

Winmate Inc.
Antenna Specification

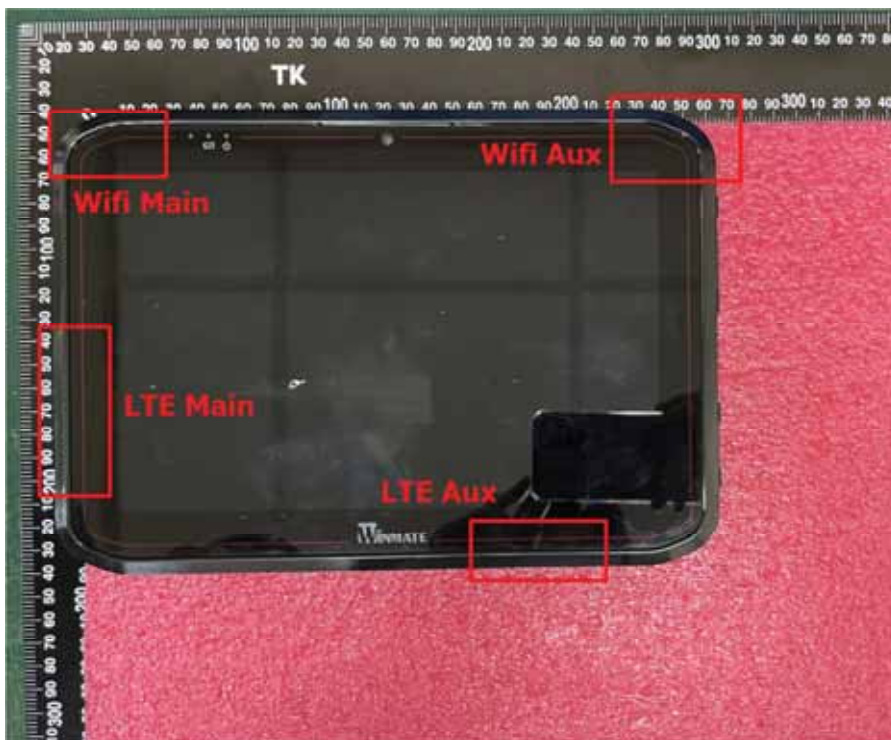
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1. Antenna Placement



2. Wi-Fi Main Antenna Specification

Winmate Part Number: 90RF0500001R

2.1. Electrical Characteristics

Frequency(MHz): 2400-2500 / 5150-6000

SWR: ≤ 1.70 @2400-2500MHz

≤ 2.31 @5150-6000MHz

Return Loss: ≤ -16.1 dB@2400-2500MHz

≤ -13.7 dB@5150-5850MHz

Peak Gain: 2.16dBi@2400-2500MHz

1.29dBi@5150-6000MHz

Impedance: 50ohm

Polarization: Linear

2.2. Mechanical Characteristics

Cable: 50 Ω $\varnothing$ 0.81 RF cable

Connector: MHF4

PCB: FR4 /Thickness 0.2mm

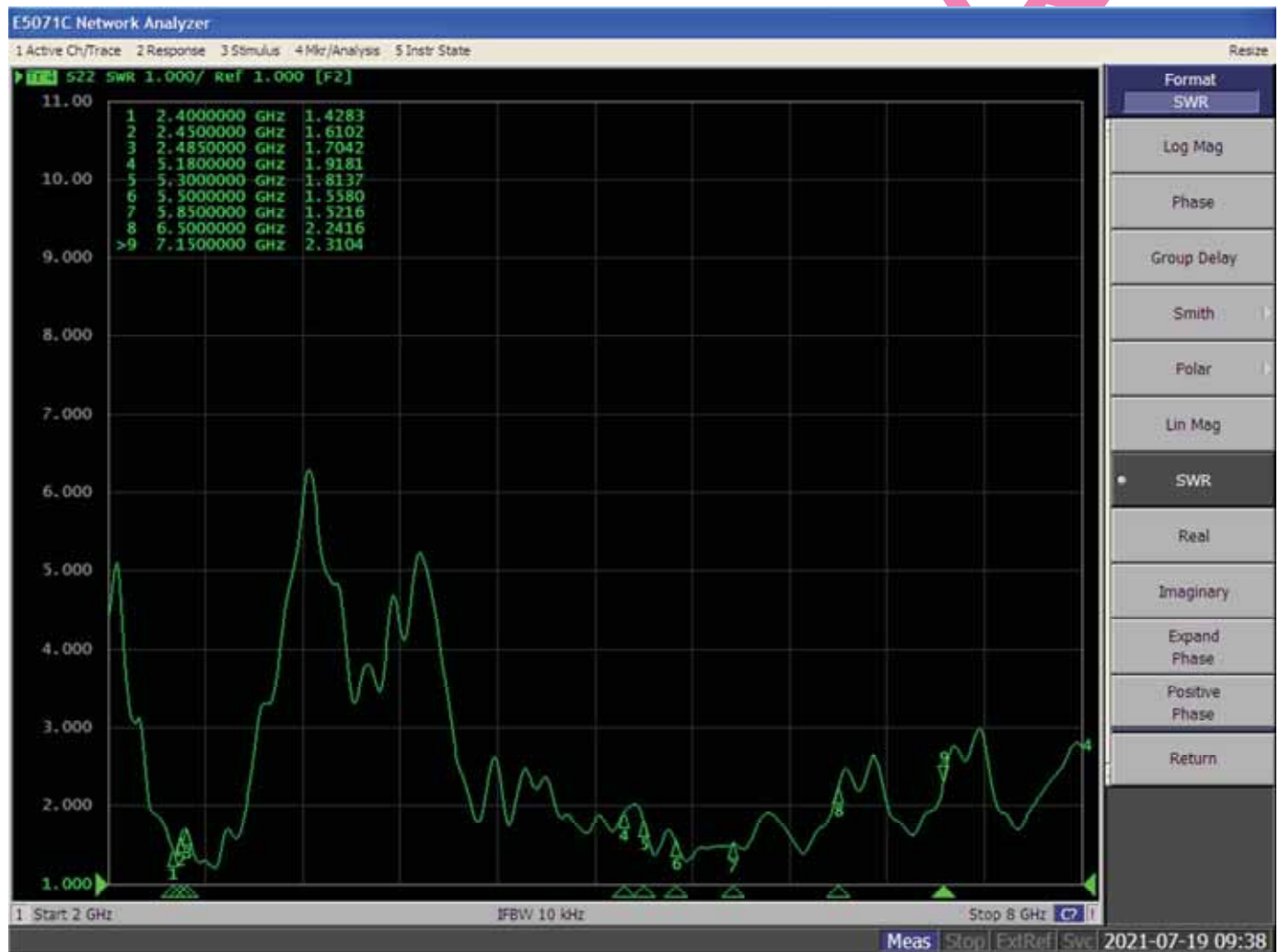
Type: Monopole

2.3. Environmental Characteristics

Operating Temperature: -30°C to 80°C

2.4. RF Performance Characteristics

2.4.1. SWR



2.4.2. Return Loss



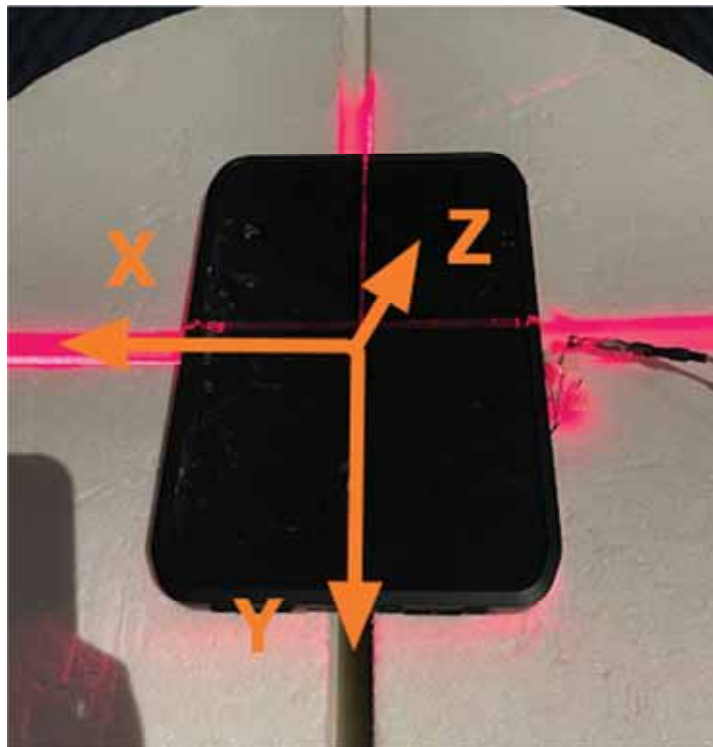
2.4.3. Gain / Efficiency

Frequency	2400	2427	2450	2472	2500	5150	5250	5350	5470	5540
Directivity (dBi)	4.67	4.64	4.56	4.73	4.68	4.92	5.09	4.65	4.88	4.92
Efficiency (dB)	-2.57	-2.48	-2.50	-2.74	-2.58	-5.21	-5.32	-4.39	-4.98	-4.54
Efficiency (%)	55.34	56.45	56.29	53.19	55.26	30.16	29.39	36.41	31.77	35.15
Peak Gain (dBi)	2.10	2.16	2.07	1.99	2.11	-0.29	-0.23	0.26	-0.10	0.38

Frequency	5600	5725	5850	5925	6000					
Directivity (dBi)	5.09	4.89	5.11	5.26	5.70					
Efficiency (dB)	-4.14	-4.43	-4.62	-4.54	-4.41					
Efficiency (%)	38.53	36.02	34.48	35.19	36.25					
Peak Gain (dBi)	0.95	0.45	0.49	0.73	1.29					

