

EX5512 2Gx4 5Gx4

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Prepared By: Neal

Reviewed By: Stone

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Specification

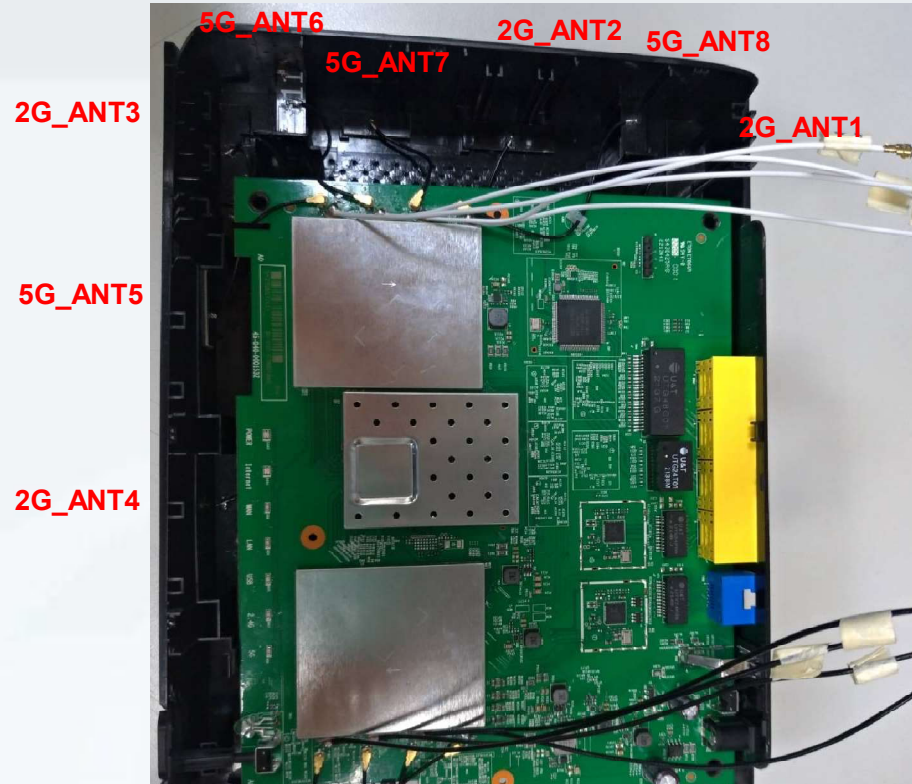
Requirements of Antenna Design

| RF Function | Number of ANT | Frequency Band | Remark |
|-------------|---------------|------------------|--------|
| 2G | 4 | 2412 – 2483.5MHz | |
| 5G | 4 | 4900 – 5900MHz | |
| | | | |

Requirements of Measurement

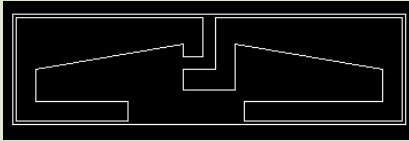
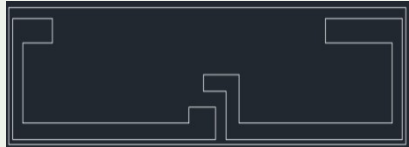
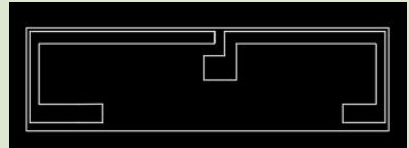
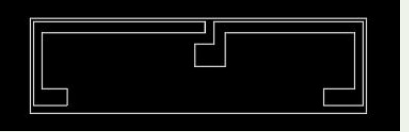
| Test Item | Specification | Remark |
|-------------|--|--------|
| Return Loss | 2.4GHz >10dB , 5GHz >10dB | |
| Isolation | > 20dB | |
| Peak gain | < 3.5dBi for WiFi 2.4GHz, < 4.5dBi for WiFi 5GHz | |
| Efficiency | > 60% | |
| Directivity | 2.4GHz< 4.5dB , 5GHz< 4.8dB | |

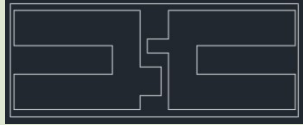
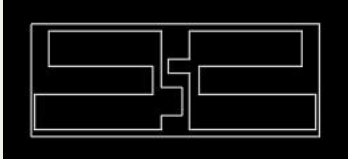
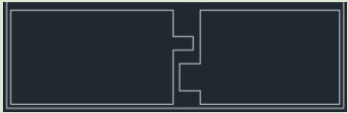
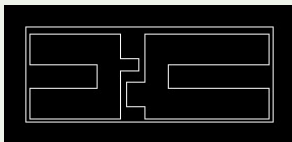
Antenna Placement & Solution



| ANT | ANT Type | Size (L * W * H) | Cable Length (mm) | Cable Type | Connector |
|---------|------------|---------------------|-------------------|-----------------|-----------|
| 2G_ANT1 | Dipole ANT | 30mm*8.5mm*1mm | Total:313mm | Φ=1.13 Low Loss | CCT |
| 2G_ANT2 | Dipole ANT | 30mm*8.5mm*1mm | Total:258mm | Φ=1.13 Low Loss | CCT |
| 2G_ANT3 | Dipole ANT | 30mm*8.5mm*1mm | Total:263mm | Φ=1.13 Low Loss | CCT |
| 2G_ANT4 | Dipole ANT | 30mm*8.5mm*1mm | Total:145mm | Φ=1.13 Low Loss | CCT |
| 5G_ANT5 | Dipole ANT | 20.5mm*8mm*0.6mm | Total:59mm | Φ=1.13 Low Loss | CCT |
| 5G_ANT6 | Dipole ANT | 20.61mm*7.9mm*0.6mm | Total:50mm | Φ=1.13 Low Loss | CCT |
| 5G_ANT7 | Dipole ANT | 20.61mm*7.9mm*0.6mm | Total:45mm | Φ=1.13 Low Loss | CCT |
| 5G_ANT8 | Dipole ANT | 20.61mm*7.9mm*0.6mm | Total:80mm | Φ=1.13 Low Loss | CCT |

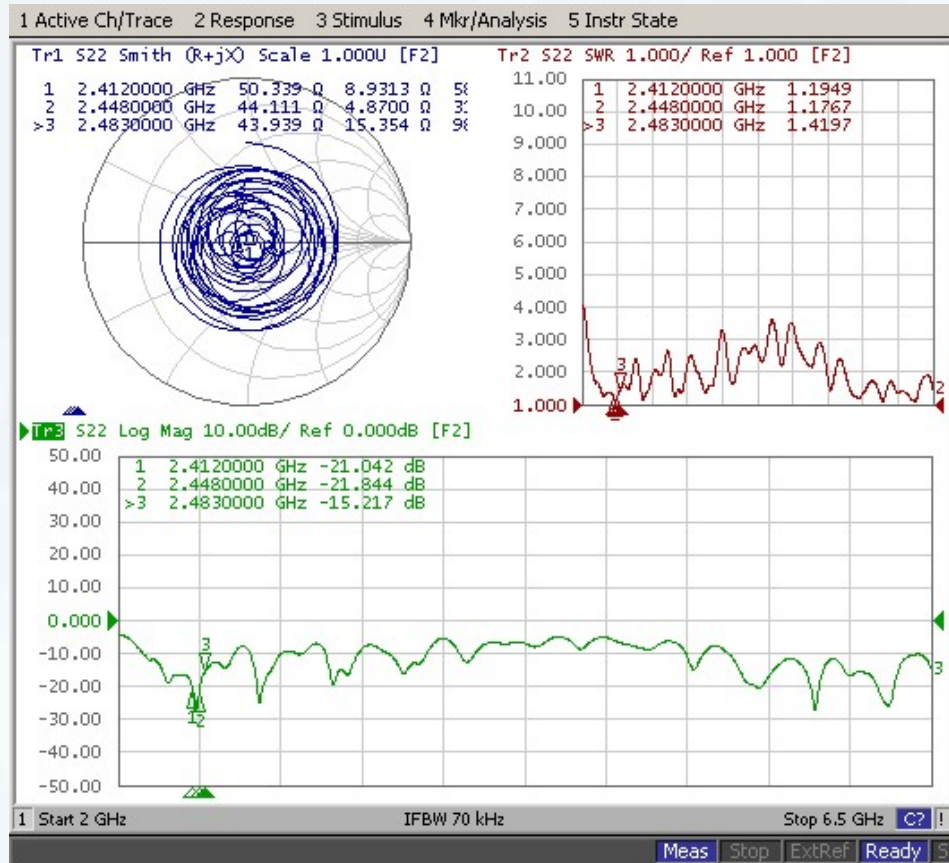
Antenna Placement & Solution

| Antenna | Current Version |
|---------|--|
| 2G_ANT1 |  |
| 2G_ANT2 |  |
| 2G_ANT3 |  |
| 2G_ANT4 |  |

| Antenna | Current Version |
|---------|---|
| 5G_ANT5 |  |
| 5G_ANT6 |  |
| 5G_ANT7 |  |
| 5G_ANT8 |  |

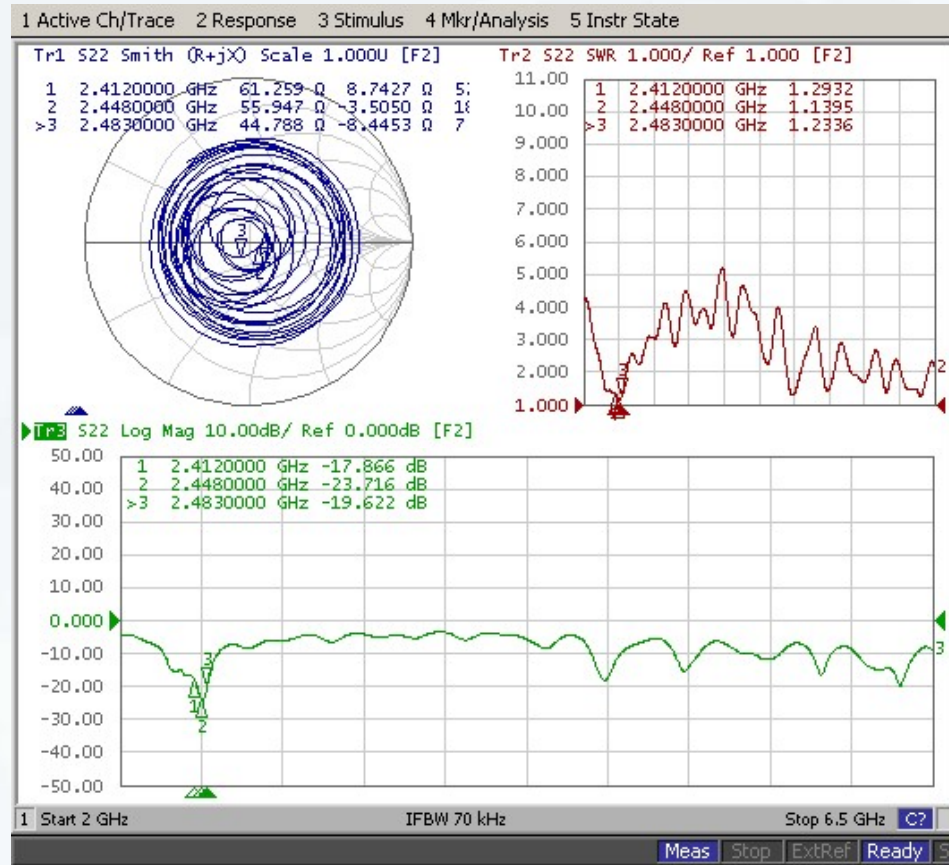
Return Loss Results

2G_ANT1 (2412 MHz– 2483.5MHz) (Criterion:>10dB)



