



Antenna Composite Gain Test Report

Equipment	BGW320-500 Wireless Integrated ONT Residential Gateway
Brand Name	HUMAX
Model Name	BGW320-500
Applicant	Humax Networks, INC. 216, Hwangsaeul-ro, Bundang-gu, Seongnam-si, 463-875, South Korea
Manufacturer	Humax Networks, INC. 216, Hwangsaeul-ro, Bundang-gu, Seongnam-si, 463-875, South Korea
Sample Received	Apr. 25, 2022
Start Test Date	Apr. 25, 2022
Final Test Date	Apr. 25, 2022



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History of this test report

Report No.	Version	Description	Issued Date
AR242501AA	01	Initial issue of report	Aug. 15, 2022
AP242501AA	02	Changing the brand name of Antenna to GALTRONICS from CALTRONICS	Aug. 29, 2022

1. Operation Mode and Antenna Information

Antenna Position	RF Port		Brand Name	Model Name	Ant. Type	Connector	Modes of Operation
	2.4GHz	5GHz					
2G5GLAnt1	1	1	GALTRONICS	02102140-06811U1	PCB	I-PEX	2.4GHz, 5GHz UNII 1, 2A
2G5GLAnt2	2	2	GALTRONICS	02102140-06811U1	PCB	I-PEX	2.4GHz, 5GHz UNII 1, 2A
2G5GLAnt3	3	3	GALTRONICS	02102140-06811U1	PCB	I-PEX	2.4GHz, 5GHz UNII 1, 2A
2G5GLAnt4	4	4	GALTRONICS	02102140-06811U1	PCB	I-PEX	2.4GHz, 5GHz UNII 1, 2A
5G Ant1	-	1	GALTRONICS	02102140-06811U1	PCB	I-PEX	5GHz UNII 2C, 3
5G Ant2	-	2	GALTRONICS	02102140-06811U1	PCB	I-PEX	5GHz UNII 2C, 3
5G Ant3	-	3	GALTRONICS	02102140-06811U1	PCB	I-PEX	5GHz UNII 2C, 3
5G Ant4	-	4	GALTRONICS	02102140-06811U1	PCB	I-PEX	5GHz UNII 2C, 3

Note:

2.4GHz and 5GHz UNII 1, 2A Operation Mode (4TX/4RX)

2G5GLAnt1~2G5GLAnt4 can be used as transmitting/receiving antenna.

2G5GLAnt1~2G5GLAnt4 could transmit/receive simultaneously.

5GHz UNII 2C, 3 Operation Mode (4TX/4RX)

5G Ant1~5G Ant4 can be used as transmitting/receiving antenna.

5G Ant1~5G Ant4 could transmit/receive simultaneously.

2. Test Frequency

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

Band [MHz]	Test Frequency [MHz]
2400-2483.5	2450
5150-5250	5200
5250-5350	5300
5470-5725	5600
5725-5850	5785



3. Testing Location

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

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	05CH03-HY	Rex Liao	23.5-24.5 / 50-55	Apr. 25, 2022

Note:

