



# TAOGLAS®



# Datasheet

## Hercules 2-in-1

**Part No:**

MA520.A.BC.008

**Description:**

Hercules 2-in-1 Cellular and Wi-Fi Permanent Mount  
with 2m of RG-316 with SMA(M) for Cellular and RP-SMA(M) Wi-Fi

**Features:**

Cellular 4G/3G/2G  
Dual Band Wi-Fi 2.4 GHz / 5.8 GHz  
Low Profile and Vandal Proof  
IP65 Rated Enclosure  
Heavy Duty Permanent Mount  
Cellular: 2m RG-316 SMA(M)  
Wi-Fi: 2m RG-316 RP-SMA(M)  
RoHS & REACH Compliant

|                            |    |
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## 1. Introduction



The MA520 Hercules 2-in-1 Cellular and 2.4/5.8GHz Antenna is the smallest package high performance screw-mount (permanent mount) antenna available, for external use on vehicles and outdoor assets worldwide. Everything is in the one housing reducing the need for multiples antenna installations. This is the ideal antenna for 3G gateway routers that provide Wi-Fi hotspots.

Typical Applications Include:

- Smart Metering
- Routers and Gateways
- Connected Enterprise

It has been designed for heavy duty work with extra thick threads; with durable UV-resistant, IP65 rated enclosure, ABS housing is resistant to vandalism and direct attack. At only 29mm high and 49mm in diameter this antenna enables covert operation and its quality is proven by growing adoption by many of the world's largest wireless brands. The standard cable length is 2 meters. The Hercules MA520's exceptional design means it can work equally well mounted on or without ground-plane.

The cables and connectors are fully customizable, for further information please contact your regional Taoglas customer support team.

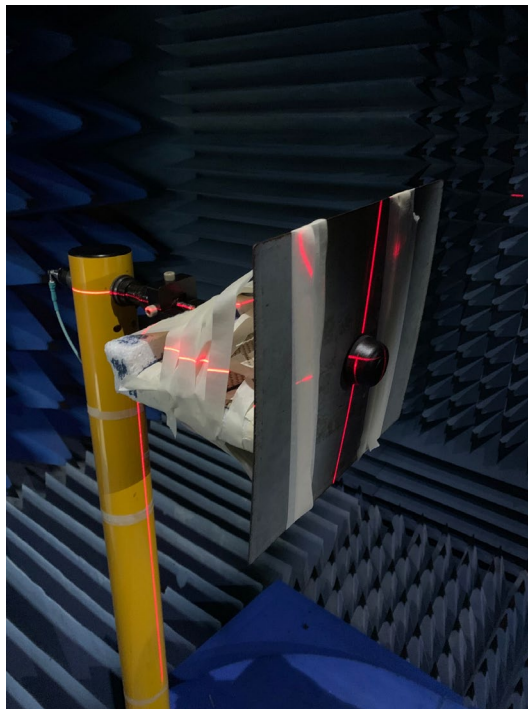
## 2. Specifications

| Cellular Electrical                         |                 |                                                                      |                |                   |                 |                 |              |                   |                   |
|---------------------------------------------|-----------------|----------------------------------------------------------------------|----------------|-------------------|-----------------|-----------------|--------------|-------------------|-------------------|
| Band                                        | Frequency (MHz) |                                                                      | Efficiency (%) | Average Gain (dB) | Peak Gain (dBi) | Max Input Power | Impedance    | Polarization      | Radiation Pattern |
| 5G NR/4G<br>Band 5,8,18,19,20, 26,27,28, 29 | 700~960         | Free space                                                           | 37.4           | -4.3              | 0               | 10W             | 50 Ω         | Linear            | Omni              |
|                                             |                 | 30*30cm Ground Plane                                                 | 32.2           | -4.9              | 0.7             |                 |              |                   |                   |
| 4G/3G<br>Band 1,2,3,4,9,23,25,35,39,66      | 1710~2200       | Free space                                                           | 32             | -4.9              | 0.9             |                 |              |                   |                   |
|                                             |                 | 30*30cm Ground Plane                                                 | 30.9           | -5.1              | 2.4             |                 |              |                   |                   |
| 4G/3G<br>Band 7,38,41                       | 2490~2690       | Free space                                                           | 7.9            | -11               | -4.2            |                 |              |                   |                   |
|                                             |                 | 30*30cm Ground Plane                                                 | 10.3           | -9.9              | -2.9            |                 |              |                   |                   |
| 5G NR/4G<br>Band 22,42,43,48,77,78,79       | 3300~3800       | Free space                                                           | 9.1            | -10.4             | -2.2            |                 |              |                   |                   |
|                                             |                 | 30*30cm Ground Plane                                                 | 15.2           | -8.2              | -0.3            |                 |              |                   |                   |
| LTE5200/<br>Wi-Fi 5800                      | 5150~5925       | Free space                                                           | 13.6           | -8.7              | 1.7             |                 |              |                   |                   |
|                                             |                 | 30*30cm Ground Plane                                                 | 21.2           | -6.7              | 1.1             |                 |              |                   |                   |
| Wi-Fi Electrical                            |                 |                                                                      |                |                   |                 |                 |              |                   |                   |
| Band                                        |                 | Frequency (MHz)                                                      | Efficiency (%) | Peak Gain (dBi)   | Max Power Input | Impedance       | Polarization | Radiation Pattern |                   |
| 2.4GHz Wi-Fi                                |                 | 2400~2500                                                            | 25             | 2.1               | 10W             | 50 Ω            | Linear       | Omni              |                   |
| 5.8GHz Wi-Fi                                |                 | 5150~5850                                                            | 20             | -3.2              |                 |                 |              |                   |                   |
| Mechanical                                  |                 |                                                                      |                |                   |                 |                 |              |                   |                   |
| Dimensions                                  |                 | 29*Ø49mm                                                             |                |                   |                 |                 |              |                   |                   |
| Cable                                       |                 | 2m RG-316                                                            |                |                   |                 |                 |              |                   |                   |
| Connector                                   |                 | Cellular: SMA(M) Straight<br>Wi-Fi: Reverse Polarity SMA(M) Straight |                |                   |                 |                 |              |                   |                   |
| Thread Diameter                             |                 | 18mm                                                                 |                |                   |                 |                 |              |                   |                   |
| Casing                                      |                 | UV Resistant ABS                                                     |                |                   |                 |                 |              |                   |                   |
| Weatherproof Gasket                         |                 | CR4305 Foam with 3M9448B Double sided adhesive                       |                |                   |                 |                 |              |                   |                   |
| Sealant                                     |                 | Rubber Stopper                                                       |                |                   |                 |                 |              |                   |                   |
| Base Thread                                 |                 | Nickel Plated                                                        |                |                   |                 |                 |              |                   |                   |
| Environmental                               |                 |                                                                      |                |                   |                 |                 |              |                   |                   |
| Corrosion                                   |                 | 5% NaCl for 96hrs                                                    |                |                   |                 |                 |              |                   |                   |
| Temperature Range                           |                 | -40°C to +85°C                                                       |                |                   |                 |                 |              |                   |                   |
| Thermal Shock                               |                 | 100 cycles -40°C to +85°C                                            |                |                   |                 |                 |              |                   |                   |
| Humidity                                    |                 | Non-condensing 65°C 95% RH                                           |                |                   |                 |                 |              |                   |                   |
| Shock (Drop Test)                           |                 | 1m drop on concrete 6 axes                                           |                |                   |                 |                 |              |                   |                   |
| RoHs & REACH Compliant                      |                 | Yes                                                                  |                |                   |                 |                 |              |                   |                   |
| Ingress Protection                          |                 | IP65                                                                 |                |                   |                 |                 |              |                   |                   |

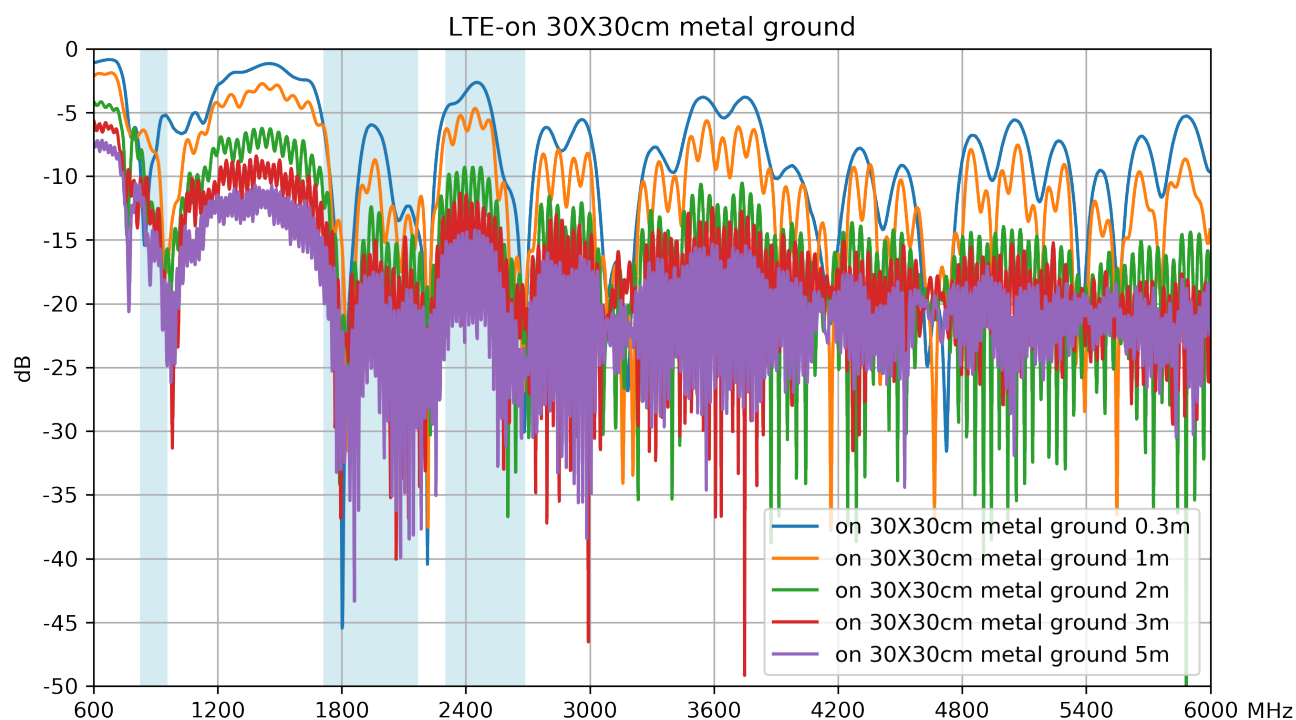
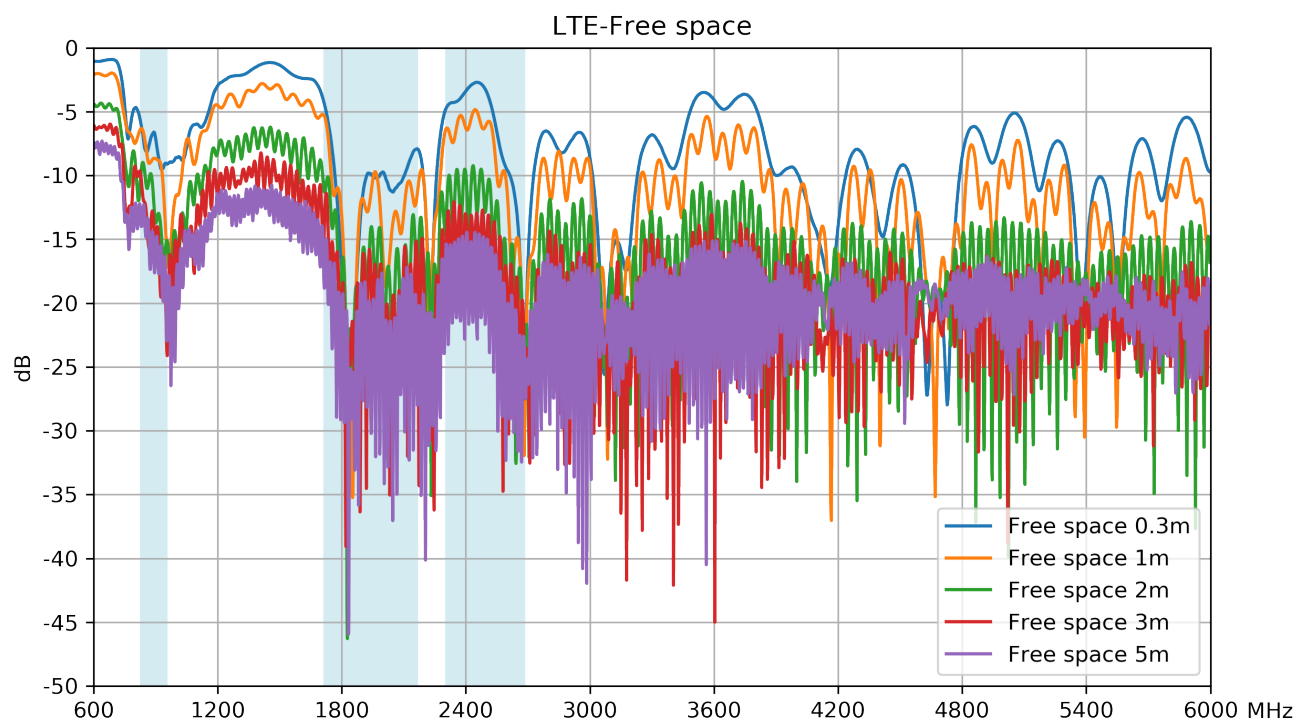
| 5G/4G Bands |                                                                    |                      |         |
|-------------|--------------------------------------------------------------------|----------------------|---------|
| Band Number | 5G NR / FR1 / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA |                      |         |
|             | Uplink                                                             | Downlink             | Covered |
| 1           | UL: 1920 to 1980                                                   | DL: 2110 to 2170     | ✓       |
| 2           | UL: 1850 to 1910                                                   | DL: 1930 to 1990     | ✓       |
| 3           | UL: 1710 to 1785                                                   | DL: 1805 to 1880     | ✓       |
| 4           | UL: 1710 to 1755                                                   | DL: 2110 to 2155     | ✓       |
| 5           | UL: 824 to 849                                                     | DL: 869 to 894       | ✓       |
| 7           | UL: 2500 to 2570                                                   | DL: 2620 to 2690     | ✓       |
| 8           | UL: 880 to 915                                                     | DL: 925 to 960       | ✓       |
| 9           | UL: 1749.9 to 1784.9                                               | DL: 1844.9 to 1879.9 | ✓       |
| 11          | UL: 1427.9 to 1447.9                                               | DL: 1475.9 to 1495.9 | ✗       |
| 12          | UL: 699 to 716                                                     | DL: 729 to 746       | ✗       |
| 13          | UL: 777 to 787                                                     | DL: 746 to 756       | ✗       |
| 14          | UL: 788 to 798                                                     | DL: 758 to 768       | ✓       |
| 17          | UL: 704 to 716                                                     | DL: 734 to 746       | ✗       |
| 18          | UL: 815 to 830                                                     | DL: 860 to 875       | ✓       |
| 19          | UL: 830 to 845                                                     | DL: 875 to 890       | ✓       |
| 20          | UL: 832 to 862                                                     | DL: 791 to 821       | ✓       |
| 21          | UL: 1447.9 to 1462.9                                               | DL: 1495.9 to 1510.9 | ✗       |
| 22          | UL: 3410 to 3490                                                   | DL: 3510 to 3590     | ✓       |
| 23          | UL: 2000 to 2020                                                   | DL: 2180 to 2200     | ✓       |
| 24          | UL: 1625.5 to 1660.5                                               | DL: 1525 to 1559     | ✓       |
| 25          | UL: 1850 to 1915                                                   | DL: 1930 to 1995     | ✓       |
| 26          | UL: 814 to 849                                                     | DL: 859 to 894       | ✓       |
| 27          | UL: 807 to 824                                                     | DL: 852 to 869       | ✓       |
| 28          | UL: 703 to 748                                                     | DL: 758 to 803       | ✓       |
| 29          | UL: -                                                              | DL: 717 to 728       | ✗       |
| 30          | UL: 2305 to 2315                                                   | DL: 2350 to 2360     | ✗       |
| 31          | UL: 452.5 to 457.5                                                 | DL: 462.5 to 467.5   | ✗       |
| 32          | UL: -                                                              | DL: 1452 – 1496      | ✗       |
| 35          |                                                                    | 1850 to 1910         | ✓       |
| 38          |                                                                    | 2570 to 2620         | ✓       |
| 39          |                                                                    | 1880 to 1920         | ✓       |
| 40          |                                                                    | 2300 to 2400         | ✗       |
| 41          |                                                                    | 2496 to 2690         | ✓       |
| 42          |                                                                    | 3400 to 3600         | ✓       |
| 43          |                                                                    | 3600 to 3800         | ✓       |
| 48          |                                                                    | 3550 to 3700         | ✓       |
| 66          | UL: 1710-1780                                                      | DL: 2110-2200        | ✓       |
| 71          |                                                                    | 617 to 698           | ✗       |
| 74/75/76    |                                                                    | 1427 to 1518         | ✗       |
| 77          |                                                                    | 3300 to 4200         | ✓       |
| 78          |                                                                    | 3300 to 3800         | ✓       |
| 79          |                                                                    | 4400 to 5000         | ✓       |

