

## SPECIFICATION

|              |   |                                                                                                                                                                                                                                                                                                                                                                              |
|--------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part No.     | : | <b>MA850.A.LBICG.001</b>                                                                                                                                                                                                                                                                                                                                                     |
| Product Name | : | MA850 5in1 Permanent Mount Antenna<br>LTE MIMO*2, Wi-Fi MIMO*2 &<br>GPS/GLONASS/GALILEO/BeiDou                                                                                                                                                                                                                                                                               |
| Features     | : | 2* LTE MIMO<br>698~960MHz/1710~2170MHz/2490~2690MHz<br>2* Wi-Fi MIMO 2.4GHz/5.8GHz<br>1* GPS-GLONASS-GALILEO-BeiDou Antenna<br>Permanent Mount<br>Worldwide 4G Bands including 3G and 2G<br>IP67 Enclosure<br>Dims: Diameter 94.3mm, Height 57.4mm<br>0.3M RG174 with SMA(M)/RP-SMA(M) connectors as<br>standard<br>Custom Cables and Connectors Available<br>RoHS Compliant |



## 1. Introduction

The Colosseum MA850 5in1 antenna is a low profile, heavy-duty, fully IP67 waterproof external M2M antenna for use in worldwide telematics applications which require best in class LTE, Wi-Fi and GNSS performance. It is ideal for solutions that do not have space for mounting the larger Pantheon dome antennas but still require good efficiency and gain.

This unique product, at only 57.4mm tall, delivers powerful worldwide 4G LTE MIMO antenna technology at 700MHz/800MHz/1700MHz/1800MHz/2600MHz, dual-band Wi-Fi MIMO, plus GPS-GLONASS-GALILEO-BeiDou for next generation location accuracy. The LTE antenna also includes legacy 3G and 2G bands to enable fallback using the correct modems in areas where there is no 4G signal.

Typical Applications include:

- Bus Telematics
- Remote Asset and Pipeline Monitoring
- HD Video over LTE
- First Responder and Emergency Services
- Automotive Vehicle Tracking and Telematics

LTE 4G applications demand high speed data uplink and downlink. High efficiency and high gain MIMO antennas are necessary to achieve the required signal to noise ratio and throughput required to solve these challenges. Taoglas also takes care to have high isolation between the two MIMO antennas to prevent self-interference. Low loss cables are used to keep efficiency high over long cable lengths. In contrast, smaller MIMO antennas with poorer quality thinner cables will have much reduced efficiency and isolation, which would lead to a large drop in system throughput or drops, and may indeed not make a system connection at all.

The GPS-GLONASS-GALILEO-BeiDou active antenna has been carefully designed to work well on GPS, GLONASS, GALILEO and BeiDou L1 bands, leading to higher location accuracy and stability of tracking in urban environments.

Cable length and connector types are customizable. Contact your regional Taoglas sales office for support.

## 2. Specification (30\*30cm Ground Plane)

| GPS-GLONASS-GALILEO-BeiDou                                 |                                                                                |                    |                    |                    |
|------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------|--------------------|--------------------|
| Center Frequency                                           | GPS/GALILEO:1575.42±1.023MHz<br>GLONASS:1602±5MHz<br>BeiDou:1561.098±2.046MHz  |                    |                    |                    |
| Passive Antenna Efficiency                                 | GPS/GALILEO: 44%<br>GLONASS: 58%<br>BeiDou: 49%                                |                    |                    |                    |
| Passive Antenna Average Gain                               | GPS/GALILEO: -3.5dBi<br>GLONASS: -2.4dBi<br>BeiDou: -3.1dBi                    |                    |                    |                    |
| Passive Antenna Peak Gain                                  | GPS/GALILEO: 2.3dBi<br>GLONASS: 4.3dBi<br>BeiDou: 3.3dBi                       |                    |                    |                    |
| VSWR                                                       | 3:1 Max                                                                        |                    |                    |                    |
| Impedance                                                  | 50Ω                                                                            |                    |                    |                    |
| Axial Ratio                                                | GPS/GALILEO:<6.2<br>GLONASS:<9.8<br>BeiDou:<16.5                               |                    |                    |                    |
| Polarization                                               | RHCP                                                                           |                    |                    |                    |
| Cable                                                      | 0.3 meter RG174 standard, fully customizable                                   |                    |                    |                    |
| Connector                                                  | SMA(M), standard, fully customizable                                           |                    |                    |                    |
| LNA and Filter Electrical Properties                       |                                                                                |                    |                    |                    |
| Center Frequency                                           | GPS/GALILEO:1575.42±1.023MHz<br>GLONASS:1602±5MHz<br>BeiDou: 1561.098±2.046MHz |                    |                    |                    |
| Pout 1dB Gain<br>Compression Point                         | -6dBm Min. -2 dBm Typ. (1561MHz,1575.42MHz,1602MHz)                            |                    |                    |                    |
| Output Impedance                                           | 50 Ohm                                                                         |                    |                    |                    |
| VSWR                                                       | < 2:1                                                                          |                    |                    |                    |
| Return Loss                                                | 10 dB Min.                                                                     |                    |                    |                    |
| LNA Gain, Current Draw,<br>and Noise Figure @GPS           | Voltage                                                                        | LNA<br>Gain(Typ.)  | Current Draw(Typ.) | Noise Figure(Typ.) |
|                                                            | Min 1.8V                                                                       | 28dB               | 7.9mA              | 1.9dB              |
|                                                            | Typ. 3.0V                                                                      | 28dB               | 8.3mA              | 2.7dB              |
|                                                            | Max 5.5V                                                                       | 30dB               | 8.3mA              | 2.2dB              |
| Total specification (Through Antenna, SAW Filter, and LNA) |                                                                                |                    |                    |                    |
| Frequency                                                  | 1561.068±2.046MHz                                                              | 1575.42±1.023MHz   | 1602±5MHz          |                    |
| Gain@3V                                                    | 1575.42MHz:31±3dBi                                                             | 1575.42MHz:31±3dBi | 1602MHz:31±3dBi    |                    |
| Output Impedance                                           | 50Ω                                                                            |                    |                    |                    |

| 4G/3G/2G LTE Antenna             |      |         |                                                 |         |           |           |           |           |
|----------------------------------|------|---------|-------------------------------------------------|---------|-----------|-----------|-----------|-----------|
| Frequency (MHz)                  |      | LTE700  | GSM850                                          | GSM900  | DCS       | PCS       | UMTS1     | LTE2600   |
|                                  |      | 698~803 | 824~894                                         | 880~960 | 1710~1880 | 1850~1990 | 1920~2170 | 2490~2690 |
| Efficiency (%)                   |      |         |                                                 |         |           |           |           |           |
| MIMO_1                           | 30cm | 46.72   | 58.11                                           | 69.94   | 51.37     | 43.13     | 37.85     | 56.94     |
|                                  | 1M   | 41.52   | 50.61                                           | 60.91   | 42.18     | 35.37     | 30.76     | 44.60     |
|                                  | 2M   | 34.77   | 41.93                                           | 49.67   | 31.76     | 26.48     | 22.88     | 31.77     |
|                                  | 3M   | 29.04   | 34.51                                           | 40.92   | 24.03     | 19.75     | 16.96     | 22.53     |
|                                  | 5M   | 20.37   | 23.63                                           | 27.49   | 13.73     | 11.05     | 9.35      | 11.36     |
| MIMO_2                           | 30cm | 56.05   | 58.56                                           | 55.08   | 53.24     | 48.41     | 43.71     | 55.22     |
|                                  | 1M   | 49.82   | 51.01                                           | 47.98   | 43.71     | 39.67     | 35.53     | 43.25     |
|                                  | 2M   | 41.75   | 42.30                                           | 39.13   | 32.91     | 29.72     | 26.44     | 30.80     |
|                                  | 3M   | 34.88   | 34.83                                           | 32.22   | 24.90     | 22.15     | 19.60     | 21.84     |
|                                  | 5M   | 24.49   | 23.87                                           | 21.65   | 14.23     | 12.39     | 10.80     | 11.01     |
| Average Gain(dBi)                |      |         |                                                 |         |           |           |           |           |
| MIMO_1                           | 30cm | -3.32   | -2.39                                           | -1.56   | -2.90     | -3.68     | -4.23     | -2.45     |
|                                  | 1M   | -3.83   | -2.99                                           | -2.16   | -3.75     | -4.55     | -5.13     | -3.52     |
|                                  | 2M   | -4.60   | -3.81                                           | -3.04   | -4.98     | -5.81     | -6.42     | -4.99     |
|                                  | 3M   | -5.38   | -4.65                                           | -3.88   | -6.20     | -7.08     | -7.72     | -6.48     |
|                                  | 5M   | -6.92   | -6.29                                           | -5.61   | -8.63     | -9.61     | -10.32    | -9.45     |
| MIMO_2                           | 30cm | -2.52   | -2.32                                           | -2.59   | -2.74     | -3.17     | -3.62     | -2.59     |
|                                  | 1M   | -3.03   | -2.92                                           | -3.19   | -3.60     | -4.03     | -4.52     | -3.65     |
|                                  | 2M   | -3.80   | -3.74                                           | -4.08   | -4.83     | -5.29     | -5.81     | -5.12     |
|                                  | 3M   | -4.58   | -4.58                                           | -4.92   | -6.04     | -6.57     | -7.11     | -6.61     |
|                                  | 5M   | -6.12   | -6.22                                           | -6.65   | -8.47     | -9.09     | -9.70     | -9.59     |
| Peak Gain(dBi)                   |      |         |                                                 |         |           |           |           |           |
| MIMO_1                           | 30cm | 2.01    | 2.69                                            | 3.32    | 2.88      | 2.12      | 1.94      | 6.91      |
|                                  | 1M   | 1.51    | 2.09                                            | 2.72    | 1.98      | 1.32      | 1.04      | 5.91      |
|                                  | 2M   | 0.71    | 1.19                                            | 1.82    | 0.78      | 0.02      | -0.36     | 4.41      |
|                                  | 3M   | -0.09   | 0.39                                            | 1.02    | -0.42     | -1.18     | -1.66     | 2.89      |
|                                  | 5M   | -1.69   | -1.31                                           | -0.68   | -2.72     | -3.68     | -4.26     | -0.19     |
| MIMO_2                           | 30cm | 4.06    | 2.55                                            | 2.55    | 3.27      | 2.59      | 3.26      | 5.99      |
|                                  | 1M   | 3.56    | 1.95                                            | 1.95    | 2.37      | 1.79      | 2.36      | 4.99      |
|                                  | 2M   | 2.86    | 1.15                                            | 1.15    | 1.17      | 0.49      | 0.96      | 3.49      |
|                                  | 3M   | 2.06    | 0.25                                            | 0.25    | -0.03     | -0.71     | -0.34     | 1.99      |
|                                  | 5M   | 0.56    | -1.36                                           | -1.45   | -2.39     | -3.21     | -3.14     | -1.09     |
| Envelope Correlation Coefficient |      |         | All bands <0.3                                  |         |           |           |           |           |
| Impedance                        |      |         | 50Ω                                             |         |           |           |           |           |
| Polarization                     |      |         | Linear                                          |         |           |           |           |           |
| VSWR                             |      |         | All bands < 3.5                                 |         |           |           |           |           |
| Cable                            |      |         | 0.3M RG174 standard, fully customizable         |         |           |           |           |           |
| Connector                        |      |         | SMA(M) / RP-SMA(M) standard, fully customizable |         |           |           |           |           |

| 2.4GHz/5GHz Wi-Fi Antenna        |                                                      |           |           |
|----------------------------------|------------------------------------------------------|-----------|-----------|
| Frequency (MHz)                  |                                                      | 2400~2500 | 4900~5850 |
| Efficiency (%)                   |                                                      |           |           |
| MIMO_1                           | 30cm                                                 | 50.34     | 48.64     |
|                                  | 1M                                                   | 39.54     | 34.11     |
|                                  | 2M                                                   | 28.65     | 20.75     |
|                                  | 3M                                                   | 20.28     | 12.45     |
|                                  | 5M                                                   | 10.53     | 4.55      |
| MIMO_2                           | 30cm                                                 | 54.35     | 44.84     |
|                                  | 1M                                                   | 42.78     | 31.39     |
|                                  | 2M                                                   | 30.99     | 19.09     |
|                                  | 3M                                                   | 21.94     | 11.45     |
|                                  | 5M                                                   | 11.39     | 4.18      |
| Average Gain(dBi)                |                                                      |           |           |
| MIMO_1                           | 30cm                                                 | -3.00     | -3.16     |
|                                  | 1M                                                   | -4.05     | -4.70     |
|                                  | 2M                                                   | -5.45     | -6.86     |
|                                  | 3M                                                   | -6.95     | -9.08     |
|                                  | 5M                                                   | -9.97     | -13.46    |
| MIMO_2                           | 30cm                                                 | -2.65     | -3.52     |
|                                  | 1M                                                   | -3.70     | -5.06     |
|                                  | 2M                                                   | -5.10     | -7.22     |
|                                  | 3M                                                   | -6.60     | -9.44     |
|                                  | 5M                                                   | -9.44     | -13.82    |
| Peak Gain(dBi)                   |                                                      |           |           |
| MIMO_1                           | 30cm                                                 | 3.89      | 5.25      |
|                                  | 1M                                                   | 2.79      | 3.65      |
|                                  | 2M                                                   | 1.39      | 1.42      |
|                                  | 3M                                                   | -0.11     | -0.77     |
|                                  | 5M                                                   | -3.01     | -4.97     |
| MIMO_2                           | 30cm                                                 | 3.88      | 5.46      |
|                                  | 1M                                                   | 2.78      | 3.96      |
|                                  | 2M                                                   | 1.38      | 1.86      |
|                                  | 3M                                                   | -0.12     | -0.34     |
|                                  | 5M                                                   | -2.98     | -4.64     |
| Envelope Correlation Coefficient | 2400MHz to 2500MHz <0.3<br>4900MHz to 5850MHz <0.3   |           |           |
| Impedance                        | 50Ω                                                  |           |           |
| Polarization                     | Linear                                               |           |           |
| VSWR                             | 2400MHz to 2500MHz < 2.0<br>4900MHz to 5850MHz < 3.5 |           |           |
| Cable                            | 0.3M RG174 standard, fully customizable              |           |           |
| Connector                        | RP-SMA(M) standard, fully customizable               |           |           |

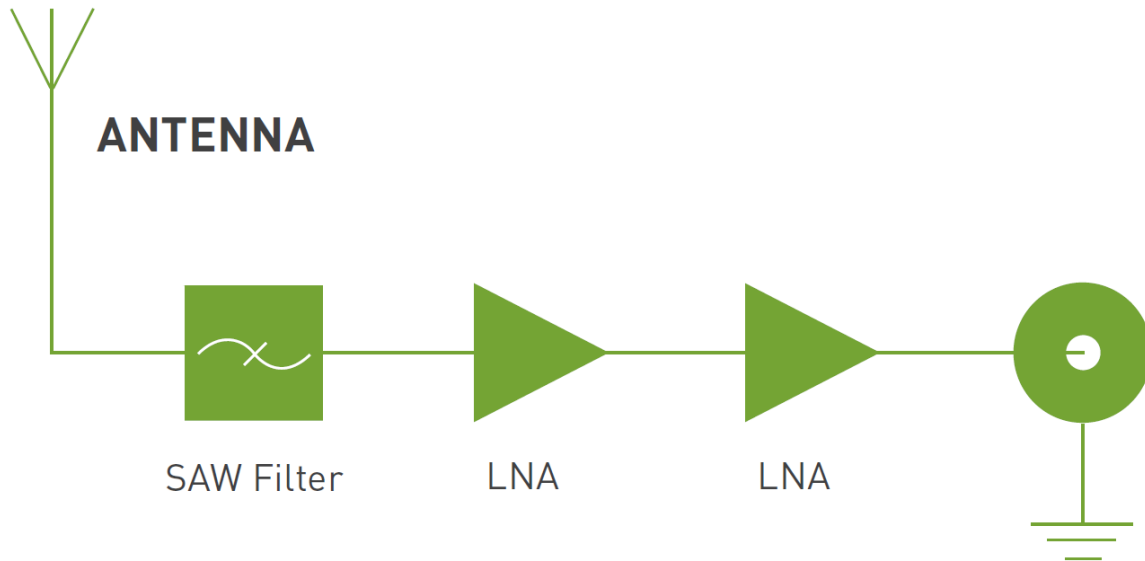
| MECHANICAL                |                                   |
|---------------------------|-----------------------------------|
| Dimensions                | Diameter: 94.3mm, Height: 57.4 mm |
| Casing                    | ASA                               |
| Base and thread           | Zinc Alloy                        |
| Weight                    | 250g                              |
| Ingress Protection Rating | IP67                              |
| Maximum Assembly Torque   | 39.2 N•m                          |
| ENVIRONMENTAL             |                                   |
| Operation Temperature     | -40°C to 85°C                     |
| Storage Temperature       | -40°C to 85°C                     |
| Humidity                  | Non-condensing 65°C 95% RH        |

| LTE BANDS   |                                                      |                               |        |        |
|-------------|------------------------------------------------------|-------------------------------|--------|--------|
| Band Number | LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA |                               |        |        |
|             | Uplink                                               | Downlink                      | MIMO 1 | MIMO 2 |
| 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 (LTE only)     | ✓      | ✓      |
| 18          | UL: 815 to 830                                       | DL: 860 to 875 (LTE only)     | ✓      | ✓      |
| 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 (LTE only)   | ✓      | ✓      |
| 24          | UL: 1625.5 to 1660.5                                 | DL: 1525 to 1559 (LTE only)   | ✓      | ✓      |
| 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 (LTE only)     | ✓      | ✓      |
| 28          | UL: 703 to 748                                       | DL: 758 to 803 (LTE only)     | ✓      | ✓      |
| 29          | UL: -                                                | DL: 717 to 728 (LTE only)     | ✓      | ✓      |
| 30          | UL: 2305 to 2315                                     | DL: 2350 to 2360 (LTE only)   | ✓      | ✓      |
| 31          | UL: 452.5 to 457.5                                   | DL: 462.5 to 467.5 (LTE only) | ✗      | ✗      |
| 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                                         |                               | ✗      | ✗      |

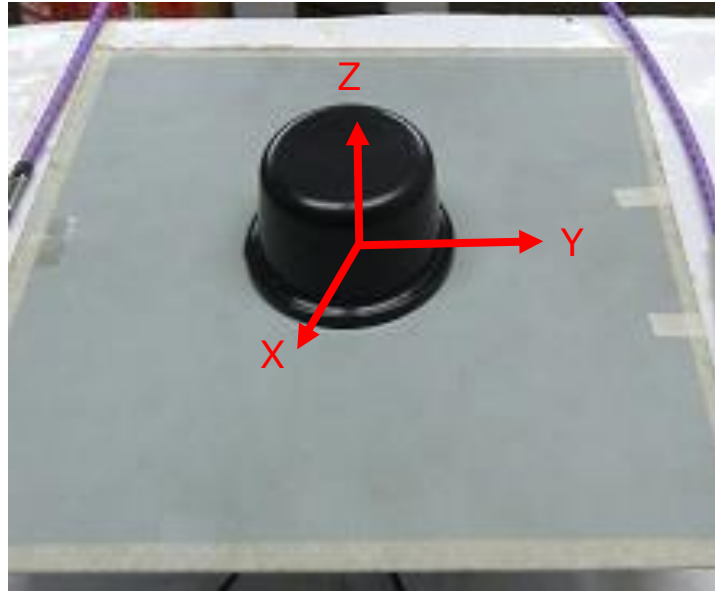
## 3. Antenna Characteristics

### 3.1. GPS-GLONASS-GALILEO-BeiDou Antenna

#### 3.1.1. Block Diagram

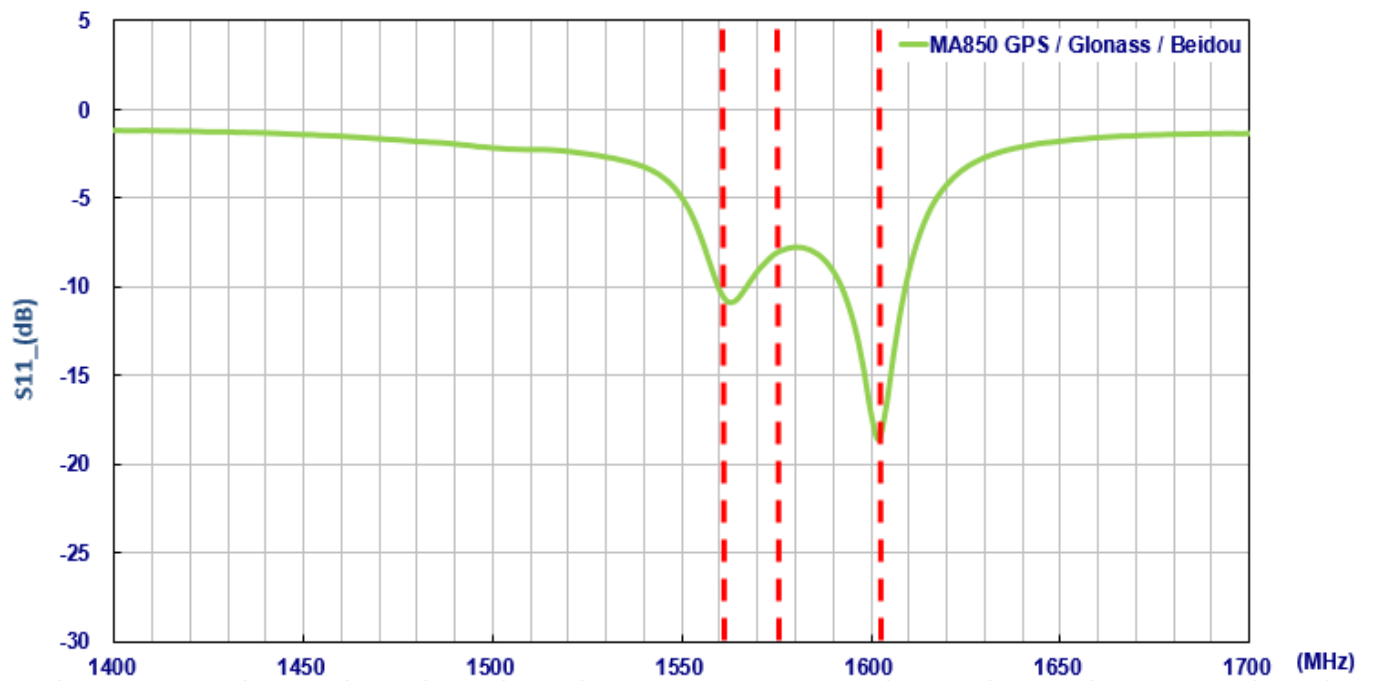


### 3.1.2. Test Setup

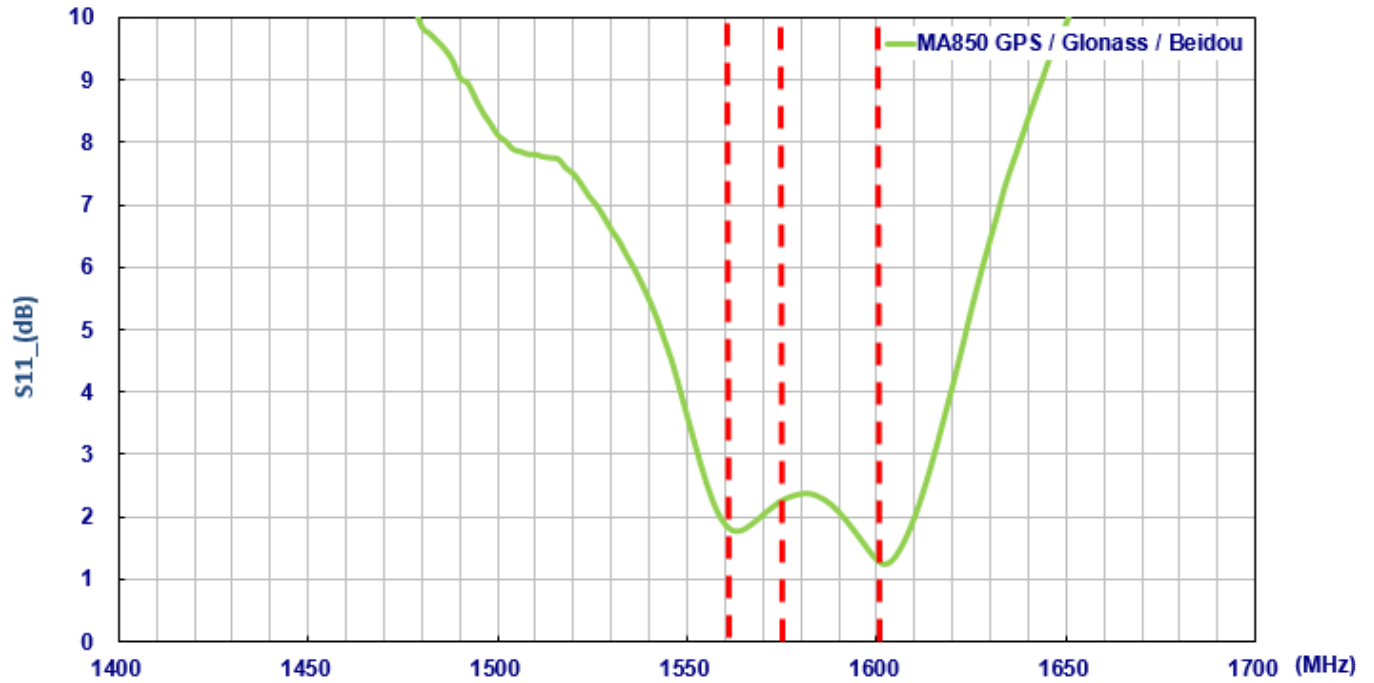


Ground plane: 30\*30cm

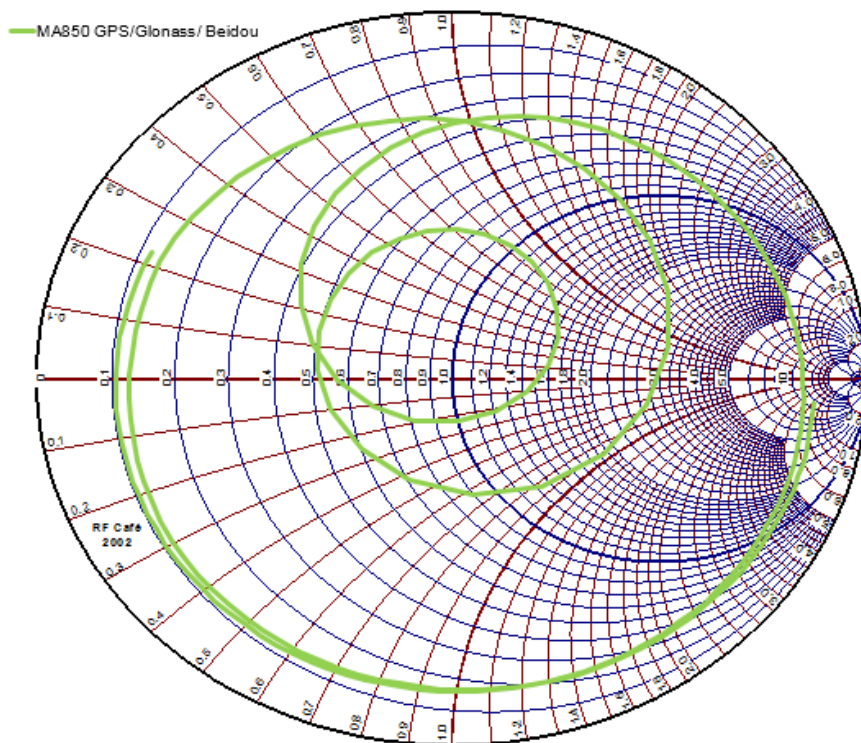
### 3.1.3. GPS-GLONASS-GALILEO-BeiDou Return Loss



