



**TAOGLAS®**

**Leica**  
**Geosystems**



# Datasheet

## High Precision GNSS Board

Taoglas / Leica Part No:  
MAT.200A / 956186 A

### Description

PCB With Multi-band GNSS Antenna and 2x Wi-Fi Antennas

### Features:

- 1 \* GPDF5012.A Multi-Band L1/L2/L5 GNSS Antenna
  - 2 \* WLA.01 Wi-Fi Single Band at 2.4 GHz
- Dims: 102.5mm \* 102.5mm \* 18.6mm
- 3 \* 1.37mm SMA cable with U.FL connectors
- RoHS & Reach Compliant

|           |                                |           |
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# 1. Introduction

The MAT.200A is a populated PCB manufactured by Taoglas for Leica. It is intended to be used inside the Leica Crocodile device.

The PCB includes one [GPDF5012.A](#) high-precision GNSS antenna as well as two [WLA.01](#) Wi-Fi antennas. This PCB has been designed and tested for use inside an enclosure, as supplied by Leica. All tests shown within this datasheet were performed with the PCB inserted inside the device enclosure.



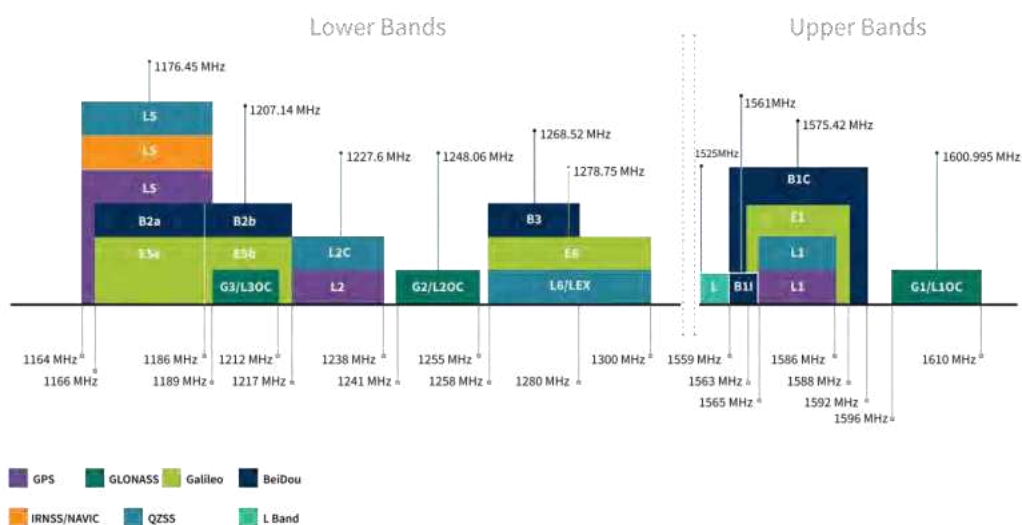
Figure 1 MAT.200A PCB Supplied to Leica



Figure 2 Enclosure For the MAT.200A

## 2. Specification

| GNSS Frequency Bands |                         |                           |                    |                    |                   |
|----------------------|-------------------------|---------------------------|--------------------|--------------------|-------------------|
| GPS                  | L1<br>1575.42 MHz       | L2<br>1227.6 MHz          | L5<br>1176.45 MHz  |                    |                   |
|                      | ■                       | ■                         | ■                  |                    |                   |
| GLONASS              | G1<br>1602 MHz          | G2<br>1248 MHz            | G3<br>1207 MHz     |                    |                   |
|                      | ■                       | ■                         | ■                  |                    |                   |
| Galileo              | E1<br>1575.24 MHz       | E5a<br>1176.45 MHz        | E5b<br>1201.5 MHz  | E6<br>1278.75 MHz  |                   |
|                      | ■                       | ■                         | ■                  | □                  |                   |
| Bei Dou              | B1C<br>1575.42 MHz      | B1I<br>1561 MHz           | B2a<br>1176.45 MHz | B2b<br>1207.14 MHz | B3<br>1268.52 MHz |
|                      | ■                       | ■                         | ■                  | ■                  | □                 |
| QZSS (Regional)      | L1<br>1575.42 MHz       | L2C<br>1227.6 MHz         | L5<br>1176.45 MHz  | L6<br>1278.75e6    |                   |
|                      | ■                       | ■                         | ■                  | □                  |                   |
| IRNSS (Regional)     | L5<br>1176.45 MHz       |                           |                    |                    |                   |
|                      | ■                       |                           |                    |                    |                   |
| SBAS                 | L1/E1/B1<br>1575.42 MHz | L5/B2a/E5a<br>1176.45 MHz | G1<br>1602 MHz     | G2<br>1248 MHz     | G3<br>1207 MHz    |
|                      | ■                       | ■                         | ■                  | ■                  | ■                 |



### GNSS Bands and Constellations

| GNSS Electrical                                             |                 |         |        |       |       |         |       |
|-------------------------------------------------------------|-----------------|---------|--------|-------|-------|---------|-------|
| Frequency (MHz)                                             | 1176.45         | 1201.55 | 1227.6 | 1248  | 1561  | 1575.42 | 1603  |
| Axial Ratio (dB) at Zenith                                  | 0.96            | 0.74    | 1.37   | 1.6   | 0.78  | 0.52    | 0.29  |
| Axial Ratio (dB) from Zenith to 30° Elevation for Phi = 0   | 1               | 0.67    | 1.41   | 1.64  | 0.82  | 0.45    | 0.27  |
| Axial Ratio (dB) from Zenith to 30° Elevation for Phi = 90° | 0.98            | 0.65    | 1.39   | 1.61  | 0.79  | 0.41    | 0.29  |
| PCO (cm)                                                    | 1.03            | 0.95    | 0.99   | 1.16  | 1.5   | 1.42    | 1.38  |
| PCV (cm)                                                    | 0.52            | 0.46    | 0.45   | 0.49  | 0.52  | 0.57    | 0.47  |
| Group Delay Mean (ns)                                       | 18.74           | 19.02   | 15.88  | 16.17 | 50.26 | 37.18   | 41.19 |
| Group Delay Variation (ns)                                  | 5               | 4       | 3      | 2     | 9     | 26      | 5     |
| Polarization                                                | RHCP            |         |        |       |       |         |       |
| Impedance                                                   | 50 $\Omega$     |         |        |       |       |         |       |
| Cable                                                       | 3x 1.37mm cable |         |        |       |       |         |       |
| Connector                                                   | U.FL            |         |        |       |       |         |       |

| LNA and Filter Electrical Properties (Typical Values) |         |         |        |       |      |         |      |
|-------------------------------------------------------|---------|---------|--------|-------|------|---------|------|
| Frequency (MHz)                                       | 1176.45 | 1201.55 | 1227.6 | 1248  | 1561 | 1575.42 | 1603 |
| Gain@3.0V (dB)                                        | 28.05   | 29.72   | 28.66  | 28.65 | 31.2 | 31.75   | 31.3 |
| Noise@3.0V (dB)                                       | 3.05    | 2.55    | 2.42   | 2.33  | 2.4  | 2.18    | 2.05 |
| Power consumption@3.0V (mA)                           | 17      |         |        |       |      |         |      |

| Total Specification (Through Antenna, SAW Filter, LNA, Power Dividers & Hybrid Couplers) |         |         |        |      |      |         |       |
|------------------------------------------------------------------------------------------|---------|---------|--------|------|------|---------|-------|
| Frequency (MHz)                                                                          | 1176.45 | 1201.55 | 1227.6 | 1248 | 1561 | 1575.42 | 1603  |
| Gain@3V (dBi)                                                                            | 24.86   | 28.94   | 27.5   | 25.4 | 28.7 | 29.15   | 28.78 |

| Wi-Fi Electrical |                 |         |                |                   |                 |             |              |                   |
|------------------|-----------------|---------|----------------|-------------------|-----------------|-------------|--------------|-------------------|
| Band             | Frequency (MHz) | Antenna | Efficiency (%) | Average Gain (dB) | Peak Gain (dBi) | Impedance   | Polarization | Radiation Pattern |
| Wi-Fi – 2.4 GHz  | 2400-2500       | Wi-Fi1  | 33.4           | -4.77             | -0.12           | 50 $\Omega$ | Linear       | Omni              |
|                  |                 | Wi-Fi2  | 35.0           | -4.56             | 0.08            |             |              |                   |

| Mechanical |                            |
|------------|----------------------------|
| Dimensions | 102.5mm x 102.5mm x 18.6mm |
| Weight     | 130g                       |
| Material   | FR-4 PCB                   |

| Environmental          |                            |
|------------------------|----------------------------|
| Operation Temperature  | -40°C to 85°C              |
| Storage Temperature    | -40°C to 85°C              |
| Relative Humidity      | Non-condensing 65°C 95% RH |
| RoHs & REACH Compliant | Yes                        |

## 3. Antenna Characteristics

### 3.1 Test Setup

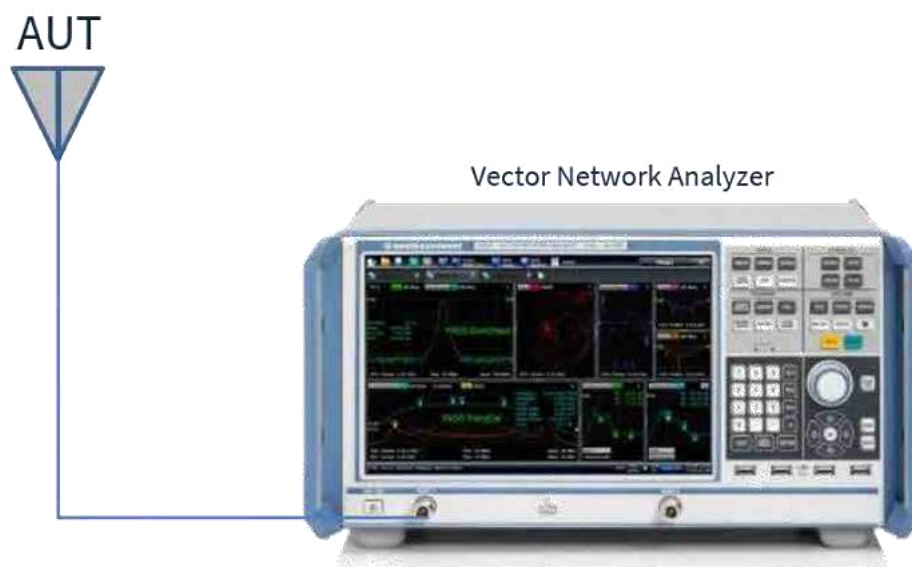
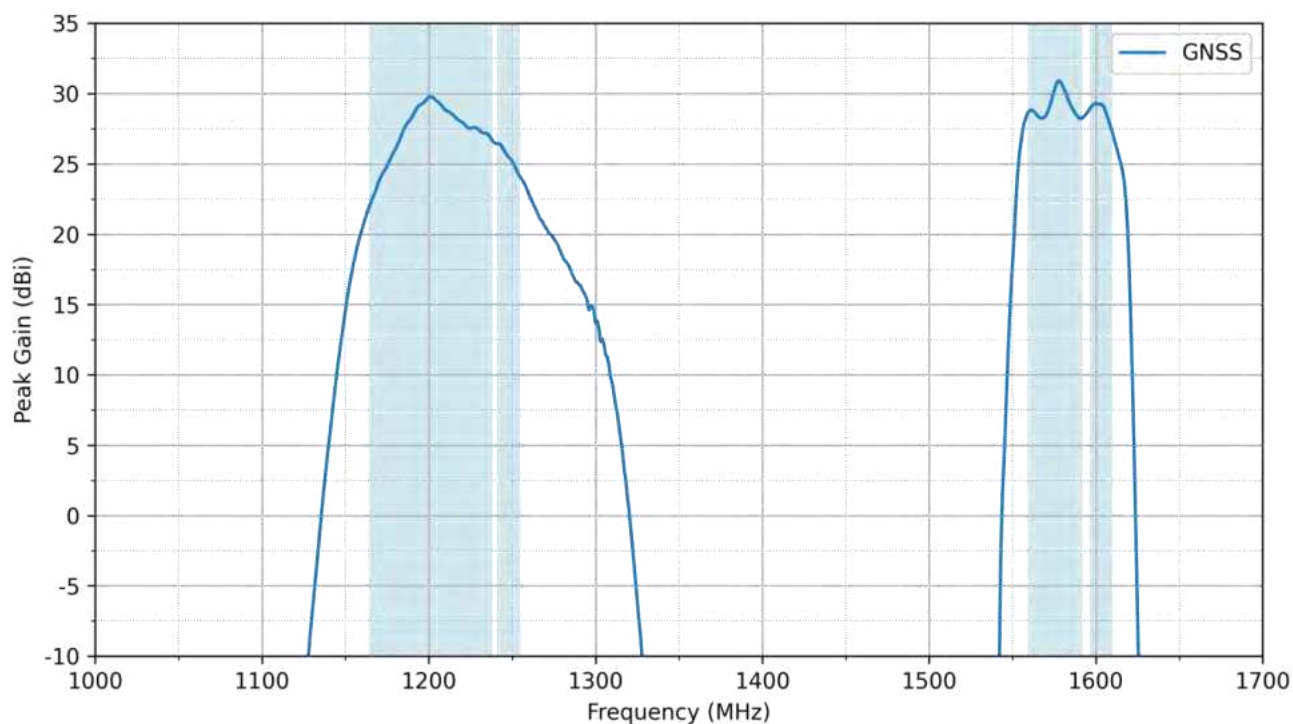
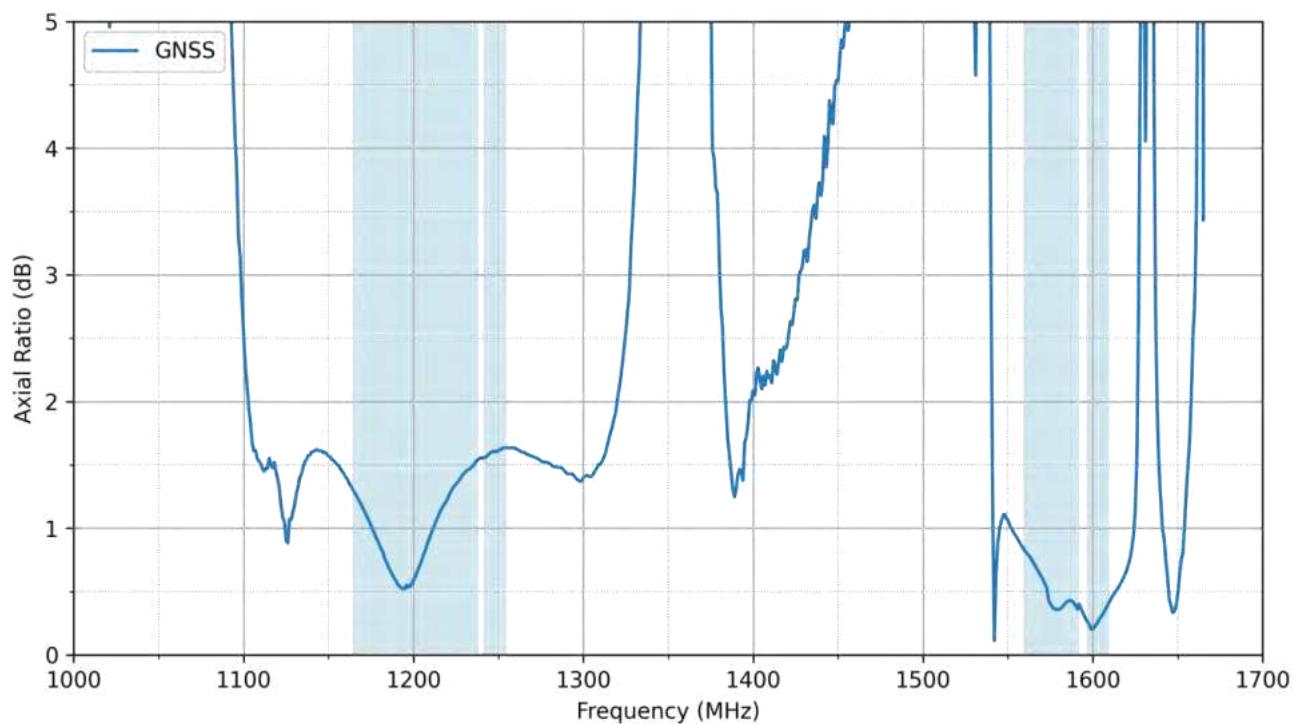


