



Antenna Composite Gain Test Report

Equipment	WiFi 7 Tri-radio concurrent indoor ceiling mount AP
Brand Name	Senao
Model Name	IAP4701A
Applicant	Senao Networks, Inc. 3F., No.529, Zhongzheng Rd., Xindian Dist., New Taipei City, Taiwan
Manufacturer	Senao Networks, Inc. 3F., No.529, Zhongzheng Rd., Xindian Dist., New Taipei City, Taiwan
Standard	KDB 662911 D03 v01
Sample Received	Oct. 31, 2023
Start Test Date	Nov. 03, 2023
Final Test Date	Nov. 04, 2023



Approved by: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory

No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
AP381814	01	Initial issue of report	Feb. 01, 2024



1. Operation Mode and Antenna Information

Antenna Position	RF Port	Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
2G Ant1	1	Senao	5718A0738300	PIFA	I-Pex	2.4G
2G Ant2	2	Senao	5718A0739300	PIFA	I-Pex	2.4G
2G Ant3	3	Senao	5718A0740300	PIFA	I-Pex	2.4G
2G Ant4	4	Senao	5718A0741300	PIFA	I-Pex	2.4G
5G Ant1	1	Senao	5718A0742300	PIFA	I-Pex	5G
5G Ant2	2	Senao	5718A0743300	PIFA	I-Pex	5G
5G Ant3	3	Senao	5718A0744300	PIFA	I-Pex	5G
5G Ant4	4	Senao	5718A0745300	PIFA	I-Pex	5G
6G Ant1	1	ADVANCED WIRELESS & ANTENNA Inc.	A8P8P-100089	Alford loop	I-Pex	6G
6G Ant2	2	ADVANCED WIRELESS & ANTENNA Inc.	A8P8P-100090	Alford loop	I-Pex	6G
6G Ant3	3	ADVANCED WIRELESS & ANTENNA Inc.	A8P8P-100091	Alford loop	I-Pex	6G
6G Ant4	4	ADVANCED WIRELESS & ANTENNA Inc.	A8P8P-100092	Alford loop	I-Pex	6G

Note:

2.4GHz Operation Mode (4TX/4RX)

2G Ant1, 2G Ant2, 2G Ant3 and 2G Ant4 could transmit/receive simultaneously.

5GHz Operation Mode (4TX/4RX)

5G Ant1, 5G Ant2, 5G Ant3 and 5G Ant4 could transmit/receive simultaneously.

6GHz Operation Mode (4TX/4RX)

6G Ant1, 6G Ant2, 6G Ant3 and 6G Ant4 could transmit/receive simultaneously.

2. Test Frequency

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

Band [MHz]	Test Frequency [MHz]
2400-2483.5	2400, 2450, 2483.5
5150-5250	5200
5250-5350	5300
5470-5725	5600
5725-5850	5785
5925-6425	6175
6425-6525	6475
6525-6875	6695
6875-7125	6995



3. Testing Location

Test Lab. : Sporton International Inc. Hsinhua Laboratory				
<input checked="" type="checkbox"/> Wen 33rd.St.	ADD:	No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)		
	TEL: 886-3-318-0787	FAX: 886-3-318-0287		
Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	05CH03-HY	Rex Liao	23.5~24.5°C/50~55%	Nov. 03, 2023~ Nov. 04, 2023

Note:

Testing Site Information

Brand Name: TDK

Dimension: 11m*6m*6m

Characteristic: Fully Anechoic Chamber

4. Test Facility and Configuration

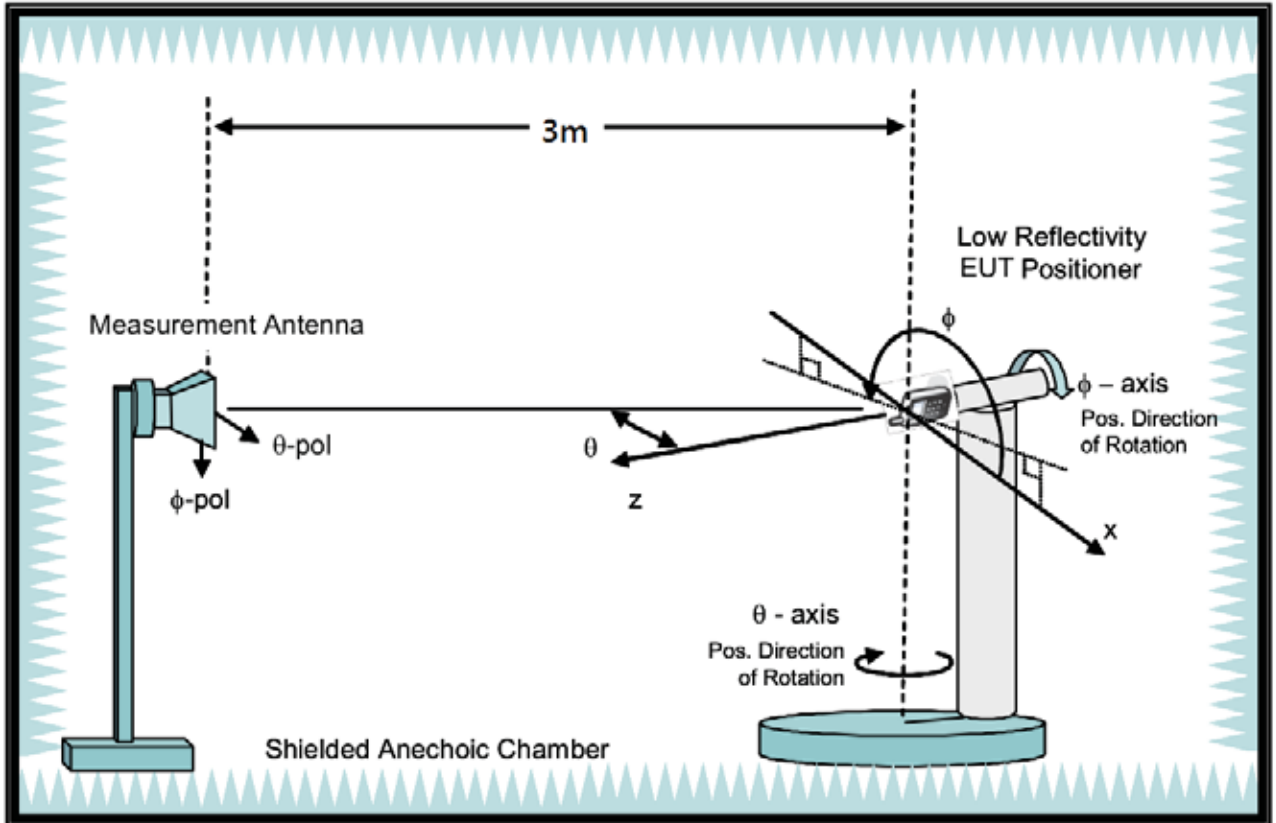
Test configuration: Reference to CITA OTA distributed-axes system configuration.

Chamber: Fully Anechoic Chamber.

Measurement antenna: Dual Polarization Horn antenna

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

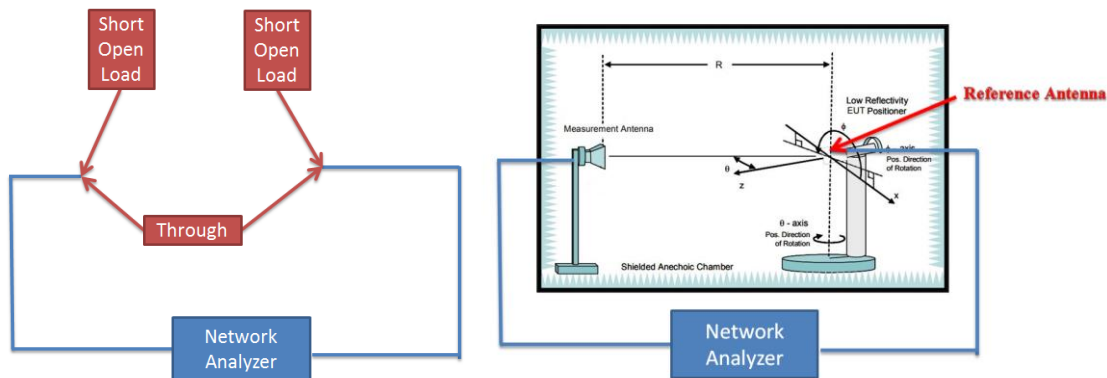
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



5. 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	7200
G(theta) reading (dB)	-33.75	-33.64	-32.91	-32.21	-32.45	-32.33	-32.57	-32.94	-32.78	-33.35	-32.91	-33.81	-34.54	-35.64
G(phi) reading (dB)	-33.19	-32.12	-32.48	-32.51	-32.64	-31.68	-32.24	-32.45	-32.45	-32.85	-32.45	-33.62	-34.48	-35.24
Reference gain (dBi)	10	10.4	10.6	12.3	12.5	13.3	13.3	13.2	13.1	13	13.2	12.4	11.8	11.1
Factor(theta) (dB)	43.75	44.04	43.51	44.51	44.95	45.63	45.87	46.14	45.88	46.35	46.11	46.21	46.34	46.74
Factor(phi) (dB)	43.19	42.52	43.08	44.81	45.14	44.98	45.54	45.65	45.55	45.85	45.65	46.02	46.28	46.34

Note:

$$G \text{ reading (dB)} = 20 \cdot \log(V2/V1) = 10 \cdot \log(P2/P1)$$

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.

