

# Regulatory WLAN Antenna Information

| Platform information                                                                                                                                                           |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------|---------------------------------------|--------------------------------------------------------------|----------------------------------|------------------------|--------------------------------------------|------------------------|------------------------|-------------------------|------------------------------------------|
| Brand                                                                                                                                                                          | ODM                         | ****End product model name | Intel platform<br>(ex: Yes, No or NA) | Platform type<br>(ex: regular NB, convertible PC, AIO...etc) | *SAR minimum separation (mm)     |                        |                                            |                        |                        |                         |                                          |
| Dell                                                                                                                                                                           | Compal                      | P176G                      | YES                                   | Regular NB                                                   | 3.65 mm<br>(w/o bumper: 2.15 mm) |                        |                                            |                        |                        |                         |                                          |
| ****Please fill in exact product model name and make sure the model name is visible on product cover or any parts for end users recognize for authority inspection.            |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| Antenna information                                                                                                                                                            |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| Vendor                                                                                                                                                                         |                             | Type                       |                                       | Antenna Part number (Main)                                   |                                  |                        | Antenna Part number (Aux)                  |                        |                        |                         |                                          |
| SPEEDWIRE                                                                                                                                                                      |                             | PIFA                       |                                       | F-0G-FH-6164-001-00<br>DC33002RP0L(Compal)                   |                                  |                        | F-0G-FH-6164-001-00<br>DC33002RP0L(Compal) |                        |                        |                         |                                          |
| Peak gain w/ cable loss (dBi)*                                                                                                                                                 |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
|                                                                                                                                                                                | 2.4GHz<br>2400-2483.5 MHz   | 5.2GHz<br>5150-5250MHz     | 5.3GHz<br>5250-5350MHz                | 5.6GHz<br>5470-5725MHz                                       | 5.8GHz<br>5725-5850MHz           | 5.9GHz<br>5850-5895MHz | 6.2GHz<br>5925-6425MHz                     | 6.5GHz<br>6425-6525MHz | 6.7GHz<br>6525-6875MHz | 7.0 GHz<br>6875-7125MHz |                                          |
| Main                                                                                                                                                                           | -0.75                       | 2.58                       | 3.33                                  | 3.85                                                         | 4.05                             | 4.41                   | 4.43                                       | 3.91                   | 4.18                   | 4.31                    |                                          |
| Aux                                                                                                                                                                            | 0.64                        | 2.62                       | 2.62                                  | 3.31                                                         | 1.73                             | 1.41                   | 3.43                                       | 2.90                   | 2.75                   | 2.53                    |                                          |
| Intel Reference Gain/Type/ Separation distance                                                                                                                                 |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| Antenna Type                                                                                                                                                                   | Antenna Peak gain (In dBi)* |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         | Distance to the end user (mm)            |
|                                                                                                                                                                                | 2.4GHz<br>2400-2483.5 MHz   | 5.2GHz<br>5150-5250MHz     | 5.3GHz<br>5250-5350MHz                | 5.6GHz<br>5470-5725MHz                                       | 5.8GHz<br>5725-5850MHz           | 5.9GHz<br>5850-5895MHz | 6.2GHz<br>5925-6425MHz                     | 6.5GHz<br>6425-6525MHz | 6.7GHz<br>6525-6875MHz | 7.0GHz<br>6875-7125MHz  | Generic: refer to modular FCC SAR report |
| Design                                                                                                                                                                         | 3.00                        | 5.00                       | 5.00                                  | 5.00                                                         | 5.00                             | 5.00                   | 5.00                                       | 5.00                   | 5.00                   | 5.00                    | Mid-power: ≥ 8 mm<br>Low power: ≥ 5 mm   |
| PIFA                                                                                                                                                                           | 3.24                        | 3.64                       | 3.73                                  | 4.77                                                         | 4.97                             | 4.72                   | 4.83                                       | 4.30                   | 5.37                   | 5.59                    |                                          |
| Dipole                                                                                                                                                                         | 2.89                        | 2.92                       | 3.19                                  | 4.41                                                         | 4.22                             | 4.22                   | 4.83                                       | 4.30                   | 4.49                   | 5.34                    |                                          |
| Notes (marked with *)                                                                                                                                                          |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| * SAR minimum separation (mm)                                                                                                                                                  |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| - Regular NB: Minimum antenna-to-body (from antenna bottom to the bottom of the device)                                                                                        |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| - Tablet / Convertible PC: Minimum antenna-to-edge (5 sides of the device)                                                                                                     |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| - Mini-tablet: Minimum antenna-to-edge (6 sides of the device)                                                                                                                 |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| * 3D Peak Antenna gain should be equal or greater than -2 dBi                                                                                                                  |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |
| - If a host integrator plans to use a lower gain antenna of the same type, additional CBP(FCC)/EDT(EU) testing need to be performed while the module is installed in the host. |                             |                            |                                       |                                                              |                                  |                        |                                            |                        |                        |                         |                                          |

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1. Applicable test methods

The gain measurement shall follow by following conditions:

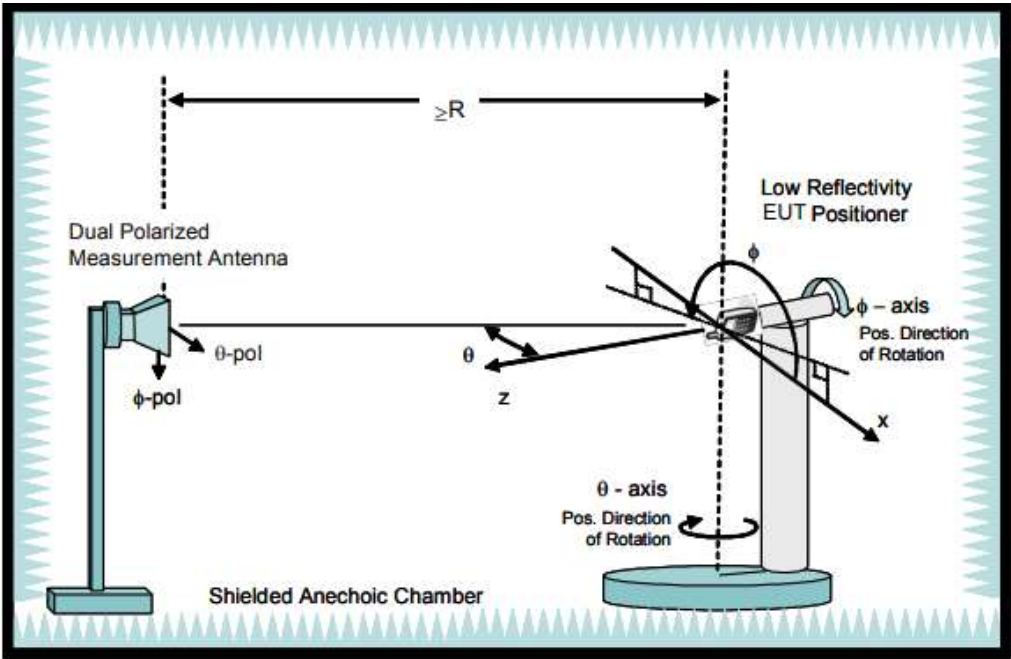
- It is required that all the antenna gain to be measured spherically and computed by spatial average be computed of the resultant gain.
- During gain measurement, all other antennas not under test should be terminated by 50 Ohm load in end of cable.
- Space points of 3D gain measurement are increase by specific steps from Theta 0~180 degrees, and Phi, 0~360 degrees, as figure below. The increments steps are different steps are different by antenna functions.

|                 |            |               |            |
|-----------------|------------|---------------|------------|
| Theta Start     | 0 degree   | Phi Start     | 0 degree   |
| Theta Stop      | 165 degree | Phi Stop      | 345 degree |
| Theta Increment | 15 degree  | Phi Increment | 15 degree  |

2. Test & System Description

a. Test setup

The testing of antenna gain should be made at a CTIA qualified lab with an RF anechoic chamber with at least 3-meter separation from the receive antenna to the antenna under test. The antenna gain report from unqualified lab can't be referenced a passing. Besides, all test equipment including horn antennas, adapters, cables, network analyzers, and receivers shall be calibrated per manufacturer's minimum calibration requirements.



