

BE3600(V+H)- AOT passive measurement Report

- V1.1.7

- Eric
- 01/13/2026

History

- 2025.09.05-V1.1.0: Initial antenna solution.
- 2025.09.15-V1.1.1: Optimize isolation.
- 2025.09.29-V1.1.2: Update combined for 5G.
- 2025.10.30-V1.1.3: Passive Measurement .
- 2025.10.31-V1.1.4: Update Isolation.
- 2025.11.03-V1.1.5: Update horizontal antenna.
- 2025.12.15-V1.1.6: Antenna holder structure was modified.
- 2025.12.15-V1.1.7: Antenna holder structure was modified(V+H).



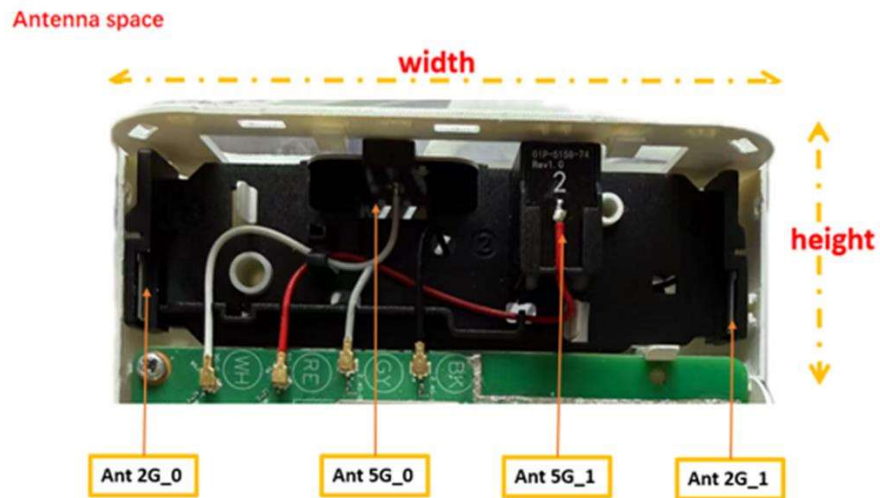
Agenda

- Antenna simulation setup
- S parameter
- Efficiency
- Radiation Performance
- Conclusion



Simulation Setup

Simulation Model of The Antennas



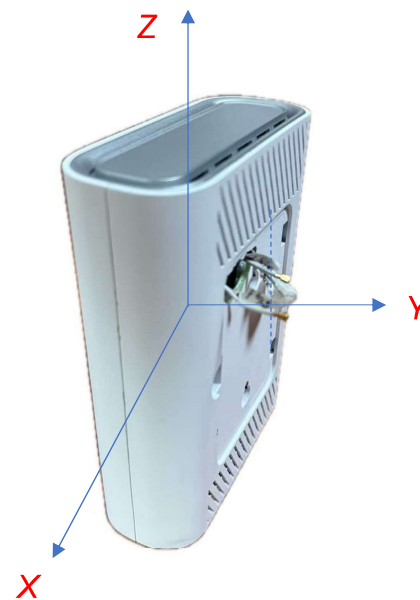
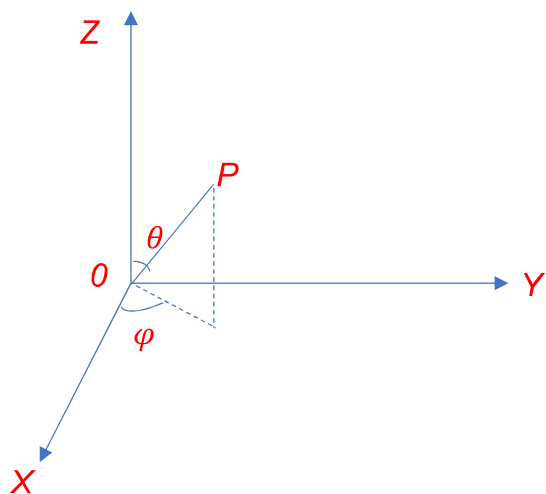
Ant	Polarization	Material	Dimension (mm)	Cable Type	Cable Length (mm)	Cable phase (degree, center frequency for desired band)
Ant 2G_0	Vertical	FR4	30x11.6x0.6	1.37 Low Loss	90	
Ant 2G_1	Vertical	FR4	30x11.6x0.7	1.37 Low Loss	115	
Ant 5G_0	Horizontal	ZYF350	30x30x1.2	1.37 Low Loss	80	
Ant 5G_1	Vertical	FR4	21x11.6x0.7	1.37 Low Loss	105	



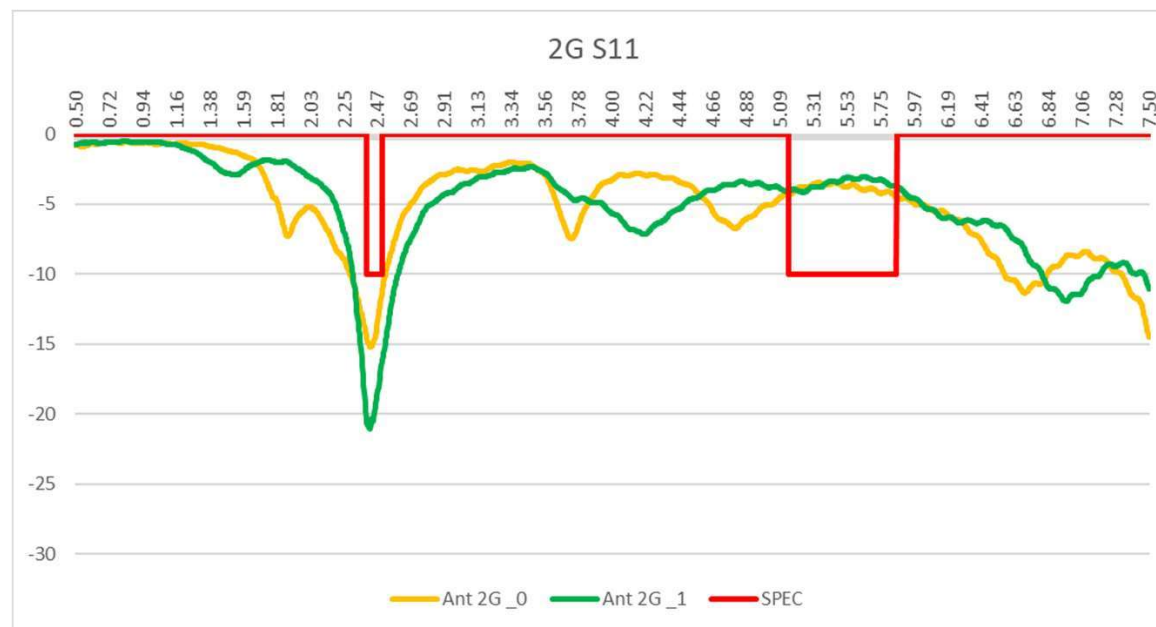
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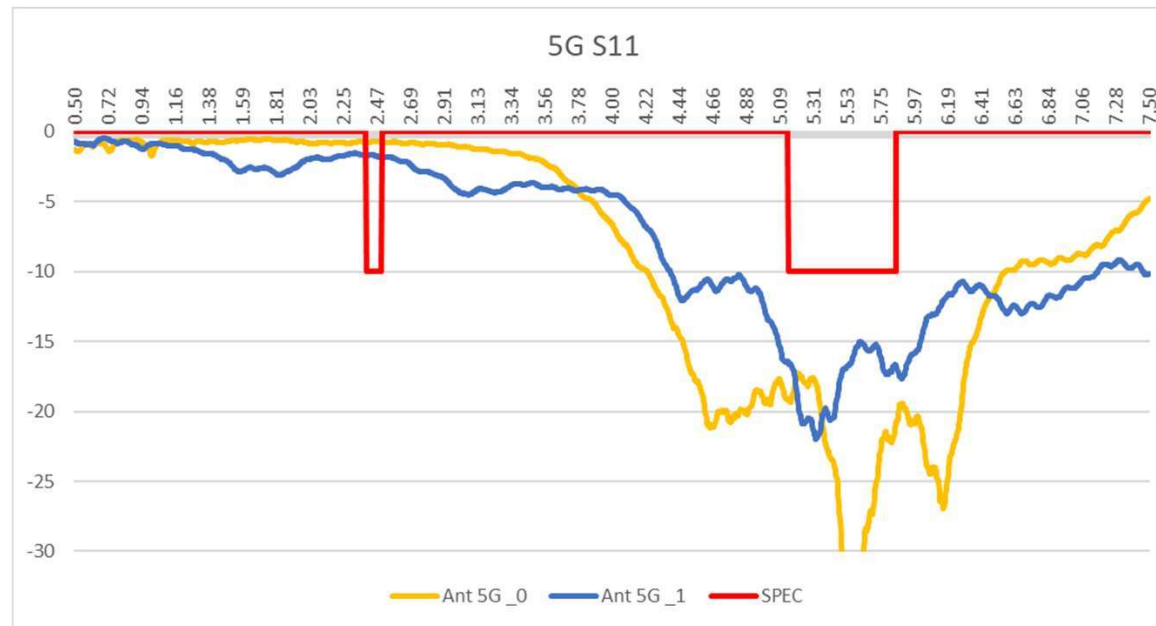
Explanation of the polarization number



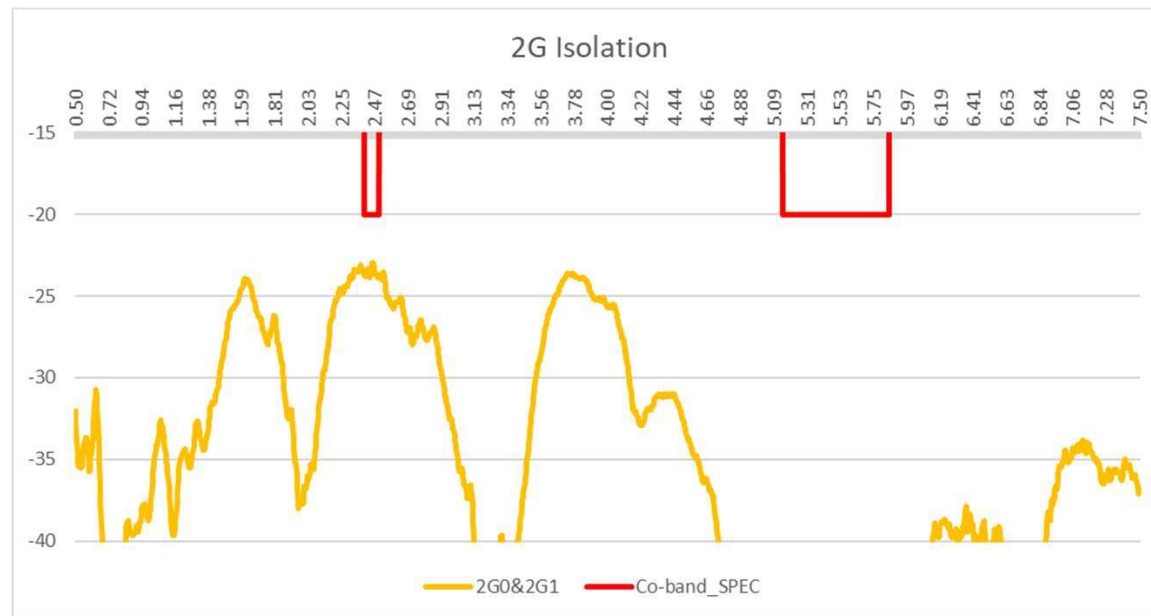
S parameters_S11



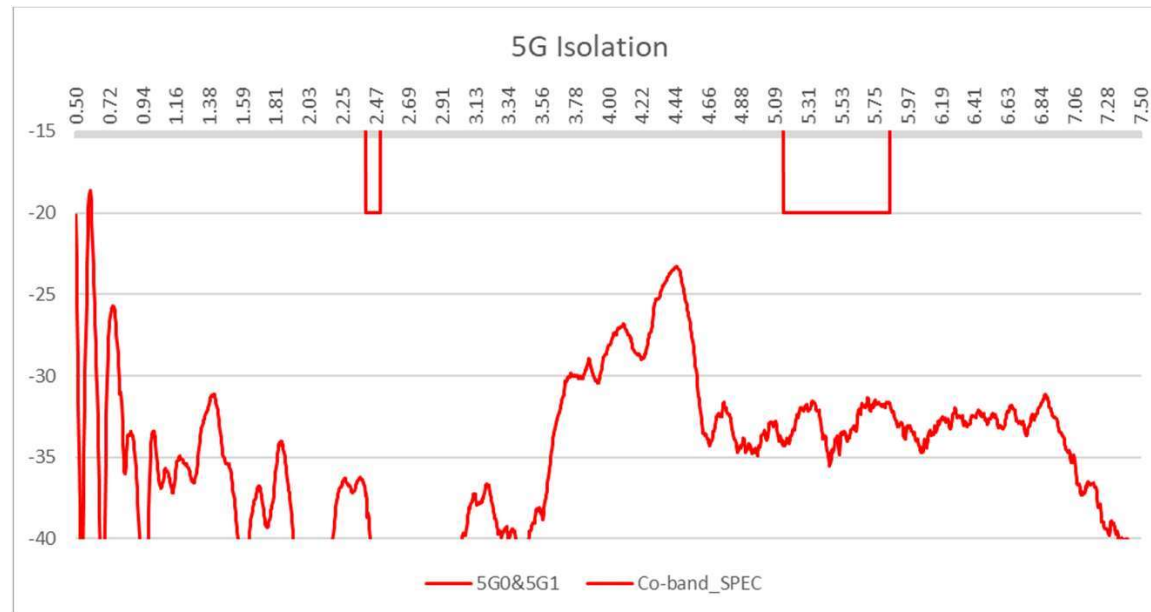
S parameters_S11



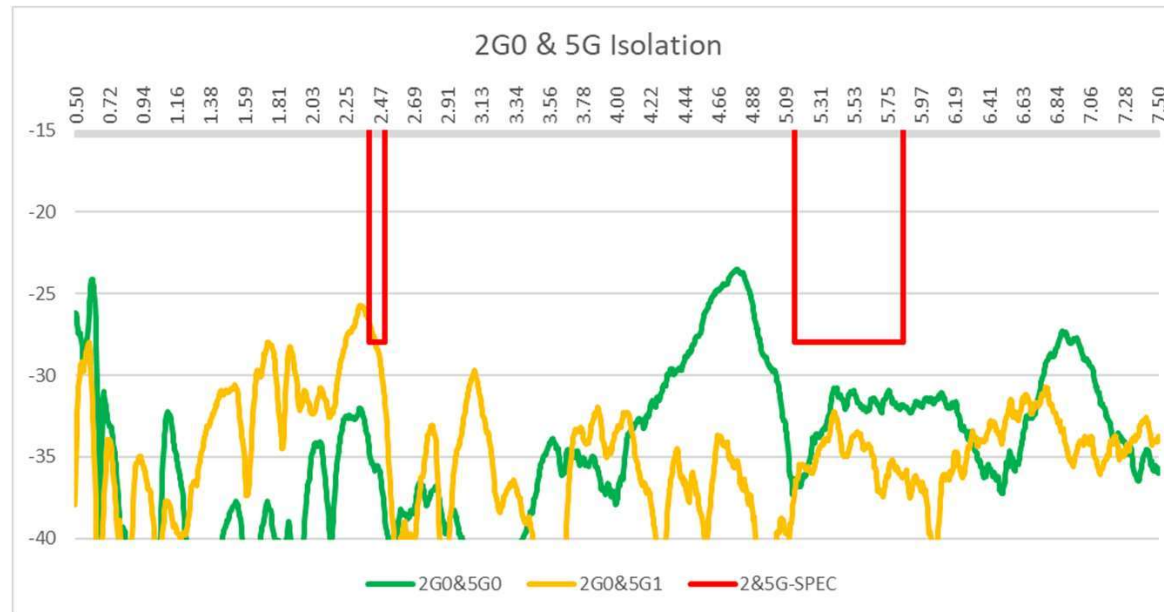
S Parameters – Isolation



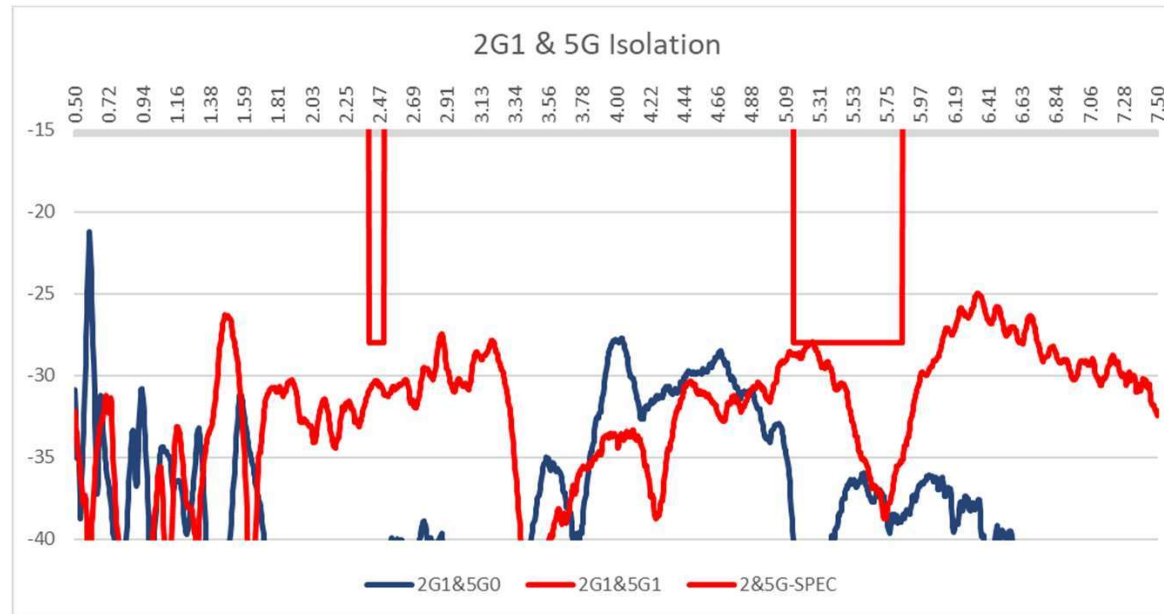
S Parameters – Isolation



S Parameters – Isolation



S Parameters – Isolation



S Parameters Summary(*Optional*)

	S11(worst point)
Ant 2G_0	-11.4dB@2.5GHz
Ant 2G_1	-16.3dB@2.4GHz
Ant 5G_0	-17.2dB@5.35GHz
Ant 5G_1	-15.0dB@5.15GHz

Isolation(worst point)	Ant 2G_0	Ant 2G_1	Ant 5G_0	Ant 5G_1
Ant 2G_0	\	-23.0@2.4GHz	-34.8@2.42G -30.8@5.15G	-26.7@2.44G -32.3@5.68G
Ant 2G_1	\	\	-41.7@2.40G -35.9@5.37G	-30.3@2.43G -27.9@5.15G
Ant 5G_0	-34.8@2.42G -30.8@5.15G	-26.7@2.44G -32.3@5.68G	\	-31.3@5.24G
Ant 5G_1	-41.7@2.40G -35.9@5.37G	-30.3@2.43G -27.9@5.15G	-31.3@5.24G	\



Efficiency

	Efficiency (%)		Efficiency (dB)	
Frequency (GHz)	Ant 2G_0	Ant 2G_1	Ant 2G_0	Ant 2G_1
2.4	76%	77%	-1.2	-1.1
2.45	78%	78%	-1.1	-1.1
2.5	76%	78%	-1.2	-1.1
Average	77%	78%	-1.2	-1.1

	Efficiency (%)		Efficiency (dB)	
Frequency (GHz)	Ant 5G_0	Ant 5G_1	Ant 5G_0	Ant 5G_1
5.15	87%	83%	-0.6	-0.8
5.25	82%	83%	-0.9	-0.8
5.35	80%	77%	-1.0	-1.1
5.45	79%	77%	-1.0	-1.1
5.55	78%	76%	-1.1	-1.2
5.65	78%	76%	-1.1	-1.2
5.75	81%	80%	-0.9	-1.0
5.85	79%	78%	-1.0	-1.1
Average	81%	79%	-0.9	-1.0



Antenna Gain

	Individual Average Gain (dB)	
Frequency (GHz)	Ant 2G_0	Ant 2G_1
2.4	-1.9	-2.3
2.45	-1.7	-2.2
2.5	-1.8	-2.2
Average	-1.8	-2.2

	Individual Peak Gain (dB)	
Frequency (GHz)	Ant 2G_0	Ant 2G_1
2.4	3.1	3.4
2.45	3.4	3.1
2.5	3.1	3.3
Average	3.2	3.3

	Individual Average Gain (dB)	
Frequency (GHz)	Ant 5G_0	Ant 5G_1
5.15	-1.7	-1.9
5.25	-2.0	-2.0
5.35	-2.0	-2.3
5.45	-2.0	-2.3
5.55	-2.0	-2.3
5.65	-2.1	-2.2
5.75	-1.9	-2.0
5.85	-2.0	-2.1
Average	-2.0	-2.1

	Individual Peak Gain (dB)	
Frequency (GHz)	Ant 5G_0	Ant 5G_1
5.15	4.3	2.9
5.25	3.9	3.0
5.35	4.0	2.7
5.45	3.6	3.0
5.55	3.3	2.9
5.65	3.3	2.6
5.75	3.3	2.7
5.85	3.6	3.4
Average	3.7	2.9



Peak Composite Gain of Transmit Antennas in 2G Band

Frequency MHz	Correlated(dBi)	Uncorrelated(d Bi)
2400	5.5	2.5
2410	5.5	2.6
2420	5.4	2.4
2430	5.3	2.3
2440	5.3	2.3
2450	5.3	2.3
2460	5.2	2.3
2470	5.2	2.2
2480	5.1	2.2
2490	5.0	2.0



