

## Regulatory WLAN Antenna Information (Metal)

| 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)     |                               |                        |                        |                        |                         |                                                                                    |
| Lenovo                                                                                                                                                                         | Compal                      | IdeaPad Slim 5<br>14IRL8<br>IdeaPad Slim 5<br>14IAH8 | Yes                                   | Regular NB                                                   | w/ bumper:11.5<br>w/o bumper:9.6 |                               |                        |                        |                        |                         |                                                                                    |
|                                                                                                                                                                                |                             | IdeaPad Slim 5<br>14ABR8                             | No                                    |                                                              |                                  |                               |                        |                        |                        |                         |                                                                                    |
| *****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)     |                        |                        |                        |                         |                                                                                    |
| High-Tek Electronics Co., Ltd                                                                                                                                                  |                             | PIFA                                                 | DC33002SS10<br>(0ACCN022011N)         |                                                              |                                  | DC33002SS10<br>(0ACCN022011N) |                        |                        |                        |                         |                                                                                    |
| 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                                                                                                                                                                           | -1.10                       | -1.15                                                | -1.36                                 | -1.11                                                        | -1.78                            | -1.72                         | 2.82                   | 1.23                   | 2.06                   | 0.69                    |                                                                                    |
| Aux                                                                                                                                                                            | -0.84                       | -0.47                                                | 0.04                                  | 0.59                                                         | -1.34                            | -1.46                         | 1.36                   | 1.36                   | 1.45                   | 1.45                    |                                                                                    |
| 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<br>Mid-power: ≥ 8 mm<br>Low power: ≥ 5 mm |
| Design                                                                                                                                                                         | 3.00                        | 5.00                                                 | 5.00                                  | 5.00                                                         | 5.00                             | 5.00                          | 5.00                   | 5.00                   | 5.00                   | 5.00                    |                                                                                    |
| 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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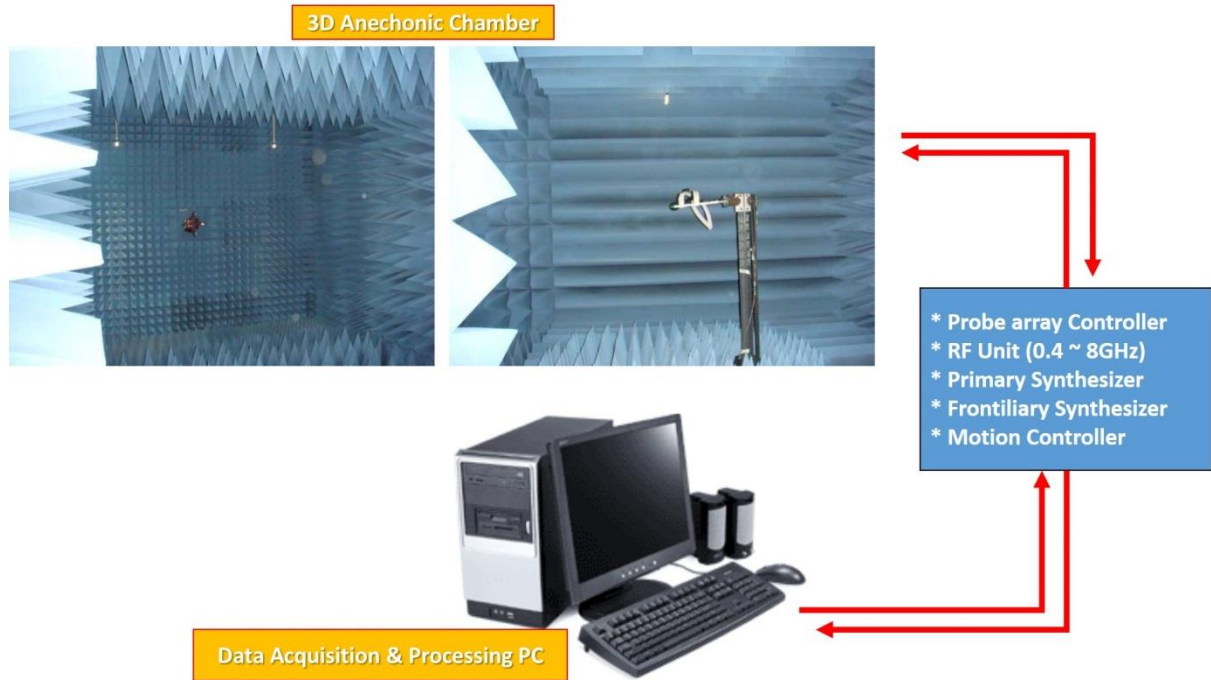
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### 1. Applicable test methods

The radiation pattern of antenna is measured in both horizontal polarization and vertical polarization. The radiation pattern measurements are performed in the three-dimensional anechoic chamber. The chamber provides less than  $-30\text{dB}$  reflectivity from  $800\text{MHz}$  through  $8\text{GHz}$ . The chamber is calibrated using both standard dipole antenna and horn antenna. The Gain here is expressed as dBi that standardizes the isotropic antenna. The Gain measurements and antenna radiation pattern are also performed in the same chamber described previously. Figure 2 shows the schematic diagram for measuring radiation pattern and Gain.



## 2. Test & System Description

### a. Test setup

#### 1. Frequency Range

2400~2500MHz, for WLAN application.

5150~5850MHz, for WLAN application

#### 2. Antenna Configuration

The antenna basically has two parts; the stamping and the cable assembly with the connector on one side. The detailed drawing is attached.