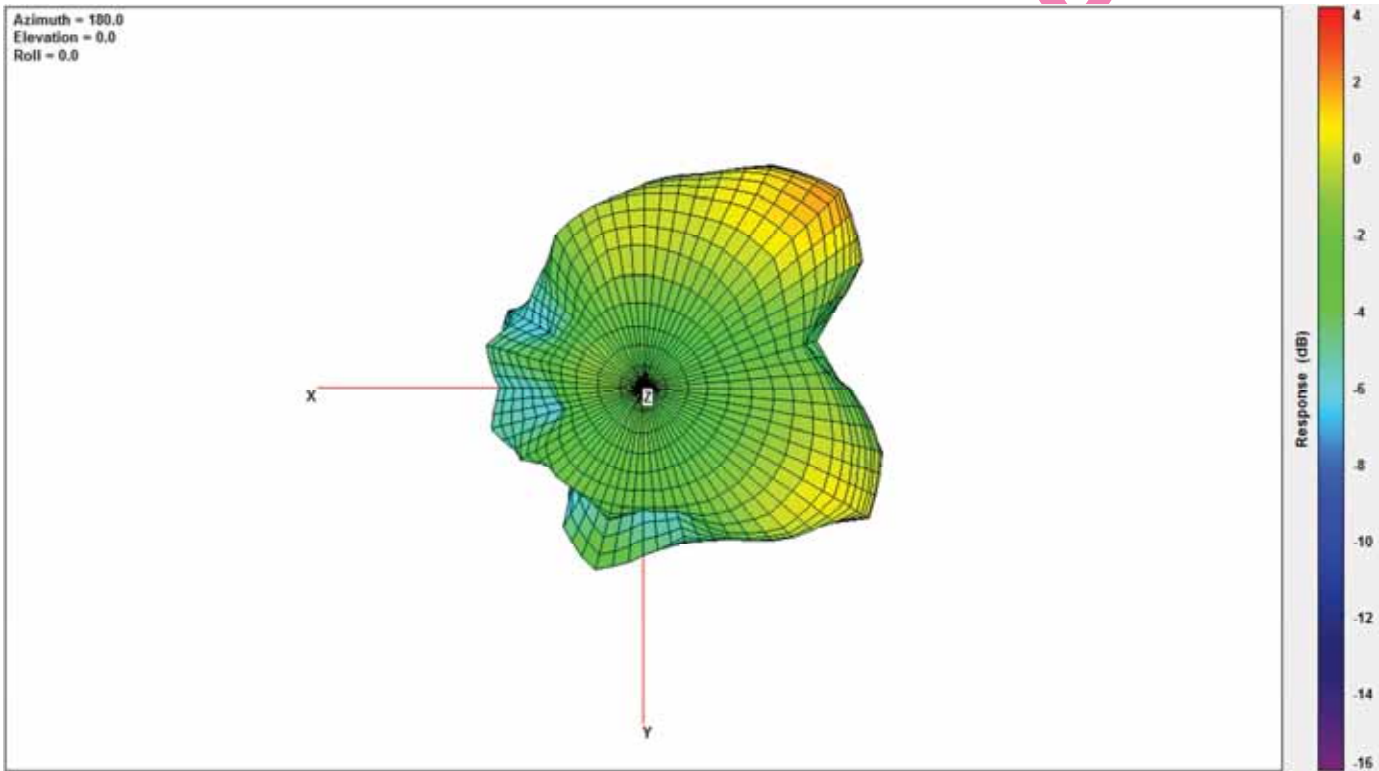
2.4.4. Radiation Patterns

2.4.4.1. Tets Setup

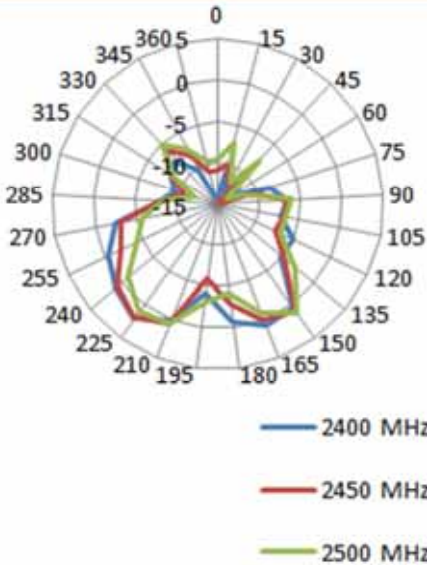


2.4.4.2. Straight 2D & 3D Radiation Patterns

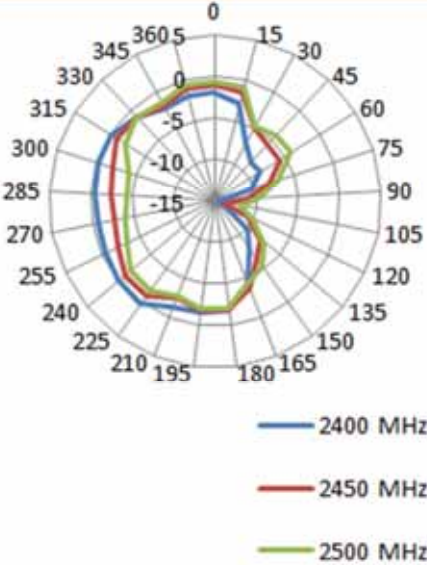
2450MHz



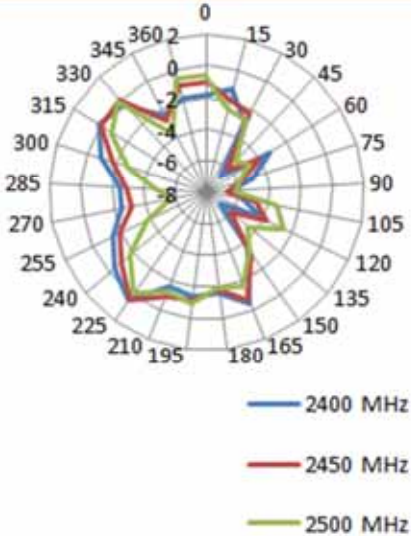
XY Plane



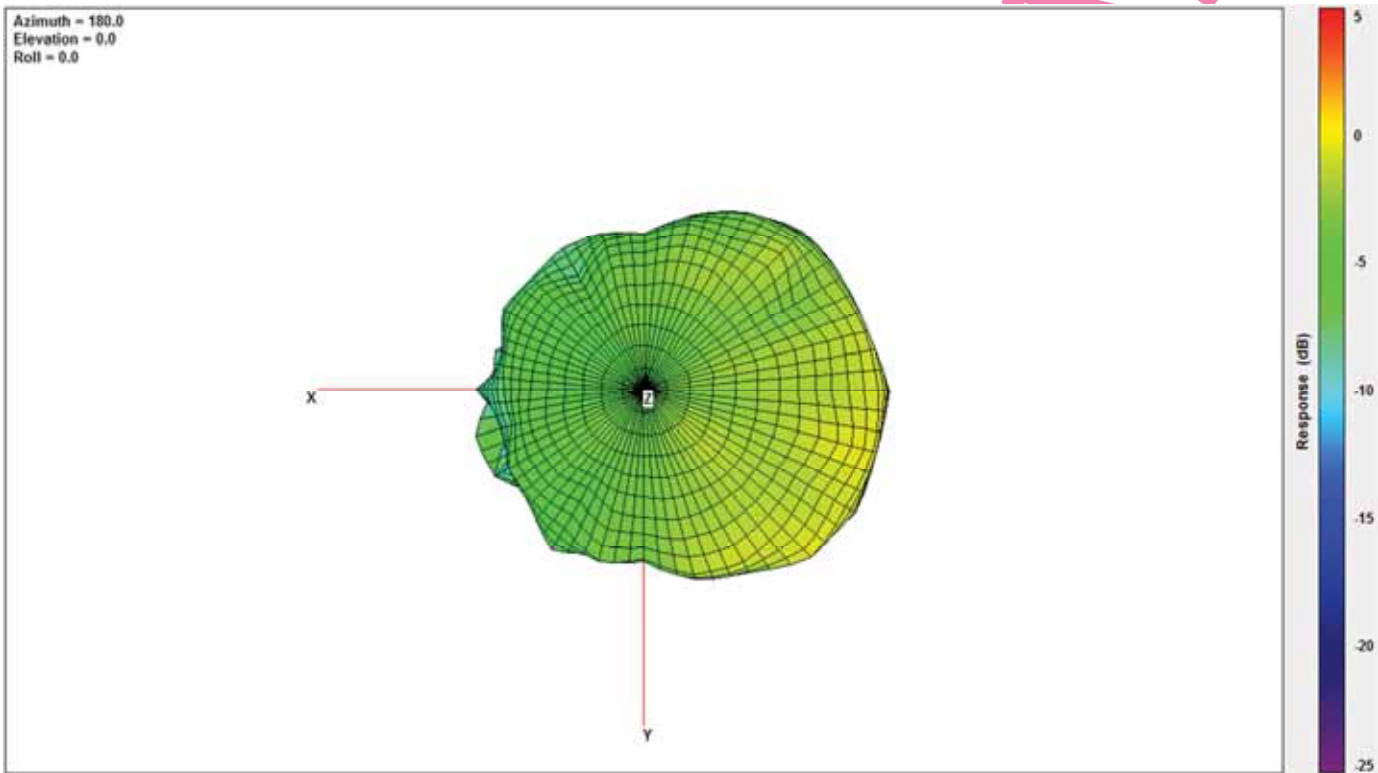
XZ Plane



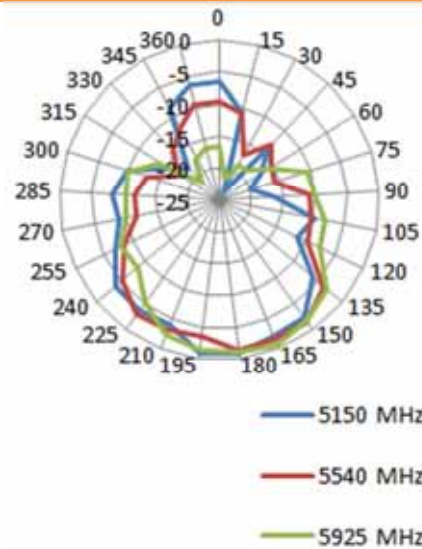
YZ Plane



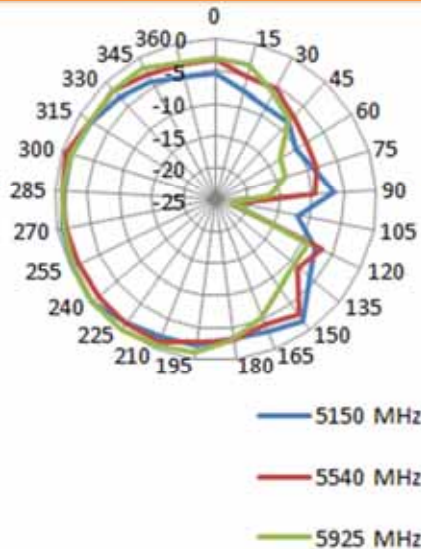
5540MHz



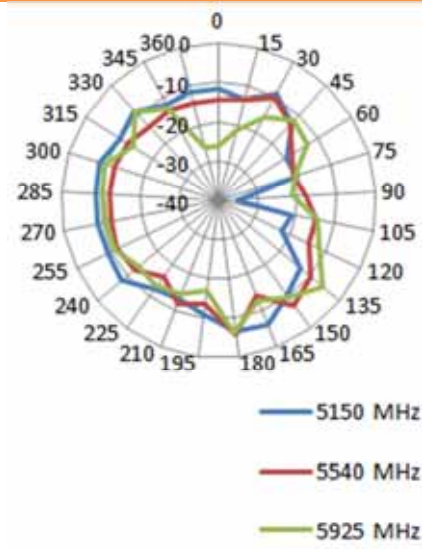
XY Plane



XZ Plane

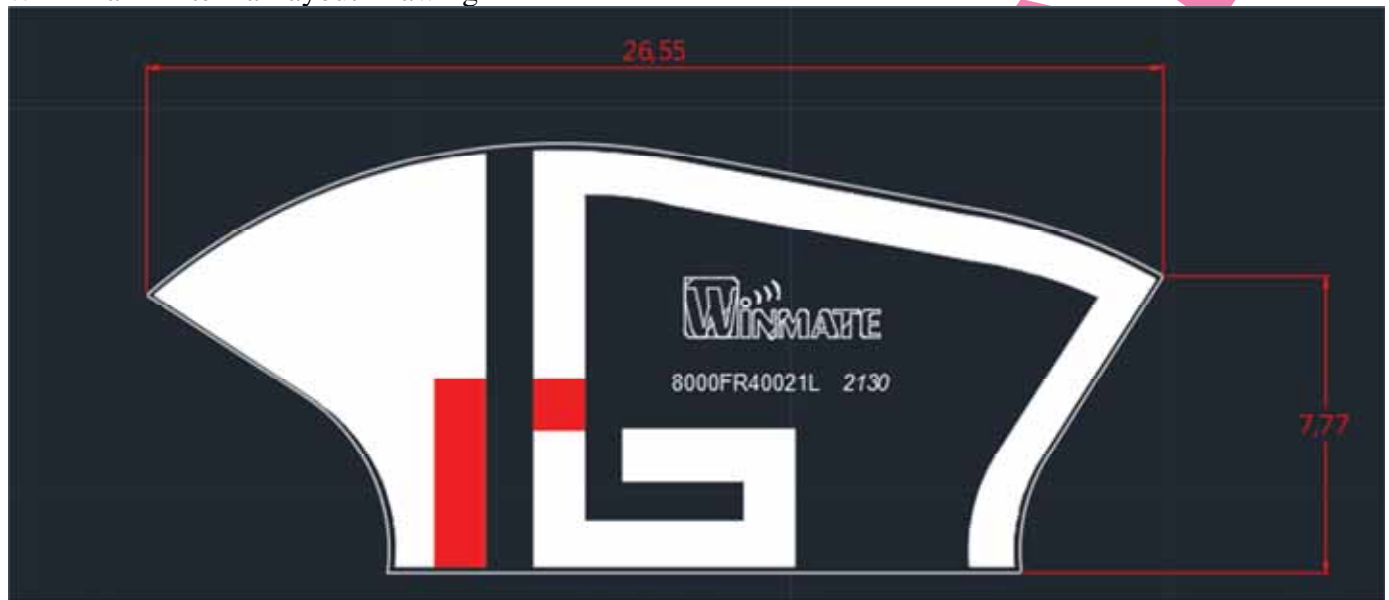


YZ Plane



2.5. Drawing

WiFi Main Antenna Layout Drawing



RF cable Drawing



Antenna Assembly



Winmate Part Number: 90RF0500001R

3. WiFi Aux Antenna Specification

Winmate Part Number: 90RF0600001G

3.1. Electrical Characteristics

Frequency(MHz): 2400-2500 / 5150-6000

SWR: $\leq 1.66@2400-2500\text{MHz}$

$\leq 1.87@5150-6000\text{MHz}$

Return Loss: $\leq -19.4\text{dB}@2400-2500\text{MHz}$

$\leq -15.7\text{dB}@5150-6000\text{MHz}$

Peak Gain: $2.61\text{dBi}@2400-2500\text{MHz}$

$2.68\text{dBi}@5150-6000\text{MHz}$

Impedance: 50ohm

Polarization: Linear

3.2. Mechanical Characteristics

Cable: 50Ω $\varnothing$ 0.81 RF cable

Connector: MHF4

PCB: FR4 /Thickness 0.2mm

Type: Monopole

3.3. Environmental Characteristics

Operating Temperature: -30°C to 80°C

3.4. RF Performance Characteristics

3.4.1 SWR



3.4.2 Return Loss



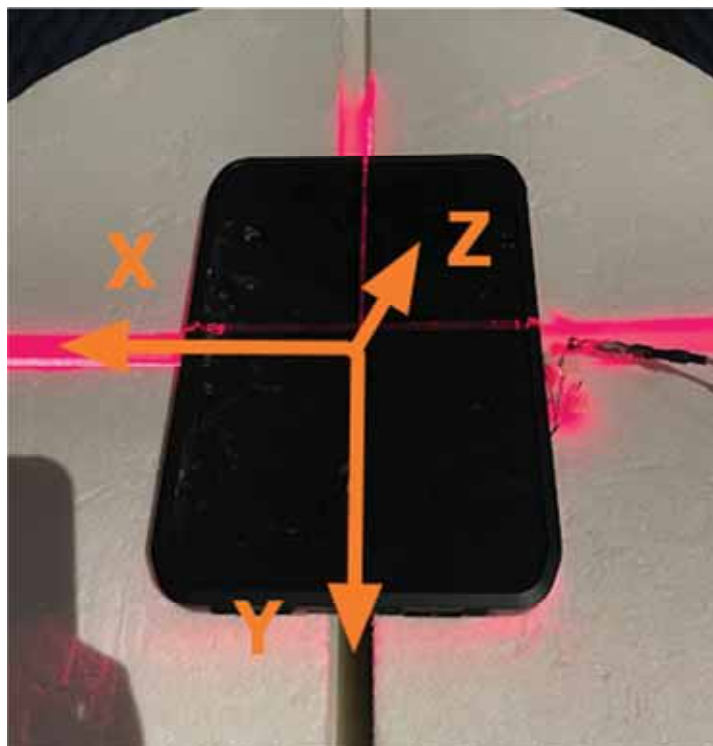
3.4.3. Gain / Efficiency

Frequency	2400	2427	2450	2472	2500	5150	5250	5350	5470	5540
Directivity (dBi)	7.03	7.09	6.93	6.81	7.11	4.87	5.48	5.51	5.12	5.29
Efficiency (dB)	-4.83	-4.72	-4.71	-4.70	-4.00	-2.25	-2.88	-2.32	-2.64	-2.09
Efficiency (%)	32.87	33.76	33.84	33.89	39.78	59.57	51.47	58.67	54.48	61.75
Peak Gain (dBi)	2.19	2.38	2.22	2.11	2.61	2.62	2.60	2.39	2.48	2.20

Frequency	5600	5725	5850	5925	6000					
Directivity (dBi)	5.64	5.56	5.56	5.26	5.47					
Efficiency (dB)	-1.75	-2.38	-2.45	-2.47	-2.55					
Efficiency (%)	66.81	57.81	56.89	56.56	55.59					
Peak Gain (dBi)	2.59	2.68	2.51	2.59	2.42					

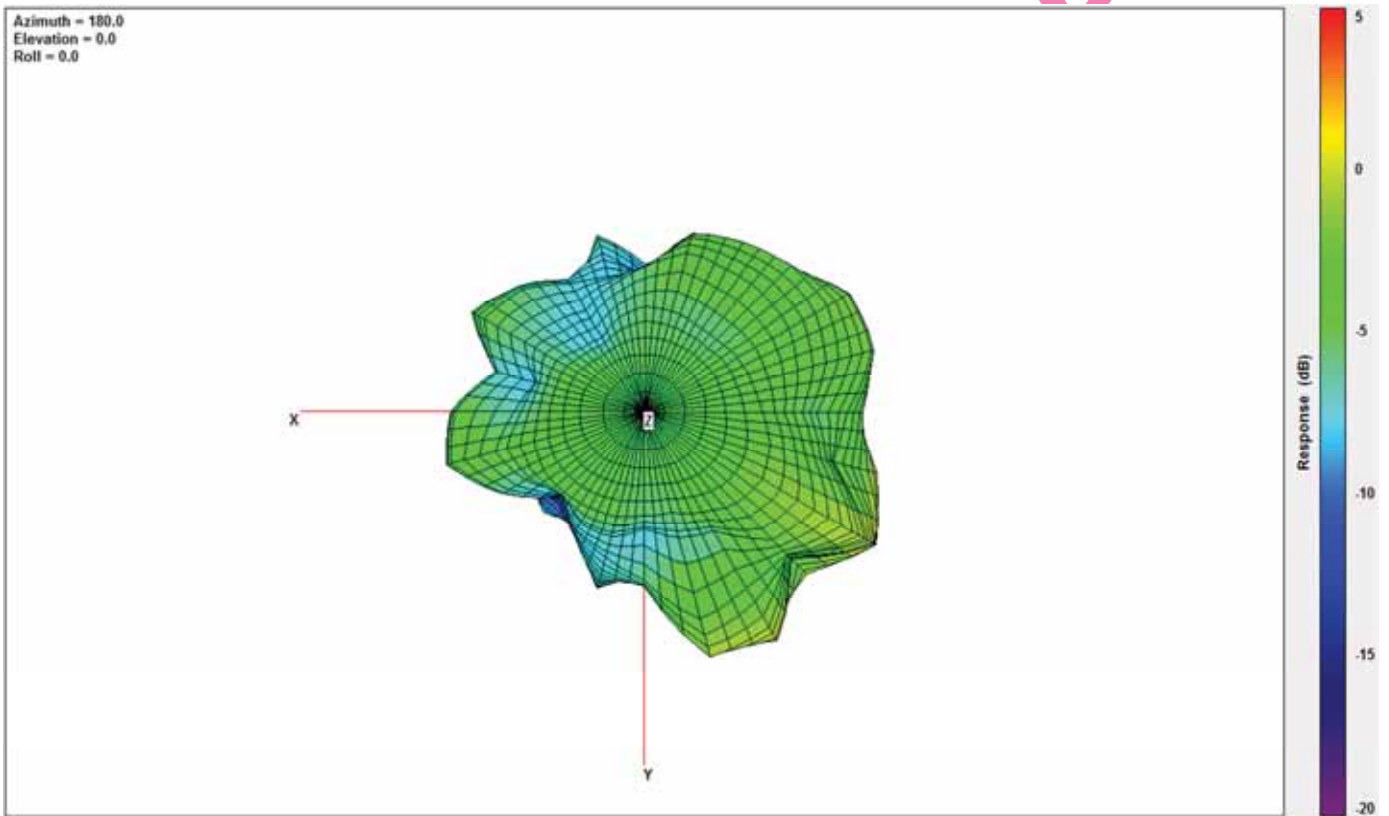
3.4.4. Radiation Patterns

3.4.4.1. Tets Setup



3.4.4.2. Straight 2D & 3D Radiation Patterns

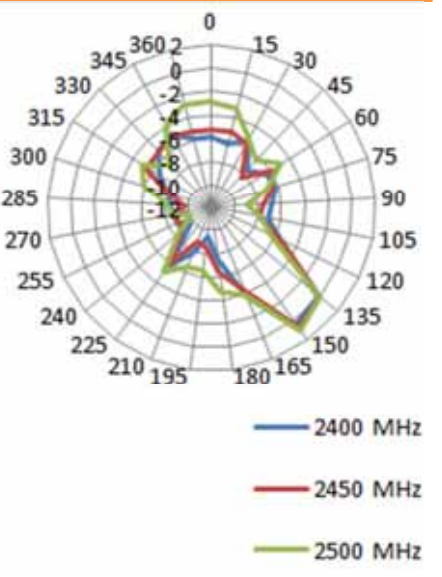
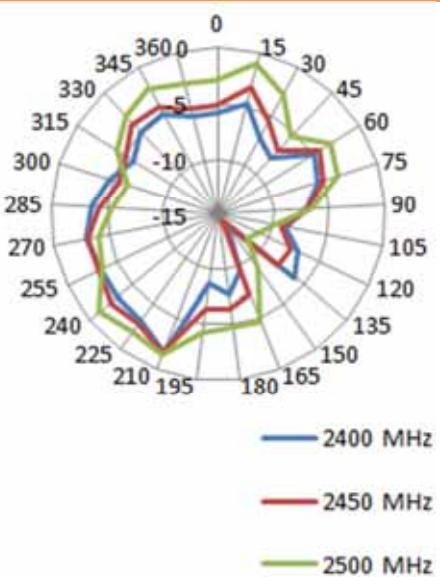
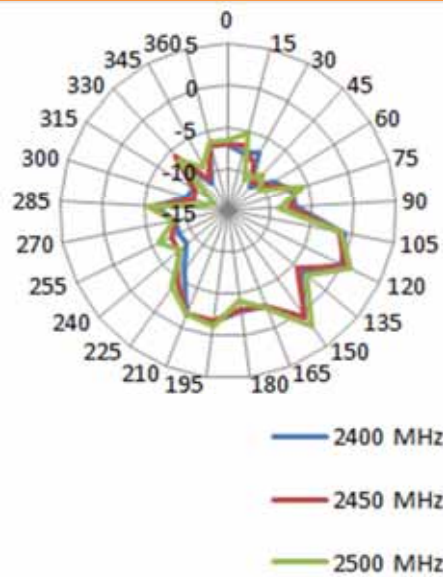
2450MHz



