



**Senao Networks Inc.**

# NSG200-CW

## Antenna Test Report

|                     |                                |
|---------------------|--------------------------------|
| Customer            | Netskope                       |
| Project             | NSG200-CW                      |
| Project Description | Dual antenna*2<br>5G antenna*1 |
| Date                | 2024/10/01                     |
| Prepared by         | Tony                           |
| Report Version      | A04                            |

- **WiFi Antenna Performance**
  - Placement and Specification
  - S11 & Isolation
  - Radiation Pattern
  - Combine Pattern
  - Efficiency and Gain
- **5G NR/LTE Antenna Performance**
  - S11 & Isolation
  - Radiation Pattern
  - Efficiency and Gain

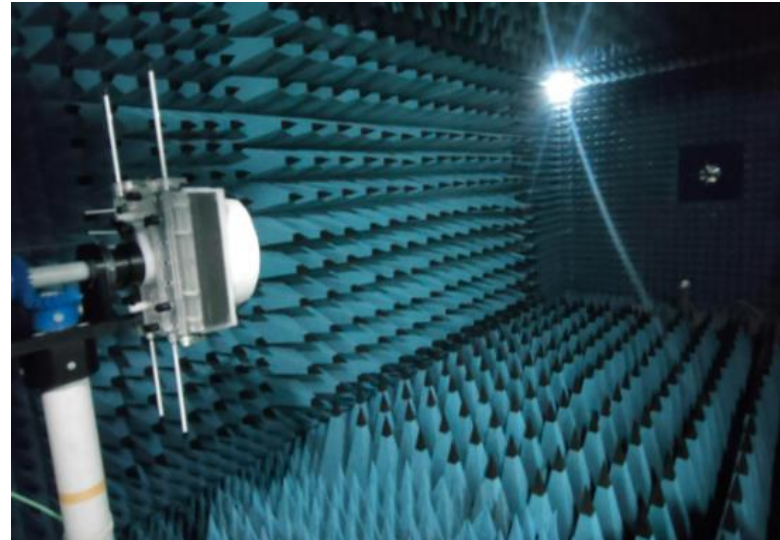
## 3D Anechoic Chamber - BWANT

- Size: 7.32M(L)x3.66M(W)x3.66M(H)
- Testing range from 600MHz to 8.5GHz
- Chamber Isolation : 10KHz to 10GHz >100dB (NSA 94-106)
- Calibration antenna : BWANT SD650 /SD740 /SD900 /SD1150 /SD1575 /SD1800 /SD2140 /SD2450 /SD3200 /SD3600 /SD4550 /SD5400 /HA-0508
- Test software : BWANT 3D Passive

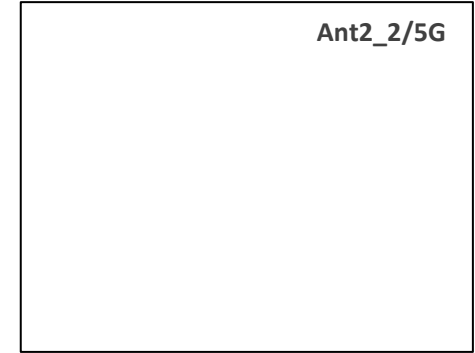
Turn table  
MF-7802

Keysight  
E5063A

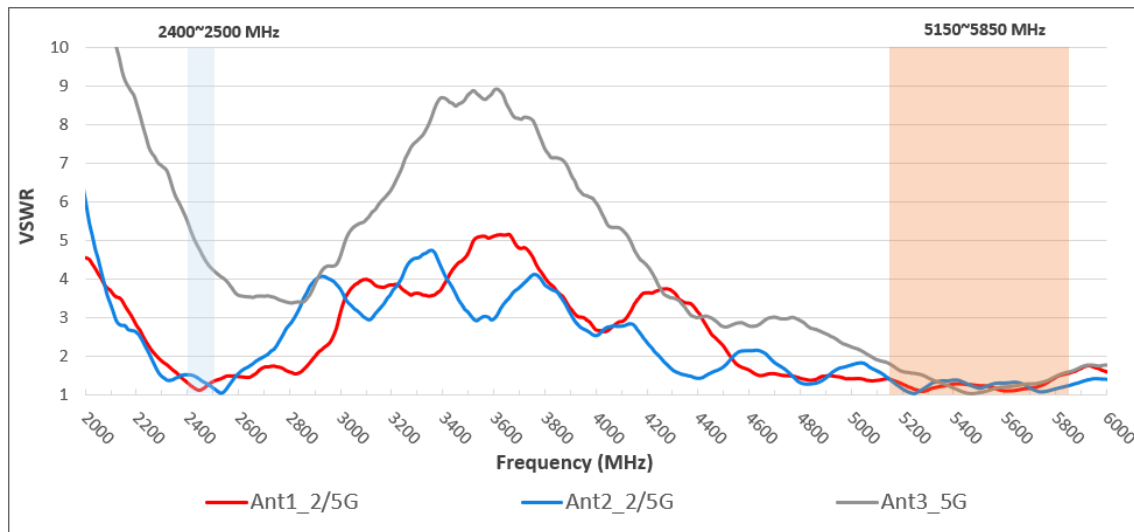
BWANT  
switch



# WiFi Antenna performance

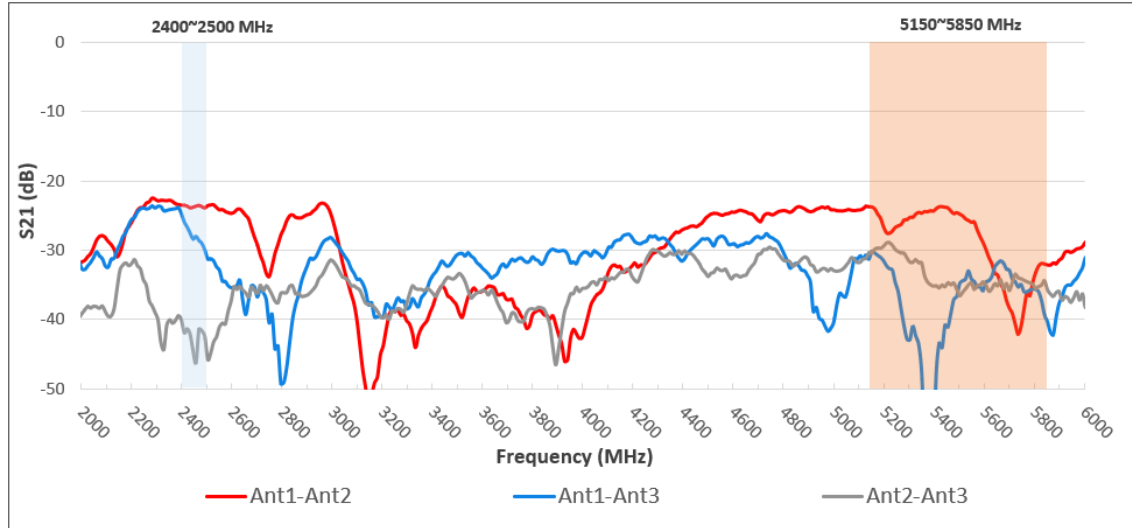


| Ant No. | Operating Band     | Gain (dBi) | Efficiency (%) | Ant Type | Feeding |
|---------|--------------------|------------|----------------|----------|---------|
| Ant1    | 2400MHz ~ 2500 MHz | 4.34@2G    | 72.77@2G       | PIFA     | Cable   |
|         | 5150MHz ~ 5850 MHz | 4.66@5G    | 73.54@5G       |          |         |
| Ant2    | 2400MHz ~ 2500 MHz | 3.94@2G    | 72.77@2G       | PIFA     | Cable   |
|         | 5150MHz ~ 5850 MHz | 4.86@5G    | 73.54@5G       |          |         |
| Ant3    | 5150MHz ~ 5850 MHz | 4.71       | 68.19          | Dipole   | Cable   |



| Antenna VSWR |           |           |         |
|--------------|-----------|-----------|---------|
| Freq. (MHz)  | Ant1_2/5G | Ant2_2/5G | Ant3_5G |
| 2400         | 1.30      | 1.52      | 5.48    |
| 2450         | 1.11      | 1.41      | 4.76    |
| 2500         | 1.31      | 1.22      | 4.27    |
| 5150         | 1.39      | 1.40      | 1.78    |
| 5550         | 1.19      | 1.27      | 1.13    |
| 5850         | 1.54      | 1.23      | 1.57    |

- The gray text indicates that the antenna does not support the corresponding frequency band and can be disregarded.

