

# ANTENNA INFORMATION

|                                                           |                 |
|-----------------------------------------------------------|-----------------|
| OEM                                                       | DELL            |
| ODM                                                       | Wistron         |
| Platform model name                                       | P135F           |
| Intel platform (ex: Yes, No or NA)                        | Yes             |
| Platform type (ex: regular NB, convertible PC, AIO...etc) | Regular NB      |
| SAR minimum separation (mm)                               | FCC (1g) 5.25mm |
|                                                           | ISED (1g) N/A   |
|                                                           | ISED (10g) N/A  |

|                      |                 |                                                                                 |
|----------------------|-----------------|---------------------------------------------------------------------------------|
| Antenna manufacturer | Company name    | HongBo                                                                          |
|                      | Address         | 4F., No. 143, Xinhua 1st Rd., Neihu Dist., Taipei City 114758 , Taiwan (R.O.C.) |
| Test location        | Company name    | SPORTON                                                                         |
|                      | Address         | No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)             |
| Test Personnel       | Name(Full name) | OTA03                                                                           |
|                      | E-mail          | rickhuang@hong-bo.com.tw                                                        |
|                      | Tel/Mobile      | 03-6688-340 #206                                                                |
| Testing date         |                 | 2024.08.23                                                                      |

|                                       |      |                            |
|---------------------------------------|------|----------------------------|
| Antenna Part number                   | Main | 330-29032 (025.902GU.0001) |
|                                       | Aux  | 330-29034 (025.902GV.0001) |
| Antenna type (ex: PIFA, Dipole...etc) |      | PIFA                       |

| Antenna 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                                   | 1.19                      | 1.95                   | 2.01                   | 2.38                   | 1.31                   | 1.28                   | 2.5                    | 3.16                   | 3.28                   | 2.74                    |
| Aux                                    | 2.27                      | 0.58                   | 0.93                   | 1.19                   | 1.28                   | 1.77                   | 2.53                   | 2.92                   | 3.12                   | 3.07                    |

| Cable Assembly Part Number and Information |               |                  |                    |                |                |
|--------------------------------------------|---------------|------------------|--------------------|----------------|----------------|
|                                            | Cable PN      | Cable length(mm) | Cable diameter(mm) | Impedance(ohm) | Connector type |
| Main                                       | SY113L/50-143 | 234mm            | 1.13mm             | 50             | IPEX           |
| Aux                                        | SY113L/50-118 | 211mm            | 1.13mm             | 50             | IPEX           |

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

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## 1. Intel Reference Gain and Type

| Antenna Peak gain w/ cable loss (dBi) |                         |                                  |                               |                               |                               |                               |                               |                               |                               |                               |                                |
|---------------------------------------|-------------------------|----------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|
| Band/Frequency                        |                         | <b>2.4GHz</b><br>2400-2483.5 MHz | <b>5.2GHz</b><br>5150-5250MHz | <b>5.3GHz</b><br>5250-5350MHz | <b>5.6GHz</b><br>5470-5725MHz | <b>5.8GHz</b><br>5725-5850MHz | <b>5.9GHz</b><br>5850-5895MHz | <b>6.2GHz</b><br>5925-6425MHz | <b>6.5GHz</b><br>6425-6525MHz | <b>6.7GHz</b><br>6525-6875MHz | <b>7.0 GHz</b><br>6875-7125MHz |
| Design                                | EU/UK                   | 3.00                             | 5.00                          | 5.00                          | 5.00                          | 5.00                          | 5.00                          | 5.00                          | 5.00                          | 5.00                          | 5.00                           |
| PIFA                                  | For WiFi 6E and earlier | 3.24                             | 3.64                          | 3.73                          | 4.77                          | 4.97                          | 4.72                          | 4.83                          | 4.30                          | 5.37                          | 5.59                           |
|                                       | From WiFi 7             | 2.95                             | 5.11                          | 4.55                          | 5.15                          | 5.13                          | 4.45                          | 5.02                          | 5.02                          | 4.96                          | 4.96                           |
| Dipole                                | For WiFi 6E and earlier | 2.89                             | 2.92                          | 3.19                          | 4.41                          | 4.22                          | 4.22                          | 4.83                          | 4.30                          | 4.49                          | 5.34                           |
|                                       | From WiFi 7             | 2.95                             | 4.03                          | 4.11                          | 5.15                          | 5.13                          | 4.45                          | 5.02                          | 4.71                          | 4.49                          | 4.96                           |
| Monopole                              | From WiFi 7             | 2.83                             | 4.57                          | 4.44                          | 4.95                          | 4.95                          | 4.43                          | 4.87                          | 4.91                          | 4.91                          | 4.79                           |

