/5.04   | 4.92/3.66   | 3.59/4.81   | 4.94/4.53   | 4.97/3.17   | 2.17/3.78   | 4.36/4.64   | 4.22/4.9    |
| Θ (100°) | 5.42/2.94   | 2.14/2.74   | 3.86/2.4    | 2.65/2.65   | 4.2/2.63    | 3.25/1.71   | 1.49/1.07   | 3.96/1.38   | 2.17/2.73   | 4.12/4.51   | 5.43/5      | 4.1/4.9     | 4.34/5.42   | 4.24/3.71   | 5.2/2.17    | 1.78/4.35   | 4.59/4.74   | 4.71/5.52   |
| Θ (110°) | 3.53/0.09   | 0.67/1.37   | 1.92/1.3    | 2.66/0.75   | 2.15/0.59   | 0.8/1.1     | 1.15/-1.55  | 2.11/-1.22  | -0.47/0.93  | 3.03/1.83   | 1.37/2.73   | 2.64/2.43   | 1.52/2.92   | 3.05/2.09   | 3.63/1.72   | -1.01/2.85  | 2.32/0.57   | 0.43/3.04   |
| Θ (120°) | 4.24/1.64   | 0.23/-0.96  | -2.82/-0.58 | 0.48/-2.69  | -1.17/-1.95 | -5.68/-5.86 | -1.57/-4.24 | -2.5/0.55   | -0.53/-0.59 | 2.44/1.8    | -0.83/0.77  | 1.47/2.12   | 1.31/0.85   | 0.03/-1.4   | 2.46/-5.2   | -1.06/1.91  | 0.49/0.11   | -0.35/3.48  |
| Θ (130°) | -0.99/-0.26 | -3.7/-3.16  | -6.71/-2.28 | -2/-2.34    | -2.04/-2.85 | -7.39/-5.15 | -1.72/-2.66 | -7.53/-2.38 | -1.96/-1.2  | -1.96/-1.9  | -0.47/-1.17 | -2.28/-1.63 | -2.1/-2.15  | -3.09/-2.96 | -2.39/-4.74 | -4.34/-5.11 | -0.09/0.09  | -0.9/-1.77  |
| Θ (140°) | -3.49/-1.17 | -0.8/-4.46  | -4.77/-3.58 | -2.62/-2.73 | -1.53/-1.91 | -4.47/-4.18 | -2.12/-2.49 | -4.23/-7.3  | -6.09/-1.79 | -0.69/-1.92 | -4.34/-2.57 | -3.17/-2.79 | -1.15/-0.83 | -2.46/-5.05 | -3.61/-4.15 | -4.2/-3.25  | -3.34/-1.78 | -3.25/-2.13 |
| Θ (150°) | -0.75/-3    | -3.73/-2.3  | -2.34/-3.18 | -4.8/-5.73  | -3.76/-3.56 | -3.76/-3.61 | -2.42/-3.22 | -4.7/-3.01  | -2.07/-1.44 | -0.81/-0.39 | -0.87/-1.78 | -3.68/-2.8  | -2.71/-2.69 | -5.1/-10.1  | -5.95/-4.34 | -3.21/-4.18 | -4.34/-2.76 | -2.17/-0.81 |
| Θ (160°) | -2.46/-0.82 | -1.21/-2.65 | -3.56/-3.95 | -3.96/-3.79 | -3.01/-2.59 | -2.33/-2.53 | -2.96/-3.26 | -3.2/-2.31  | -1/0.03     | 0.46/0.17   | -0.53/-0.97 | -2.09/-2.5  | -3.39/-5.6  | -6.91/-8.17 | -6.8/-5.04  | -4.76/-5.79 | -4.85/-3.91 | -5.43/-4.3  |
| Θ (170°) | -3.72/-4.17 | -3.5/-2.69  | -2.63/-3.63 | -3.8/-3.19  | -2.99/-2.97 | -3.68/-3.49 | -2.57/-2.2  | -2.15/-2.46 | -2.74/-2.71 | -1.98/-1.55 | -1.36/-1.16 | -0.89/-0.86 | -1.32/-2.57 | -4.18/-5.47 | -5.02/-3.41 | -1.92/-1.21 | -1.36/-1.42 | -1.96/-3.12 |
| Θ (180°) | -2.67/-1.41 | -1.3/-1.7   | -2.32/-3.14 | -4.1/-5.15  | -6.29/-6.83 | -6.16/-5.5  | -5.15/-5.04 | -4.77/-3.71 | -2.91/-1.82 | -1.03/-0.98 | -1.38/-1.98 | -2.68/-3.56 | -4.78/-5.74 | -6.46/-7.49 | -8.61/-8.93 | -9.14/-9.56 | -8.18/-6.76 | -4.67/-3.39 |





