

B/S/H/ GED	Antenna_Specification Antenna_Specification eP_SMM_S2	Doc.-ID: 60100005053536 Rev, Seq: A1 Date: 2021-04-30 CR-No.: CR-Rev:
Specification		

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National Designation: Antenna_Specification

Second International Designation: eP_SMM_S2

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Owner: Krusche, Mathias [GED-HWP6]

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	Name	Department	Date
1. Checker	Daniel Schindler	GED-HWP6	13.04.2021
2. Checker	Sheraz Ahmed	GED-HWP6	13.04.2021
Responsible	Stefan Vollmann	GED-HWP6	13.04.2021
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Abbreviations

SMM	Systemmaster
SMM_EXT_ST	Systemmaster Extended Stamp
SME	Systemmaster Extended

List of changes:

[illegible]

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1 Referenced documents

Ref.	Description	Document name/ No.	Lang.	Review status	Responsible
1.					
2.					
3.					
4.					
5.					

2 Scope of the document

This document specifies the two PCB antennas of the SystemMaster S2

3 Contacts

Division	Name	Phone	Email
BSH	Ludwig Stöckl	+49 941 8994 2447	Ludwig.Stoeckl@bshg.com
BSH	Gerald Bollinger	+49 941 8994 2423	Gerald.bollinger@bshg.com
BSH	Matthias Rusch	+49 941 8994 2294	Matthias.rusch@bshg.com
BSH	Daniel Schindler	+49 941 8994 2538	Daniel.Schindler@bshg.com
BSH	Stefan Vollmann	+49 941 8994 2268	Stefan.Vollmann@bshg.com

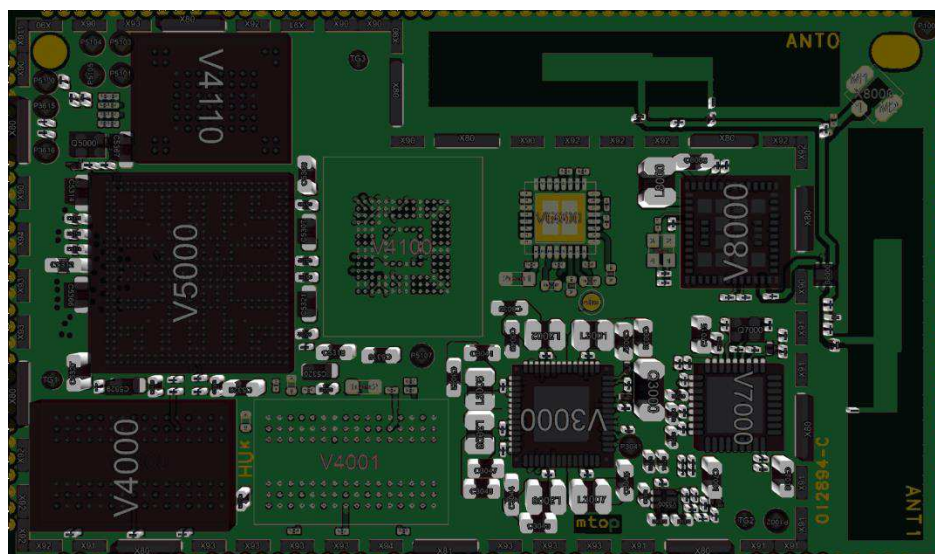
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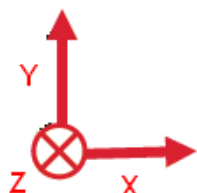
4 Antennas

4.1 Placement on board

Antenna 0



Antenna 1



4.2 Specifications valid for each antenna

Antenna type:	Dual band PCB
Material antenna:	Copper
Material PCB:	FR4
Colour solder mask:	Green
Operation Temperature:	0°C to +85°C
Impedance:	50 Ohm
Frequency range:	2400 MHz to 2484 MHz and 5180 MHz to 5825MHz
Connectors:	No external connection to antennas possible
Radiation pattern:	Omnidirectional

