



# Antenna Composite Gain Test Report

FCC ID	Z8H89FT0072
Equipment	XE5-8
Brand Name	Cambium Networks
Model Name	XE5-8
Applicant	Cambium Networks Inc. 3800 Golf Road, Suite 360 Rolling Meadows, IL 60008, USA
Manufacturer	Cambium Networks, Ltd. Ashburton, TQ13 7UP, UK
Sample Received	Dec. 07, 2021
Start Test Date	Jun. 20, 2022
Final Test Date	Jun. 20, 2022

Approved by: **Sam Chen**

**Sporton International Inc. Hsinchu Laboratory**

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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### 1. Operation Mode and Antenna Information

Antenna Position	Port	Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
Radio 2 Ant1 5.9G	4	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 2 Ant2 5.9G	2	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 2 Ant3 5.9G	3	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 2 Ant4 5.9G	1	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 3 Ant1 5.9G	4	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 3 Ant2 5.9G	2	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 3 Ant3 5.9G	3	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8
Radio 3 Ant4 5.9G	1	ACCTON	EAP9819A-6E-1120-CAM	Metal	I-PEX	5GHz UNII 1~4 & 6GHz UNII5~8

Note:

Radio 2:

5.9G Operation Mode (4TX/4RX)

Radio 2 Ant1 5.9G~Radio 2 Ant4 5.9G can be used as transmitting/receiving antenna.

Radio 2 Ant1 5.9G~Radio 2 Ant4 5.9G could transmit/receive simultaneously.

Radio 3:

5.9G Operation Mode (4TX/4RX)

Radio 3 Ant1 5.9G~Radio 3 Ant4 5.9G can be used as transmitting/receiving antenna.

Radio 3 Ant1 5.9G~Radio 3 Ant4 5.9G 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]
5850-5895	5850
5850-5895	5885
5850-5895	5895

## 3. Testing Location

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

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	05CH03-HY	Rex Liao	23-24 / 40-50	Jun. 20, 2022

Note:

Testing Site Information

Brand Name: TDK

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

Characteristic: Fully Anechoic Chamber

#### 4. Test Facility and Configuration

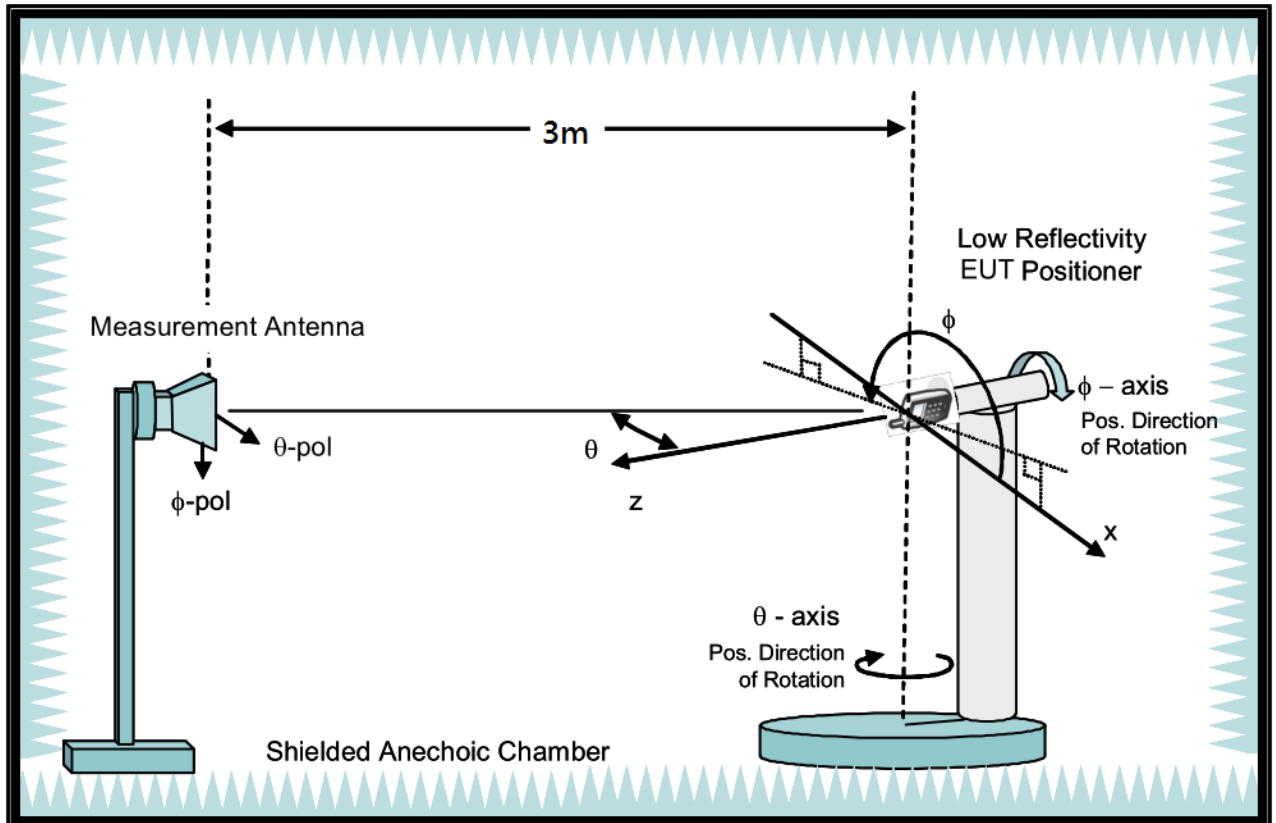
Test configuration: Reference to CITA OTA distributed-axes system configuration.

Chamber: Fully Anechoic Chamber.

Measurement antenna: Dual Polarization Horn antenna

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

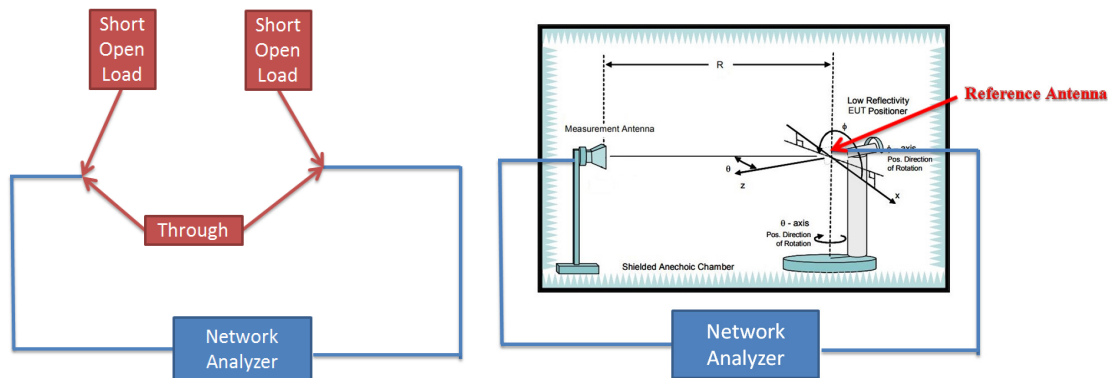
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



### 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	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:

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

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 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 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

#### Radio 2 5.9GHz 4TX

#### DG\_1SS Max Value Position

Frequency (Hz)	5.85G	5.885G	5.895G
Ant. 1 (dBi)	0.02	0.42	0.52
Ant. 2 (dBi)	0.02	-0.29	-0.21
Ant. 3 (dBi)	2.55	2.9	2.97
Ant. 4 (dBi)	0.86	1.4	1.36
DG [1SS] (dBi)	6.95	7.21	7.26
Polarization	Theta	Theta	Theta
$\Theta(^{\circ})$	70	70	70
$\Phi(^{\circ})$	140	140	140

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)	5.85G	5.885G	5.895G
Ant. 1 [10 <sup>^(G/20)</sup> ]	10 <sup>^(0.02/20)</sup>	10 <sup>^(0.42/20)</sup>	10 <sup>^(0.52/20)</sup>
Ant. 2 [10 <sup>^(G/20)</sup> ]	10 <sup>^(0.02/20)</sup>	10 <sup>^(-0.29/20)</sup>	10 <sup>^(-0.21/20)</sup>
Ant. 3 [10 <sup>^(G/20)</sup> ]	10 <sup>^(2.55/20)</sup>	10 <sup>^(2.9/20)</sup>	10 <sup>^(2.97/20)</sup>
Ant. 4 [10 <sup>^(G/20)</sup> ]	10 <sup>^(0.86/20)</sup>	10 <sup>^(1.4/20)</sup>	10 <sup>^(1.36/20)</sup>
Ant. 1 [10 <sup>^(G/20)</sup> ] value	1.002	1.05	1.062
Ant. 2 [10 <sup>^(G/20)</sup> ] value	1.002	0.967	0.976
Ant. 3 [10 <sup>^(G/20)</sup> ] value	1.341	1.396	1.408
Ant. 4 [10 <sup>^(G/20)</sup> ] value	1.104	1.175	1.169
Sum All Antenna [Amax]	4.45	4.588	4.615
DG [10*log(Amax <sup>2</sup> /Nant)]	6.95	7.21	7.26

Note:

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

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



Radio 3 5.9GHz 4TX

DG\_1SS Max Value Position

Frequency (Hz)	5.85G	5.885G	5.895G
Ant. 1 (dBi)	-1.63	-0.08	0.12
Ant. 2 (dBi)	0.38	0.97	1.29
Ant. 3 (dBi)	-3.4	-3.12	-4.43
Ant. 4 (dBi)	0.17	-0.04	0.27
DG [1SS] (dBi)	5.03	5.58	5.59
Polarization	Theta	Theta	Theta
$\Theta$ (°)	60	60	60
$\Phi$ (°)	160	180	180

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)	5.85G	5.885G	5.895G
Ant. 1 [10^(G/20)]	10^(-1.63/20)	10^(-0.08/20)	10^(0.12/20)
Ant. 2 [10^(G/20)]	10^(0.38/20)	10^(0.97/20)	10^(1.29/20)
Ant. 3 [10^(G/20)]	10^(-3.4/20)	10^(-3.12/20)	10^(-4.43/20)
Ant. 4 [10^(G/20)]	10^(0.17/20)	10^(-0.04/20)	10^(0.27/20)
Ant. 1 [10^(G/20)] value	0.829	0.991	1.014
Ant. 2 [10^(G/20)] value	1.045	1.118	1.16
Ant. 3 [10^(G/20)] value	0.676	0.698	0.6
Ant. 4 [10^(G/20)] value	1.02	0.995	1.032
Sum All Antenna [Amax]	3.569	3.803	3.806
DG [10*log(Amax^2/Nant)]	5.03	5.58	5.59

Note:

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

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



## 8. Summary of Test Result

### Radio 2 5.9GHz 4TX

Frequency (Hz)	5.85G	5.885G	5.895G
Ant. 1 Max Gain (dBi)	3.6	3.74	3.59
Ant. 2 Max Gain (dBi)	3.2	2.71	2.88
Ant. 3 Max Gain (dBi)	4.16	4.53	4.72
Ant. 4 Max Gain (dBi)	3.19	3.54	3.26
Max Gain (dBi)	4.16	4.53	4.72
DG [1SS] (dBi)	6.95	7.21	7.26
DG [2SS] (dBi)	4.16	4.53	4.72
DG [4SS] (dBi)	4.16	4.53	4.72

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.
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain.