# Radiated Composite Gain Data of 2.4GHz and 5GHz UNII 1, 2A

# Appendix A

|        |             |             |             |             |           |          |           |      |
|--------|-------------|-------------|-------------|-------------|-----------|----------|-----------|------|
| Θ(60°) | -5.11/-3.48 | -3.36/-1.97 | -2.13/-1.73 | -3.95/-2.61 | 1.51/3.84 | 1.43/2.1 | 1.56/1.34 | 2.08 |
|--------|-------------|-------------|-------------|-------------|-----------|----------|-----------|------|







Radiated Composite Gain Data of 2.4GHz and 5GHz UNII 1, 2A

Appendix A

|         |              |              |             |               |               |               |               |              |   |
|---------|--------------|--------------|-------------|---------------|---------------|---------------|---------------|--------------|---|
| Θ(150°) | -9.74/-15.84 | -13.65/-7.66 | -8.93/-12.9 | -16.72/-18.49 | -19.99/-20.16 | -17.35/-12.42 | -11.04/-13.11 | -10.43/-6.66 | - |
|---------|--------------|--------------|-------------|---------------|---------------|---------------|---------------|--------------|---|



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| Freq(Hz)                                               | 5.6G          | 5.785G       | 5.885G       |
|--------------------------------------------------------|---------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 1.43          | 2.08         | 2.5          |
| Ant. 2 Max Gain (dBi)                                  | 1.66          | 1.91         | 2.89         |
| Ant. 3 Max Gain (dBi)                                  | 2.8           | 3.51         | 3.79         |
| Ant. 4 Max Gain (dBi)                                  | 2.55          | 3.36         | 3.65         |
| Ant. 1 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/120/180 | Theta/70/0   | Theta/80/0   |
| Ant. 2 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/50/180  | Theta/50/190 | Theta/50/190 |
| Ant. 3 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/90/0    | Theta/90/0   | Theta/90/0   |
| Ant. 4 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/90/280  | Theta/90/180 | Theta/90/180 |
| Max Gain (dBi)                                         | 2.8           | 3.51         | 3.79         |
| DG [1SS] (dBi)                                         | 6.13          | 7.23         | 6.76         |
| DG [2SS] (dBi)                                         | 3.13          | 4.23         | 3.79         |
| DG [4SS] (dBi)                                         | 2.8           | 3.51         | 3.79         |