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4.3 Antenna 0

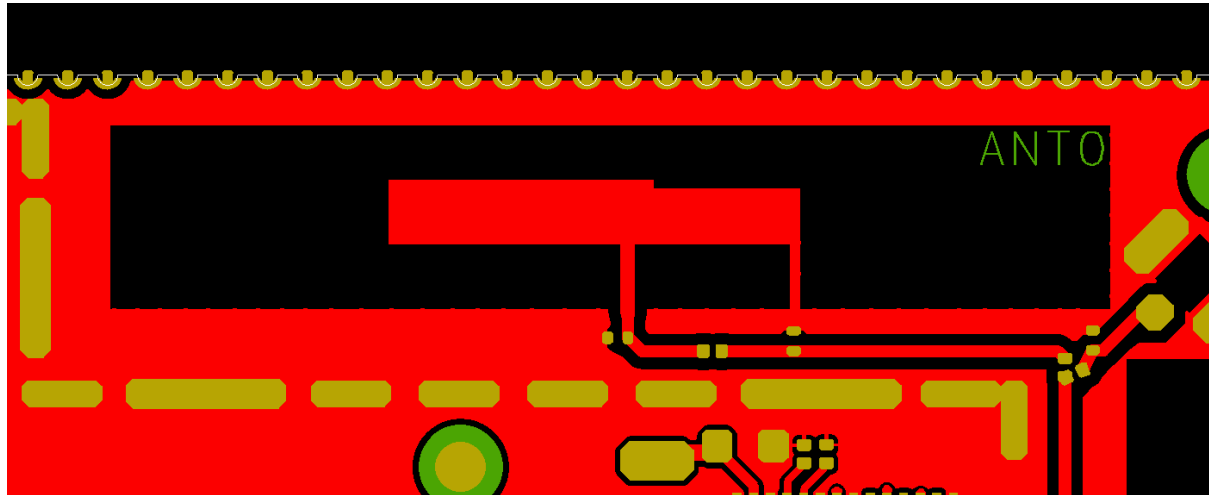


Figure 1: Layout antenna 0

Dimension: X = 30.0 mm Y = 5.5 mm

Max. Gain in 2.4 GHz Band: 4.16 dBi
Max. Gain in 5 GHz Band: 5.83 dBi

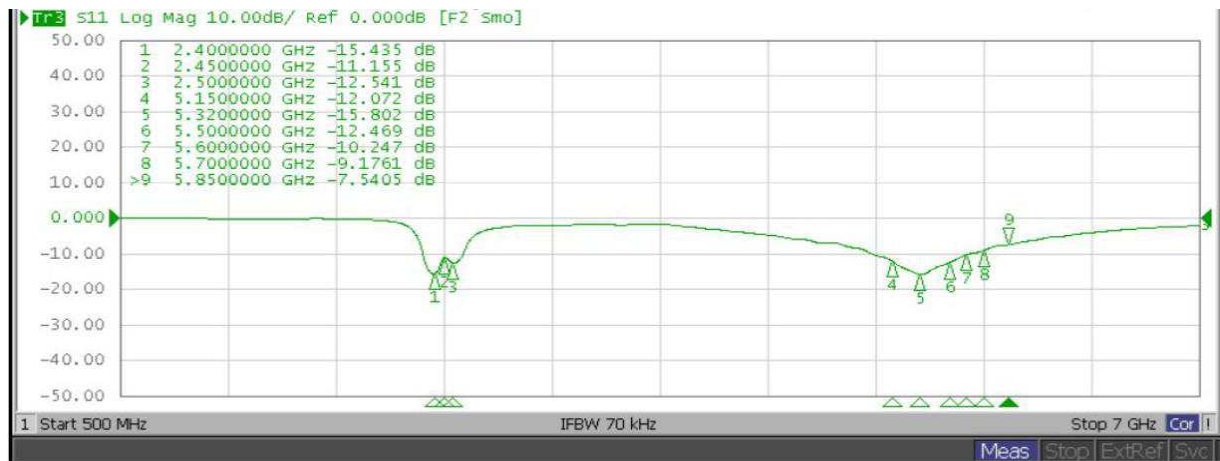


Figure 2: Returnloss of antenna 0

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Frequency [MHZ]	Efficiency [%]	Peak Gain [dBi]
2400	68	4.16
2412	67	3.89
2437	64	3.71
2450	62	3.47
2462	61	3.24
2500	59	3.37
5150	61	5.60
5180	62	5.83
5320	61	4.45
5500	61	4.41
5600	56	4.10
5700	54	3.30
5785	53	4.40
5805	51	4.25

Figure 3: 3D Peak Gain & Efficiency List of antenna 0

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4.4 Antenna 1

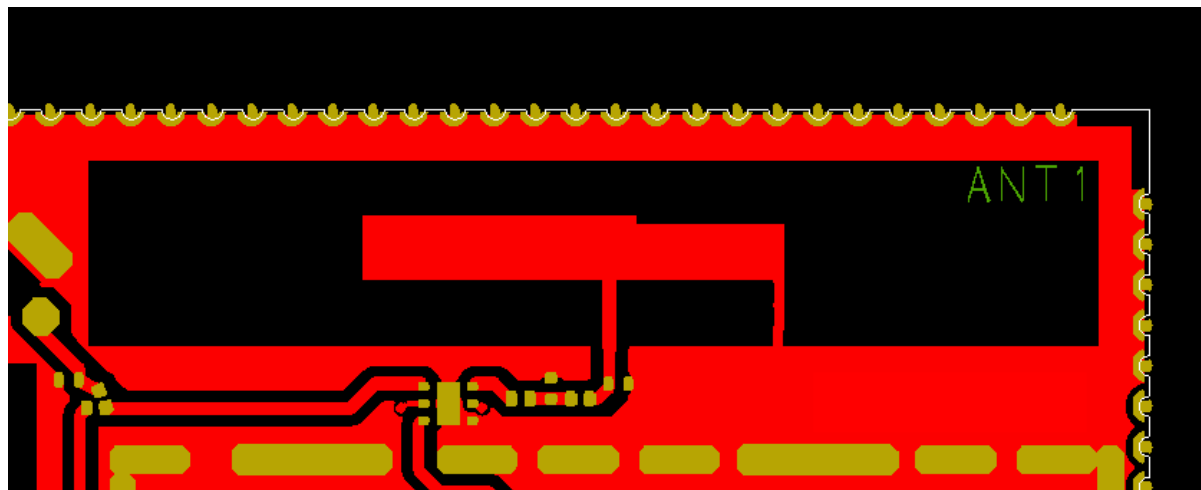


Figure 4: Layout antenna 1

Dimension: X =30.0 mm Y = 5.5 mm

Max. Gain in 2.4 GHz Band: 4.82 dBi

Max. Gain in 5 GHz Band: 6.84 dBi

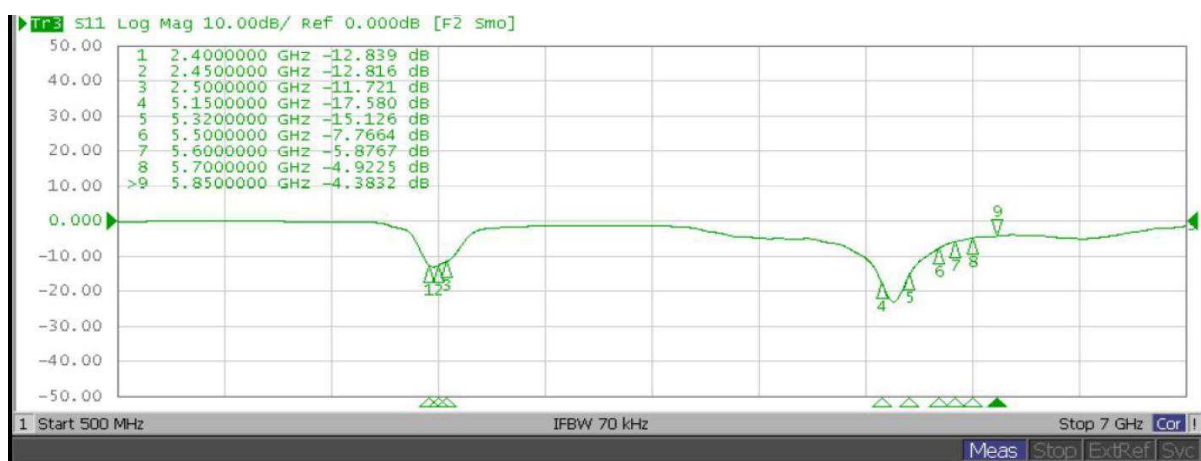


Figure 5: Returnloss of antenna 1

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Frequency [MHZ]	Efficiency [%]	Peak Gain [dBi]
2400	60	4.82
2412	61	4.70
2437	61	4.33
2450	60	3.98
2462	58	3.79
2500	56	3.09
5150	75	6.84
5180	74	6.84
5320	66	6.00
5500	56	5.71
5600	48	5.27
5700	45	4.84
5785	44	4.86
5805	42	4.74

Figure 6: 3D Peak Gain & Efficiency List of antenna 1

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4.5 Antenna characteristics summary of antenna 0

2.4 GHz WiFi band			
Frequency	2400 MHz	2450 MHz	2500 MHz
Max. realized gain	4.16 dBi (max. value)	3.47 dBi	3.37 dBi
Total efficiency	68 %	62 %	59 %

5 GHz WiFi band			
Frequency	5180 MHz	5500 MHz	5805 MHz
Max. realized gain	5.83 dBi (max. value)	4.41 dBi	4.25 dBi
Total efficiency	62 %	61 %	51 %

