

Report No. 25061-RP

Antenna gain and pattern measurement report

Page 1 of 35

Customer:

Applicant's Name	Resideo
Applicant's Address	Avenida Victo Hugo 11517
City, ZIP, Country	Chihuahua, 31136, Mexico

Equipment Under Test:

Product	Antennas of Denali thermostat
Manufacturer's Name	Elite Pro Series
Model	THX1200W5/U

Test Information:

Date of test	5/5/2025 – 5/7/2025
Data of issue	5/12/2025

Environmental Conditions:

Ambient temperature	+15 °C to + 35 °C
Relative humidity	20 % to 75 %
Atmospheric Pressure	86 kPa – 106 kPa

Approval:

Created and tested by	Josef Grygar, Test Engineer
Approved by	Libor Palíšek, Head of TL

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General information

This device has been tested by Ademco CZ s.r.o. testing laboratory on address: Tuřanka 1460/106a, Brno, 627 00, Czech Republic.

Ademco CZ s.r.o. testing laboratory is accredited by CAI according to ČSN EN ISO/IEC 17025:2018.

Laboratory number: 1695

Ademco CZ s.r.o. testing laboratory is FCC recognized to perform compliance testing.

Designation Number: CZ0004

Registration Number: 860869

Scope: FCC Part15, Subpart B; FCC Part15, Subpart C

Test results are applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of Ademco CZ s.r.o. testing laboratory

Measurement Uncertainty and Test Equipment

The measurement uncertainty was calculated according to EN 55016-4-2, ETSI TR 100 028-1, ETSI TR 100 028-2.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ such that the coverage probability corresponds to approximately 95 %.

Measurement Uncertainties were not taken into account and are published for informational purposes only.

Test	Standard Uncertainty
Radio frequency	$\pm 1 \times 10^{-7}$
RF power - conducted	± 0.75 dB
Effective radiated power	± 3.5 dB
Radiated emissions	± 5.6 dB
Radiated emissions- Substitution	± 4.3 dB
Conducted Spurious emissions	± 3.3 dB
Occupied Bandwidth	± 0.006 %
Temperature	± 0.6 °C
Humidity	± 3 %

The measuring equipment utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

Asset No.	Manufacturer	Model	Description	Cal. Date	Cal. Due date
951448	RF Spin	QRH11	Antenna (Horn)	3/9/2020	3/8/2026
950776	Rohde & Schwarz	FSV40	Signal analyzer	05/31/2023	5/30/2025
-	UTiFLEX	UFB142A	RF Cable	N/A	N/A
951537	Fluke	F175	Multimeter	02/14/2023	02/13/2026
951131	Kikusui	PCR500M	Power source	N/A	N/A

Equipment Under Test

Product Name	Antennas of Denali thermostat
Test Model	Denali (THX1200W5/U)
HW, SW	-
Power supply	24VAC, 60Hz
Continuous radiation power setting	Redlink – 12 dBm BLE – 12 dBm WLAN 2.4 GHz – 21 dBm WLAN 5 GHz – 19 dBm

EUT antennas

	Antenna type	Frequency range (MHz)
Antenna A	Redlink - SubGHz	903 MHz – 926.4 MHz
Antenna B	Redlink - SubGHz	903 MHz – 926.4 MHz
Antenna SIDE	BLE + WLAN 2.4GHz + 5 GHz	2402 MHz-2480 MHz, 2412 MHz-2462 MHz, 5180 MHz-5825 MHz
Antenna TOP	BLE + WLAN 2.4GHz + 5 GHz	2402 MHz-2480 MHz, 2412 MHz-2462 MHz, 5180 MHz-5825 MHz



Figure 1 EUT – Front side



Figure 2 EUT- back side

Test facility and methodology

Test facility:

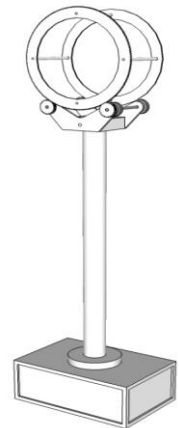
Total EIRP value was measured in the FAR chamber as a summary of EIRP for both horizontal and vertical measurement polarization. FAR chamber is equipped by positioner, which rotates the EUT by 360° in azimuth and elevation with increment of 10°. Measurement distance is 3m.

Antenna chamber

- 800 MHz – 18 GHz
- Full conformity with CTIA (The Wireless Association)
- Shielding effectiveness: 100 dB (30 MHz – 8 GHz), 80 dB (8 GHz – 18 GHz)
- 5.7 m x 3.5 m x 4 m (3 m measurement distance)
- Quiet zone: $\varnothing$ 0.7 m (800 MHz), $\varnothing$ 0.25 m (6 GHz), $\varnothing$ 0.15 m (up to 18 GHz)
- Quiet zone perturbation: - 15 dB (800 MHz), - 20 dB (1 GHz), - 30 dB (2 GHz), - 40 dB (4 GHz - 18 GHz)
- Feedthroughs for data (universal optical convertor)
- Feedthroughs for power supply
- Absorbers: MT 45, MT65 – Minimum Return loss is -40 dB.

Positioner

- Sunol Sciences FS-121 turntable
- 3D radiation pattern
- Max. load 1 kg (3D), 10 kg (2D)
- Software to control measurement with data processing and visualization



Test Methodology:

Antenna gain is measured in active way. EUT has a test FW, which is capable of transmitting.

Antenna gain is obtained as the result of subtraction of Total Effective radiated power (EIRP) and conducted power on antenna input. For conducted power measurement was EUT connected with signal analyzer and antenna input power was recorded. Cable attenuation was taken into account.