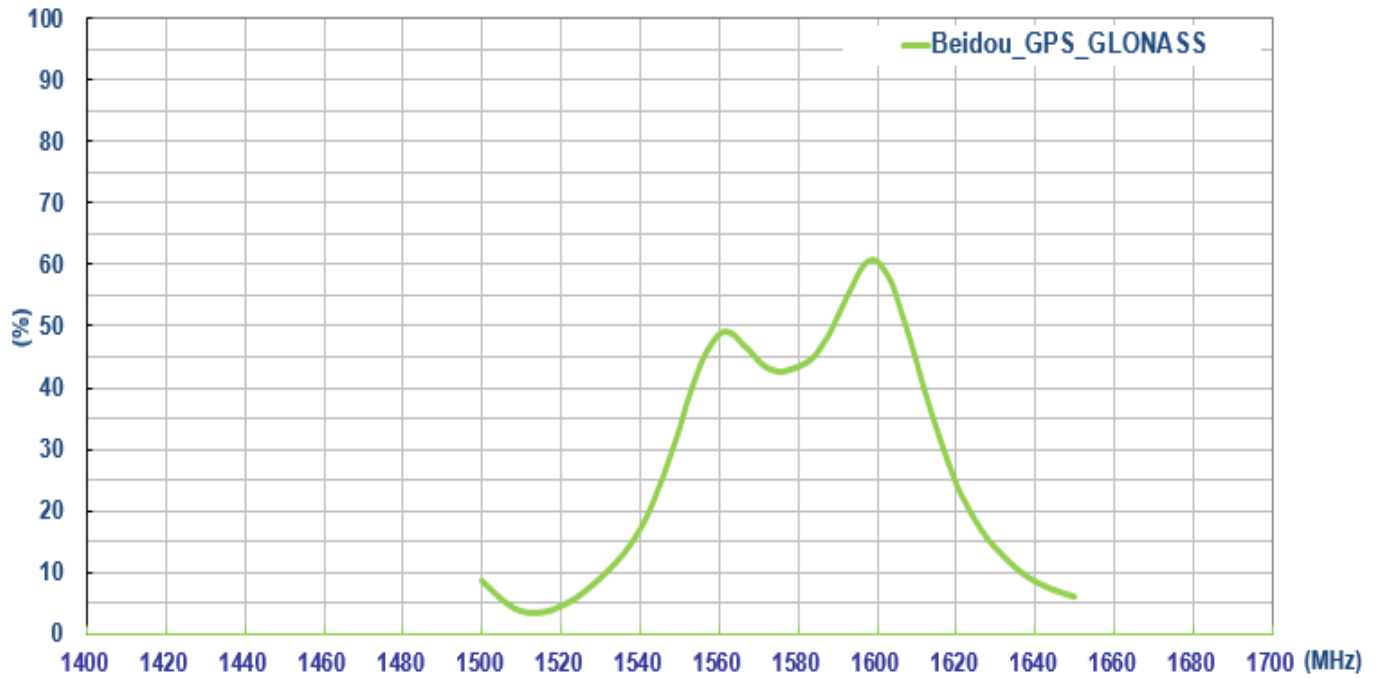
### 3.1.4. GPS-GLONASS-GALILEO-BeiDou VSWR



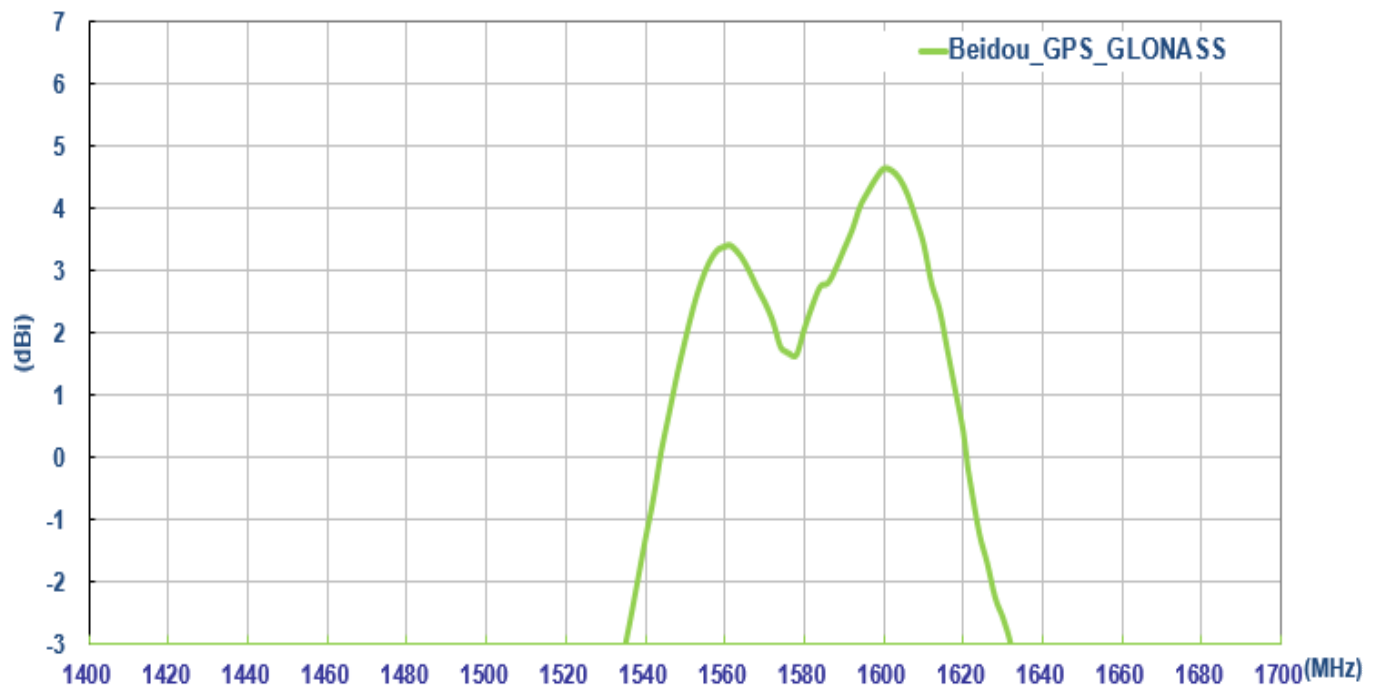
### 3.1.5. GPS-GLONASS-GALILEO-BeiDou Smith Chart



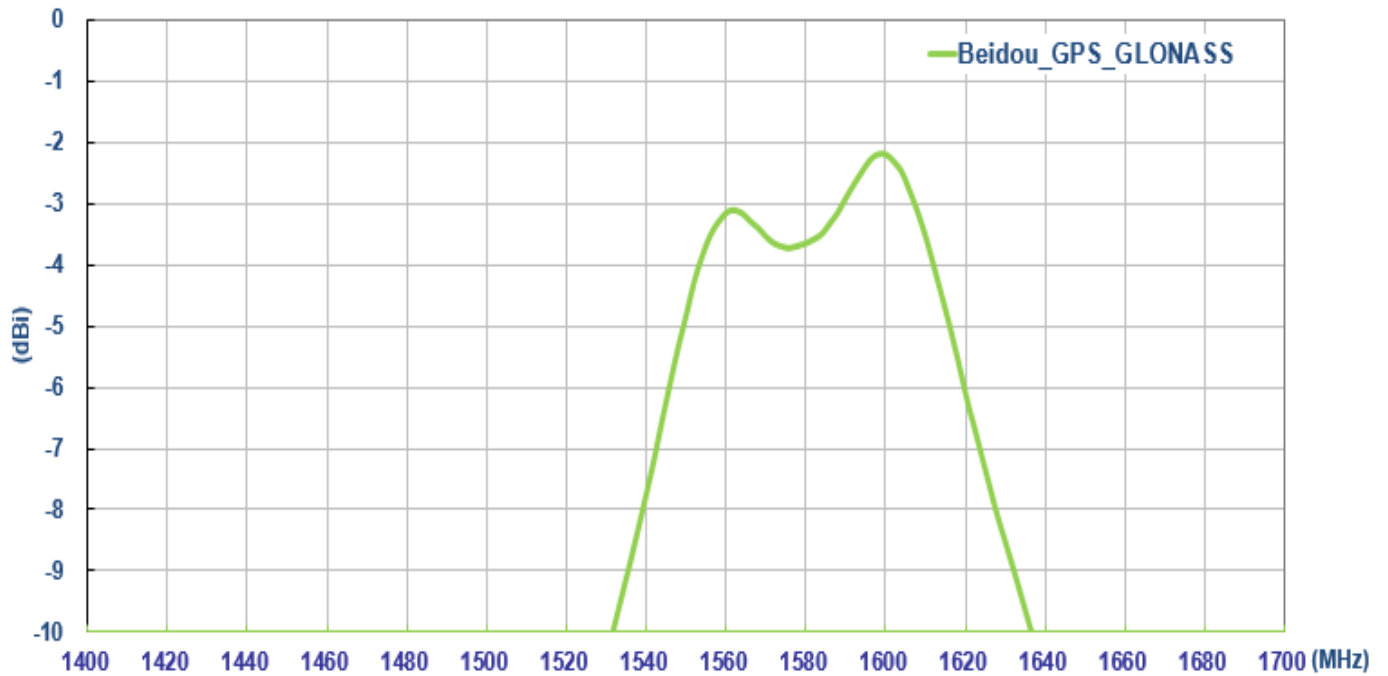
### 3.1.6 GPS-GLONASS-GALILEO-BeiDou Antenna Efficiency



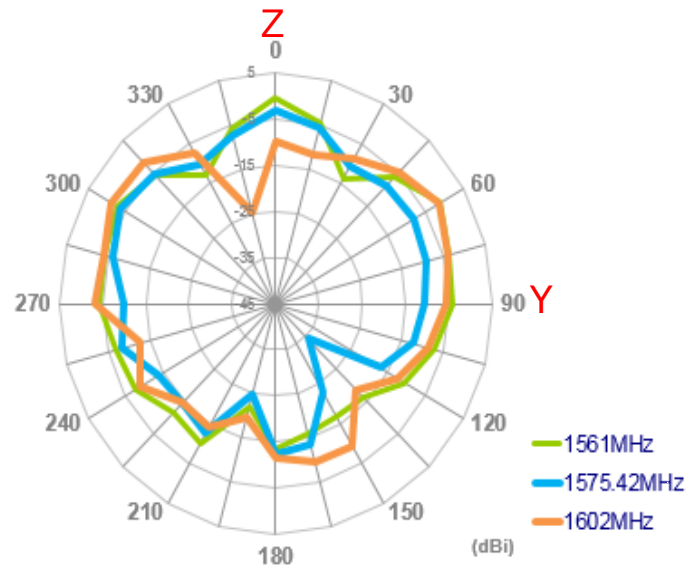
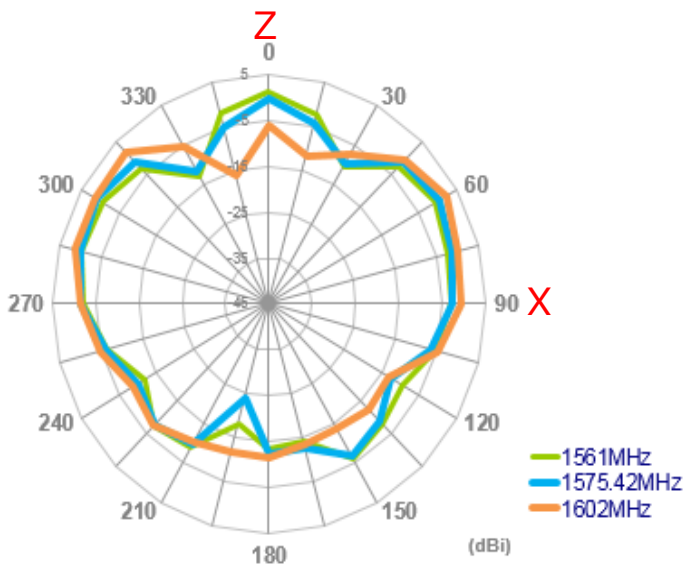
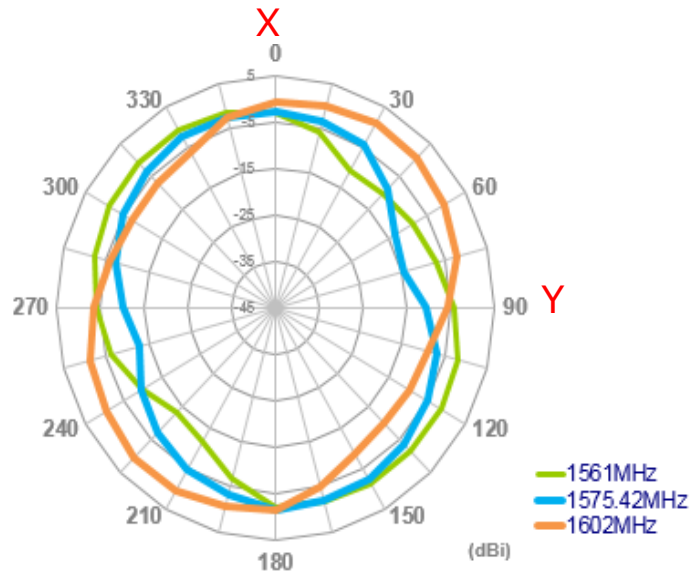
### 3.1.7 GPS-GLONASS-GALILEO-BeiDou Antenna Peak Gain



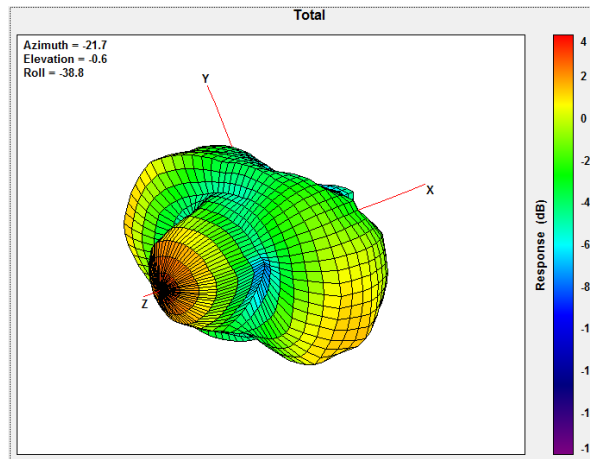
### 3.1.8 GPS-GLONASS-GALILEO-BeiDou Antenna Average Gain



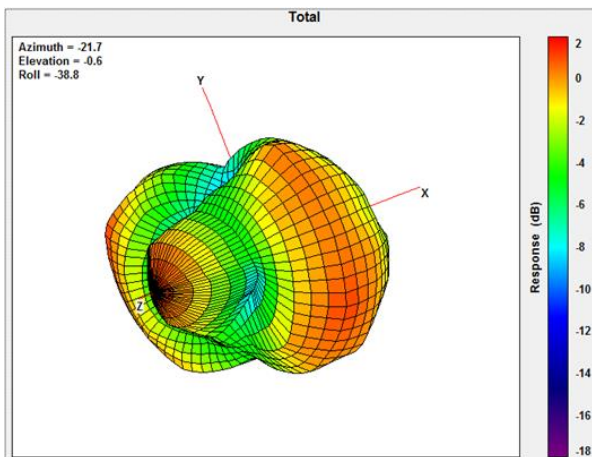
### 3.1.6. GPS-GLONASS-GALILEO-BeiDou Radiation Pattern (Passive antenna) 2D Radiation Pattern



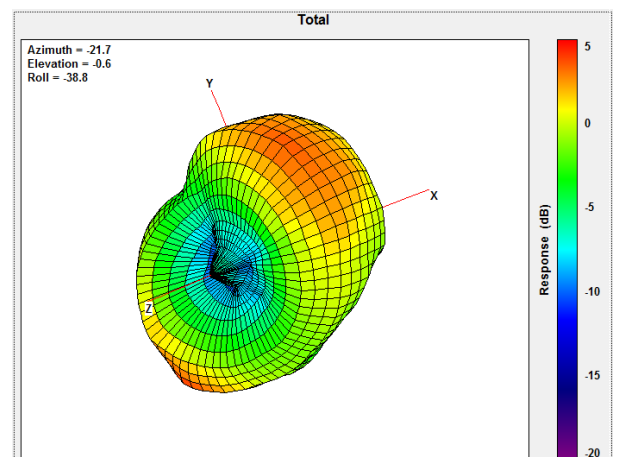
### 3.1.7. 3D Radiation Pattern (Passive antenna)



1561MHz

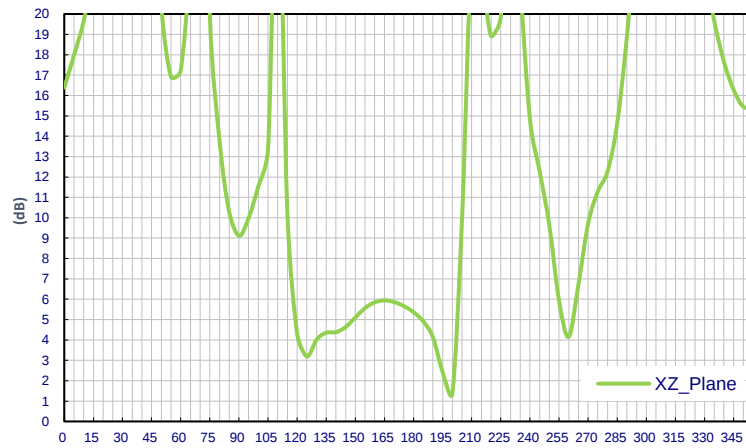


1575.42MHz

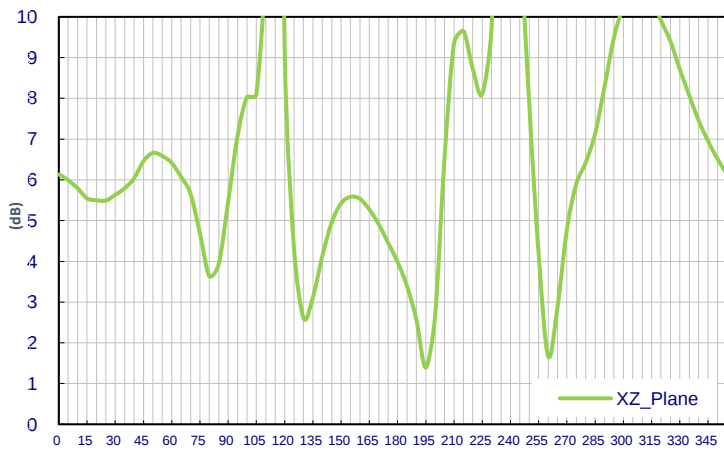


1602MHz

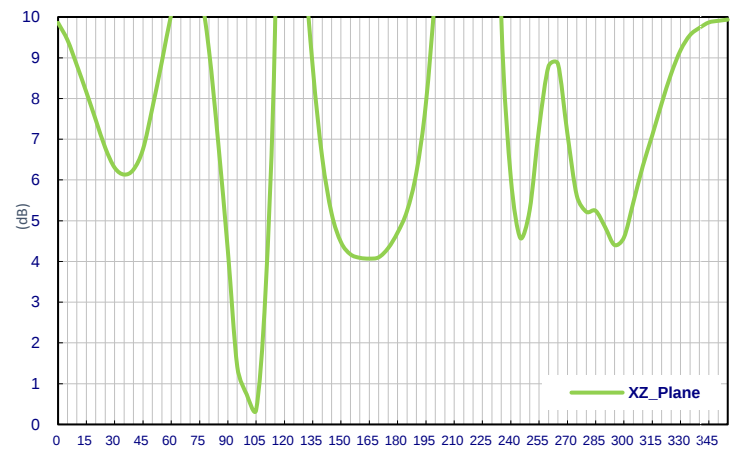
### 3.1.8. Axial Pattern (Passive antenna)



1561MHz

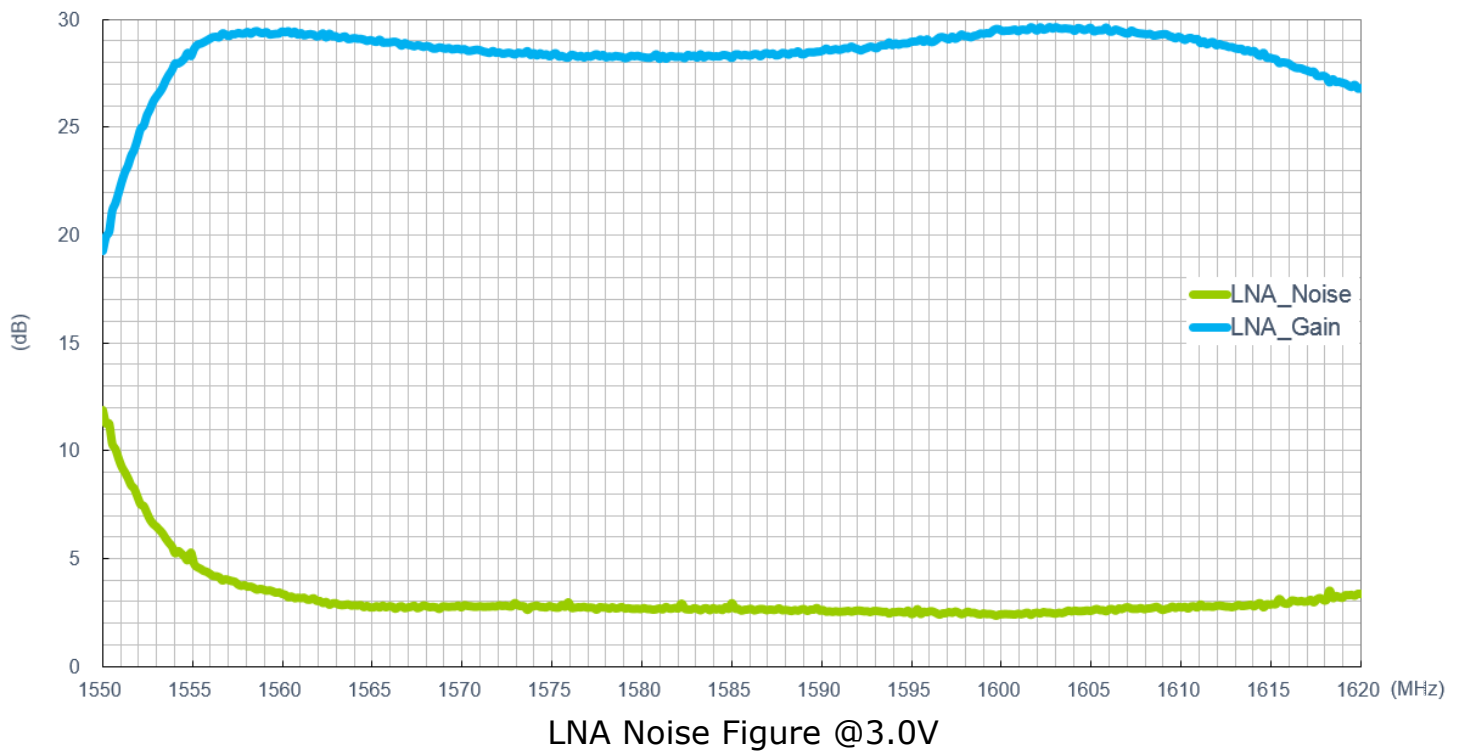
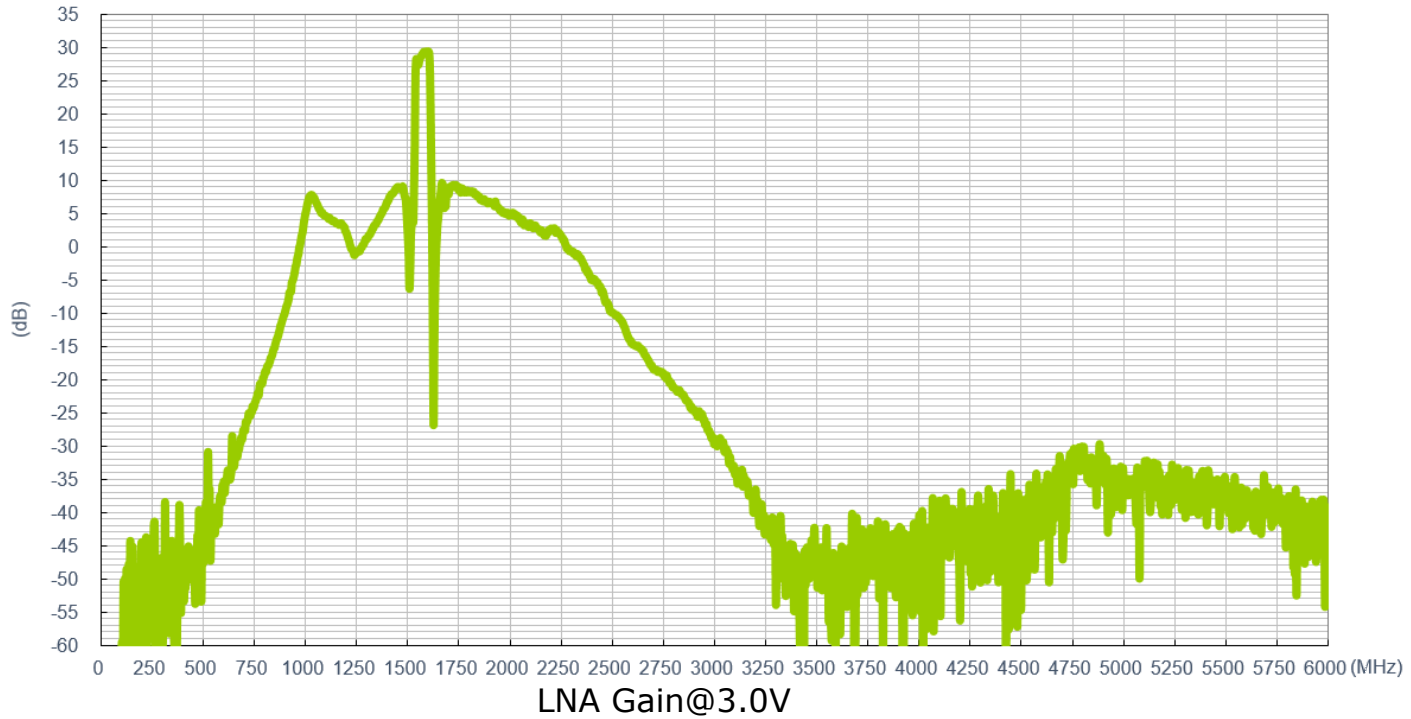


