



Antenna Composite Gain Test Report

FCC ID	2ABLK-GS5239XX
Equipment	GS7 XGS Tri Gateway, GS7 10GE Tri Gateway
Brand Name	Calix
Model Name	GS7 XGS GS5239XG, GS7 10GE GS5239E
Applicant	Calix Inc. 1035 N. McDowell Blvd. Petaluma, CA94954 U.S.A.
Standard	KDB662911 D03 v01
Sample Received	Mar. 25, 2024
Start Test Date	Apr. 11, 2024
Final Test Date	May 22, 2024

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

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1. Operation Mode and Antenna Information

Antenna Position	RF Port			Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
	2.4GHz	5GHz	6GHz					
2G5G Ant1	1	3	-	Alpha	290-20543	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~3
2G5G Ant2	2	4	-	Alpha	290-20544	Dipole	I-PEX	2.4GHz, 5GHz UNII 1~3
5G Ant3	-	1	-	Alpha	290-20546	Dipole	I-PEX	5GHz UNII 1~3
5G Ant4	-	2	-	Alpha	290-20545	Dipole	I-PEX	5GHz UNII 1~3
6G Ant1	-	-	1	Alpha	290-20548	Dipole	I-PEX	6GHz
6G Ant2	-	-	2	Alpha	290-20549	Omni	I-PEX	6GHz
6G Ant3	-	-	3	Alpha	290-20547	Dipole	I-PEX	6GHz
6G Ant4	-	-	4	Alpha	290-20550	Omni	I-PEX	6GHz

Note:

2.4GHz Operation Mode (2TX/2RX)

2G5G Ant1~2 can be used as transmitting/receiving antenna.

2G5G Ant1~2 could transmit/receive simultaneously.

5GHz Operation Mode (4TX/4RX)

2G5G Ant1~2 and 5G Ant3~4 can be used as transmitting/receiving antenna.

2G5G Ant1~2 and 5G Ant3~4 could transmit/receive simultaneously.

6GHz Operation Mode (4TX/4RX)

6G Ant1~4 can be used as transmitting/receiving antenna.

6G Ant1~4 could transmit/receive simultaneously.

2. Table for Multiple Listing

The EUT has two equipment/model names, the difference is listed in the following table:

EUT	Equipment Name	Model Name	BOSA	10G PHY port	SLIC IC
1	GS7 XGS Tri Gateway	GS7 XGS GS5239XG	With	1 port	Brand : Intel Model : SLC220
2	GS7 10GE Tri Gateway	GS7 10GE GS5239E	Without	2 port	Brand : Microsemi Model : Le9632

Note1: From the above, EUT 2 has been selected as representative mode for the test and its data was recorded in this report

Note2: The above information was declared by manufacturer.



3. Table for EUT Supports Functions

Function
AP Router
Bridge
Extender

Note: The above information was declared by manufacturer.

4. Test Frequency

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

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

5. 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	Rofy Chen	23.5-24.5 / 50-55	Apr. 11, 2024 ~ May 22, 2024

Note:

Testing Site Information

Brand Name: TDK

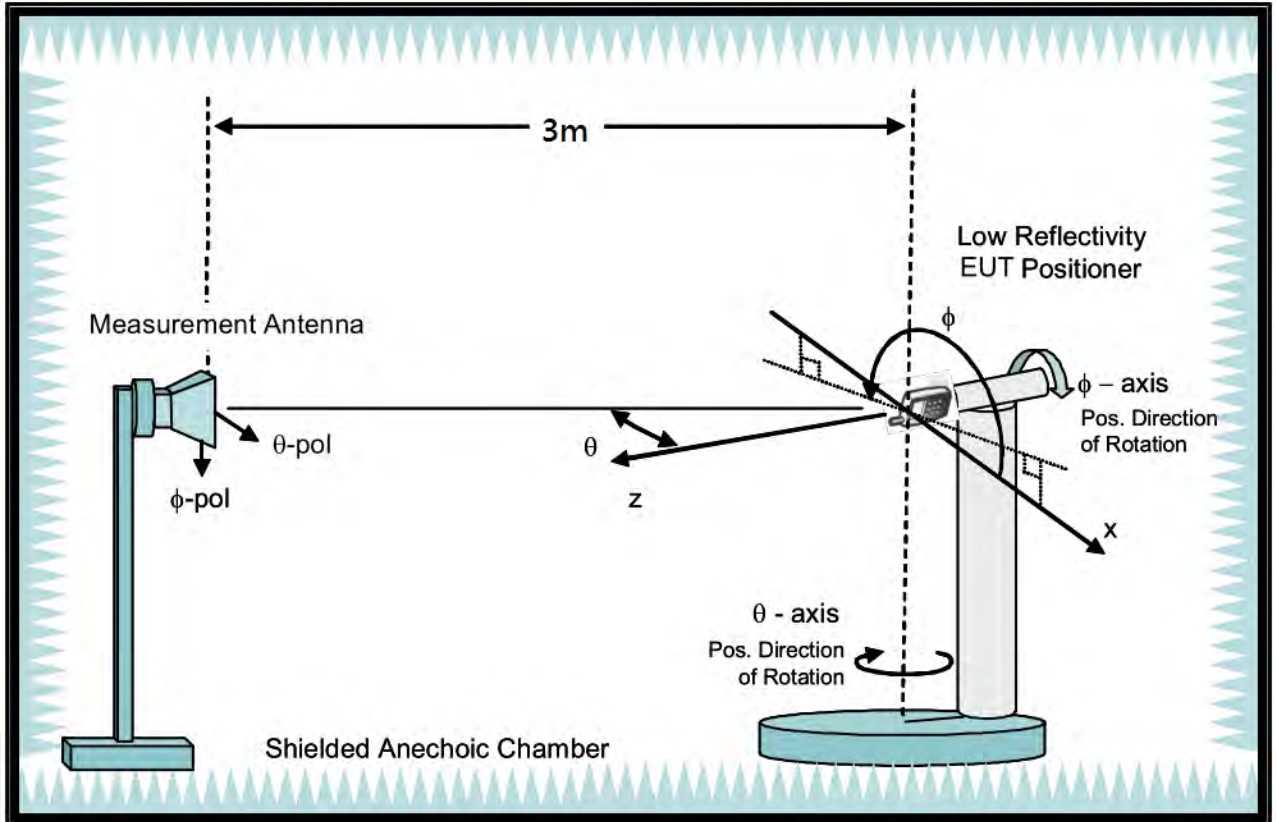
Dimension: 11m*6m*6m

Characteristic: Fully Anechoic Chamber

6. Test Facility and Configuration

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

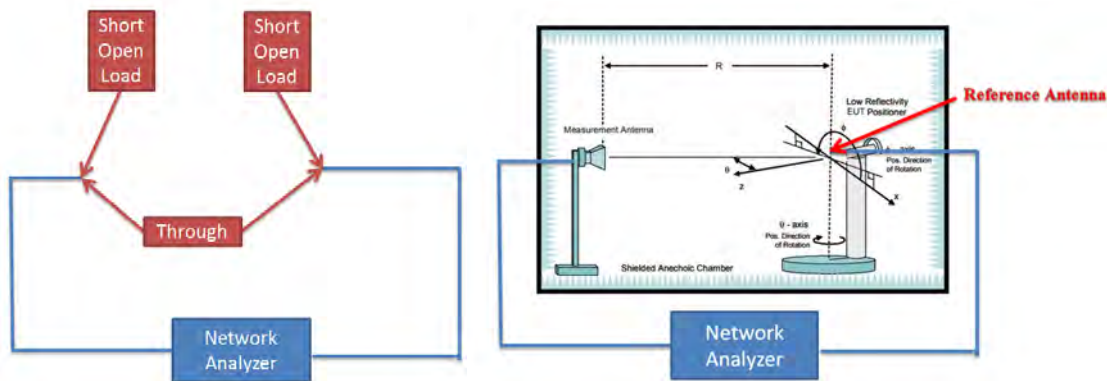
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