Peak Composite Gain of Transmit Antennas in 5G Band

Frequency MHz	Correlated(dBi)	Uncorrelated(dBi)
5150	6.2	3.2
5170	6.3	3.3
5180	6.2	3.2
5200	6.2	3.2
5220	6.2	3.2
5240	6.3	3.4
5260	6.4	3.4
5280	6.4	3.4
5300	6.3	3.4
5320	6.5	3.5
5340	6.2	3.2
5360	6.2	3.2
5380	6.1	3.2
5400	5.9	3.0

Frequency MHz	Correlated(dBi)	Uncorrelated(dBi)
5420	5.8	2.9
5440	5.8	2.9
5460	5.9	2.9
5480	5.9	2.9
5500	5.8	2.8
5520	5.7	2.7
5540	5.7	2.7
5560	5.9	2.9
5580	5.6	2.6
5600	5.5	2.5
5620	5.5	2.5
5640	5.5	2.5
5660	5.4	2.4
5680	5.5	2.5



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Peak Composite Gain of Transmit Antennas in 5G Band

Frequency MHz	Correlated(dBi)	Uncorrelated(dBi)
5700	5.4	2.4
5720	5.7	2.7
5740	5.7	2.6
5760	5.5	2.5
5780	5.6	2.6
5800	5.6	2.6
5820	5.6	2.6
5840	5.5	2.5
5850	5.5	2.5

1、 Correlated Directional Gain(Beamformin Gains)

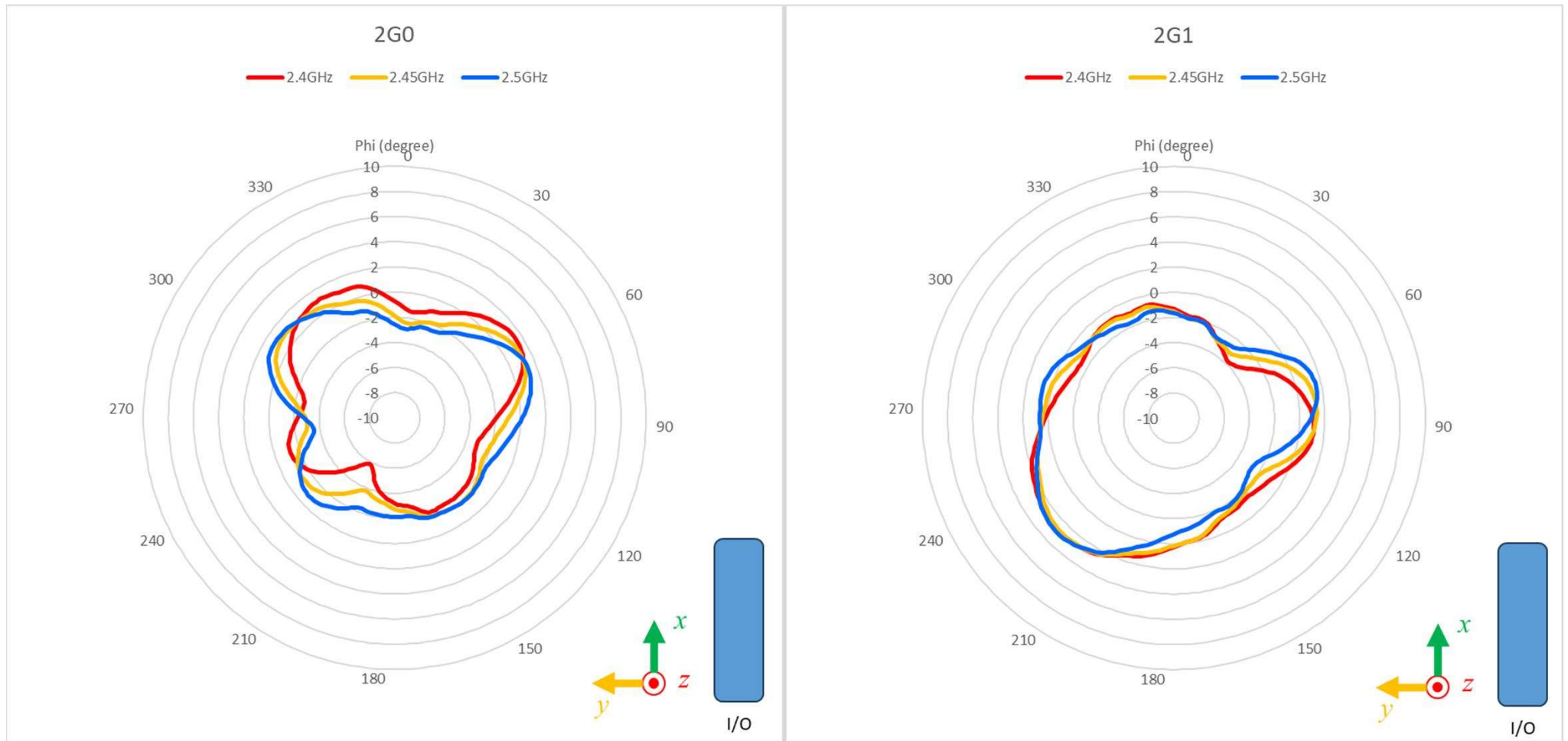
Correlated Gain = $10\log_{10} [(10^{(G_1/20)} + 10^{(G_2/20)} + \dots + 10^{(G_n/20)})^2 / N_Ant.]$ (dBi)

2、 Uncorrelated Directional

Uncorrelated Gain = $10\log_{10} [(10^{(G_1/10)} + 10^{(G_2/10)} + \dots + 10^{(G_n/10)}) / N_Ant.]$ (dBi)



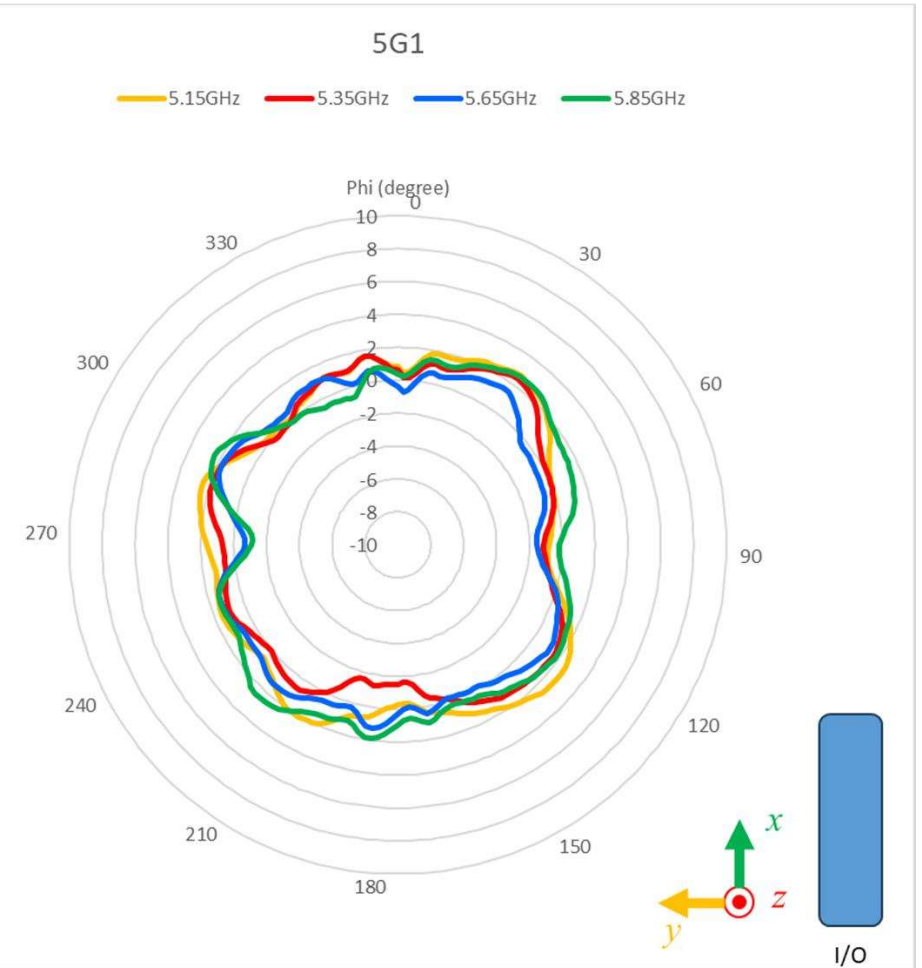
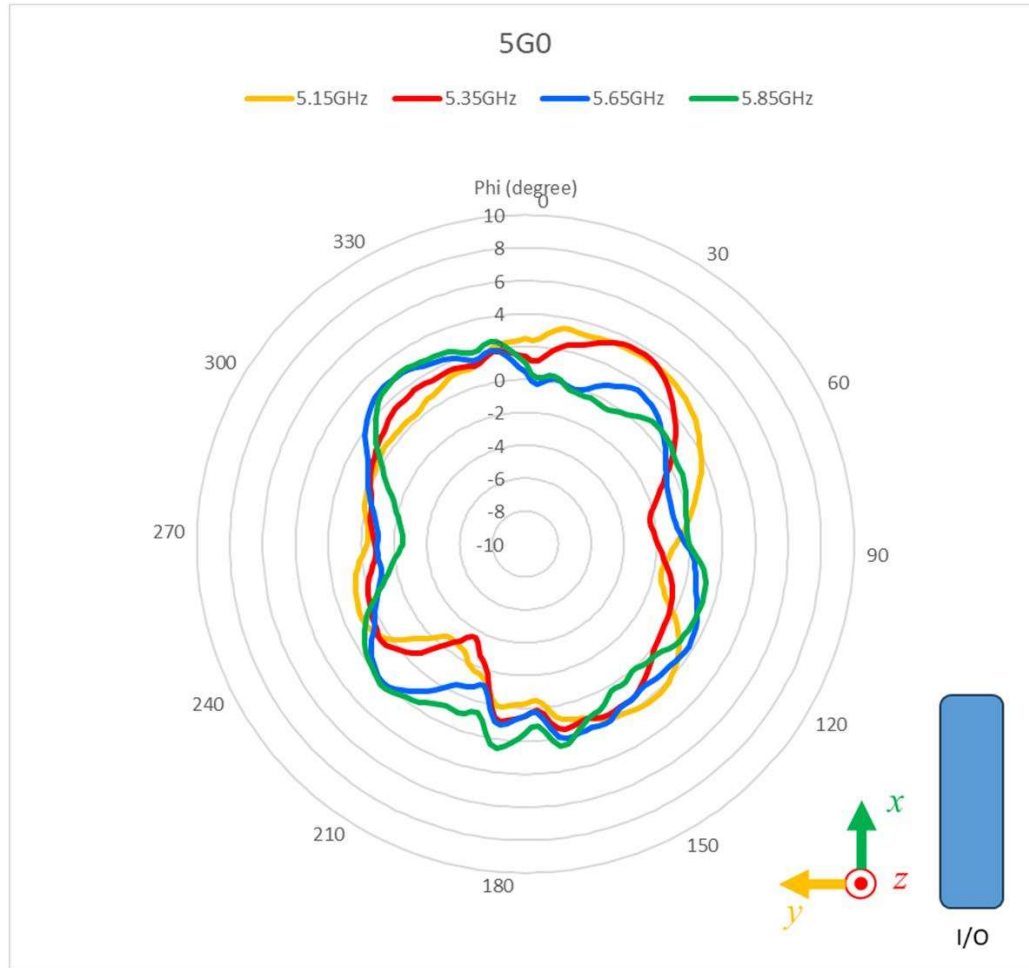
Individual 2D Theta70 XY – plane



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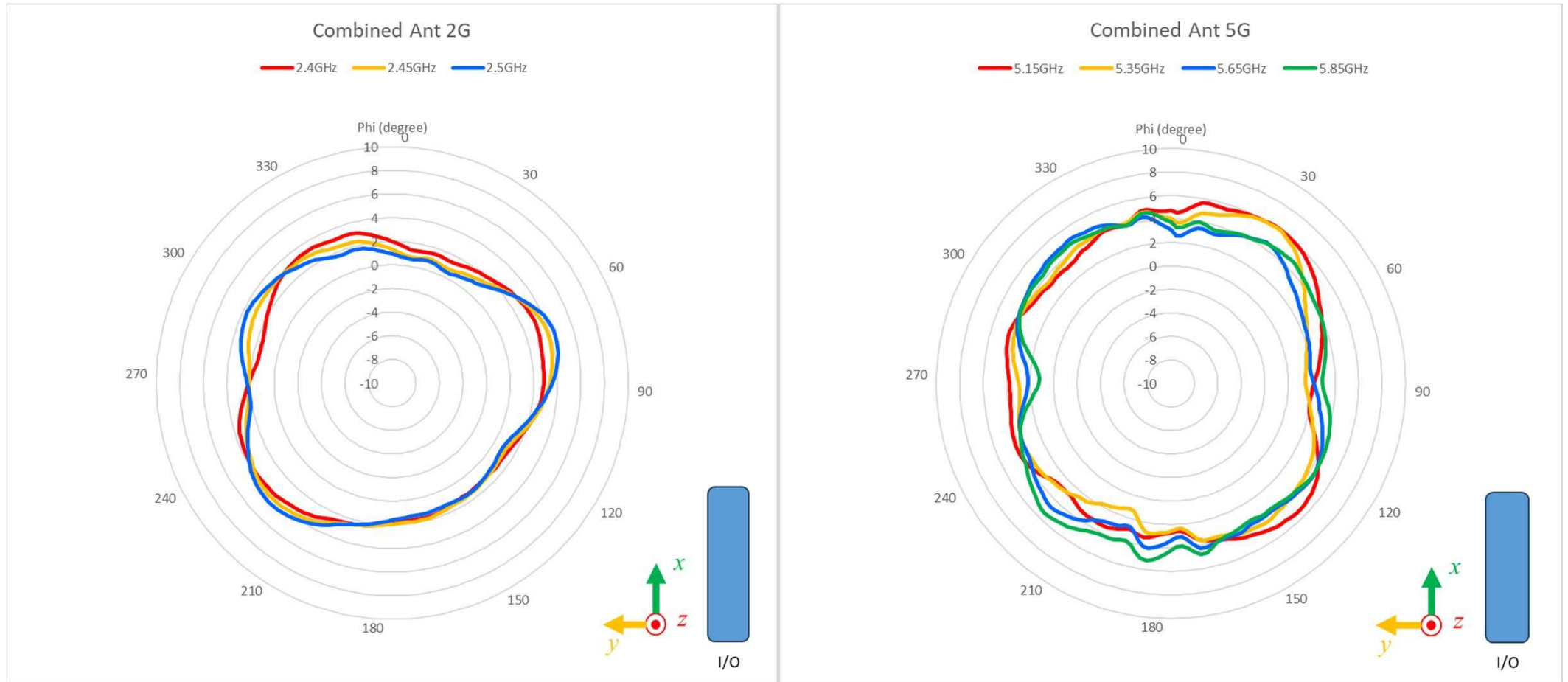
Individual 2D Theta70 XY – plane



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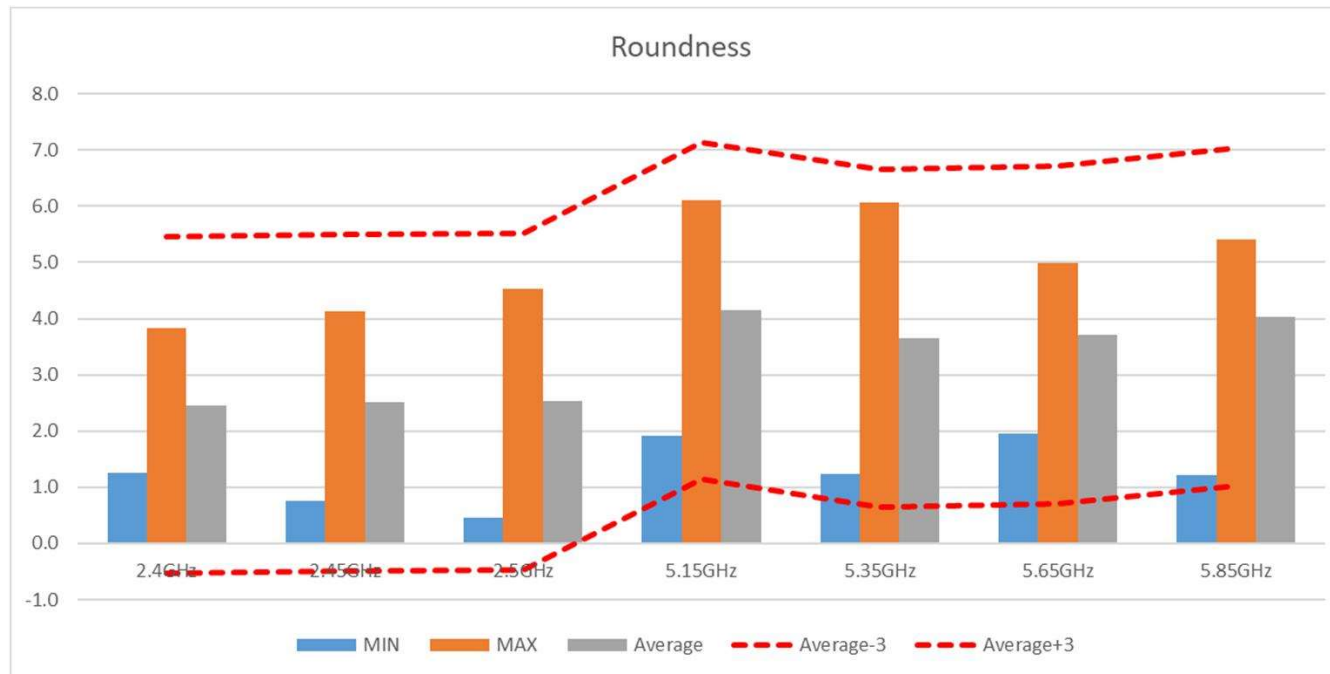
Combined 2D Theta70 XY – plane



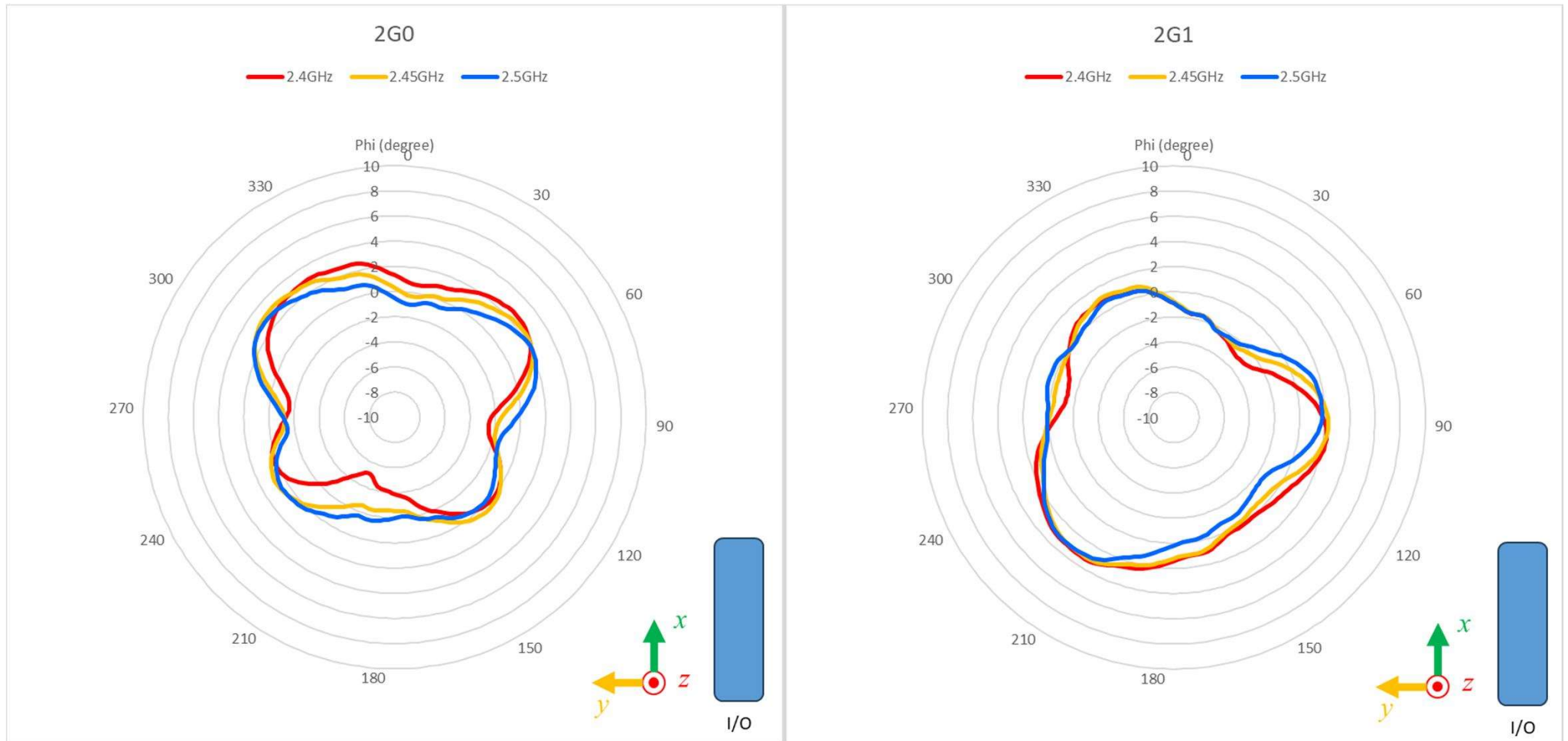
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Combined 2D Theta70 XY – plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	1.3	0.8	0.5	1.9	1.2	2.0	1.2
MAX	3.8	4.1	4.5	6.1	6.1	5.0	5.4
Average	2.5	2.5	2.5	4.1	3.7	3.7	4.0
Average-3	-0.5	-0.5	-0.5	1.1	0.7	0.7	1.0
Average+3	5.5	5.5	5.5	7.1	6.7	6.7	7.0