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



6. 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 7.5 degree from 0 to 352.5 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 7 tables.

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



7. Measured Values and Calculation of Maximum Gain Positions

DG_1SS max value position

Frequency (Hz)	2.4G	2.45G	2.4835G
Ant. 1 (dBi)	2.6	-0.46	-2.96
Ant. 2 (dBi)	-2.91	-0.5	0.21
Ant. 3 (dBi)	-2.52	2.29	0.88
Ant. 4 (dBi)	-1.74	-0.69	2.69
DG [1SS] (dBi)	5.18	6.27	6.46
Polarization	Theta	Theta	Theta
$\Theta(^{\circ})$	15	60	52.5
$\Phi(^{\circ})$	292.5	45	135

Note: The DG 1SS max value position is the maximum value of section 11 table DG 1SS Result.

DG_1SS max value position calculation

Frequency (Hz)	2.4G	2.45G	2.4835G
Ant. 1 [$10^{(G/20)}$]	$10^{(2.6/20)}$	$10^{(-0.46/20)}$	$10^{(-2.96/20)}$
Ant. 2 [$10^{(G/20)}$]	$10^{(-2.91/20)}$	$10^{(-0.5/20)}$	$10^{(0.21/20)}$
Ant. 3 [$10^{(G/20)}$]	$10^{(-2.52/20)}$	$10^{(2.29/20)}$	$10^{(0.88/20)}$
Ant. 4 [$10^{(G/20)}$]	$10^{(-1.74/20)}$	$10^{(-0.69/20)}$	$10^{(2.69/20)}$
Ant. 1 [$10^{(G/20)}$] value	1.349	0.948	0.711
Ant. 2 [$10^{(G/20)}$] value	0.715	0.944	1.024
Ant. 3 [$10^{(G/20)}$] value	0.748	1.302	1.107
Ant. 4 [$10^{(G/20)}$] value	0.818	0.924	1.363
Sum All Antenna [Amax]	3.631	4.118	4.205
DG [$10 \cdot \log(A_{max}^2/N_{ant})$]	5.18	6.27	6.46

Note:

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

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



DG_1SS max value position

Frequency (Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 (dBi)	-0.01	3.87	5.45	4.73
Ant. 2 (dBi)	-0.96	1.21	4.39	4.94
Ant. 3 (dBi)	2.99	-0.88	-0.26	-0.29
Ant. 4 (dBi)	2.51	1.32	-1.28	1.07
DG [1SS] (dBi)	7.31	7.57	8.57	8.92
Polarization	Theta	Theta	Theta	Theta
$\Theta(^{\circ})$	67.5	75	75	67.5
$\Phi(^{\circ})$	22.5	217.5	150	150

Note: The DG 1SS max value position is the maximum value of section 11 table DG 1SS Result.

DG_1SS max value position calculation

Frequency (Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 [$10^{(G/20)}$]	$10^{(-0.01/20)}$	$10^{(3.87/20)}$	$10^{(5.45/20)}$	$10^{(4.73/20)}$
Ant. 2 [$10^{(G/20)}$]	$10^{(-0.96/20)}$	$10^{(1.21/20)}$	$10^{(4.39/20)}$	$10^{(4.94/20)}$
Ant. 3 [$10^{(G/20)}$]	$10^{(2.99/20)}$	$10^{(-0.88/20)}$	$10^{(-0.26/20)}$	$10^{(-0.29/20)}$
Ant. 4 [$10^{(G/20)}$]	$10^{(2.51/20)}$	$10^{(1.32/20)}$	$10^{(-1.28/20)}$	$10^{(1.07/20)}$
Ant. 1 [$10^{(G/20)}$] value	0.999	1.561	1.873	1.724
Ant. 2 [$10^{(G/20)}$] value	0.895	1.149	1.658	1.766
Ant. 3 [$10^{(G/20)}$] value	1.411	0.904	0.971	0.967
Ant. 4 [$10^{(G/20)}$] value	1.335	1.164	0.863	1.131
Sum All Antenna [Amax]	4.64	4.779	5.364	5.588
DG [$10 \cdot \log(A_{max}^2/N_{ant})$]	7.31	7.57	8.57	8.92

Note:

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

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



DG_1SS max value position

Frequency (Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 (dBi)	4.72	4.14	4.94	4.45
Ant. 2 (dBi)	4.22	4.46	2.35	4.54
Ant. 3 (dBi)	4.1	3.77	2.68	2.83
Ant. 4 (dBi)	2.68	3.2	3.84	3.42
DG [1SS] (dBi)	9.98	9.93	9.53	9.86
Polarization	Phi	Phi	Phi	Phi
$\Theta(^{\circ})$	60	60	45	52.5
$\Phi(^{\circ})$	307.5	300	285	262.5

Note: The DG 1SS max value position is the maximum value of section 11 table DG 1SS Result.

DG_1SS max value position calculation

Frequency (Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 [10^(G/20)]	10^(4.72/20)	10^(4.14/20)	10^(4.94/20)	10^(4.45/20)
Ant. 2 [10^(G/20)]	10^(4.22/20)	10^(4.46/20)	10^(2.35/20)	10^(4.54/20)
Ant. 3 [10^(G/20)]	10^(4.1/20)	10^(3.77/20)	10^(2.68/20)	10^(2.83/20)
Ant. 4 [10^(G/20)]	10^(2.68/20)	10^(3.2/20)	10^(3.84/20)	10^(3.42/20)
Ant. 1 [10^(G/20)] value	1.722	1.611	1.766	1.669
Ant. 2 [10^(G/20)] value	1.626	1.671	1.311	1.687
Ant. 3 [10^(G/20)] value	1.603	1.543	1.361	1.385
Ant. 4 [10^(G/20)] value	1.361	1.445	1.556	1.483
Sum All Antenna [Amax]	6.312	6.271	5.994	6.223
DG [10*log(Amax^2/Nant)]	9.98	9.93	9.53	9.86

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*log(10^(G_{ant1}/20)+10^(G_{ant2}/20)+ +10^(G_{ant3}/20) +10^(G_{ant4}/20)+.....)^2/N_{ant})



8. Summary of Test Result

2G Ant.

Freq(Hz)	2.4G	2.45G	2.4835G
Ant. 1 Max Gain (dBi)	2.71	2.64	2.82
Ant. 2 Max Gain (dBi)	2.38	2.35	2.39
Ant. 3 Max Gain (dBi)	2.01	2.29	2.33
Ant. 4 Max Gain (dBi)	2.17	2.32	2.69
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/15/300	Phi/30/67.5	Theta/60/172.5
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/45/210	Theta/60/112.5	Theta/52.5/120
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/22.5/255	Theta/60/45	Phi/22.5/262.5
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/22.5/30	Phi/30/172.5	Theta/52.5/135
Max Gain (dBi)	2.71	2.64	2.82
DG [1SS] (dBi)	5.18	6.27	6.46
DG [2SS] (dBi)	2.71	3.27	3.46
DG [4SS] (dBi)	2.71	2.64	2.82

5G Ant.

Freq(Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	4.81	4.19	5.45	4.98
Ant. 2 Max Gain (dBi)	2.63	3.44	5.31	5.17
Ant. 3 Max Gain (dBi)	5.06	5.29	4.27	3.96
Ant. 4 Max Gain (dBi)	3.72	3.52	4.66	4.51
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/52.5/292.5	Theta/60/345	Theta/75/150	Theta/52.5/307.5
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/52.5	Theta/75/150	Theta/60/150	Theta/60/150
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/52.5/112.5	Theta/67.5/7.5	Theta/75/22.5	Theta/60/52.5
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/60/22.5	Theta/75/315	Theta/67.5/232.5	Theta/75/322.5
Max Gain (dBi)	5.06	5.29	5.45	5.17
DG [1SS] (dBi)	7.31	7.57	8.57	8.92
DG [2SS] (dBi)	5.06	5.29	5.57	5.92
DG [4SS] (dBi)	5.06	5.29	5.45	5.17