### 3. Antenna Characteristics

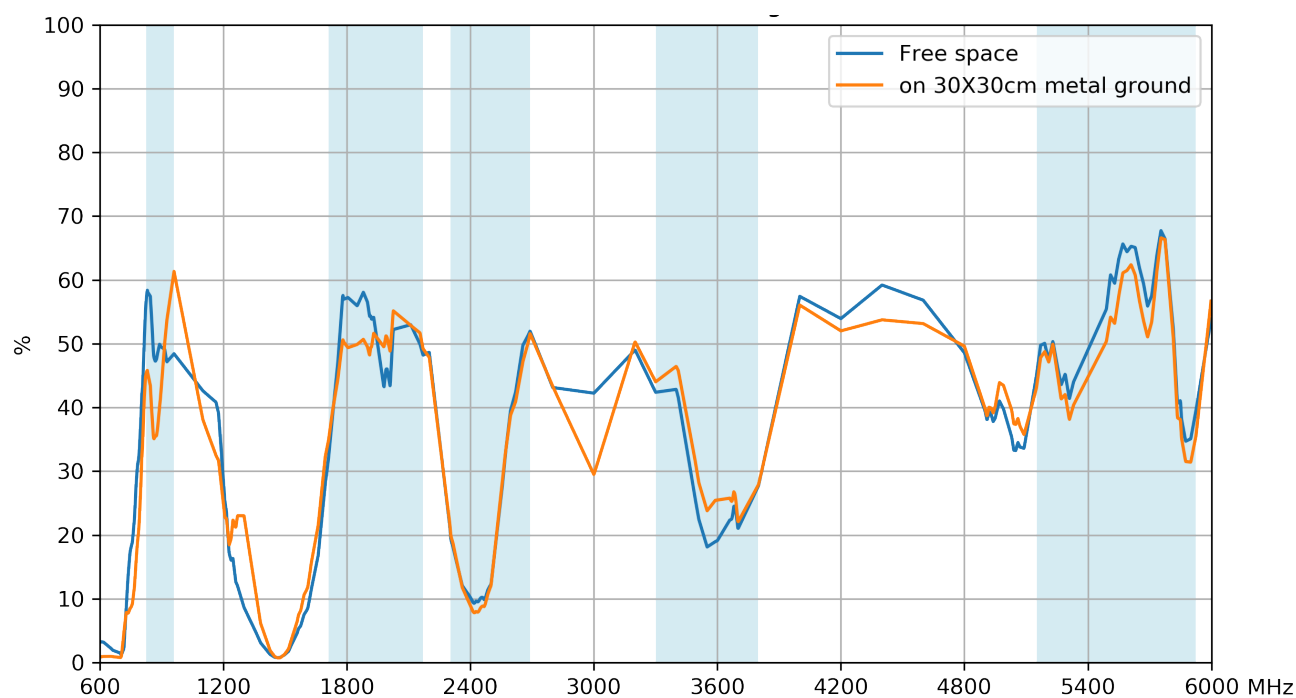
#### 3.1 Test Setup – 30\*30cm Ground Plane