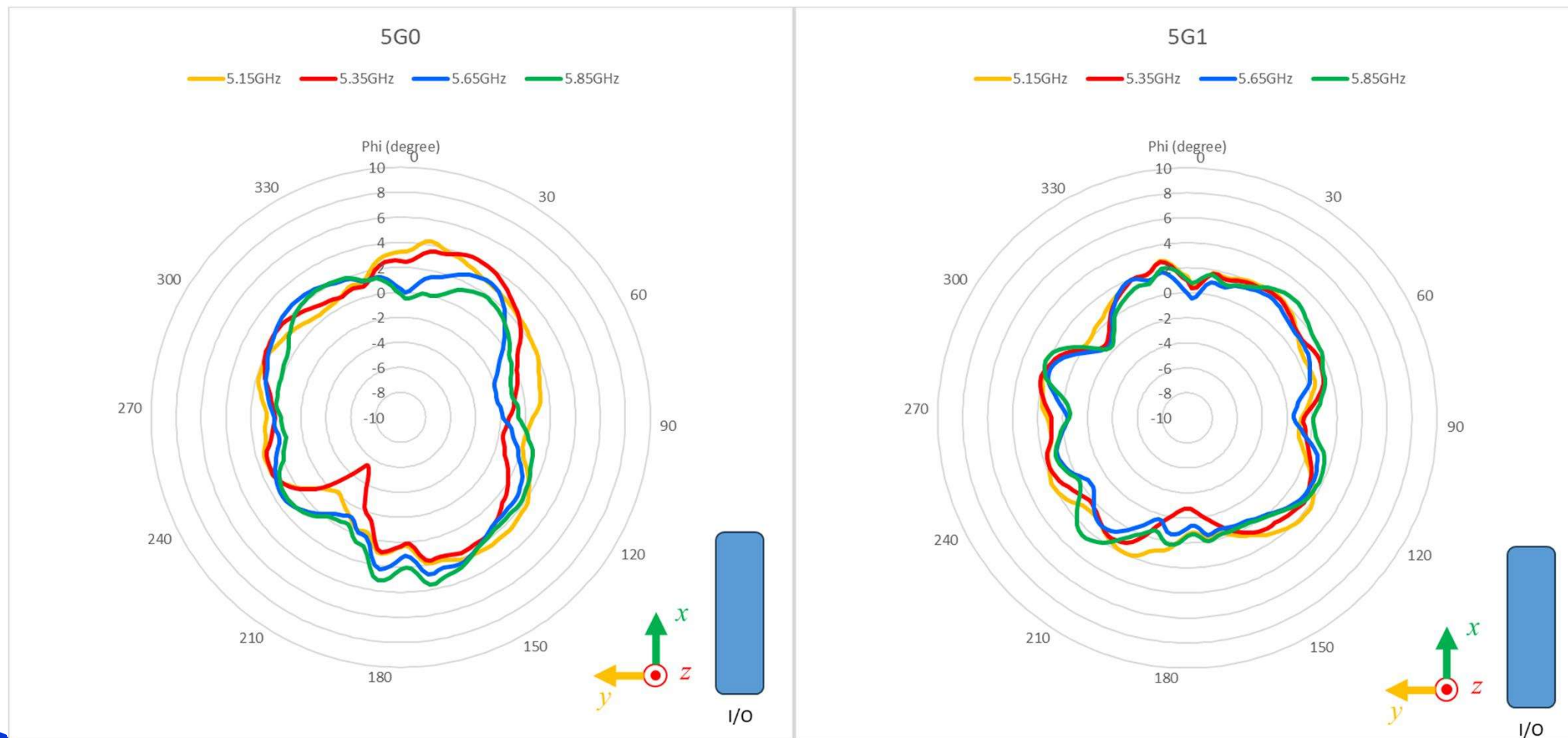
Individual 2D Theta80 XY – plane



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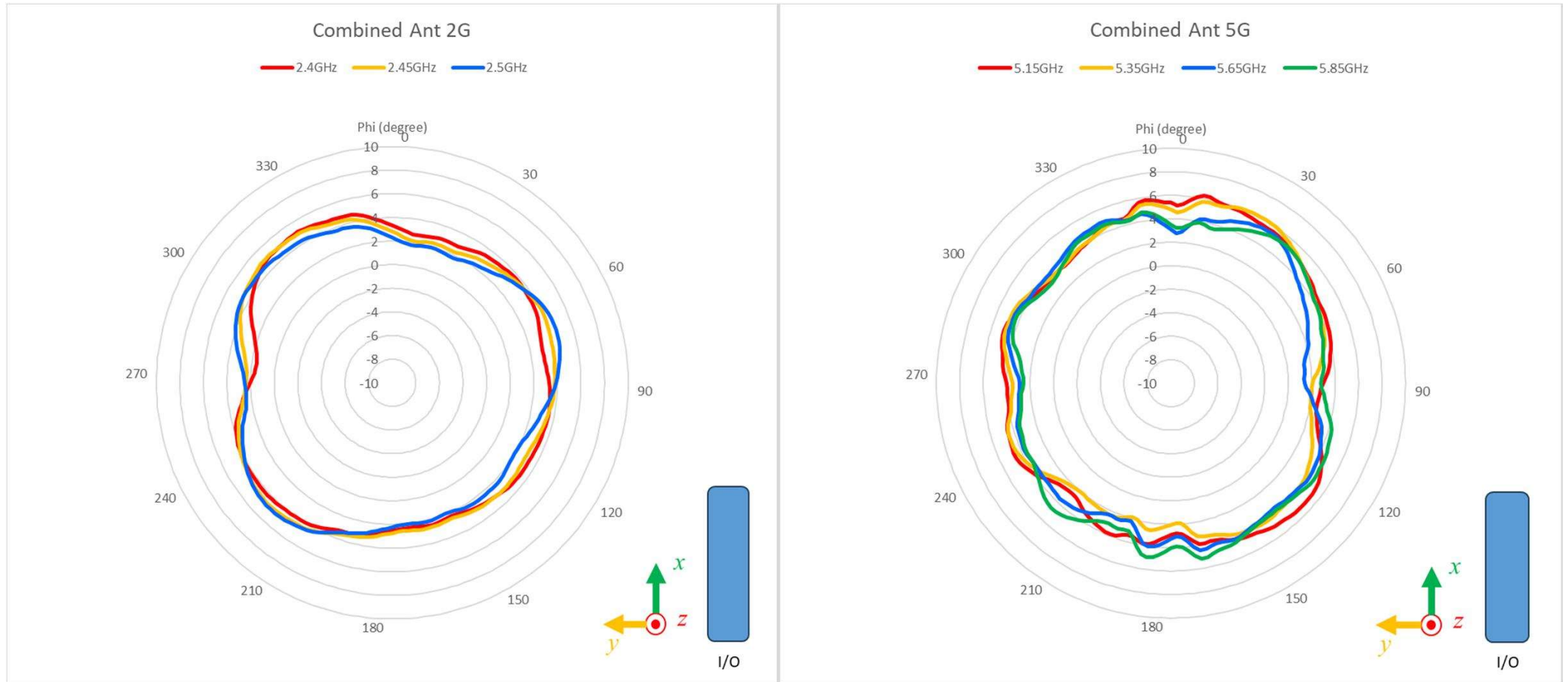
Individual 2D Theta80 XY – plane



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Combined 2D Theta80 XY – plane

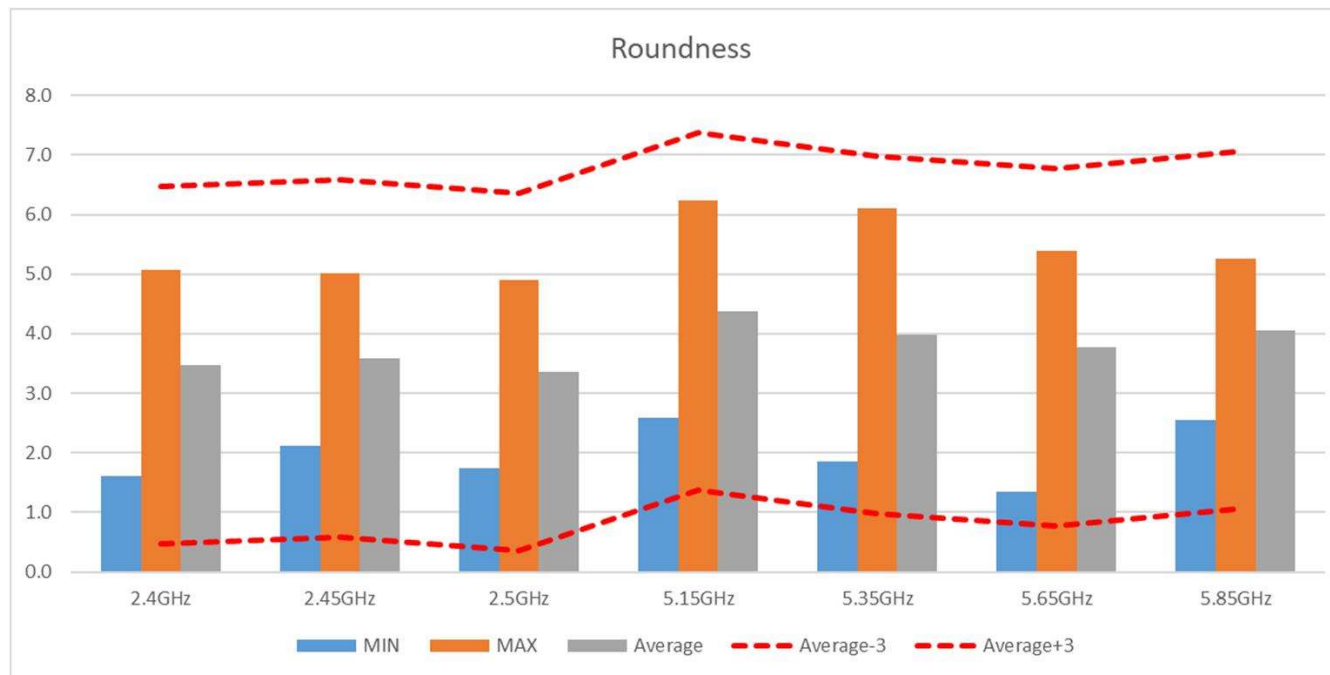


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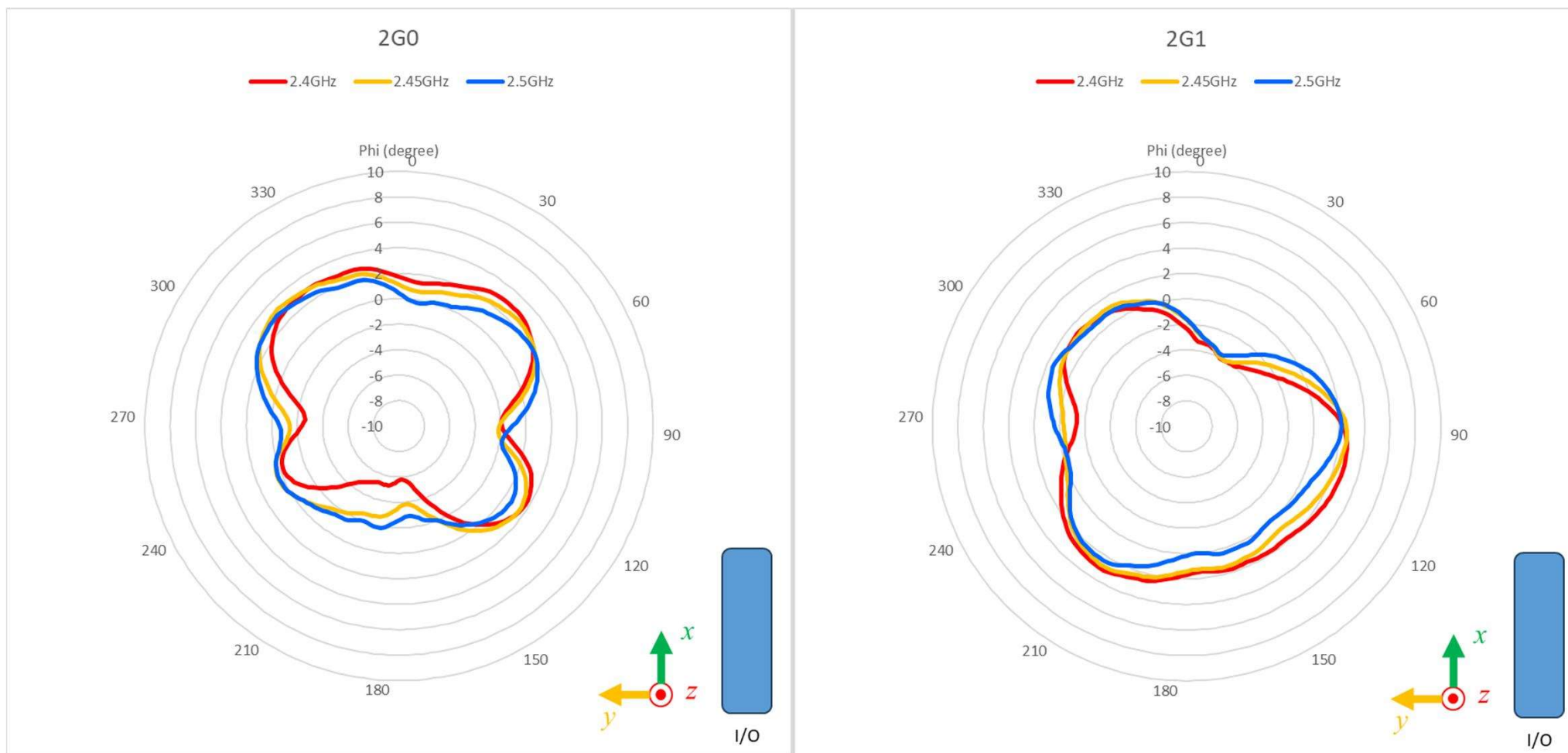
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Combined 2D Theta80 XY – plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	1.6	2.1	1.7	2.6	1.9	1.3	2.5
MAX	5.1	5.0	4.9	6.2	6.1	5.4	5.3
Average	3.5	3.6	3.4	4.4	4.0	3.8	4.0
Average-3	0.5	0.6	0.4	1.4	1.0	0.8	1.0
Average+3	6.5	6.6	6.4	7.4	7.0	6.8	7.0



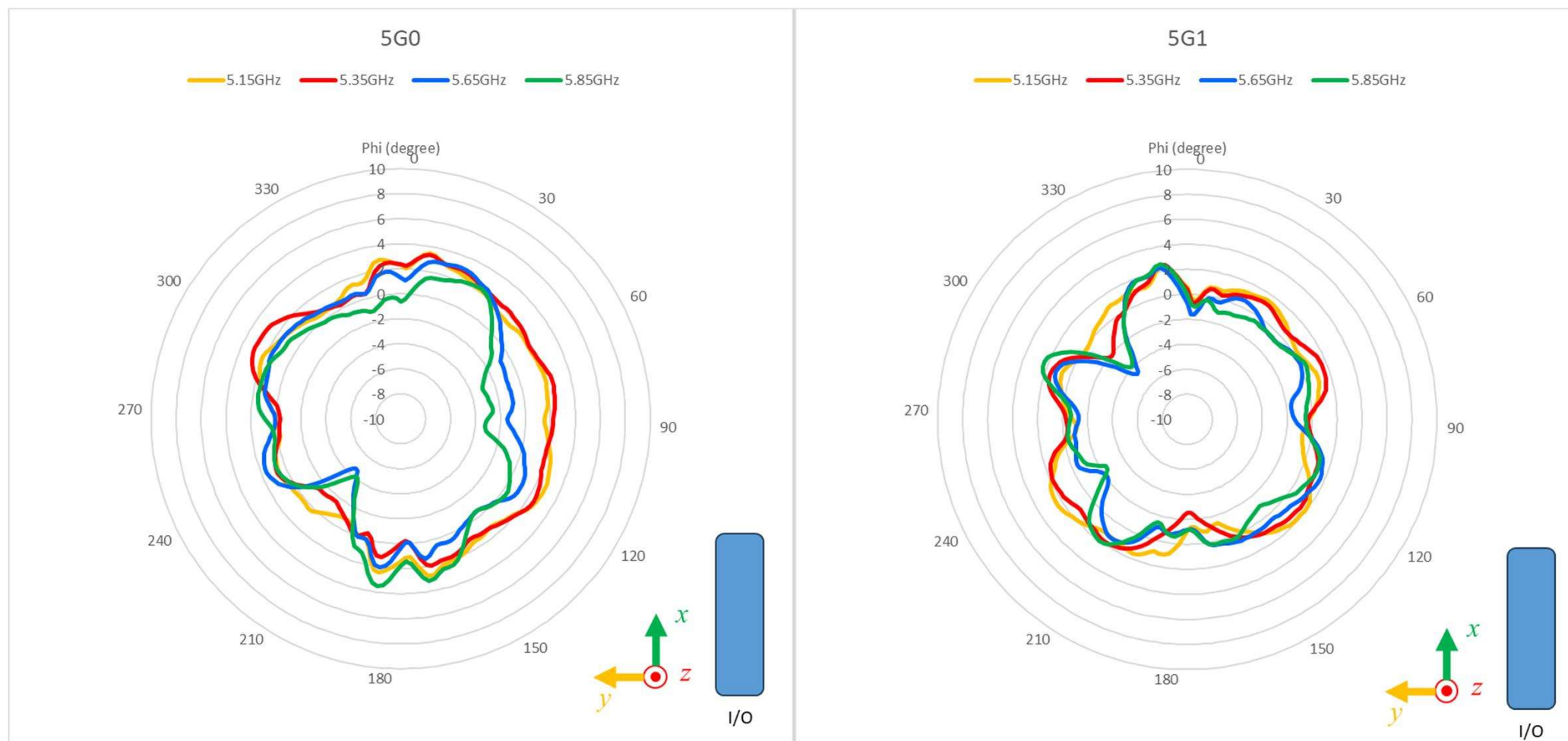
Individual 2D Theta90 XY – plane



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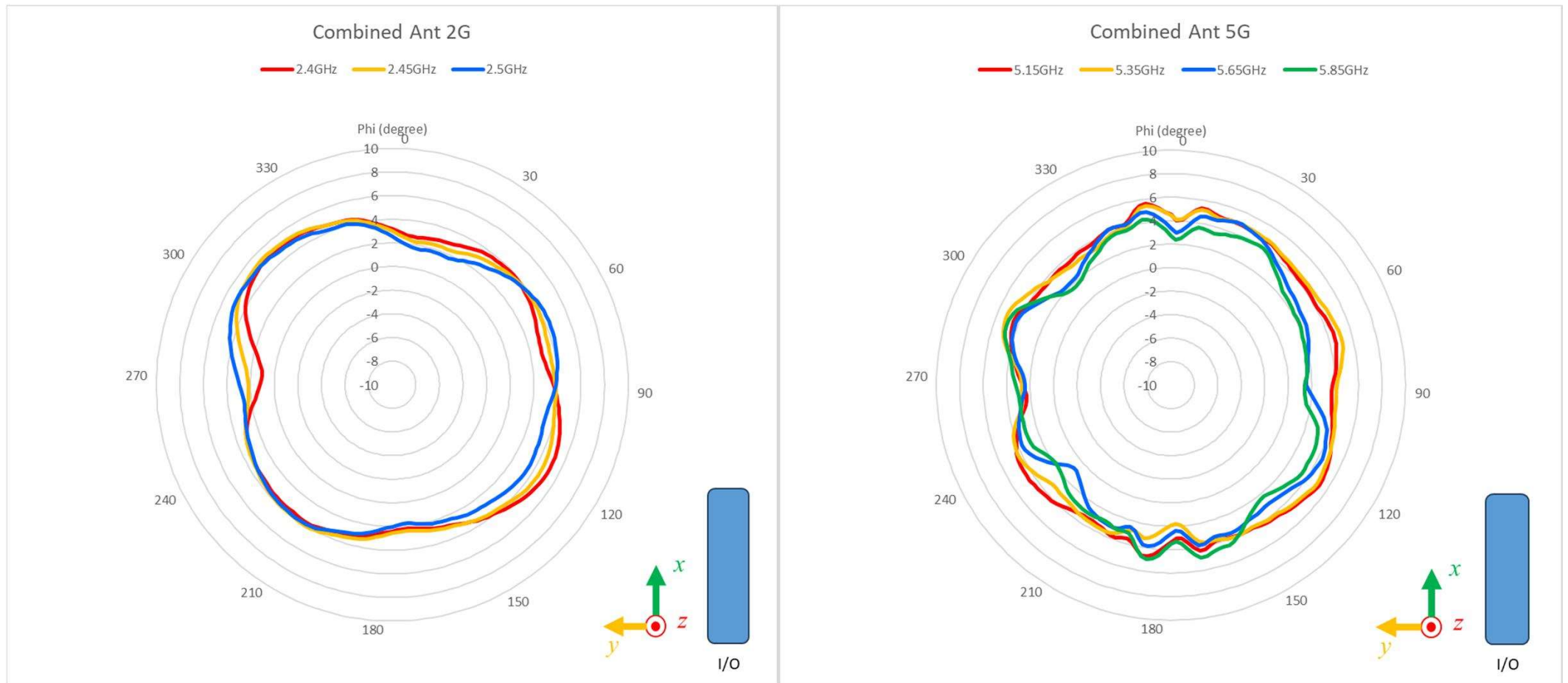
Individual 2D Theta90 XY – plane