Testing Site Information

Brand Name: TDK

Dimension: 11m*6m*6m

Characteristic: Fully Anechoic Chamber

4. Test Facility and Configuration

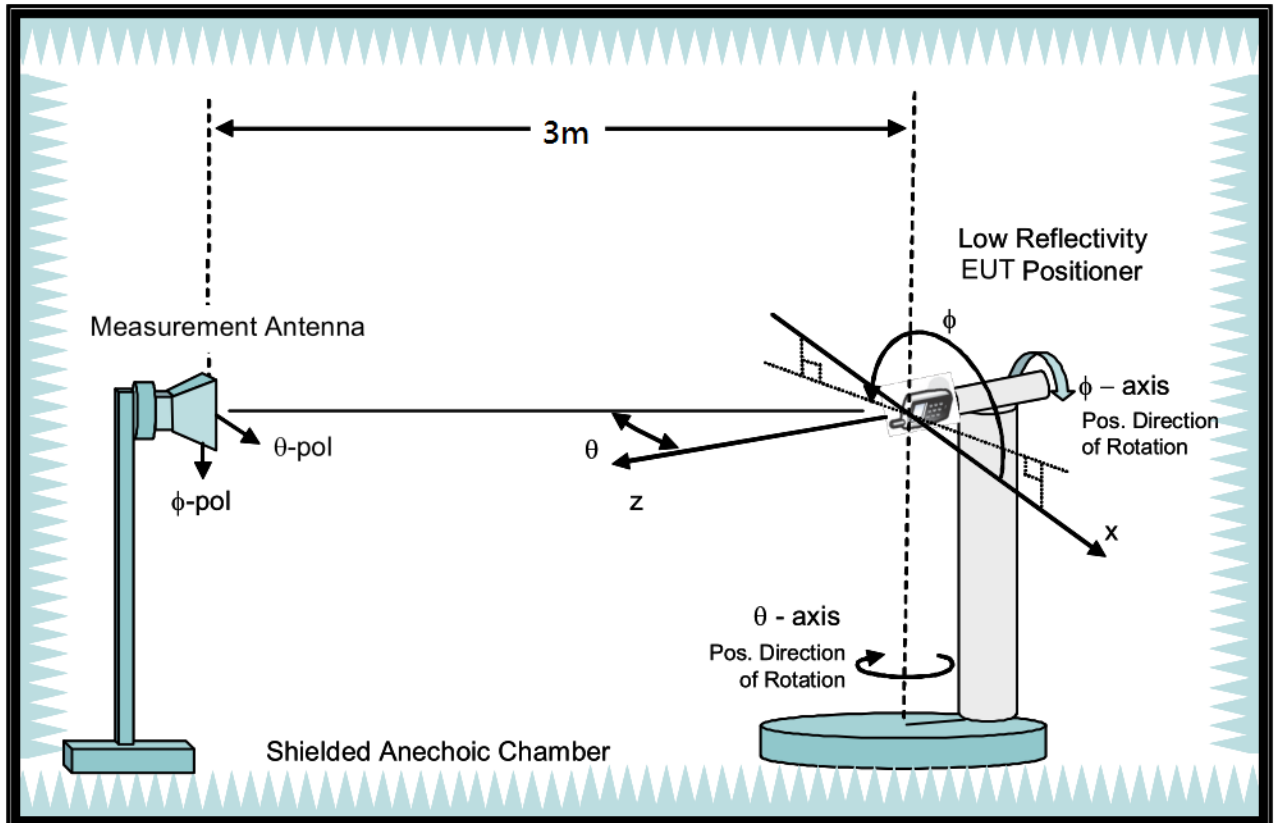
Test configuration: Reference to CITA OTA distributed-axes system configuration.

Chamber: Fully Anechoic Chamber.

Measurement antenna: Dual Polarization Horn antenna

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

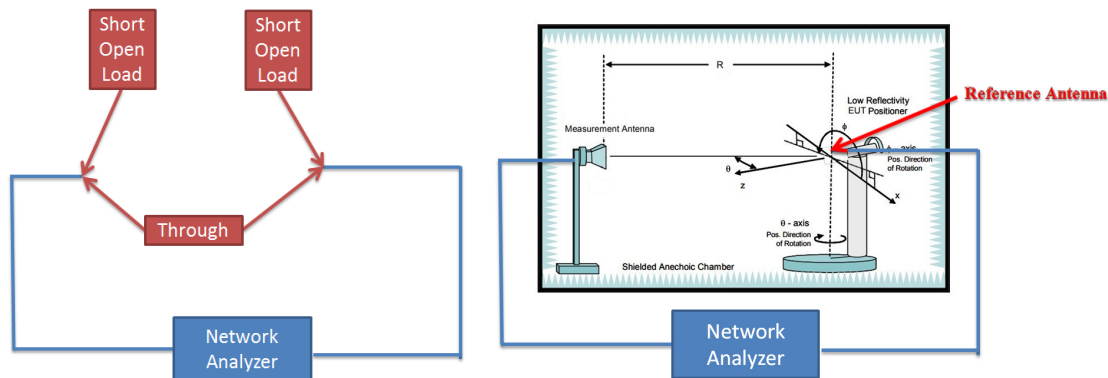
#Reference to CTIA "ctia-test-plan-for-wireless-device-over-the-air-performance-ver-3-7-1"



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	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

For 2.4GHz/5GHz UNII 1, 2A

DG_1SS max value position

Frequency (Hz)	2.45G	5.2G	5.3G
Ant. 1 (dBi)	-7.37	-1.59	-1.82
Ant. 2 (dBi)	2.89	-0.06	0.22
Ant. 3 (dBi)	-2.89	2.93	1.92
Ant. 4 (dBi)	3.21	-19.2	-19.04
DG [1SS] (dBi)	5.99	4.45	4.07
Polarization	Phi	Theta	Theta
Θ (°)	30	70	80
Φ (°)	30	230	240