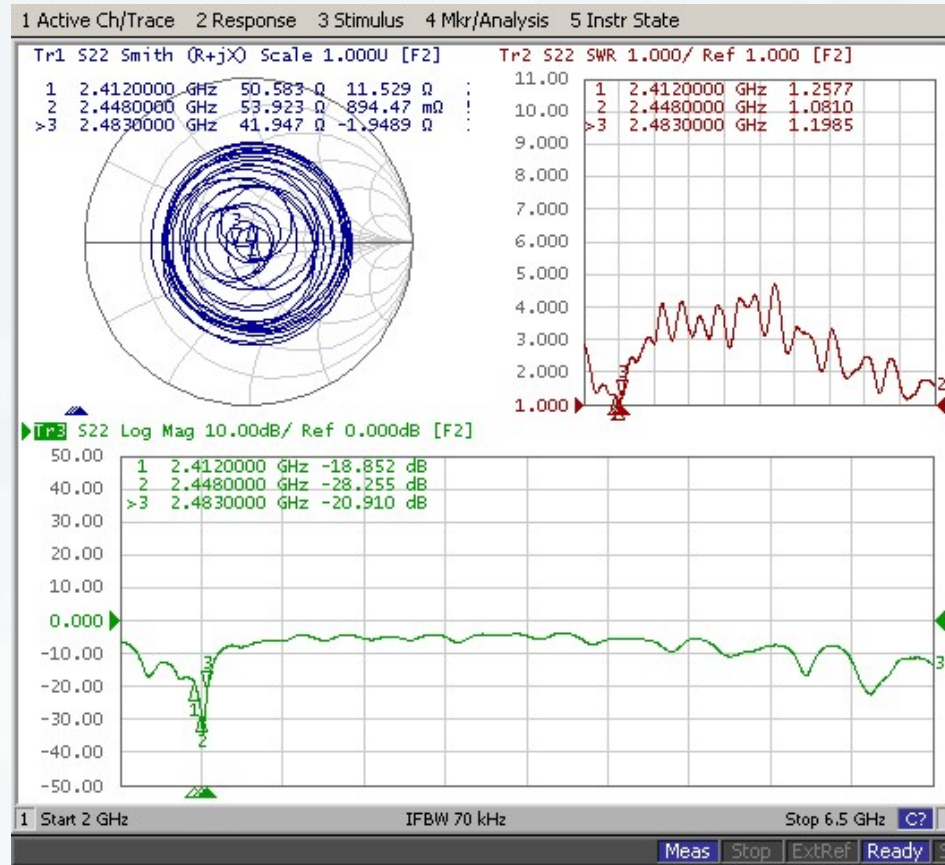
Return Loss Results

2G_ANT2 (2412 MHz– 2483.5MHz) (Criterion:>10dB)



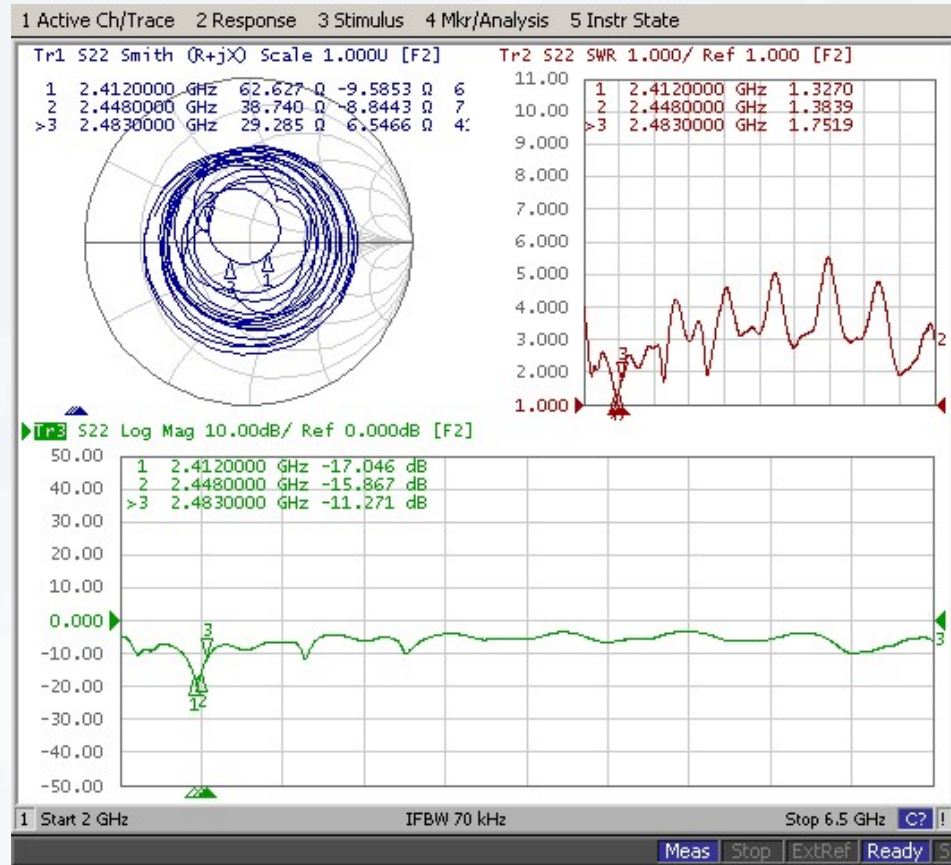
Return Loss Results

2G_ANT3 (2412 MHz– 2483.5MHz) (Criterion:>10dB)



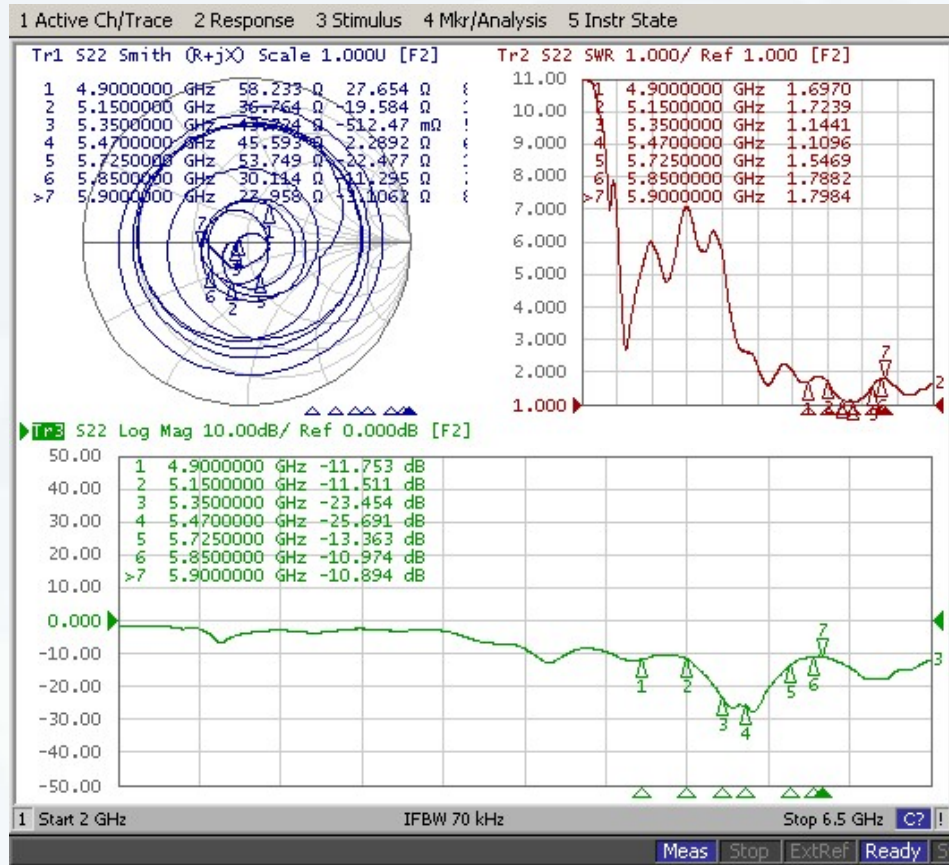
Return Loss Results

2G_ANT4 (2412 MHz– 2483.5MHz) (Criterion:>10dB)



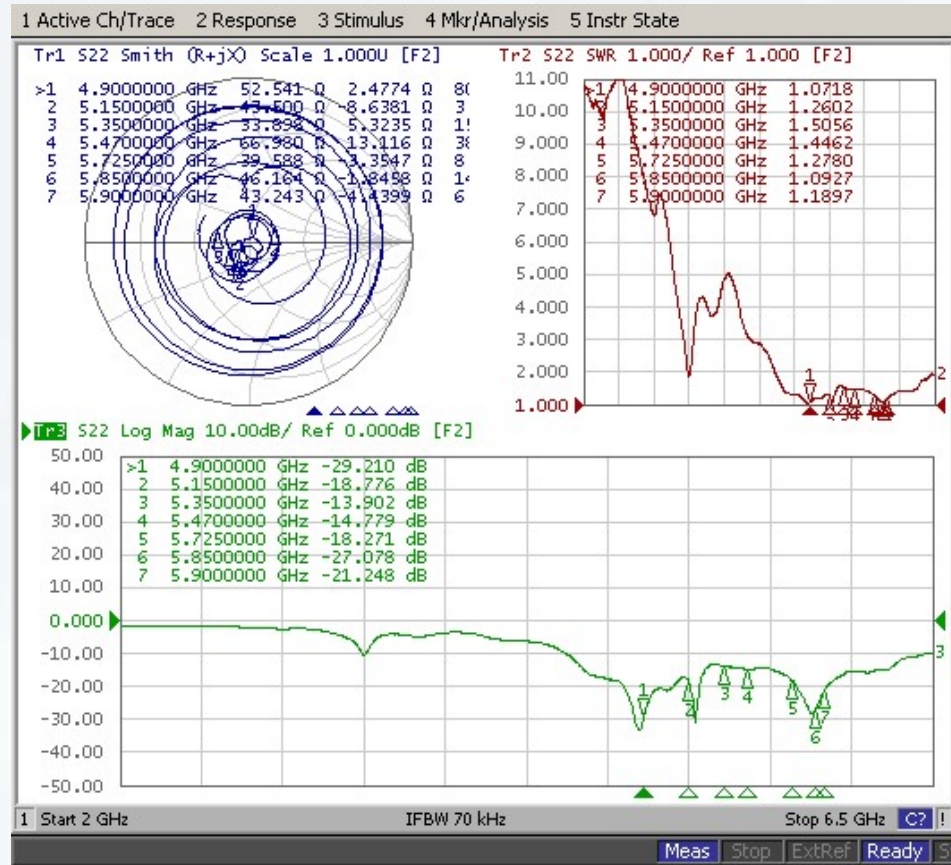
Return Loss Results

5G_ANT5 (4900MHz~5900MHz) (Criterion:>10dB)



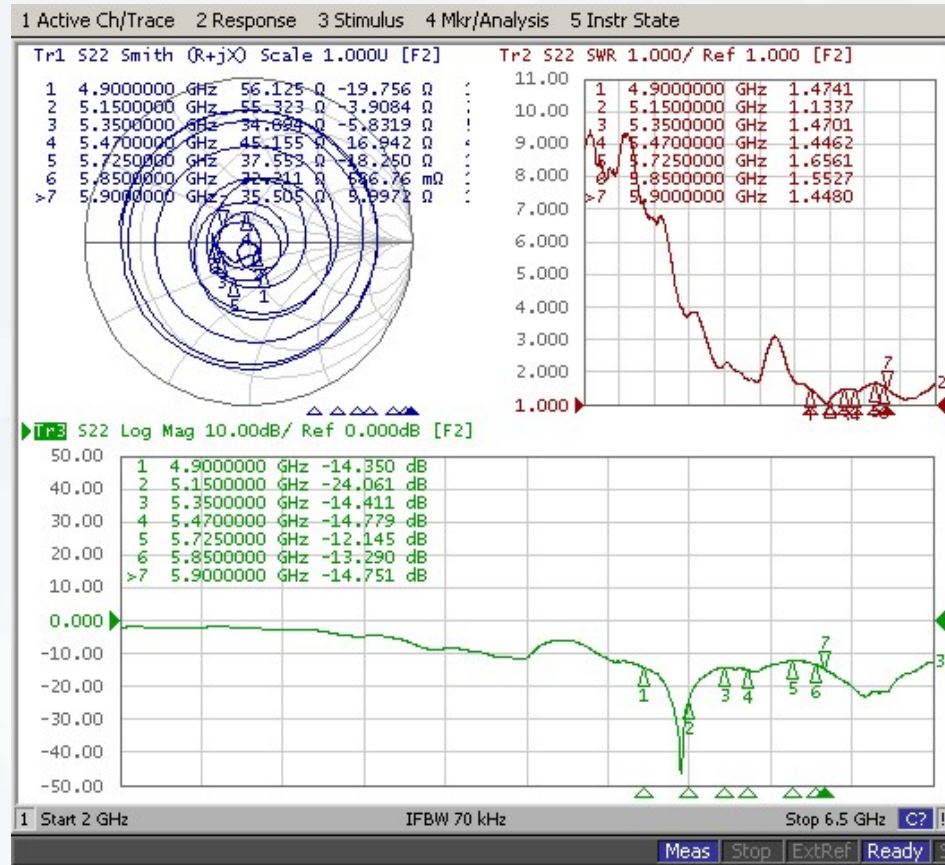
Return Loss Results

5G_ANT6 (4900MHz~5900MHz) (Criterion:>10dB)