Figure 3 Test Setup for VNA Measurements

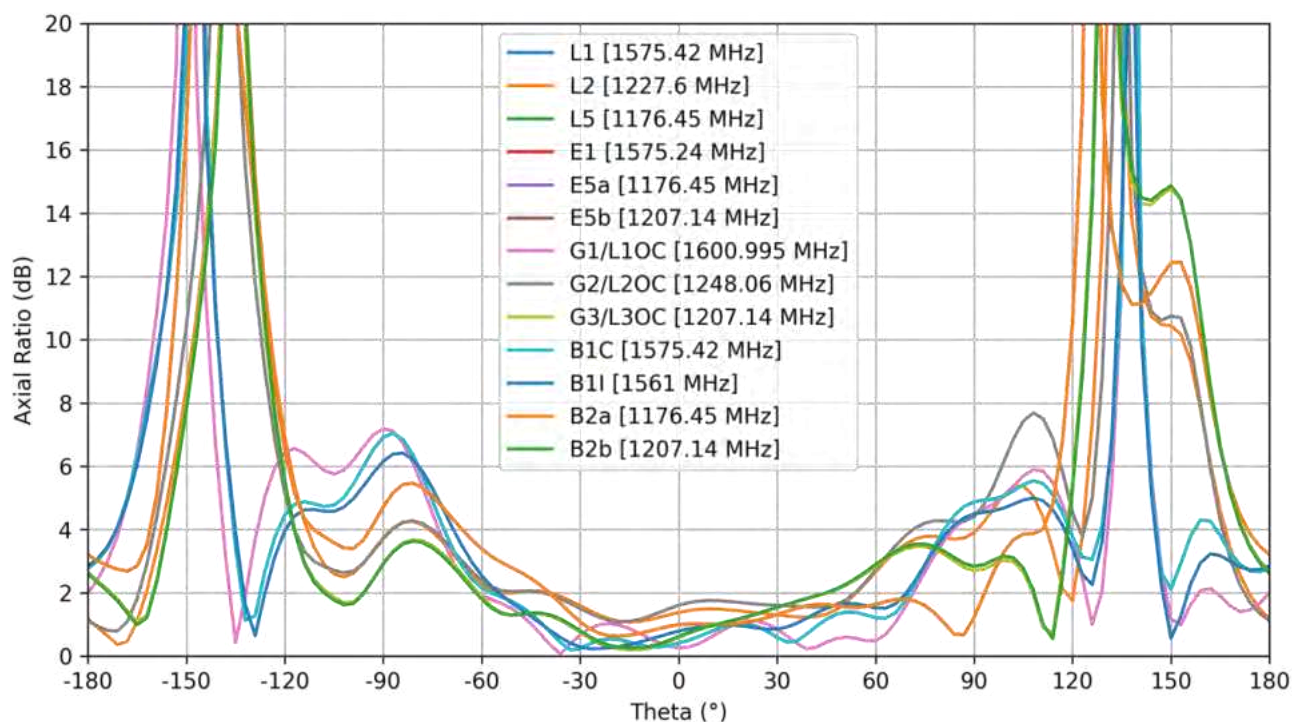
### 3.2 GNSS - Peak Gain



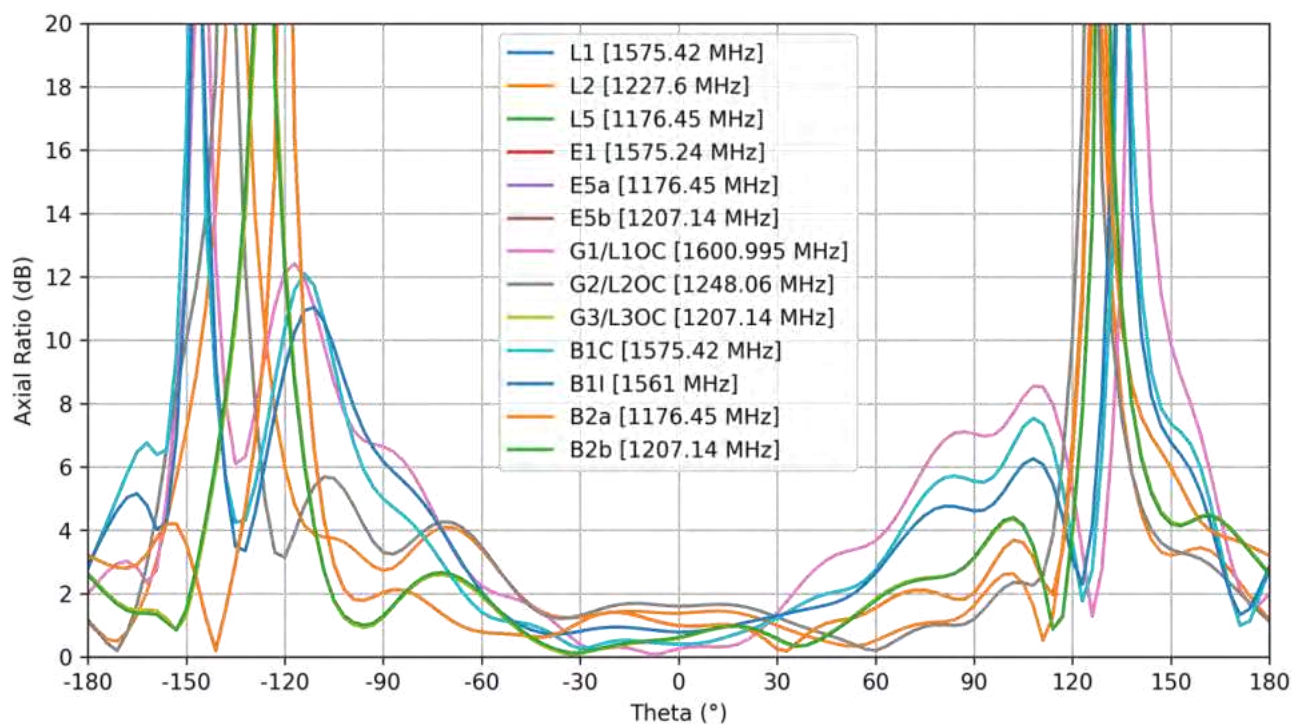
### 3.3 GNSS - Axial Ratio



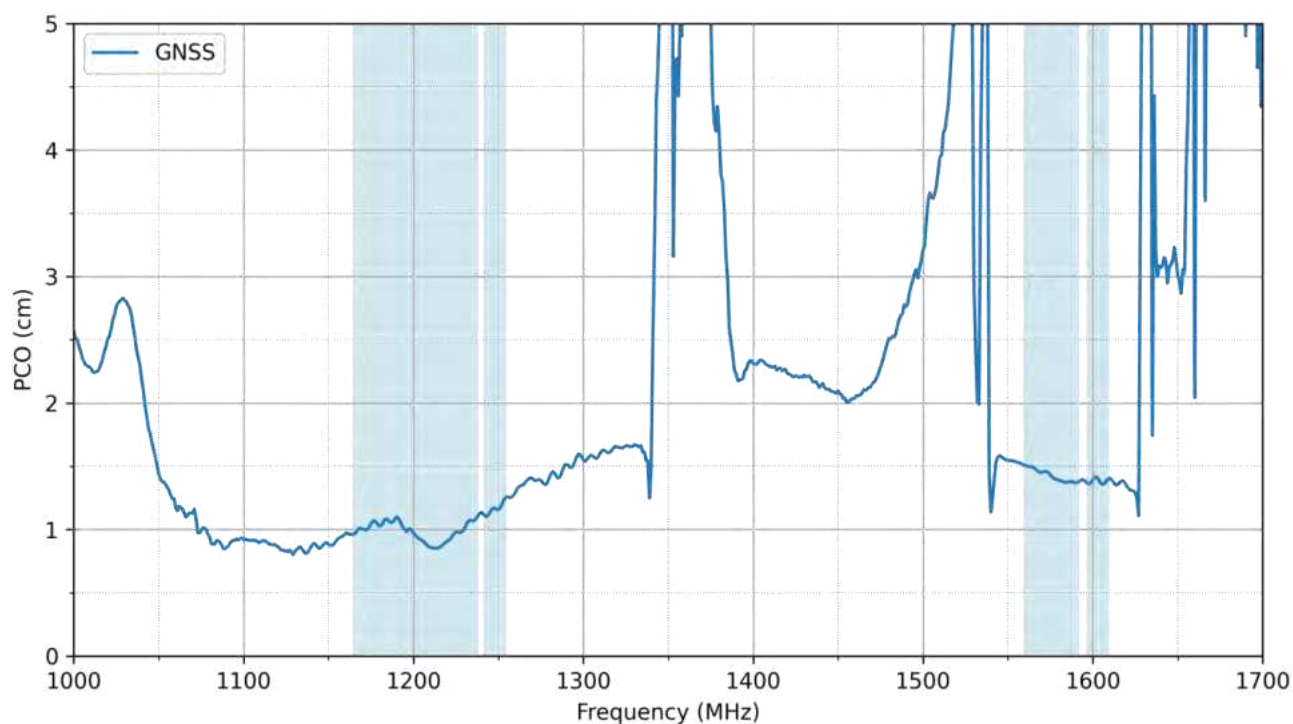
### 3.4 GNSS - Axial Ratio vs Angle for $\Phi=0^\circ$



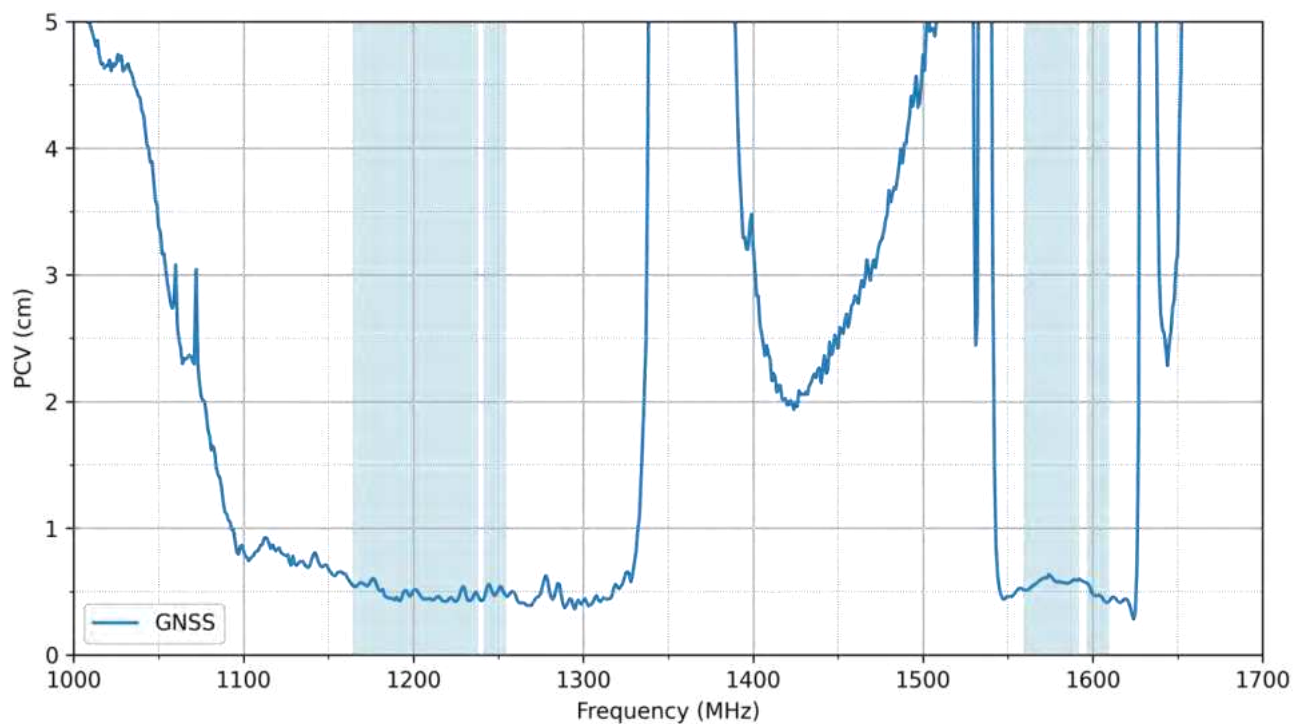
### 3.5 GNSS - Axial Ratio vs Angle for $\Phi=90^\circ$



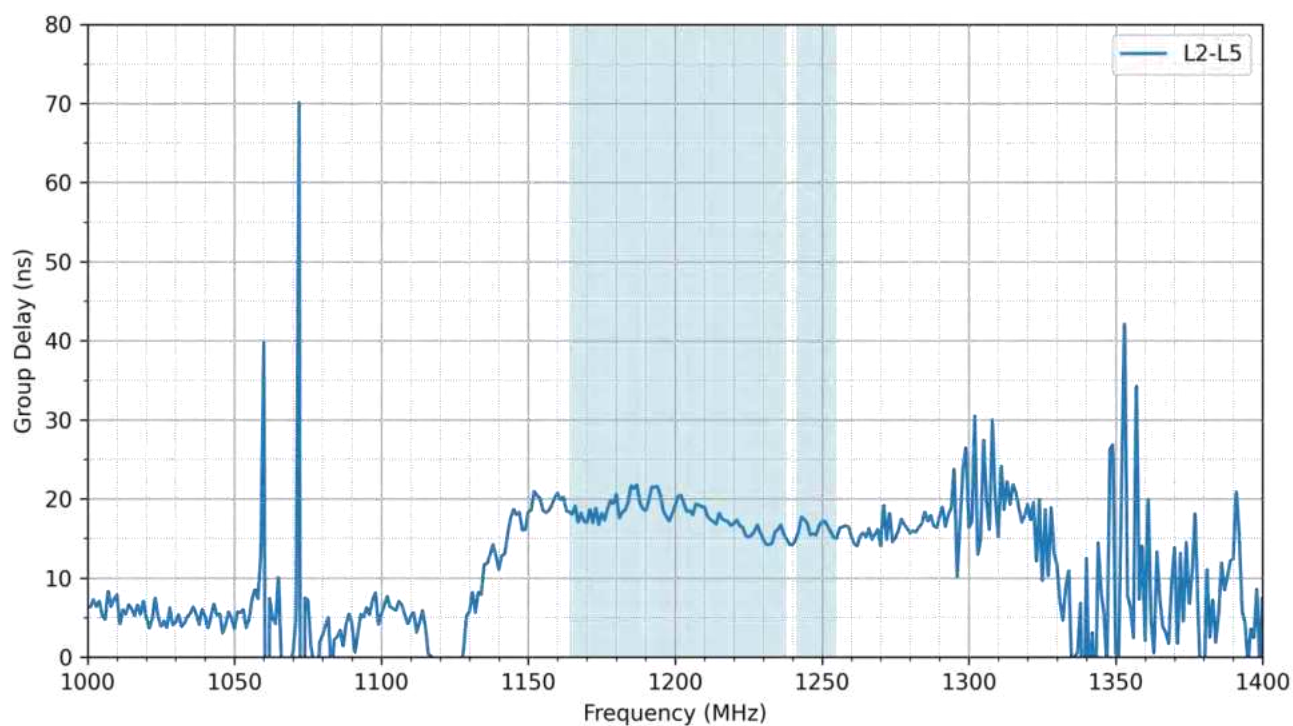
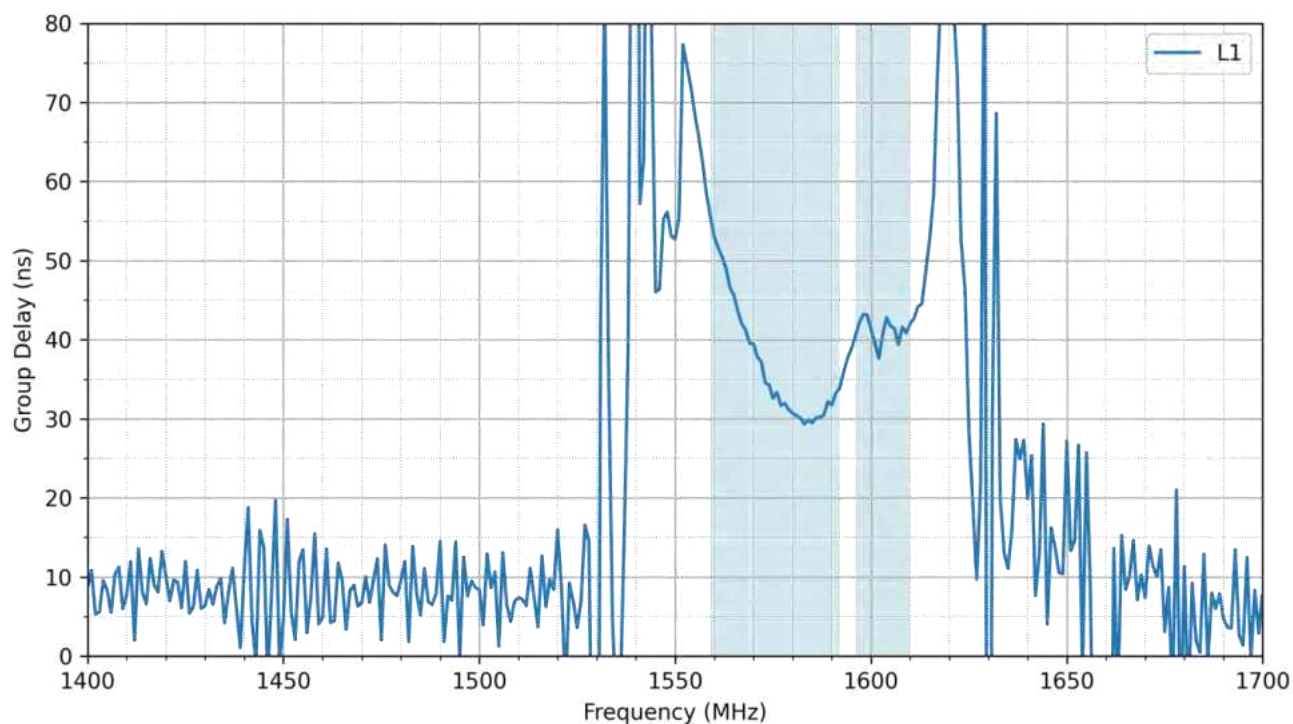
### 3.6 GNSS - PCO