4.6 Antenna characteristics summary of antenna 1

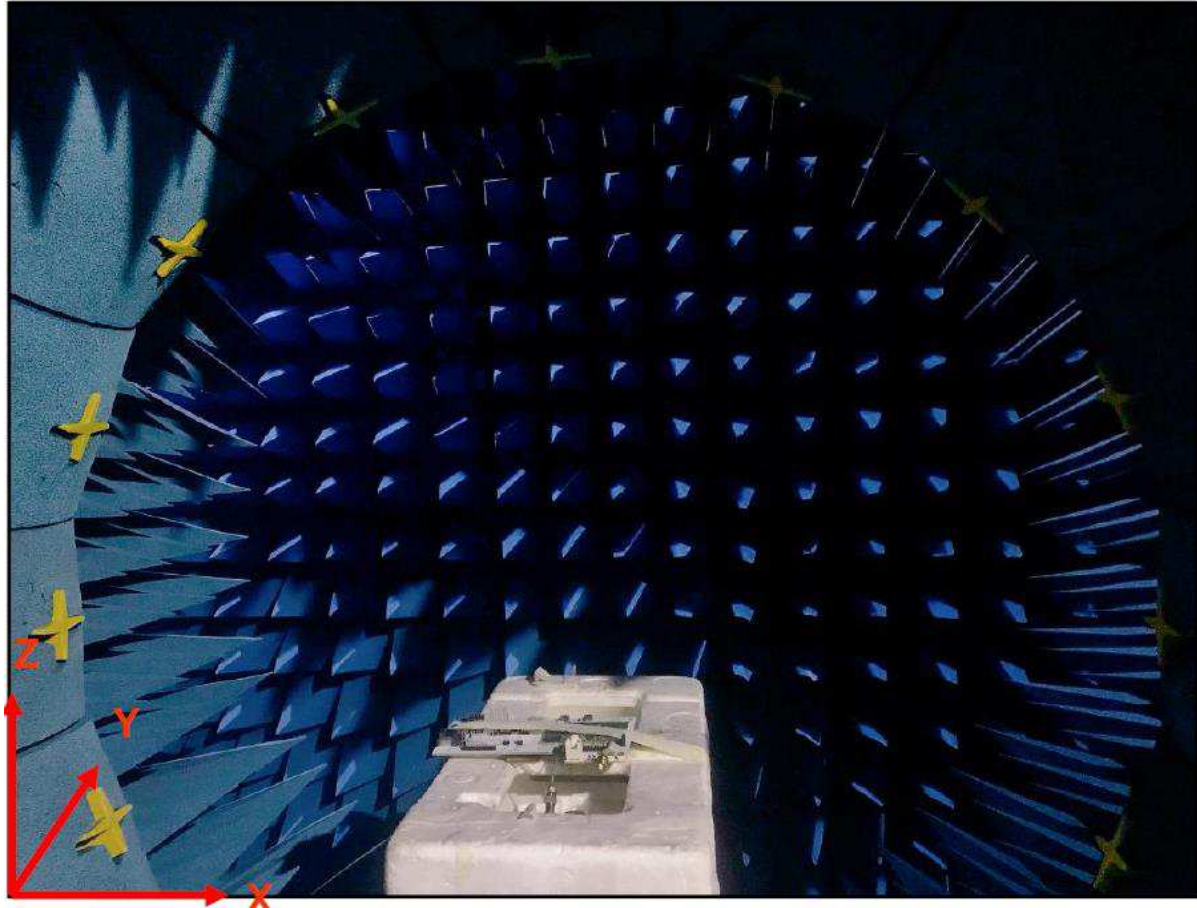
2.4 GHz WiFi band			
Frequency	2400 MHz	2450 MHz	2500 MHz
Max. realized gain	4.82 dBi (max. value)	3.98 dBi	3.09 dBi
Total efficiency	60 %	60 %	56 %

5 GHz WiFi band			
Frequency	5180 MHz	5500 MHz	5805 MHz
Max. realized gain	6.84 dBi (max. value)	5.71 dBi	4.74 dBi
Total efficiency	74 %	56 %	42 %