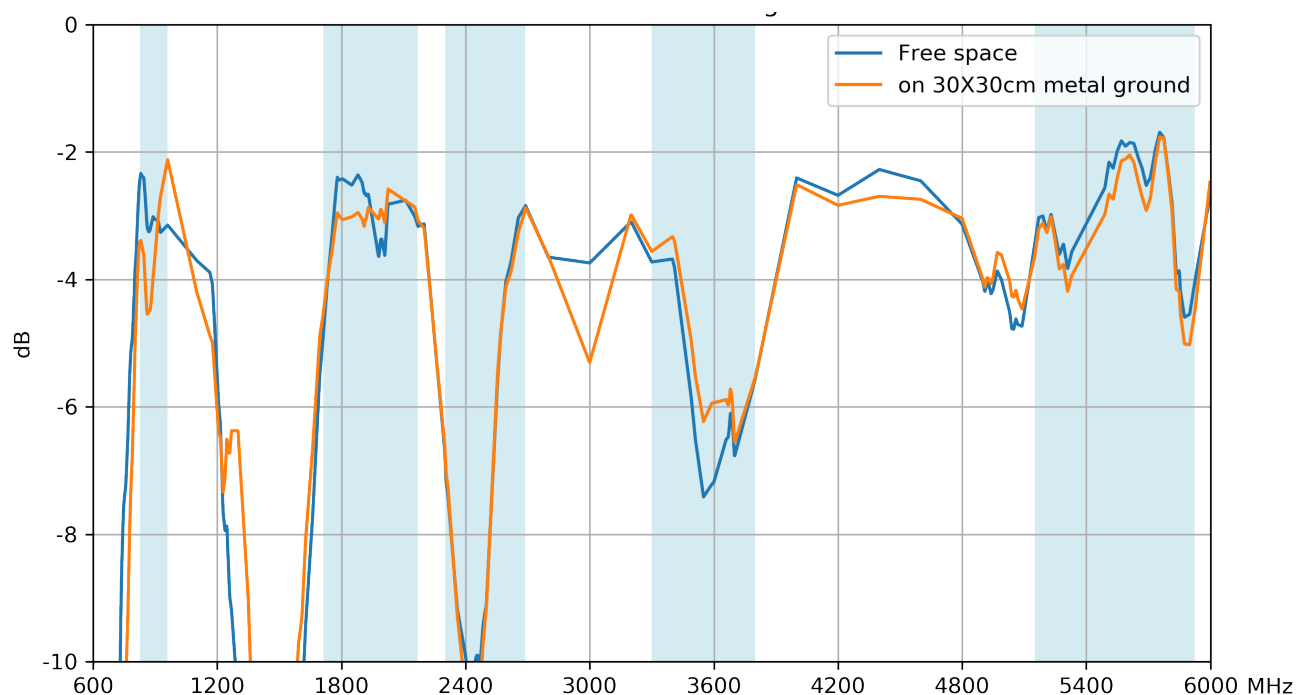
## 3.2 Return Loss – Cellular



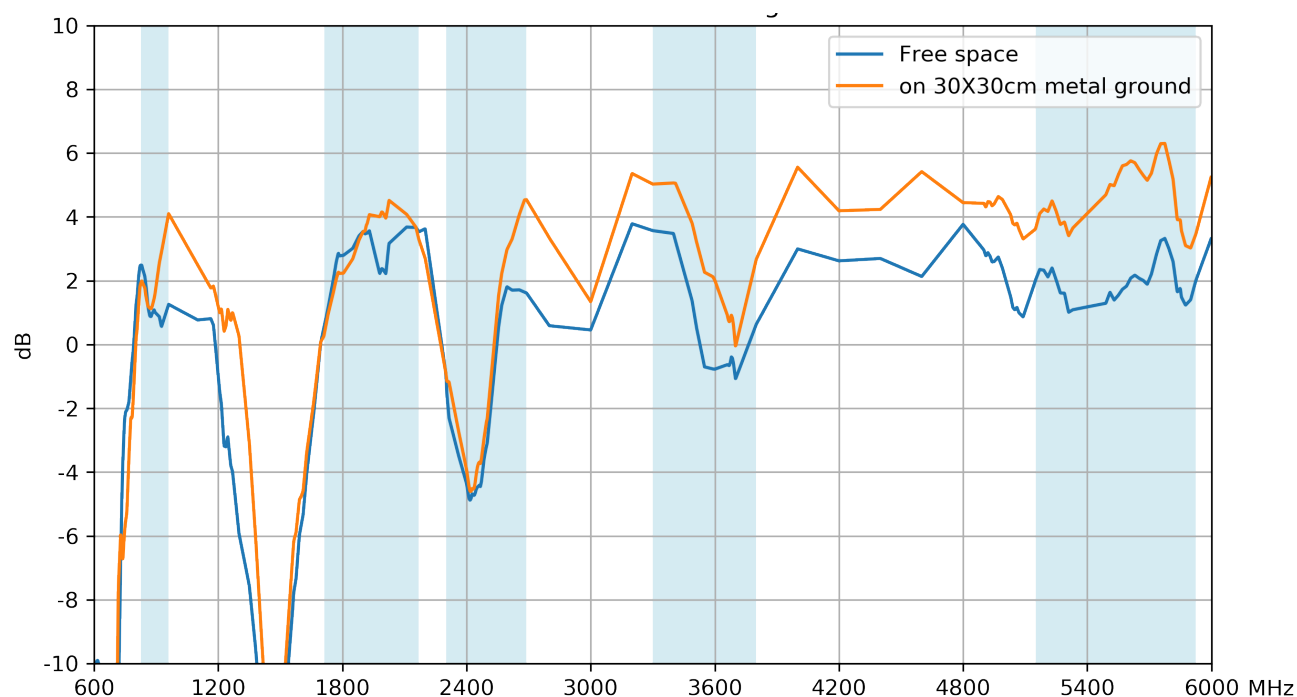
### 3.3 Efficiency – Cellular



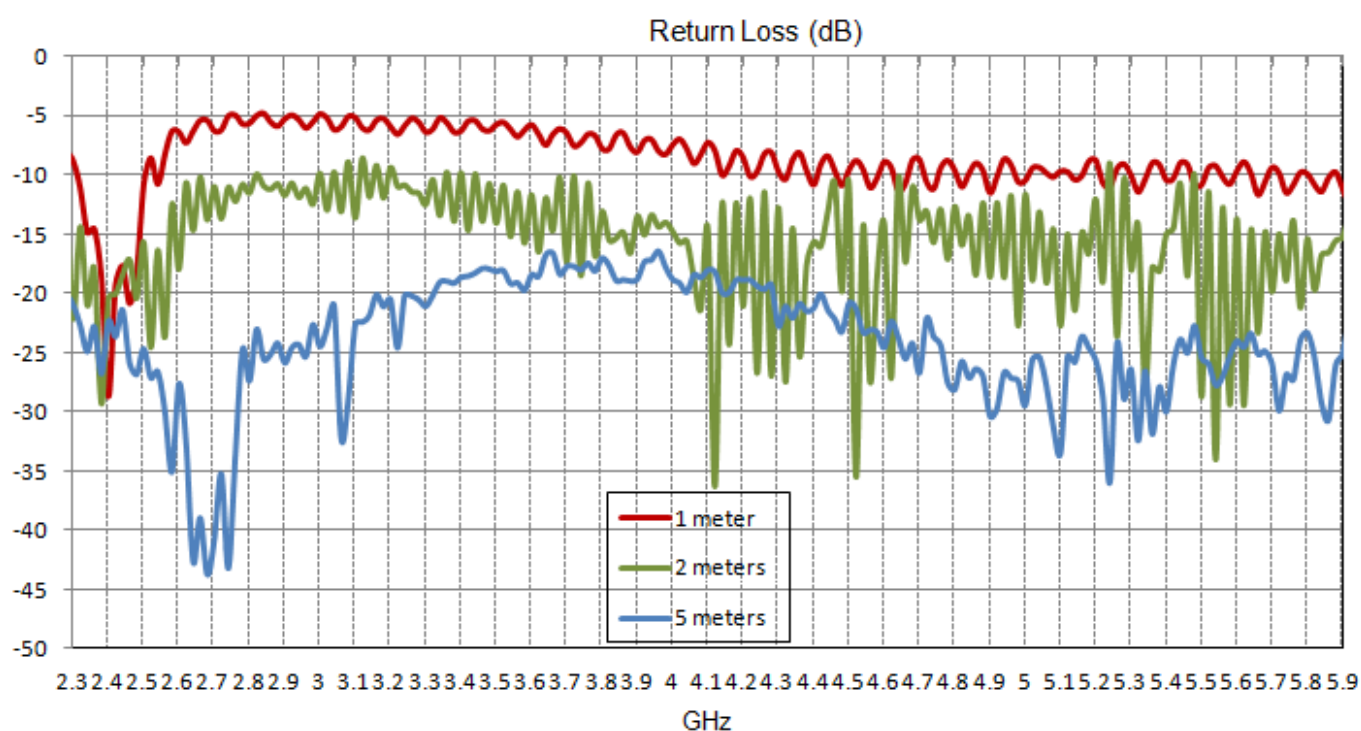
### 3.4 Average Gain – Cellular



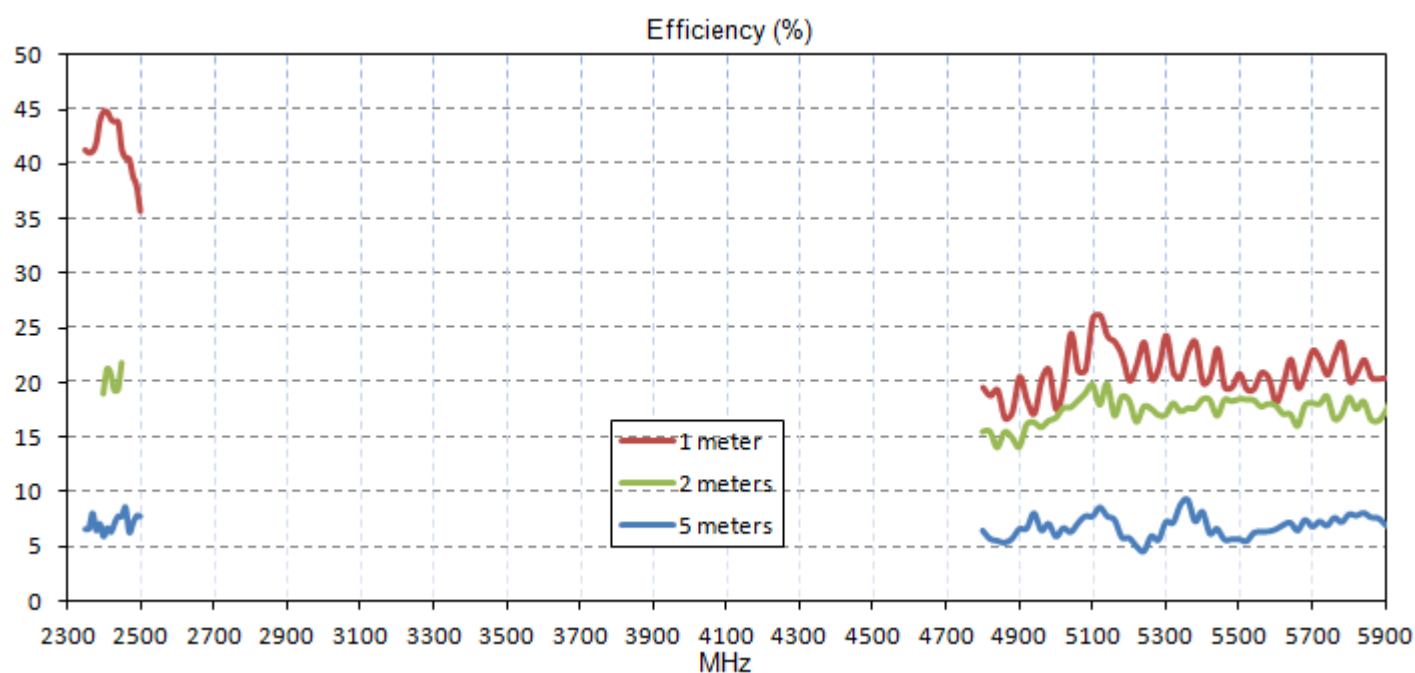
### 3.5 Peak Gain – Cellular



### 3.6 Return Loss – Wi-Fi

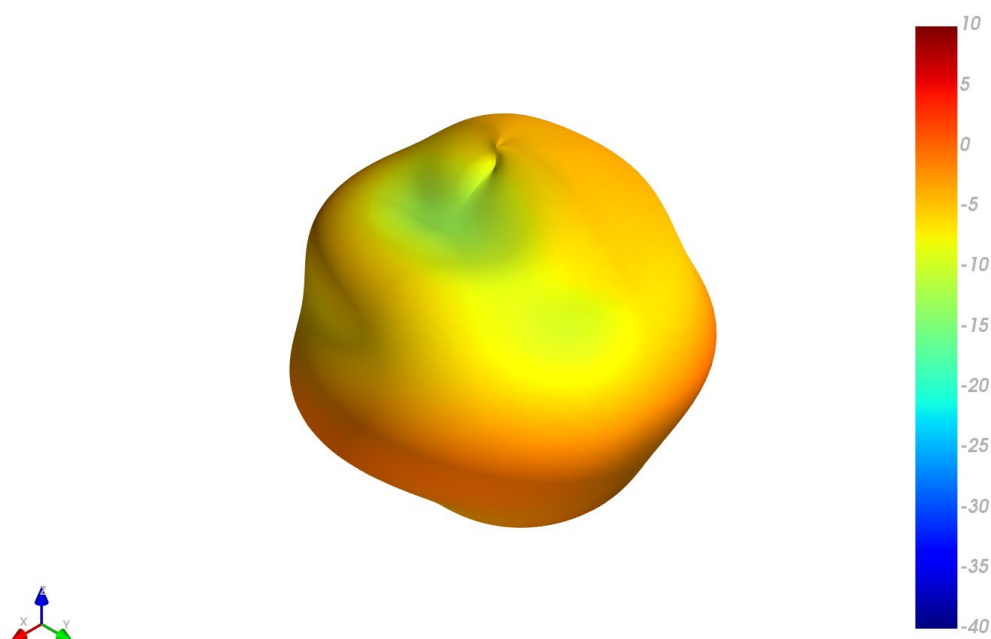


### 3.7 Efficiency – Wi-Fi

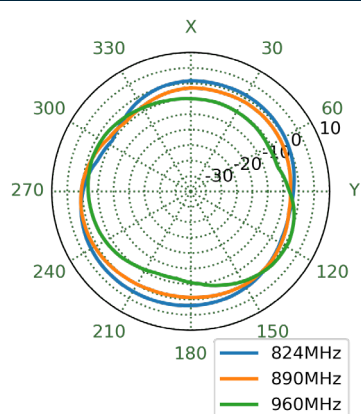


## 4. Radiation Patterns

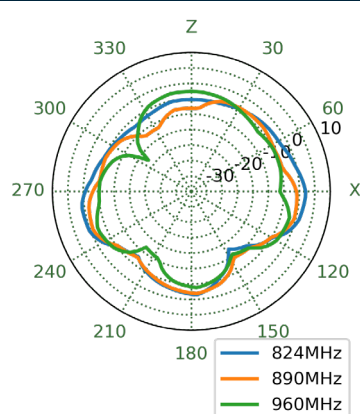
### 4.1 890MHz 3D and 2D Radiation Patterns – Free Space



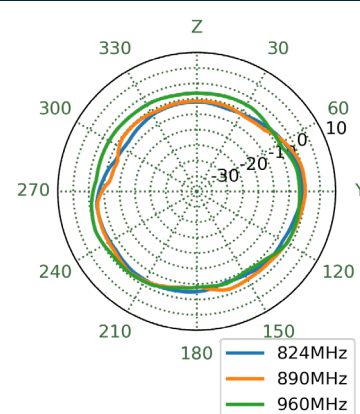
XY Plane



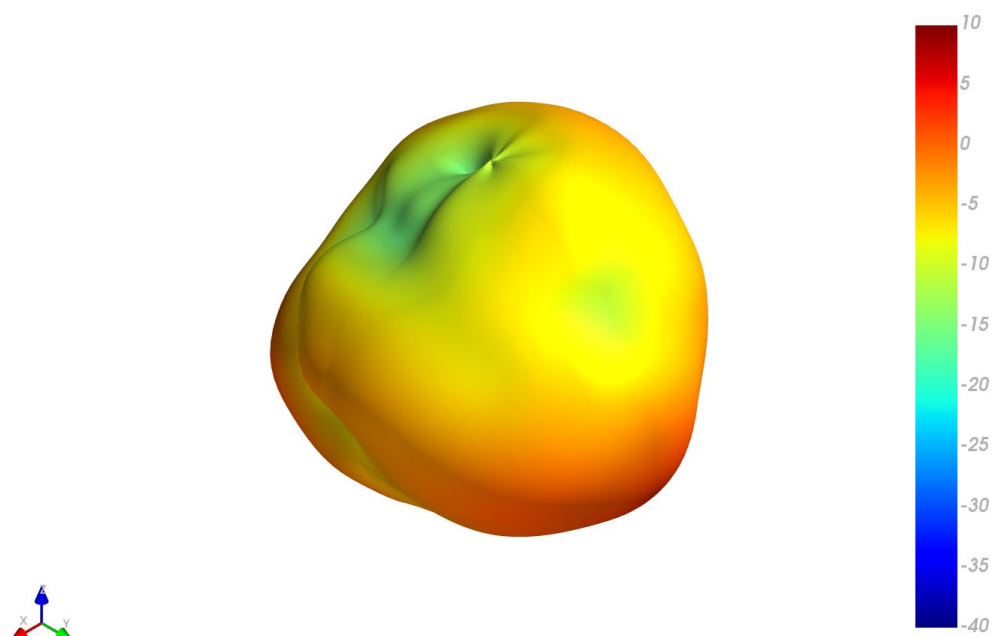
XZ Plane



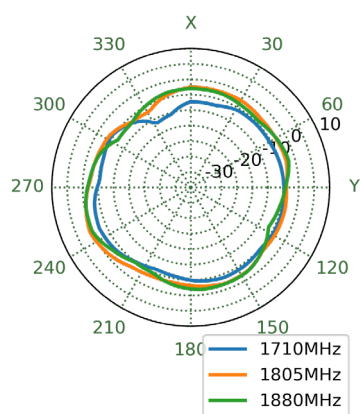
YZ Plane



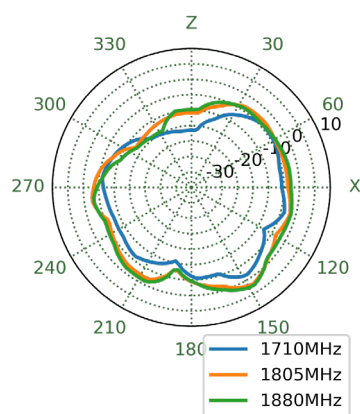
## 4.2 1805MHz 3D and 2D Radiation Patterns – Free Space