#### 3. VSWR

The VSWR is measured with network analyzer that support up to 8GHz. All the measurements are performed with the customer provided fixture. Figure 1 shows the typical schematic diagram for measuring VSWR.

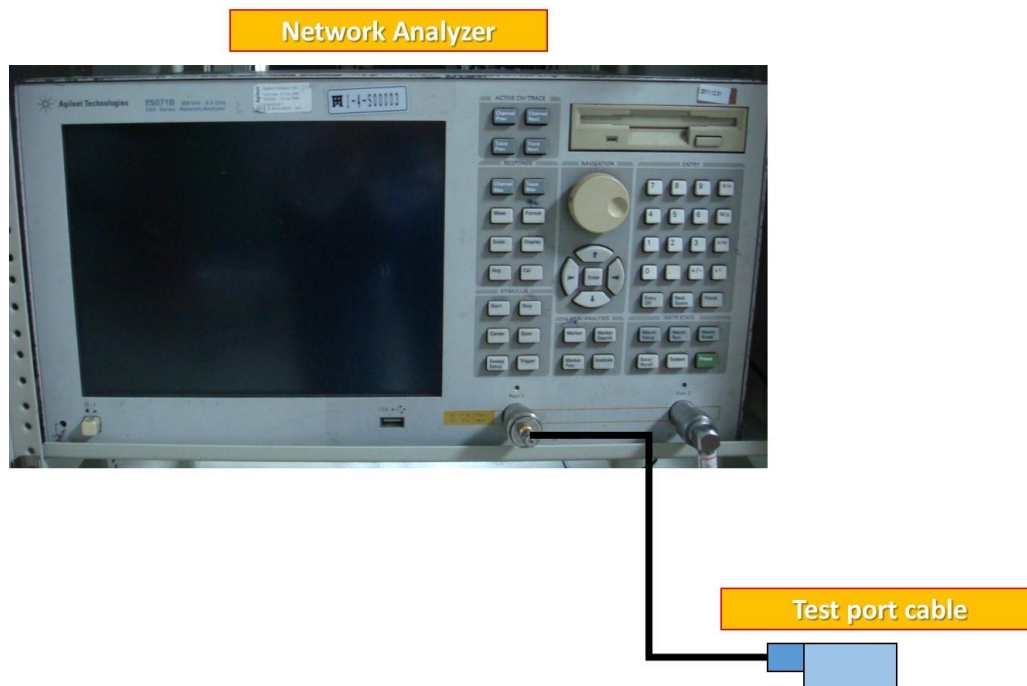


Figure 1. The schematic diagram for measuring VSWR

## b. Equipment list

**Test Equipment**

The equipment for the antenna measurement we used is as follows:

- A. Network Analyzer, support up to 8GHz, to measure the VSWR and input impedance of antenna.
- B. Three-dimensional anechoic chamber to measure antenna gain and radiation pattern(Standard horn antenna was used to calibrate the chamber)
- C. Digital caliper to measure the dimensions.
- D. Climatic chamber for mechanical tests.

**Radiated Setup**

| item | Device                                                                                                | Type/Model     | manufacturer | Cal. Date  | Cal. Due Date |
|------|-------------------------------------------------------------------------------------------------------|----------------|--------------|------------|---------------|
| 1    | Anechoic Chamber                                                                                      | AMS-8500       | ETS-Lindgren | 2021/12/20 | 2022/12/20    |
| 2    | Turn Table                                                                                            | ETS            | ETS-Lindgren | N/A        | N/A           |
| 3    | Measurement SW                                                                                        | EMQuest1.08    | ETS-Lindgren | N/A        | N/A           |
| 4    | Vector Network Analyzer                                                                               | Agilent E5071B | Agilent      | 2021/12/17 | 2022/12/17    |
| 5    | Receive Antenna<br>Absorber Nested Dual-<br>Polarized Dual-Vivaldi Array<br>Antenna<br>700MHz to 6GHz | EMCO 3164-08   | ETS-Lindgren | N/A        | N/A           |
| 6    | Multi Axis Positioning System<br>(MAPS™)                                                              | EMCO 2115CR    | ETS-Lindgren | N/A        | N/A           |
| 7    | MAPS™ Controller                                                                                      | MECO 2090      | ETS-Lindgren | N/A        | N/A           |
| 8    | Horn antenna                                                                                          | 3164-08        | ETS-Lindgren | 2021/12/15 | 2022/12/15    |
| 9    | Cable 0.5m - 700MHz~10GHz                                                                             | RG316          | Senyu        | 2021/12/21 | 2022/12/21    |