Radiated Composite Gain Data of 5GHz UNII 2C~4 Mode 1

Appendix B

|          |             |             |             |             |             |              |             |             |             |             |             |             |             |             |               |              |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|--------------|-------------|-------------|
| Θ (60°)  | 3.95/3.19   | 2.08/3.38   | 2.45/0.75   | 0.57/1.33   | 2.54/2.99   | 1.74/0.92    | 2.34/2.81   | 2.81/1      | 0.81/3.65   | 3.69/4.43   | 3.83/2.99   | 1.05/2.2    | 1.77/0.9    | 0.73/1.89   | 0.32/0.9      | -0.47/1.18   | 2.45/2.5    | 3.42/2.92   |
| Θ (70°)  | 4.41/3.41   | 2.33/3.28   | 1.93/0.22   | 2.28/1.45   | 2.22/3.01   | 2.44/1.71    | 2.89/1.83   | 1.78/0.31   | 0.54/3.36   | 3.76/3.74   | 4.13/3.92   | 1.89/3.24   | 3.87/2.19   | 3.35/3.63   | 1.32/2.56     | 2.41/3.06    | 3.28/3.63   | 5.24/5.03   |
| Θ (80°)  | 5.01/3.2    | 2.84/4.31   | 2.96/1.42   | 3.92/2.62   | 3.86/3.41   | 4.6/2.59     | 3.56/1.58   | 1.25/2.33   | 3.02/4.07   | 5.43/4.68   | 4.71/4.19   | 2.04/4.25   | 5.89/3.81   | 3.26/3.44   | 3.36/4.25     | 4.1/3.88     | 3.47/4.41   | 5.32/5.08   |
| Θ (90°)  | 4.99/2.63   | 3.32/5.17   | 2.33/1.71   | 3.97/2.21   | 3.06/3.42   | 3.03/2.94    | 3.58/3.71   | 1.57/3.98   | 2.47/4.17   | 6.17/4.86   | 6.09/6.35   | 3.75/3.49   | 6.46/4.2    | 3.55/2.79   | 2.55/4.22     | 5.49/3.01    | 4.05/6.76   | 6.23/4.7    |
| Θ (100°) | 4.75/2.34   | 2.07/3.64   | 0.9/1.44    | 3.56/3.56   | 4.07/4.19   | 3.63/3.69    | 3.77/2.69   | -0.69/2.91  | 2.61/2.99   | 5.49/2.44   | 4.5/5.28    | 3.28/1      | 5.98/3.95   | 3.52/1.52   | 2.72/4.07     | 4.19/0.79    | 4.19/6.56   | 5.82/5.63   |
| Θ (110°) | 4.37/3.1    | 3.22/4.65   | 3.11/2.99   | 2.99/3.52   | 3.77/3.98   | 2.83/3.96    | 3.48/3.07   | 2.68/3.35   | 1.58/2.18   | 3.13/2.26   | 3.36/3.22   | 3.08/-0.21  | 2.99/0.82   | 1.67/-0.29  | 2.74/2.44     | 0.28/0.04    | 2.67/3.74   | 1.9/1.85    |
| Θ (120°) | 4.18/4.48   | 3.25/1.69   | 1.01/0.01   | 0.35/0.62   | 0.91/0.33   | 0.21/1.87    | 2.15/2.14   | 2.56/3.96   | 2.49/2.61   | 3.51/3.08   | 1.83/1.98   | 1.66/0.86   | 2.33/1.88   | -3.06/-0.83 | 0.39/1.86     | 0.82/1.74    | 2.83/2.05   | 1.49/1.16   |
| Θ (130°) | 4.32/2.35   | 2.74/2.3    | 0.12/0.29   | 0.69/0.9    | 1.4/-0.34   | -0/-0.71     | -0.96/-0.36 | -0.61/2.58  | 2.79/1.42   | 2.77/2.12   | 2.56/1.57   | -0.05/-0.69 | 0.65/3.04   | 1.04/-0.63  | 0.58/3.05     | 0.79/-1.98   | 0.46/2.6    | 2.42/2.05   |
| Θ (140°) | 2.99/3.74   | 2.53/2.15   | 1.82/0.87   | -0.14/-1.5  | -1.03/-2.47 | -2.23/-1.7   | -2.5/-0.86  | -2.05/-2.68 | -0.93/1.55  | 0.98/-1.26  | -0.37/-2.11 | -4.57/-1.19 | -1.34/-3.78 | -3.45/-7.97 | -3.96/0.16    | -3.96/-5.91  | -4.46/-0.4  | 0.87/0.7    |
| Θ (150°) | -1.1/-0.3   | -1.7/1.36   | -1.07/-1.19 | -2.66/-3.46 | -4.91/6.91  | -3.82/-2.12  | -2.33/-1.67 | -2.08/2.18  | -2.63/-3.72 | -3.55/-0.79 | -0.34/-2.95 | -4.01/-0.01 | 0.04/-3.56  | -5.88/-7.56 | -4.41/-1.82   | -1.67/-7.35  | -6.61/-0.89 | 0.31/-0.06  |
| Θ (160°) | -0.66/-0.75 | -0.95/-2.29 | -4/-4.1     | -3.81/-4.9  | -5.58/-5.54 | -5.12/-3.82  | -4.11/-4    | -3.47/-1.69 | -0.37/-0.98 | -1.61/-0.97 | 0.42/0.71   | -0.18/-1.85 | -3.87/-6.09 | -7.05/-7.99 | -7.03/-4.15   | -2.17/-1.07  | -0.37/0.15  | 0.65/0.33   |
| Θ (170°) | -0.55/-1.05 | -1.02/-1.17 | -1.69/-3.06 | -4.49/-5.09 | -6.03/-7.11 | -8.14/-7.67  | -6.26/-5.43 | -4.36/-2.65 | -1.33/-0.81 | -0.98/-1.95 | -3.21/4.58  | -5.24/-4.95 | -5.66/-6.95 | -8.07/-7.89 | -6.39/-5.86   | -4.95/-3.92  | -3.49/-2.5  | -0.95/-1.62 |
| Θ (180°) | -2.93/-2.67 | -2.38/-2.86 | -4.52/-4.83 | -5.38/-6.94 | -9.6/-11.04 | -12.42/-11.5 | -11.3/-9.68 | -7.69/-5.89 | -4.76/-3.62 | -2.79/-2.3  | -2.24/-2.6  | -3.03/-3.88 | -5.43/-7.14 | -9.17/-9.77 | -10.27/-12.52 | -11.77/-9.96 | -8.8/-6.02  | -4.47/-4.94 |











Radiated Composite Gain Data of 5GHz UNII 2C~4 Mode 1

Appendix B

|         |               |              |             |               |               |             |              |               |        |
|---------|---------------|--------------|-------------|---------------|---------------|-------------|--------------|---------------|--------|
| Θ(150°) | -10.79/-10.54 | -10.62/-8.63 | -6.85/-10.9 | -12.79/-11.63 | -17.26/-10.57 | -6.56/-8.72 | -18.78/-17.8 | -15.44/-18.41 | -18.16 |
|---------|---------------|--------------|-------------|---------------|---------------|-------------|--------------|---------------|--------|



