

# Regulatory WLAN Antenna Information (Metal)

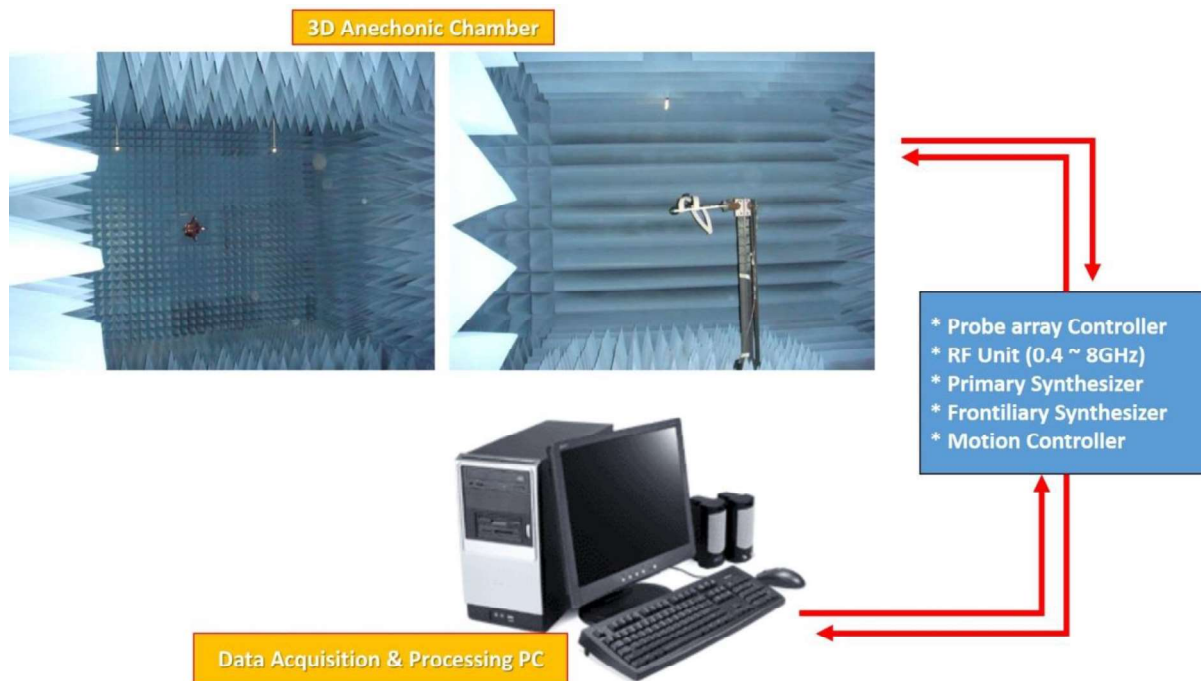
| Platform information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                                                      |                                       |                                                              |                                   |                        |                               |                        |                        |                         |                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------|---------------------------------------|--------------------------------------------------------------|-----------------------------------|------------------------|-------------------------------|------------------------|------------------------|-------------------------|------------------------------------------------------------------------------------|
| 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>16IRL8<br>IdeaPad Slim 5<br>16IAH8 | Yes                                   | NB                                                           | w/ bumper:12.5<br>w/o bumper:10.6 |                        |                               |                        |                        |                         |                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | IdeaPad Slim 5<br>16ABR8                             | 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                                                 | DC33002ST10<br>(0ACCN022017N)         |                                                              |                                   |                        | DC33002ST10<br>(0ACCN022017N) |                        |                        |                         |                                                                                    |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2.81                        | 2.61                                                 | 2.48                                  | 2.76                                                         | 2.56                              | 2.92                   | 3.90                          | 3.90                   | 3.93                   | 3.71                    |                                                                                    |
| Aux                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2.63                        | 2.88                                                 | 2.88                                  | 2.81                                                         | 1.53                              | 2.07                   | 3.60                          | 3.61                   | 3.80                   | 3.65                    |                                                                                    |
| 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  |                                                                                    |
| Design                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.00                        | 5.00                                                 | 5.00                                  | 5.00                                                         | 5.00                              | 5.00                   | 5.00                          | 5.00                   | 5.00                   | 5.00                    | Generic: refer to modular FCC SAR report<br>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                    |                                                                                    |
| <b>Notes (marked with *)</b><br><b>* SAR minimum separation (mm)</b><br>- Regular NB: Minimum antenna-to-body (from antenna bottom to the bottom of the device)<br>- Tablet / Convertible PC: Minimum antenna-to-edge (5 sides of the device)<br>- Mini-tablet: Minimum antenna-to-edge (6 sides of the device)<br><b>* 3D Peak Antenna gain should be equal or greater than -2 dBi</b><br>- 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 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  $\text{dBi}$  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.