7. Reference Calibration

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

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



Frequency (MHz)	2400	2450	2500	5150	5200	5300	5600	5750	5800	5900	6000	6500	7000	7200
G(theta) reading (dB)	-33.55	-33.38	-32.91	-32.29	-32.48	-32.25	-32.33	-32.85	-32.67	-33.37	-32.53	-33.75	-34.72	-35.33
G(phi) reading (dB)	-33.11	-32.68	-32.48	-32.45	-32.85	-31.35	-32.76	-32.68	-32.57	-32.81	-32.85	-33.62	-34.33	-35.29
Reference gain (dBi)	10.3	10.3	10.1	11.1	11.3	11.7	12.1	11.5	11.2	11.1	11.3	11	11.1	10.5
Factor(theta) (dB)	43.85	43.68	43.01	43.39	43.78	43.95	44.43	44.35	43.87	44.47	43.83	44.75	45.82	45.83
Factor(phi) (dB)	43.41	42.98	42.58	43.55	44.15	43.05	44.86	44.18	43.77	43.91	44.15	44.62	45.43	45.79

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.

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



8. Test Method

EUT set on multi-axis positioner and adjust EUT's physical center to measurement reference center. Measurement antenna set at phi polarization and 1.5 meter height. Port 1 of Network analyzer connect to antenna 1 of EUT. Record G value every 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 9 tables.

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

9. Measured Values and Calculation of Maximum Gain Positions

DG_1SS max value position

Frequency (Hz)	2.45G	5.2G	5.3G	5.6G	5.785G
Ant. 1 (dBi)	1.46	-1.71	0.54	-0.43	0.38
Ant. 2 (dBi)	0.69	1.46	-2.82	1.36	2.43
Ant. 3 (dBi)	-	1.44	2.92	2.17	3.43
Ant. 4 (dBi)	-	1.82	2.87	3.31	-1.61
DG [1SS] (dBi)	4.09	6.88	7.19	7.73	7.39
Polarization	Theta	Theta	Theta	Theta	Theta
$\Theta(^{\circ})$	60	97.5	105	105	82.5
$\Phi(^{\circ})$	30	285	300	307.5	75

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

DG_1SS max value position calculation

Frequency (Hz)	2.45G	5.2G	5.3G	5.6G	5.785G
Ant. 1 [$10^{(G/20)}$]	$10^{(1.46/20)}$	$10^{(-1.71/20)}$	$10^{(0.54/20)}$	$10^{(-0.43/20)}$	$10^{(0.38/20)}$
Ant. 2 [$10^{(G/20)}$]	$10^{(0.69/20)}$	$10^{(1.46/20)}$	$10^{(-2.82/20)}$	$10^{(1.36/20)}$	$10^{(2.43/20)}$
Ant. 3 [$10^{(G/20)}$]	-	$10^{(1.44/20)}$	$10^{(2.92/20)}$	$10^{(2.17/20)}$	$10^{(3.43/20)}$
Ant. 4 [$10^{(G/20)}$]	-	$10^{(1.82/20)}$	$10^{(2.87/20)}$	$10^{(3.31/20)}$	$10^{(-1.61/20)}$
Ant. 1 [$10^{(G/20)}$] value	1.183	0.821	1.064	0.952	1.045
Ant. 2 [$10^{(G/20)}$] value	1.083	1.183	0.723	1.169	1.323
Ant. 3 [$10^{(G/20)}$] value	-	1.18	1.4	1.284	1.484
Ant. 4 [$10^{(G/20)}$] value	-	1.233	1.392	1.464	0.831
Sum All Antenna [Amax]	2.266	4.418	4.578	4.869	4.683
DG [$10 \cdot \log(A_{max}^2/N_{ant})$]	4.09	6.88	7.19	7.73	7.39

Note:

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

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



DG_1SS max value position

Frequency (Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 (dBi)	-0.57	0.47	-1.9	-2.5
Ant. 2 (dBi)	2.59	3.09	2.5	3.03
Ant. 3 (dBi)	-2.78	-5.24	-5.56	-7.73
Ant. 4 (dBi)	3.76	4.51	4.33	2.95
DG [1SS] (dBi)	7.14	7.44	6.67	5.98
Polarization	Phi	Phi	Phi	Phi
$\Theta(^{\circ})$	60	75	67.5	75
$\Phi(^{\circ})$	22.5	30	30	30

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

DG_1SS max value position calculation

Frequency (Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 [$10^{(G/20)}$]	$10^{(-0.57/20)}$	$10^{(0.47/20)}$	$10^{(-1.9/20)}$	$10^{(-2.5/20)}$
Ant. 2 [$10^{(G/20)}$]	$10^{(2.59/20)}$	$10^{(3.09/20)}$	$10^{(2.5/20)}$	$10^{(3.03/20)}$
Ant. 3 [$10^{(G/20)}$]	$10^{(-2.78/20)}$	$10^{(-5.24/20)}$	$10^{(-5.56/20)}$	$10^{(-7.73/20)}$
Ant. 4 [$10^{(G/20)}$]	$10^{(3.76/20)}$	$10^{(4.51/20)}$	$10^{(4.33/20)}$	$10^{(2.95/20)}$
Ant. 1 [$10^{(G/20)}$] value	0.936	1.056	0.804	0.75
Ant. 2 [$10^{(G/20)}$] value	1.347	1.427	1.334	1.417
Ant. 3 [$10^{(G/20)}$] value	0.726	0.547	0.527	0.411
Ant. 4 [$10^{(G/20)}$] value	1.542	1.681	1.646	1.404
Sum All Antenna [Amax]	4.552	4.711	4.311	3.982
DG [$10 \cdot \log(A_{max}^2/N_{ant})$]	7.14	7.44	6.67	5.98

Note:

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

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



10. Summary of Test Result

Freq(Hz)	2.45G	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	2.61	4.07	4.41	3.66	3.3
Ant. 2 Max Gain (dBi)	3.15	3.95	3.69	3.56	3.77
Ant. 3 Max Gain (dBi)	-	3.9	3.52	4.19	3.67
Ant. 4 Max Gain (dBi)	-	4.07	3.62	4.6	4.99
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/120/330	Theta/52.5/270	Theta/52.5/277.5	Theta/82.5/105	Theta/60/247.5
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/180	Theta/60/90	Theta/60/45	Theta/75/97.5	Theta/75/90
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	-	Theta/105/292.5	Theta/90/82.5	Theta/97.5/82.5	Theta/75/352.5
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	-	Phi/97.5/292.5	Theta/127.5/307.5	Theta/112.5/307.5	Theta/112.5/307.5
Max Gain (dBi)	3.15	4.07	4.41	4.6	4.99
DG [1SS] (dBi)	4.09	6.88	7.19	7.73	7.39
DG [2SS] (dBi)	3.15	4.07	4.41	4.73	4.99
DG [4SS] (dBi)	-	4.07	4.41	4.6	4.99

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)