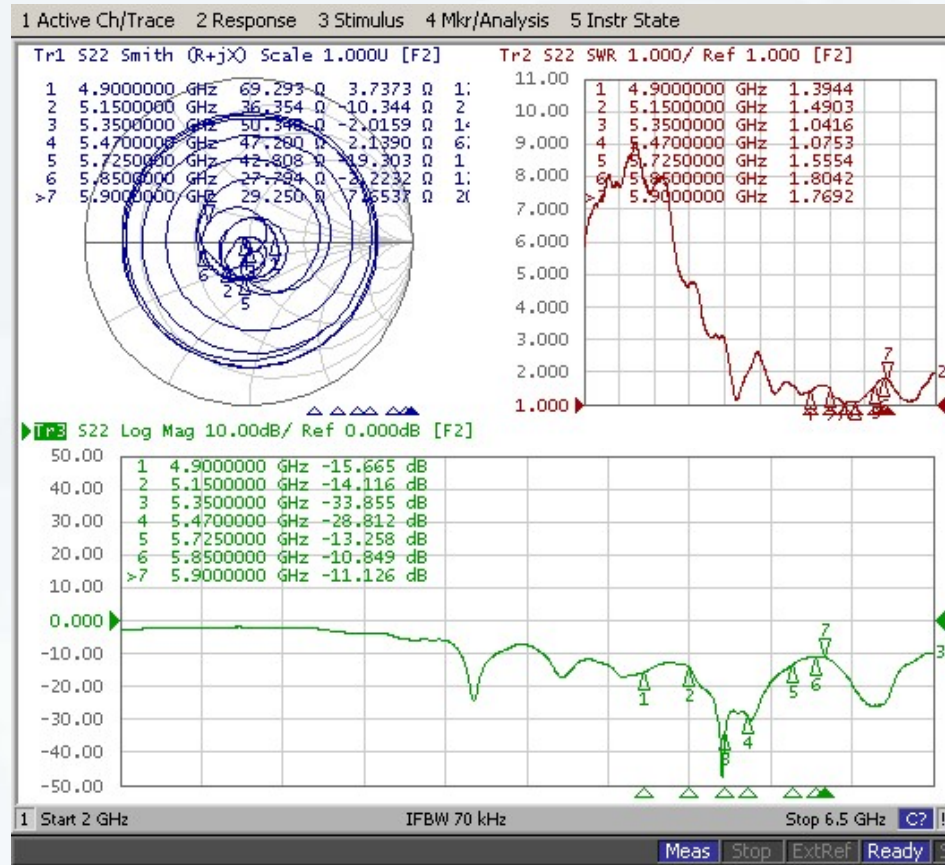
Return Loss Results

5G_ANT7 (4900MHz~5900MHz) (Criterion:>10dB)



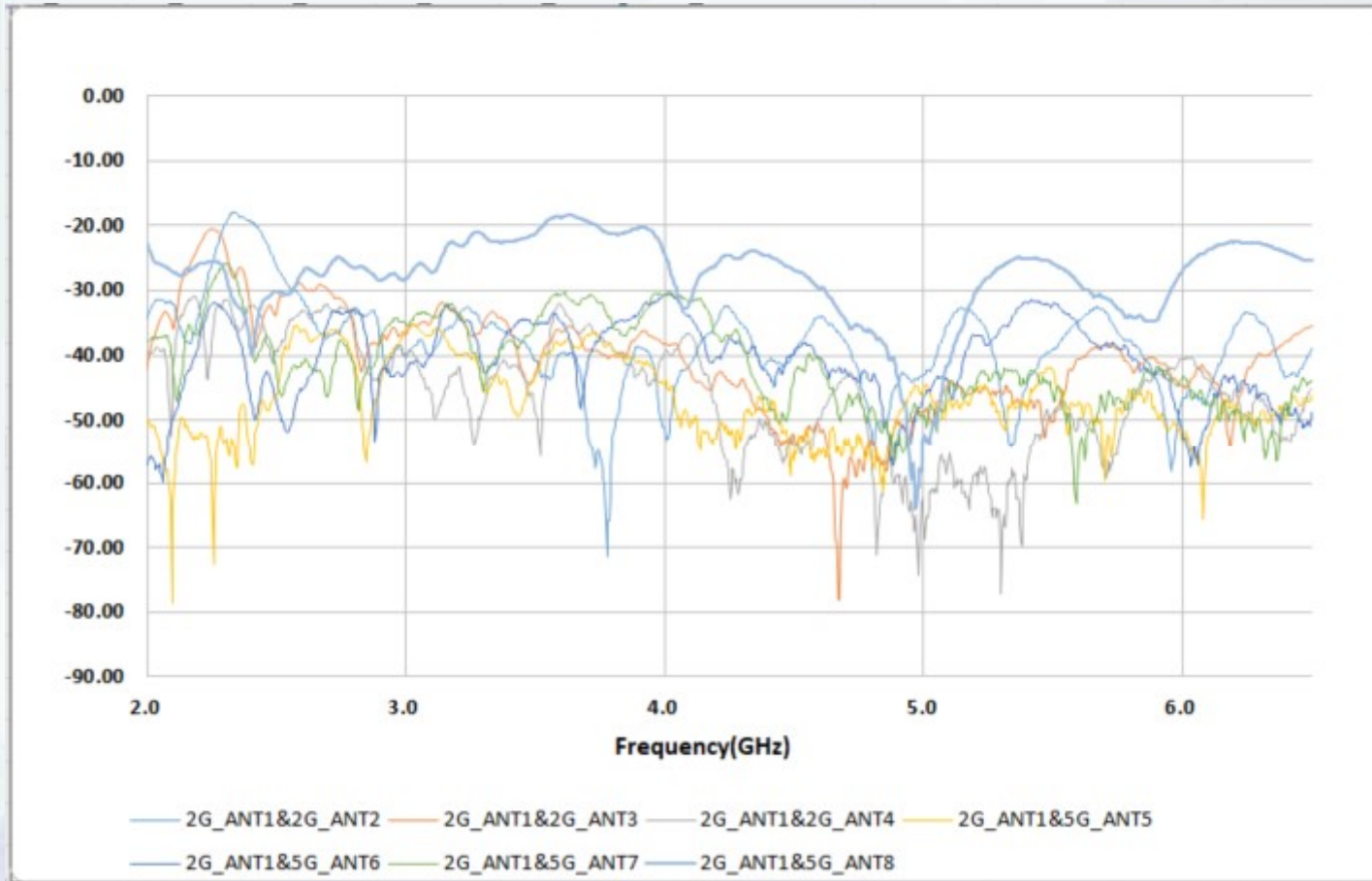
Return Loss Results

5G_ANT8 (4900MHz~5900MHz) (Criterion:>10dB)



