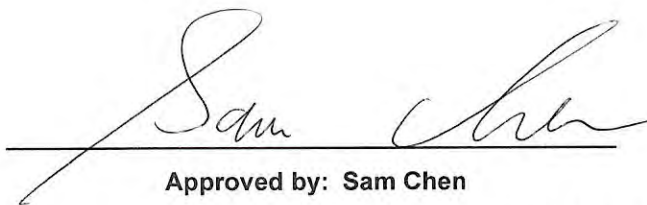




# Antenna Composite Gain Test Report

FCC ID	Z3WAIR4985
Equipment	Wi-Fi 6E Smart Mesh System
Brand Name	Airties
Model Name	Air 4985
SW version	4.144.8.0_wltest
HW version	PCB-4985-D01-M01-R02
Serial Number	J48LB2HV100108
Applicant	Airties Wireless Networks Sehit Mehmet Mikdat Uluunlu Sokagi No:23 Esentepe, Sisli Istanbul, 34394 Turkey
Manufacturer	Airties Wireless Networks Sehit Mehmet Mikdat Uluunlu Sokagi No:23 Esentepe, Sisli Istanbul, 34394 Turkey
Sample Received	Aug. 19, 2022
Start Test Date	Aug. 25, 2022
Final Test Date	Aug. 25, 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.)



## Table of Contents

History of this test report.....	3
1. Operation Mode and Antenna Information .....	4
2. Test Frequency .....	4
3. Testing Location.....	5
4. Test Facility and Configuration.....	6
5. Reference Calibration .....	7
6. Test Method .....	8
7. Measured Values and Calculation of Maximum Gain Positions.....	9
8. Summary of Test Result .....	11
9. Test Setup .....	12
10. Test Equipment and Calibration Data .....	13
11. Test Results .....	14





### 1. Operation Mode and Antenna Information

Antenna Position	RF Port			Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
	2.4G	5G	6G					
2G/6G Ant1	1	-	1	AirTies	ANT A00	PCB	N/A	2.4GHz, 6GHz UNII5~8
2G/6G Ant2	2	-	2	AirTies	ANT A11	PCB	N/A	2.4GHz, 6GHz UNII5~8
5G Ant1	-	1	-	AirTies	ANT A0X	PCB	N/A	5GHz UNII 1~3
5G Ant2	-	2	-	AirTies	ANT A1X	PCB	N/A	5GHz UNII 1~3
5G Ant3	-	3	-	AirTies	ANT A2X	PCB	N/A	5GHz UNII 1~3
5G Ant4	-	4	-	AirTies	ANT A3X	PCB	N/A	5GHz UNII 1~3

Note:

2.4GHz and 6GHz Operation Mode (2TX/2RX)

2G 6GAnt1~2 can be used as transmitting/receiving antenna.

2G 6GAnt1~2 could transmit/receive simultaneously.

5GHz Operation Mode (4TX/4RX)

5G Ant1~4 can be used as transmitting/receiving antenna.

5G Ant1~4 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	2450
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

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	Aug. 25, 2022

Note:

Testing Site Information

Brand Name: TDK

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

Characteristic: Fully Anechoic Chamber

#### 4. Test Facility and Configuration

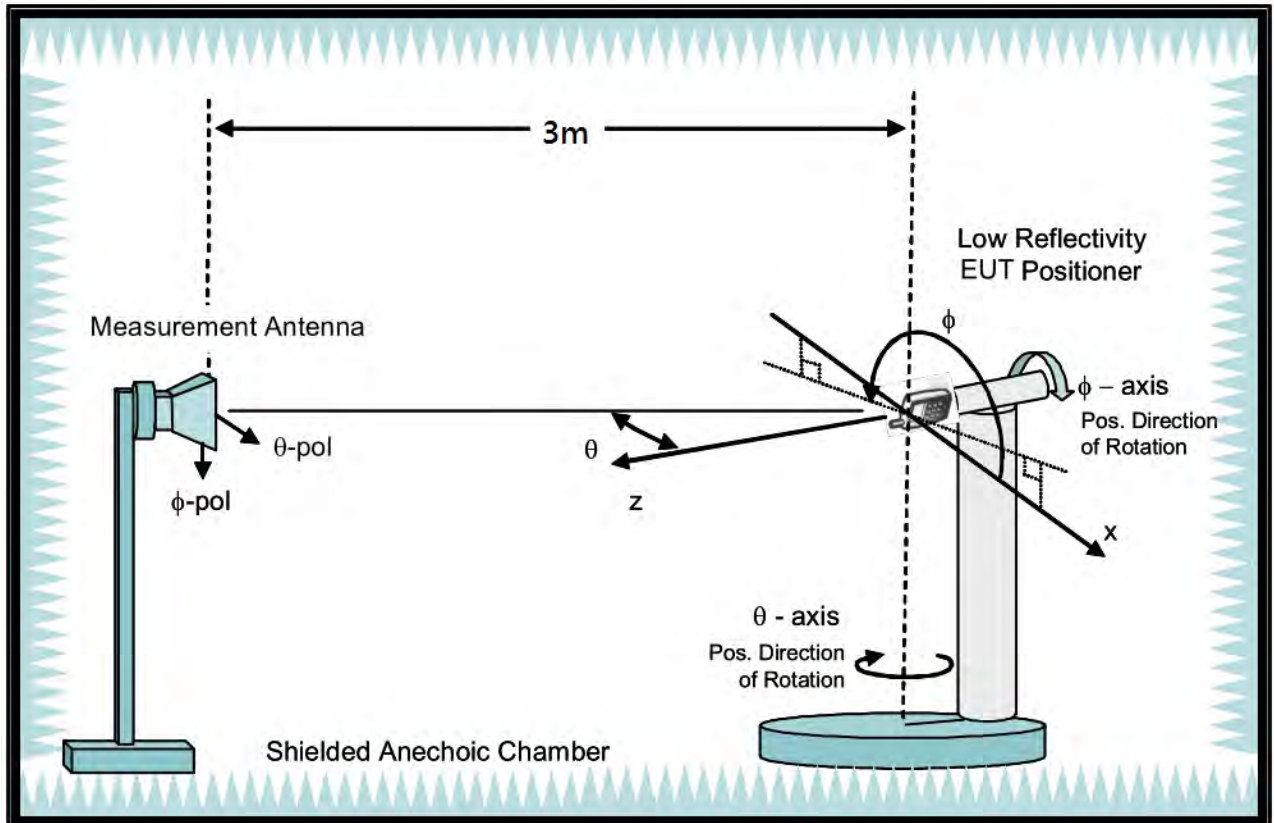
Test configuration: Reference to CITA OTA distributed-axes system configuration.

Chamber: Fully Anechoic Chamber.