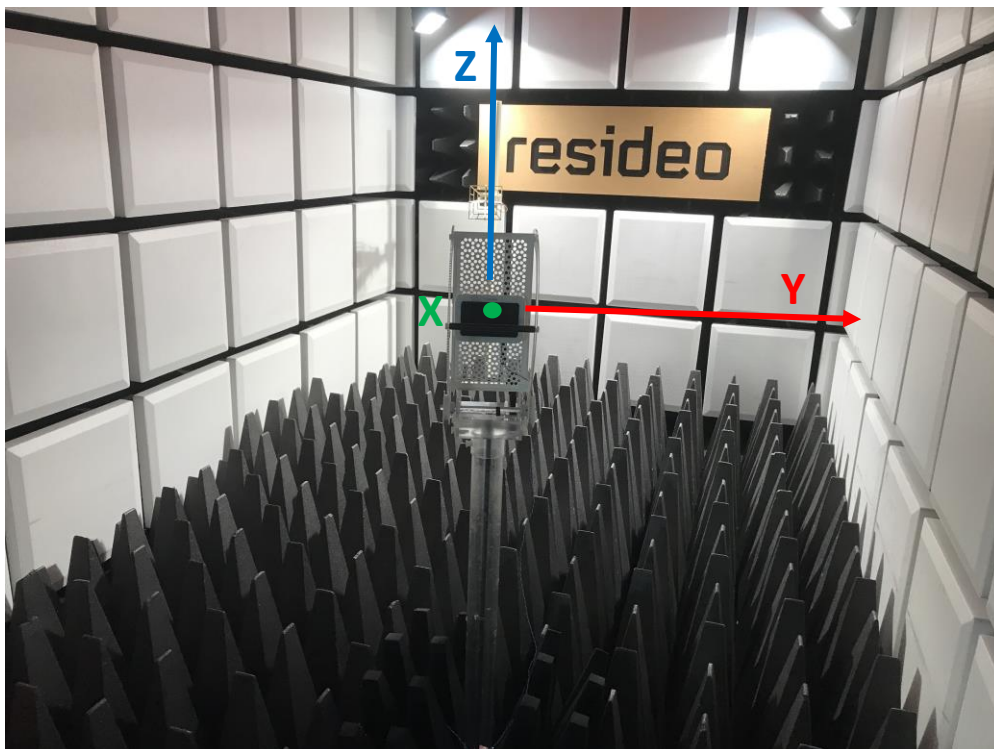


Figure 3 EUT zero position and orientation

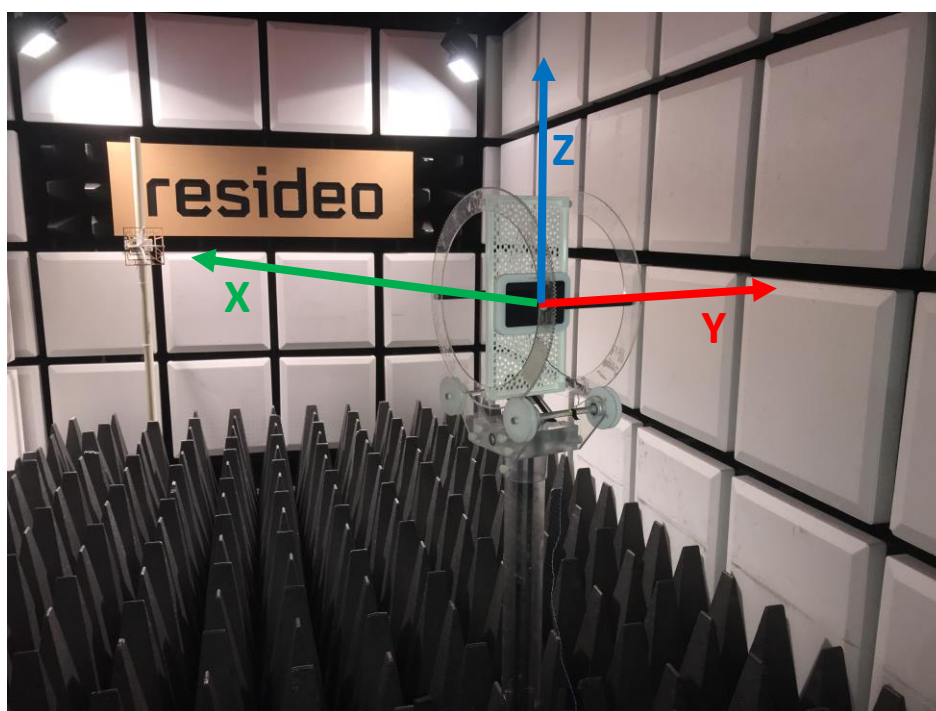


Figure 4 EUT zero position and orientation

Test results

ANTENNA A

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
903	10.7	12.0	1.3
914.6	10.7	11.4	0.7
926.4	10.7	11.0	0.3

ANTENNA B

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
903	10.7	9.9	-0.8
914.6	10.7	10.8	0.1
926.4	10.7	10.4	-0.3

ANTENNA SIDE – BLE

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
2402	11.6	12.6	1.0
2442	11.7	14.2	2.5
2480	11.8	14.8	3.0

ANTENNA TOP – BLE

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
2402	11.4	12.0	0.6
2442	11.2	12.3	1.1
2480	11.3	13.2	1.9

ANTENNA SIDE – WLAN 2.4 GHz + 5 GHz

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
2412	19.9	21.1	1.2
2437	19.3	21.7	2.4
2462	19.6	22.0	2.4
5180	19.8	23.6	3.8
5320	19.7	22.9	3.2
5500	19.5	23.6	4.1
5700	19.5	22.2	2.7
5825	19.4	21.9	2.5

ANTENNA TOP– WLAN 2.4 GHz + 5 GHz

Frequency	Conducted Power [dBm]	Total EIRP [dBm]	Ant. Gain [dBi]
2412	19.1	20.3	1.2
2437	18.9	20.2	1.3
2462	19.2	20.0	0.8
5180	18.6	21.0	2.4
5320	18.7	20.4	1.7
5500	18.9	22.1	3.2
5700	18.9	20.2	1.3
5825	18.9	19.6	0.7

Ant. Gain (dBi) = Total EIRP (dBm) – Conducted power (dBm)

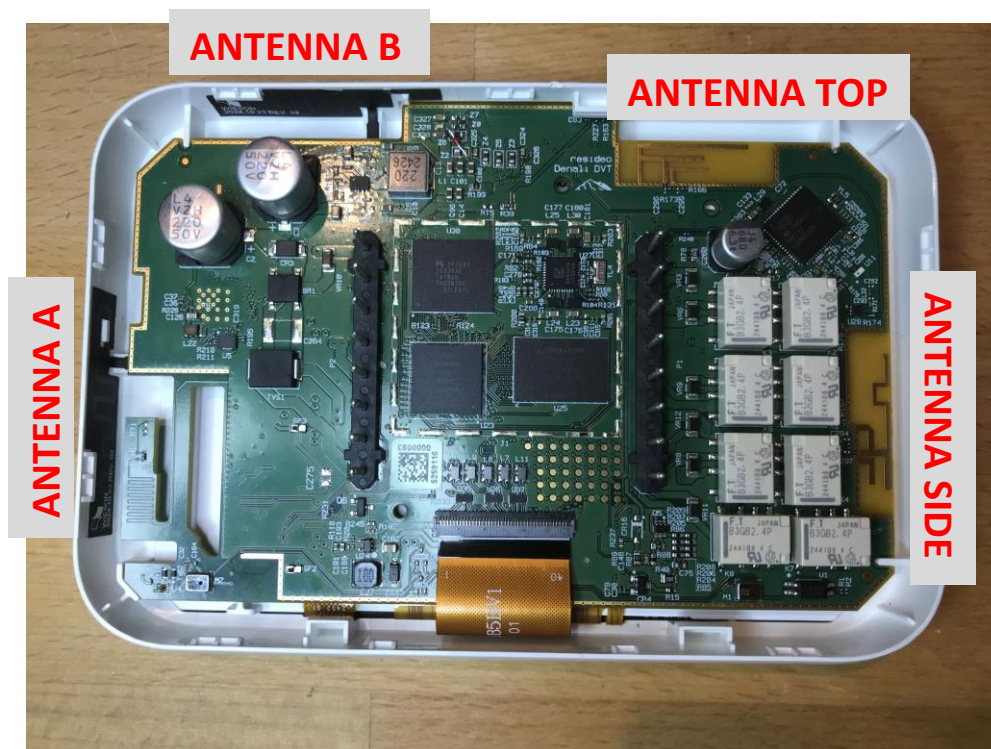
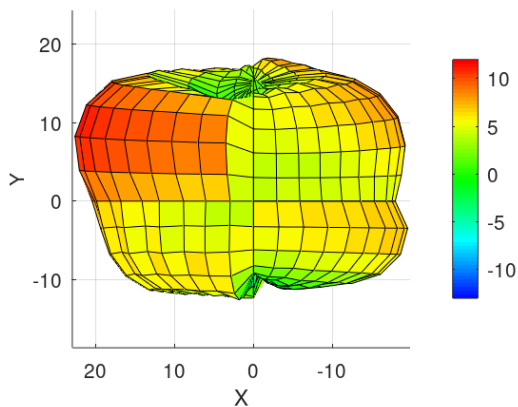