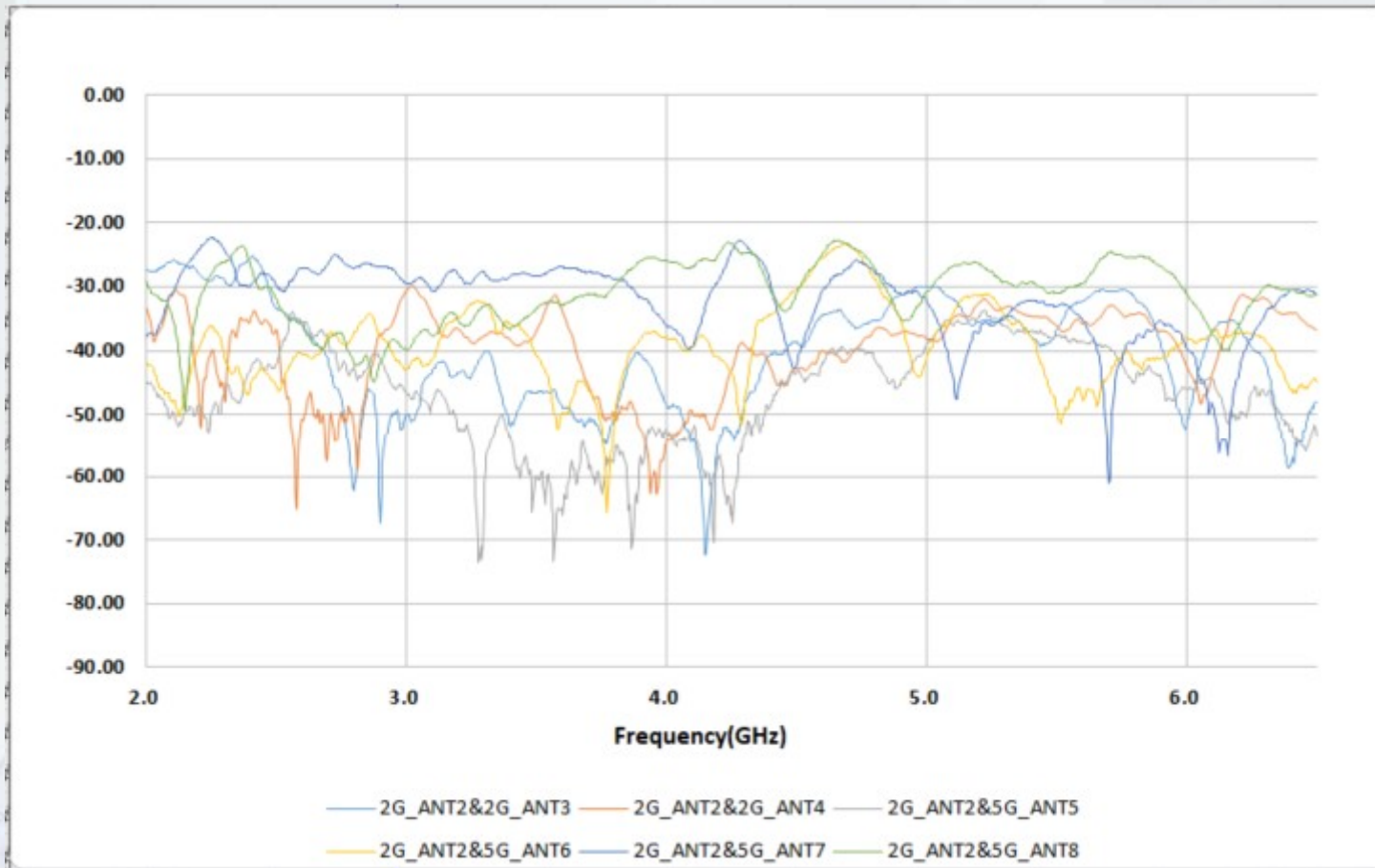
Isolation Results

2G_ANT1 to 5G_ANT8



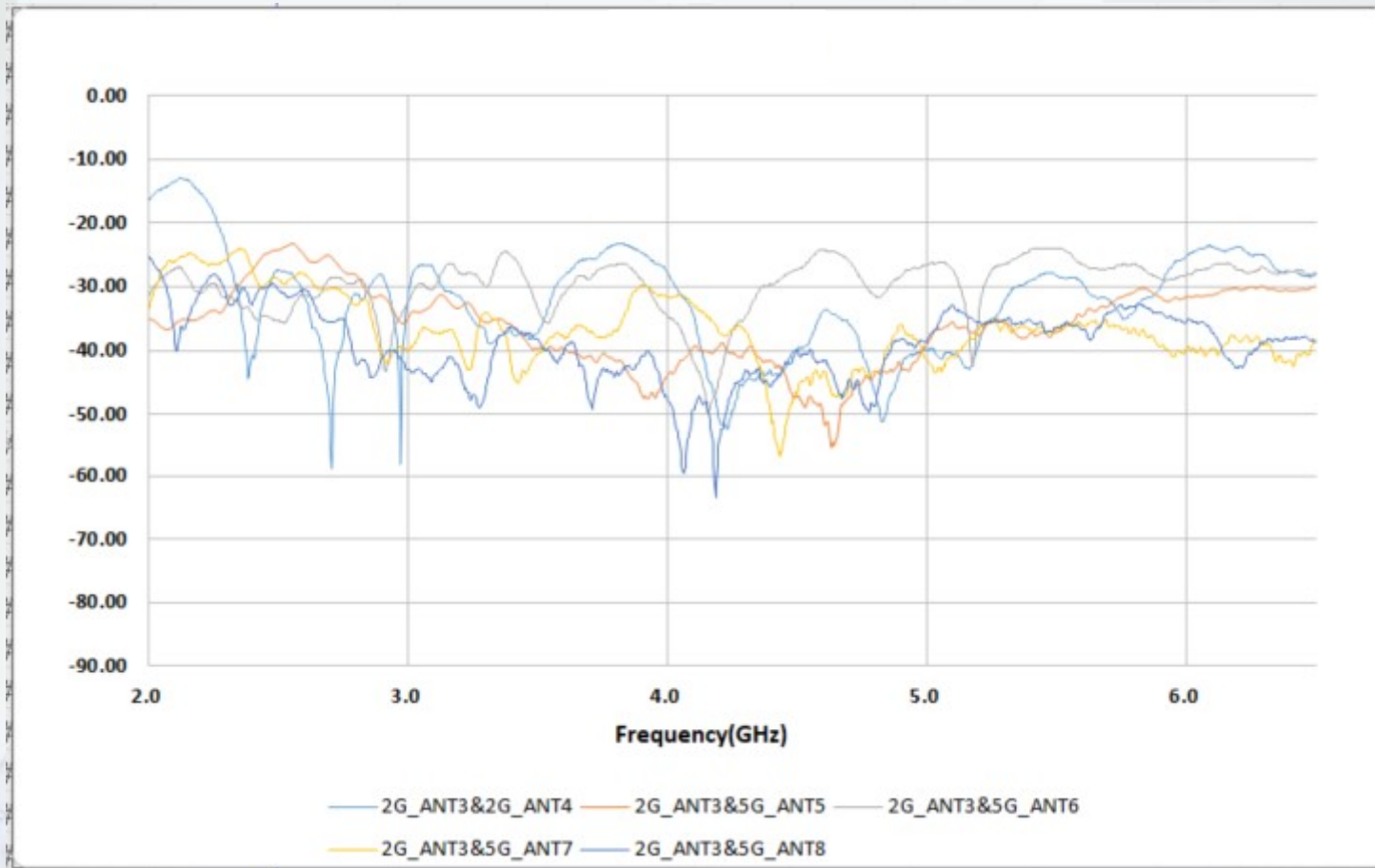
Isolation Results

2G_ANT2 to 5G_ANT8



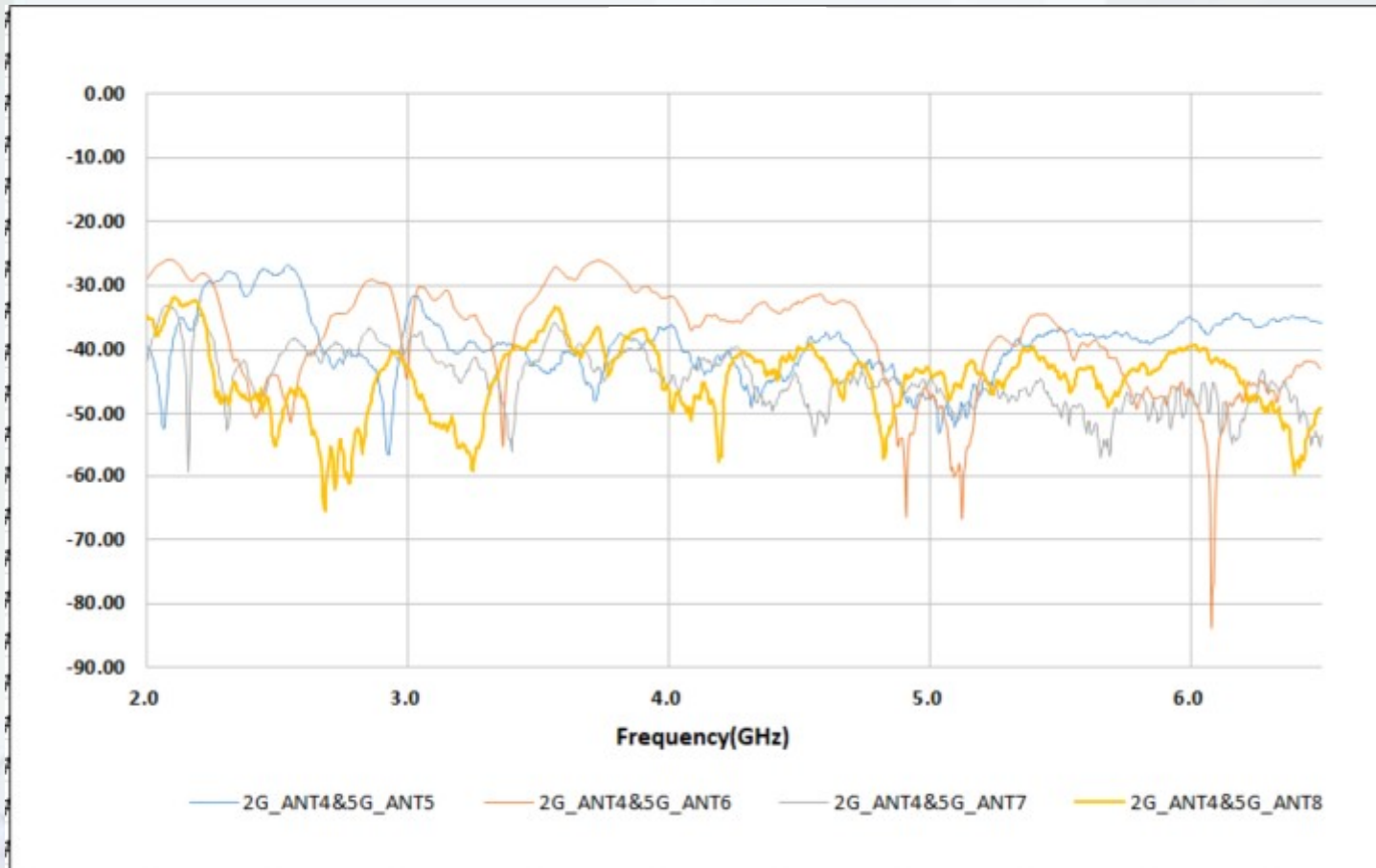
Isolation Results

2G_ANT3 to 5G_ANT8



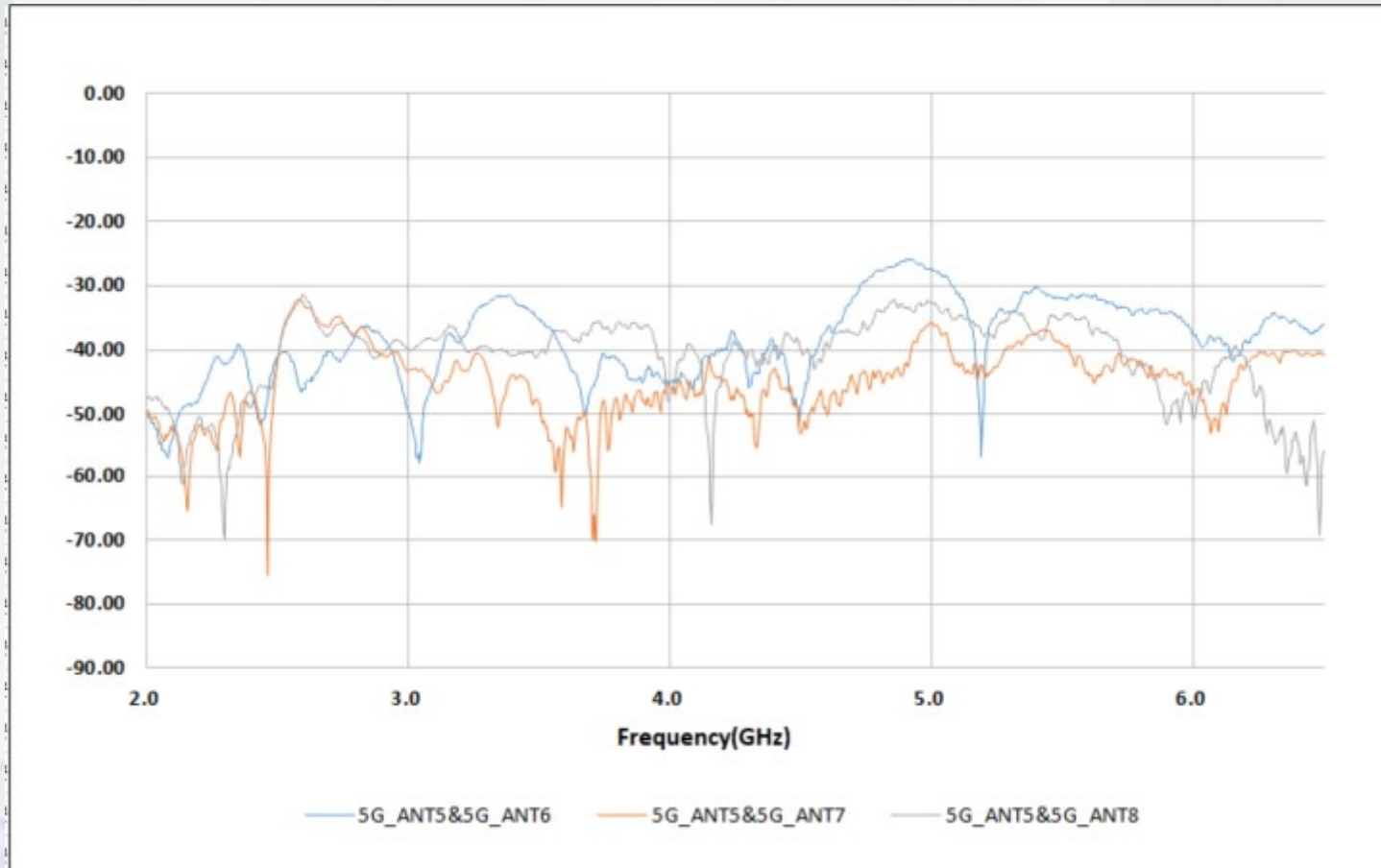
Isolation Results

2G_ANT4 to 5G_ANT8



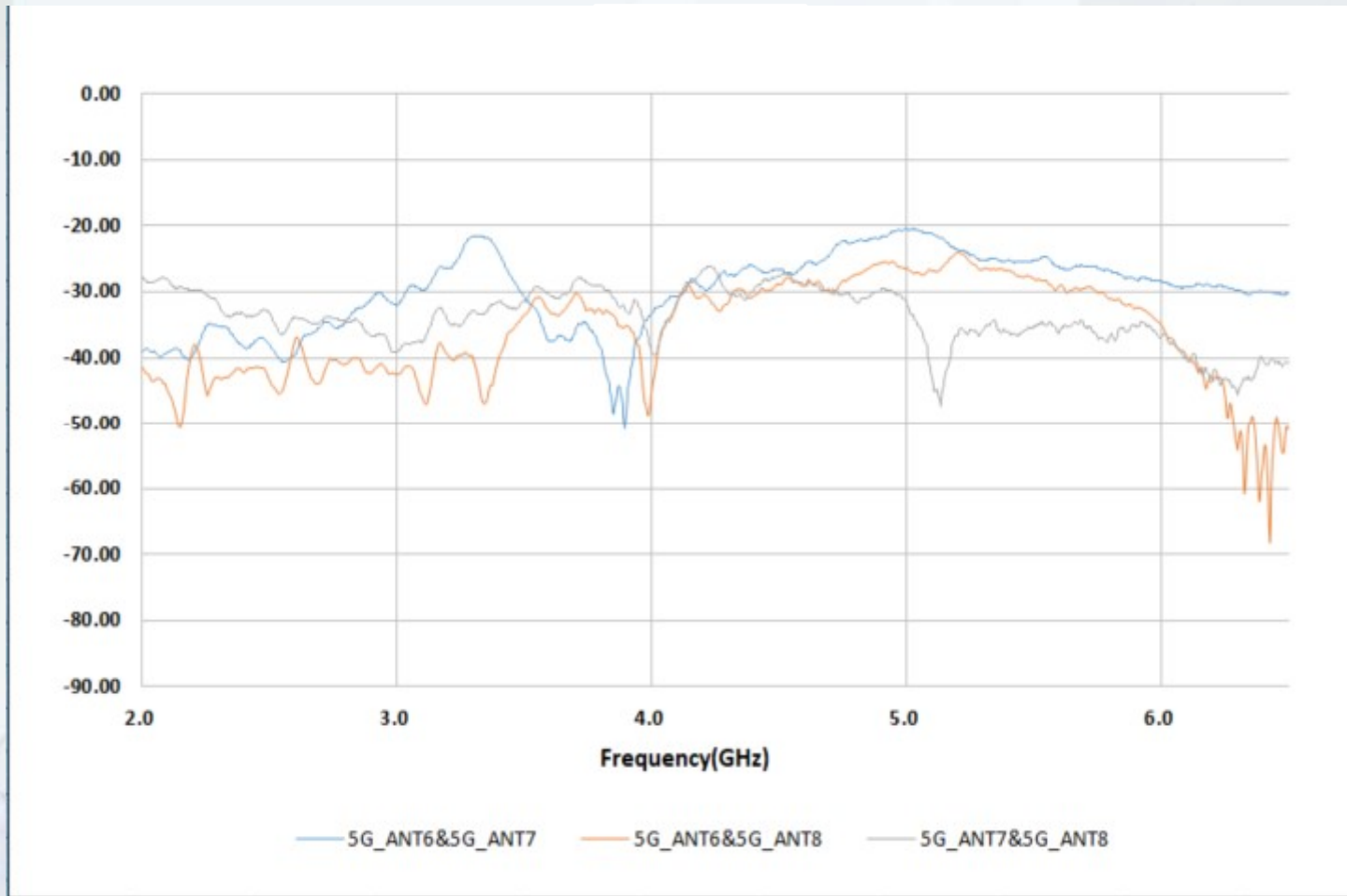
Isolation Results

5G_Ant5 to 5G_ANT8

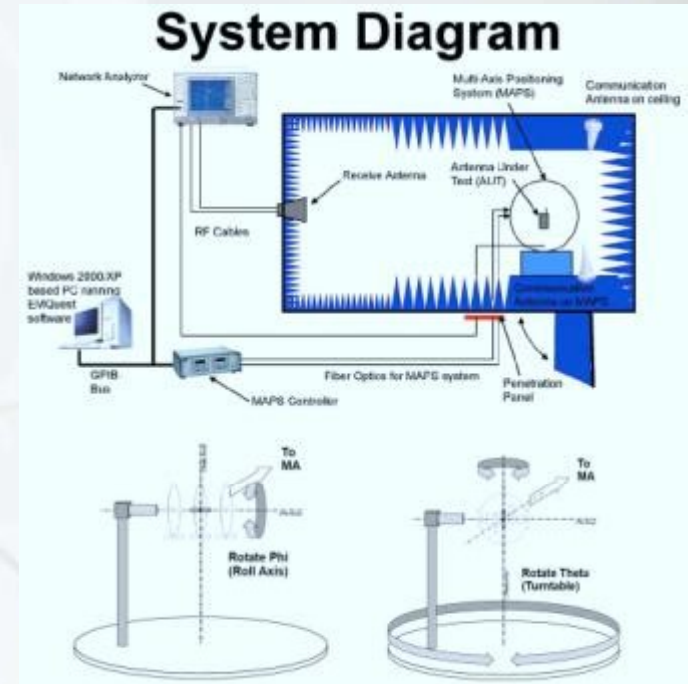
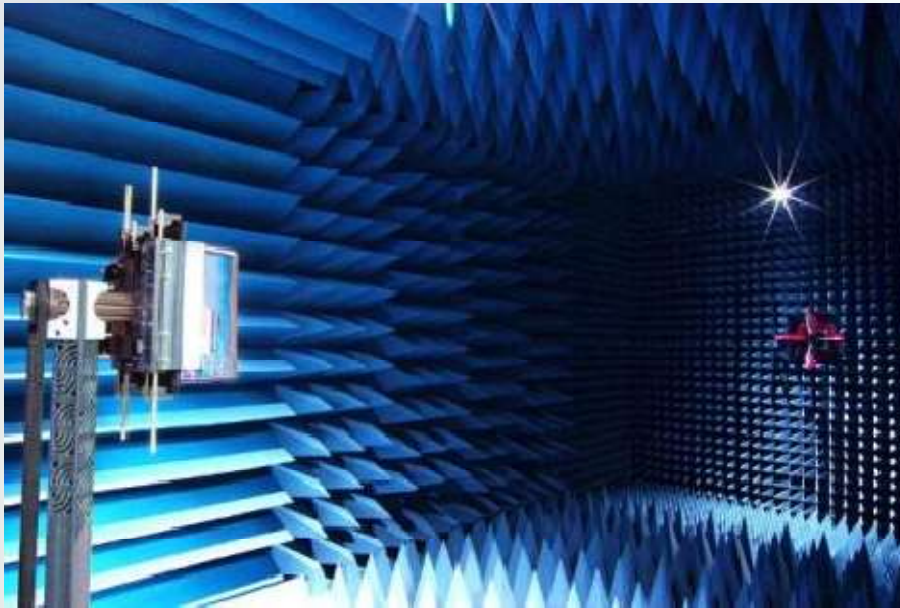


Isolation Results

5G_Ant6 to 5G_ANT8 & 5G_Ant7 to 5G_Ant8