Measurement antenna: Dual Polarization Horn antenna

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

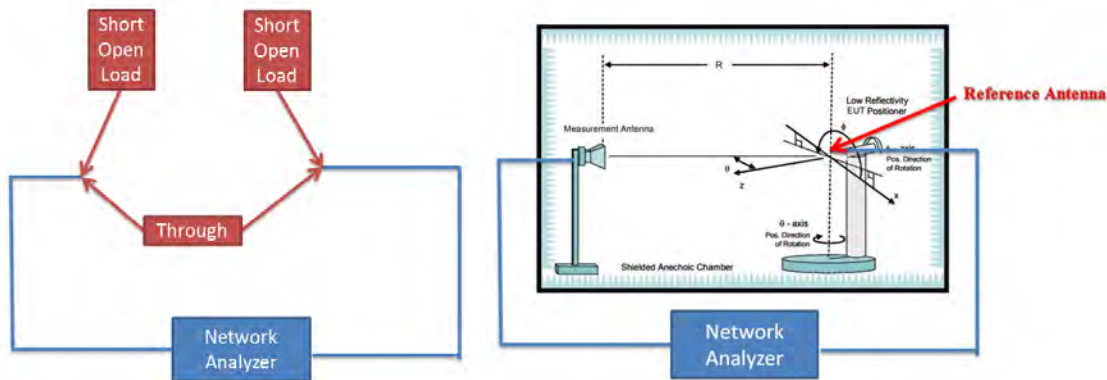
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



### 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	7200
G(theta) reading (dB)	-33.55	-33.27	-32.92	-32.91	-32.73	-32.02	-32.67	-32.82	-32.98	-33.18	-32.8	-33.92	-34.62	-35.57
G(phi) reading (dB)	-33.15	-32.7	-32.41	-32.61	-32.43	-31.72	-32.37	-32.51	-32.52	-32.66	-32.5	-33.62	-34.32	-35.48
Reference gain (dBi)	10.1	10.4	10.7	12.5	12.7	13.5	13.4	13.3	13.3	13.2	13.4	12.5	12.1	11.4
Factor(theta) (dB)	43.65	43.67	43.62	45.41	45.43	45.52	46.07	46.12	46.28	46.38	46.2	46.42	46.72	46.97
Factor(phi) (dB)	43.25	43.1	43.11	45.11	45.13	45.22	45.77	45.81	45.82	45.86	45.9	46.12	46.42	46.88

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)	2.45G	6.175G	6.475G	6.695G	6.995G
Ant. 1 (dBi)	0.87	1.32	-1.14	0.04	1.88
Ant. 2 (dBi)	2.11	0.12	1.98	2.07	0.58
DG [1SS] (dBi)	4.52	3.75	3.57	4.12	4.26
Polarization	Theta	Phi	Phi	Phi	Phi
$\Theta$ (°)	142.5	97.5	75	97.5	120
$\Phi$ (°)	30	172.5	0	165	195

Frequency (Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 (dBi)	-5.75	-5.52	2.85	1.03
Ant. 2 (dBi)	1.81	1.29	-3.32	-3.03
Ant. 3 (dBi)	-0.96	0.6	-8.51	-6.51
Ant. 4 (dBi)	-2.58	-2.37	2.11	3.5
DG [1SS] (dBi)	4.57	4.92	5.39	5.58
Polarization	Theta	Theta	Theta	Theta
$\Theta$ (°)	105	105	150	150
$\Phi$ (°)	262.5	262.5	0	0

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)	2.45G	6.175G	6.475G	6.695G	6.995G
Ant. 1 [10^(G/20)]	10^(0.87/20)	10^(1.32/20)	10^(-1.14/20)	10^(0.04/20)	10^(1.88/20)
Ant. 2 [10^(G/20)]	10^(2.11/20)	10^(0.12/20)	10^(1.98/20)	10^(2.07/20)	10^(0.58/20)
Ant. 1 [10^(G/20)] value	1.105	1.164	0.877	1.005	1.242
Ant. 2 [10^(G/20)] value	1.275	1.014	1.256	1.269	1.069
Sum All Antenna [Amax]	2.38	2.178	2.133	2.274	2.311
DG [10*log(Amax^2/Nant)]	4.52	3.75	3.57	4.12	4.26

Frequency (Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 [10^(G/20)]	10^(-5.75/20)	10^(-5.52/20)	10^(2.85/20)	10^(1.03/20)
Ant. 2 [10^(G/20)]	10^(1.81/20)	10^(1.29/20)	10^(-3.32/20)	10^(-3.03/20)
Ant. 3 [10^(G/20)]	10^(-0.96/20)	10^(0.6/20)	10^(-8.51/20)	10^(-6.51/20)
Ant. 4 [10^(G/20)]	10^(-2.58/20)	10^(-2.37/20)	10^(2.11/20)	10^(3.5/20)
Ant. 1 [10^(G/20)] value	0.516	0.53	1.388	1.126
Ant. 2 [10^(G/20)] value	1.232	1.16	0.682	0.706
Ant. 3 [10^(G/20)] value	0.895	1.072	0.375	0.473
Ant. 4 [10^(G/20)] value	0.743	0.761	1.275	1.496
Sum All Antenna [Amax]	3.386	3.522	3.721	3.8
DG [10*log(Amax^2/Nant)]	4.57	4.92	5.39	5.58