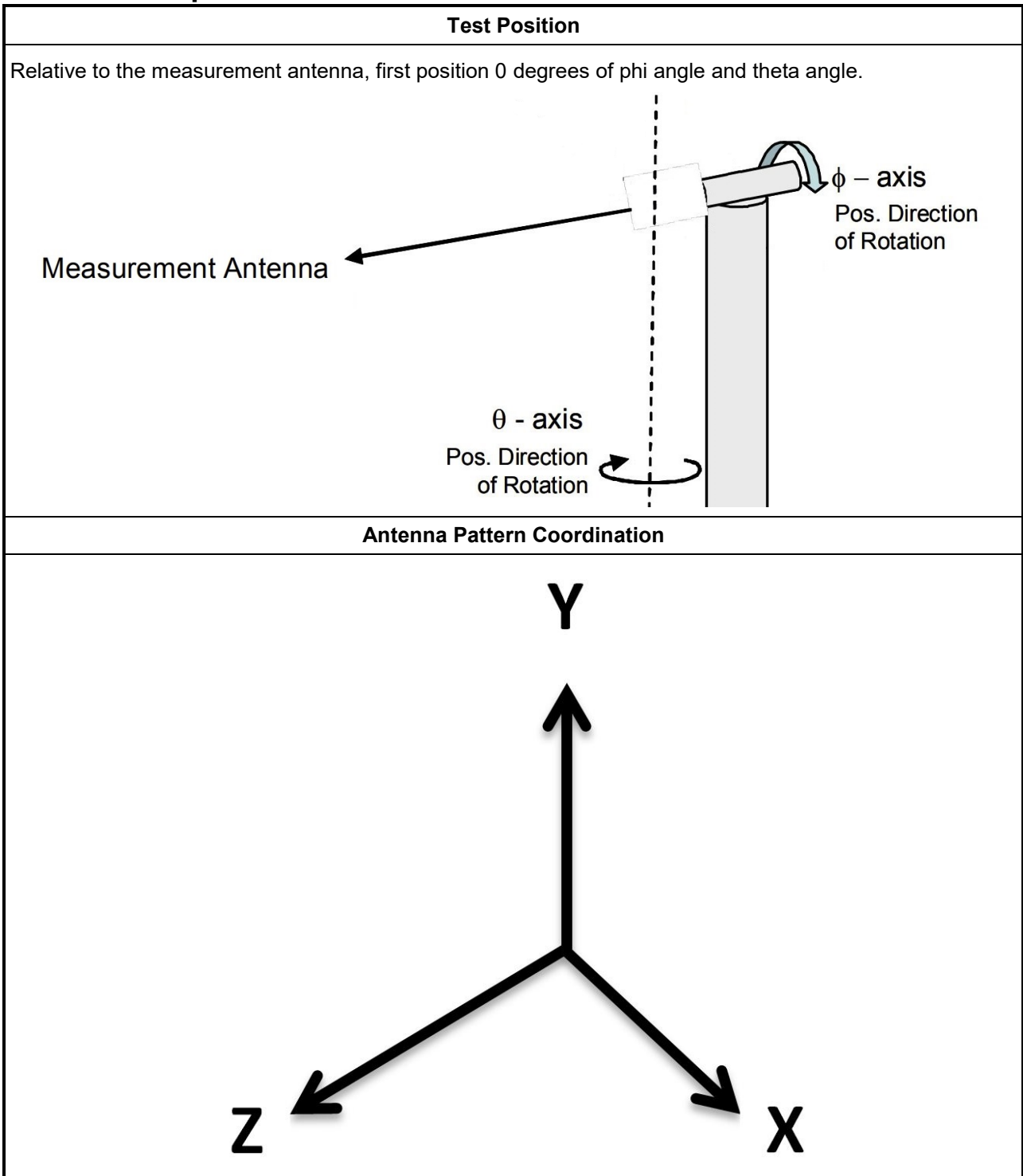
Radio 3 5.9GHz 4TX

Frequency (Hz)	5.85G	5.885G	5.895G
Ant. 1 Max Gain (dBi)	1.04	2.35	2.53
Ant. 2 Max Gain (dBi)	1.61	2.03	2.09
Ant. 3 Max Gain (dBi)	2.87	3.06	2.69
Ant. 4 Max Gain (dBi)	2.33	2.17	1.77
Max Gain (dBi)	2.87	3.06	2.69
DG [1SS] (dBi)	5.03	5.58	5.59
DG [2SS] (dBi)	2.87	3.06	2.69
DG [4SS] (dBi)	2.87	3.06	2.69

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.
4. Directional Gain (4SS) = Directional Gain (1SS) – 6dB. If directional gain is less than max gain, use max gain as directional gain.

### 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-1292	1GHz~18GHz	Aug. 04, 2021	Aug. 03, 2022
Dual Polarization Horn Antenna	Sporton	S0209DP	S0209DP-001	2GHz~9GHz	N.C.R.	N.C.R.
ENA Series Network 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.



## 11. Test Results

Please refer to the appendix.

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Freq(Hz)	5.85G	5.885G	5.895G
Ant. 1 Max Gain (dBi)	3.6	3.74	3.59
Ant. 2 Max Gain (dBi)	3.2	2.71	2.88
Ant. 3 Max Gain (dBi)	4.16	4.53	4.72
Ant. 4 Max Gain (dBi)	3.19	3.54	3.26
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/70/240	Theta/70/240	Theta/70/240
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/40/100	Theta/30/20	Theta/30/20
Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/60/90	Theta/50/90	Theta/50/90
Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/10/160	Phi/10/170	Phi/10/170
Max Gain (dBi)	4.16	4.53	4.72
DG [1SS] (dBi)	6.95	7.21	7.26
DG [2SS] (dBi)	4.16	4.53	4.72
DG [4SS] (dBi)	4.16	4.53	4.72





# Radiated Composite Gain Data\_Radio 2.5.9GHz

# Appendix A

## DG 1SS Result

Phi(°)	Phi(0°)	Phi(30°)	Phi(45°)	Phi(60°)	Phi(75°)	Phi(90°)	Phi(105°)	Phi(120°)	Phi(135°)	Phi(150°)	Phi(165°)	Phi(180°)	Phi(200°)	Phi(220°)	Phi(240°)	Phi(260°)	Phi(280°)	Phi(300°)	Phi(320°)	Phi(340°)	Phi(350°)	
0	0.4108	0.2702	-0.0104	0.9514	1.4119	1.7225	1.9318	1.8415	1.2602	1.1305	0.5604	0.9907	0.9413	1.8729	2.5278	2.6526	2.3112	1.8206	1.0662			
10	0.8206	-0.0413	-0.9209	0.7724	3.11	3.78	4.063	4.263	3.783	2.613	1.303	0.463	1.841	3.184	4.844	5.519	5.178	3.931	2.623	1.270		
20	2.2623	1.1203	1.4811	-0.7525	4.8111	5.5935	6.2426	6.7323	6.9527	6.7323	5.5935	4.8111	3.184	2.613	1.303	0.463	1.841	3.184	4.844	5.519		
30	2.9624	3.1203	3.1812	3.0244	2.7824	2.2710	1.6124	0.9527	0.2933	-0.3733	-1.0527	-1.7323	-2.4123	-3.0923	-3.7723	-4.4523	-5.1323	-5.8123	-6.4923	-7.1723		
40	1.8803	0.6502	-0.5502	1.0123	0.061	0.6923	1.3823	2.0723	2.7623	3.4523	4.1423	4.8323	5.5223	6.2123	6.9023	7.5923	8.2823	8.9723	9.6623	10.3523		
50	0.3403	0.3801	-0.1202	0.4813	0.6207	0.3507	-0.3307	-1.0207	-1.7107	-2.4007	-3.0907	-3.7807	-4.4707	-5.1607	-5.8507	-6.5407	-7.2307	-7.9207	-8.6107	-9.3007		
60	-2.4309	-0.2601	-0.3803	-0.2605	0.0721	-2.2509	-1.4508	-3.4305	-4.4102	-5.3900	-6.3700	-7.3500	-8.3300	-9.3100	-10.2900	-11.2700	-12.2500	-13.2300	-14.2100	-15.1900		
70	-1.3613	-0.9803	-2.4903	-0.8304	-3.2804	-4.0503	-1.1202	-10.4504	-4.7603	-4.3702	-6.6407	-8.4508	-5.8203	-8.4508	-5.8203	-6.6407	-4.3702	-4.7603	-1.1202	-10.4504		
80	-2.8814	-1.4803	-3.1204	-1.2205	-2.1107	-3.3106	-2.0409	-3.7403	-3.4403	-4.7502	-5.9503	-7.1504	-8.3505	-9.5506	-10.7507	-11.9508	-13.1509	-14.3510	-15.5511	-16.7512		
90	-3.7305	-7.6504	-3.7705	-3.5305	-2.6803	-3.3706	-1.4608	-6.4507	-9.0805	-11.7103	-14.3401	-16.9700	-19.6000	-22.2300	-24.8600	-27.4900	-30.1200	-32.7500	-35.3800	-38.0100		
100	-5.1606	-7.8204	-4.6306	-3.9101	-4.1803	-1.7903	-8.7604	-3.7603	-7.3507	-9.9405	-12.5204	-15.1003	-17.6802	-20.2601	-22.8400	-25.4200	-28.0000	-30.5800	-33.1600	-35.7400		
110	-5.5109	-8.6805	-5.1107	-4.8804	-5.8704	-3.8803	-9.1902	-4.1407	-8.1407	-11.1203	-13.7002	-16.2801	-18.8600	-21.4400	-24.0200	-26.6000	-29.1800	-31.7600	-34.3400	-36.9200		
120	-6.4806	-9.6807	-7.2605	-6.6506	-7.9405	-5.9404	-11.4608	-6.9405	-6.9405	-10.8806	-13.4605	-16.0404	-18.6203	-21.2002	-23.7801	-26.3600	-28.9400	-31.5200	-34.1000	-36.6800		
130	-8.7802	-10.2106	-7.6106	-6.2707	-6.2306	-4.9702	-9.0905	-7.8507	-8.8502	-12.8303	-15.4102	-17.9901	-20.5700	-23.1500	-25.7300	-28.3100	-30.8900	-33.4700	-36.0500	-38.6300		
140	-10.0111	-11.6103	-8.1206	-6.7705	-6.7705	-5.4802	-9.7407	-8.5102	-9.5102	-13.4903	-16.0702	-18.6501	-21.2300	-23.8100	-26.3900	-28.9700	-31.5500	-34.1300	-36.7100	-39.2900		
150	-8.2105	-8.7308	-6.1909	-6.7104	-6.7104	-5.4202	-9.7407	-8.5102	-9.5102	-13.4903	-16.0702	-18.6501	-21.2300	-23.8100	-26.3900	-28.9700	-31.5500	-34.1300	-36.7100	-39.2900		
160	-7.7308	-11.8803	-10.3706	-10.0705	-8.0804	-11.6603	-11.6603	-10.5102	-12.3102	-14.8901	-17.4700	-20.0500	-22.6300	-25.2100	-27.7900	-30.3700	-32.9500	-35.5300	-38.1100	-40.6900		
170	-11.7303	-12.0308	-10.4807	-8.7306	-8.2307	-4.2402	-9.8102	-11.2203	-10.8603	-14.4402	-17.0201	-19.6000	-22.1800	-24.7600	-27.3400	-29.9200	-32.5000	-35.0800	-37.6600	-40.2400		
180	-12.1206	-10.3809	-8.8102	-8.4703	-9.0304	-10.2907	-9.1102	-11.1203	-11.0803	-14.0602	-16.6401	-19.2200	-21.8000	-24.3800	-26.9600	-29.5400	-32.1200	-34.7000	-37.2800	-39.8600		