## b. Equipment list

| Device                            | Type/Model                      | Serial #       | Manufacturer | Cal. Date | Cal. Due Date |
|-----------------------------------|---------------------------------|----------------|--------------|-----------|---------------|
| Anechoic Chamber                  | AMS8500                         | -              | ETS-Lindgren | 22-Jun-22 | 10-Jul-24     |
| Turn Table                        | 2117-7200                       | SN00231447     | ETS-Lindgren | 22-Jun-22 | 10-Jul-24     |
| Switch & Positioning systems      | EMCenter                        | SN00242606     | ETS-Lindgren | 22-Jun-22 | 10-Jul-24     |
| Measurement SW                    | EMQuest<br>V1.15<br>build 27347 | SN1802         | ETS-Lindgren | 22-Jun-22 | 10-Jul-24     |
| Horn antenna                      | 3164-10                         | SN00246202     | ETS-Lindgren | 22-Jun-22 | 10-Jul-24     |
| Vector Network Analyzer           | E5071C                          | PN5188-4462    | Keysight     | 30-May-22 | 30-Nov-23     |
| Cable 7.5m 400MHz to 18GHz(H-pol) | SS402                           | 00100A1F5A1XXS | WOKEN        | 22-Jun-22 | 10-Nov-24     |
| Cable 7.5m 400MHz to 18GHz(V-pol) | SS402                           | 00100A1F5A1XXS | WOKEN        | 22-Jun-22 | 10-Nov-24     |
| Cable 14m 400MHz to 18GHz         | SS402                           | 00100A1F5A1XXS | WOKEN        | 22-Jun-22 | 10-Nov-24     |
| Temp & Humidity Logger            | 830                             | SN84972        | PROVA        | 16-Jul-22 | 10-Jul-23     |

# Antenna Information

## Section 1. Antenna Assembly Specifications

| 1A                                      | 1B           | 1C           | 1D                                                                       |                | 1E                              | 1F                             | 1G       | 1H              |
|-----------------------------------------|--------------|--------------|--------------------------------------------------------------------------|----------------|---------------------------------|--------------------------------|----------|-----------------|
| Antenna Part Number                     | Manufacturer | Antenna Type | Cable Assembly Part Number and Information                               | Freq Range MHz | * Peak Gain W/ Cable loss (dBi) | Peak Gain w/o Cable Loss (dBi) | Max VSWR | Cable Loss (dB) |
| (P/N: F-0G-FH-6164-001-00) Main Antenna | Speed        | PIFA         | Connector : IPEX 4L<br><br>50 ohm Coaxial length: 74mm diameter: 1.13mm  | 2400-2483.5    | -0.75                           | -0.54                          | 3.5      | 0.21            |
|                                         |              |              |                                                                          | 5150-5250      | 2.58                            | 2.90                           | 3.5      | 0.32            |
|                                         |              |              |                                                                          | 5250-5350      | 3.33                            | 3.65                           | 3.5      | 0.32            |
|                                         |              |              |                                                                          | 5470-5725      | 3.85                            | 4.19                           | 3.5      | 0.34            |
|                                         |              |              |                                                                          | 5725-5850      | 4.05                            | 4.39                           | 3.5      | 0.34            |
|                                         |              |              |                                                                          | 5850-5895      | 4.41                            | 4.75                           | 3.5      | 0.34            |
|                                         |              |              |                                                                          | 5925-6425      | 4.43                            | 4.78                           | 3.5      | 0.35            |
|                                         |              |              |                                                                          | 6425-6525      | 3.91                            | 4.27                           | 3.5      | 0.36            |
|                                         |              |              |                                                                          | 6525-6875      | 4.18                            | 4.56                           | 3.5      | 0.38            |
|                                         |              |              |                                                                          | 6875-7125      | 4.31                            | 4.70                           | 3.5      | 0.39            |
| (P/N: F-0G-FH-6164-001-00) Aux Antenna  | Speed        | PIFA         | Connector : IPEX 4L<br><br>50 ohm Coaxial length: 179mm diameter: 1.13mm | 2400-2483.5    | 0.64                            | 1.16                           | 3.5      | 0.52            |
|                                         |              |              |                                                                          | 5150-5250      | 2.62                            | 3.39                           | 3.5      | 0.77            |
|                                         |              |              |                                                                          | 5250-5350      | 2.62                            | 3.39                           | 3.5      | 0.77            |
|                                         |              |              |                                                                          | 5470-5725      | 3.31                            | 4.11                           | 3.5      | 0.80            |
|                                         |              |              |                                                                          | 5725-5850      | 1.73                            | 2.55                           | 3.5      | 0.82            |
|                                         |              |              |                                                                          | 5850-5895      | 1.41                            | 2.24                           | 3.5      | 0.83            |
|                                         |              |              |                                                                          | 5925-6425      | 3.43                            | 4.3                            | 3.5      | 0.87            |
|                                         |              |              |                                                                          | 6425-6525      | 2.90                            | 3.78                           | 3.5      | 0.88            |
|                                         |              |              |                                                                          | 6525-6875      | 2.75                            | 3.64                           | 3.5      | 0.89            |
|                                         |              |              |                                                                          | 6875-7125      | 2.53                            | 3.47                           | 3.5      | 0.94            |

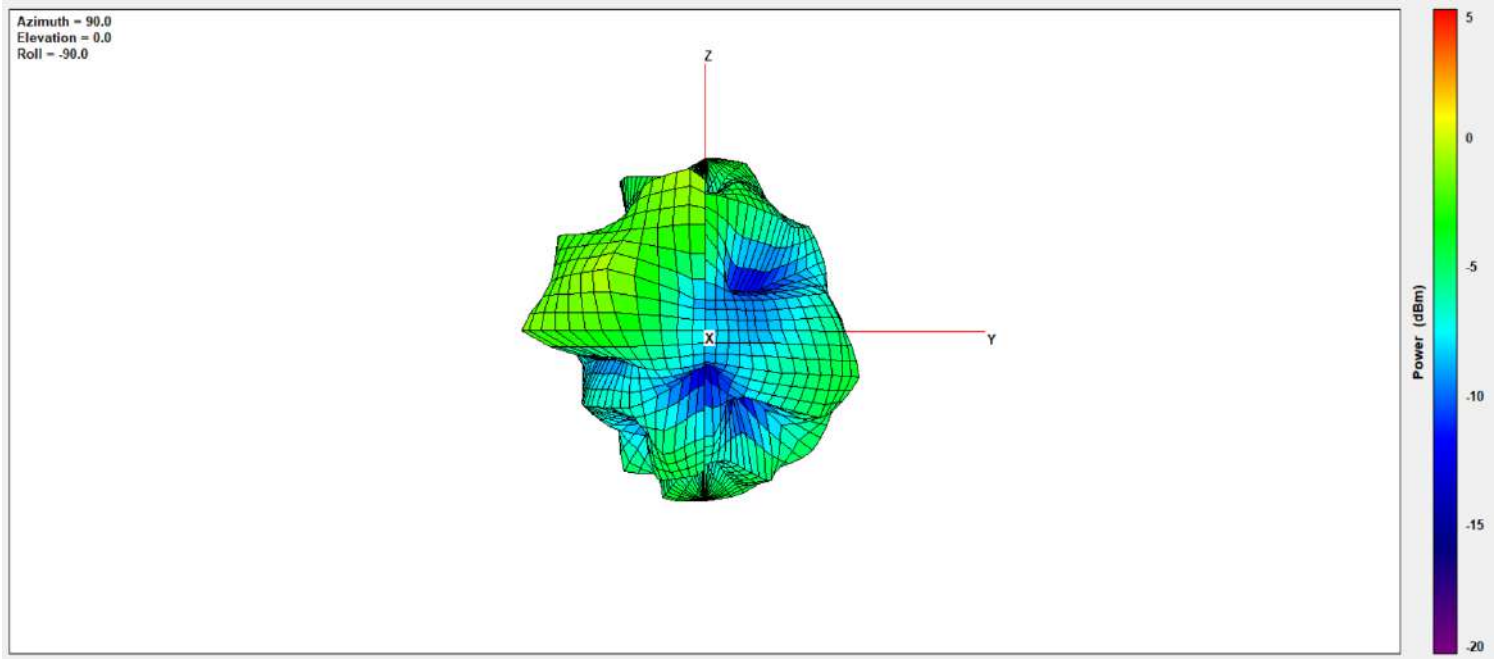
- 3D Antenna Peak Gain required being test in system basis.

Section 3. Radiation characteristics of antenna loaded in Host Platform

Main Antenna

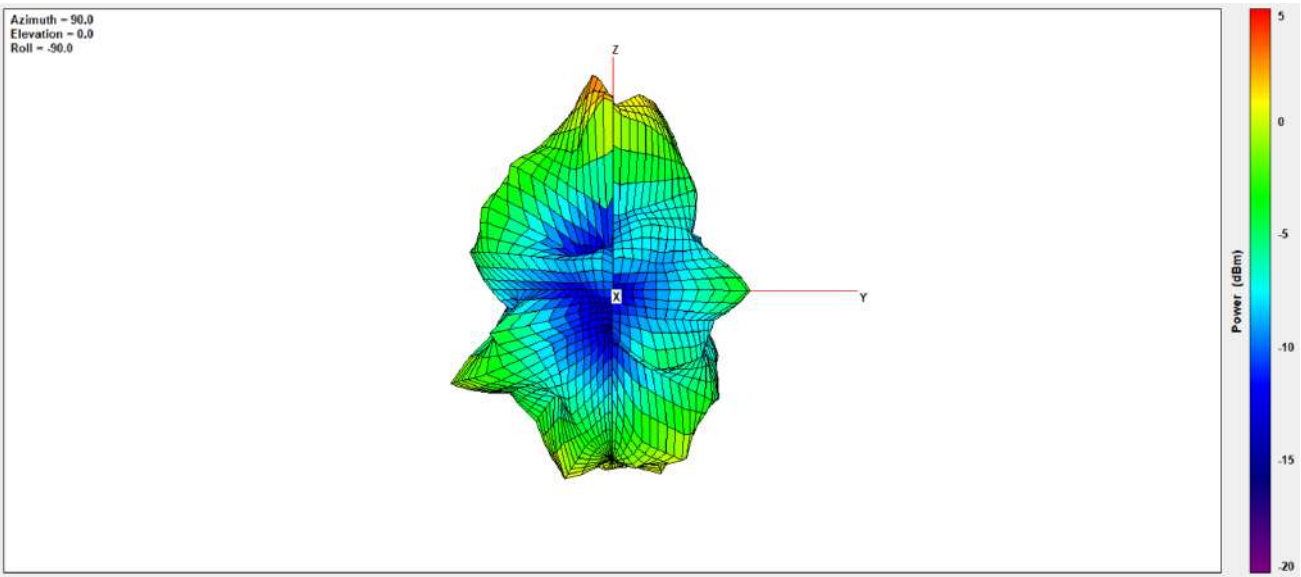
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | -0.75                         |