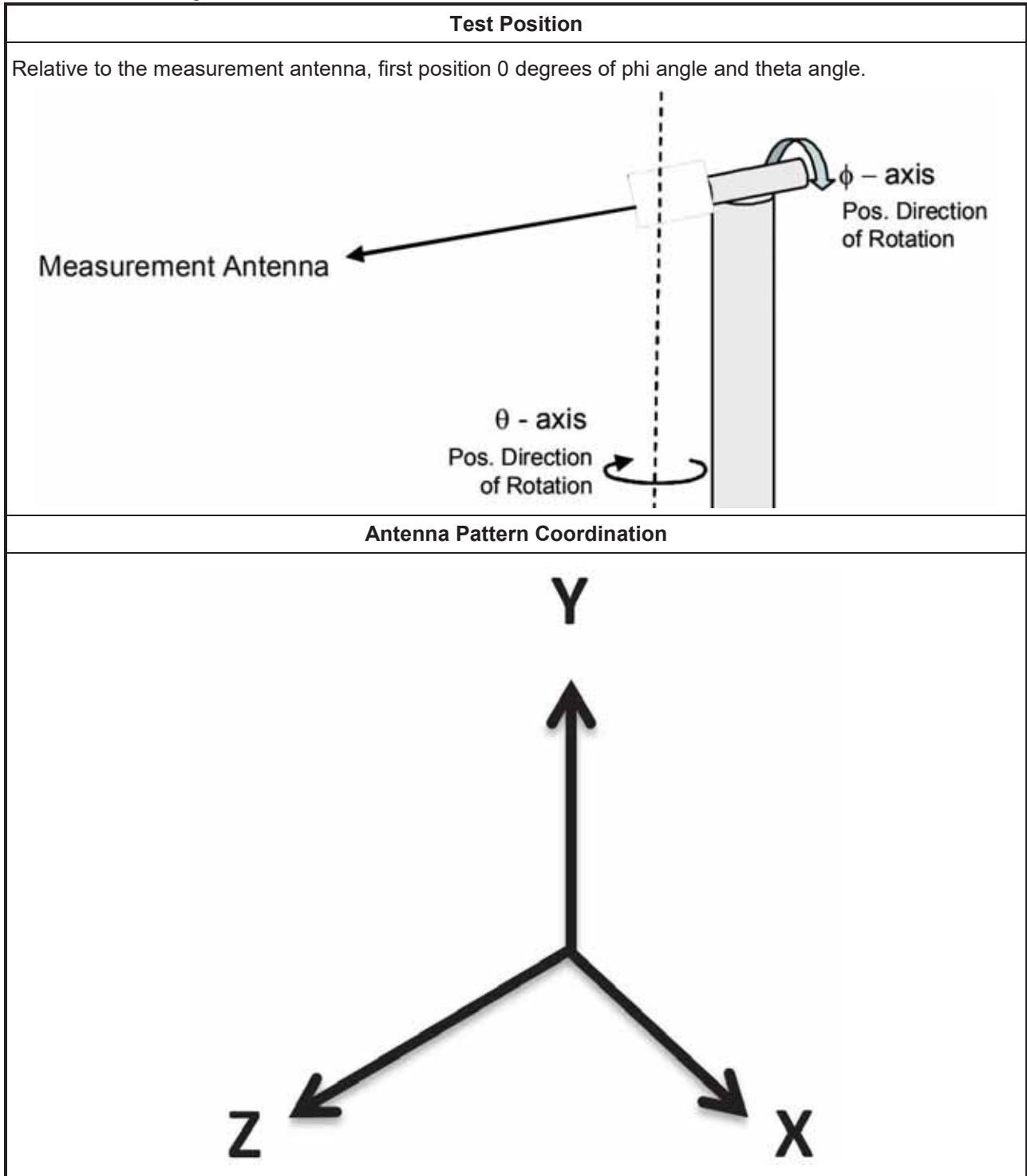
6G Ant.

Freq(Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.96	4.99	4.98	4.78
Ant. 2 Max Gain (dBi)	4.72	4.74	4.53	4.69
Ant. 3 Max Gain (dBi)	4.88	4.63	4.47	4.94
Ant. 4 Max Gain (dBi)	4.77	4.84	4.61	4.26
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/60/322.5	Phi/45/277.5	Phi/45/277.5	Phi/45/285
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/37.5/270	Phi/75/262.5	Phi/75/285	Phi/67.5/292.5
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/75/307.5	Phi/75/285	Phi/75/300	Phi/82.5/300
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/45/322.5	Phi/52.5/307.5	Phi/52.5/300	Phi/45/277.5
Max Gain (dBi)	4.96	4.99	4.98	4.94
DG [1SS] (dBi)	9.98	9.93	9.53	9.86
DG [2SS] (dBi)	6.98	6.93	6.53	6.86
DG [4SS] (dBi)	4.96	4.99	4.98	4.94

Note:

1. Antenna max gain is the max value of each individual antenna 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. Refer to KDB662911D01 (F) (2) (e) (ii)
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain. Refer to KDB662911D01 (F) (2) (e) (ii)

9. Test Setup



Note:

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



10. Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1543	1GHz~18GHz	May 11, 2023	May 10, 2024
Dual Polarization Horn Antenna	Sporton	S0209DP	S0209DP-001	2GHz~9GHz	N.C.R.	N.C.R.
ENA Series Network Analyzer	AGILENT	E5071C	MY46419477	100kHz~8.5GHz	Jul. 28, 2023	Jul. 27, 2024
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	V1.0.8	-	N.C.R.	N.C.R.

Note: Calibration Interval of instruments listed above is one year. NCR means Non-Calibration required.



11. Test Results

Please refer to the appendix.

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————THE END————



Radiated Composite Gain Data of 2.4GHz

Appendix A

Freq(Hz)	2.4G	2.45G	2.4835G
Ant. 1 Max Gain (dBi)	2.71	2.64	2.82
Ant. 2 Max Gain (dBi)	2.38	2.35	2.39
Ant. 3 Max Gain (dBi)	2.01	2.29	2.33
Ant. 4 Max Gain (dBi)	2.17	2.32	2.69
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/15/300	Phi/30/67.5	Theta/60/172.5
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/45/210	Theta/60/112.5	Theta/52.5/120
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/22.5/255	Theta/60/45	Phi/22.5/262.5
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/22.5/30	Phi/30/172.5	Theta/52.5/135
Max Gain (dBi)	2.71	2.64	2.82
DG [1SS] (dBi)	5.18	6.27	6.46
DG [2SS] (dBi)	2.71	3.27	3.46
DG [4SS] (dBi)	2.71	2.64	2.82

Radiated Composite Gain Data of 2.4GHz

Appendix A

Gain Result

Table with columns: Freq(Hz), Pth(Watt), and Gain (dBi) for various parameters across different gain levels. The table is organized into multiple sections (Gain 1 to Gain 4) and contains numerical data for each parameter combination.

Sporton International Inc.