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5 Coordinate System

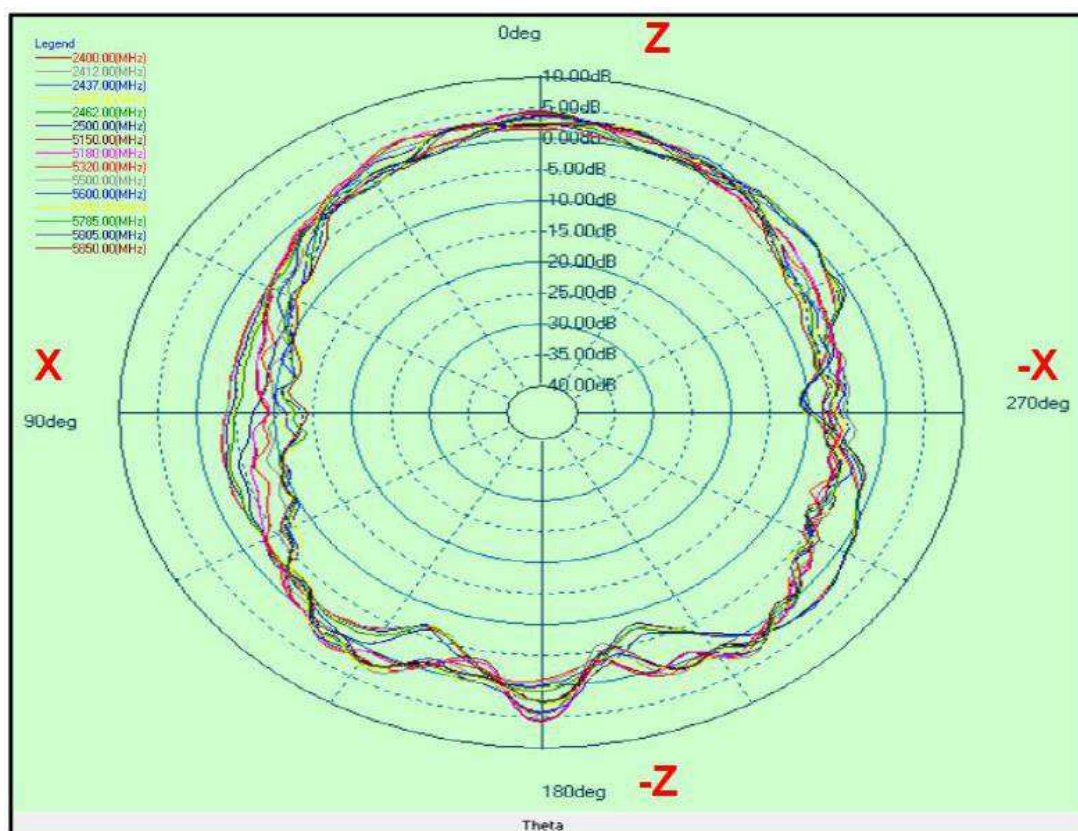


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6 2D Radiation Patterns

6.1 Antenna 0 – Direction ZX

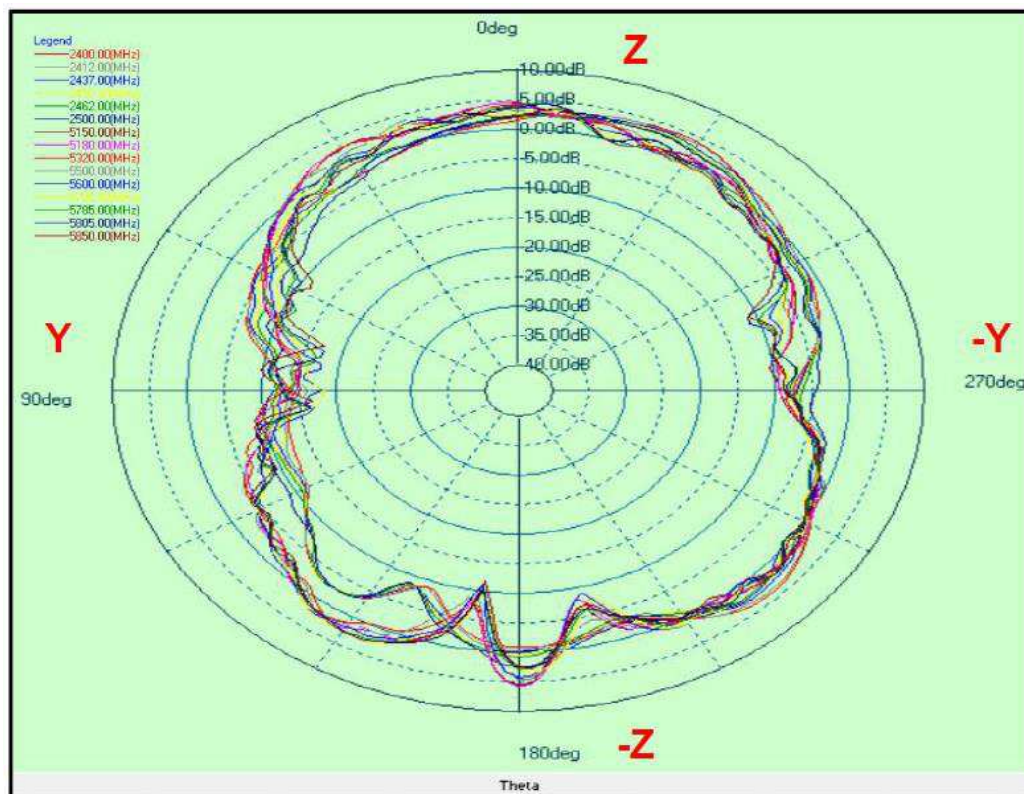


Layer	Max value	Min value	Average
2400 (MHz)	2.44 dB	-10.58 dB	-1.87 dB
2412 (MHz)	2.57 dB	-10.57 dB	-1.88 dB
2437 (MHz)	2.67 dB	-10.88 dB	-1.89 dB
2450 (MHz)	2.56 dB	-11.26 dB	-1.90 dB
2462 (MHz)	2.56 dB	-11.15 dB	-1.86 dB
2500 (MHz)	2.77 dB	-10.55 dB	-1.79 dB
5150 (MHz)	5.60 dB	-9.50 dB	-1.26 dB
5180 (MHz)	5.83 dB	-9.40 dB	-1.18 dB
5320 (MHz)	4.44 dB	-9.28 dB	-1.33 dB
5500 (MHz)	4.40 dB	-10.71 dB	-1.49 dB
5600 (MHz)	4.10 dB	-12.35 dB	-1.68 dB
5700 (MHz)	3.02 dB	-13.02 dB	-1.97 dB
5785 (MHz)	4.05 dB	-14.06 dB	-2.11 dB
5805 (MHz)	3.59 dB	-13.77 dB	-2.29 dB
5850 (MHz)	2.94 dB	-14.45 dB	-2.60 dB

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6.2 Antenna 0 – Direction ZY

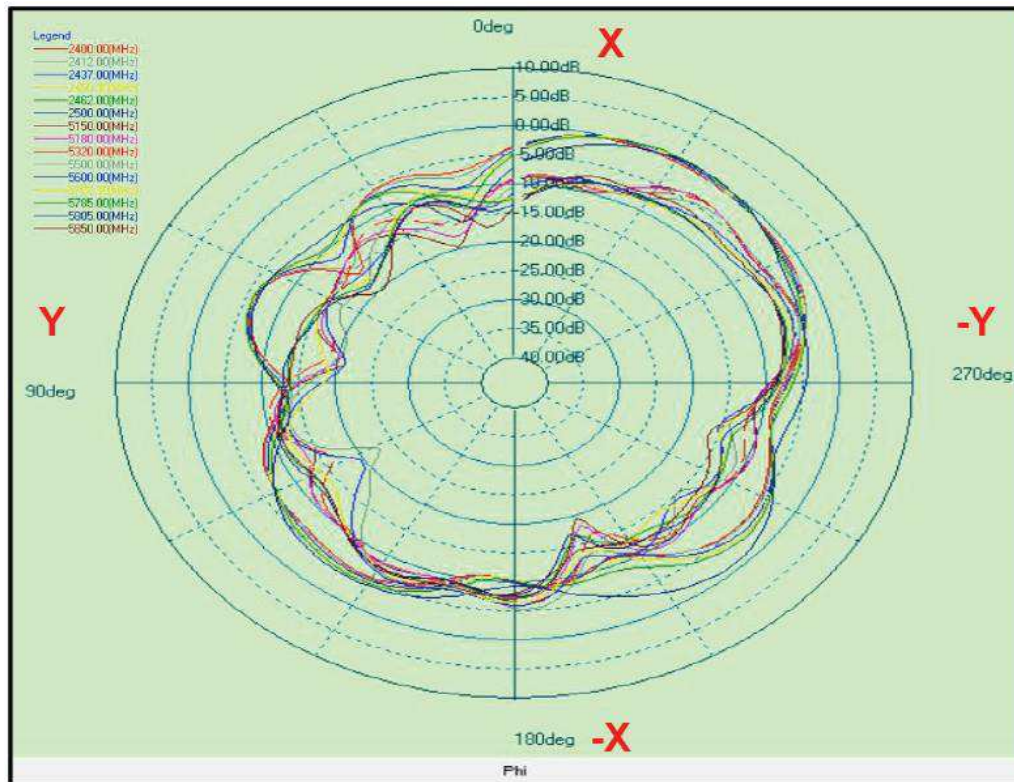


Layer	Max value	Min value	Average
2400 (MHz)	4.13 dB	-14.11 dB	-1.78 dB
2412 (MHz)	3.89 dB	-13.63 dB	-1.85 dB
2437 (MHz)	3.63 dB	-12.73 dB	-2.00 dB
2450 (MHz)	3.35 dB	-12.42 dB	-2.13 dB
2462 (MHz)	3.06 dB	-12.19 dB	-2.19 dB
2500 (MHz)	3.36 dB	-12.56 dB	-2.05 dB
5150 (MHz)	5.60 dB	-15.30 dB	-1.19 dB
5180 (MHz)	5.83 dB	-14.96 dB	-1.13 dB
5320 (MHz)	4.44 dB	-15.30 dB	-1.38 dB
5500 (MHz)	4.40 dB	-16.37 dB	-1.41 dB
5600 (MHz)	4.10 dB	-18.15 dB	-1.69 dB
5700 (MHz)	3.30 dB	-18.44 dB	-1.81 dB
5785 (MHz)	4.39 dB	-16.75 dB	-1.94 dB
5805 (MHz)	4.25 dB	-17.57 dB	-2.00 dB
5850 (MHz)	3.62 dB	-17.32 dB	-2.25 dB