### 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.

## 2. Document Revision History

| Revision # | Revision Details | Issued Date |
|------------|------------------|-------------|
| Rev. 00    | First Issue      | 2024.08.23  |

### 3. Test & System Description

#### 3.1 Measurement Method and System

ETS-Lindgren AMS-8500 system is 3D fully anechoic chamber, it is applied to the “Conical Cut test method”, the detail description is described as below.

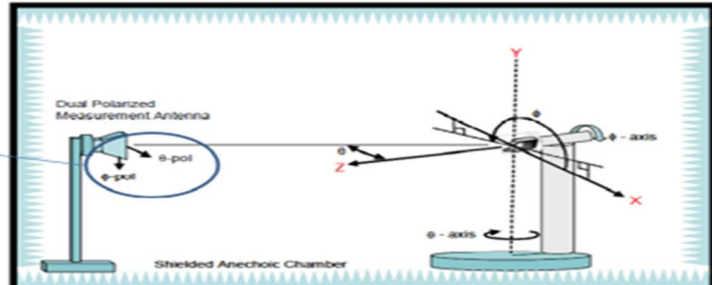
The Conical Cut method requires the ability of the Measurement Antenna to be physically rotated in the theta plane (overhead) of the EUT for implementations using a single Measurement Antenna, Eleven conical cuts are required to capture data at every 15 degrees from the EUT, with the top (0 degrees) and bottom (180 degrees) cuts not being measured. Typically, the EUT will remain affixed to a turntable during the entire measurement process. The Measurement Antenna will be positioned at a starting theta angle. The EUT will then be rotated around the full 360 degrees of phi rotation. The Measurement Antenna will then be positioned at the next theta angle, and the process repeated.

#### 3.2 Test setup

### Chamber Coordinate

- Both Theta- and Phi-axis rotate clockwise.
- From center of Quiet Zone
  - To 90-degree Phi  $\rightarrow$  X axis
  - To ceiling  $\rightarrow$  Y axis
  - To 3164 measurement antenna  $\rightarrow$  Z axis

Theta Polarization  $\rightarrow$  Horizontal  
Phi Polarization  $\rightarrow$  Vertical



### AMS-8500 Basics

- Chamber Size: 24ft L x 12ft W x 12ft H  
7.32m x 3.66m x 3.66m
- Test Distance: 4.9 meter
- Frequency: 700MHz – 6GHz
- Fully anechoic covered with EHP-12, 24inch absorbers
- Quiet Zone Diameter:
  - 30cm
  - 50cm
  - per CTIA 2.x / 3.x versions