1575.42MHz



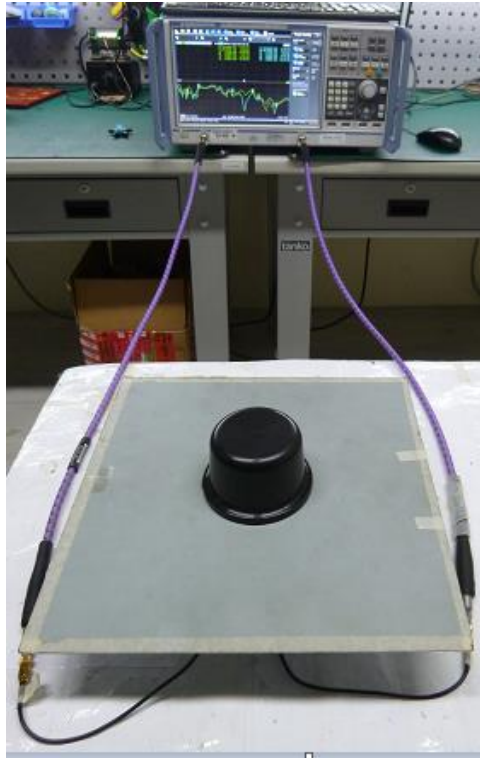
1602MHz

### 3.1.9. BeiDou-GPS-GLONASS LNA Gain and Noise Figure (Active antenna)



## 3.2. LTE MIMO & Wi-Fi MIMO Antenna

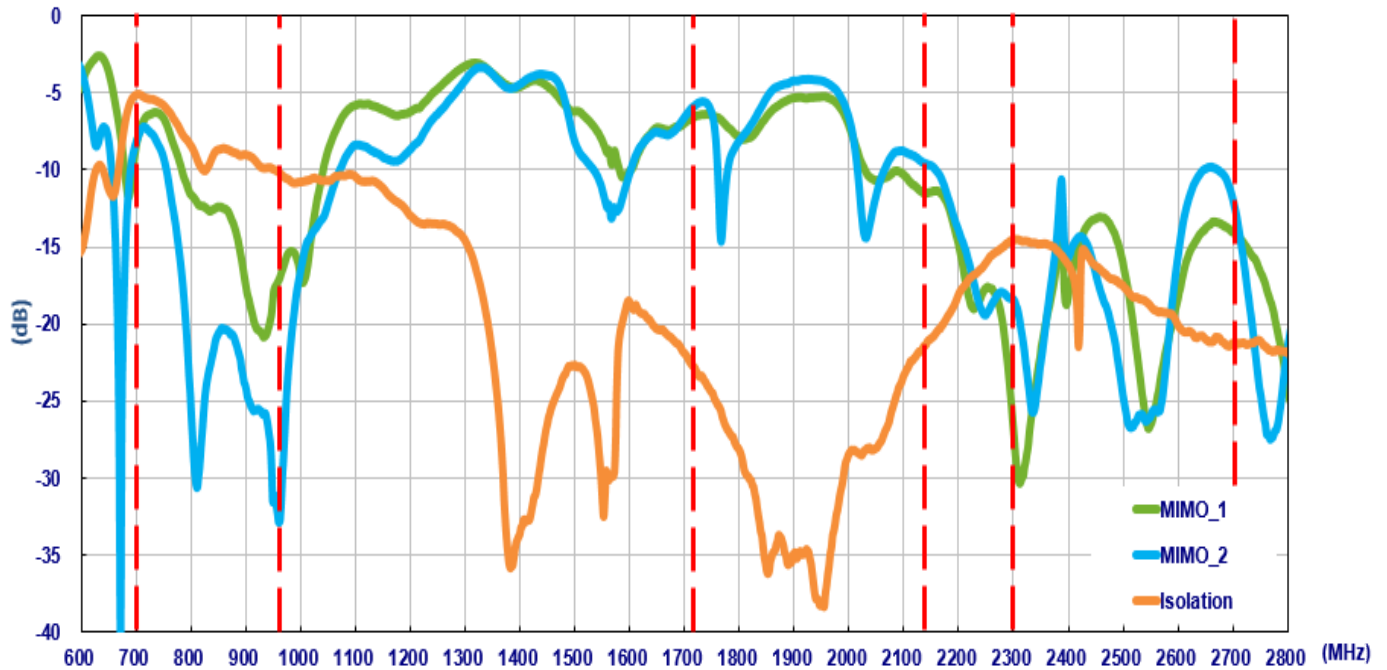
### 3.2.1. Test Setup



Ground plane: 30\*30cm

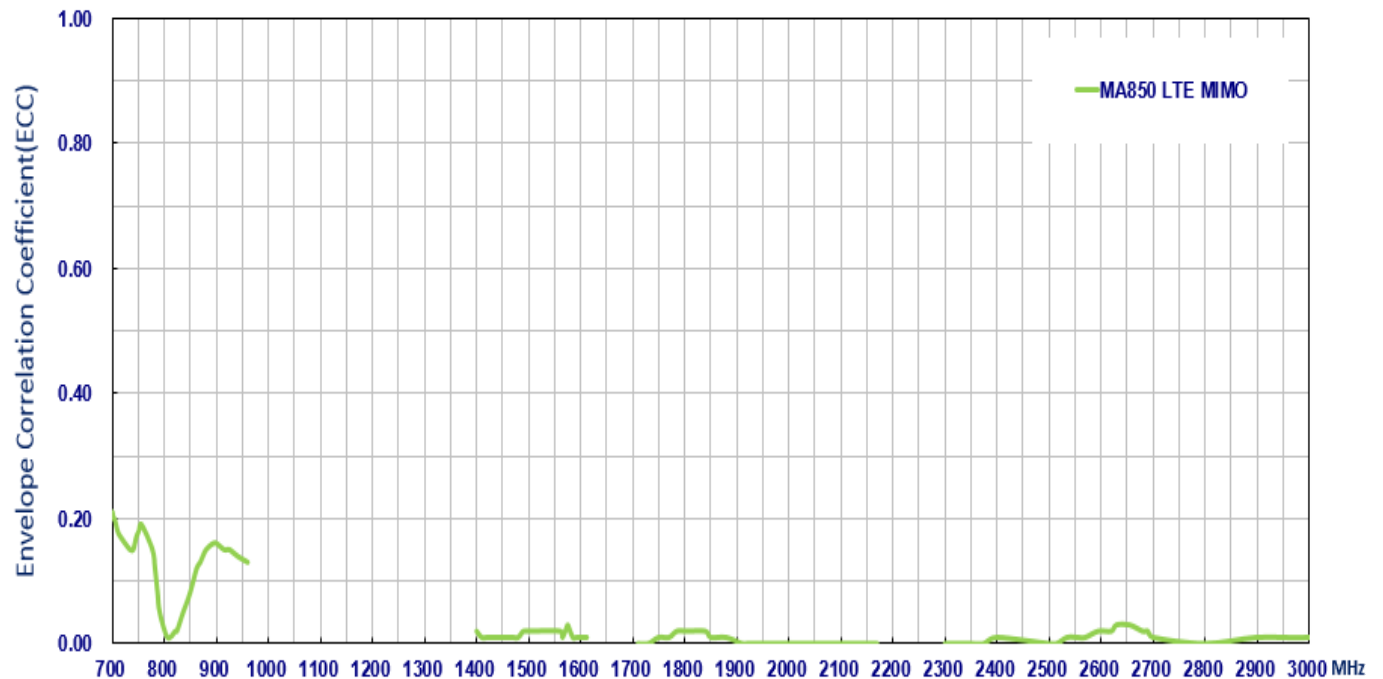
### 3.2.2. LTE Antenna Return Loss

Setup in free space with 0.3M cable length



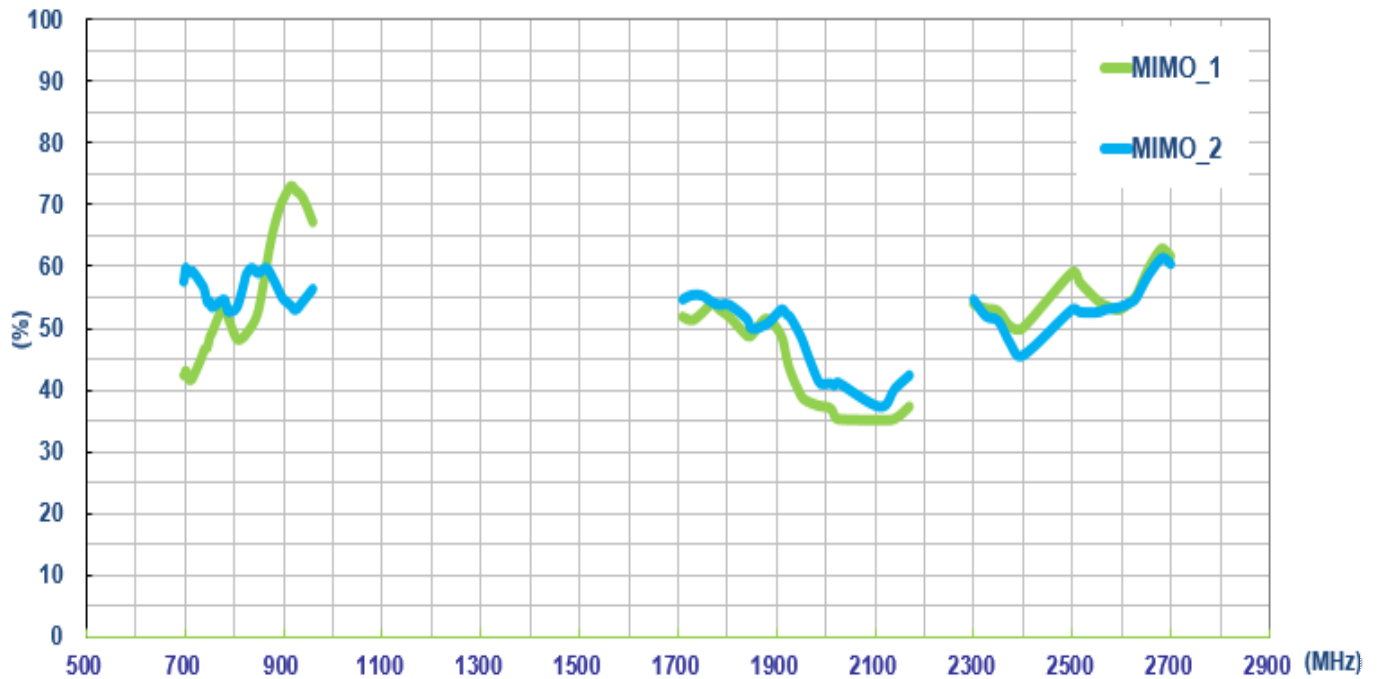
### 3.2.3. LTE Envelope Correlation Coefficient

Setup in free space with 0.3M cable length



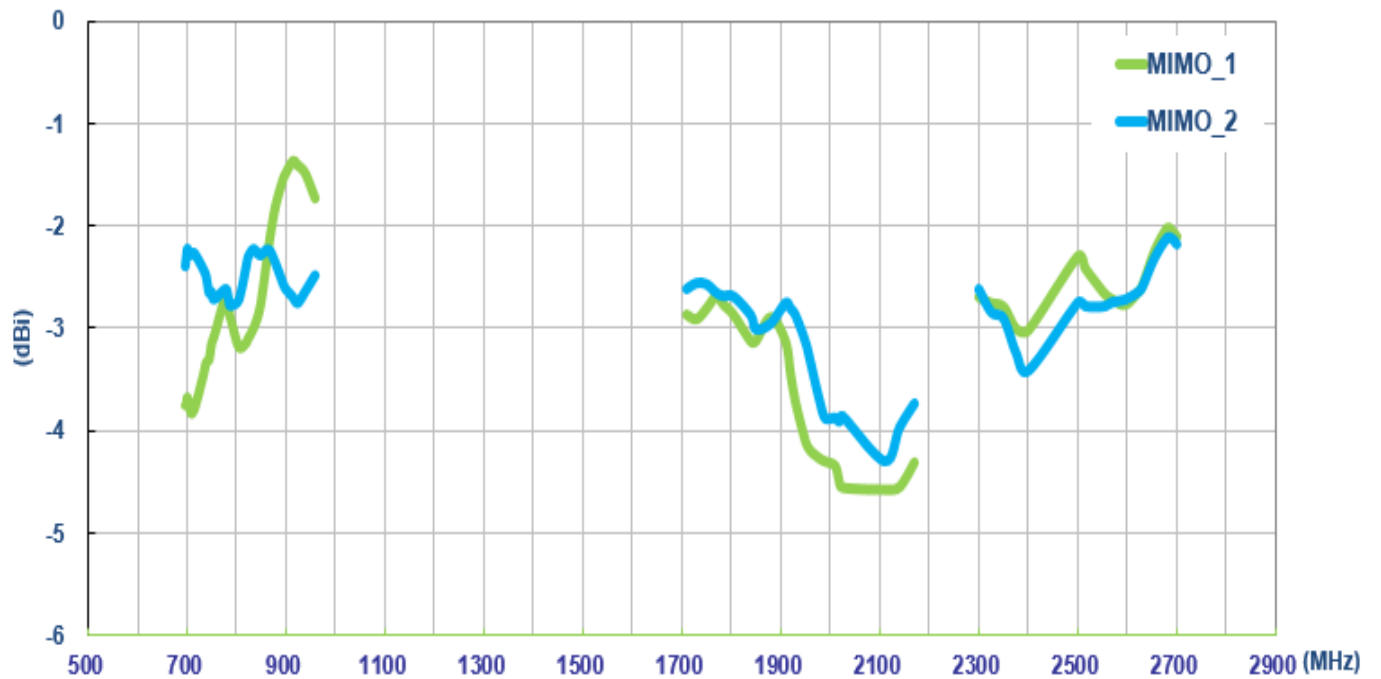
### 3.2.4. LTE Antenna Efficiency

Setup in free space with 0.3M cable length



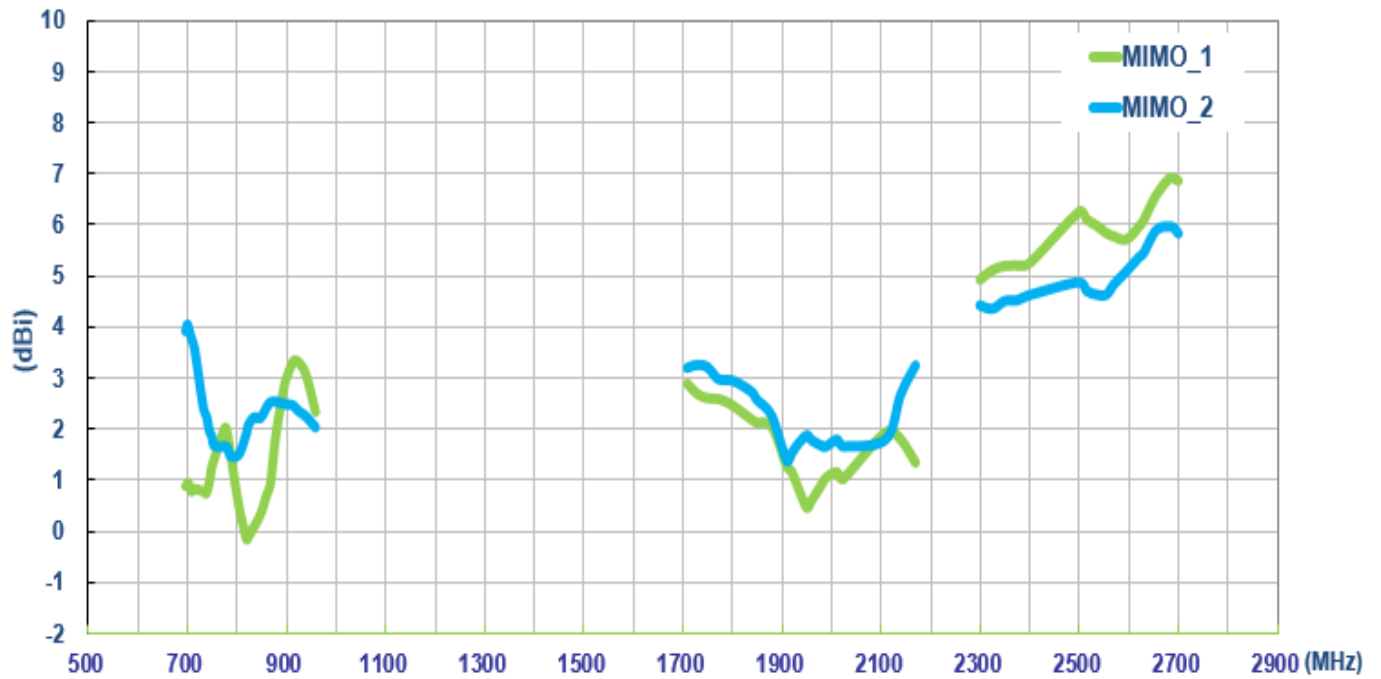
### 3.2.5. LTE Antenna Average Gain

Setup in free space with 0.3M cable length



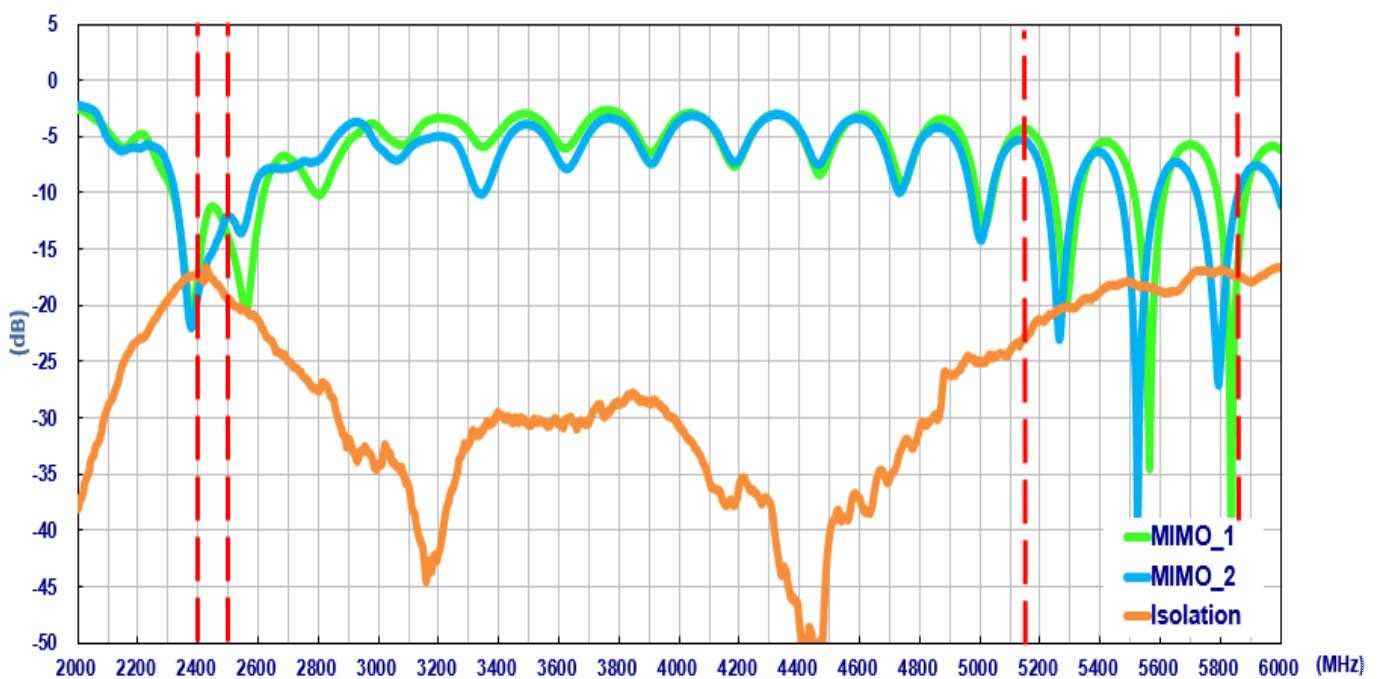
### 3.2.6. LTE Antenna Peak Gain

Setup in free space with 0.3M cable length



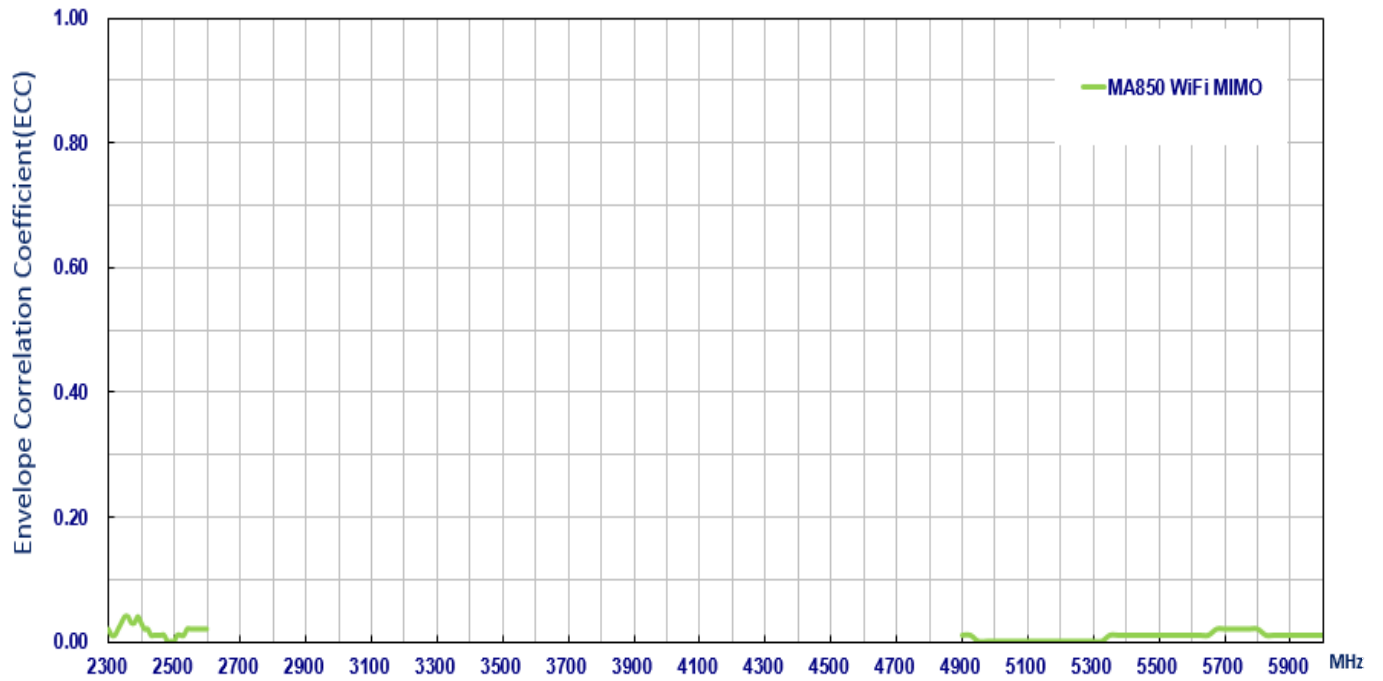
### 3.2.7. Wi-Fi Antenna Return Loss

Setup in free space with 0.3M cable length



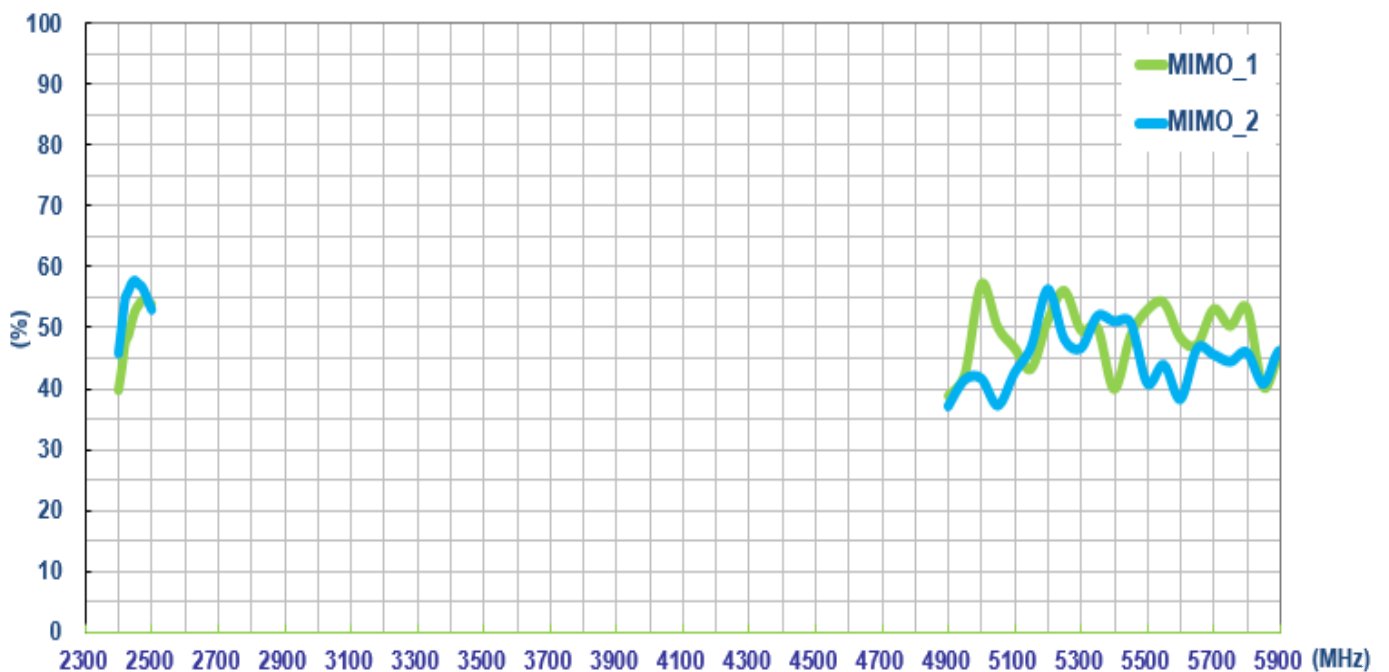
### 3.2.8. Wi-Fi Envelope Correlation Coefficient