# Radiated Composite Gain Data\_Radio 2 5.9GHz

# Appendix A

Θ(60°)	4.19/4.38	1.93/2.81	-1.39/2.39	2.58/3.94	3.95/6.22	5.21/3.56	4.67/2.04	6.25/3.02	1.62/0.33	-0.96/0.49	0.25/0.59	2.32/2.16	1.52/0.03	1.49/0.86	2.21/5.35	2.33/4.44	4.78/1.52	4.39/0.89
Θ(70°)	2.92/4.5	2.82/5.9	-1.71/1.53	1.61/5.05	3.51/5.58	4.76/5.76	2.88/4.58	7.26/4.21	3.57/2.23	1.95/2.51	2.36/1.86	0.79/0.86	3.17/0.24	0.43/2.71	3.25/3.43	2.27/3.09	2.59/1.3	4.04/3.35
Θ(80°)	2.17/4.01	3.14/3.49	-0.34/0.89	0.52/4.37	4.45/4.83	3.99/4.7	1.45/4.12	4.82/2.9	2.41/1.98	2.38/1.66	0.88/0.88	0.84/1.17	3.16/1.21	2.02/4.4	3.53/2.3	-0.07/0.39	1.97/0.26	2.33/3.22
Θ(90°)	1.78/2.69	2.44/2.97	0.17/0.37	-0.83/3.57	4.21/3.17	2.63/2.22	-0.27/2.15	2.81/3.24	-0.03/-2.87	-0.97/-1.81	-2.02/-1.32	0.29/0.26	0.27/3.05	1.62/2.77	1.21/0.2	-1.37/-1.61	1.38/-0.72	0.88/1.53
Θ(100°)	1/0.33	1.04/2.28	-1.38/0.2	-2.91/0.72	1.5/0.78	-0.11/-1.21	-3.38/-0.39	-0.19/-4.37	-2.2/-3.98	-0.86/-2.75	-2.6/-3.73	-2.73/-3.26	-3.29/-4.65	-1.48/-2.61	-3.54/-1.42	-1.09/-0.22	-0.85/-1.48	0.23/-0.66
Θ(110°)	-0.18/-0.78	-0.52/1.39	-1.6/-1.27	-5.15/-3.7	-2.1/-2.67	-2.14/-2.49	-7/-4.38	-5.38/-3.49	-6.05/-6.6	-3.42/-5.76	-9.03/-5.06	-7.05/-8.84	-4.82/-6.81	-1.53/-2.22	-4.75/-1.87	-4.5/-0.61	-2.78/-2.67	-0.5/-1.98
Θ(120°)	-2.17/-2.56	-2.57/0.81	-1.58/-4.19	-6.97/-7.12	-5.85/-4.82	-4.32/-7.94	-5.98/-6.76	-8.15/-6.23	-5.8/-8.32	-5.23/-6.54	-5.23/-9.37	-8.14/-5.21	-7.69/-7.13	-3.82/-3.65	-6.38/-5.76	-5.12/-3.08	-4.88/-3.35	-3.94/-4.02
Θ(130°)	-3.91/-4.57	-3.33/-1.21	-2.08/-5.47	-9.22/-7.77	-5.41/-8.38	-6.37/-7.83	-7.86/-4.51	-6.76/-11.32	-8.24/-5.8	-7.07/-10.49	-6.6/-9.03	-7.87/-8.53	-7.69/-7.17	-8.27/-6.64	-8.33/-9.97	-6.21/-4.64	-4.48/-4.43	-4.1/-5.23
Θ(140°)	-5.23/-5.35	-5.75/-5.63	-3.52/-3.46	-6.47/-7.87	-11.16/-9.99	-10.3/-10.06	-7.63/-10.74	-6.93/-7.37	-9.6/-8.07	-11.32/-10.43	-9.1/-12.07	-12.27/-9.07	-8.55/-9.68	-7.41/-7.07	-9.85/-8.79	-10.36/-4.34	-6.83/-8.21	-7.27/-10.28
Θ(150°)	-6.41/-7.7	-5.51/-5.47	-5.17/-5.77	-6.4/-6.88	-7.79/-8.16	-8.06/-9.25	-7.63/-10.45	-10.94/-7.39	-6.66/-9.93	-9.98/-7.83	-9.3/-11.94	-11.87/-11.56	-9.44/-7.06	-10.95/-12.3	-10.07/-6.78	-9.14/-9.71	-9.28/-10.78	-8.53/-6.21
Θ(160°)	-8.89/-8.04	-8.02/-6.95	-8.11/-8.24	-7.57/-7.59	-7.03/-7.32	-10.25/-11.41	-8.04/-9.47	-8.05/-8.08	-10.33/-10.55	-10.41/-10.76	-10.58/-11.37	-12.6/-12.3	-9.82/-8.15	-10.02/-9.26	-8.22/-9.1	-9.96/-10.32	-11.44/-11.51	-10.27/-10.14
Θ(170°)	-9.11/-9.34	-10.07/-11.29	-9.54/-8.58	-7.28/-8.66	-9.23/-9.68	-9.84/-10.73	-10.06/-10.59	-11.79/-11.03	-11.66/-12.26	-12.06/-10.92	-10.28/-9.54	-9.6/-9.17	-9.57/-9.32	-8.08/-8.25	-8.92/-9.52	-10.68/-10.98	-10.82/-8.84	-9.44/-9.11
Θ(180°)	-9.99/-10.94	-10.35/-11.33	-10.52/-10.64	-10.38/-10.71	-12.24/-11.21	-12.04/-12.21	-11.44/-11.19	-11.9/-11.83	-11.26/-11.2	-12.01/-11.9	-10.87/-10.5	-11.29/-11.56	-11.52/-12.21	-12.2/-12.48	-12.41/-11.57	-11.68/-11.06	-9.34/-11.16	-10.37/-9.75



# Radiated Composite Gain Data\_Radio 2.59GHz

# Appendix A

## Gain Result

Gain	Phi(0°)Phi(10°)	Phi(20°)Phi(30°)	Phi(40°)Phi(50°)	Phi(60°)Phi(70°)	Phi(80°)Phi(90°)	Phi(100°)Phi(110°)	Phi(120°)Phi(130°)	Phi(140°)Phi(150°)	Phi(160°)Phi(170°)	Phi(180°)Phi(190°)	Phi(200°)Phi(210°)	Phi(220°)Phi(230°)	Phi(240°)Phi(250°)	Phi(260°)Phi(270°)	Phi(280°)Phi(290°)	Phi(300°)Phi(310°)	Phi(320°)Phi(330°)	Phi(340°)Phi(350°)
Gain	Phi(0°)Phi(10°)	Phi(20°)Phi(30°)	Phi(40°)Phi(50°)	Phi(60°)Phi(70°)	Phi(80°)Phi(90°)	Phi(100°)Phi(110°)	Phi(120°)Phi(130°)	Phi(140°)Phi(150°)	Phi(160°)Phi(170°)	Phi(180°)Phi(190°)	Phi(200°)Phi(210°)	Phi(220°)Phi(230°)	Phi(240°)Phi(250°)	Phi(260°)Phi(270°)	Phi(280°)Phi(290°)	Phi(300°)Phi(310°)	Phi(320°)Phi(330°)	Phi(340°)Phi(350°)
Theta(0°)	-3.04/-1.3	-1.91/-2.8	-3.43/-3.23	-3.66/-4.69	-5.54/-6.44	-7.59/-8.92	-8.94/-6.92	-6.05/-5.33	-4.94/-4.54	-3.91/-3.54	-3.18/-3.76	-4.11/-4.28	-4.68/-5.43	-6.57/-6.95	-7.99/-8.84	-9.38/-10.1	-11.62/-12.59	-14.45/-15.98
Theta(10°)	-3.24/-1.71	-0.76/-0.86	-1.73/-4.39	5.17/-7.1	6.69/-9.93	-3.69/-2.48	-1.51/-0.33	1.45/2.32	2.02/1.34	-0.29/-1.47	-0.56/-1.04	-1.81/-2.64	-4.87/-7.77	-10.55/-16.19	-14.82/-6.91	-2.81/-1.22	-0.58/-1.17	-4.01/-5.5
Theta(20°)	-10.76/-5.69	-3.28/-3.49	-1.81/-1.46	-2.91/-3.39	4.95/-7.53	-3.89/-2.88	-2.54/-2.8	-4.43/-3.54	-1.04/-0.19	-0.98/-1.17	0.82/0.45	-1.51/-3.9	-10.06/-14.23	-18.06/-15.49	-11.37/-10.34	-15.41/-18.36	-11.65/-5.62	-2.52/-7.69
Theta(30°)	-5.88/-3.87	-3.89/-3.44	-6.21/-7.19	-13.98/3.82	-2.77/3.26	-2.11/-7.64	-4.57/-5.1	-5.64/-5.84	-4.13/-0.88	-1.51/-0.18	0.16/-4.35	-8.42/-9.55	-9.39/-8.84	-7.74/-18.76	-14.26/-12.59	-14.45/-11.98	-2.14/-2	-
Theta(40°)	-4.71/6.12	-9.81/-13.25	-18.29/-11.42	-7.75/-9.98	-19.06/-8.44	-8.28/-10.39	-9.11/-7.49	-6.76/-6.81	-6.24/0.76	-2.41/1.41	1.23/2.26	-7.81/-8.76	-9.35/-9.38	-9.29/-10.57	-5.97/-6.1	-4.24/-10.61	-19.09/-11.11	-9.82/-4.66
Theta(50°)	-7.71/-15.7	-13.17/-5.98	-7.67/-17.54	-12.74/-11.67	-6.24/-7.34	-6.65/-12.81	-8.09/-7.35	-12.16/-5.44	-2.48/-0.55	-4.76/-2.29	-10.77/2.39	-9.79/-18.77	-9.05/-15.15	-11.4/-6.55	-5.78/-6.88	-11.54/-7.12	-7.63/-6.78	-5.43/-3.47
Theta(60°)	-12.46/-18.66	-18.8/-5.5	-13.14/-8.11	-14.49/-10.97	-12.34/-19.44	-17.53/-15.17	-17.71/-14.04	-6.76/-4.12	-5.23/-5.86	-17.11/-14.59	-15.79/-18.11	-17.98/-15.48	-10.19/-7.76	-4.29/-4.39	-8.85/-9.29	-5.54/-9.6	-9.2/-12.23	-
Theta(70°)	-10.96/-18.58	-12.74/-10.71	-15.88/-8.73	-19.12/-18.79	-18.71/-17.17	-17.93/-12.22	-12.59/-10.25	-17.6/-7.65	-12.45/-6.29	-5.57/-8.89	-18.25/-13.91	-18.76/-14.58	-18.05/-14.77	-6.97/-8.63	-5.52/-3.59	-4.38/-12.39	-6.55/-11.1	-11.91/-7.3
Theta(80°)	-9.64/-18.33	-15.35/-16.17	-13.53/-10.78	-13.87/-18.03	-13.04/-11.25	-17.72/-12.63	-18.02/-9.37	-8.98/-8.4	-12.32/-6.39	-5.37/-15.54	-18.58/-18.23	-17.81/-15.7	-15.18/-8.46	-7.91/-10.65	-6.31/-3.16	-4.32/-13.26	-9.98/-10.8	-11.5/-4.1
Theta(90°)	-9.31/-9	-18.18/-17.45	-13.25/-12.07	-12.11/-14.32	-18.16/-14.14	-10.82/-19.01	-16.68/-18.12	-11.35/-7.06	-7.92/-17.75	-16.68/-17.91	-17.91/-14.96	-16.28/-8.06	-5.95/-13.27	-13.08/-12.76	-8.39/-4.5	-4.24/-10.61	-19.09/-11.11	-9.82/-4.66
Theta(100°)	-9.68/-18.63	-18.86/-17.8	-17.97/-16.45	-14.45/-10.18	-19.03/-14.66	-12.82/-18.57	-19.21/-16.45	-10.38/-19.42	-12.66/-11.01	-13.82/-18.19	-17.19/-17.91	-17.68/-15.12	-17.95/-11.01	-17.24/-13.15	-9.95/-8.56	-9.61/-12.78	-14.88/-15.63	-11.66/-9.65
Theta(110°)	-9.81/-18.75	-18.51/-16.29	-17.72/-17.37	-18.03/-14.65	-17.32/-17.55	-18/-12.15	-18.38/-18.5	-17.99/-11.65	-14.72/-19.27	-18.73/-12.04	-13.84/-16.28	-17.98/-16.47	-11.59/-14.16	-19.48/-11.4	-9.79/-10.43	-14.93/-18.84	-17.11/-18.85	-17.79/-12.17
Theta(120°)	-13.21/-18.46	-15.71/-18.25	-18.69/-18.7	-18.77/-16.53	-18.19/-16.79	-18.85/-14.32	-18.25/-16.15	-12.64/-18.73	-16.74/-17.96	-16.09/-17.36	-12.84/-16.03	-16.66/-16.34	-15.03/-18.42	-11.63/-10.42	-11.53/-15.34	-16.36/-19.16	-19.37/-11.89	-
Theta(130°)	-16.61/-18.11	-17.81/-17.83	-19.41/-17.89	-17.51/-17.14	-18.43/-14.56	-19.38/-19.07	-15.75/-17.92	-10.65/-18.57	-12.21/-11.8	-11.57/-15.07	-15.34/-18.57	-12.29/-10	-10.09/-17.45	-8.78/-11.61	-12.21/-14.02	-18.79/-15.98	-18.37/-15.68	-18.01/-16.47
Theta(140°)	-18.69/-17.84	-16.67/-9.15	-15.31/-7.61	-13.63/-17.45	-17.59/-19.64	-17.51/-18.9	-13.61/-19.16	-18.23/-15.7	-14.36/-11.66	-18.91/-12.4	-9.59/-12.18	-12.94/-8.7	-15.85/-13.39	-10.14/-13.51	-12.94/-17.57	-18.55/-18.1	-16.05/-14.94	-18.94/-16.66
Theta(150°)	-13.17/-15.84	-13.04/-12.12	-17.12/-18.62	-18.69/-18.17	-18.95/-18.18	-18.88/-17.89	-17.79/-15.81	-18.15/-13.47	-18.37/-18.66	-17.81/-12.24	-13.42/-10.64	-12.84/-15.51	-17.63/-13.55	-16.91/-17.64	-18.58/-15.98	-14.11/-16.39	-15.19/-15.09	-
Theta(160°)	-17.62/-13.76	-17.85/-18.73	-17.76/-17.14	-16.68/-14.27	-14.55/-16.87	-16.17/-17.43	-18.94/-17.52	-18.18/-15.08	-18.61/-17.08	-15.36/-17.37	-10.61/-11.01	-11.66/-11.96	-11.85/-14.08	-14.38/-15.54	-17.53/-19.38	-18.65/-18.54	-18.97/-17.52	-17.84/-18.06
Theta(170°)	-19.04/-18.57	-16.45/-14.84	-14.55/-13.72	-14.61/-16.77	-18.05/-18.04	-18.42/-19.09	-18.41/-18.23	-17.78/-18.76	-18.92/-18.71	-18.83/-18.44	-18.59/-19.25	-16.75/-17.92	-18/-17.81	-18.06/-17.69	-17.91/-18.79	-18.97/-18.12	-18.94/-18.66	-
Theta(180°)	-17.54/-19	-18.84/-18.07	-18.94/-14.95	-16.76/-17.71	-17.05/-17.41	-15.64/-18.82	-18.41/-18.83	-19.17/-9.98	-18.71/-19.09	-17.88/-17.65	-17.89/-18.9	-18.73/-17.9	-18.77/-18.44	-18.96/-19.17	-18.06/-18.6	-18.41/-18.41	-18.81/-18.09	-18.89/-17.66