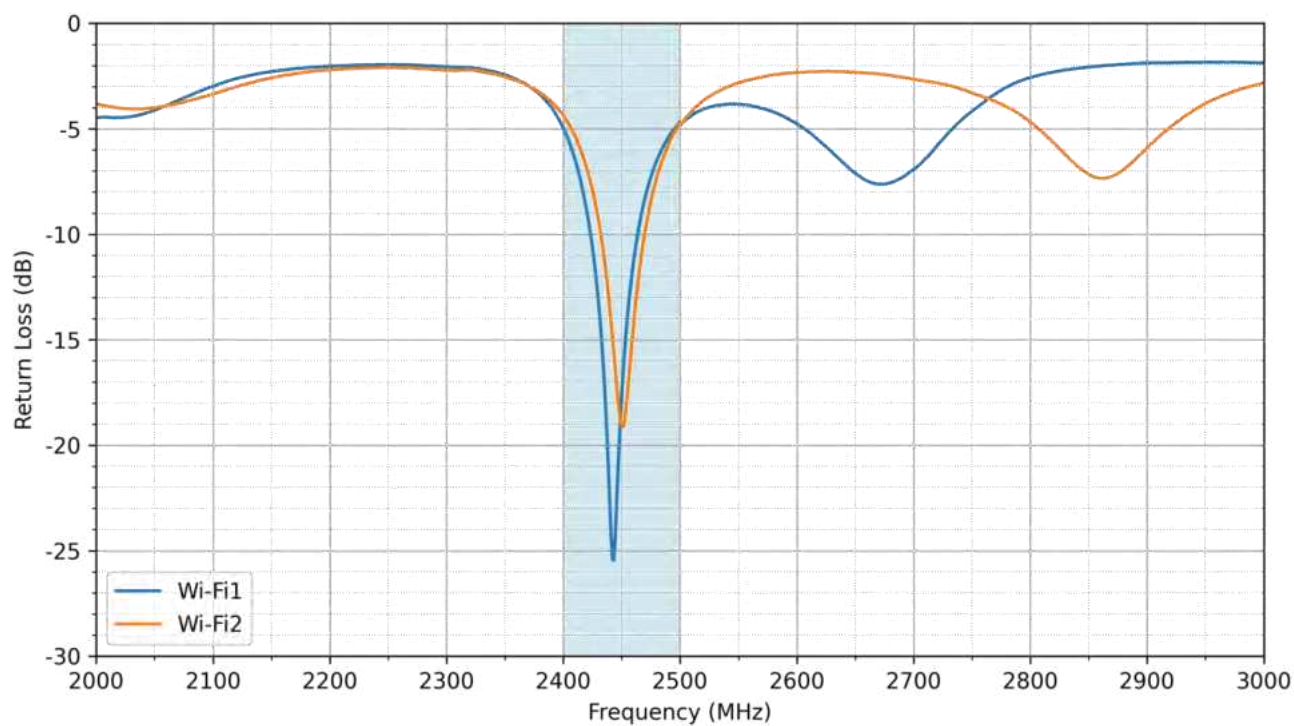
### 3.7 GNSS - PCV



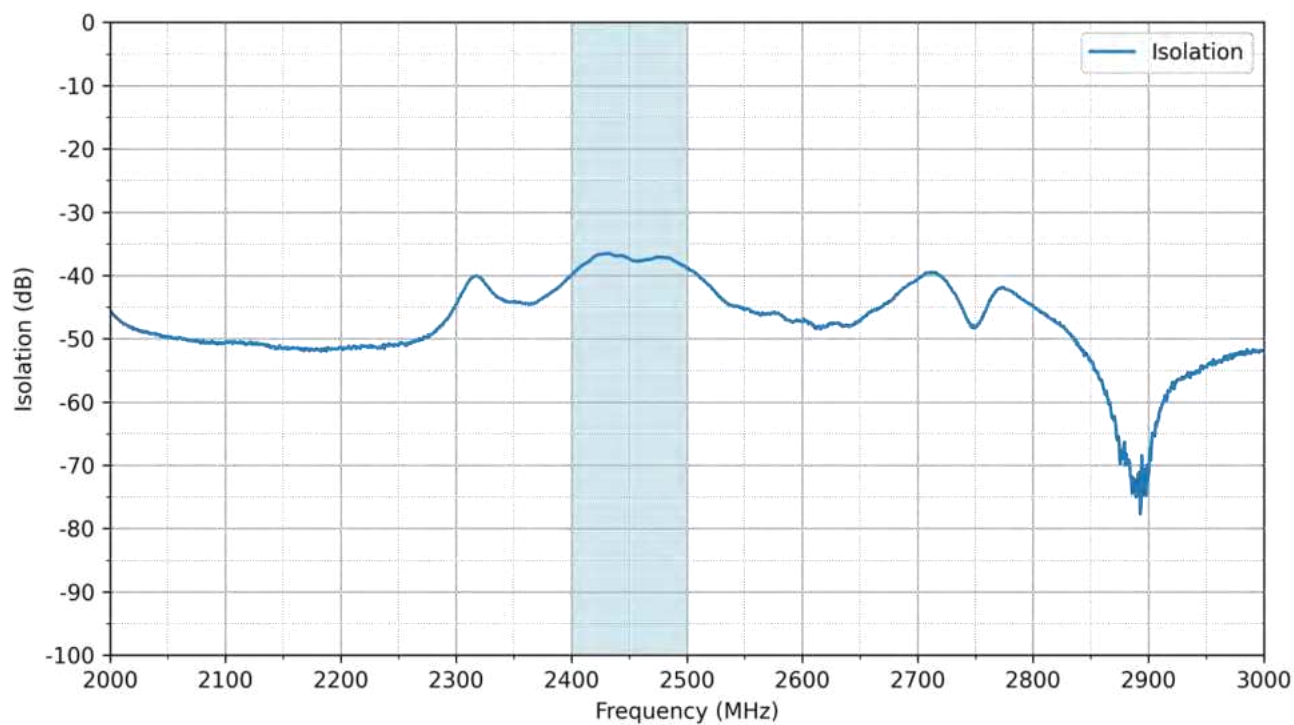
### 3.8 GNSS - Group Delay



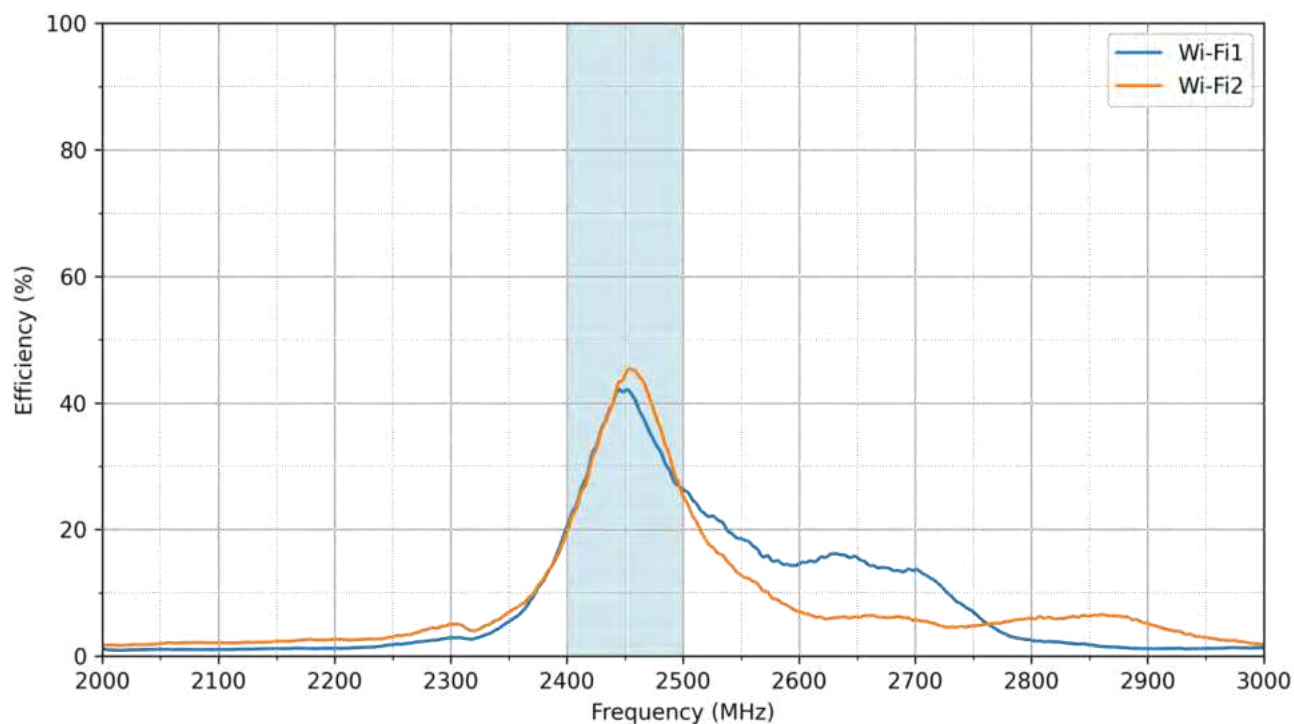
### 3.9 Wi-Fi - Return Loss



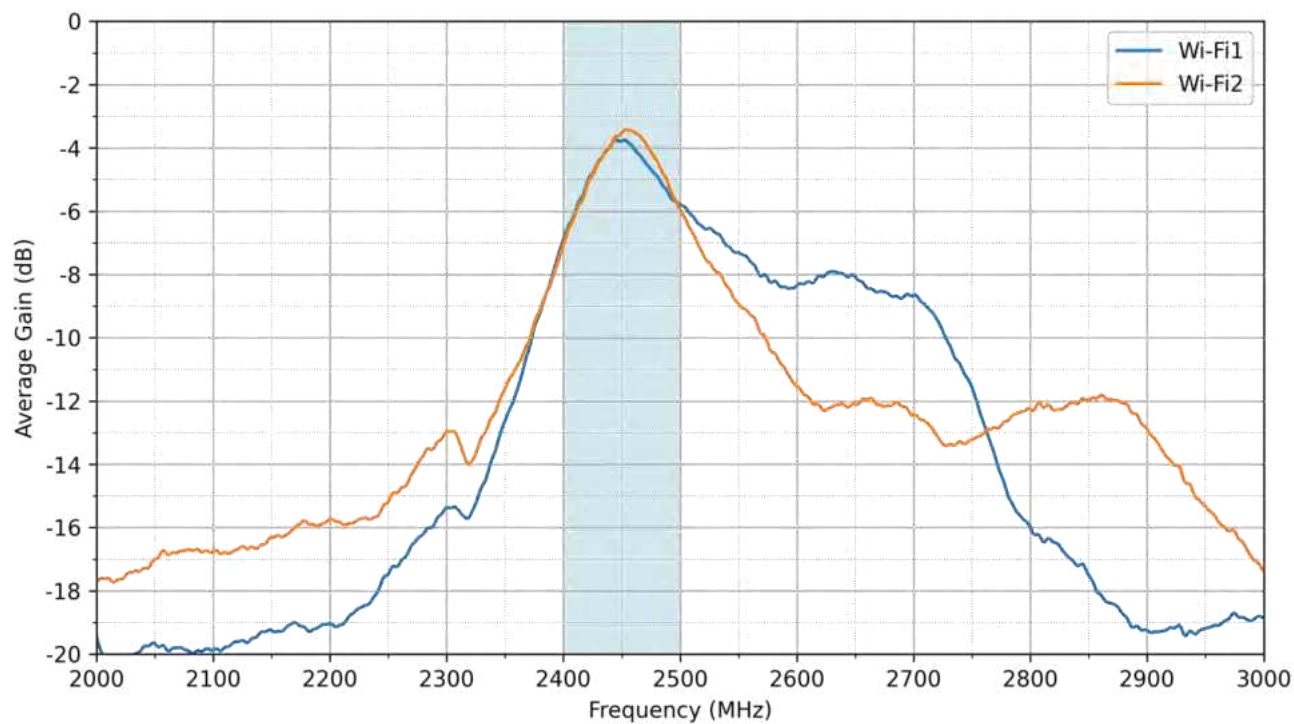
### 3.10 Wi-Fi - Isolation



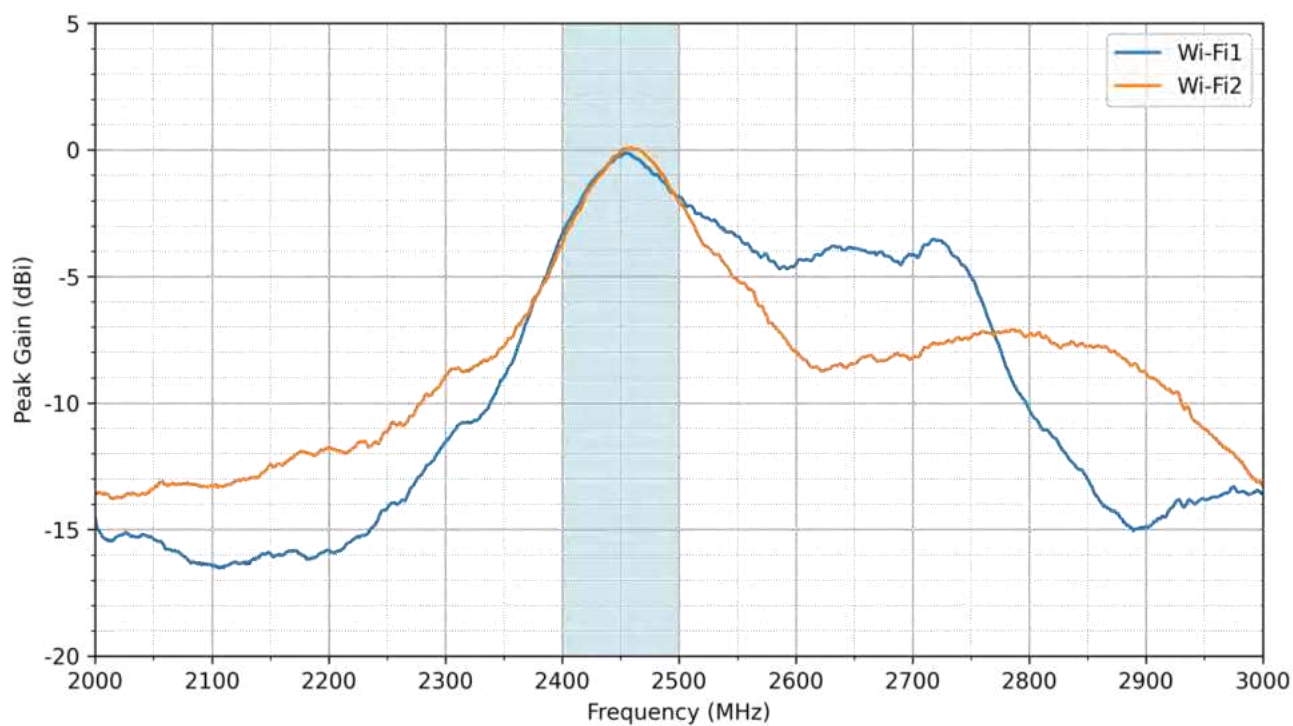
### 3.11 Wi-Fi - Efficiency



### 3.12 Wi-Fi - Average Gain

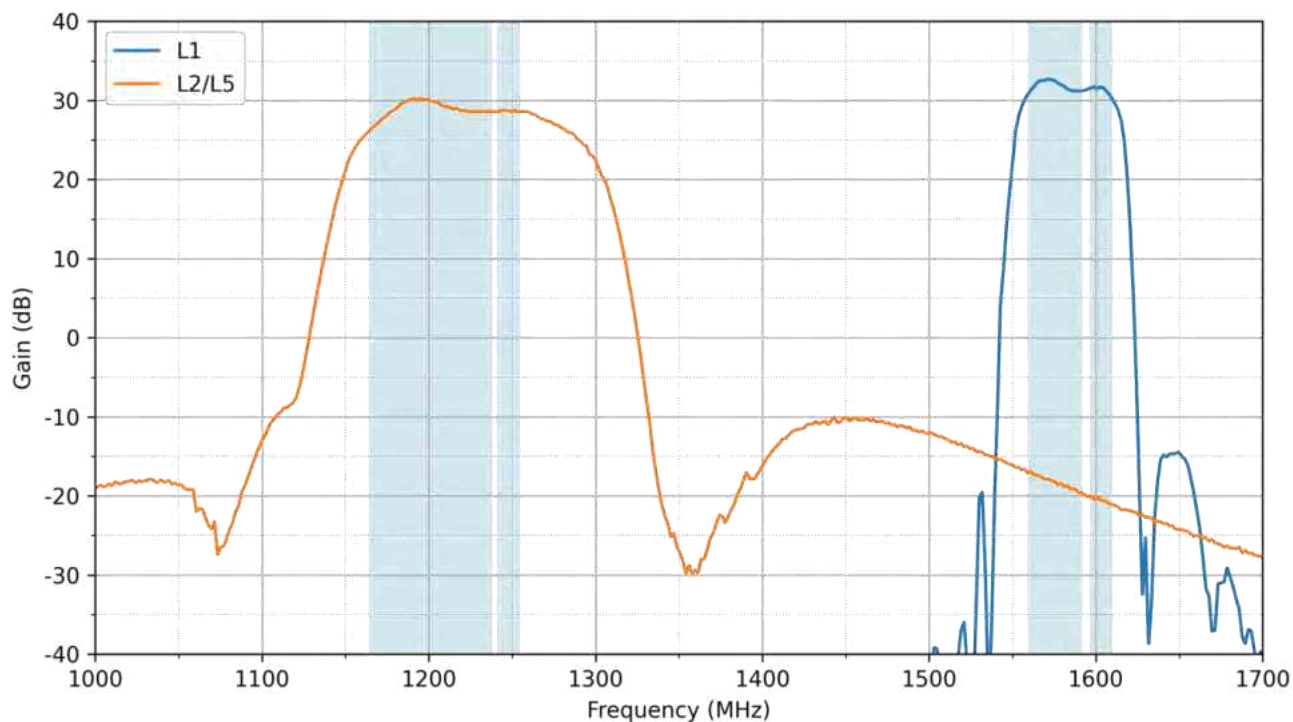


### 3.13 Wi-Fi - Peak Gain

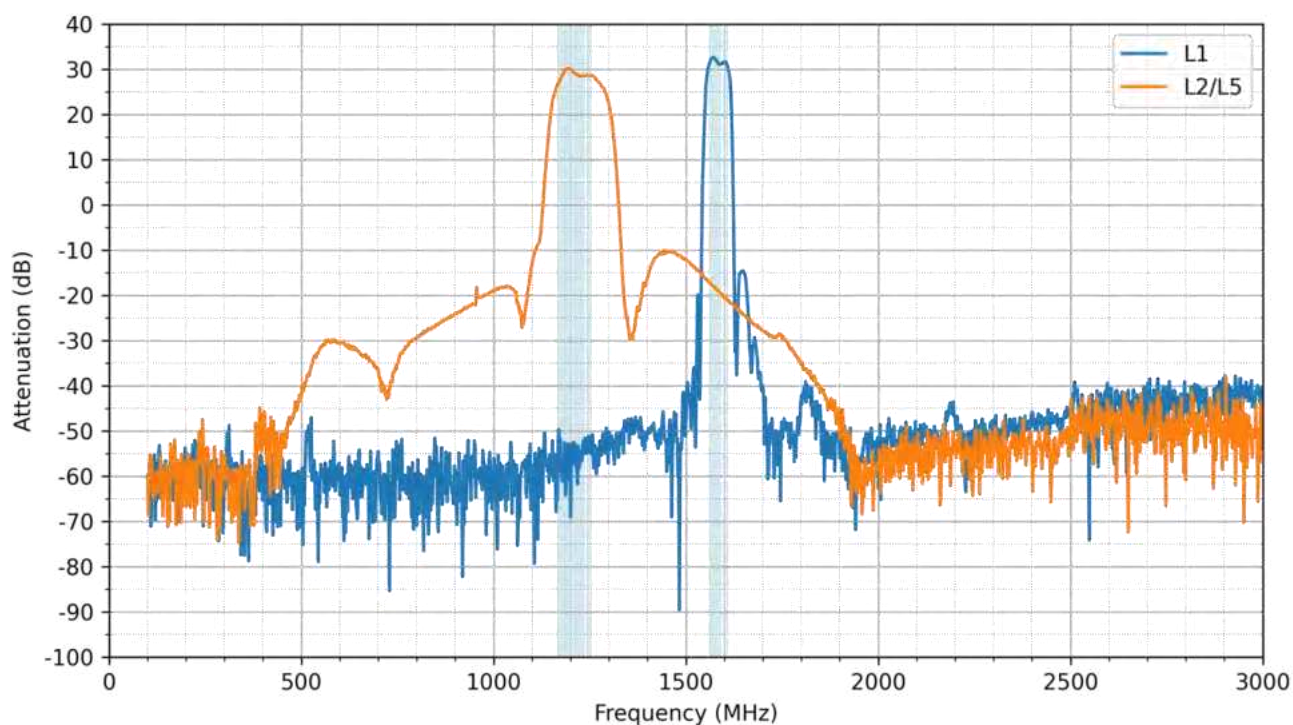


## 4. Active Characteristics

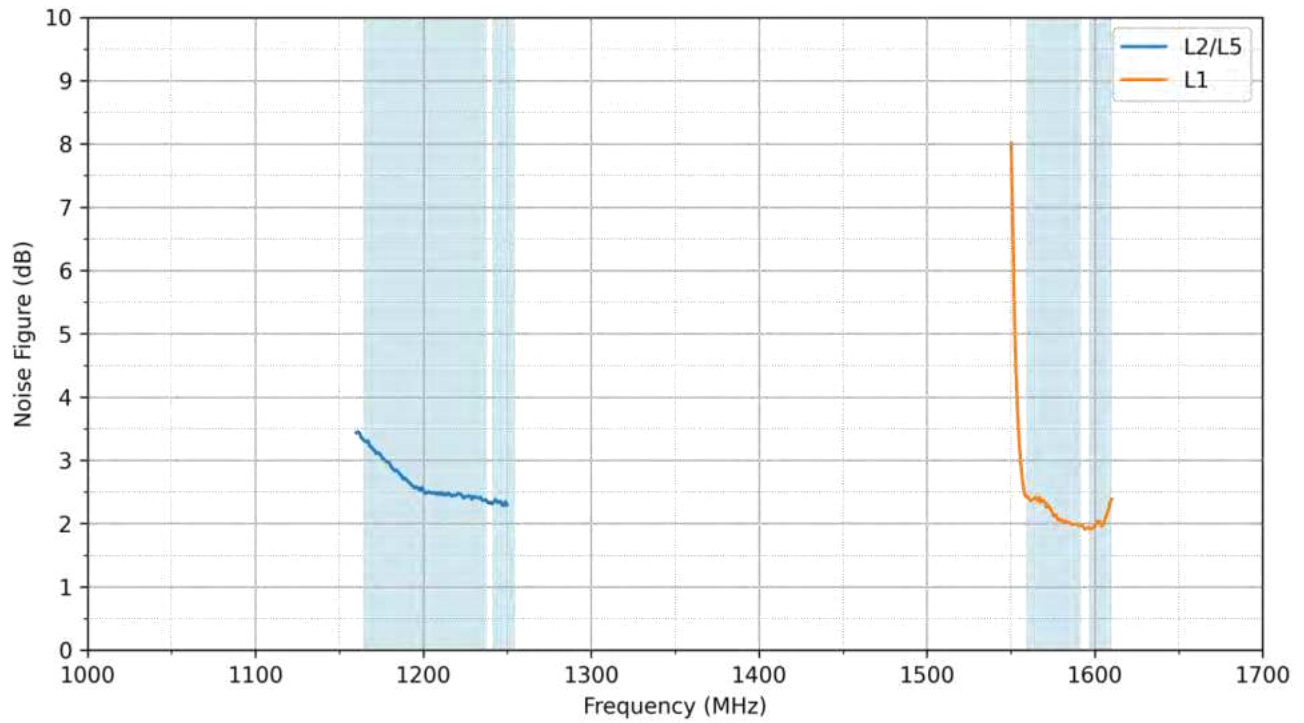
### 4.1 Active Circuit Gain



### 4.2 Active Circuit Out of Band Attenuation



### 4.3 Active Circuit Noise Figure



## 5. Radiation Patterns

### 5.1 Test Setup

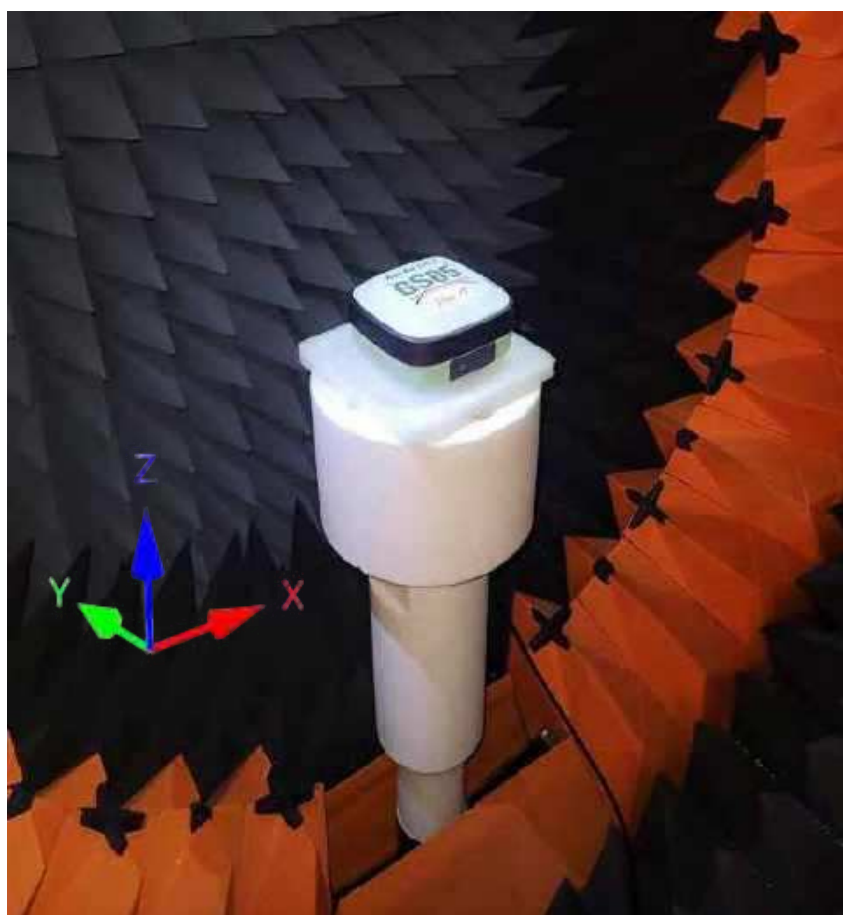
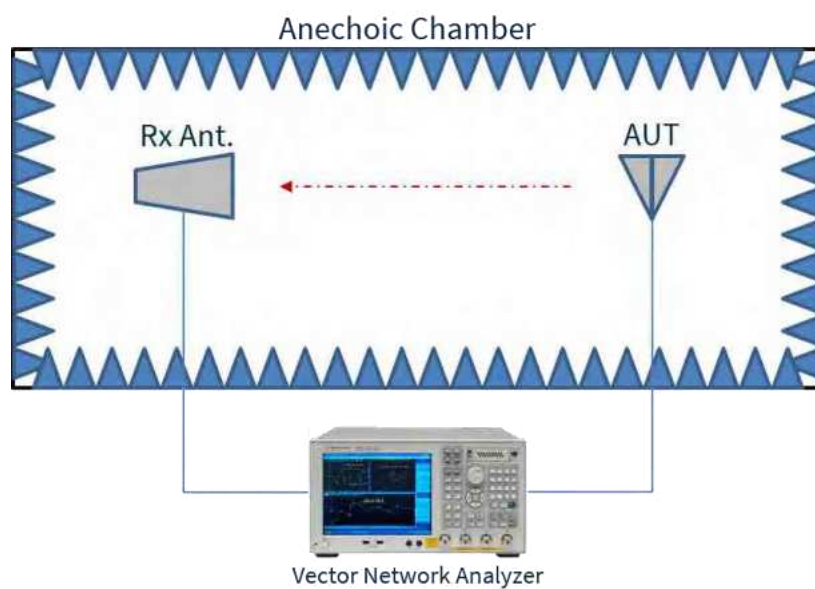
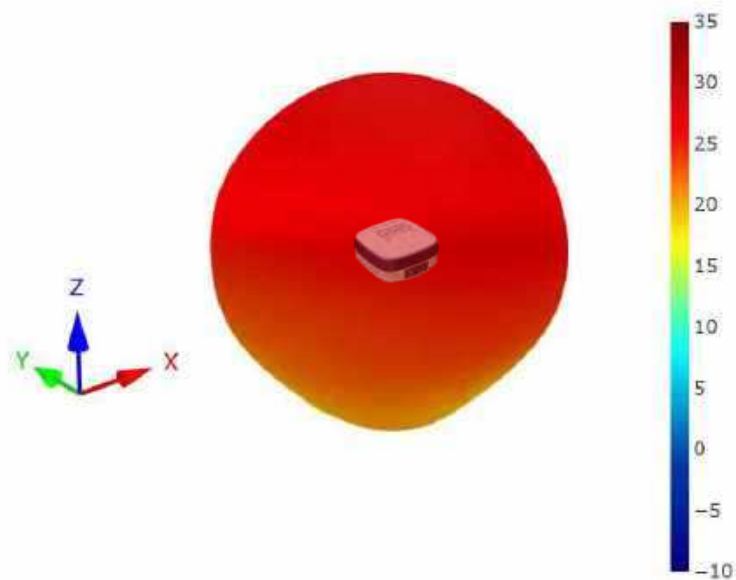
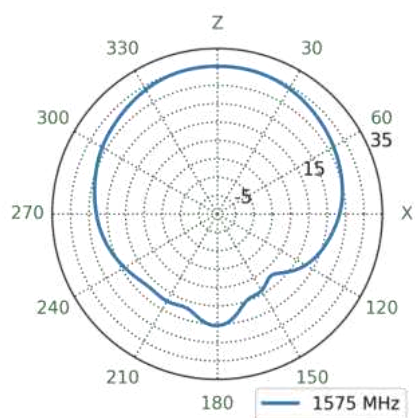