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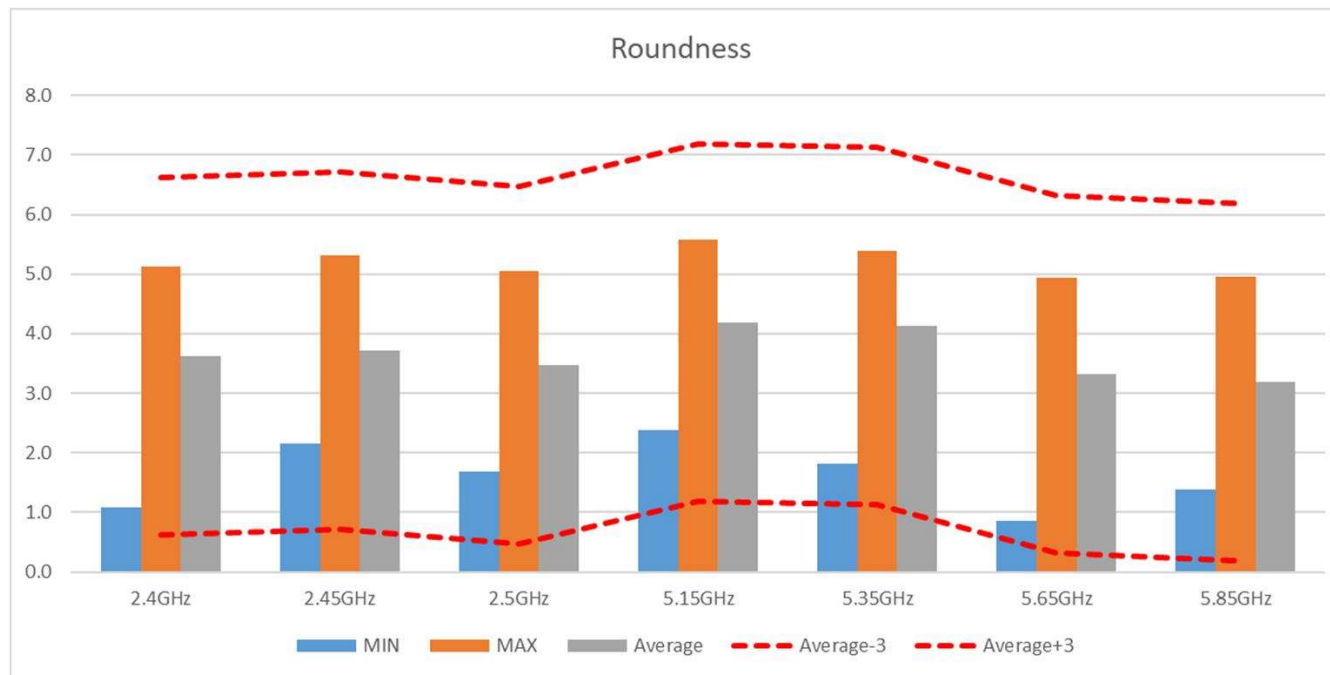
Combined 2D Theta90 XY – plane



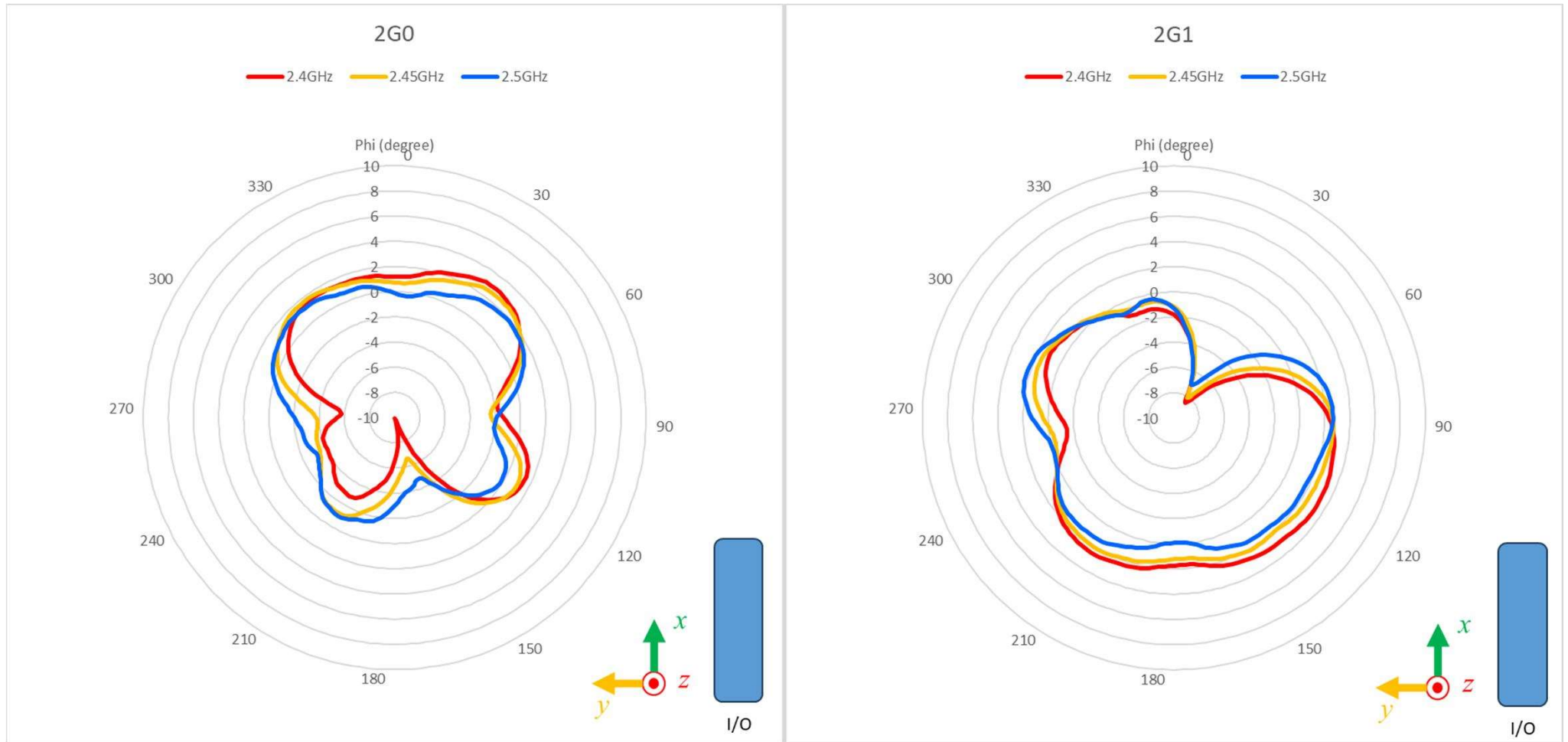
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Combined 2D Theta90 XY – plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	1.1	2.2	1.7	2.4	1.8	0.9	1.4
MAX	5.1	5.3	5.1	5.6	5.4	4.9	5.0
Average	3.6	3.7	3.5	4.2	4.1	3.3	3.2
Average-3	0.6	0.7	0.5	1.2	1.1	0.3	0.2
Average+3	6.6	6.7	6.5	7.2	7.1	6.3	6.2



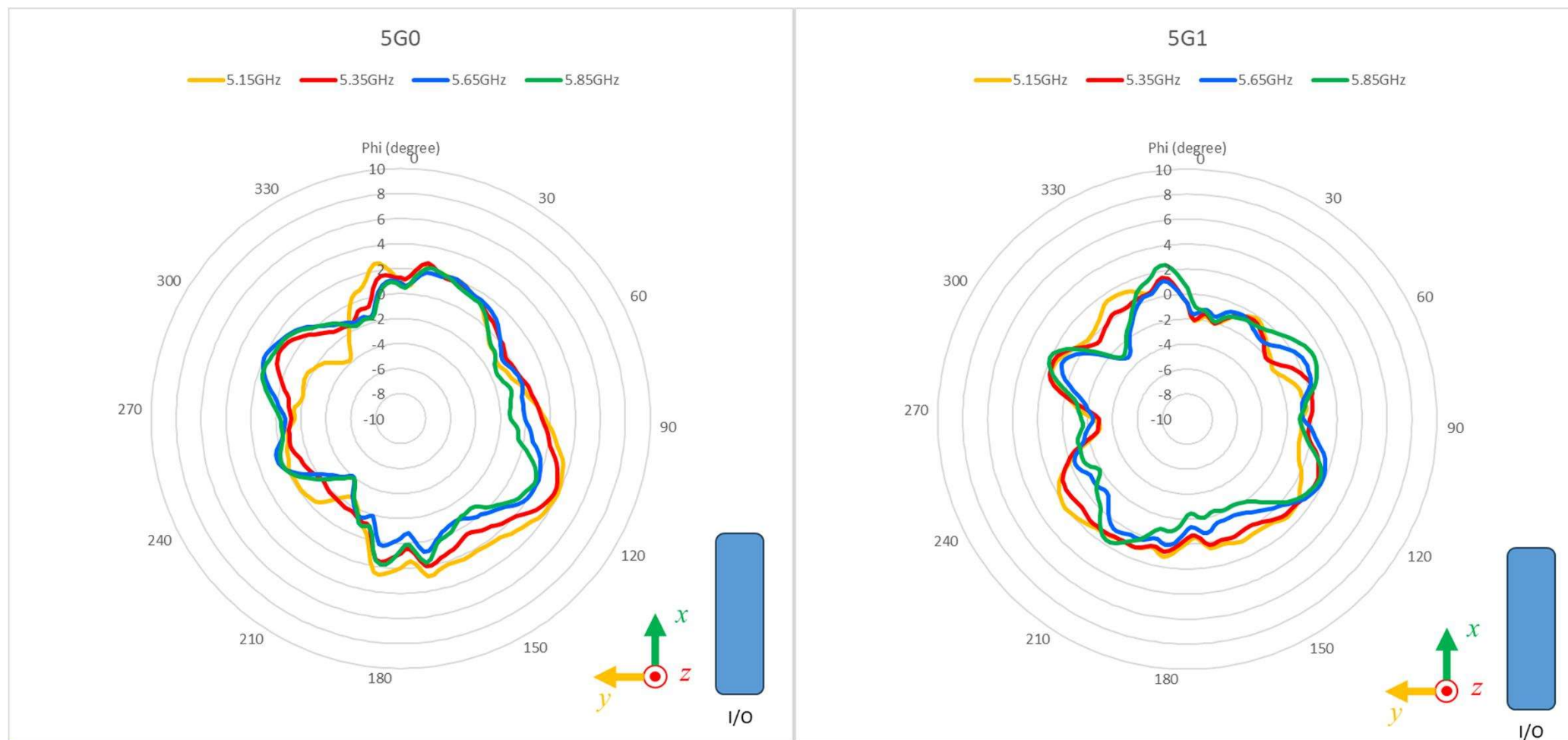
Individual 2D Theta100 XY – plane



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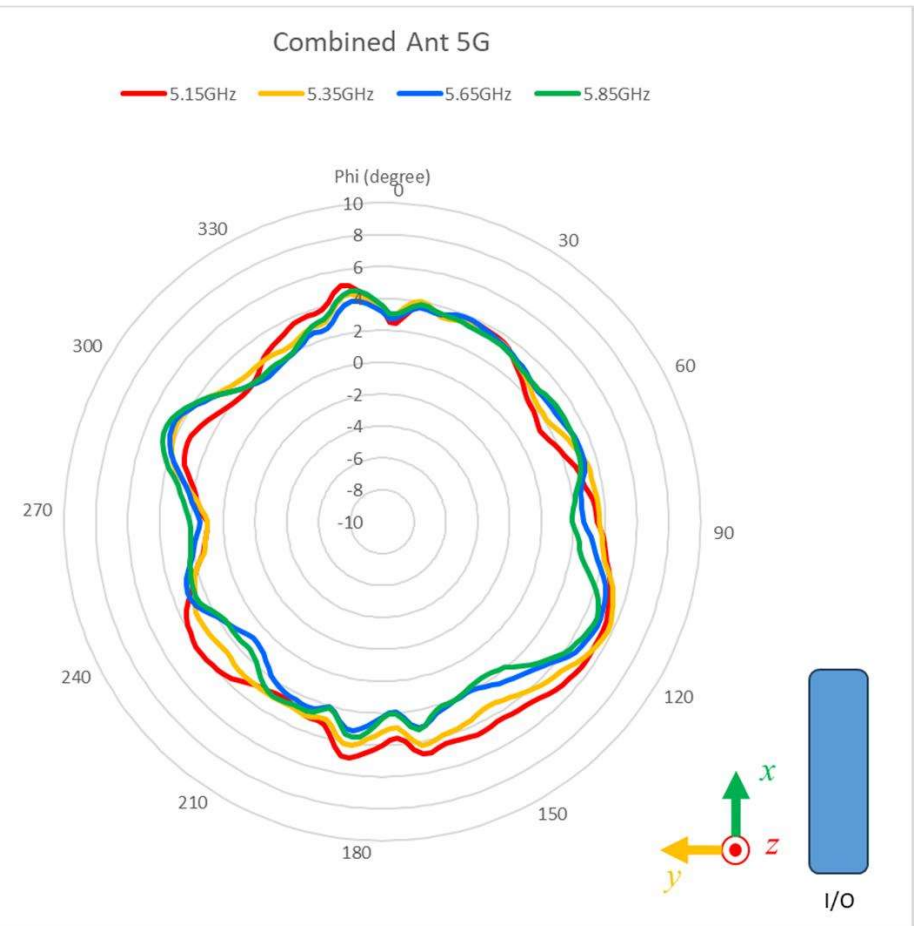
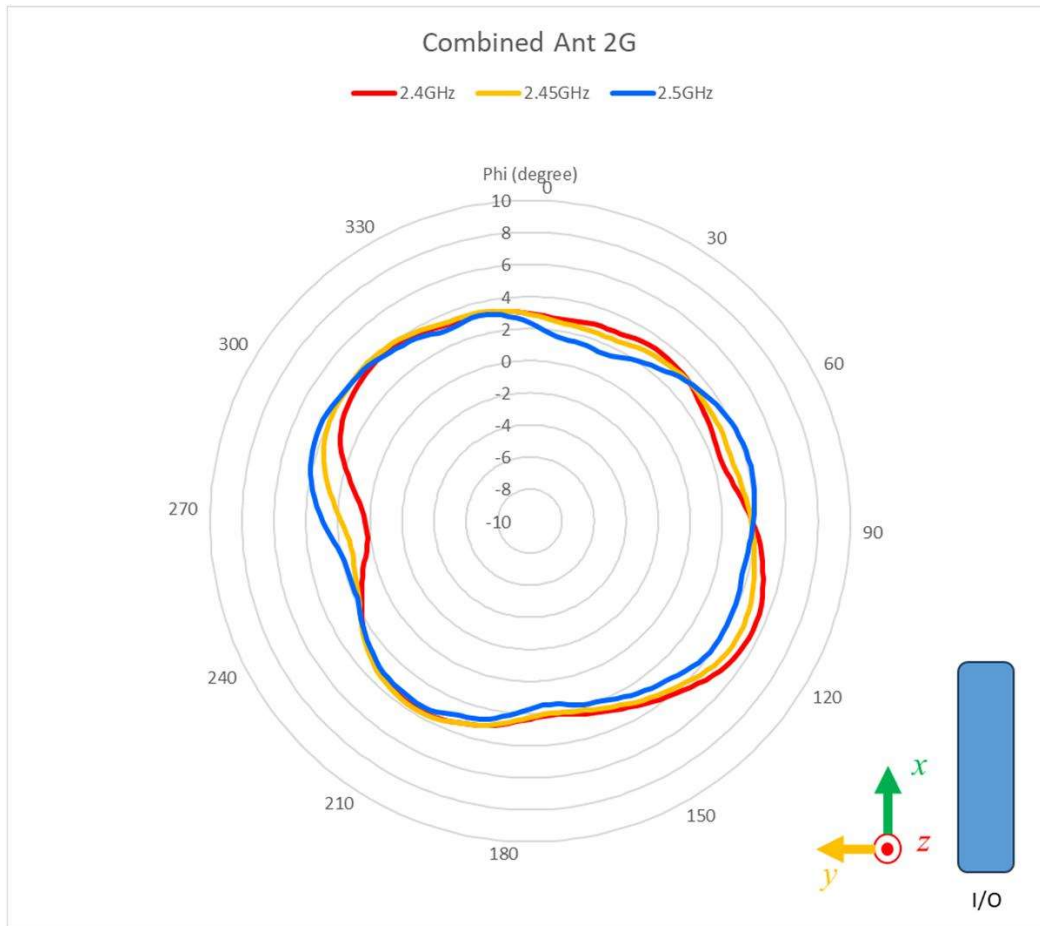
Individual 2D Theta100 XY – plane



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Combined 2D Theta100 XY – plane



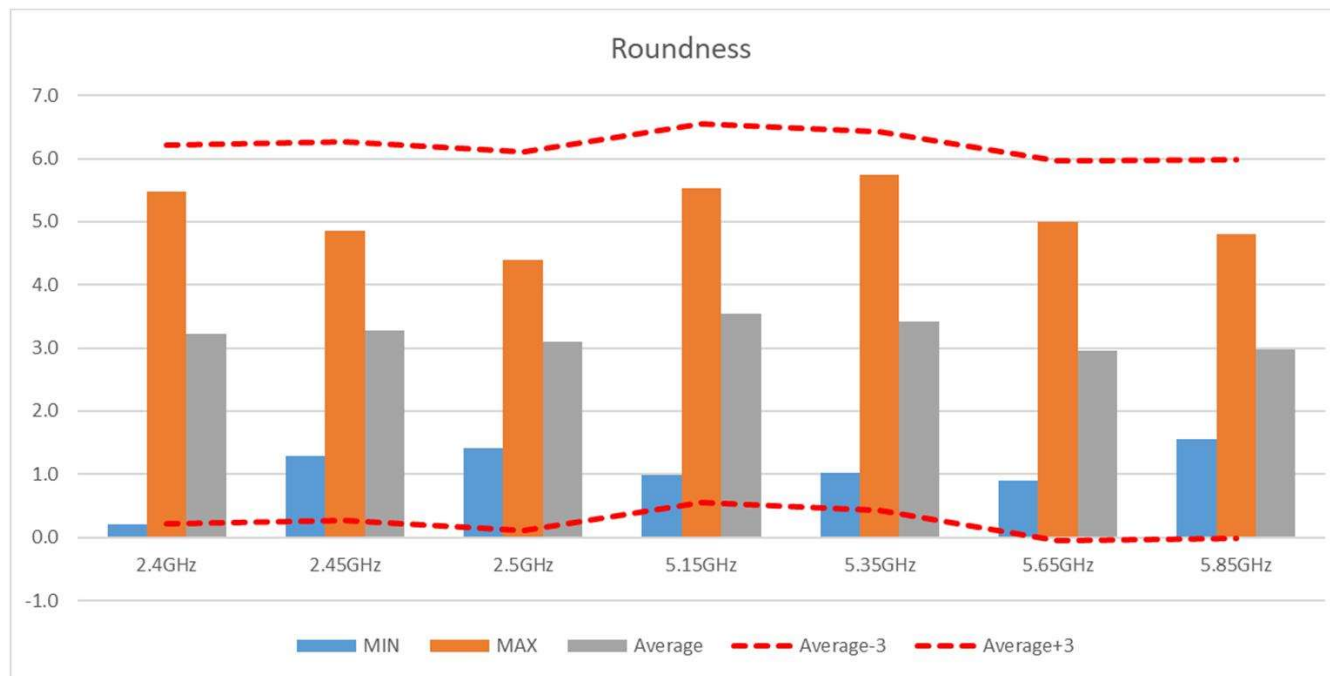
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Combined 2D Theta100 XY – plane

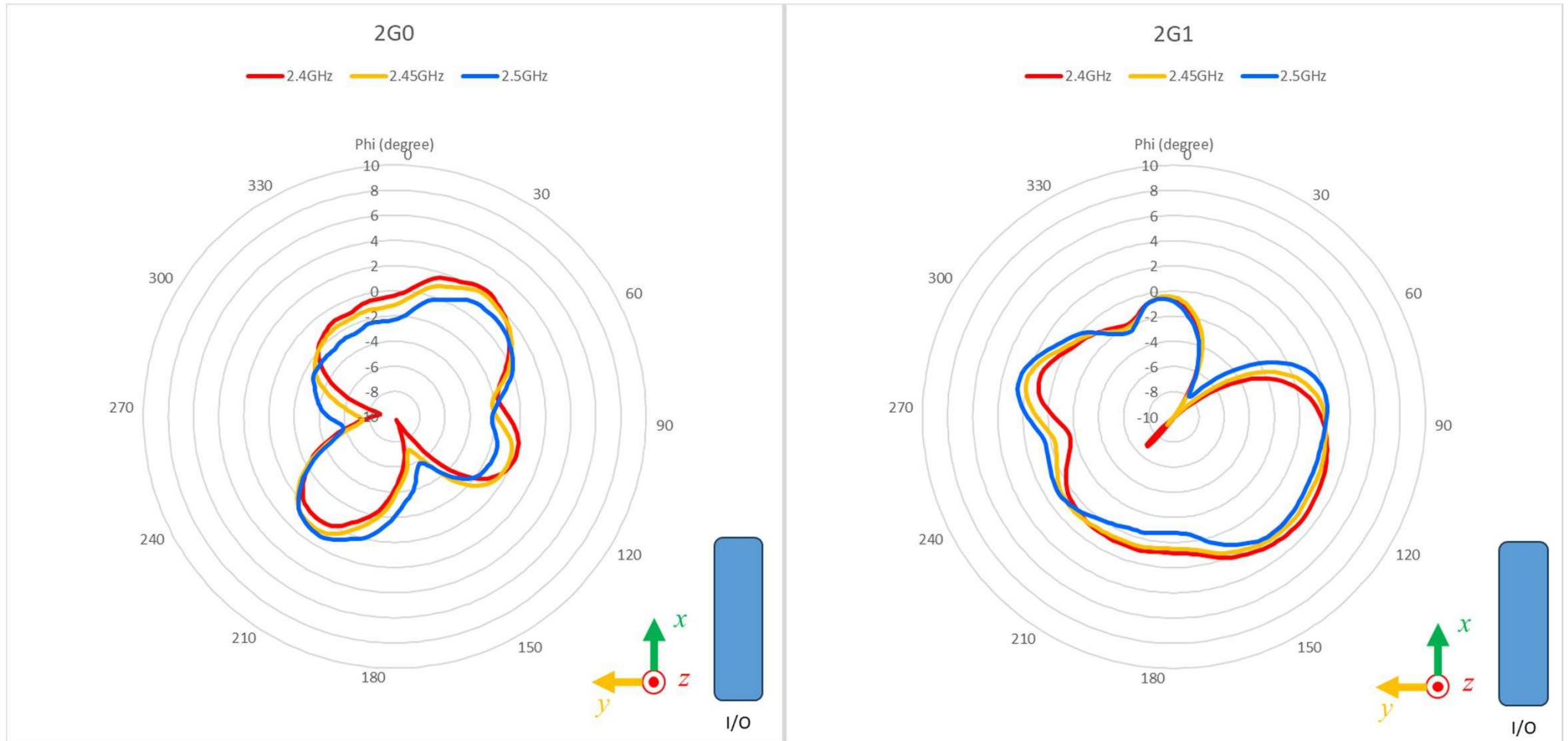
	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	0.2	1.3	1.4	1.0	1.0	0.9	1.5
MAX	5.5	4.9	4.4	5.5	5.7	5.0	4.8
Average	3.2	3.3	3.1	3.6	3.4	3.0	3.0
Average-3	0.2	0.3	0.1	0.6	0.4	0.0	0.0
Average+3	6.2	6.3	6.1	6.6	6.4	6.0	6.0