Radiated Composite Gain Data of 2.4GHz

Appendix A

Gain	0°/0°/0°	0°/0°/90°	0°/0°/180°	0°/0°/270°	0°/90°/0°	0°/90°/90°	0°/90°/180°	0°/90°/270°	0°/180°/0°	0°/180°/90°	0°/180°/180°	0°/180°/270°	0°/270°/0°	0°/270°/90°	0°/270°/180°	0°/270°/270°	90°/0°/0°	90°/0°/90°	90°/0°/180°	90°/0°/270°	90°/90°/0°	90°/90°/90°	90°/90°/180°	90°/90°/270°	90°/180°/0°	90°/180°/90°	90°/180°/180°	90°/180°/270°	90°/270°/0°	90°/270°/90°	90°/270°/180°	90°/270°/270°	180°/0°/0°	180°/0°/90°	180°/0°/180°	180°/0°/270°	180°/90°/0°	180°/90°/90°	180°/90°/180°	180°/90°/270°	180°/180°/0°	180°/180°/90°	180°/180°/180°	180°/180°/270°	270°/0°/0°	270°/0°/90°	270°/0°/180°	270°/0°/270°	270°/90°/0°	270°/90°/90°	270°/90°/180°	270°/90°/270°	270°/180°/0°	270°/180°/90°	270°/180°/180°	270°/180°/270°																																																																																																																																																																						
(H120)	-11.55±2.25	-12.40±18.01	-10.77±11.99	-19.21±11.78	8.08±12.12	-17.56±22.52	-13.18±18.68	-18.47±15.55	-17.34±17.89	-18.23±18.15	-15.65±14.16	-14.81±18.77	-15.20±17.74	-18.36±19.16	-19.42±18.48	-18.80±15.16	-12.72±11.4	-12.12±15.07	-16.88±12.82	-8.31±2.25	-4.36±4.61	-7.87±8.48	8.66±12.74	-18.65±16.97	(H121)	8.55±6.88	-11.34±13.3	-10.88±11.53	-18.18±14.58	-11.95±14.4	-18.96±14.24	-13.97±12.15	-17.88±13.11	-16.88±19.38	-17.61±18.1	-17.04±12.2	-12.44±15.2	-18.78±17.28	-18.33±16.55	-18.96±18.88	-14.88±13.1	-12.26±12.7	-14.73±19.23	-18.16±14.33	-10.54±9	-8.61±9.66	6.35±9.82	8.95±10.73	-11.27±8.52	(H130)	6.46±7.86	-10.88±14.75	-14.39±15.61	-18.56±16.69	-13.36±15.29	-17.10±9.8	-15.89±16.05	-13.24±11.69	-11.05±12.91	-16.05±19.13	-17.34±13.82	-12.71±6.22	-17.93±17.82	-18.83±18.34	-17.34±19.49	-14.72±13.81	-14.15±15.44	-17.81±16.41	-18.16±15.15	-11.33±9.82	-8.69±9.68	9.33±9.24	-7.41±7.16	-18.06±16.62	(H140)	8.18±10.63	-15.22±16.06	-19.11±8.1	-18.62±16.33	-14.84±14.64	-15.96±14.4	-15.26±12.24	-13.71±11.1	-11.11±10.2	-13.54±17.96	-17.78±18.79	-13.32±13.71	-17.79±16.1	-18.93±19.76	-18.31±17.64	-18.42±19.56	-17.04±18.82	-17.91±15.72	-18.76±14.12	-10.92±9.21	-8.43±9.05	7.63±9.64	6.48±6.61	-6.84±1.8	(H150)	-18.16±18.82	-18.74±18.38	-15.24±16.13	-18.85±19.94	-18.81±18.8	-18.88±11.2	-16.32±13.68	-12.22±11.13	-10.76±10.5	-11.57±11.62	-15.88±16.96	-15.24±15.43	-16.43±18.02	-18.38±18.91	-18.85±18.56	-18.98±17.8	-17.26±17.57	-17.93±17.64	-15.67±10.37	-10.74±9.42	-8.88±8.67	-7.71±9.1	-8.74±11.8	-10.98±14.62	(H160)	-15.92±13.4	-12.21±13.4	-13.81±17.1	-18.25±17.95	-18.38±19.6	-17.76±18.4	-16.23±14.9	-11.63±10.29	8.62±9.7	-10.51±18.5	-12.64±12.33	-11.89±12.25	-12.96±13.93	-15.29±13.71	-19.26±17.86	-18.47±18.07	-18.87±13.31	-17.88±18.63	-18.47±17.87	-15.88±14.89	-14.37±14.67	-15.52±17.2	-17.93±18.4	-18.76±18.16	(H170)	-14.07±13.67	-15.62±19.63	-15.62±19.02	-18.12±14.82	-17.61±17.82	-17.76±18.14	-16.32±14.19	-11.21±12.16	-12.99±13.73	-13.86±12.26	-12.87±12.88	-14.56±12.57	-14.79±16.52	-17.09±16.87	-17.17±16.08	-18.29±18.38	-18.68±18.08	-18.13±18.5	-17.54±18.31	-17.66±18.51	-17.40±18.29	-17.66±18.51	-18.07±19.24	-18.16±18.16	(H180)	-17.52±19.37	-17.95±19.37	-17.95±19.37	-18.38±18.1	-17.67±18.14	-17.41±16.1	-15.71±14.61	-14.26±14.34	-14.94±15.68	-16.21±14.47	-16.21±15.63	-15.24±14.68	-14.76±14.15	-15.51±17.52	-15.98±19.86	-17.36±19.84	-18.96±18.4	-18.71±17.99	-19.70±18.06	-17.88±19.37	-18.53±19.37	-18.33±19.15	-18.22±19.04	(H190)	-18.84±17.91	-17.93±17.85	-17.93±17.85	-18.89±18.28	-18.61±17.73	-18.78±17.1	-15.38±14.64	-14.29±14.59	-15.99±16.2	-16.58±17.47	-15.91±14.6	-13.91±13.43	-13.34±13.67	-13.56±16.66	-16.77±17.77	-18.41±17.88	-18.29±17.27	-18.59±17.97	-18.17±18.65	-18.11±17.48	-18.79±17.94	-18.64±18.4	-17.98±18.2



Radiated Composite Gain Data of 5GHz

Appendix B

Freq(Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	4.81	4.19	5.45	4.98
Ant. 2 Max Gain (dBi)	2.63	3.44	5.31	5.17
Ant. 3 Max Gain (dBi)	5.06	5.29	4.27	3.96
Ant. 4 Max Gain (dBi)	3.72	3.52	4.66	4.51
Ant. 1 Polarization/ θ (°)/ ϕ (°)	Theta/52.5/292.5	Theta/60/345	Theta/75/150	Theta/52.5/307.5
Ant. 2 Polarization/ θ (°)/ ϕ (°)	Theta/75/52.5	Theta/75/150	Theta/60/150	Theta/60/150
Ant. 3 Polarization/ θ (°)/ ϕ (°)	Theta/52.5/112.5	Theta/67.5/7.5	Theta/75/22.5	Theta/60/52.5
Ant. 4 Polarization/ θ (°)/ ϕ (°)	Theta/60/22.5	Theta/75/315	Theta/67.5/232.5	Theta/75/322.5
Max Gain (dBi)	5.06	5.29	5.45	5.17
DG [1SS] (dBi)	7.31	7.57	8.57	8.92
DG [2SS] (dBi)	5.06	5.29	5.57	5.92
DG [4SS] (dBi)	5.06	5.29	5.45	5.17



Radiated Composite Gain Data of 5GHz

Appendix B

Table with columns for frequency (MHz), gain (dBi), and various gain data points. The table is organized into sections for different antenna types: 5.020Pha, 5.030Pha, 5.040Pha, 5.050Pha, 5.060Pha, 5.070Pha, 5.080Pha, 5.090Pha, 5.100Pha, 5.110Pha, 5.120Pha, 5.130Pha, 5.140Pha, 5.150Pha, 5.160Pha, 5.170Pha, 5.180Pha, 5.190Pha, 5.200Pha, 5.210Pha, 5.220Pha, 5.230Pha, 5.240Pha, 5.250Pha, 5.260Pha, 5.270Pha, 5.280Pha, 5.290Pha, 5.300Pha, 5.310Pha, 5.320Pha, 5.330Pha, 5.340Pha, 5.350Pha, 5.360Pha, 5.370Pha, 5.380Pha, 5.390Pha, 5.400Pha, 5.410Pha, 5.420Pha, 5.430Pha, 5.440Pha, 5.450Pha, 5.460Pha, 5.470Pha, 5.480Pha, 5.490Pha, 5.500Pha, 5.510Pha, 5.520Pha, 5.530Pha, 5.540Pha, 5.550Pha, 5.560Pha, 5.570Pha, 5.580Pha, 5.590Pha, 5.600Pha, 5.610Pha, 5.620Pha, 5.630Pha, 5.640Pha, 5.650Pha, 5.660Pha, 5.670Pha, 5.680Pha, 5.690Pha, 5.700Pha, 5.710Pha, 5.720Pha, 5.730Pha, 5.740Pha, 5.750Pha, 5.760Pha, 5.770Pha, 5.780Pha, 5.790Pha, 5.800Pha, 5.810Pha, 5.820Pha, 5.830Pha, 5.840Pha, 5.850Pha, 5.860Pha, 5.870Pha, 5.880Pha, 5.890Pha, 5.900Pha, 5.910Pha, 5.920Pha, 5.930Pha, 5.940Pha, 5.950Pha, 5.960Pha, 5.970Pha, 5.980Pha, 5.990Pha, 6.000Pha. Each section contains multiple rows of data points.



Radiated Composite Gain Data of 5GHz

Appendix B

Table with columns for frequency (GHz) and gain (dBi) for various antenna configurations. The table is organized into sections for different antenna types and frequencies, with each section containing a grid of gain values.



Radiated Composite Gain Data of 5GHz

Appendix B

Table with 44 columns and 30 rows containing radiated composite gain data for 5GHz. The table includes frequency ranges and gain values in dB.