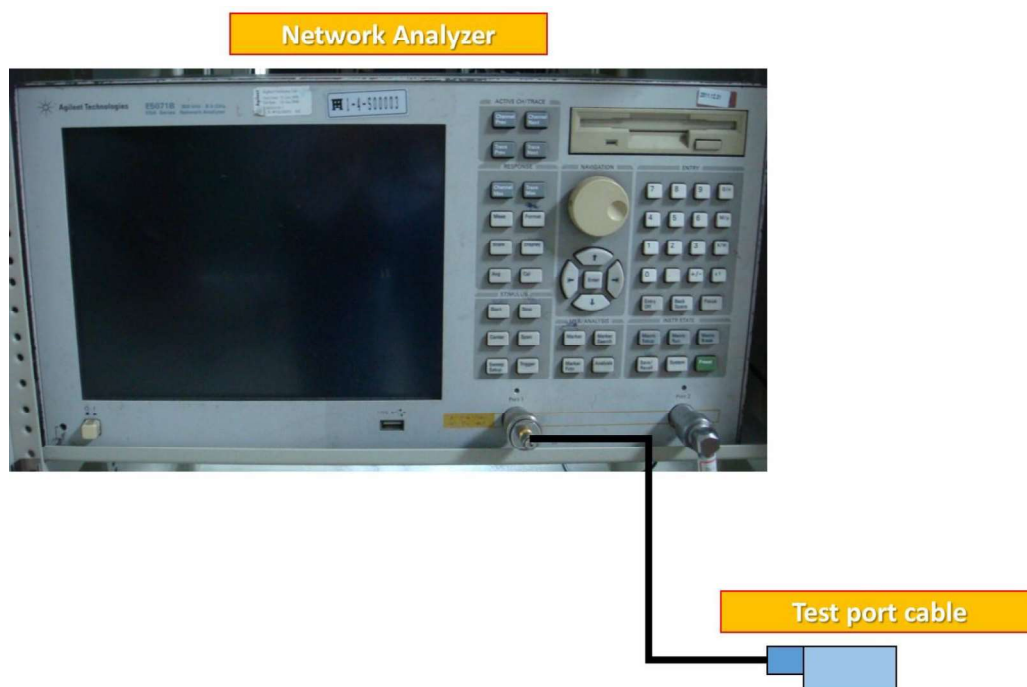


Figure 1. The schematic diagram for measuring VSWR

## 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: DC33002ST10 (0ACCN022017N)) Main Antenna | High-Tek Electronics Co., Ltd | PIFA         | 1)Connector: SpeedTeh<br>2)Connector P/N: C87P115-00002-H<br>3) 50ohm coaxial cable<br>4)length : 353 mm<br>Diameter:1.13mm<br>Type: L/L | 2400-2483.5    | 2.81                            | 3.88                           | 3.0      | 1.07            |
|                                                |                               |              |                                                                                                                                          | 5150-5250      | 2.61                            | 4.13                           | 3.0      | 1.52            |
|                                                |                               |              |                                                                                                                                          | 5250-5350      | 2.48                            | 4.00                           | 3.0      | 1.52            |
|                                                |                               |              |                                                                                                                                          | 5470-5725      | 2.76                            | 4.39                           | 3.0      | 1.63            |
|                                                |                               |              |                                                                                                                                          | 5725-5850      | 2.56                            | 4.21                           | 3.0      | 1.65            |
|                                                |                               |              |                                                                                                                                          | 5850-5895      | 2.92                            | 5.25                           | 3.0      | 1.67            |
|                                                |                               |              |                                                                                                                                          | 5925-6425      | 3.90                            | 5.63                           | 3.0      | 1.73            |
|                                                |                               |              |                                                                                                                                          | 6425-6525      | 3.90                            | 5.65                           | 3.0      | 1.75            |
|                                                |                               |              |                                                                                                                                          | 6525-6875      | 3.93                            | 5.72                           | 3.0      | 1.79            |
|                                                |                               |              |                                                                                                                                          | 6875-7125      | 3.71                            | 5.60                           | 3.0      | 1.89            |