# Radiated Composite Gain Data\_Radio 2.5.9GHz

# Appendix A

Theta	-4.1/2.29	-1.47/-3.93	-1.21/-1.46	-2.15/-1.31	-3.16/-2.03	-4.72/-6.37	-18.45/-12.56	-7.12/-9.43	-14.89/-12.84	-8.64/-15.77	-8.07/-14.38	-11.18/-14.14	-15.35/-18.67	-11.65/-5.59	-6.29/-5.17	-11.65/-11.66	-14.38/-6.21	-11.23/-4.39
Gain	$\Phi(0^\circ)/\Phi(10^\circ)$	$\Phi(20^\circ)/\Phi(30^\circ)$	$\Phi(40^\circ)/\Phi(50^\circ)$	$\Phi(60^\circ)/\Phi(70^\circ)$	$\Phi(80^\circ)/\Phi(90^\circ)$	$\Phi(100^\circ)/\Phi(110^\circ)$	$\Phi(120^\circ)/\Phi(130^\circ)$	$\Phi(140^\circ)/\Phi(150^\circ)$	$\Phi(160^\circ)/\Phi(170^\circ)$	$\Phi(180^\circ)/\Phi(190^\circ)$	$\Phi(200^\circ)/\Phi(210^\circ)$	$\Phi(220^\circ)/\Phi(230^\circ)$	$\Phi(240^\circ)/\Phi(250^\circ)$	$\Phi(260^\circ)/\Phi(270^\circ)$	$\Phi(280^\circ)/\Phi(290^\circ)$	$\Phi(300^\circ)/\Phi(310^\circ)$	$\Phi(320^\circ)/\Phi(330^\circ)$	$\Phi(340^\circ)/\Phi(350^\circ)$
$\Theta(0^\circ)$	4.77/-1.19	-6.28/-8.15	-6.83/-12.92	-15.09/-18.87	-18.42/-19	-13.15/-9.77	-8.11/-6.59	-6.01/-6.45	-6.44/-7.42	-7.04/-9.14	-9.37/-10.53	-13.67/-18.8	-18.21/-18.71	-1.81/-12.36	-10.96/-8.66	-7.76/-6.19	-5.67/-4.91	-5.15/-4.96
$\Theta(10^\circ)$	-4.56/-3.58	-4.18/-5.28	-8.49/-18.19	-16.64/-14.64	-1.51/-8	-3.22/-5.05	-0.86/-1.31	-4.1/-6.65	-9.87/-12.44	-2.42/-3.8	-1.33/-10.39	-6.02/-5.68	-7.14/-9.95	-4.53/-8.01	-10.72/-8.96	-6.56/-6.75	-6.65/-6.76	-
$\Theta(20^\circ)$	-8.01/-6.24	-5.83/-9.48	-11.61/-7.54	-13.41/-14.49	-7.49/-5.21	-2.41/-3.19	-6.17/-2.07	-1.41/-1.85	-2.34/-2.23	-1.99/-2.61	-3.1/-6.71	-17.62/-8.44	-7.54/-8.52	-7.54/-7.89	-9.37/-12.09	-13.24/-15.67	-11.37/-8.5	-10.06/-12.29
$\Theta(30^\circ)$	-9.16/-9.79	-8.32/-7.44	-12.91/-17.57	-7.39/-6.23	-3.65/-1.63	-3.42/-3.03	-17.47/-5.32	-3.91/-3.53	-6.04/-6.8	-6.88/-6.35	-5.84/-7.29	-2.71/-5.01	-14.67/-8.33	-14.82/-5.86	-10.98/-5.8	-1.02/-3.94	-3.9/-5.98	-
$\Theta(40^\circ)$	-5.99/-8.18	-4.76/-11.13	-17.13/-7.66	-2.61/-2.33	-6.73/-13	-1.05/-2.23	-4.76/-11.3	-1.72/-5.27	-14.14/-19.39	-5.62/-8.19	-1.08/-11.18	-3.53/-5.15	-6.71/-3.19	-5.65/-6.56	-6.71/-3.19	-6.63/-4.94	-	-
$\Theta(50^\circ)$	-9.05/-12.7	-15.86/-6.57	-4.1/-2.62	-6.84/-1.6	1.374/7.2	3.38/1.58	4.22/3.54	0.12/4.25	-5.35/-4.93	-8.19/-5.58	-7.97/-9.1	-6.19/-8.71	-7.67/-1.67	-7.78/-11.72	-7.71/-3.46	-2.61/-1.69	-3.71/-4.75	-1.96/-3.1
$\Theta(60^\circ)$	-3.75/-11.19	-8.78/-4.52	-3.22/-4	-2.08/-0.99	2.37/4.6	2.86/-0.24	2.94/0.61	-8.07/-2.81	-6.36/-9.32	-13.13/-4.47	-2.57/-12.69	-7.31/-7.29	-8.76/-8.37	-6.14/-9.1	-6.41/-14	-1.47/-9.56	-4.09/-5.75	-
$\Theta(70^\circ)$	-8.61/-13.61	-5.83/-3.56	-4.61/-5.89	-1.46/3.23	1.89/1.43	-1.99/-0.9	-2.35/-1	-5.82/-3.88	-4.44/-2.28	-3.87/-0.52	-4.27/-17.56	-3.87/-0.52	-4.27/-17.56	-3.87/-0.52	-4.27/-17.56	-3.87/-0.52	-4.27/-17.56	-4.87/-1.13
$\Theta(80^\circ)$	-13.16/-10.85	-9.09/-2.46	-5.11/-2.81	-0.96/2.35	1.65/-1.08	-4.19/-1.59	-8.83/-0.86	0.04/-2.8	-3.22/-2.68	-5.15/-1.11	-1.89/-4.2	-3.65/-4.04	-2.29/-15.72	-3.68/-3.9	-4.88/-4.23	-7.41/-7.65	-3.36/-4.95	-5.38/-2.91
$\Theta(90^\circ)$	-8.28/-11.84	-9.34/-3.13	-3.9/-3.62	-2.59/0.3	0.95/-2.66	-4.68/-2.74	-11.95/-4.5	-4.04/-5.56	-5.43/-11.92	-11.48/-4.6	-5.98/-10.52	-5.79/-5.93	-4.86/-19.28	-3.36/-3.79	-8.46/-7.28	-7.87/-11.41	-5.24/-5.4	-6.62/-4.1
$\Theta(100^\circ)$	-6.82/-12.11	-8.47/-3.25	-5.51/-3.29	-10.55/-15.86	-6.09/-6.15	-7.76/-7.79	-8.61/-8.44	-6.09/-4.15	-7.76/-7.79	-8.61/-8.44	-6.09/-4.15	-7.76/-7.79	-8.61/-8.44	-6.09/-4.15	-7.76/-7.79	-8.61/-8.44	-6.09/-4.15	-7.76/-7.79
$\Theta(110^\circ)$	-7.17/-12.94	-7.89/-4.74	-7.05/-7.59	-9.79/-9.98	-5.74/-9.01	-9.34/-8.82	-14.02/-9.37	-13.65/-6.5	-7.91/-14.27	-9.95/-10.03	-17.81/-6.59	-9.08/-17.24	-12.86/-19.08	-6.05/-7.35	-17.8/-10.97	-11.73/-7.32	-7.8/-7.92	-7.8/-9.86
$\Theta(120^\circ)$	-6.61/-13.67	-10.48/-7.43	-6.98/-8.31	-11.37/-11.21	-9.95/-11.77	-17.79/-11.63	-18.35/-12.42	-9.55/-8.89	-12.7/-12.21	-6.33/-17.63	-11.57/-14.56	-17.99/-18.34	-7.68/-9.89	-16.29/-15.84	-10.01/-18.7	-10.47/-14.48	-13.28/-10.6	-
$\Theta(130^\circ)$	-11.81/-10.65	-8.83/-9.97	-6.54/-8.91	-15.08/-15.11	-11.16/-18.45	-19.22/-19.11	-14.11/-15.8	-11.49/-17.91	-11.07/-9.83	-11.49/-17.91	-11.07/-9.83	-11.49/-17.91	-11.07/-9.83	-11.49/-17.91	-11.07/-9.83	-11.49/-17.91	-11.07/-9.83	-11.49/-17.91
$\Theta(140^\circ)$	-10.37/-9.72	-9.93/-10.36	-9.57/-8.98	-12.68/-18	-14.1/-19.14	-14.85/-17.8	-11.07/-19.03	-9.67/-9.55	-17.12/-12.89	-16.34/-12.94	-12.94/-18.38	-18.44/-18.85	-18.95/-15.46	-13.13/-13.67	-18.28/-12.87	-18.31/-15.22	-18.87/-18.37	-19/-16.1
$\Theta(150^\circ)$	-10.05/-12.64	-11.5/-10.87	-10.09/-10.14	-12.47/-12.83	-12.1/-3.87	-17.83/-19.48	-15.55/-18.75	-16.91/-9.64	-16.08/-15.41	-14.85/-13.16	-17.83/-19.21	-18.31/-18.12	-16.52/-11.63	-18.87/-17.88	-14.78/-12.68	-19.18/-18.73	-18.79/-13.13	-11.58/-7.1
$\Theta(160^\circ)$	-12.88/-11.44	-9.42/-10.52	-10.67/-13.17	-12.42/-10.58	-9.88/-16.31	-18.26/-16.33	-18.34/-18.79	-18.47/-17.44	-15.53/-17.9	-18.52/-18.48	-13.27/-13.64	-18.88/-18.4	-14.88/-13.05	-14.83/-18.66	-17.63/-17.59	-18.48/-17.47	-17.76/-15.43	-12.36/-13.31
$\Theta(170^\circ)$	-11.2/-11.88	-14.46/-17.67	-19.08/-14.33	-13.64/-16.5	-16.36/-18.05	-18.27/-19.11	-18.74/-18.55	-18.34/-17.35	-17.77/-18.32	-15.75/-15.75	-18.45/-18.37	-17.62/-18.32	-18.46/-18.5	-17.62/-17.47	-16.31/-16.04	-16.31/-16.04	-16.31/-16.04	-12.88/-10.89
$\Theta(180^\circ)$	-13.64/-15.59	-15.49/-19.44	-18.79/-19.09	-17.74/-18.24	-17.83/-18	-16.19/-16.49	-16.48/-16.97	-16.97/-16.99	-19.06/-18.75	-14.97/-15.46	-15.65/-17.39	-17.23/-17.56	-18.68/-18.89	-18.51/-18.74	-18.1/-17.48	-13.48/-15.38	-13.73/-13.78	-