Figure 4 Test Setup for Chamber Measurements

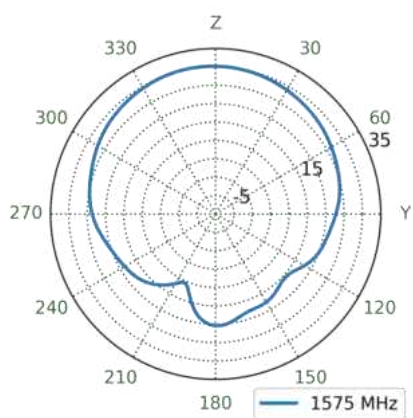
## 5.2 GNSS Patterns at 1575 MHz [L1/E1/B1C]



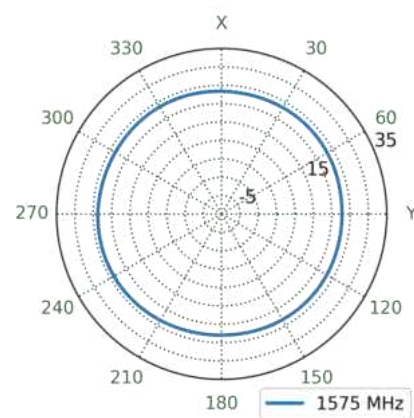
XZ Plane



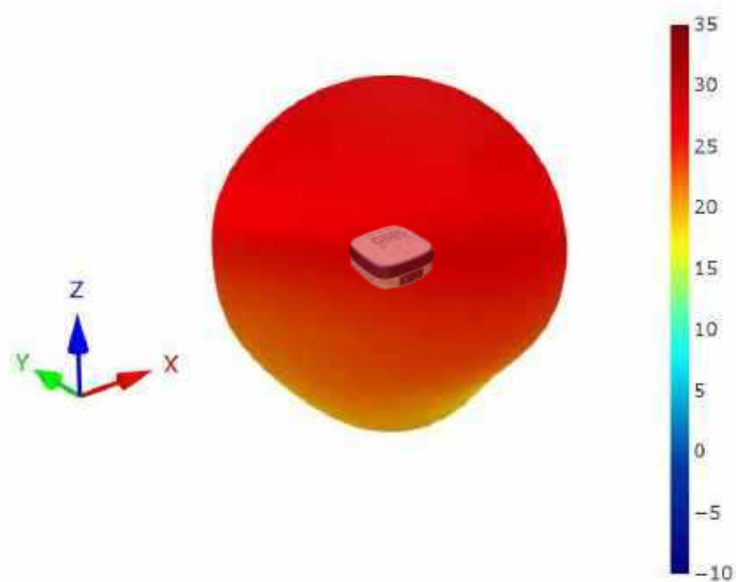
YZ Plane



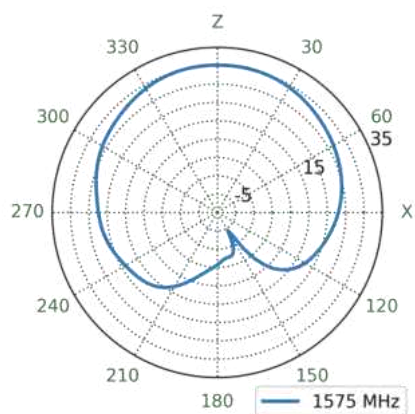
XY Plane



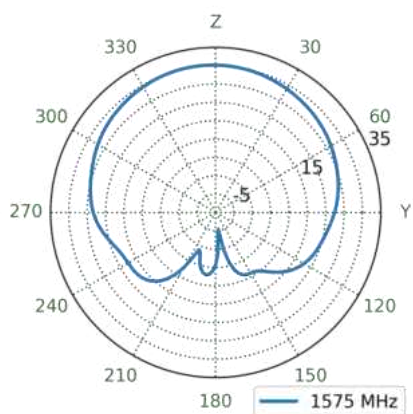
### 5.3 GNSS Patterns at 1575 MHz for GRHP [L1/E1/B1C]



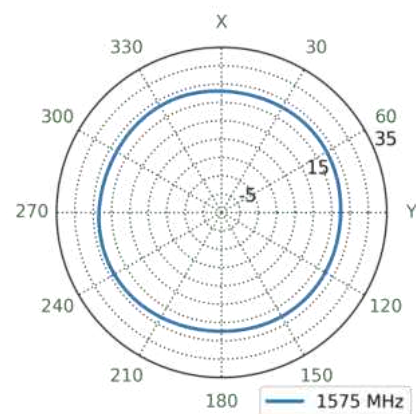
XZ Plane



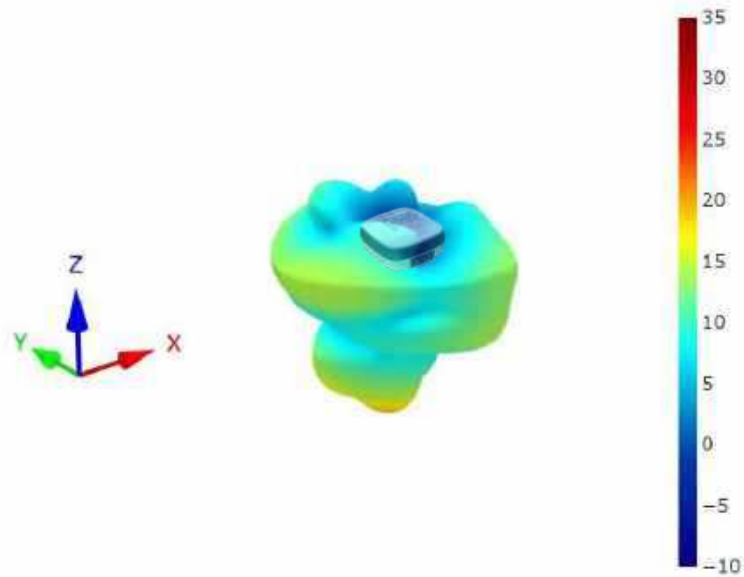
YZ Plane



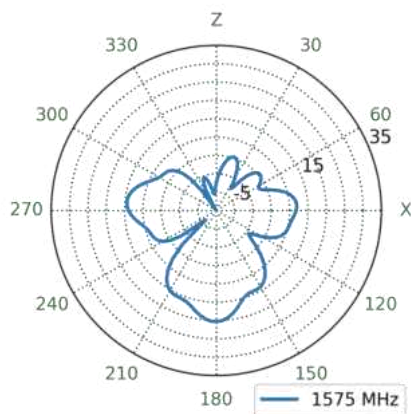
XY Plane



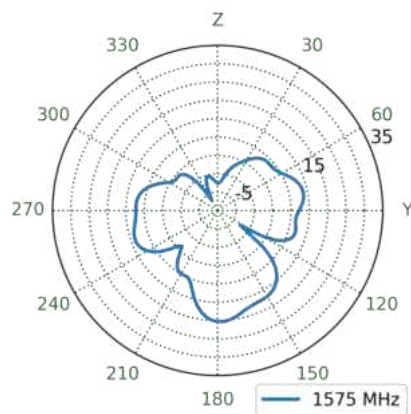
## 5.4 GNSS Patterns at 1575 MHz for GLHP [L1/E1/B1C]



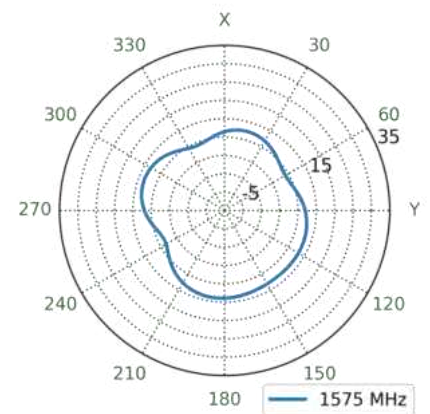
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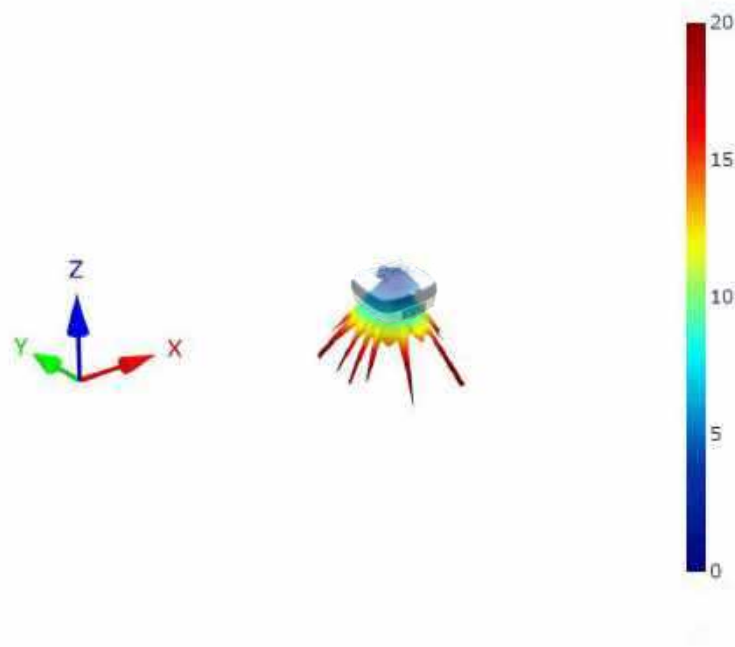
YZ Plane



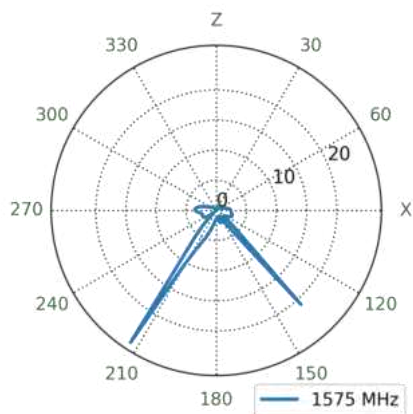
XY Plane



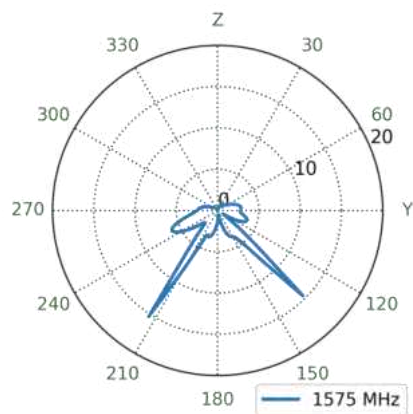
## 5.5 GNSS Patterns at 1575 MHz for AR [L1/E1/B1C]



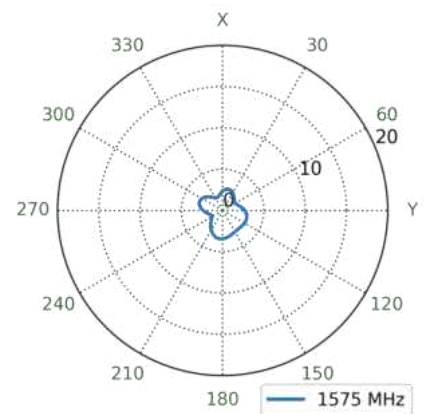
XZ Plane



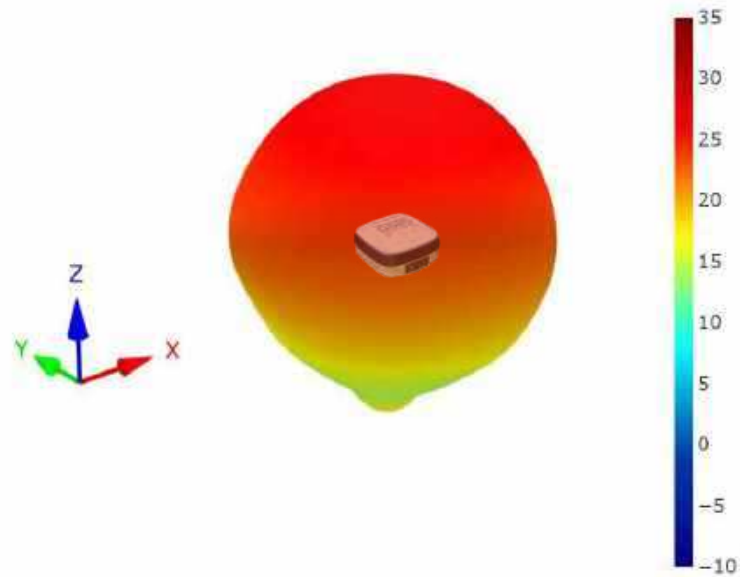
YZ Plane



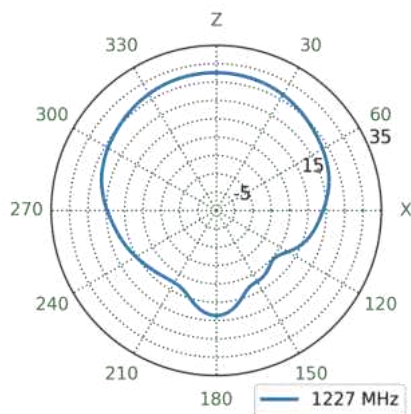
XY Plane



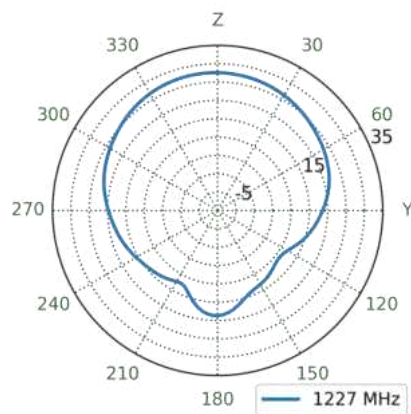
## 5.6 GNSS Patterns at 1228 MHz [L2]



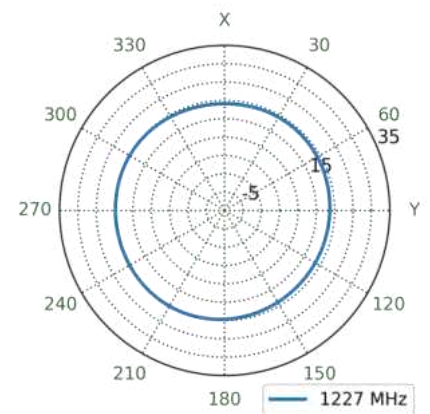
XZ Plane



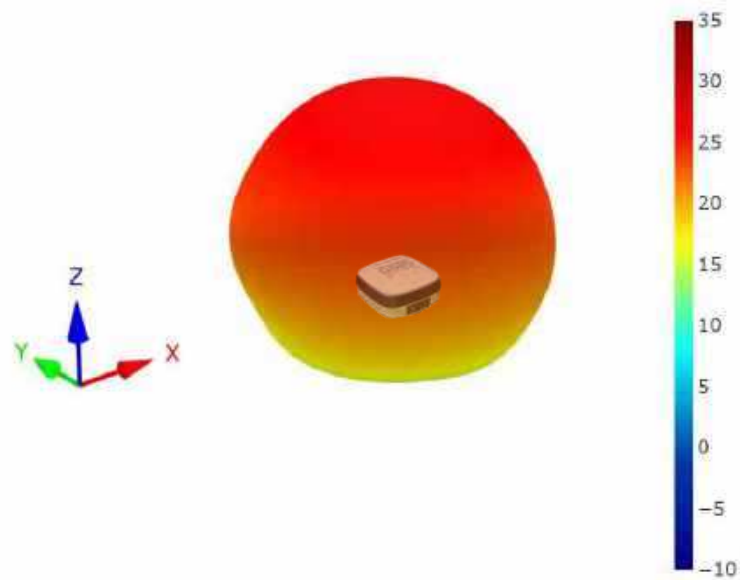
YZ Plane



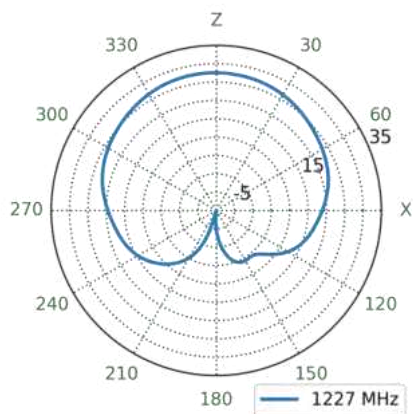
XY Plane



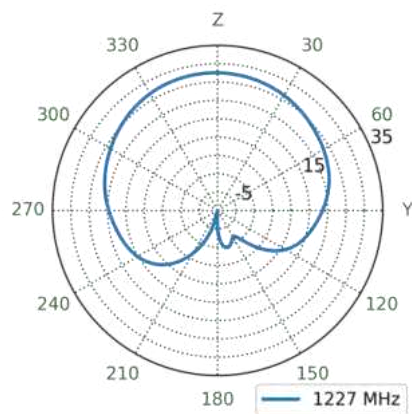
## 5.7 GNSS Patterns at 1228 MHz for GRHP [L2]



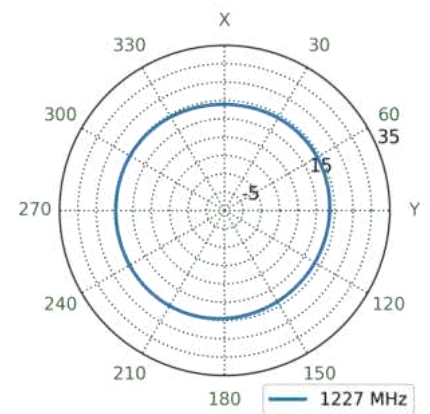
XZ Plane



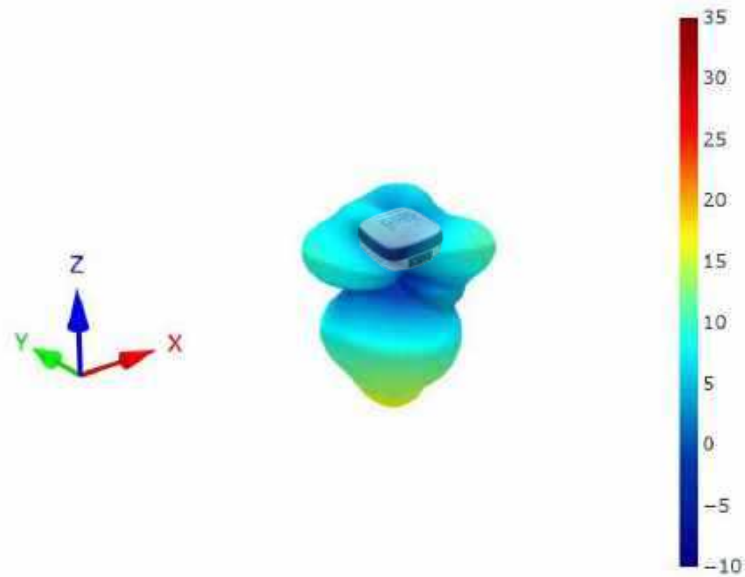
YZ Plane



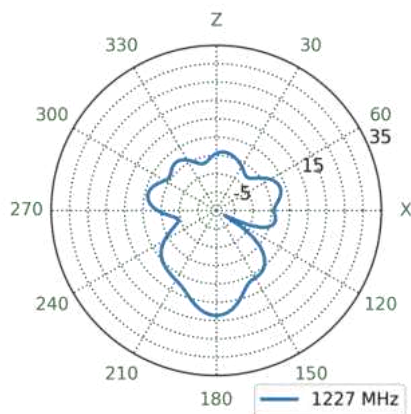
XY Plane



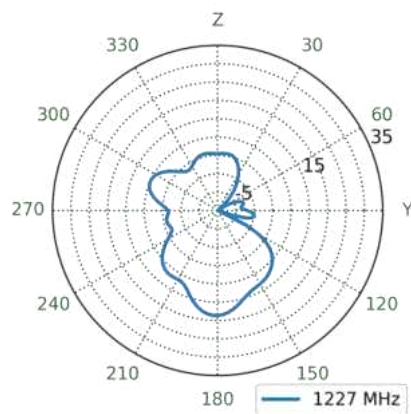
## 5.8 GNSS Patterns at 1228 MHz for GLHP [L2]



