

3D Antenna measurement (TRP)

Date: October 25th 2022

Test facility: Room 3

Location: FORCE Technology, Agro Food Park 13, 8200 Aarhus N.

Operator: Jesper Salvesen, jsal@forcetechnology.com, +45 43 25 05 29 (direct)

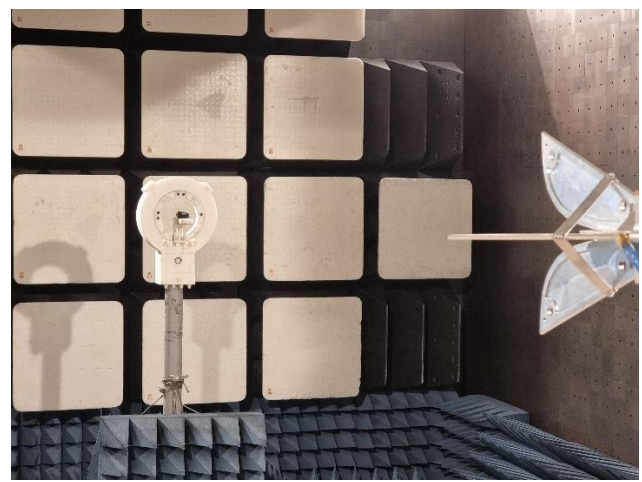
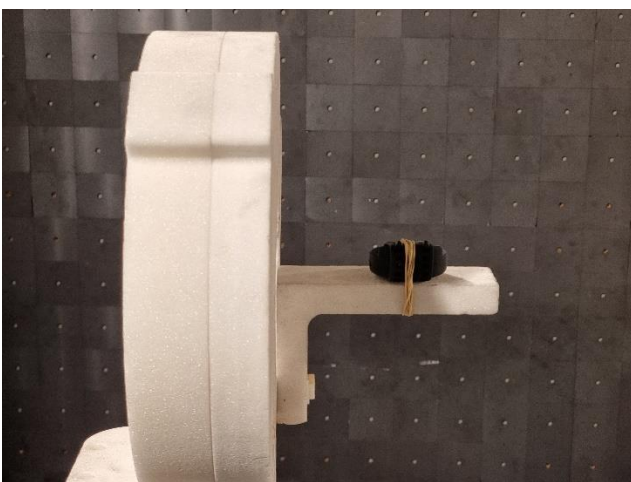
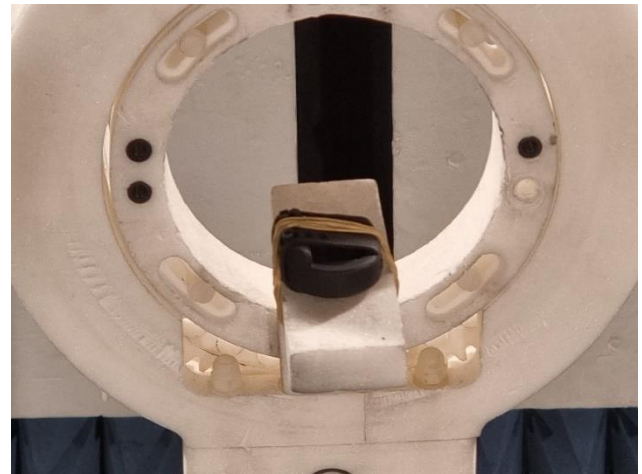
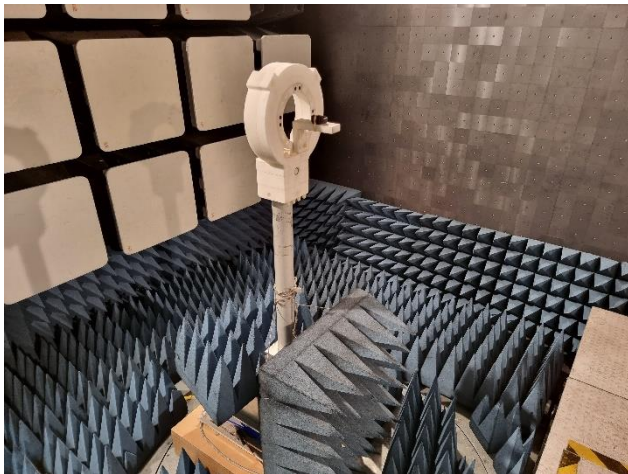
Short-format report.

Test item: Heart rate monitor for veterinary use (horse)

Sample name: 1 x Specimen_01
1 x Specimen_02

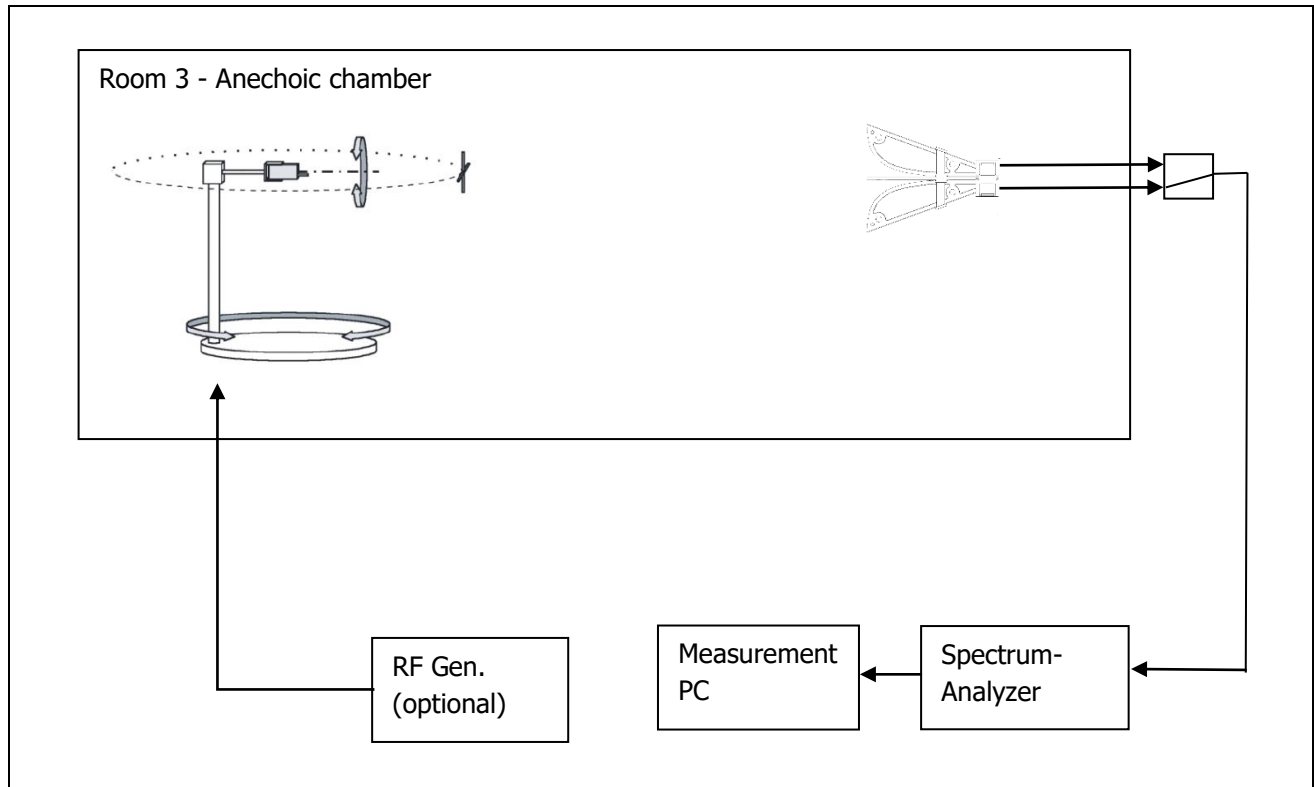
Radio parameters: BT radio in testmode - both samples where set to transmit at 2440MHz in max. power mode (CW)

Pictures describing the setup:



Setup description:

The test system is based on the roll over azimuth method.