### 3.3 Equipment list

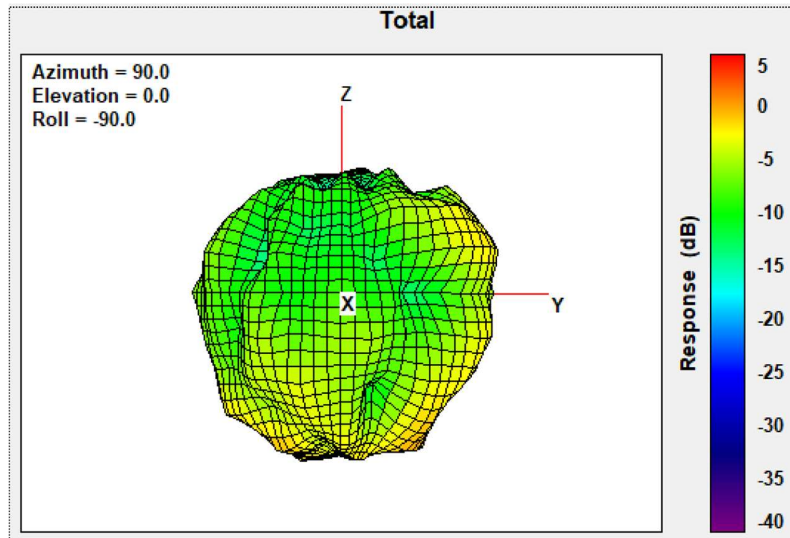
| Name                                                        | Manufacturer          | Type/Model | Serial Number | Calibration |          |
|-------------------------------------------------------------|-----------------------|------------|---------------|-------------|----------|
|                                                             |                       |            |               | Last Cal.   | Due Date |
| ENA Series Network Analyzer                                 | Keysight              | E5071C     | MY46900218    | 2022/8/4    | 2023/8/3 |
| RF Switch                                                   | N/A                   | N/A        | N/A           | 2022/8/4    | 2023/8/3 |
| Multi-Axis Positioner Controller                            | ETS-Lindgren          | 2090       | N/A           | 2022/8/4    | 2023/8/3 |
| Medium-Duty Positioner                                      | ETS-Lindgren          | 2110       | N/A           | 2022/8/4    | 2023/8/3 |
| Measurement Horn Antenna                                    | EMCO                  | Aug-64     | N/A           | 2022/8/4    | 2023/8/3 |
| 12GHz SMA(M)-SMA(M)+20core for 60cm RG316DS Cable Assembly  | Woken Technology Inc. | RG316DS    | N/A           | 2022/8/4    | 2023/8/3 |
| 12GHz SMA(M)-SMA(M)+30core for 300cm RG316DS Cable Assembly | Woken Technology Inc. | RG316DS    | N/A           | 2022/8/4    | 2023/8/3 |

#### 4. Radiation characteristics of antenna loaded in Host Platform

##### Main Antenna

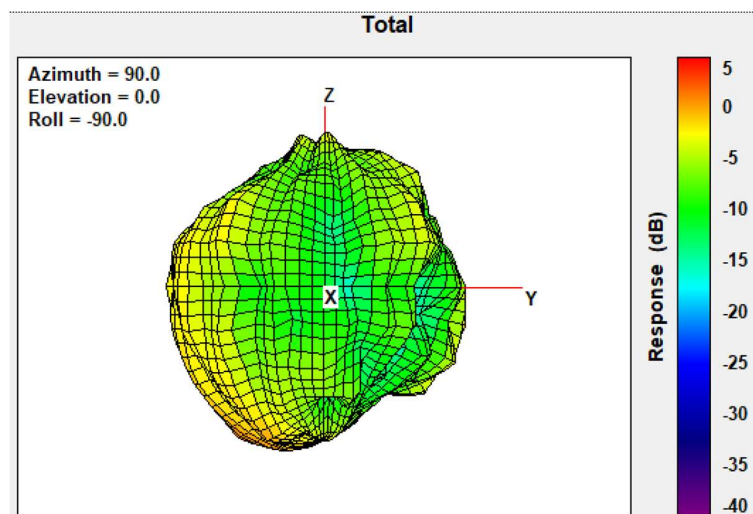
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | 1.19                          |



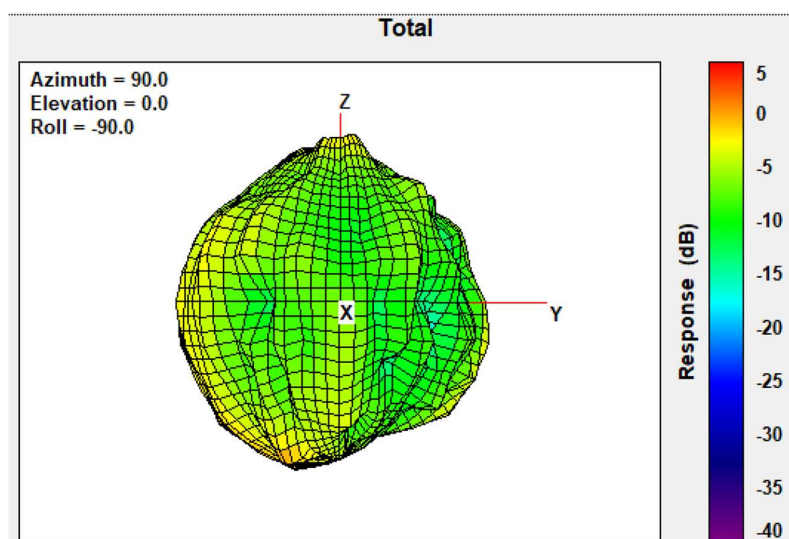
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 1.95                          |