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**

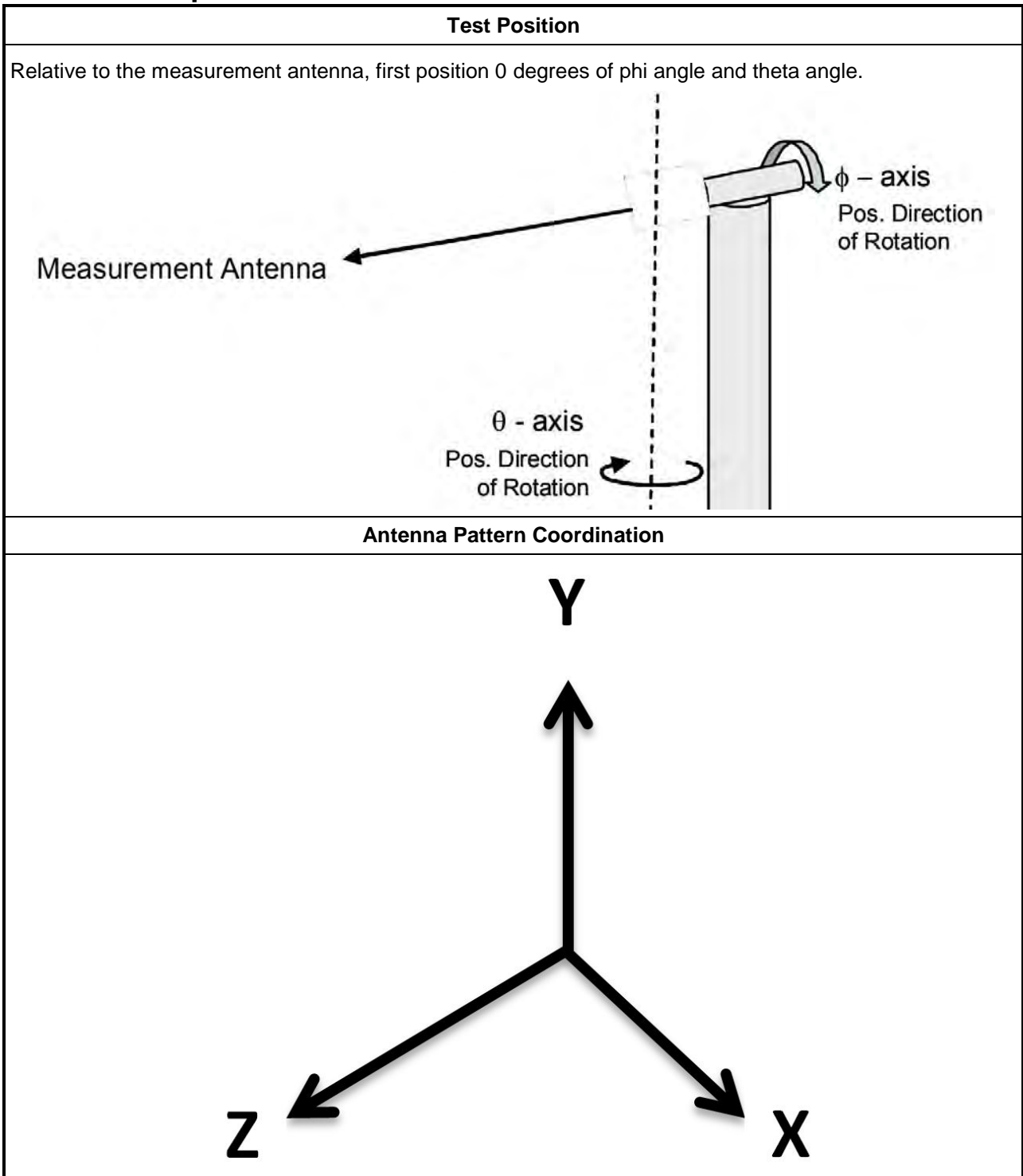
Frequency (Hz)	2.45G	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.21	1.32	1.46	1.76	2.61
Ant. 2 Max Gain (dBi)	4.42	1.62	1.98	2.47	2.12
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/112.5/60	Phi/97.5/172.5	Phi/97.5/187.5	Phi/90/180	Phi/135/195
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/112.5/292.5	Theta/37.5/29.5	Phi/75/0	Theta/45/285	Phi/120/172.5
	5	2.5			
Max Gain (dBi)	4.42	1.62	1.98	2.47	2.61
DG [1SS] (dBi)	4.52	3.75	3.57	4.12	4.26
DG [2SS] (dBi)	4.42	1.62	1.98	2.47	2.61

Frequency (Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	3.49	3.27	2.85	2.09
Ant. 2 Max Gain (dBi)	3.58	2.61	4.52	2.72
Ant. 3 Max Gain (dBi)	2.41	2.6	3.51	5.47
Ant. 4 Max Gain (dBi)	4.45	4.89	4.53	4.93
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/142.5/210	Theta/142.5/210	Theta/150/0	Theta/142.5/120
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/97.5/270	Theta/82.5/90	Theta/97.5/82.5	Theta/75/322.5
Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/105/247.5	Theta/112.5/270	Theta/97.5/262.5	Theta/105/255
Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/142.5/270	Theta/142.5/270	Theta/142.5/232.5	Theta/150/262.5
Max Gain (dBi)	4.45	4.89	4.53	5.47
DG [1SS] (dBi)	4.57	4.92	5.39	5.58
DG [2SS] (dBi)	4.45	4.89	4.53	5.47
DG [4SS] (dBi)	4.45	4.89	4.53	5.47

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	V1.0.8	-	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.

Appendix A – Radiated Composite Gain of 2.4GHz and 6GHz.....	Page 15
Appendix B – Radiated Composite Gain of 5GHz U-NII 1 and U-NII 3.....	Page 24
Appendix C – Antenna Pattern of 2.4GHz and 6GHz.....	Page 35
Appendix D – Antenna Pattern of 5GHz U-NII 1 and U-NII 3.....	Page 39
Appendix E – Test Photos.....	Page 45

Freq(Hz)	2.45G	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.21	1.32	1.46	1.76	2.61
Ant. 2 Max Gain (dBi)	4.42	1.62	1.98	2.47	2.12
Ant. 1 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/112.5/60	Phi/97.5/172.5	Phi/97.5/187.5	Phi/90/180	Phi/135/195
Ant. 2 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Phi/112.5/292.5	Theta/37.5/292.5	Phi/75/0	Theta/45/285	Phi/120/172.5
Max Gain (dBi)	4.42	1.62	1.98	2.47	2.61
DG [1SS] (dBi)	4.52	3.75	3.57	4.12	4.26
DG [2SS] (dBi)	4.42	1.62	1.98	2.47	2.61