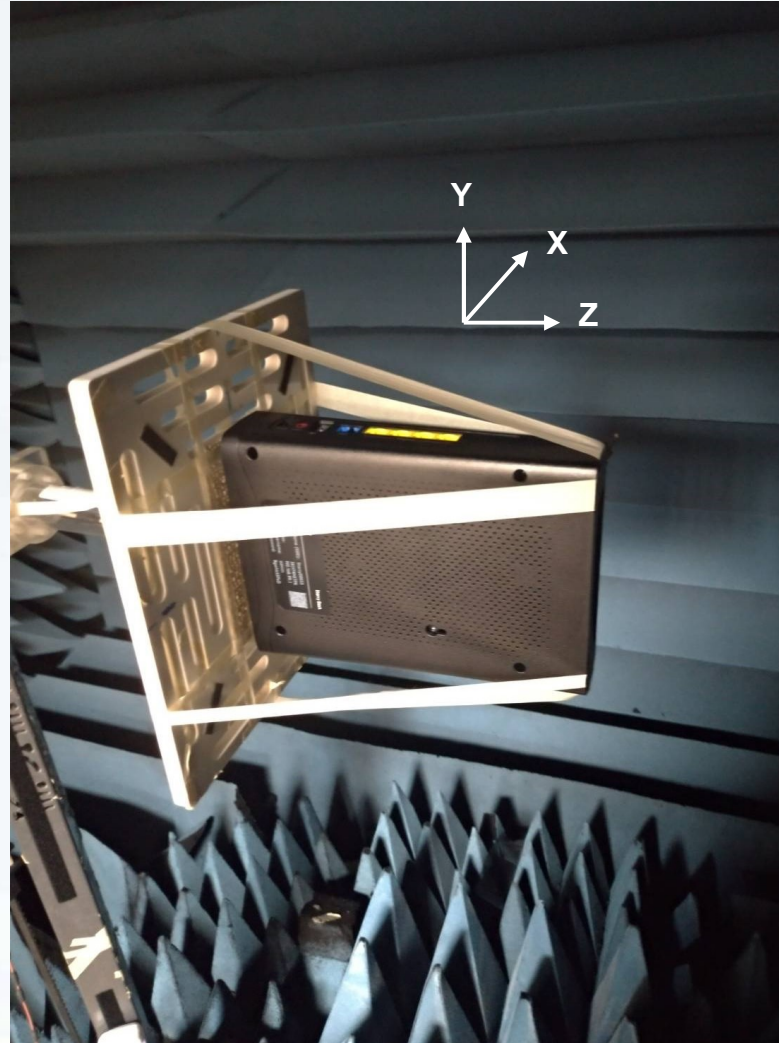
Chamber Information



| Chamber | Brand | Model | Location |
|---------|-------|----------|----------------|
| ETS | ETS | AMS-8200 | Taiwan HsinChu |

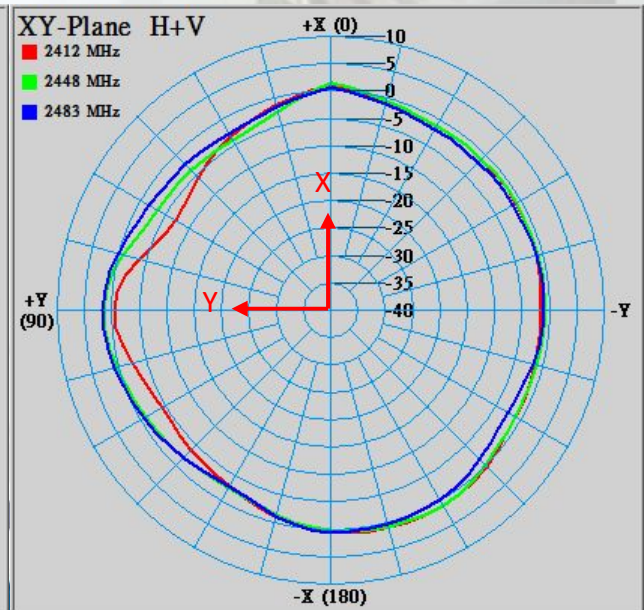
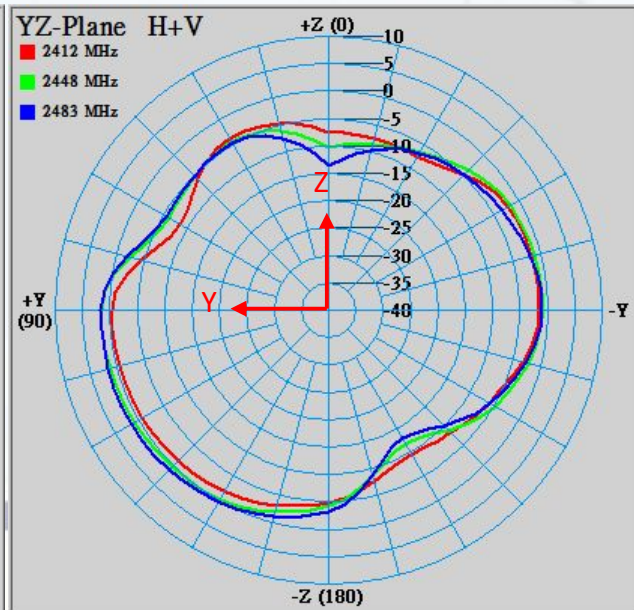
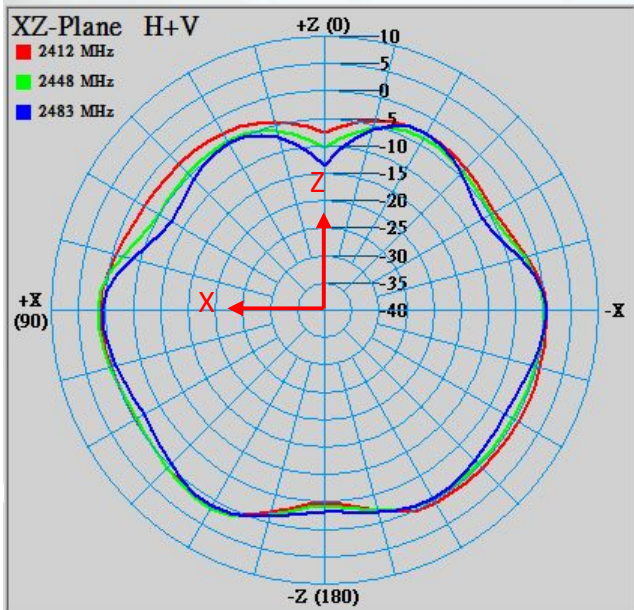
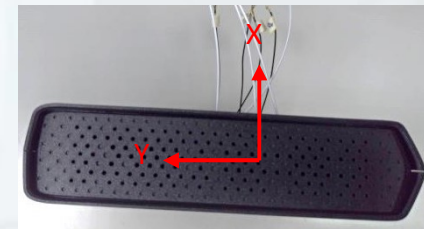
| | θ | ϕ |
|-------------------------------|----------|--------|
| Total angle | 180° | 360° |
| How many angle scan one point | 15° | 15° |
| Total scan point | 12 | 24 |