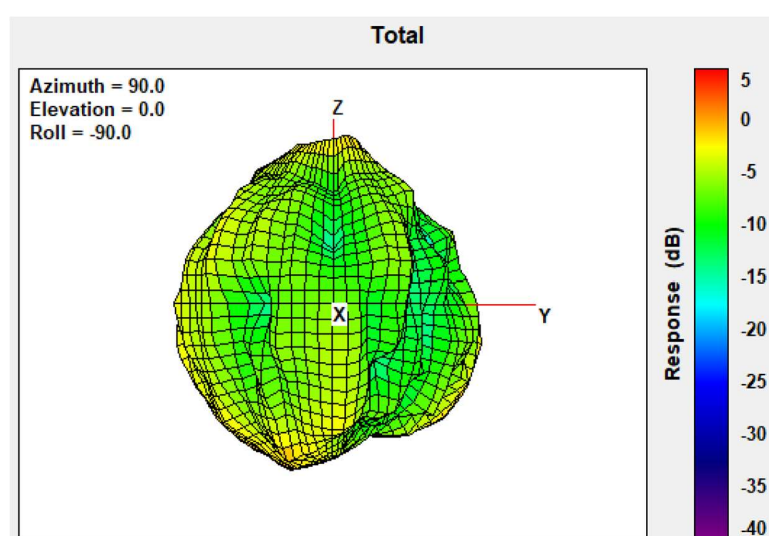
## Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5250-5350       | 2.01                          |



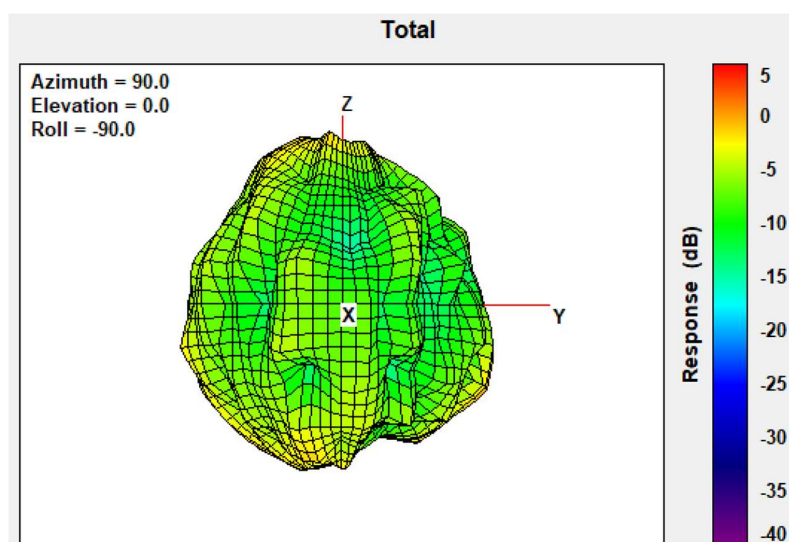
## Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5470-5725       | 2.38                          |



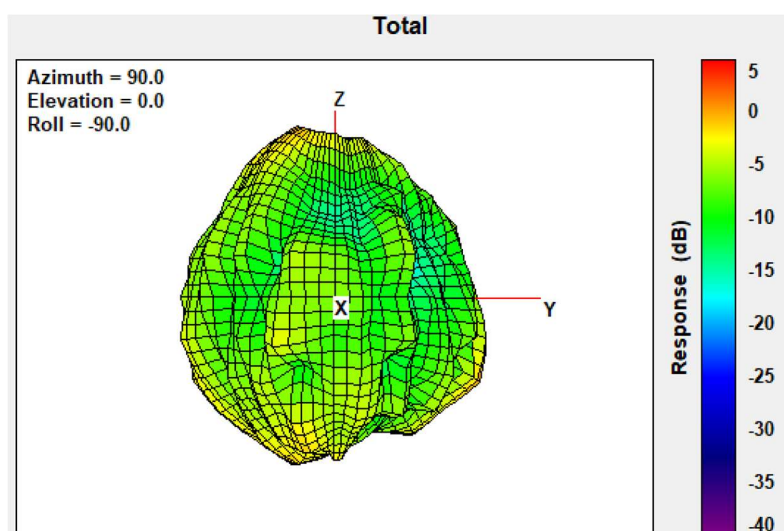
## Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 1.31                          |