Setup in free space with 0.3M cable length



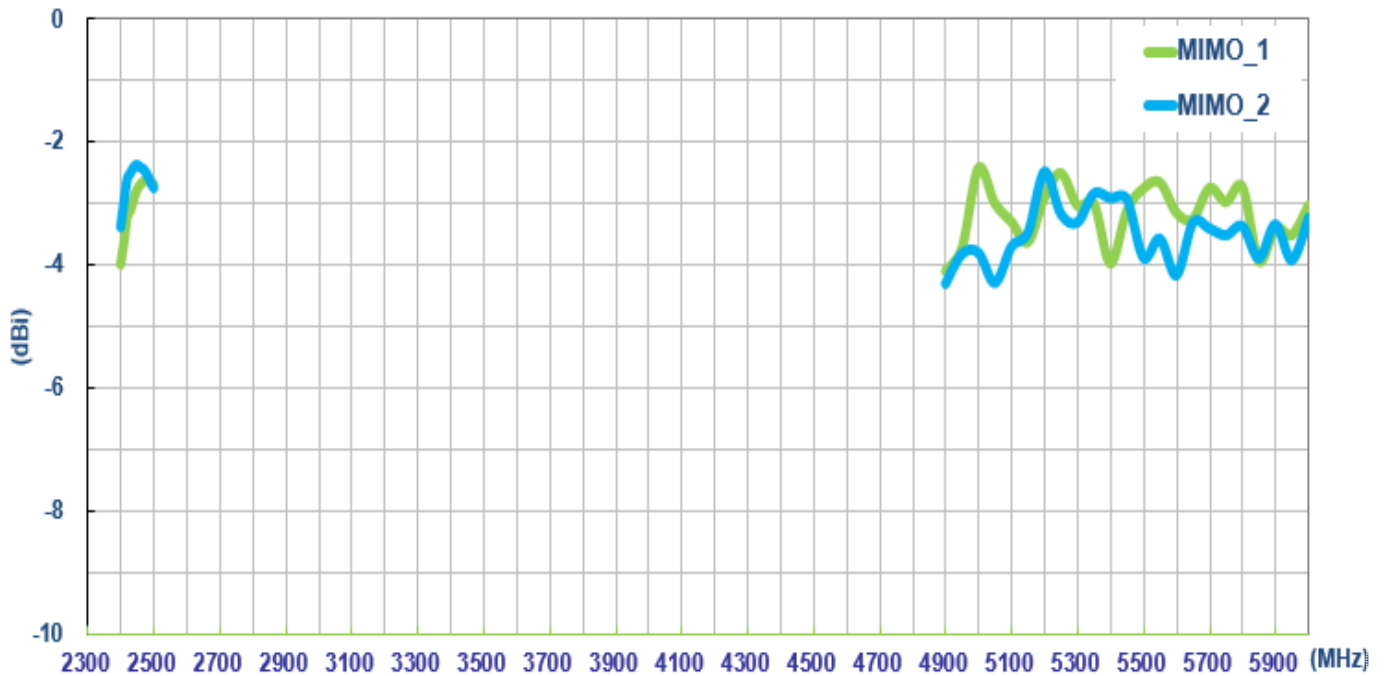
### 3.2.9. Wi-Fi Antenna Efficiency

Setup in free space with 0.3M cable length



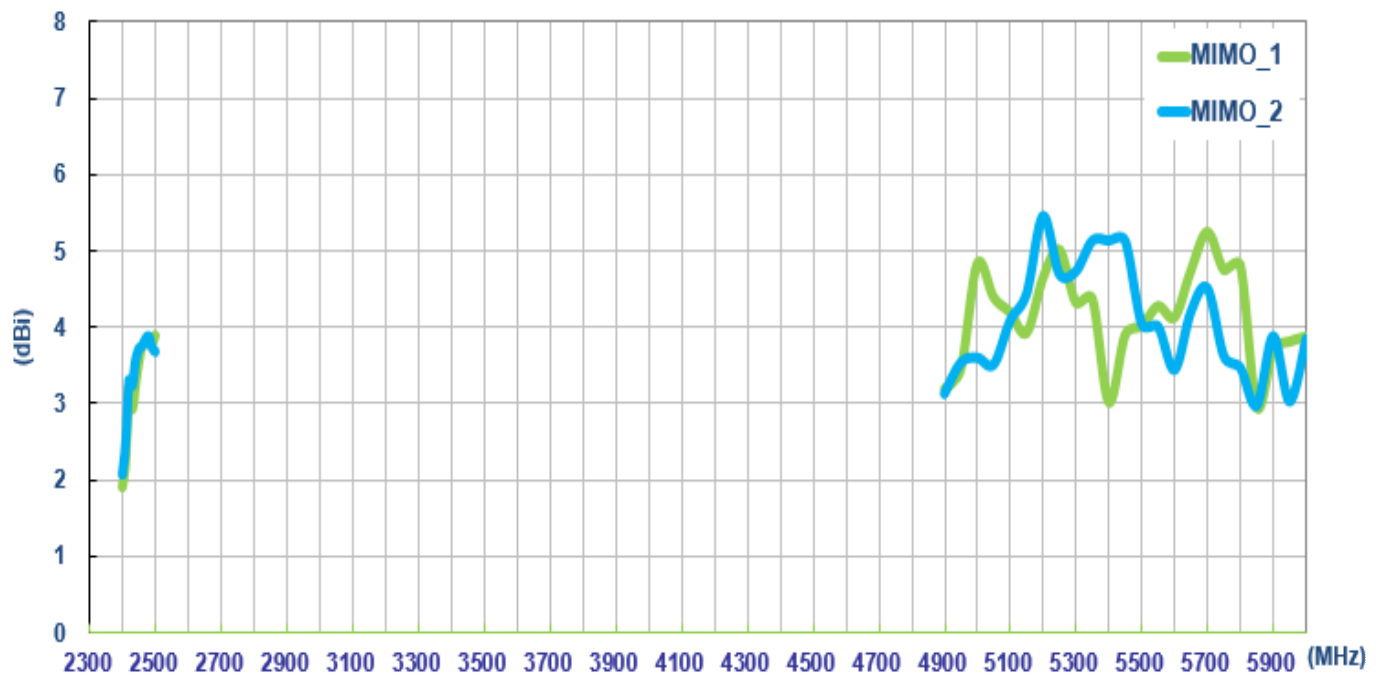
### 3.2.10. Wi-Fi Antenna Average Gain

Setup in free space with 0.3M cable length

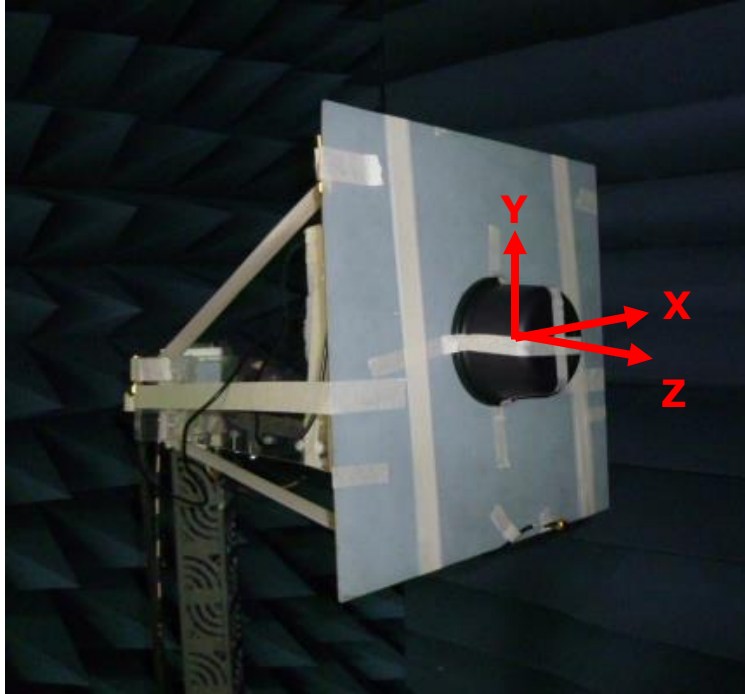


### 3.2.11. Wi-Fi Antenna Peak Gain

Setup in free space with 0.3M cable length



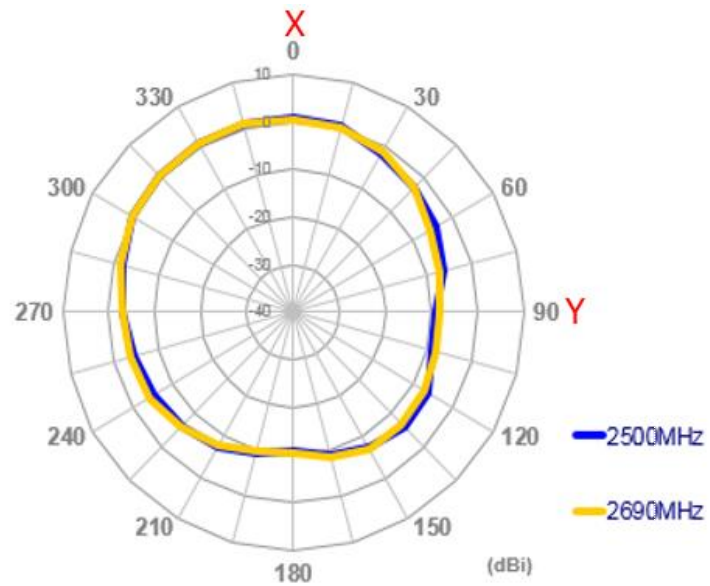
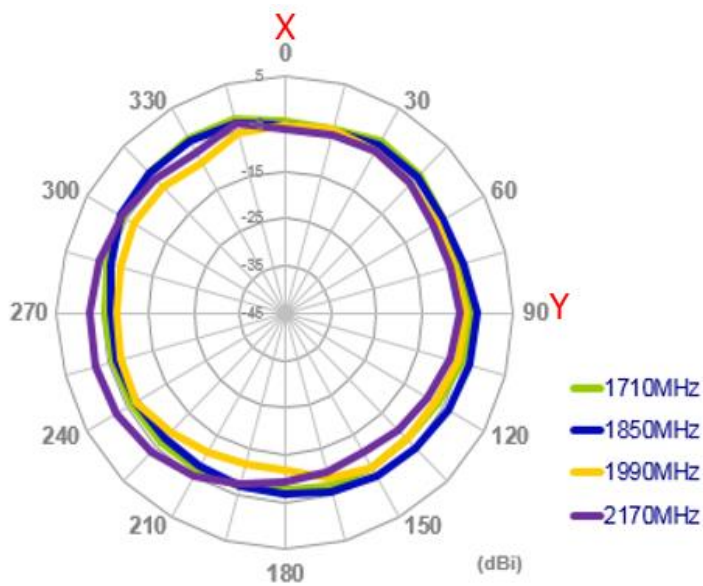
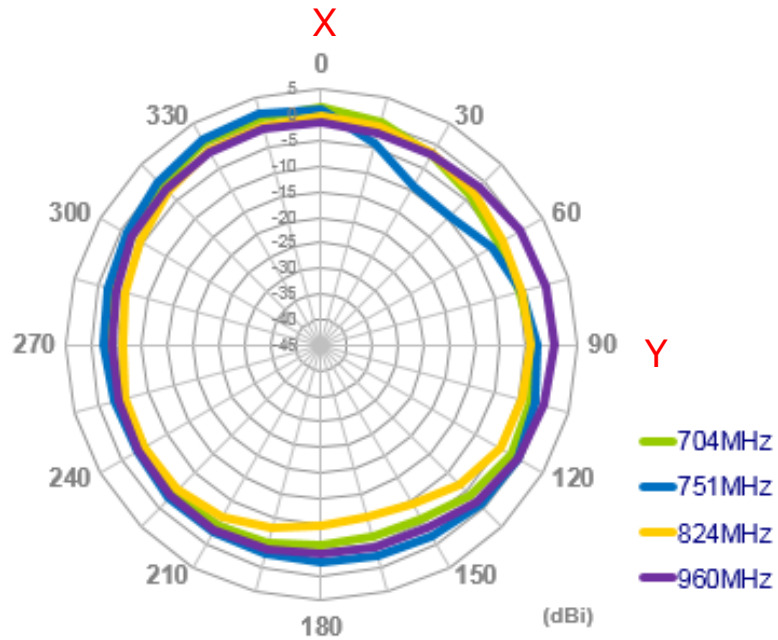
### 3.2.12. Test setup for antenna radiation pattern (ETS Anechoic chamber)



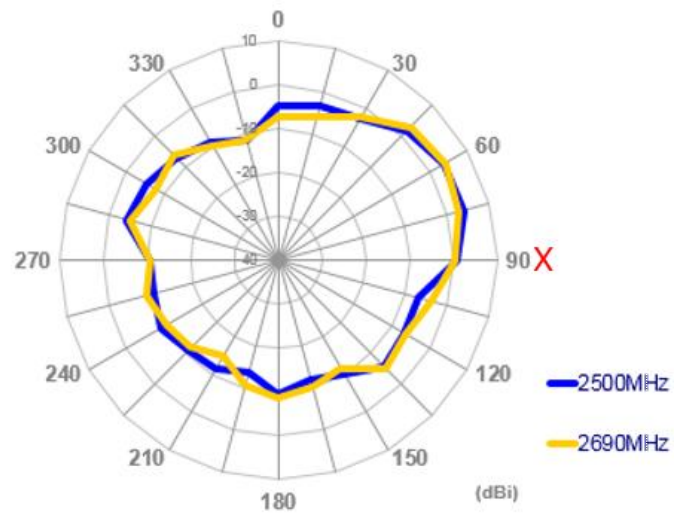
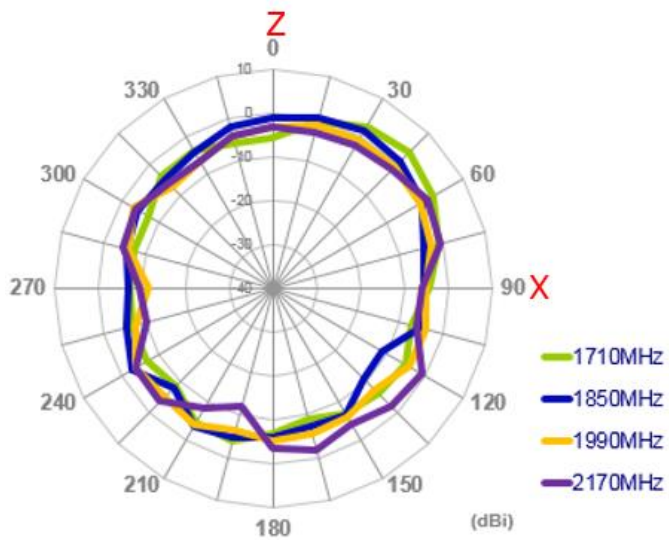
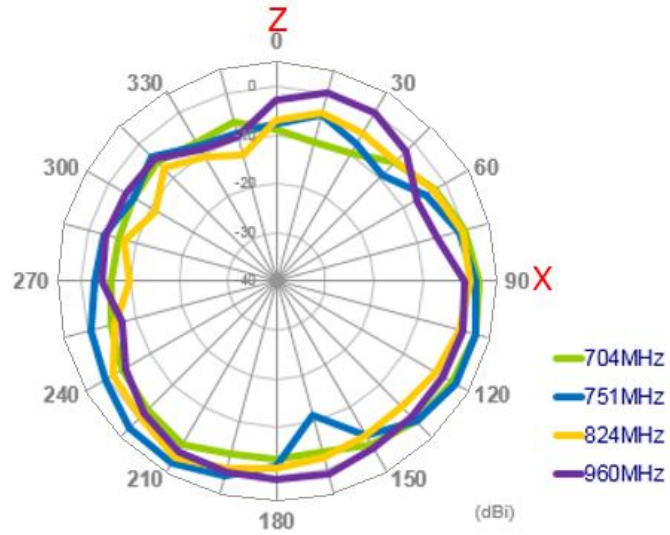
Testing Setup in ETS Anechoic Chamber

### 3.2.13. 2D Radiation Pattern (LTE MIMO1 with 0.3M cable length)

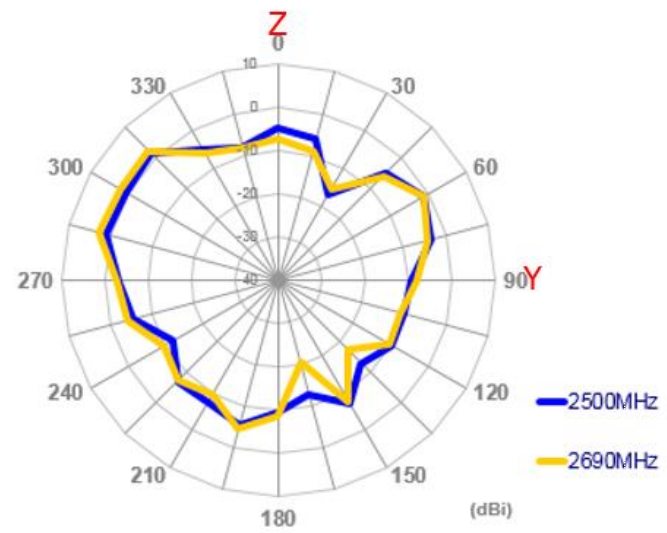
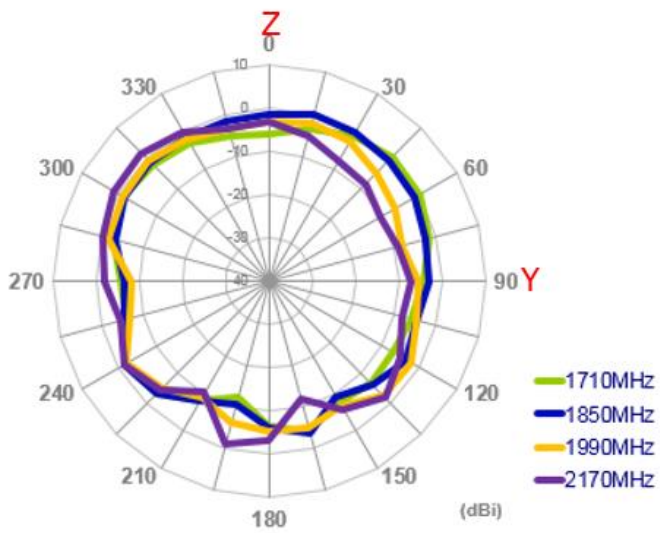
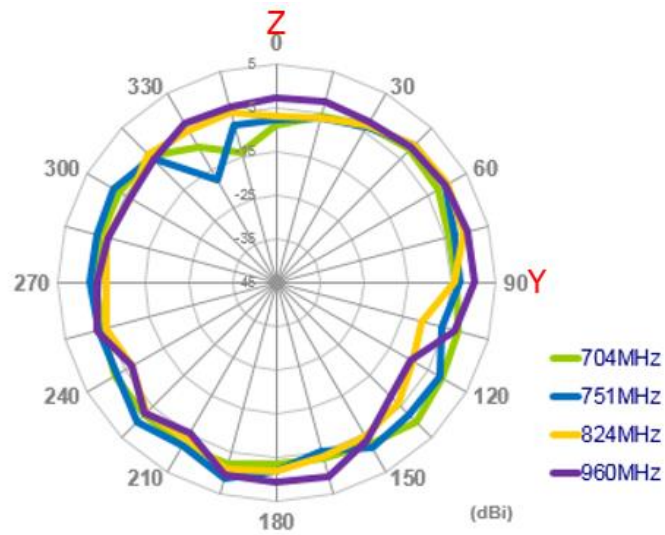
XY Plane



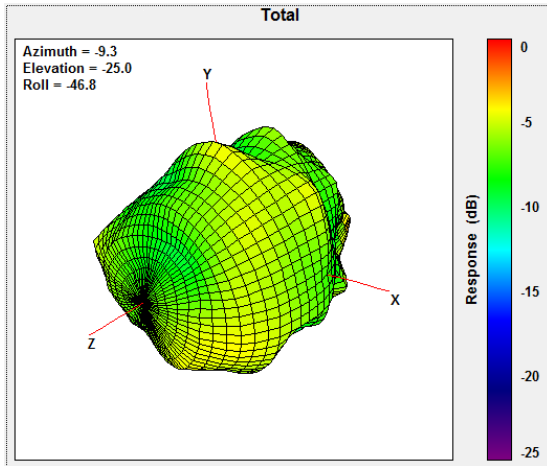
## XZ Plane



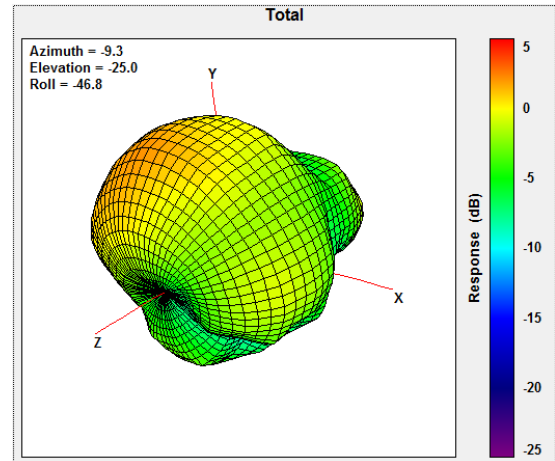
## YZ Plane



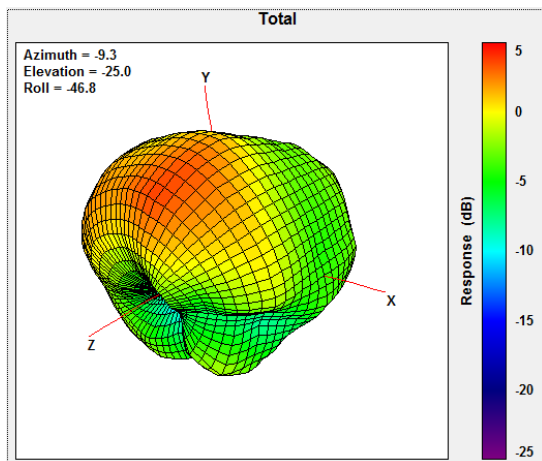
### 3.2.14. 3D Radiation Pattern (LTE MIMO1 with 0.3M cable length on the 30\*30cm ground plane)