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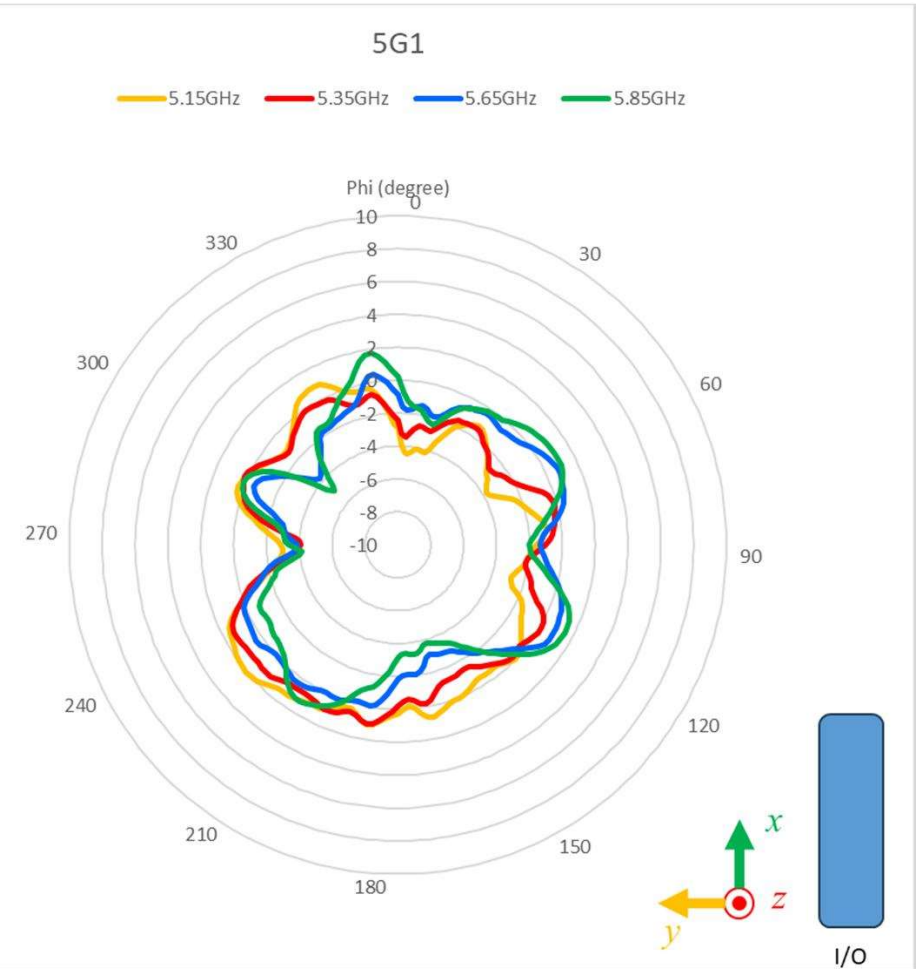
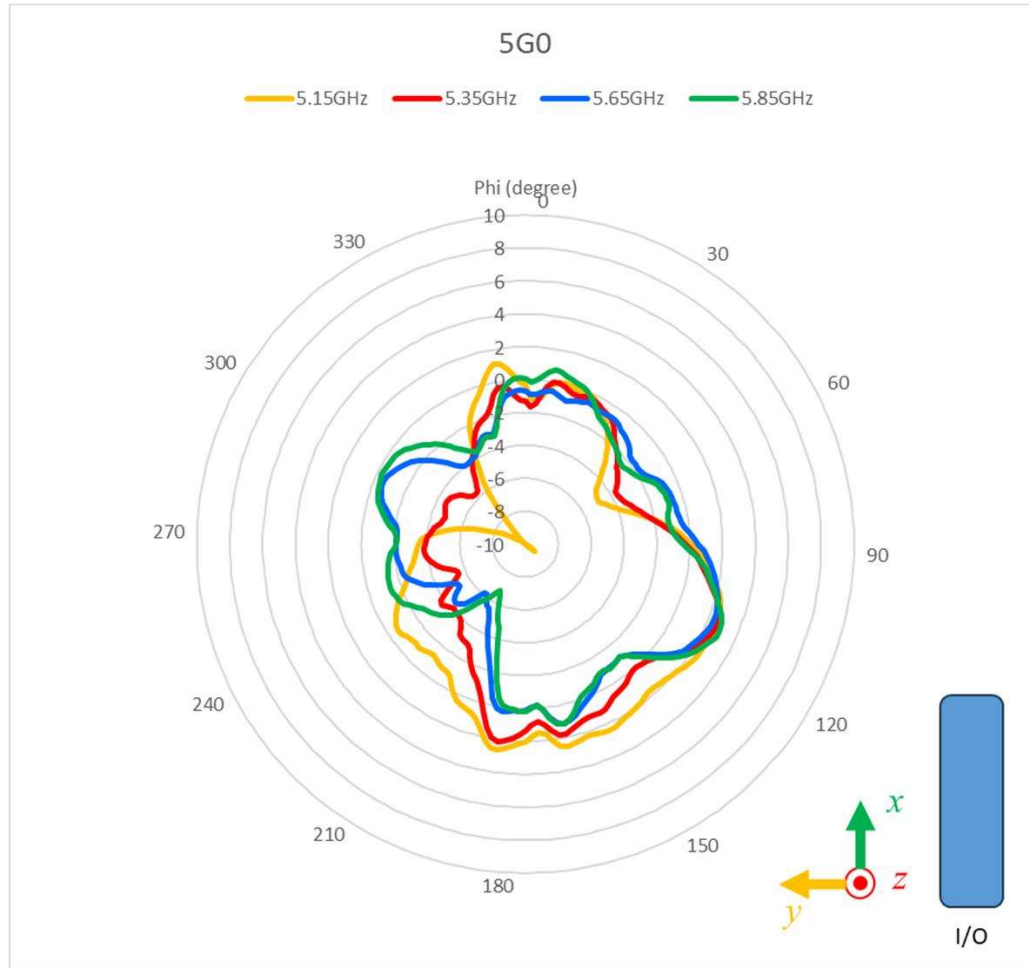
Individual 2D Theta110 XY – plane



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Individual 2D Theta110 XY – plane

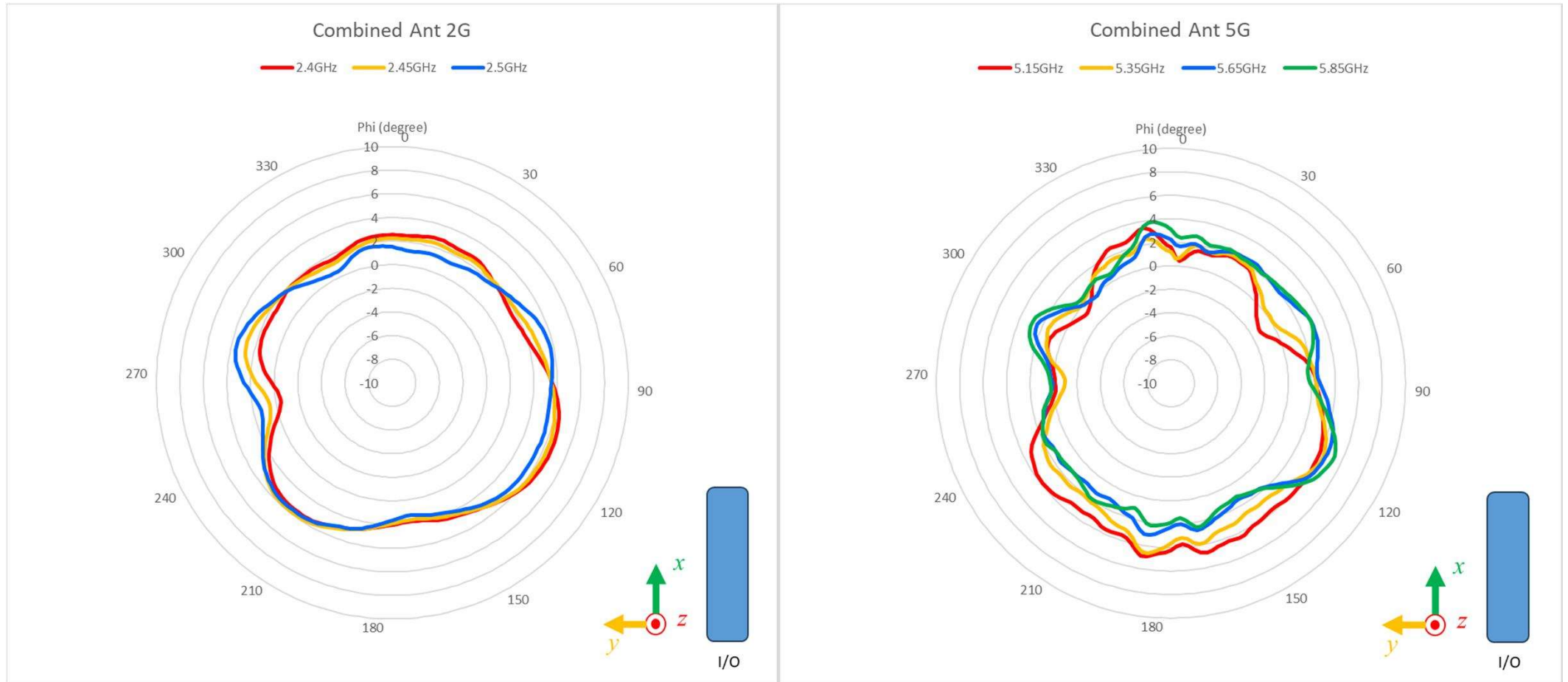


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Combined 2D Theta110 XY – plane



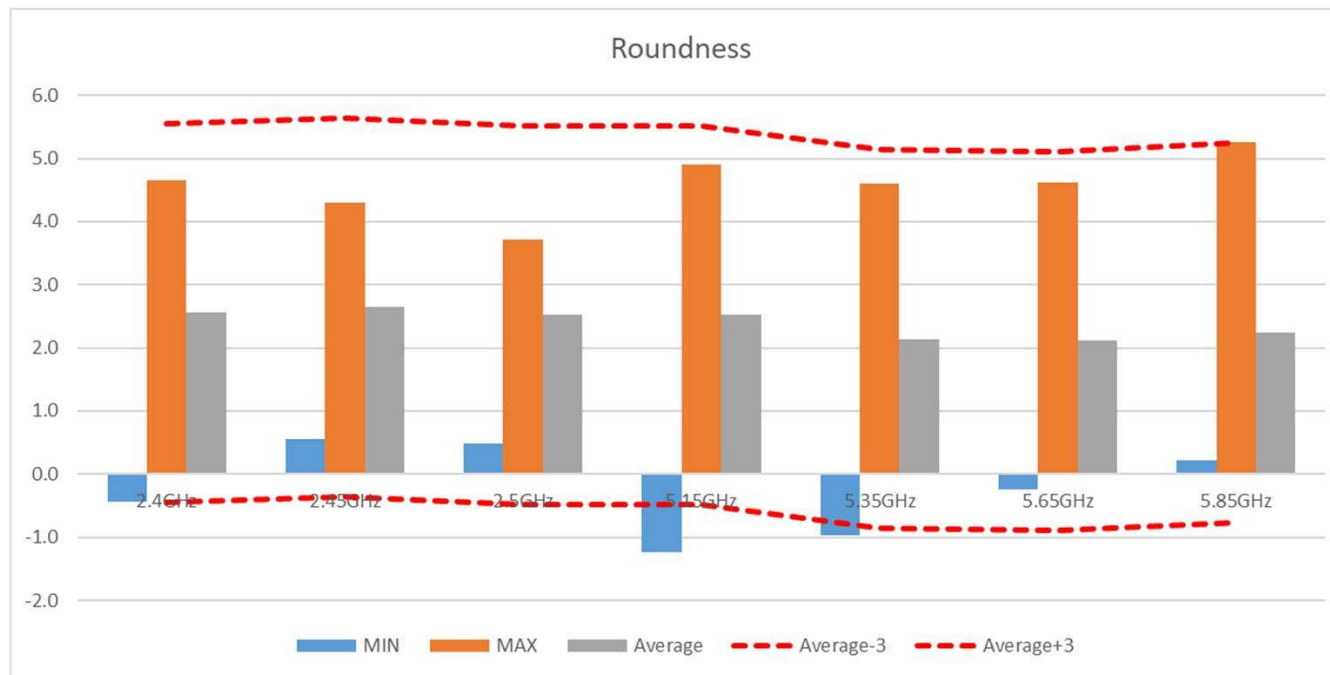
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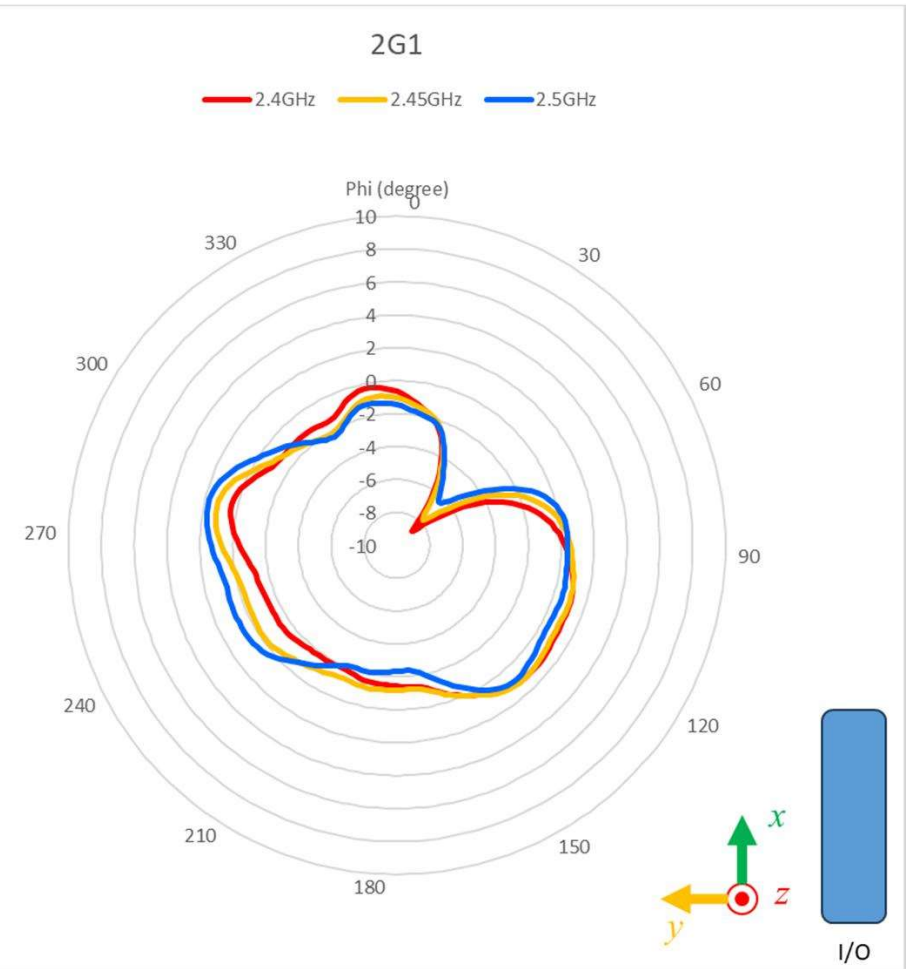
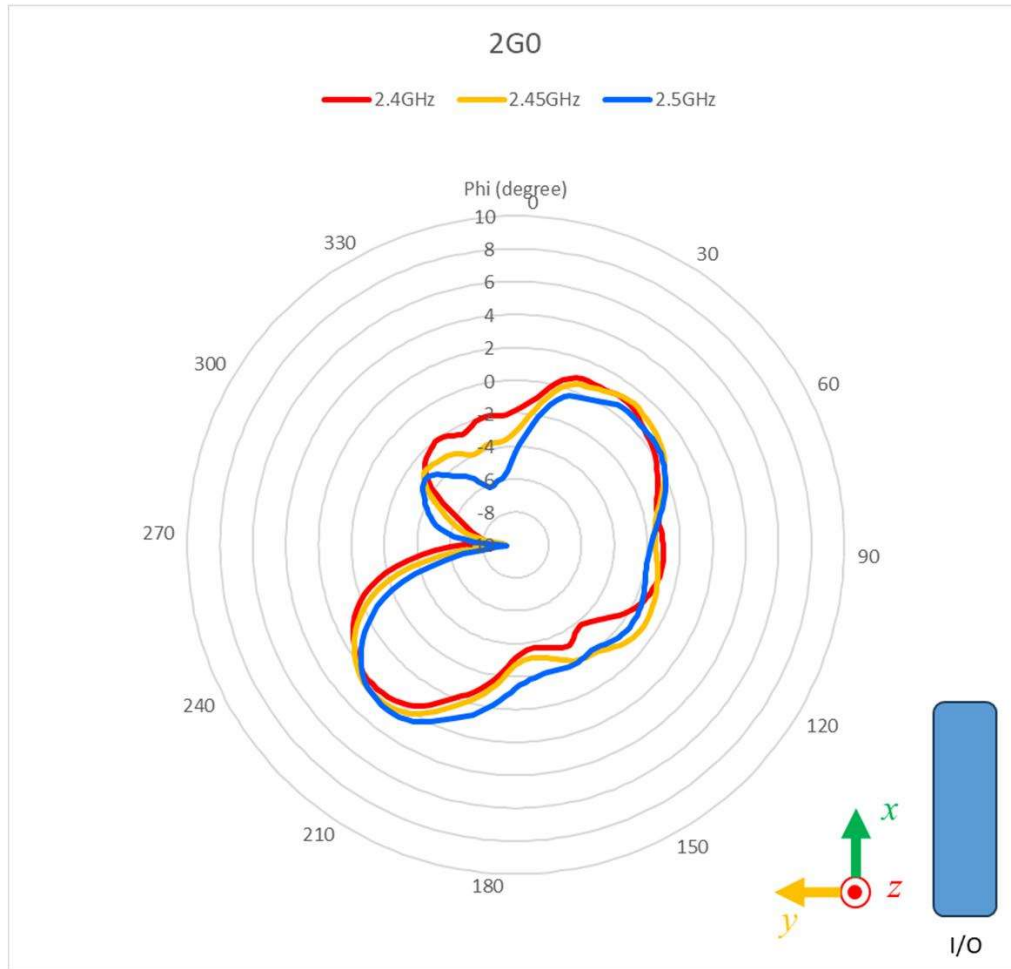
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Combined 2D Theta110 XY – plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	-0.4	0.5	0.5	-1.2	-1.0	-0.2	0.2
MAX	4.7	4.3	3.7	4.9	4.6	4.6	5.3
Average	2.6	2.6	2.5	2.5	2.1	2.1	2.2
Average-3	-0.4	-0.4	-0.5	-0.5	-0.9	-0.9	-0.8
Average+3	5.6	5.6	5.5	5.5	5.1	5.1	5.2