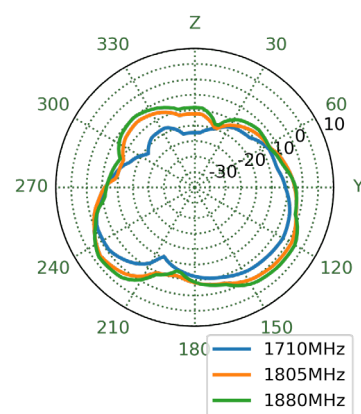
XY Plane



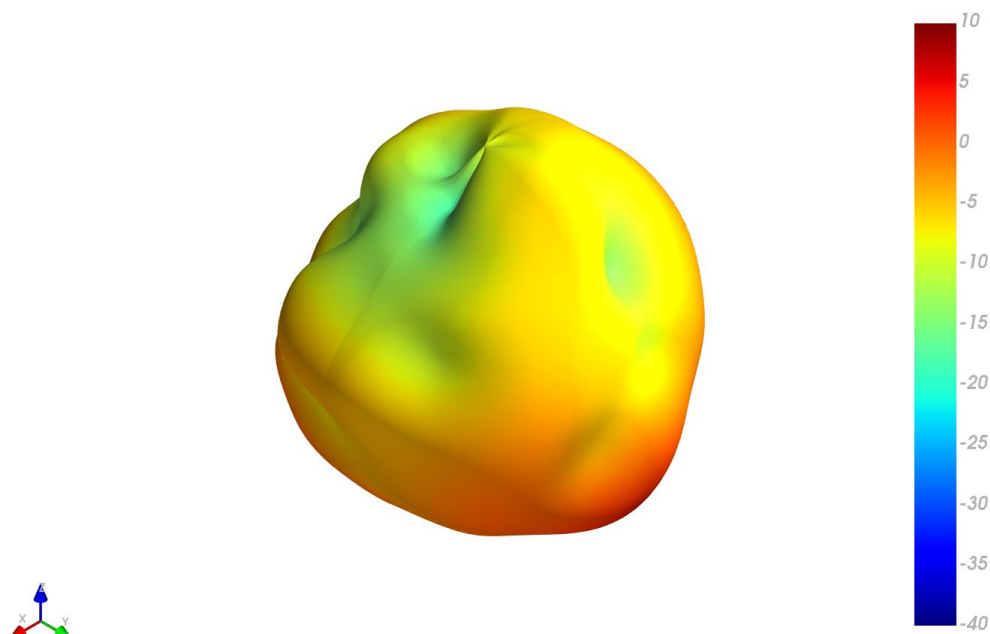
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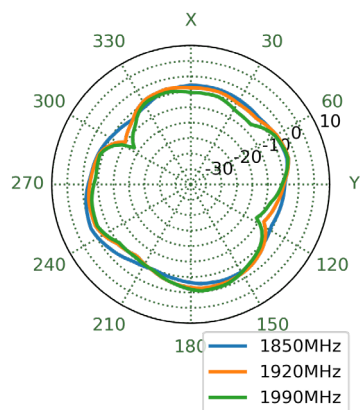
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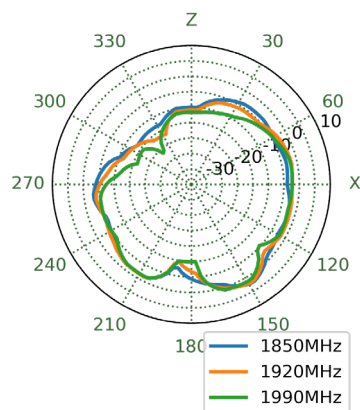
## 4.3 1920MHz 3D and 2D Radiation Patterns – Free Space



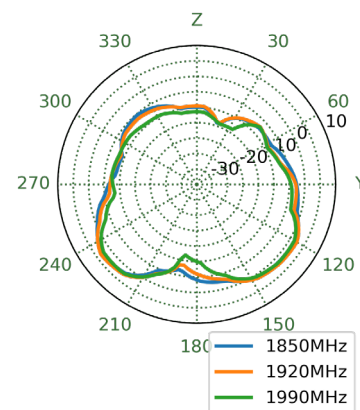
XY Plane



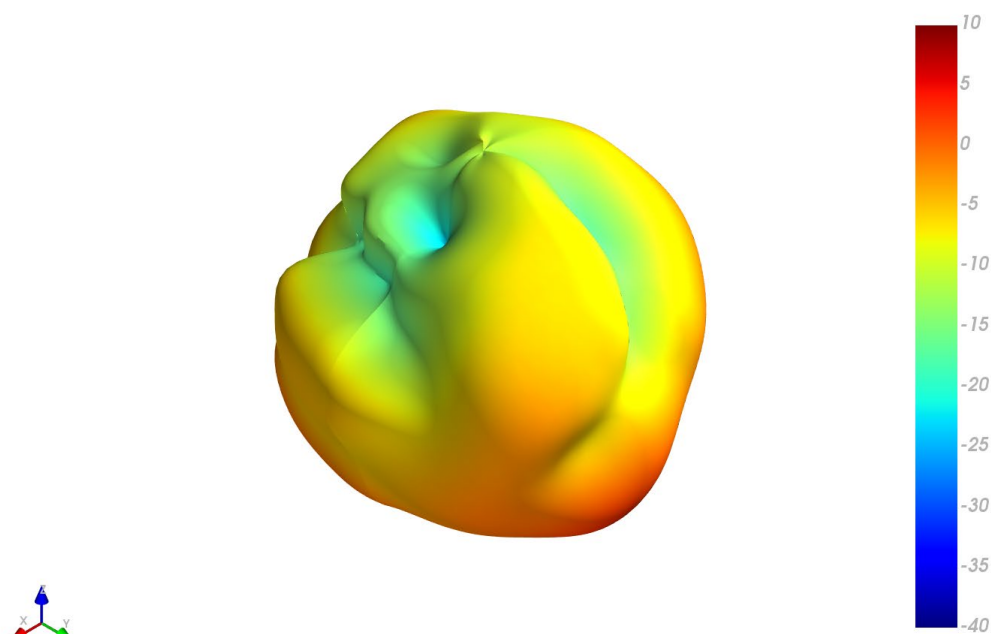
XZ Plane



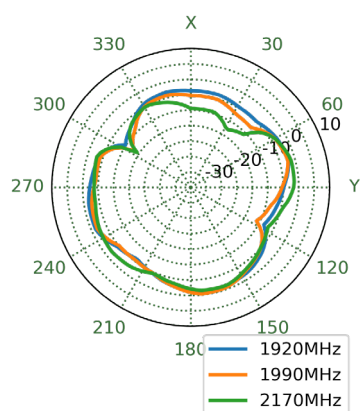
YZ Plane



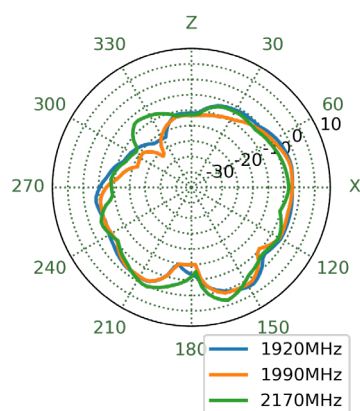
## 4.4 1990MHz 3D and 2D Radiation Patterns – Free Space



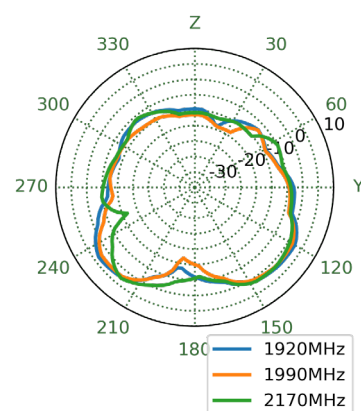
XY Plane



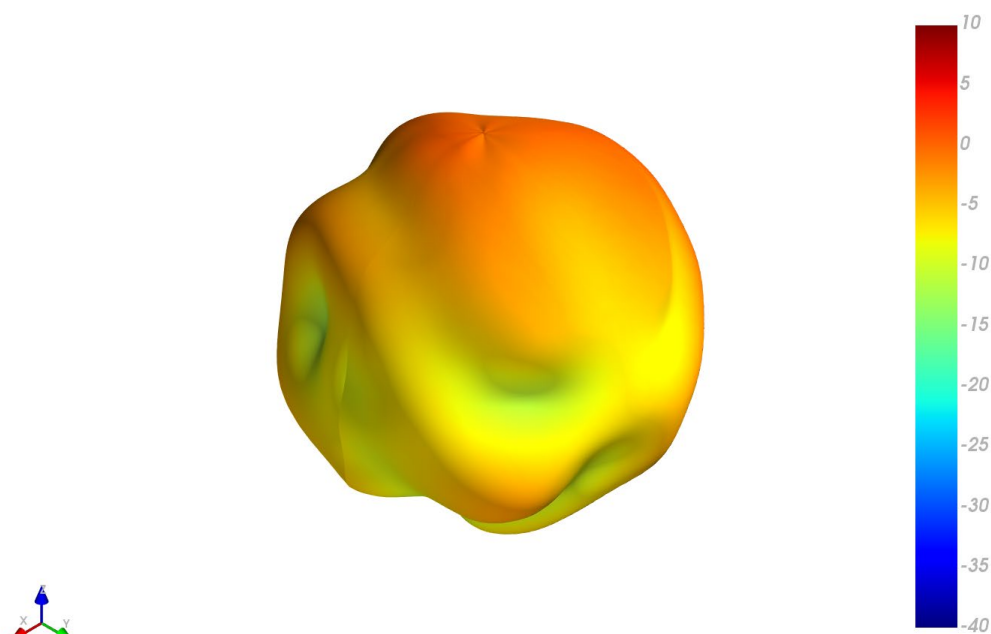
XZ Plane



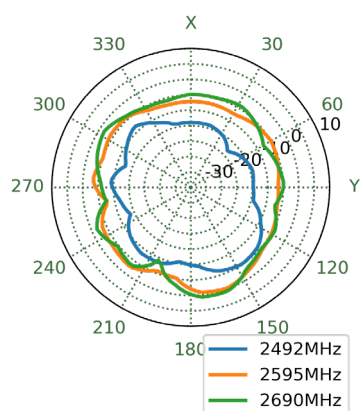
YZ Plane



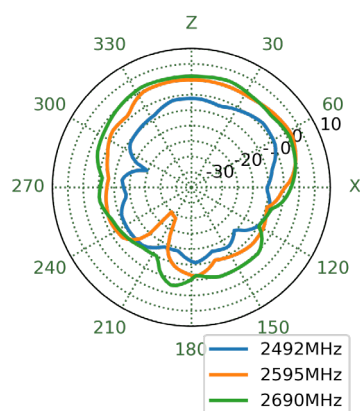
## 4.5 2595MHz 3D and 2D Radiation Patterns – Free Space



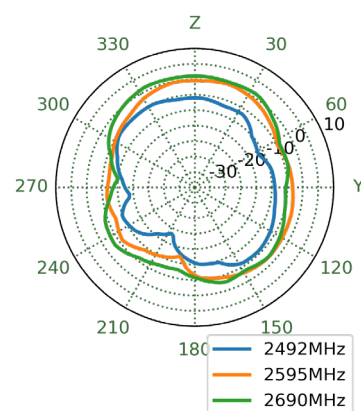
XY Plane



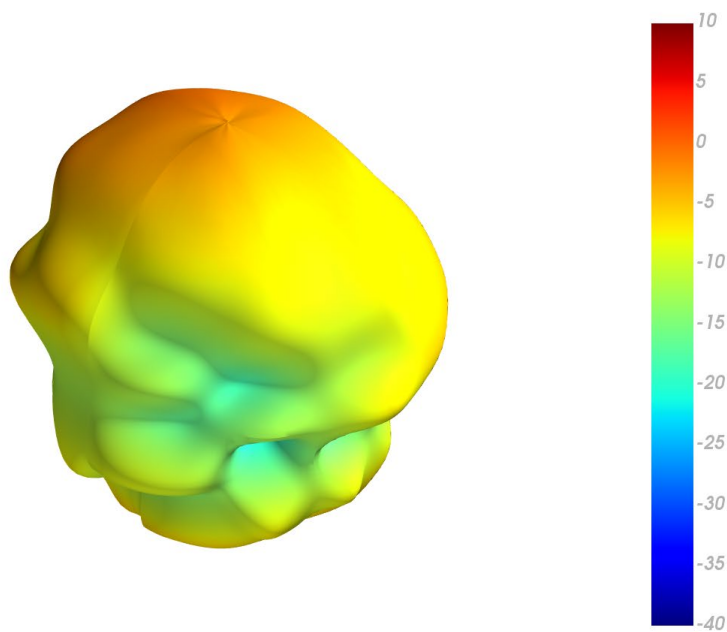
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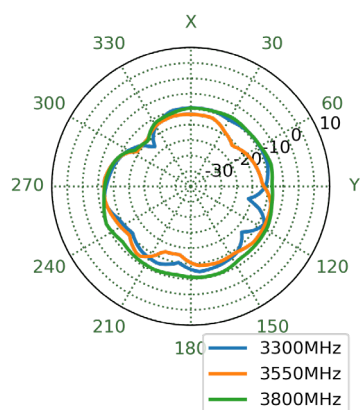
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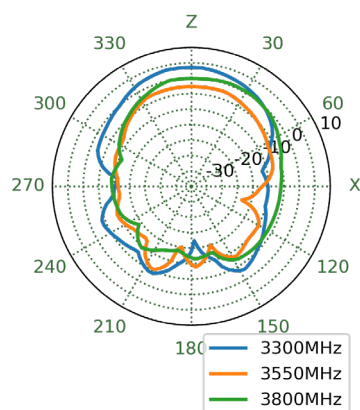
## 4.6 3550MHz 3D and 2D Radiation Patterns – Free Space