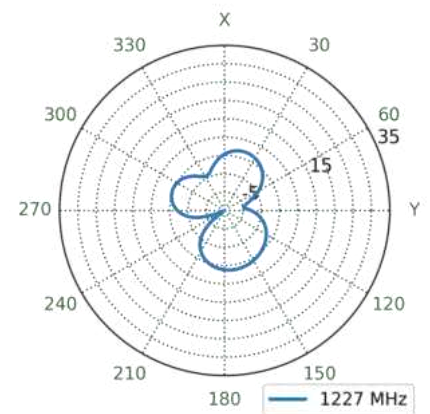
XZ Plane



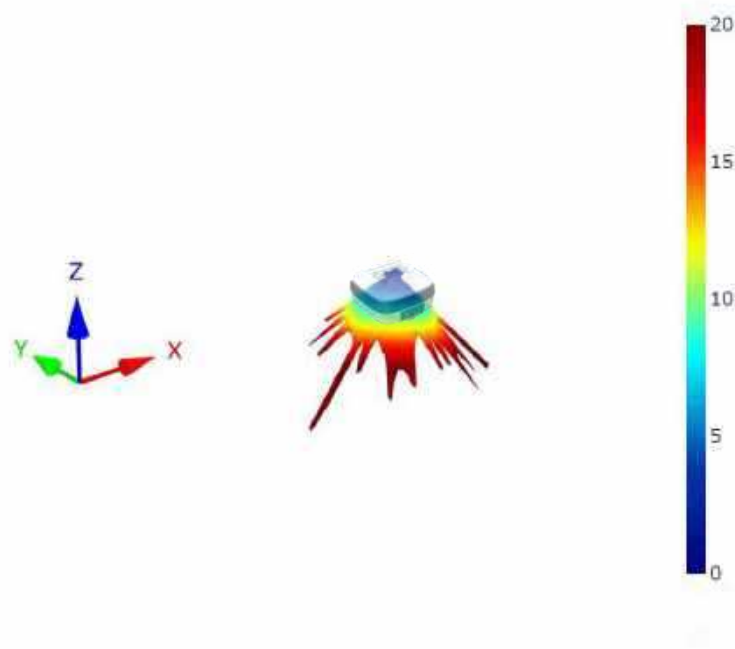
YZ Plane



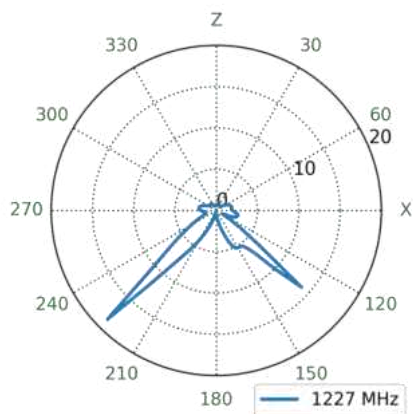
XY Plane



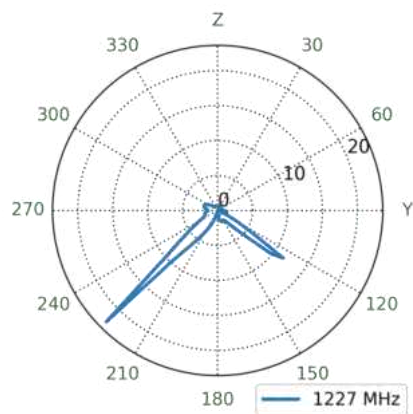
## 5.9 GNSS Patterns at 1228 MHz for AR [L2]



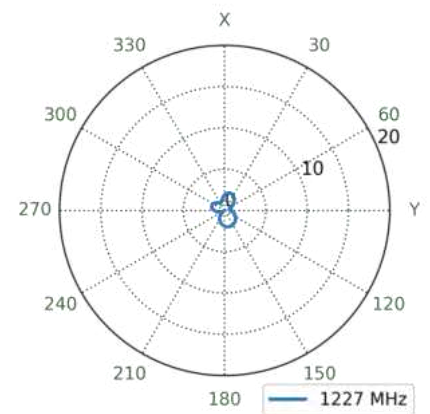
XZ Plane



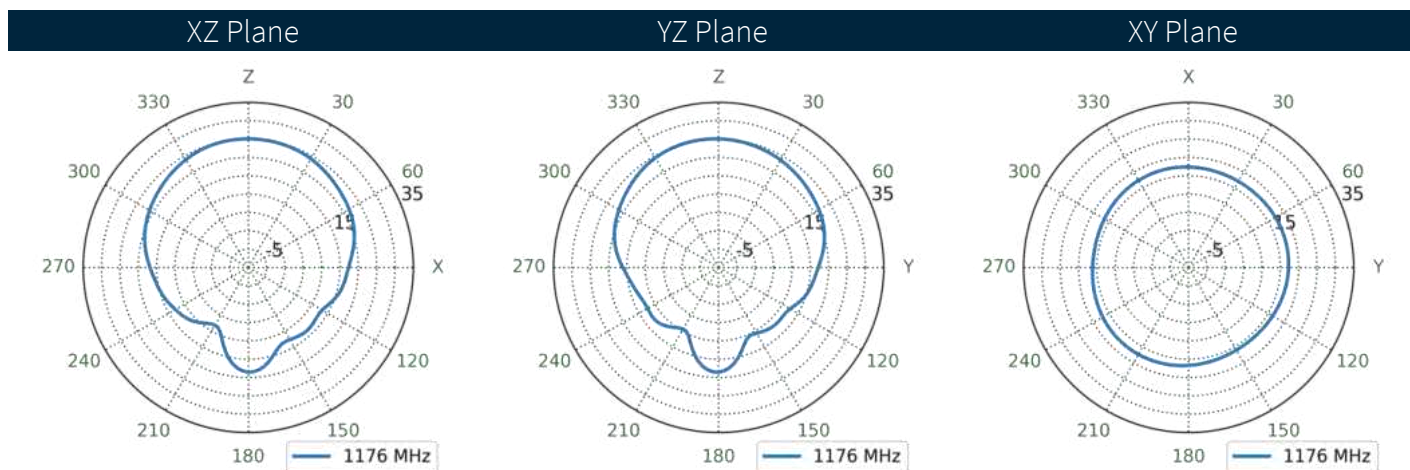
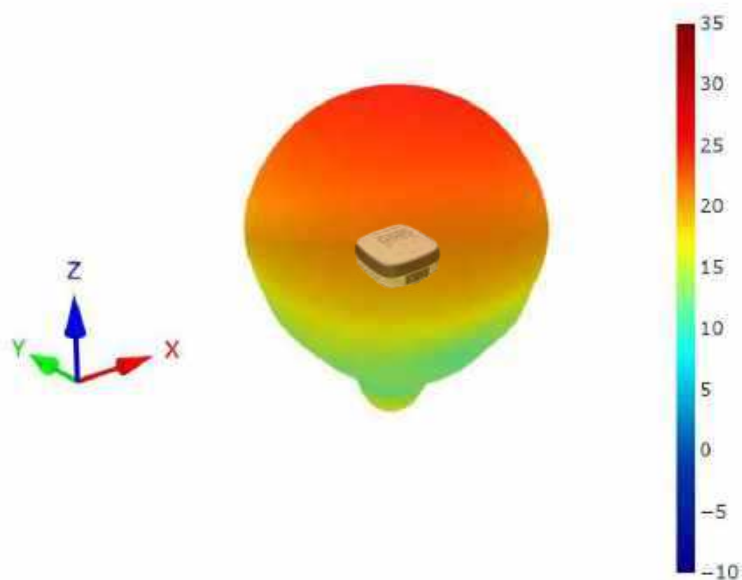
YZ Plane



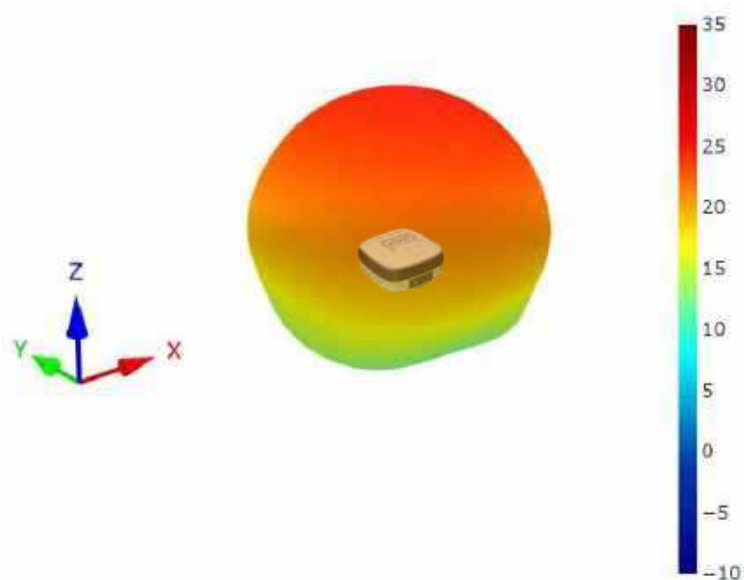
XY Plane



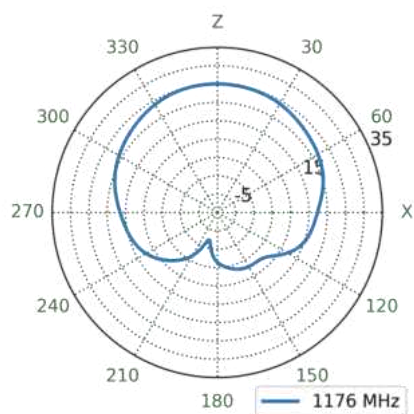
## 5.10 GNSS Patterns at 1176 MHz [L5/B2a/E5a]



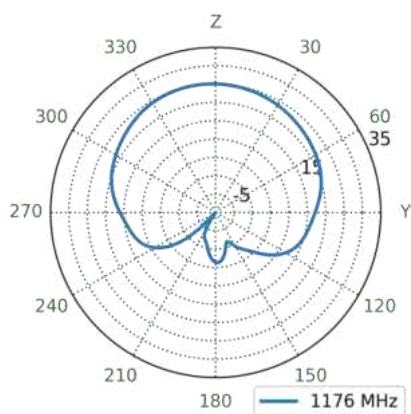
## 5.11 GNSS Patterns at 1176 MHz for GRHP [L5/B2a/E5a]



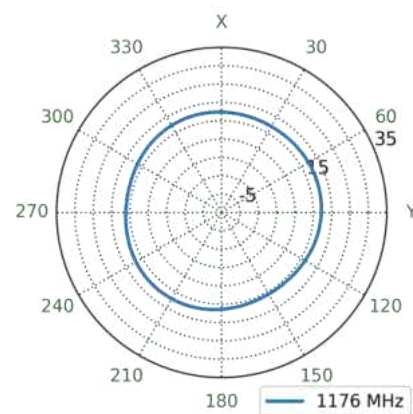
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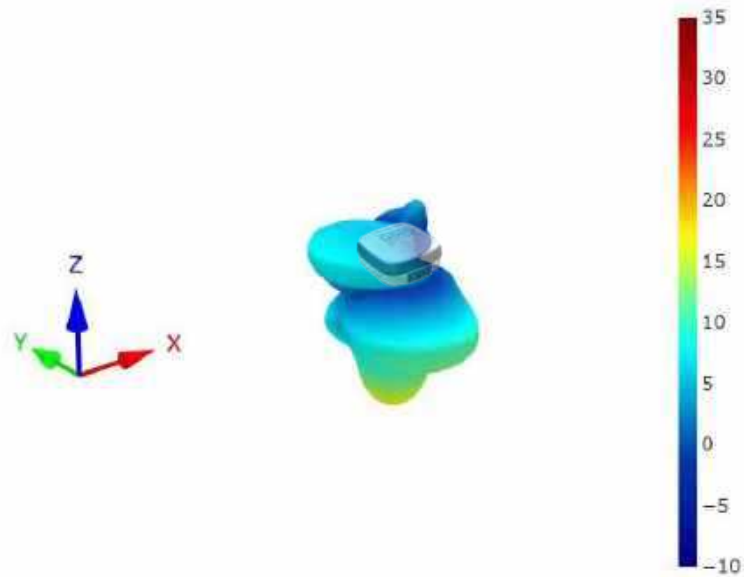
YZ Plane



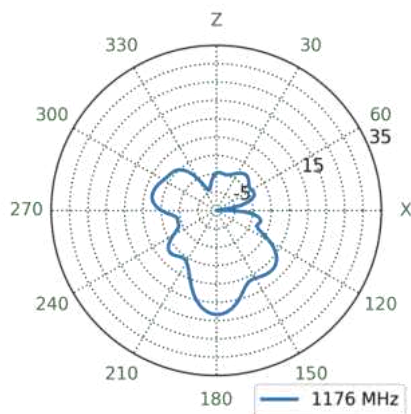
XY Plane



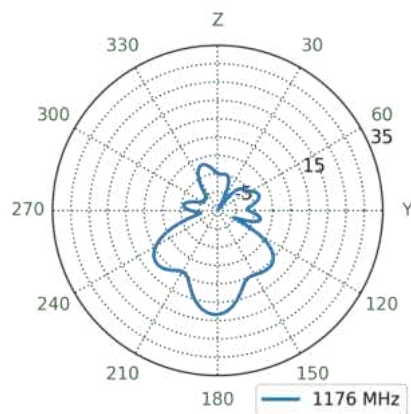
## 5.12 GNSS Patterns at 1176 MHz for GLHP [L5/B2a/E5a]



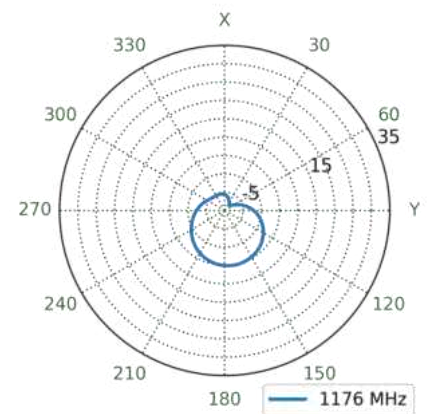
XZ Plane



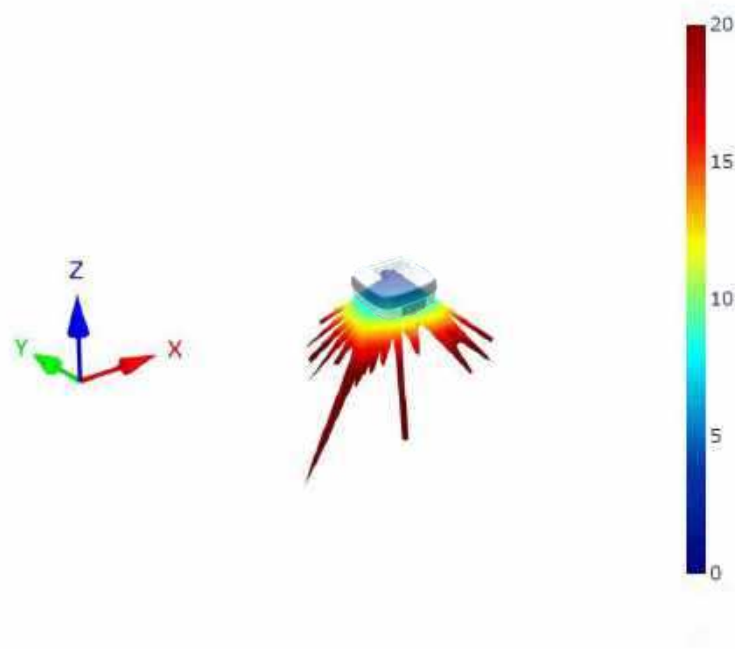
YZ Plane



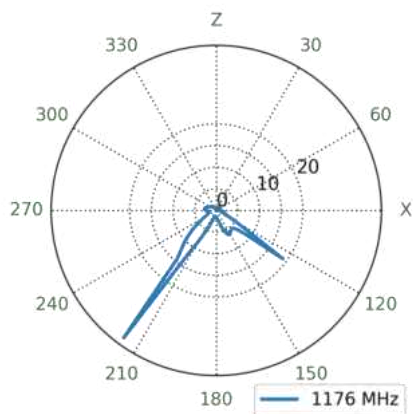
XY Plane



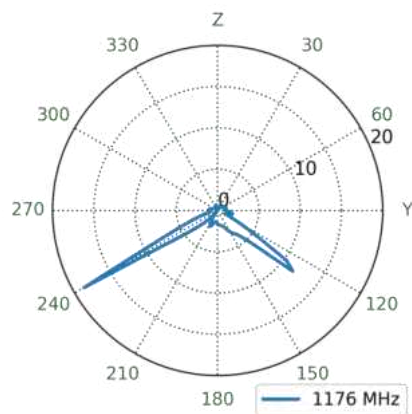
### 5.13 GNSS Patterns at 1176 MHz for AR [L5/B2a/E5a]



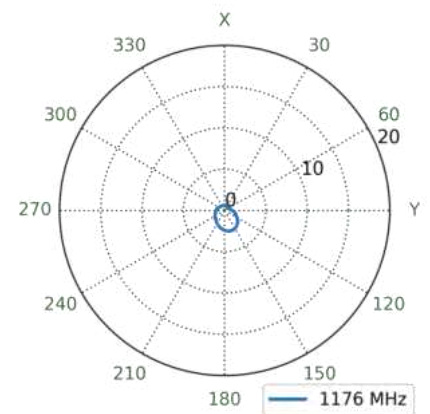
XZ Plane



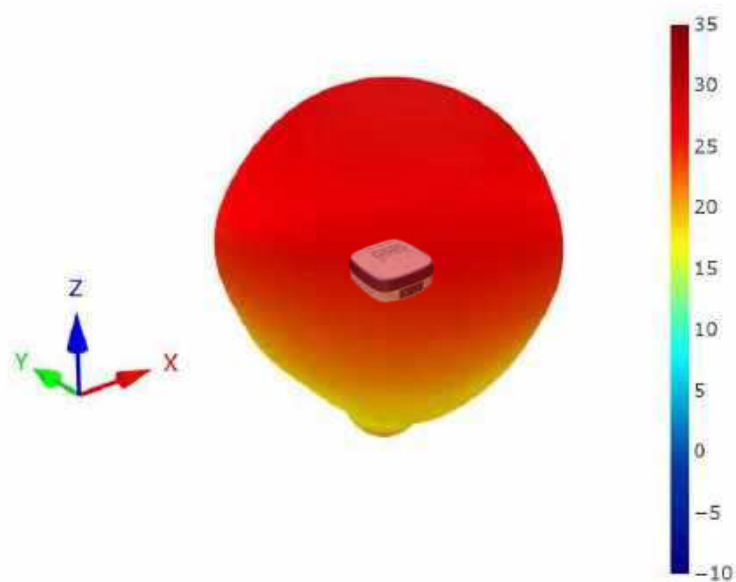
YZ Plane



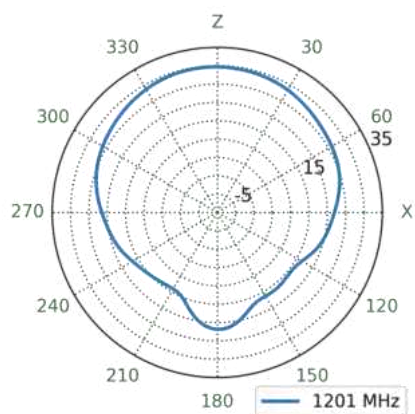
XY Plane



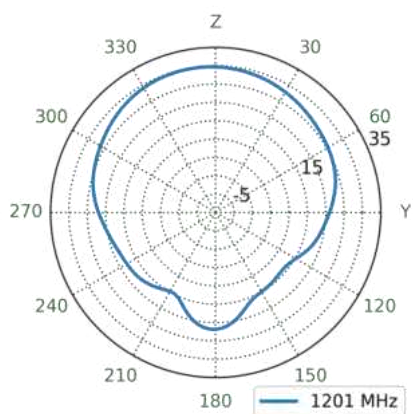
## 5.14 GNSS Patterns at 1201 MHz [B2b/E3b/G3]