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	5.2G	5.3G
Ant. 1 [10 ^{^(G/20)}]	10 ^{^(-7.37/20)}	10 ^{^(-1.59/20)}	10 ^{^(-1.82/20)}
Ant. 2 [10 ^{^(G/20)}]	10 ^{^(2.89/20)}	10 ^{^(-0.06/20)}	10 ^{^(0.22/20)}
Ant. 3 [10 ^{^(G/20)}]	10 ^{^(-2.89/20)}	10 ^{^(2.93/20)}	10 ^{^(1.92/20)}
Ant. 4 [10 ^{^(G/20)}]	10 ^{^(3.21/20)}	10 ^{^(-19.2/20)}	10 ^{^(-19.04/20)}
Ant. 1 [10 ^{^(G/20)}] value	0.428	0.833	0.811
Ant. 2 [10 ^{^(G/20)}] value	1.395	0.993	1.026
Ant. 3 [10 ^{^(G/20)}] value	0.717	1.401	1.247
Ant. 4 [10 ^{^(G/20)}] value	1.447	0.11	0.112
Sum All Antenna [Amax]	3.987	3.337	3.196
DG [10*log(Amax ² /Nant)]	5.99	4.45	4.07

Note:

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

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



For 5GHz UNII 2C, 3

DG_1SS max value position

Frequency (Hz)	5.6G	5.785G
Ant. 1 (dBi)	-5.23	-5.86
Ant. 2 (dBi)	-0.9	-0.75
Ant. 3 (dBi)	-9.55	-11.07
Ant. 4 (dBi)	3.09	4.21
DG [1SS] (dBi)	4.11	4.43
Polarization	Theta	Theta
Θ (°)	70	100
Φ (°)	60	50

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)	5.6G	5.785G
Ant. 1 [10 ^{^(G/20)}]	10 ^{^(-5.23/20)}	10 ^{^(-5.86/20)}
Ant. 2 [10 ^{^(G/20)}]	10 ^{^(-0.9/20)}	10 ^{^(-0.75/20)}
Ant. 3 [10 ^{^(G/20)}]	10 ^{^(-9.55/20)}	10 ^{^(-11.07/20)}
Ant. 4 [10 ^{^(G/20)}]	10 ^{^(3.09/20)}	10 ^{^(4.21/20)}
Ant. 1 [10 ^{^(G/20)}] value	0.548	0.509
Ant. 2 [10 ^{^(G/20)}] value	0.902	0.917
Ant. 3 [10 ^{^(G/20)}] value	0.333	0.28
Ant. 4 [10 ^{^(G/20)}] value	1.427	1.624
Sum All Antenna [Amax]	3.21	3.33
DG [10*log(Amax ² /Nant)]	4.11	4.43

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	5.2G	5.3G
Ant. 1 Max Gain (dBi)	4.3	2.43	2.5
Ant. 2 Max Gain (dBi)	3.63	2.08	2.97
Ant. 3 Max Gain (dBi)	2.69	2.93	2.8
Ant. 4 Max Gain (dBi)	4.67	3.28	3.24
Ant. 1 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Theta/80/170	Theta/100/100	Theta/100/90
Ant. 2 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/10/30	Phi/120/190	Phi/120/190
Ant. 3 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/100/80	Theta/70/230	Theta/80/230
Ant. 4 Polarization/ $\Theta(^{\circ})/\Phi(^{\circ})$	Phi/50/20	Phi/30/190	Phi/30/200
Max Gain (dBi)	4.67	3.28	3.24
DG [1SS] (dBi)	5.99	4.45	4.07
DG [2SS] (dBi)	4.67	3.28	3.24
DG [4SS] (dBi)	4.67	3.28	3.24

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.