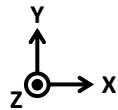
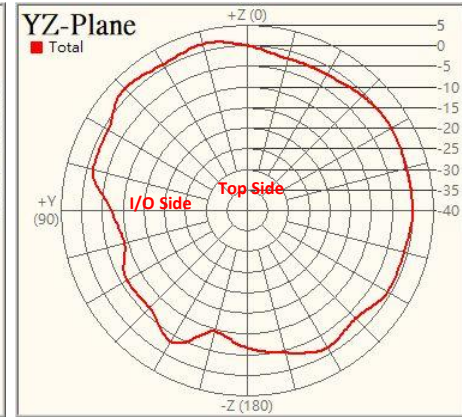
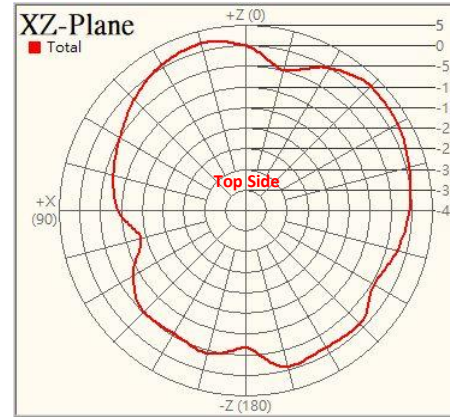
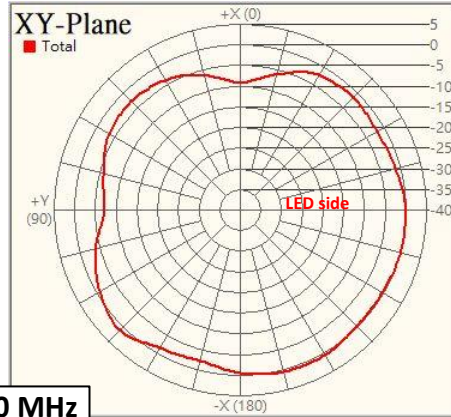


| Antenna S11 |           |           |           |
|-------------|-----------|-----------|-----------|
| Freq. (MHz) | Ant1-Ant2 | Ant1-Ant3 | Ant2-Ant3 |
| 2400        | -23.45    | -24.74    | -40.07    |
| 2450        | -23.75    | -28.41    | -44.57    |
| 2500        | -23.85    | -29.96    | -42.48    |
| 5150        | -23.71    | -30.19    | -30.42    |
| 5550        | -25.91    | -34.17    | -34.78    |
| 5850        | -31.94    | -39.34    | -34.47    |

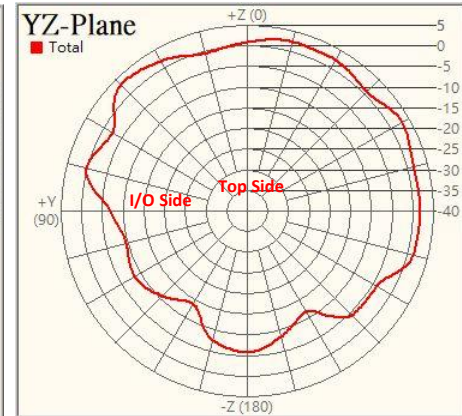
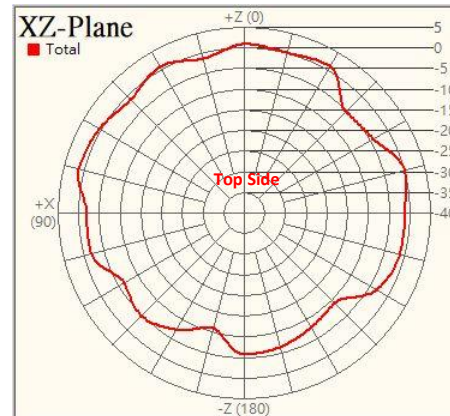
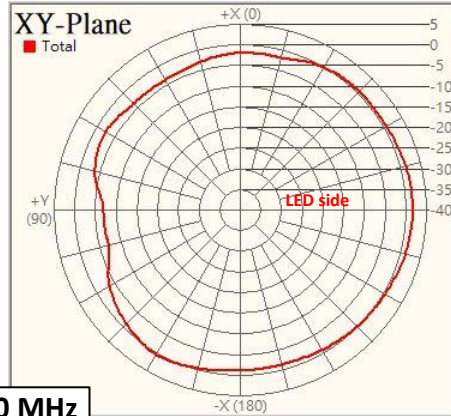
# 2D Radiation Pattern – Ant 1

Ant1

2450 MHz

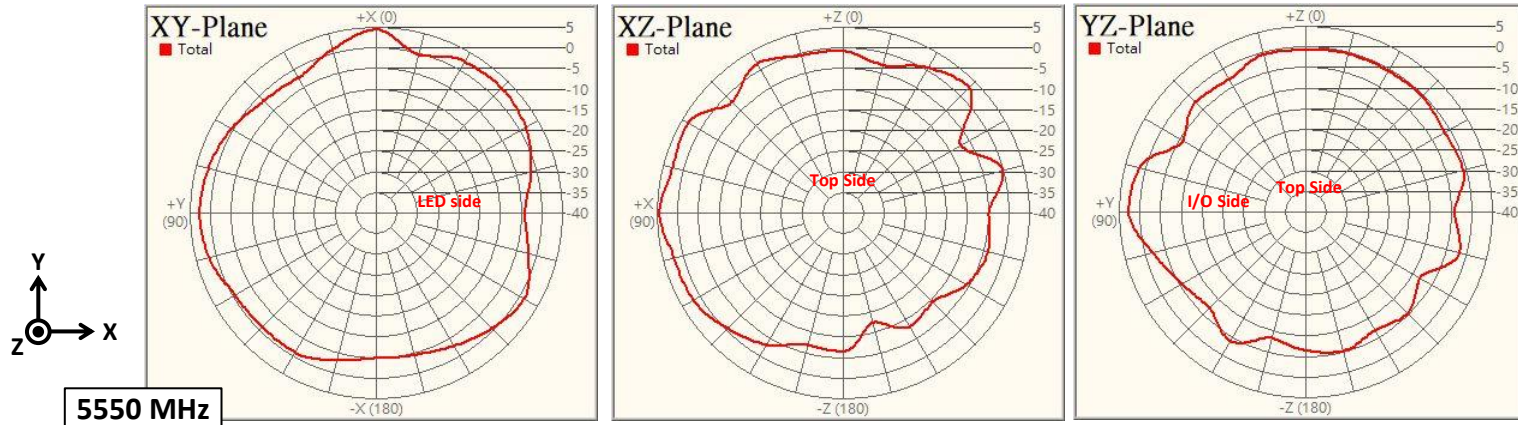
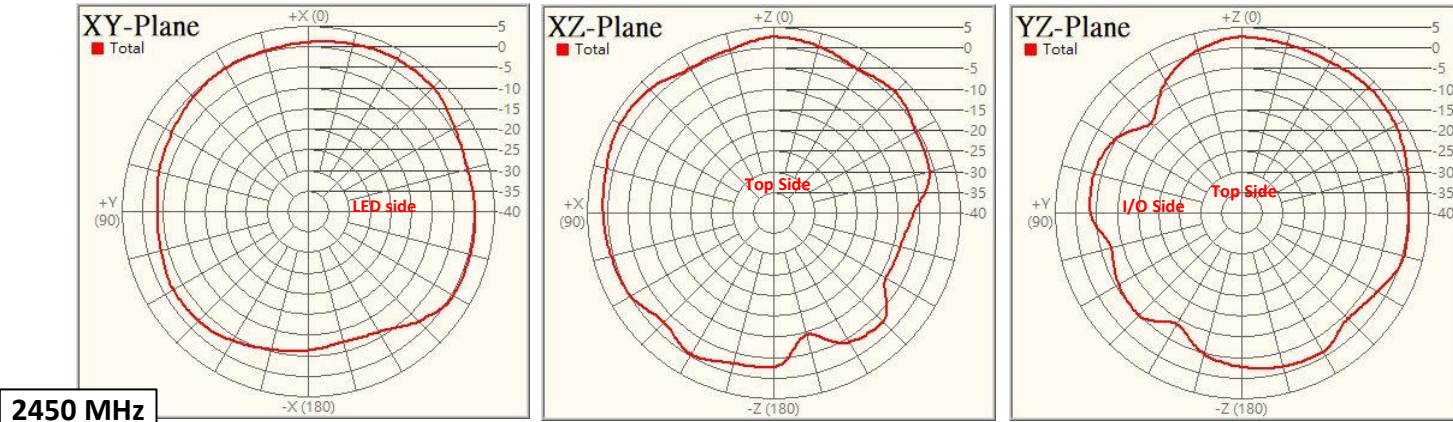