Radiated Composite Gain Data of 5GHz

Appendix B

Frequency (MHz)	31.25/33	33.00/6.77	4.29/5	6.38/7.09	6.79/8.45	5.45/6.91	7.16/4.48	12.02/4.98	4.53/6.44	4.40/6.93	-5.47/11.29	-11.94/2.95	-2.19/5.18	-13.09/6.15	-5.46/11.77	-7.25/2.57	-4.15/2.56	-4.2/2.77	3.15/6.03	-7.63/2.26	-4.96/6.3	-3.42/4.59	-1.61/2.43	-16.91/17.48	
Gain	0.00070757	0.0151902275	0.0303703751	0.0455505225	0.0607306751	0.0759108275	0.09109098	0.1062711325	0.121451285	0.1366314375	0.15181159	0.1669917425	0.182171895	0.1973520475	0.2125322	0.2277123525	0.242892505	0.2580726575	0.27325281	0.2884329625	0.303613115	0.3187932675	0.33397342	0.3491535725	0.364333725
Theta (112.5)	5.56/11.5	-17.46/-12.3	-6.89/4.1	-12.14/8.4	-8.64/3.1	6.32/6.91	8.53/9.1	5.59/6.5	7.3/6.28	-10.57/0.02	-9.96/16.26	-10.96/5.15	-5.76/9.48	-15.5/8.08	-7.24/4.29	-6.67/7.02	-8.99/9.4	8.14/7.78	-6.85/12.72	-10.47/4.48	-5.23/9.59	-6.89/5.63	-5.23/7.24	9.96/9	-10.52/13.92
Theta (120)	6.06/6.59	-15.82/-11.52	-6.04/9.37	-11.49/11.11	-7.81/7.99	9.24/4.36	9.4/6.65	-11.99/7.92	-8.35/11.61	6.54/12.22	6.11/7.09	7.91/10.57	-19.29/9.84	-5.37/8.1	-7.71/10.31	-8.89/9.06	4.81/7.04	-10.84/-10.12	-10.81/4.87	-6.02/12.46	4.24/5.72	-5.91/8.96	-10.52/13.92		
Theta (127.5)	5.15/5.81	-12.15/-16.74	9.52/-12.16	-15.99/8.9	8.71/12.44	-10.59/8.54	-13.14/11.72	12.74/-12.41	9.59/9.84	-14.45/12.64	-8.46/11.87	-7.7/8.81	7.49/15.16	-17.47/11.29	-6.56/12.69	-10.85/8.48	-8.87/8.66	2.77/10.51	-17.14/-7.07	-10.89/3.1	-18.65/8.5	-7.93/8.67	-9.86/12.13	-12.17/12.98	
Theta (135)	6.54/10.53	-17.82/-16.66	-12.76/-14.2	-17.53/-12.16	8.37/11.03	-11.53/-9.03	-10.24/-14.57	12.66/-11.2	5.87/9.27	-17.62/-17.87	-17.24/-17.84	-13.69/-11.64	-15.79/-16.65	-18.27/12.81	-6.76/13.92	-14.59/8.54	-17.86/17.58	7.3/17.29	-18.44/-6.07	-12.78/-16.43	-12.18/13	8.61/8.45	-7.16/14	-16.33/-14.25	
Theta (142.5)	6.74/9.72	-11.18/-14.38	-14.69/-12.08	-15.44/-14.1	-10.48/9.87	-12.78/-16.66	-13.51/-15.52	-18.76/-18.09	-9.23/11.55	-18.96/-14.25	-17.23/14.9	8.74/-10.4	7.84/12.27	-15.92/14.14	-17.16/-19.28	-14.49/-14.56	-14.89/-10.78	-14.78/-13.88	6.59/8.06	-7.57/5.54	-10.26/-17.61	8.63/9.49	-11.03/-11.88	-15.07/18.79	-16.81/11.9
Theta (150)	6.36/9.85	-15.49/-17.05	-13.52/-15.06	-18.31/-17.77	-13.78/9.84	-8.19/7.98	-10.34/-13.37	-14.05/-11.5	8.14/8.55	-11.69/-14.89	-17.89/16.42	-18.99/-12.86	-13.82/-14.26	-16.78/17.65	-11.62/18.23	-14.49/-14.92	-14.89/-10.88	-8.99/12.28	-16.84/13.85	-16.39/-13.82	-19.29/-18.17	-18.94/16.15	-9.54/15.1		
Theta (157.5)	-16.96/-13.89	-12.32/14.07	-16.62/-18.49	-18.86/-14.53	-11.16/8.69	-7.41/7.31	8.59/10.15	-12.51/14.59	-15.32/13.88	-11.15/-10.57	-12.34/-18	-12.38/14.17	-18.34/-12.63	-12.03/-18.46	-15.12/19.28	-18.99/-18.94	-18.91/17.89	-18.59/15.82	-15.12/-14.54	-15.81/11.94	-12.72/-15.74	-19.16/17.6	-18.56/13.42	-17.17/18.21	-14.11/16.61
Theta (165)	-11.81/12.35	-12.84/14.57	-18.4/-18.84	-17.39/-18.69	-17.19/13.04	-13.62/-14.21	-13.98/11.15	-10.98/11.78	-11.96/12.54	-12.84/-12.37	-12.84/-12.37	-13.96/-15.12	-14.42/-13.29	-14.81/16.32	-12.9/13.36	-14.14/14.48	-13.46/11.41	-11.48/13.25	-12.61/11.94	-12.72/-15.74	-19.16/17.6	-18.56/13.42	-17.17/18.21		
Theta (172.5)	11.32/11.1	8.48/8.85	8.6/8.45	-11.17/14.34	-18.57/17.73	-17.53/-13.52	-11.93/11.3	-12.16/15.09	-15.77/14.83	-12.99/12.16	-14.01/16.85	-18.87/16.72	-13.86/12.35	-12.23/13.82	-16.28/-16.28	-16.2/-16.84	-18.11/16.89	-18.74/16.48	-19.16/18.79	-18.62/18.46	-18.42/18.46	-18.23/16.63	-19.11/17.73	-13.77/11.55	
Theta (180)	18.03/16.74	17.58/16.89	-18.16/18.22	-18.19/17.88	-18.13/18.68	-18.4/-17.9	-17.28/18.07	-18.25/18.61	-18.71/17.78	-19.21/18.92	-18.66/18.72	-11.62/10.92	-11.23/11.07	-12.77/14.08	-14.44/13.54	-13.9/13.36	-18.86/17.5	-19.08/18.06	-17.79/17.82	-17.71/17.84	-17.58/15.94	-16.69/15.2	-14.89/15.45		
FreqHz	5.78529Pa	Psi=1.4																							



Radiated Composite Gain Data of 6GHz

Appendix C

Freq(Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.96	4.99	4.98	4.78
Ant. 2 Max Gain (dBi)	4.72	4.74	4.53	4.69
Ant. 3 Max Gain (dBi)	4.88	4.63	4.47	4.94
Ant. 4 Max Gain (dBi)	4.77	4.84	4.61	4.26
Ant. 1 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/60/322.5	Phi/45/277.5	Phi/45/277.5	Phi/45/285
Ant. 2 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/37.5/270	Phi/75/262.5	Phi/75/285	Phi/67.5/292.5
Ant. 3 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/75/307.5	Phi/75/285	Phi/75/300	Phi/82.5/300
Ant. 4 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/45/322.5	Phi/52.5/307.5	Phi/52.5/300	Phi/45/277.5
Max Gain (dBi)	4.96	4.99	4.98	4.94
DG [1SS] (dBi)	9.98	9.93	9.53	9.86
DG [2SS] (dBi)	6.98	6.93	6.53	6.86
DG [4SS] (dBi)	4.96	4.99	4.98	4.94



Radiated Composite Gain Data of 6GHz

Appendix C

Gain Result

Freq(Hz)	A(759dBS)	Phi(Val. 1)	Phi(Val. 2)	Phi(Val. 3)	Phi(Val. 4)	Phi(Val. 5)	Phi(Val. 6)	Phi(Val. 7)	Phi(Val. 8)	Phi(Val. 9)	Phi(Val. 10)	Phi(Val. 11)	Phi(Val. 12)	Phi(Val. 13)	Phi(Val. 14)	Phi(Val. 15)	Phi(Val. 16)	Phi(Val. 17)	Phi(Val. 18)	Phi(Val. 19)	Phi(Val. 20)	Phi(Val. 21)	Phi(Val. 22)	Phi(Val. 23)	Phi(Val. 24)	Phi(Val. 25)	Phi(Val. 26)	Phi(Val. 27)	Phi(Val. 28)	Phi(Val. 29)	Phi(Val. 30)	Phi(Val. 31)	Phi(Val. 32)	Phi(Val. 33)	Phi(Val. 34)	Phi(Val. 35)	
0(0)	0.07(0.5)	0.15(0.025)	0.10(0.015)	0.07(0.015)	0.05(0.015)	0.03(0.015)	0.02(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	0.01(0.015)	
0(1)	0.01(1)	-0.02(1)	-0.04(1)	-0.06(1)	-0.08(1)	-0.10(1)	-0.12(1)	-0.14(1)	-0.16(1)	-0.18(1)	-0.20(1)	-0.22(1)	-0.24(1)	-0.26(1)	-0.28(1)	-0.30(1)	-0.32(1)	-0.34(1)	-0.36(1)	-0.38(1)	-0.40(1)	-0.42(1)	-0.44(1)	-0.46(1)	-0.48(1)	-0.50(1)	-0.52(1)	-0.54(1)	-0.56(1)	-0.58(1)	-0.60(1)	-0.62(1)	-0.64(1)	-0.66(1)	-0.68(1)	-0.70(1)	-0.72(1)