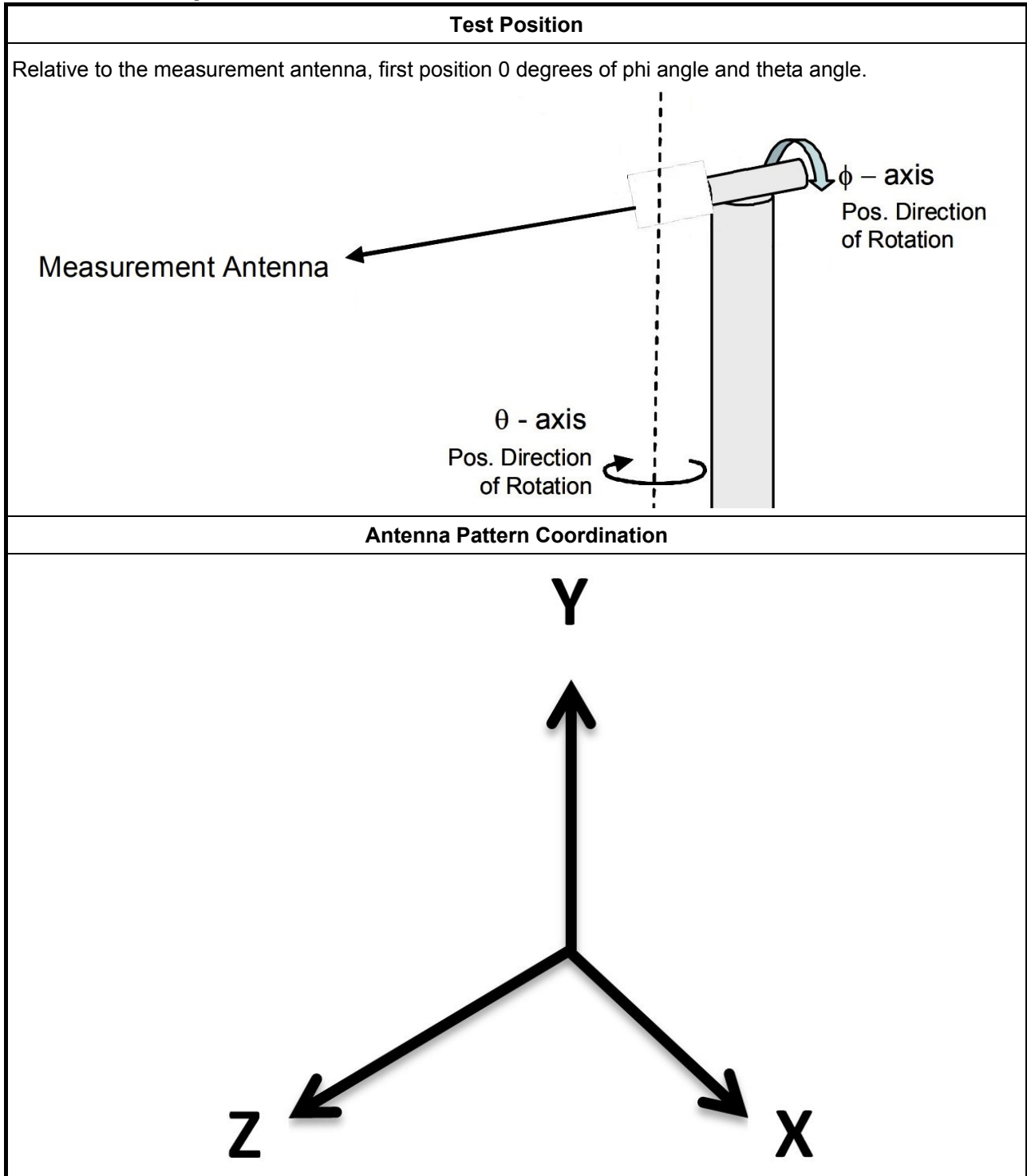


Frequency (Hz)	5.6G	5.785G
Ant. 1 Max Gain (dBi)	2.57	2.64
Ant. 2 Max Gain (dBi)	3.98	4.12
Ant. 3 Max Gain (dBi)	2.29	2.9
Ant. 4 Max Gain (dBi)	3.18	4.21
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/50/280	Phi/70/190
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/90/250	Theta/90/250
Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/40/50	Phi/80/60
Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/90/60	Theta/100/50
Max Gain (dBi)	3.98	4.21
DG [1SS] (dBi)	4.11	4.43
DG [2SS] (dBi)	3.98	4.21
DG [4SS] (dBi)	3.98	4.21

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.

Appendix A – Radiated Composite Gain of 2.4GHz, 5GHz U-NII 1 and U-NII 2A.....Page 16
Appendix B – Radiated Composite Gain of 5GHz U-NII 2C and U-NII 3.....Page 21
Appendix C – Antenna Pattern of 2.4GHz, 5GHz U-NII 1 and U-NII 2A.....Page 25
Appendix D – Antenna Pattern of 5GHz U-NII 2C and U-NII 3..... Page 29
Appendix E – Test Photos..... Page 32



