



HIGH-TEK HARNESS ENTERPRISE

Antenna Testing Report

Gibbon

	<i>Prepared by</i>	<i>Approved by</i>
	<i>JAMES</i>	

General Information

- Measurement Resume**

<i>Date</i>	<i>Engineer</i>	<i>2.4~2.5 GHz</i>	<i>5.15~5.35 GHz</i>	<i>5.47~5.725 GHz</i>	<i>5.725~5,825 GHz</i>
2005/12/29	JAMES	▼	▼	▼	▼

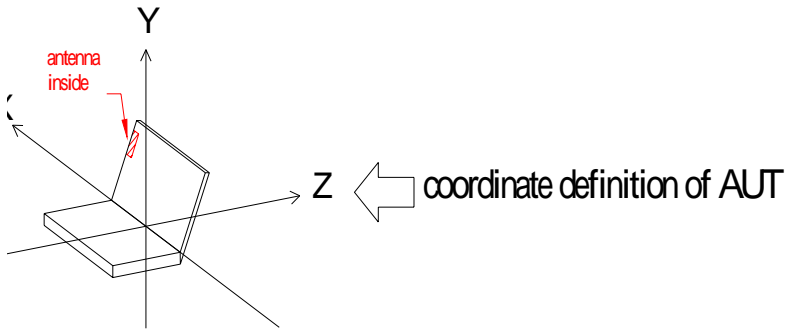
- Antenna specifications: maximum size, unit: mm**

<i>PIFA Type</i>	<i>Length</i>	<i>Width</i>	<i>Height</i>	<i>Cable length</i>
MAIN				590
AUX				785

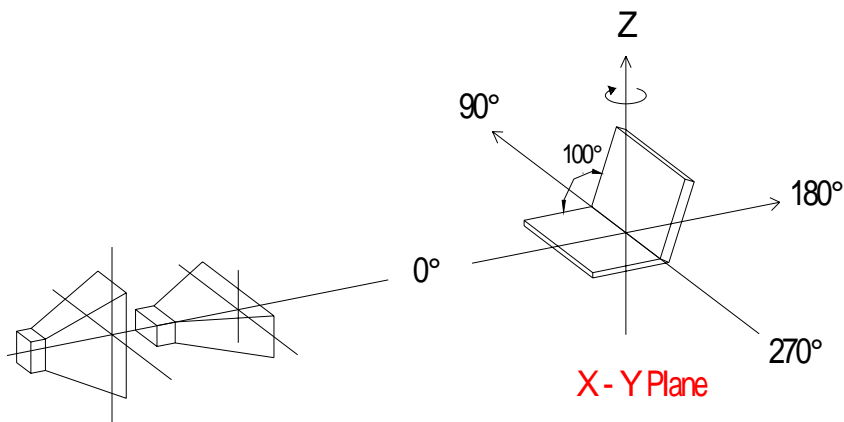
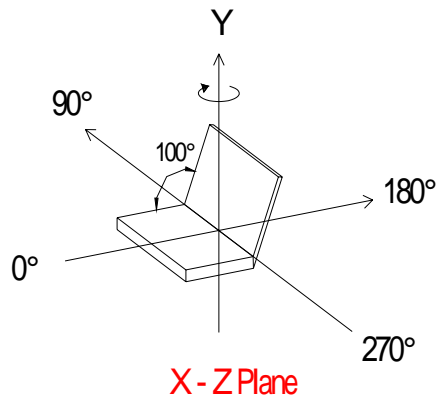
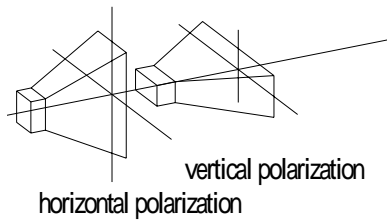
- Measurement Setup & Environment**

<i>Temp.</i>	<i>Humidity</i>	<i>Instrument</i>	<i>System</i>	<i>Entry</i>
20	50%	VNA HP8753ES, 7x4x4 m anechoic chamber	NSI antenna measurement system	VSWR, Return, Radiation pattern