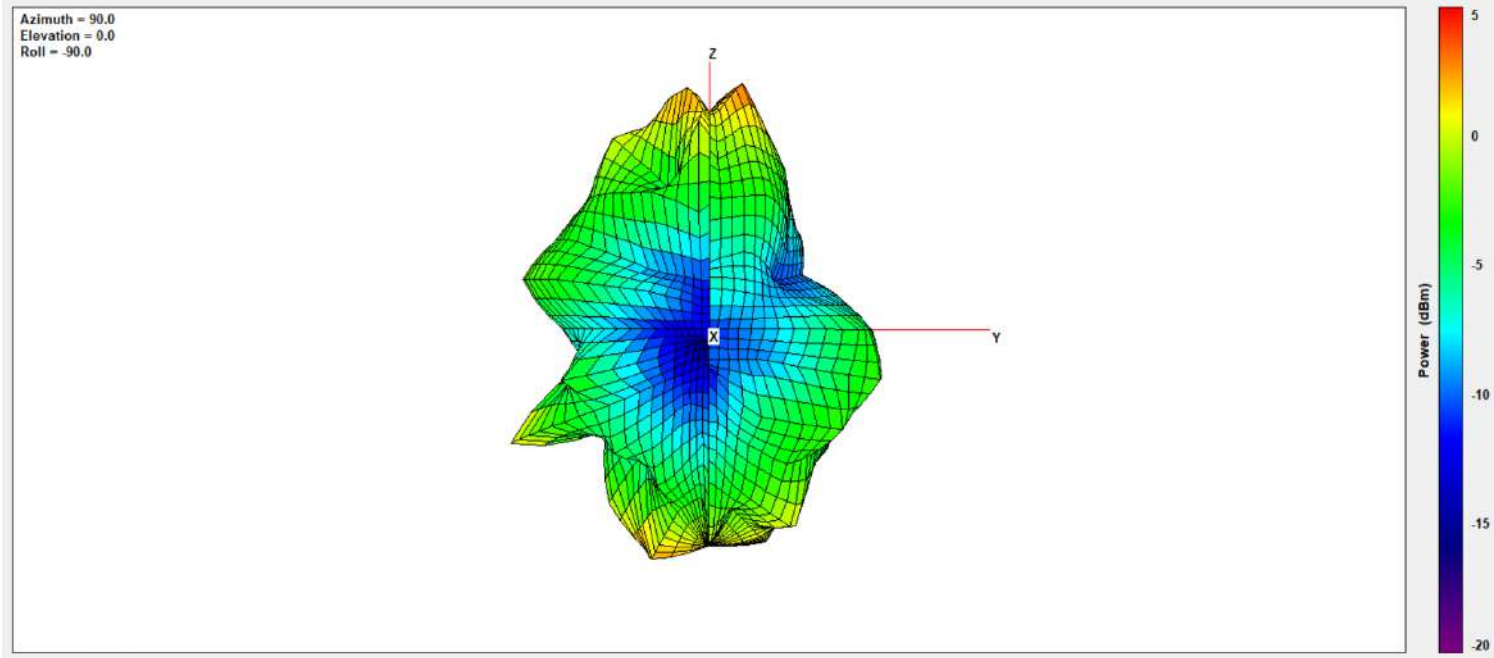
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 2.58                          |



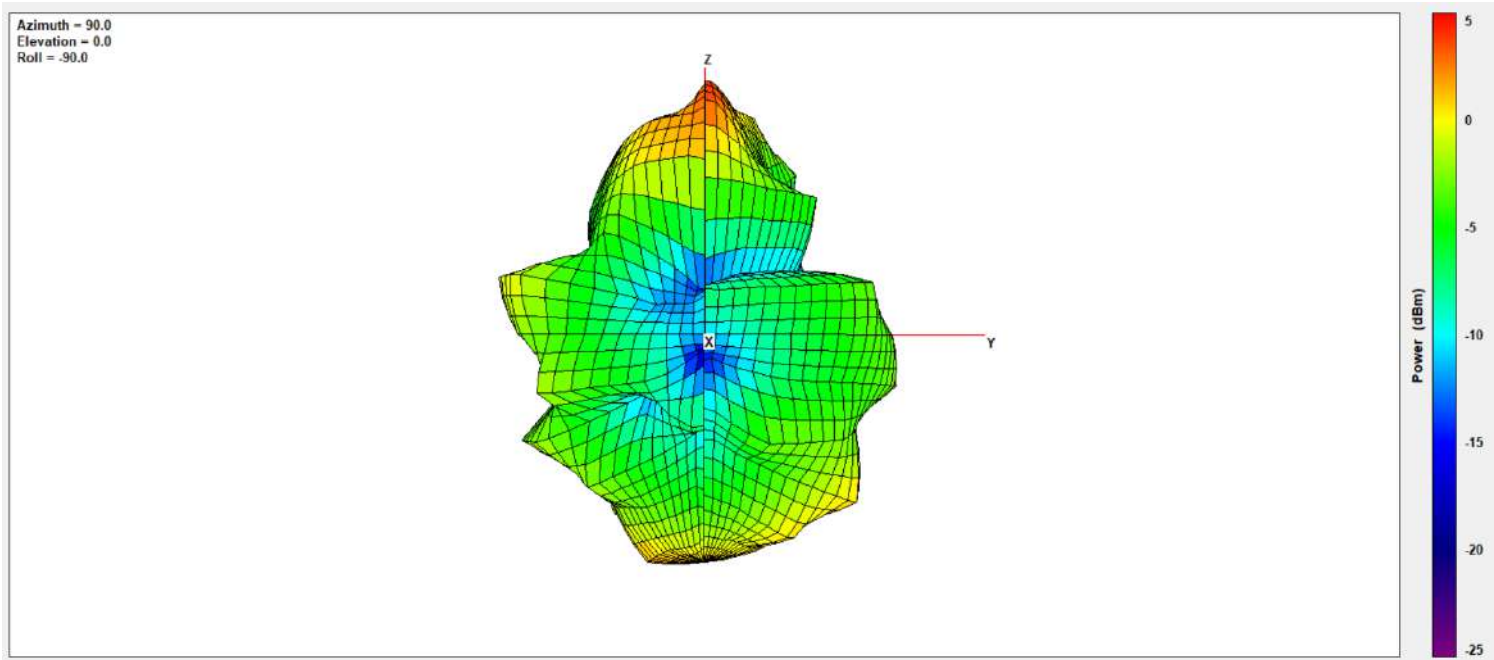
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5250-5350       | 3.33                          |



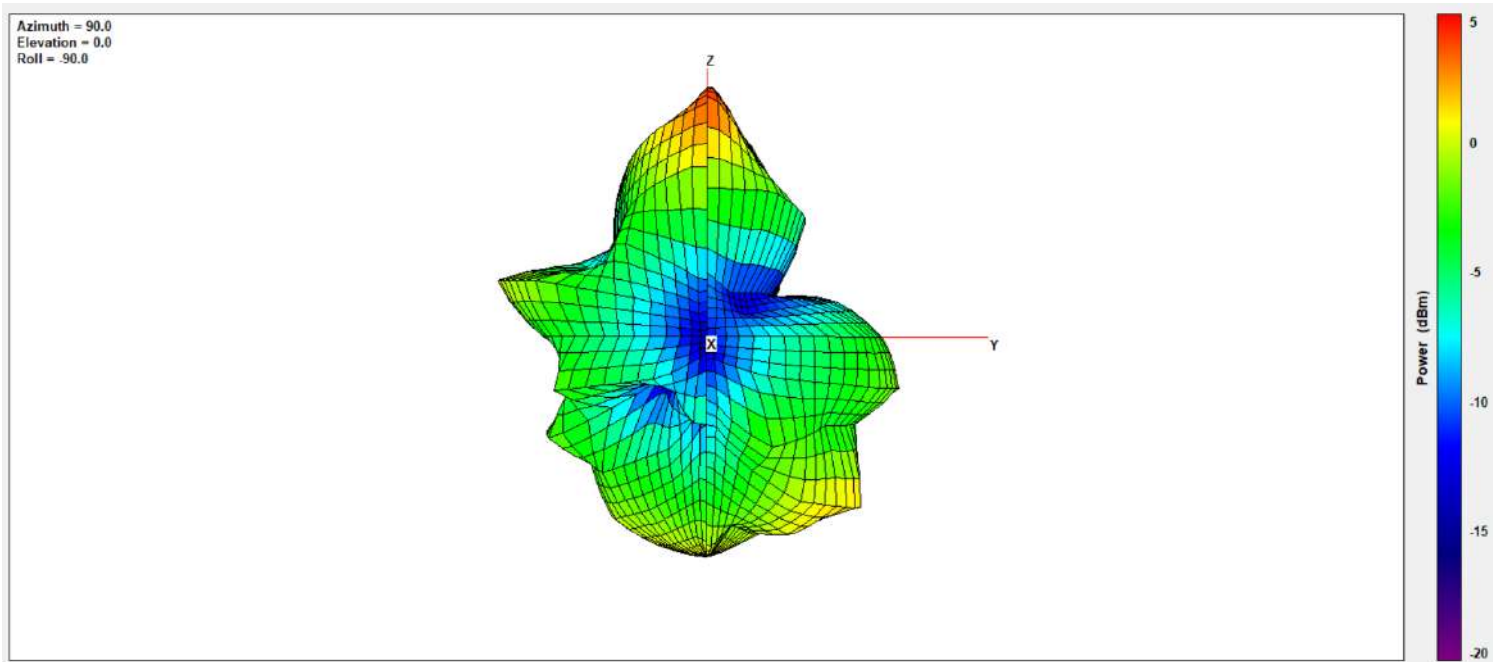
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5470-5725       | 3.85                          |