# Radiated Composite Gain Data

# Appendix A

## DG 1SS Result

Freq(Hz)	2.45GPol.	Phi	Phi(15°)	Phi(30°)	Phi(45°)	Phi(60°)	Phi(75°)	Phi(90°)	Phi(105°)	Phi(120°)	Phi(135°)	Phi(150°)	Phi(165°)	Phi(180°)	Phi(195°)	Phi(210°)	Phi(225°)	Phi(240°)	Phi(255°)	Phi(270°)	Phi(285°)	Phi(300°)	Phi(315°)	Phi(330°)	Phi(345°)			
DG(Phi)	Phi(7.5°)	Phi(22.5°)	Phi(37.5°)	Phi(52.5°)	Phi(67.5°)	Phi(82.5°)	Phi(97.5°)	Phi(112.5°)	Phi(127.5°)	Phi(142.5°)	Phi(157.5°)	Phi(172.5°)	Phi(187.5°)	Phi(202.5°)	Phi(217.5°)	Phi(232.5°)	Phi(247.5°)	Phi(262.5°)	Phi(277.5°)	Phi(292.5°)	Phi(307.5°)	Phi(322.5°)	Phi(337.5°)	Phi(352.5°)				
0	-0.62-0.48	-0.67-0.79	-1.07-1.51	-2.09-2.49	-2.81-2.97	-3.61-3.84	-4.37-4.92	-5.76-6.84	-7.56-7.96	-9.61-10.46	-11.81-12.81	-14.16-15.16	-16.61-17.61	-19.16-20.16	-21.81-22.81	-24.56-25.56	-27.41-28.41	-30.36-31.36	-33.41-34.41	-36.56-37.56	-39.81-40.81	-43.16-44.16	-46.61-47.61	-50.16-51.16	-53.81-54.81	-57.56-58.56		
0(7.5)	-0.83-0.78	-0.74-0.88	-1.19-1.51	-2.04-2.28	-2.48-2.61	-2.86-3.4	-3.85-4.79	-5.85-7.42	-8.17-7.04	-10.68-11.1	-13.21-12.79	-15.74-15.32	-18.27-17.85	-20.8-20.38	-23.33-22.91	-25.86-25.44	-28.39-27.97	-30.92-30.5	-33.45-33.03	-35.98-35.56	-38.51-38.09	-41.04-40.62	-43.57-43.15	-46.1-45.68	-48.63-48.21	-51.16-50.74	-53.69-53.27	
0(15)	-0.73-0.49	-0.41-0.56	-0.87-1.58	-2.01-2.35	-2.61-2.55	-2.82-3.24	-4.07-5.43	-6.99-8.1	-8.16-6.72	-5.57-4.45	-3.16-2.16	-1.39-0.93	-0.61-0.45	-0.4-0.5	-0.85-1.39	-2.17-3.11	-3.68-4.5	-5.09-5.69	-6.32-6.4	-8.2-5.78	-6.31-6.95	-6.52-6.08	-4.15-2.86	-1.82-1.31	-0.73-0.5	-0.25-0.17		
0(22.5)	-1.43-1.17	-0.98-1.11	-1.62-2.14	-2.29-2.53	-2.5-2.8	-3.33-3.94	-5.36-7.16	-9.61-9.88	-8.53-7.36	-5.67-4.16	-3.16-2.02	-1.36-0.73	-0.52-0.29	-0.36-0.54	-1.24-1.9	-2.89-3.95	-4.56-5.36	-6.22-6.79	-7.98-8.61	-9.82-8.05	-8.88-7.59	-5.07-3.51	-2.45-1.78	-1.16-0.8	-0.57-0.35	-0.33-0.29		
0(30)	-1.66-1.57	-1.75-2.28	-3.12-3.33	-3.61-3.42	-3.96-3.68	-4.15-4.69	-5.91-8.14	-10.27-11.5	-10.33-8.87	-7.04-5.14	-3.72-2.63	-1.75-1.21	-0.83-0.77	-0.83-1.29	-2.13-3.02	-4.01-5.19	-6.57-7.29	-9.59-7.59	-13.51-7.14	-17.21-4.1	-21.71-4.1	-26.21-4.1	-30.71-4.1	-35.21-4.1	-39.71-4.1	-44.21-4.1		
0(37.5)	-1.39-1.49	-2.15-3.36	-4.54-5.69	-5.84-5.88	-5.66-5.87	-5.84-6.2	-7.3-8.82	-9.73-11.08	-11.61-10.68	-8.52-6.28	-4.54-3.22	-2.37-1.7	-1.38-1.49	-2.03-3.05	-4.1-5.46	-6.85-7.23	-9.73-7.34	-12.71-6.65	-15.8-6.26	-18.9-5.7	-22.0-5.4	-25.1-5.1	-28.2-4.8	-31.3-4.5	-34.4-4.2	-37.5-3.9		
0(45)	-1.13-1.65	-3.02-4.7	-6.94-8.94	-10.56-10.45	-10.01-9.57	-9.68-10.8	-12.29-12.11	-14.06-11.64	-12.29-12.11	-9.68-8.51	-6.21-4.5	-3.52-1.99	-2.04-3.47	-3.61-5.19	-5.18-7.1	-6.71-10.6	-8.24-11.64	-9.77-11.08	-11.3-12.64	-12.83-11.64	-14.36-12.64	-15.89-11.08	-17.42-10.8	-18.95-10.8	-20.48-10.8	-22.01-10.8	-23.54-10.8	
0(52.5)	-0.93-1.19	-2.21-3.84	-6.32-9.31	-9.99-9.85	-9.3-9.29	-9.31-9.58	-10.99-10.39	-11.49-11.5	-10.85-9.65	-7.39-5.1	-2.93-1.5	-0.530-0.2	-0.01-0.71	-1.61-3.19	-4.55-6.54	-8.31-11.61	-12.79-11.59	-17.51-6.79	-22.51-4.66	-27.51-4.47	-32.51-4.47	-37.51-4.47	-42.51-4.47	-47.51-4.47	-52.51-4.47	-57.51-4.47		
0(60)	-0.02-0.19	-1.21-3.05	-5.94-7.93	-8.23-7.46	-6.43-6.67	-7.66-7.88	-8.86-10.67	-11.18-10.68	-8.88-8.51	-7.4-5.45	-3.52-1.99	-0.93-0.27	-0.28-0.81	-2.04-3.47	-5.18-7.1	-9.06-10.96	-12.23-11.64	-15.99-7.08	-19.99-4.78	-24.23-4.38	-28.61-4.38	-33.01-4.38	-37.41-4.38	-41.81-4.38	-46.21-4.38	-50.61-4.38		
0(67.5)	-0.23-1.54	-3.28-4.98	-5.4-8.6	-4.87-4.22	-4.14-4.72	-5.69-7.09	-8.35-9.43	-10.87-11.63	-11.92-12.53	-12.88-9.85	-6.68-4.25	-2.42-1.59	-1.1-1.1	-1.43-2.04	-3.23-4.36	-5.66-7.21	-8.71-10.04	-12.73-7.44	-17.73-4.42	-22.73-4.42	-27.73-4.42	-32.73-4.42	-37.73-4.42	-42.73-4.42	-47.73-4.42	-52.73-4.42		
0(75)	1.51-0.32	-1.32-2.66	-3.16-3.25	-2.51-1.8	-2.08-3.57	-5.22-6.46	-7.86-8.47	-7.42-5.68	-4.55-4.49	-5.05-5.37	-5.47-6.25	-2.9-1.2	-0.11-0.29	0.11-0.5	-1.48-2.52	-3.62-5.43	-6.09-4.37	-8.73-7.96	-11.47-6.24	-14.21-4.14	-16.95-1.98	-19.69-0.59	-22.43-1.12	-25.17-1.09	-27.91-1.09	-30.65-1.09		