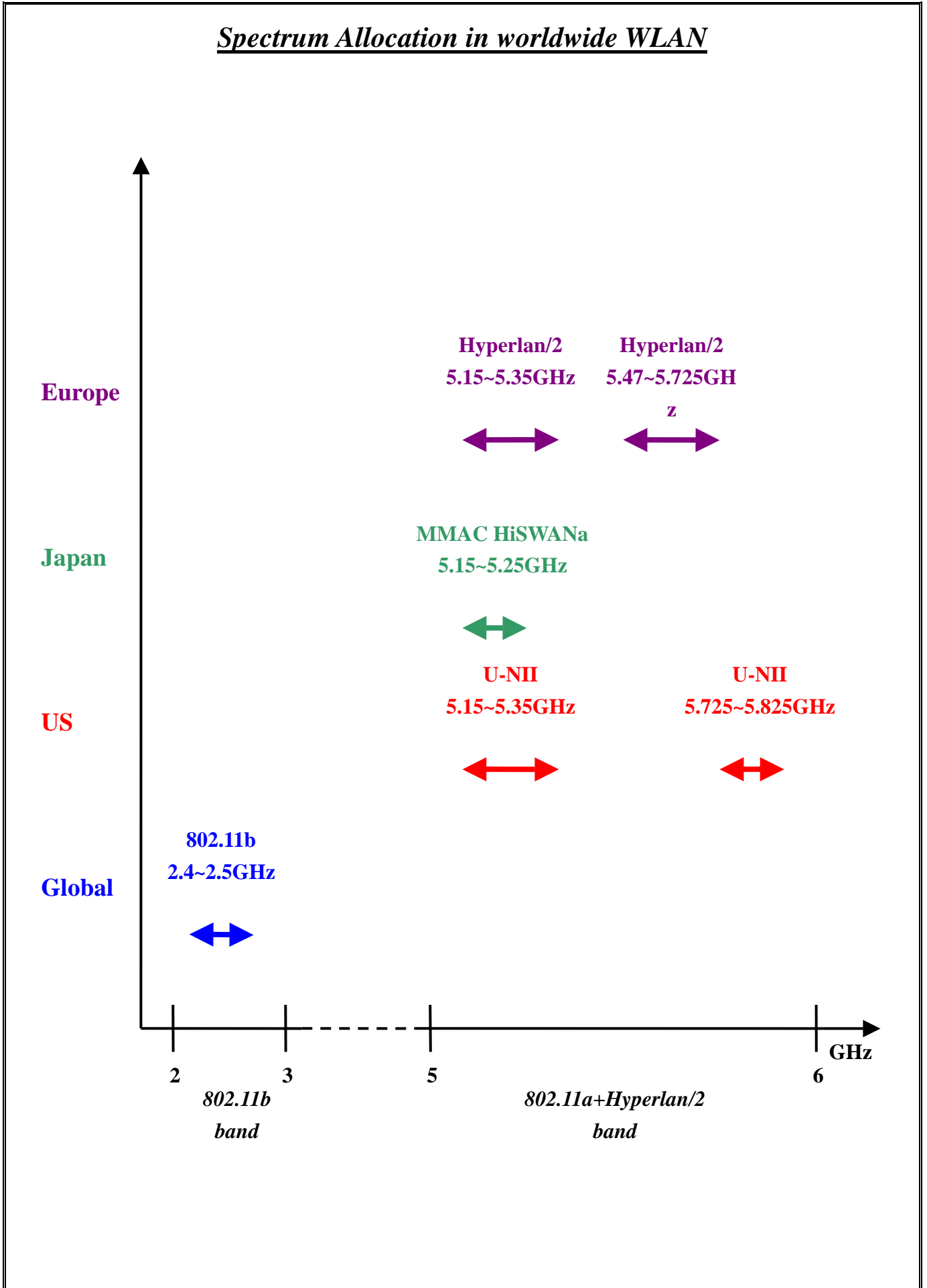
Coordinate Definition



HOORN ANTENNA

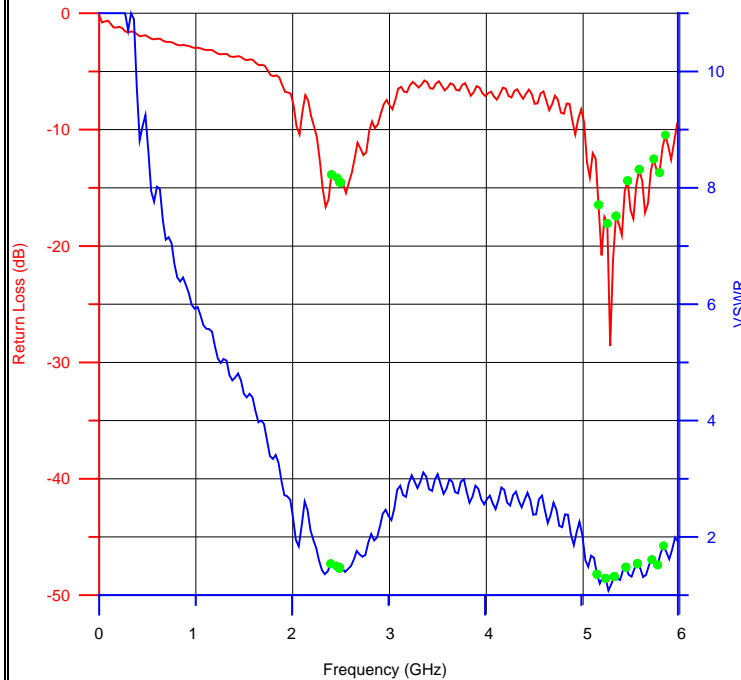


Spectrum Allocation in worldwide WLAN



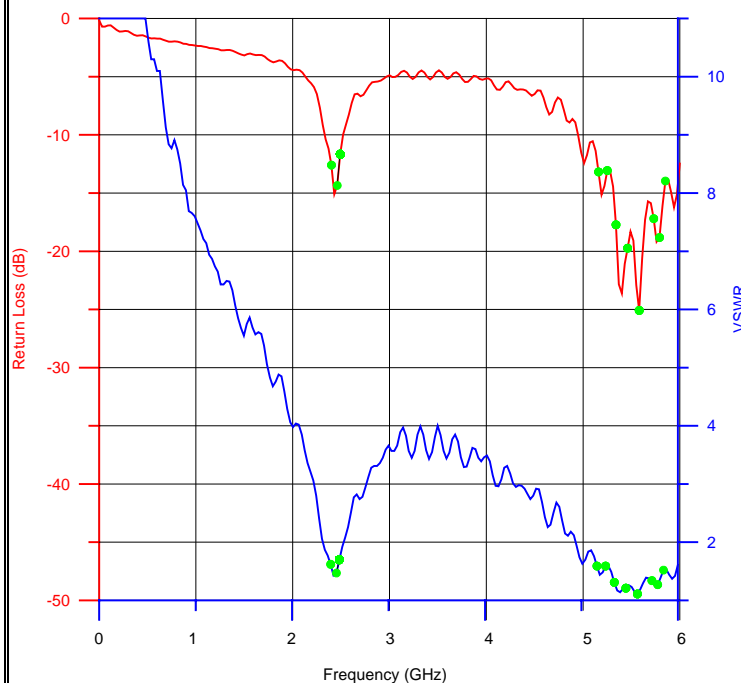
Return Loss & VSWR

Main-Antenna



2.4~2.5 GHz Center freq. @MHz		2450 5850
Beam Width @MHz		150
freq.	Return Loss(dB)	VSWR
2.40 GHz	-13.86	1.54
2.45 GHz	-14.14	1.50
2.50 GHz	-14.52	1.47
5.15 GHz	-16.46	1.36
5.25 GHz	-18.07	1.29
5.35 GHz	-17.42	1.32
5.47 GHz	-14.39	1.48
5.59 GHz	-13.42	1.54
5.72 GHz	-12.52	1.61
5.78 GHz	-13.96	1.52
5.85 GHz	-10.45	1.85