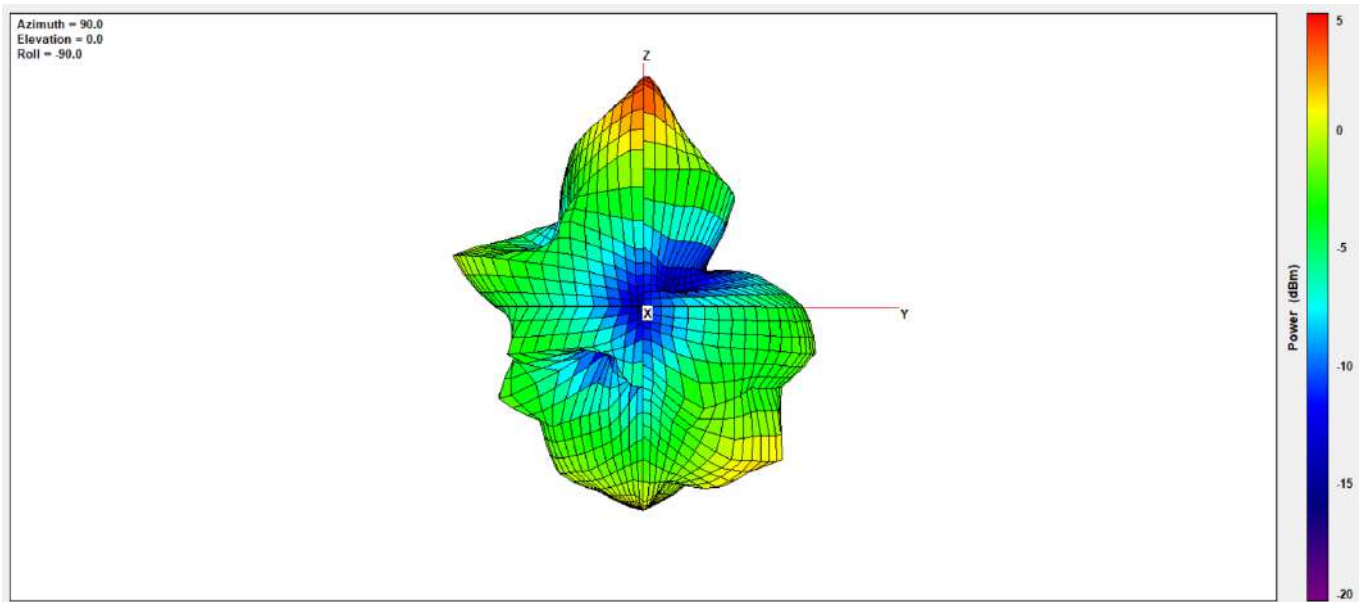
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 4.05                          |



Max Antenna 3D Radiation Pattern 5850-5895 MHz

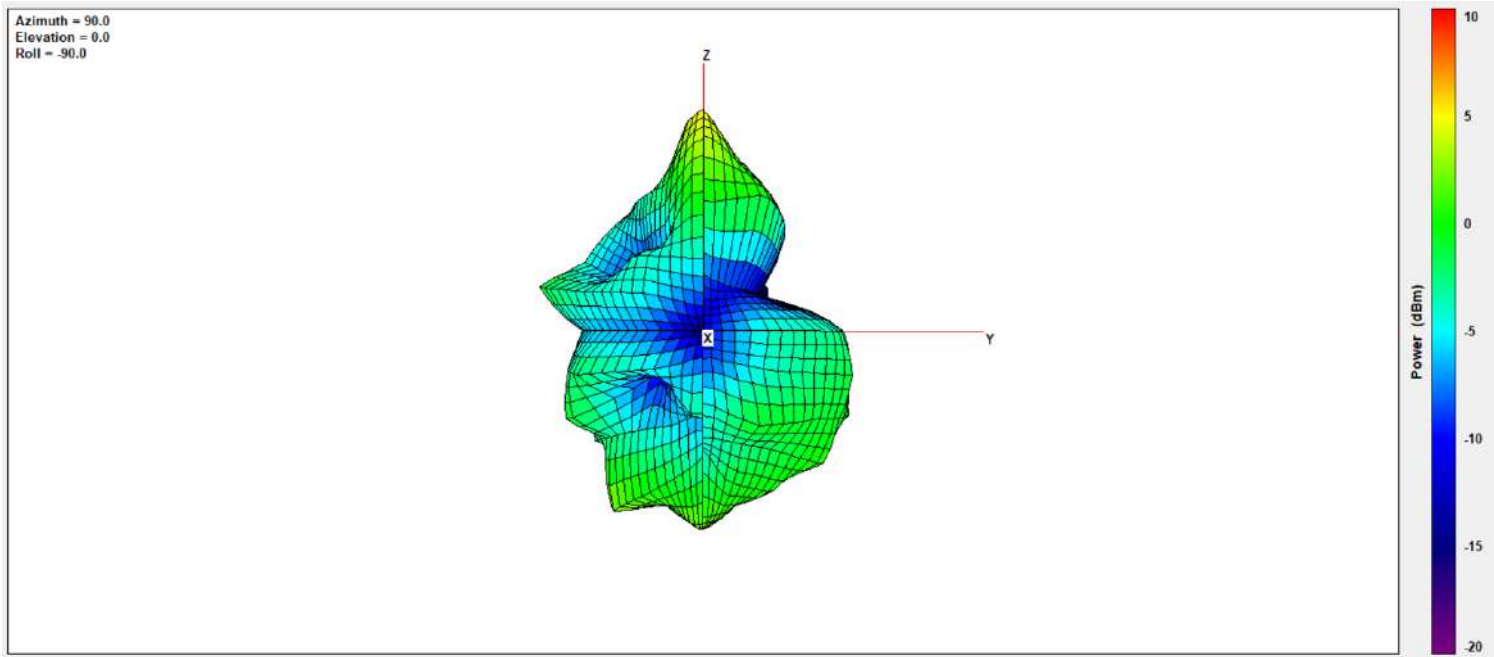
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 4.41                          |





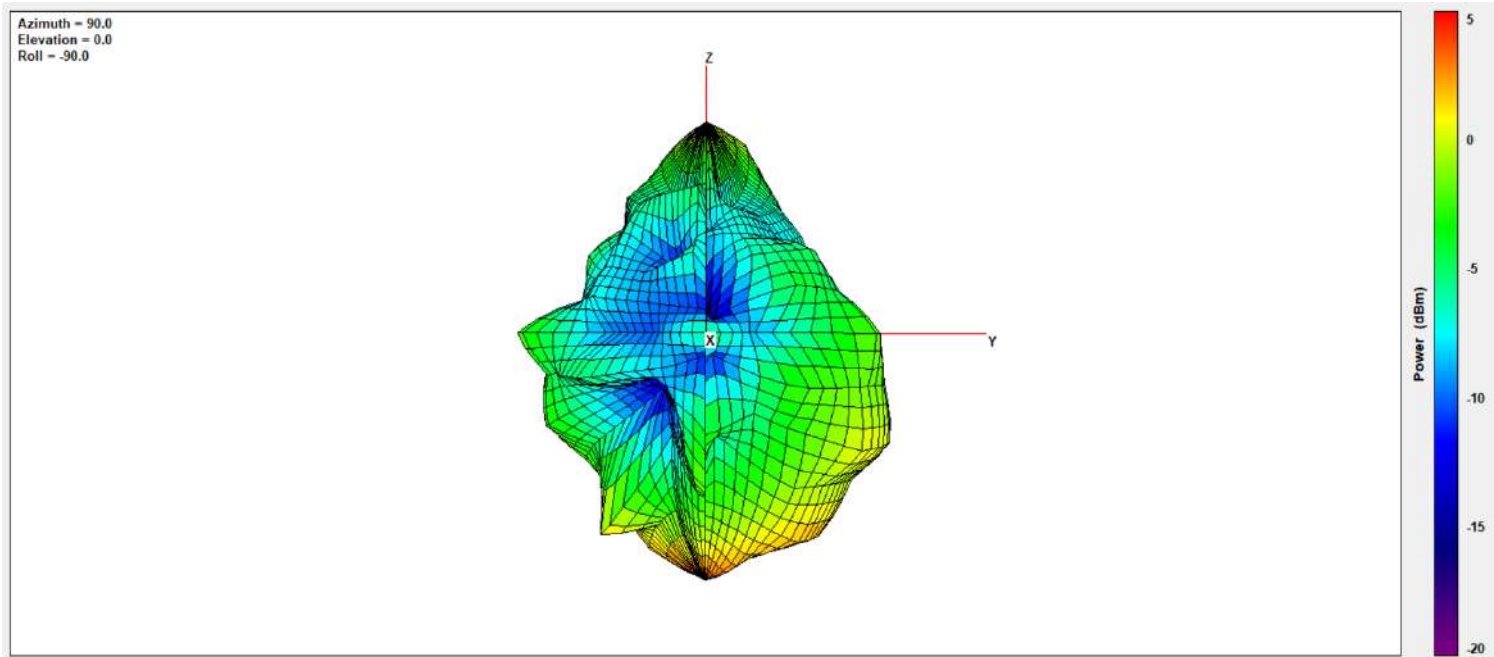
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 4.43                          |