0(82.5)	1.72-0.86	-1.06-2.86	-3.54-2.58	-1.1-0.16	-0.74-2.83	-3.86-3.73	-4.06-5.06	-4.91-3.72	-3.06-3.28	-4.57-6.08	-6.07-4.38	-2.07-0.1	1.19-1.68	1.55-1.23	0.85-0.29	-0.92-2.99	-3.42-6.33	-5.13-3.87	-6.27-4.13	-7.41-2.98	-8.55-1.83	-9.69-0.7	-10.83-0.48	-11.97-0.48	-13.11-0.48	-14.25-0.48	-15.39-0.48	
0(90)	1.74-0.34	-2.64-4.95	-5.4-6.37	-1.17-0.13	0.19-1.07	-3.04-4.19	-5.19-5.2	-3.2-1.18	-0.16-0.37	-1.36-2.86	-4.44-5.22	-3.8-0.97	0.35-0.68	0.75-0.89	1.09-0.75	-0.35-1.9	-3.56-4.57	-6.45-2.89	-9.34-1.03	-12.23-0.64	-15.12-0.64	-18.01-0.64	-20.9-0.64	-23.79-0.64	-26.68-0.64	-29.57-0.64		
0(97.5)	2.11-0.83	-1.53-3.25	-2.67-2.13	-0.55-0.13	-1.14-2.57	-3.31-3.65	-4.91-5.37	-2.82-3.08	1.09-1.46	1.17-0.13	-0.97-2.24	-3.27-2.31	-0.70-0.51	1.68-2.45	2.59-2.35	1.74-0.74	-1.1-2.88	-3.52-3.09	-2.26-1.03	0.28-0.79	0.28-1.65	-3.33-3.68	-2.67-0.48	1.24-1.24	2.22-0.79	3.2-0.79		
0(105)	2.25-1.03	-1.58-2.82	-2.87-1.01	1.52-2.87	1.98-0.74	-3.41-3.72	-5.19-5.96	-3.52-0.79	1.22-2.27	1.21-0.13	1.04-0.38	-2.27-1.07	-0.85-0.6	0.62-0.86	0.67-0.81	0.80-1	-1.74-2.86	-2.83-2.74	-1.25-0.46	0.28-0.79	1.83-0.34	-1.45-3.13	-2.19-0.21	1.61-2.14	2.59-0.79	3.54-0.79		
0(112.5)	1.64-1.08	-0.81-2.48	-2.65-1.61	1.99-0.97	4.07-2.63	0.22-2.13	-4.44-7.85	-7.99-3.23	-0.23-0.1	0.75-0.03	0.09-0.45	-1.31-1.06	-0.05-0.39	0.15-0.11	1.17-0.55	-0.71-1.37	-1.63-1.08	0.94-2.6	3.36-3.28	2.68-1.43	-1.78-3.14	-2.76-2.59	-0.01-0.1	0.67-1.54	1.61-1.54	2.56-1.54		
0(120)	1.54-0.86	-1.88-6.31	-6.32-6.08	-2.31-4.2	2.82-2.48	0.88-1.69	-4.01-5.95	-4.89-1.76	0.25-1.05	1.21-0.75	2.04-1.5	-0.12-2.29	-3.59-3.91	-3.98-4.19	-3.97-2.98	-2.31-2.1	-2.46-2.41	-2.64-2.16	0.18	2.66-2.65	2.22-0.79	-1.35-2.62	-3.21-0.73	0.91-1.55	1.82-1.55	2.73-1.55		
0(127.5)	-0.96-1.23	-3.16-1.73	-1.11-1.21	-1.43-0.31	1.36-1.85	1.21-0.6	-3.14-5.28	-4.86-2.8	-1.47-1.13	-0.40-1.9	2.02-0.71	-2.12-2.92	-3.49-3.52	-3.29-2.93	-3.01-2.5	-2.71-2.09	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69	-2.71-1.69
0(135)	-4.75-5.31	-3.93-2.04	-1.14-0.92	-0.87-0.01	1.38-2.45	2.49-1.55	-0.16-2.28	-3.89-4.28	-3.98-2.48	-0.72-0.18	0.40-0.38	-1.38-2.65	-3.59-4.04	-3.76-3.43	-2.42-1.98	-2.38-2.86	-2.87-2.67	-2.68-1.92	-0.21-2.25	2.03-2.2	2.49-2.98	2.71-1.08	-1.41-3.28	-3.25-3.38	-5.02-3.38	-6.79-3.38		
0(142.5)	-2.89-3.59	-3.37-2.04	-0.75-0.21	-0.49-0.69	-0.14-0.86	1.23-1.06	0.05-1.34	-2.76-2.47	-1.44-0.04	0.99-1.33	0.83-0.1	-1.34-2.24	-2.38-1.43	-0.38-0.64	1.42-1.47	0.64-0.82	-2.51-3.75	-4.4-6.62	-3.43-2.2	-1.08-0.87	0.37-1.48	1.75-0.84	-0.58-1.42	-1.37-1.54	-2.16-1.54	-2.95-1.54		
0(150)	-1.31-3.68	-4.67-4.65	-3-2.15	-2.57-3.06	-3.56-3.67	-2.92-2.17	-1.42-0.51	0.67-3.22	2.02-2.97	2.31-87	1.01-0.02	-0.67-0.88	-0.57-0.18	0.95-1.46	1.77-1.51	0.59-0.79	-2.64-4.75	-4.06-2.88	-3.14-5.8	-4.03-3.62	-2.53-1.12	-0.52-1.04	-1.93-2.71	-2.71-2.76	-3.5-2.76	-4.29-2.76		
0(157.5)	-5.44-5.7	-7.48-8.09	-6.03-4.94	-4.18-3.95	-4.18-4.54	-4.32-3.3	-1.65-0.26	0.85-1.61	1.89-1.82	1.39-0.54	-0.31-1.1	-1.52-1.69	-1.47-1.01	-0.61-0.26	-0.28-1.01	-2.34-4.58	-7.53-10.51	-10.33-7.91	-5.77-4.53	-3.72-3.1	-2.31-1.98	-1.86-2.23	-3.33-4.61	-5.42-4.61	-7.51-4.61			
0(165)	-7.36-7.2	-7.67-6.76	-5.33-4.02	-3.62-3.42	-3.76-2.49	-4.88-5.14	-4.88-4.15	-1.33-2.52	-2.27-2.4	-2.88-3.59	-4.38-5.41	-5.54-5.57	-4.88-4.25	-3.55-3.18	-3.54-7.46	-6.71-9.08	-11.71-7.9	-9.88-6.54	-4.09-3.03	-2.39-1.89	-1.82-1.89	-2.22-2.88	-3.99-5.7	-5.73-7.4	-7.33-7.4			
0(172.5)	-6.22-6.49	-6.78-6.32	-5.93-5.38	-5.26-5.25	-5.83-6.94	-7.72-8.83	-9.68-10.45	-11.58-12.63	-12.53-11.92	-10.59-9.26	-7.93-6.55	-5.76-5.07	-4.4-4.21	-4.49-4.89	-5.91-5.7	-7.4-10.3	-10.27-7.8	-5.54-4.09	-3.4-2.23	-1.96-1.89	-2.11-2.57	-3.13-3.85	-4.16-6.68	-5.16-6.68	-6.16-6.68			
0(180)	-4.09-4.64	-5.84-6.71	-7.3-8.29	-8.44-8.38	-8.4-8.88	-9.88-10.36	-10.22-9.6	-9.07-8.36	-7.92-7.38	-6.68-6.15	-5.41-4.98	-4.84-4.95	-5.22-5.78	-6.61-7.25	-8.28-9.02	-9.75-9.98	-7.02-5.43	-4.18-3.36	-3.07-2.69	-2.57-2.83	-3.45-4.17	-5-5.63	-5.82-5.95	-6.66-5.95	-7.51-5.95			