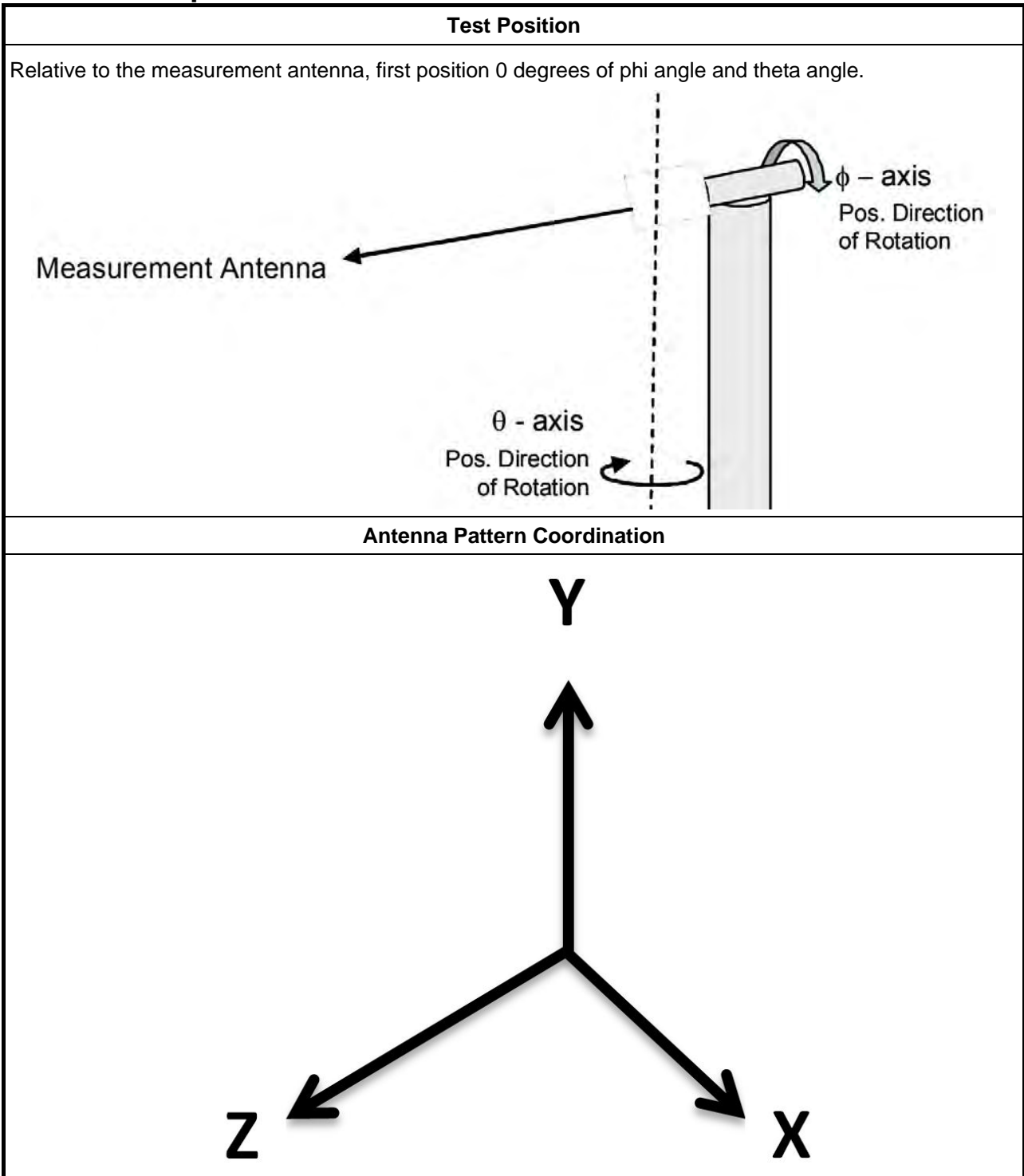


Frequency (Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.57	4.18	3.89	3.82
Ant. 2 Max Gain (dBi)	3.78	4.25	4.39	4.07
Ant. 3 Max Gain (dBi)	5.99	4.05	4.08	4.55
Ant. 4 Max Gain (dBi)	4.64	4.51	4.33	3.64
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/22.5/90	Phi/135/195	Theta/60/90	Theta/30/90
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/67.5/195	Phi/82.5/15	Phi/67.5/15	Phi/60/352.5
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/75/270	Theta/75/270	Theta/82.5/262.5	Theta/90/262.5
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/75/15	Phi/75/30	Phi/67.5/30	Phi/82.5/202.5
Max Gain (dBi)	5.99	4.51	4.39	4.55
DG [1SS] (dBi)	7.14	7.44	6.67	5.98
DG [2SS] (dBi)	5.99	4.51	4.39	4.55
DG [4SS] (dBi)	5.99	4.51	4.39	4.55

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)

11. Test Setup



Note:

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



12. Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1531	1GHz~18GHz	Dec. 20, 2023	Dec. 19, 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.



13. Test Results

Please refer to the appendix.