| (P/N: DC33002ST10 (0ACCN022017N)) Aux Antenna  | High-Tek Electronics Co., Ltd | PIFA         | 1)Connector: SpeedTeh<br>2)Connector P/N: C87P115-00002-H<br>3) 50ohm coaxial cable<br>4)length : 433 mm<br>Diameter:1.13mm<br>Type: L/L | 2400-2483.5    | 2.63                            | 3.94                           | 3.0      | 1.31            |
|                                                |                               |              |                                                                                                                                          | 5150-5250      | 2.88                            | 4.74                           | 3.0      | 1.86            |
|                                                |                               |              |                                                                                                                                          | 5250-5350      | 2.88                            | 4.75                           | 3.0      | 1.87            |
|                                                |                               |              |                                                                                                                                          | 5470-5725      | 2.81                            | 4.81                           | 3.0      | 2.00            |
|                                                |                               |              |                                                                                                                                          | 5725-5850      | 1.53                            | 3.56                           | 3.0      | 2.03            |
|                                                |                               |              |                                                                                                                                          | 5850-5895      | 2.07                            | 4.11                           | 3.0      | 2.04            |
|                                                |                               |              |                                                                                                                                          | 5925-6425      | 3.60                            | 5.72                           | 3.0      | 2.12            |
|                                                |                               |              |                                                                                                                                          | 6425-6525      | 3.61                            | 5.75                           | 3.0      | 2.14            |
|                                                |                               |              |                                                                                                                                          | 6525-6875      | 3.80                            | 6.00                           | 3.0      | 2.20            |
|                                                |                               |              |                                                                                                                                          | 6875-7125      | 3.65                            | 5.97                           | 3.0      | 2.32            |

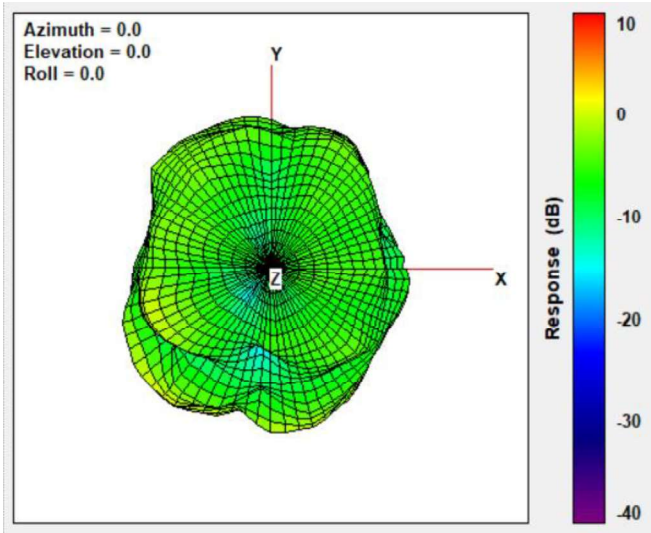
- 3D Antenna Peak Gain required being test in system basis.

Section 3. Radiation characteristics of antenna loaded in Host Platform

Main Antenna

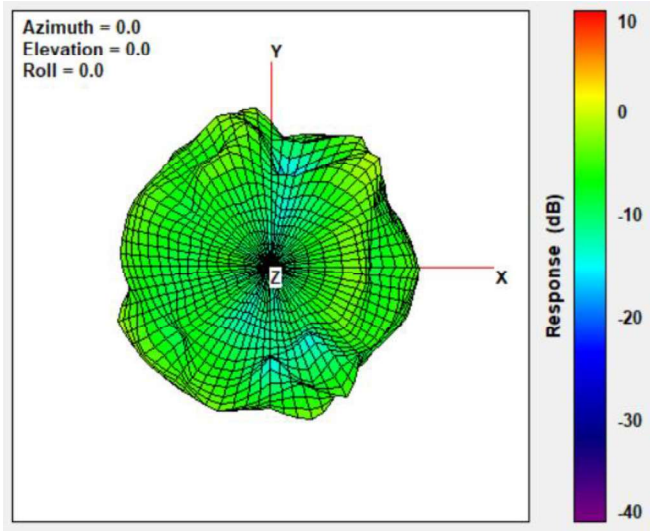
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | 2.81                          |