N/A : Not Applicable

# 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: DC33002SS10 (0ACCN022011N)) Main Antenna | High-Tek Electronics Co., Ltd | PIFA         | Connector Type:SpeedTech (P/N: C87P115-00002-H)<br><br>50 ohm Coaxial length: 260mm diameter: 1.13mm | 2400-2483.5    | -1.10                           | -0.31                          | 3        | 0.79            |
|                                                |                               |              |                                                                                                      | 5150-5250      | -1.15                           | -0.03                          | 3        | 1.12            |
|                                                |                               |              |                                                                                                      | 5250-5350      | -1.36                           | -0.24                          | 3        | 1.12            |
|                                                |                               |              |                                                                                                      | 5470-5725      | -1.11                           | 0.84                           | 3        | 1.95            |
|                                                |                               |              |                                                                                                      | 5725-5850      | -1.78                           | 0.20                           | 3        | 1.98            |
|                                                |                               |              |                                                                                                      | 5850-5895      | -1.72                           | 0.27                           | 3        | 1.99            |
|                                                |                               |              |                                                                                                      | 5925-6425      | 2.82                            | 4.88                           | 3        | 2.06            |
|                                                |                               |              |                                                                                                      | 6425-6525      | 1.23                            | 3.32                           | 3        | 2.09            |
|                                                |                               |              |                                                                                                      | 6525-6875      | 2.06                            | 4.20                           | 3        | 2.14            |
|                                                |                               |              |                                                                                                      | 6875-7125      | 0.69                            | 2.95                           | 3        | 2.26            |
| (P/N: DC33002SS10 (0ACCN022011N)) Aux Antenna  | High-Tek Electronics Co., Ltd | PIFA         | Connector Type:SpeedTech (P/N: C87P115-00002-H)<br><br>50 ohm Coaxial length: 317mm diameter: 1.13mm | 2400-2483.5    | -0.84                           | 0.12                           | 3        | 0.96            |
|                                                |                               |              |                                                                                                      | 5150-5250      | -0.47                           | 0.90                           | 3        | 1.37            |
|                                                |                               |              |                                                                                                      | 5250-5350      | 0.04                            | 1.41                           | 3        | 1.37            |
|                                                |                               |              |                                                                                                      | 5470-5725      | 0.59                            | 2.06                           | 3        | 1.47            |
|                                                |                               |              |                                                                                                      | 5725-5850      | -1.34                           | 0.15                           | 3        | 1.49            |
|                                                |                               |              |                                                                                                      | 5850-5895      | -1.46                           | 0.04                           | 3        | 1.50            |
|                                                |                               |              |                                                                                                      | 5925-6425      | 1.36                            | 2.91                           | 3        | 1.55            |
|                                                |                               |              |                                                                                                      | 6425-6525      | 1.36                            | 2.93                           | 3        | 1.57            |
|                                                |                               |              |                                                                                                      | 6525-6875      | 1.45                            | 3.06                           | 3        | 1.61            |
|                                                |                               |              |                                                                                                      | 6875-7125      | 1.45                            | 3.15                           | 3        | 1.70            |

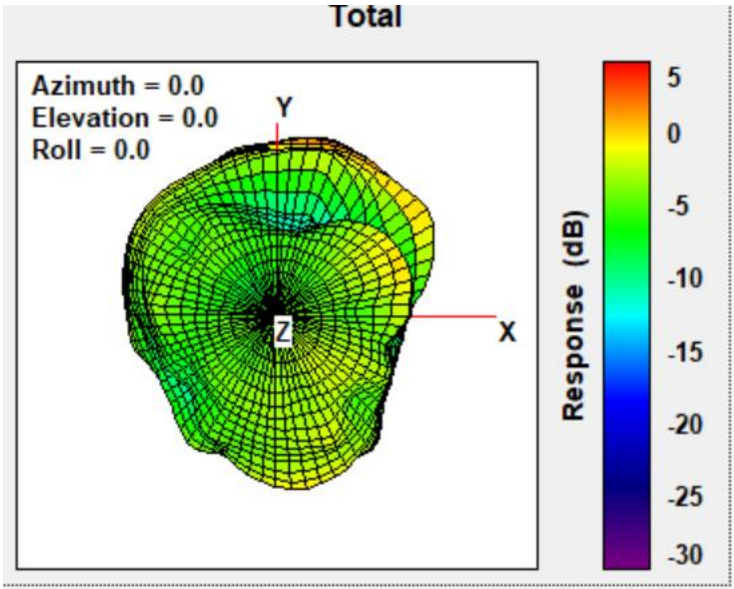
- 3D Antenna Peak Gain required being test in system basis.

Section 3. Radiation characteristics of antenna loaded in Host Platform

Main Antenna

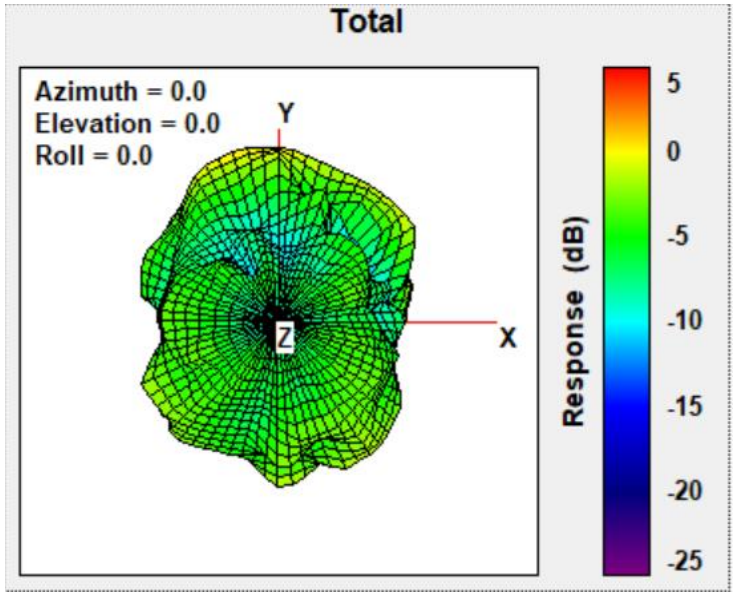
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | -1.10                         |