Freq(Hz)	2.45G	5.2G	5.8G
Ant. 1 Max Gain (dBi)	4.3	2.43	2.5
Ant. 2 Max Gain (dBi)	3.63	2.08	2.97
Ant. 3 Max Gain (dBi)	2.69	2.93	2.8
Ant. 4 Max Gain (dBi)	4.67	3.28	3.24
Ant. 1 Polarization/ Θ (°)/ Φ (°)	Theta/80/170	Theta/100/100	Theta/100/90
Ant. 2 Polarization/ Θ (°)/ Φ (°)	Phi/10/30	Phi/120/190	Phi/120/190
Ant. 3 Polarization/ Θ (°)/ Φ (°)	Phi/100/80	Theta/70/230	Theta/80/230
Ant. 4 Polarization/ Θ (°)/ Φ (°)	Phi/50/20	Phi/30/190	Phi/30/200
Max Gain (dBi)	4.67	3.28	3.24
DG [1SS] (dBi)	5.99	4.45	4.07
DG [2SS] (dBi)	4.67	3.28	3.24
DG [4SS] (dBi)	4.67	3.28	3.24



Radiated Composite Gain of 2.4GHz, 5GHz U-NII 1 and U-NII 2A

Appendix A

DG 1SS Result

Table with columns: FreqHz, EIRPmW, and 20 columns of gain data (G1-G20). Rows include various frequency and power level combinations.



Radiated Composite Gain of 2.4GHz, 5GHz U-NII 1 and U-NII 2A

Appendix A

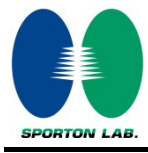
Table with columns for Frequency (MHz), Gain (dBi), and various test parameters. The table contains multiple rows of data for different frequencies and gain values.



Radiated Composite Gain of 2.4GHz, 5GHz U-NII 1 and U-NII 2A

Appendix A

Table with columns for frequency (MHz), power (mW), and various gain metrics (dBm, dBd, etc.) for frequencies ranging from 4810 to 8395 MHz.



Freq(Hz)	5.6G	5.785G
Ant. 1 Max Gain (dBi)	2.57	2.64
Ant. 2 Max Gain (dBi)	3.98	4.12
Ant. 3 Max Gain (dBi)	2.29	2.9
Ant. 4 Max Gain (dBi)	3.18	4.21
Ant. 1 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/50/280	Phi/70/190
Ant. 2 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/90/250	Theta/90/250
Ant. 3 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Phi/40/50	Phi/80/60
Ant. 4 Polarization/ $\theta(^{\circ})/\Phi(^{\circ})$	Theta/90/60	Theta/100/50
Max Gain (dBi)	3.98	4.21
DG [1SS] (dBi)	4.11	4.43
DG [2SS] (dBi)	3.98	4.21
DG [4SS] (dBi)	3.98	4.21



Antenna Pattern of 2.4GHz, 5GHz U-NII 1 and U-NII 2A

Appendix C

Total Gain Data

Freq(Hz)	2.45GPol.	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°)	-10.57/-9.83	-9.23/-8.80	-9.22/-9.35	-8.73/-8.25	-8.11/-8.56	-9.87/-10.58	-8.12/-8.30	-8.73/-8.86	-10.22/-10.49	-6.56/-7.02	-8.77/-8.81	-10.22/-10.49	-6.56/-7.02	-8.77/-8.81	-10.22/-10.49	-6.56/-7.02	-8.77/-8.81	-10.22/-10.49	-6.56/-7.02