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6.3 Antenna 0 – Direction XY

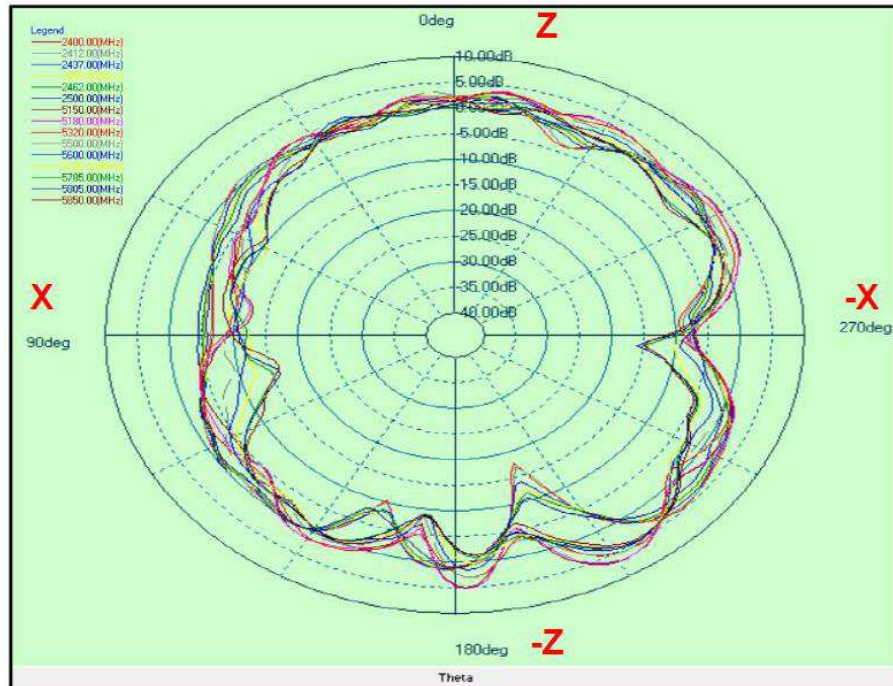


Layer	Max value	Min value	Average
2400 (MHz)	-0.32 dB	-16.29 dB	-5.98 dB
2412 (MHz)	-0.13 dB	-14.78 dB	-5.93 dB
2437 (MHz)	0.22 dB	-13.61 dB	-5.82 dB
2450 (MHz)	0.37 dB	-13.47 dB	-5.75 dB
2462 (MHz)	0.47 dB	-13.52 dB	-5.60 dB
2500 (MHz)	0.25 dB	-15.87 dB	-5.21 dB
5150 (MHz)	-3.80 dB	-21.29 dB	-10.13 dB
5180 (MHz)	-3.83 dB	-20.45 dB	-9.95 dB
5320 (MHz)	-3.88 dB	-19.19 dB	-9.93 dB
5500 (MHz)	-4.12 dB	-23.04 dB	-10.32 dB
5600 (MHz)	-4.95 dB	-21.23 dB	-10.68 dB
5700 (MHz)	-5.40 dB	-19.01 dB	-10.73 dB
5785 (MHz)	-6.05 dB	-18.56 dB	-10.71 dB
5805 (MHz)	-6.26 dB	-18.90 dB	-10.80 dB
5850 (MHz)	-6.33 dB	-20.45 dB	-10.83 dB

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6.4 Antenna 1 – Direction ZX