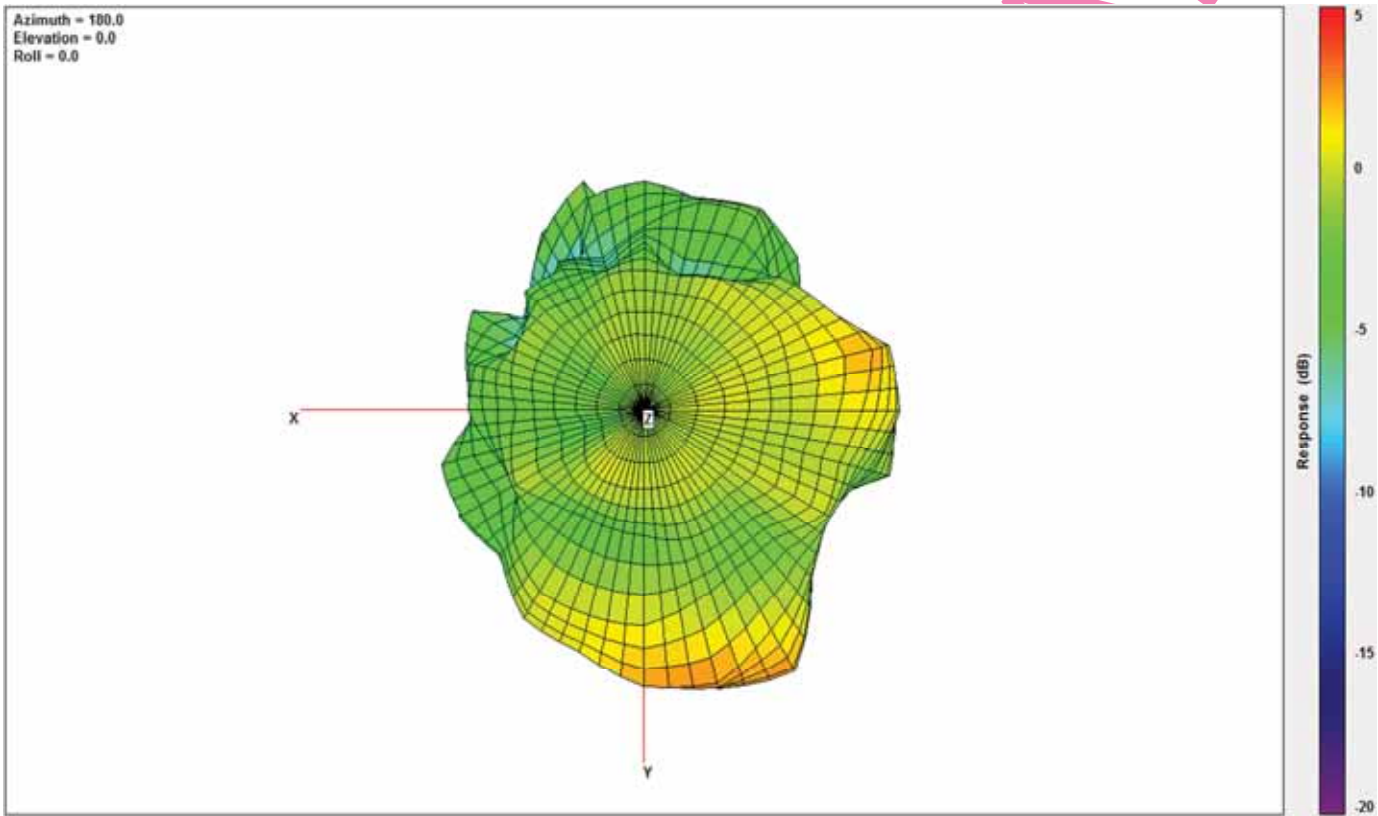
XY Plane

XZ Plane

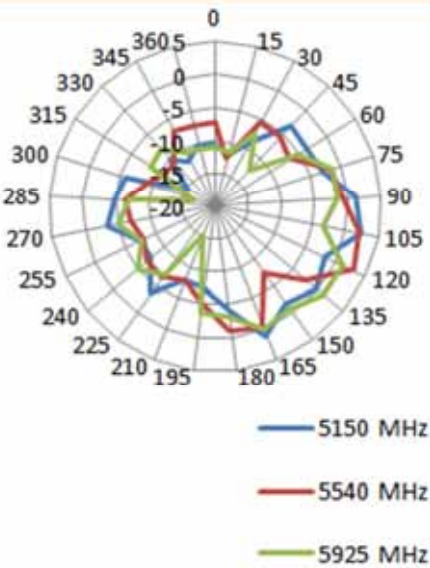
YZ Plane



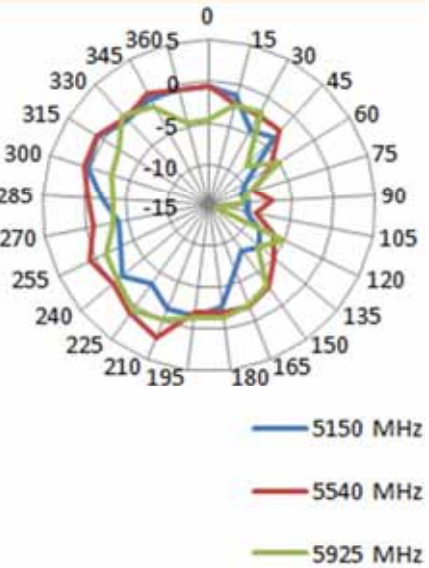
5540MHz



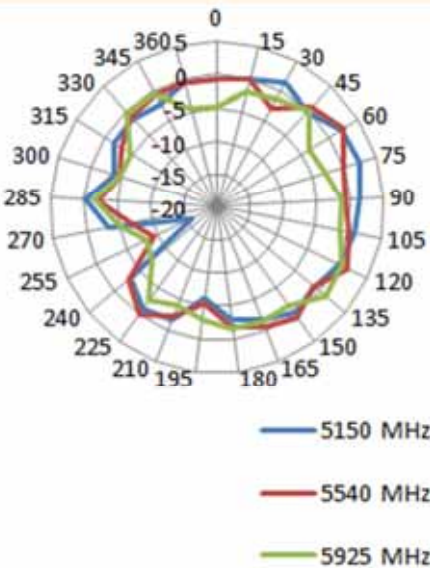
XY Plane



XZ Plane

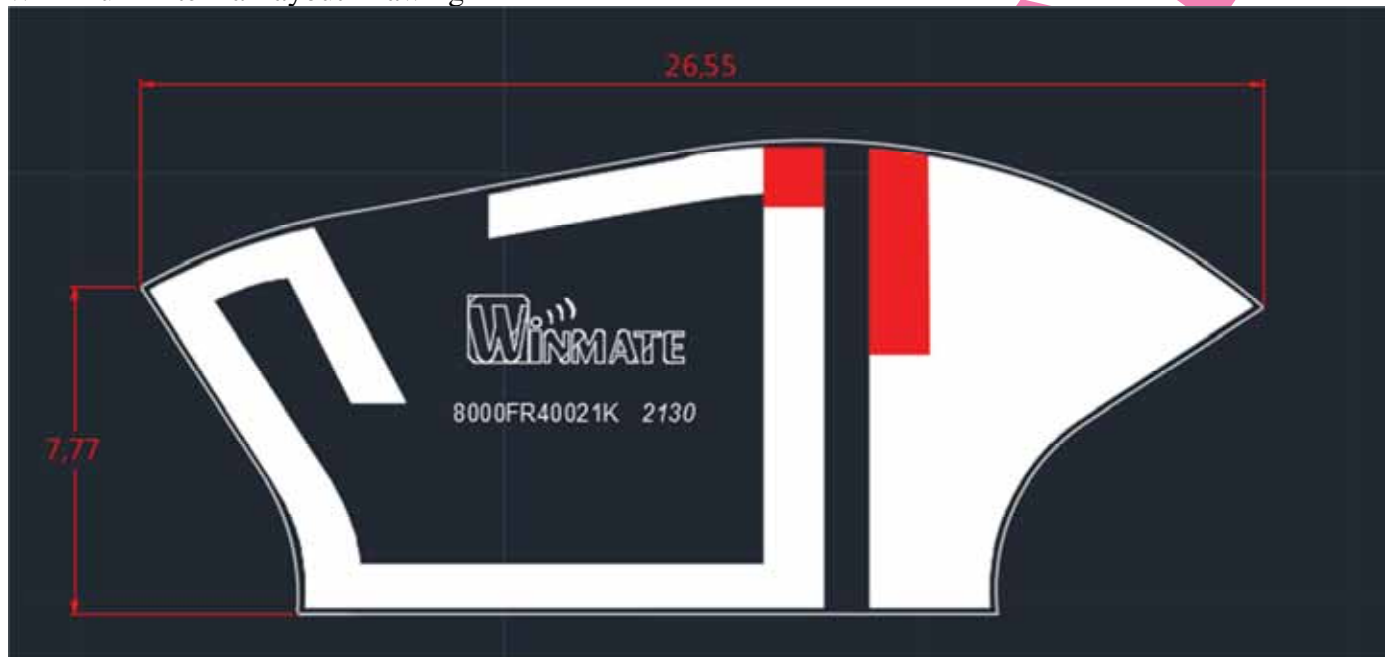


YZ Plane

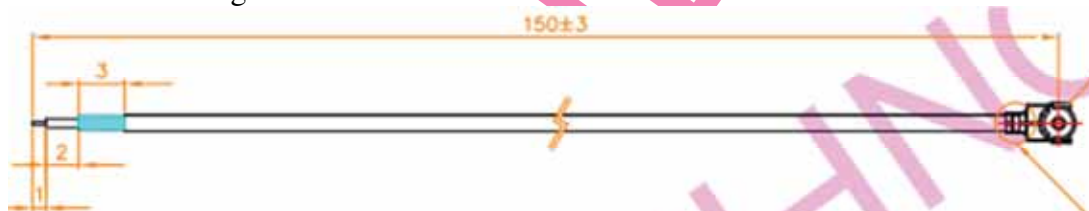


3.5. Drawing

WiFi Aux Antenna Layout Drawing



RF Cable Drawing



Antenna Assembly



Winmate Part Number: 90RF0600001G

4. LTE Main Antenna Specification

Winmate Part Number: 90RF0100001B

4.1. Electrical Characteristics

Frequency(MHz): 700-960 / 1710-2170 / 2500-2690

SWR: $\leq 3.53:1$ typ. (with Enclosure)

Peak Gain: 2.30 dBi typ. (with Enclosure)

Impedance: 50ohm

Polarization: Linear

4.2. Mechanical Characteristics

Cable: 50 Ω φ 0.81 RF cable

Connector: MHF 4

PCB: FPCB /Thickness 0.2mm

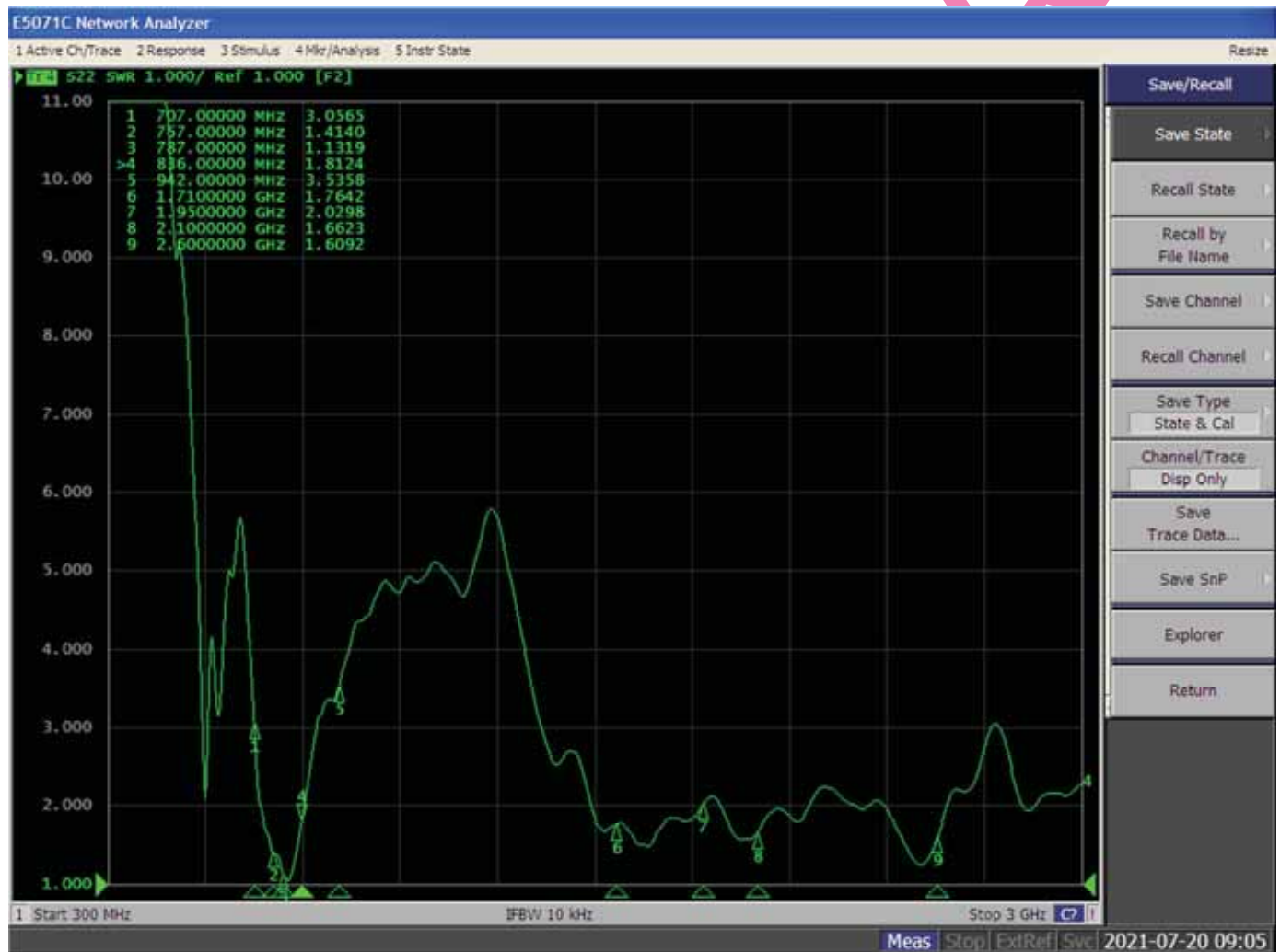
Type:PIFA

4.3. Environmental Characteristics

Operating Temperature: -30°C to 80°C

4.4. RF Performance Characteristics

4.4.1. SWR



4.4.2. Return Loss



4.4.3. Gain / Efficiency

Frequency	699	707.5	716	729	737.5	746	751	777	782	787
Directivity (dBi)	4.40	4.60	4.87	5.15	4.91	5.07	5.18	5.16	4.77	4.65
Efficiency (dB)	-9.47	-8.36	-7.40	-6.76	-5.86	-5.17	-4.93	-5.15	-5.07	-4.90
Efficiency (%)	11.29	14.59	18.22	21.10	25.97	30.39	32.14	30.56	31.15	32.38
Peak Gain (dBi)	-5.07	-3.76	-2.53	-1.61	-0.94	-0.11	0.25	0.02	-0.29	-0.25

Frequency	814	824	831.5	836.5	849	859	869	876.5	881.5	894
Directivity (dBi)	3.64	3.70	3.80	3.76	3.53	3.60	3.57	3.55	3.57	4.10
Efficiency (dB)	-3.16	-2.91	-2.87	-2.79	-3.02	-3.15	-3.38	-3.44	-3.49	-3.69
Efficiency (%)	48.33	51.21	51.67	52.59	49.85	48.39	45.89	45.27	44.74	42.72
Peak Gain (dBi)	0.48	0.79	0.93	0.97	0.51	0.45	0.19	0.11	0.08	0.41

Frequency	1710	1732.5	1755	1850	1880	1882.5	1910	1915	1930	1960
Directivity (dBi)	6.64	6.41	6.19	5.10	5.09	5.16	5.35	5.27	4.95	5.07
Efficiency (dB)	-2.80	-3.21	-3.40	-5.16	-4.92	-4.87	-4.56	-4.57	-4.59	-4.67
Efficiency (%)	52.52	47.76	45.72	30.51	32.25	32.59	34.97	34.88	34.72	34.12
Peak Gain (dBi)	2.14	2.20	2.30	-0.06	0.17	0.29	0.78	0.70	0.35	0.40

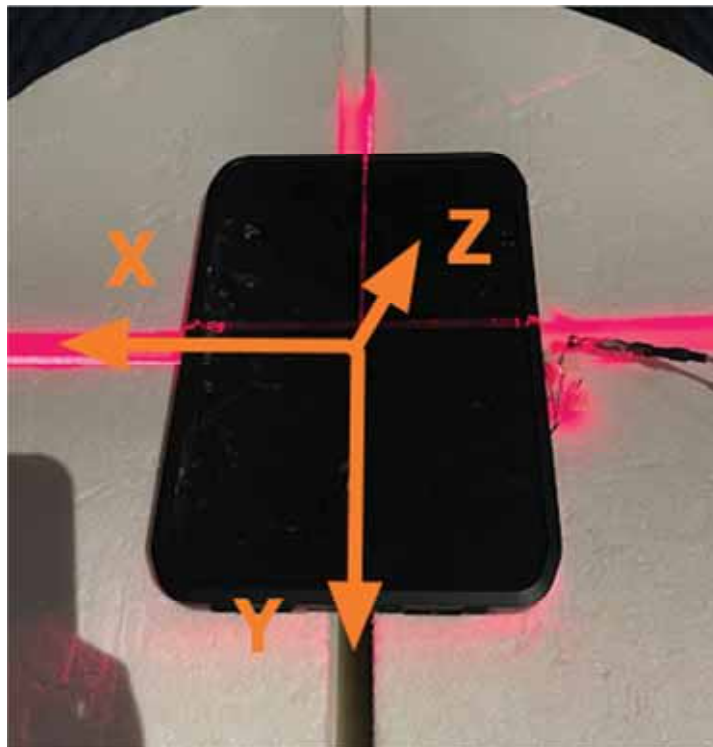
Frequency	1962.5	1990	1995	2110	2132.5	2155	2305	2310	2315	2350
Directivity (dBi)	5.14	5.57	5.62	5.74	5.78	5.55	3.73	3.71	3.72	4.04
Efficiency (dB)	-4.67	-4.55	-4.47	-4.56	-4.70	-4.81	-5.11	-5.13	-5.12	-4.91
Efficiency (%)	34.15	35.09	35.75	34.97	33.87	33.01	30.83	30.71	30.75	32.30
Peak Gain (dBi)	0.47	1.02	1.15	1.18	1.08	0.73	-1.38	-1.41	-1.40	-0.87

Frequency	2355	2360	2496	2500	2535	2570	2593	2620	2655	2690
Directivity (dBi)	4.10	4.20	5.04	4.98	5.15	5.13	5.51	5.36	5.74	5.80
Efficiency (dB)	-4.87	-4.82	-5.55	-5.52	-5.66	-5.79	-5.98	-6.22	-6.71	-6.60
Efficiency (%)	32.55	32.94	27.89	28.08	27.14	26.36	25.25	23.89	21.31	21.90
Peak Gain (dBi)	-0.78	-0.62	-0.51	-0.54	-0.51	-0.66	-0.47	-0.86	-0.97	-0.80

Frequency	3300	3550	3625	3700	3750	3800	4200	4400	4700	5000
Directivity (dBi)	5.93	6.83	7.27	7.07	6.51	5.54	7.15	7.90	5.23	5.25
Efficiency (dB)	-6.37	-7.86	-9.26	-9.87	-9.17	-8.24	-8.58	-6.69	-6.39	-6.41
Efficiency (%)	23.07	16.38	11.85	10.30	12.10	14.99	13.88	21.42	22.95	22.85
Peak Gain (dBi)	-0.44	-1.02	-1.99	-2.80	-2.66	-2.70	-1.42	1.20	-1.16	-1.16