Specimen_01 testresults:

OTA Evaluation Results:

Total Radiated Power	-2,41 dBm	
Directivity	3,00 dBi	
Total Efficiency	-2,41 dB	(Calculated, based 0 dBm conducted power)
Total Efficiency	57,43 %	(Calculated, based 0 dBm conducted power)
Peak Relaxed Gain	0,59 dBi	
NHPRP 45°	-4,26 dBm	
NHPRP 45° / TRP	-1,85 dB	
NHPRP 45° / TRP	65,36 %	
NHPRP 30°	-5,99 dBm	
NHPRP 30° / TRP	-3,58 dB	
NHPRP 30° / TRP	43,87 %	
NHPRP 22.5°	-7,23 dBm	
NHPRP 22.5° / TRP	-4,83 dB	
NHPRP 22.5° / TRP	32,92 %	
UHRP	-4,88 dBm	
UHRP / TRP	-2,47 dB	
UHRP / TRP	56,67 %	
LHRP	-6,04 dBm	
LHRP / TRP	-3,63 dB	
LHRP / TRP	43,33 %	
PGRP (0-120°)	-3,63 dBm	
PGRP / TRP	-1,22 dB	
PGRP / TRP	75,54 %	
Front/Back Ratio	1,36	
PhiBW	200,3 deg	
PhiBW Up	112,2 deg	
PhiBW Down	88,1 deg	
ThetaBW	137,9 deg	
ThetaBW Up	47,5 deg	
ThetaBW Down	90,4 deg	
Boresight Phi	135 deg	
Boresight Theta	45 deg	
Maximum Power	0,59 dBm	
Minimum Power	-12,21 dBm	
Average Power	-2,09 dBm	
Max/Min Ratio	12,79 dB	
Max/Avg Ratio	2,67 dB	
Min/Avg Ratio	-10,12 dB	
Worst Single Value	-20,55 dBm	
Worst Position	Azi = 15 deg; Elev = 75 deg; Pol = Hor	
Best Single Value	0,16 dBm	
Best Position	Azi = 150 deg; Elev = 45 deg; Pol = Hor	

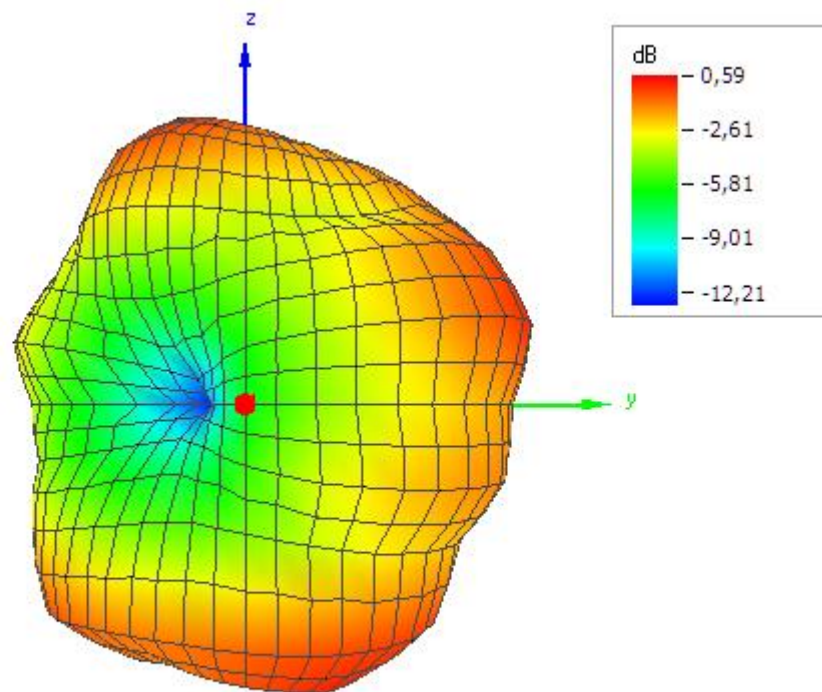
Result Table:

Azimuth (deg)	Elevation 0 deg (dB)	Elevation 15 deg (dB)	Elevation 30 deg (dB)	Elevation 45 deg (dB)	Elevation 60 deg (dB)	Elevation 75 deg (dB)	Elevation 90 deg (dB)	Elevation 105 deg (dB)
0.00	-0.84	-0.60	-1.35	-3.25	-3.98	-5.66	-6.22	-5.18
15.00	-0.84	-0.75	-1.52	-3.35	-3.11	-3.74	-4.11	-3.02
30.00	-0.84	-0.90	-1.69	-3.14	-2.00	-2.18	-2.79	-1.91
45.00	-0.84	-1.06	-1.43	-2.57	-1.06	-0.78	-1.99	-1.29
60.00	-0.84	-1.22	-1.19	-1.37	-0.39	-0.01	-1.55	-1.06
75.00	-0.84	-0.90	-0.76	-0.71	-0.01	0.29	-1.16	-1.07
90.00	-0.84	-0.60	-0.36	-0.20	0.09	0.36	-1.25	-1.24
105.00	-0.84	-0.32	-0.04	0.30	0.08	0.33	-1.56	-1.65
120.00	-0.84	-0.06	0.26	0.54	-0.03	-0.01	-1.85	-2.22
135.00	-0.84	-0.04	0.29	0.59	-0.20	-0.48	-2.33	-2.82
150.00	-0.84	-0.02	0.32	0.44	-0.34	-0.89	-2.82	-3.45
165.00	-0.84	-0.01	0.19	0.14	-0.43	-1.21	-2.66	-4.12
180.00	-0.84	0.01	0.04	-0.25	-0.61	-1.55	-3.11	-4.45
195.00	-0.84	-0.21	-0.30	-0.72	-0.58	-1.76	-2.70	-4.50
210.00	-0.84	-0.44	-0.67	-1.22	-0.62	-1.67	-3.22	-4.16
225.00	-0.84	-0.69	-1.06	-1.67	-0.84	-1.54	-3.11	-3.43
240.00	-0.84	-0.95	-1.49	-2.16	-1.26	-1.40	-2.84	-2.96
255.00	-0.84	-0.55	-1.28	-2.69	-1.82	-1.33	-2.67	-2.80
270.00	-0.84	-0.18	-1.08	-2.67	-2.29	-1.87	-3.33	-3.29
285.00	-0.84	0.17	-0.71	-2.47	-3.14	-2.94	-4.85	-4.06
300.00	-0.84	0.48	-0.37	-2.27	-4.25	-4.77	-6.58	-5.77
315.00	-0.84	0.24	-0.42	-2.34	-5.19	-7.66	-10.27	-7.61
330.00	-0.84	-0.03	-0.48	-2.57	-5.55	-10.38	-12.21	-8.77
345.00	-0.84	-0.31	-0.89	-2.88	-5.14	-8.88	-9.67	-7.68
360.00	-0.84	-0.60	-1.35	-3.25	-3.98	-5.66	-6.22	-5.18