Sparton International



Radiated Composite Gain Data of 6GHz

Appendix C

	(120)	(121)	(122)	(123)	(124)	(125)	(126)	(127)	(128)	(129)	(130)	(131)	(132)	(133)	(134)	(135)	(136)	(137)	(138)	(139)	(140)	(141)	(142)	(143)	(144)	(145)	(146)	(147)	(148)	(149)	(150)	(151)	(152)	(153)	(154)	(155)	(156)	(157)	(158)	(159)	(160)	(161)	(162)	(163)	(164)	(165)	(166)	(167)	(168)	(169)	(170)	(171)	(172)	(173)	(174)	(175)	(176)	(177)	(178)	(179)	(180)	(181)	(182)	(183)	(184)	(185)	(186)	(187)	(188)	(189)	(190)	(191)	(192)	(193)	(194)	(195)	(196)	(197)	(198)	(199)	(200)	(201)	(202)	(203)	(204)	(205)	(206)	(207)	(208)	(209)	(210)	(211)	(212)	(213)	(214)	(215)	(216)	(217)	(218)	(219)	(220)	(221)	(222)	(223)	(224)	(225)	(226)	(227)	(228)	(229)	(230)	(231)	(232)	(233)	(234)	(235)	(236)	(237)	(238)	(239)	(240)	(241)	(242)	(243)	(244)	(245)	(246)	(247)	(248)	(249)	(250)	(251)	(252)	(253)	(254)	(255)	(256)	(257)	(258)	(259)	(260)	(261)	(262)	(263)	(264)	(265)	(266)	(267)	(268)	(269)	(270)	(271)	(272)	(273)	(274)	(275)	(276)	(277)	(278)	(279)	(280)	(281)	(282)	(283)	(284)	(285)	(286)	(287)	(288)	(289)	(290)	(291)	(292)	(293)	(294)	(295)	(296)	(297)	(298)	(299)	(300)	(301)	(302)	(303)	(304)	(305)	(306)	(307)	(308)	(309)	(310)	(311)	(312)	(313)	(314)	(315)	(316)	(317)	(318)	(319)	(320)	(321)	(322)	(323)	(324)	(325)	(326)	(327)	(328)	(329)	(330)	(331)	(332)	(333)	(334)	(335)	(336)	(337)	(338)	(339)	(340)	(341)	(342)	(343)	(344)	(345)	(346)	(347)	(348)	(349)	(350)	(351)	(352)	(353)	(354)	(355)	(356)	(357)	(358)	(359)	(360)	(361)	(362)	(363)	(364)	(365)	(366)	(367)	(368)	(369)	(370)	(371)	(372)	(373)	(374)	(375)	(376)	(377)	(378)	(379)	(380)	(381)	(382)	(383)	(384)	(385)	(386)	(387)	(388)	(389)	(390)	(391)	(392)	(393)	(394)	(395)	(396)	(397)	(398)	(399)	(400)	(401)	(402)	(403)	(404)	(405)	(406)	(407)	(408)	(409)	(410)	(411)	(412)	(413)	(414)	(415)	(416)	(417)	(418)	(419)	(420)	(421)	(422)	(423)	(424)	(425)	(426)	(427)	(428)	(429)	(430)	(431)	(432)	(433)	(434)	(435)	(436)	(437)	(438)	(439)	(440)	(441)	(442)	(443)	(444)	(445)	(446)	(447)	(448)	(449)	(450)	(451)	(452)	(453)	(454)	(455)	(456)	(457)	(458)	(459)	(460)	(461)	(462)	(463)	(464)	(465)	(466)	(467)	(468)	(469)	(470)	(471)	(472)	(473)	(474)	(475)	(476)	(477)	(478)	(479)	(480)	(481)	(482)	(483)	(484)	(485)	(486)	(487)	(488)	(489)	(490)	(491)	(492)	(493)	(494)	(495)	(496)	(497)	(498)	(499)	(500)	(501)	(502)	(503)	(504)	(505)	(506)	(507)	(508)	(509)	(510)	(511)	(512)	(513)	(514)	(515)	(516)	(517)	(518)	(519)	(520)	(521)	(522)	(523)	(524)	(525)	(526)	(527)	(528)	(529)	(530)	(531)	(532)	(533)	(534)	(535)	(536)	(537)	(538)	(539)	(540)	(541)	(542)	(543)	(544)	(545)	(546)	(547)	(548)	(549)	(550)	(551)	(552)	(553)	(554)	(555)	(556)	(557)	(558)	(559)	(560)	(561)	(562)	(563)	(564)	(565)	(566)	(567)	(568)	(569)	(570)	(571)	(572)	(573)	(574)	(575)	(576)	(577)	(578)	(579)	(580)	(581)	(582)	(583)	(584)	(585)	(586)	(587)	(588)	(589)	(590)	(591)	(592)	(593)	(594)	(595)	(596)	(597)	(598)	(599)	(600)	(601)	(602)	(603)	(604)	(605)	(606)	(607)	(608)	(609)	(610)	(611)	(612)	(613)	(614)	(615)	(616)	(617)	(618)	(619)	(620)	(621)	(622)	(623)	(624)	(625)	(626)	(627)	(628)	(629)	(630)	(631)	(632)	(633)	(634)	(635)	(636)	(637)	(638)	(639)	(640)	(641)	(642)	(643)	(644)	(645)	(646)	(647)	(648)	(649)	(650)	(651)	(652)	(653)	(654)	(655)	(656)	(657)	(658)	(659)	(660)	(661)	(662)	(663)	(664)	(665)	(666)	(667)	(668)	(669)	(670)	(671)	(672)	(673)	(674)	(675)	(676)	(677)	(678)	(679)	(680)	(681)	(682)	(683)	(684)	(685)	(686)	(687)	(688)	(689)	(690)	(691)	(692)	(693)	(694)	(695)	(696)	(697)	(698)	(699)	(700)	(701)	(702)	(703)	(704)	(705)	(706)	(707)	(708)	(709)	(710)	(711)	(712)	(713)	(714)	(715)	(716)	(717)	(718)	(719)	(720)	(721)	(722)	(723)	(724)	(725)	(726)	(727)	(728)	(729)	(730)	(731)	(732)	(733)	(734)	(735)	(736)	(737)	(738)	(739)	(740)	(741)	(742)	(743)	(744)	(745)	(746)	(747)	(748)	(749)	(750)	(751)	(752)	(753)	(754)	(755)	(756)	(757)	(758)	(759)	(760)	(761)	(762)	(763)	(764)	(765)	(766)	(767)	(768)	(769)	(770)	(771)	(772)	(773)	(774)	(775)	(776)	(777)	(778)	(779)	(780)	(781)	(782)	(783)	(784)	(785)	(786)	(787)	(788)	(789)	(790)	(791)	(792)	(793)	(794)	(795)	(796)	(797)	(798)	(799)	(800)	(801)	(802)	(803)	(804)	(805)	(806)	(807)	(808)	(809)	(810)	(811)	(812)	(813)	(814)	(815)	(816)	(817)	(818)	(819)	(820)	(821)	(822)	(823)	(824)	(825)	(826)	(827)	(828)	(829)	(830)	(831)	(832)	(833)	(834)	(835)	(836)	(837)	(838)	(839)	(840)	(841)	(842)	(843)	(844)	(845)	(846)	(847)	(848)	(849)	(850)	(851)	(852)	(853)	(854)	(855)	(856)	(857)	(858)	(859)	(860)	(861)	(862)	(863)	(864)	(865)	(866)	(867)	(868)	(869)	(870)	(871)	(872)	(873)	(874)	(875)	(876)	(877)	(878)	(879)	(880)	(881)	(882)	(883)	(884)	(885)	(886)	(887)	(888)	(889)	(890)	(891)	(892)	(893)	(894)	(895)	(896)	(897)	(898)	(899)	(900)	(901)	(902)	(903)	(904)	(905)	(906)	(907)	(908)	(909)	(910)	(911)	(912)	(913)	(914)	(915)	(916)	(917)	(918)	(919)	(920)	(921)	(922)	(923)	(924)	(925)	(926)	(927)	(928)	(929)	(930)	(931)	(932)	(933)	(934)	(935)	(936)	(937)	(938)	(939)	(940)	(941)	(942)	(943)	(944)	(945)	(946)	(947)	(948)	(949)	(950)	(951)	(952)	(953)	(954)	(955)	(956)	(957)	(958)	(959)	(960)	(961)	(962)	(963)	(964)	(965)	(966)	(967)	(968)	(969)	(970)	(971)	(972)	(973)	(974)	(975)	(976)	(977)	(978)	(979)	(980)	(981)	(982)	(983)	(984)	(985)	(986)	(987)	(988)	(989)	(990)	(991)	(992)	(993)	(994)	(995)	(996)	(997)	(998)	(999)	(1000)
Phi(120)	12.46	15.58	-17.96	17.74	-11.96	15.34	12.84	12.96	13.98	8.80	7.79	-9.29	12.96	13.41	-17.71	-10.43	11.88	-11.93	-16.96	-18.93	-17.73	-14.67	-18.26	16.71	-11.31	4.99	1.53	-17.77	-13.93	7.27	4.65	-10.28	12.24	7.29	11.18	-15.38	-8.79	8.82	7.11	-15.12	-13.24	-11.87	4.87	-10.55	-16.93	-18.15	-10.63																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Theta(120)	14.91	10.98	-18.46	-17.21	-16.87	-18.77	-18.31	-17.9	-18.88	-12.1	-10.22	-14.63	-12.1	14.78	-10.46	-12.45	15.2	-10.76	-15.99	-13.89	-13.1	-18.78	-18.88	-13.49	8.85	-10.27	1.51	-10.81	-11.73	-13.17	-18.92	-18.41	8.68	17.48	-17.17	-11.22	-11.86	-17.77	-11.39	8.3	8.43	-16.3	-18.63	-15.89	-13.62																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Gamma(120)	-18.95	-15.63	-18.41	-18.17	-17.62	-19.46	-19.09	-19.74	-14.41	-18.63	-14.91	-17.79	-12.69	-13.9	-17.5	15.57	-14.17	-18.87	-18.03	-16.34	15.64	-14.12	-11.21	-13.75	-18.64	12.99	16.21	-12.99	-15.59	-11.68	-18.55	-10.31	5.43	9.19	-13.09	-6.27	2.96	8.66	-12.99	-10.9	-15.84	-17.16	-17.8	-11.22																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					