Appendix A – Radiated Composite Gain of 2.4GHz and 5GHz U-NII 1~3.....Page 16
Appendix B – Radiated Composite Gain of 6GHz U-NII 5~8.....Page 29
Appendix C – Antenna Pattern of 2.4GHz and 5GHz U-NII 1~3.....Page 40
Appendix D – Antenna Pattern of 6GHz U-NII 5~8..... Page 47
Appendix E – Test Photos..... Page 53

Freq(Hz)	2.45G	5.2G	5.3G	5.6G	5.785G
Ant. 1 Max Gain (dBi)	2.61	4.07	4.41	3.66	3.3
Ant. 2 Max Gain (dBi)	3.15	3.95	3.69	3.56	3.77
Ant. 3 Max Gain (dBi)		3.9	3.52	4.19	3.67
Ant. 4 Max Gain (dBi)		4.07	3.62	4.6	4.99
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/120/330	Theta/52.5/270	Theta/52.5/277.5	Theta/82.5/105	Theta/60/247.5
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/75/180	Theta/60/90	Theta/60/45	Theta/75/97.5	Theta/75/90
Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$		Theta/105/292.5	Theta/90/82.5	Theta/97.5/82.5	Theta/75/352.5
Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$		Phi/97.5/292.5	Theta/127.5/307.5	Theta/112.5/307.5	Theta/112.5/307.5
Max Gain (dBi)	3.15	4.07	4.41	4.6	4.99
DG [1SS] (dBi)	4.09	6.88	7.19	7.73	7.39
DG [2SS] (dBi)	3.15	4.07	4.41	4.73	4.99
DG [4SS] (dBi)		4.07	4.41	4.6	4.99



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Gain Result

Table with columns for Frequency (Freq), Polarization (Pol), and various gain measurements (Gain) for different antenna configurations and frequencies (2.45G Pol, 5.2G Pol).



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Main data table containing gain measurements for various frequencies (5.785GHz to 5.25GHz) and polarization states (Theta/Ant 1, 2). The table is organized into multiple sections, with columns for frequency, polarization, and gain values. It includes sub-headers for Gain (Phi(Theta)) and Phi(Ant) for each polarization state. The data is presented in a grid format, with some cells containing numerical values and others being blank or containing small text like '0' or '1'.



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Theta	Phi	Gain	Phi(15)	Phi(22.5)	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)
Theta(°)	Phi(°)	Gain	Phi(15)	Phi(22.5)	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)
Theta(°)	Phi(°)	Gain	Phi(15)	Phi(22.5)	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)



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Theta (deg)	-12.76/13.22	-15.87/17.53	-17.75/19	-18.71/18.81	-18.16/19.08	-17.37/18.79	-19.03/18.59	-16.84/15.1	-12.76/12.36	-9.72/7.15	-5.4/4.55	-4.69/4.92	-5.13/5.26	-6.02/8.19	-11.18/14.84	-17.62/14.07	-11.79/10.06	-9.15/9.46	-10.1/10.42	-10.18/10.6	-11.29/12.72	-13.69/12.69	-11.52/12.9	-15.98/15.23
Freq(Hz)	5.6GPol	ThetaAnt 2	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Gain	Phi(75)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(0)	-13.64/11.23	-9.26/7.77	-6.61/6.07	-5.27/4.47	-4.44/3.33	-4.24/3.89	-3.49/4.31	-3.51/3.73	-3.96/4.35	-5.26/6.71	-8.09/10.39	-12.95/15.77	-17.41/12.37	-9.46/7.05	-5.31/4.14	-3.45/3.06	-2.55/3.22	-2.2/2.27	-2.82/3.43	-4.02/4.81	-6.08/6.92	-8.72/10.83	-14.67/18.99	-18.47/17.37



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Theta (deg)	Phi (deg)	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°)
Theta (135°)	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°)
Gain	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Theta (135°)	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°)
Gain	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Radiated Composite Gain Data 2.4GHz, 5GHz U-NII 1~3

Appendix A

Table with 40 columns and 40 rows. Columns represent gain values in dBSm for various combinations of elevation angle (Theta) and frequency (Phi). Rows represent elevation angles from 0 to 180 degrees. Headers include 'Freq(Hz)' and 'Gain'. The table contains numerical data for each combination.