Test Setup for Radiation Pattern Measurement



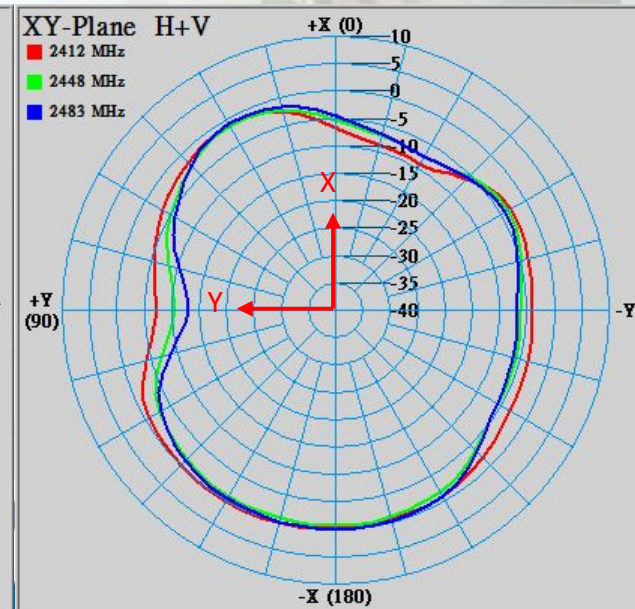
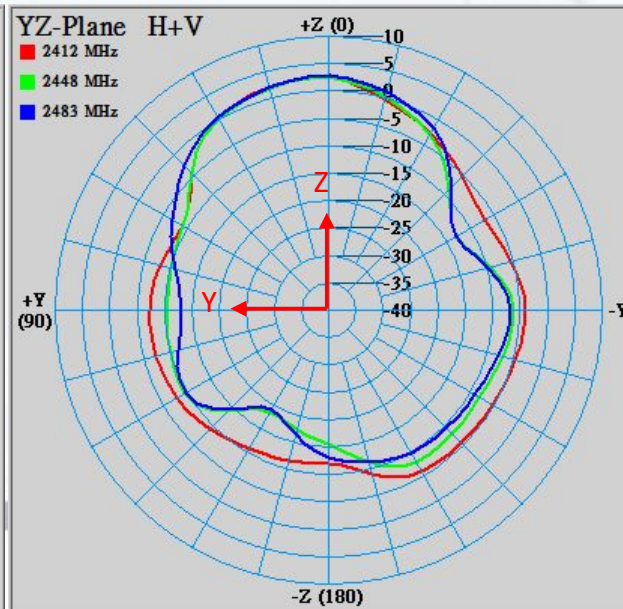
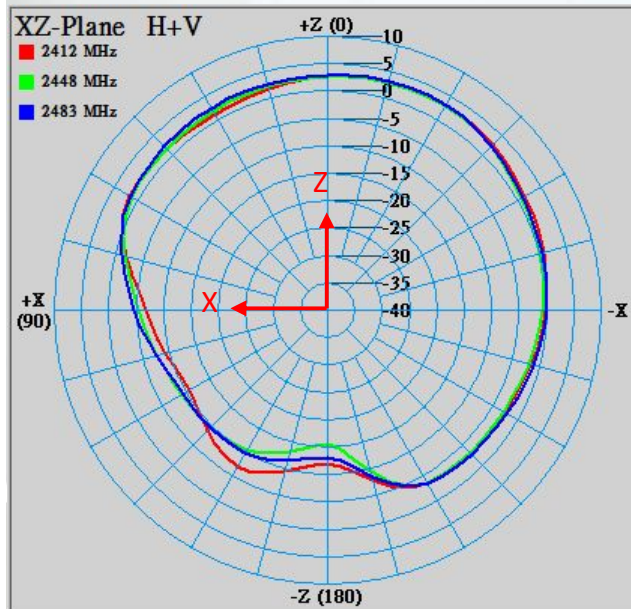
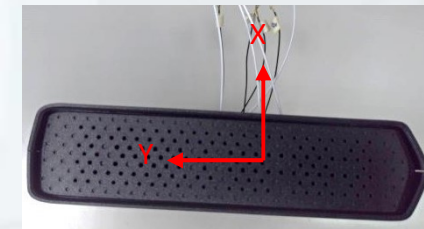
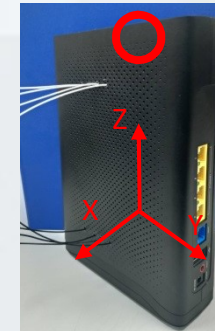
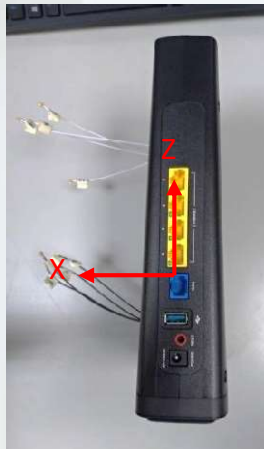
2D Radiation Pattern Results

2G_ANT1



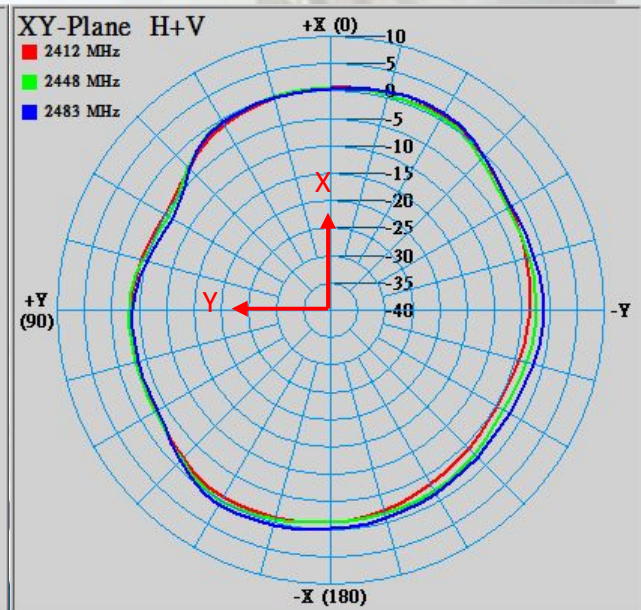
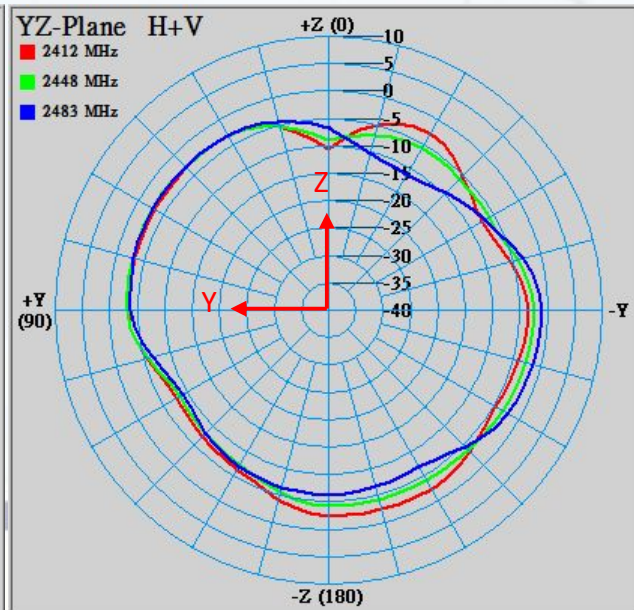
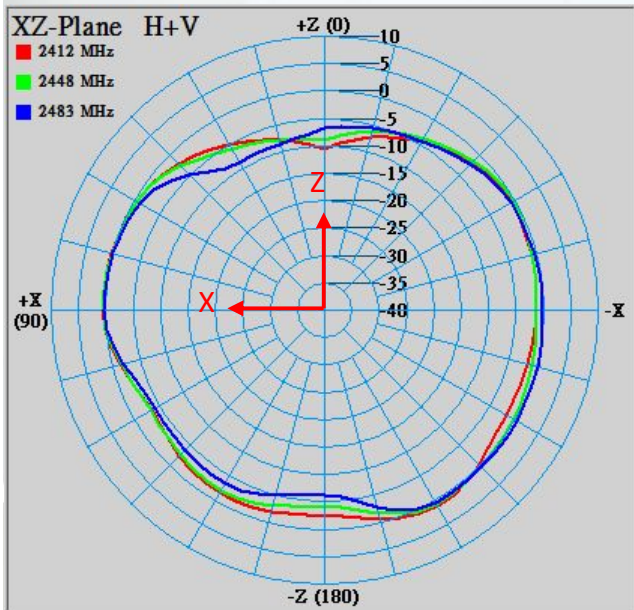
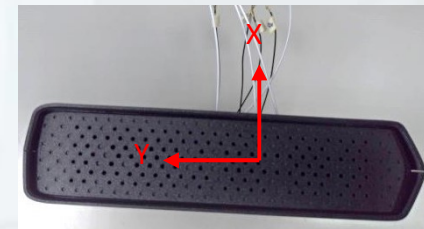
2D Radiation Pattern Results

2G_ANT2



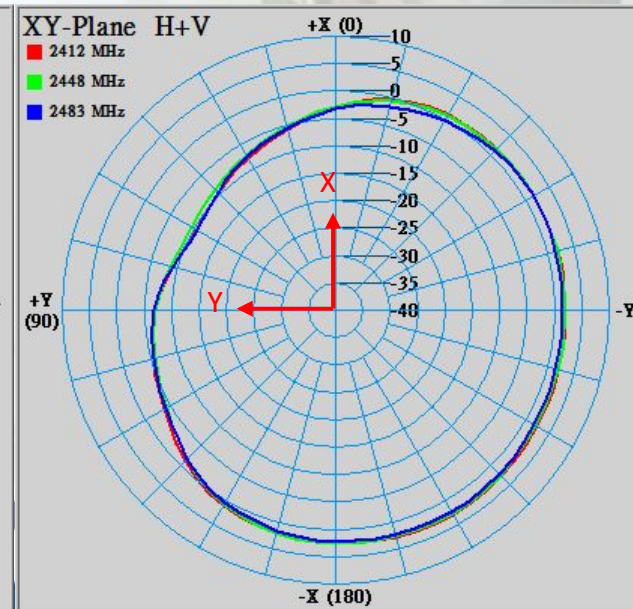
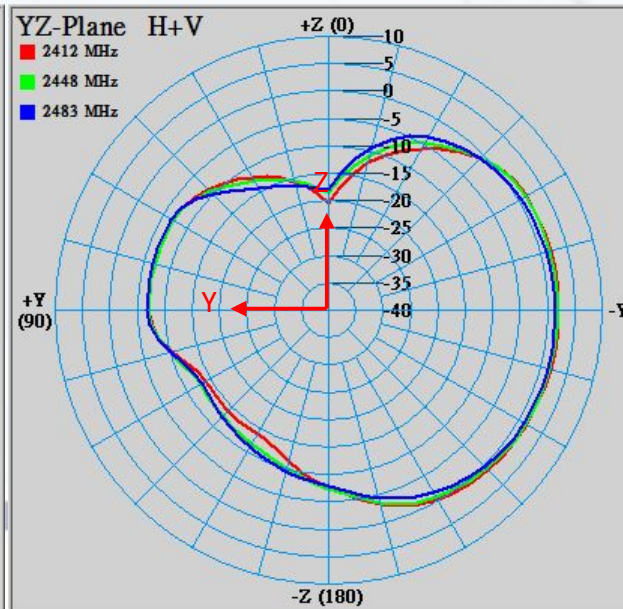
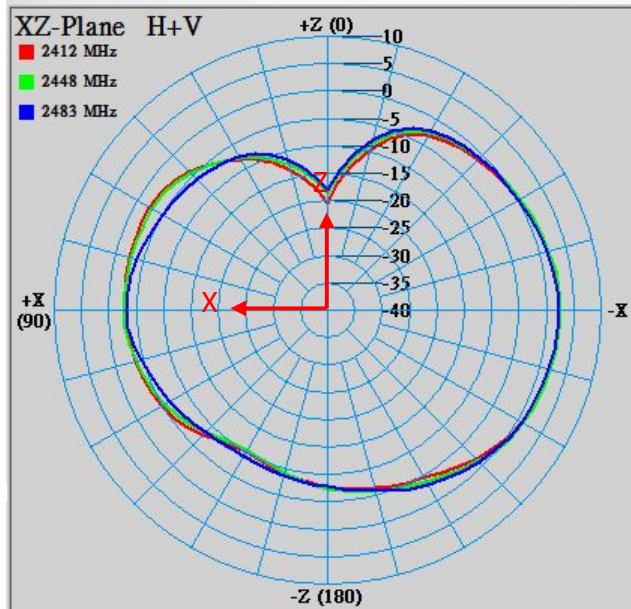
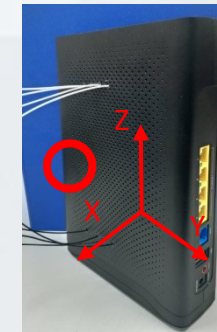
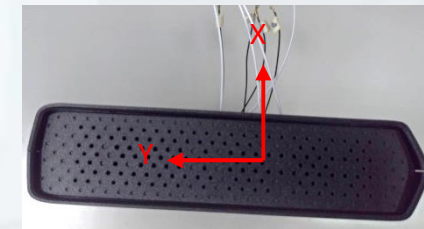
2D Radiation Pattern Results