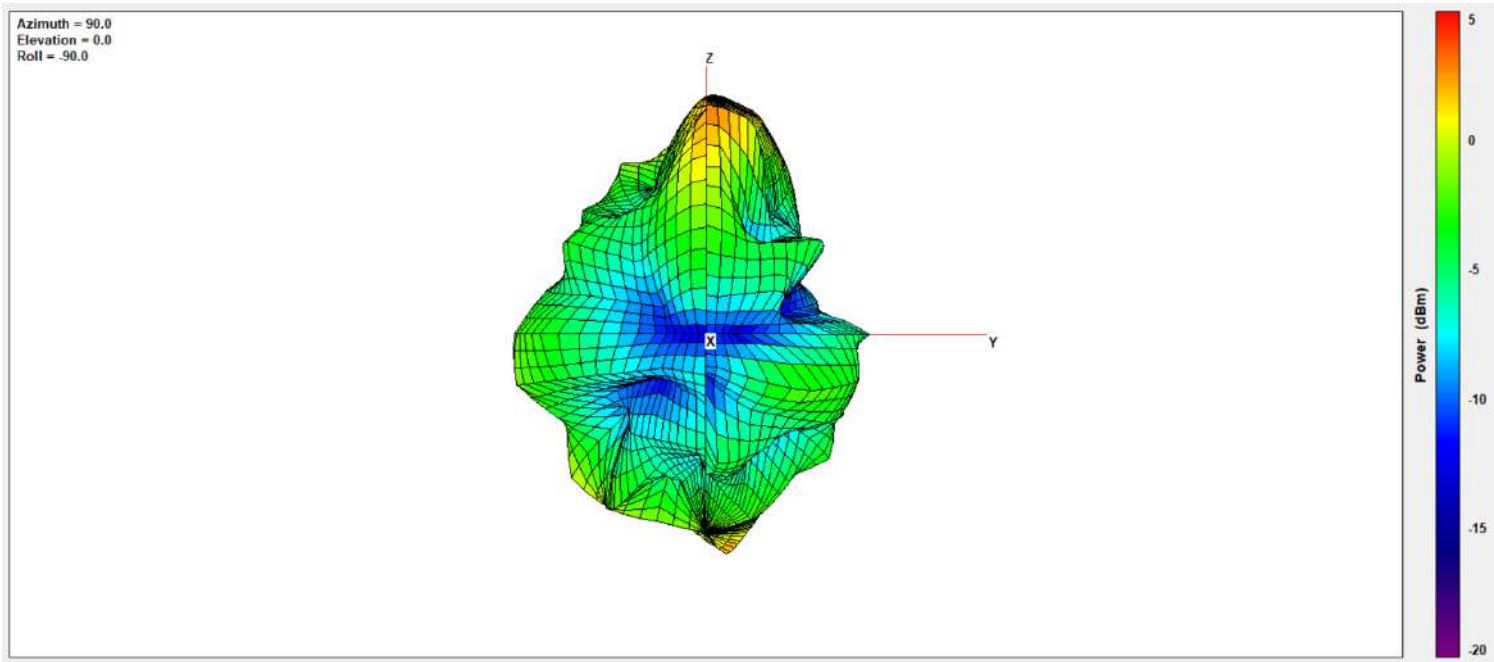
Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 3.91                          |



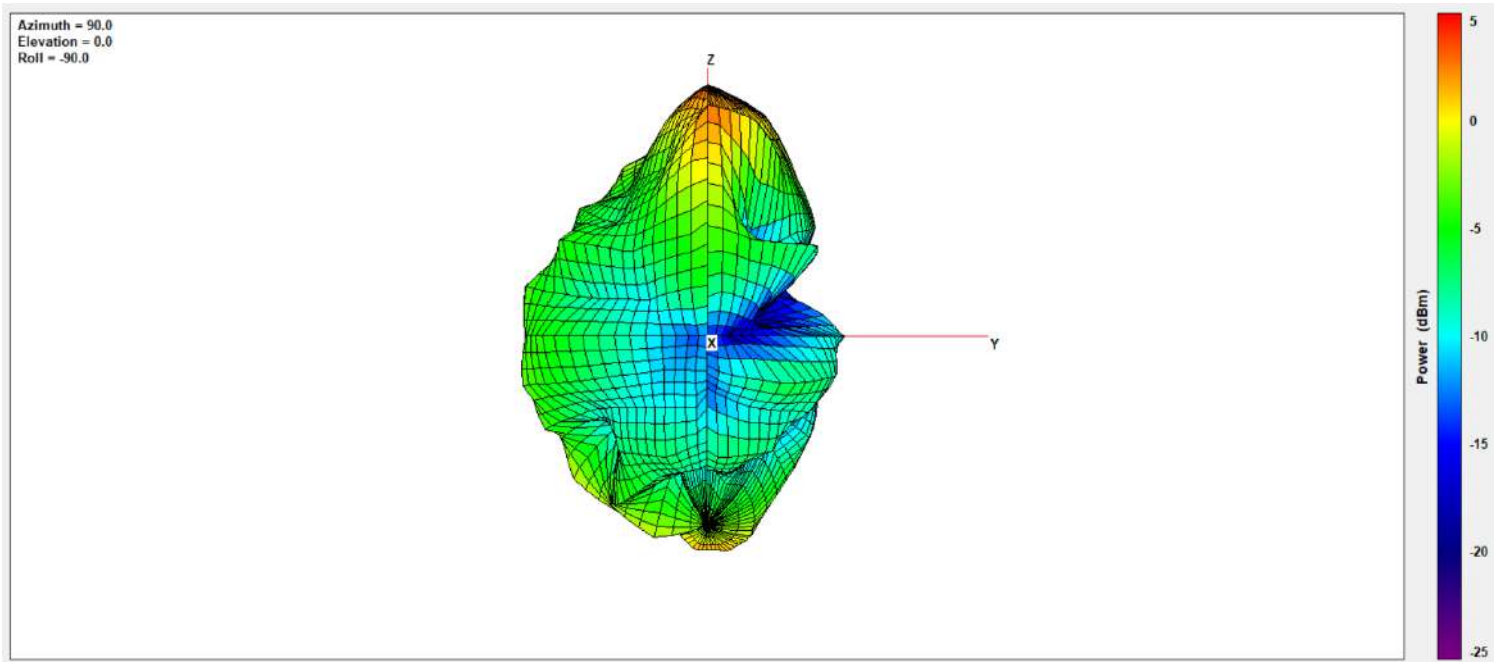
Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 4.18                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