Figure 5 EUT Antennas

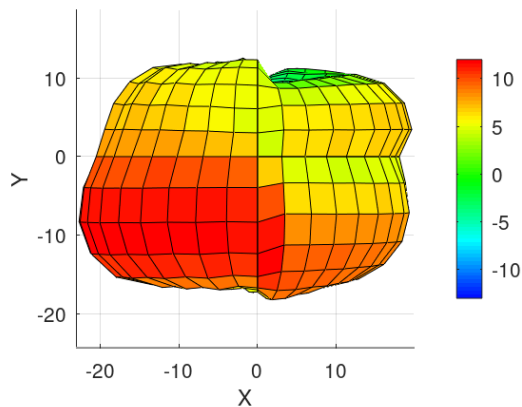
3D PLOTS

ANTENNA A (903 MHz)

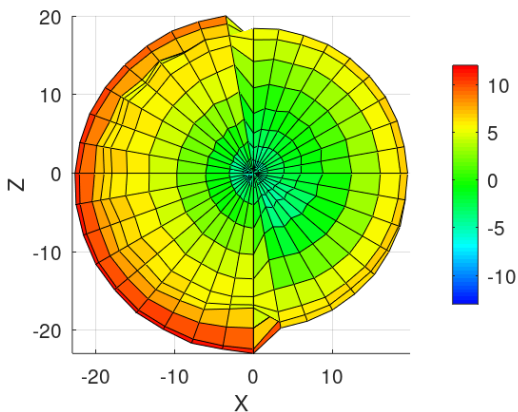
Total EIRP [dBm], Top View
Azimuth = 0°, elevation = 0°



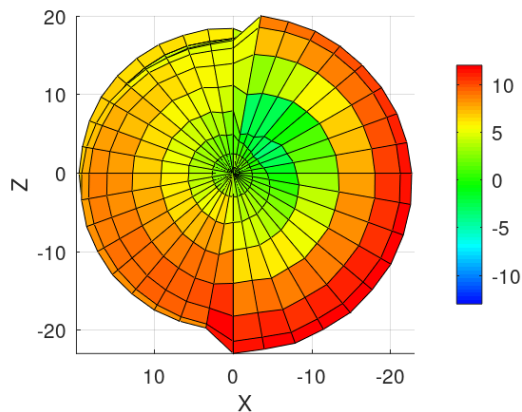
Total EIRP [dBm], Bottom View
Azimuth = 0°, elevation = 180°



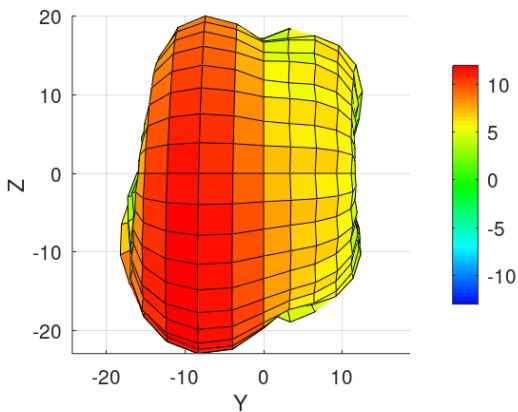
Total EIRP [dBm], Left Side View
Azimuth = 0°, elevation = 90°



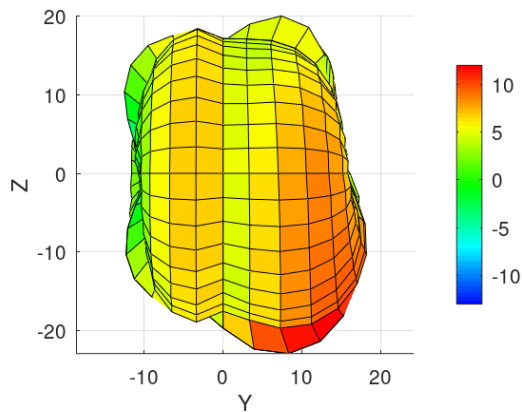
Total EIRP [dBm], Right Side View
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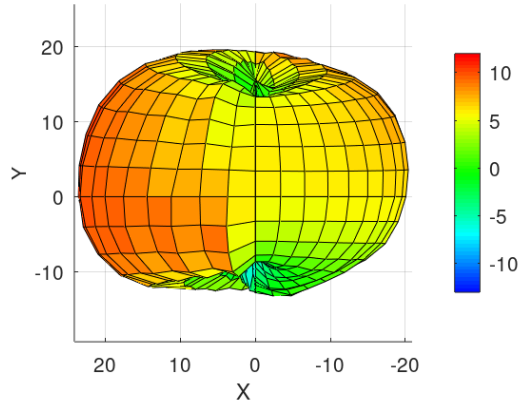
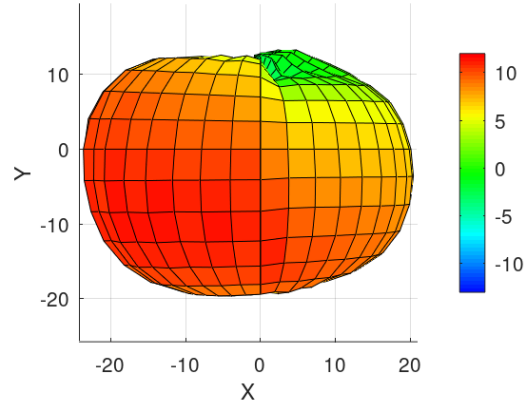
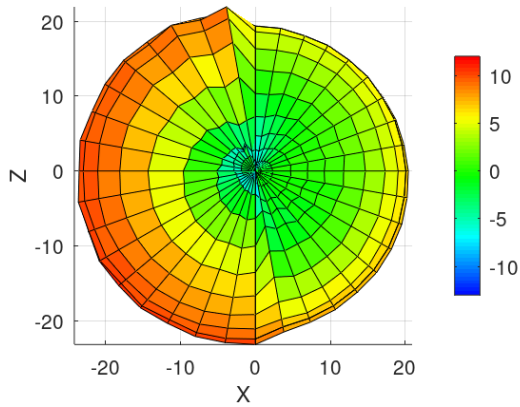
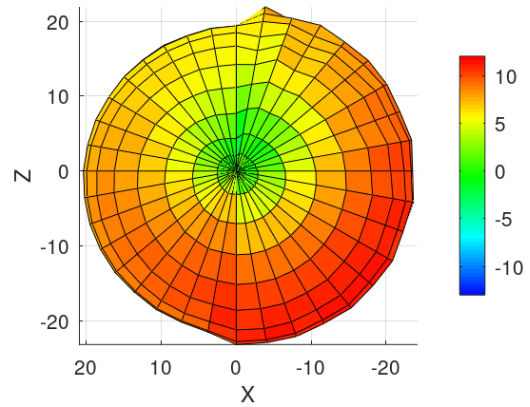
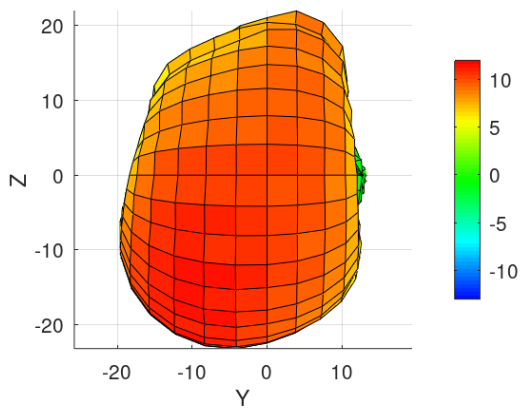
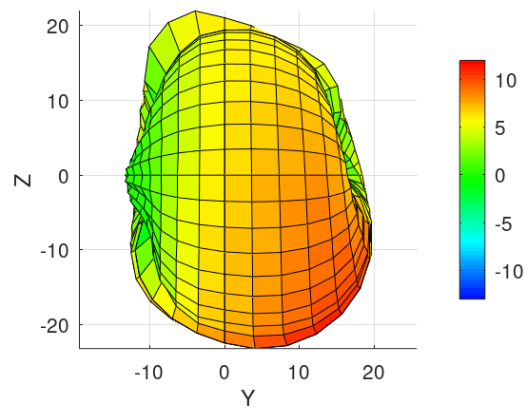