Freq(Hz)	6.175G	6.475G	6.695G	6.995G
Ant. 1 Max Gain (dBi)	4.57	4.18	3.89	3.82
Ant. 2 Max Gain (dBi)	3.78	4.25	4.39	4.07
Ant. 3 Max Gain (dBi)	5.99	4.05	4.08	4.55
Ant. 4 Max Gain (dBi)	4.64	4.51	4.33	3.64
Ant. 1 Polarization/ θ ($^{\circ}$)/ Φ ($^{\circ}$)	Theta/22.5/90	Phi/135/195	Theta/60/90	Theta/30/90
Ant. 2 Polarization/ θ ($^{\circ}$)/ Φ ($^{\circ}$)	Phi/67.5/195	Phi/82.5/15	Phi/67.5/15	Phi/60/352.5
Ant. 3 Polarization/ θ ($^{\circ}$)/ Φ ($^{\circ}$)	Theta/75/270	Theta/75/270	Theta/82.5/262.5	Theta/90/262.5
Ant. 4 Polarization/ θ ($^{\circ}$)/ Φ ($^{\circ}$)	Phi/75/15	Phi/75/30	Phi/67.5/30	Phi/82.5/202.5
Max Gain (dBi)	5.99	4.51	4.39	4.55
DG [1SS] (dBi)	7.14	7.44	6.67	5.98
DG [2SS] (dBi)	5.99	4.51	4.39	4.55
DG [4SS] (dBi)	5.99	4.51	4.39	4.55



Radiated Composite Gain Data 6GHz U-NII 5~8

Appendix B

DG 1SS Result

Table with 34 columns representing frequency bands from 6.175GHz to 6.475GHz and 34 rows representing gain values in dBm. Includes sub-headers for Theta and Phi angles.



Radiated Composite Gain Data 6GHz U-NII 5~8

Appendix B

Table with columns for frequency (Freq), antenna (Theta, Phi), and gain (Gain) for various combinations of frequencies and antenna orientations. The table contains a large amount of numerical data.



Radiated Composite Gain Data 6GHz U-NII 5~8

Appendix B

Theta	Phi	Gain	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)
Theta(127.5)	Phi(7.5)	-9.69/-7.61	-15.71/-6.89	-4.38/-12.36	-19.02/-13.67	-9.26/-10.74	-11.24/-16.54	-17.74/-19.22	-15.97/-11.91	-11.06/-11.47	-9.76/-15.73	-11.91/-12.61	-10.76/-13.58	-11.51/-18.85	-17.25/-11.73	-15.11/-8	-9.76/-5.58	-9.37/-9.66	-11.76/-9.24	-8.12/-7.7	-7.76/-9.6	-14.66/-18.82	-13.52/-8.24	9.1/-6.01	-12.05/-13.18	



Radiated Composite Gain Data 6GHz U-NII 5~8

Appendix B

Theta	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(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°)
Theta	Phi(0°)	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°)	Phi(360°)	Phi(375°)	Phi(390°)	Phi(405°)
Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain	Gain
Theta	Phi(0°)	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°)	Phi(360°)	Phi(375°)	Phi(390°)	Phi(405°)

Theta	Phi	Phi(5°)	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°)
Theta(75°)	Phi(0°)	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°)	
Theta(75°)	Phi(0°)	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°)	
Theta(75°)	Phi(0°)	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°)	
Theta(75°)	Phi(0°)	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°)	



Antenna Pattern 2.4GHz, 5GHz U-NII 1~3

Appendix C

Table with columns for frequency (2.450GHz, 5.2GHz, 5.3GHz) and various antenna configurations (Gain, 0°, 7.5°, 15°, 30°, 45°, 60°, 75°, 82.5°, 90°, 105°, 120°, 127.5°, 135°, 142.5°, 150°, 157.5°, 165°, 172.5°, 180°). Each configuration has two columns of gain values.

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