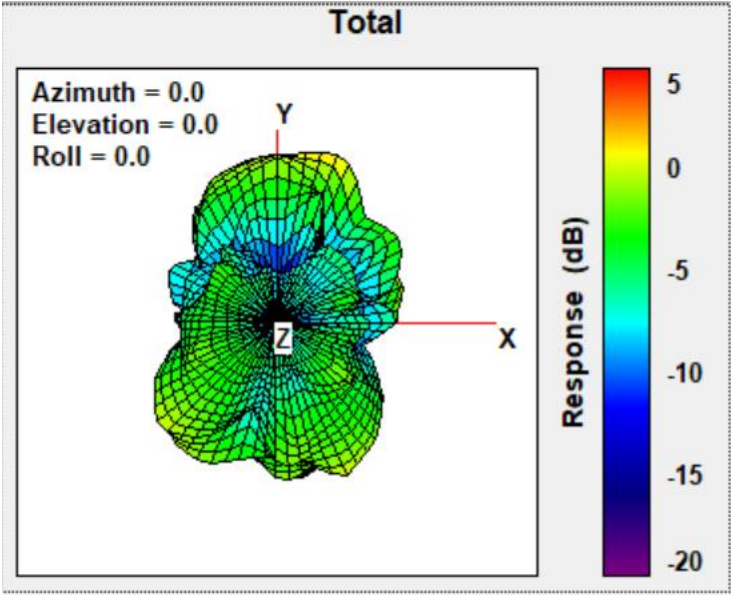
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | -1.15                         |



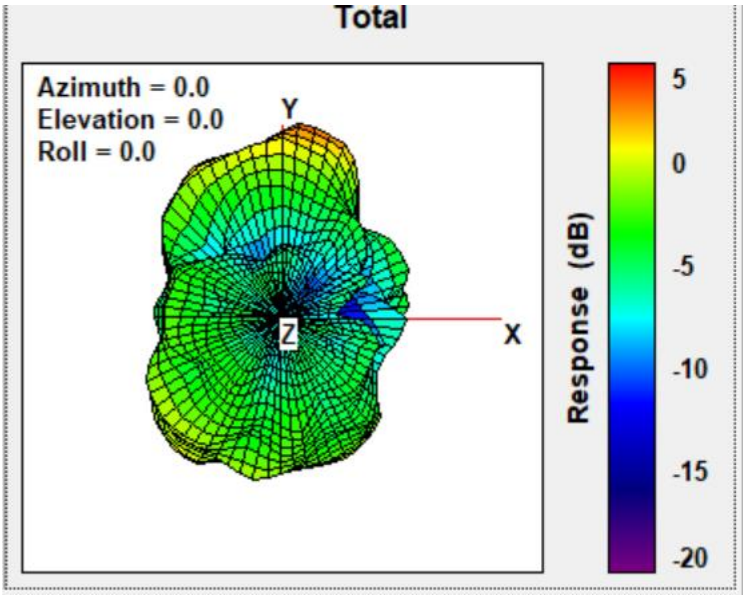
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5250-5350       | -1.36                         |



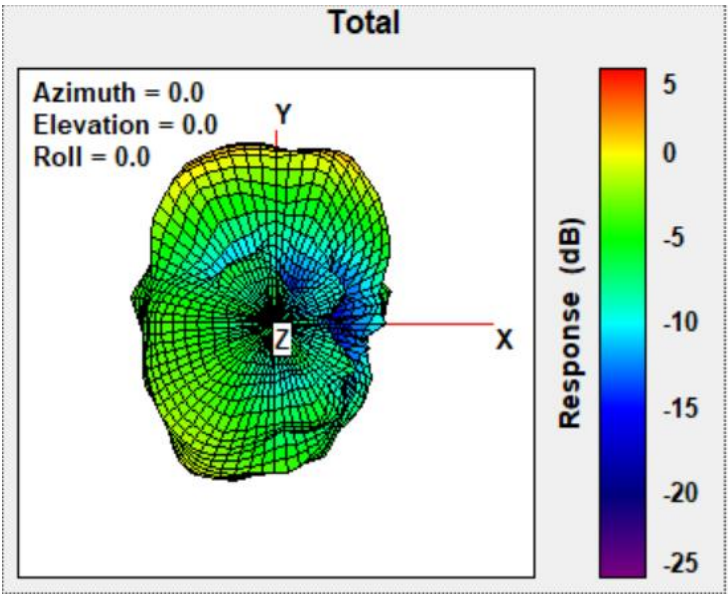
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5470-5725       | -1.11                         |



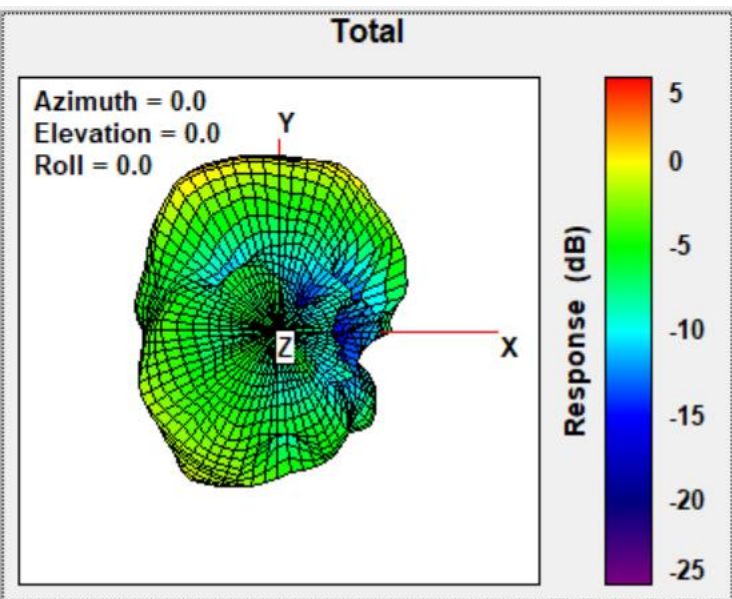
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | -1.78                         |