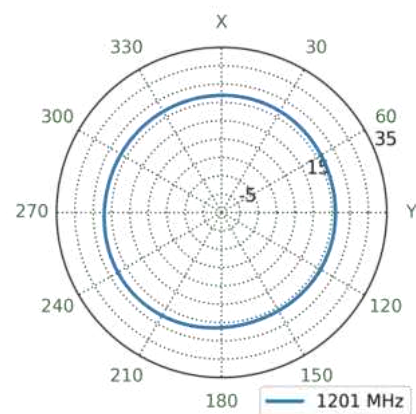
XZ Plane



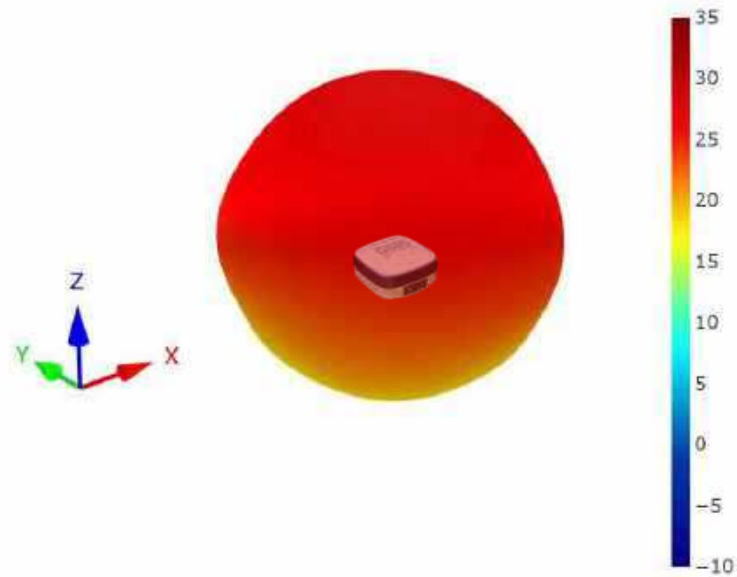
YZ Plane



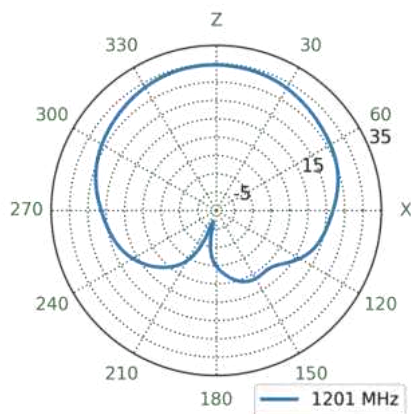
XY Plane



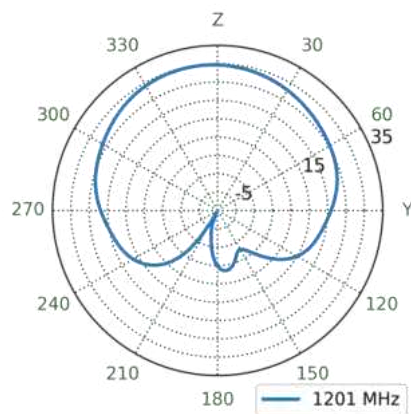
## 5.15 GNSS Patterns at 1201 MHz for GRHP [B2b/E3b/G3]



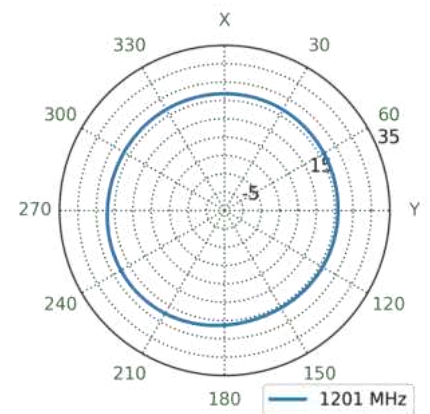
XZ Plane



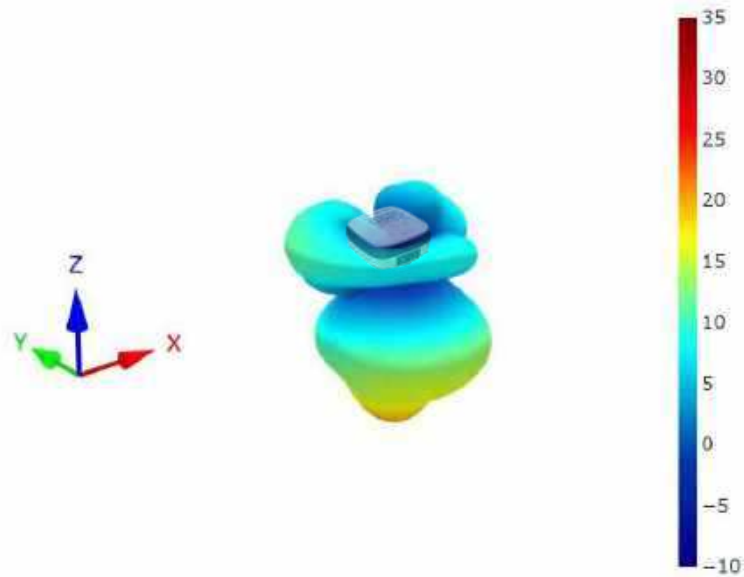
YZ Plane



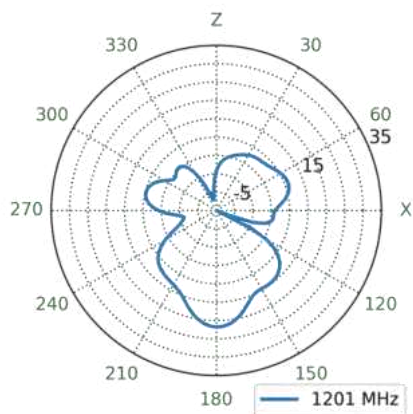
XY Plane



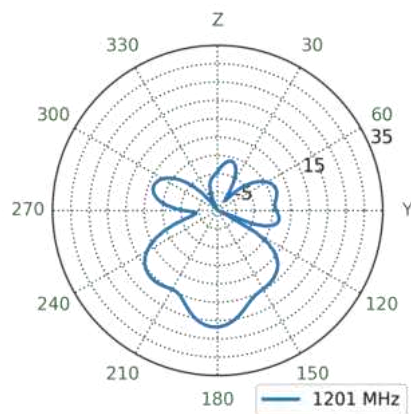
## 5.16 GNSS Patterns at 1201 MHz for GLHP [B2b/E3b/G3]



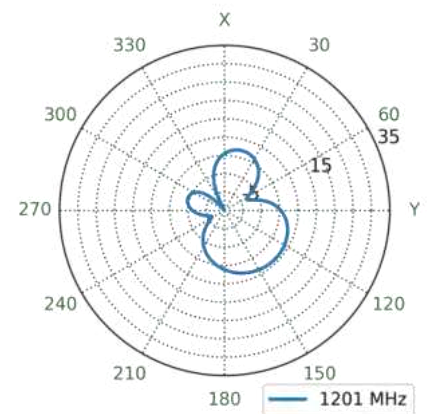
XZ Plane



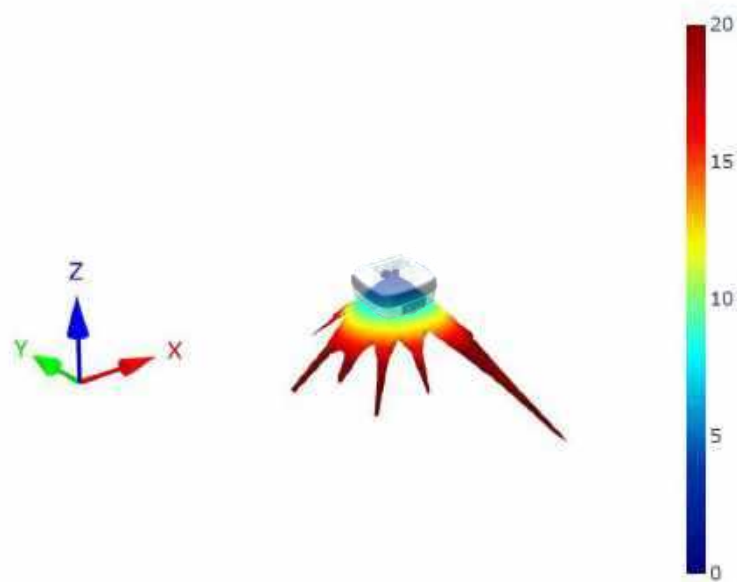
YZ Plane



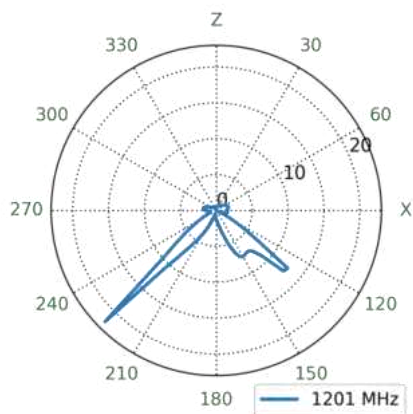
XY Plane



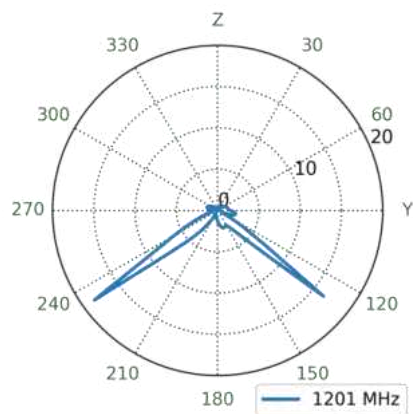
## 5.17 GNSS Patterns at 1201 MHz for AR [B2b/E3b/G3]



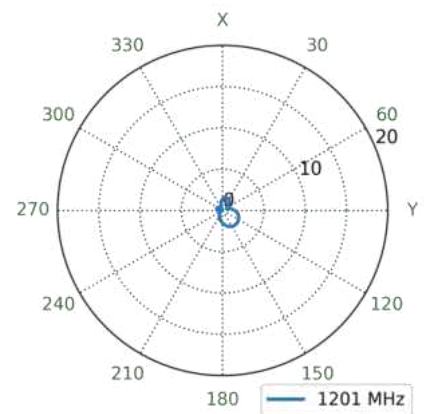
XZ Plane



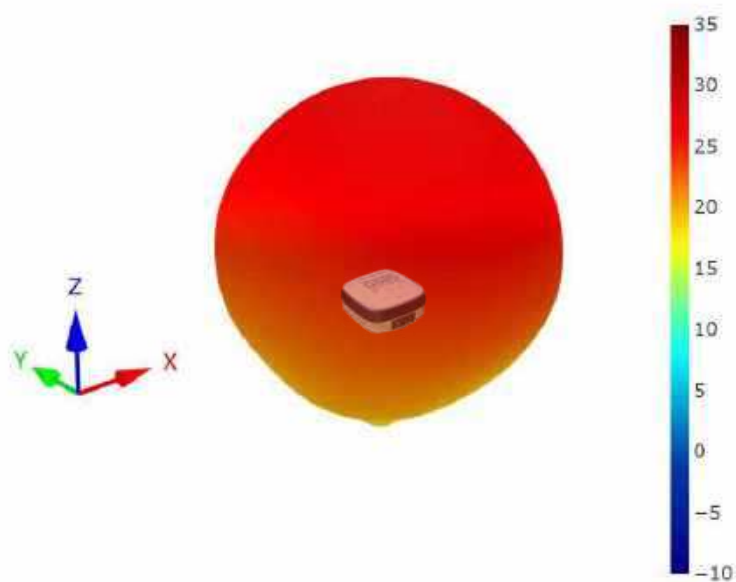
YZ Plane



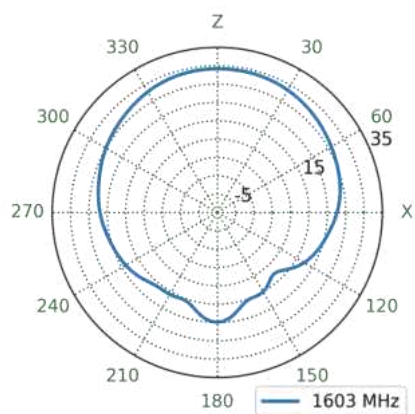
XY Plane



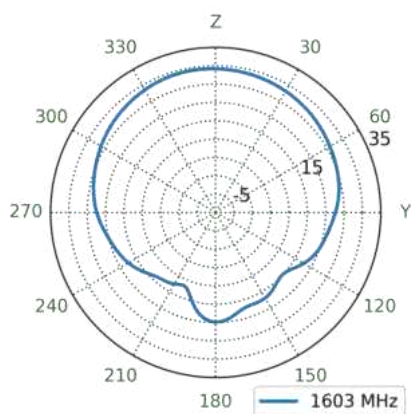
## 5.18 GNSS Patterns at 1603 MHz [G1]



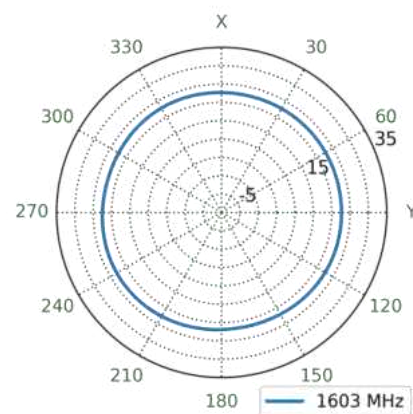
XZ Plane



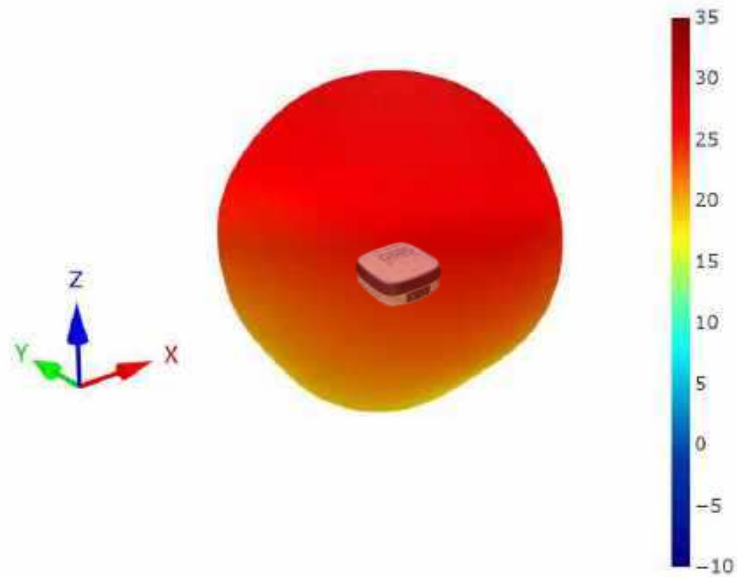
YZ Plane



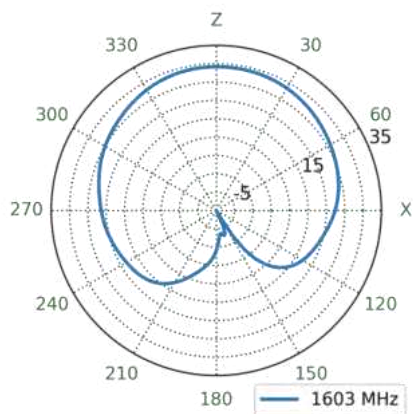
XY Plane



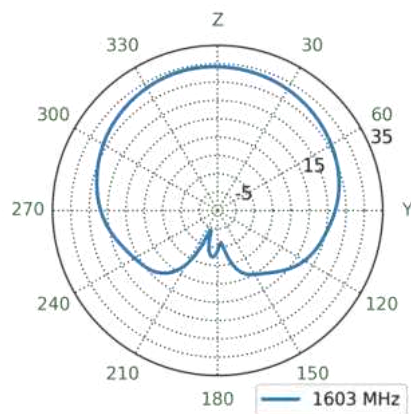
## 5.19 GNSS Patterns at 1603 MHz for GRHP [G1]



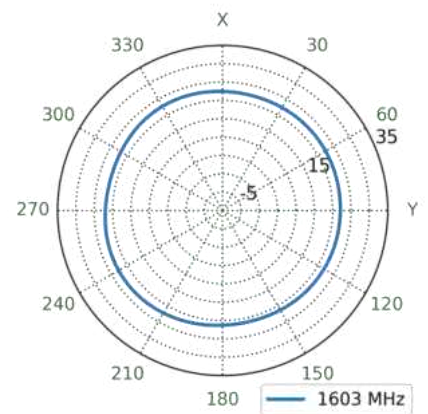
XZ Plane



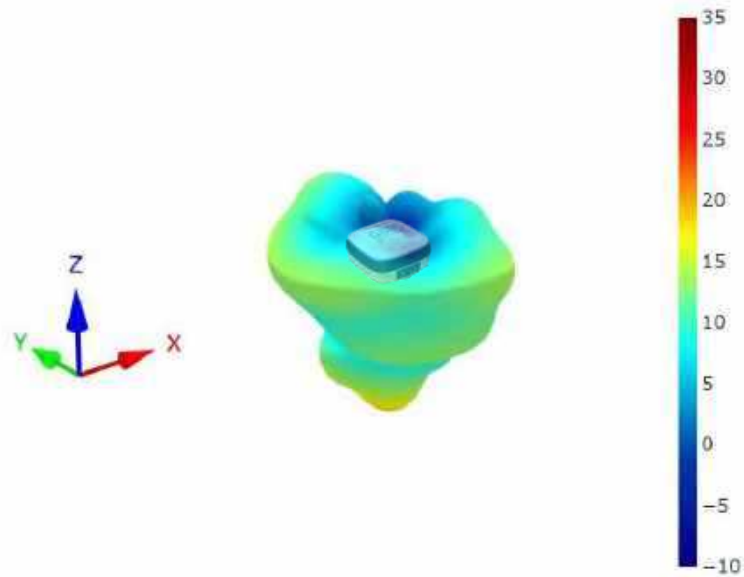
YZ Plane



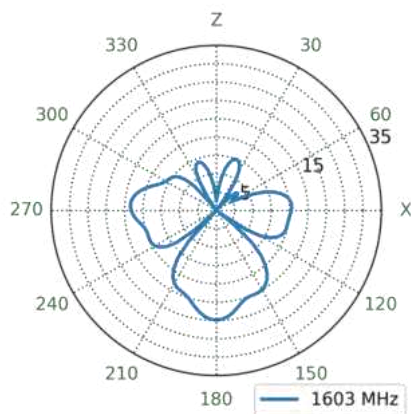
XY Plane



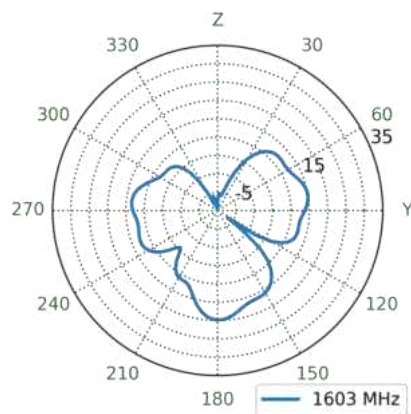
## 5.20 GNSS Patterns at 1603 MHz for GLHP [G1]



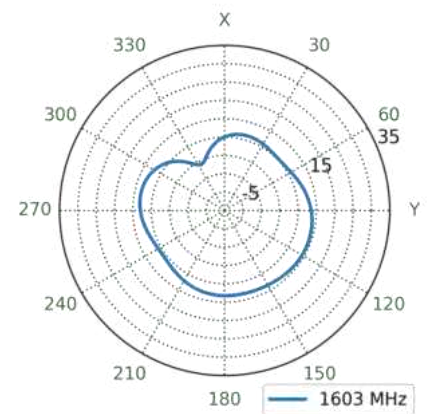
XZ Plane



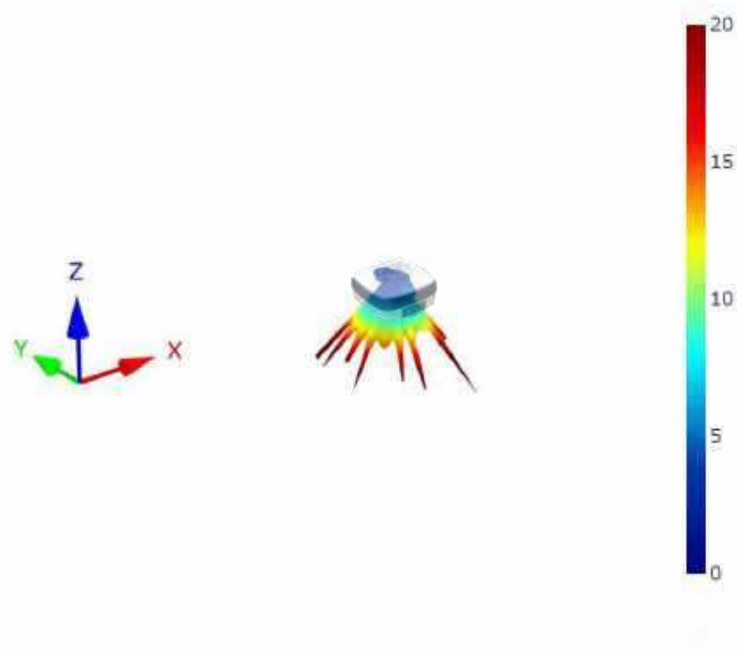
YZ Plane



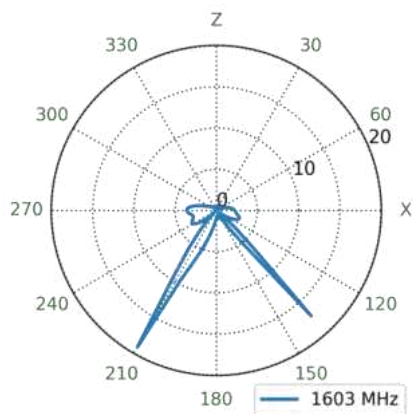
XY Plane



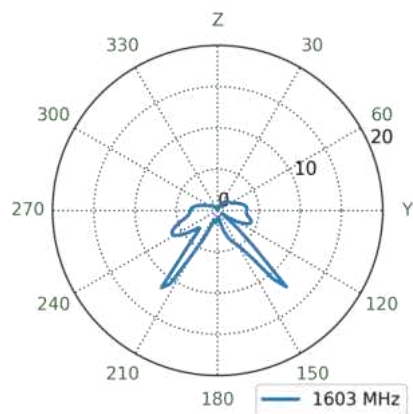
## 5.21 GNSS Patterns at 1603 MHz for AR [G1]