5550 MHz



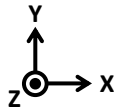
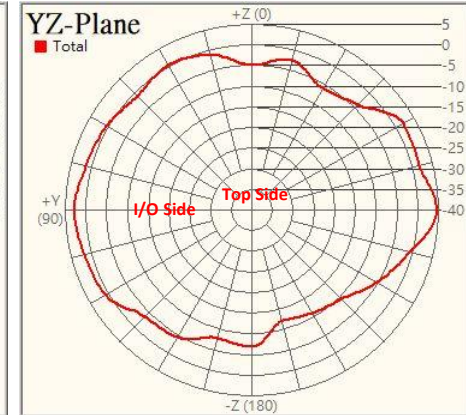
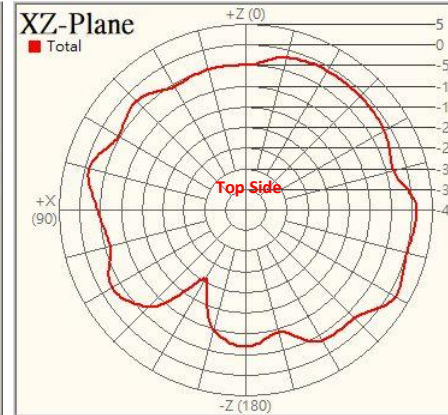
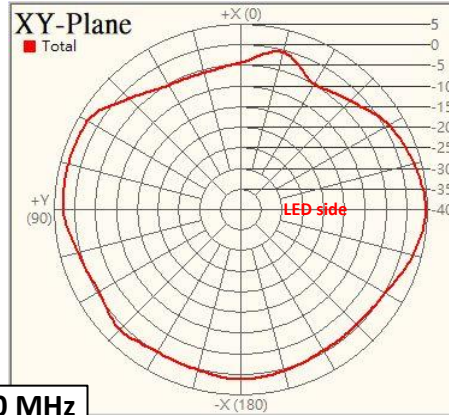
# 2D Radiation Pattern – Ant 2

Ant2



Ant3

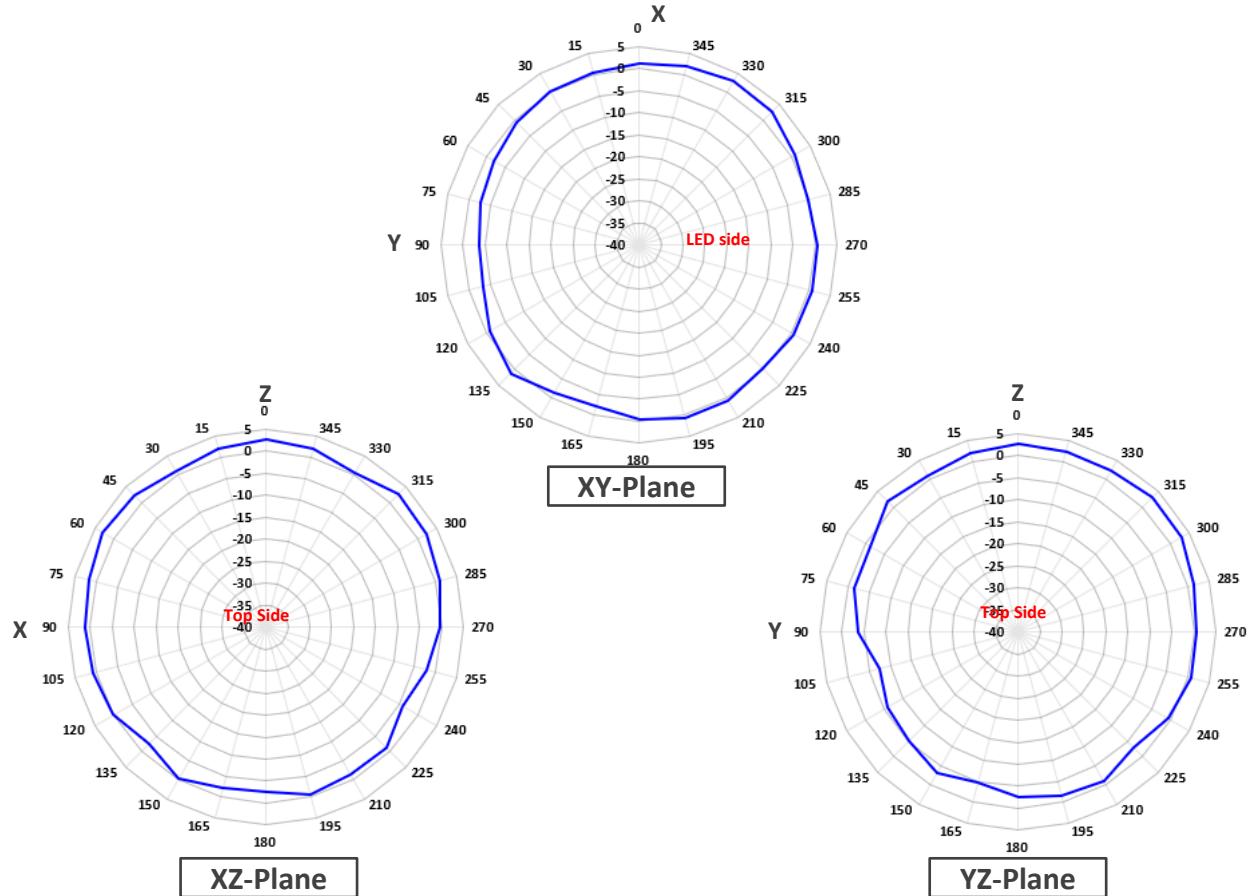
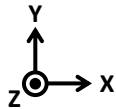
5550 MHz