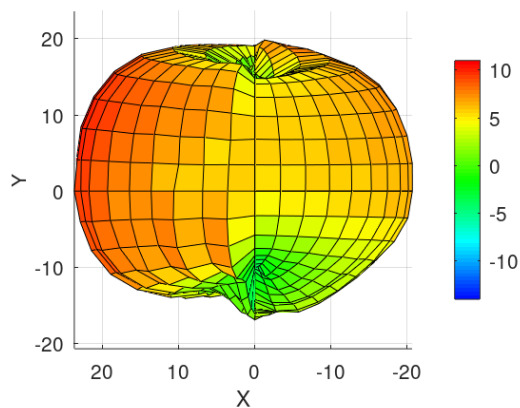
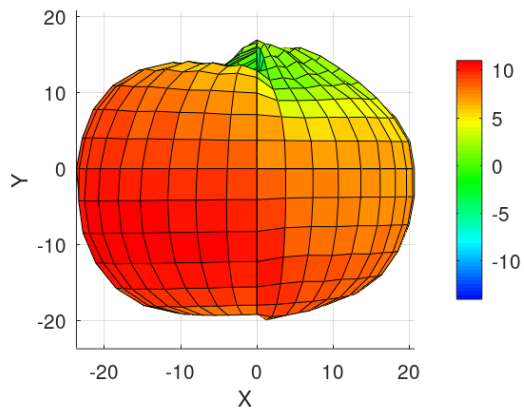
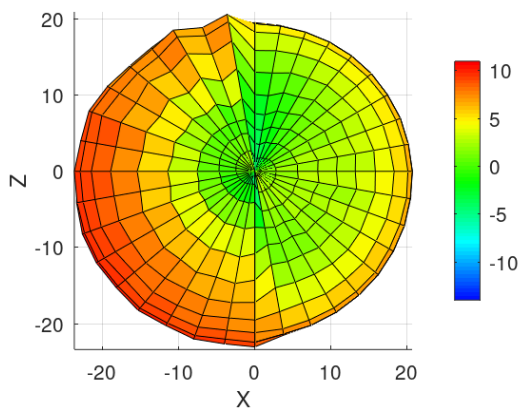
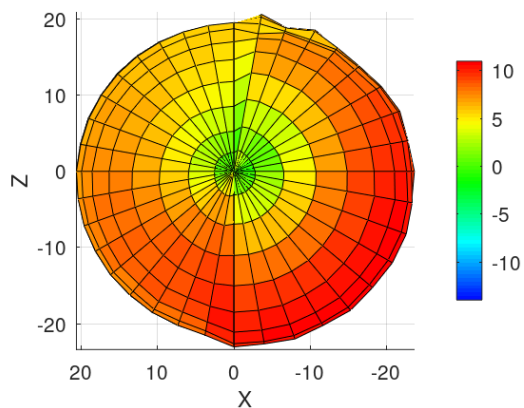
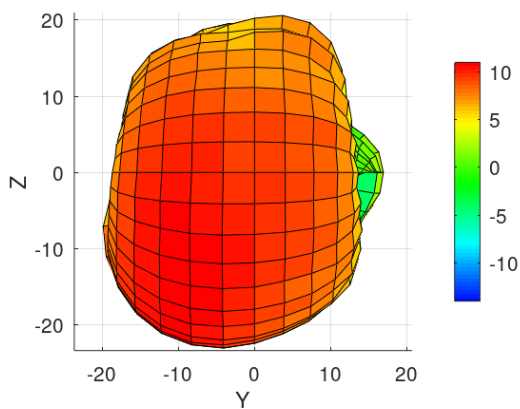
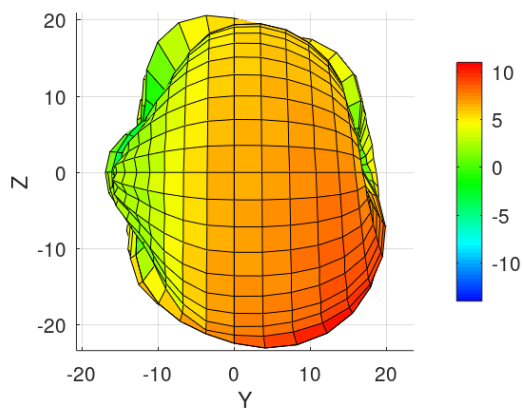
Total EIRP [dBm], Front Face View
Azimuth = 90°, elevation = 0°

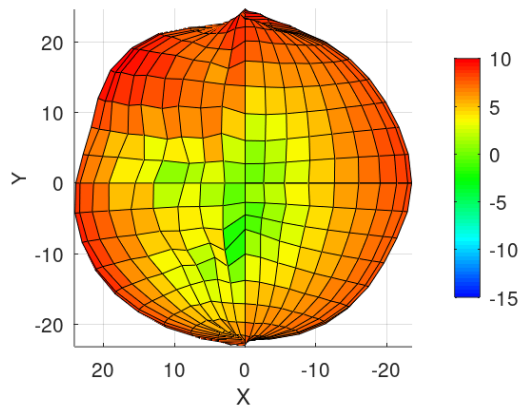
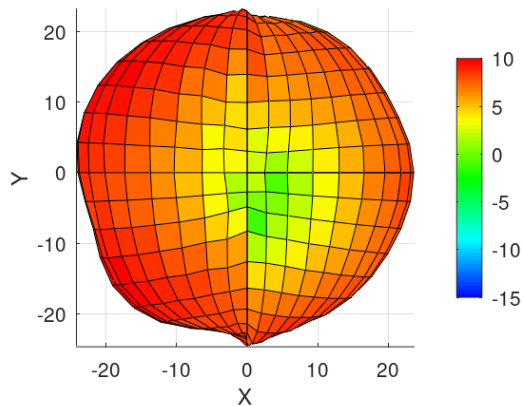
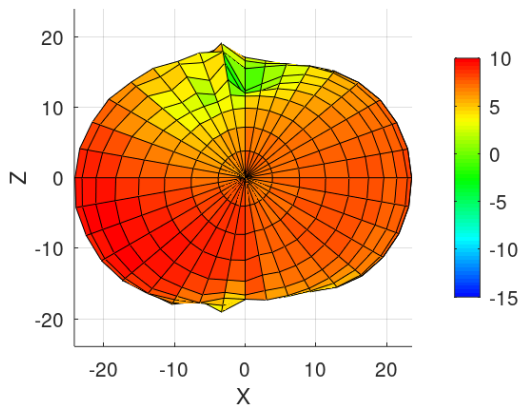
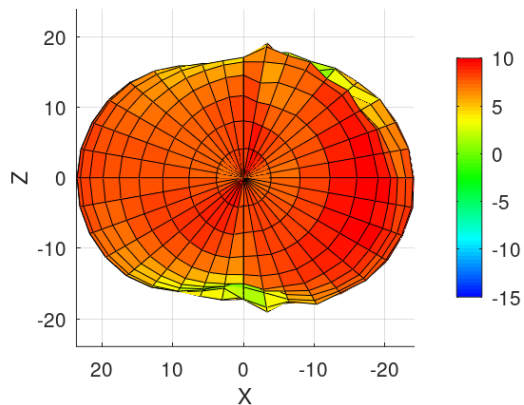
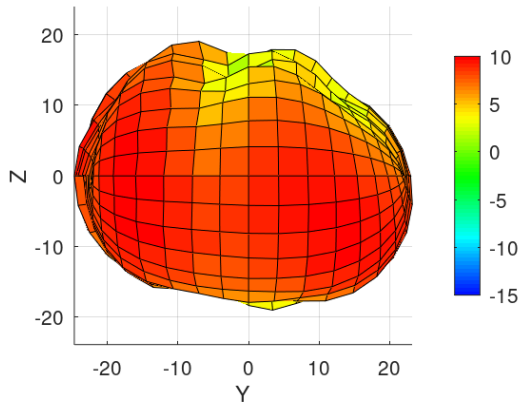
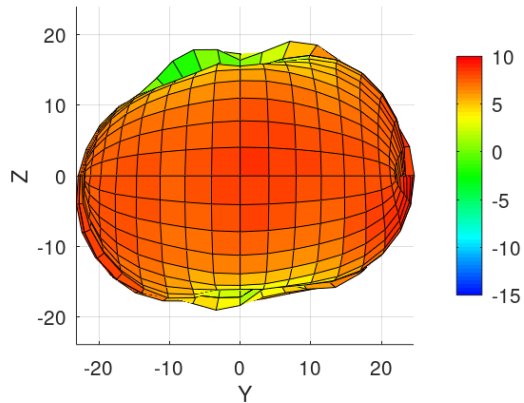