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| Freq(Hz)                                               | 5.6G          | 5.785G       | 5.885G       |
|--------------------------------------------------------|---------------|--------------|--------------|
| Ant. 1 Max Gain (dBi)                                  | 1.43          | 2.08         | 2.5          |
| Ant. 2 Max Gain (dBi)                                  | 1.66          | 1.91         | 2.89         |
| Ant. 3 Max Gain (dBi)                                  | 2.8           | 3.51         | 3.79         |
| Ant. 5 Max Gain (dBi)                                  | 3.64          | 3.64         | 3.29         |
| Ant. 1 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/120/180 | Theta/70/0   | Theta/80/0   |
| Ant. 2 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/50/180  | Theta/50/190 | Theta/50/190 |
| Ant. 3 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/90/0    | Theta/90/0   | Theta/90/0   |
| Ant. 5 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$ | Theta/20/20   | Theta/0/180  | Phi/80/290   |
| Max Gain (dBi)                                         | 3.64          | 3.64         | 3.79         |
| DG [1SS] (dBi)                                         | 4.83          | 5.25         | 4.95         |
| DG [2SS] (dBi)                                         | 3.64          | 3.64         | 3.79         |
| DG [4SS] (dBi)                                         | 3.64          | 3.64         | 3.79         |





Radiated Composite Gain Data of 5GHz UNII 2C~4 Mode 2

Appendix C

|          |             |             |             |             |              |               |               |              |             |             |             |             |             |             |               |               |             |             |
|----------|-------------|-------------|-------------|-------------|--------------|---------------|---------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|---------------|-------------|-------------|
| Θ (70°)  | 2.98/0.89   | -0.51/0.81  | 0.14/-2.44  | -0.37/-1.05 | -0.53/1      | 0.72/-0.29    | 2.37/1.98     | 2.12/1.49    | 2.34/3.42   | 2.66/1.86   | 1.94/1.41   | -1.28/1.96  | 2.5/-0.31   | 0.25/0.86   | -1.24/-1.1    | 0.1/1.71      | 2.54/2.83   | 3.59/3.25   |
| Θ (80°)  | 3.73/0.71   | 0.88/2.02   | 0.41/-2.13  | 0.97/0.1    | 1.76/2.33    | 2.49/1.13     | 2.62/1.9      | 1.31/2.32    | 2.93/3.79   | 3.52/2.52   | 2.88/2.33   | 0.2/2.4     | 4.07/1.28   | 0.54/0.29   | 0.57/0.84     | 1.63/2.57     | 1.46/2.28   | 3.21/2.95   |
| Θ (90°)  | 3.92/0.33   | 1.69/3.17   | 0.61/-1.35  | 0.42/-0.48  | 2.34/2.4     | 1.46/0.67     | 3.53/3.38     | 2.22/3.08    | 2.18/3.28   | 3.38/1.82   | 3.5/3.57    | 2.26/1.62   | 4.73/2.34   | 1.19/-0.44  | -0.4/0.31     | 3.67/1.95     | 2.45/4.85   | 3.91/3.06   |
| Θ (100°) | 3.44/0.43   | 0.59/2.24   | -2.56/-1.8  | 1.11/2.53   | 3.14/3.04    | 2.11/2.5      | 3.53/1.97     | -0.93/1.29   | 1.34/2.63   | 2.75/-0.46  | 2.91/2.93   | 1.44/0.53   | 4.39/1.42   | 1/-2.64     | 0.94/0.74     | 2.34/-1.12    | 2.54/4.95   | 3.26/2.96   |
| Θ (110°) | 2.8/0.54    | 0.86/2.61   | 1.68/1.55   | 2.19/2.95   | 2.73/2.45    | 1.88/2.52     | 3.14/2.82     | 2.16/3.45    | 2.25/2.27   | 0.95/1.18   | 2.64/2.19   | 2.56/-0.46  | 1.94/-3.68  | -0.62/-3.33 | 0.1/-0.71     | -2.1/-1.15    | -0.57/0.49  | -1.77/-2.06 |
| Θ (120°) | 1.71/1.43   | 0.41/-0.25  | 0.26/-1.2   | -0.02/0.36  | 0.36/-0.59   | -1.74/0.8     | 2.59/3.14     | 3.01/3.89    | 2.62/2.8    | 1.75/1.76   | 0.92/-0.08  | -0.05/-0.64 | 0.79/-2.12  | -3.54/-4.48 | -3.84/-1.1    | -2.54/-0.36   | -0.1/-2.9   | -4.64/-4.83 |
| Θ (130°) | 2.5/0.95    | 0.49/1      | -1.69/-1.81 | 0.29/1.68   | 1.96/-0.93   | -2.41/-0.83   | -1.7/-1.47    | -1.54/0.21   | 1.2/-0.1    | 0.26/0.54   | 1.71/-0.05  | -0.67/-2.45 | -1.58/-0.37 | 1.07/-4.67  | -1.75/0.72    | -2.03/-2.93   | -1.72/-1.92 | -1.63/-2.03 |
| Θ (140°) | -0.21/1.12  | 1.28/1.49   | 0.92/0.38   | 0.7/-1.28   | -1.91/-3.64  | -3.85/-2.18   | -2.18/-1.72   | -1.93/-2.01  | -2.06/0.1   | -0.21/-1.39 | -0.23/-3.06 | -4.47/-4.09 | -4.86/-4.43 | -3.09/-9.55 | -4.74/-1.49   | -5.35/-5.2    | -7.24/-4.64 | -3.53/-3.89 |
| Θ (150°) | -2.55/-1.08 | -2.22/-2.27 | -2.58/-2.71 | -3.23/-4.79 | -5.87/-7.29  | -4.51/-2.37   | -2.03/-1.59   | -1.41/-1.28  | -1.13/-2.59 | -4.51/-2.2  | -1.12/-2.64 | -4.21/-1.15 | -2.55/-6.26 | -6.64/-9.57 | -5.97/-4.33   | -2.83/-8.23   | -8.76/-4.16 | -1.49/-1.82 |
| Θ (160°) | -3.18/-3.02 | -3/-3.83    | -4.49/-4.99 | -4.99/-5.77 | -5.86/-5.3   | -4.39/-3.41   | -4.12/-4.07   | -2.94/-1.52  | -0.66/-1.07 | -1.58/-1.31 | -0.31/0.34  | -0.66/-3.03 | -4.81/-5.23 | -6.73/-10.3 | -9.77/-7.11   | -4.2/-2.52    | -2.16/-1.83 | -0.99/-1.21 |
| Θ (170°) | -3.22/-3.23 | -2.7/-2.48  | -3.2/-3.8   | -4.55/-4.92 | -6.45/-7.67  | -8.3/-7.77    | -6.1/-4.57    | -3.48/-2.48  | -2/-1.79    | -2.16/-3.24 | -4.29/-5.25 | -5.27/-4.86 | -5.69/-7.43 | -9.48/-10.7 | -8.9/-8.52    | -8.52/-7.54   | -7.28/-5.81 | -3.9/-4.4   |
| Θ (180°) | -6.93/-6    | -5.58/-5.93 | -7.12/-6.8  | -6.89/-7.49 | -8.24/-10.14 | -11.79/-11.54 | -12.75/-11.72 | -10.31/-9.44 | -8.24/-6.89 | -5.79/-5.37 | -5.2/-5.17  | -5.49/-5.96 | -6.88/-7.86 | -9.27/-9.6  | -10.14/-12.57 | -13.18/-12.56 | -12.07/-9.3 | -8.76/-9.32 |