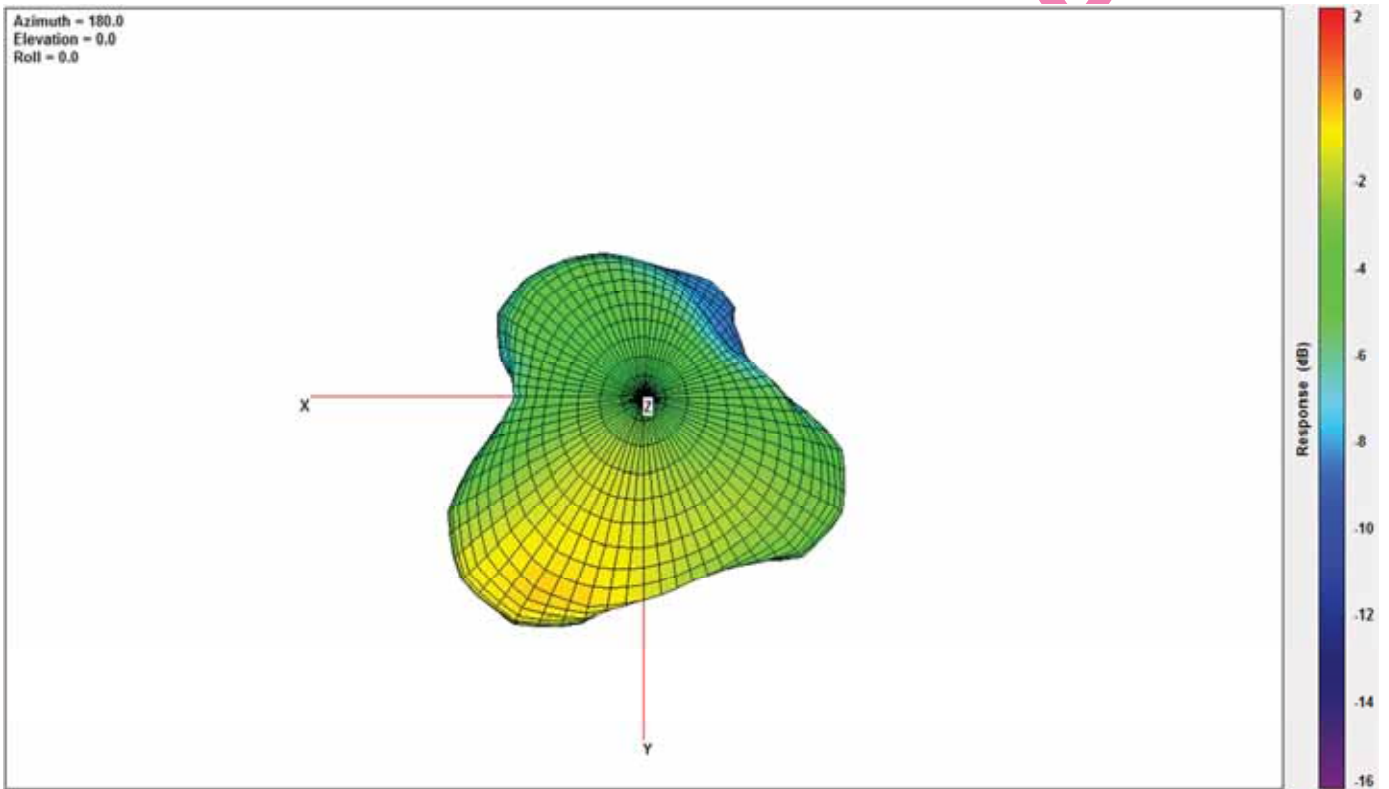
4.4.4. Radiation Patterns

4.4.4.1. Tets Setup



4.4.4.2. Straight 2D & 3D Radiation Patterns

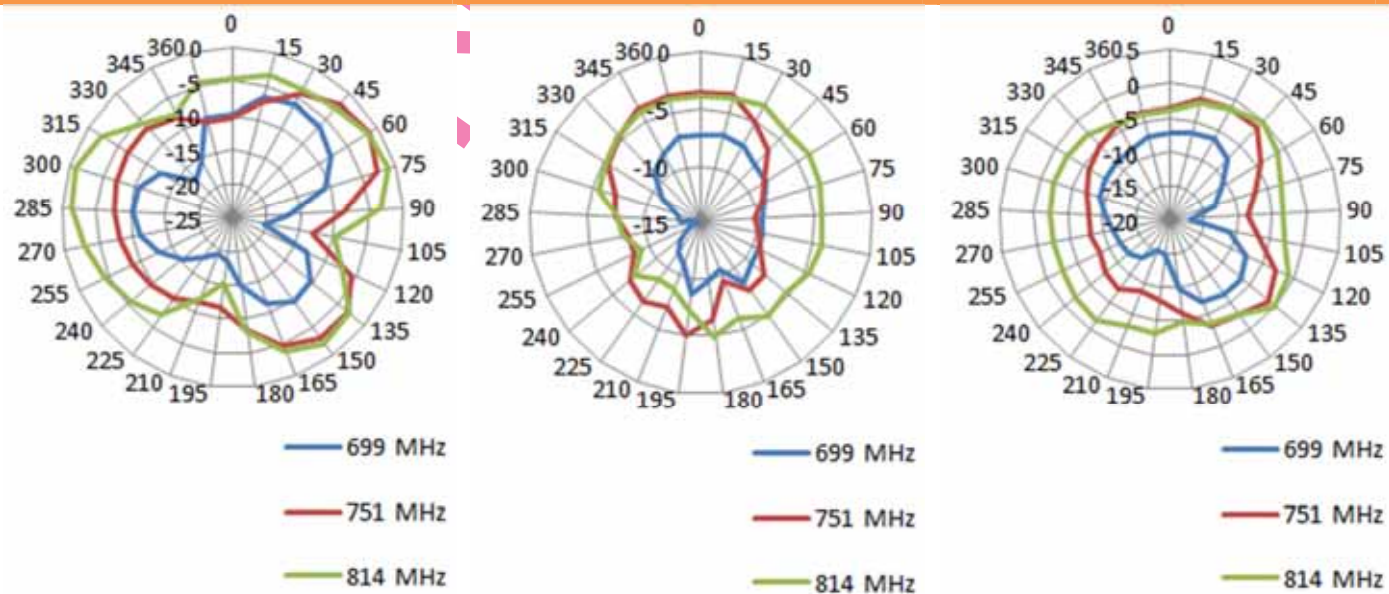
751MHz



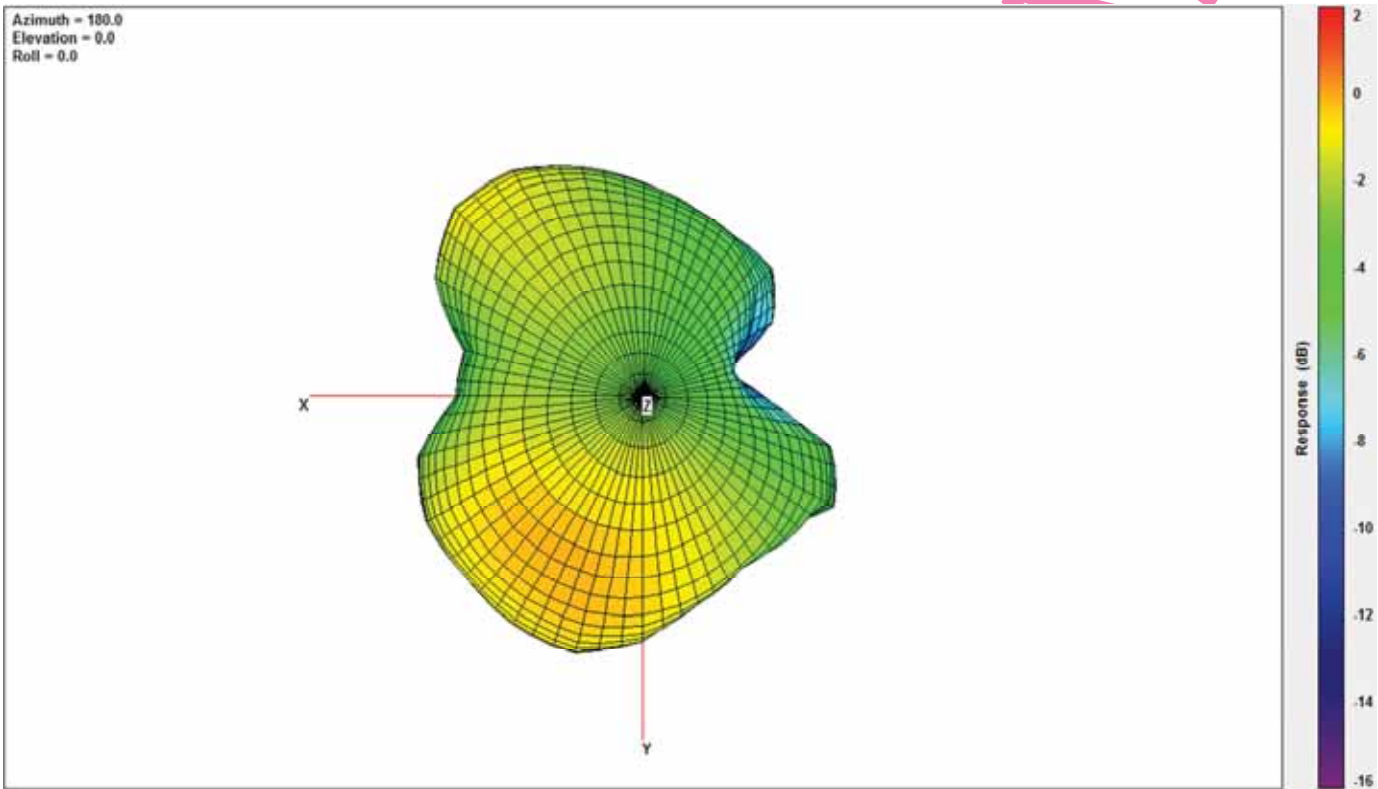
XY Plane

XZ Plane

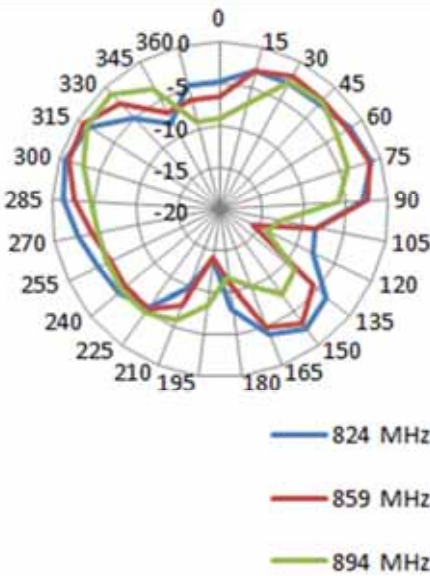
YZ Plane



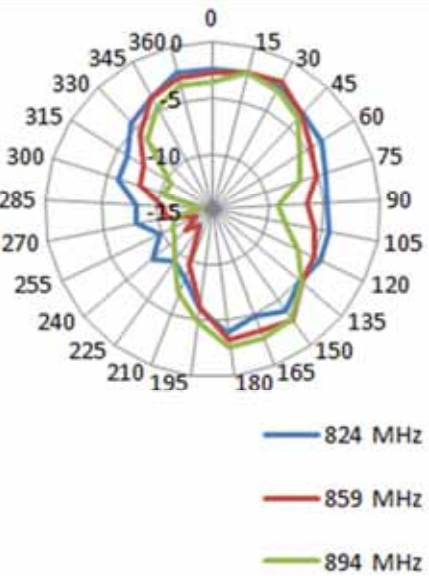
859MHz



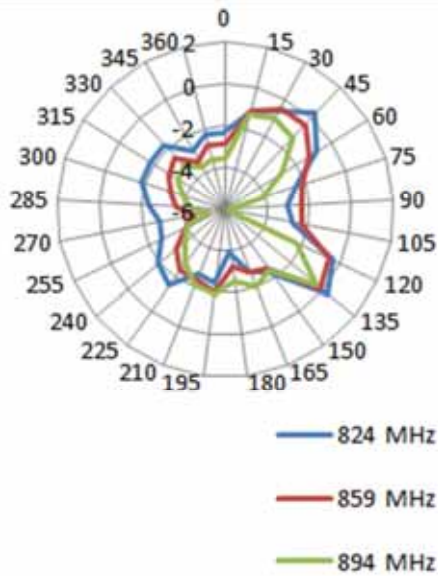
XY Plane



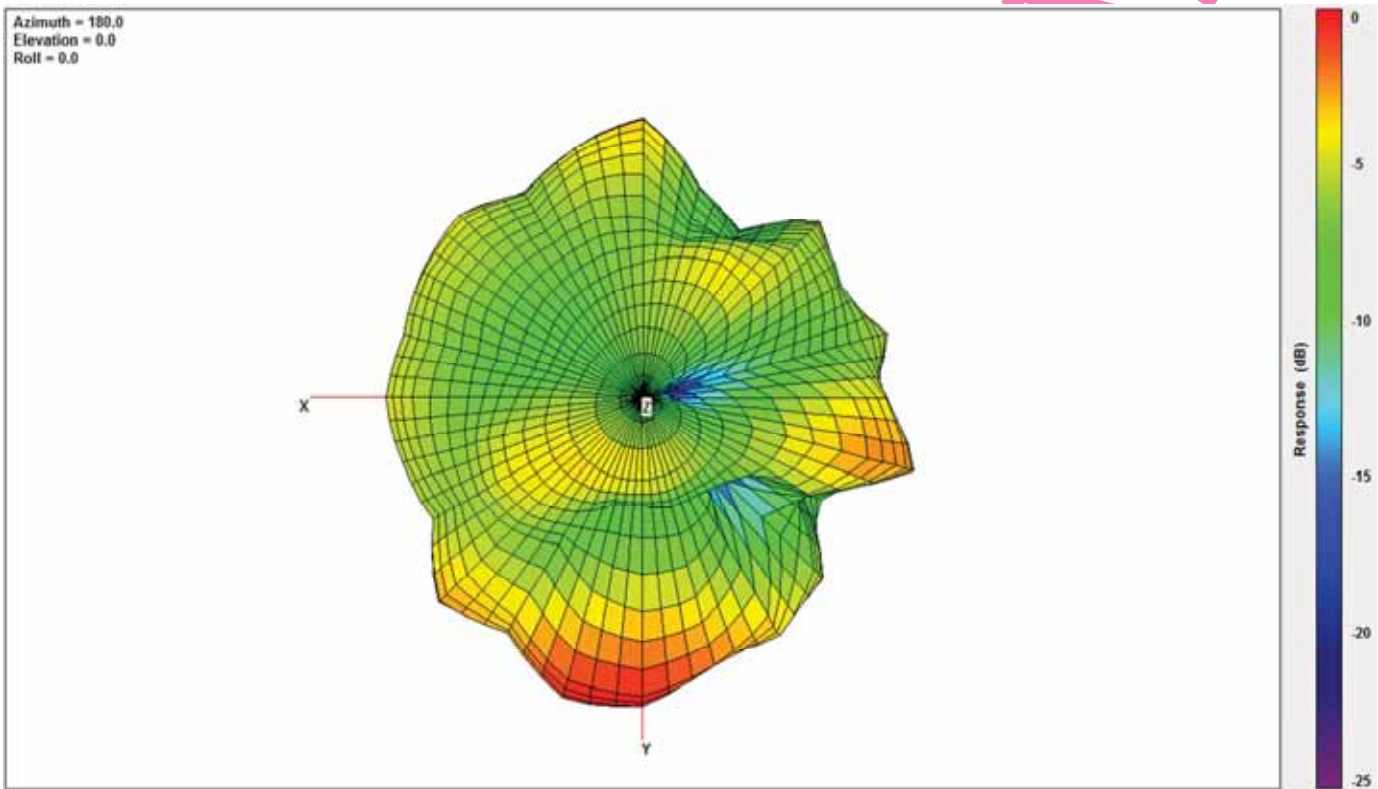
XZ Plane



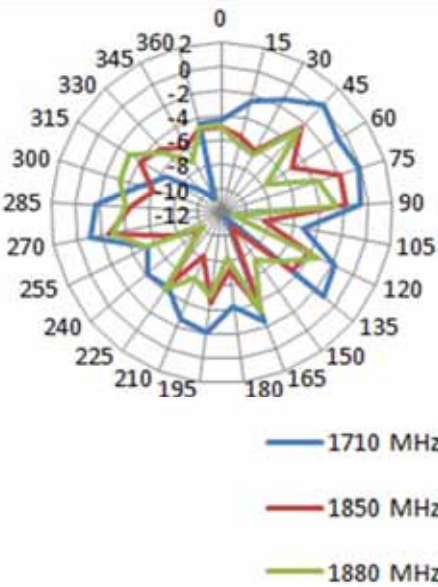
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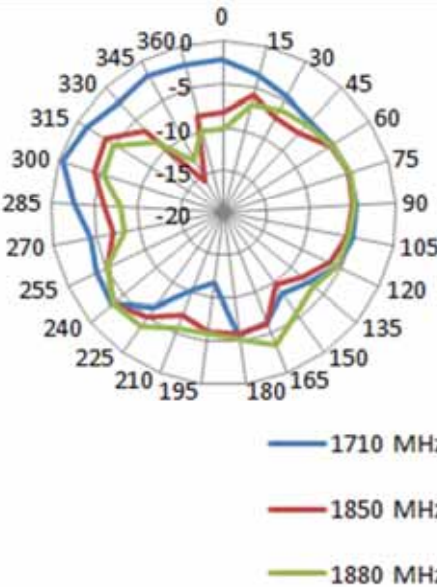
1850MHz