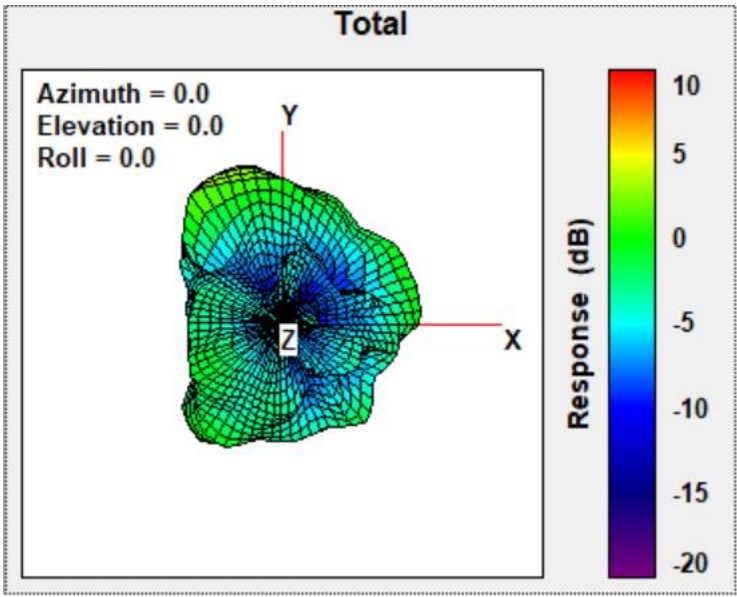
Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | -1.72                         |



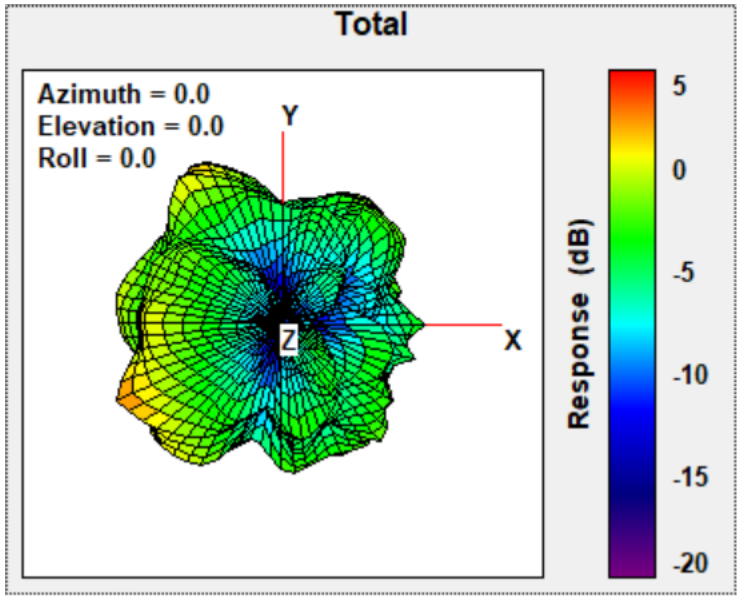
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 2.82                          |



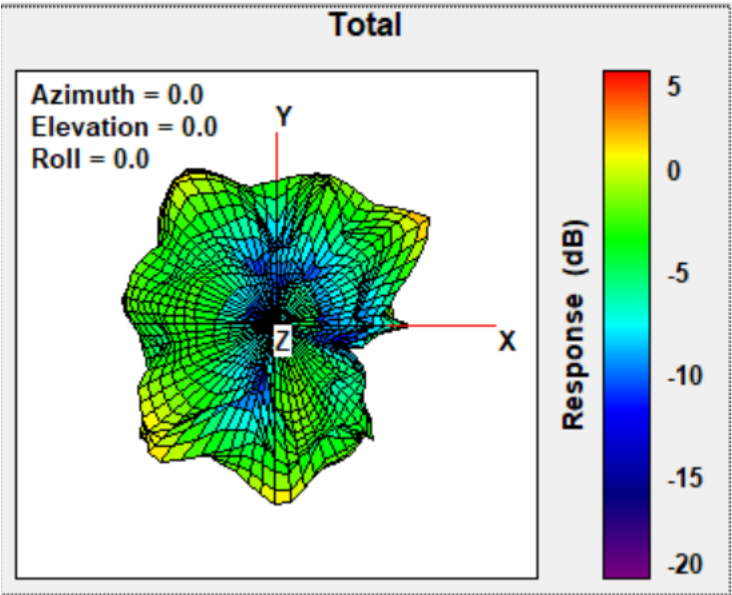
Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 1.23                          |