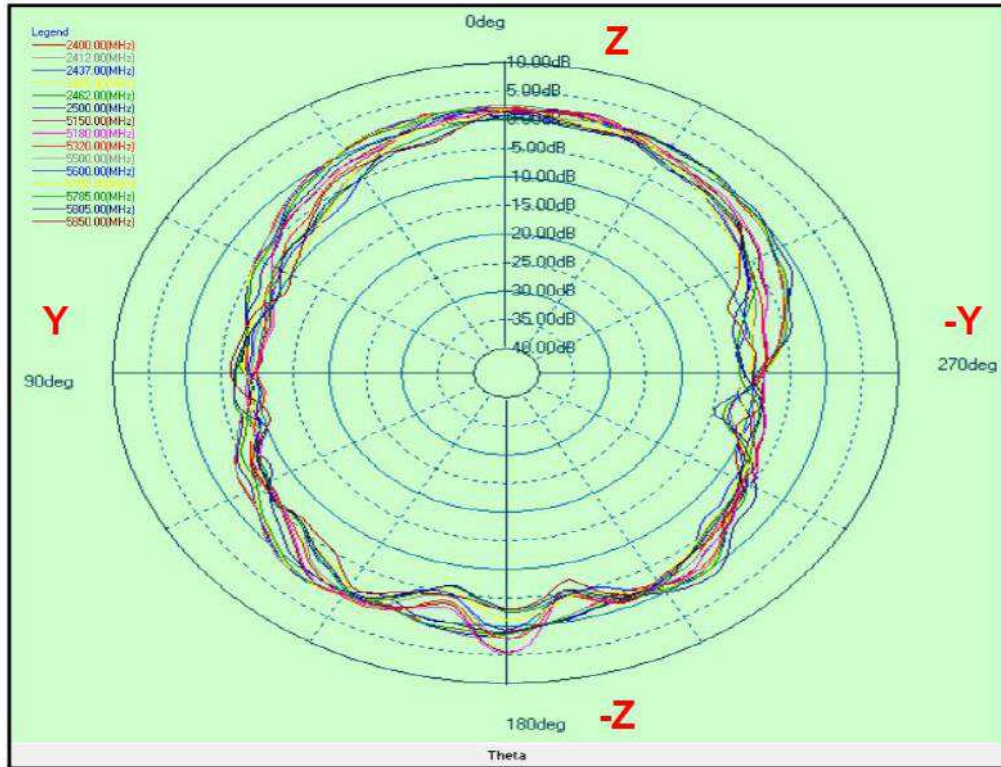


Layer	Max value	Min value	Average
2400 (MHz)	4.60 dB	-17.82 dB	-1.15 dB
2412 (MHz)	4.46 dB	-16.89 dB	-1.12 dB
2437 (MHz)	3.85 dB	-14.03 dB	-1.12 dB
2450 (MHz)	3.43 dB	-12.65 dB	-1.24 dB
2462 (MHz)	3.18 dB	-11.61 dB	-1.35 dB
2500 (MHz)	2.28 dB	-10.61 dB	-1.64 dB
5150 (MHz)	6.76 dB	-12.80 dB	-0.05 dB
5180 (MHz)	6.69 dB	-12.34 dB	0.06 dB
5320 (MHz)	5.50 dB	-10.18 dB	-0.36 dB
5500 (MHz)	5.48 dB	-10.10 dB	-0.95 dB
5600 (MHz)	4.86 dB	-11.76 dB	-1.82 dB
5700 (MHz)	4.60 dB	-12.95 dB	-2.38 dB
5785 (MHz)	4.79 dB	-15.28 dB	-2.62 dB
5805 (MHz)	4.69 dB	-16.35 dB	-2.74 dB
5850 (MHz)	4.38 dB	-16.49 dB	-2.73 dB

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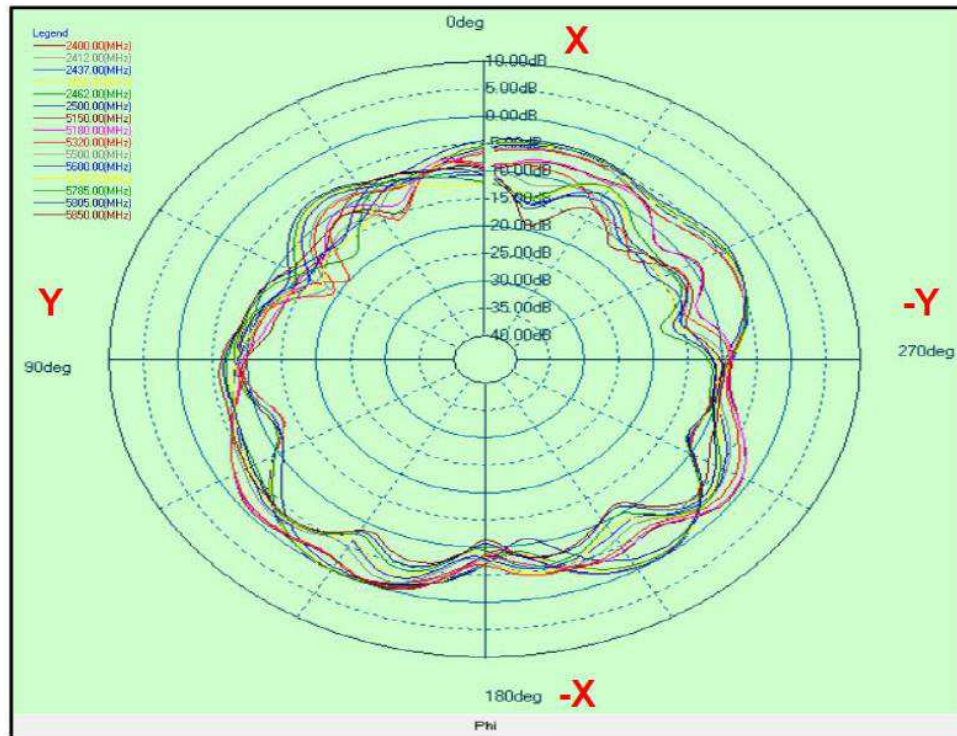
6.5 Antenna 1 – Direction ZY



Layer	Max value	Min value	Average
2400 (MHz)	2.03 dB	-12.71 dB	-1.85 dB
2412 (MHz)	2.35 dB	-12.74 dB	-1.72 dB
2437 (MHz)	1.93 dB	-12.82 dB	-1.75 dB
2450 (MHz)	1.92 dB	-13.22 dB	-1.82 dB
2462 (MHz)	1.89 dB	-13.43 dB	-1.93 dB
2500 (MHz)	2.14 dB	-14.80 dB	-2.18 dB
5150 (MHz)	4.40 dB	-10.78 dB	-2.84 dB
5180 (MHz)	4.64 dB	-11.29 dB	-2.83 dB
5320 (MHz)	2.06 dB	-10.94 dB	-3.33 dB
5500 (MHz)	2.35 dB	-10.02 dB	-3.74 dB
5600 (MHz)	1.45 dB	-12.36 dB	-4.51 dB
5700 (MHz)	1.45 dB	-11.91 dB	-4.48 dB
5785 (MHz)	0.01 dB	-12.13 dB	-4.53 dB
5805 (MHz)	0.41 dB	-12.26 dB	-4.75 dB
5850 (MHz)	1.42 dB	-11.62 dB	-4.64 dB

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6.6 Antenna 1 – Direction XY