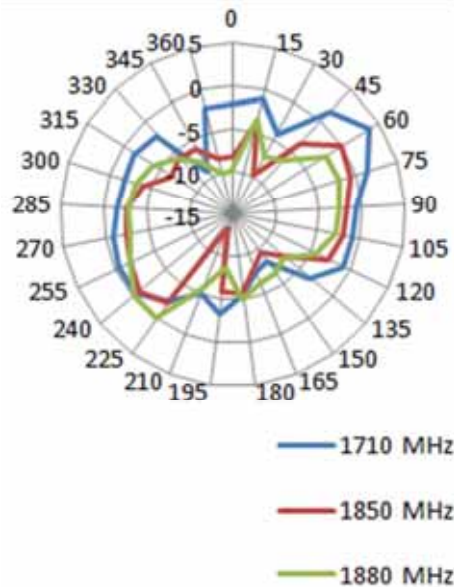
XY Plane



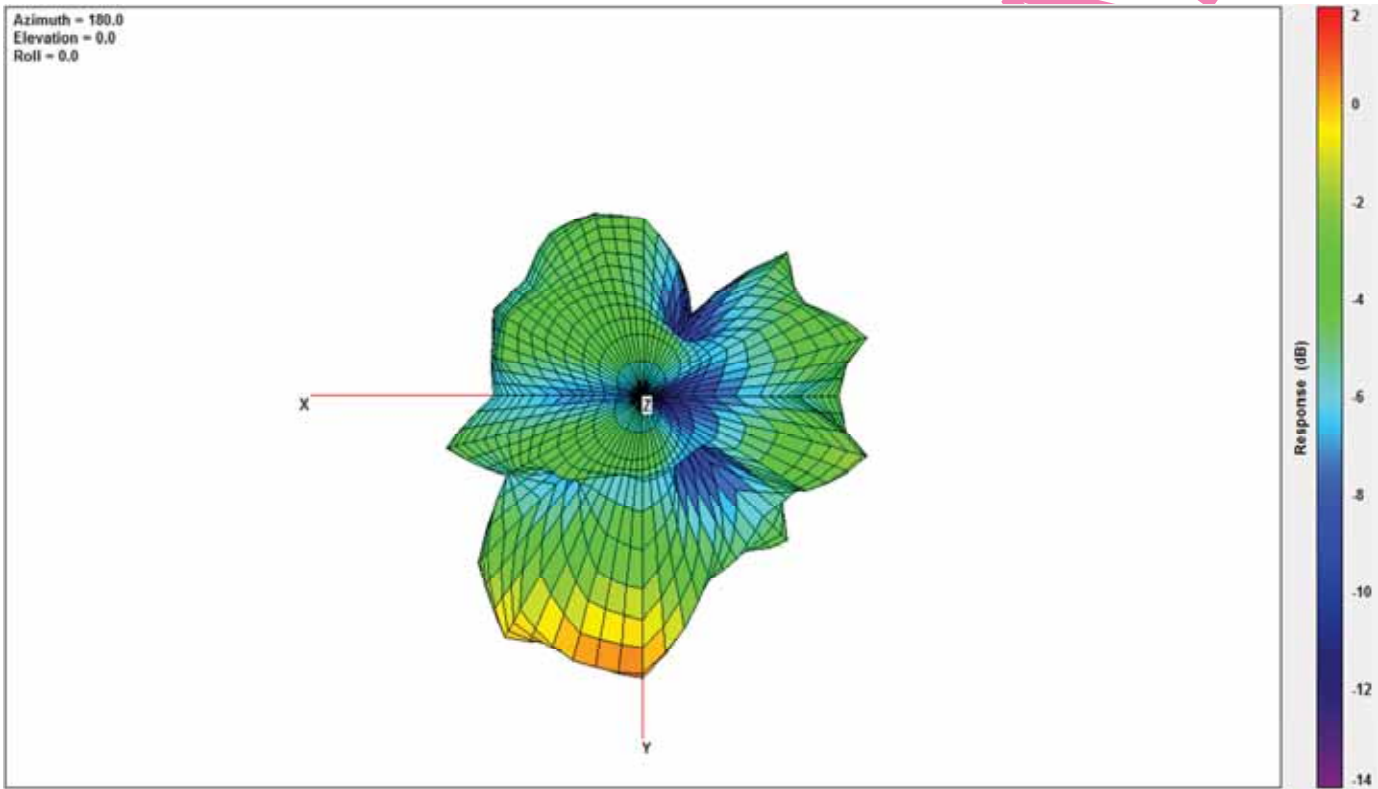
XZ Plane



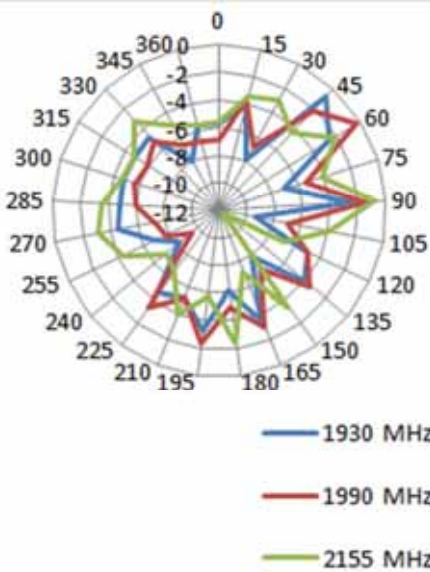
YZ Plane



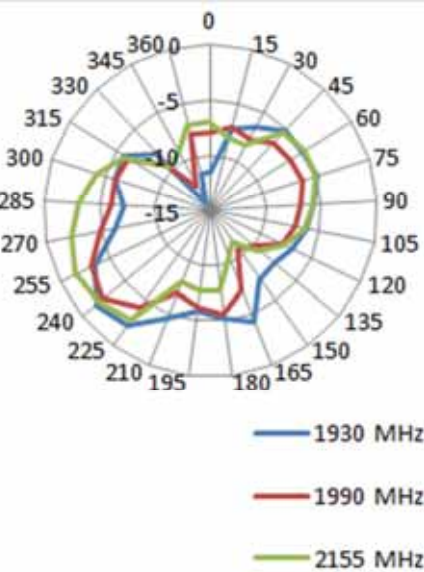
1990MHz



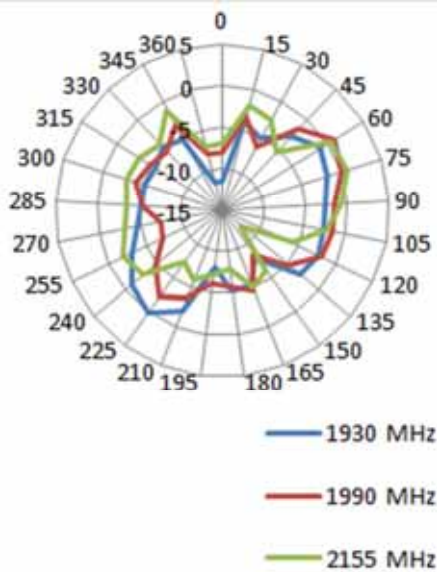
XY Plane



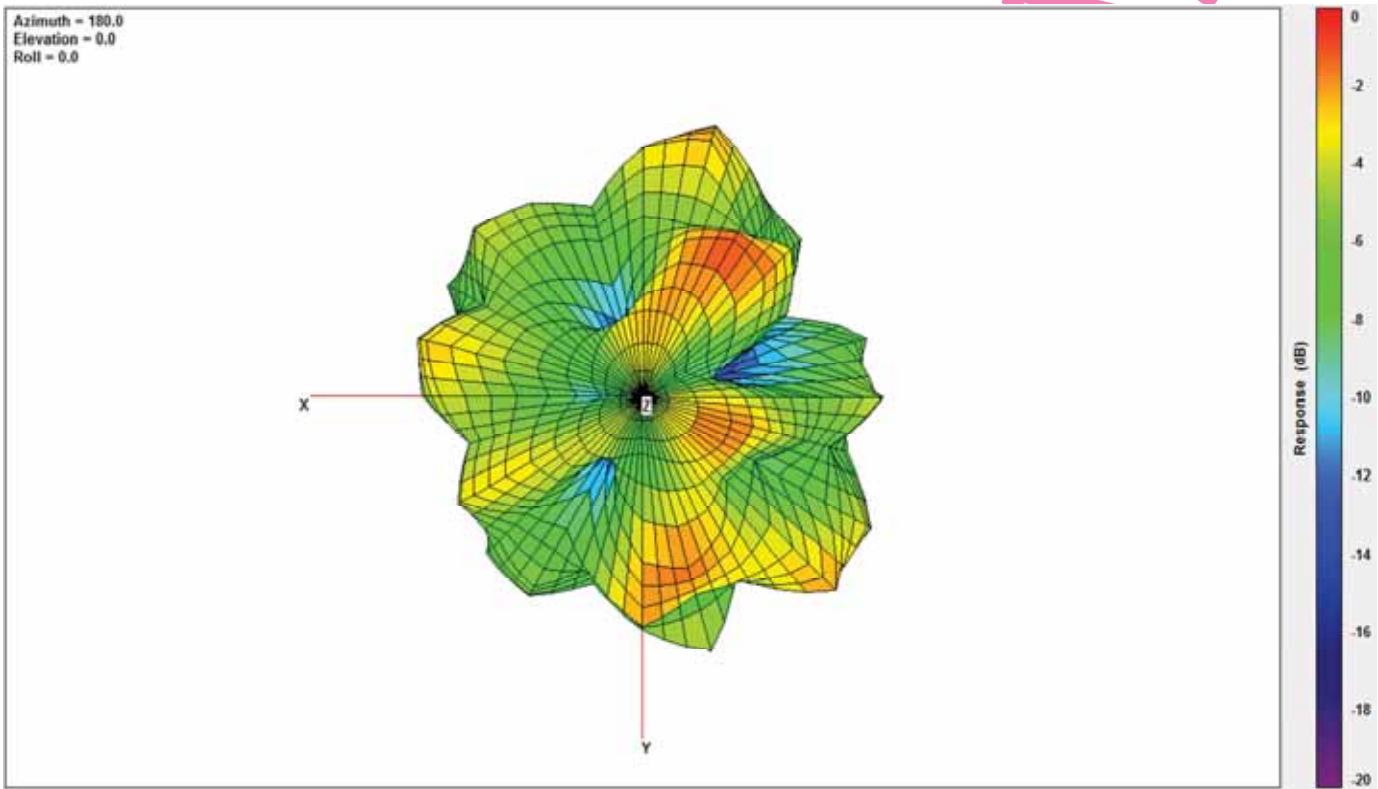
XZ Plane



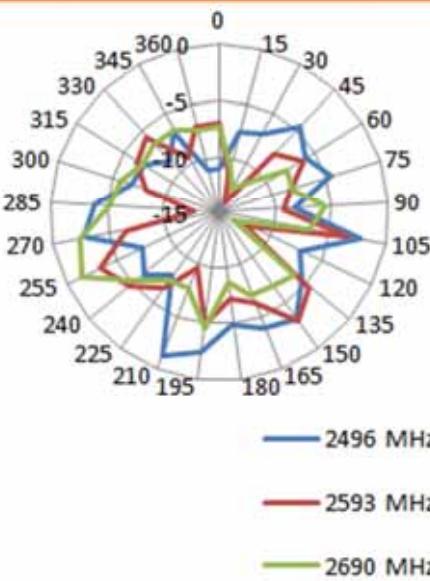
YZ Plane



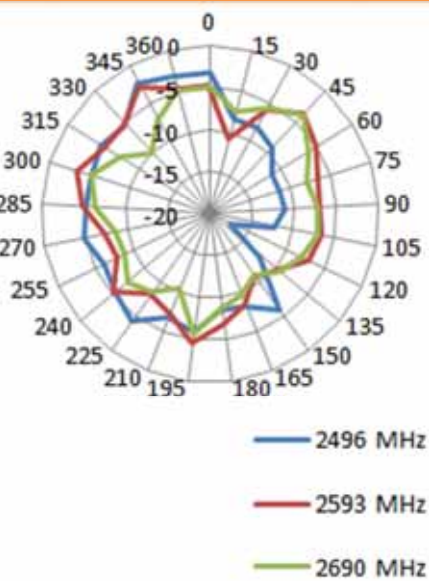
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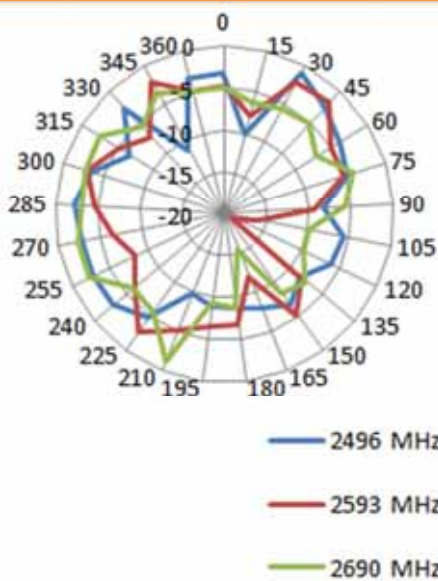
XY Plane