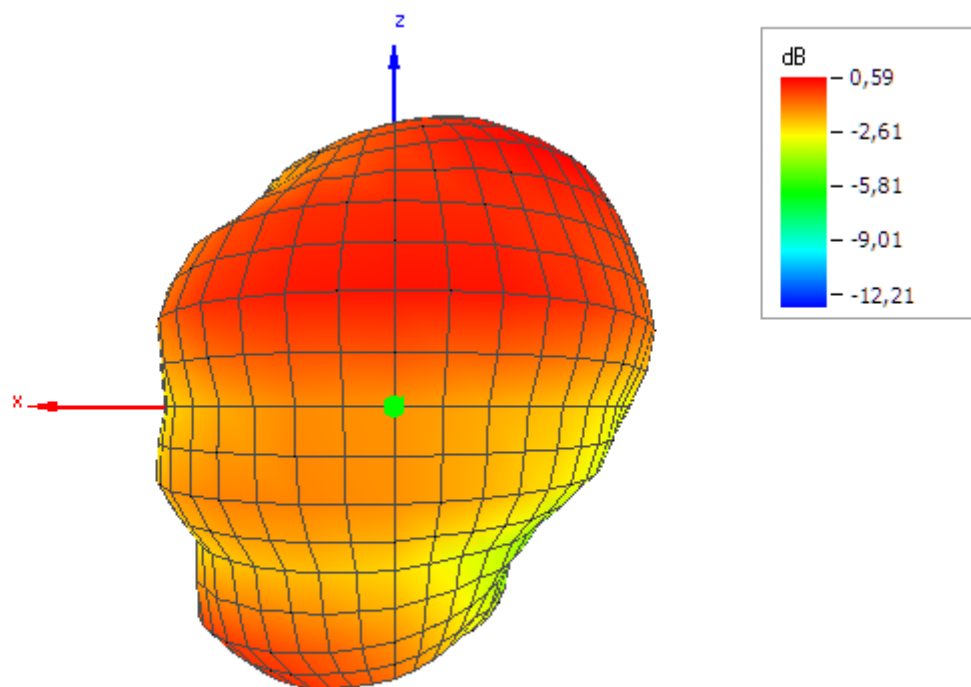
Azimuth (deg)	Elevation 120 deg (dB)	Elevation 135 deg (dB)	Elevation 150 deg (dB)	Elevation 165 deg (dB)	Elevation 180 deg (dB)
0.00	-4.21	-0.65	-0.38	-4.58	-8.45
15.00	-3.35	-0.35	-0.06	-4.44	-8.45
30.00	-2.51	-0.18	0.23	-4.30	-8.45
45.00	-2.02	-0.14	0.12	-4.17	-8.45
60.00	-1.81	-0.27	0.00	-4.05	-8.45
75.00	-1.82	-0.63	-0.38	-3.78	-8.45
90.00	-2.10	-1.22	-0.79	-3.53	-8.45
105.00	-2.82	-2.17	-1.52	-3.30	-8.45
120.00	-3.38	-3.19	-2.41	-3.08	-8.45
135.00	-4.24	-4.34	-2.77	-3.21	-8.45
150.00	-5.30	-5.59	-3.17	-3.35	-8.45
165.00	-5.92	-6.20	-3.46	-3.49	-8.45
180.00	-5.87	-6.14	-3.77	-3.64	-8.45
195.00	-5.60	-5.43	-3.44	-4.22	-8.45
210.00	-4.67	-4.14	-3.14	-4.88	-8.45
225.00	-3.35	-2.63	-2.26	-5.66	-8.45
240.00	-2.28	-1.42	-1.53	-6.61	-8.45
255.00	-1.73	-0.48	-0.98	-6.41	-8.45
270.00	-1.68	-0.10	-0.50	-6.21	-8.45
285.00	-2.21	-0.13	-0.57	-6.02	-8.45
300.00	-3.03	-0.41	-0.65	-5.84	-8.45
315.00	-3.89	-0.77	-0.83	-5.49	-8.45
330.00	-4.59	-0.94	-1.03	-5.16	-8.45
345.00	-4.89	-0.90	-0.69	-4.86	-8.45
360.00	-4.21	-0.65	-0.38	-4.58	-8.45

3D plots:

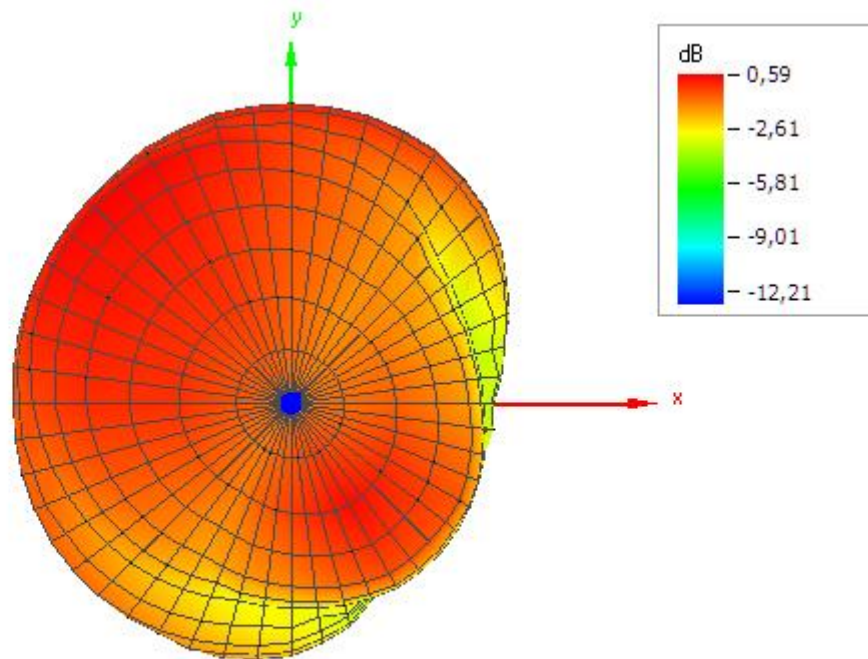
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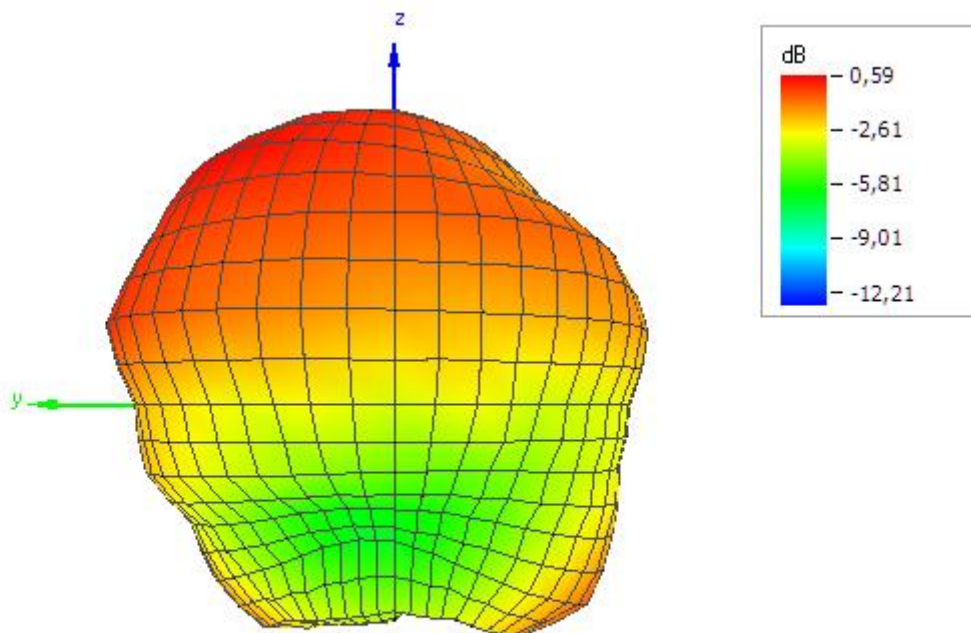
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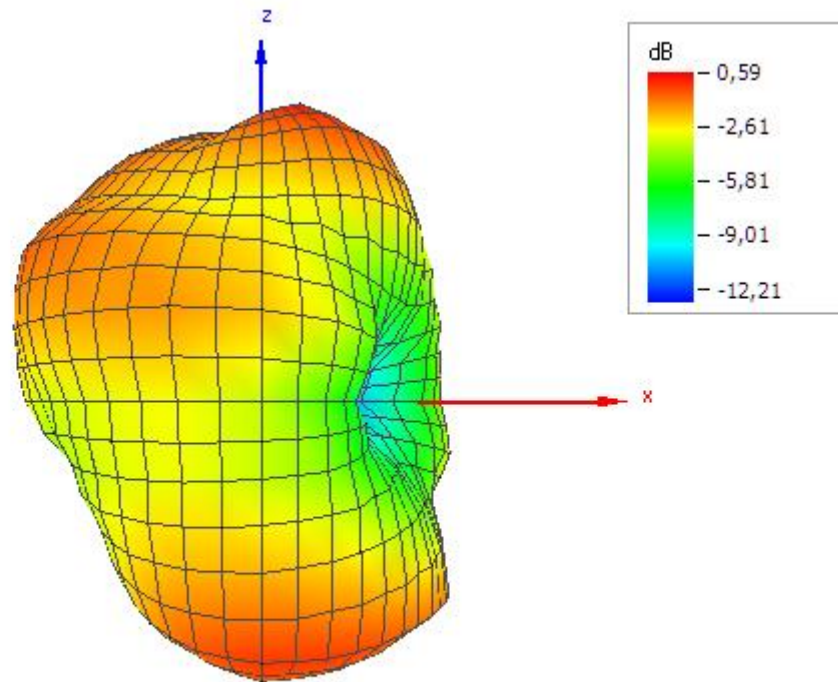
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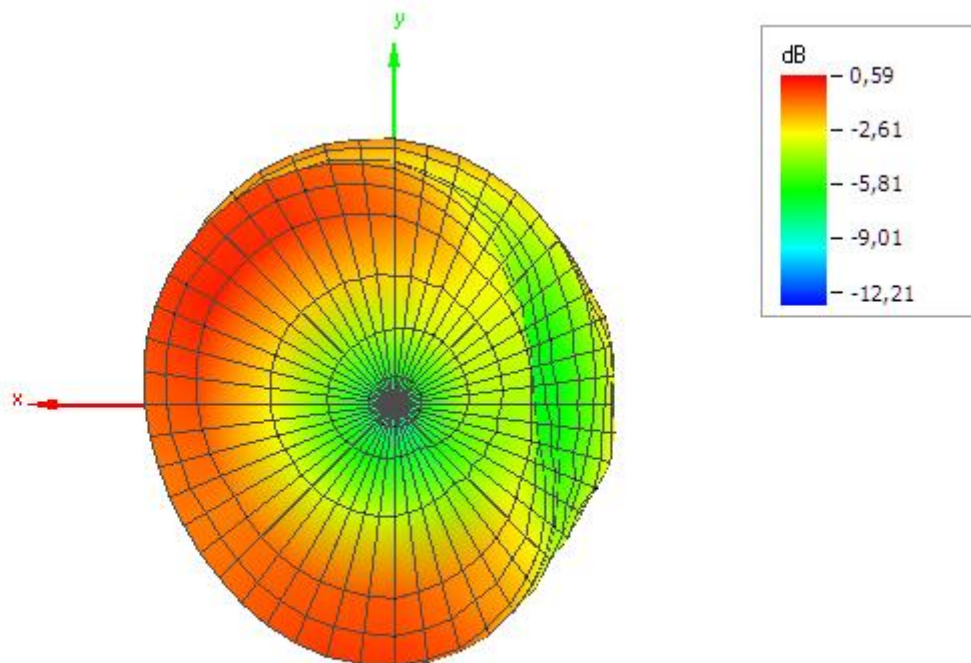
Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 180, Phi = 0