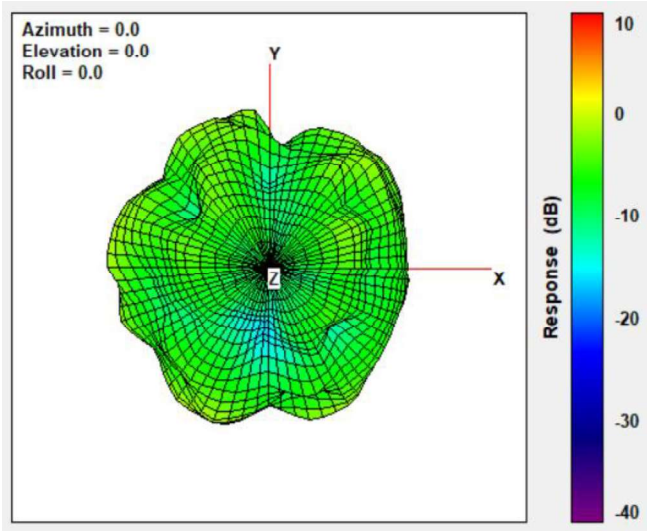
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 2.61                          |



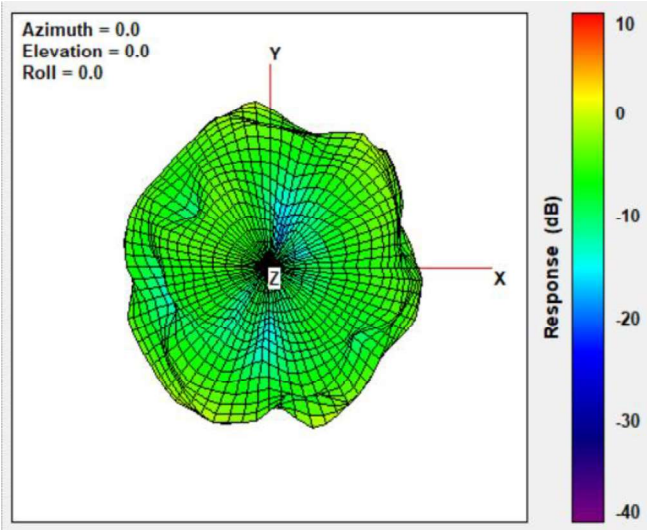
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5250-5350          | 2.48                             |



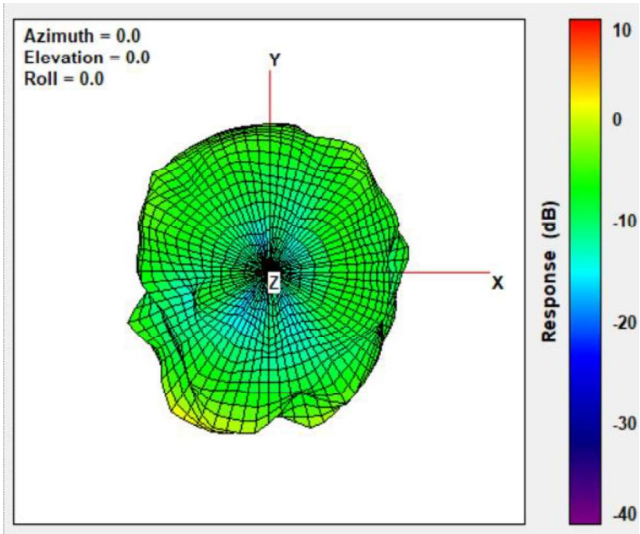
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5470-5725          | 2.76                             |