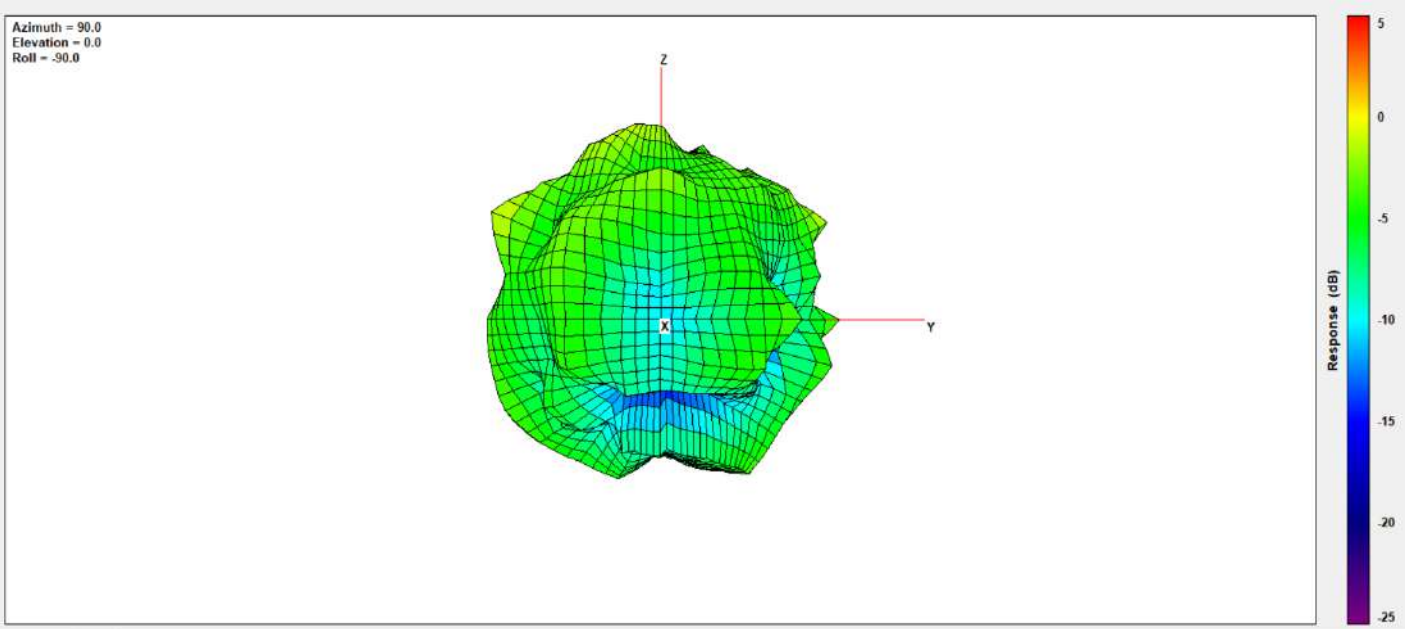
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 4.31                          |



Auxiliary Antenna

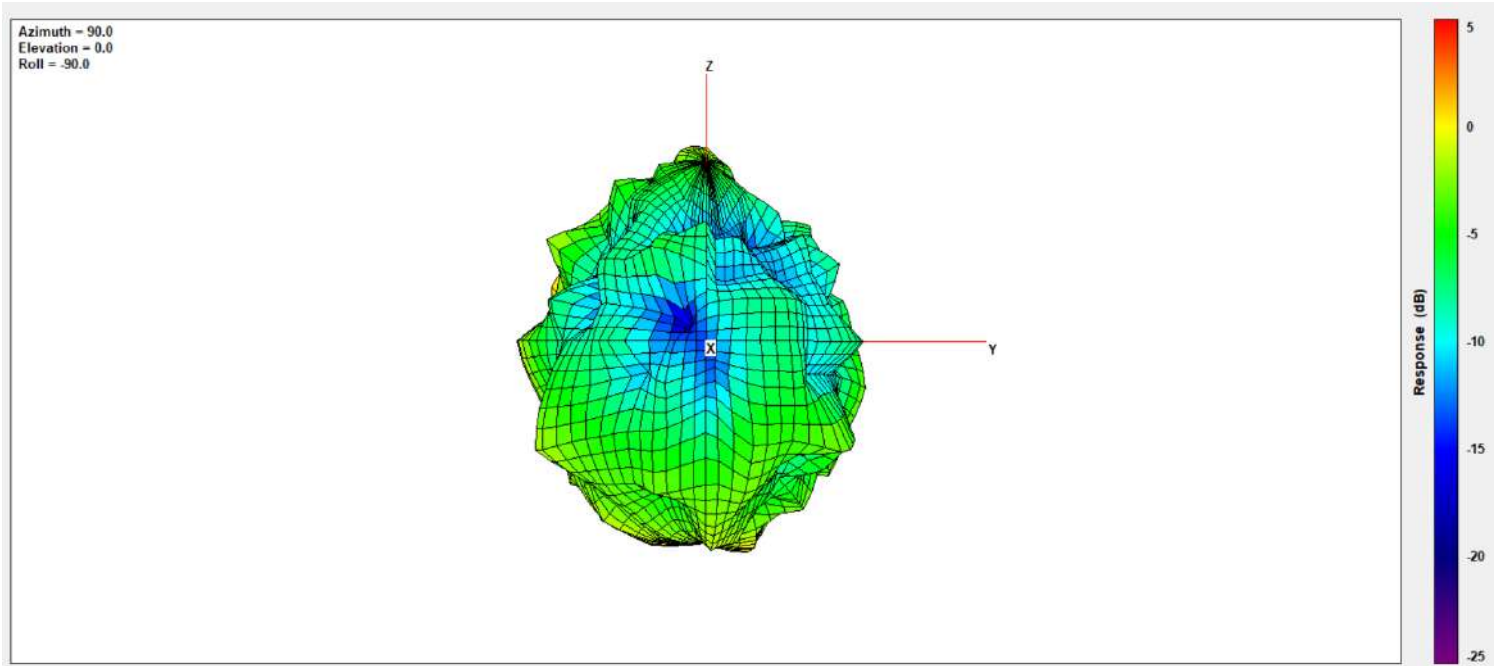
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | 0.64                          |



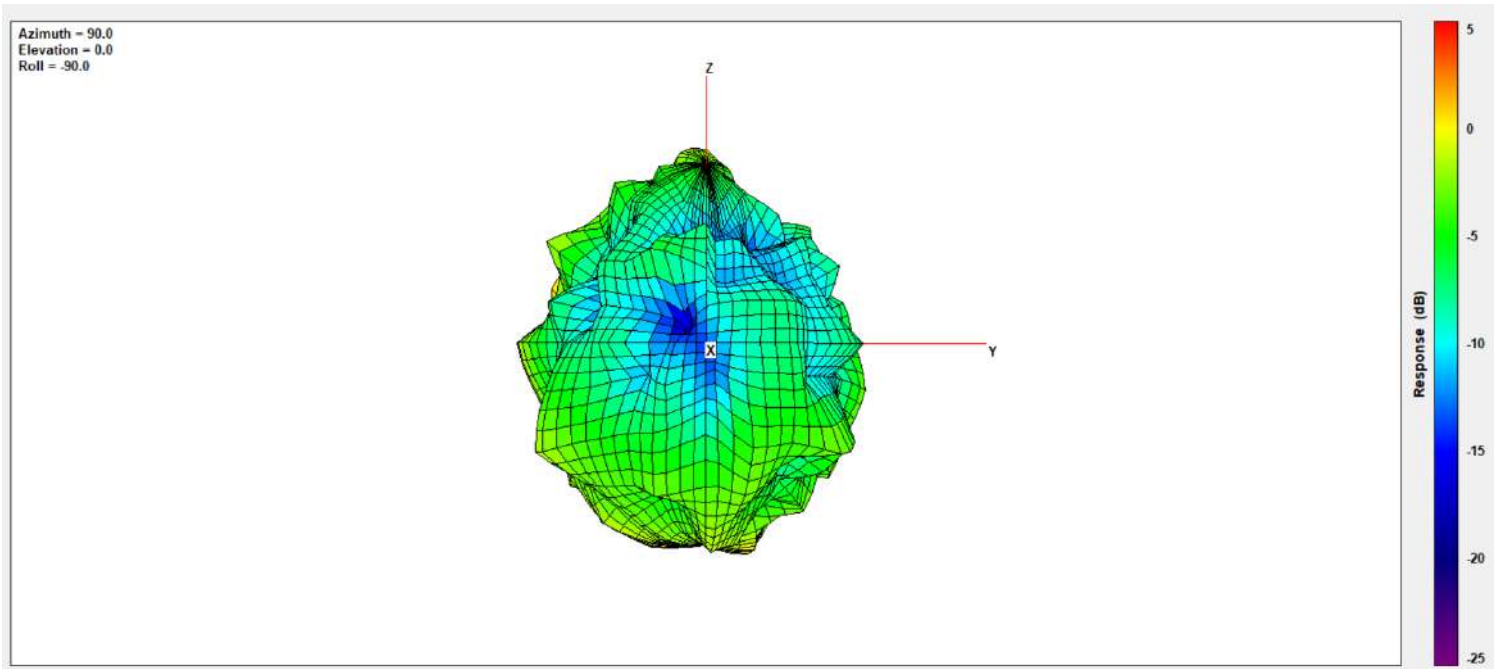
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 2.62                          |