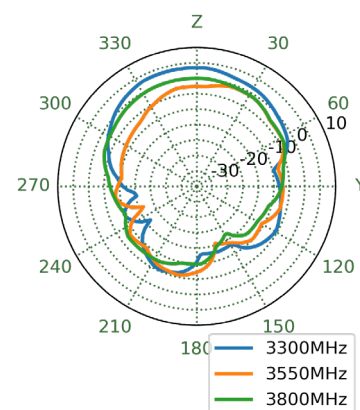
XY Plane



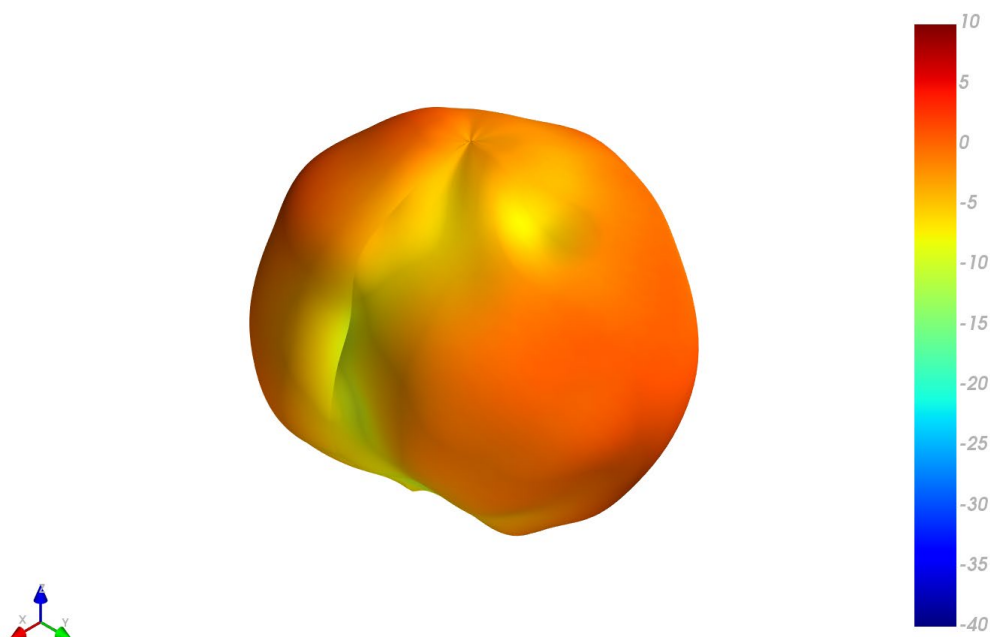
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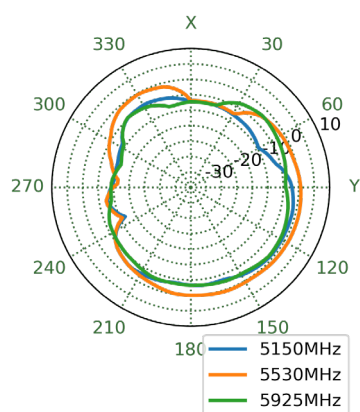
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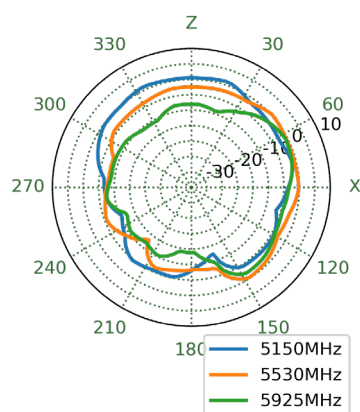
## 4.7 5530MHz 3D and 2D Radiation Patterns – Free Space



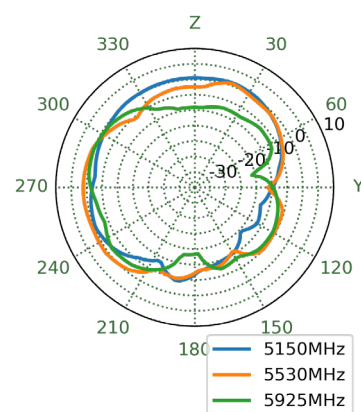
XY Plane



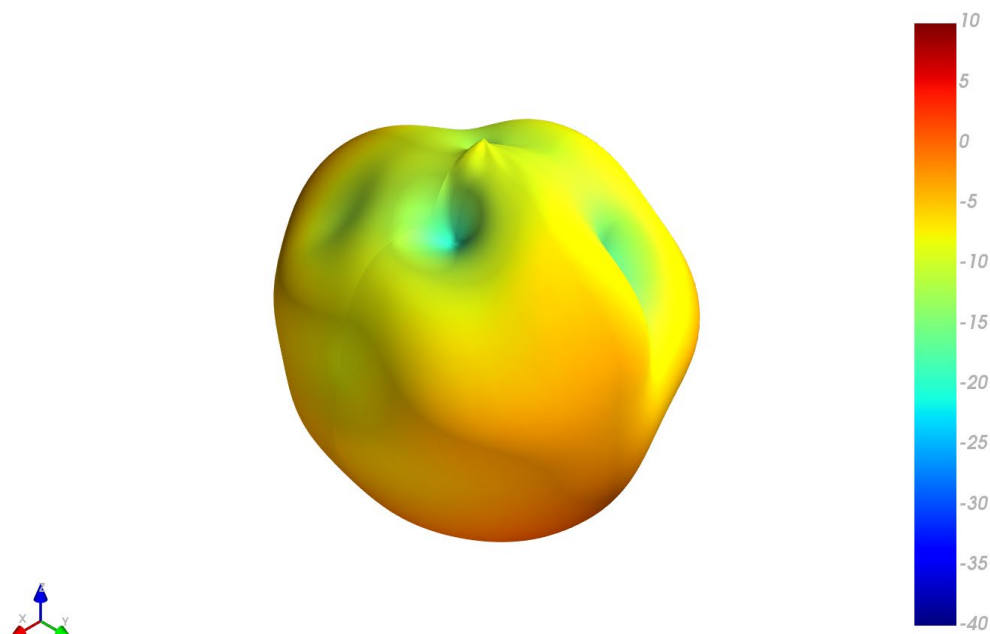
XZ Plane



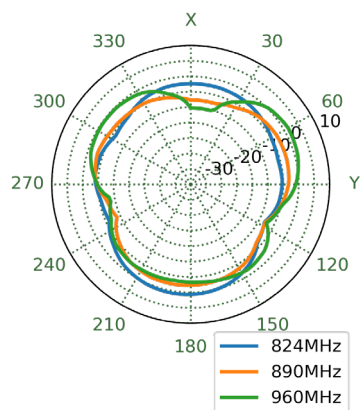
YZ Plane



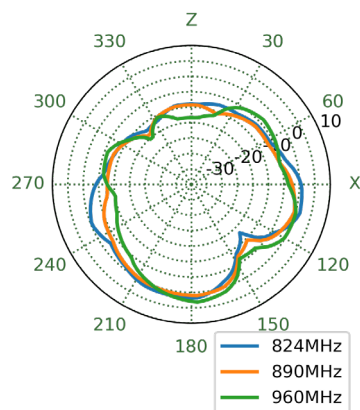
## 4.8 890MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



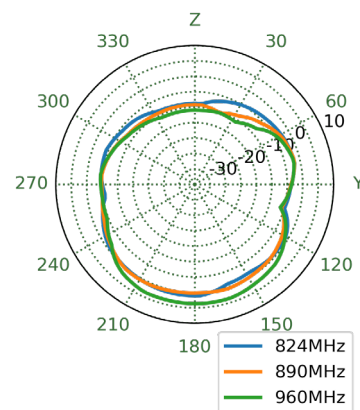
XY Plane



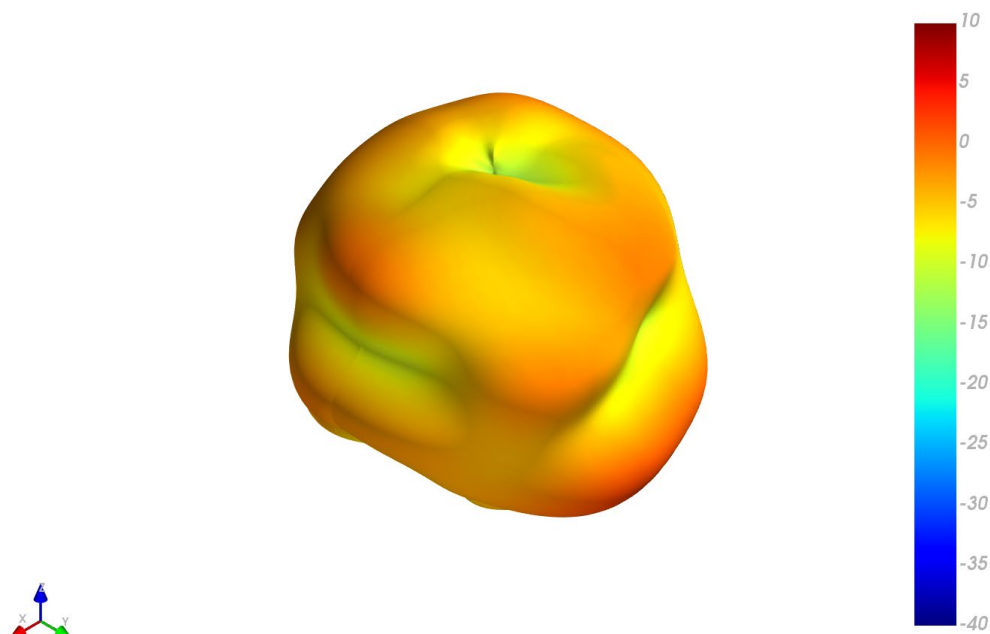
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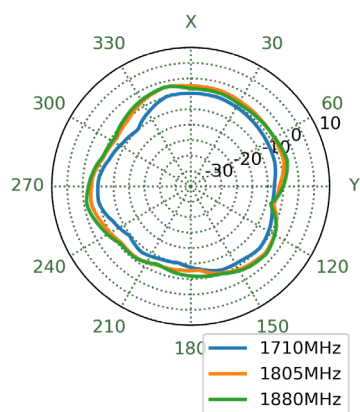
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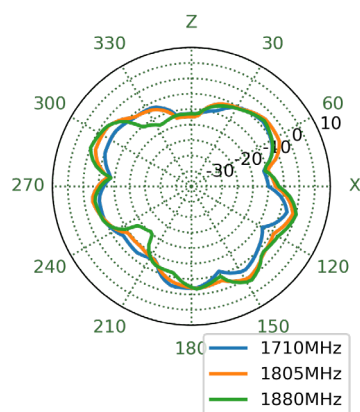
## 4.9 1805MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



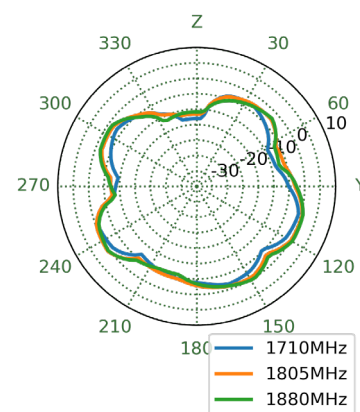
XY Plane



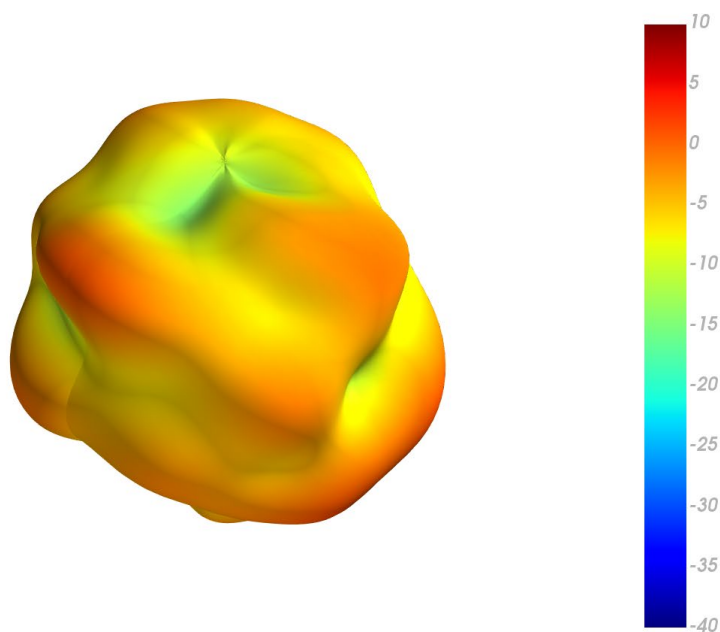
XZ Plane



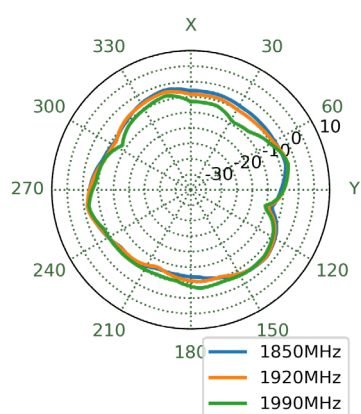
YZ Plane



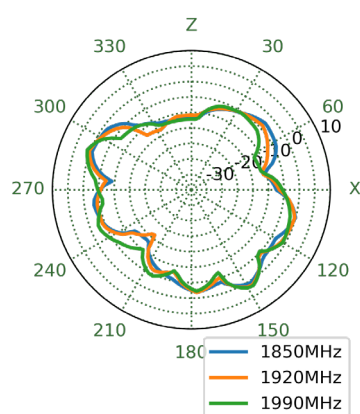
## 4.10 1920MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