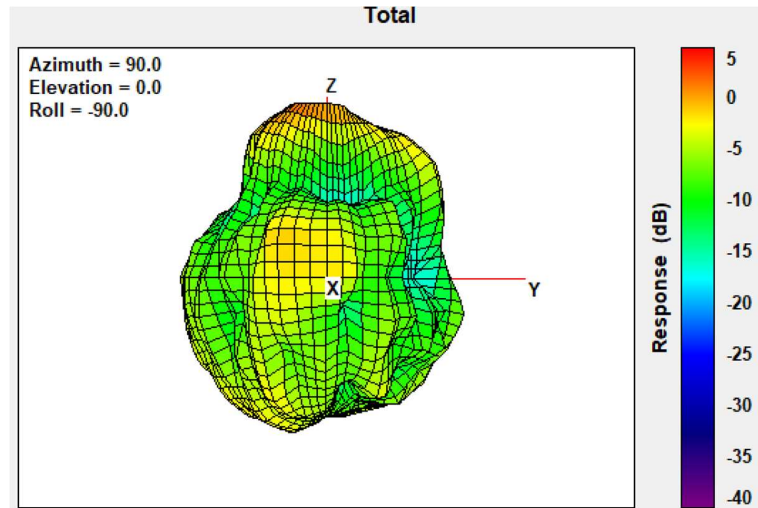
## Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 1.28                          |



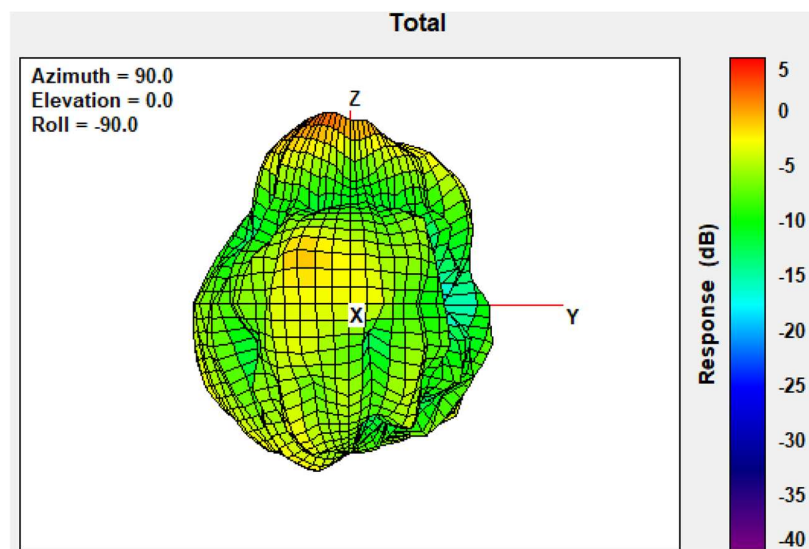
## Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 2.5                           |



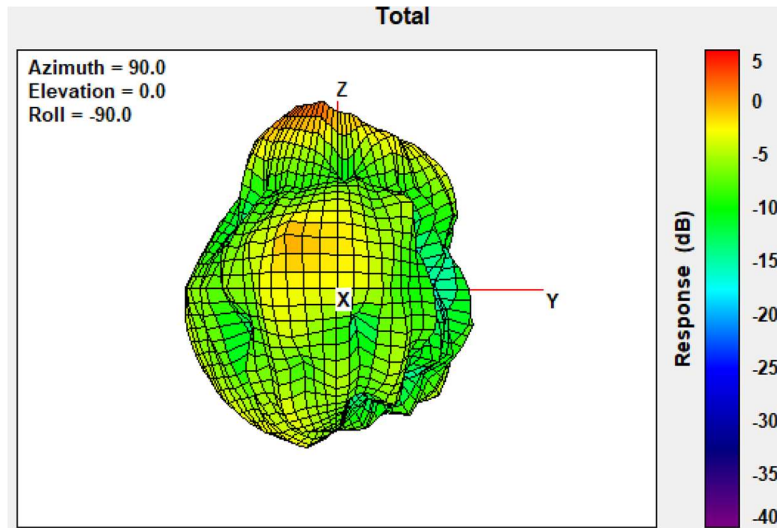
## Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 3.16                          |