Ant2

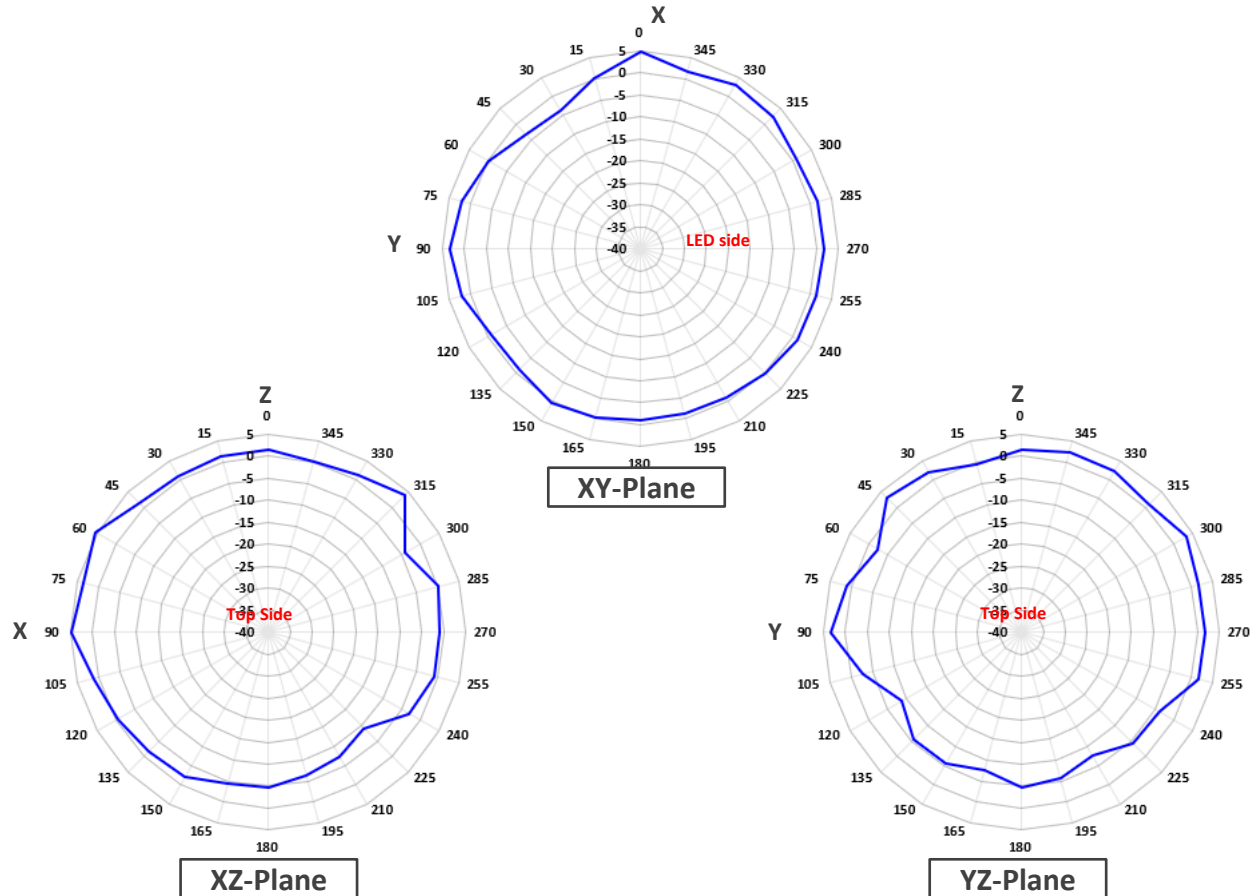
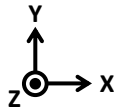
Ant1