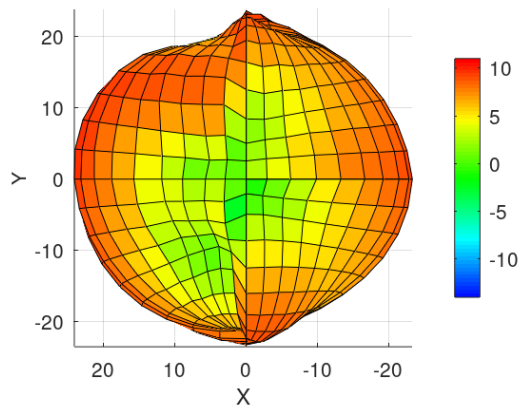
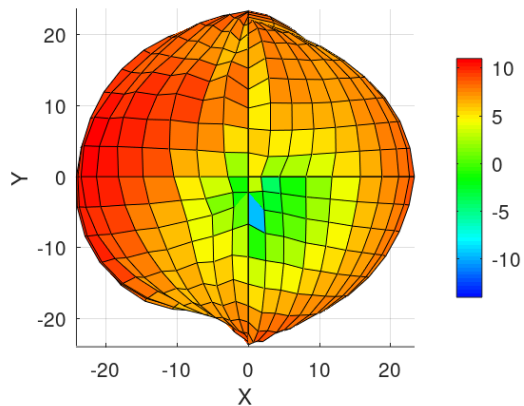
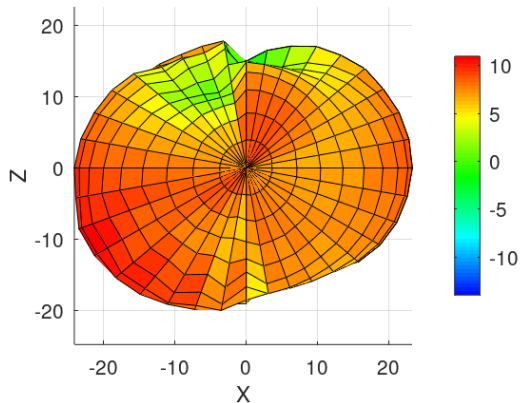
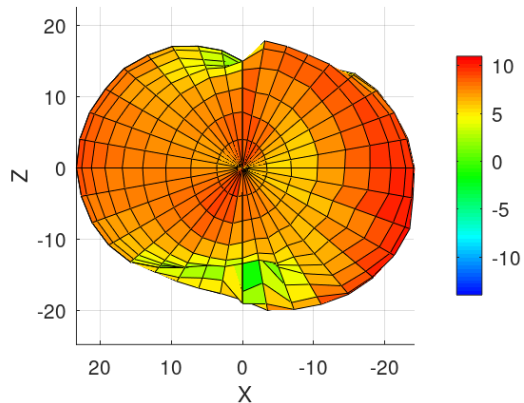
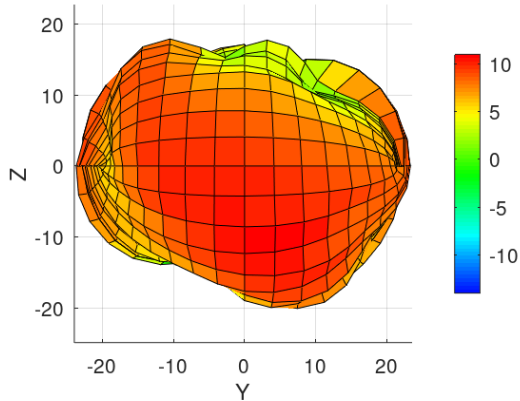
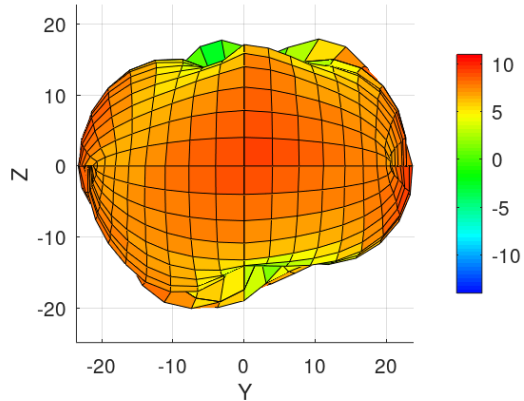
Total EIRP [dBm], Back Face View
Azimuth = -90°, elevation = 0°