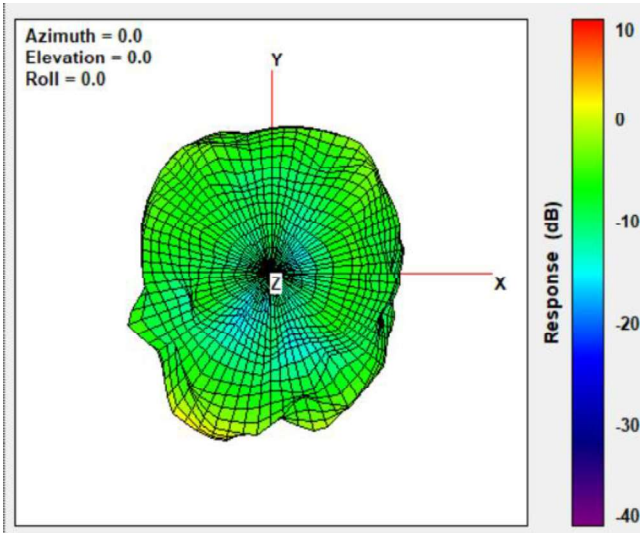
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 2.56                          |



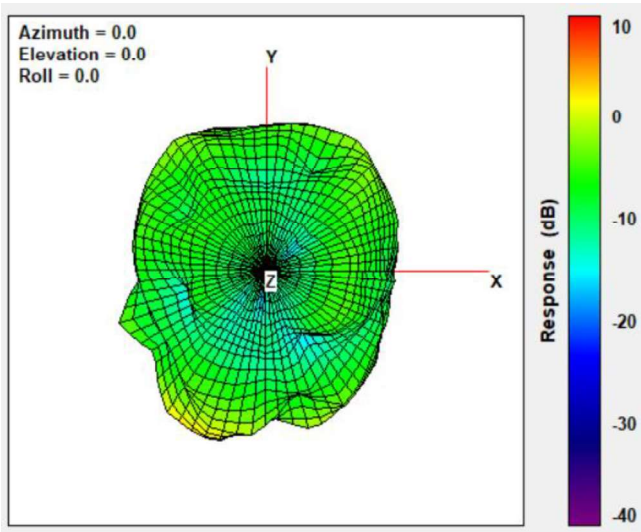
Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 2.92                          |



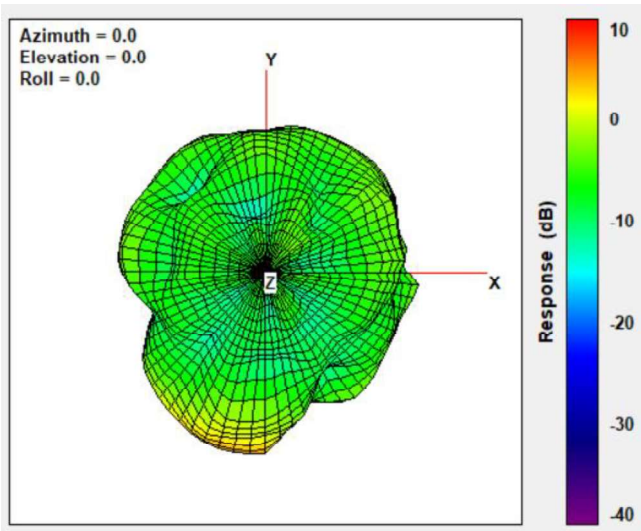
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 3.90                          |



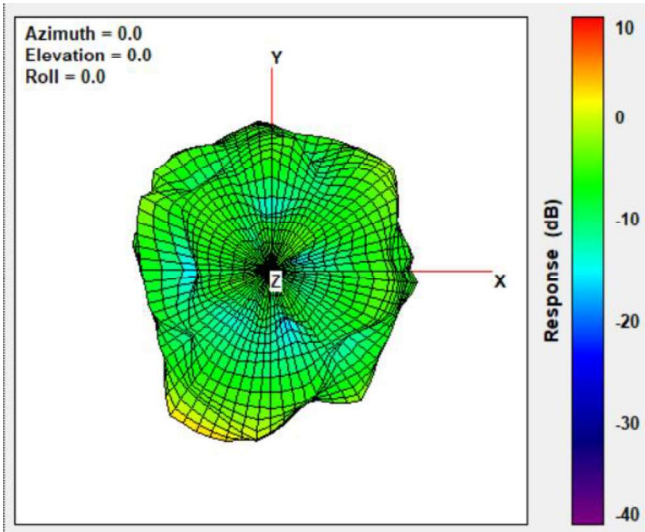
Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 3.90                          |