Radiated Composite Gain Data of 5GHz UNII 2C~4 Mode 2

Appendix C

|         |               |               |               |               |            |              |               |              |              |
|---------|---------------|---------------|---------------|---------------|------------|--------------|---------------|--------------|--------------|
| Θ(150°) | -15.94/-17.56 | -16.82/-16.74 | -13.17/-17.13 | -18.78/-17.11 | -19/-19.12 | -14.22/-11.6 | -16.59/-17.17 | -11.69/-12.6 | -12.51/-15.5 |
|---------|---------------|---------------|---------------|---------------|------------|--------------|---------------|--------------|--------------|





# Antenna Pattern of 2.4GHz and 5GHz UNII 1, 2A

# Appendix D

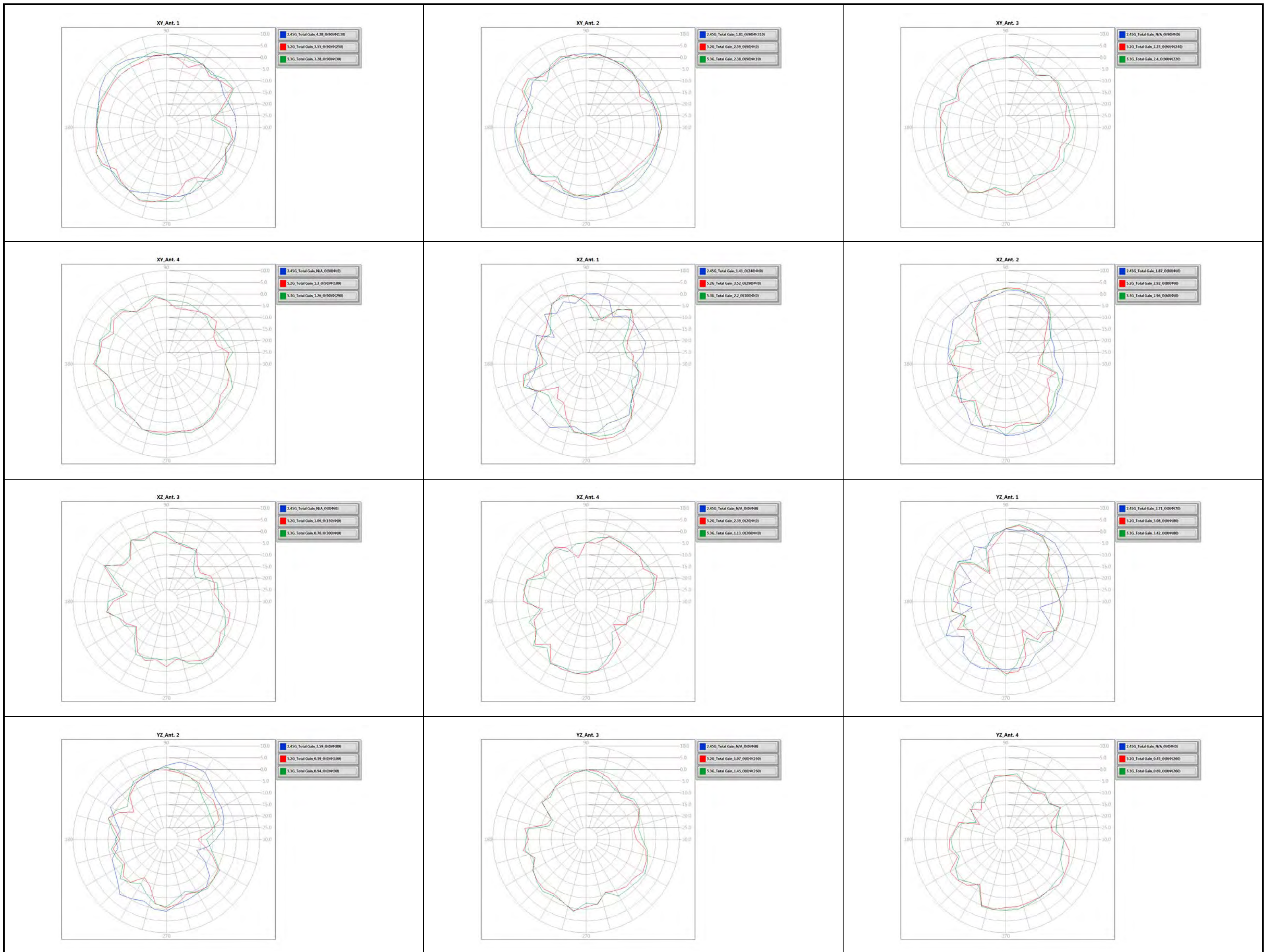
|        |           |           |             |             |             |             |             |           |   |
|--------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-----------|---|
| Θ(60°) | 2.96/2.90 | 1.89/0.32 | -2.11/-1.66 | -0.73/-3.14 | -5.90/-2.91 | -3.72/-3.39 | -4.55/-2.28 | 1.45/2.40 | 0 |
|--------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-----------|---|