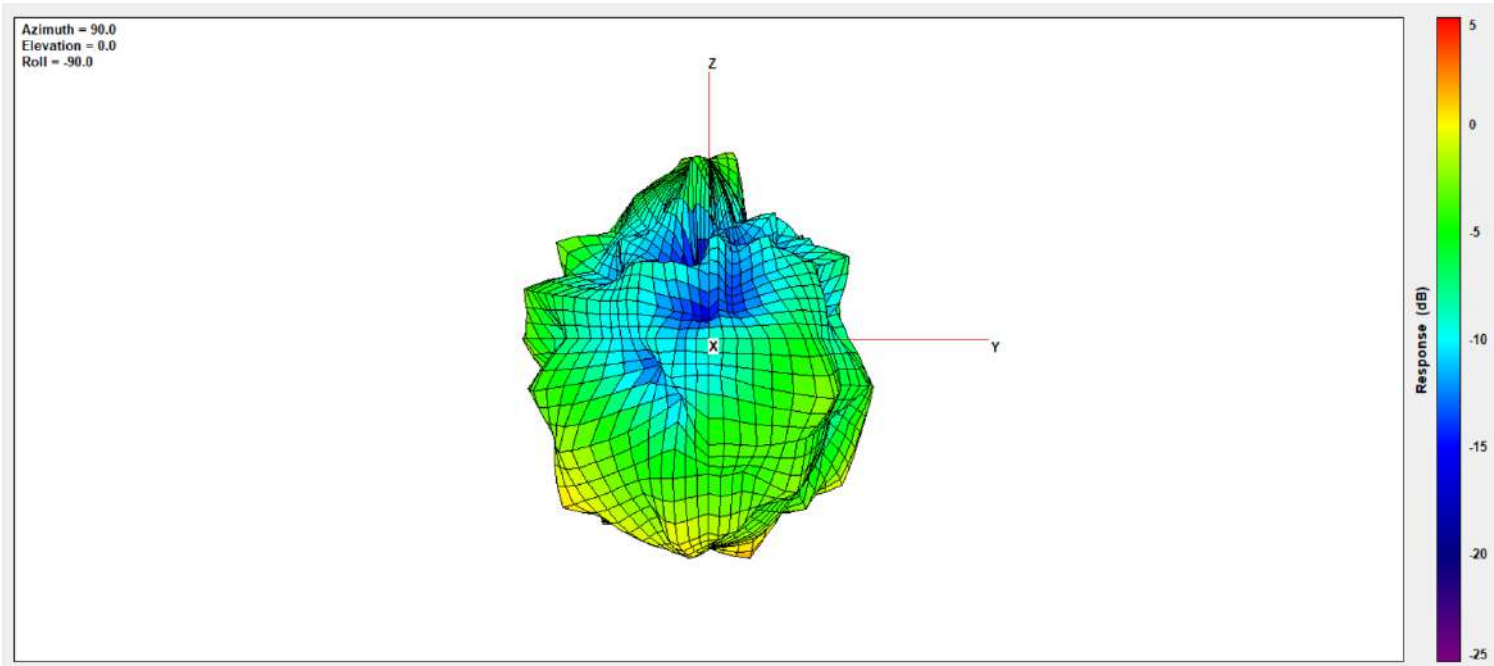
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5250-5350          | 2.62                             |



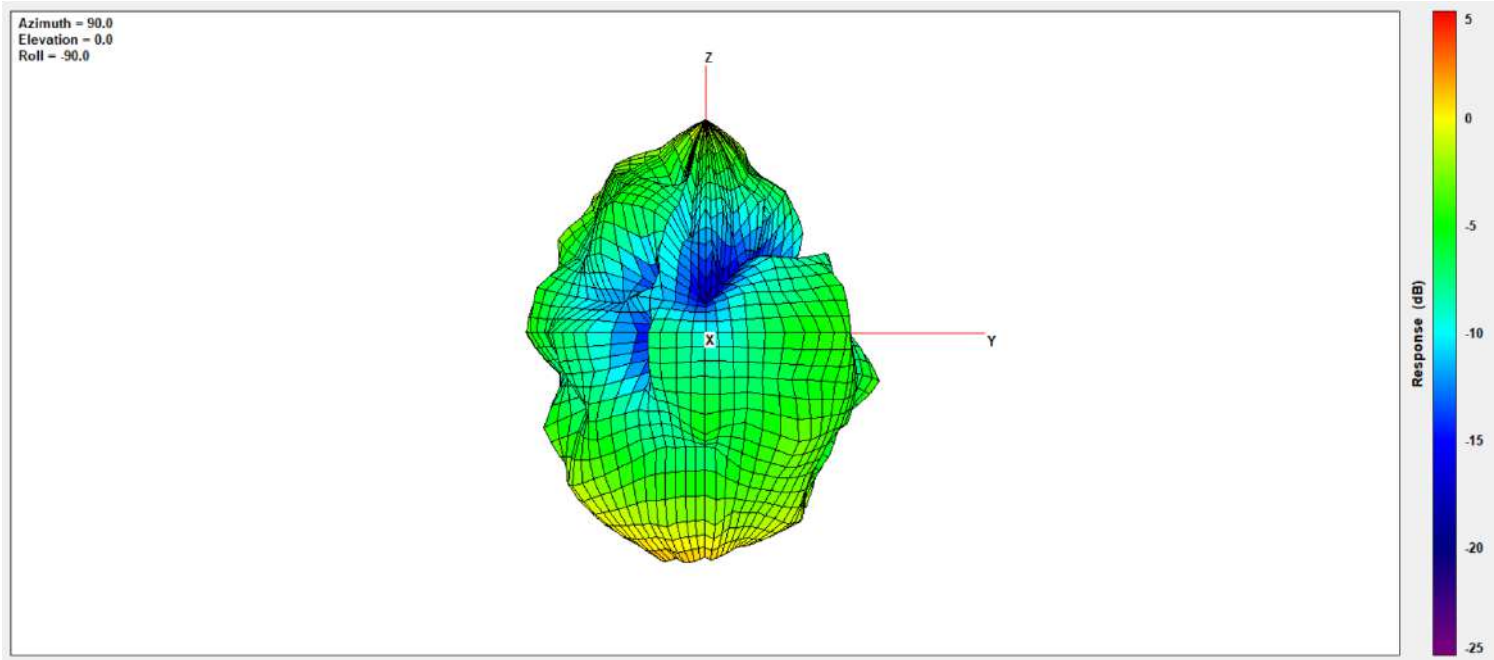
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5470-5725          | 3.31                             |



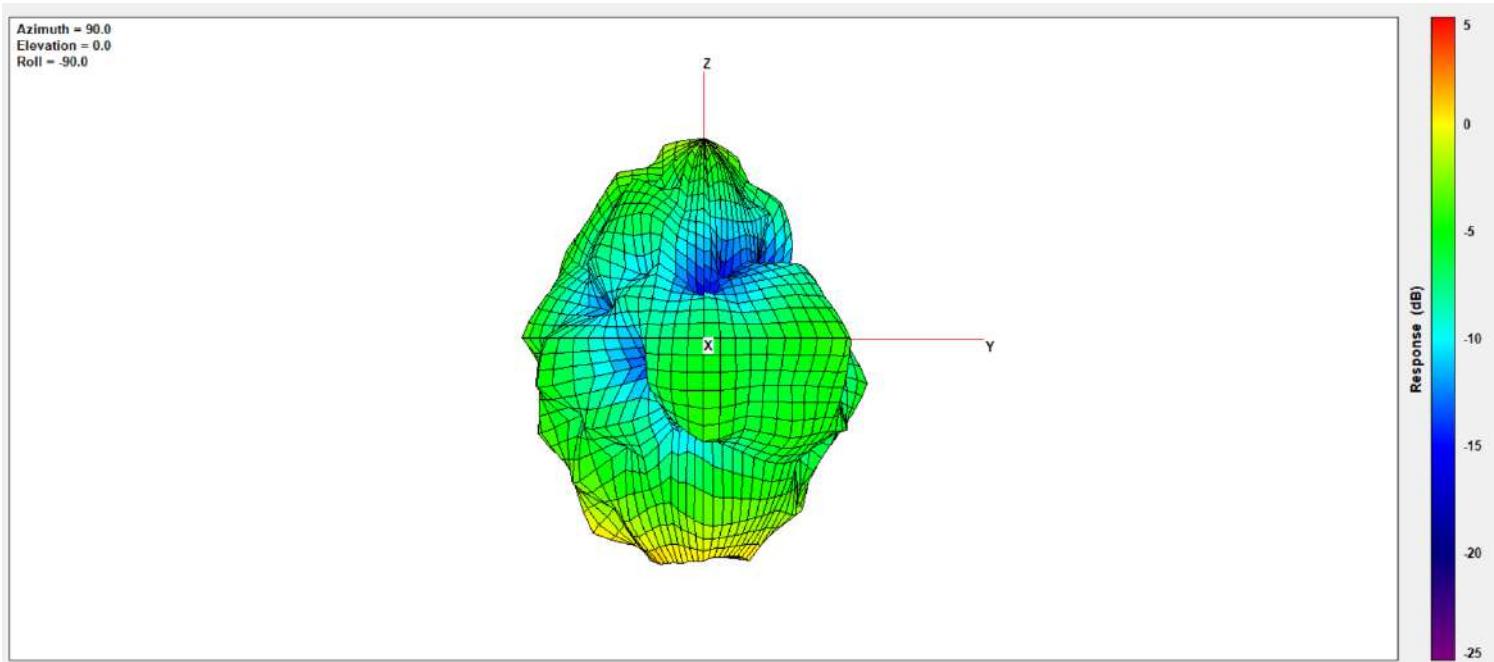
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 1.73                          |