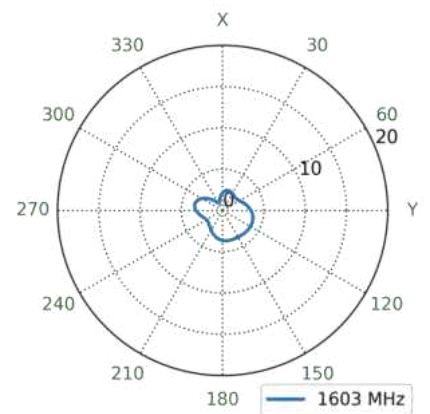
XZ Plane



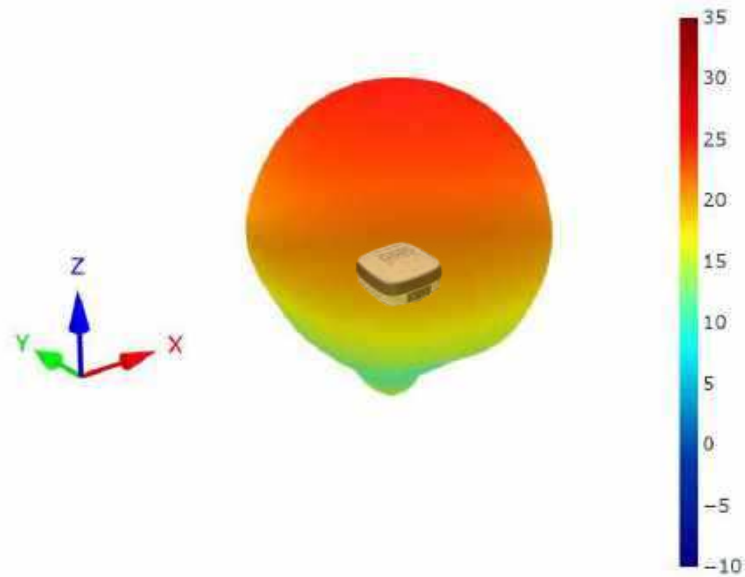
YZ Plane



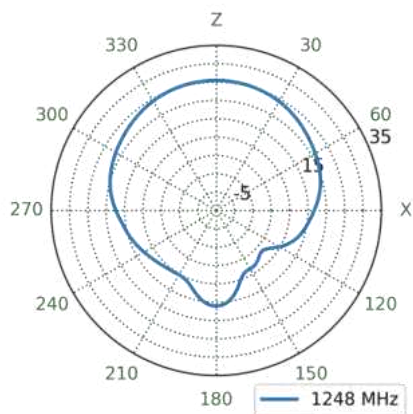
XY Plane



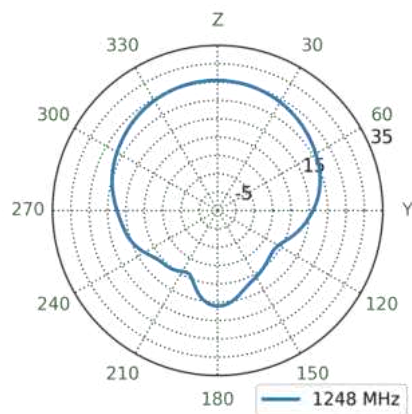
## 5.22 GNSS Patterns at 1248 MHz [G2]



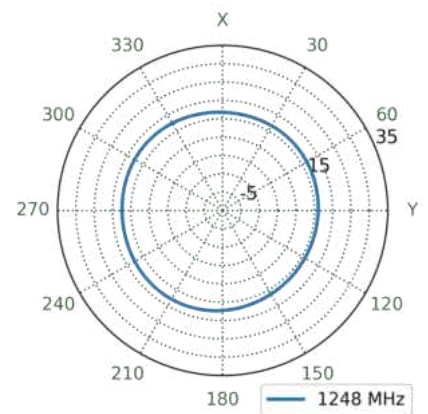
XZ Plane



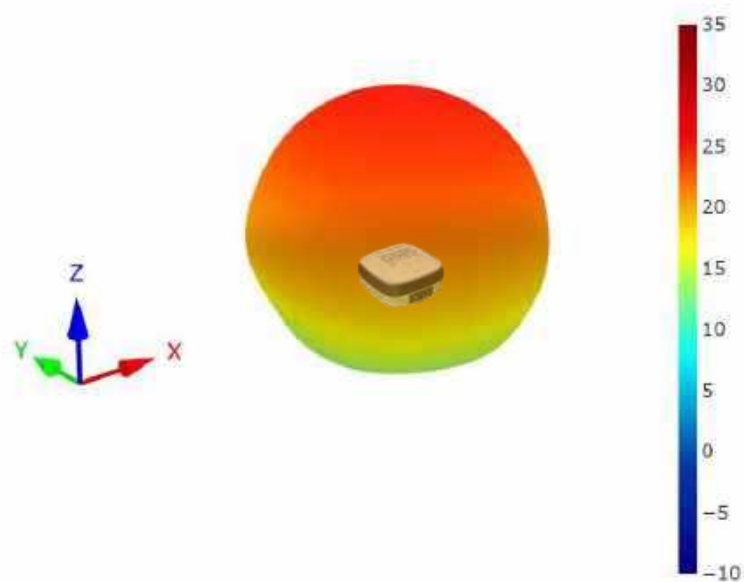
YZ Plane



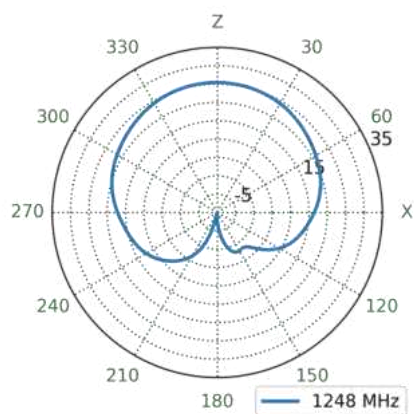
XY Plane



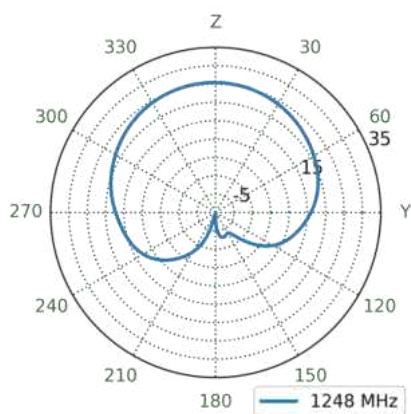
## 5.23 GNSS Patterns at 1248 MHz for GRHP [G2]



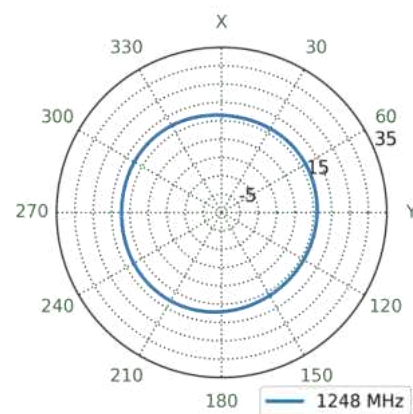
XZ Plane



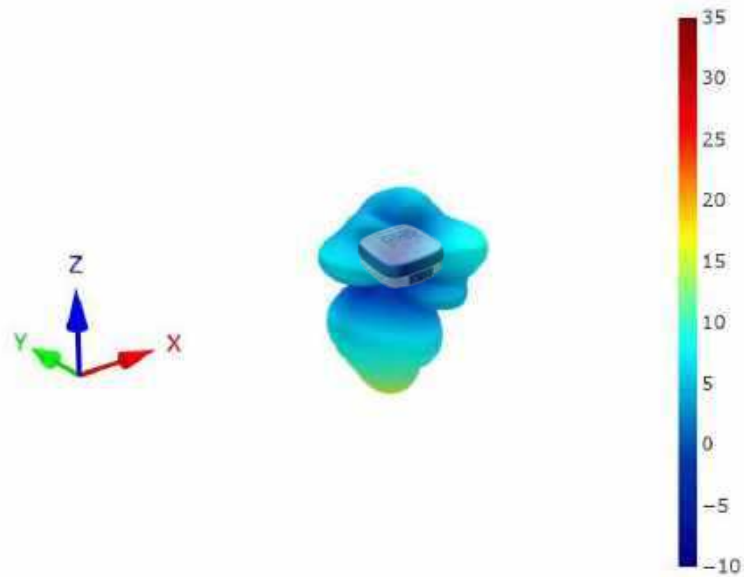
YZ Plane



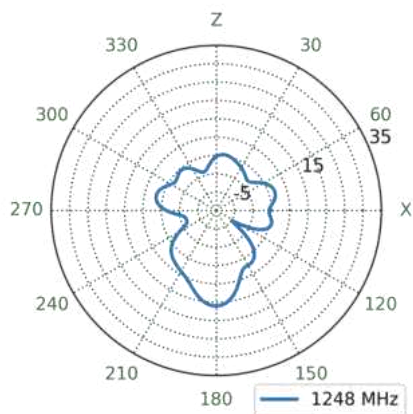
XY Plane



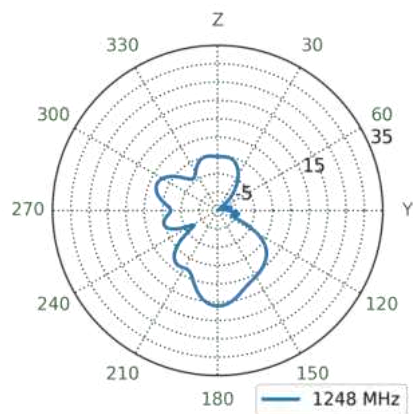
## 5.24 GNSS Patterns at 1248 MHz for GLHP [G2]



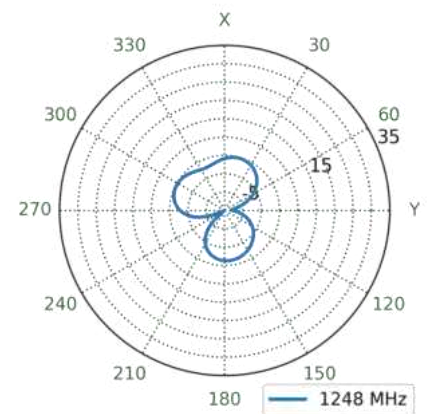
XZ Plane



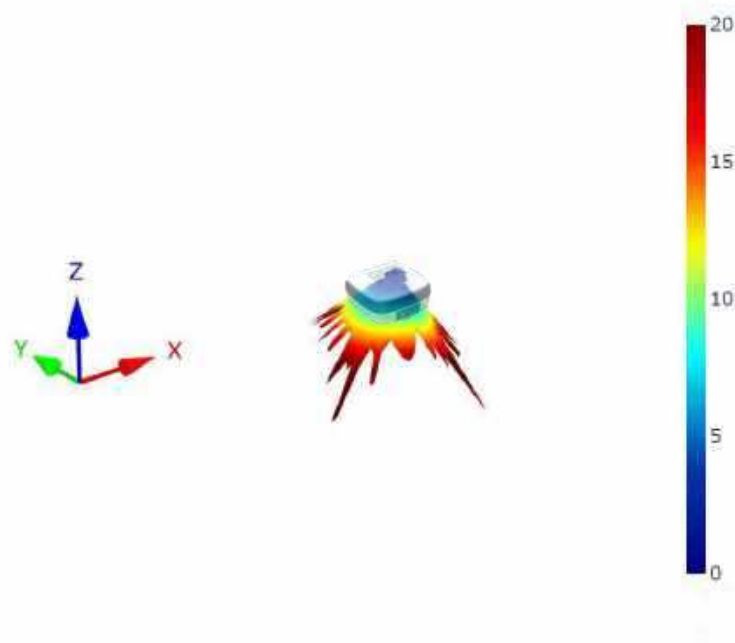
YZ Plane



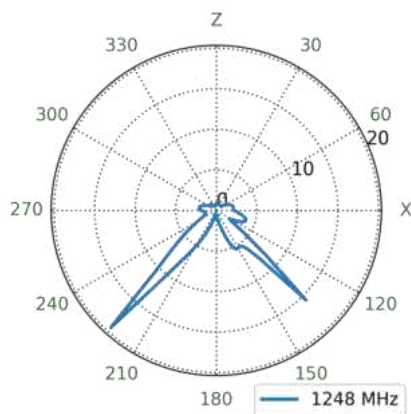
XY Plane



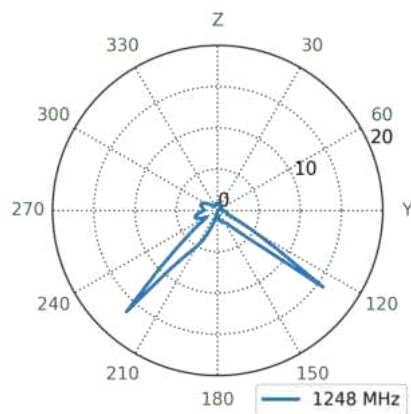
## 5.25 GNSS Patterns at 1248 MHz for AR [G2]



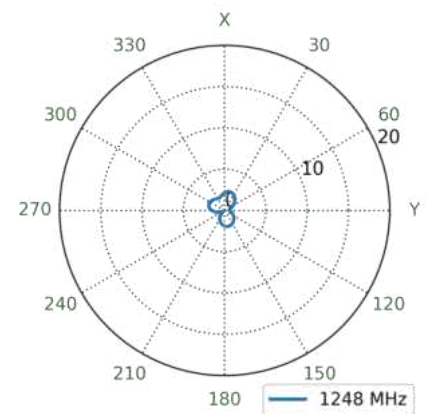
XZ Plane



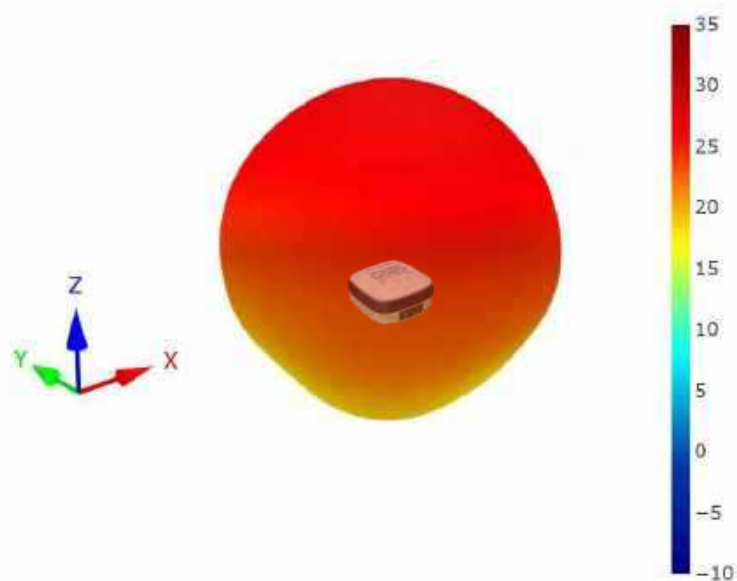
YZ Plane



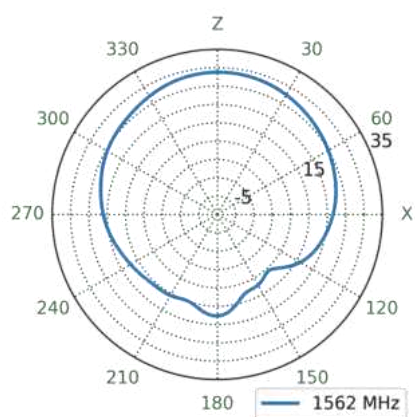
XY Plane



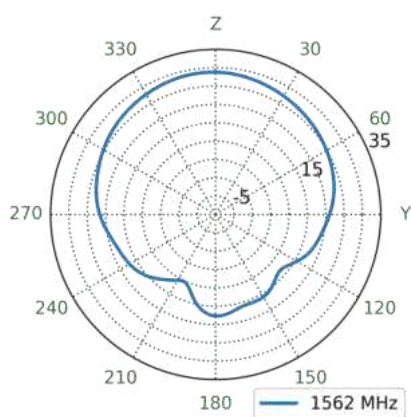
## 5.26 GNSS Patterns at 1562 MHz [B11]



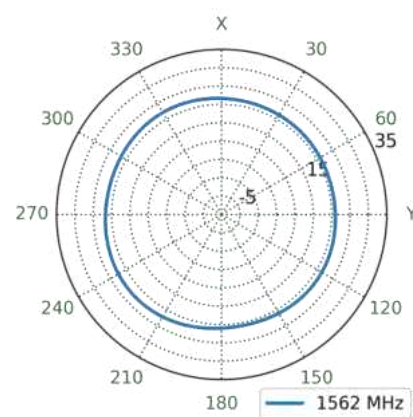
XZ Plane



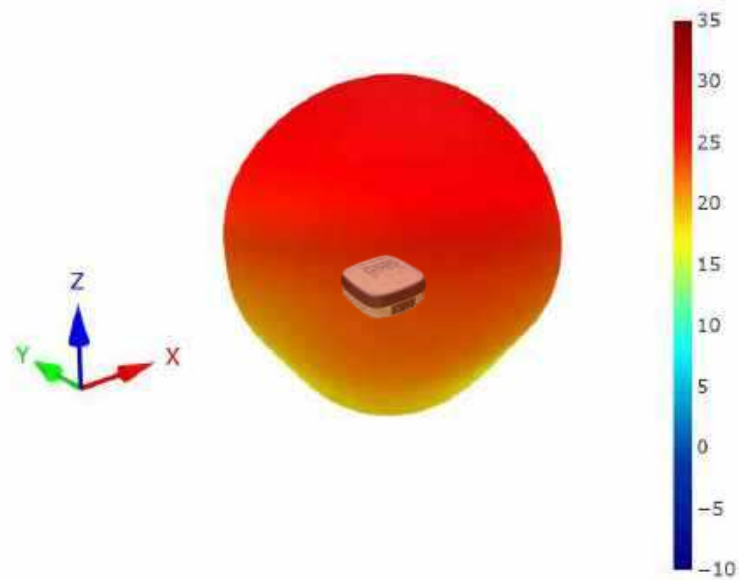
YZ Plane



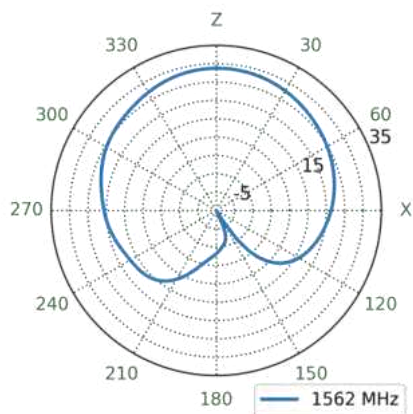
XY Plane



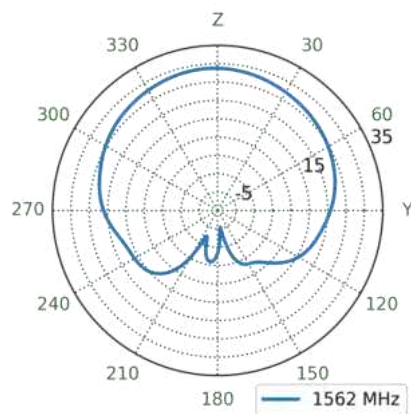
## 5.27 GNSS Patterns at 1562 MHz for GRHP [B1I]