TopSide



Ant2

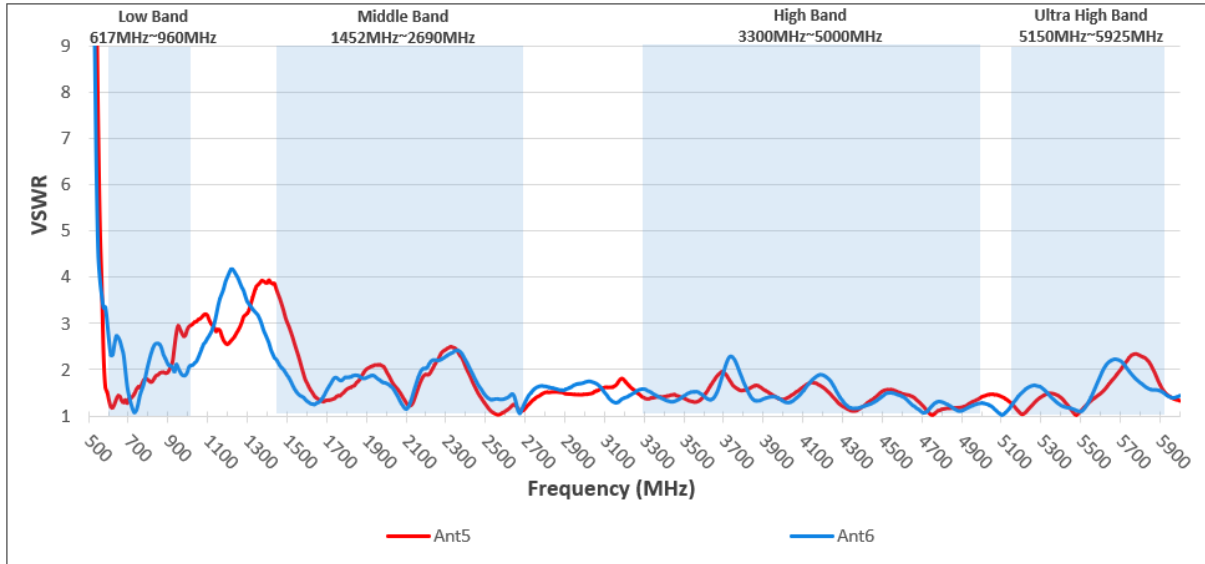
Ant1



# WiFi Antenna Efficiency and Gain

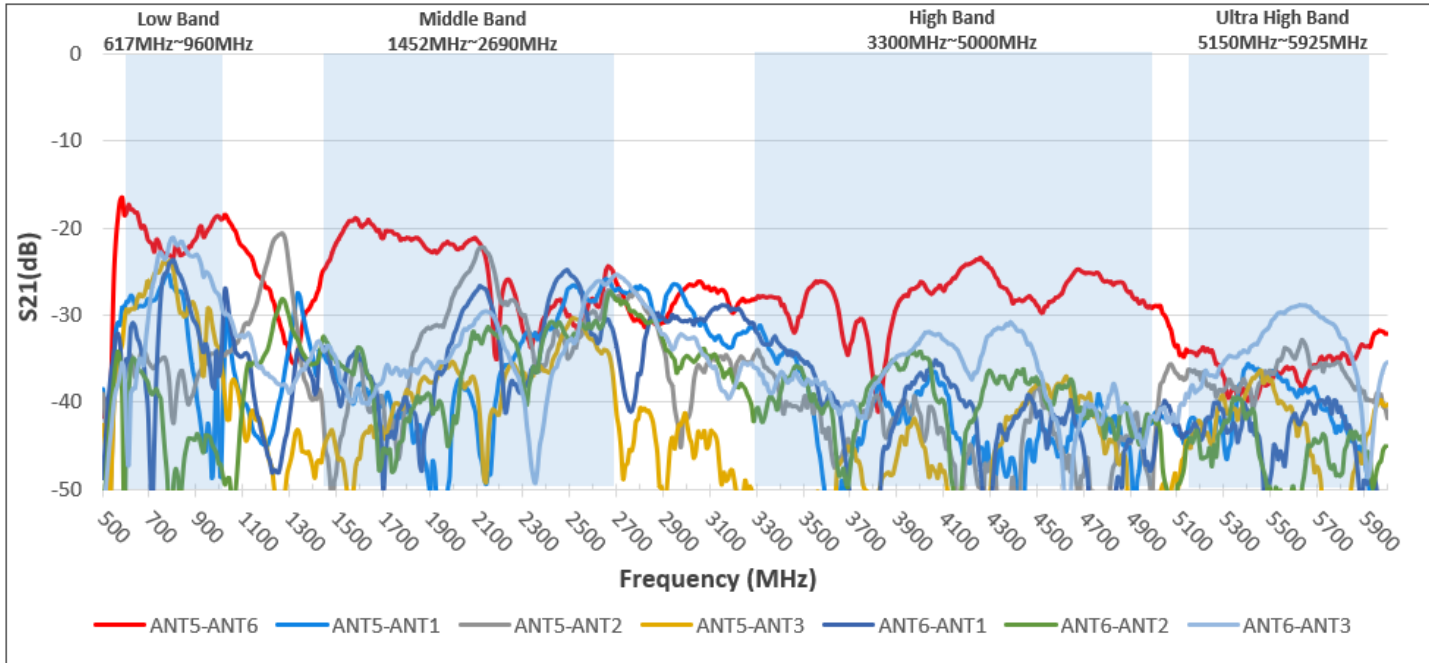
| Freq. (MHz) | ANT1_2/5G      |                 | ANT2_2/5G      |                 | ANT3_5G        |                 |
|-------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|
|             | Efficiency (%) | Peak Gain (dBi) | Efficiency (%) | Peak Gain (dBi) | Efficiency (%) | Peak Gain (dBi) |
| <b>2400</b> | <b>66.47</b>   | <b>3.60</b>     | <b>69.97</b>   | <b>3.10</b>     |                |                 |
| <b>2450</b> | <b>69.90</b>   | <b>4.34</b>     | <b>72.77</b>   | <b>3.94</b>     |                |                 |
| <b>2500</b> | <b>66.87</b>   | <b>4.18</b>     | <b>67.75</b>   | <b>3.62</b>     |                |                 |
| <b>5150</b> | <b>66.02</b>   | <b>4.01</b>     | <b>69.45</b>   | <b>4.46</b>     | <b>63.46</b>   | <b>4.49</b>     |
| <b>5550</b> | <b>69.19</b>   | <b>3.64</b>     | <b>66.36</b>   | <b>4.34</b>     | <b>68.19</b>   | <b>4.71</b>     |
| <b>5850</b> | <b>68.92</b>   | <b>4.66</b>     | <b>73.54</b>   | <b>4.86</b>     | <b>66.92</b>   | <b>4.12</b>     |

# 5G NR/LTE Antenna performance



| Antenna VSWR |      |      |
|--------------|------|------|
| Freq. (MHz)  | Ant5 | Ant6 |
| 610          | 1.19 | 2.31 |
| 700          | 1.37 | 1.43 |
| 800          | 1.76 | 2.18 |
| 900          | 1.98 | 2.09 |
| 960          | 2.88 | 1.96 |
| 1450         | 3.63 | 2.15 |
| 1710         | 1.34 | 1.64 |
| 1900         | 2.02 | 1.83 |
| 2100         | 1.25 | 1.15 |
| 2300         | 2.43 | 2.28 |
| 2400         | 2.08 | 2.21 |
| 2600         | 1.11 | 1.37 |
| 2700         | 1.17 | 1.31 |
| 3300         | 1.38 | 1.57 |
| 3500         | 1.39 | 1.43 |
| 3800         | 1.56 | 1.73 |
| 4000         | 1.36 | 1.31 |
| 4200         | 1.64 | 1.89 |
| 4400         | 1.21 | 1.20 |
| 4800         | 1.15 | 1.30 |
| 5100         | 1.42 | 1.01 |
| 5500         | 1.13 | 1.10 |
| 5800         | 2.31 | 1.72 |

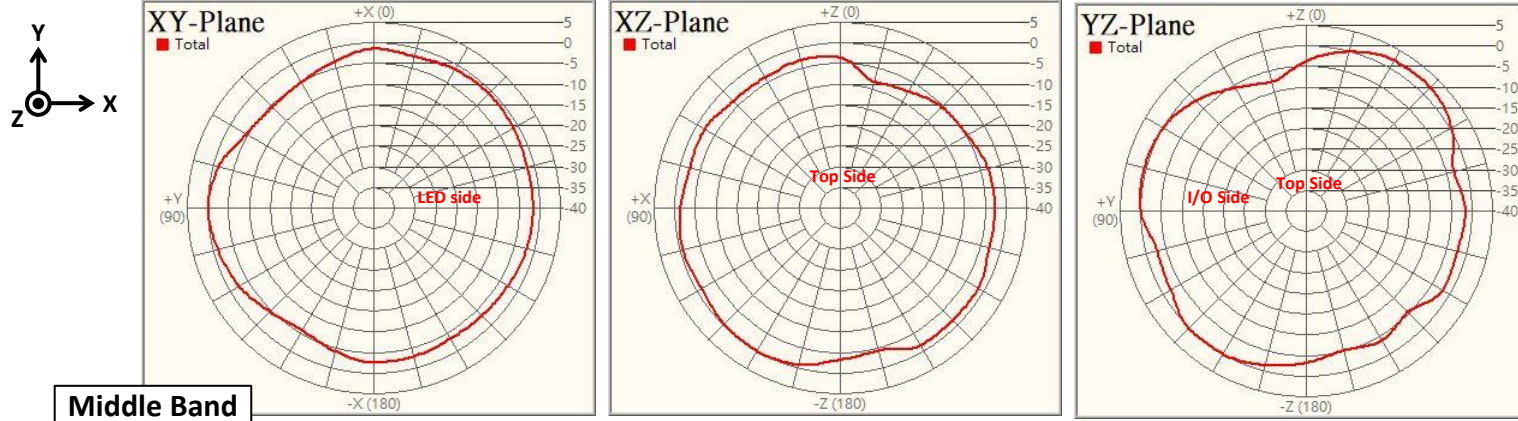
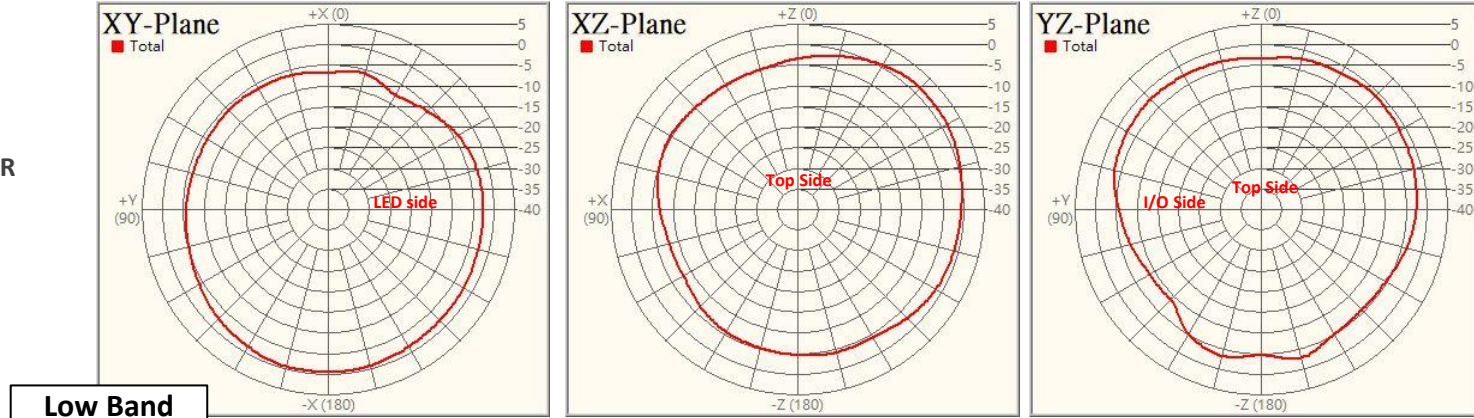
# Antenna Isolation (S21)