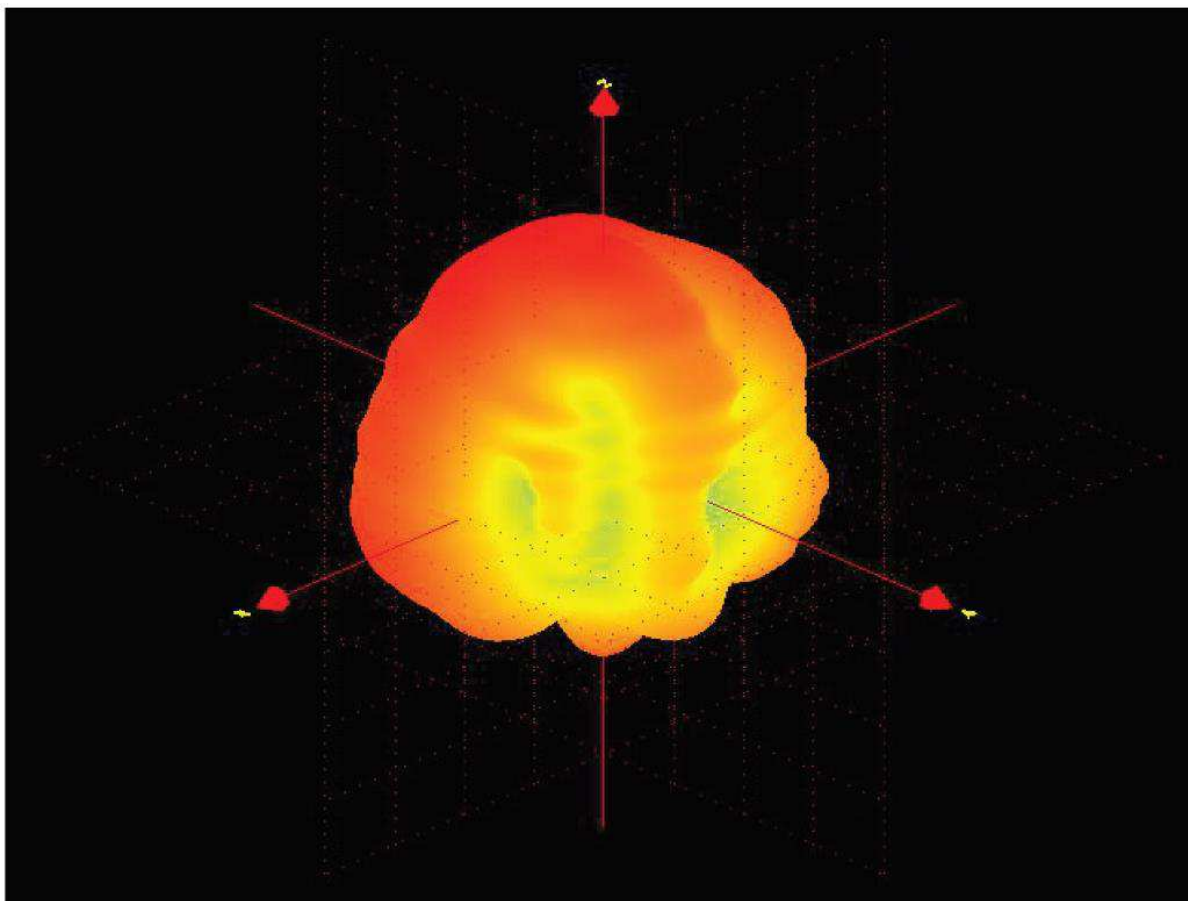
Layer	Max value	Min value	Average
2400 (MHz)	-0.17 dB	-19.56 dB	-6.48 dB
2412 (MHz)	-0.06 dB	-18.09 dB	-6.32 dB
2437 (MHz)	0.07 dB	-15.52 dB	-5.94 dB
2450 (MHz)	0.04 dB	-14.49 dB	-5.90 dB
2462 (MHz)	0.01 dB	-13.44 dB	-5.83 dB
2500 (MHz)	-0.58 dB	-12.70 dB	-6.04 dB
5150 (MHz)	-0.29 dB	-14.99 dB	-6.51 dB
5180 (MHz)	-0.52 dB	-14.91 dB	-6.53 dB
5320 (MHz)	-0.50 dB	-20.23 dB	-7.13 dB
5500 (MHz)	-1.72 dB	-16.41 dB	-7.97 dB
5600 (MHz)	-2.68 dB	-15.88 dB	-8.64 dB
5700 (MHz)	-3.24 dB	-17.29 dB	-8.74 dB
5785 (MHz)	-3.13 dB	-18.43 dB	-8.83 dB
5805 (MHz)	-3.94 dB	-16.60 dB	-9.05 dB
5850 (MHz)	-3.95 dB	-19.29 dB	-9.04 dB