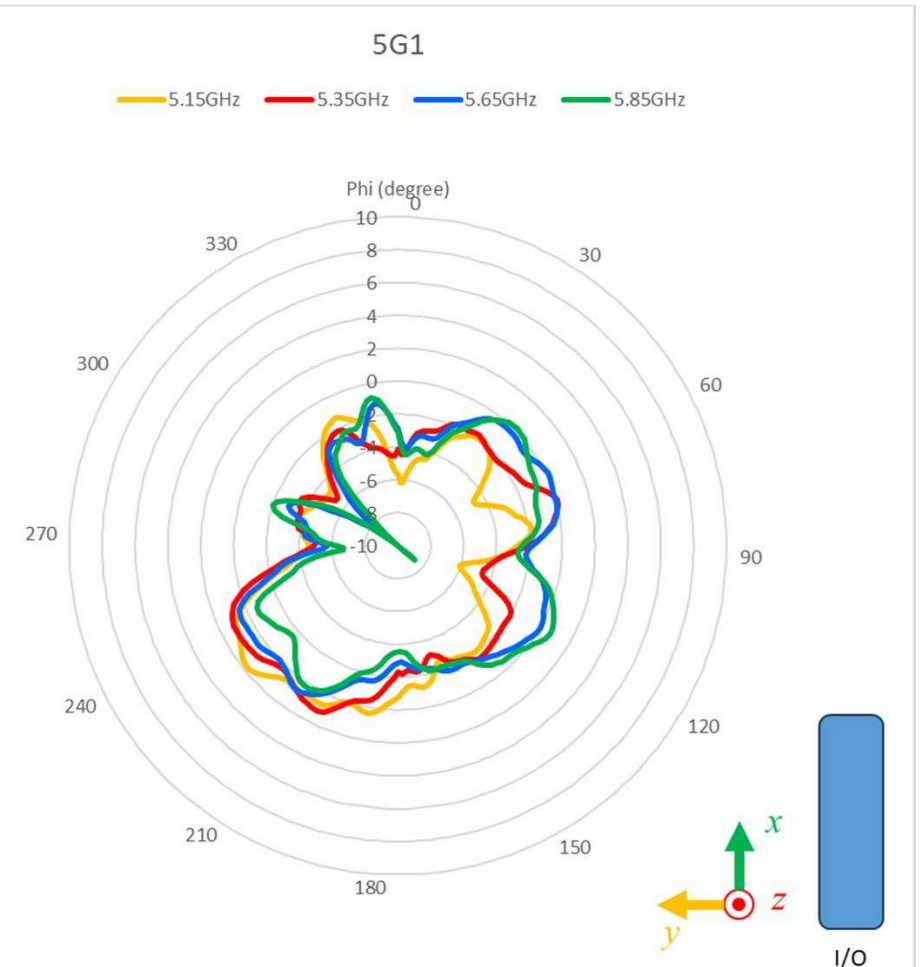
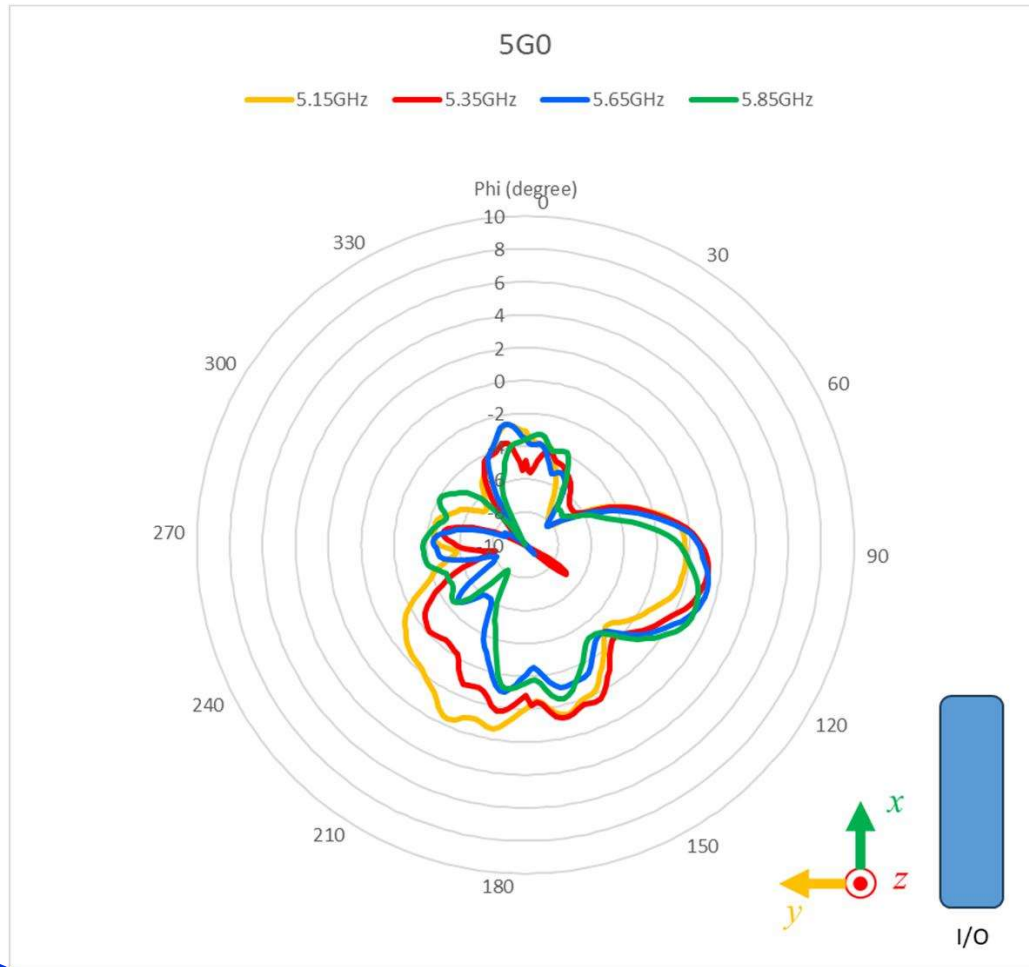
Individual 2D Theta120 XY – plane



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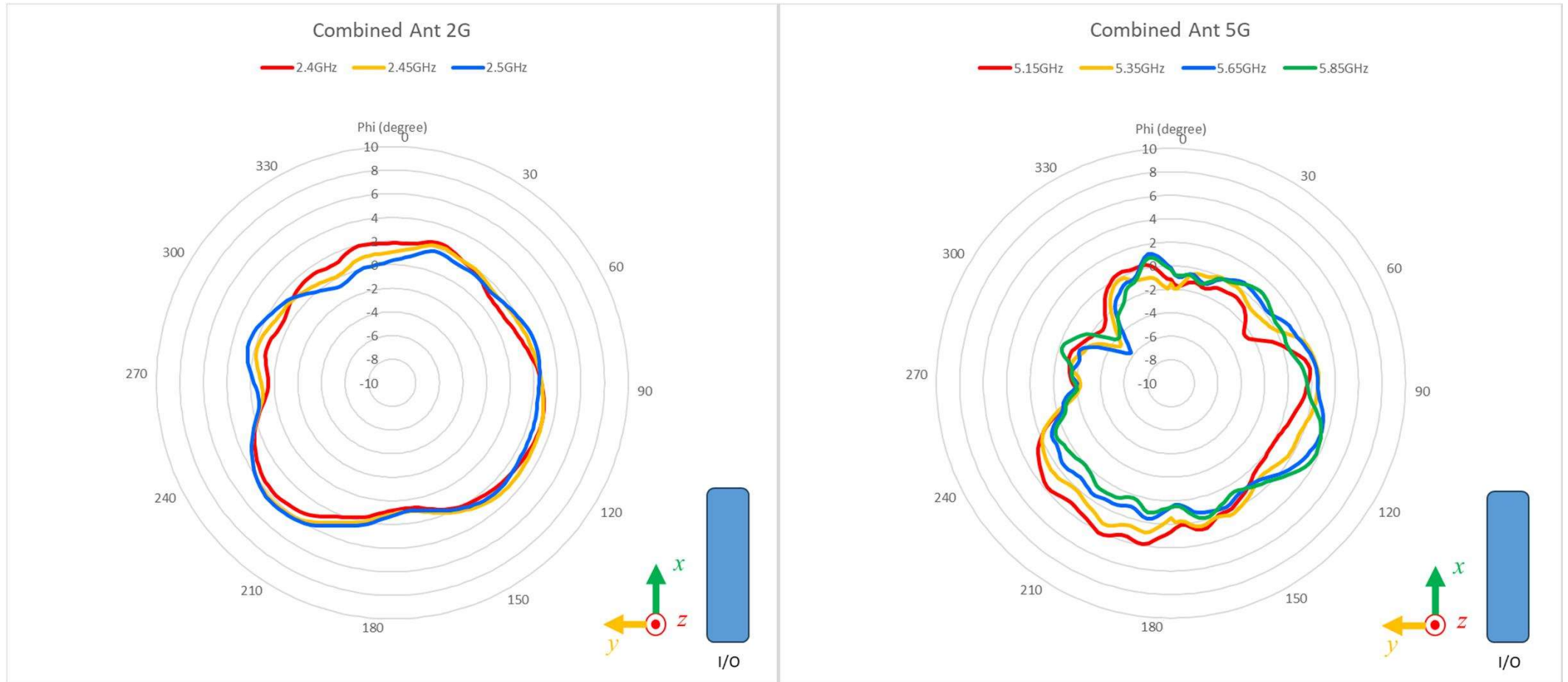
Individual 2D Theta120 XY – plane



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Combined 2D Theta120 XY – plane



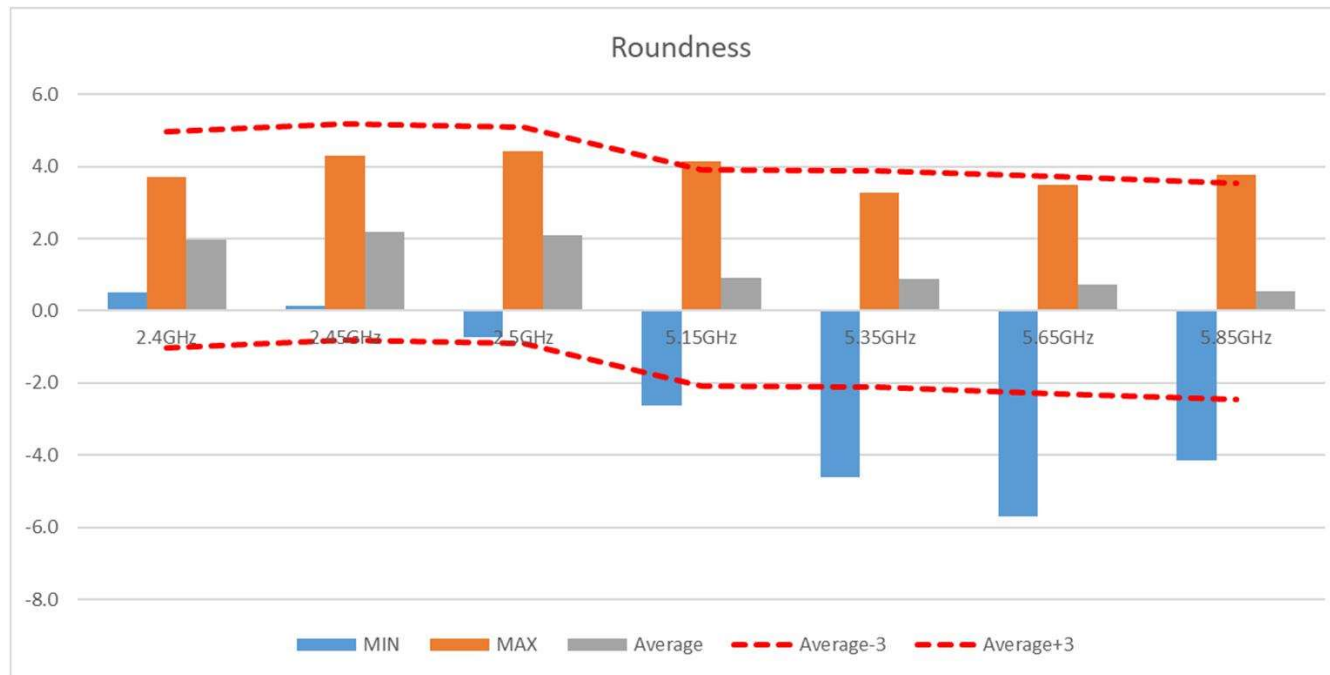
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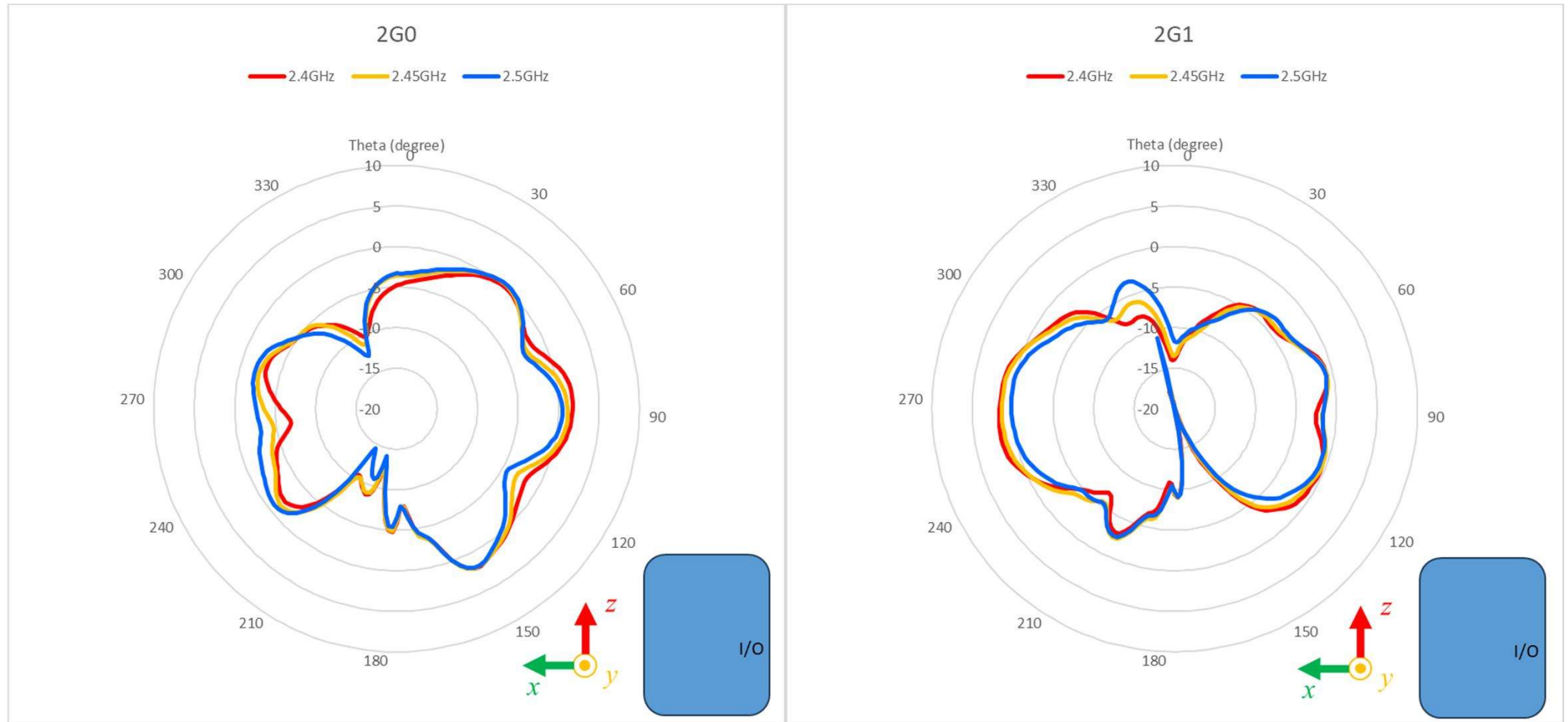
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Combined 2D Theta120 XY – plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	0.5	0.1	-0.7	-2.6	-4.6	-5.7	-4.1
MAX	3.7	4.3	4.4	4.2	3.3	3.5	3.8
Average	2.0	2.2	2.1	0.9	0.9	0.7	0.5
Average-3	-1.0	-0.8	-0.9	-2.1	-2.1	-2.3	-2.5
Average+3	5.0	5.2	5.1	3.9	3.9	3.7	3.5



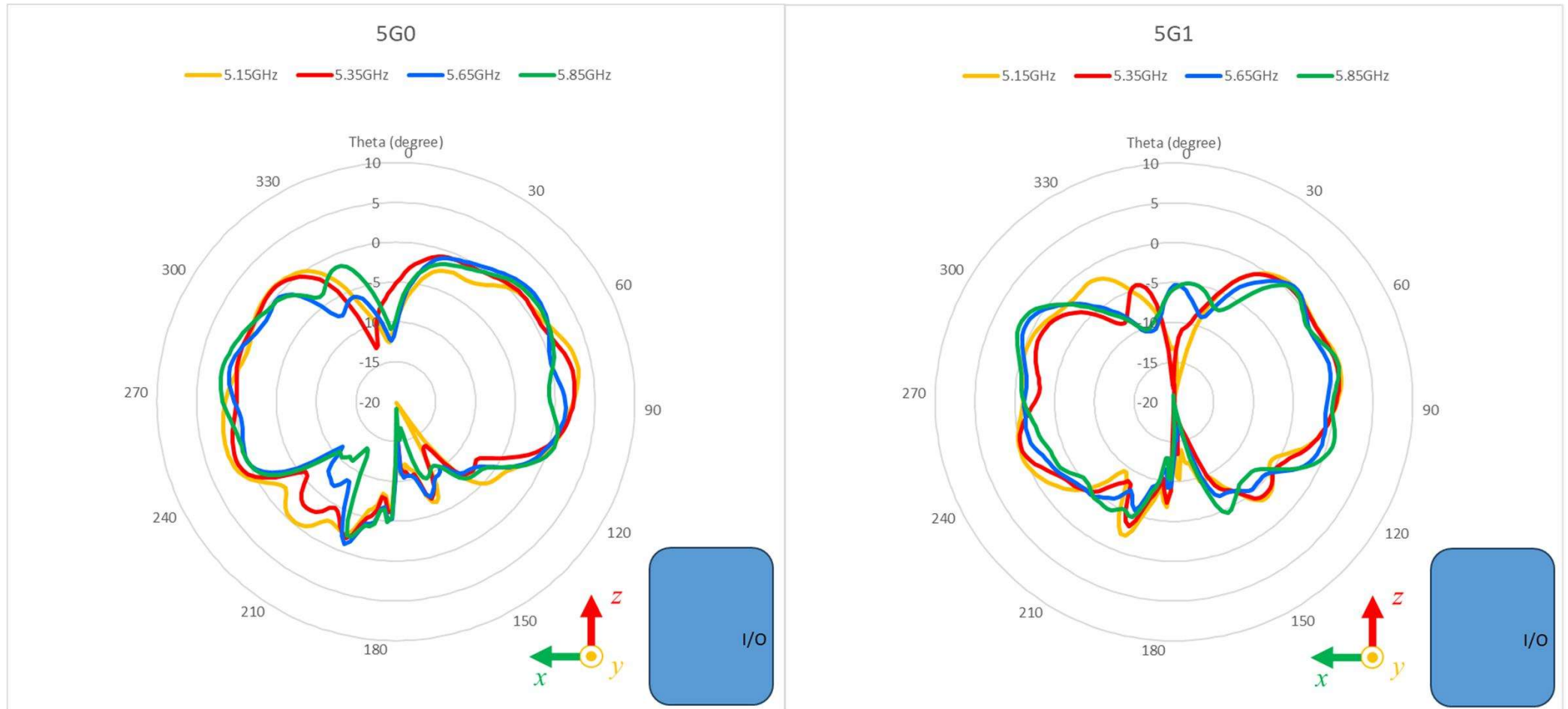
Individual 2D XZ- plane



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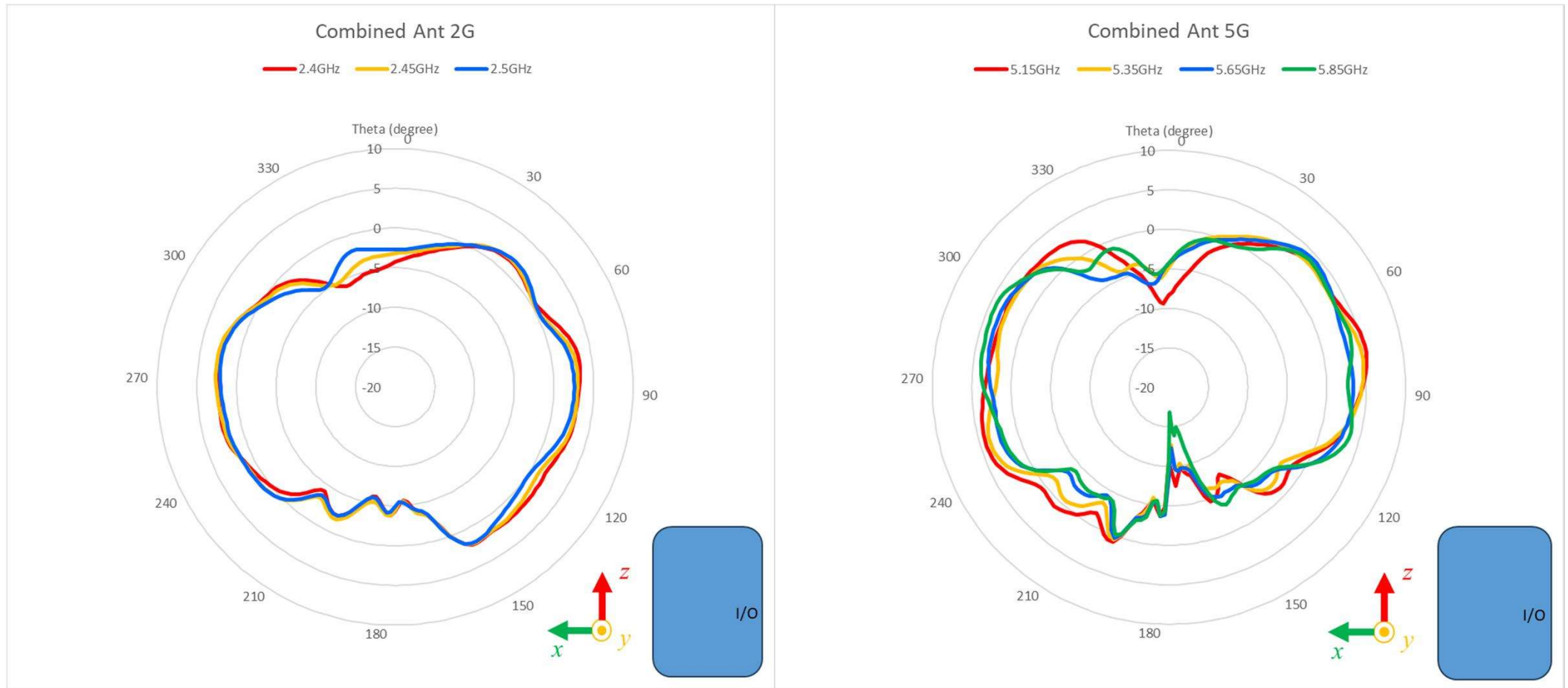
Individual 2D XZ- plane