2G_ANT3



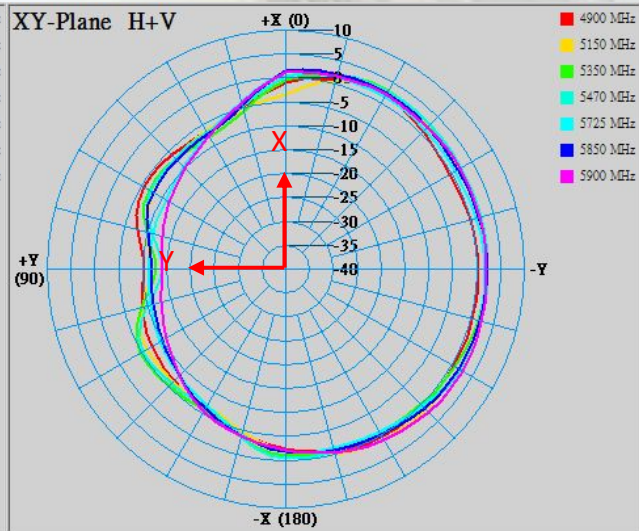
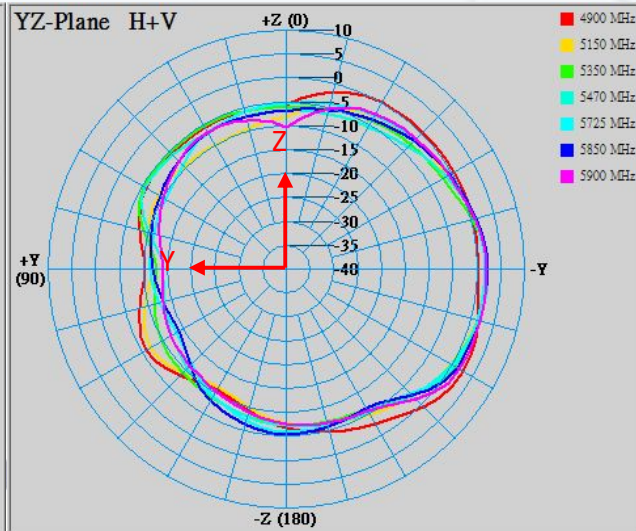
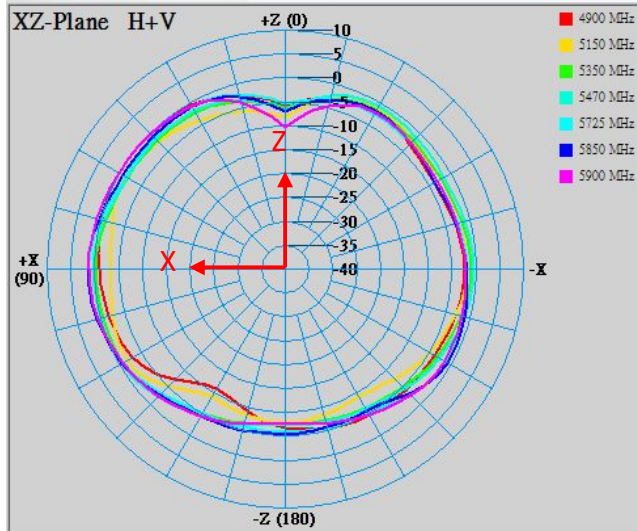
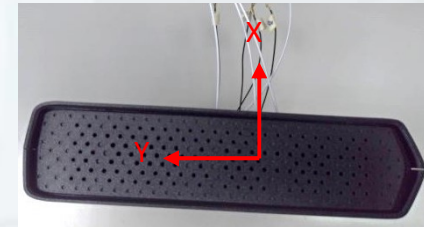
2D Radiation Pattern Results

2G_ANT4



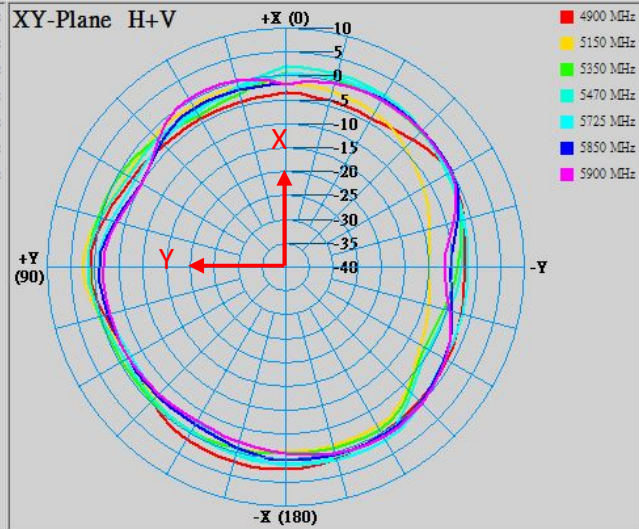
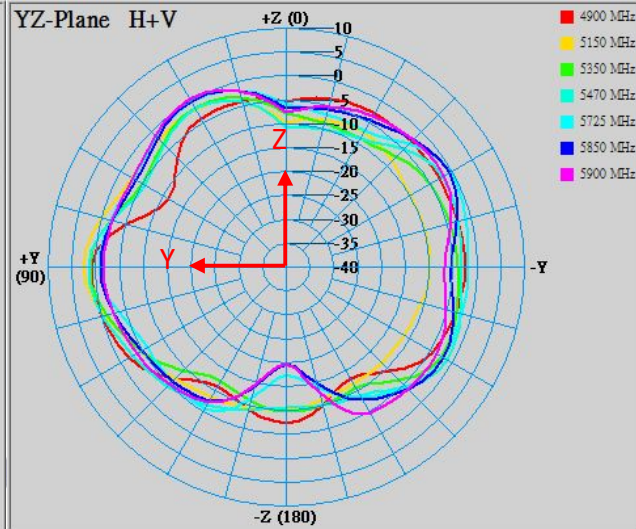
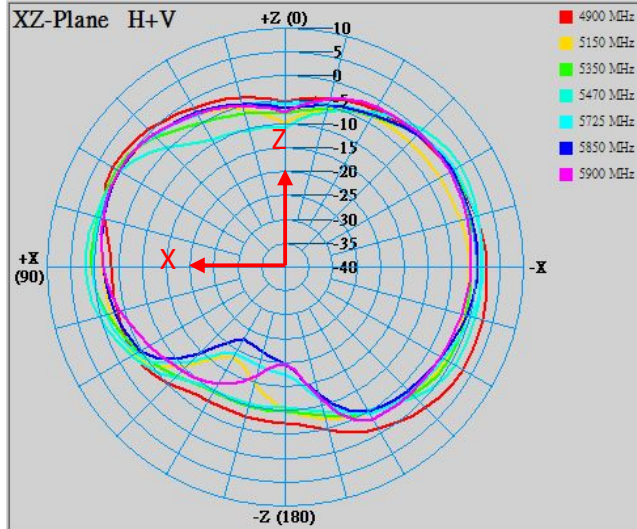
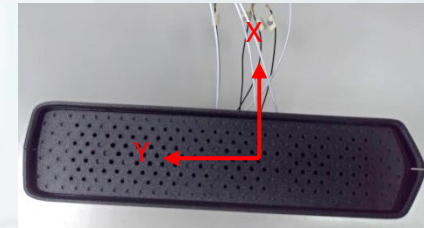
2D Radiation Pattern Results

5G_ANT5



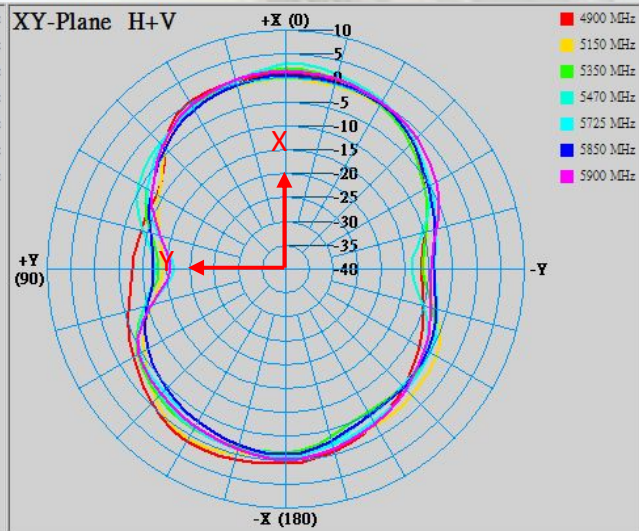
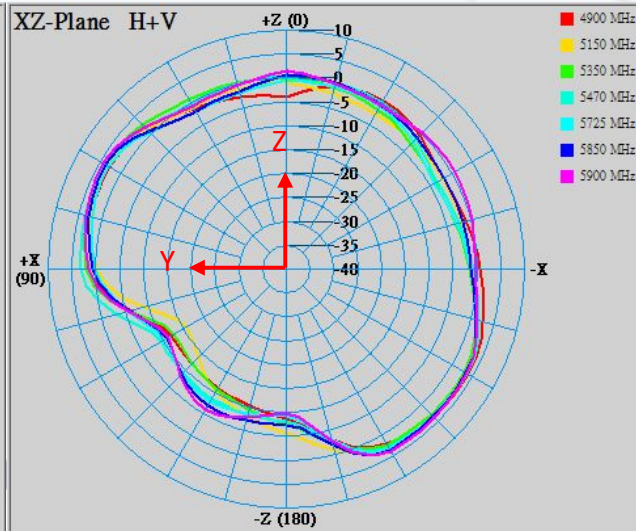
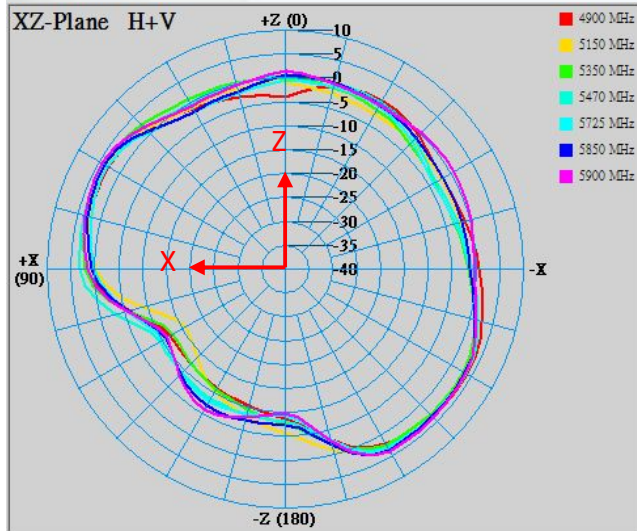
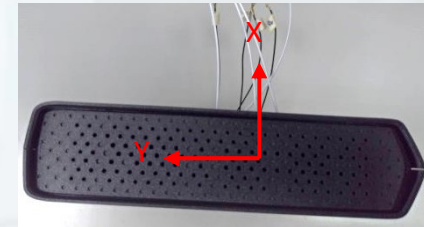
2D Radiation Pattern Results