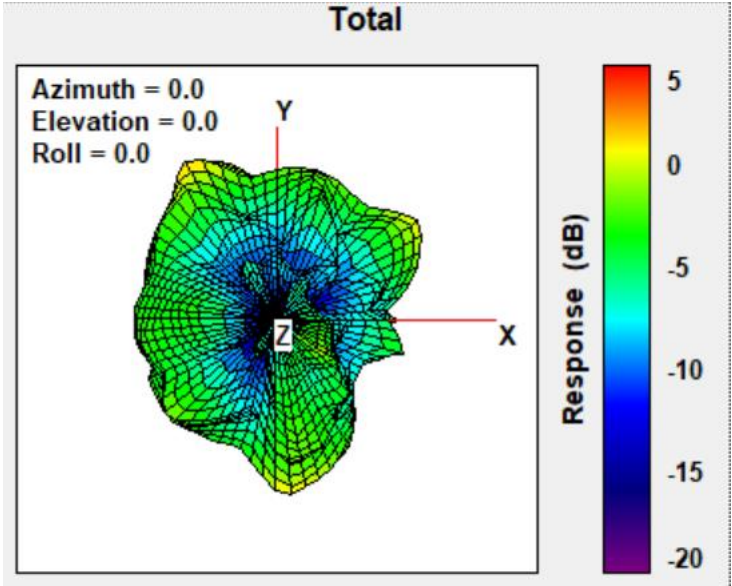
Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 2.06                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

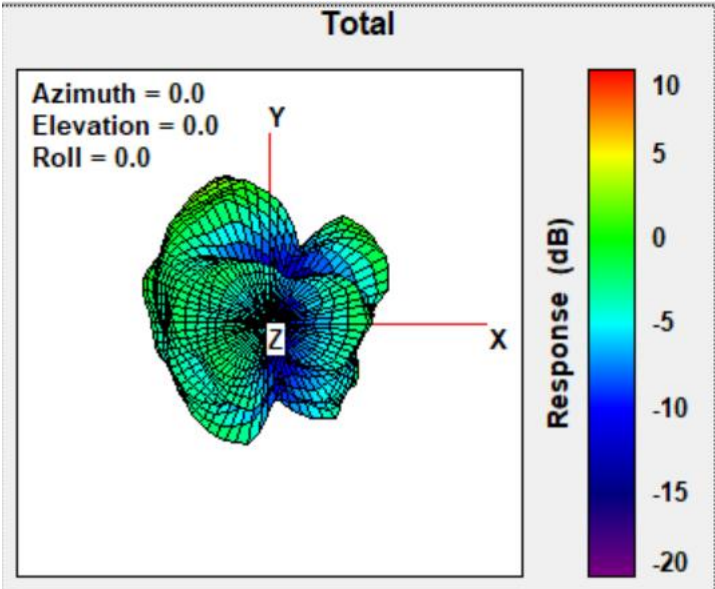
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 0.69                          |



Auxiliary Antenna

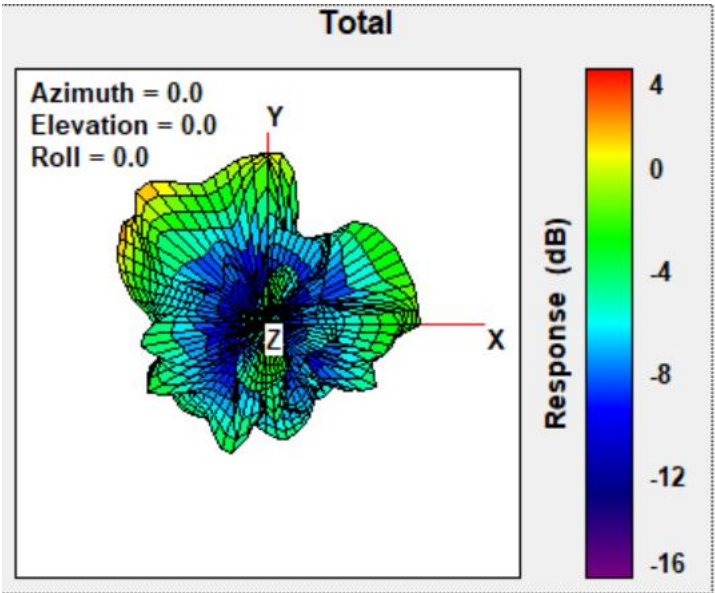
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | -0.84                         |



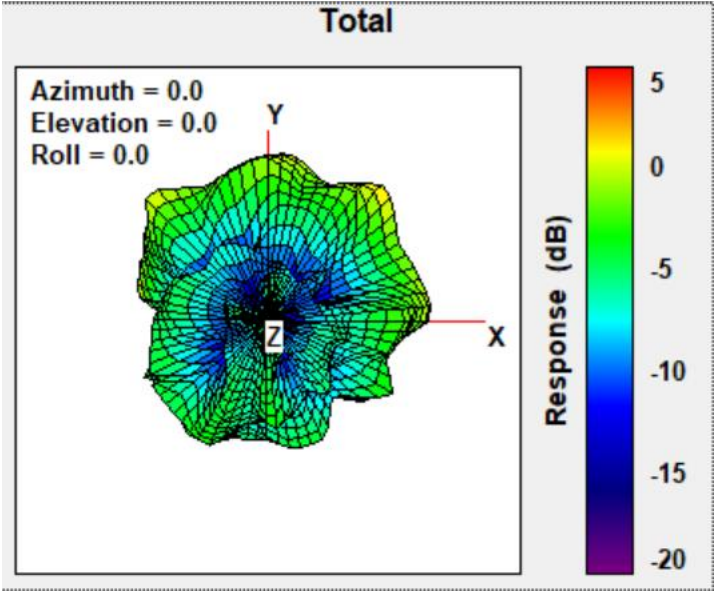
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | -0.47                         |