Specimen_02 testresults:

OTA Evaluation Results:

Total Radiated Power	-2,62 dBm	
Directivity	3,07 dBi	
Total Efficiency	-2,62 dB	(Calculated, based 0 dBm conducted power)
Total Efficiency	54,72 %	(Calculated, based 0 dBm conducted power)
Peak Relaxed Gain	0,45 dBi	
NHPRP 45°	-4,45 dBm	
NHPRP 45° / TRP	-1,83 dB	
NHPRP 45° / TRP	65,66 %	
NHPRP 30°	-6,17 dBm	
NHPRP 30° / TRP	-3,55 dB	
NHPRP 30° / TRP	44,16 %	
NHPRP 22.5°	-7,41 dBm	
NHPRP 22.5° / TRP	-4,79 dB	
NHPRP 22.5° / TRP	33,16 %	
UHRP	-5,03 dBm	
UHRP / TRP	-2,41 dB	
UHRP / TRP	57,39 %	
LHRP	-6,32 dBm	
LHRP / TRP	-3,70 dB	
LHRP / TRP	42,61 %	
PGRP (0-120°)	-3,80 dBm	
PGRP / TRP	-1,19 dB	
PGRP / TRP	76,11 %	
Front/Back Ratio	1,07	
PhiBW	208,1 deg	
PhiBW Up	130,1 deg	
PhiBW Down	78,1 deg	
ThetaBW	153,0 deg	
ThetaBW Up	62,1 deg	
ThetaBW Down	90,9 deg	
Boresight Phi	120 deg	
Boresight Theta	45 deg	
Maximum Power	0,45 dBm	
Minimum Power	-13,25 dBm	
Average Power	-2,35 dBm	
Max/Min Ratio	13,70 dB	
Max/Avg Ratio	2,80 dB	
Min/Avg Ratio	-10,90 dB	
Worst Single Value	-21,84 dBm	
Worst Position	Azi = 15 deg; Elev = 75 deg; Pol = Hor	
Best Single Value	0,05 dBm	
Best Position	Azi = 150 deg; Elev = 45 deg; Pol = Hor	

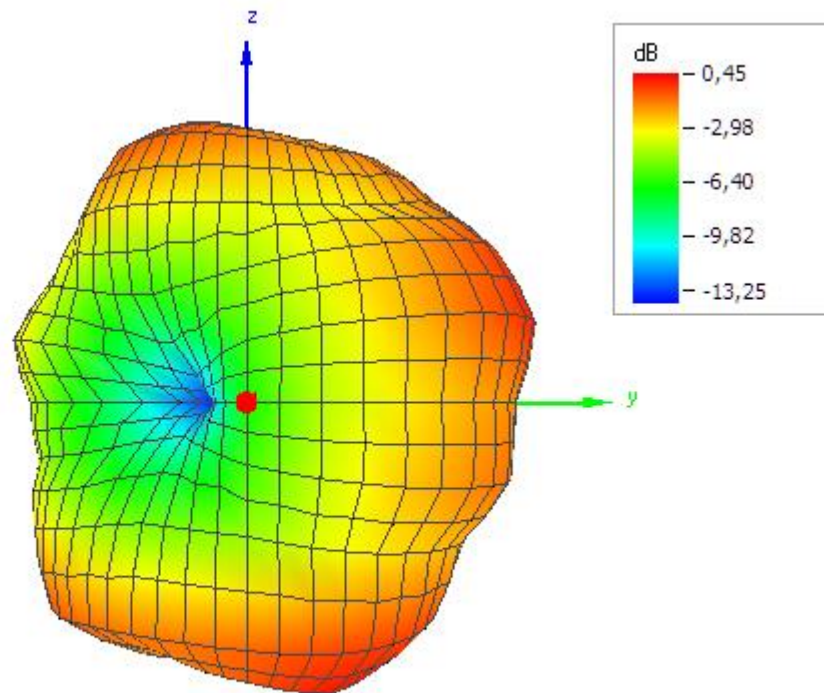
Result table:

Azimuth (deg)	Elevation 0 deg (dB)	Elevation 15 deg (dB)	Elevation 30 deg (dB)	Elevation 45 deg (dB)	Elevation 60 deg (dB)	Elevation 75 deg (dB)	Elevation 90 deg (dB)	Elevation 105 deg (dB)
0.00	-1.37	-1.05	-1.32	-3.24	-4.25	-5.53	-6.30	-5.53
15.00	-1.37	-1.15	-1.47	-3.24	-3.11	-3.63	-3.94	-3.67
30.00	-1.37	-1.25	-1.62	-2.98	-2.15	-2.14	-2.74	-2.25
45.00	-1.37	-1.35	-1.32	-2.44	-1.21	-0.88	-1.86	-1.44
60.00	-1.37	-1.45	-1.03	-1.49	-0.48	-0.17	-1.52	-1.04
75.00	-1.37	-1.23	-0.67	-0.84	-0.05	0.26	-1.30	-1.16
90.00	-1.37	-1.02	-0.34	-0.27	0.22	0.33	-1.36	-1.23
105.00	-1.37	-0.82	-0.14	0.26	-0.01	0.19	-1.73	-1.73
120.00	-1.37	-0.63	0.06	0.45	-0.16	-0.11	-2.25	-2.37
135.00	-1.37	-0.56	0.08	0.44	-0.36	-0.46	-2.71	-2.97
150.00	-1.37	-0.50	0.09	0.28	-0.61	-0.86	-3.05	-3.65
165.00	-1.37	-0.45	-0.07	0.04	-0.85	-1.33	-3.15	-4.21
180.00	-1.37	-0.39	-0.24	-0.39	-0.92	-1.60	-3.19	-4.75
195.00	-1.37	-0.59	-0.52	-0.90	-0.89	-1.72	-3.44	-5.06
210.00	-1.37	-0.81	-0.82	-1.31	-0.92	-1.76	-3.54	-4.78
225.00	-1.37	-1.04	-1.12	-1.82	-1.08	-1.62	-3.34	-4.08
240.00	-1.37	-1.28	-1.44	-2.30	-1.43	-1.53	-3.19	-3.33
255.00	-1.37	-0.94	-1.28	-2.68	-2.00	-1.53	-2.93	-3.12
270.00	-1.37	-0.63	-1.12	-2.67	-2.61	-2.02	-3.48	-3.55
285.00	-1.37	-0.34	-0.85	-2.54	-3.43	-3.05	-4.92	-4.63
300.00	-1.37	-0.07	-0.59	-2.43	-4.49	-5.12	-7.45	-5.99
315.00	-1.37	-0.29	-0.71	-2.63	-5.50	-8.20	-11.24	-8.49
330.00	-1.37	-0.53	-0.83	-2.89	-5.85	-10.92	-13.25	-9.61
345.00	-1.37	-0.78	-1.07	-3.11	-5.21	-8.92	-10.19	-7.92
360.00	-1.37	-1.05	-1.32	-3.24	-4.25	-5.53	-6.30	-5.53

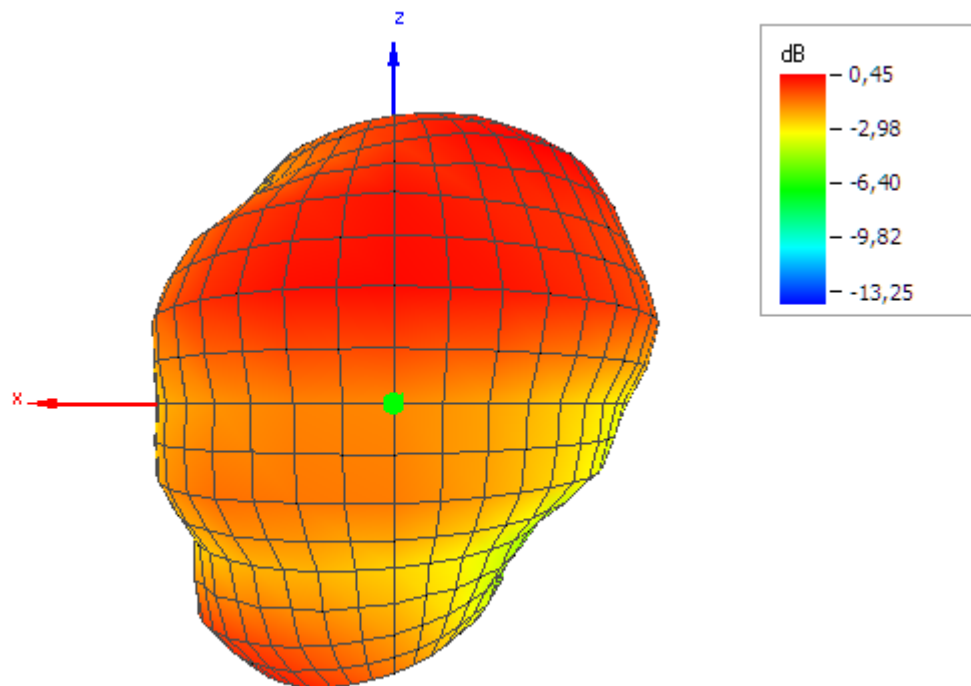
Azimuth (deg)	Elevation 120 deg (dB)	Elevation 135 deg (dB)	Elevation 150 deg (dB)	Elevation 165 deg (dB)	Elevation 180 deg (dB)
0.00	-4.32	-0.89	-0.71	-5.28	-8.61
15.00	-3.43	-0.53	-0.20	-4.94	-8.61
30.00	-2.69	-0.36	0.25	-4.63	-8.61
45.00	-2.18	-0.36	0.11	-4.34	-8.61
60.00	-1.94	-0.58	-0.03	-4.07	-8.61
75.00	-1.99	-1.03	-0.55	-3.90	-8.61
90.00	-2.38	-1.67	-1.13	-3.74	-8.61
105.00	-2.89	-2.54	-1.87	-3.58	-8.61
120.00	-3.63	-3.56	-2.76	-3.43	-8.61
135.00	-4.63	-4.79	-3.35	-3.60	-8.61
150.00	-5.65	-6.21	-4.03	-3.77	-8.61
165.00	-6.24	-6.91	-4.21	-3.96	-8.61
180.00	-6.25	-6.81	-4.40	-4.15	-8.61
195.00	-6.02	-5.91	-4.01	-4.66	-8.61
210.00	-4.92	-4.31	-3.66	-5.24	-8.61
225.00	-3.67	-3.04	-2.63	-5.90	-8.61
240.00	-2.65	-1.94	-1.79	-6.69	-8.61
255.00	-2.04	-0.99	-1.25	-6.61	-8.61
270.00	-1.98	-0.54	-0.76	-6.54	-8.61
285.00	-2.47	-0.46	-0.92	-6.46	-8.61
300.00	-3.23	-0.63	-1.09	-6.38	-8.61
315.00	-4.22	-0.98	-1.28	-6.08	-8.61
330.00	-4.89	-1.14	-1.48	-5.79	-8.61
345.00	-4.71	-1.12	-1.08	-5.53	-8.61
360.00	-4.32	-0.89	-0.71	-5.28	-8.61

3D plots:

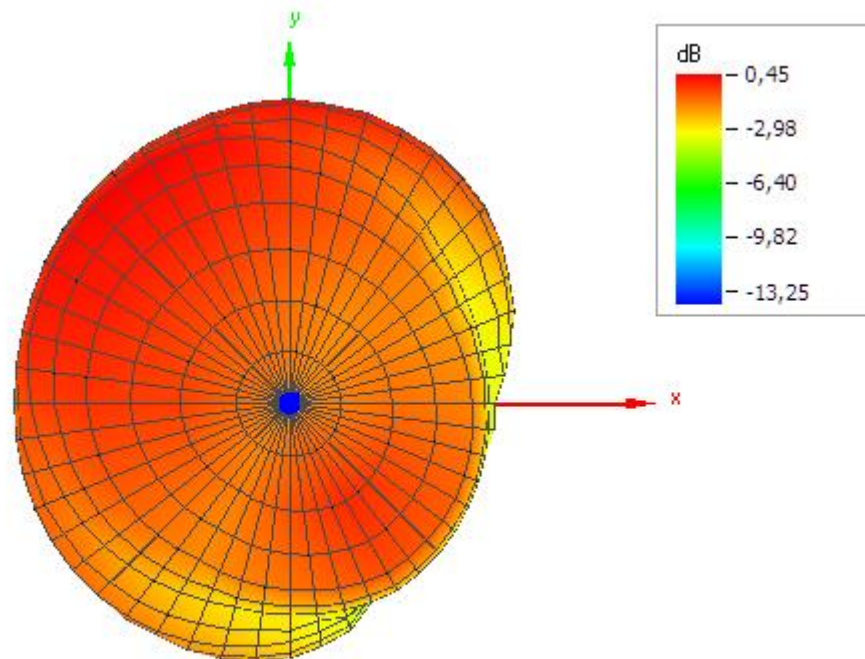
Theta = 90, Phi = 0



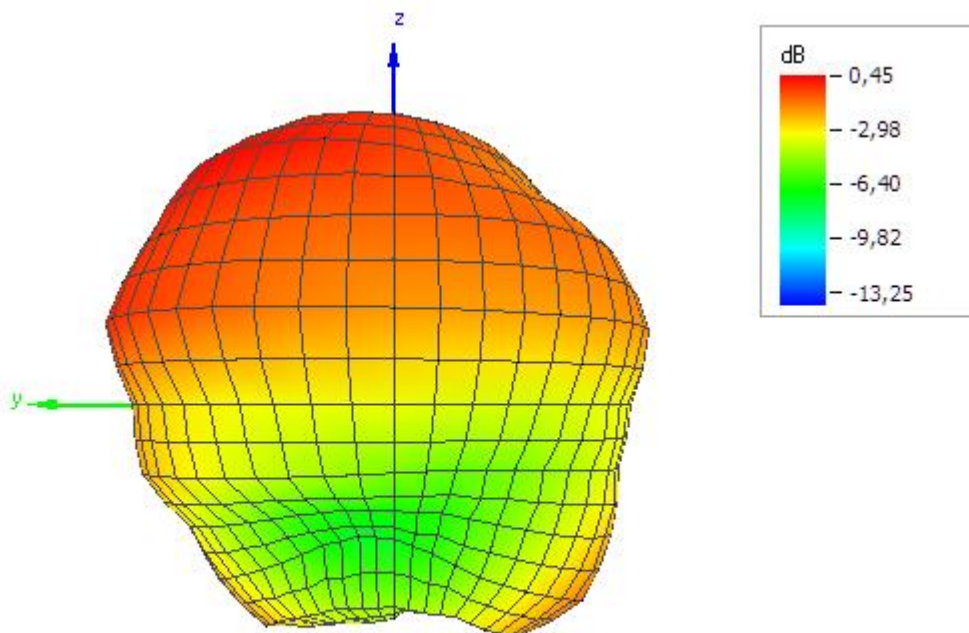
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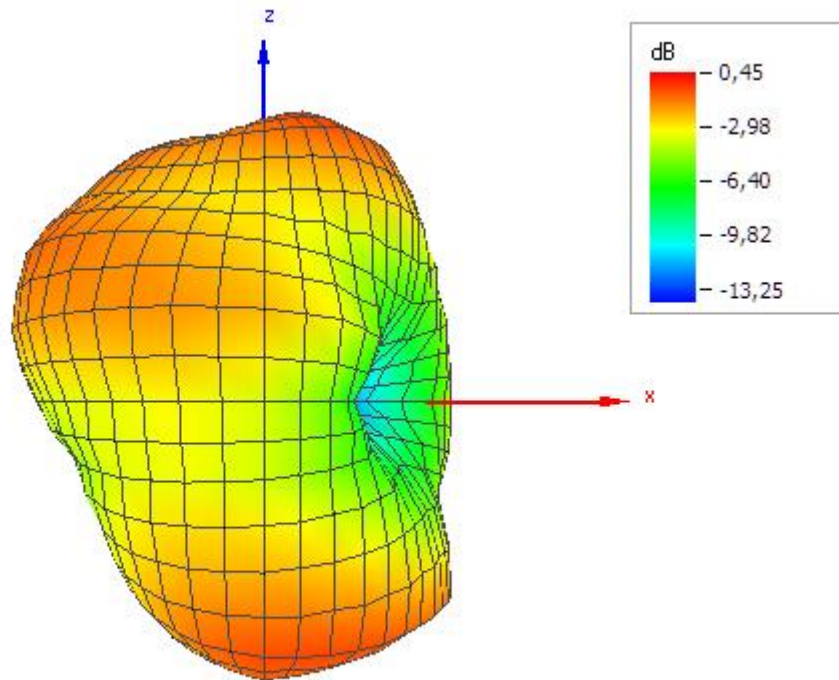
Theta = 0, Phi = 0



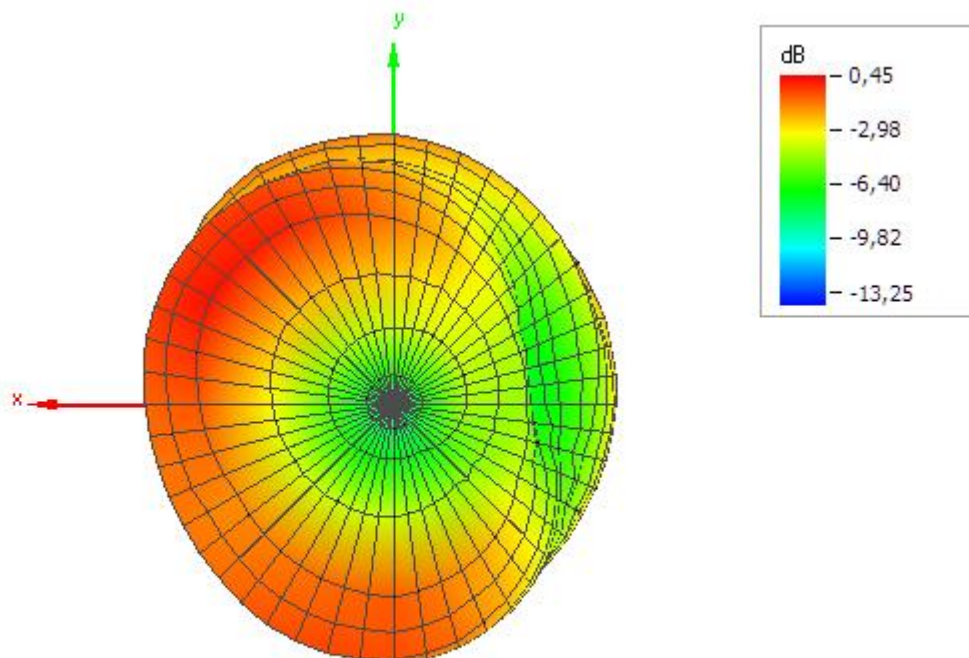
Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 180, Phi = 0

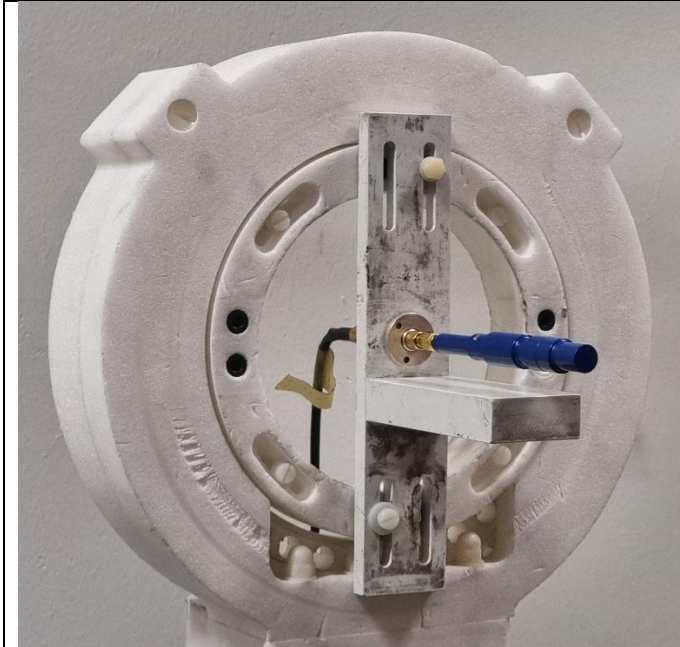


Annex A – Satimo reference antenna

Test signal at 2440 MHz

0 dBm applied at antenna connector

Test picture:



OTA Test Results for Frequency 2440.000 MHz

OTA Evaluation Results:

Total Radiated Power	-0,29 dBm
Directivity	2,76 dBi
Total Efficiency	-0,29 dB
Total Efficiency	93,49 %
Peak Relaised Gain	2,46 dBi
NHPRP 45°	-1,30 dBm
NHPRP 45° / TRP	-1,01 dB
NHPRP 45° / TRP	79,31 %
NHPRP 30°	-2,67 dBm
NHPRP 30° / TRP	-2,37 dB
NHPRP 30° / TRP	57,90 %
NHPRP 22.5°	-3,81 dBm
NHPRP 22.5° / TRP	-3,52 dB
NHPRP 22.5° / TRP	44,47 %
UHRP	-2,61 dBm
UHRP / TRP	-2,31 dB
UHRP / TRP	58,69 %
LHRP	-4,13 dBm
LHRP / TRP	-3,84 dB
LHRP / TRP	41,31 %
PGRP (0-120°)	-1,11 dBm
PGRP / TRP	-0,82 dB
PGRP / TRP	82,80 %
Front/Back Ratio	2,93
PhiBW	360,0 deg
PhiBW Up	360,0 deg
PhiBW Down	360,0 deg
ThetaBW	91,2 deg
ThetaBW Up	51,6 deg
ThetaBW Down	39,6 deg
Boresight Phi	255 deg
Boresight Theta	75 deg
Maximum Power	2,46 dBm
Minimum Power	-13,60 dBm
Average Power	-1,10 dBm
Max/Min Ratio	16,06 dB
Max/Avg Ratio	3,56 dB
Min/Avg Ratio	-12,50 dB
Worst Single Value	-22,93 dBm
Worst Position	Azi = 90 deg; Elev = 30 deg; Pol = Ver
Best Single Value	2,36 dBm
Best Position	Azi = 255 deg; Elev = 75 deg; Pol = Hor

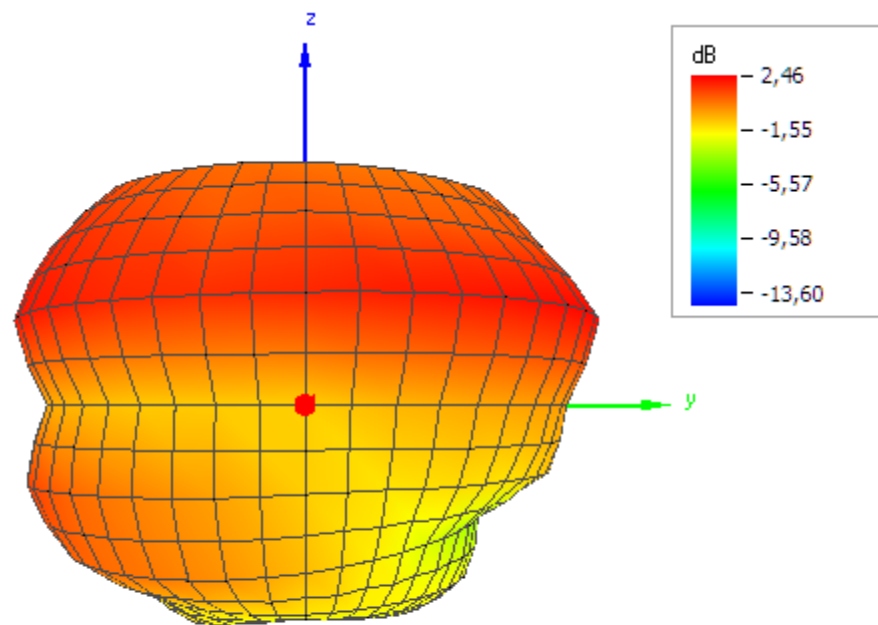
Result table:

Azimuth (deg)	Elevation 0 deg (dB)	Elevation 15 deg (dB)	Elevation 30 deg (dB)	Elevation 45 deg (dB)	Elevation 60 deg (dB)	Elevation 75 deg (dB)	Elevation 90 deg (dB)	Elevation 105 deg (dB)
0.00	-8.23	-6.46	-1.99	0.64	1.12	1.86	-0.81	-0.78
15.00	-8.23	-5.54	-1.64	0.57	1.02	2.06	-0.42	-1.15
30.00	-8.23	-4.79	-1.31	0.58	1.03	2.18	-0.20	-1.03
45.00	-8.23	-4.15	-1.00	0.68	1.14	2.32	-0.06	-1.13
60.00	-8.23	-3.59	-0.71	0.99	1.25	2.39	-0.04	-0.88
75.00	-8.23	-3.51	-0.69	1.13	1.26	2.39	-0.02	-0.47
90.00	-8.23	-3.43	-0.67	1.25	1.22	2.33	-0.05	-0.52
105.00	-8.23	-3.35	-0.80	1.43	1.17	2.31	-0.31	-0.68
120.00	-8.23	-3.28	-0.94	1.15	0.98	2.14	-0.52	-0.72
135.00	-8.23	-3.90	-1.34	0.87	0.74	1.86	-0.78	-0.54
150.00	-8.23	-4.63	-1.79	0.66	0.62	1.68	-0.81	-0.05
165.00	-8.23	-5.51	-2.09	0.70	0.70	1.55	-0.88	0.26
180.00	-8.23	-6.60	-2.42	0.92	0.88	1.61	-0.88	0.40
195.00	-8.23	-6.56	-2.37	1.13	1.11	1.85	-0.71	0.69
210.00	-8.23	-6.52	-2.33	1.21	1.30	2.08	-0.39	1.06
225.00	-8.23	-6.48	-2.12	1.42	1.65	2.25	-0.10	1.43
240.00	-8.23	-6.44	-1.92	1.59	2.00	2.39	0.10	1.70
255.00	-8.23	-6.64	-1.79	1.69	2.21	2.46	0.12	1.77
270.00	-8.23	-6.86	-1.67	1.76	2.39	2.30	0.00	1.81
285.00	-8.23	-7.09	-1.73	1.65	2.15	2.24	-0.17	1.62
300.00	-8.23	-7.33	-1.80	1.42	1.84	2.15	-0.31	1.35
315.00	-8.23	-7.10	-1.82	1.08	1.64	2.05	-0.49	0.82
330.00	-8.23	-6.87	-1.84	0.88	1.40	1.84	-0.72	0.40
345.00	-8.23	-6.66	-1.91	0.74	1.03	1.75	-0.75	-0.07
360.00	-8.23	-6.46	-1.99	0.64	1.12	1.86	-0.81	-0.78

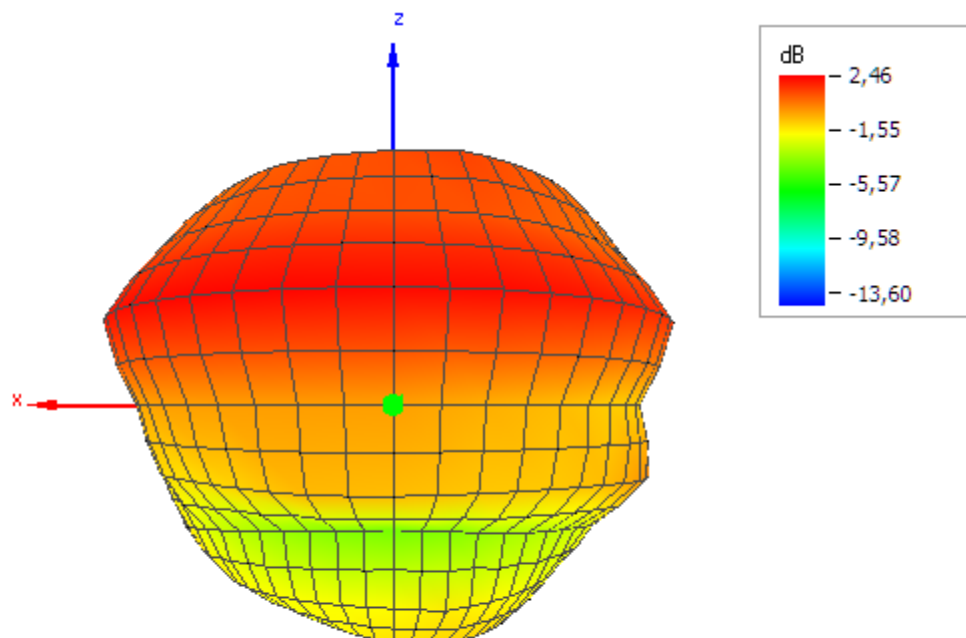
Azimuth (deg)	Elevation 120 deg (dB)	Elevation 135 deg (dB)	Elevation 150 deg (dB)	Elevation 165 deg (dB)	Elevation 180 deg (dB)
0.00	-0.50	-1.16	-2.52	-5.85	-13.60
15.00	-1.30	-1.33	-2.34	-5.49	-13.60
30.00	-2.04	-1.47	-2.16	-5.16	-13.60
45.00	-2.65	-1.57	-1.94	-4.85	-13.60
60.00	-3.13	-1.59	-1.74	-4.56	-13.60
75.00	-3.51	-1.60	-1.41	-4.46	-13.60
90.00	-3.69	-1.52	-1.09	-4.36	-13.60
105.00	-3.47	-1.27	-0.99	-4.27	-13.60
120.00	-2.94	-1.48	-0.88	-4.17	-13.60
135.00	-2.62	-1.66	-0.96	-4.11	-13.60
150.00	-2.25	-1.77	-1.03	-4.05	-13.60
165.00	-1.59	-1.66	-0.97	-3.98	-13.60
180.00	-0.94	-1.69	-0.91	-3.92	-13.60
195.00	-0.35	-1.82	-0.96	-3.74	-13.60
210.00	-0.14	-2.09	-1.00	-3.57	-13.60
225.00	0.16	-2.19	-0.96	-3.40	-13.60
240.00	0.49	-2.21	-0.92	-3.24	-13.60
255.00	0.72	-2.13	-0.84	-3.23	-13.60
270.00	0.87	-1.78	-0.75	-3.22	-13.60
285.00	0.98	-1.36	-0.87	-3.21	-13.60
300.00	0.92	-1.03	-1.00	-3.20	-13.60
315.00	0.79	-0.95	-1.40	-3.73	-13.60
330.00	0.55	-0.98	-1.84	-4.32	-13.60
345.00	0.13	-1.06	-2.17	-5.02	-13.60
360.00	-0.50	-1.16	-2.52	-5.85	-13.60