| Antenna Isolation_5G NR to WiFi antenna |           |           |           |           |           |           |           |
|-----------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Freq. (MHz)                             | ANT5-ANT6 | ANT5-ANT1 | ANT5-ANT2 | ANT5-ANT3 | ANT6-ANT1 | ANT6-ANT2 | ANT6-ANT3 |
| 610                                     | -17.32    | -28.35    | -35.53    | -29.59    | -35.31    | -38.81    | -47.22    |
| 700                                     | -21.64    | -28.49    | -35.72    | -26.85    | -47.37    | -38.71    | -28.56    |
| 800                                     | -23.31    | -26.73    | -42.46    | -24.89    | -23.66    | -49.21    | -21.18    |
| 900                                     | -20.94    | -39.88    | -37.33    | -30.06    | -31.31    | -43.63    | -23.10    |
| 960                                     | -19.94    | -44.19    | -34.62    | -29.41    | -35.76    | -43.96    | -25.62    |
| 1450                                    | -24.57    | -35.02    | -45.58    | -44.53    | -34.01    | -32.90    | -34.03    |
| 1710                                    | -20.40    | -39.54    | -43.04    | -44.21    | -46.35    | -45.35    | -36.19    |
| 1900                                    | -22.73    | -50.19    | -31.62    | -37.71    | -41.31    | -39.38    | -35.56    |
| 2100                                    | -21.49    | -43.35    | -22.68    | -39.07    | -27.07    | -32.28    | -30.41    |
| 2300                                    | -31.58    | -32.99    | -30.13    | -36.54    | -38.26    | -36.87    | -39.08    |
| 2400                                    | -30.13    | -31.73    | -35.64    | -36.37    | -29.75    | -31.62    | -40.54    |
| 2600                                    | -28.20    | -28.32    | -29.60    | -32.77    | -32.22    | -31.10    | -26.68    |
| 2700                                    | -26.43    | -27.08    | -28.01    | -41.43    | -33.65    | -28.29    | -25.34    |
| 3300                                    | -27.87    | -31.55    | -34.06    | -52.78    | -32.10    | -40.63    | -36.28    |
| 3500                                    | -29.17    | -37.05    | -40.18    | -56.17    | -35.21    | -36.68    | -38.02    |
| 3800                                    | -37.66    | -39.99    | -39.70    | -54.63    | -67.34    | -37.42    | -38.22    |
| 4000                                    | -26.23    | -39.15    | -41.64    | -44.26    | -36.66    | -34.20    | -32.76    |
| 4200                                    | -24.20    | -45.96    | -46.61    | -55.44    | -40.49    | -43.43    | -36.27    |
| 4400                                    | -28.38    | -47.52    | -50.90    | -41.56    | -41.65    | -37.05    | -31.40    |
| 4800                                    | -26.09    | -42.66    | -56.03    | -45.26    | -56.18    | -41.99    | -40.63    |
| 5100                                    | -33.52    | -43.62    | -36.86    | -49.87    | -42.44    | -49.51    | -42.30    |
| 5500                                    | -37.45    | -36.42    | -36.68    | -37.45    | -47.79    | -50.79    | -30.64    |
| 5800                                    | -35.05    | -43.29    | -35.69    | -54.31    | -40.53    | -48.39    | -32.57    |

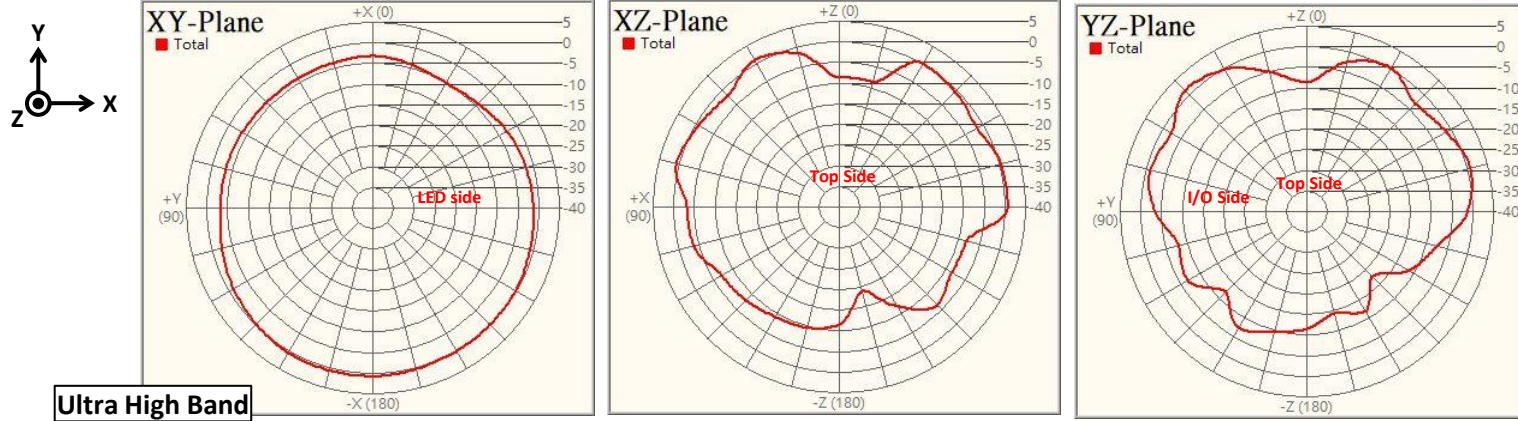
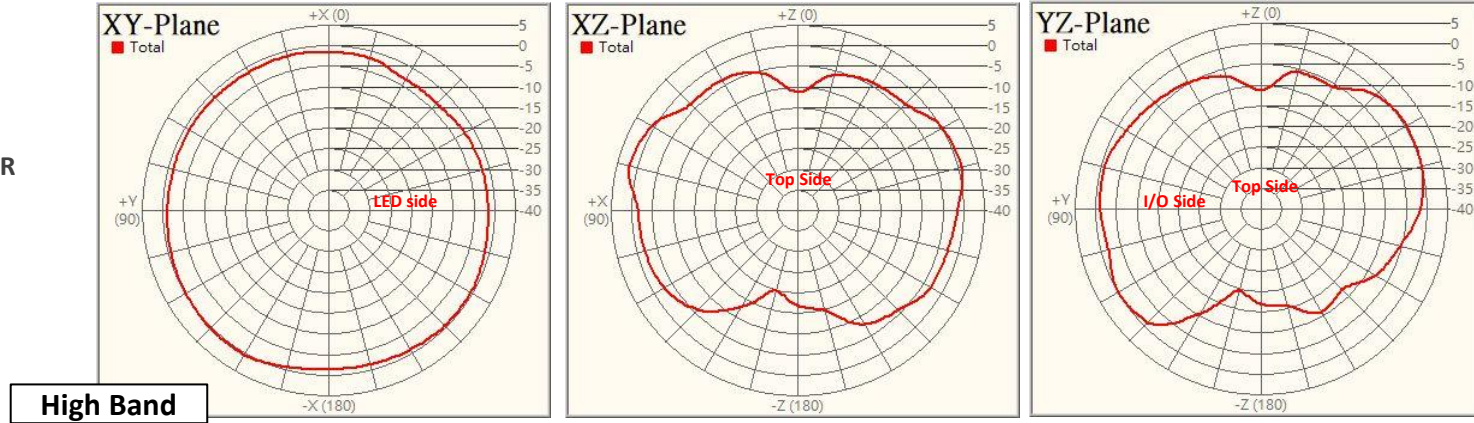
# 2D Radiation Pattern – Ant 5