Antenna Pattern of 2.4GHz

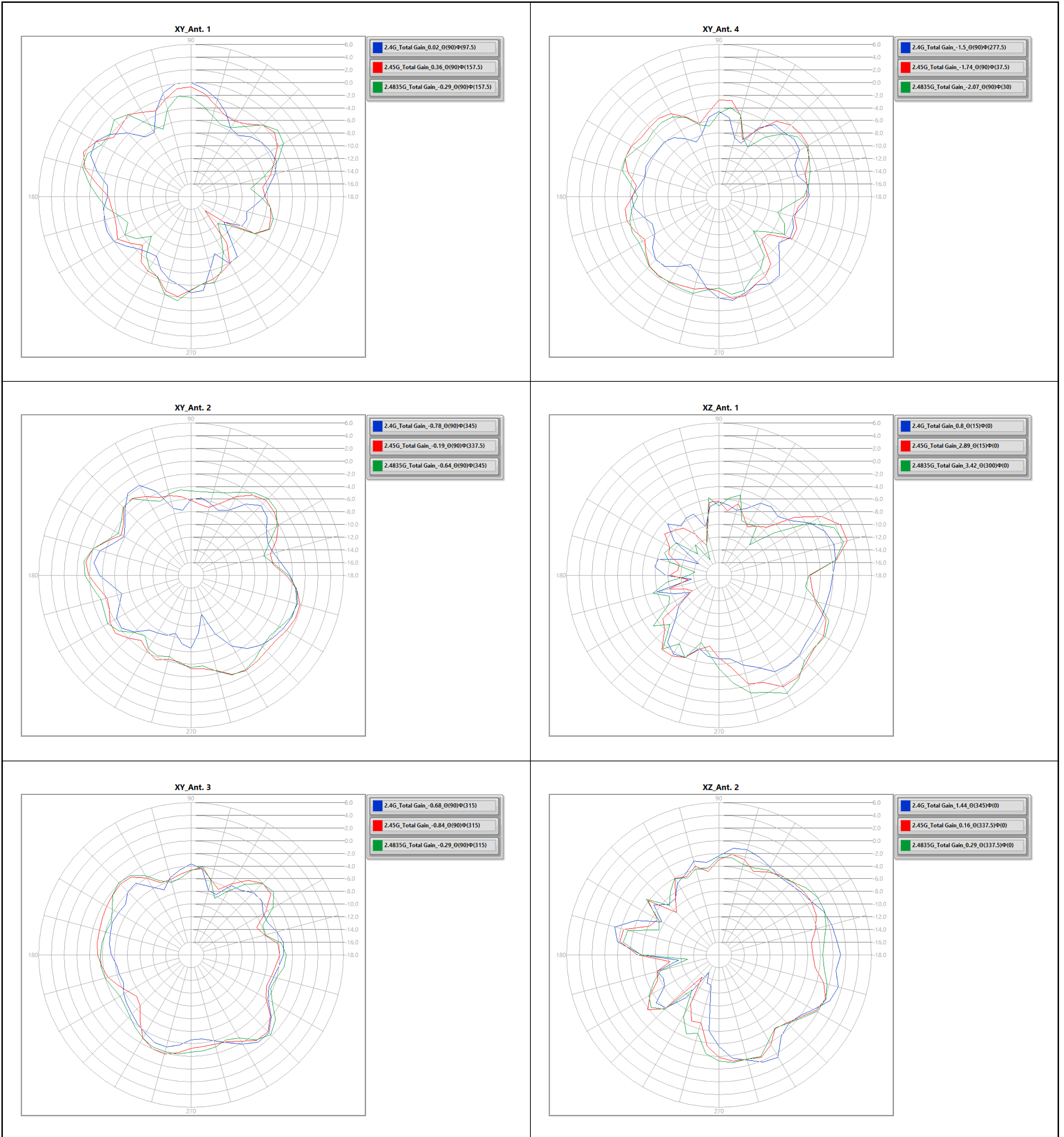
Appendix D

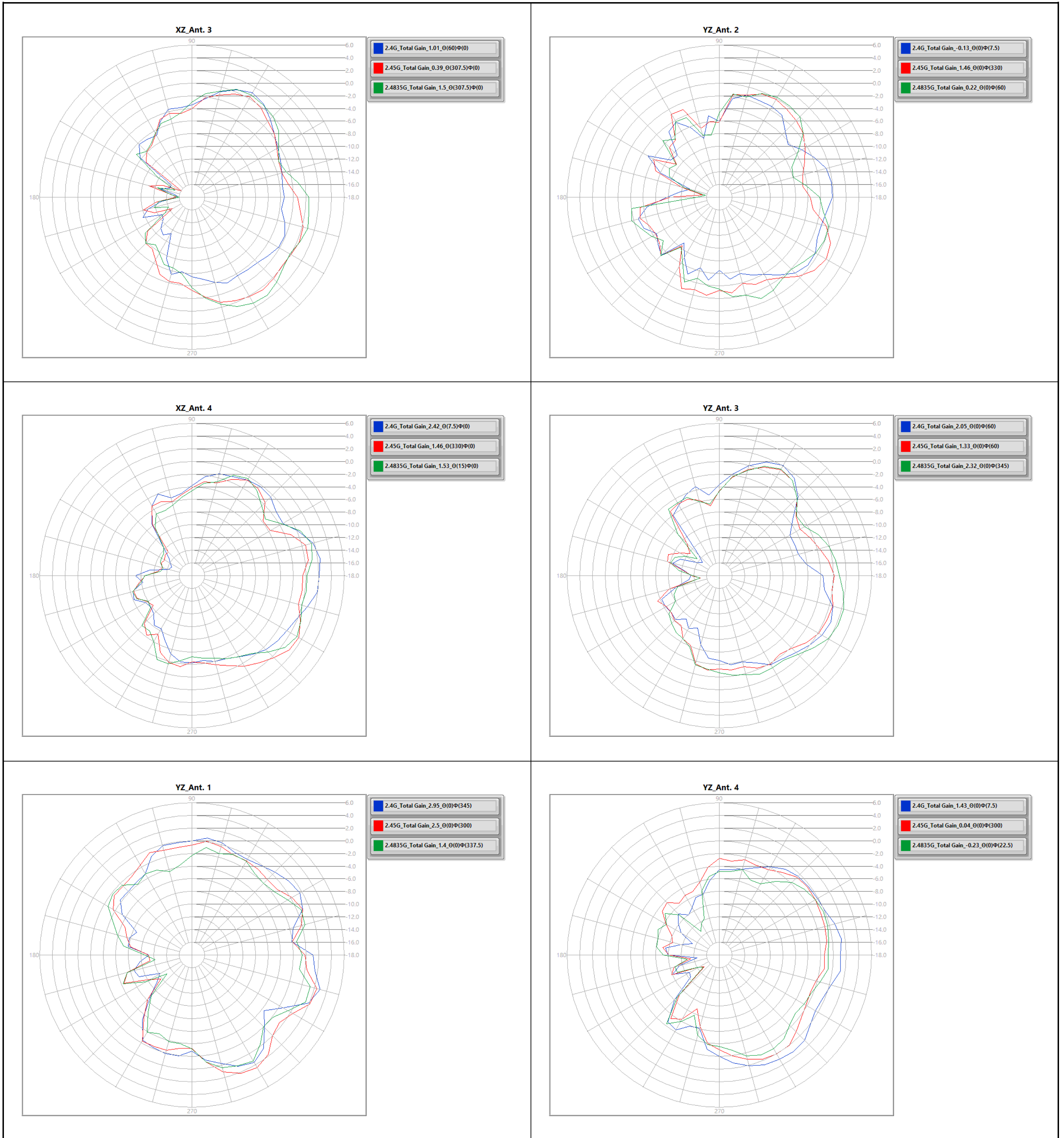
Total Gain Data

Table with columns for Azimuth (Free/Gain) and Elevation (Tab/Tab1) for various antenna models and frequencies, ranging from 2.450GHz to 2.485GHz.