Freq(Hz)	5.85G	5.885G	5.895G
Ant. 1 Max Gain (dBi)	1.04	2.35	2.53
Ant. 2 Max Gain (dBi)	1.61	2.03	2.09
Ant. 3 Max Gain (dBi)	2.87	3.06	2.69
Ant. 4 Max Gain (dBi)	2.33	2.17	1.77
Ant. 1 Polarization/ $\theta$ (°)/ $\Phi$ (°)	Theta/40/310	Theta/40/310	Theta/40/310
Ant. 2 Polarization/ $\theta$ (°)/ $\Phi$ (°)	Theta/70/230	Theta/70/230	Theta/70/230
Ant. 3 Polarization/ $\theta$ (°)/ $\Phi$ (°)	Theta/50/120	Theta/50/120	Theta/50/120
Ant. 4 Polarization/ $\theta$ (°)/ $\Phi$ (°)	Theta/40/250	Theta/40/250	Theta/40/250
Max Gain (dBi)	2.87	3.06	2.69
DG [1SS] (dBi)	5.03	5.58	5.59
DG [2SS] (dBi)	2.87	3.06	2.69
DG [4SS] (dBi)	2.87	3.06	2.69





# Radiated Composite Gain Data\_Radio 3 5.9GHz

# Appendix B

## DG 1SS Result

Freq(Hz)	5.85GPol.	Phi-	Phi+	Phi(30°)	Phi(45°)	Phi(60°)	Phi(75°)	Phi(90°)	Phi(105°)	Phi(120°)	Phi(135°)	Phi(150°)	Phi(165°)	Phi(180°)	Phi(210°)	Phi(225°)	Phi(240°)	Phi(255°)	Phi(270°)	Phi(285°)	Phi(300°)	Phi(315°)	Phi(330°)	Phi(345°)	Phi(350°)
DG(dB)	Phi(0°)Phi(10°)	Phi(20°)Phi(30°)	Phi(40°)Phi(50°)	Phi(60°)Phi(70°)	Phi(80°)Phi(90°)	Phi(100°)Phi(110°)	Phi(120°)Phi(130°)	Phi(140°)Phi(150°)	Phi(160°)Phi(170°)	Phi(180°)Phi(190°)	Phi(200°)Phi(210°)	Phi(220°)Phi(230°)	Phi(240°)Phi(250°)	Phi(260°)Phi(270°)	Phi(280°)Phi(290°)	Phi(300°)Phi(310°)	Phi(320°)Phi(330°)	Phi(340°)Phi(350°)							
Theta(°)	1.64/1.23	1.55/1.64	1.20/5.02	0.15/0.20	0.68/0.96	0.86/0.73	0.50/0.31	0.68/0.96	0.75/0.61	2.25/1.95	2.13/1.98	1.07/0.81	1.07/0.81	1.10/0.81	1.10/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81	1.07/0.81



# Radiated Composite Gain Data\_Radio 3 5.9GHz

# Appendix B

Θ(60°)	-2.33/1.78	0.62/1.93	1.72/2.6	1.36/1.44	0.28/0.12	2/3.46	3.22/55	2.15/3.59	5.36/4.89	5.59/2.67	-2/0.6	0.23/2.65	3.59/2.77	2.92/-0.21	4.04/1.25	3.75/0.36	2.01/-0.07	2.23/0.64
Θ(70°)	1.53/0.95	0.45/1.38	2.42/2.86	3.73/3.64	1.63/4.1	2.39/2.1	2.54/0.64	1.31/2.7	4.55/4.77	3.18/3.31	-2.32/0.84	-0.62/3.7	3.53/1.9	1.55/-0.19	3.05/3.74	4.09/1.59	2.29/2.77	0.93/2.16
Θ(80°)	1.03/0.7	0.32/2.4	3.15/3.41	4.58/2.31	2.26/3.77	2.73/1.97	2.87/1.05	0.07/2.5	3.59/2.83	1.69/4.06	-1.58/-0.57	1.41/3.29	4.2/0.45	1.58/1.61	2.1/3.05	2.48/3.32	2.62/2.58	0.67/1.14
Θ(90°)	-1.73/-0.96	-1.79/1.02	1.45/1.67	2.23/-0.55	0.4/2.52	1.3/0.99	1.9/0.43	-2.2/0.83	1.63/1.1	0.37/2.88	-1.6/-2.42	1.09/1.73	3.26/-2.75	0.77/1.36	2.55/-0.67	0.04/2.2	0.66/0.39	-1.23/-1.3
Θ(100°)	-4.78/-4.22	-6.85/-2.27	-3.21/-1.29	-1.96/-3.59	-2.95/-0.19	-2.06/-0.85	-0.83/-1.19	-5.13/-0.92	0.05/-0.81	-0.04/1.22	-2.88/-4.89	-1.11/-0.51	0.04/-4.16	-4.12/-1.43	0.72/-3.42	-4.24/-2.91	-1.93/-2.71	-6.2/-6.5
Θ(110°)	-6.2/-6.07	-8.61/-4.45	-8.56/-4.52	-6.89/-8.29	-5.42/-2.27	-4.08/-4.41	-3.67/-5.2	-5.41/-2.48	-1.42/-1.72	-2.25/-0.23	-6.03/-3.75	-2.97/-2.06	-2.26/-4.16	-7.12/-6.27	-5.16/-6.73	-8.01/-6.51	-2.3/-5.36	-10.18/-8.4
Θ(120°)	-7.94/-9.47	-8.96/-8.79	-7.12/-8.08	-10.17/-7.57	-7.6/-5.25	-8.88/-7.9	-7.99/-7.15	-6.24/-5.64	-4.94/-3.08	-5.16/-2.83	-5.01/-6.06	-5.81/-6.3	-3.52/-6.89	-7.61/-6.65	-6.45/-7.71	-8.62/-8.7	-7.99/-10.61	-10.94/-10.33
Θ(130°)	-8.48/-8.45	-11.8/-9.33	-5.28/-9.05	-9.42/-9.24	-7.76/-8.74	-10.9/-10.19	-9.21/-7.14	-7.5/-7.89	-4.21/-5.26	-3.48/-2.48	-3.73/-8.51	-5.98/-5.9	-7.63/-9.08	-7.25/-8.89	-6.47/-6.72	-8.17/-7.83	-8.71/-9.49	-7.78/-10.02
Θ(140°)	-11.97/-9.84	-10.56/-10.88	-10.62/-7.72	-11.7/-9.56	-8.87/-10.73	-12.1/-10.71	-11.2/-8.84	-8.3/-7.28	-4.82/-7.47	-7.22/-5.25	-5.53/-8.25	-5.65/-6.94	-10.94/-10.58	-10.21/-8.66	-10.4/-10.68	-7.67/-8.44	-12.55/-12.37	-11.3/-11.84
Θ(150°)	-12.17/-11.67	-9.95/-10.45	-10.67/-12.32	-9.89/-7.79	-10.97/-10.95	-11.89/-10.66	-9.36/-10.92	-11.18/-8.99	-8.16/-6.81	-7/-8.98	-7.21/-8.1	-8.74/-8.69	-10.9/-10.97	-10.91/-10.29	-11.07/-12.26	-12.1/-10.99	-10.8/-11.79	-10.93/-11.68
Θ(160°)	-12/-11.99	-11.64/-8.42	-8.28/-9.18	-10.82/-10.87	-11.57/-11.29	-10.87/-10.2	-11.85/-10.52	-10.79/-10.31	-9.43/-10.37	-10.03/-10.01	-7.51/-9.68	-10.74/-11.78	-11.12/-11.41	-12.17/-11.64	-10.61/-11.79	-10.51/-10.2	-10.82/-11.34	-12.02/-12.97
Θ(170°)	-11.31/-10.33	-10.61/-12.09	-11.52/-10.75	-10.45/-10.32	-10.08/-12.01	-12.56/-11.49	-11.29/-11.2	-12.37/-11.44	-11.98/-9.76	-10/-10.28	-10.36/-10.36	-12.51/-12.24	-11.43/-11.33	-11.47/-11.56	-11.79/-12.3	-11.73/-10.27	-9.41/-11.44	-11.54/-10.96
Θ(180°)	-11.88/-11.41	-11.47/-11.28	-11.52/-12.18	-11.59/-12.03	-12.17/-11.86	-12.77/-12.58	-12.26/-12.55	-11.62/-11.79	-11.82/-12.44	-11.73/-11.04	-11.35/-12.1	-11.85/-11.1	-11.79/-12.36	-12.07/-12.14	-12.54/-11.95	-12.02/-11.55	-12.27/-12	-11.45/-11.25





# Radiated Composite Gain Data\_Radio 3 5.9GHz

# Appendix B

Freq(Hz)	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2	PhiAnt. 2
Theta(°)	-3.24/-2.83	-2.26/-3.43	-0.73/-0.01	-7.11/-8.96	-6.18/-3.05	-5.68/-6.21	-2.77/-2.39	-0.01/-2.39	-0.73/-0.01	0.12/-5.08	-9.04/-8.74	-7.05/-6.04	-6.38/-5.84	-6.91/-7.47	0.65/-1.22	2.25/-2.76	-1.84/-0.39	0.97/-0.18
Gain	Phi(0°)/Phi(10°)	Phi(20°)/Phi(30°)	Phi(40°)/Phi(50°)	Phi(60°)/Phi(70°)	Phi(80°)/Phi(90°)	Phi(100°)/Phi(110°)	Phi(120°)/Phi(130°)	Phi(140°)/Phi(150°)	Phi(160°)/Phi(170°)	Phi(180°)/Phi(190°)	Phi(200°)/Phi(210°)	Phi(220°)/Phi(230°)	Phi(240°)/Phi(250°)	Phi(260°)/Phi(270°)	Phi(280°)/Phi(290°)	Phi(300°)/Phi(310°)	Phi(320°)/Phi(330°)	Phi(340°)/Phi(350°)