Antenna Pattern of 2.4GHz and 5GHz UNII 1, 2A

Appendix D

|          |              |               |               |               |               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|----------|--------------|---------------|---------------|---------------|---------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Θ (160°) | -2.93/-3.43  | -4.08/-3.69   | -2.28/-0.81   | -0.41/-1.66   | -4.93/-8.70   | -11.60/-13.30   | -14.80/-14.11   | -9.44/-7.26     | -6.43/-6.25     | -6.37/-6.87     | -7.88/-9.29     | -11.02/-8.65    | -6.88/-5.90     | -7.00/-8.07     | -9.18/-8.10     | -6.07/-6.01     | -5.56/-3.97     | -4.01/-3.45     |
| Θ (170°) | -3.14/-4.68  | -4.36/-5.09   | -6.26/-6.51   | -8.67/-12.48  | -11.20/-7.79  | -5.77/-5.21     | -4.87/-5.24     | -6.36/-8.53     | -10.91/-11.77   | -11.11/-9.65    | -9.17/-8.81     | -9.94/-10.06    | -8.40/-7.01     | -5.73/-5.62     | -6.29/-6.59     | -5.51/-3.64     | -2.17/-1.67     | -1.56/-2.09     |
| Θ (180°) | -3.00/-1.75  | -2.23/-2.97   | -3.19/-3.97   | -4.34/-4.32   | -4.98/-5.90   | -5.99/-5.03     | -3.95/-2.97     | -2.70/-2.85     | -2.77/-2.73     | -2.56/-2.37     | -2.06/-1.95     | -2.20/-2.07     | -2.14/-1.93     | -1.81/-2.14     | -2.26/-2.30     | -2.50/-3.20     | -3.94/-4.86     | -4.68/-3.99     |
| Freq(Hz) | 5.3G/Pol     | TotalAnt. 4   | -/-           | -/-           | -/-           | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             | -/-             |
| Gain     | Φ(0°)/Φ(10°) | Φ(20°)/Φ(30°) | Φ(40°)/Φ(50°) | Φ(60°)/Φ(70°) | Φ(80°)/Φ(90°) | Φ(100°)/Φ(110°) | Φ(120°)/Φ(130°) | Φ(140°)/Φ(150°) | Φ(160°)/Φ(170°) | Φ(180°)/Φ(190°) | Φ(200°)/Φ(210°) | Φ(220°)/Φ(230°) | Φ(240°)/Φ(250°) | Φ(260°)/Φ(270°) | Φ(280°)/Φ(290°) | Φ(300°)/Φ(310°) | Φ(320°)/Φ(330°) | Φ(340°)/Φ(350°) |
| Θ (0°)   | -6.73/-6.18  | -6.90/-7.70   | -7.06/-5.91   | -6.09/-6.44   | -5.25/-4.91   | -6.55/-7.95     | -8.45/-7.45     | -5.66/-5.71     | -6.07/-6.61     | -6.77/-6.94     | -6.51/-5.91     | -5.71/-5.83     | -6.33/-7.06     | -7.13/-6.64     | -6.33/-5.76     | -5.66/-6.47     | -6.56/-6.46     | -6.73/-6.81     |
| Θ (10°)  | -1.06/-1.32  | -2.28/-2.87   | -3.22/-3.15   | -4.60/-5.49   | -6.82/-8.06   | -7.95/-7.39     | -6.30/-6.08     | -4.87/-4.16     | -4.46/-5.41     | -6.09/-5.94     | -5.63/-5.45     | -5.44/-5.67     | -6.06/-5.99     | -5.62/-5.43     | -4.16/-3.02     | -2.05/-1.45     | -1.44/-1.48     | -1.23/-1.16     |
| Θ (20°)  | 1.01/0.70    | -0.13/-0.68   | -1.11/-1.10   | -2.28/-3.68   | -6.72/-6.77   | -5.80/-5.41     | -5.08/-5.41     | -6.16/-7.62     | -9.12/-8.91     | -8.87/-10.66    | -11.80/-12.46   | -11.49/-9.56    | -7.99/-6.70     | -5.07/-5.02     | -3.98/-2.00     | -0.32/0.28      | 0.33/0.56       | 0.83/0.71       |