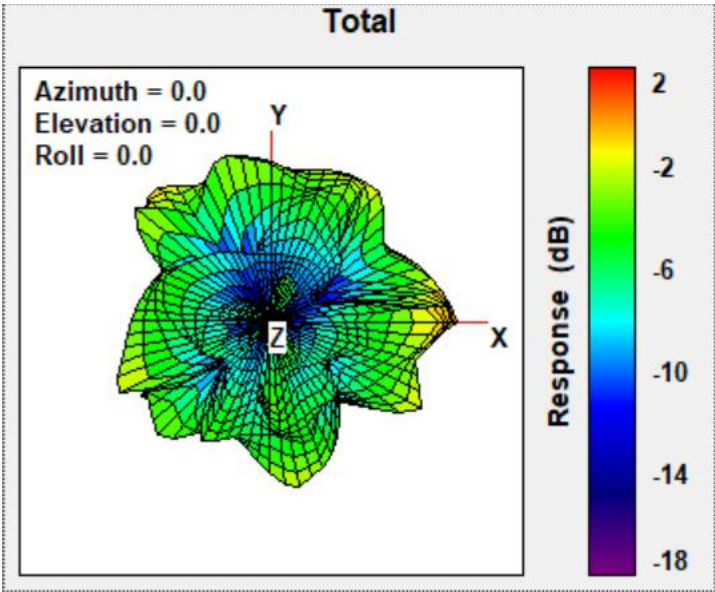
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5250-5350       | 0.04                          |



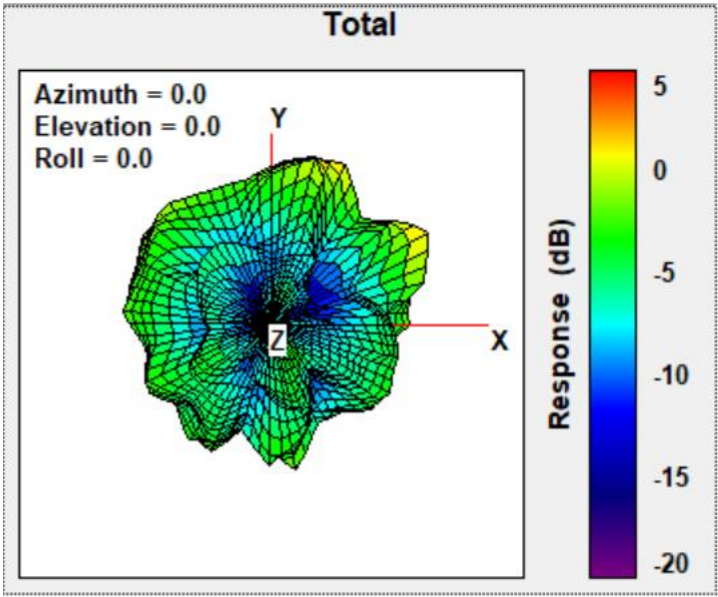
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5470-5725       | 0.59                          |



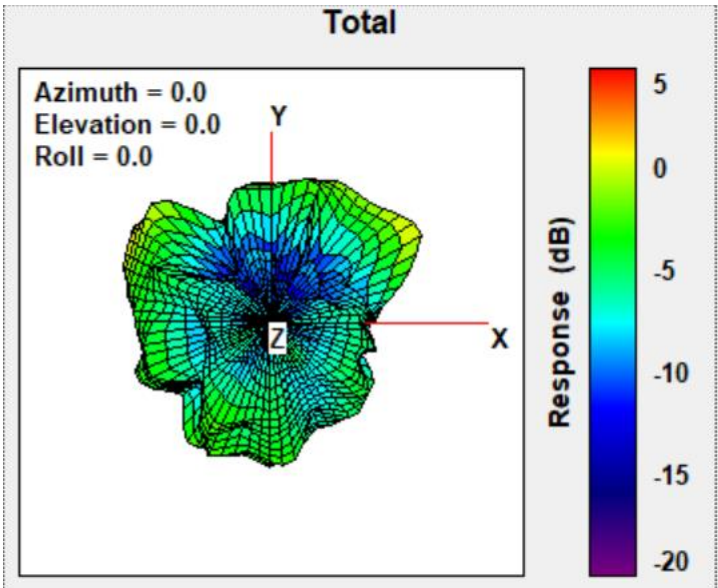
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | -1.34                         |



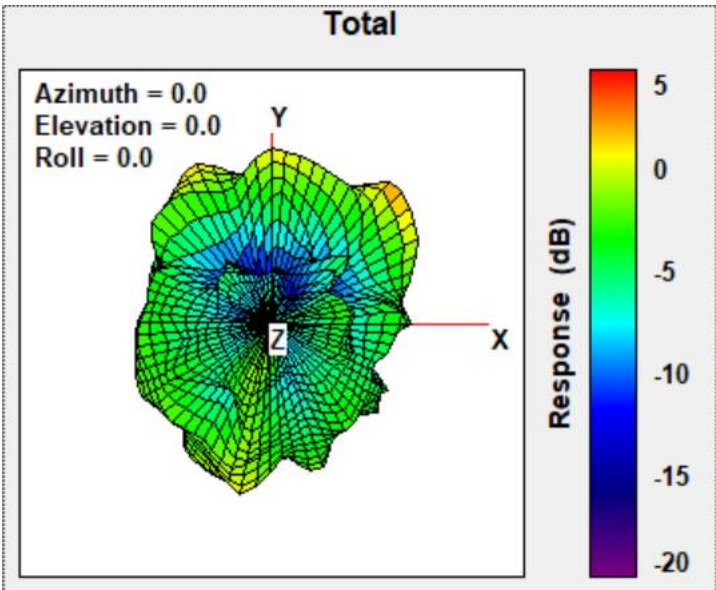
Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | -1.46                         |