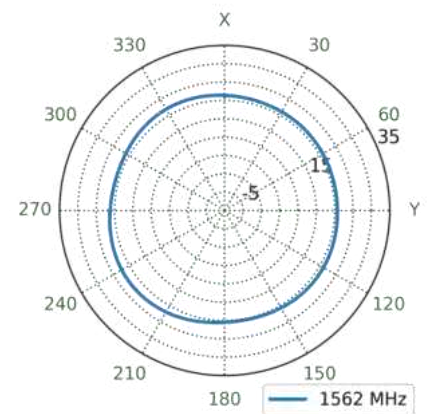
XZ Plane



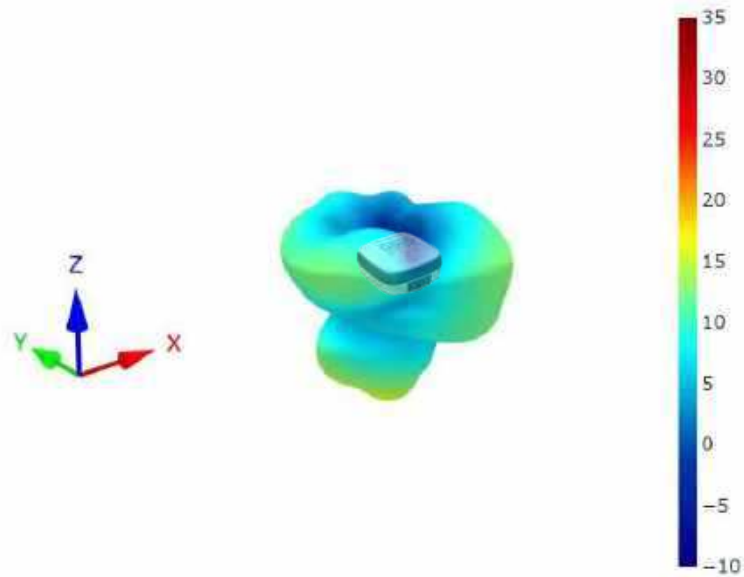
YZ Plane



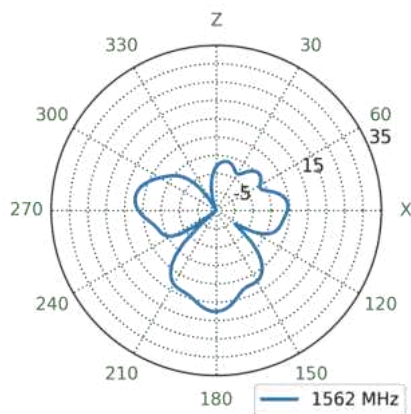
XY Plane



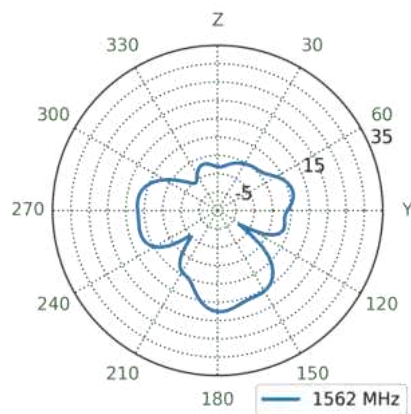
## 5.28 GNSS Patterns at 1562 MHz for GLHP [B1I]



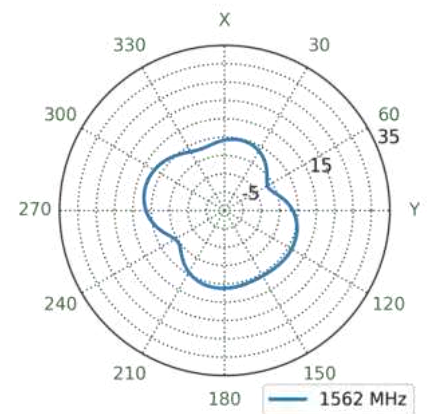
XZ Plane



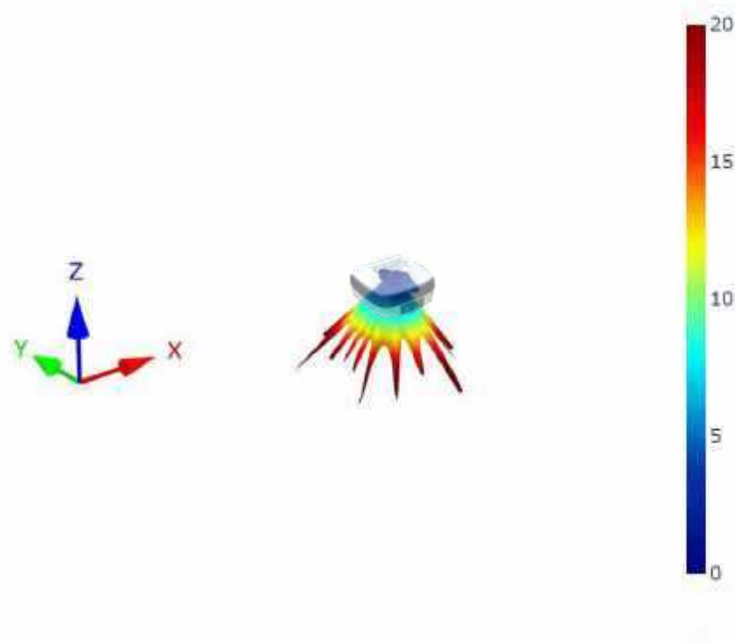
YZ Plane



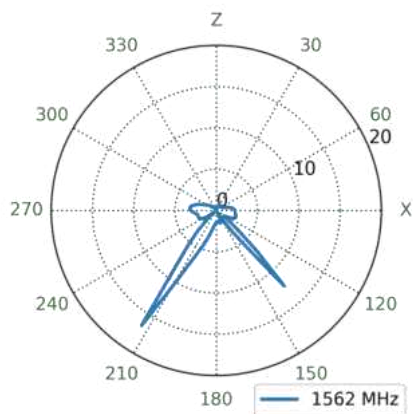
XY Plane



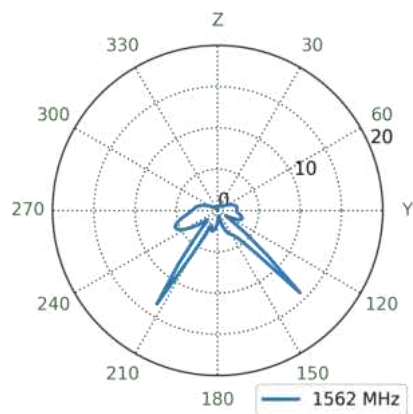
## 5.29 GNSS Patterns at 1562 MHz for AR [B1I]



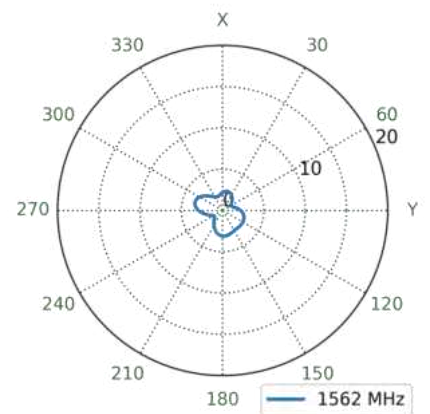
XZ Plane



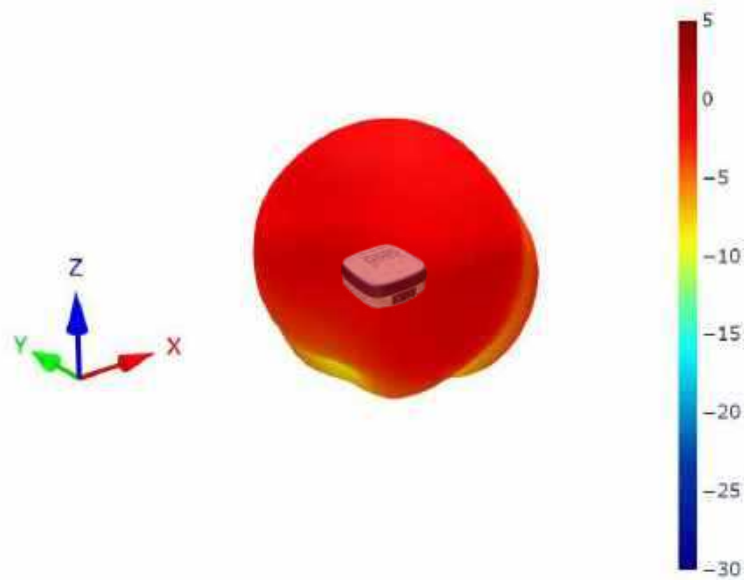
YZ Plane



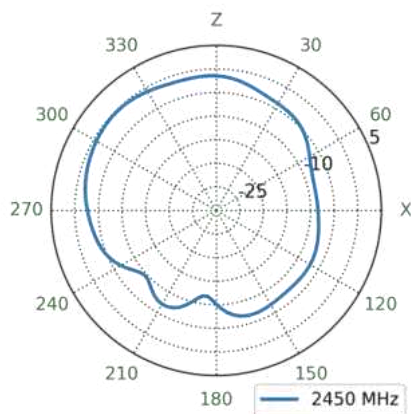
XY Plane



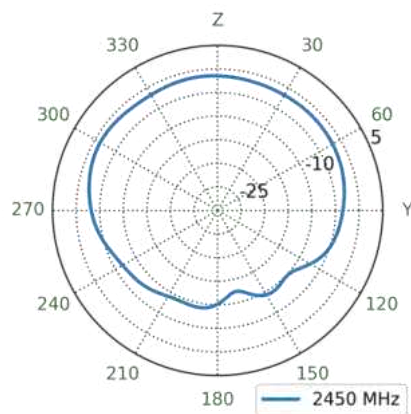
## 5.30 Wi-Fi1 Patterns at 2450 MHz



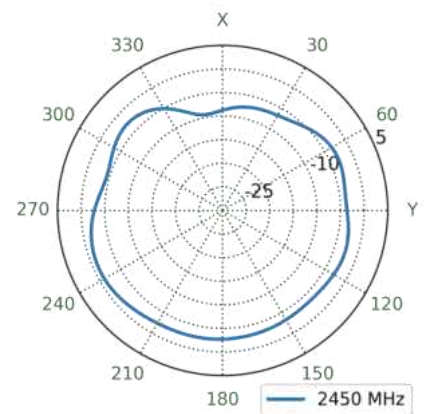
XZ Plane



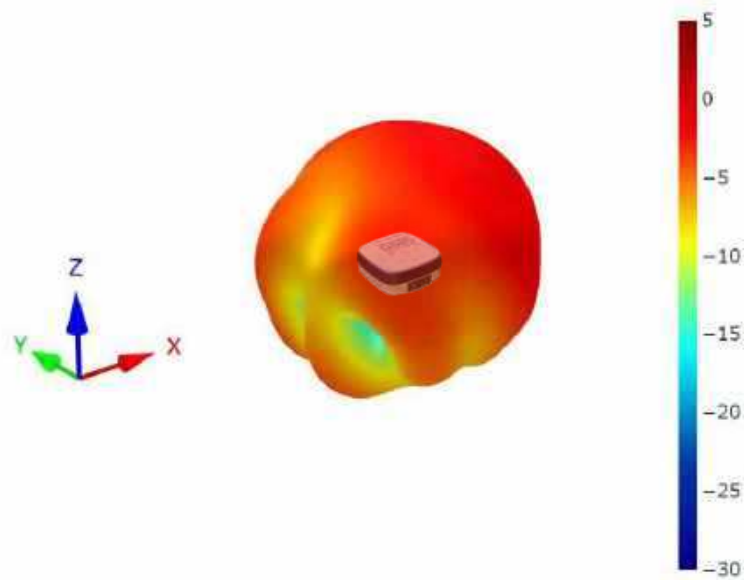
YZ Plane



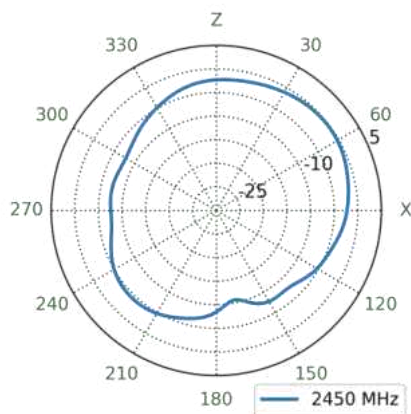
XY Plane



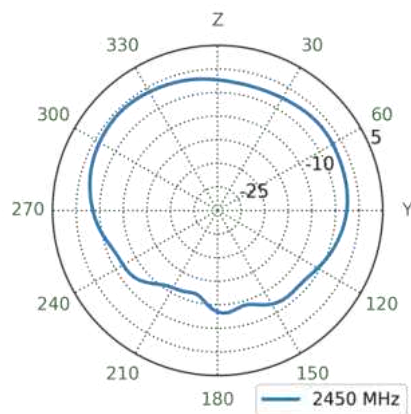
## 5.31 Wi-Fi2 Patterns at 2450 MHz



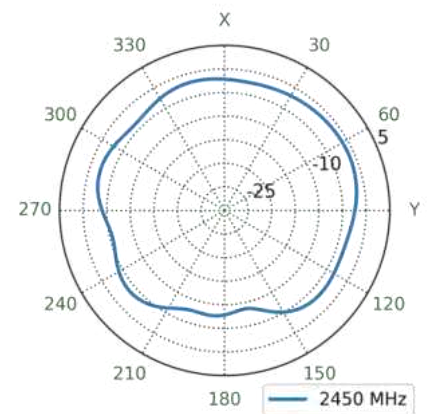
XZ Plane



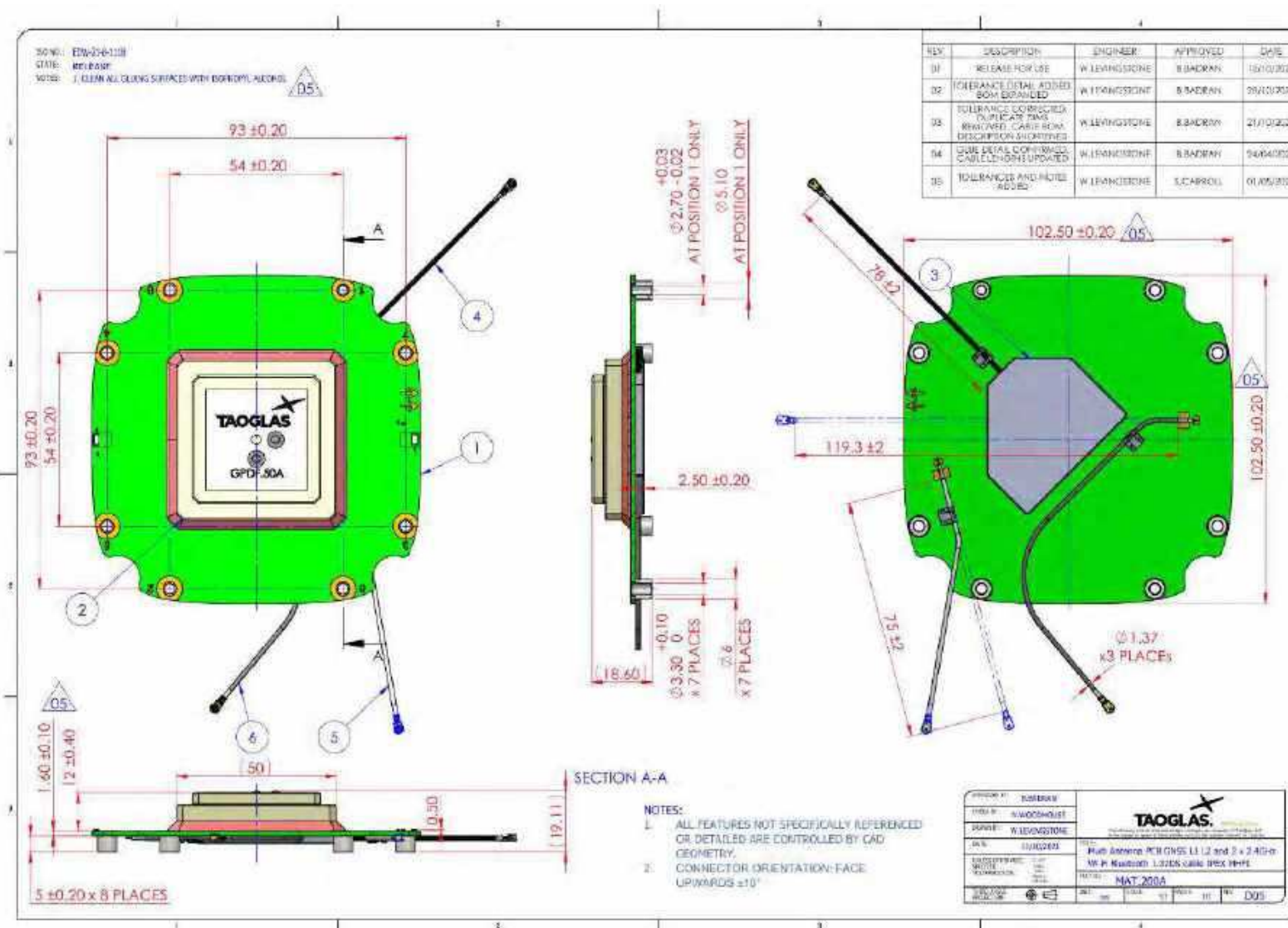
YZ Plane



XY Plane



## 6. Mechanical Drawings





| ITEM NO. | DESCRIPTION                                                  | MATERIAL | FINISH        | QTY. |
|----------|--------------------------------------------------------------|----------|---------------|------|
| 2        | PCBA (R04 5012 W/4 ETX)                                      | -        | -             | 1    |
|          | PCB                                                          | FR4 LOT  | BLACK         | 1    |
|          | WAGO                                                         | CERAMIC  | NATURAL       | 2    |
|          | SPOT CABLE CLIP                                              |          | TIN           | 3    |
|          | 940 STEPS, SPACER WITH THROUGH HOLE                          | STEEL    | TIN           | 5    |
|          | 940 STEPS, SPACER WITH THROUGH HOLE                          | STEEL    | TIN           | 7    |
| 2        | ANTENNA GNS G0005                                            | CERAMIC  | NATURAL       | 1    |
|          | SHIELD CASE FOR G0005/2                                      | SPR      | NICKEL PLATED | 1    |
| 4        | IPX1 (0.1, COMPATIBLE) AU PLATED FOR 1.37 LOW LOSS (BLACK)   |          |               | 1    |
|          | 1.37 COAXIAL CABLE (LOW LOSS); BLACK                         | COAX     | BLACK         | 1    |
|          | IPX1 MHWT 1.37 BRASS AU PLATED                               | BRASS    | AU PLATED     | 1    |
| 5        | IPX1 (0.1, COMPATIBLE) AU PLATED FOR 1.37 MICRO COAX (WHITE) |          |               | 1    |
|          | 1.37 COAX CABLE WHITE                                        | COAX     | WHITE         | 1    |
|          | IPX1 MHWT 1.37 BRASS AU PLATED                               | BRASS    | AU PLATED     | 1    |
| 6        | IPX1 (0.1, COMPATIBLE) AU PLATED FOR 1.37 MICRO COAX (GRAY)  |          |               | 1    |
|          | 1.37 COAXIAL CABLE (SPR GRAY)                                | COAX     | GRAY          | 1    |
|          | IPX1 MHWT 1.37 BRASS AU PLATED                               | BRASS    | AU PLATED     | 1    |
| 7        | AMP 2P600L 230004                                            | ALU      | BRIDGE-RED    | 1    |

### ISOMETRIC VIEWS

NOTES:

1. ALL FEATURES NOT SPECIFICALLY REFERENCED OR DETAILED ARE CONTROLLED BY CAD GEOMETRY
2. CONNECTOR ORIENTATION: FACE UPWARDS ±10°
3. CLEAN ALL GLUING SURFACES WITH ISOPROPYL ALCOHOL

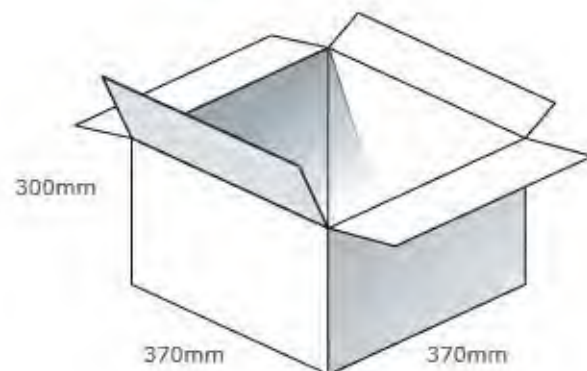
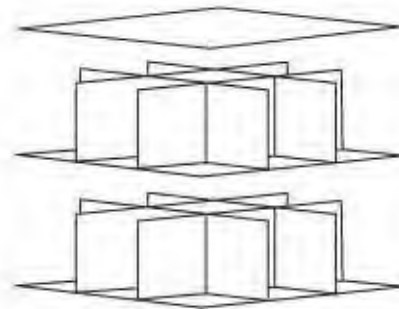
|                  |                                                                         |
|------------------|-------------------------------------------------------------------------|
| NOVOTEC          | TAOGLAS                                                                 |
| DATE: 09/10/2024 | MULTI ARMED PCB CHSE L2 AND 2 x 24W LED Bluetooth 1.3765 cable IPER B&F |
|                  | MAT. 2024                                                               |

## 7. Packaging

1 pcs per antistatic bubble bag + PE Bag  
1 PCS per Desiccant 3g  
Weight : 130g



72 PCS per Carton  
4 PCS per Pocket  
2 PCS per Frame  
3 PCS per Bulkhead Board  
Carton Label  
Carton(mm) 370x370x300



Changelog for the datasheet

SPE-23-8-082 – MAT.200A

| Revision: B (Current Version) |                                               |
|-------------------------------|-----------------------------------------------|
| Date:                         | 2023-05-16                                    |
| Notes:                        | Implemented changes after feedback from Leica |
| Author:                       | Lukas van Vuuren                              |

Previous Revisions

| Revision: A (Original First Release) |                         |
|--------------------------------------|-------------------------|
| Date:                                | 2023-04-03              |
| Notes:                               | New Datasheet for Leica |
| Author:                              | Gary West               |



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