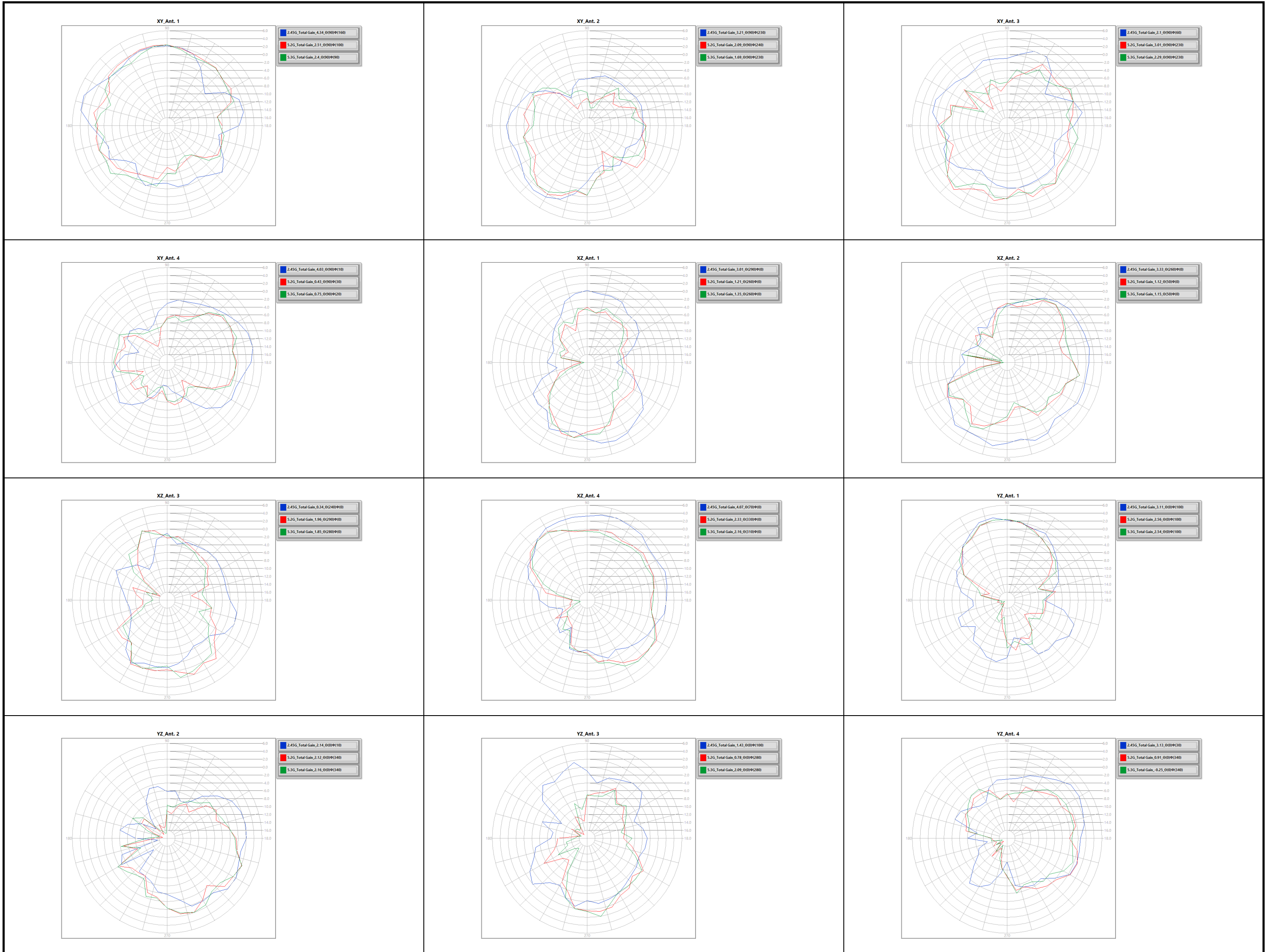


Antenna Pattern of 2.4GHz, 5GHz U-NII 1 and U-NII 2A

Appendix C

θ (170°)	-7.33/-8.21	-9.21/-8.88	-7.34/-6.48	-6.70/-7.77	-7.65/-7.42	-8.84/-11.30	-12.69/-12.48	-12.31/-11.77	-13.15/-14.29	-13.63/-14.50	-16.86/-16.50	-16.45/-15.90	-16.60/-16.68	-15.47/-14.46	-13.71/-12.87	-13.39/-14.16	-13.35/-12.30	-11.26/-8.56
θ (180°)	-14.37/-14.40	-13.75/-14.56	-15.89/-15.90	-14.07/-15.05	-13.94/-14.17	-16.31/-17.00	-16.79/-16.23	-16.19/-16.90	-15.68/-16.41	-16.77/-16.15	-16.39/-14.52	-15.02/-16.09	-14.76/-13.69	-14.77/-15.75	-15.03/-14.06	-16.00/-15.19	-14.98/-16.19	-16.50/-14.71
Freq(Hz)	5.3G/Pol.	Total/Ant. 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gain	Φ(0°)/Φ(10°)	Φ(20°)/Φ(30°)	Φ(40°)/Φ(50°)	Φ(60°)/Φ(70°)	Φ(80°)/Φ(90°)	Φ(100°)/Φ(110°)	Φ(120°)/Φ(130°)	Φ(140°)/Φ(150°)	Φ(160°)/Φ(170°)	Φ(180°)/Φ(190°)	Φ(200°)/Φ(210°)	Φ(220°)/Φ(230°)	Φ(240°)/Φ(250°)	Φ(260°)/Φ(270°)	Φ(280°)/Φ(290°)	Φ(300°)/Φ(310°)	Φ(320°)/Φ(330°)	Φ(340°)/Φ(350°)
θ (0°)	-1.25/-1.13	-1.15/-1.38	-1.24/-1.38	-1.17/-0.93	-1.15/-1.59	-1.59/-1.54	-1.87/-1.94	-1.84/-1.91	-1.82/-1.76	-1.61/-1.41	-1.34/-1.36	-1.54/-1.79	-1.77/-2.14	-3.02/-3.02	-2.74/-3.20	-3.19/-2.90	-2.75/-2.55	-2.15/-1.79
θ (10°)	-0.87/-0.71	-0.25/-0.19	-0.45/-0.87	-0.83/-0.32	0.08/-0.87	-1.64/-0.93	-0.70/-1.36	-1.74/-1.96	-2.11/-1.93	-1.51/-1.34	-1.34/-1.18	-0.70/-0.58	-0.52/-0.59	-1.10/-1.14	-1.42/-2.02	-2.66/-3.51	-3.36/-2.74	-1.86/-1.25
θ (20°)	-0.39/-0.24	0.57/0.13	-0.48/-0.48	-0.52/-0.93	-0.98/-0.93	-0.55/-0.37	-0.69/-1.17	-0.46/-0.30	-0.32/0.09	0.12/0.07	0.89/1.66	2.09/1.70	1.53/1.03	0.22/-0.25	-0.54/-1.65	-2.26/-2.66	-3.35/-2.88	-1.70/-0.89
θ (30°)	-0.96/-0.48	0.13/0.67	0.77/0.68	0.30/-0.71	-0.92/-0.75	-1.91/-1.48	-0.45/-0.39	0.03/0.45	0.87/1.45	1.86/2.52	3.30/3.30	2.73/1.66	1.28/0.62	-0.84/-1.47	-0.66/-0.19	-0.66/-1.05	-1.32/-1.63	-0.65/-0.38