# Radiated Composite Gain Data

# Appendix A

## Gain Result

Freq(Hz)	2.45GPol.	PhiAnt. 1	PhiAnt. 2	PhiAnt. 3	PhiAnt. 4	PhiAnt. 5	PhiAnt. 6	PhiAnt. 7	PhiAnt. 8	PhiAnt. 9	PhiAnt. 10	PhiAnt. 11	PhiAnt. 12	PhiAnt. 13	PhiAnt. 14	PhiAnt. 15	PhiAnt. 16	PhiAnt. 17	PhiAnt. 18	PhiAnt. 19	PhiAnt. 20	PhiAnt. 21	PhiAnt. 22	PhiAnt. 23	PhiAnt. 24	PhiAnt. 25	PhiAnt. 26	PhiAnt. 27	PhiAnt. 28	PhiAnt. 29	PhiAnt. 30
Gain	$\Phi(0^\circ)\Phi(7.5^\circ)$	$\Phi(15^\circ)\Phi(22.5^\circ)$	$\Phi(30^\circ)\Phi(37.5^\circ)$	$\Phi(45^\circ)\Phi(52.5^\circ)$	$\Phi(60^\circ)\Phi(67.5^\circ)$	$\Phi(75^\circ)\Phi(82.5^\circ)$	$\Phi(90^\circ)\Phi(97.5^\circ)$	$\Phi(105^\circ)\Phi(112.5^\circ)$	$\Phi(120^\circ)\Phi(127.5^\circ)$	$\Phi(135^\circ)\Phi(142.5^\circ)$	$\Phi(150^\circ)\Phi(157.5^\circ)$	$\Phi(165^\circ)\Phi(172.5^\circ)$	$\Phi(180^\circ)\Phi(187.5^\circ)$	$\Phi(195^\circ)\Phi(202.5^\circ)$	$\Phi(210^\circ)\Phi(217.5^\circ)$	$\Phi(225^\circ)\Phi(232.5^\circ)$	$\Phi(240^\circ)\Phi(247.5^\circ)$	$\Phi(255^\circ)\Phi(262.5^\circ)$	$\Phi(270^\circ)\Phi(277.5^\circ)$	$\Phi(285^\circ)\Phi(292.5^\circ)$	$\Phi(300^\circ)\Phi(307.5^\circ)$	$\Phi(315^\circ)\Phi(322.5^\circ)$	$\Phi(330^\circ)\Phi(337.5^\circ)$	$\Phi(345^\circ)\Phi(352.5^\circ)$							
$\Theta(0^\circ)$	-1.92-1.37	-1.12-0.81	-0.67-0.73	-0.88-1.02	-1.25-1.49	-2.26-3.04	-4.27-5.41	-7.51-10.54	-14.41-17.32	-14.06-10.08	-7.15	-3.46-2.22	-1.35-0.68	-1.10	0.26-0.36	0.45-0.24	-0.24-0.71	-1.49-2.31	-3.67-5.14	-7.14-10.37	-14.76-17.29	-13.33-8.76	-6.19-4.61	-3.62-2.65							
$\Theta(7.5^\circ)$	-2.41-1.71	-1.01-0.58	-0.11-0.08	-0.03-0.31	-0.61-1.13	-2.11-3.38	-4.69-6.57	-8.93-12.24	-13.79-11.47	-8.85-6.22	-4.47-3.07	-2.01-1.22	-0.64-0.24	0.02-0.22	0.24-0.23	-0.08-0.43	-0.86-1.5	-2.16-3.31	-4.57-5.93	-8.19-10.99	-16.09-18.29	-18.47-11.6	-8.05-6.06	-4.53-2.21							
$\Theta(15^\circ)$	-2.68-1.76	-0.84-0.26	0.13-0.22	0.04-0.34	-0.99-1.8	-2.87-4.18	-6.8-8.46	-11.58-13.09	-11.21-8.07	-8.81-4.22	-2.87-1.9	-1.12-0.7	-0.32-0.2	-0.04-0.14	-0.24-0.51	-0.91-1.43	-3.56-4.29	-5.42-6.56	-7.77-9.09	-12.11-16.87	-17.71-17.06	-10.68-7.43	-5.21-3.85								





Radiated Composite Gain Data

Appendix A

Table with 28 columns representing gain data for various frequency bands and antenna configurations. The table is organized into multiple sections based on frequency ranges and antenna types (e.g., 6.95GHz, 2.45GHz).







Freq(Hz)	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	3.49	3.27	2.85	2.09
Ant. 2 Max Gain (dBi)	3.58	2.61	4.52	2.72
Ant. 3 Max Gain (dBi)	2.41	2.6	3.51	5.47
Ant. 4 Max Gain (dBi)	4.45	4.89	4.53	4.93
Ant. 1 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Theta/142.5/210	Theta/142.5/210	Theta/150/0	Theta/142.5/120
Ant. 2 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Theta/97.5/270	Theta/82.5/90	Theta/97.5/82.5	Theta/75/322.5
Ant. 3 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Theta/105/247.5	Theta/112.5/270	Theta/97.5/262.5	Theta/105/255
Ant. 4 Polarization/ $\theta(^{\circ})/\phi(^{\circ})$	Theta/142.5/270	Theta/142.5/270	Theta/142.5/232.5	Theta/150/262.5
Max Gain (dBi)	4.45	4.89	4.53	5.47
DG [1SS] (dBi)	4.57	4.92	5.39	5.58
DG [2SS] (dBi)	4.45	4.89	4.53	5.47
DG [4SS] (dBi)	4.45	4.89	4.53	5.47





Radiated Composite Gain Data

Appendix B

DG 1SS Result

Table with columns for Frequency (MHz), Polarization (Phi), and various gain measurements (DG(Phi), Theta) for 30 different angles (Theta) from 0 to 180 degrees. The table is divided into three sections: 5.2GHz Pol, 5.3GHz Pol, and 5.6GHz Pol. Each section contains 30 rows of data corresponding to the Theta angles.



Radiated Composite Gain Data

Appendix B

Table with columns for frequency (MHz), gain (dBi), and various test configurations (Theta, Phi). The table contains numerical data for various frequencies and angles, with some cells highlighted in red.





# Radiated Composite Gain Data

# Appendix B

Θ (22.5°)	Θ (30°)	Θ (37.5°)	Θ (45°)	Θ (52.5°)	Θ (60°)	Θ (67.5°)	Θ (75°)	Θ (82.5°)	Θ (90°)	Θ (97.5°)	Θ (105°)	Θ (112.5°)	Θ (120°)	Θ (127.5°)	Θ (135°)	Θ (142.5°)	Θ (150°)	Θ (157.5°)	Θ (165°)	Θ (172.5°)	Θ (180°)	Gain	Φ (0°) Φ (7.5°)	Φ (15°) Φ (22.5°)	Φ (30°) Φ (37.5°)	Φ (45°) Φ (52.5°)	Φ (60°) Φ (67.5°)	Φ (75°) Φ (82.5°)	Φ (90°) Φ (97.5°)	Φ (105°) Φ (112.5°)	Φ (120°) Φ (127.5°)	Φ (135°) Φ (142.5°)	Φ (150°) Φ (157.5°)	Φ (165°) Φ (172.5°)	Φ (180°) Φ (187.5°)	Φ (195°) Φ (202.5°)	Φ (210°) Φ (217.5°)	Φ (225°) Φ (232.5°)	Φ (240°) Φ (247.5°)	Φ (255°) Φ (262.5°)	Φ (270°) Φ (277.5°)	Φ (285°) Φ (292.5°)	Φ (300°) Φ (307.5°)	Φ (315°) Φ (322.5°)	Φ (330°) Φ (337.5°)	Φ (345°) Φ (352.5°)
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		
-4.71-6.13	-5.03-7.87	-4.87-7.24	-3.14-3.63	-5.13-4.87	-12.96-12.91	-18.17-18.07	-14.83-10.16	-8.84-7.85	-7.15-6.47	-6.67-7.28	-8.77-9.28	-10.24-8.88	-7.82-8.31	-9.96-10.87	-10.77-9.92	-13.95-19.35	-18.31-18.47	-19.12-19.48	-13.81-10.37	-8.75-8.59	-8.18-8.5	-9.03-11.07	-12.63-16.27	-18.62-18.8	-18.48-11.5	-8.54-6.53	-4.5-8	-3.43-4.44																		