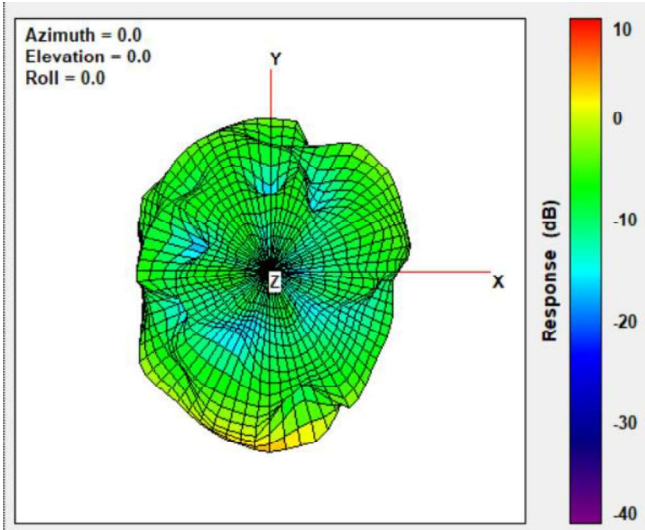
Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 3.93                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

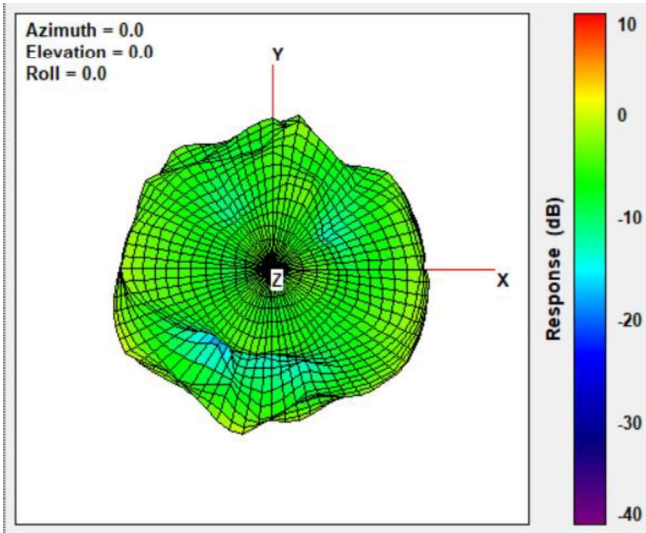
| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 3.71                          |



Auxiliary Antenna

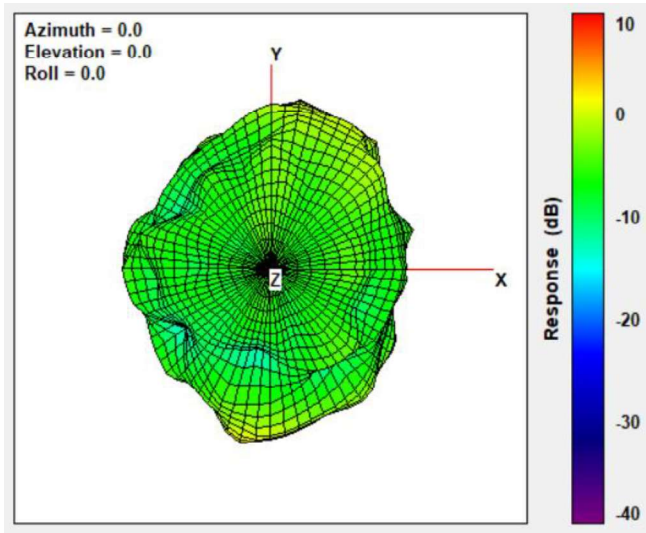
Max Antenna 3D Radiation Pattern 2400 – 2483.5 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 2400-2483.5     | 2.63                          |



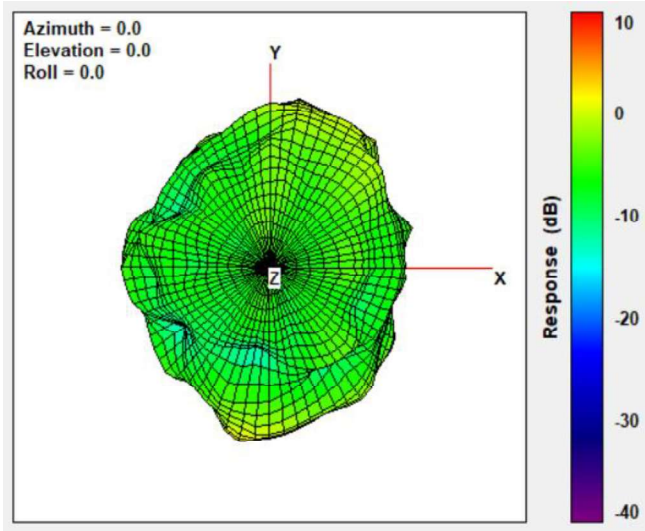
Max Antenna 3D Radiation Pattern 5150-5250 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5150-5250       | 2.88                          |