θ (40°)	-0.33/-0.04	1.09/2.01	2.68/2.31	1.51/0.53	-0.49/-1.22	-2.24/-3.61	-2.98/-1.08	0.94/1.16	0.89/1.44	2.03/1.92	2.77/2.39	1.11/-0.52	-1.37/-1.08	-2.29/-3.92	-3.43/-2.73	-1.37/-0.97	-1.89/-1.63	-0.33/-0.17
θ (50°)	-0.66/0.83	2.35/3.31	3.37/2.57	1.46/-0.14	-1.63/-1.88	-2.84/-4.52	-4.40/-1.81	0.28/0.60	-0.51/1.49	2.16/0.78	0.90/-0.59	-1.85/-0.56	-2.45/-4.10	-4.16/-3.79	-2.83/-2.17	-1.40/-1.43	-1.16/-1.81	-0.32/-0.44
θ (60°)	-1.16/0.58	2.21/2.53	2.06/1.28	0.07/-1.86	-3.85/-4.00	-4.62/-5.13	-3.72/-2.02	0.32/0.10	-0.43/1.01	1.21/-0.84	-1.81/-2.31	-1.97/-3.92	-3.55/-4.81	-6.08/-5.30	-6.26/-5.97	-4.85/-2.26	-1.97/-2.41	-0.36/-0.58
θ (70°)	-1.10/-0.01	1.82/2.64	1.78/0.20	-1.87/-3.99	-5.58/-5.73	-5.16/-4.40	-4.53/-4.00	-1.31/-1.43	-0.94/-0.64	-1.18/-4.06	-2.88/-4.45	-4.63/-4.24	-6.99/-7.94	-5.45/-5.52	-6.70/-6.37	-6.33/-5.25	-4.38/-3.37	-1.54/-0.35
θ (80°)	-0.55/-0.45	2.12/2.10	1.30/-0.02	-3.28/-5.67	-5.47/-6.37	-8.07/-8.19	-6.10/-5.26	-2.37/-2.23	-3.39/-1.91	-1.84/-3.54	-4.64/-5.24	-6.13/-5.70	-8.97/-11.16	-7.09/-3.88	-5.58/-7.73	-7.52/-5.42	-5.69/-3.71	-1.13/-0.45
θ (90°)	-0.61/-1.23	0.75/0.26	0.51/-1.46	-5.25/-7.07	-6.22/-6.99	-8.90/-9.09	-8.98/-6.58	-6.57/-3.99	-4.98/-4.88	-4.39/-4.96	-9.61/-11.18	-9.39/-9.30	-8.03/-11.29	-11.71/-8.50	-7.87/-8.41	-8.31/-9.75	-8.47/-4.17	-0.89/-0.61
θ (100°)	-0.13/-1.60	-0.28/-0.53	-1.64/-2.43	-3.63/-4.74	-4.70/-8.01	-13.68/-12.53	-9.26/-11.85	-8.02/-5.05	-7.44/-7.59	-5.00/-6.36	-9.87/-10.09	-8.61/-9.47	-9.93/-8.17	-13.96/-10.32	-10.77/-7.02	-7.90/-7.87	-5.53/-3.99	-1.49/-0.37
θ (110°)	0.83/-0.09	0.22/-0.71	-1.49/-0.45	-1.36/-2.54	-3.19/-6.13	-9.96/-10.74	-9.24/-9.97	-15.21/-7.40	-14.12/-8.16	-5.29/-10.44	-10.94/-9.31	-9.09/-16.21	-11.96/-15.16	-16.24/-12.60	-13.94/-12.27	-10.49/-11.26	-3.84/-2.66	-1.43/-0.30
θ (120°)	1.76/0.32	-0.05/0.20	-0.61/-1.51	-1.08/-0.82	-1.88/-3.66	-7.57/-10.47	-11.06/-14.38	-16.59/-13.82	-15.14/-9.37	-9.17/-11.36	-12.90/-10.31	-13.76/-11.10	-12.41/-9.67	-16.02/-15.97	-9.09/-10.80	-11.63/-9.77	-5.85/-1.26	-0.37/1.46