# Radiated Composite Gain Data

# Appendix B

Theta (°)	8.31-5.26	6.28-4.45	4.83-3.72	3.48-2.77	2.24-1.91	1.13-1.57	-1.82-1.88	-3.31-1.73	-5.22-9.95	-9.53-11	-16.41-12.77	-11.57-8.26	-8.04-7.44	-9.13-7.78	-8.76-9.49	-10.79-11.22	-12.37-12.67	-16.61-17.33	-11.53-10.01	-9.52-10.33	-13.82-14.1	-14.34-13.98	-14-10.97	-11.92-9.17	-6.57-9.04	-17.72-10.23
Gain	Phi(0)Phi(7.5)	Phi(15)Phi(22.5)	Phi(30)Phi(37.5)	Phi(45)Phi(52.5)	Phi(60)Phi(67.5)	Phi(75)Phi(82.5)	Phi(90)Phi(97.5)	Phi(105)Phi(112.5)	Phi(120)Phi(127.5)	Phi(135)Phi(142.5)	Phi(150)Phi(157.5)	Phi(165)Phi(172.5)	Phi(180)Phi(187.5)	Phi(195)Phi(202.5)	Phi(210)Phi(217.5)	Phi(225)Phi(232.5)	Phi(240)Phi(247.5)	Phi(255)Phi(262.5)	Phi(270)Phi(277.5)	Phi(285)Phi(292.5)	Phi(300)Phi(307.5)	Phi(315)Phi(322.5)	Phi(330)Phi(337.5)	Phi(345)Phi(352.5)		
Theta (°)	8.31-5.26	6.28-4.45	4.83-3.72	3.48-2.77	2.24-1.91	1.13-1.57	-1.82-1.88	-3.31-1.73	-5.22-9.95	-9.53-11	-16.41-12.77	-11.57-8.26	-8.04-7.44	-9.13-7.78	-8.76-9.49	-10.79-11.22	-12.37-12.67	-16.61-17.33	-11.53-10.01	-9.52-10.33	-13.82-14.1	-14.34-13.98	-14-10.97	-11.92-9.17	-6.57-9.04	-17.72-10.23
Gain	Phi(0)Phi(7.5)	Phi(15)Phi(22.5)	Phi(30)Phi(37.5)	Phi(45)Phi(52.5)	Phi(60)Phi(67.5)	Phi(75)Phi(82.5)	Phi(90)Phi(97.5)	Phi(105)Phi(112.5)	Phi(120)Phi(127.5)	Phi(135)Phi(142.5)	Phi(150)Phi(157.5)	Phi(165)Phi(172.5)	Phi(180)Phi(187.5)	Phi(195)Phi(202.5)	Phi(210)Phi(217.5)	Phi(225)Phi(232.5)	Phi(240)Phi(247.5)	Phi(255)Phi(262.5)	Phi(270)Phi(277.5)	Phi(285)Phi(292.5)	Phi(300)Phi(307.5)	Phi(315)Phi(322.5)	Phi(330)Phi(337.5)	Phi(345)Phi(352.5)		
Theta (°)	8.31-5.26	6.28-4.45	4.83-3.72	3.48-2.77	2.24-1.91	1.13-1.57	-1.82-1.88	-3.31-1.73	-5.22-9.95	-9.53-11	-16.41-12.77	-11.57-8.26	-8.04-7.44	-9.13-7.78	-8.76-9.49	-10.79-11.22	-12.37-12.67	-16.61-17.33	-11.53-10.01	-9.52-10.33	-13.82-14.1	-14.34-13.98	-14-10.97	-11.92-9.17	-6.57-9.04	-17.72-10.23





# Radiated Composite Gain Data

# Appendix B

Freq (Hz)	Theta Ant 3	Phi (0°)	Phi (7.5°)	Phi (15°)	Phi (22.5°)	Phi (30°)	Phi (37.5°)	Phi (45°)	Phi (52.5°)	Phi (60°)	Phi (67.5°)	Phi (75°)	Phi (82.5°)	Phi (90°)	Phi (97.5°)	Phi (105°)	Phi (112.5°)	Phi (120°)	Phi (127.5°)	Phi (135°)	Phi (142.5°)	Phi (150°)	Phi (157.5°)	Phi (165°)	Phi (172.5°)	Phi (180°)	Phi (187.5°)	Phi (195°)	Phi (202.5°)	Phi (210°)	Phi (217.5°)	Phi (225°)	Phi (232.5°)	Phi (240°)	Phi (247.5°)	Phi (255°)	Phi (262.5°)	Phi (270°)	Phi (277.5°)	Phi (285°)	Phi (292.5°)	Phi (300°)	Phi (307.5°)	Phi (315°)	Phi (322.5°)	Phi (330°)	Phi (337.5°)	Phi (345°)	Phi (352.5°)								
5.2GPol																																																									
Gain																																																									
0°																																																									
7.5°																																																									









Radiated Composite Gain Data

Appendix B

Table with 33 columns and 112 rows. Columns include angle (Theta), frequency (FREQ), and gain values for various configurations. The table contains numerical data for gain in dB for different angles and frequencies.