| Θ (30°)  | 0.52/-0.04   | -1.85/-3.42   | -2.91/-2.32   | -3.95/-5.37   | -4.67/-3.16   | -3.30/-3.32     | -4.01/-6.04     | -7.83/-8.60     | -9.35/-10.48    | -10.57/-11.25   | -11.41/-11.75   | -11.83/-6.90    | -3.34/-2.30     | -2.89/-1.37     | 0.34/1.00       | 1.62/1.52       | 0.47/-0.46      | -0.81/-0.30     |
| Θ (40°)  | -0.10/0.23   | -0.79/-1.86   | -1.99/-2.54   | -5.52/-6.24   | -6.00/-5.86   | -5.51/-5.29     | -4.57/-2.94     | -2.39/-3.89     | -7.66/-12.69    | -11.99/-10.26   | -8.53/-7.75     | -10.21/-7.16    | -2.04/-0.42     | -0.95/-2.01     | -0.06/2.13      | 2.22/1.88       | 1.72/2.21       | 1.49/0.18       |
| Θ (50°)  | -0.00/-1.27  | -1.76/-2.04   | -3.20/-6.86   | -7.55/-6.14   | -4.97/-3.79   | -5.71/-8.58     | -5.18/-2.88     | -3.25/-7.24     | -7.97/-8.94     | -12.82/-10.39   | -6.72/-6.22     | -6.18/-5.91     | -3.40/-1.35     | -1.50/-1.36     | 0.51/1.45       | 1.66/1.02       | 1.60/2.66       | 2.20/0.89       |
| Θ (60°)  | -0.67/-0.39  | -1.86/-2.71   | -3.19/-4.94   | -5.34/-2.98   | -3.63/-5.35   | -8.51/-13.54    | -5.84/-3.67     | -4.87/-6.92     | -4.10/-4.74     | -6.80/-4.74     | -5.23/-7.48     | -7.30/-5.59     | -3.31/-1.60     | -1.82/-1.12     | 0.21/0.77       | 0.50/0.30       | 0.64/1.33       | 0.78/-0.77      |
| Θ (70°)  | -0.68/-0.77  | -1.63/-0.70   | -0.84/-3.27   | -2.19/-1.27   | -1.65/-5.07   | -3.57/-3.64     | -4.15/-3.83     | -2.18/-1.16     | 0.20/-1.35      | -3.89/-5.31     | -4.09/-4.95     | -6.78/-2.98     | -1.25/-0.09     | 0.09/-0.49      | -0.14/0.75      | 0.13/0.83       | 0.33/0.56       | 0.71/0.00       |
| Θ (80°)  | -2.29/-3.01  | -2.50/-2.26   | -3.10/-4.58   | -2.03/-0.77   | -1.73/-1.50   | -1.43/-3.11     | -5.32/-3.90     | -0.42/-0.14     | 0.91/0.05       | -0.29/-6.69     | -5.59/-2.59     | -5.19/-4.71     | 0.32/1.55       | 1.17/0.48       | 0.55/1.42       | -0.56/-0.21     | -0.74/0.45      | 1.41/-0.48      |
| Θ (90°)  | -4.85/-0.97  | -2.86/-4.08   | -5.20/-3.43   | -3.20/-2.27   | -2.53/-2.53   | -0.39/-2.61     | -4.41/0.49      | 0.79/-2.06      | 0.34/-0.95      | 0.62/-4.14      | -5.88/-4.09     | -1.67/-2.46     | -2.27/-0.36     | 0.40/0.41       | -0.45/1.26      | 0.72/-0.26      | -1.39/-1.10     | 0.20/-2.15      |
| Θ (100°) | -4.91/-6.02  | -8.57/-8.02   | -5.03/-7.47   | -7.68/-5.15   | -4.92/-3.18   | -1.36/-4.22     | -3.13/1.33      | 0.36/-5.43      | -0.69/-0.29     | 1.13/-1.40      | -0.27/-0.98     | -2.61/-3.63     | -0.10/-0.83     | -1.06/0.69      | 0.15/-2.38      | 1.21/1.27       | -0.50/-1.30     | -2.17/-3.44     |