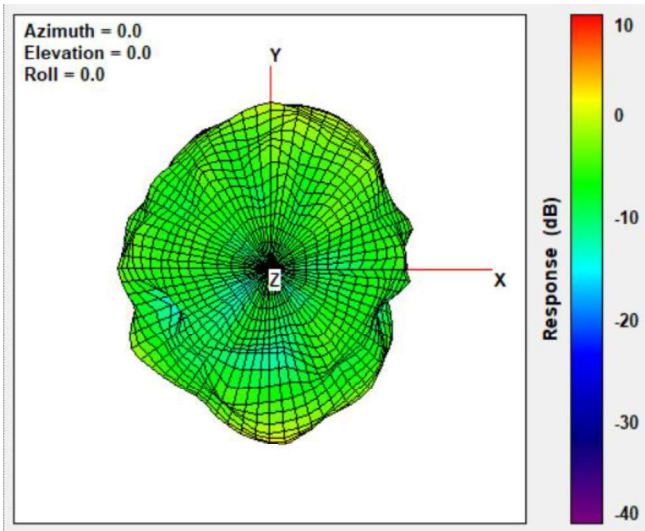
Max Antenna 3D Radiation Pattern 5250-5350 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5250-5350          | 2.88                             |



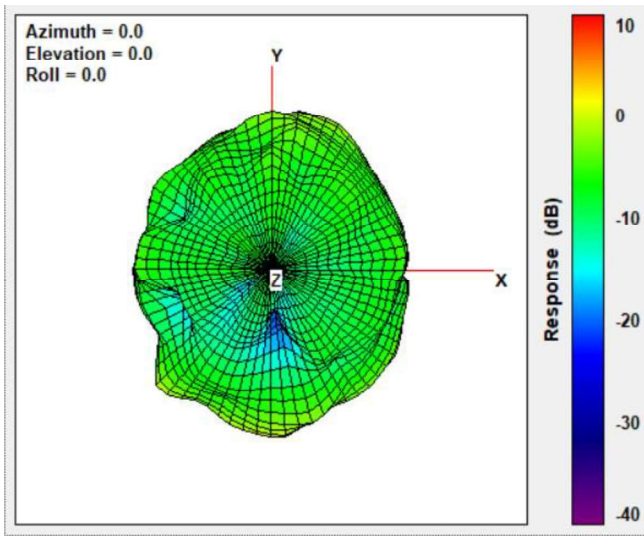
Max Antenna 3D Radiation Pattern 5470-5725 MHz

| Frequency<br>(MHz) | Peak Gain w/ Cable Loss<br>(dBi) |
|--------------------|----------------------------------|
| 5470-5725          | 2.81                             |



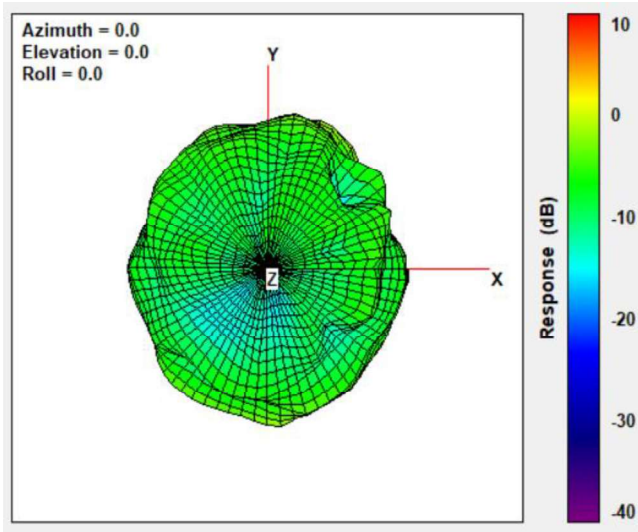
Max Antenna 3D Radiation Pattern 5725-5850 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5725-5850       | 1.53                          |