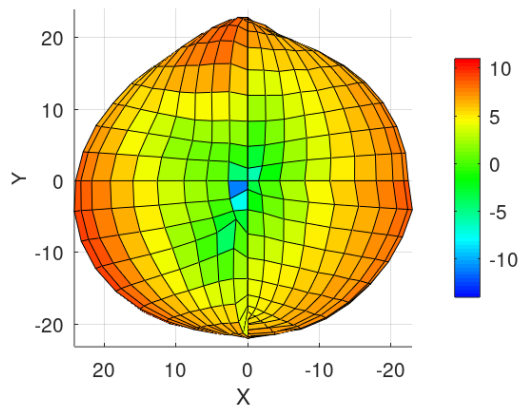
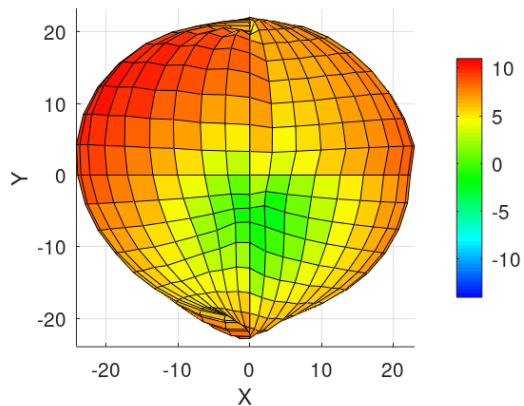
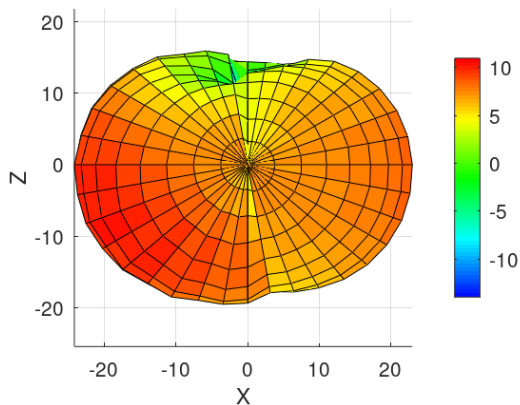
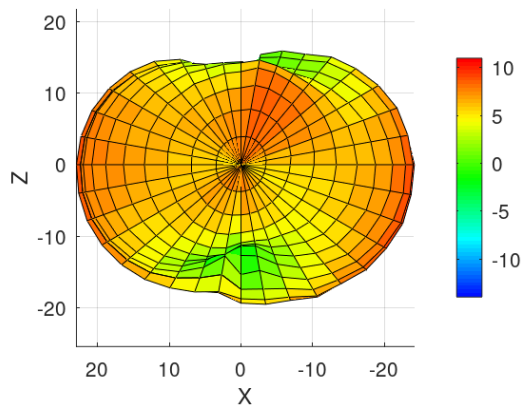
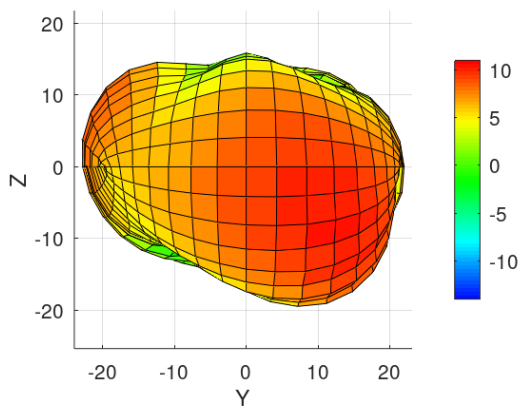
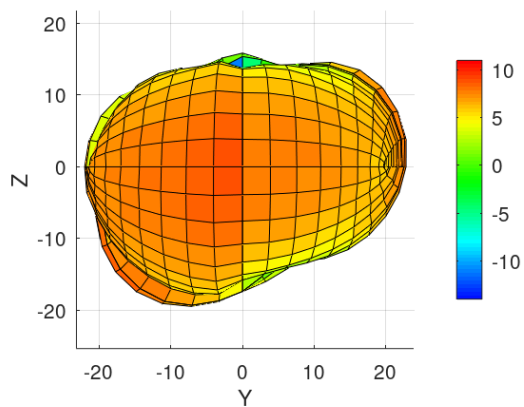


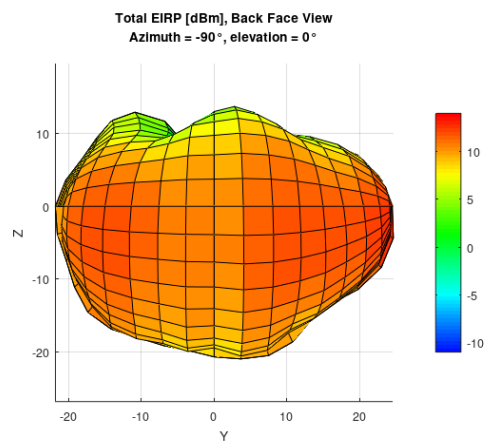
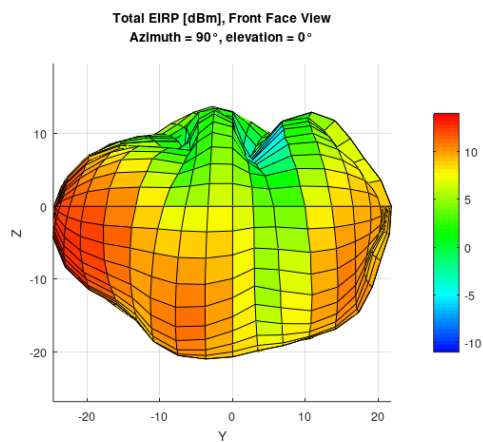
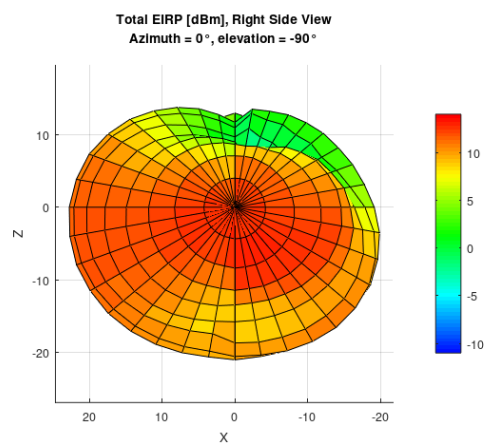
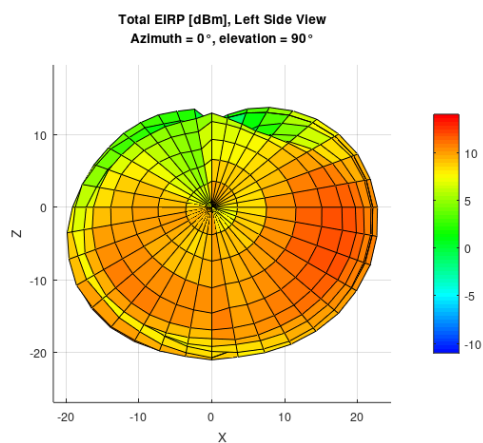
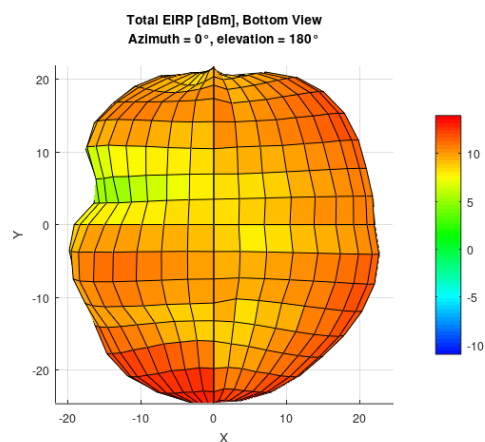
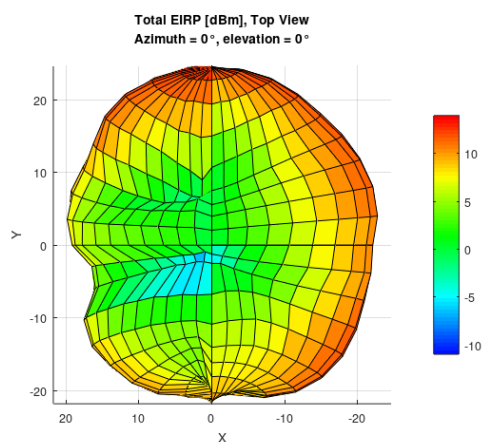
ANTENNA A (914.6 MHz)**Total EIRP [dBm], Top View**
Azimuth = 0°, elevation = 0°**Total EIRP [dBm], Bottom View**
Azimuth = 0°, elevation = 180°**Total EIRP [dBm], Left Side View**
Azimuth = 0°, elevation = 90°**Total EIRP [dBm], Right Side View**
Azimuth = 0°, elevation = -90°**Total EIRP [dBm], Front Face View**
Azimuth = 90°, elevation = 0°**Total EIRP [dBm], Back Face View**
Azimuth = -90°, elevation = 0°