# Radiated Composite Gain Data\_Radio 3.5.9GHz

# Appendix B

Freq(Hz)	5.895GPaL	ThetaAnt 3																	
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°)	-1.95-1.49	-1.90-1.73	-1.89-12.24	-9.54-7.23	-6.09-4.52	-3.81-3.33	-2.88-3.2	-4.02-4.2	-6.08-7.69	-9.91-14.85	-18.91-18.8	-15.41-10.7	-7.43-6.03	-5.58-4.73	-4.12-4.15	-4.29-4.85	-5.37-6.44	-7.03-6.98	





# Antenna Pattern\_Radio 2 5.9GHz

# Appendix C

## Total Gain Data

Freq(Hz)	5.85GPol.	TotalAnt. 1	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
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°)	-1.91/-1.55	-1.54/-2.10	-2.50/-1.84	-1.48/-1.89	-2.06/-1.80	-2.05/-2.73	-1.74/-2.74	-2.77/-2.56	-2.19/-2.52	-2.71/-2.02	-1.74/-2.15	-2.37/-1.86	-1.94/-2.64	-2.25/-2.26	-2.05/-2.26	-2.25/-2.24	-1.46/-0.51	-1.46/-0.51	-2.36/-2.19	-1.10/-0.96
θ(10°)	-1.41/-1.23	-0.69/-0.70	-1.00/-1.70	-1.99/-2.58	-2.74/-2.13	-1.53/-0.66	0.33/-1.21	2.31/2.85	2.45/2.06	0.98/0.88	1.98/2.54	3.11/3.32	3.00/2.37	2.33/2.40	2.58/2.93	3.06/2.41	1.48/0.47	1.48/0.47	-1.72/-2.17	-1.10/-0.96
θ(20°)	-1.43/-1.95	-2.82/-3.26	-1.43/-1.23	-2.23/-1.31	-1.69/-4.25	-1.38/0.58	0.55/-1.12	-1.85/-0.78	1.49/2.45	1.40/0.82	2.39/2.08	0.56/-1.46	-1.42/0.59	1.10/0.62	-2.48/-2.26	-4.22/-3.15	-1.46/-0.51	-1.46/-0.51	0.24/-0.99	0.24/-0.99
θ(30°)	-1.88/-2.13	-3.71/-3.00	-3.40/-3.95	-6.68/-3.06	-2.44/-2.21	0.69/0.16	0.72/0.18	-0.07/0.90	0.98/-0.95	-0.51/1.52	2.11/1.76	2.28/2.51	1.79/2.04	2.14/1.82	-0.25/-0.83	-0.49/-3.10	-4.20/-3.51	-4.20/-3.51	-1.10/-0.96	-1.10/-0.96
θ(40°)	-1.16/0.40	-4.00/-3.76	-1.71/-4.19	-1.68/-4.27	-9.60/-6.75	-3.96/-2.96	-2.89/-2.02	-2.51/0.37	-0.95/2.13	-1.07/2.58	2.88/2.99	2.27/2.75	3.35/0.42	2.98/1.79	1.42/2.48	1.14/-1.19	-8.89/-7.00	-8.89/-7.00	-5.17/-3.67	-5.17/-3.67
θ(50°)	-1.46/1.51	-1.11/0.35	-0.50/0.74	-1.93/-2.54	-1.05/-1.45	-1.37/-3.17	-0.73/-1.12	-0.43/-1.48	-0.34/0.41	-3.70/-1.19	-2.16/2.80	0.15/1.76	2.79/-0.48	0.45/0.38	1.52/-0.11	-3.42/-4.09	-0.38/-1.68	-0.38/-1.68	-4.15/-1.14	-4.15/-1.14
θ(60°)	-0.02/0.14	-2.34/0.42	-2.73/1.10	-1.46/0.73	-1.91/-0.70	-1.46/0.73	-1.91/-0.70	-1.46/0.73	-1.91/-0.70	-1.46/0.73	-1.91/-0.70	-1.46/0.73	-1.91/-0.70	1.31/1.07	2.03/3.28	0.06/0.30	0.36/-1.12	0.36/-1.12	-2.64/-1.55	-2.64/-1.55
θ(70°)	1.29/-0.06	-1.80/-2.16	-3.76/-1.72	-1.54/-2.13	-6.56/-0.98	-2.61/-1.19	-2.91/0.16	0.09/-1.54	-4.77/-0.63	-4.85/-5.16	-8.46/-3.50	-4.39/-2.20	3.63/0.38	0.69/1.56	1.19/2.52	0.46/2.31	-2.66/-4.38	-2.66/-4.38	-0.82/-1.16	-0.82/-1.16
θ(80°)	1.26/-0.15	-2.29/-4.42	-4.69/-6.50	-3.55/-6.43	-2.94/-5.03	-3.43/-0.02	-1.12/0.92	-0.68/-5.09	-7.10/-2.20	-3.83/-6.47	-9.85/-3.58	-3.92/-2.01	3.27/-1.37	1.02/2.44	2.05/2.42	-0.55/-0.51	-2.46/-8.52	-2.46/-8.52	-2.82/-0.73	-2.82/-0.73
θ(90°)	0.20/-0.52	-2.94/-5.76	-5.26/-9.84	-4.85/-5.59	-2.66/-2.69	-0.01/0.96	-0.01/0.96	-0.01/0.96	-0.01/0.96	-0.01/0.96	-0.01/0.96	-0.01/0.96	-0.01/0.96	1.01/0.86	1.01/0.86	-1.32/-1.44	-1.25/-10.72	-1.25/-10.72	-3.10/-2.58	-3.10/-2.58
θ(100°)	-0.68/-2.21	-3.93/-7.44	-8.20/-11.41	-7.07/-6.41	-5.02/-5.16	-5.42/-6.81	-8.89/-8.71	-3.75/-16.10	-9.93/-7.01	-6.02/-8.90	-8.68/-9.17	-7.32/-7.79	-4.33/-6.65	-3.66/-1.59	-1.99/-2.44	-3.44/-1.96	-2.30/-10.48	-2.30/-10.48	-3.66/-5.68	-3.66/-5.68
θ(110°)	-3.34/-4.15	-6.84/-8.05	-11.53/-15.92	-10.37/-11.65	-6.81/-6.95	-4.90/-6.51	-15.66/-13.55	-10.98/-7.64	-13.12/-14.85	-10.56/-10.39	-9.44/-13.14	-10.37/-10.14	-5.40/-10.50	-7.43/-3.36	-3.30/-3.67	-8.44/-3.31	-5.58/-10.49	-5.58/-10.49	-6.35/-6.80	-6.35/-6.80
θ(120°)	-6.36/-4.82	-10.43/-6.88	-14.36/-14.36	-14.88/-14.08	-14.36/-12.76	-15.27/-12.27	-10.64/-12.74	-13.88/-13.70	-14.36/-13.51	-13.79/-13.79	-15.73/-9.73	-9.48/-6.80	-8.54/-11.41	-5.87/-3.25	-4.36/-1.77	-8.48/-3.66	-8.71/-8.84	-8.71/-8.84	-9.42/-5.50	-9.42/-5.50
θ(130°)	-7.52/-9.21	-10.17/-9.88	-12.12/-14.23	-14.61/-14.31	-15.32/-9.70	-8.56/-13.84	-14.18/-9.70	-9.89/-14.76	-10.49/-8.79	-9.73/-12.19	-13.12/-14.02	-10.83/-6.31	-5.52/-9.54	-6.81/-4.80	-6.86/-12.74	-10.18/-3.93	-8.61/-10.58	-8.61/-10.58	-7.91/-9.38	-7.91/-9.38
θ(140°)	-11.26/-10.15	-11.24/-8.01	-12.13/-12.85	-12.71/-14.92	-14.77/-11.27	-14.58/-15.60	-11.91/-11.23	-11.36/-11.88	-12.88/-10.35	-15.73/-11.32	-10.76/-6.39	-8.49/-10.40	-7.12/-9.95	-11.07/-11.80	-11.07/-11.80	-11.07/-11.80	-11.07/-11.80	-11.07/-11.80	-11.55/-12.37	-11.55/-12.37
θ(150°)	-11.04/-10.64	-8.80/-11.53	-10.43/-11.03	-14.69/-15.74	-15.13/-15.42	-14.69/-15.74	-15.13/-15.42	-14.69/-15.74	-15.13/-15.42	-14.69/-15.74	-15.13/-15.42	-14.69/-15.74	-15.13/-15.42	-12.00/-15.49	-13.61/-13.93	-12.57/-12.23	-12.68/-13.93	-12.68/-13.93	-13.78/-11.37	-13.78/-11.37
θ(160°)	-14.89/-11.62	-11.82/-10.81	-14.60/-14.67	-14.68/-11.25	-9.80/-10.55	-12.61/-14.32	-11.11/-10.56	-12.38/-12.16	-14.33/-13.64	-13.36/-14.60	-9.89/-10.31	-10.92/-11.04	-10.91/-12.73	-12.34/-10.62	-10.41/-10.28	-10.53/-11.71	-13.55/-14.64	-13.55/-14.64	-15.00/-14.22	-15.00/-14.22
θ(170°)	-15.79/-15.39	-14.63/-13.08	-13.09/-12.47	-13.12/-14.12	-15.17/-15.53	-15.10/-14.75	-14.48/-14.36	-13.89/-14.56	-14.61/-14.98	-15.68/-15.77	-15.42/-14.73	-15.31/-15.83	-14.40/-14.42	-11.34/-10.87	-12.60/-12.90	-13.06/-13.53	-14.61/-15.41	-14.61/-15.41	-15.19/-14.91	-15.19/-14.91
θ(180°)	-15.36/-15.64	-15.89/-15.43	-15.78/-12.88	-13.86/-15.41	-14.57/-14.57	-15.39/-15.24	-15.89/-15.09	-15.55/-15.97	-14.89/-14.95	-15.09/-15.54	-15.52/-14.53	-15.56/-15.63	-15.38/-16.05	-15.13/-15.35	-15.27/-15.36	-15.73/-15.12	-15.65/-15.04	-15.65/-15.04	-15.65/-15.04	-15.65/-15.04