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





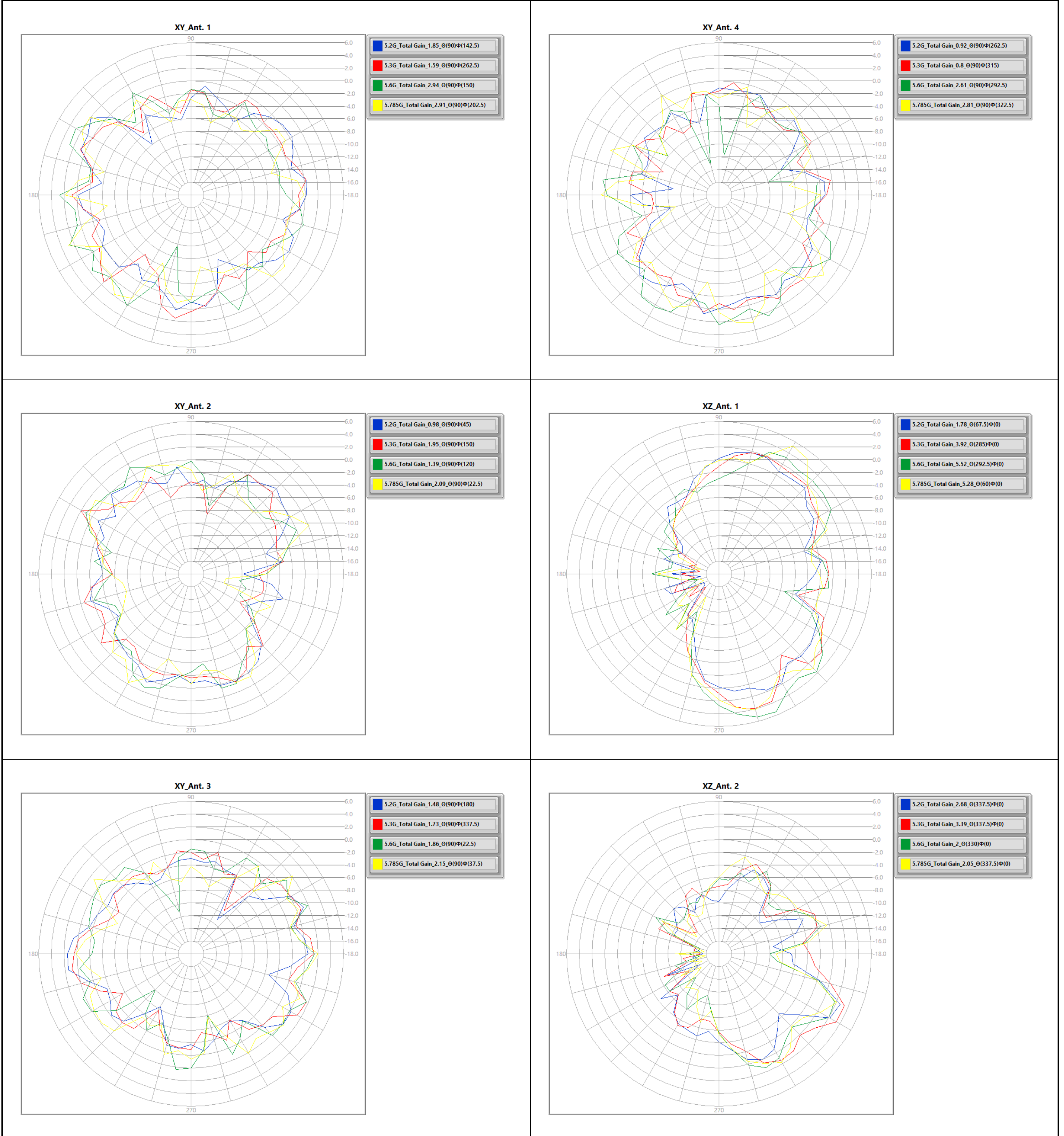


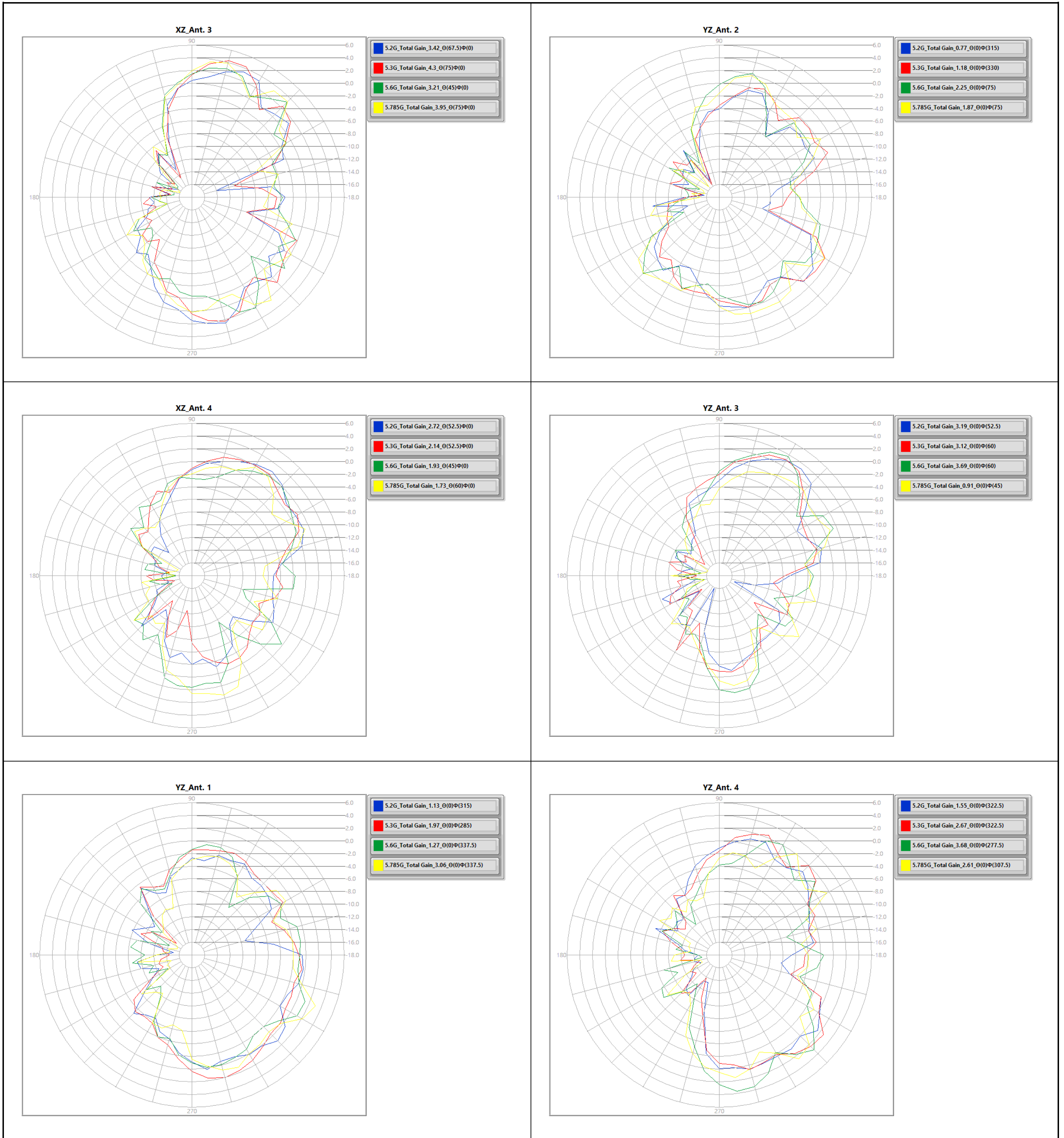
Antenna Pattern of 5GHz

Appendix E

Table with columns for frequency (MHz), elevation angle (deg), and azimuth angle (deg), followed by a grid of gain values (dBS) for various antenna configurations across a range of frequencies and angles.

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 6GHz

Appendix F

Total Gain

Frequency	Theta 0 deg	Theta 15 deg	Theta 30 deg	Theta 45 deg	Theta 60 deg	Theta 75 deg	Theta 90 deg	Theta 105 deg	Theta 120 deg	Theta 135 deg	Theta 150 deg	Theta 165 deg	Theta 180 deg	Theta 195 deg	Theta 210 deg	Theta 225 deg	Theta 240 deg	Theta 255 deg	Theta 270 deg	Theta 285 deg	Theta 300 deg	Theta 315 deg	Theta 330 deg	Theta 345 deg
Gain	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Theta 0 deg	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Theta 15 deg	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00

Sporton International Inc.

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Antenna Pattern of 6GHz

Appendix F

Table with 38 columns and 100 rows of numerical data representing antenna patterns across various frequency bands and azimuth/elevation angles.

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