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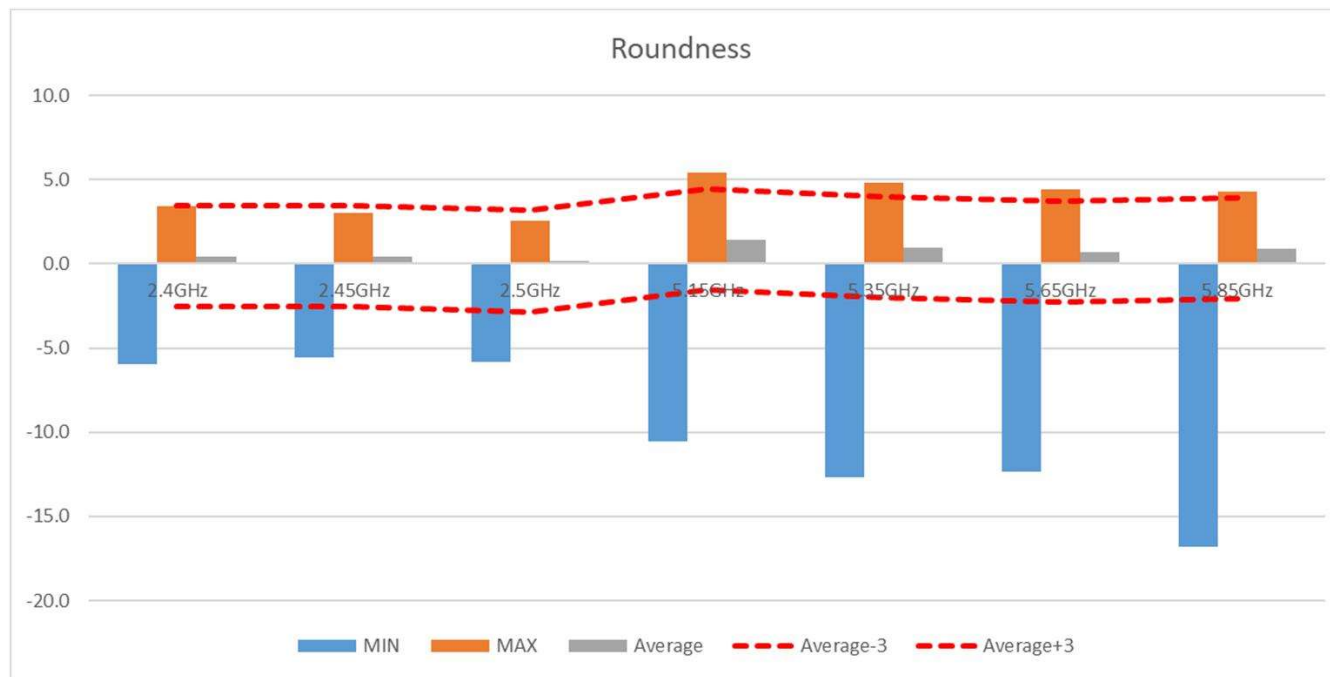
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Combined 2D XZ- plane

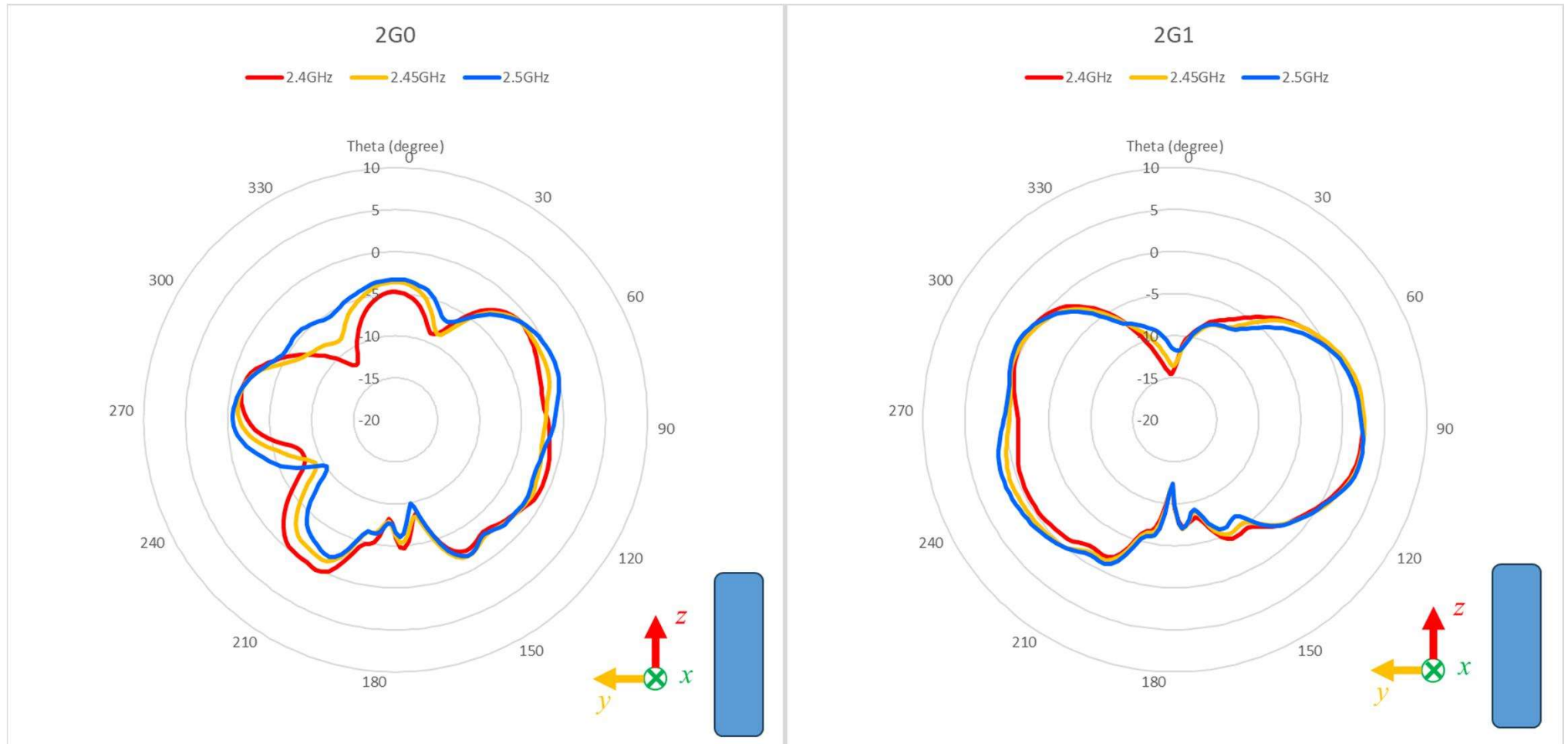


Combined 2D XZ- plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	-6.0	-5.6	-5.8	-10.6	-12.7	-12.4	-16.8
MAX	3.4	3.0	2.6	5.4	4.8	4.4	4.3
Average	0.4	0.4	0.2	1.4	1.0	0.7	0.9
Average-3	-2.6	-2.6	-2.8	-1.6	-2.0	-2.3	-2.1
Average+3	3.4	3.4	3.2	4.4	4.0	3.7	3.9



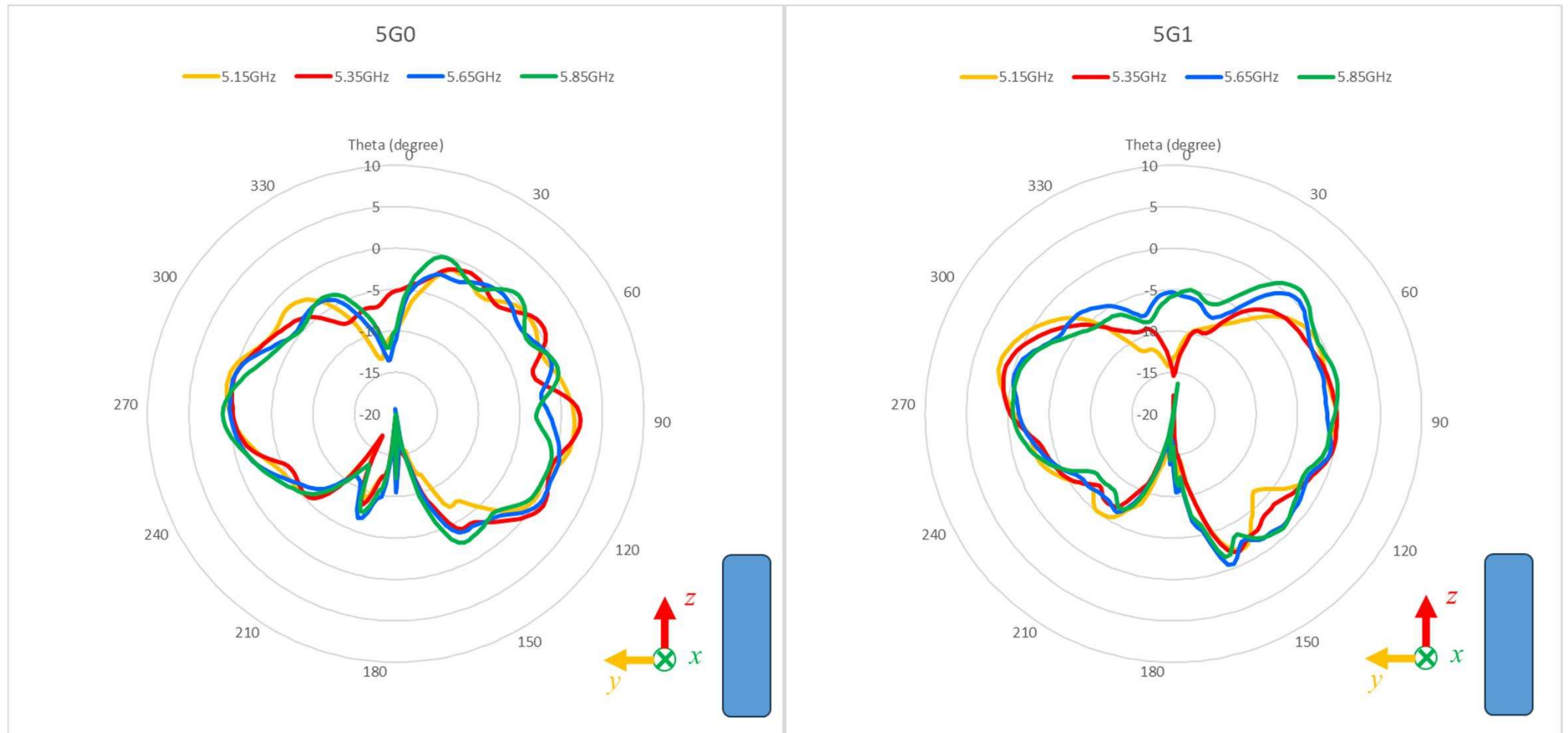
Individual 2D YZ- plane



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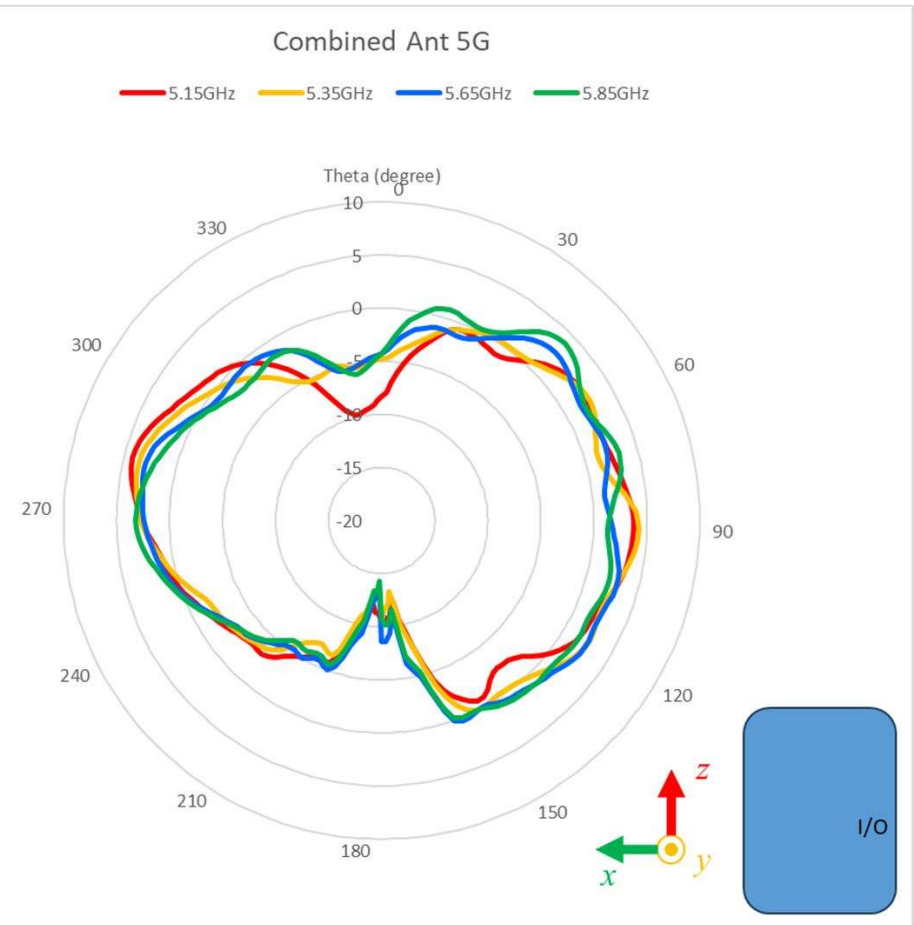
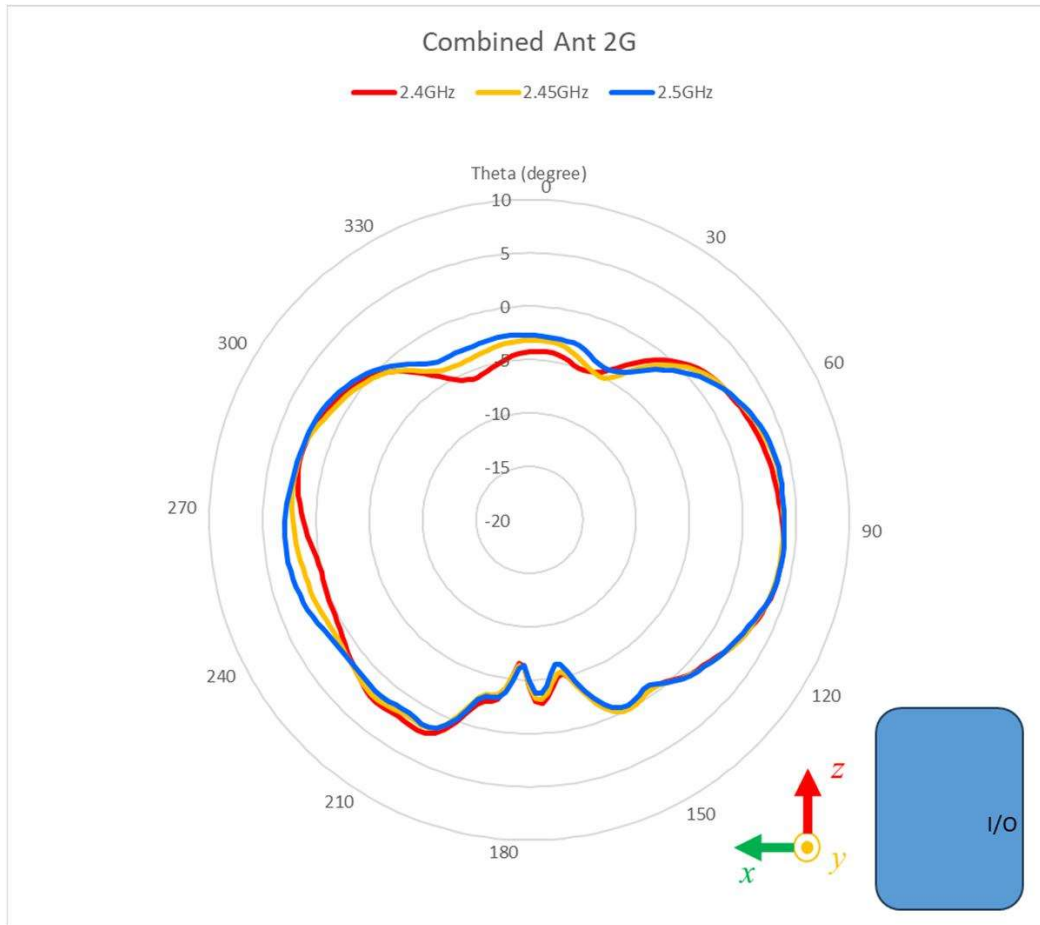
Individual 2D YZ- plane



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Combined 2D YZ- plane



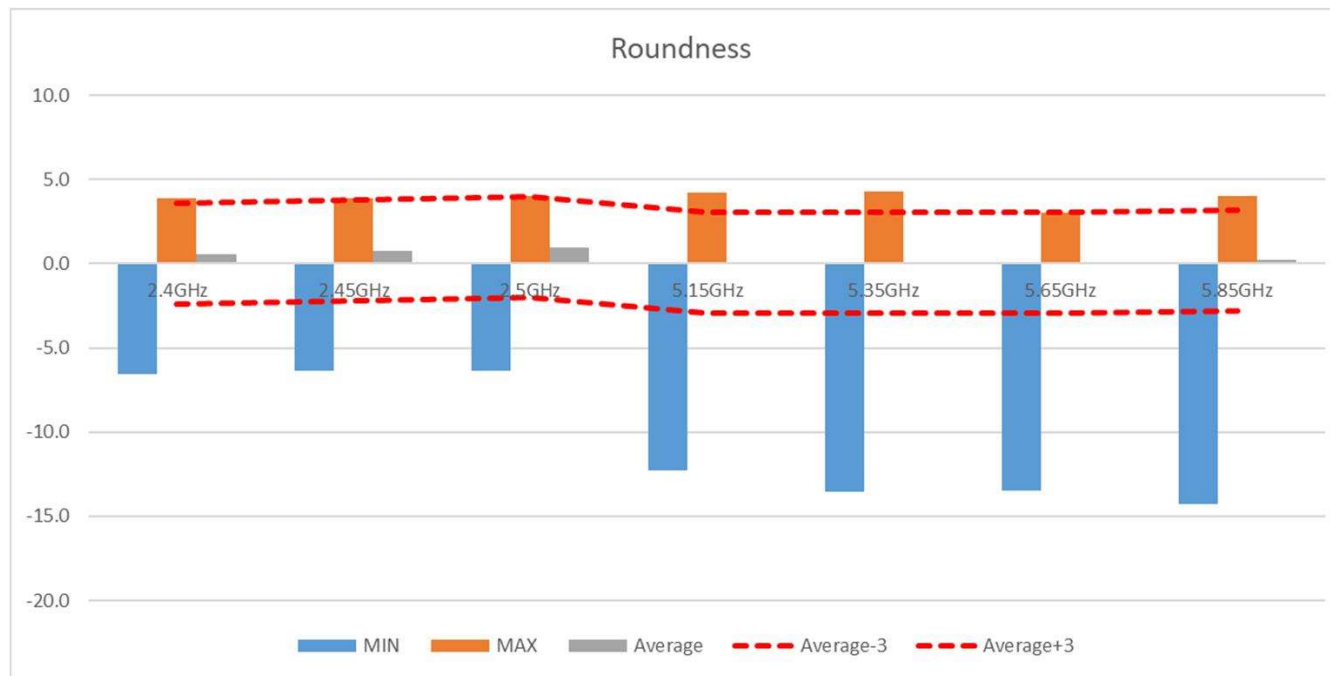
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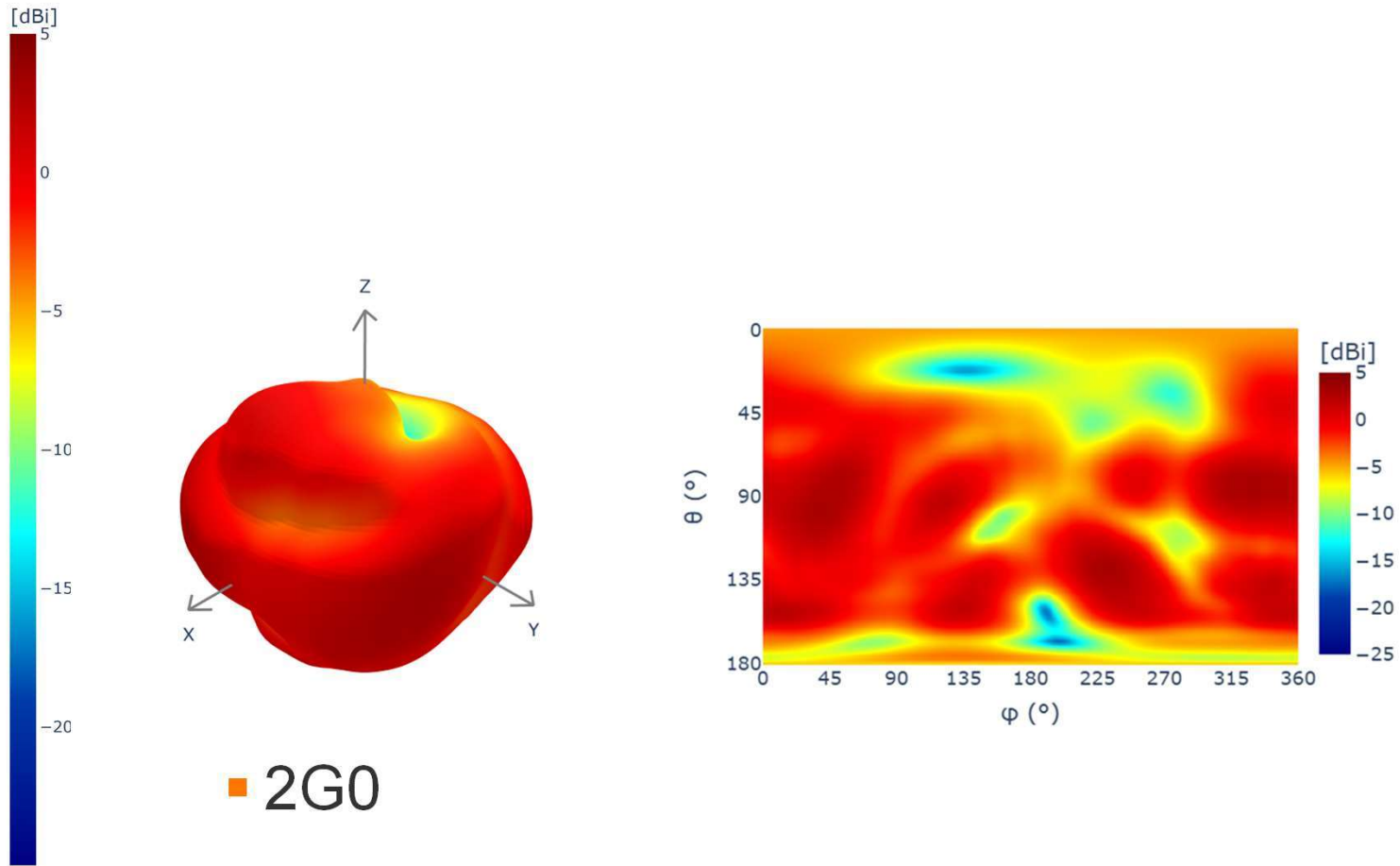
48