5G_ANT6



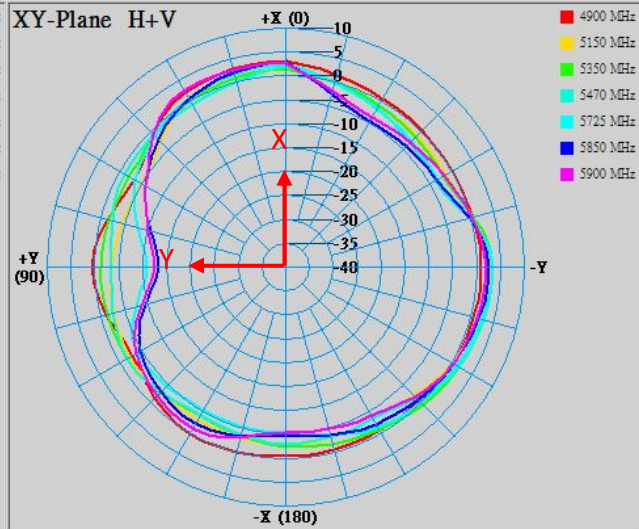
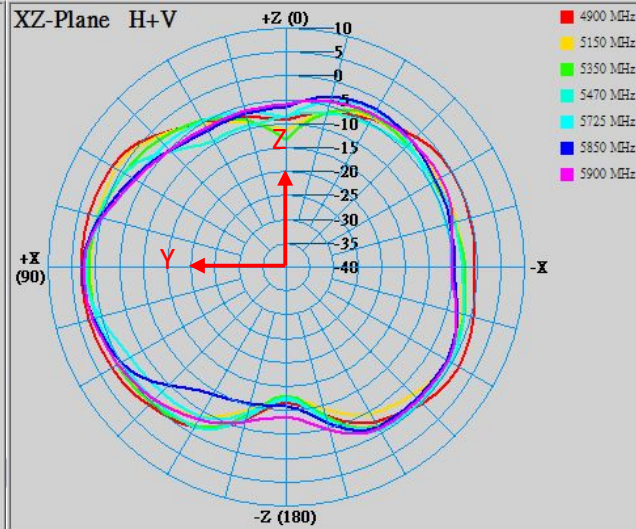
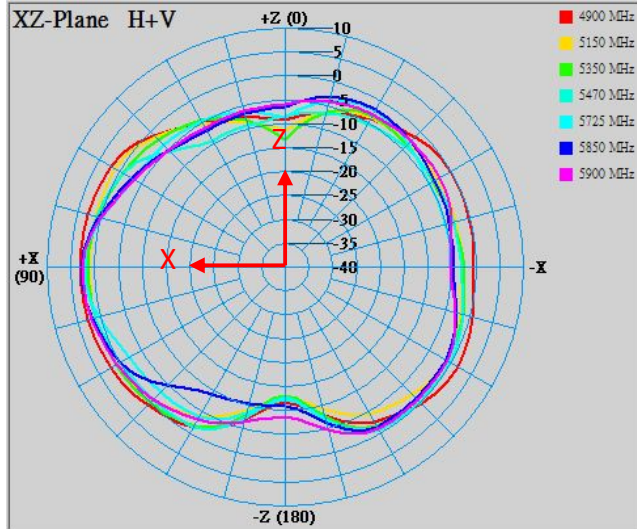
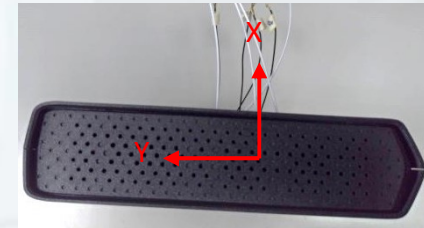
2D Radiation Pattern Results

5G_ANT7



2D Radiation Pattern Results

5G_ANT8



Results Summary

Return Loss (Criterion: >10dB)

| Frequency (MHz) | 2G_ANT1 | 2G_ANT2 | 2G_ANT3 | 2G_ANT4 |
|-----------------|---------|---------|---------|---------|
| 2412 MHz | 21.0 | 17.8 | 18.8 | 17.0 |
| 2448 MHz | 21.8 | 23.7 | 28.2 | 15.8 |
| 2483 MHz | 15.2 | 19.6 | 20.9 | 11.2 |

Results Summary

Return Loss (Criterion: >10dB)

| Frequency (MHz) | 5G_ANT5 | 5G_ANT6 | 5G_ANT7 | 5G_ANT8 |
|-----------------|---------|---------|---------|---------|
| 4900 MHz | 11.7 | 29.2 | 14.3 | 15.6 |
| 5150 MHz | 11.5 | 18.7 | 24.0 | 14.1 |
| 5350 MHz | 23.4 | 13.9 | 14.4 | 33.8 |
| 5470 MHz | 25.6 | 14.7 | 14.7 | 28.8 |
| 5725 MHz | 13.3 | 18.2 | 12.1 | 13.2 |
| 5850 MHz | 10.9 | 27.0 | 13.2 | 10.8 |
| 5900 MHz | 10.9 | 21.2 | 14.7 | 11.1 |

Results Summary

Isolation (Criterion: >20dB)

| | 2G Ant1 & 2G Ant2 | 2G Ant1 & 2G Ant3 | 2G Ant1 & 2G Ant4 | 2G Ant1 & 5G Ant5 | 2G Ant1 & 5G Ant6 | 2G Ant1 & 5G Ant7 | 2G Ant1 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 23 | 37 | 32 | 57 | 49 | 40 | 23 |
| 2448 MHz | 21 | 35 | 34 | 47 | 44 | 39 | 21 |
| 2483 MHz | 24 | 33 | 41 | 47 | 44 | 39 | 24 |
| 4900 MHz | 44 | 51 | 59 | 49 | 53 | 52 | 44 |
| 5150 MHz | 33 | 45 | 62 | 48 | 42 | 46 | 33 |
| 5350 MHz | 53 | 47 | 58 | 48 | 34 | 42 | 53 |
| 5470 MHz | 40 | 51 | 48 | 42 | 32 | 44 | 40 |
| 5725 MHz | 35 | 38 | 57 | 56 | 39 | 46 | 35 |
| 5850 MHz | 40 | 41 | 44 | 47 | 42 | 43 | 40 |
| 5900 MHz | 44 | 41 | 43 | 49 | 42 | 42 | 44 |

Results Summary

Isolation (Criterion: >20dB)

| | 2G Ant2 & 2G Ant3 | 2G Ant2 & 2G Ant4 | 2G Ant2 & 5G Ant5 | 2G Ant2 & 5G Ant6 | 2G Ant2 & 5G Ant7 | 2G Ant2 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 25 | 34 | 42 | 44 | 29 | 28 |
| 2448 MHz | 27 | 36 | 43 | 43 | 28 | 30 |
| 2483 MHz | 32 | 37 | 43 | 45 | 29 | 31 |
| 4900 MHz | 31 | 37 | 45 | 35 | 31 | 35 |
| 5150 MHz | 35 | 35 | 36 | 32 | 42 | 26 |
| 5350 MHz | 35 | 34 | 37 | 35 | 33 | 30 |
| 5470 MHz | 39 | 35 | 38 | 46 | 33 | 31 |
| 5725 MHz | 31 | 33 | 40 | 42 | 46 | 25 |
| 5850 MHz | 34 | 35 | 43 | 41 | 37 | 25 |
| 5900 MHz | 39 | 37 | 44 | 41 | 35 | 27 |

Results Summary

Isolation (Criterion: >20dB)

| | 2G Ant3 & 2G Ant4 | 2G Ant3 & 5G Ant5 | 2G Ant3 & 5G Ant6 | 2G Ant3 & 5G Ant7 | 2G Ant3 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 39 | 26 | 35 | 28 | 31 |
| 2448 MHz | 31 | 24 | 34 | 29 | 30 |
| 2483 MHz | 27 | 24 | 35 | 28 | 29 |
| 4900 MHz | 42 | 42 | 28 | 35 | 38 |
| 5150 MHz | 42 | 36 | 33 | 38 | 34 |
| 5350 MHz | 30 | 37 | 25 | 36 | 35 |
| 5470 MHz | 27 | 37 | 24 | 36 | 37 |
| 5725 MHz | 32 | 32 | 27 | 36 | 33 |
| 5850 MHz | 31 | 30 | 27 | 37 | 33 |
| 5900 MHz | 30 | 31 | 28 | 39 | 34 |

Results Summary

Isolation (Criterion: >20dB)

| | 2G Ant4 & 5G Ant5 | 2G Ant4 & 5G Ant6 | 2G Ant4 & 5G Ant7 | 2G Ant4 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 29 | 50 | 46 | 46 |
| 2448 MHz | 27 | 46 | 48 | 49 |
| 2483 MHz | 28 | 43 | 43 | 53 |
| 4900 MHz | 46 | 57 | 46 | 44 |
| 5150 MHz | 49 | 55 | 48 | 42 |
| 5350 MHz | 38 | 38 | 46 | 40 |
| 5470 MHz | 36 | 35 | 48 | 42 |
| 5725 MHz | 37 | 42 | 49 | 46 |
| 5850 MHz | 38 | 47 | 49 | 43 |
| 5900 MHz | 37 | 47 | 47 | 41 |

Results Summary

Isolation (Criterion: >20dB)

| | 5G Ant5 & 5G Ant6 | 5G Ant5 & 5G Ant7 | 5G Ant5 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 48 | 47 | 47 |
| 2448 MHz | 50 | 53 | 45 |
| 2483 MHz | 42 | 47 | 44 |
| 4900 MHz | 26 | 41 | 33 |
| 5150 MHz | 35 | 43 | 35 |
| 5350 MHz | 31 | 38 | 34 |
| 5470 MHz | 31 | 38 | 34 |
| 5725 MHz | 33 | 41 | 40 |
| 5850 MHz | 33 | 44 | 44 |
| 5900 MHz | 34 | 43 | 51 |

Results Summary

Isolation (Criterion: >20dB)

| | 5G Ant6 & 5G Ant7 | 5G Ant6 & 5G Ant8 | 5G Ant7 & 5G Ant8 |
|----------|-------------------------|-------------------------|-------------------------|
| 2412 MHz | 38 | 41 | 33 |
| 2448 MHz | 37 | 41 | 33 |
| 2483 MHz | 37 | 41 | 32 |
| 4900 MHz | 21 | 25 | 29 |
| 5150 MHz | 22 | 25 | 43 |
| 5350 MHz | 24 | 26 | 34 |
| 5470 MHz | 25 | 27 | 35 |
| 5725 MHz | 26 | 29 | 35 |
| 5850 MHz | 27 | 31 | 35 |
| 5900 MHz | 28 | 32 | 35 |

Results Summary

Peak gain & Efficiency – 2G ANT1

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 2412MHz | 2.2 | 63.5 |
| 2448MHz | 2.3 | 65.7 |
| 2483MHz | 2.6 | 67.6 |

Results Summary

Peak gain & Efficiency – 2G ANT2

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 2412MHz | 3.2 | 61.5 |
| 2448MHz | 3.1 | 63.2 |
| 2483MHz | 3.3 | 65.4 |

Results Summary

Peak gain & Efficiency – 2G ANT3

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 2412MHz | 2.8 | 62.6 |
| 2448MHz | 3.1 | 63.4 |
| 2483MHz | 2.8 | 61.8 |

Results Summary

Peak gain & Efficiency – 2G ANT4

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 2412MHz | 3.2 | 73.3 |
| 2448MHz | 2.9 | 74.2 |
| 2483MHz | 2.7 | 68.3 |

Results Summary

Peak gain & Efficiency – 5G ANT5

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 4900MHz | 3.1 | 67.7 |
| 5150MHz | 3.2 | 63.3 |
| 5350MHz | 3.4 | 63.6 |
| 5470MHz | 4.0 | 66.8 |
| 5725MHz | 2.9 | 64.0 |
| 5850MHz | 3.3 | 69.2 |
| 5900MHz | 3.6 | 71.1 |

Results Summary

Peak gain & Efficiency – 5G ANT6

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 4900MHz | 3.6 | 69.3 |
| 5150MHz | 2.5 | 62.1 |
| 5350MHz | 2.2 | 62.6 |
| 5470MHz | 3.2 | 66.7 |
| 5725MHz | 2.4 | 64.8 |
| 5850MHz | 2.0 | 65.1 |
| 5900MHz | 2.7 | 67.4 |

Results Summary

Peak gain & Efficiency – 5G ANT7

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 4900MHz | 4.0 | 70.4 |
| 5150MHz | 3.6 | 67.4 |
| 5350MHz | 3.8 | 63.3 |
| 5470MHz | 3.9 | 70.0 |
| 5725MHz | 3.4 | 63.6 |
| 5850MHz | 3.8 | 67.0 |
| 5900MHz | 4.2 | 74.8 |

Results Summary

Peak gain & Efficiency – 5G ANT8

| Frequency (MHz) | Peak Gain (dBi) | Efficiency (%) |
|-----------------|-----------------|----------------|
| 4900MHz | 3.0 | 75.8 |
| 5150MHz | 2.4 | 68.0 |
| 5350MHz | 3.4 | 65.9 |
| 5470MHz | 3.4 | 64.6 |
| 5725MHz | 3.2 | 63.1 |
| 5850MHz | 3.2 | 65.6 |
| 5900MHz | 2.6 | 65.9 |