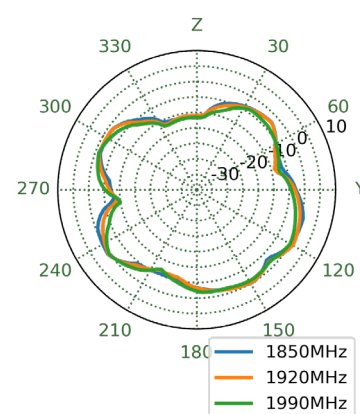
XY Plane



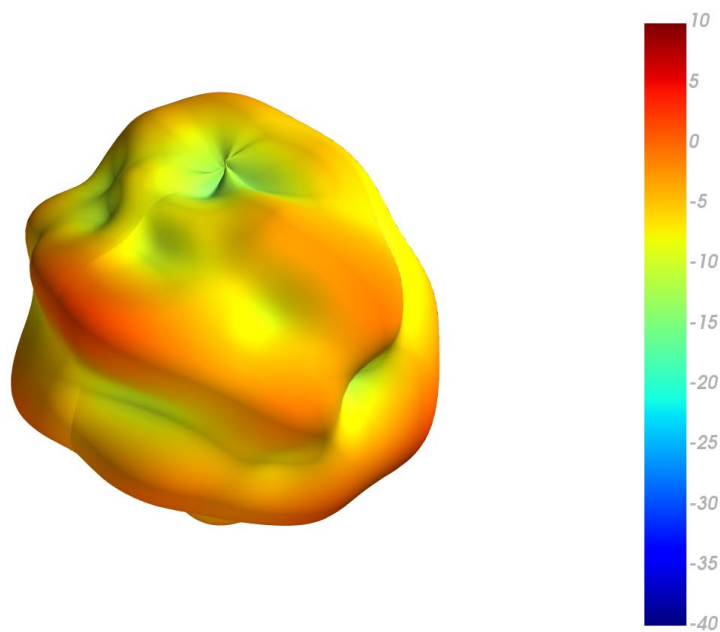
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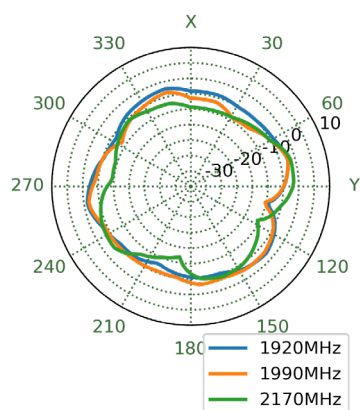
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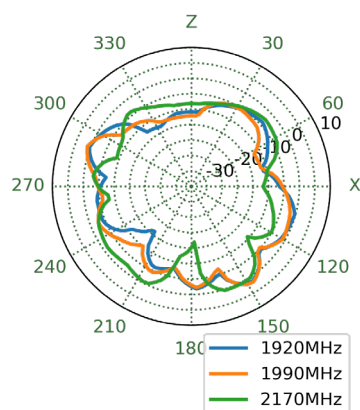
# 4.11 1990MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



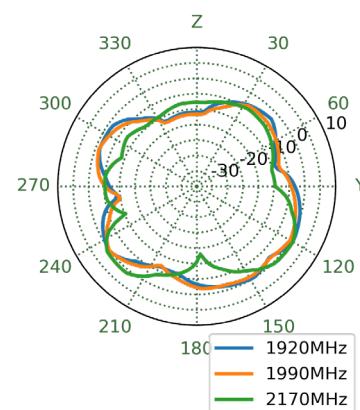
XY Plane



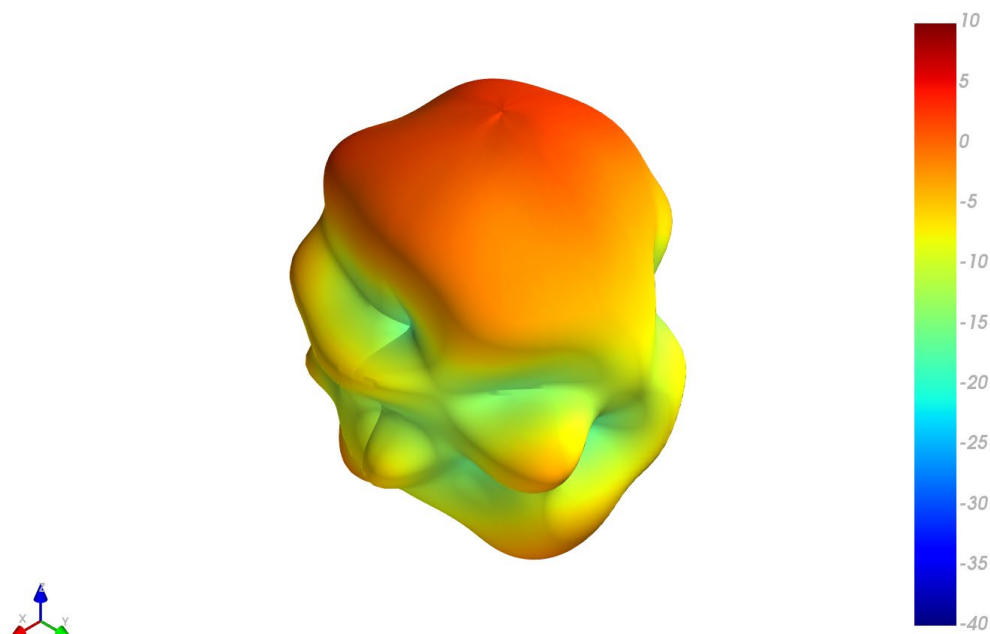
XZ Plane



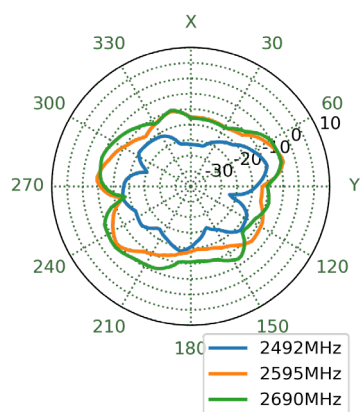
YZ Plane



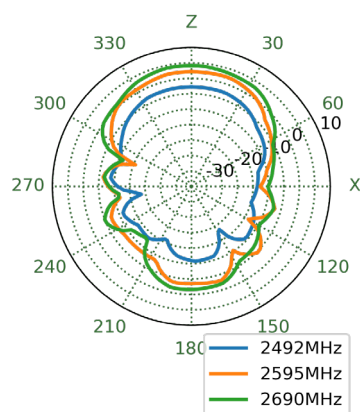
## 4.12 2595MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



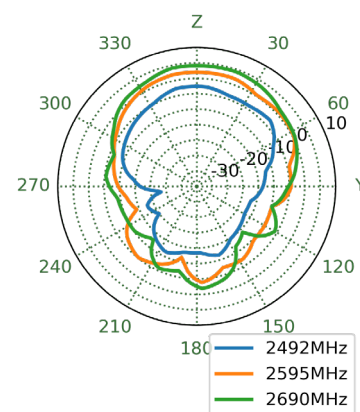
XY Plane



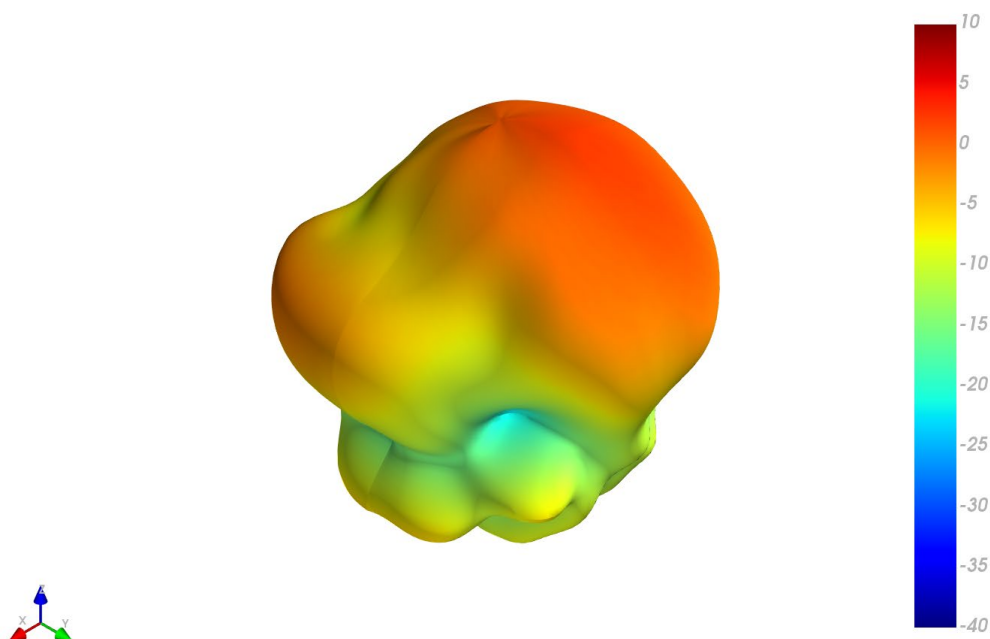
XZ Plane



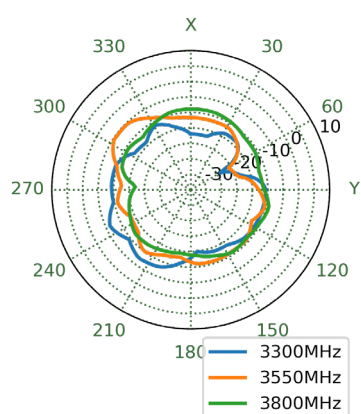
YZ Plane



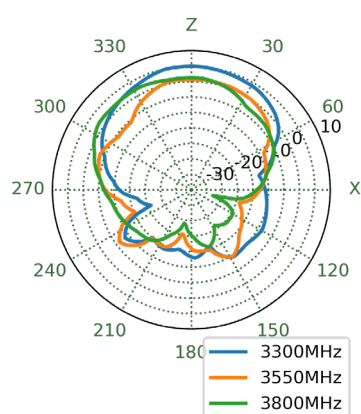
# 4.13 3550MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



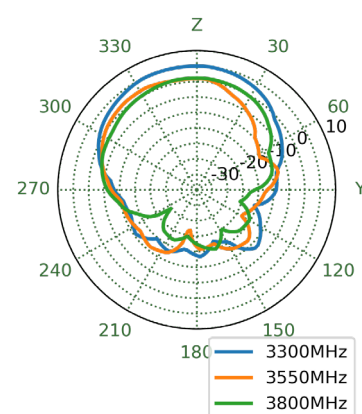
XY Plane



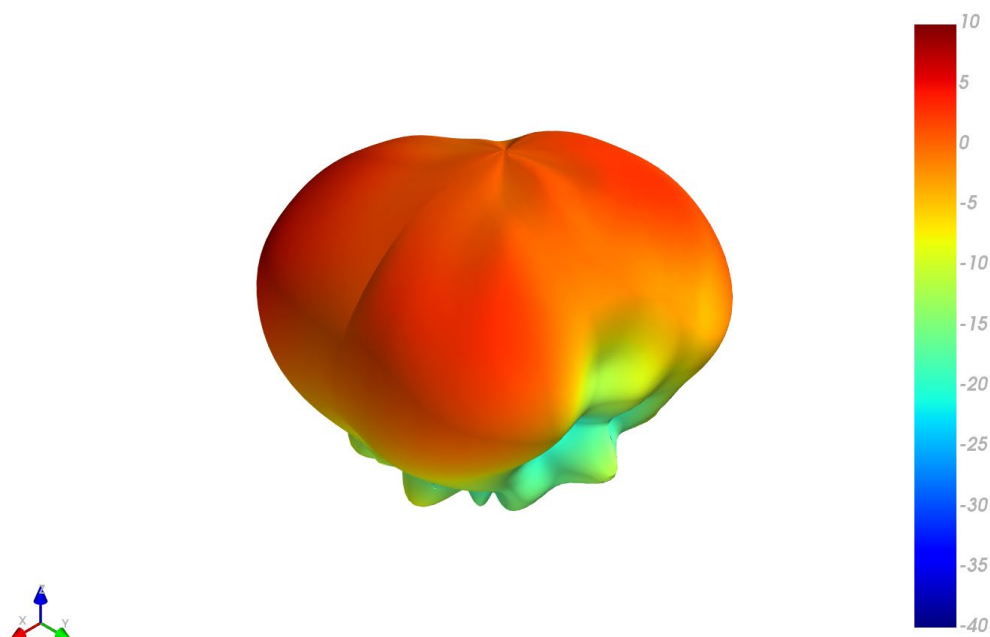
XZ Plane



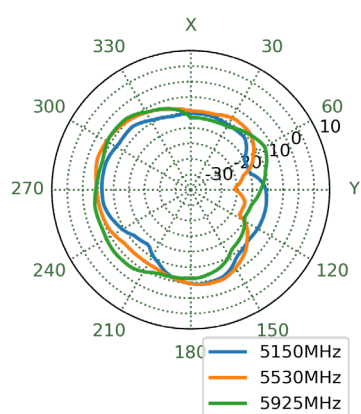
YZ Plane



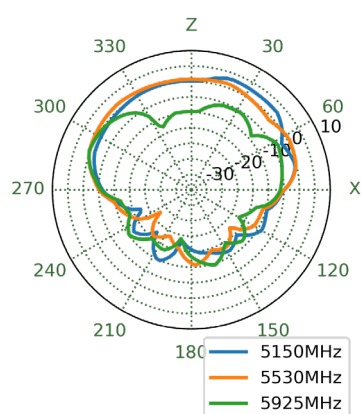
# 4.14 5530MHz 3D and 2D Radiation Patterns – 30\*30cm Ground Plane