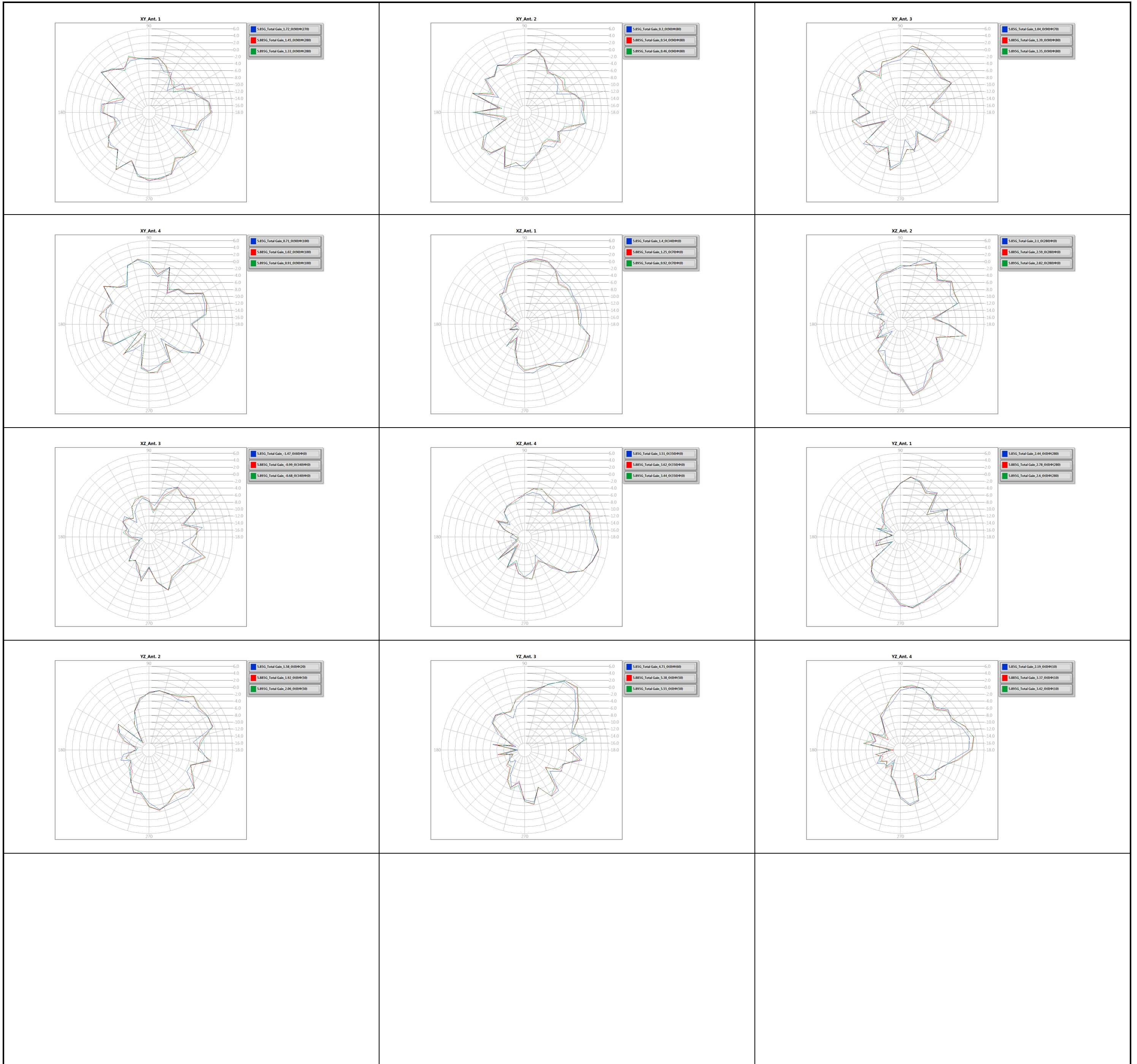


# Antenna Pattern\_Radio 2 5.9GHz

# Appendix C

Theta (°)	-11.64/-12.90	-14.94/-13.68	-10.41/-9.05	-9.10/-8.45	-10.01/-10.50	-10.27/-13.12	-8.99/-12.03	-10.23/-8.82	-14.84/-12.40	-15.89/-15.31	-12.82/-15.22	-14.67/-15.40	-12.08/-11.25	-14.79/-12.73	-10.41/-9.64	-8.92/-9.22	-10.11/-9.54	-12.88/-13.94
Theta (170°)	-14.96/-16.05	-15.65/-14.98	-14.85/-12.24	-10.20/-7.64	-7.64/-7.40	-9.28/-11.44	-10.82/-8.67	-10.87/-13.01	-15.45/-15.49	-15.85/-15.24	-15.55/-14.96	-14.87/-12.98	-15.25/-11.87	-11.62/-10.63	-9.60/-10.26	-9.10/-9.45	-11.28/-10.35	-11.64/-13.19
Theta (180°)	-15.48/-13.24	-15.16/-15.36	-14.33/-12.41	-13.22/-12.19	-14.69/-16.22	-12.50/-11.23	-10.82/-15.53	-15.58/-15.07	-15.73/-15.84	-15.35/-14.17	-15.35/-14.45	-13.74/-13.42	-15.32/-15.66	-15.65/-15.42	-15.48/-13.13	-14.14/-14.05	-14.04/-13.42	-14.10/-12.49
Freq(Hz)	5.895GPol	TotalAnt 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gain	Phi(0°)Phi(10°)	Phi(20°)Phi(30°)	Phi(40°)Phi(50°)	Phi(60°)Phi(70°)	Phi(80°)Phi(90°)	Phi(100°)Phi(110°)	Phi(120°)Phi(130°)	Phi(140°)Phi(150°)	Phi(160°)Phi(170°)	Phi(180°)Phi(190°)	Phi(200°)Phi(210°)	Phi(220°)Phi(230°)	Phi(240°)Phi(250°)	Phi(260°)Phi(270°)	Phi(280°)Phi(290°)	Phi(300°)Phi(310°)	Phi(320°)Phi(330°)	Phi(340°)Phi(350°)
Theta (0°)	2.42/2.87	2.49/2.77	2.56/2.37	2.59/2.80	2.48/2.68	2.42/2.69	2.83/2.51	2.80/2.93	3.06/2.99	3.50/3.19	2.98/2.90	3.34/2.90	3.07/3.01	3.00/2.89	3.11/3.07	2.82/2.93	2.69/2.84	2.73/2.56
Theta (10°)	1.22/0.08	-0.30/-1.05	-0.25/0.69	1.82/3.14	3.59/3.42	2.75/1.57	1.37/0.71	0.68/2.10	3.38/3.86	3.44/3.10	2.35/1.06	-0.20/-0.71	-1.62/-1.72	-1.27/-1.12	-0.58/-0.60	-0.74/-0.60	0.12/1.41	1.82/1.91
Theta (20°)	1.64/-0.37	-0.41/1.00	1.79/1.32	0.19/-1.53	0.01/1.73	0.83/-0.25	3.40/4.23	3.62/1.96	1.60/3.23	2.55/0.50	-0.70/-1.06	-2.46/-9.30	-8.92/-8.74	-5.49/-4.87	-5.56/-1.42	0.54/0.00	-1.28/-0.48	1.56/2.67
Theta (30°)	0.50/-0.42	0.04/-0.81	-1.13/-1.86	-2.29/-2.15	0.66/-0.42	0.38/1.80	0.68/-4.68	-0.12/2.88	1.77/0.87	1.33/-0.21	-0.84/-6.99	-4.52/-2.00	-2.25/-6.75	-9.57/-6.31	-5.86/-6.47	-6.59/-4.74	-0.62/-0.54	-2.21/0.90
Theta (40°)	-7.84/-4.66	-4.35/-2.13	-4.97/-6.73	-2.90/-0.75	-2.49/-0.63	-2.95/-2.18	-6.93/-3.23	-7.25/-5.12	-0.70/-1.44	-1.77/-0.12	-2.90/-1.72	-0.60/-3.40	-5.83/-6.61	-5.87/-4.80	-4.21/-3.31	-1.61/-2.84	-9.66/-1.15	-3.63/-3.28
Theta (50°)	-4.85/-0.06	-1.88/-2.09	-14.29/-3.74	-0.71/-4.61	-3.14/-2.94	-2.37/-1.90	-1.90/-6.56	-8.28/-10.22	-7.77/-2.86	-7.96/-1.72	-3.47/-2.42	-2.74/-1.61	-10.12/-7.68	-10.63/-6.83	-5.92/-1.34	-0.97/0.39	-3.00/-2.09	-0.18/-2.61
Theta (60°)	-4.44/-2.25	-1.13/-0.55	-9.18/-5.93	-3.64/-3.04	-2.08/-0.24	2.73/-0.04	-0.23/-2.15	-3.65/-5.17	-2.28/-6.63	-9.89/-3.14	0.39/-2.55	-2.38/-4.89	-12.45/-11.07	-14.99/-9.74	-7.53/-0.66	-1.16/-0.37	0.42/-0.02	2.54/-4.26
Theta (70°)	-3.43/1.20	0.28/0.40	-5.01/-4.79	-7.26/0.04	-2.51/0.75	3.31/2.08	-1.11/-2.46	1.46/-6.09	-0.65/-8.18	-8.68/-0.72	1.68/-3.78	-4.79/-7.42	-11.48/-11.83	-8.27/-2.55	-1.84/-1.41	-0.58/-2.62	0.40/0.74	1.02/3.00
Theta (80°)	-3.87/1.03	0.70/0.56	-4.34/-5.02	-5.80/0.57	-2.62/0.90	2.04/1.78	-2.97/-3.91	0.84/-6.04	-1.86/-4.27	-5.65/-2.26	-2.18/-7.68	-11.63/-6.22	-13.53/-11.33	-6.18/-1.75	-1.01/-4.54	-3.96/-6.22	-1.15/0.14	-0.73/-2.41
Theta (90°)	-5.73/-1.29	-0.28/-0.14	-4.30/-4.81	-6.57/-0.52	-3.56/-0.05	0.91/-0.19	-5.04/-4.22	-1.14/-5.75	-5.06/-3.61	-6.54/-5.02	-4.09/-6.90	-14.78/-7.11	-12.66/-15.23	-5.13/-4.10	-4.23/-6.37	-5.84/-10.83	-5.28/-1.66	-1.24/-3.59
Theta (100°)	-7.39/-5.54	-2.83/-1.02	-6.75/-4.75	-9.33/-2.95	-5.53/-2.62	-0.90/-3.31	-6.07/-5.83	-5.19/-6.29	-7.50/-3.16	-8.37/-8.46	-7.45/-9.92	-11.18/-8.28	-11.67/-15.94	-10.30/-8.36	-10.45/-6.70	-4.53/-8.44	-13.08/-3.45	-2.31/-5.09
Theta (110°)	-7.80/-10.49	-3.54/-1.86	-6.86/-5.93	-7.99/-5.19	-7.74/-5.57	-3.70/-4.80	-8.05/-5.99	-8.82/-10.27	-10.06/-8.57	-10.85/-12.51	-16.02/-15.96	-12.73/-11.03	-11.62/-11.83	-8.19/-10.31	-9.97/-5.23	-6.55/-7.50	-9.37/-5.87	-2.99/-6.59
Theta (120°)	-7.86/-13.68	-6.23/-4.26	-6.59/-10.06	-10.56/-10.27	-6.66/-6.44	-4.46/-4.97	-8.30/-9.86	-10.67/-13.30	-8.42/-12.52	-7.98/-10.12	-6.98/-14.93	-14.97/-14.76	-14.40/-13.64	-14.80/-13.85	-11.24/-8.84	-7.42/-10.71	-7.50/-4.52	-3.80/-9.58
Theta (130°)	-8.99/-13.21	-7.18/-5.00	-6.82/-8.65	-13.90/-12.49	-6.65/-10.81	-8.44/-8.57	-9.75/-10.22	-11.75/-9.35	-6.58/-8.52	-14.64/-12.45	-9.39/-15.20	-9.33/-15.20	-15.62/-14.04	-12.88/-11.57	-14.03/-14.53	-13.70/-10.93	-7.26/-4.85	-5.40/-10.65
Theta (140°)	-11.74/-14.10	-12.36/-9.50	-7.28/-6.15	-10.08/-10.09	-11.68/-12.43	-12.48/-15.40	-14.21/-15.53	-11.58/-12.77	-14.61/-9.76	-7.94/-15.44	-15.20/-14.11	-16.03/-14.19	-14.78/-13.19	-13.04/-12.89	-14.84/-13.82	-12.06/-6.29	-6.91/-7.49	-9.52/-12.95
Theta (150°)	-9.09/-13.57	-14.94/-8.16	-6.93/-10.01	-9.67/-8.66	-9.63/-7.70	-8.97/-11.97	-9.46/-11.06	-9.24/-11.82	-9.04/-12.71	-15.58/-13.21	-12.65/-15.38	-11.92/-16.08	-13.01/-13.64	-12.62/-11.15	-10.67/-10.07	-9.23/-8.49	-7.14/-6.62	-11.29/-11.23
Theta (160°)	-11.43/-14.06	-15.55/-12.59	-10.76/-9.17	-8.29/-9.22	-9.32/-9.55	-10.96/-13.84	-8.59/-12.52	-9.51/-8.99	-14.04/-13.18	-15.09/-15.93	-13.34/-16.08	-15.00/-15.42	-13.17/-11.94	-14.10/-11.92	-9.88/-9.99	-10.24/-8.91	-10.04/-10.43	-13.21/-13.97
Theta (170°)	-14.62/-14.94	-15.90/-16.27	-14.54/-13.42	-9.10/-8.73	-8.05/-7.20	-9.38/-11.48	-11.67/-9.27	-10.37/-14.31	-15.16/-15.28	-16.30/-14.66	-15.61/-15.79	-14.63/-12.29	-13.46/-12.38	-11.04/-11.02	-9.50/-9.24	-9.09/-9.99	-10.51/-11.21	-11.81/-13.21
Theta (180°)	-15.75/-15.36	-14.91/-15.08	-13.89/-13.90	-13.38/-11.62	-15.89/-15.30	-13.05/-11.57	-11.79/-14.57	-15.18/-14.86	-15.48/-15.79	-16.10/-15.00	-14.92/-14.40	-14.82/-14.49	-15.37/-15.29	-15.27/-15.67	-15.62/-14.56	-13.94/-13.97	-12.81/-15.34	-13.64/-13.17