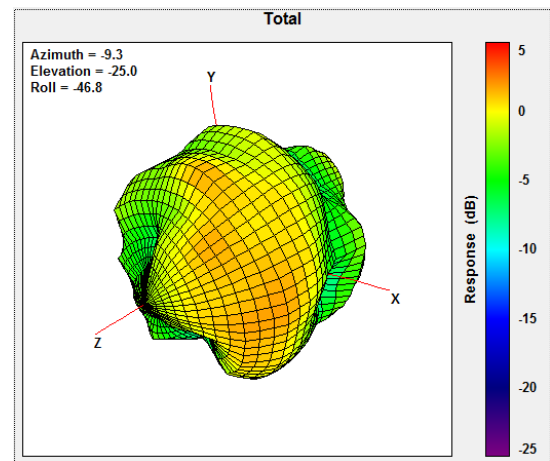
704MHz



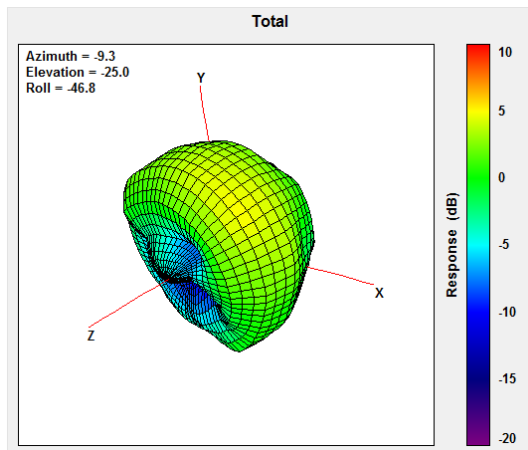
960MHz



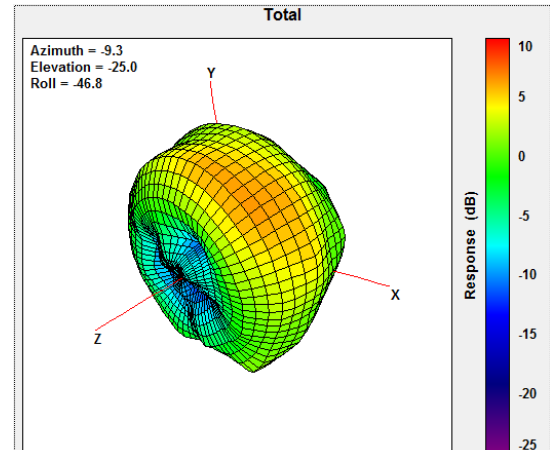
1710MHz



2170MHz



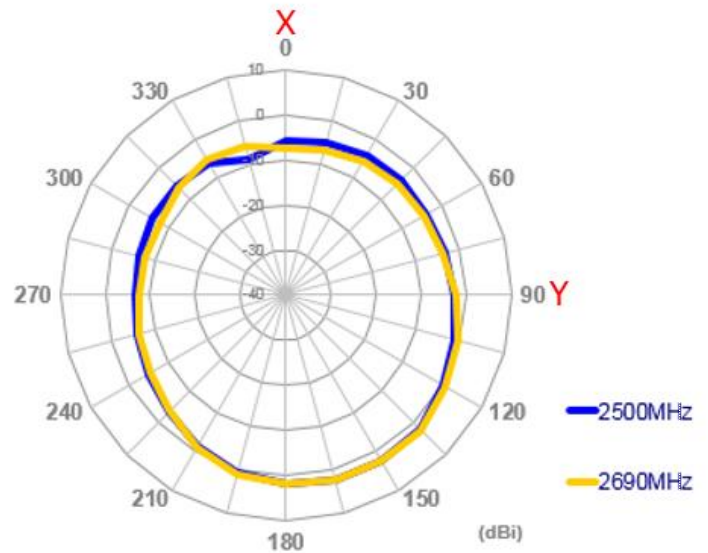
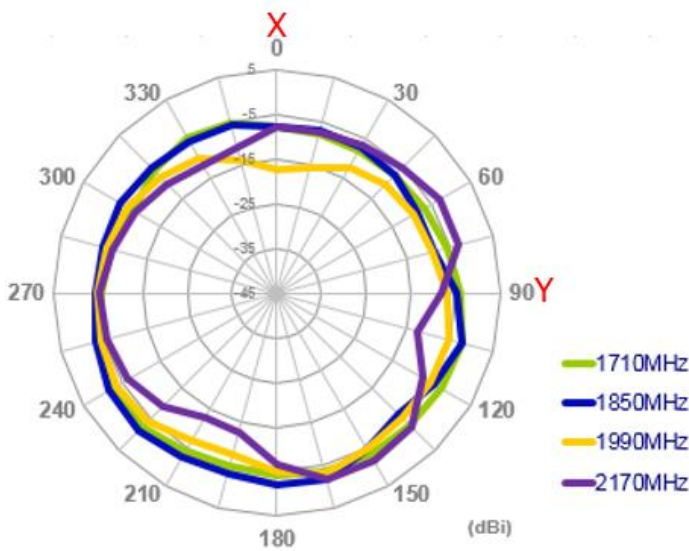
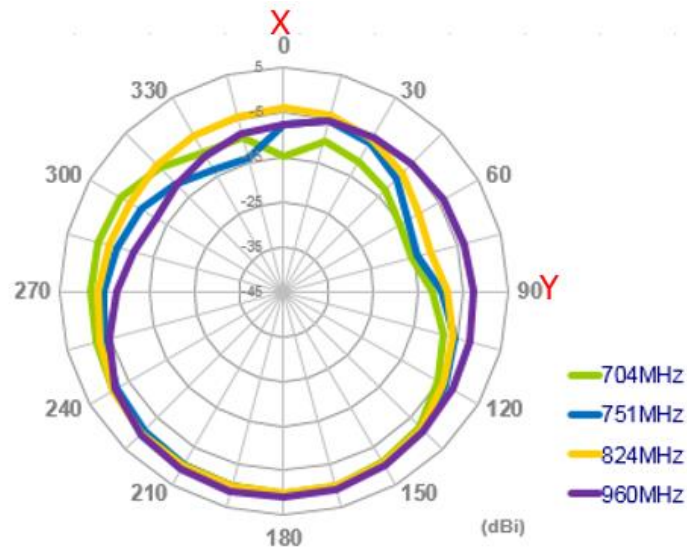
2500MHz



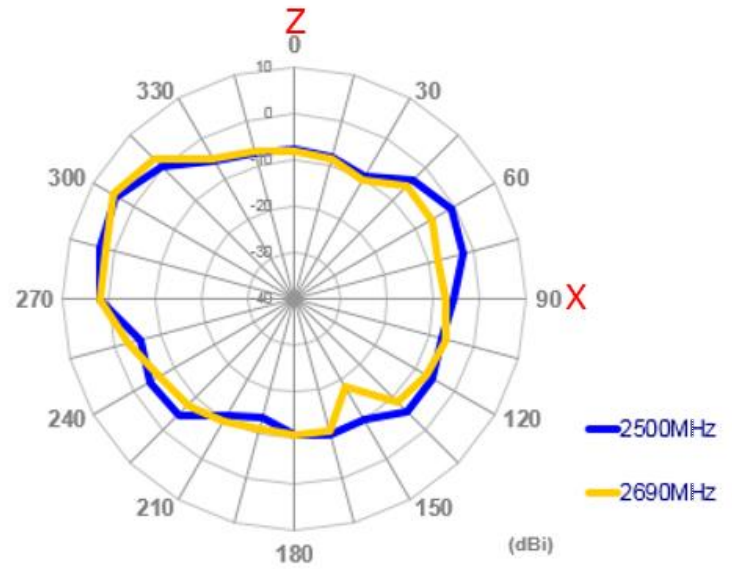
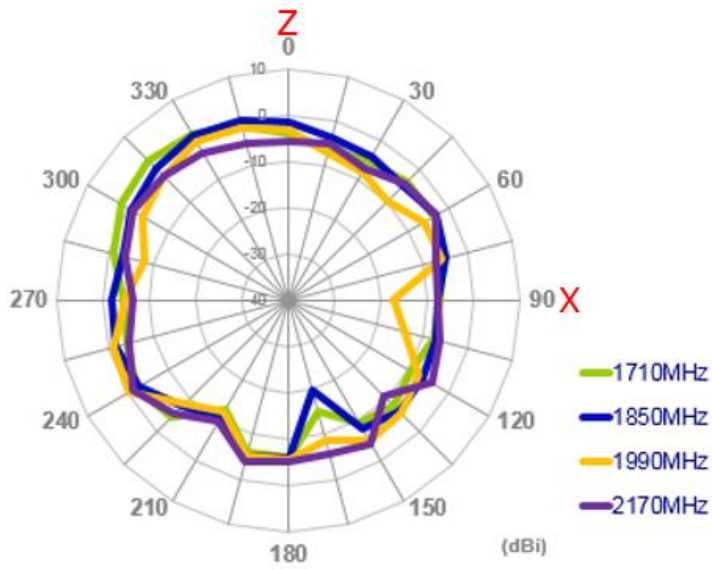
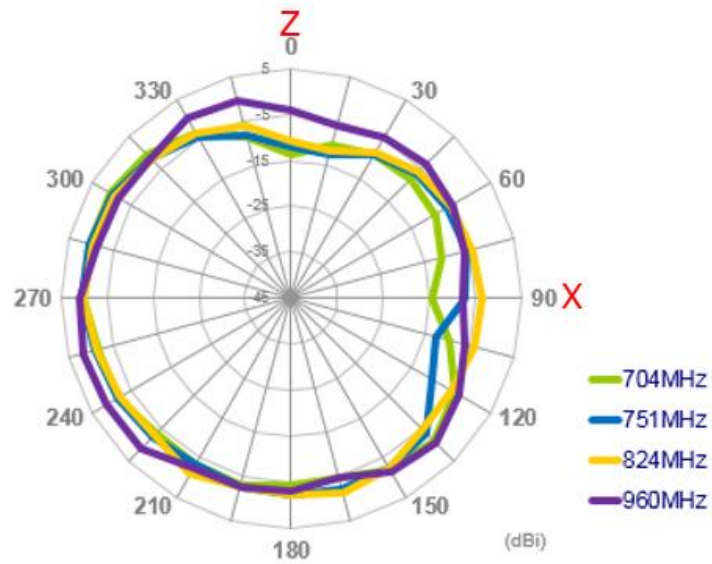
2690MHz

### 3.2.15. 2D Radiation Pattern (LTE MIMO2 with 0.3M cable length)

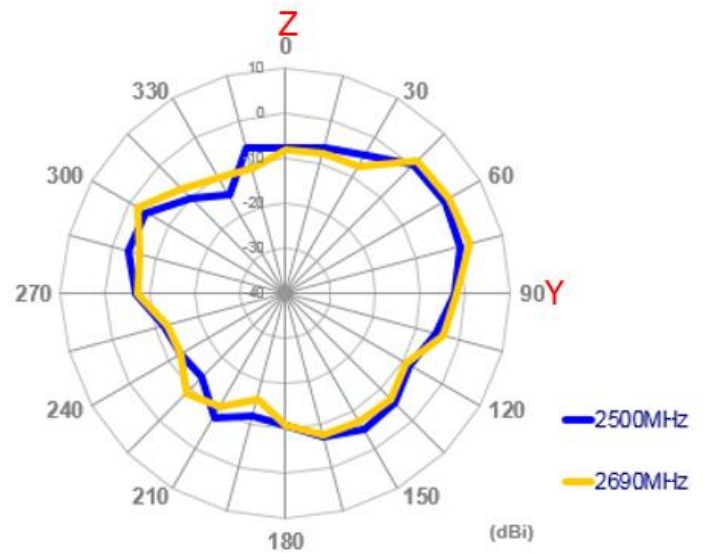
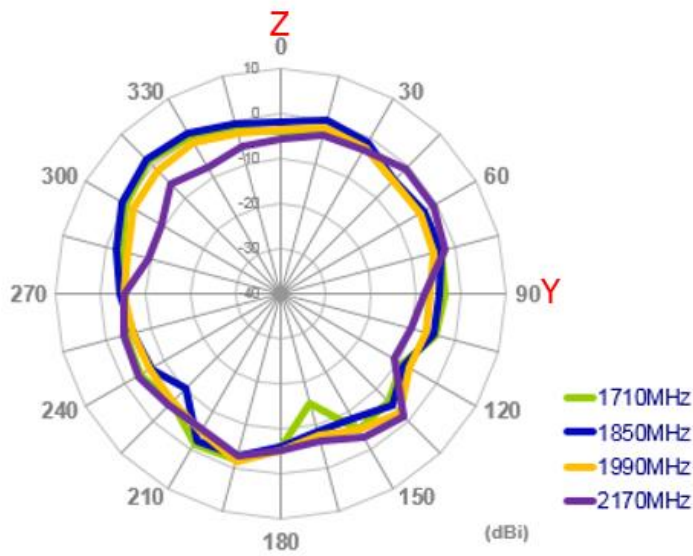
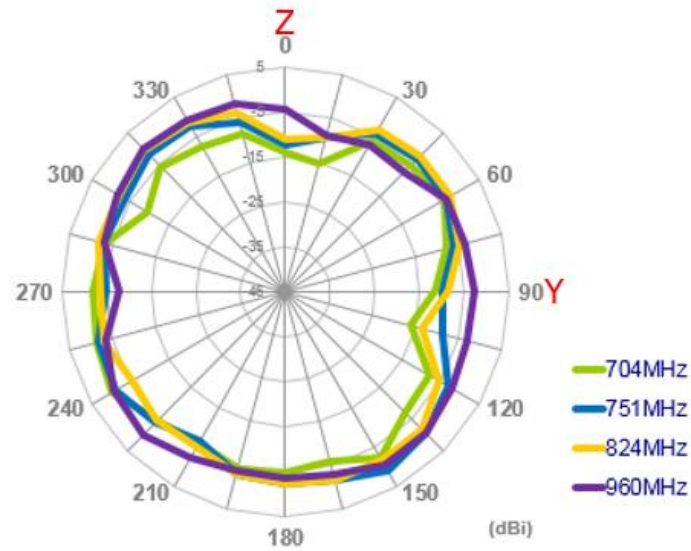
#### XY Plane



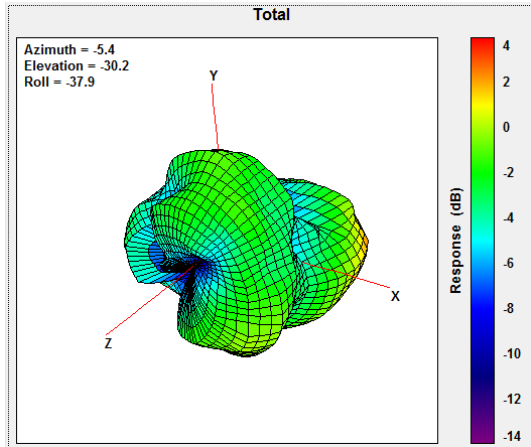
## XZ Plane



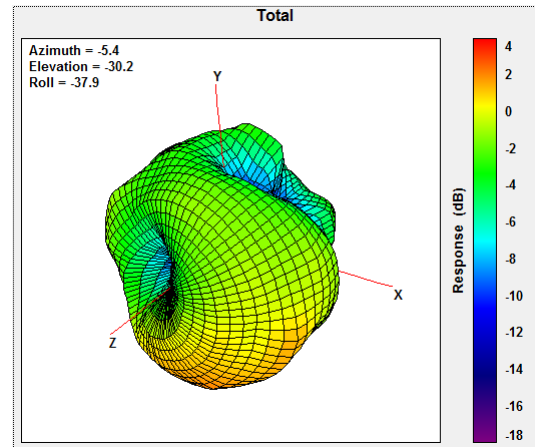
## YZ Plane



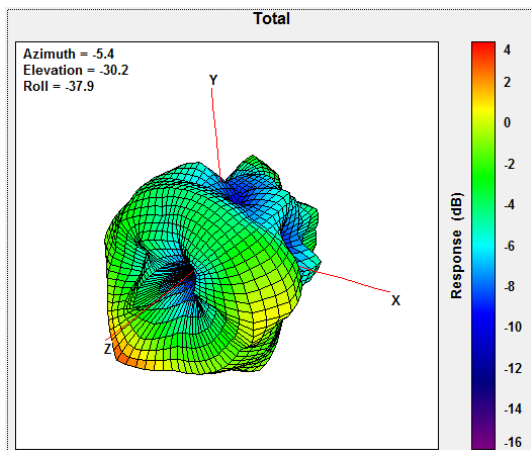
### 3.2.16. 3D Radiation Pattern (LTE MIMO2 with 0.3M cable length on the 30\*30cm ground plane)