| Θ (110°) | -7.38/-6.55  | -6.07/-8.59   | -6.65/-7.21   | -7.54/-7.24   | -8.95/-7.60   | -2.40/-3.20     | -2.69/-4.01     | -3.27/-9.87     | -2.25/-3.50     | -0.14/-0.76     | -2.38/-0.43     | -0.52/-1.57     | -5.24/0.34      | -1.34/0.50      | -0.32/0.91      | -2.06/-0.06     | 0.01/-2.38      | -2.66/-4.93     |
| Θ (120°) | -3.46/-4.87  | -8.45/-9.32   | -8.45/-10.64  | -10.43/-16.85 | -13.00/-11.88 | -6.12/-12.13    | -3.99/-4.94     | -12.47/-2.96    | -1.10/-3.03     | 0.72/0.87       | -5.98/-3.62     | -0.28/2.11      | -0.42/-3.01     | -1.76/-7.21     | -0.35/-2.15     | -1.98/-1.01     | -1.82/-2.45     | -2.98/-1.30     |
| Θ (130°) | -3.74/-6.75  | -9.28/-7.56   | -10.86/-11.41 | -16.67/-10.17 | -9.28/-9.11   | -8.88/-7.32     | -5.52/-2.08     | -9.09/-3.37     | -4.43/-1.72     | -4.05/-3.78     | -3.93/-1.16     | 0.16/-0.12      | -1.44/-2.13     | -0.32/-5.97     | -2.58/-2.99     | -3.44/-9.80     | -2.87/-2.61     | -1.96/-3.14     |
| Θ (140°) | -5.75/-3.92  | -7.40/-12.89  | -11.47/-9.44  | -11.81/-7.13  | -6.55/-10.82  | -7.78/-8.46     | -6.44/-7.06     | -9.24/-8.09     | -2.97/1.10      | -0.53/-1.79     | -3.52/0.42      | -1.21/-0.90     | 0.75/-0.14      | -1.24/-3.32     | -4.81/0.18      | -1.49/-1.32     | -10.86/-9.85    | -5.73/-5.35     |
| Θ (150°) | -9.74/-14.41 | -10.34/-8.46  | -9.95/-8.07   | -5.57/-5.28   | -7.56/-15.38  | -9.35/-6.61     | -7.18/-11.52    | -11.30/-5.94    | -3.07/-2.88     | -5.80/-5.71     | -2.87/-3.27     | -3.70/-1.71     | -1.53/-1.74     | -3.87/-5.19     | -7.03/-3.08     | -2.87/-5.48     | -5.64/-6.66     | -5.64/-7.43     |
| Θ (160°) | -3.40/-2.83  | -4.31/-6.58   | -5.74/-4.23   | -3.19/-4.40   | -7.18/-9.90   | -10.33/-10.93   | -13.23/-11.87   | -8.65/-5.33     | -3.10/-2.62     | -3.87/-6.05     | -7.12/-7.99     | -9.06/-7.73     | -5.93/-5.17     | -6.34/-8.85     | -9.48/-6.94     | -5.87/-6.70     | -5.72/-3.44     | -3.28/-3.73     |
| Θ (170°) | -2.76/-5.00  | -6.59/-6.19   | -6.13/-6.78   | -8.83/-12.47  | -11.98/-8.03  | -6.27/-5.04     | -4.68/-5.16     | -6.22/-8.01     | -10.06/-10.90   | -9.77/-8.95     | -8.85/-8.85     | -8.97/-9.11     | -9.07/-9.36     | -8.42/-6.99     | -7.25/-6.88     | -5.59/-4.29     | -3.09/-2.34     | -1.40/-1.49     |
| Θ (180°) | -4.87/-2.68  | -2.55/-3.16   | -3.62/-4.77   | -5.58/-5.68   | -6.43/-6.51   | -6.17/-5.58     | -4.74/-4.52     | -4.25/-4.31     | -4.18/-3.76     | -3.47/-3.61     | -3.82/-3.88     | -3.48/-3.13     | -3.05/-2.85     | -2.17/-1.99     | -2.36/-2.85     | -3.56/-4.31     | -4.58/-5.85     | -6.25/-6.45     |

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  $\Theta(0-180)\Phi(270)$ 







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  $\Theta(0-180)\Phi(270)$