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\_Radio 3 5.9GHz

# Appendix D

Theta (°)	-11.26/-13.39	-14.44/-10.06	-10.25/-11.25	-13.93/-12.35	-10.54/-11.55	-10.84/-10.70	-12.91/-11.29	-12.95/-13.20	-13.87/-12.91	-14.88/-15.58	-13.49/-15.11	-13.05/-13.50	-15.10/-14.91	-14.70/-15.80	-15.27/-15.56	-15.36/-13.00	-12.70/-13.70	-15.68/-10.35
Theta (170°)	-12.84/-11.11	-13.16/-13.99	-15.81/-14.83	-13.78/-13.79	-12.83/-15.09	-14.13/-14.97	-15.20/-15.32	-15.50/-14.64	-14.51/-15.22	-14.90/-15.54	-13.96/-13.99	-16.08/-15.61	-15.01/-15.05	-15.01/-15.52	-15.31/-13.83	-15.98/-15.35	-15.67/-14.61	-15.01/-15.43
Theta (180°)	-16.04/-15.35	-13.55/-13.16	-15.68/-15.10	-14.58/-15.66	-15.97/-15.39	-14.47/-14.80	-13.54/-13.81	-15.92/-15.34	-15.46/-14.33	-13.93/-14.51	-15.70/-13.69	-14.25/-13.35	-15.02/-15.45	-15.18/-15.04	-14.56/-14.33	-15.66/-15.16	-14.88/-15.79	-15.65/-15.98
Freq(Hz)	5.895GPol	TotalAnt 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gain	Phi(0°)/Phi(10°)	Phi(20°)/Phi(30°)	Phi(40°)/Phi(50°)	Phi(60°)/Phi(70°)	Phi(80°)/Phi(90°)	Phi(100°)/Phi(110°)	Phi(120°)/Phi(130°)	Phi(140°)/Phi(150°)	Phi(160°)/Phi(170°)	Phi(180°)/Phi(190°)	Phi(200°)/Phi(210°)	Phi(220°)/Phi(230°)	Phi(240°)/Phi(250°)	Phi(260°)/Phi(270°)	Phi(280°)/Phi(290°)	Phi(300°)/Phi(310°)	Phi(320°)/Phi(330°)	Phi(340°)/Phi(350°)
Theta (0°)	1.69/1.27	1.69/1.74	1.62/1.59	1.58/1.70	1.39/1.62	1.56/1.86	1.64/1.58	1.96/1.83	1.92/1.94	1.90/2.00	2.05/1.93	1.81/1.78	1.99/1.62	1.98/1.70	1.59/1.48	1.62/1.78	1.54/1.64	1.52/1.50
Theta (10°)	1.57/1.90	1.67/0.45	-1.54/-3.11	-2.56/-0.56	0.73/1.41	1.60/1.28	1.37/0.46	-0.28/-0.91	-1.58/-1.64	-1.92/-1.47	-1.28/-1.49	-2.15/-1.54	-0.87/-0.20	-0.04/-0.33	-0.60/-0.80	-1.58/-1.10	-0.93/-0.93	0.35/0.62
Theta (20°)	-1.06/1.04	-0.17/-0.91	-0.50/-1.65	-2.78/-2.26	-4.05/-5.36	-2.31/-0.21	0.27/-0.64	-1.87/-1.73	-1.93/-3.07	-3.70/-3.87	-2.57/-1.80	-2.70/-2.18	-0.11/0.25	-0.74/-0.41	0.25/-0.20	-0.32/-0.87	-0.98/-1.87	-2.85/-3.53
Theta (30°)	-3.49/-0.62	-0.84/-4.04	-2.55/-2.13	-4.32/-0.36	-1.27/-5.47	-7.53/-3.06	-1.60/-1.45	0.30/1.28	1.11/0.56	0.24/-2.66	-8.22/-8.85	-2.67/0.24	0.49/-0.07	1.18/1.60	-1.24/-1.81	-1.67/-3.74	-6.86/-2.69	-1.08/-3.80
Theta (40°)	-9.92/-0.66	-1.80/-3.32	-4.10/-3.72	-1.46/-2.01	-5.21/-5.81	-2.66/-3.81	-2.11/1.46	0.15/-0.03	3.26/3.15	1.81/0.11	-8.00/-1.41	-1.75/-1.11	0.58/2.19	0.25/-3.20	-0.28/-1.90	-1.46/-2.66	-2.06/-3.84	-7.72/-8.85
Theta (50°)	-9.03/-8.92	-5.35/-4.04	-3.66/-2.61	-4.79/-1.95	-1.21/-4.47	-0.67/-0.30	0.87/0.50	-1.65/2.59	2.83/3.09	-1.22/-1.15	-7.22/-1.27	-1.86/0.06	0.59/0.05	-0.99/-1.73	-1.44/-0.92	-2.65/-2.94	-4.33/-6.59	-4.73/-5.16
Theta (60°)	-10.74/-1.33	-1.39/-1.90	-2.75/-0.70	-8.20/-3.41	-6.38/-3.34	-2.65/-1.15	2.26/0.87	-1.05/0.72	1.64/1.15	1.72/-1.60	-8.40/-1.85	-3.03/-0.27	0.29/-2.78	-1.19/-5.17	-2.33/-2.81	-4.22/-2.69	-4.27/-9.96	-5.92/-8.71
Theta (70°)	-6.44/-3.32	-3.20/-1.69	-0.71/-1.44	-5.72/-9.22	-7.11/-3.10	-5.19/-1.72	0.73/0.18	-1.05/-1.06	0.81/0.19	-0.23/0.03	-6.19/-4.98	-3.25/-2.33	-1.12/-4.66	-2.59/-3.05	-2.15/-5.24	-1.10/-3.25	-4.47/-5.04	-16.52/-4.97
Theta (80°)	-3.67/-0.57	-2.67/-2.90	-1.46/-3.66	-4.09/-9.59	-3.80/-3.53	-4.97/-3.63	-0.02/-0.77	-4.95/-1.79	-0.47/-2.09	-2.39/-0.23	-7.88/-7.70	-5.36/-3.97	-3.19/-6.90	-2.71/-2.72	-0.88/-3.05	-1.66/-2.19	-6.40/-6.00	-9.15/-9.04
Theta (90°)	-4.11/-0.92	-3.39/-3.54	-3.94/-5.46	-5.87/-7.56	-4.26/-3.94	-4.35/-4.83	-1.48/-2.82	-11.36/-3.22	-2.19/-4.28	-3.54/-3.44	-10.53/-10.16	-9.44/-6.74	-5.79/-11.55	-3.24/-4.71	-1.93/-1.66	-2.84/-6.00	-12.64/-7.34	-10.14/-13.93
Theta (100°)	-6.66/-4.36	-8.66/-6.07	-8.11/-7.18	-8.01/-6.73	-5.72/-4.78	-5.93/-5.50	-4.05/-4.78	-12.65/-5.05	-3.84/-5.98	-5.39/-6.99	-9.71/-11.88	-12.83/-8.60	-12.46/-9.36	-9.39/-10.11	-7.06/-4.23	-3.18/-12.84	-10.62/-7.89	-13.43/-10.88
Theta (110°)	-9.54/-8.13	-14.34/-11.81	-12.01/-11.72	-9.19/-7.78	-7.12/-6.77	-6.30/-7.86	-7.15/-8.06	-10.13/-7.30	-4.27/-8.84	-9.02/-8.61	-12.99/-12.22	-13.43/-8.00	-14.34/-12.45	-14.91/-15.19	-13.12/-12.05	-7.12/-10.98	-9.84/-13.34	-12.80/-12.16
Theta (120°)	-10.69/-7.97	-10.48/-11.31	-14.39/-14.77	-13.61/-10.23	-10.31/-10.22	-9.78/-6.03	-7.85/-11.93	-12.83/-11.91	-6.14/-10.38	-10.04/-15.50	-14.43/-15.18	-14.66/-15.16	-12.48/-12.60	-14.60/-14.31	-14.66/-12.29	-9.97/-11.21	-15.25/-13.31	-10.64/-10.55
Theta (130°)	-9.20/-10.65	-14.75/-10.93	-14.02/-15.12	-13.43/-14.33	-11.37/-13.06	-11.69/-8.17	-9.42/-10.03	-10.80/-10.98	-9.90/-10.94	-8.73/-7.07	-10.44/-15.25	-12.43/-13.09	-11.07/-14.79	-12.41/-15.67	-13.66/-12.72	-13.25/-13.28	-15.57/-14.93	-15.13/-12.31
Theta (140°)	-14.46/-14.26	-12.48/-15.25	-16.04/-15.62	-14.57/-13.38	-11.60/-12.07	-14.69/-11.45	-9.88/-8.16	-7.66/-9.08	-12.42/-10.73	-10.61/-9.49	-15.59/-14.82	-15.09/-15.43	-14.53/-14.91	-16.11/-15.20	-15.37/-14.90	-13.99/-15.46	-15.46/-16.19	-13.07/-13.52
Theta (150°)	-15.44/-14.10	-12.75/-12.21	-13.93/-12.89	-12.23/-14.99	-12.75/-11.74	-12.53/-11.67	-10.25/-11.27	-11.76/-12.70	-15.44/-15.75	-15.25/-15.44	-15.39/-14.68	-13.86/-14.75	-15.74/-15.44	-13.84/-14.86	-14.93/-15.46	-16.17/-15.23	-15.18/-12.34	-15.34/-14.45
Theta (160°)	-12.01/-14.73	-14.13/-10.29	-11.53/-11.82	-14.71/-12.66	-10.51/-11.88	-10.81/-10.13	-14.05/-10.81	-11.82/-12.75	-13.81/-14.22	-13.73/-15.46	-14.17/-15.04	-13.29/-13.53	-15.76/-14.93	-15.32/-15.89	-15.29/-16.00	-15.20/-11.92	-12.76/-13.86	-15.93/-9.56
Theta (170°)	-12.42/-11.28	-13.19/-14.07	-14.74/-15.69	-13.94/-13.22	-12.56/-13.70	-15.06/-14.83	-15.43/-15.50	-15.40/-13.92	-15.22/-13.78	-15.10/-15.78	-13.78/-12.79	-15.95/-14.90	-15.33/-14.83	-15.43/-15.72	-15.56/-14.46	-16.13/-14.81	-15.41/-15.49	-15.73/-14.04
Theta (180°)	-14.85/-15.43	-14.14/-14.43	-15.80/-14.91	-14.93/-14.80	-14.83/-15.25	-15.13/-15.56	-12.26/-14.16	-14.96/-14.94	-15.25/-15.06	-14.39/-14.17	-15.10/-15.51	-13.96/-13.27	-15.03/-15.32	-15.70/-15.05	-14.65/-14.94	-15.88/-14.64	-15.78/-14.78	-15.69/-15.77

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