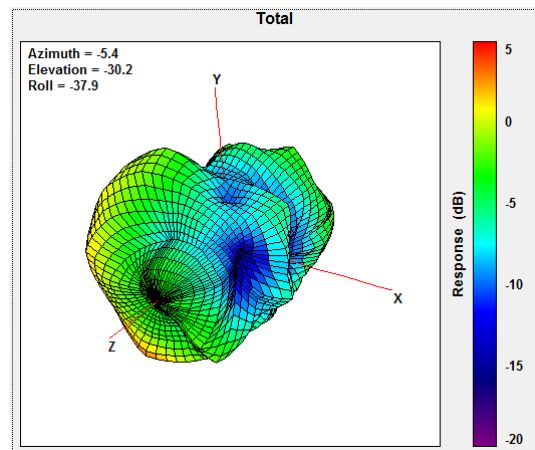
704MHz



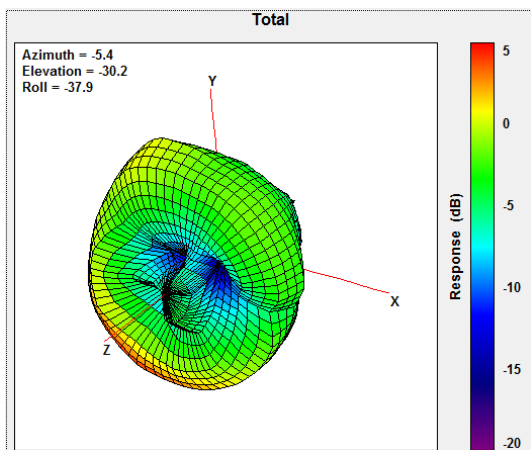
960MHz



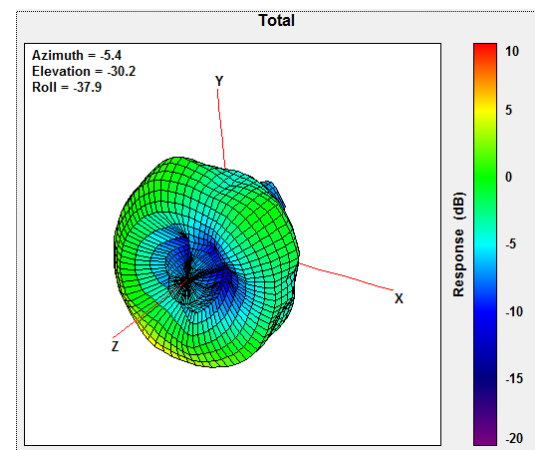
1710MHz



2170MHz



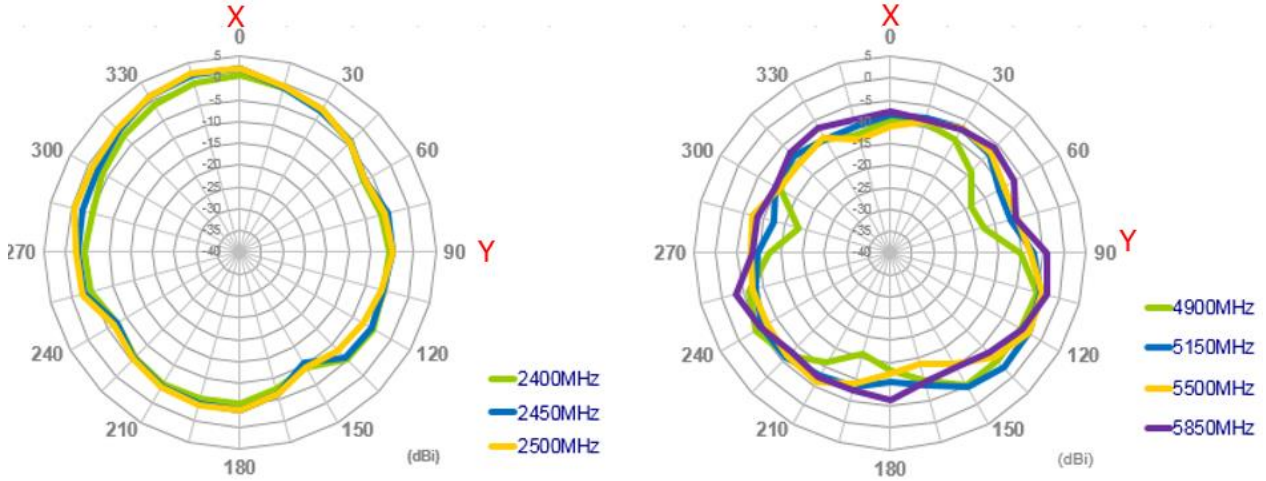
2500MHz



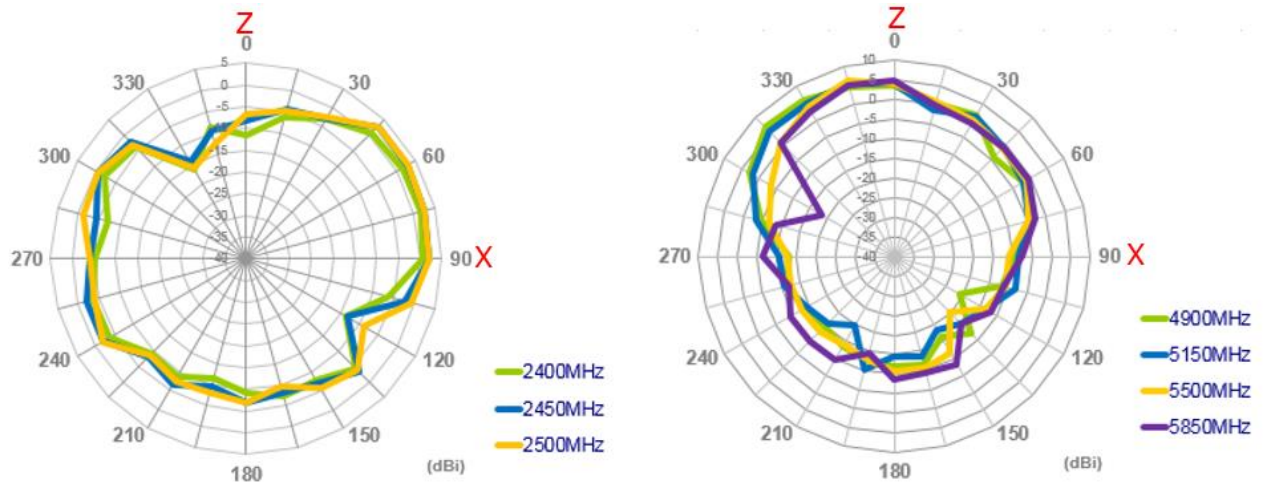
2690MHz

### 3.2.17. 2D Radiation Pattern (Wi-Fi MIMO1 with 0.3M cable length)

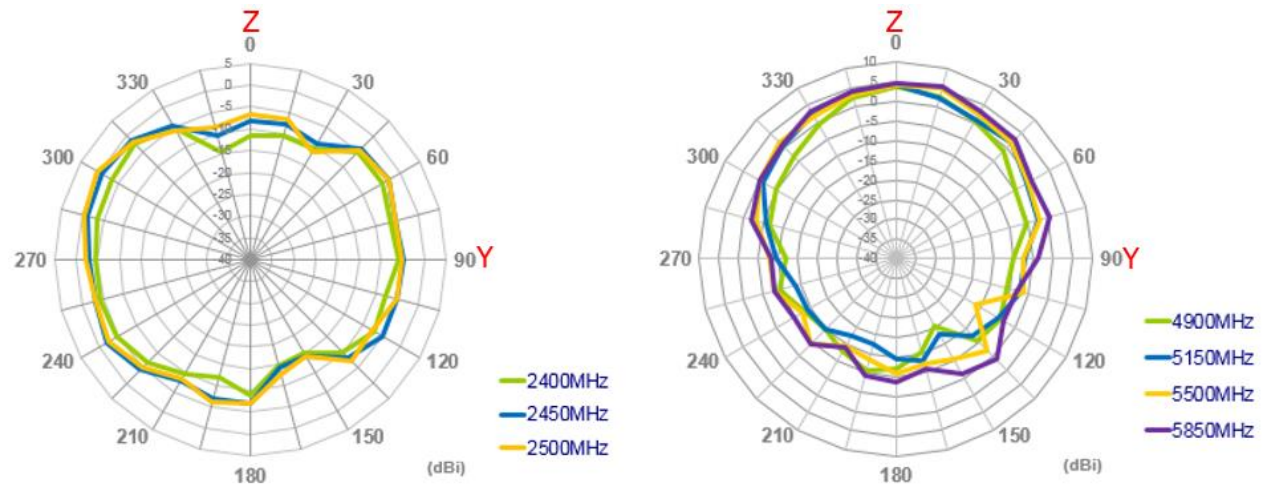
XY Plane



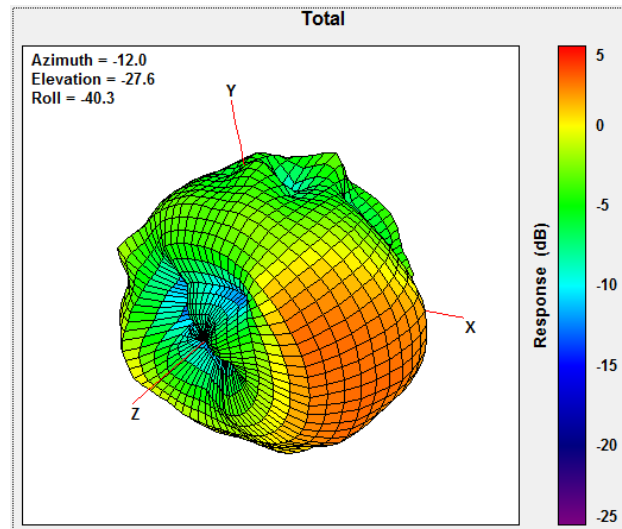
XZ Plane



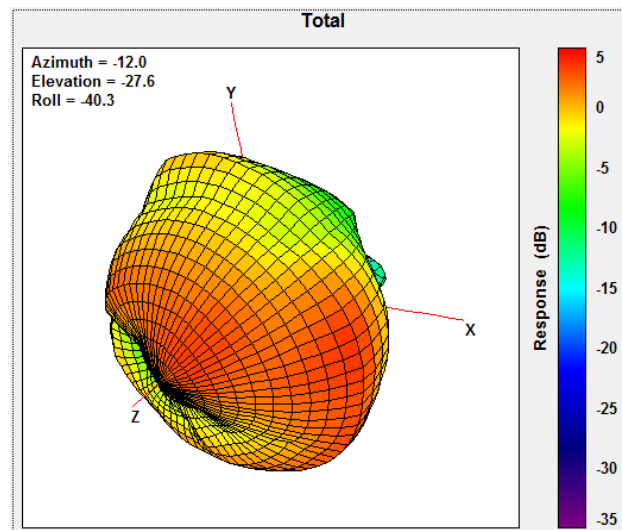
YZ Plane



### 3.2.18. 3D Radiation Pattern (Wi-Fi MIMO1 with 0.3M cable length on the 30\*30cm ground plane)



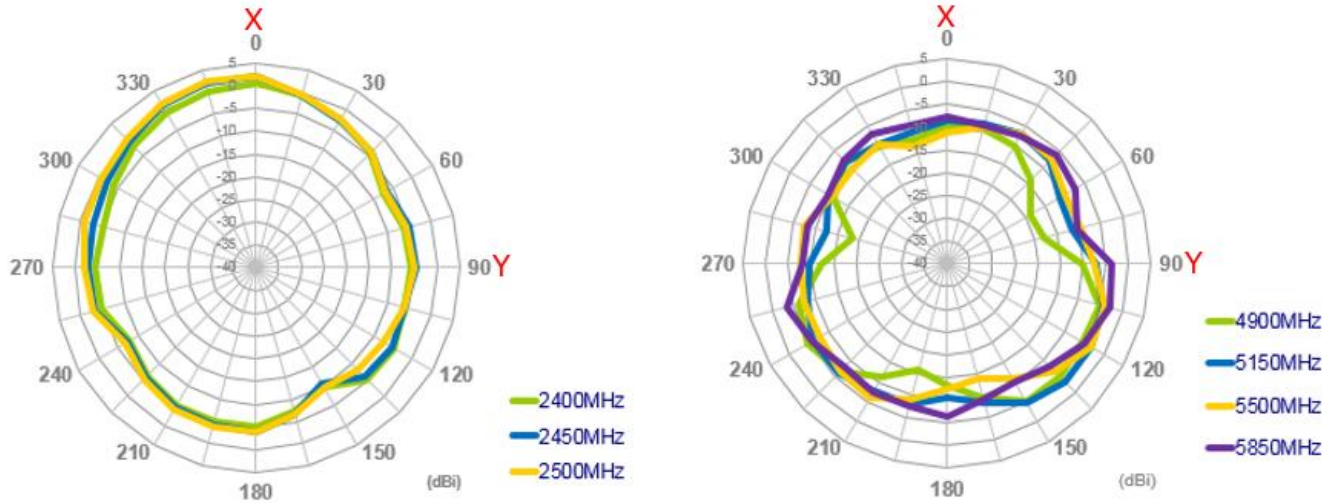
2450MHz



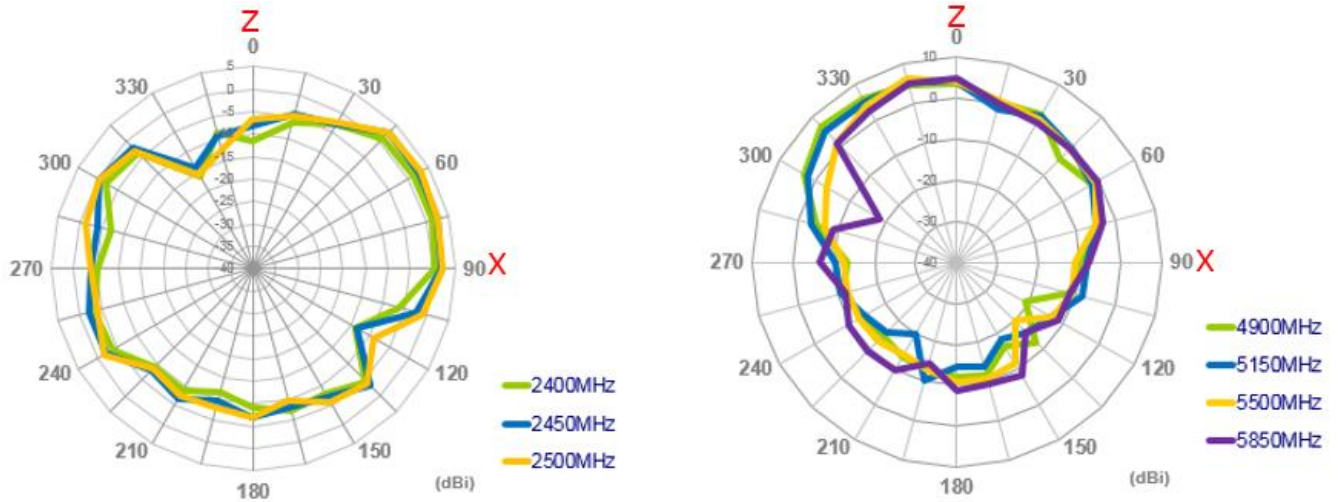
5500MHz

### 3.2.19. 2D Radiation Pattern (Wi-Fi\_MIMO2 with 0.3M cable length)

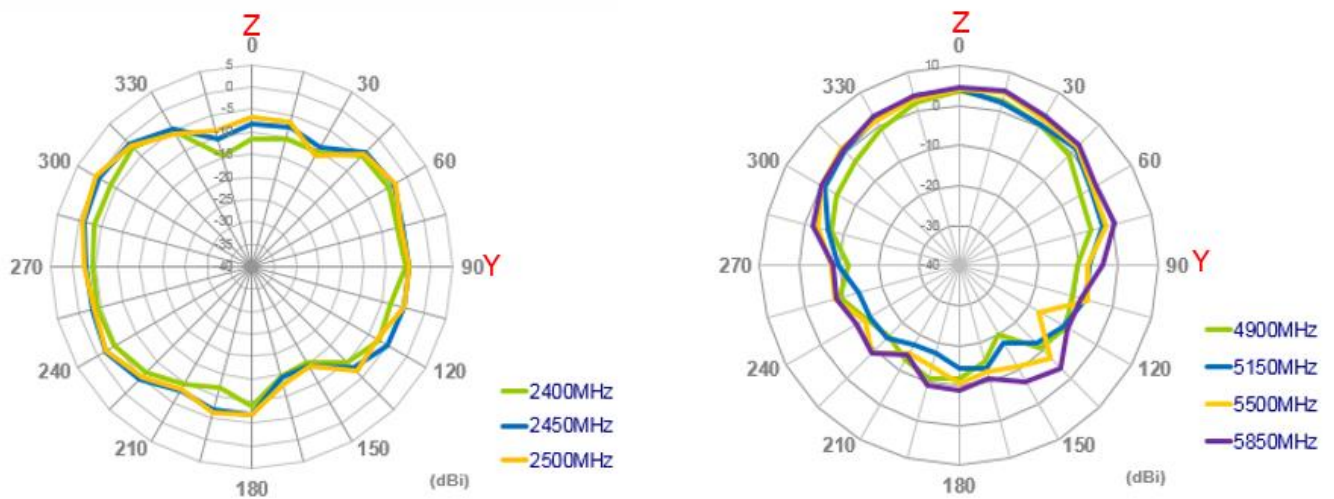
#### XY Plane



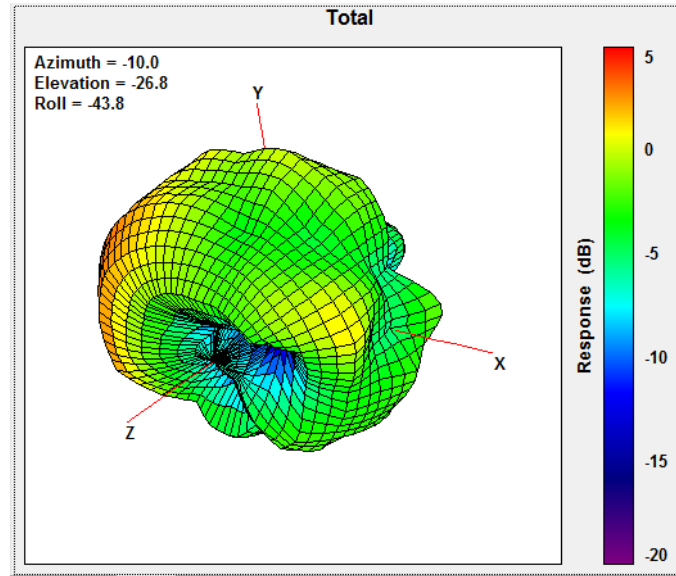
#### XZ Plane



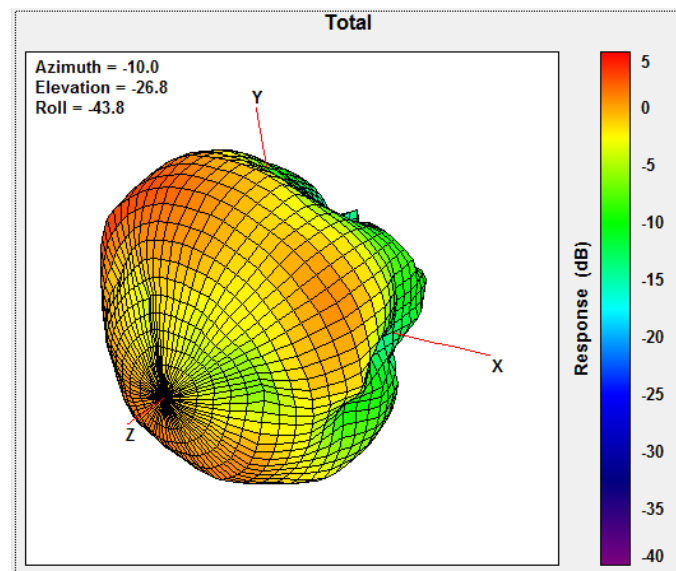
#### YZ Plane



### 3.2.20. 3D Radiation Pattern (Wi-Fi MIMO2 with 0.3M cable length on the 30\*30cm ground plane)

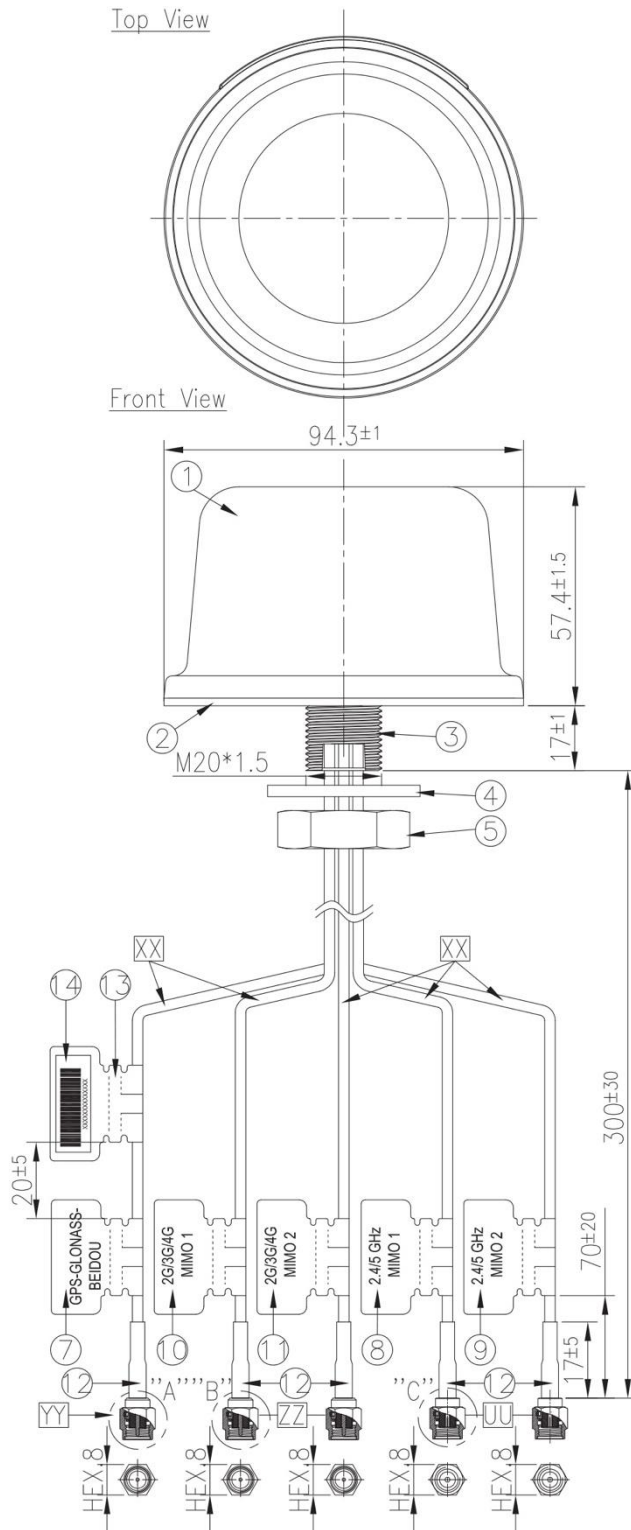


2450MHz



5500MHz

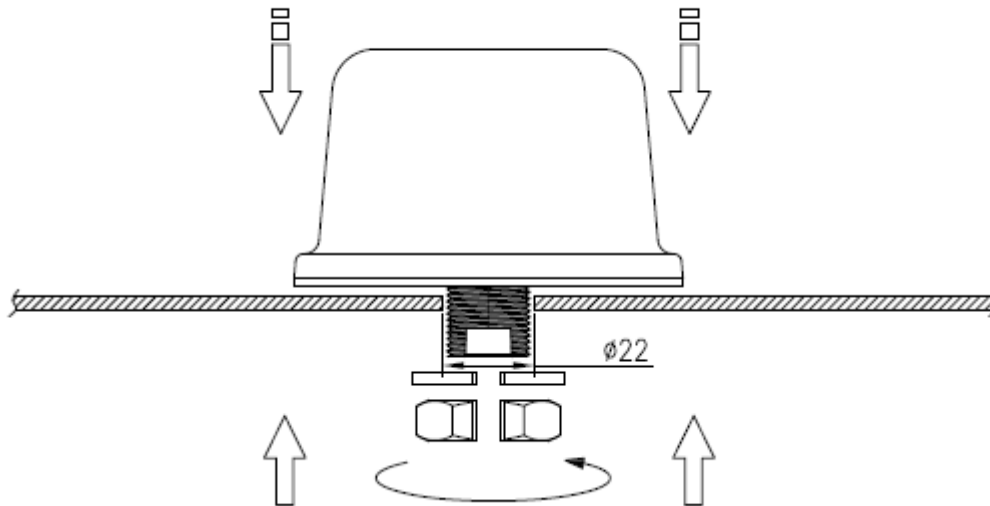
## 4. Mechanical Drawing



|    | Name                     | Material       | Finish       | QTY |
|----|--------------------------|----------------|--------------|-----|
| 1  | Mini ST Short Case       | ASA            | Black        | 1   |
| 2  | Adhesive Foam Mini ST    | 3M9448+CR 4305 | Black        | 1   |
| 3  | Mini ST Base             | Zinc Alloy     | Ni Plated    | 1   |
| 4  | Nut_M20x1.5Px10H Cut     | Steel          | Ni Plated    | 1   |
| 5  | Washer_Cut               | Steel          | Ni Plated    | 1   |
| 6  | Cable Rubber_ST_6IN1     | Silicone       | Black        | 1   |
| 7  | GPS-GLONASS-BEIDOU Label | Coated Paper   | Orange       | 1   |
| 8  | 2.4/5GHz MIMO1 Label     | Coated Paper   | Dark Green   | 1   |
| 9  | 2.4/5GHz MIMO2 Label     | Coated Paper   | Green Yellow | 1   |
| 10 | 2G/3G/4G MIMO1 Label     | Coated Paper   | Gray         | 1   |
| 11 | 2G/3G/4G MIMO2 Label     | Coated Paper   | White        | 1   |
| 12 | Heat Shrink Tube         | PE             | Black        | 5   |
| 13 | Empty Label              | PET            | White        | 1   |
| 14 | Barcode Label            | PET            | White        | 1   |

|    | Name           | Material    | Finish    | QTY |
|----|----------------|-------------|-----------|-----|
| XX | Cable Type     | RG174       | Black     | 5   |
| YY | Connector Type | SMA(M)ST    | Au Plated | 1   |
| ZZ | Connector Type | SMA(M)ST    | Au Plated | 2   |
| UU | Connector Type | RP-SMA(M)ST | Au Plated | 2   |

## 5. Installation



Recommended torque for mounting is 29.4N•m

Maximum torque for mounting is 39.2 N•m

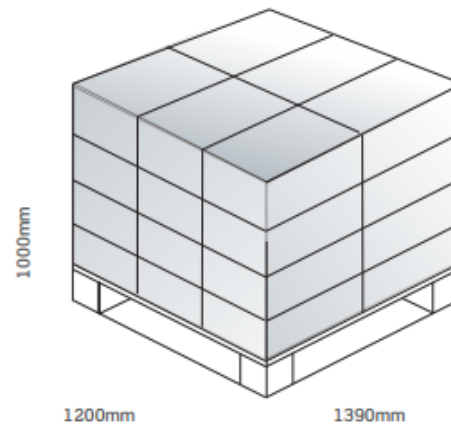
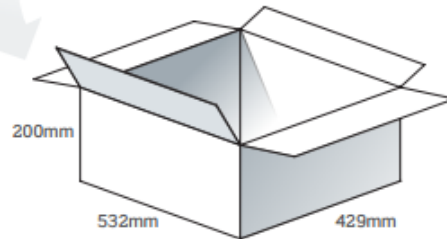
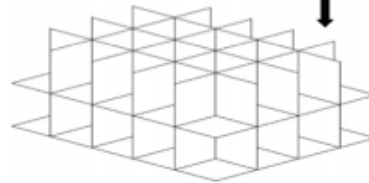
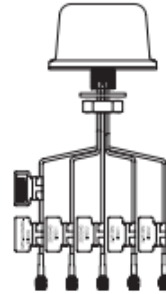
## 6. Packaging

### Packaging Specifications

20 pcs MA850.A.LBICG.001 per layer  
2 Layers per carton

40 pcs MA850.A.LBICG.001 per carton  
Carton - 532 x 429 x 200mm  
Weight - 14Kg

Pallet Dimensions 1200 x 1000 x 1390mm  
24 Cartons per Pallet  
6 Cartons per layer  
4 Layers

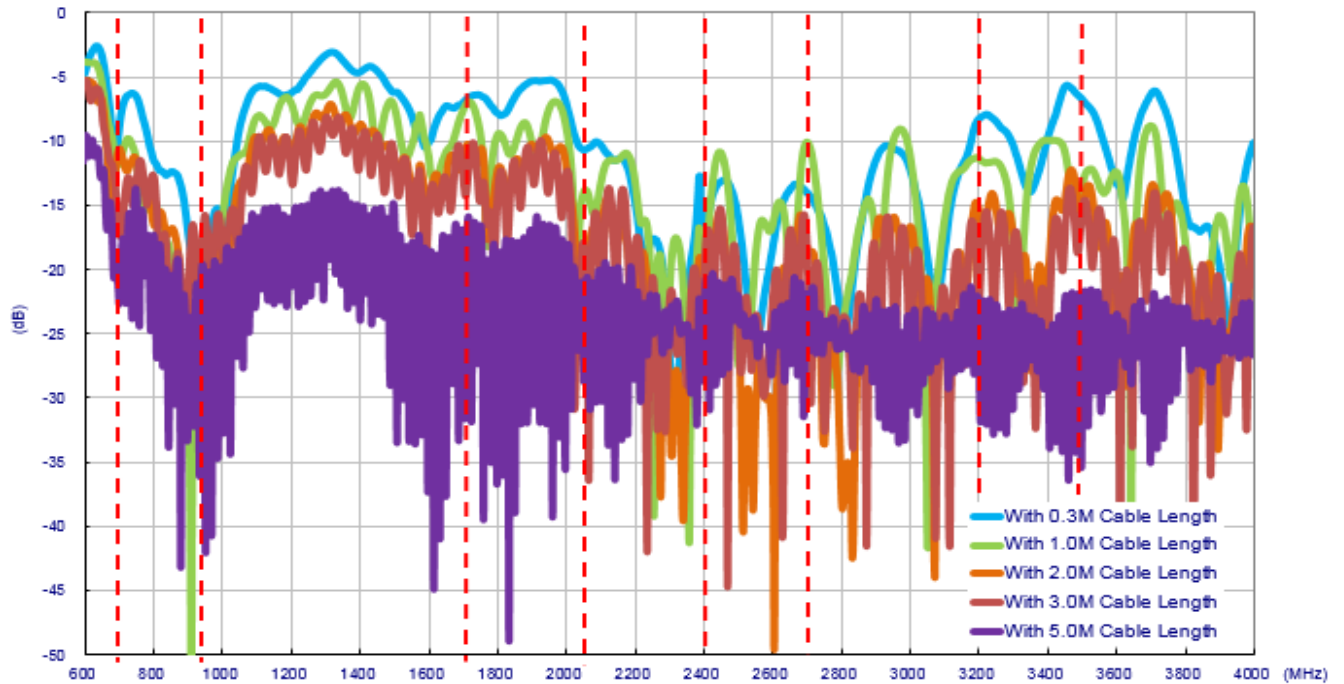


## 7. Application Note

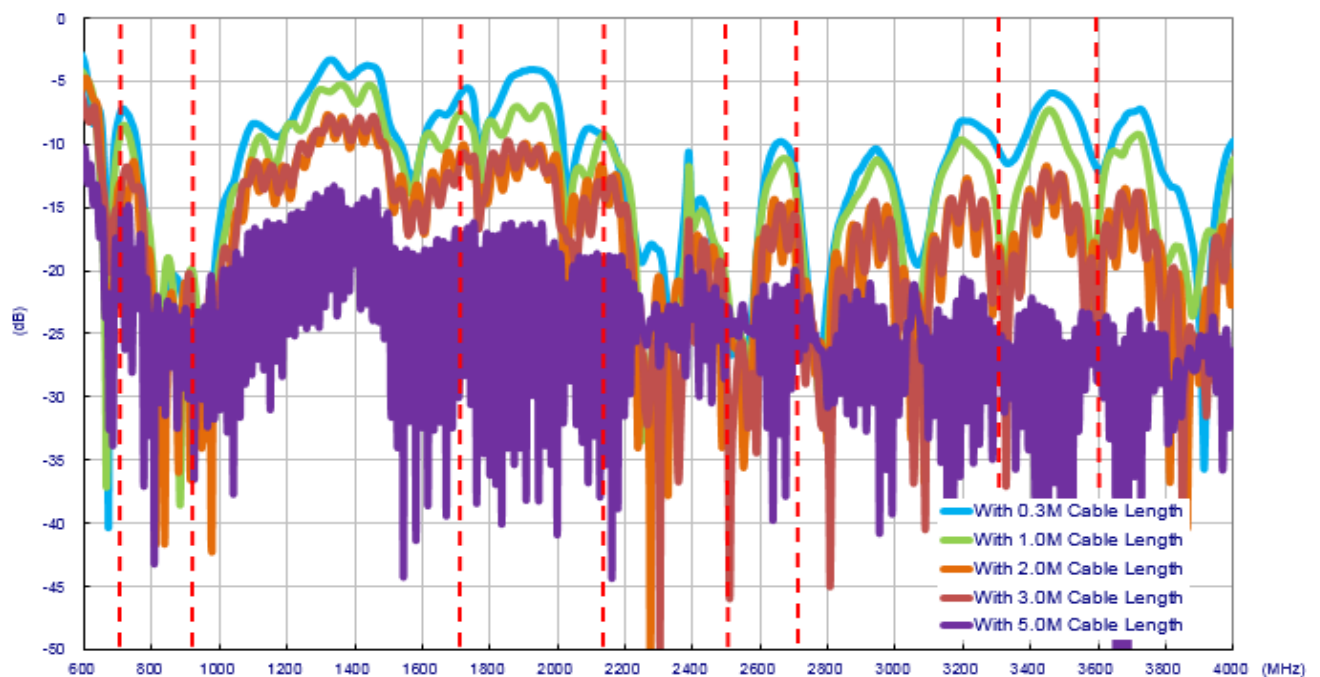
The MA850 antenna performance with different cable lengths is shown below.