Combined 2D YZ- plane

	Ant 2G			Ant 5G			
	2.4GHz	2.45GHz	2.5GHz	5.15GHz	5.35GHz	5.65GHz	5.85GHz
MIN	-6.6	-6.4	-6.3	-12.3	-13.5	-13.5	-14.3
MAX	3.9	3.9	4.0	4.2	4.3	3.0	4.0
Average	0.6	0.8	1.0	0.0	0.1	0.1	0.2
Average-3	-2.4	-2.2	-2.0	-3.0	-2.9	-2.9	-2.8
Average+3	3.6	3.8	4.0	3.0	3.1	3.1	3.2



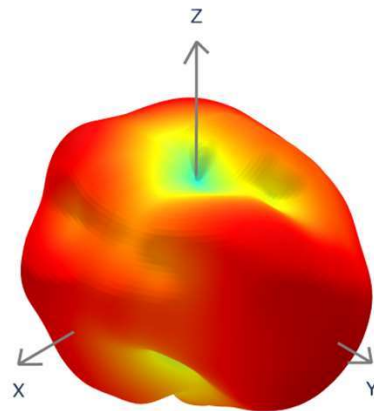
Radiation Pattern –3D



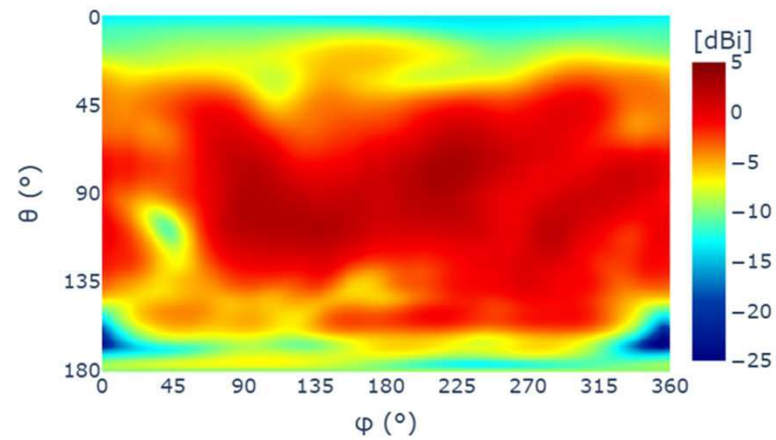
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Radiation Pattern –3D



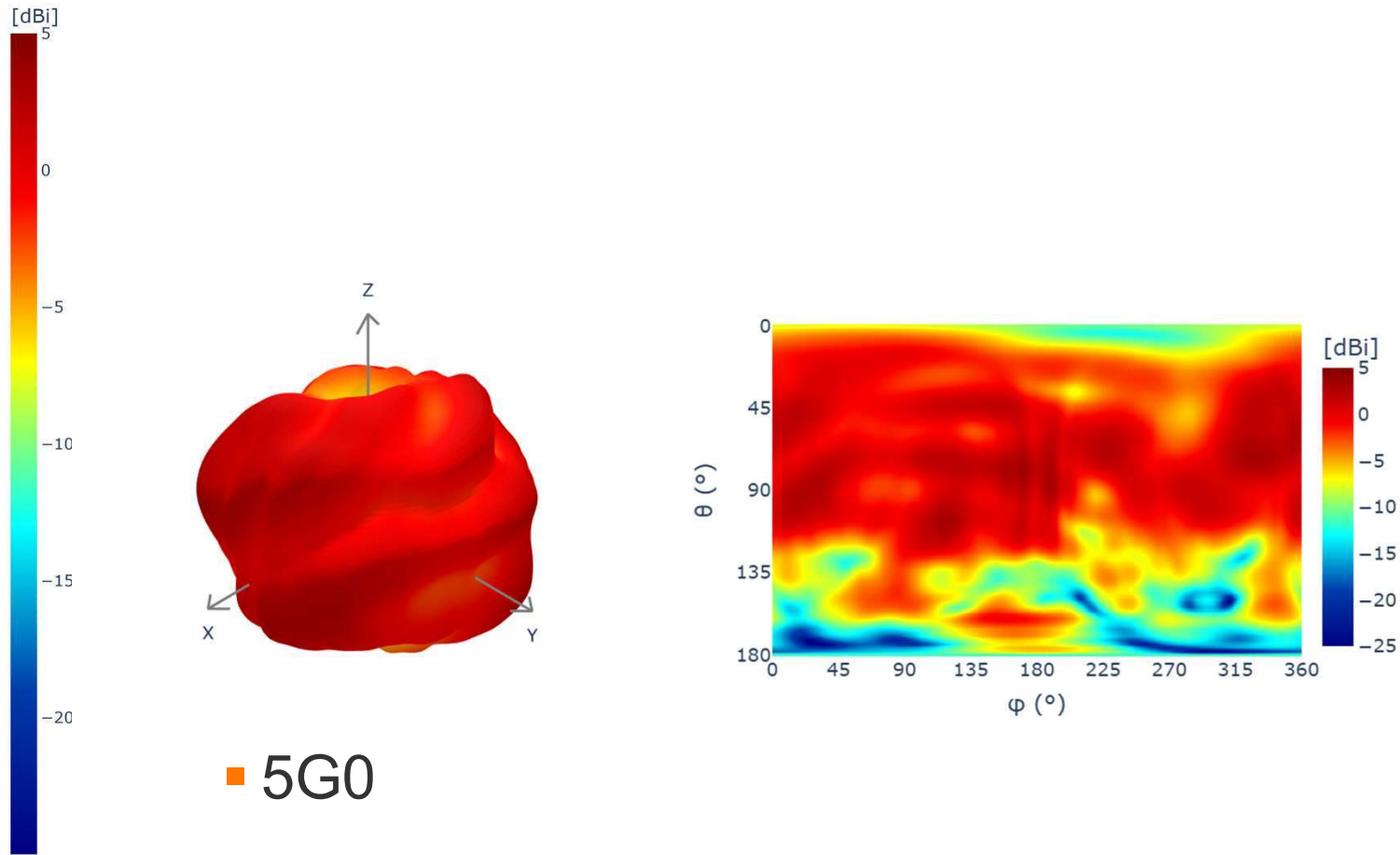
■ 2G1



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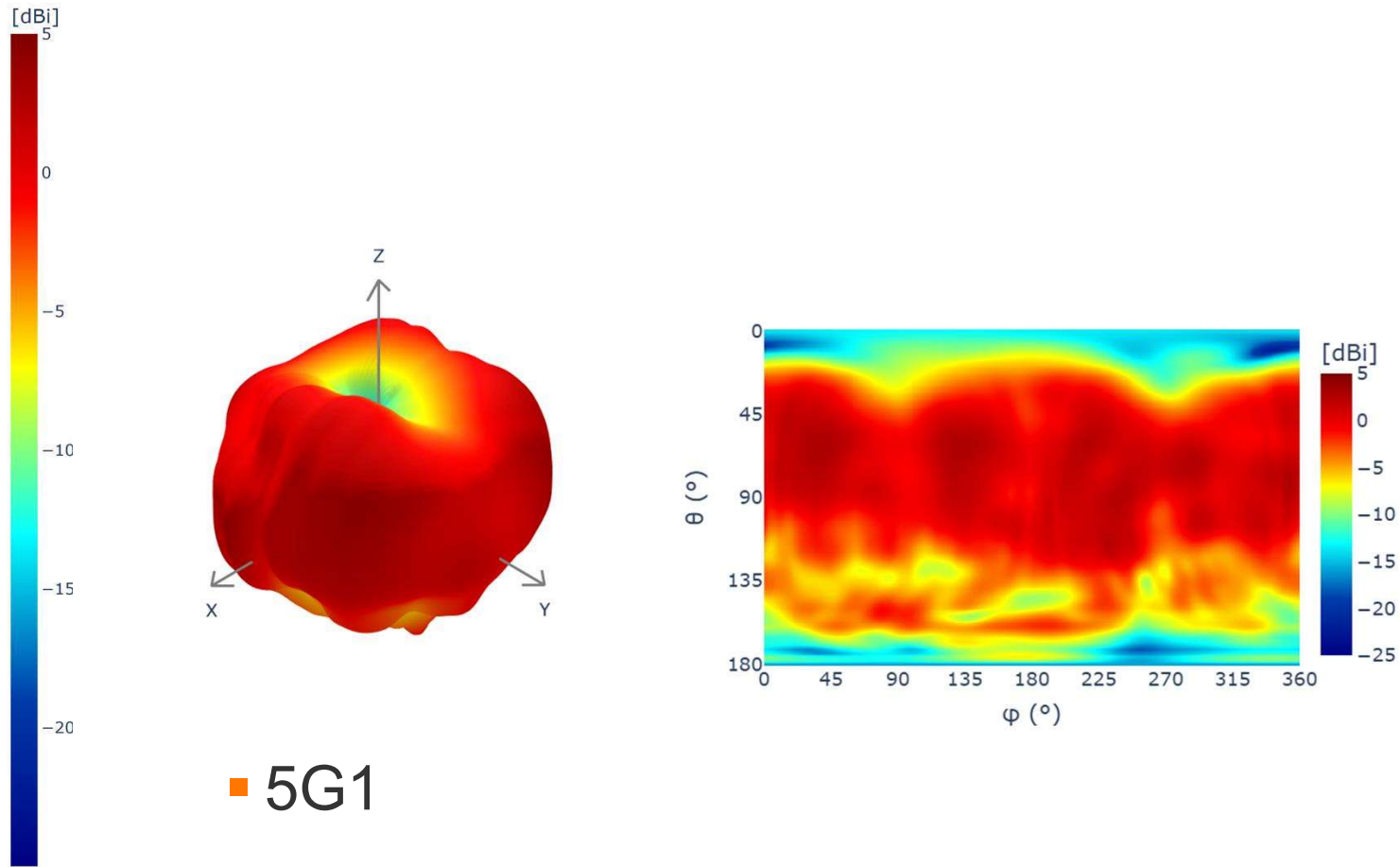
Radiation Pattern –3D



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Radiation Pattern –3D

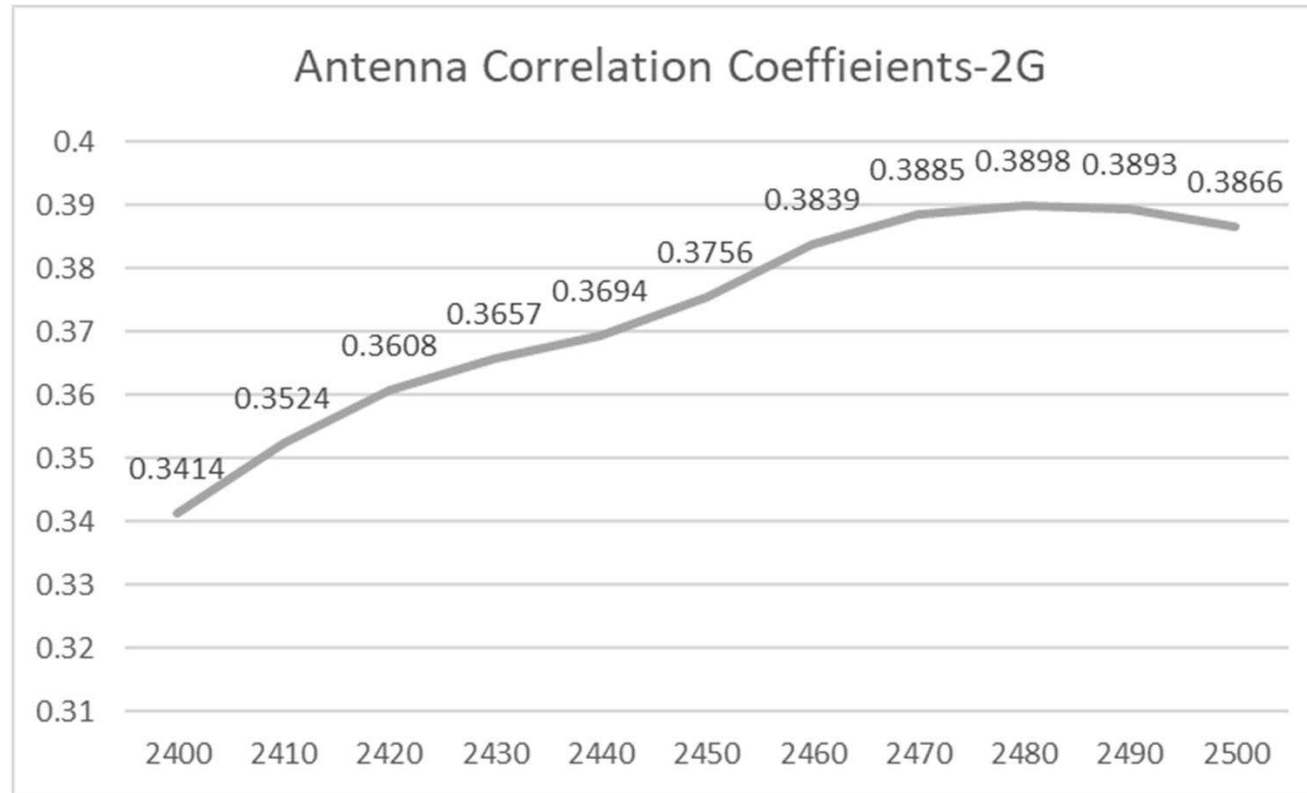


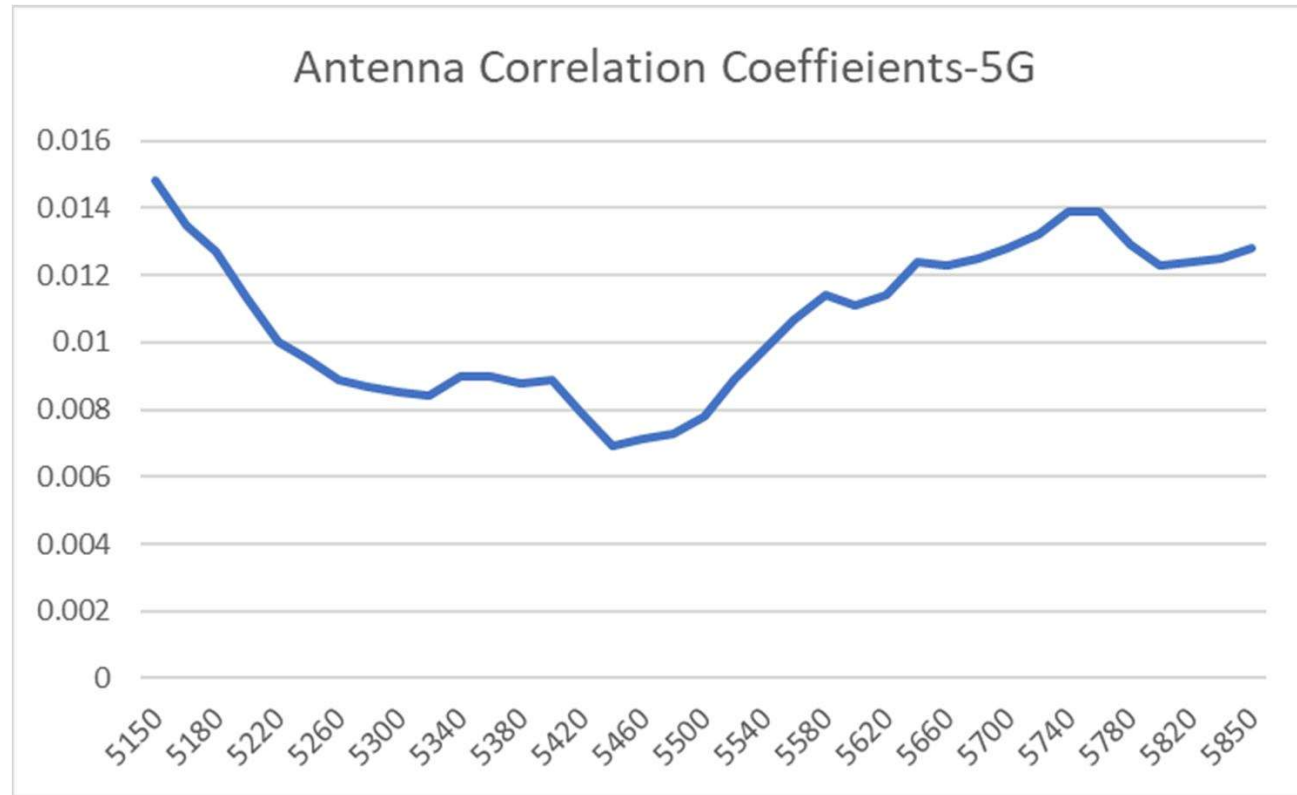
■ 5G1



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Radiation Pattern –Summary

2G4 Antennas LAG														
Frequency(GHz)	Ant 2G_0							Ant 2G_1						
	60°	70°	80°	90°	100°	110°	120°	60°	70°	80°	90°	100°	110°	120°
2.4	-3.36	-1.55	-0.33	-0.39	-1.54	-2.31	-1.73	-1.46	-0.33	0.38	0.37	0.00	-0.61	-1.36
2.45	-3.09	-1.28	0.17	0.22	-0.87	-1.94	-1.70	-1.50	-0.29	0.45	0.45	0.15	-0.30	-1.02
2.5	-2.44	-1.14	0.06	0.17	-0.82	-1.94	-2.00	-1.48	-0.39	0.20	0.25	0.15	-0.21	-0.96
Average	-2.96	-1.32	-0.04	0.00	-1.08	-2.06	-1.81	-1.48	-0.34	0.34	0.36	0.10	-0.37	-1.11

5G Antennas LAG														
Frequency(GHz)	Ant 5G_0							Ant 5G_1						
	60°	70°	80°	90°	100°	110°	120°	60°	70°	80°	90°	100°	110°	120°
5.18	0.65	0.74	1.36	1.45	0.42	-1.49	-2.93	0.85	1.15	1.05	0.67	0.03	-0.87	-2.53
5.3	0.28	0.37	0.70	1.35	0.43	-1.74	-3.61	0.03	0.53	0.71	0.55	0.00	-0.86	-2.13
5.5	-0.48	0.78	0.92	0.41	0.04	-1.41	-4.25	0.02	0.42	0.29	-0.22	-0.50	-0.99	-1.89
5.8	-0.45	0.73	0.95	-0.02	-0.09	-1.21	-3.92	0.07	1.04	0.87	-0.13	0.39	-1.01	-2.30
Average	0.00	0.65	0.98	0.79	0.20	-1.46	-3.68	0.24	0.78	0.73	0.22	-0.22	-0.93	-2.21



Radiation Pattern –Summary

2G4 Antennas Roundness												
Frequency(GHz)	Ant 2G_0						Ant 2G_1					
	70°	80°	90°	100°	110°	120°	70°	80°	90°	100°	110°	120°
2.4	3.82	4.68	5.25	7.05	5.48	5.89	3.47	4.73	7.63	6.1	3.74	2.88
2.45	2.93	3.9	4.89	6.35	5.05	5.45	2.64	3.62	6.1	6.53	5.57	3.51
2.5	2.92	3.95	4.74	6.06	5.82	5.54	2.25	3.29	5.39	7.23	8.98	6.39
Average	3.22	4.18	4.96	6.47	5.45	5.63	2.79	3.88	6.37	6.62	6.10	4.26

5G Antennas Roundness												
Frequency(GHz)	Ant 5G_0						Ant 5G_1					
	70°	80°	90°	100°	110°	120°	70°	80°	90°	100°	110°	120°
5.18	2.33	2.53	2.23	3.84	6.39	5.33	1.9	1.92	2.12	2.8	3.32	4.75
5.3	2.53	2.81	2.01	4.13	5.23	4.8	2.71	2.97	2.59	3.06	3.37	4.9
5.5	2.68	2.19	2.0	3.36	4.29	4.93	2.62	3.73	3.37	2.7	3.02	4.92
5.8	2.36	1.91	2.63	2.96	3.83	4.25	2.05	3.11	3.81	3.49	3.72	5.98
Average	2.48	2.36	2.22	3.57	4.93	4.82	2.05	2.93	2.97	3.01	3.35	5.14



Conclusion

- *AoT antenna system exhibits*
 - *The Return Loss*
 - *2G4 antennas >11.4dB @ 2G4 Band Antennas*
 - *5G antennas >15.0dB @ 5G Band Antennas*
 - *The Isolation*
 - *>23.0dB Between 2G4 Band Antennas @2G4 Band*
 - *>31.3dB Between 5G Band Antennas @5G Band*
 - *>26.7dB Between 2G4 Band Antennas @5G Band*
 - *The Efficiency*
 - *2G antennas >76%*
 - *5G antennas >77%*