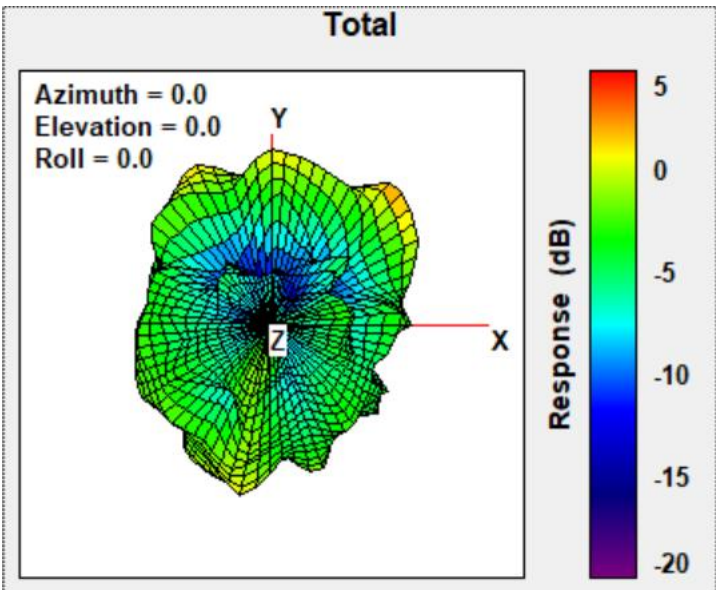
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 1.36                          |



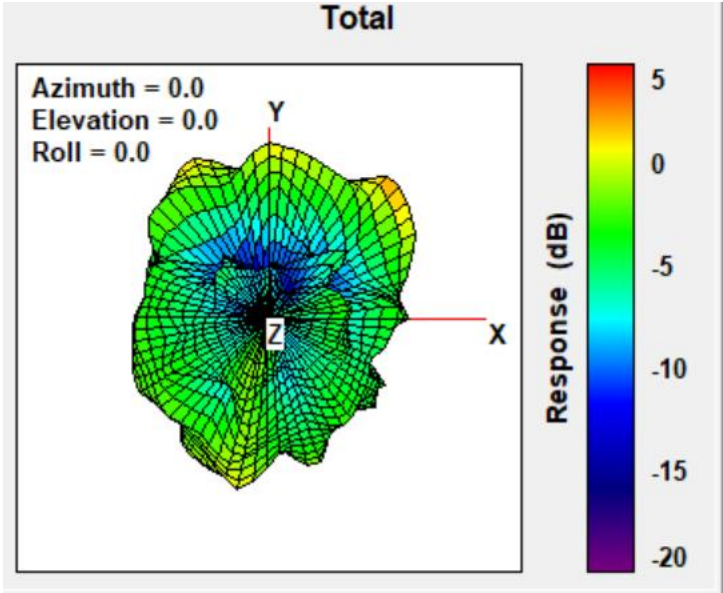
Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 1.36                          |



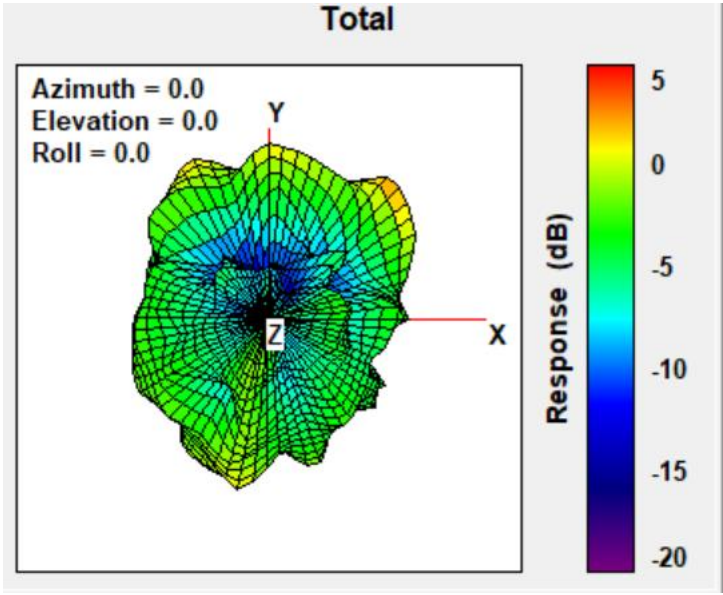
Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 1.45                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 1.45                          |



## Revision History

| Revision | Description                                                                                                                                | Date               |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 10.3     | <u>Page2-5</u><br>Add Applicable test method, Test & System Description and Setup photo                                                    | July 24, 2022      |
| 10.4     | <u>Cover page</u><br>Add Intel 5.9GHz reference antenna gain<br><u>Cover page/Section1/Section3</u><br>Add 5.9GHz antenna gain information | September 15, 2022 |