### 7.1. In free space (LTE MIMO Antenna)

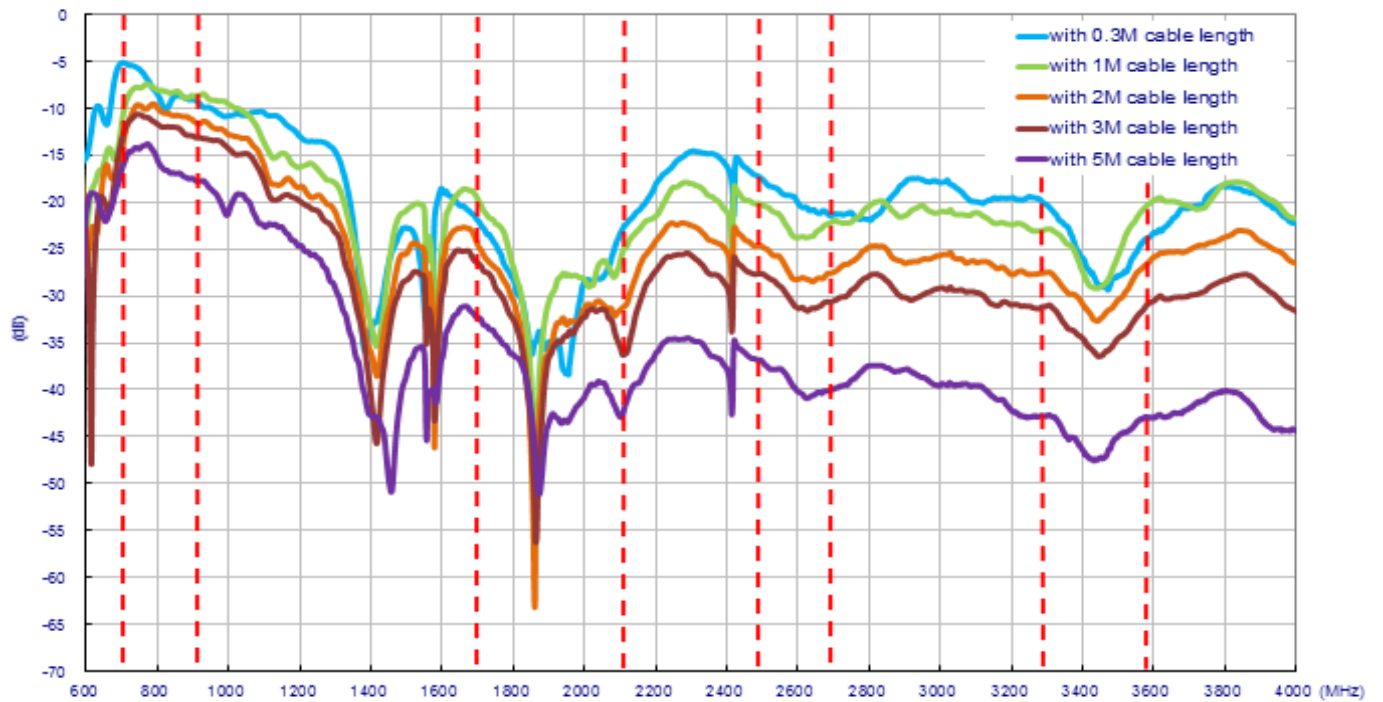
#### 7.1.1. Return Loss (LTE MIMO 1)



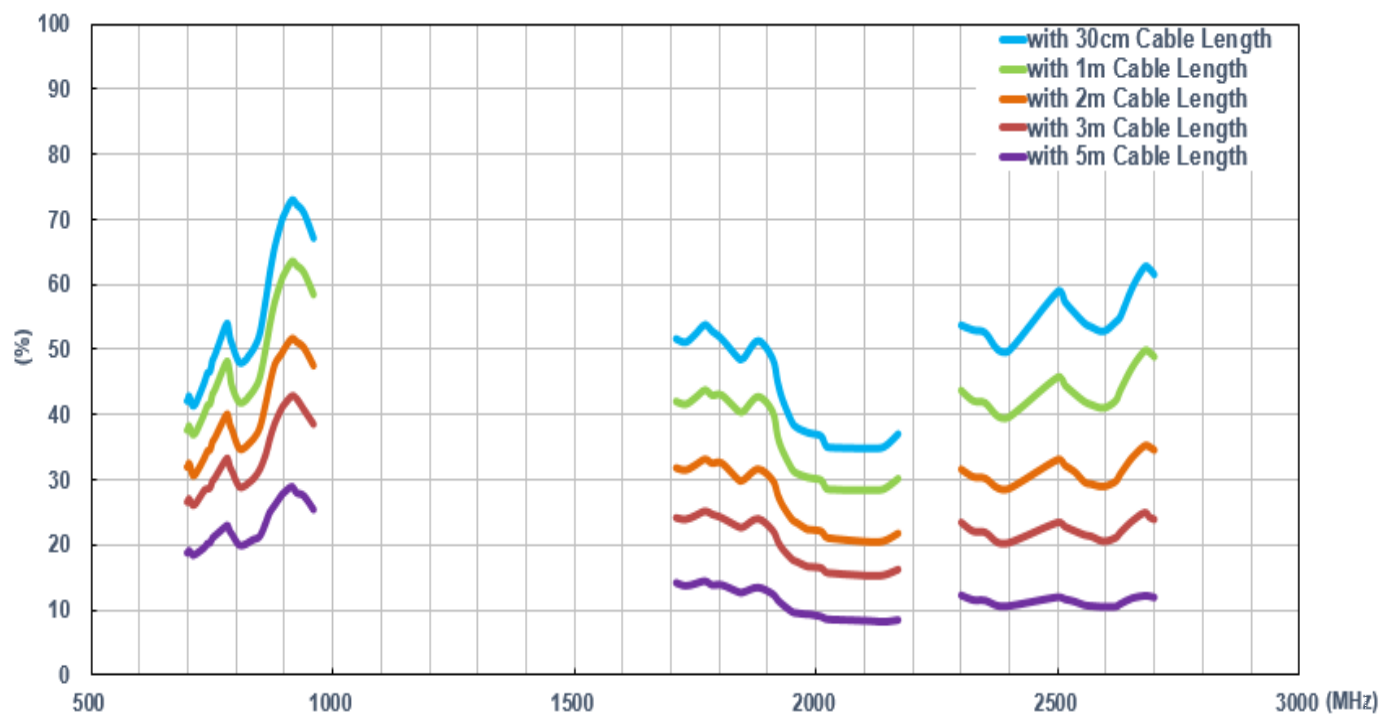
#### 7.1.2. Return Loss (LTE MIMO 2)



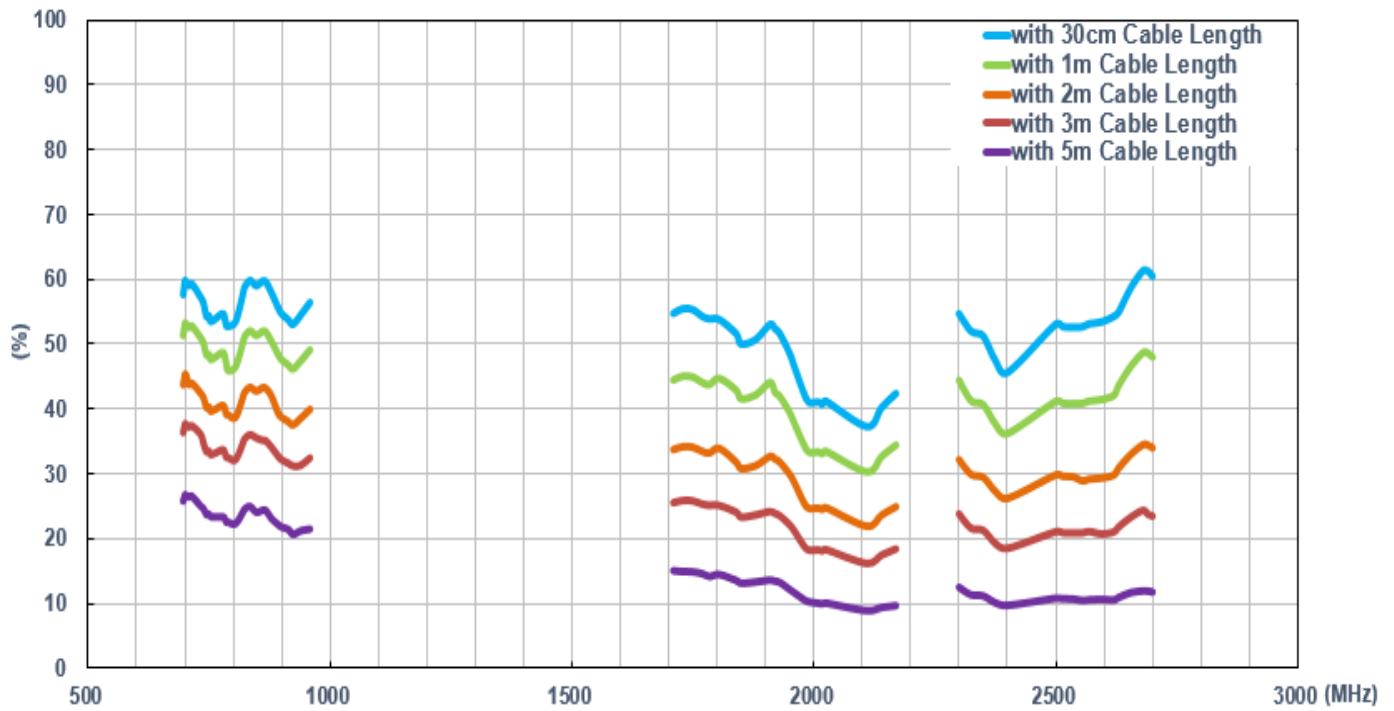
### 7.1.3. LTE Isolation



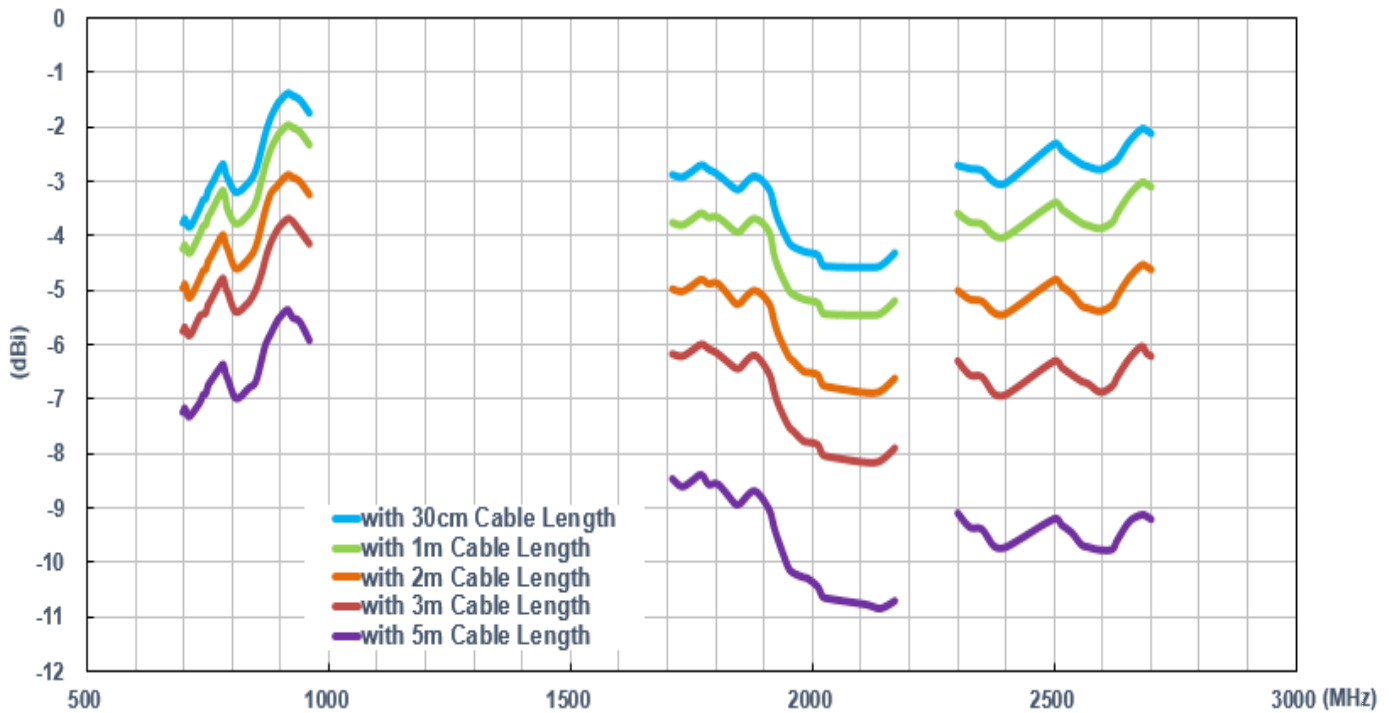
### 7.1.4. Efficiency (LTE MIMO 1)



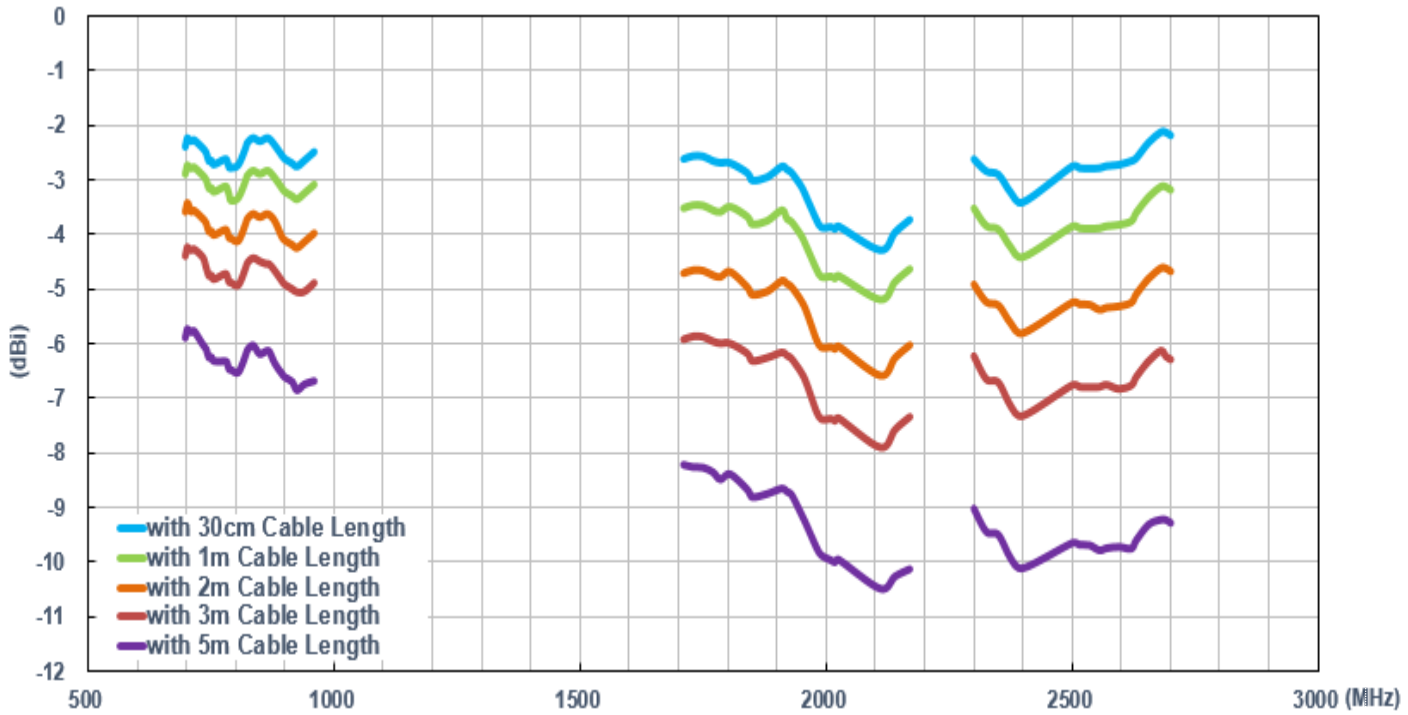
### 7.1.5. Efficiency (LTE MIMO 2)



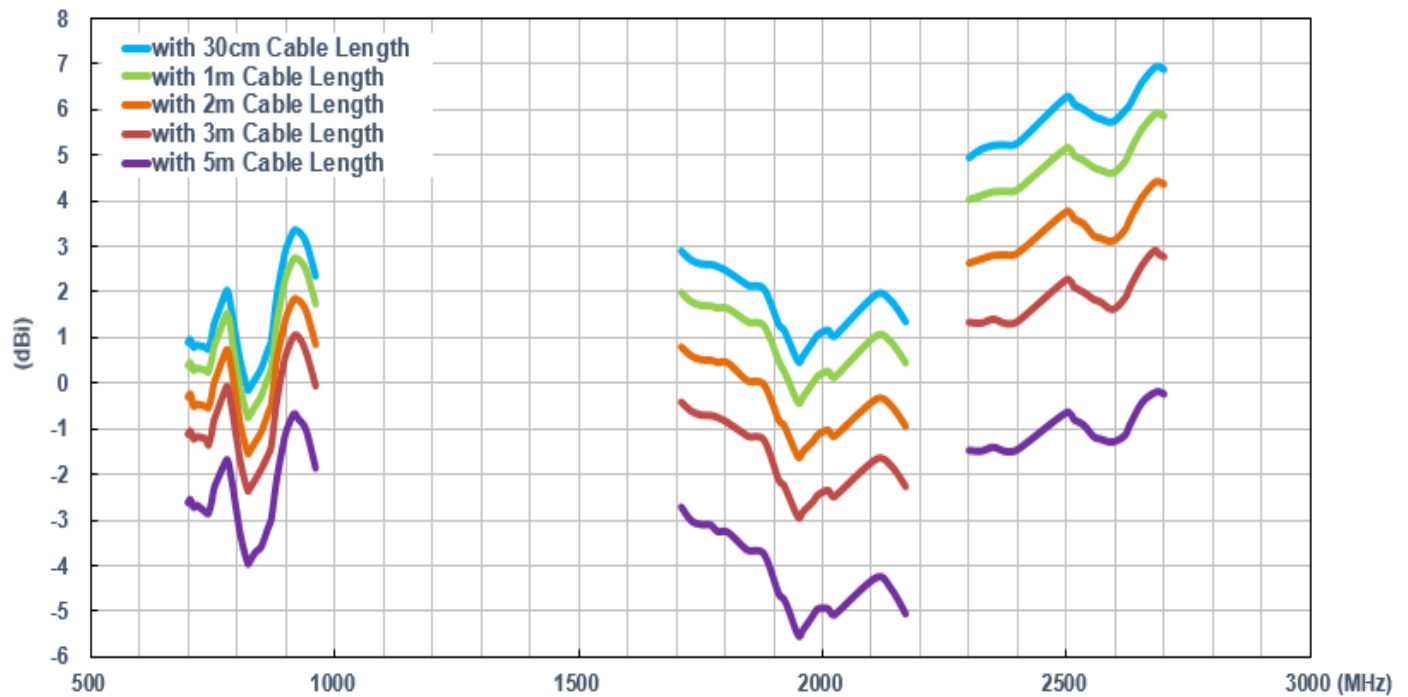
### 7.1.6. Average Gain (LTE MIMO 1)



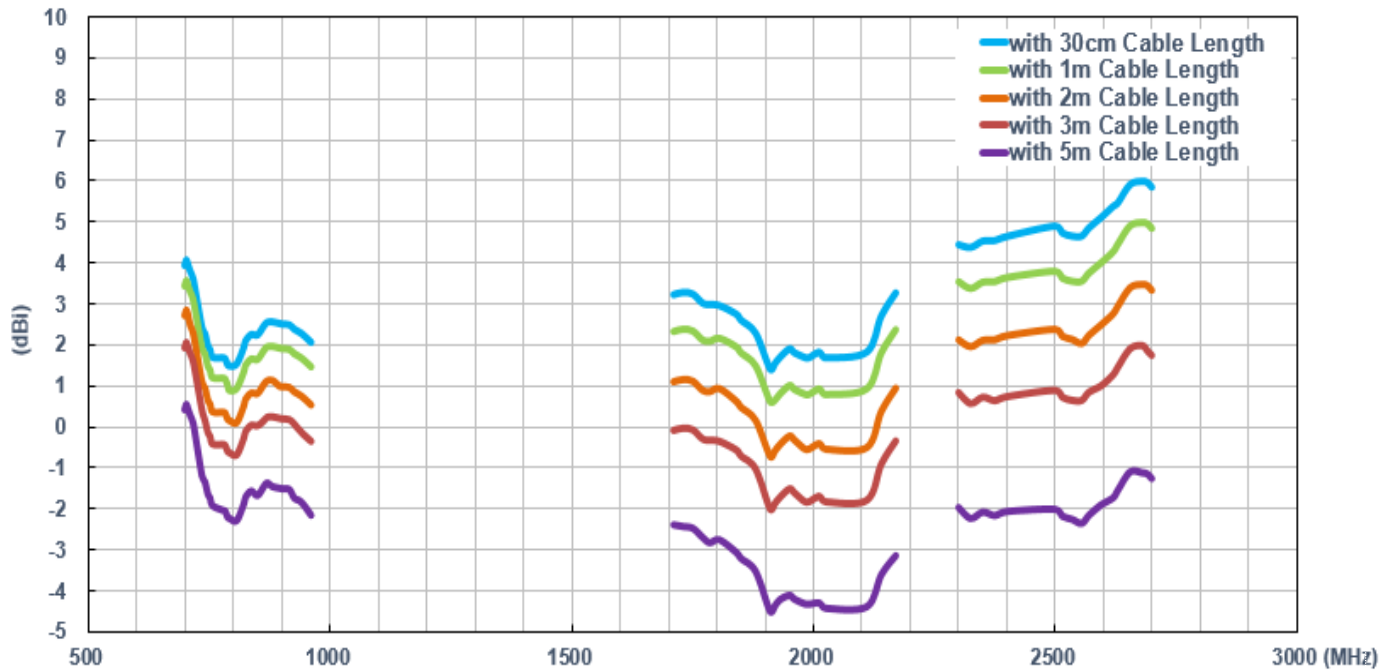
### 7.1.7. Average Gain (LTE MIMO 2)