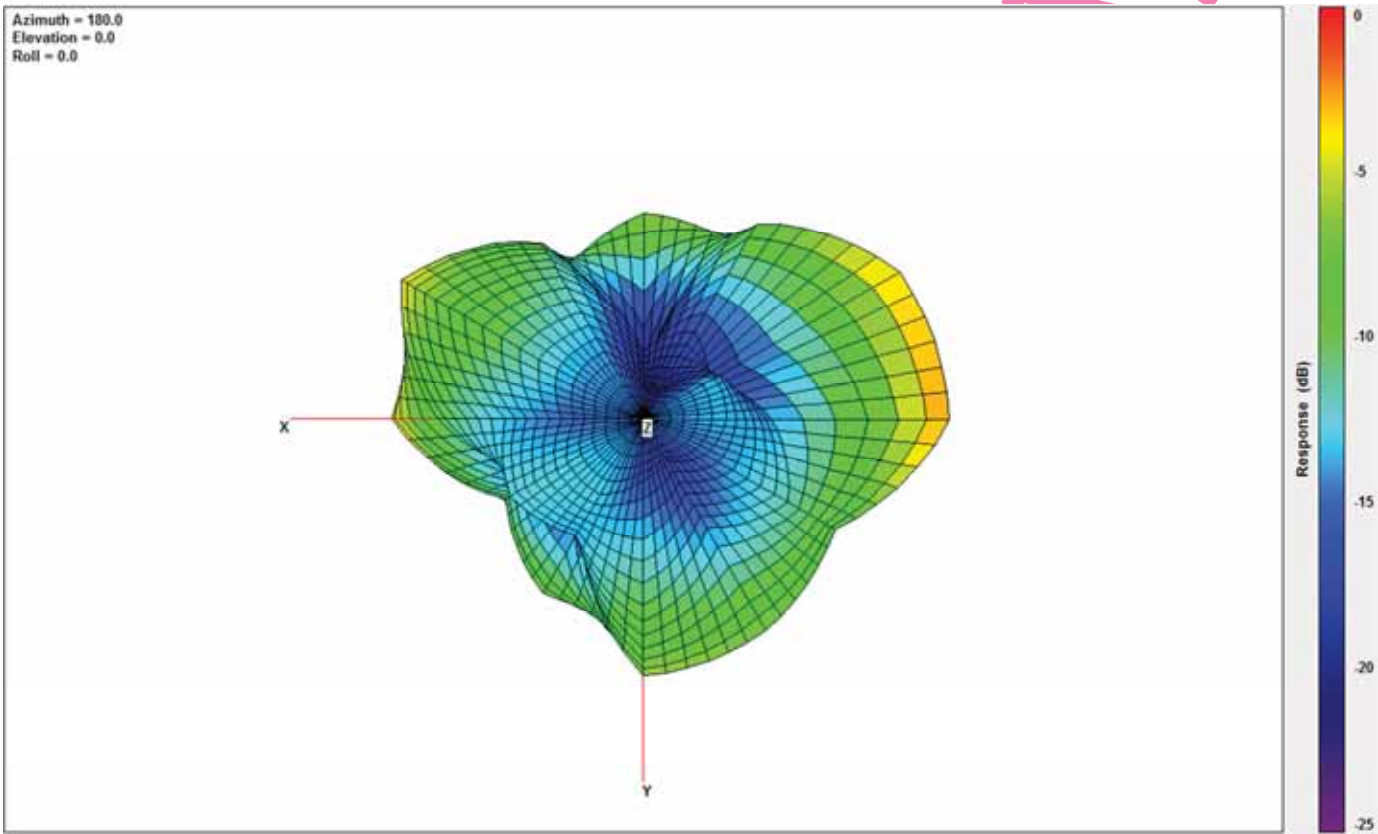
XZ Plane



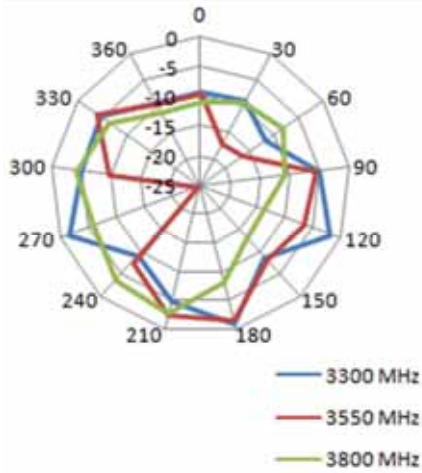
YZ Plane



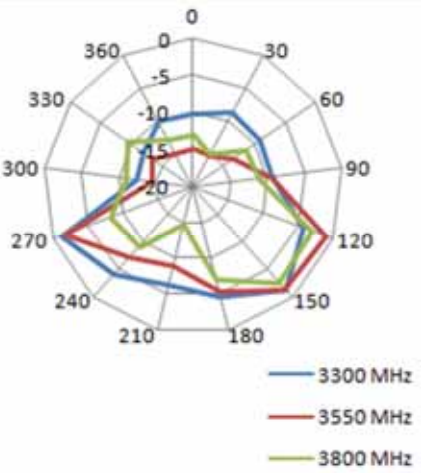
3550MHz



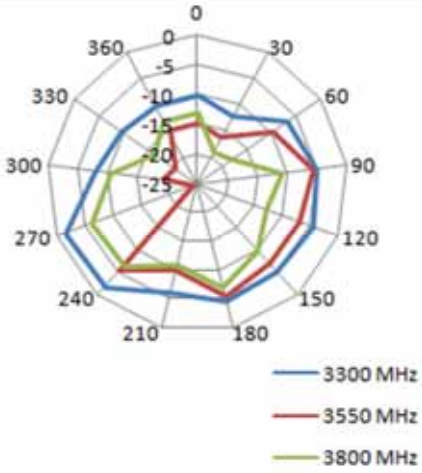
XY Plane



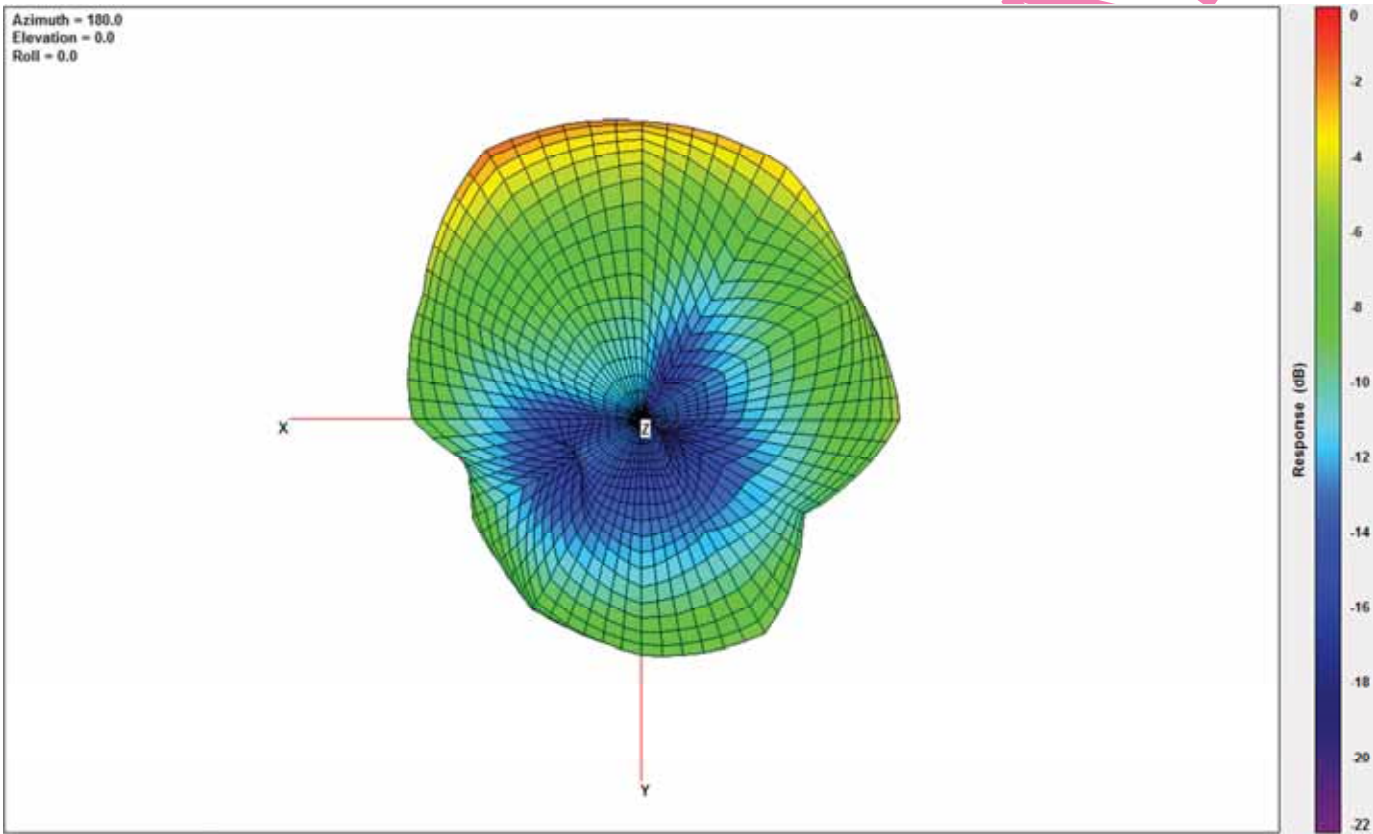
XZ Plane



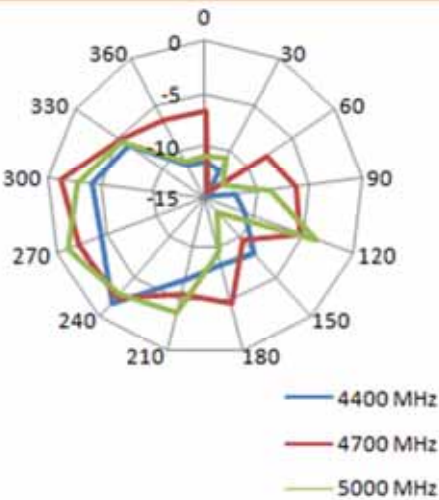
YZ Plane



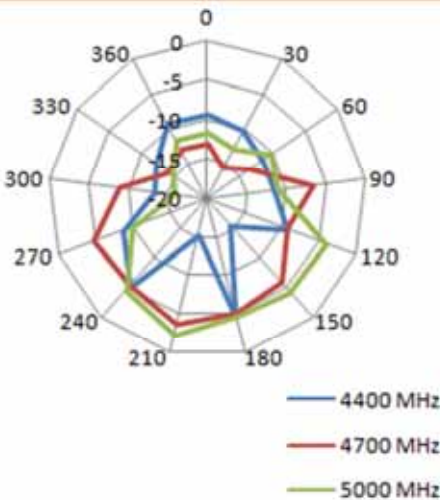
4700MHz



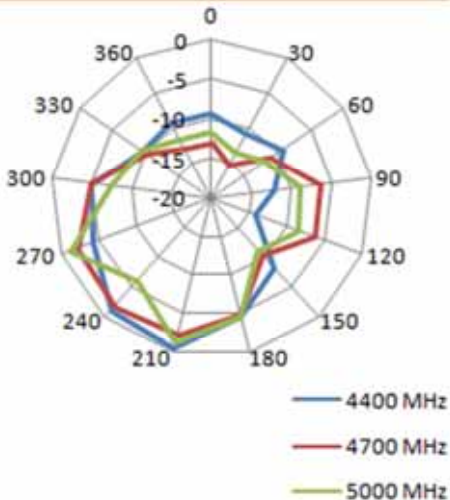
XY Plane



XZ Plane



YZ Plane



4.5. Drawing

LTE Main Antenna Layout Drawing



RF Cable Drawing



Antenna Assembly



Winmate Part Number: 90RF0100001B

5. LTE Aux Antenna Specification

Winmate Part Number: 90RF02000013

5.1. Electrical Characteristics

Frequency(MHz): 700-960 / 1710-2170 / 2500-2690

SWR: $\leq 3.43:1$ typ. (with Enclosure)

Peak Gain: 2.28dBi typ. (with Enclosure)

Impedance: 50ohm

Polarization: Linear

5.2. Mechanical Characteristics

Cable: 50 Ω φ 0.81 RF cable

Connector: MHF 4

PCB: FPCB /Thickness 0.2mm

Type: Monopole

5.3. Environmental Characteristics

Operating Temperature: -30°C to 80°C

5.4. RF Performance Characteristics

5.4.1. SWR



5.4.2. Return Loss



5.4.3. Gain / Efficiency

Frequency	699	707.5	716	729	737.5	746	751	777	782	787
Directivity (dBi)	3.95	3.77	3.55	3.94	4.58	5.28	5.44	6.12	6.09	5.92
Efficiency (dB)	-5.78	-5.92	-5.23	-4.68	-4.60	-4.43	-4.13	-3.84	-3.96	-4.02
Efficiency (%)	26.45	25.61	30.02	34.08	34.70	36.08	38.61	41.34	40.21	39.67
Peak Gain (dBi)	-1.83	-2.15	-1.68	-0.73	-0.01	0.85	1.30	2.28	2.13	1.91

Frequency	814	824	831.5	836.5	849	859	869	876.5	881.5	894
Directivity (dBi)	5.34	5.80	5.61	5.15	5.62	6.34	6.97	7.17	7.16	6.96
Efficiency (dB)	-4.27	-4.70	-5.11	-5.30	-5.92	-6.44	-7.19	-7.50	-7.59	-7.95
Efficiency (%)	37.41	33.91	30.81	29.53	25.57	22.67	19.08	17.79	17.41	16.04
Peak Gain (dBi)	1.07	1.10	0.50	-0.14	-0.30	-0.11	-0.22	-0.33	-0.43	-0.99

Frequency	1710	1732.5	1755	1850	1880	1882.5	1910	1915	1930	1960
Directivity (dBi)	6.38	5.71	4.61	5.07	4.83	4.84	4.90	4.88	4.90	5.38
Efficiency (dB)	-6.07	-6.85	-6.60	-4.81	-4.64	-4.62	-4.59	-4.64	-4.63	-4.62
Efficiency (%)	24.73	20.67	21.89	33.03	34.38	34.55	34.73	34.35	34.41	34.48
Peak Gain (dBi)	0.31	-1.14	-1.99	0.26	0.20	0.22	0.31	0.24	0.27	0.76

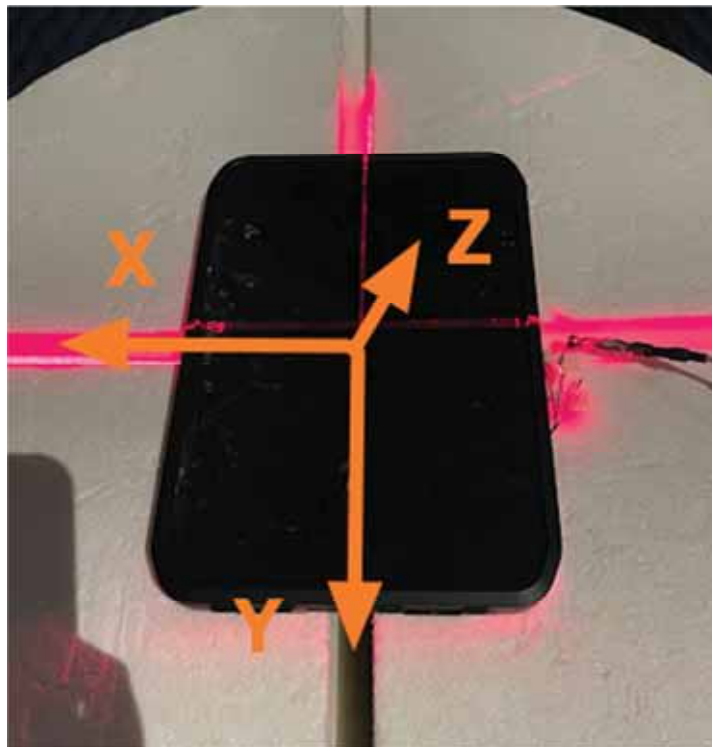
Frequency	1962.5	1990	1995	2110	2132.5	2155	2305	2310	2315	2350
Directivity (dBi)	5.42	5.47	5.45	4.37	4.63	4.83	6.10	6.02	5.96	5.91
Efficiency (dB)	-4.63	-4.91	-4.92	-5.05	-5.27	-5.55	-4.50	-4.59	-4.61	-4.68
Efficiency (%)	34.40	32.29	32.24	31.25	29.73	27.85	35.48	34.76	34.60	34.01
Peak Gain (dBi)	0.78	0.56	0.53	-0.68	-0.64	-0.72	1.60	1.43	1.36	1.23

Frequency	2355	2360	2496	2500	2535	2570	2593	2620	2655	2690
Directivity (dBi)	6.01	6.05	4.64	4.60	4.33	4.45	4.48	4.84	5.56	5.56
Efficiency (dB)	-4.69	-4.66	-4.45	-4.41	-4.62	-4.71	-4.93	-5.38	-5.79	-5.42
Efficiency (%)	33.98	34.20	35.91	36.22	34.50	33.84	32.12	29.01	26.36	28.74
Peak Gain (dBi)	1.32	1.39	0.20	0.19	-0.29	-0.26	-0.45	-0.54	-0.23	0.15

Frequency	3300	3550	3625	3700	3750	3800	4200	4400	4700	5000
Directivity (dBi)	5.13	5.34	5.36	7.06	6.77	5.98	6.23	7.12	7.31	6.78
Efficiency (dB)	-5.79	-5.41	-5.97	-6.40	-6.09	-6.38	-5.60	-5.82	-6.73	-6.52
Efficiency (%)	26.35	28.77	25.27	22.92	24.62	23.02	27.53	26.20	21.21	22.30
Peak Gain (dBi)	-0.66	-0.08	-0.61	0.67	0.68	-0.40	0.63	1.30	0.58	0.26