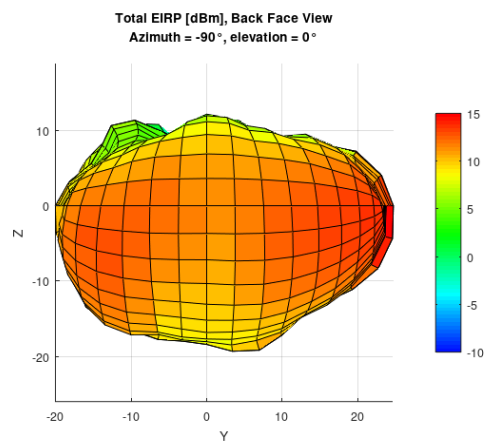
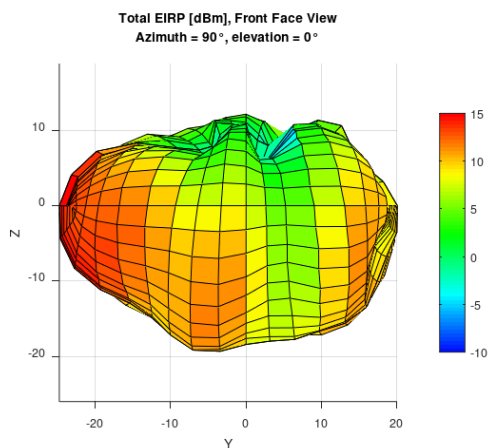
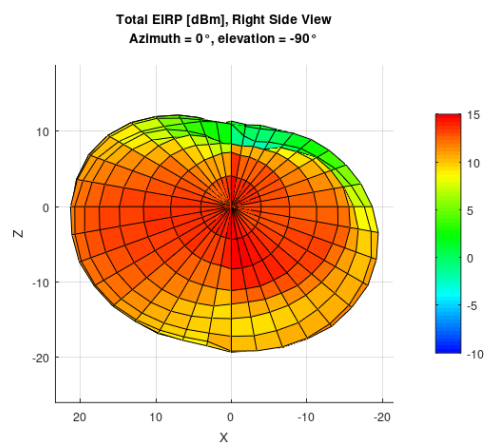
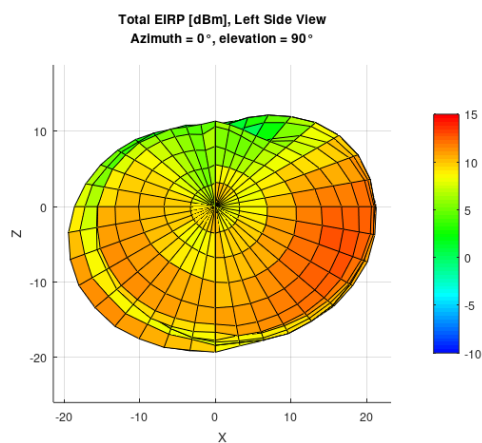
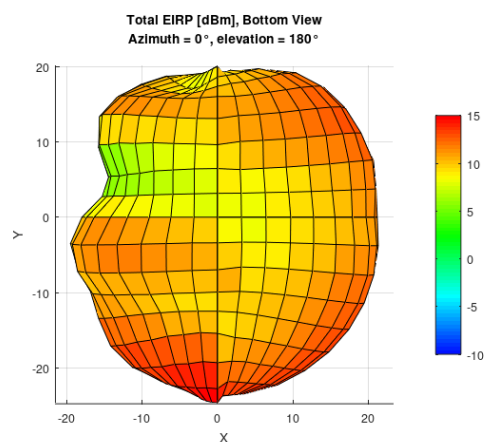
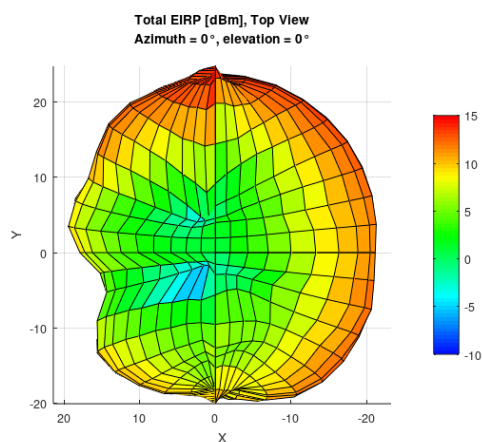
ANTENNA A (926.4MHz)**Total EIRP [dBm], Top View**
Azimuth = 0°, elevation = 0°**Total EIRP [dBm], Bottom View**
Azimuth = 0°, elevation = 180°**Total EIRP [dBm], Left Side View**
Azimuth = 0°, elevation = 90°**Total EIRP [dBm], Right Side View**
Azimuth = 0°, elevation = -90°**Total EIRP [dBm], Front Face View**
Azimuth = 90°, elevation = 0°**Total EIRP [dBm], Back Face View**
Azimuth = -90°, elevation = 0°

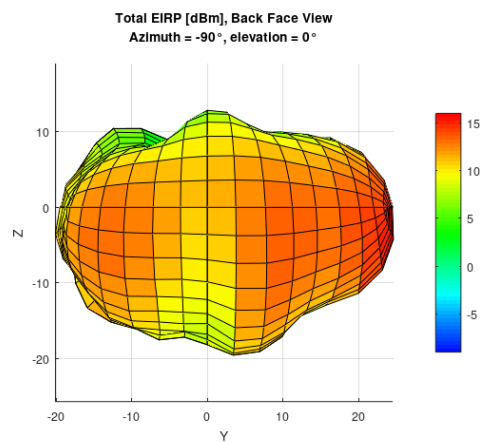
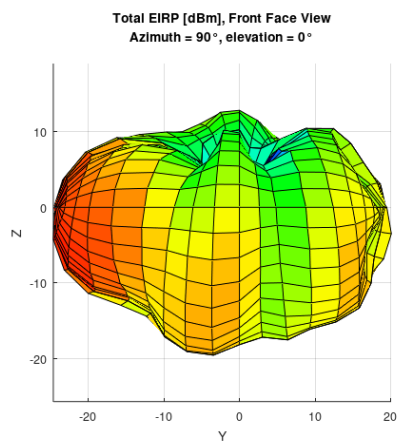
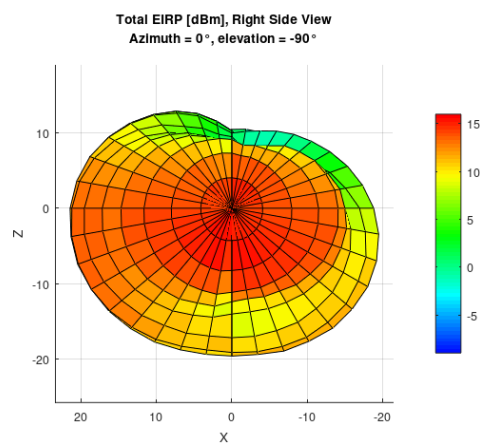
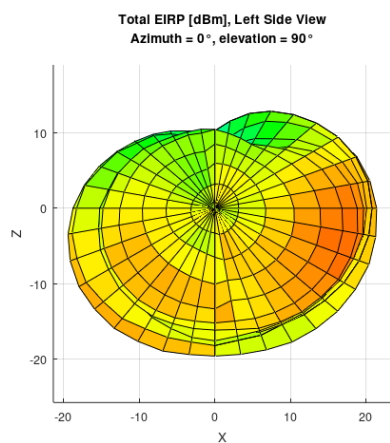
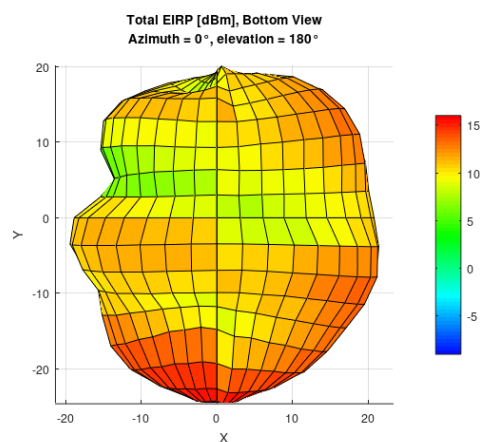
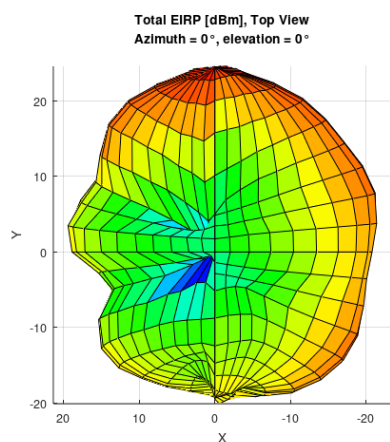
ANTENNA B (903 MHz)**Total EIRP [dBm], Top View**
Azimuth = 0°, elevation = 0°**Total EIRP [dBm], Bottom View**
Azimuth = 0°, elevation = 180°**Total EIRP [dBm], Left Side View**
Azimuth = 0°, elevation = 90°**Total EIRP [dBm], Right Side View**
Azimuth = 0°, elevation = -90°**Total EIRP [dBm], Front Face View**
Azimuth = 90°, elevation = 0°**Total EIRP [dBm], Back Face View**
Azimuth = -90°, elevation = 0°