### 7.1.8. Peak Gain (LTE MIMO 1)

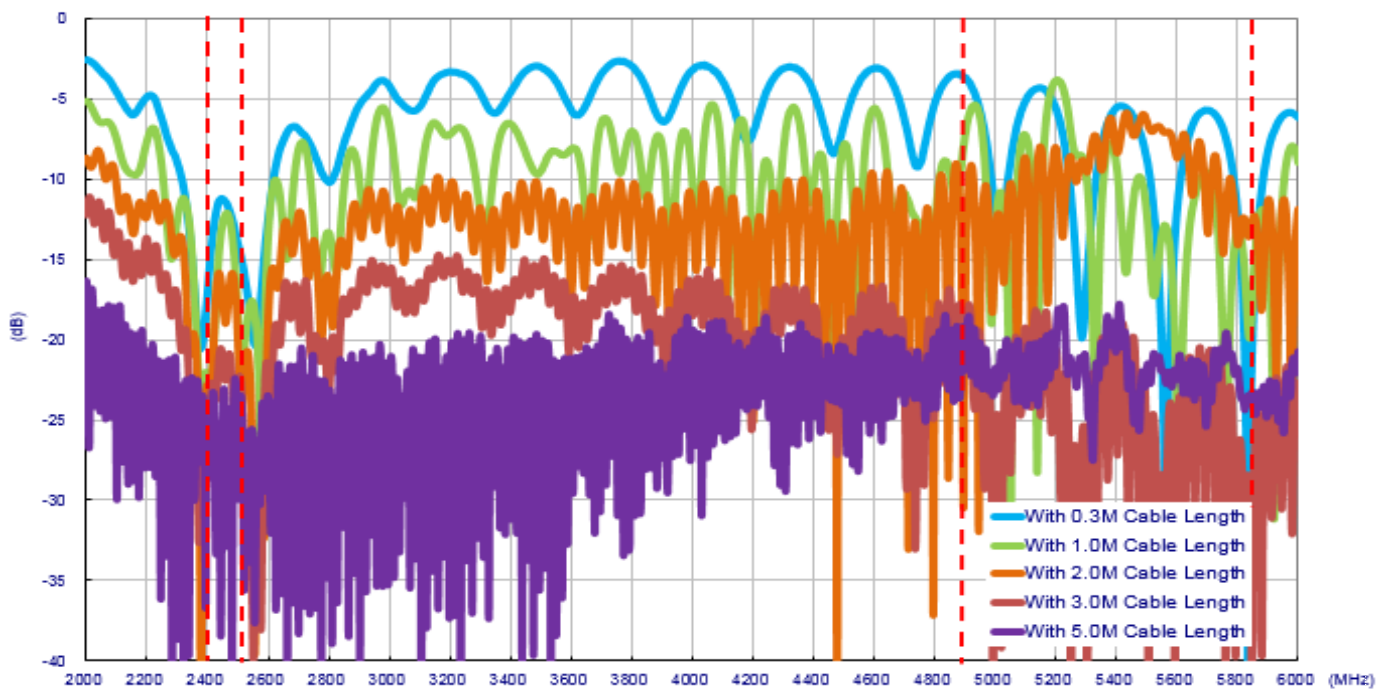


### 7.1.9. Peak Gain (LTE MIMO 2)

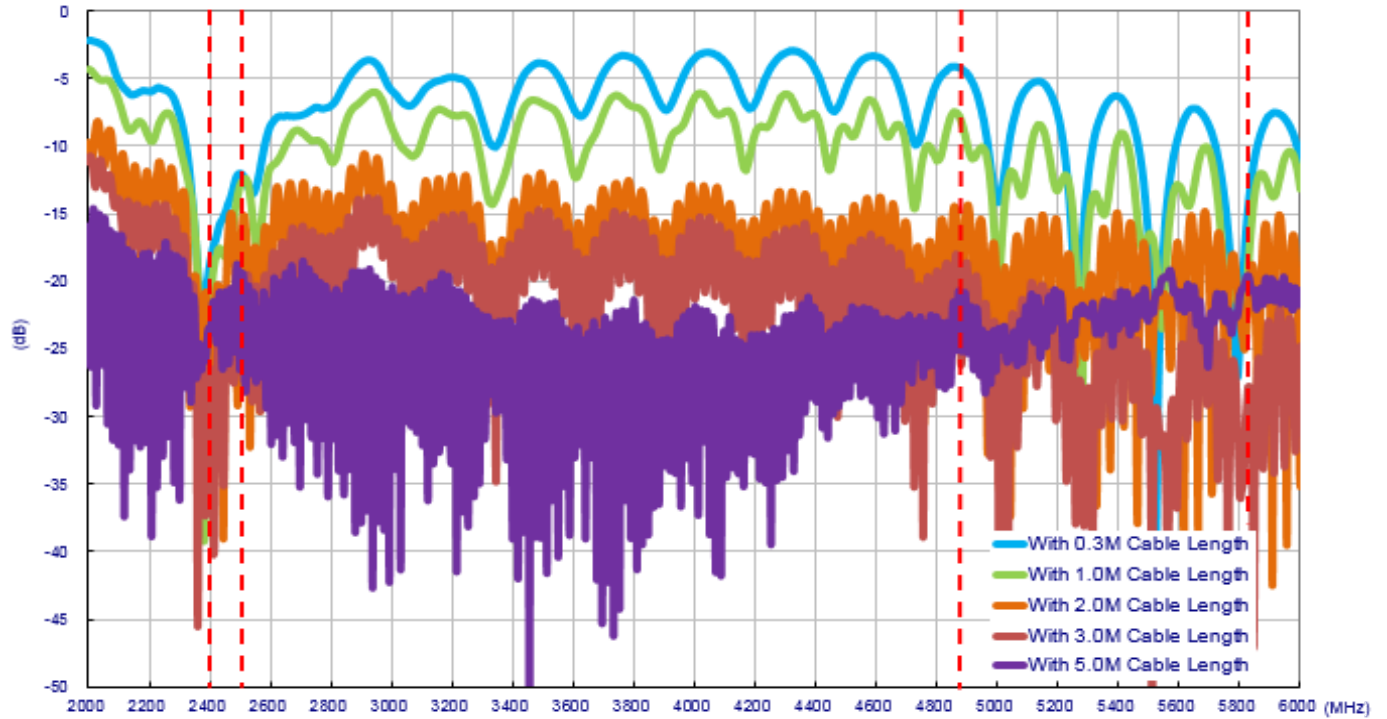


## 7.2. In free space (Wi-Fi MIMO Antenna)

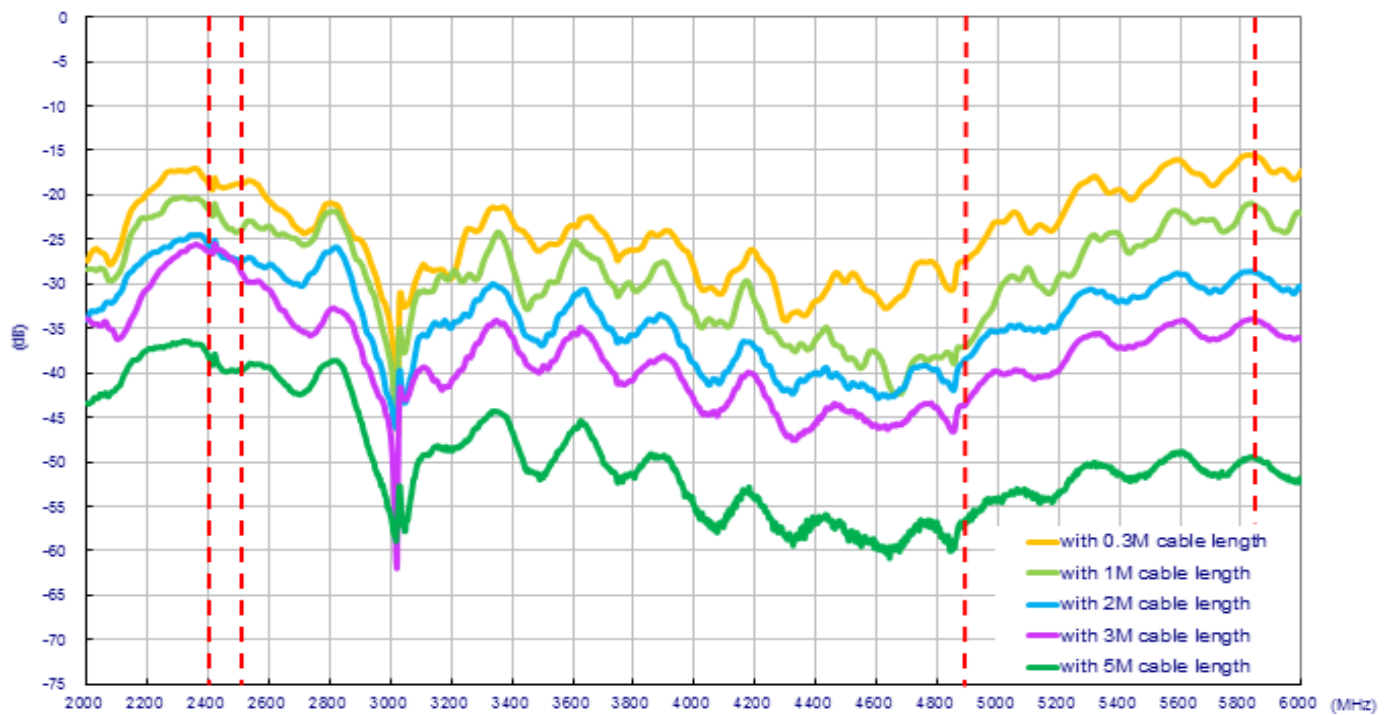
### 7.2.1. Return Loss (Wi-Fi MIMO 1)



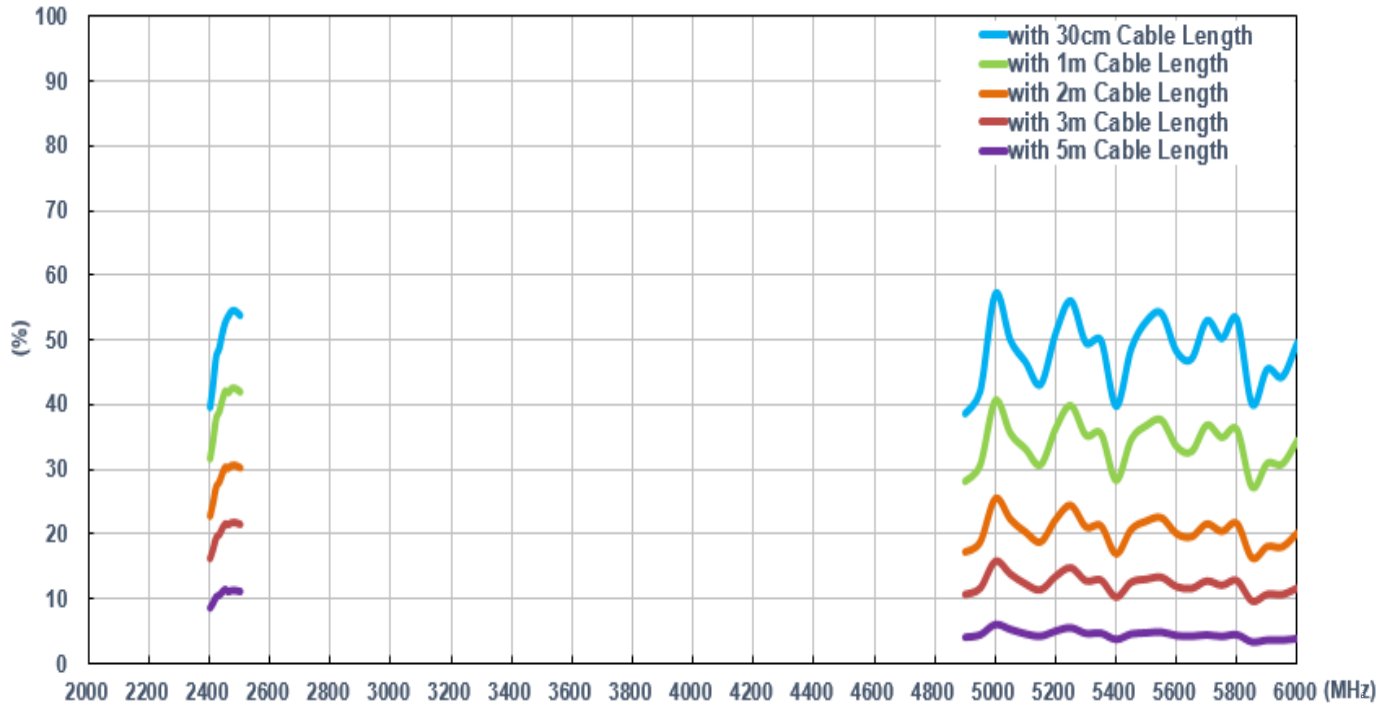
### 7.2.2. Return Loss (Wi-Fi MIMO 2)



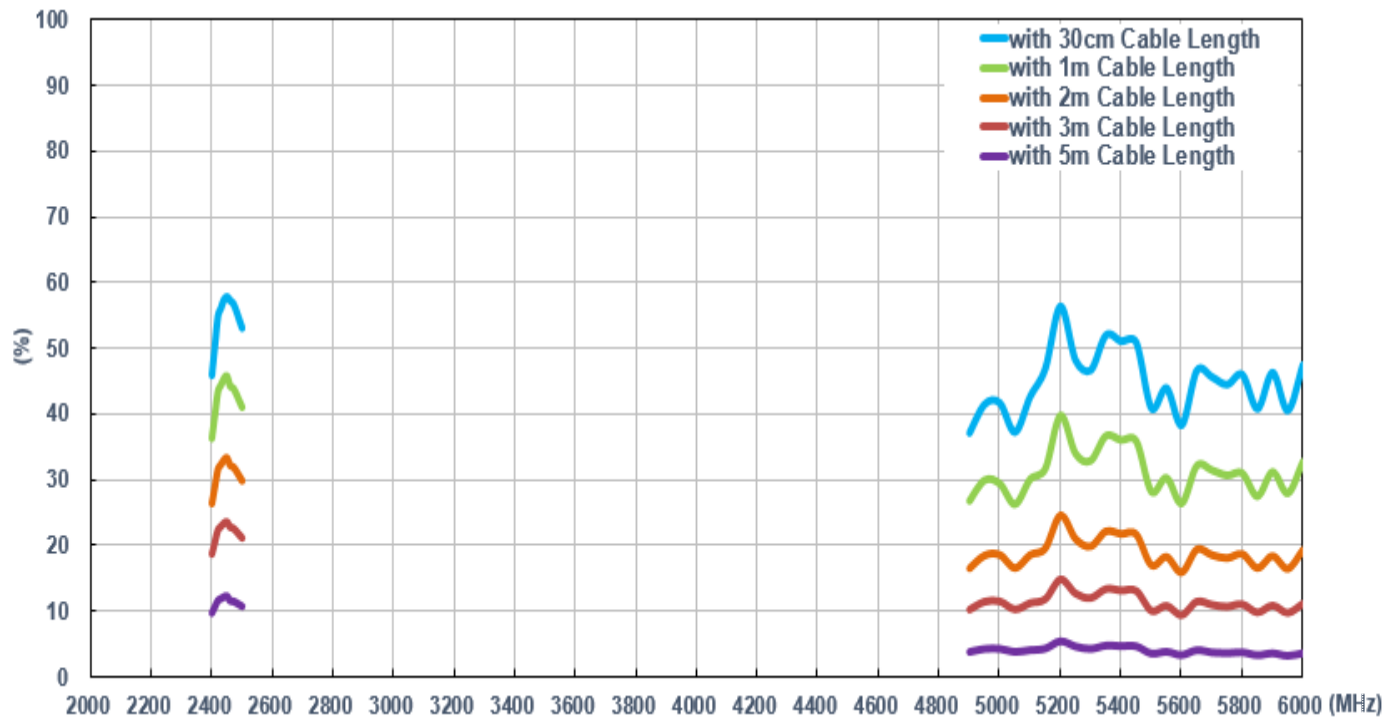
### 7.2.3. Wi-Fi Isolation



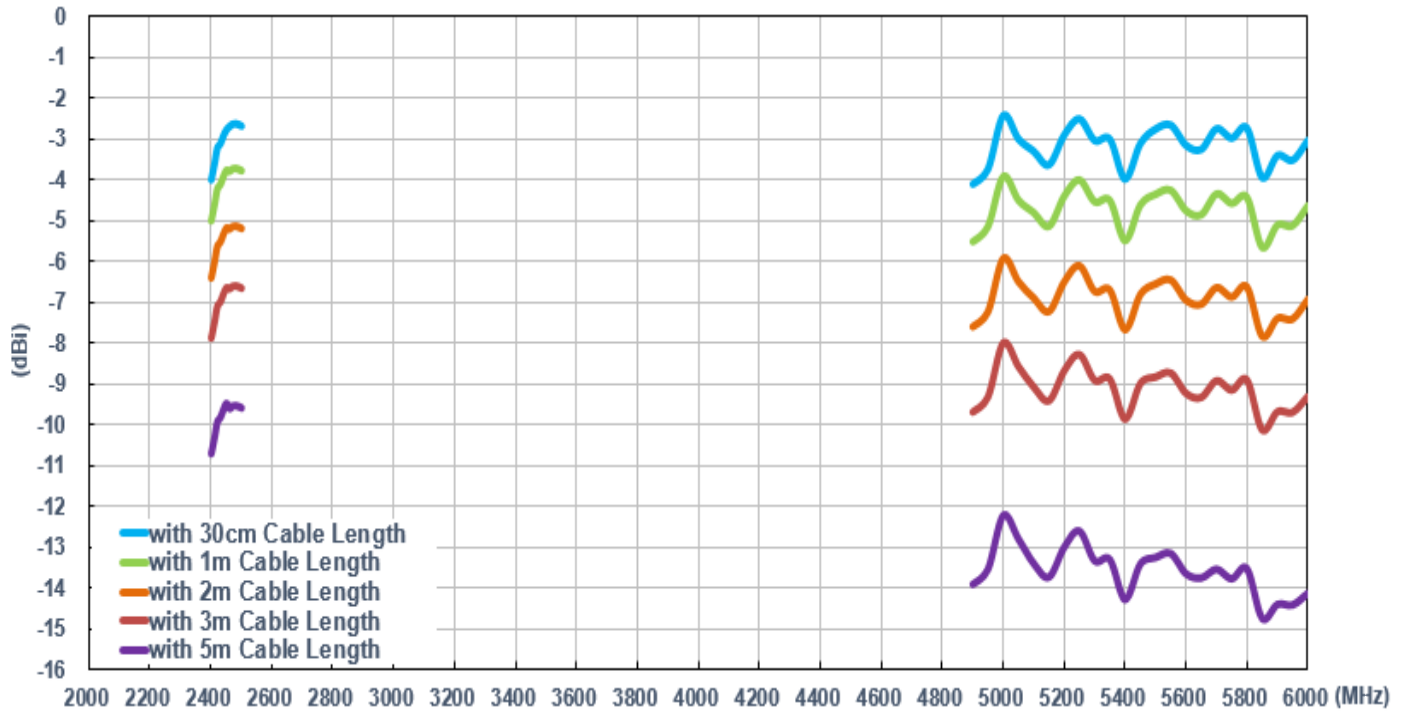
#### 7.2.4. Efficiency (Wi-Fi MIMO 1)



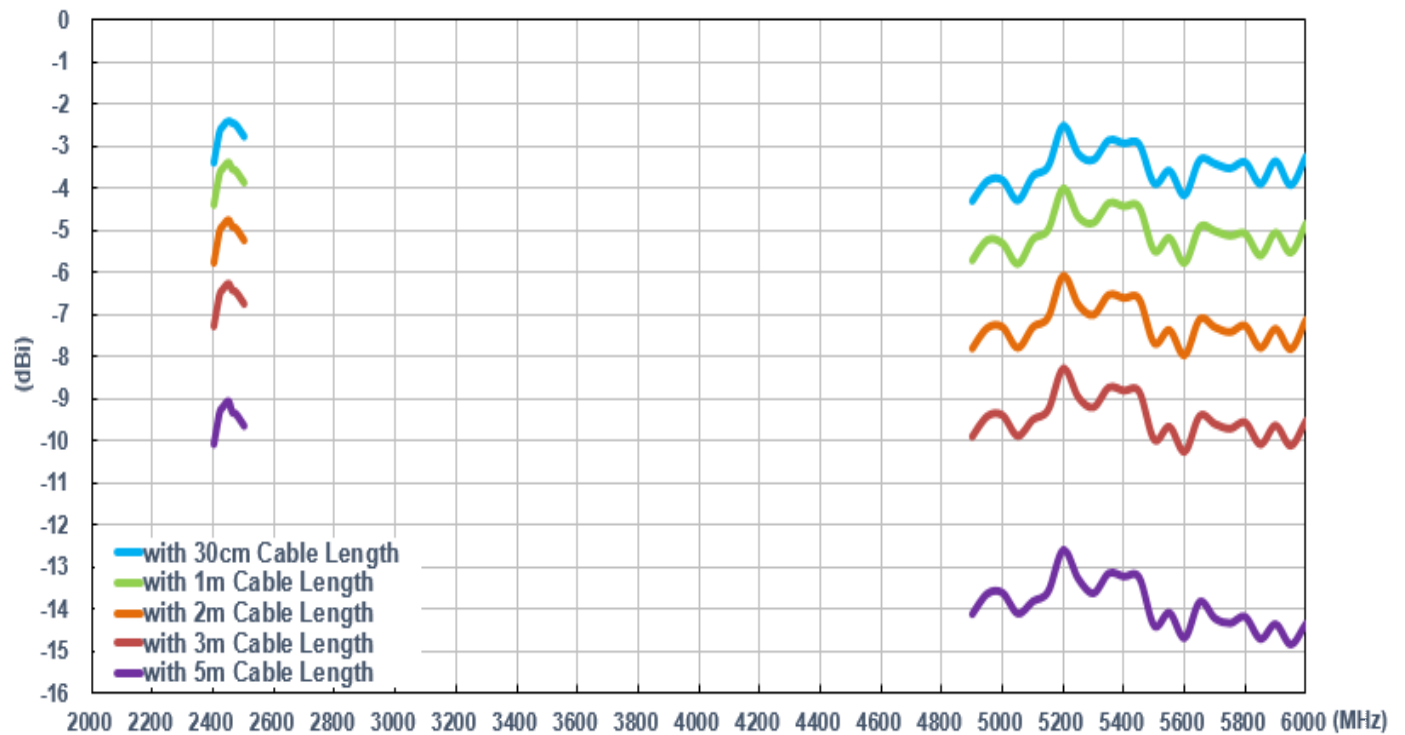
#### 7.2.5. Efficiency (Wi-Fi MIMO 2)



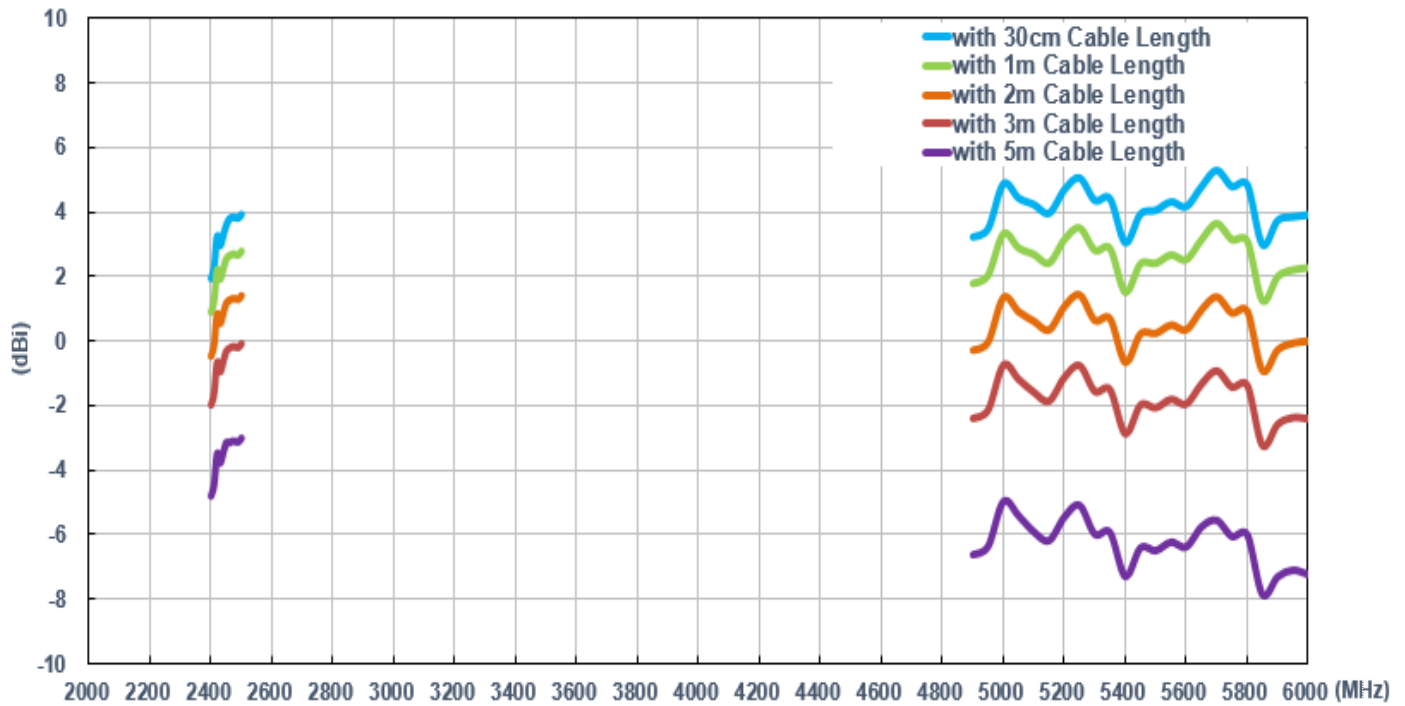
### 7.2.6. Average Gain (Wi-Fi MIMO 1)



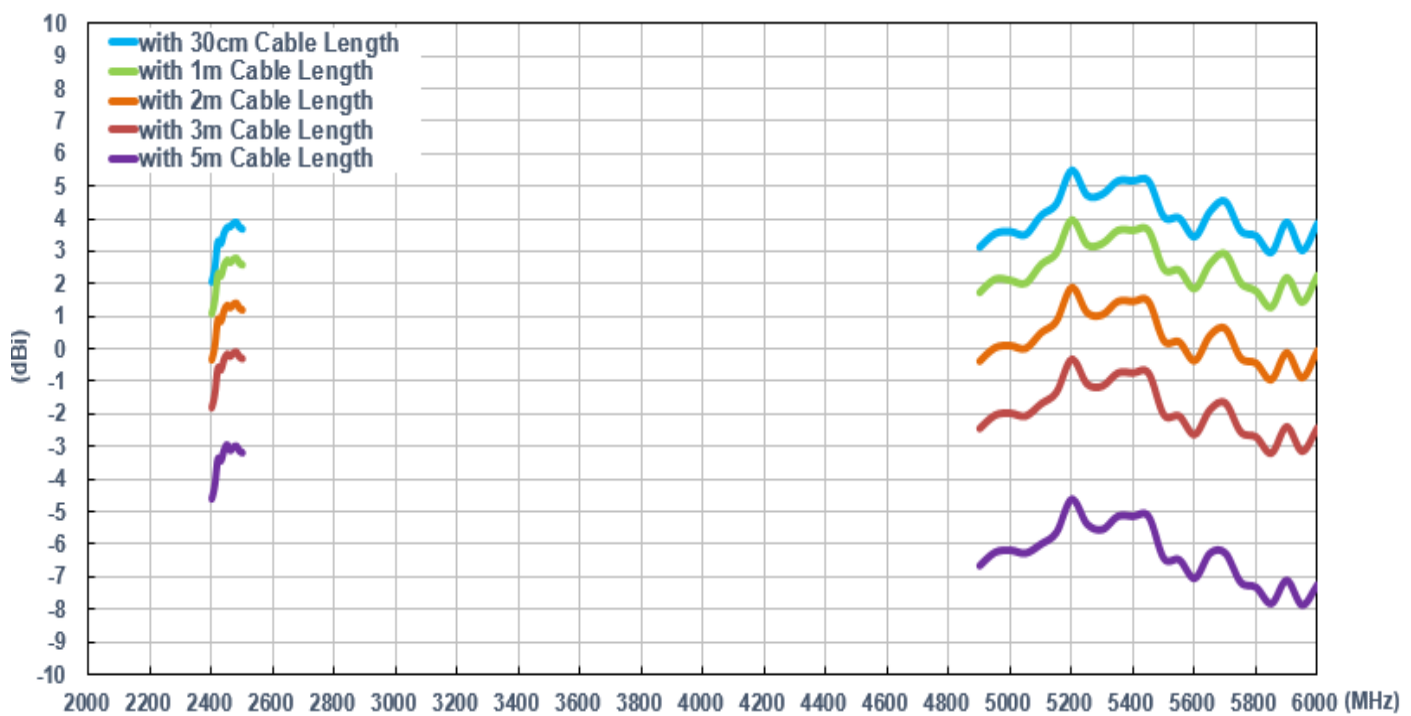
### 7.2.7. Average Gain (Wi-Fi MIMO 2)



### 7.2.8. Peak Gain (Wi-Fi MIMO 1)



### 7.2.9. Peak Gain (Wi-Fi MIMO 2)



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