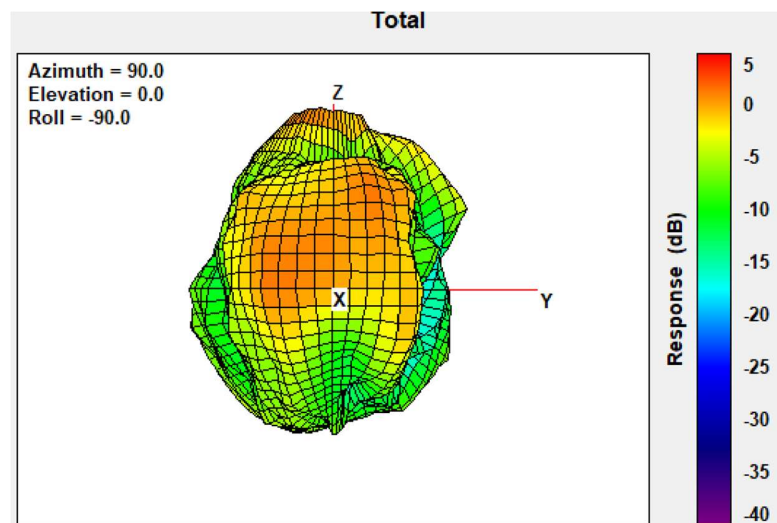
## Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 3.28                          |



## Max Antenna 3D Radiation Pattern 6875-7125 MHz

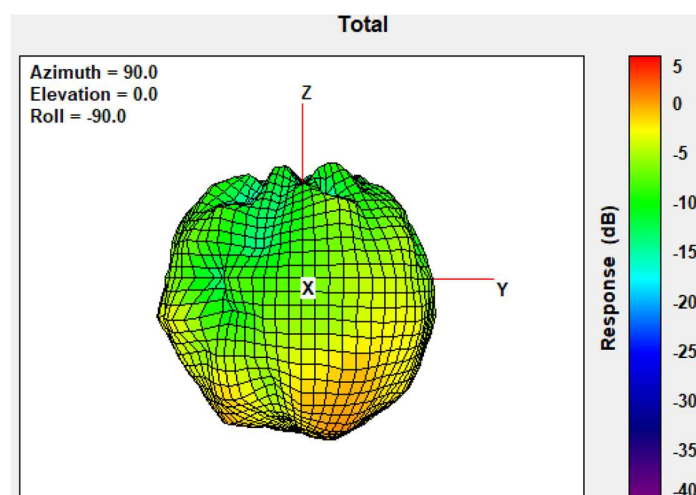
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 2.74                          |



## Auxiliary Antenna

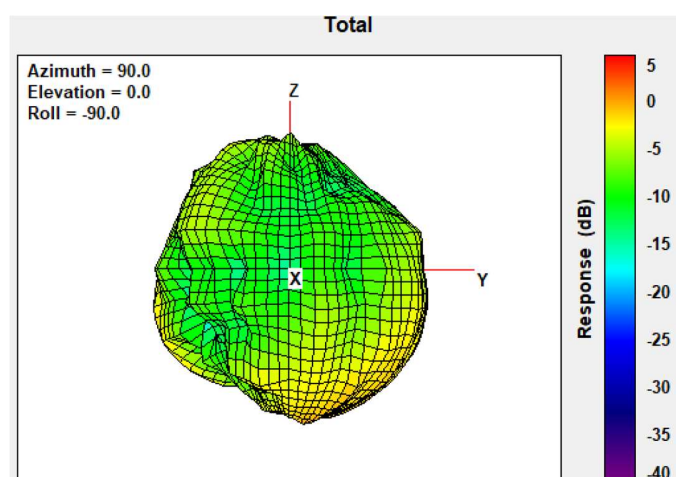
### Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | 2.27                          |