Ant5\_5G NR

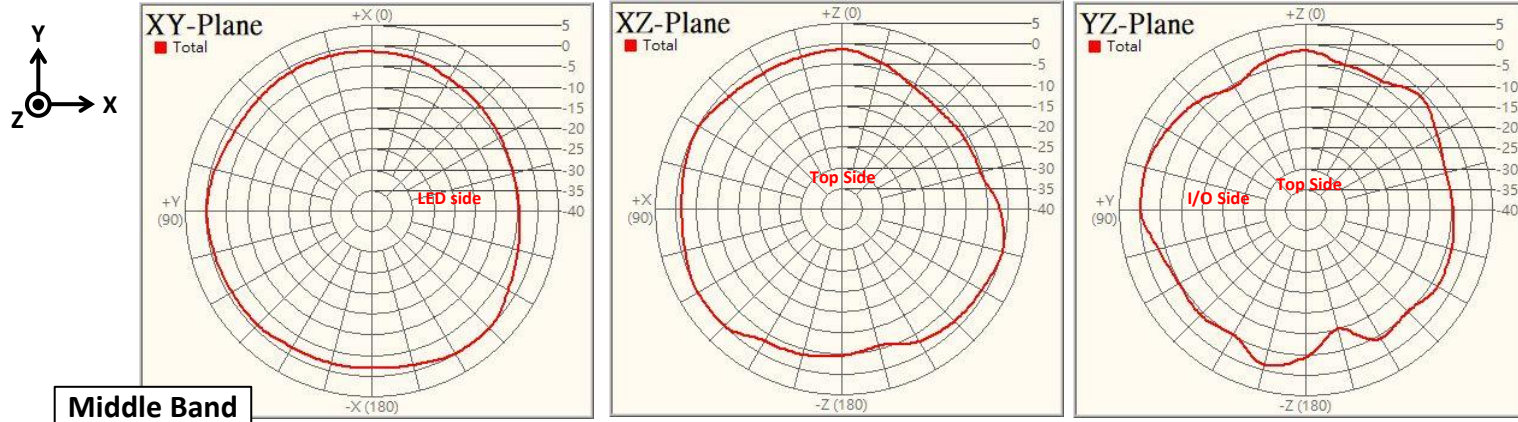
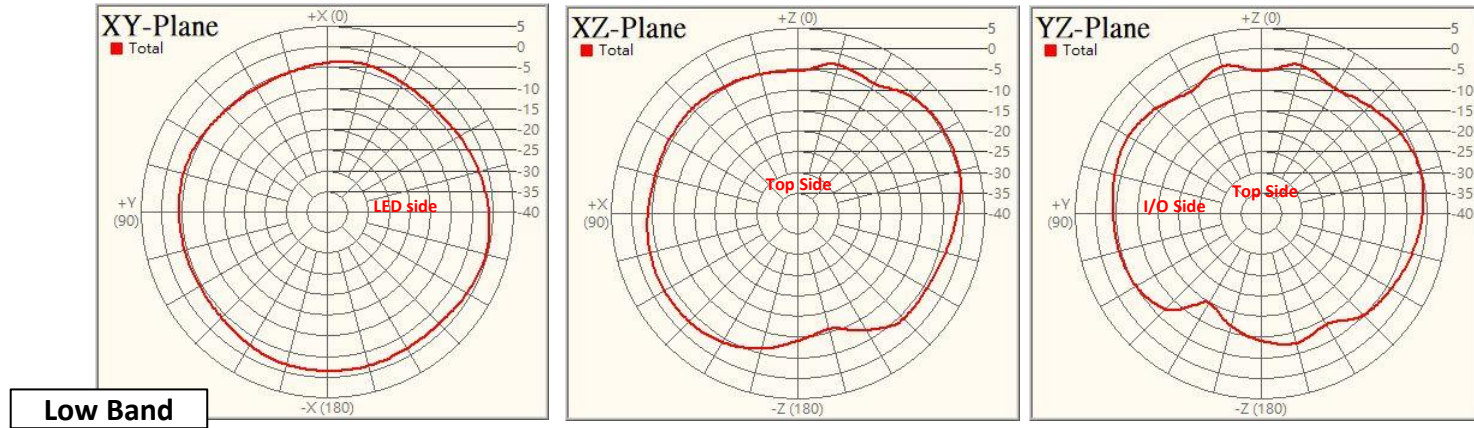


# 2D Radiation Pattern – Ant 5

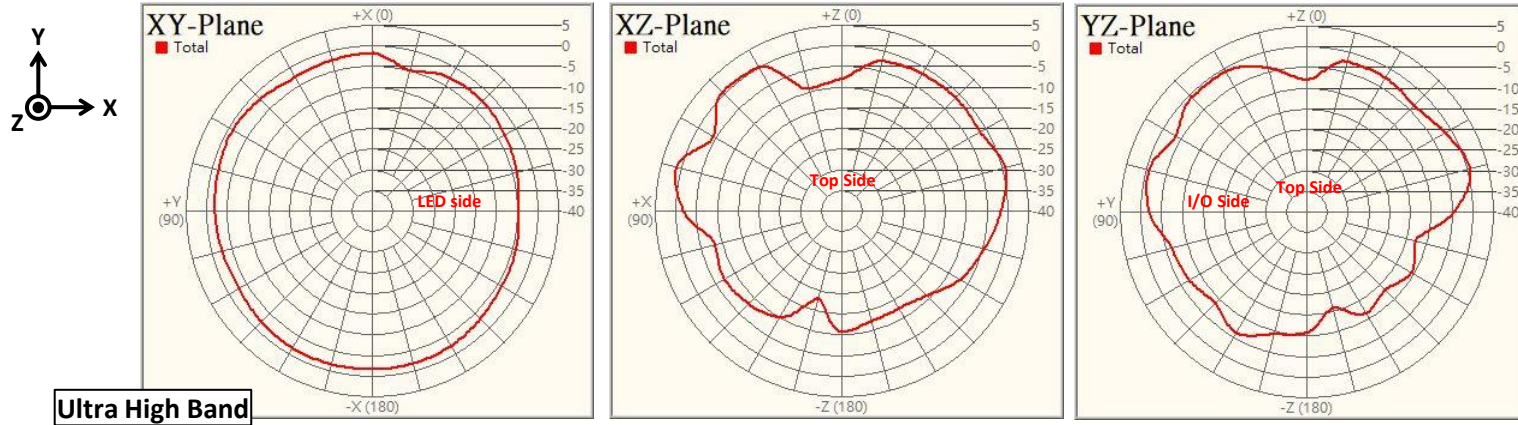
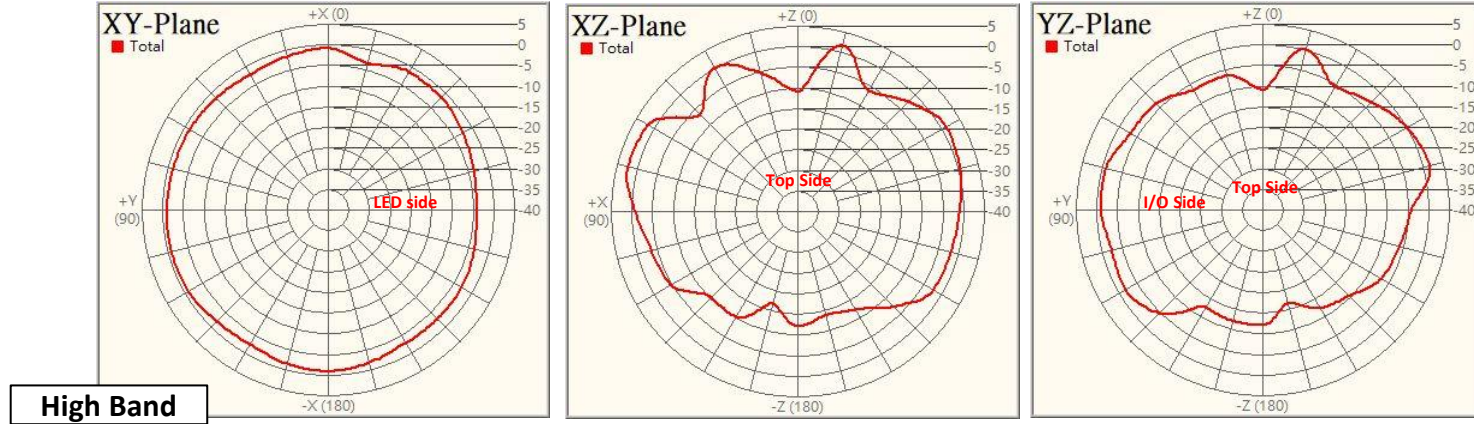
Ant5\_5G NR