Total Gain Data

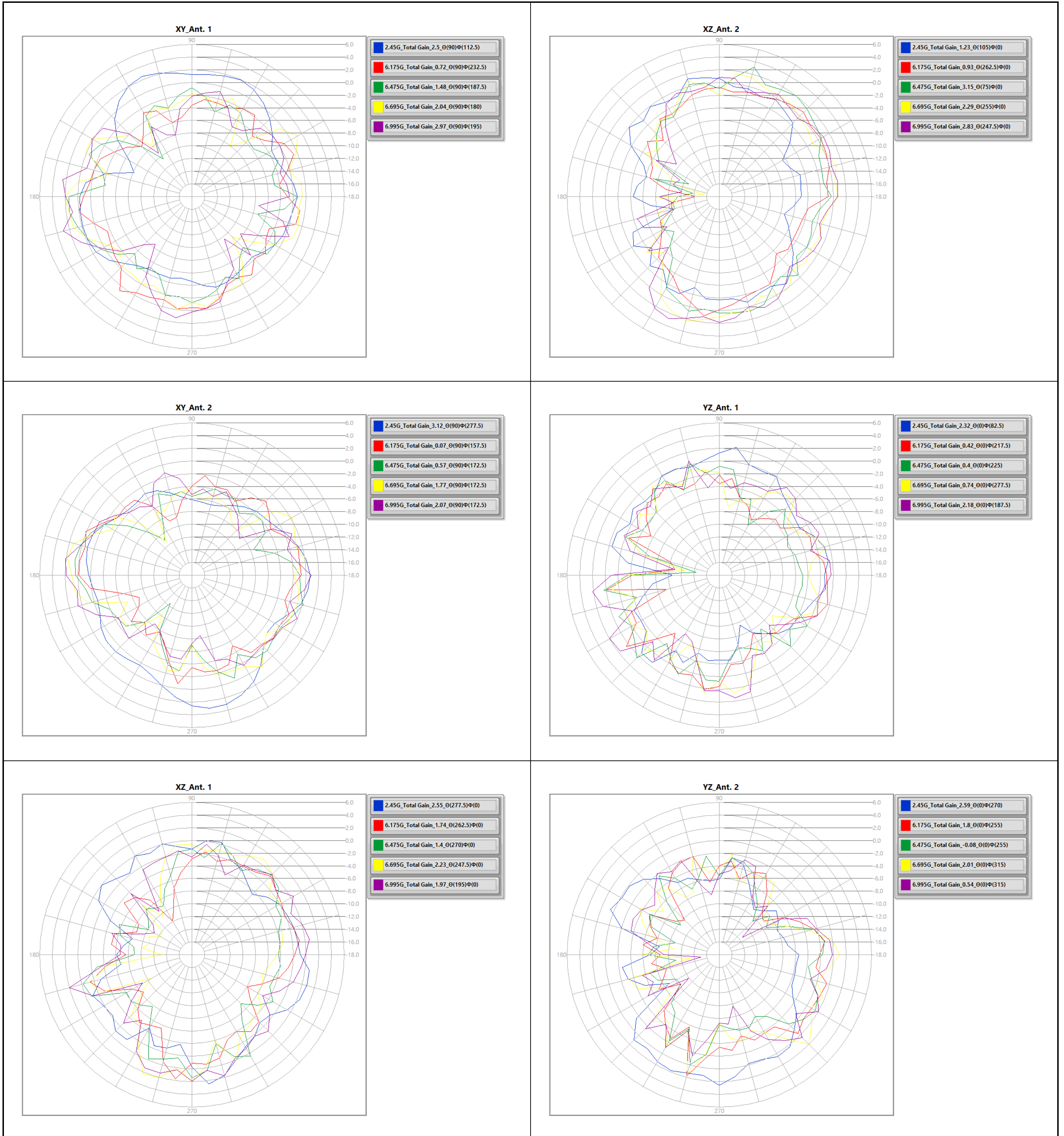
Table with columns for Frequency (MHz), Polarization, and Total Gain for various antenna configurations. The table is organized into sections for 2.45GHz, 6.175GHz, and 6.695GHz, each with a sub-section for Total Antenna Gain and a grid of gain values for different antenna types.



Table with columns for Azimuth (Theta), Elevation (Phi), Frequency (MHz), and Gain (dBi). It contains a grid of antenna pattern data points for various frequencies and 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  $\Theta(0-180)\Phi(270)$





Total Gain Data

Table with columns for Frequency (Freq/Hz), Total Ant 1, and Total Ant 2, and rows for various antenna configurations (Theta and Phi) across a range of frequencies from 0 to 150 MHz.



# Antenna Pattern

# Appendix D

Gain	Φ(0°)/Φ(7.5°)	Φ(15°)/Φ(22.5°)	Φ(30°)/Φ(37.5°)	Φ(45°)/Φ(52.5°)	Φ(60°)/Φ(67.5°)	Φ(75°)/Φ(82.5°)	Φ(90°)/Φ(97.5°)	Φ(105°)/Φ(112.5°)	Φ(120°)/Φ(127.5°)	Φ(135°)/Φ(142.5°)	Φ(150°)/Φ(157.5°)	Φ(165°)/Φ(172.5°)	Φ(180°)/Φ(187.5°)	Φ(195°)/Φ(202.5°)	Φ(210°)/Φ(217.5°)	Φ(225°)/Φ(232.5°)	Φ(240°)/Φ(247.5°)	Φ(255°)/Φ(262.5°)	Φ(270°)/Φ(277.5°)	Φ(285°)/Φ(292.5°)	Φ(300°)/Φ(307.5°)	Φ(315°)/Φ(322.5°)	Φ(330°)/Φ(337.5°)	Φ(345°)/Φ(352.5°)
Gain	Φ(0°)/Φ(7.5°)	Φ(15°)/Φ(22.5°)	Φ(30°)/Φ(37.5°)	Φ(45°)/Φ(52.5°)	Φ(60°)/Φ(67.5°)	Φ(75°)/Φ(82.5°)	Φ(90°)/Φ(97.5°)	Φ(105°)/Φ(112.5°)	Φ(120°)/Φ(127.5°)	Φ(135°)/Φ(142.5°)	Φ(150°)/Φ(157.5°)	Φ(165°)/Φ(172.5°)	Φ(180°)/Φ(187.5°)	Φ(195°)/Φ(202.5°)	Φ(210°)/Φ(217.5°)	Φ(225°)/Φ(232.5°)	Φ(240°)/Φ(247.5°)	Φ(255°)/Φ(262.5°)	Φ(270°)/Φ(277.5°)	Φ(285°)/Φ(292.5°)	Φ(300°)/Φ(307.5°)	Φ(315°)/Φ(322.5°)	Φ(330°)/Φ(337.5°)	Φ(345°)/Φ(352.5°)
Gain	Φ(0°)/Φ(7.5°)	Φ(15°)/Φ(22.5°)	Φ(30°)/Φ(37.5°)	Φ(45°)/Φ(52.5°)	Φ(60°)/Φ(67.5°)	Φ(75°)/Φ(82.5°)	Φ(90°)/Φ(97.5°)	Φ(105°)/Φ(112.5°)	Φ(120°)/Φ(127.5°)	Φ(135°)/Φ(142.5°)	Φ(150°)/Φ(157.5°)	Φ(165°)/Φ(172.5°)	Φ(180°)/Φ(187.5°)	Φ(195°)/Φ(202.5°)	Φ(210°)/Φ(217.5°)	Φ(225°)/Φ(232.5°)	Φ(240°)/Φ(247.5°)	Φ(255°)/Φ(262.5°)	Φ(270°)/Φ(277.5°)	Φ(285°)/Φ(292.5°)	Φ(300°)/Φ(307.5°)	Φ(315°)/Φ(322.5°)	Φ(330°)/Φ(337.5°)	Φ(345°)/Φ(352.5°)
Gain	Φ(0°)/Φ(7.5°)	Φ(15°)/Φ(22.5°)	Φ(30°)/Φ(37.5°)	Φ(45°)/Φ(52.5°)	Φ(60°)/Φ(67.5°)	Φ(75°)/Φ(82.5°)	Φ(90°)/Φ(97.5°)	Φ(105°)/Φ(112.5°)	Φ(120°)/Φ(127.5°)	Φ(135°)/Φ(142.5°)	Φ(150°)/Φ(157.5°)	Φ(165°)/Φ(172.5°)	Φ(180°)/Φ(187.5°)	Φ(195°)/Φ(202.5°)	Φ(210°)/Φ(217.5°)	Φ(225°)/Φ(232.5°)	Φ(240°)/Φ(247.5°)	Φ(255°)/Φ(262.5°)	Φ(270°)/Φ(277.5°)	Φ(285°)/Φ(292.5°)	Φ(300°)/Φ(307.5°)	Φ(315°)/Φ(322.5°)	Φ(330°)/Φ(337.5°)	Φ(345°)/Φ(352.5°)







Antenna Pattern

Appendix D

Table with multiple columns representing antenna patterns at various elevations and frequencies. Headers include frequency (Freq [Hz]), gain (Gain), and various elevation angles (Theta). The table contains numerical data for each parameter combination.

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