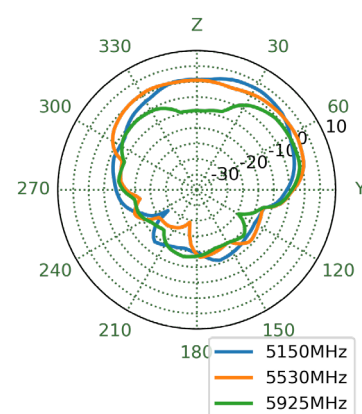
XY Plane



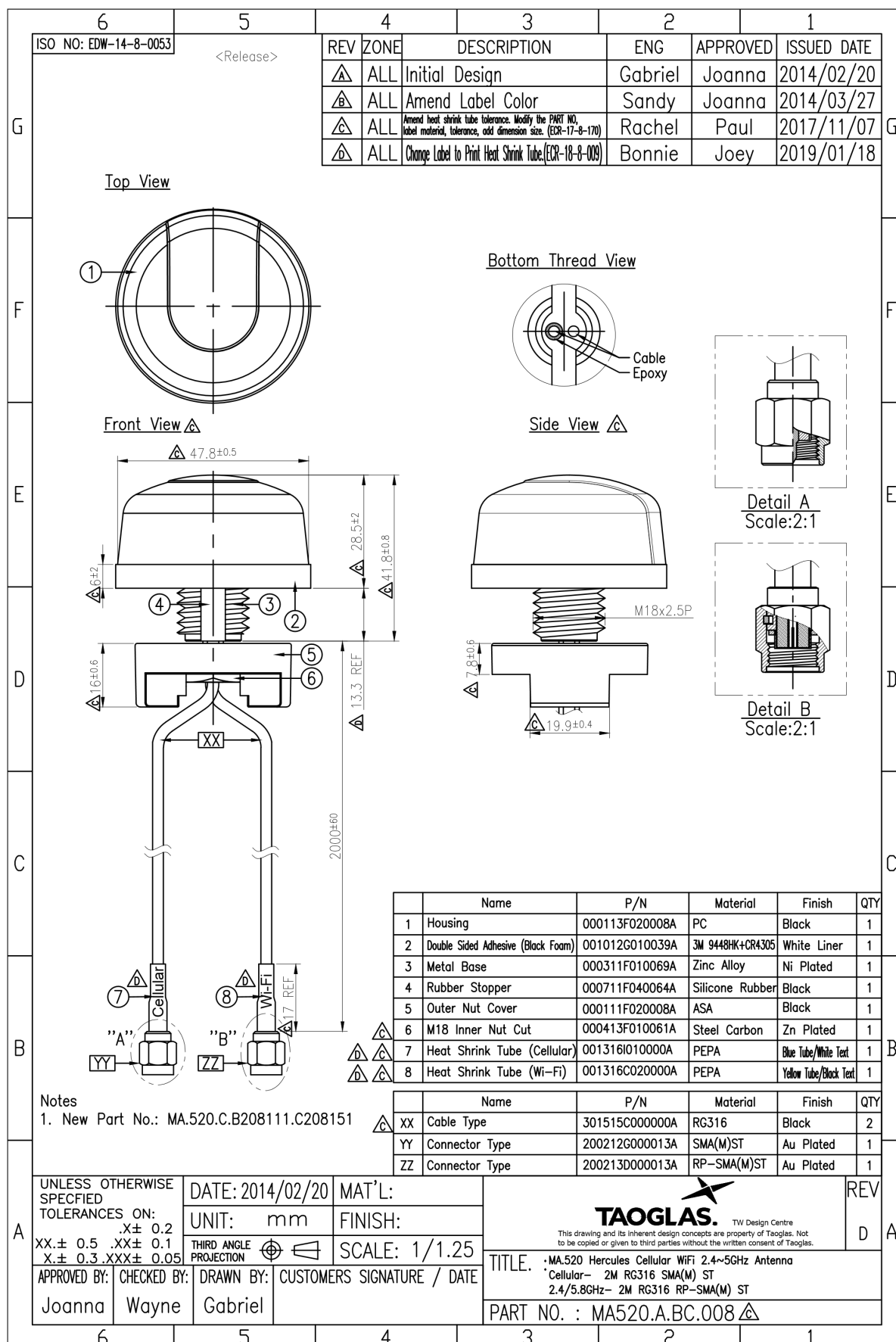
XZ Plane



YZ Plane

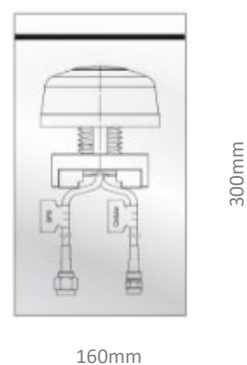


## 5. Mechanical Drawing (Units: mm)

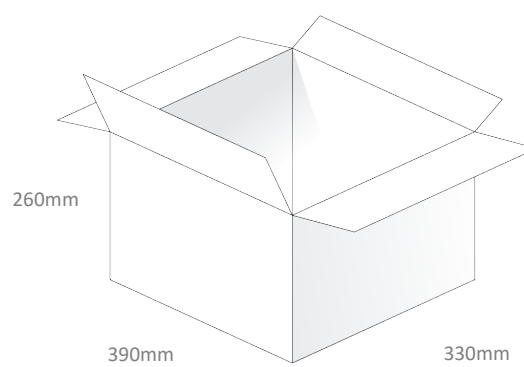


## 6. Packaging

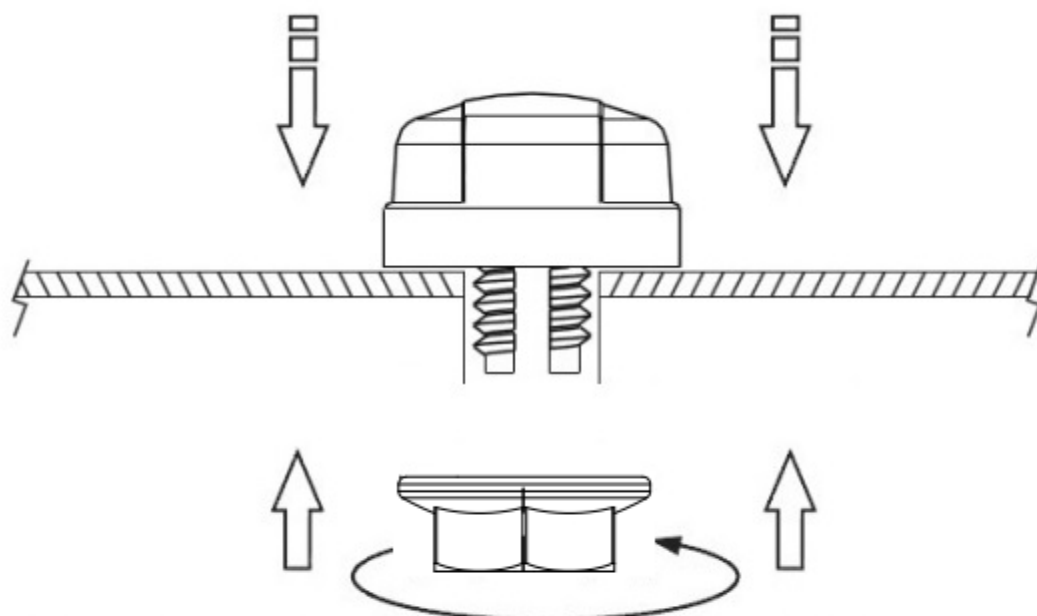
1 pcs MA520.A.BC.008 per PE Bag  
Dimensions: 300\*160mm  
Weight: 170g



60 pcs MA520.A.BC.008 per carton  
Dimensions: 390\*330\*260mm  
Weight: 10.5Kg



## 7. Installation Guidelines

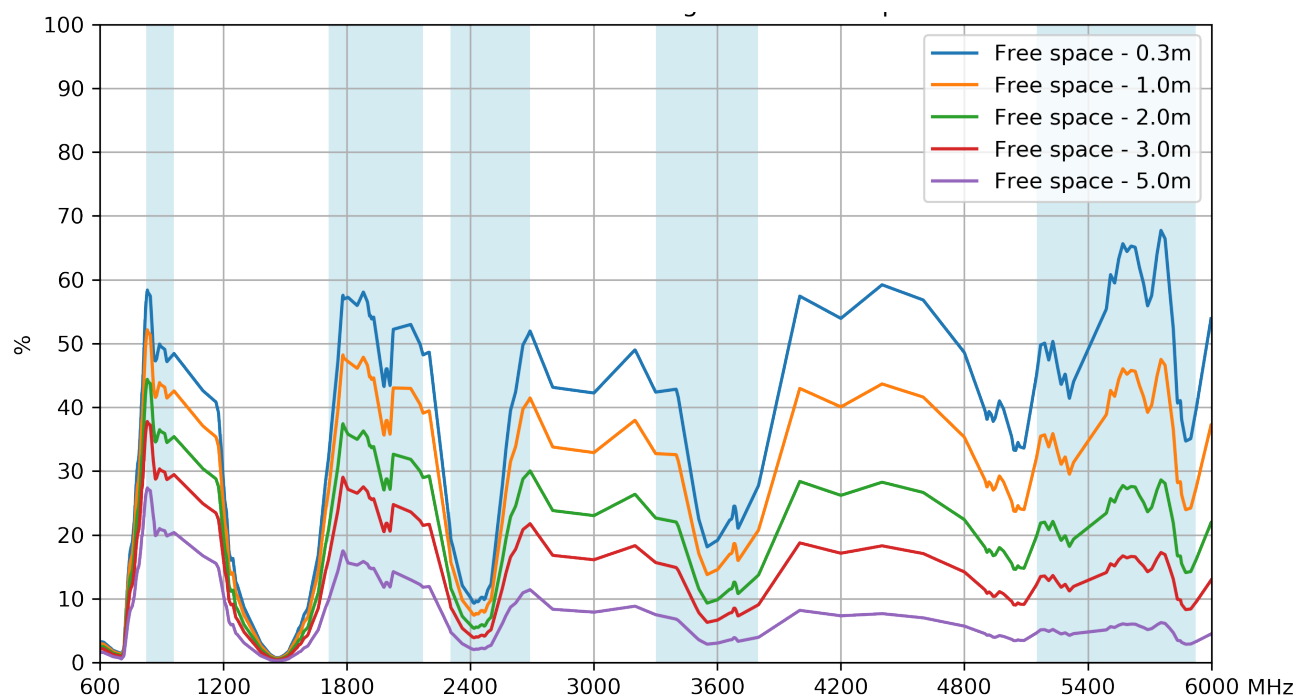


Recommended torque for Mounting is  $24.5\text{N}\cdot\text{m}$   
Maximum torque for mounting is  $29.4\text{N}\cdot\text{m}$