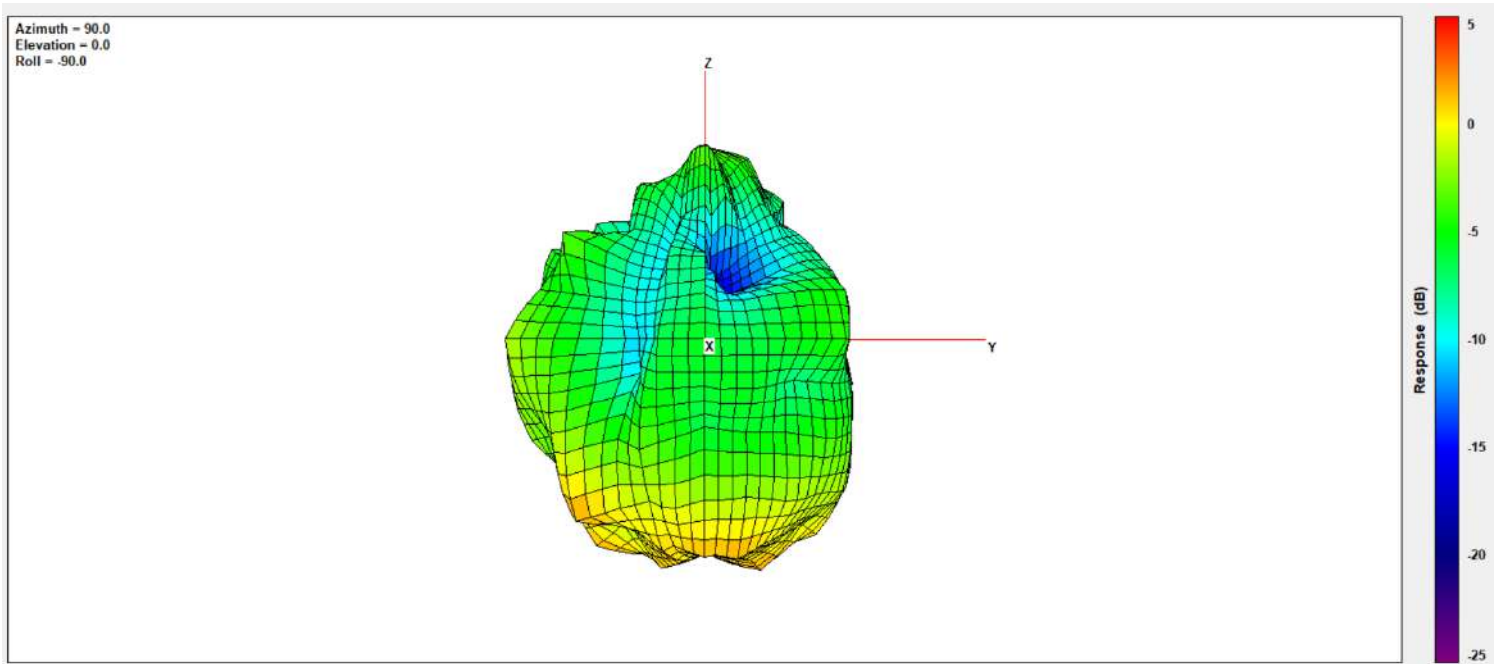
Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 1.41                          |



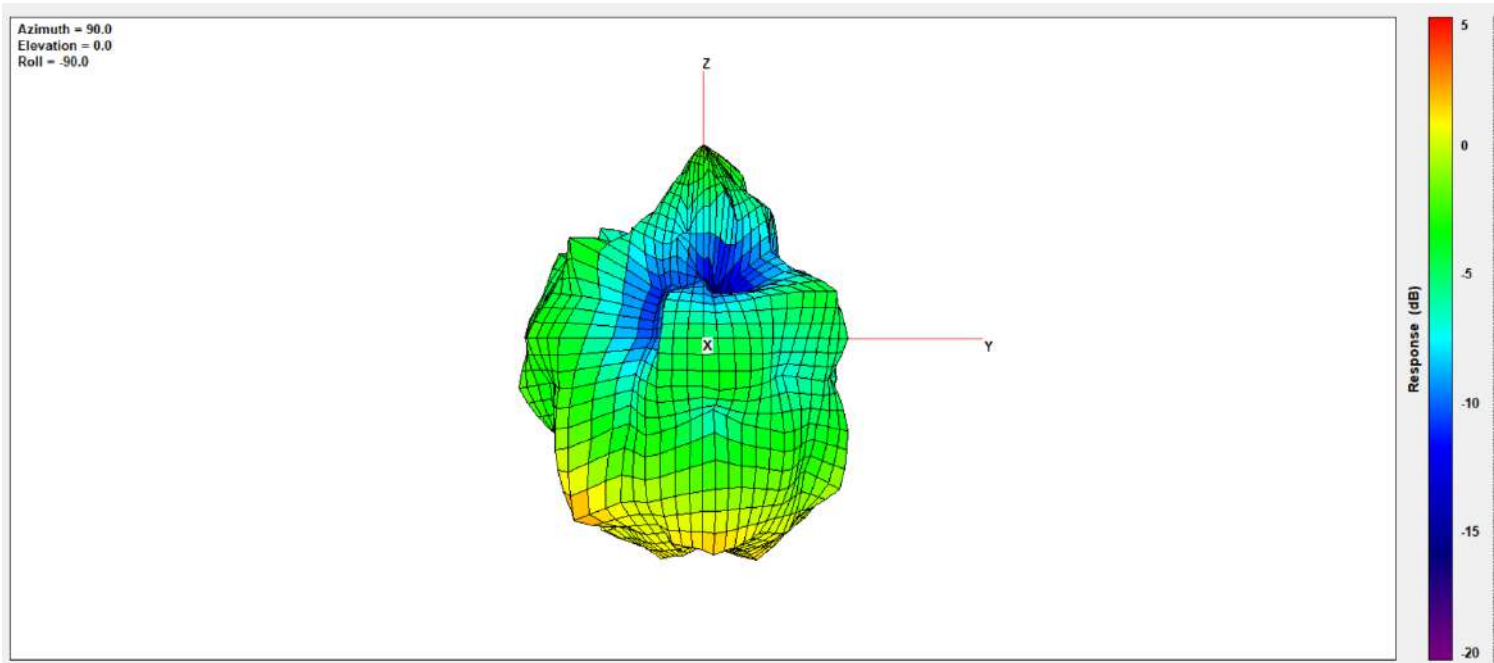
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 3.43                          |



Max Antenna 3D Radiation Pattern 6425-6525 MHz

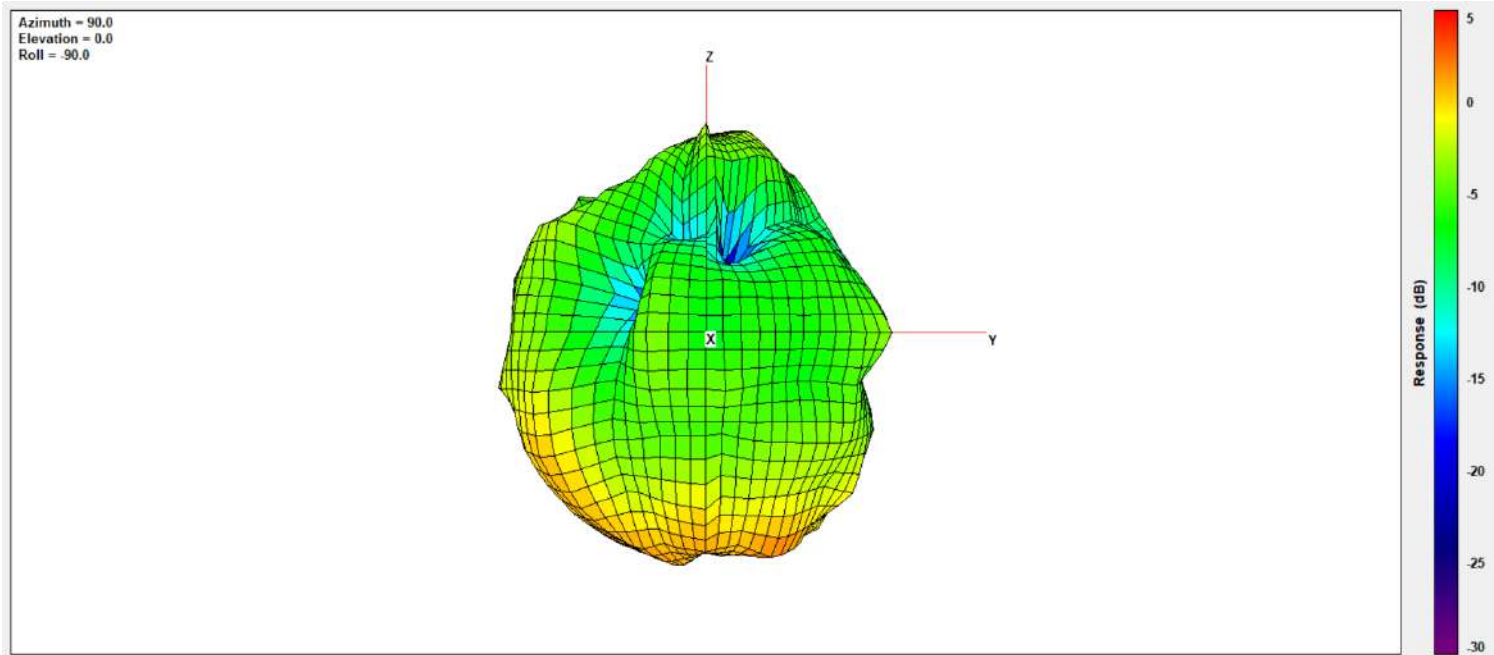
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 2.90                          |





Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 2.75                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 2.53                          |