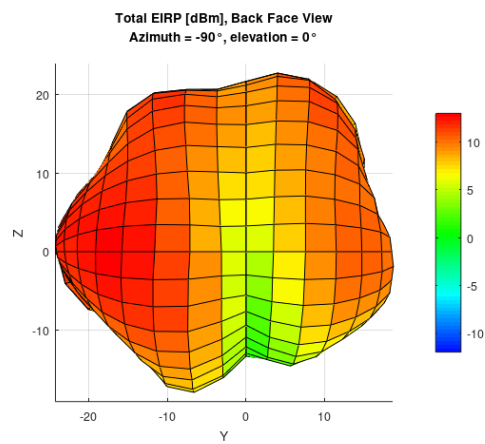
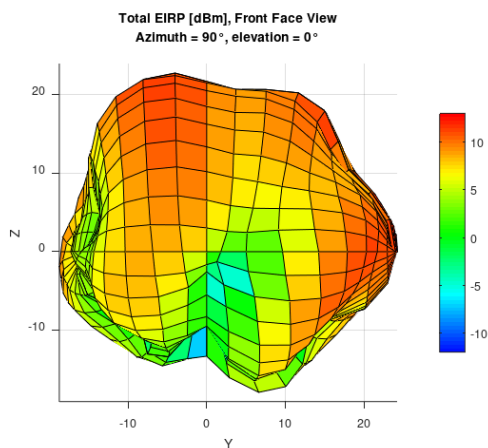
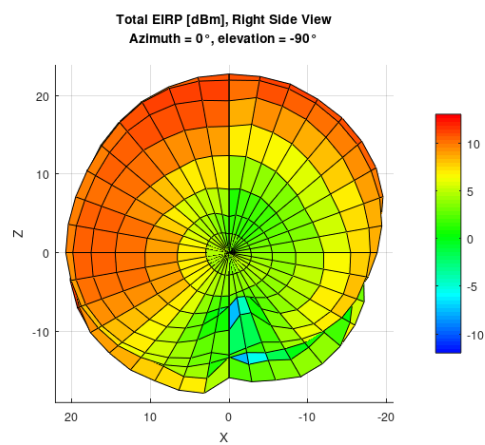
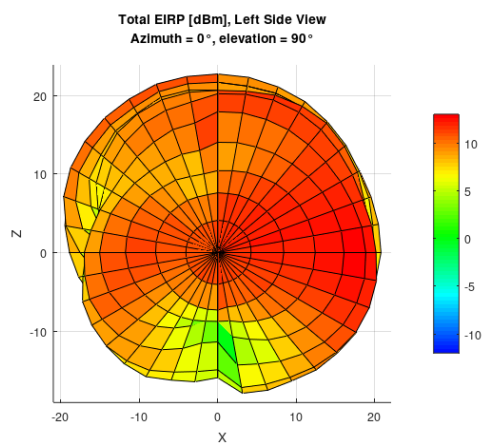
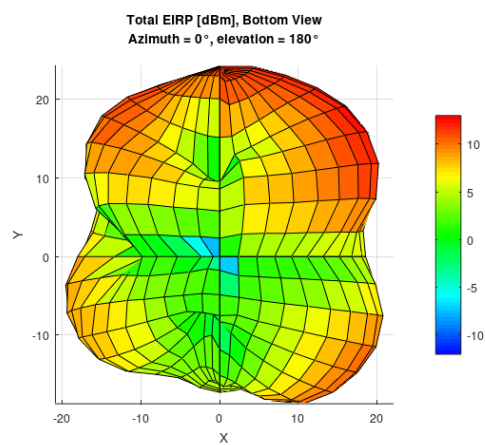
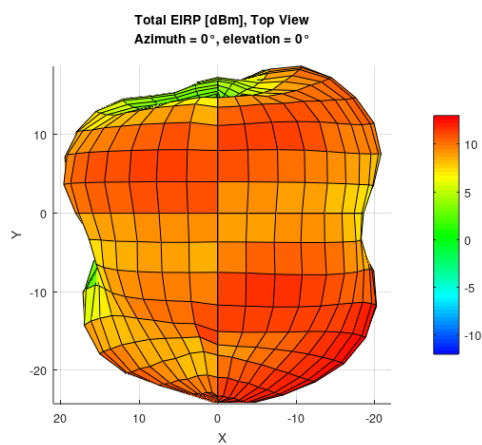
ANTENNA B (914.6 MHz)**Total EIRP [dBm], Top View**
Azimuth = 0°, elevation = 0°**Total EIRP [dBm], Bottom View**
Azimuth = 0°, elevation = 180°**Total EIRP [dBm], Left Side View**
Azimuth = 0°, elevation = 90°**Total EIRP [dBm], Right Side View**
Azimuth = 0°, elevation = -90°**Total EIRP [dBm], Front Face View**
Azimuth = 90°, elevation = 0°**Total EIRP [dBm], Back Face View**
Azimuth = -90°, elevation = 0°

ANTENNA B (926.4MHz)**Total EIRP [dBm], Top View**
Azimuth = 0°, elevation = 0°**Total EIRP [dBm], Bottom View**
Azimuth = 0°, elevation = 180°**Total EIRP [dBm], Left Side View**
Azimuth = 0°, elevation = 90°**Total EIRP [dBm], Right Side View**
Azimuth = 0°, elevation = -90°**Total EIRP [dBm], Front Face View**
Azimuth = 90°, elevation = 0°**Total EIRP [dBm], Back Face View**
Azimuth = -90°, elevation = 0°

ANTENNA SIDE - BLE (2402 MHz)

ANTENNA SIDE - BLE (2442 MHz)

ANTENNA SIDE - BLE (2480 MHz)

ANTENNA TOP - BLE (2402 MHz)

ANTENNA TOP - BLE (2442 MHz)