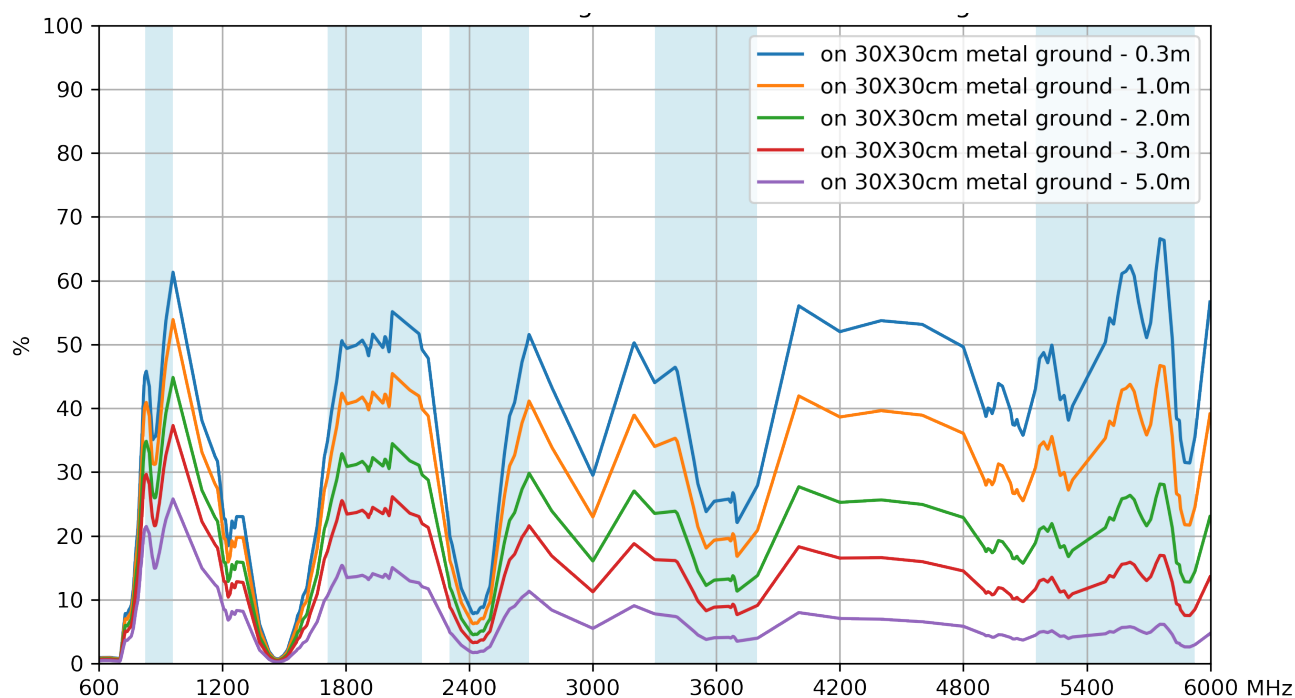
## 8. Application Note

### 8.1 Efficiency – Cellular

#### Free Space

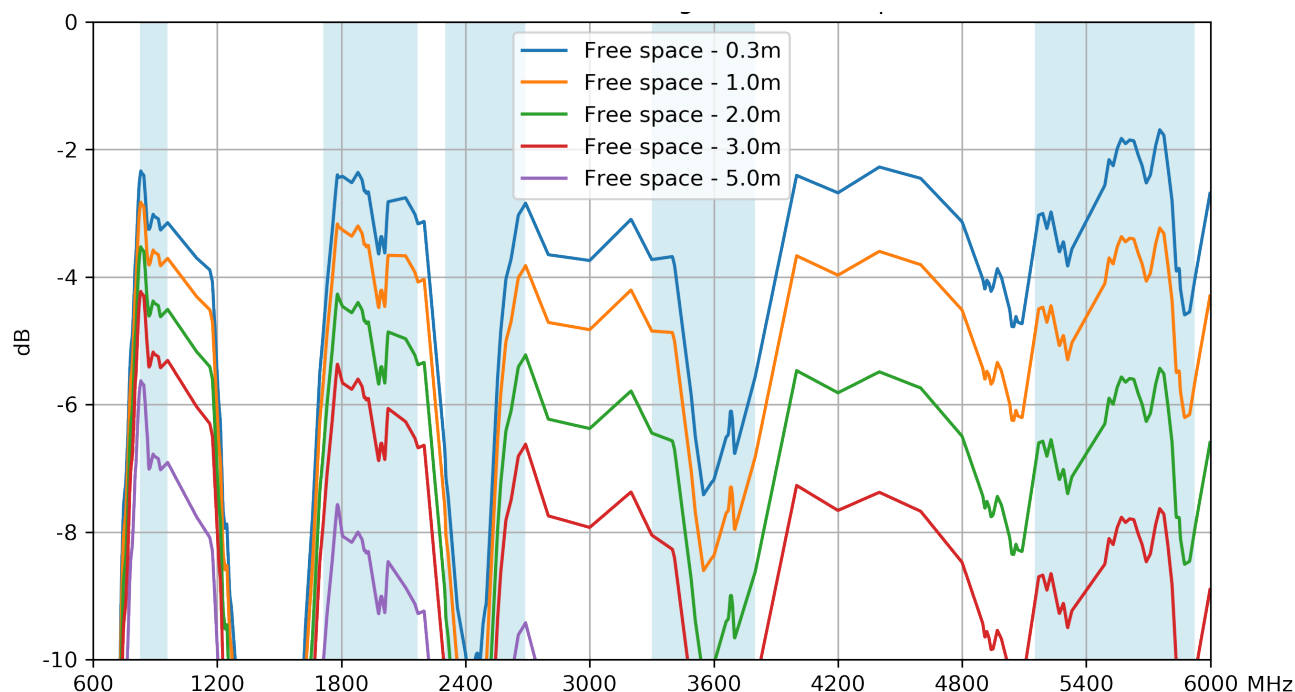


#### 30\*30cm Ground plane

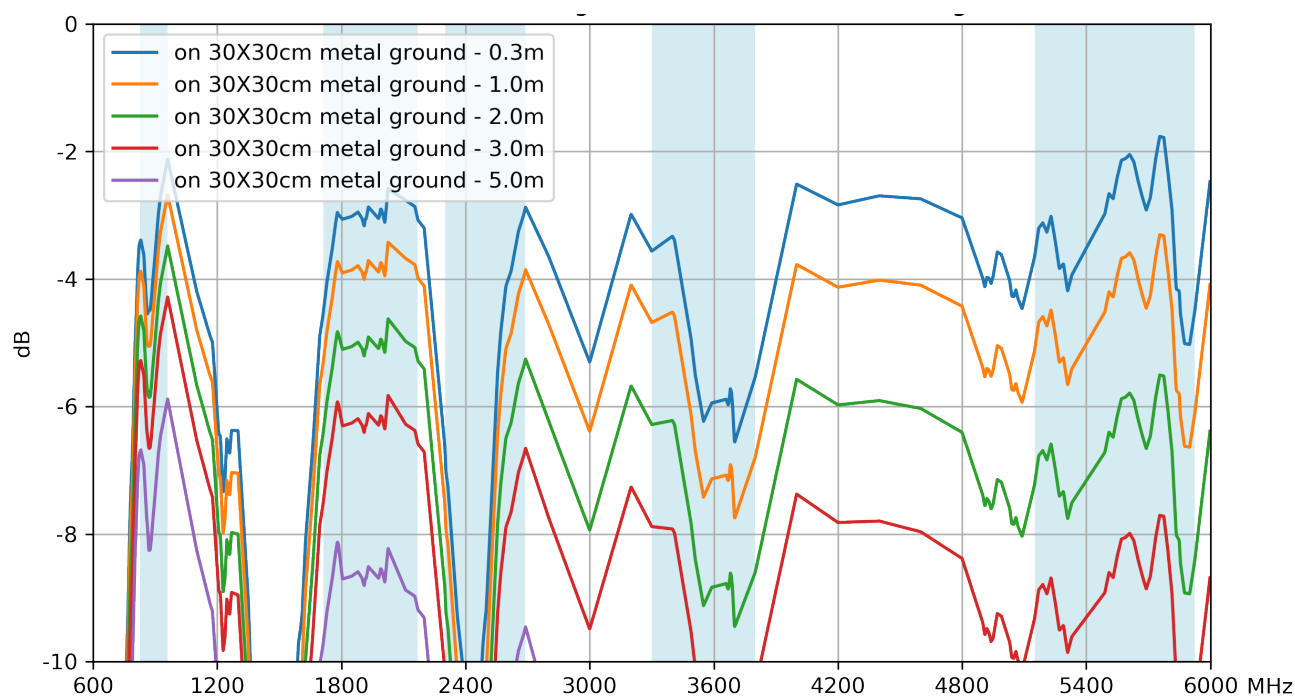


## 8.2 Average Gain – Cellular

### Free Space

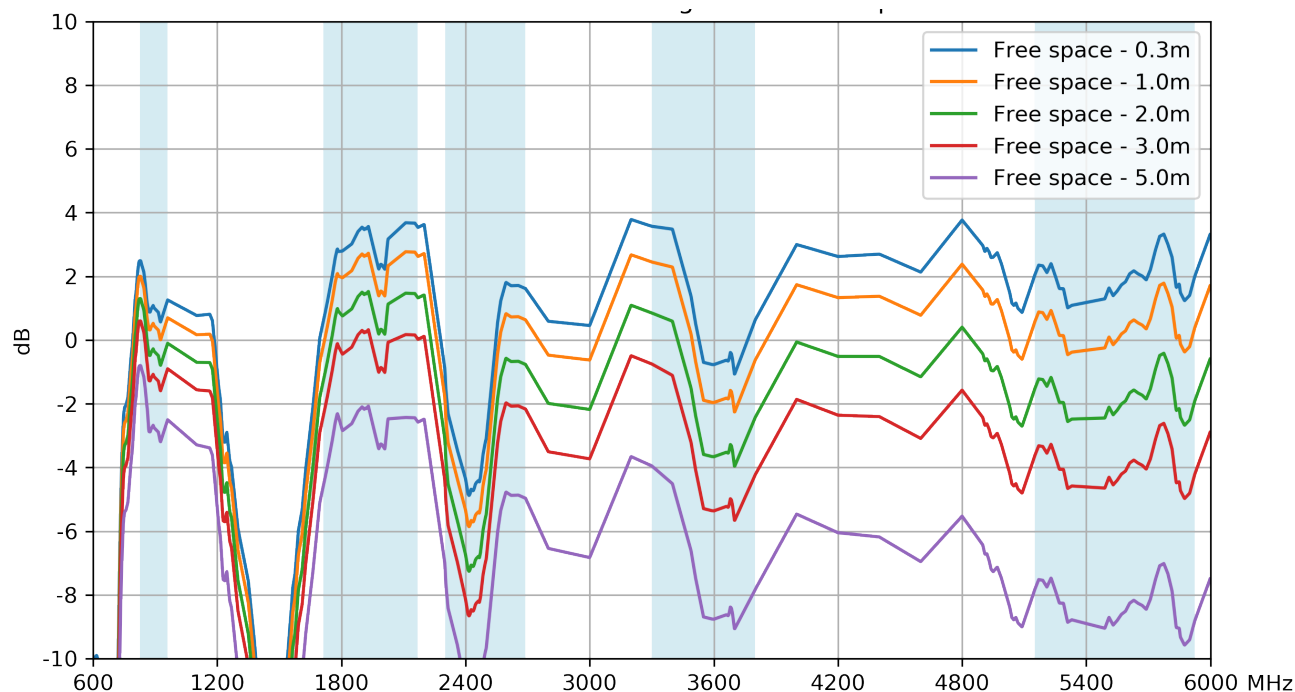


### 30\*30cm Ground plane

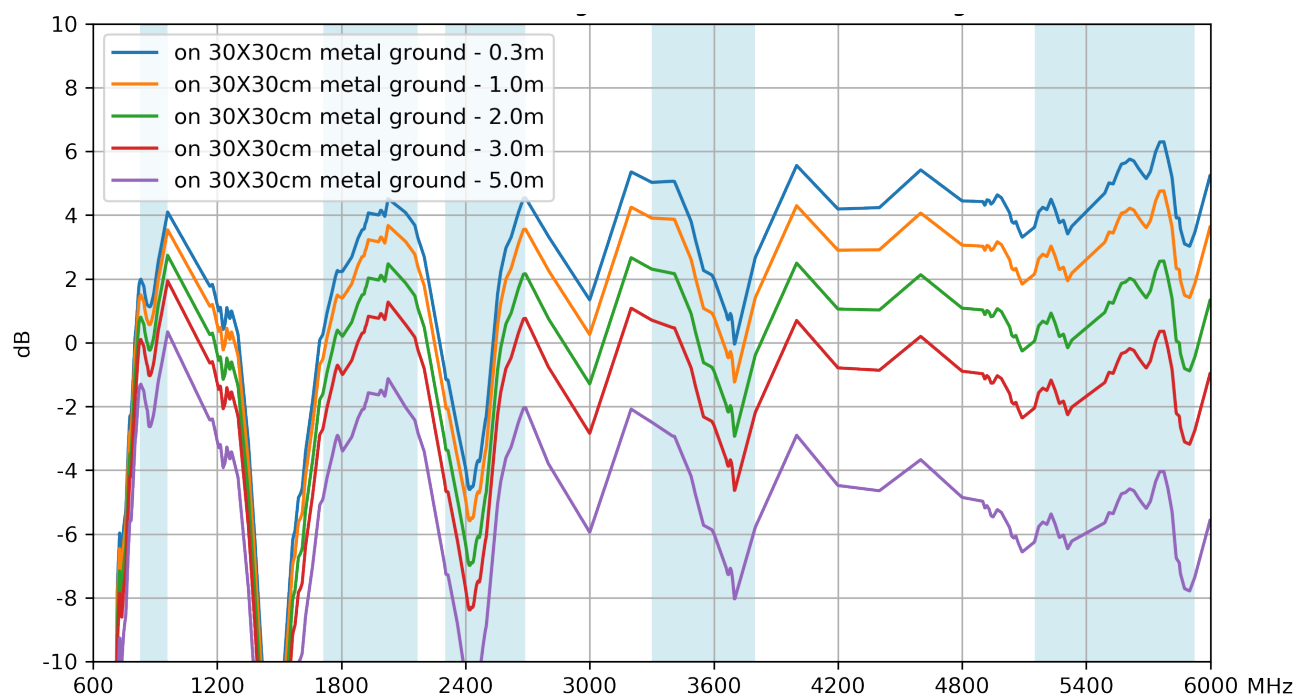


## 8.3 Peak Gain – Cellular

### Free Space



### 30\*30cm Ground plane



## Changelog for the datasheet

### SPE-13-8-071 – MA520.A.BC.008

#### Revision: H (Current Version)

|         |            |
|---------|------------|
| Date:   | 2021-09-19 |
| Notes:  | IP Rating  |
| Author: | Erik Landi |

#### Previous Revisions

##### Revision: G

|         |                                             |
|---------|---------------------------------------------|
| Date:   | 2020-04-02                                  |
| Notes:  | Updated drawing, Packaging, data and images |
| Author: | Jack Conroy                                 |

##### Revision: B

|         |                       |
|---------|-----------------------|
| Date:   | 2013-10-24            |
| Notes:  | Amended Cellular data |
| Author: | Aine Doyle            |

##### Revision: F

|         |                      |
|---------|----------------------|
| Date:   | 2017-03-01           |
| Notes:  | Updated Introduction |
| Author: | Jack Conroy          |

##### Revision: A (Original Release)

|         |                           |
|---------|---------------------------|
| Date:   | 2013-10-9                 |
| Notes:  | Initial Datasheet Release |
| Author: | Technical Writer          |

##### Revision: E

|         |                                                     |
|---------|-----------------------------------------------------|
| Date:   | 2016-12-23                                          |
| Notes:  | Updated with revised salt spray data and disclaimer |
| Author: | Andy Mahoney                                        |

##### Revision: D

|         |                              |
|---------|------------------------------|
| Date:   | 2016-05-18                   |
| Notes:  | Updated drawing and pictures |
| Author: | Aine Doyle                   |

##### Revision: C

|         |               |
|---------|---------------|
| Date:   | 2014-01-02    |
| Notes:  | Amended Photo |
| Author: | Aine Doyle    |



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