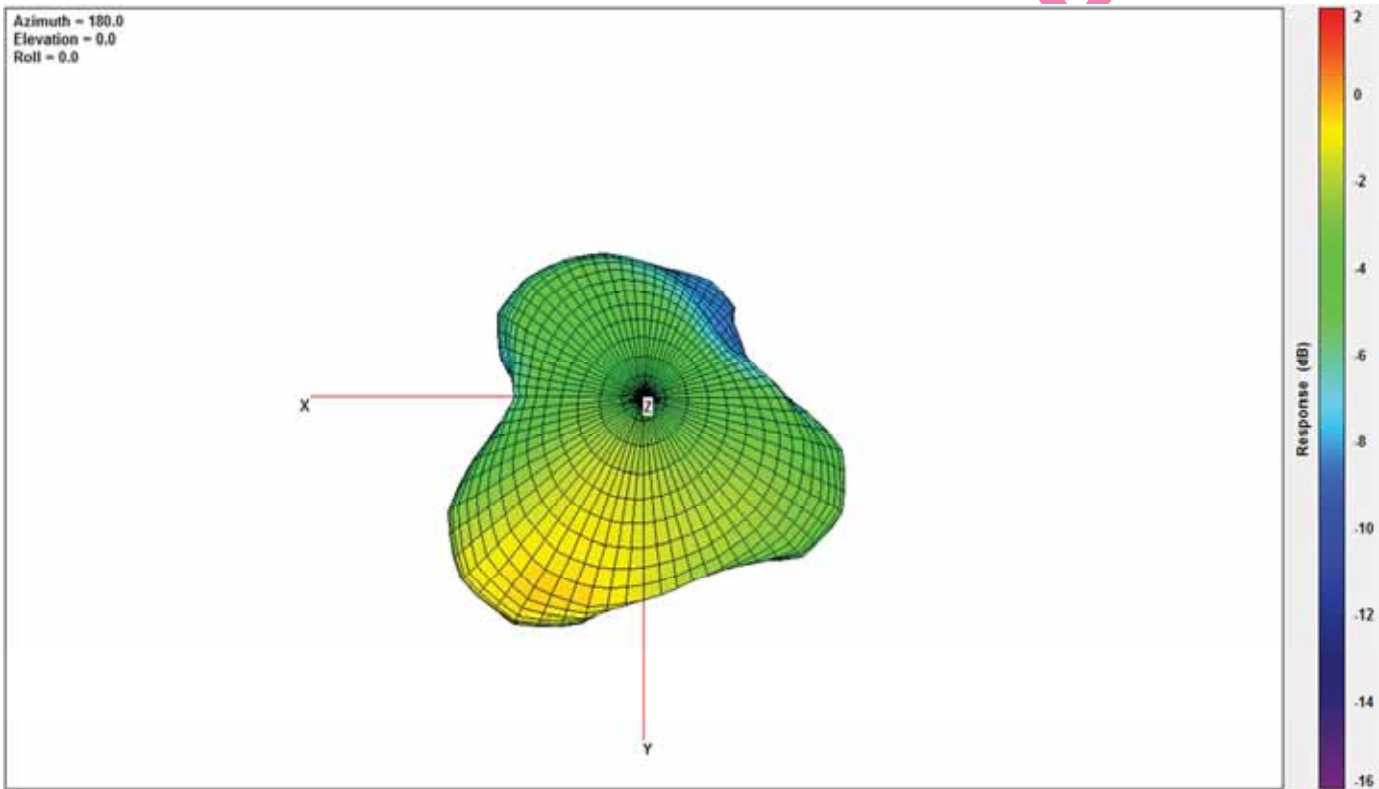
5.4.4. Radiation Patterns

5.4.4.1. Tets Setup

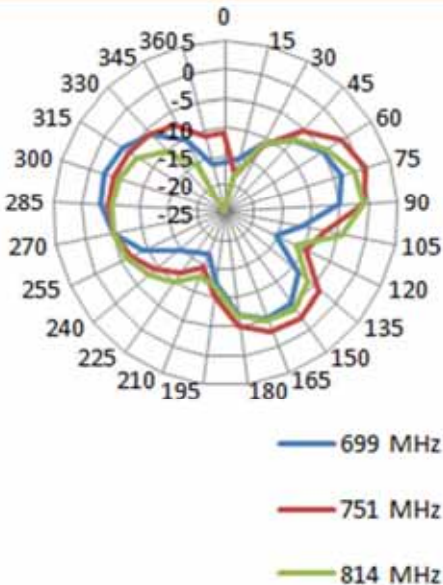


5.4.4.2. Straight 2D & 3D Radiation Patterns

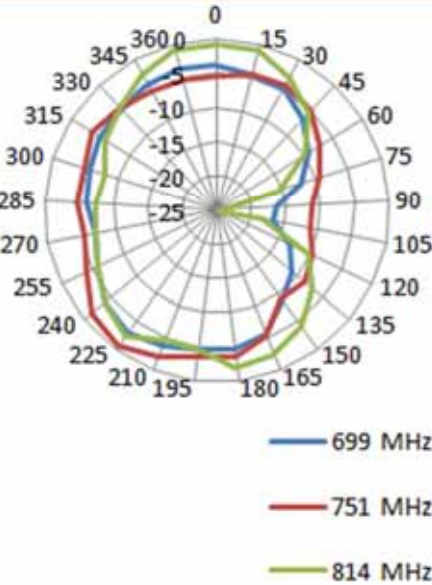
751MHz



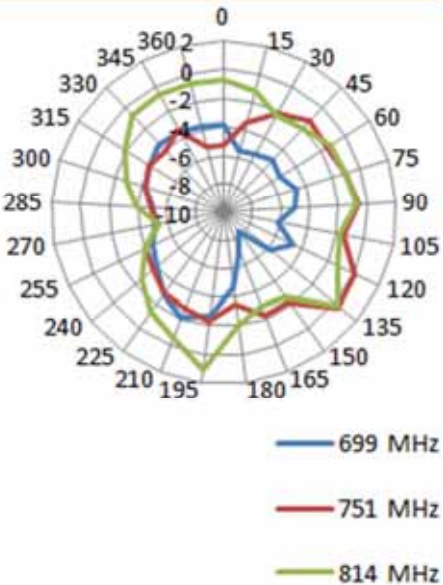
XY Plane



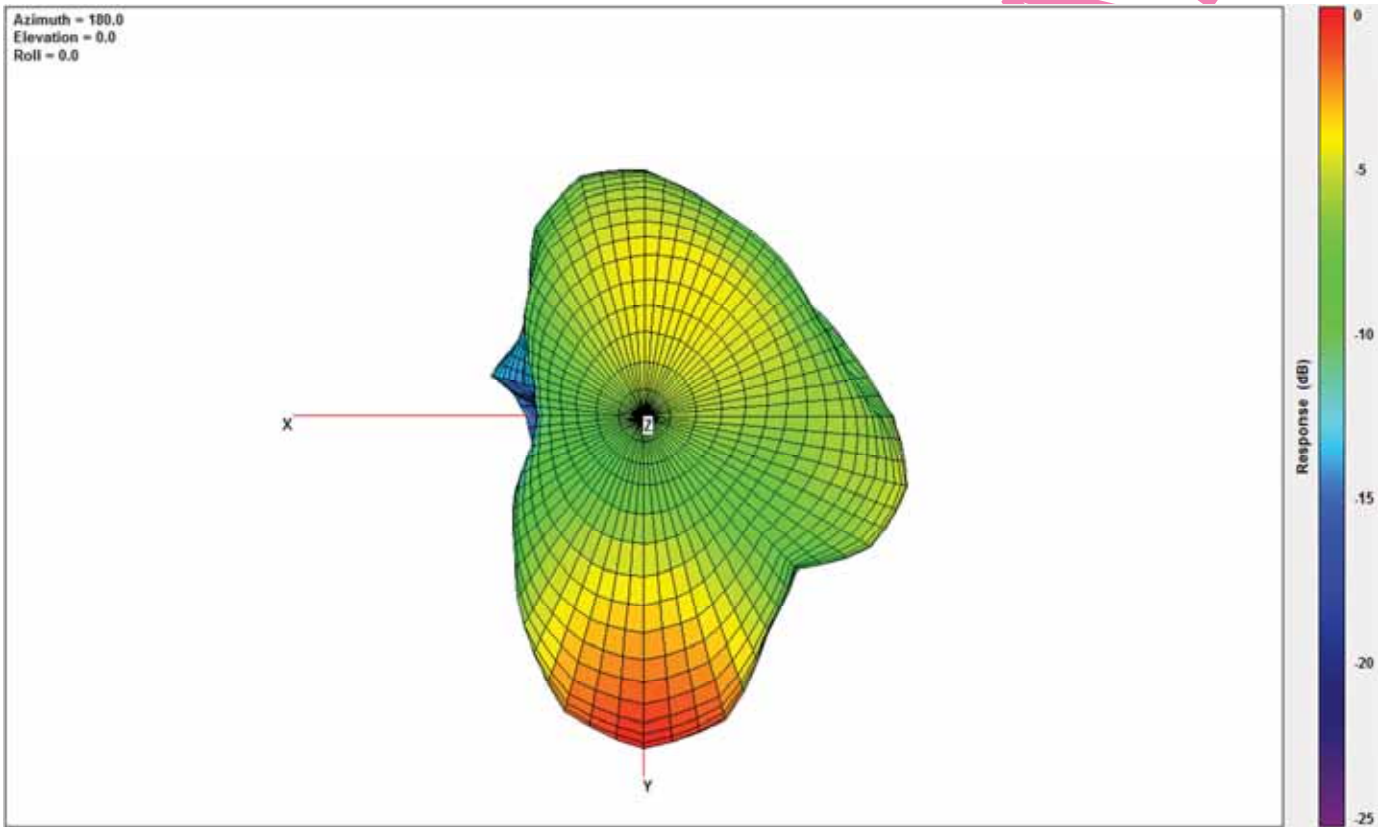
XZ Plane



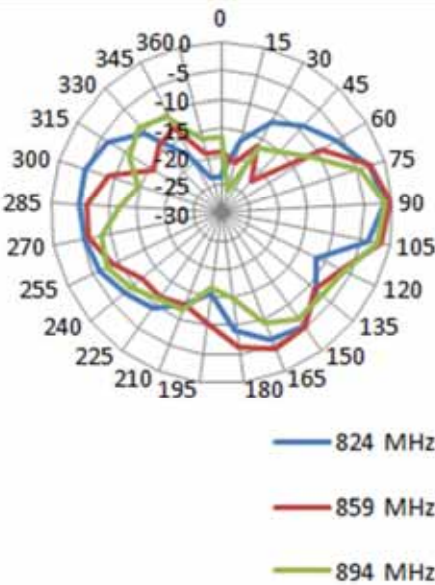
YZ Plane



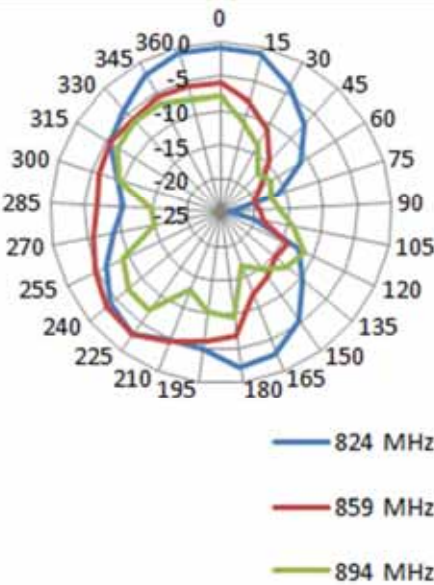
859MHz



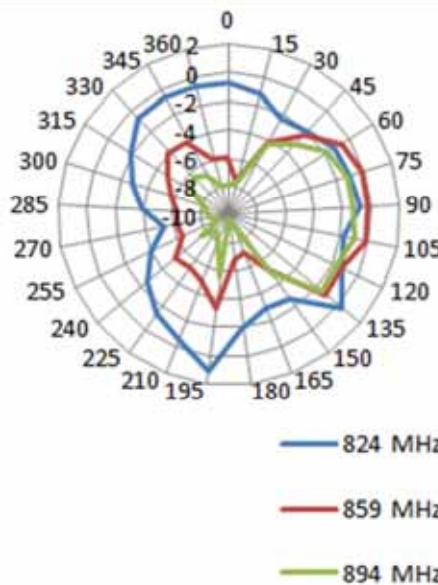
XY Plane



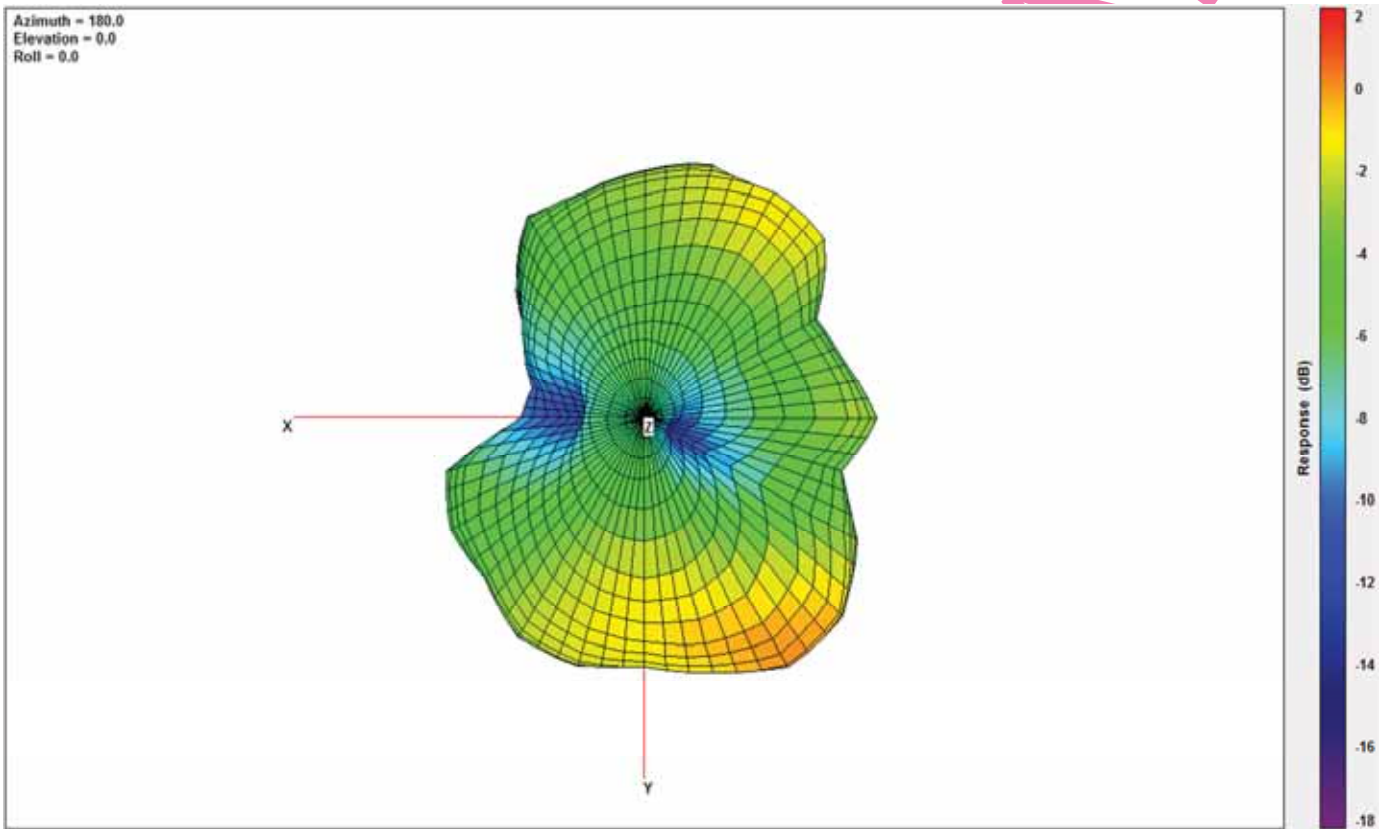
XZ Plane



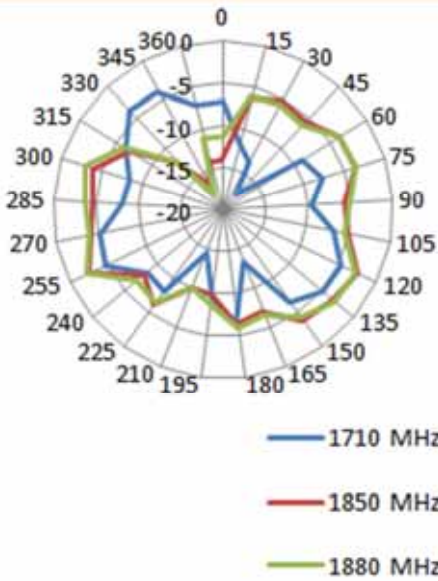
YZ Plane



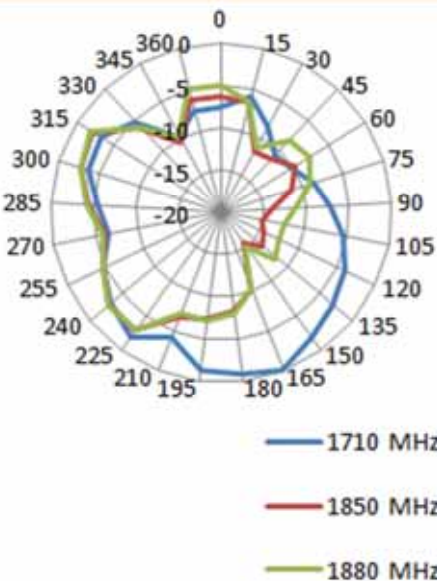
1850MHz



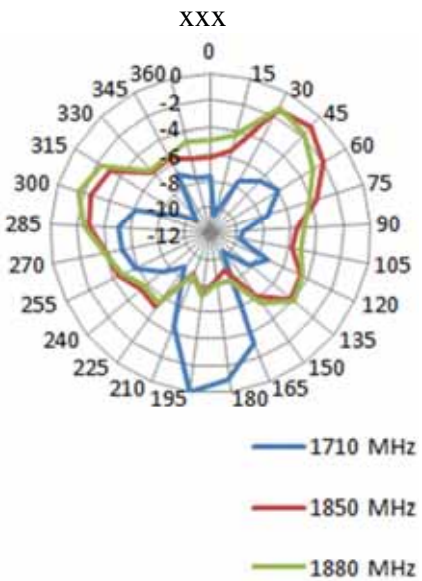
XY Plane



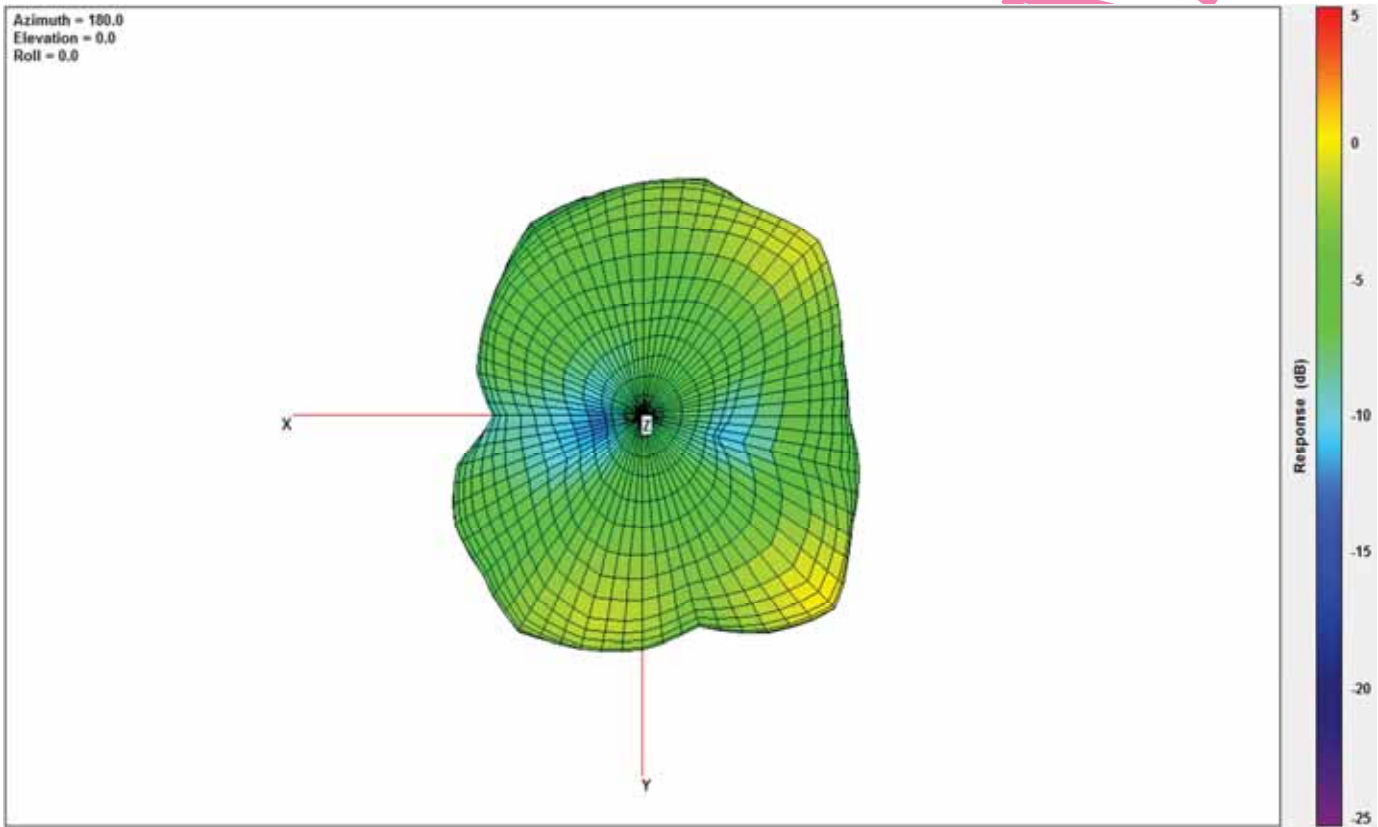
XZ Plane



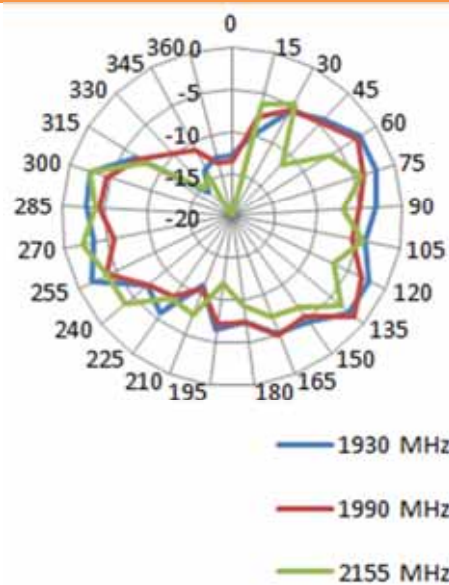
YZ Plane



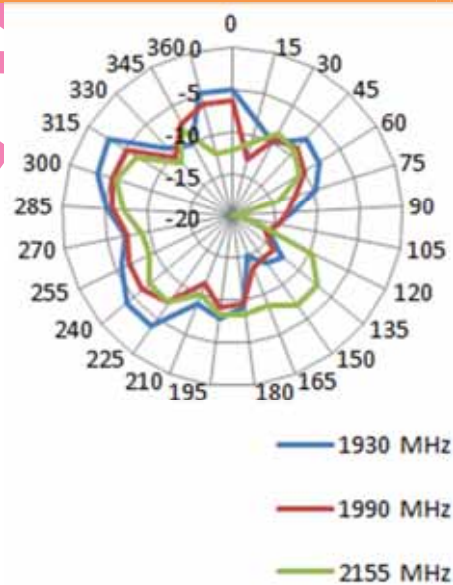
1990MHz



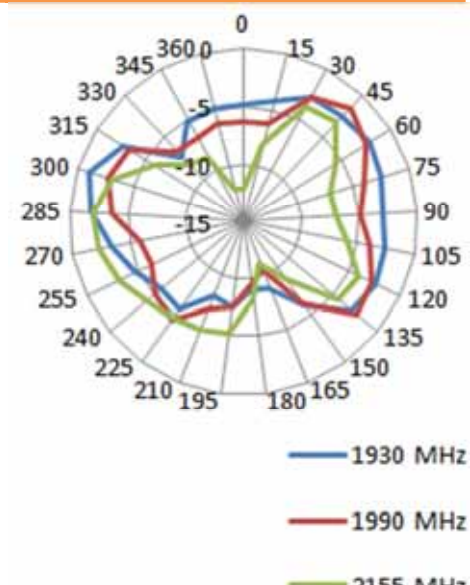
XY Plane