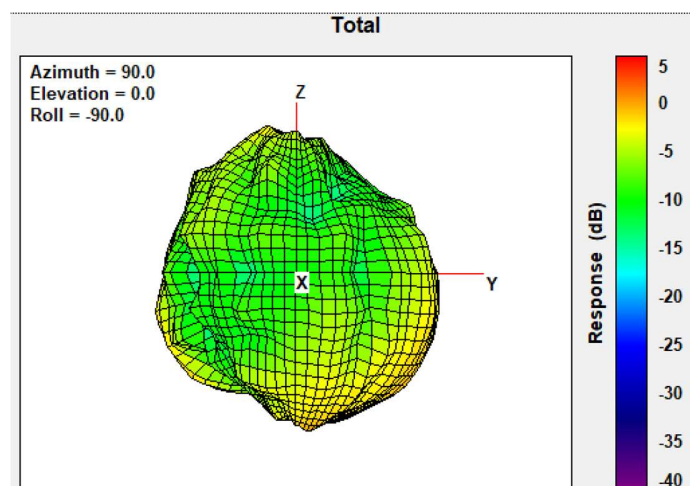
### Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 0.58                          |



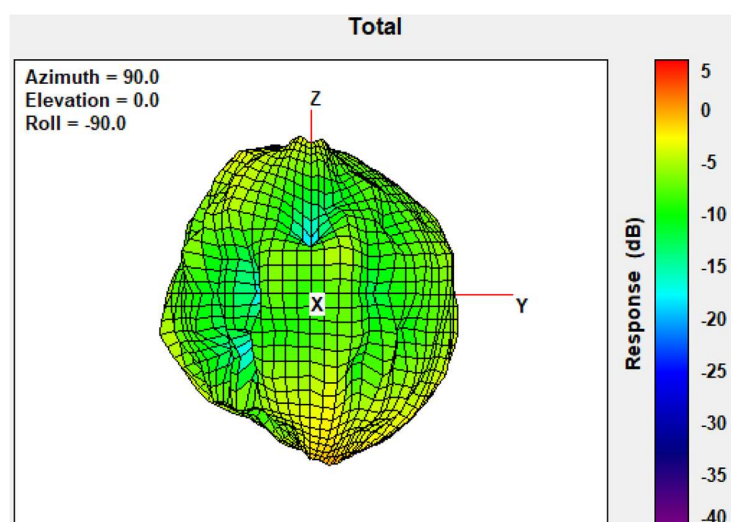
## Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5250-5350       | 0.93                          |



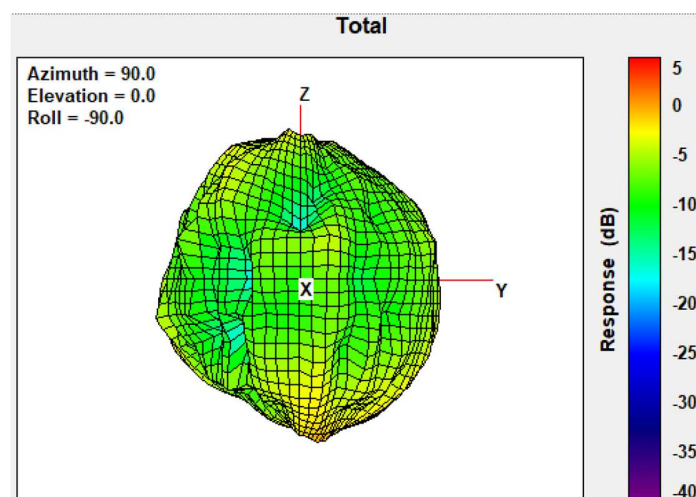
## Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5470-5725       | 1.19                          |



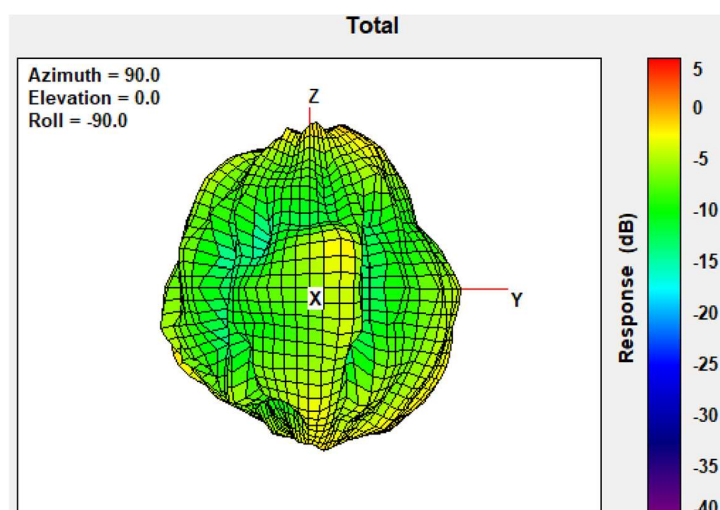
## Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 1.28                          |