3D plots:

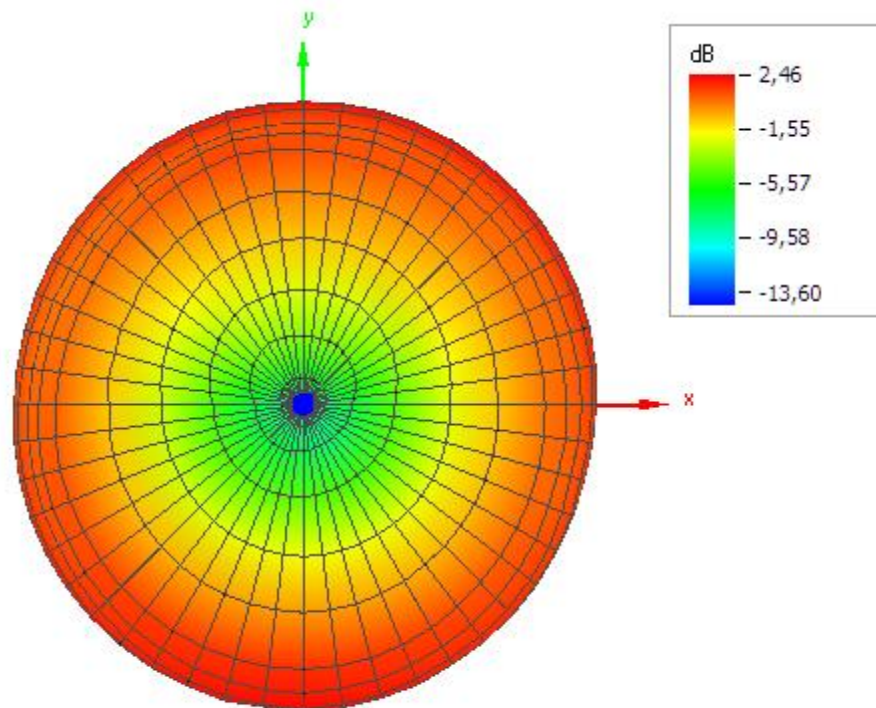
Theta = 90, Phi = 0



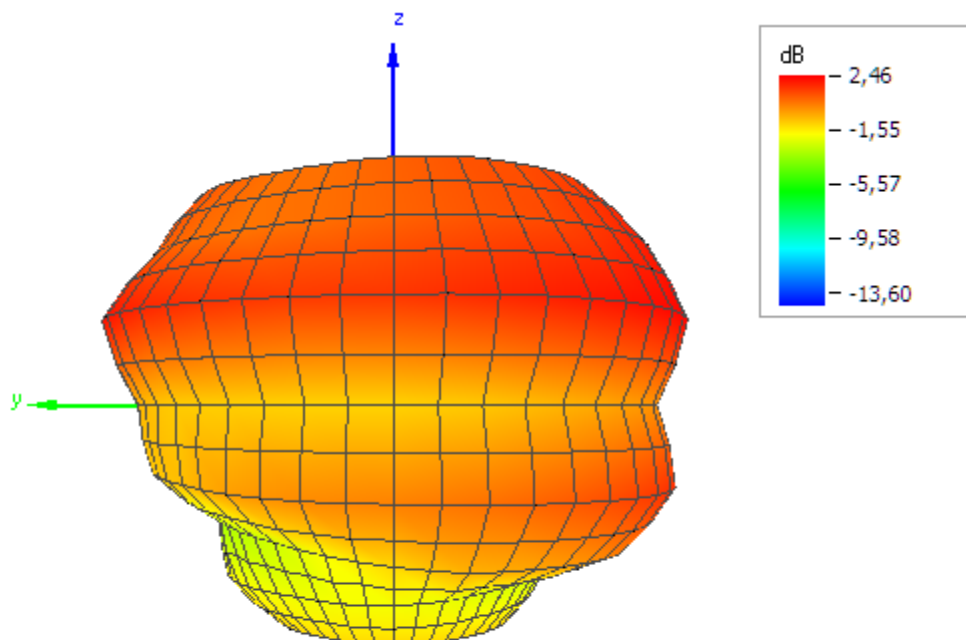
Theta = 90, Phi = 90



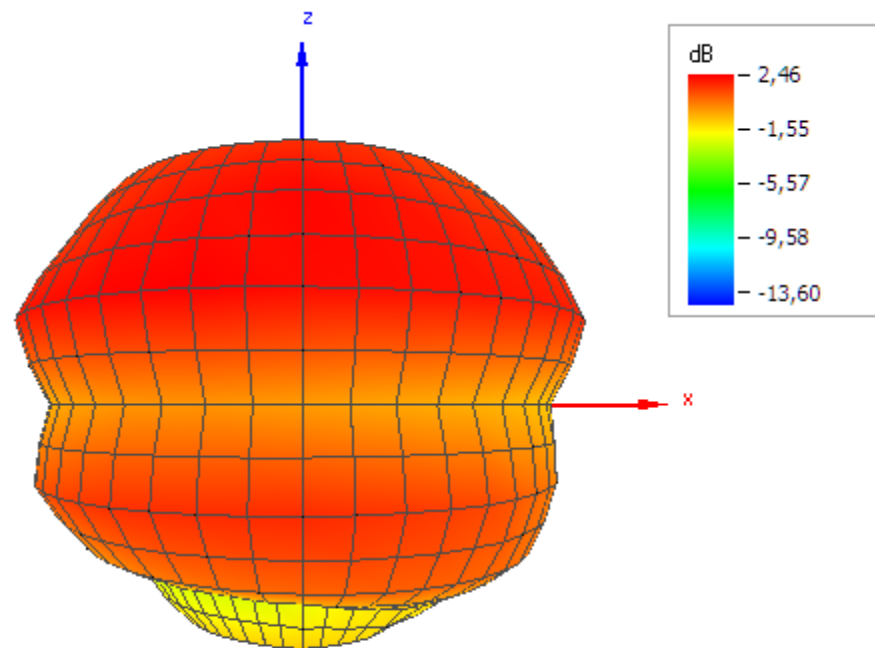
Theta = 0, Phi = 0



Theta = 90, Phi = 180



Theta = 90, Phi = 270



Theta = 180, Phi = 0