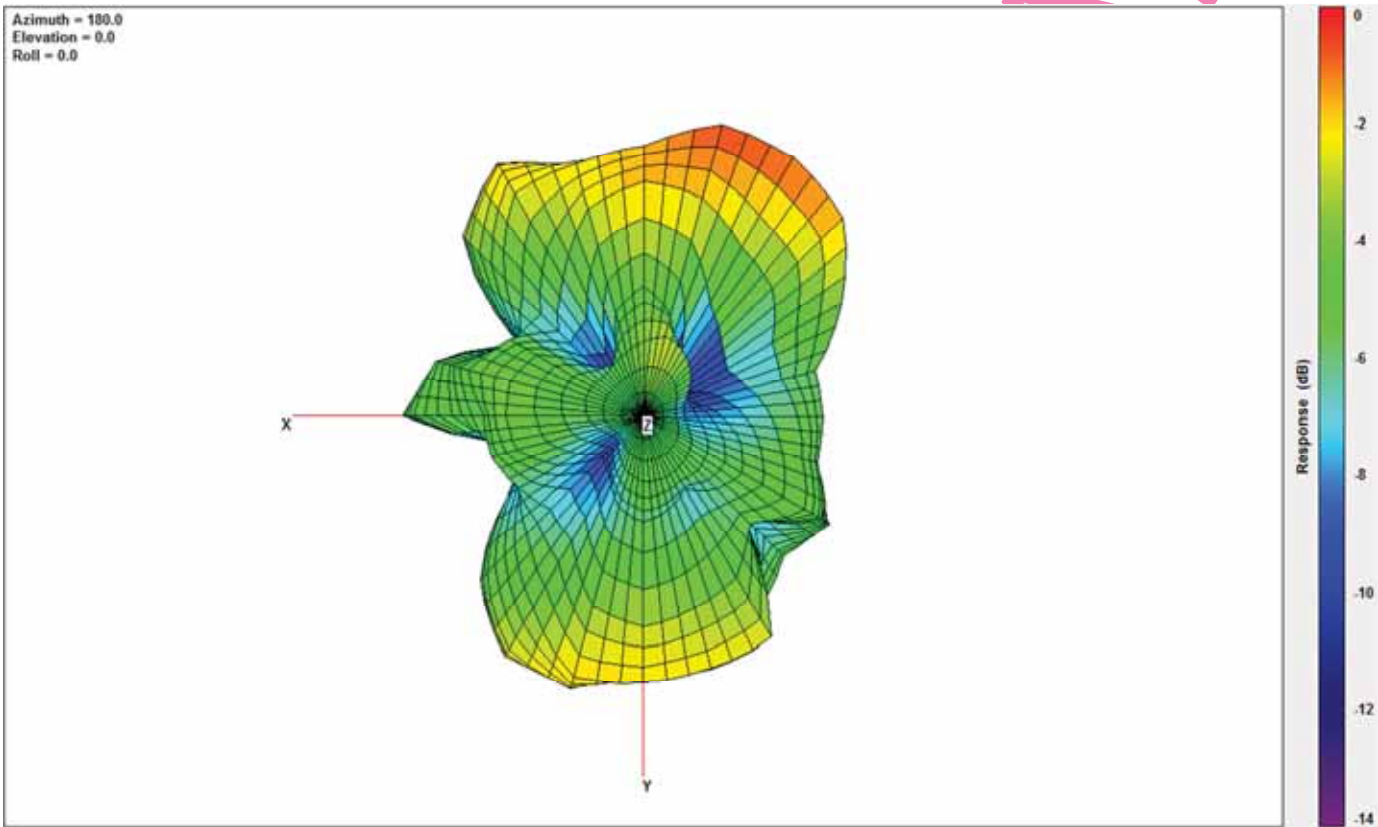
XZ Plane



YZ Plane



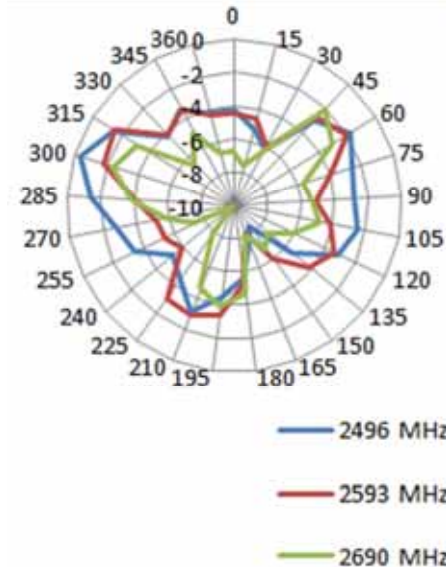
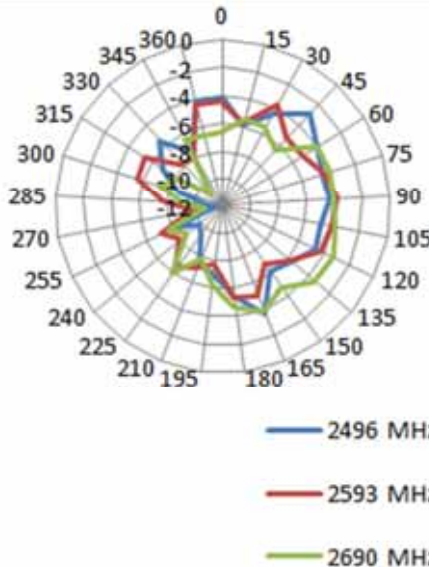
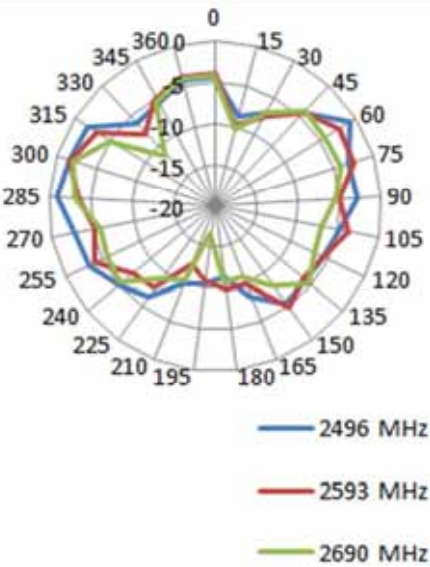
2593MHz



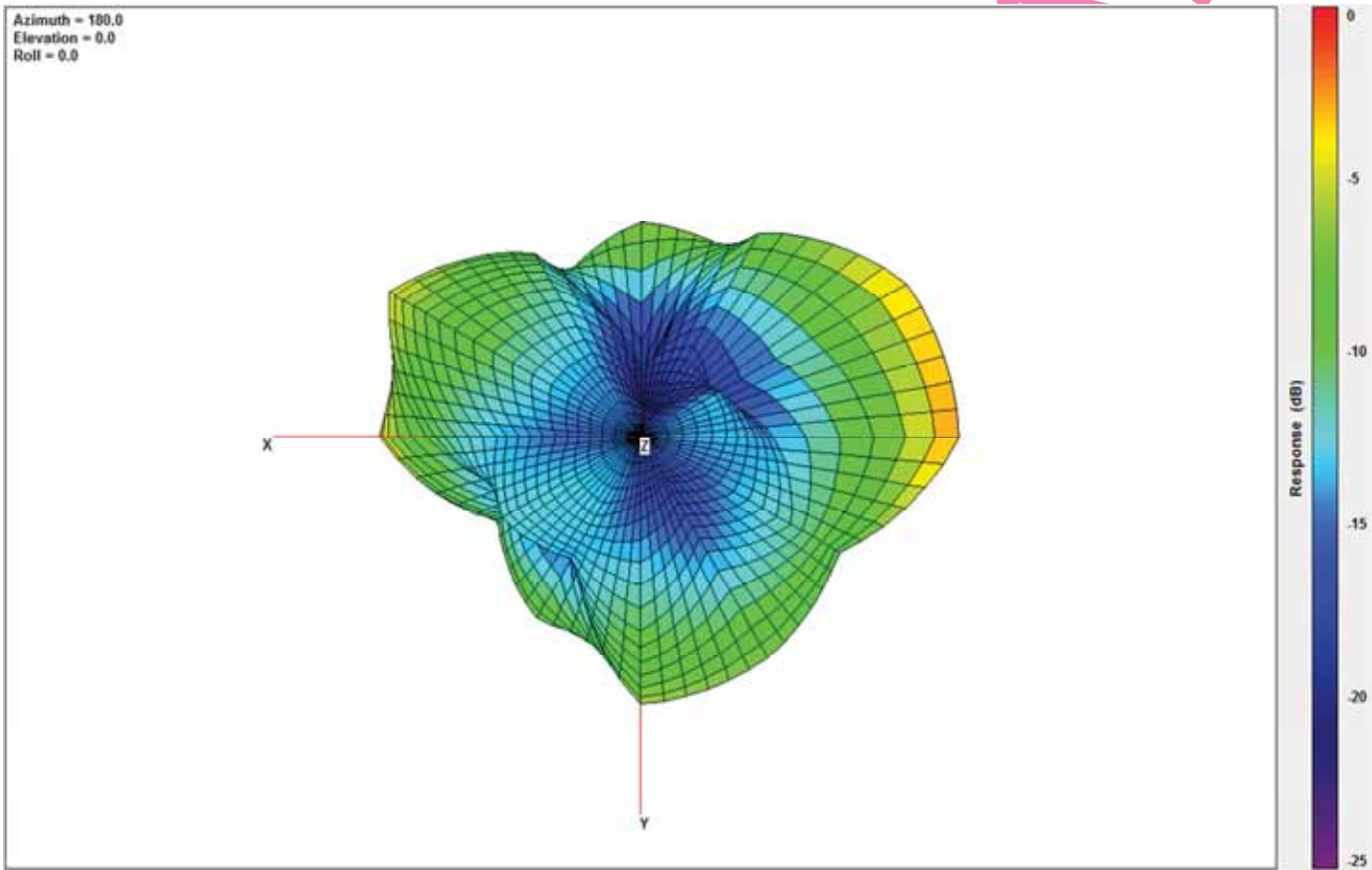
XY Plane

XZ Plane

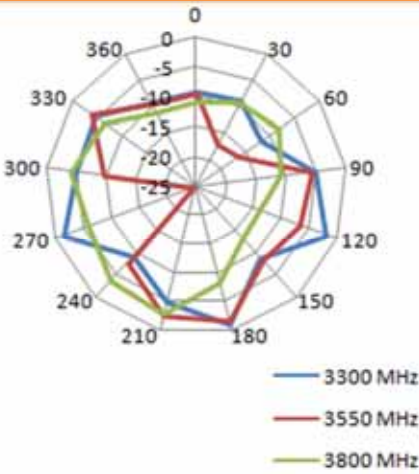
YZ Plane



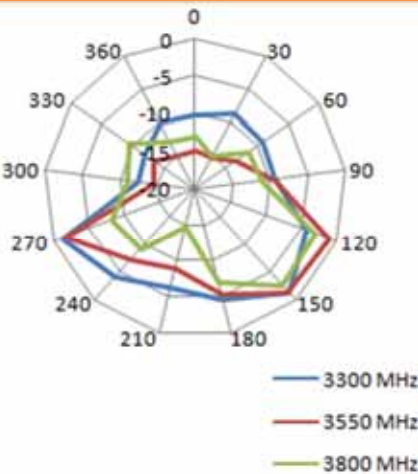
3550MHz



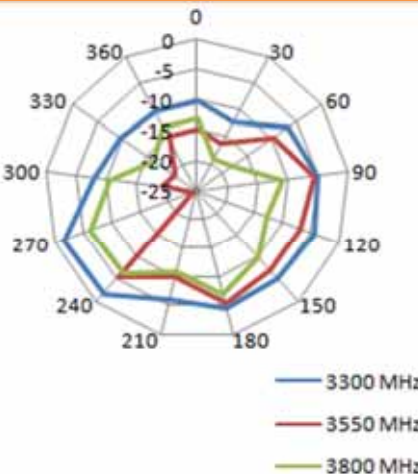
XY Plane



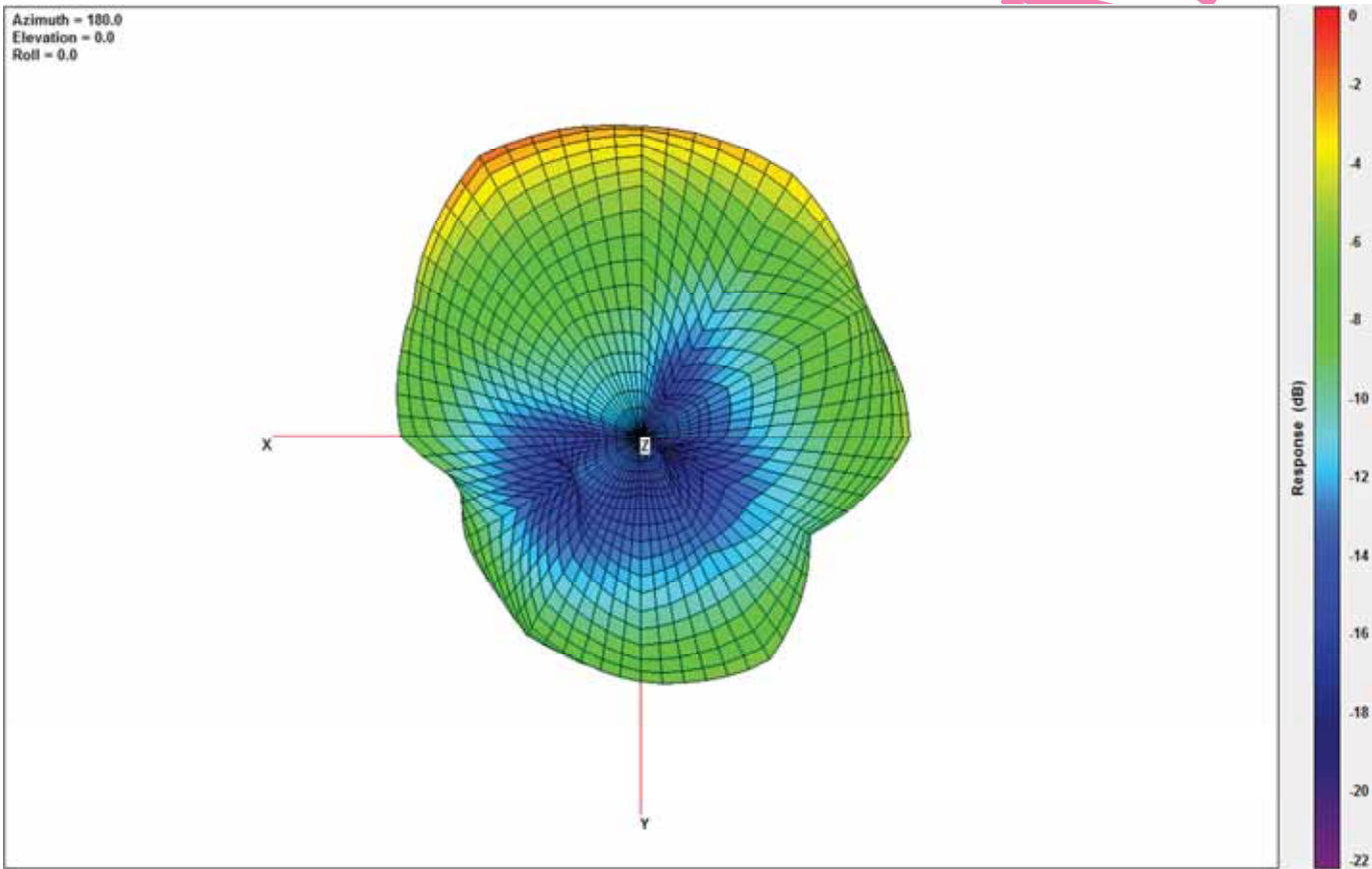
XZ Plane



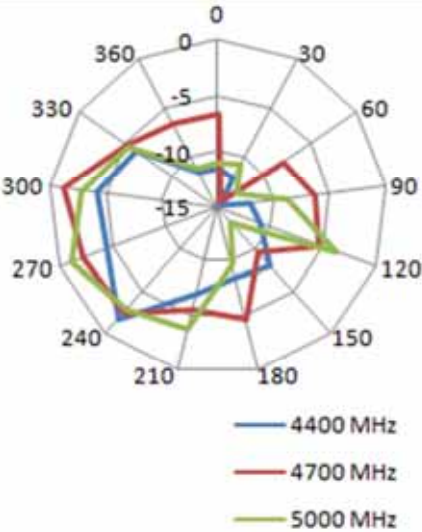
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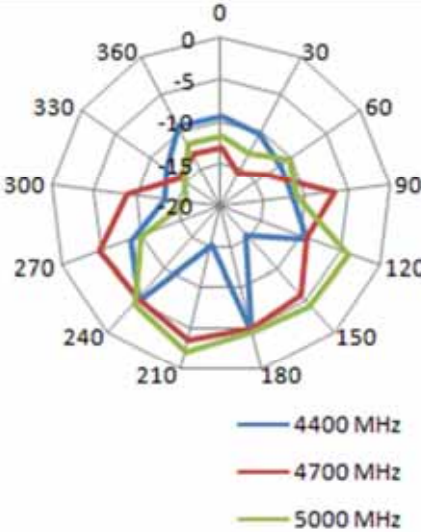
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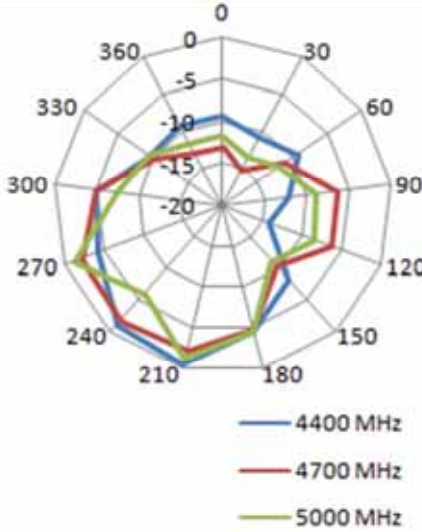
XY Plane



XZ Plane

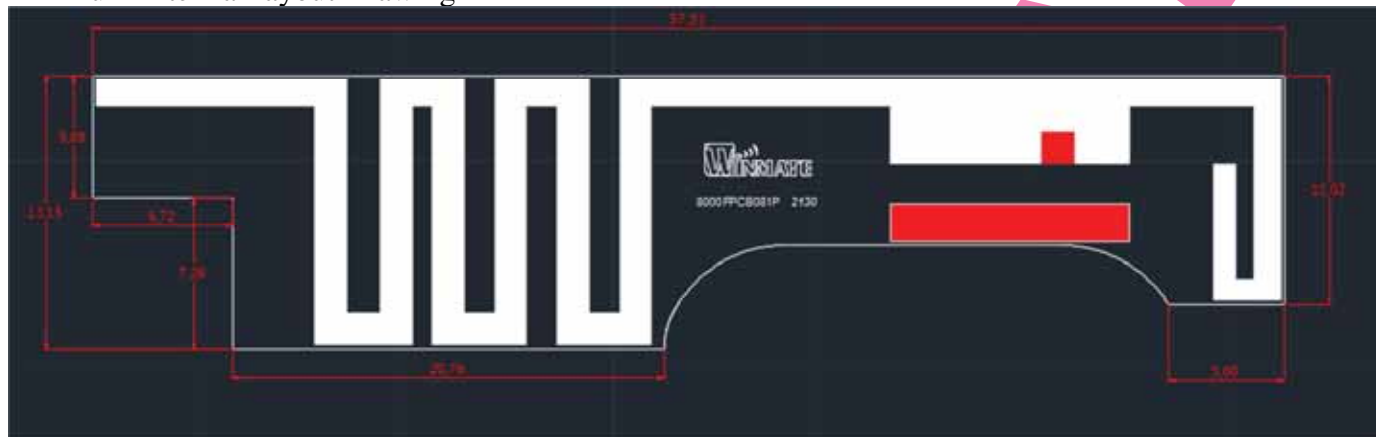


YZ Plane

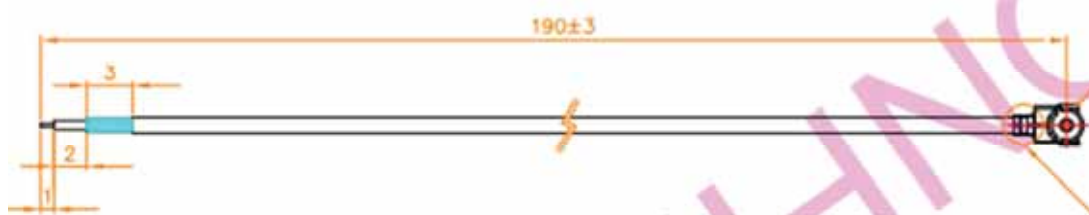


5.5. Drawing

LTE Aux Antenna Layout Drawing



RF Cable Drawing



Antenna Assembly



Winmate Part Number: 90RF02000013