Ant6\_5G NR



Ant6\_5G NR



# 5G NR Antenna Efficiency and Gain

| Freq. (MHz) | ANT5          |                | ANT6          |                |
|-------------|---------------|----------------|---------------|----------------|
|             | Efficiency(%) | Peak Gain(dBi) | Efficiency(%) | Peak Gain(dBi) |
| 617         | 62.71         | 2.57           | 40.88         | -0.76          |
| 642         | 62.40         | 2.06           | 62.18         | 0.51           |
| 662         | 64.70         | 2.26           | 60.82         | 0.11           |
| 682         | 67.66         | 2.66           | 62.69         | 0.67           |
| 704         | 65.91         | 2.71           | 65.74         | 1.10           |
| 716         | 68.51         | 2.80           | 67.80         | 1.35           |
| 740         | 69.59         | 2.74           | 67.94         | 1.30           |
| 756         | 68.80         | 2.56           | 66.95         | 2.44           |
| 782         | 73.38         | 2.80           | 74.26         | 3.31           |
| 806         | 79.99         | 3.37           | 74.38         | 2.62           |
| 824         | 77.04         | 3.34           | 66.74         | 1.83           |
| 836         | 76.22         | 3.28           | 63.23         | 1.41           |
| 869         | 69.62         | 2.91           | 55.22         | 1.11           |
| 880         | 67.18         | 2.65           | 54.51         | 0.97           |
| 900         | 65.50         | 2.21           | 55.86         | 0.85           |
| 925         | 58.99         | 0.92           | 59.62         | 1.91           |
| 940         | 49.02         | -1.15          | 55.01         | 1.18           |
| 960         | 53.80         | -0.36          | 61.78         | 2.01           |
| 1452        | 45.80         | 0.45           | 52.59         | 1.75           |
| 1476        | 51.27         | 1.68           | 59.55         | 2.08           |
| 1496        | 54.90         | 2.40           | 61.82         | 1.53           |
| 1710        | 63.29         | 2.65           | 55.19         | 2.07           |
| 1747        | 64.67         | 2.45           | 56.92         | 1.52           |
| 1805        | 67.89         | 1.91           | 58.72         | 1.03           |
| 1850        | 65.86         | 1.46           | 58.94         | 1.22           |
| 1910        | 52.92         | 0.88           | 50.72         | 1.65           |
| 1950        | 52.88         | 1.00           | 53.15         | 1.21           |
| 1990        | 55.59         | 1.06           | 54.94         | 0.83           |

| Freq. (MHz) | ANT5          |                | ANT6          |                |
|-------------|---------------|----------------|---------------|----------------|
|             | Efficiency(%) | Peak Gain(dBi) | Efficiency(%) | Peak Gain(dBi) |
| 2110        | 67.14         | 3.61           | 64.53         | 2.98           |
| 2170        | 57.47         | 3.54           | 56.40         | 2.32           |
| 2200        | 44.27         | 1.05           | 41.69         | 0.75           |
| 2300        | 46.09         | -0.34          | 40.92         | -0.75          |
| 2325        | 48.80         | -0.23          | 42.89         | -0.59          |
| 2350        | 50.66         | 0.40           | 43.12         | 0.01           |
| 2400        | 60.01         | 2.37           | 50.82         | 0.67           |
| 2442        | 62.33         | 3.88           | 54.80         | 1.90           |
| 2500        | 72.11         | 4.21           | 69.29         | 3.46           |
| 2550        | 68.55         | 3.79           | 66.01         | 3.66           |
| 2600        | 66.50         | 3.10           | 57.83         | 3.78           |
| 2655        | 55.27         | 2.56           | 53.31         | 2.56           |
| 2700        | 63.59         | 4.11           | 60.94         | 2.74           |
| 3300        | 57.83         | 0.98           | 58.77         | 0.87           |
| 3500        | 53.51         | 0.15           | 53.15         | -0.32          |
| 3600        | 50.29         | 0.41           | 48.10         | -0.35          |
| 3800        | 60.70         | 1.02           | 55.88         | 0.80           |
| 4000        | 65.52         | 1.83           | 52.76         | 1.48           |
| 4100        | 63.43         | 2.75           | 56.64         | 2.32           |
| 4200        | 62.75         | 2.11           | 55.85         | 1.94           |
| 4300        | 61.41         | 2.14           | 58.08         | 1.68           |
| 4400        | 61.46         | 1.94           | 59.12         | 1.33           |
| 4500        | 62.11         | 3.08           | 59.06         | 2.35           |
| 4600        | 66.07         | 2.82           | 58.04         | 2.64           |
| 4700        | 70.21         | 2.63           | 59.90         | 2.08           |
| 4800        | 73.35         | 3.15           | 66.78         | 3.19           |
| 4900        | 61.02         | 2.64           | 54.83         | 1.75           |
| 5000        | 53.35         | 1.58           | 46.45         | 1.18           |

| Freq. (MHz) | ANT5          |                | ANT6          |                |
|-------------|---------------|----------------|---------------|----------------|
|             | Efficiency(%) | Peak Gain(dBi) | Efficiency(%) | Peak Gain(dBi) |
| 5150        | 52.00         | 2.40           | 45.58         | 2.03           |
| 5250        | 54.09         | 3.63           | 41.45         | 2.14           |
| 5350        | 40.57         | 1.94           | 34.30         | 1.40           |
| 5470        | 37.14         | 1.02           | 32.15         | 0.48           |
| 5600        | 31.13         | 1.01           | 25.04         | -1.44          |
| 5725        | 34.31         | 1.08           | 31.45         | 0.82           |
| 5750        | 36.40         | 1.05           | 32.63         | 1.08           |
| 5800        | 38.01         | 0.85           | 36.05         | 1.48           |
| 5825        | 37.97         | 1.04           | 36.82         | 1.71           |
| 5850        | 42.14         | 1.28           | 39.78         | 2.07           |
| 5875        | 43.82         | 1.21           | 40.75         | 2.14           |
| 5900        | 41.24         | 1.20           | 38.62         | 1.70           |
| 5925        | 41.45         | 1.38           | 37.31         | 1.22           |
| 5950        | 41.61         | 1.58           | 36.15         | 0.65           |
| 5975        | 41.75         | 1.69           | 36.24         | 0.70           |
| 6000        | 41.53         | 1.61           | 36.12         | 0.97           |