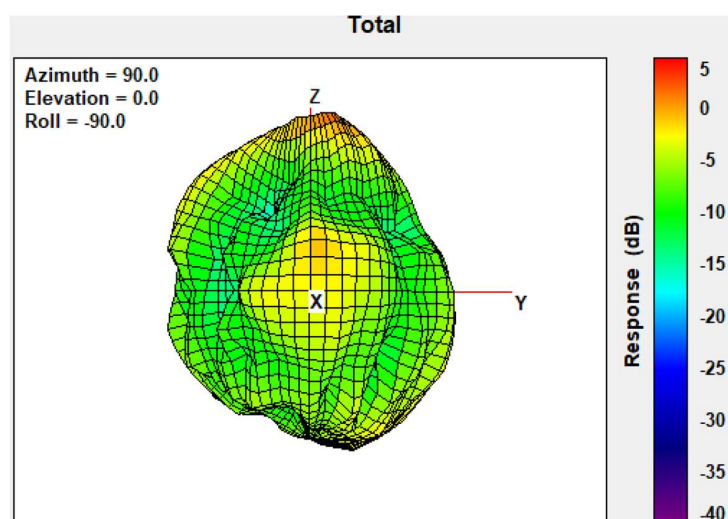
## Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 1.77                          |



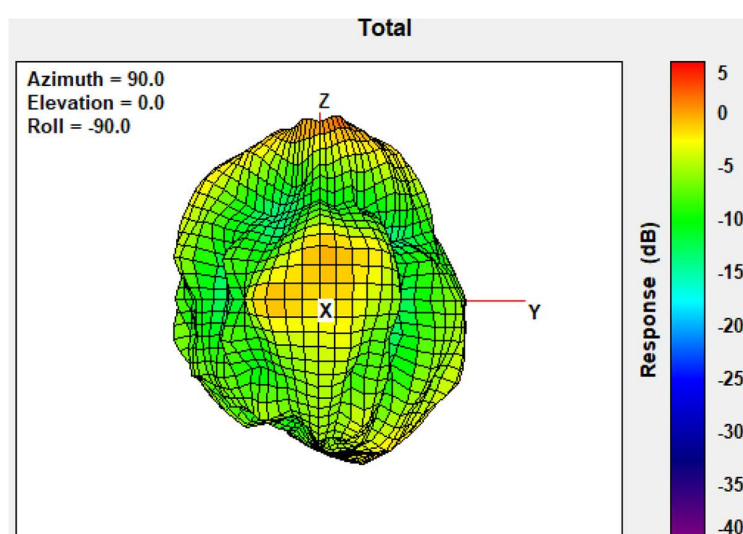
## Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 2.53                          |



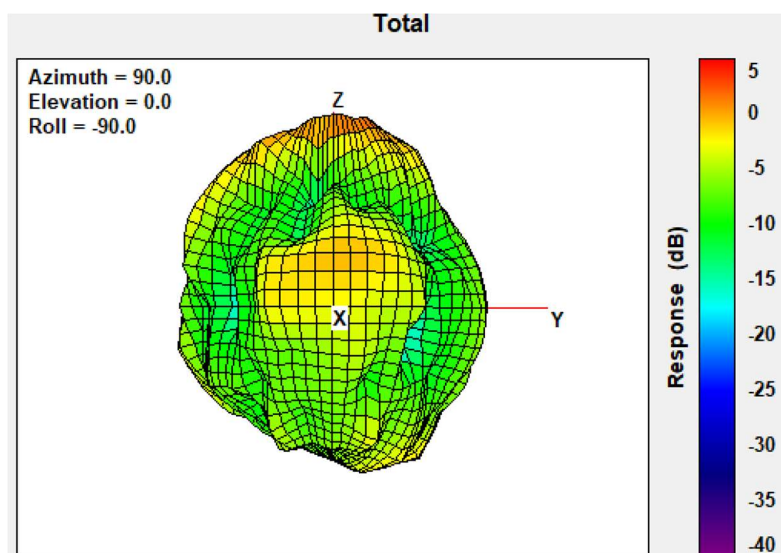
## Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 2.92                          |



## Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 3.12                          |



## Max Antenna 3D Radiation Pattern 6875-7125 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 3.07                          |