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7 3D Gain Pattern

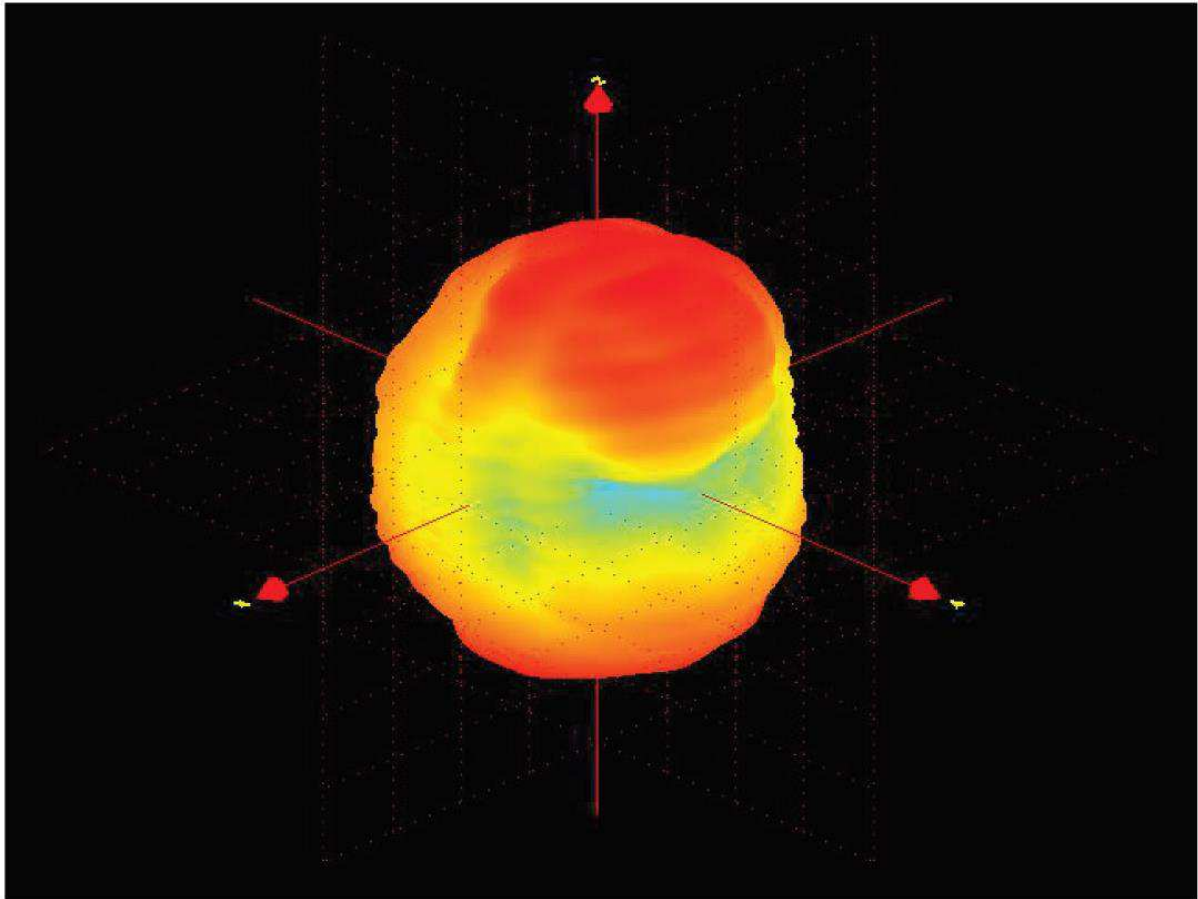
7.1 Antenna 0 – 2450MHz



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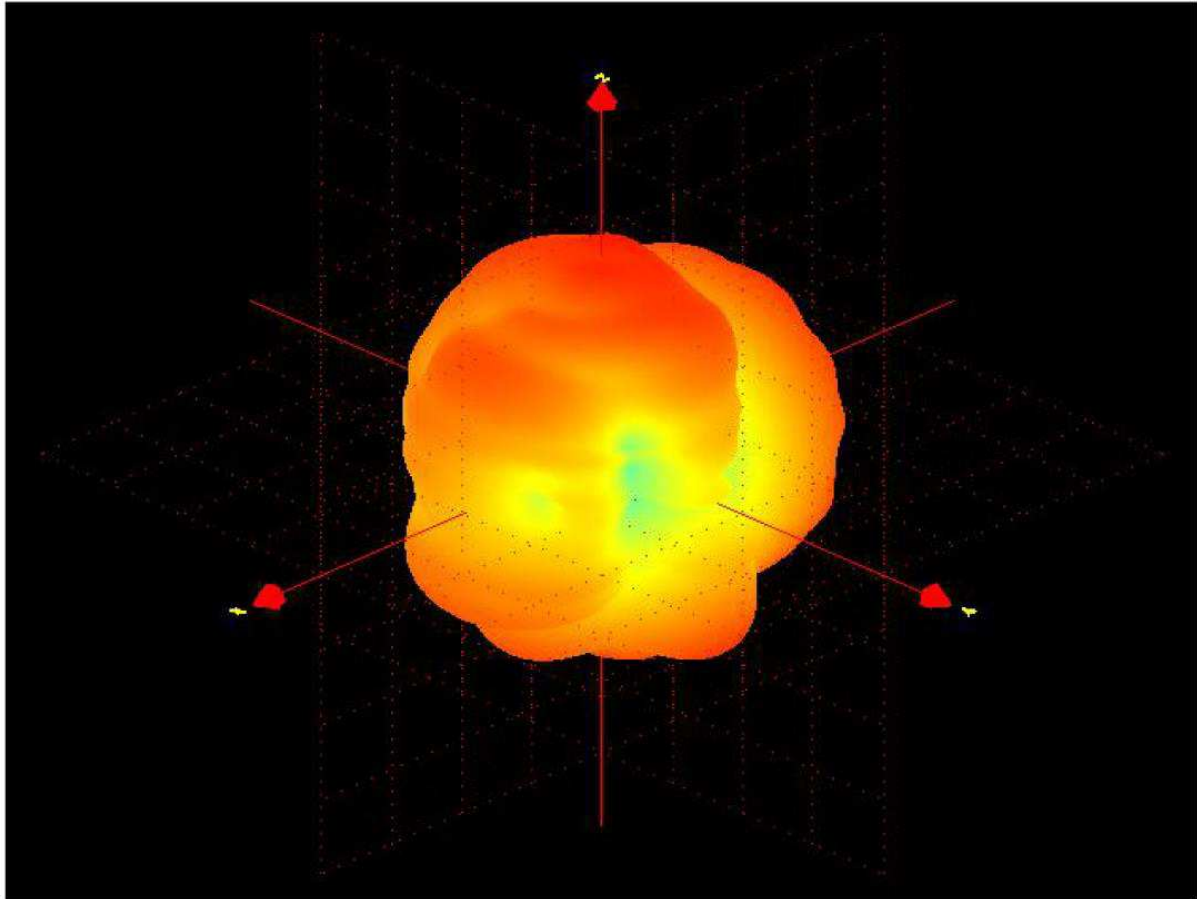
7.2 Antenna 0 – 5500MHz



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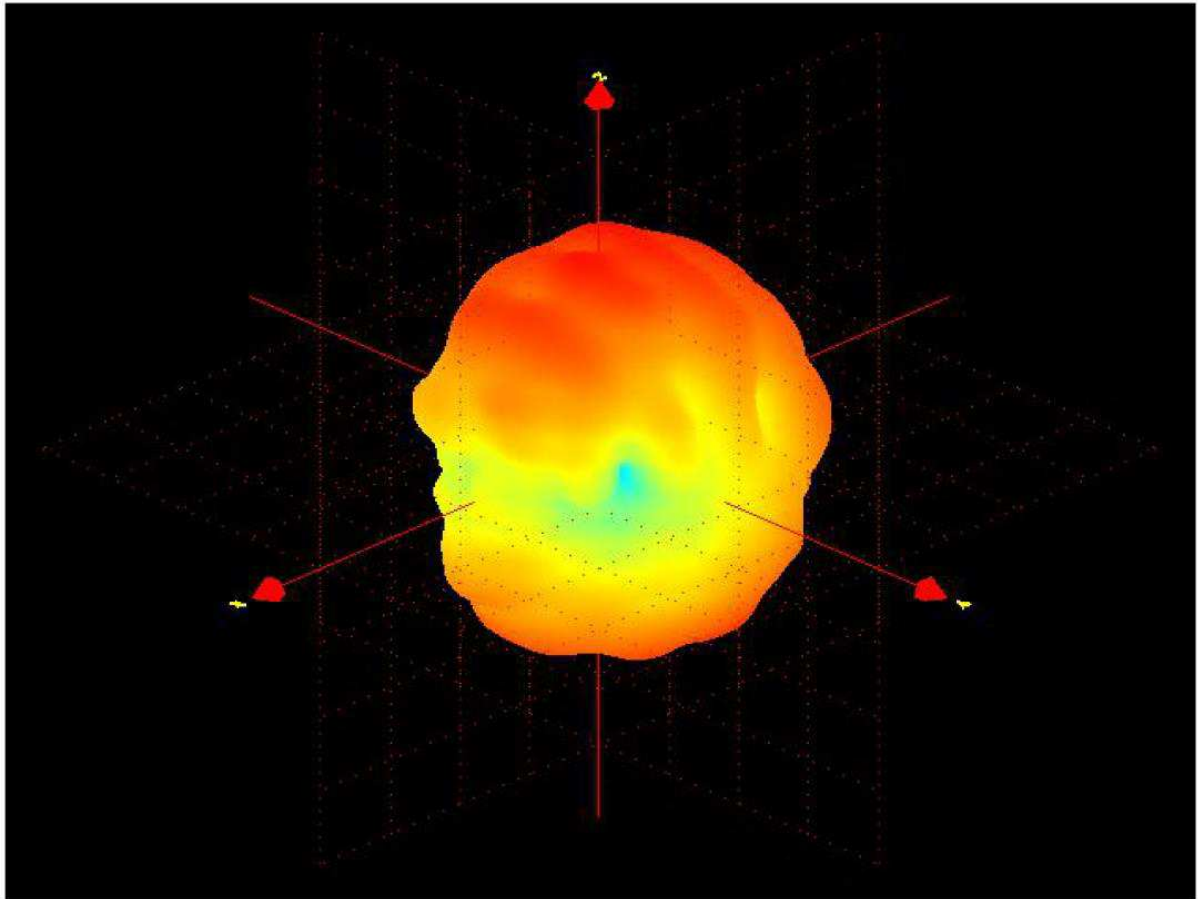
7.3 Antenna 1 – 2450MHz



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7.4 Antenna 1 – 5500MHz



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