θ (130°)	1.59/1.18	0.45/-0.23	-0.85/-0.77	-0.90/-1.41	-2.18/-3.86	-7.04/-11.27	-12.43/-12.63	-14.08/-13.33	-9.94/-6.81	-8.36/-12.82	-16.71/-12.49	-9.92/-15.21	-9.14/-14.94	-10.67/-13.57	-12.70/-11.01	-9.78/-9.87	-9.60/-5.10	-1.60/0.20
θ (140°)	0.26/1.06	1.74/1.18	-0.13/-1.66	-2.41/-2.63	-3.38/-5.11	-8.01/-9.19	-11.73/-16.57	-14.25/-16.55	-14.50/-10.25	-11.39/-15.13	-16.33/-15.88	-15.89/-10.61	-11.18/-12.26	-10.53/-16.01	-11.90/-5.07	-7.29/-4.35	-4.56/-3.20	-2.11/-1.00
θ (150°)	-2.16/-2.21	-1.02/-0.73	-1.37/-2.72	-4.33/-4.64	-5.29/-6.40	-8.28/-10.93	-16.45/-16.54	-13.40/-11.49	-11.99/-12.00	-12.33/-12.03	-14.87/-15.04	-12.68/-16.07	-15.86/-17.09	-17.06/-14.89	-16.66/-7.50	-5.19/-3.64	-3.43/-3.16	-2.76/-2.09
θ (160°)	-6.32/-7.16	-6.31/-4.91	-4.36/-4.19	-4.07/-4.24	-5.68/-7.83	-9.36/-10.18	-10.91/-10.84	-12.24/-13.46	-15.90/-15.24	-14.60/-15.82	-17.00/-15.69	-14.61/-16.01	-16.37/-16.10	-16.98/-11.25	-10.18/-9.51	-7.42/-6.93	-6.73/-6.58	
θ (170°)	-10.50/-11.01	-11.70/-10.68	-8.12/-7.10	-7.07/-7.78	-8.42/-8.19	-7.98/-8.51	-11.00/-14.32	-15.01/-14.68	-16.09/-16.84	-16.23/-15.69	-15.57/-15.92	-16.16/-16.87	-16.13/-15.95	-16.11/-13.99	-12.27/-12.18	-12.56/-14.74	-14.25/-13.25	-11.49/-11.05
θ (180°)	-14.58/-12.52	-11.33/-12.50	-13.87/-12.17	-12.21/-12.36	-11.57/-13.99	-16.15/-16.85	-16.00/-16.44	-15.80/-16.85	-16.09/-16.25	-16.82/-15.96	-15.82/-13.44	-12.97/-12.54	-12.71/-14.28	-14.47/-14.63	-15.45/-15.17	-14.13/-13.06	-13.13/-14.15	-14.27/-14.19

E1(XY plane) – $\Theta(90)\Phi(0-360)$
 E2(XZ plane) – $\Theta(0-180)\Phi(0)$ and $\Theta(0-180)\Phi(180)$
 E3(YZ plane) – $\Theta(0-180)\Phi(90)$ and $\Theta(0-180)\Phi(270)$



E1(XY plane) – $\Theta(90)\Phi(0-360)$
 E2(XZ plane) – $\Theta(0-180)\Phi(0)$ and $\Theta(0-180)\Phi(180)$
 E3(YZ plane) – $\Theta(0-180)\Phi(90)$ and $\Theta(0-180)\Phi(270)$