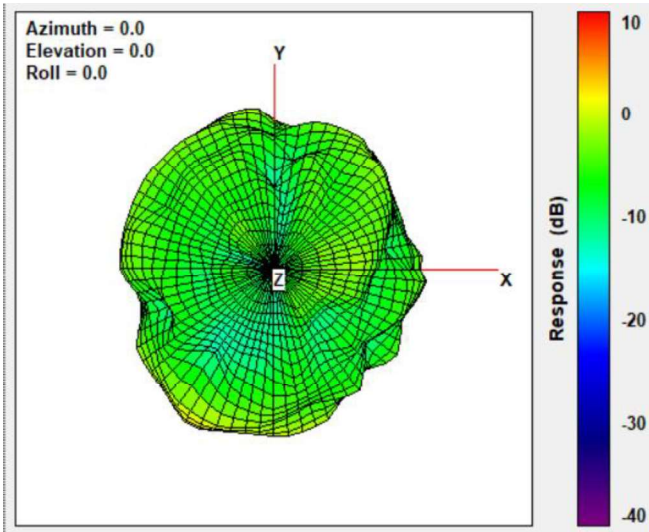
Max Antenna 3D Radiation Pattern 5850-5895 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5850-5895       | 2.07                          |



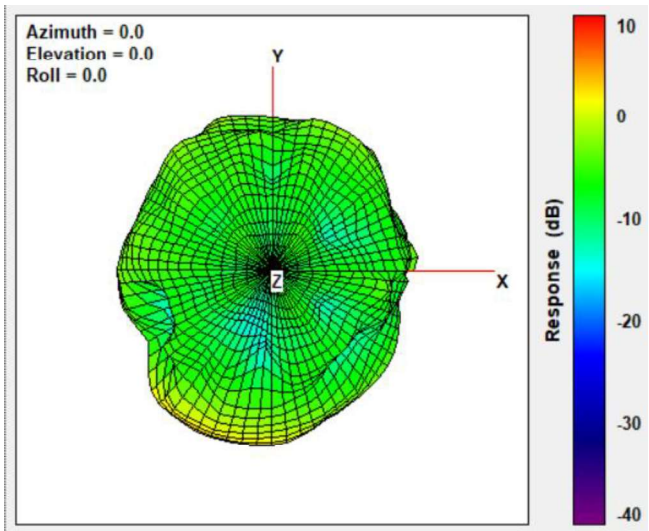
Max Antenna 3D Radiation Pattern 5925-6425 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 5925-6425       | 3.60                          |



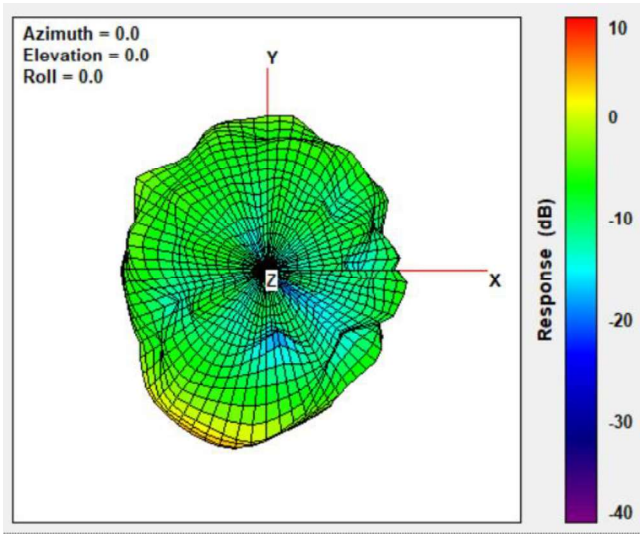
Max Antenna 3D Radiation Pattern 6425-6525 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6425-6525       | 3.61                          |



Max Antenna 3D Radiation Pattern 6525-6875 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6525-6875       | 3.80                          |



Max Antenna 3D Radiation Pattern 6875-7125 MHz

| Frequency (MHz) | Peak Gain w/ Cable Loss (dBi) |
|-----------------|-------------------------------|
| 6875-7125       | 3.65                          |