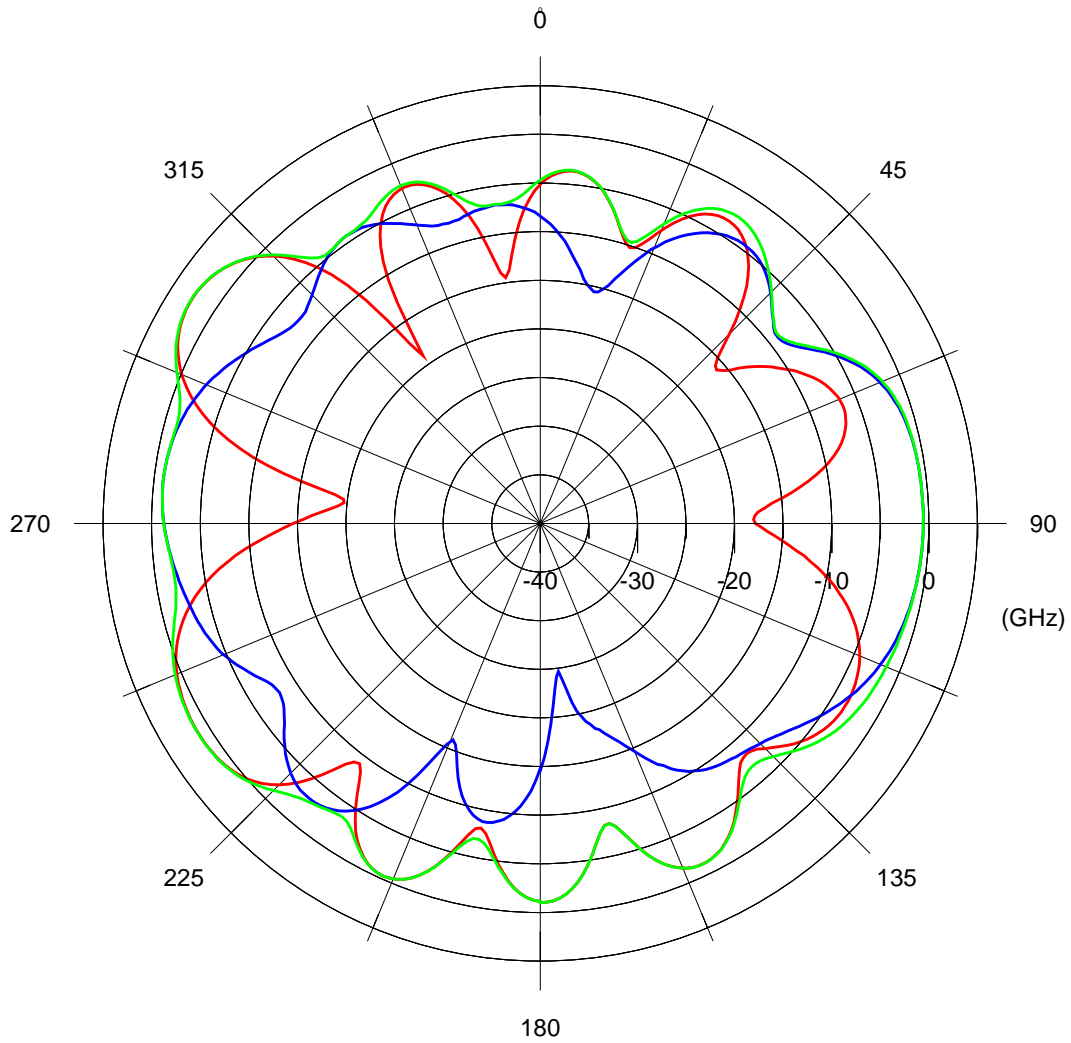
Aux-Antenna



2.4~2.5 GHz Center freq. @MHz		2450 5850
Beam Width @MHz		200
freq.	Return Loss(dB)	VSWR
2.40 GHz	-12.60	1.62
2.45 GHz	-14.35	1.47
2.50 GHz	-11.66	1.70
5.15 GHz	-13.18	1.59
5.25 GHz	-13.07	1.59
5.35 GHz	-17.73	1.31
5.47 GHz	-19.74	1.21
5.59 GHz	-25.09	1.11
5.72 GHz	-17.20	1.34
5.78 GHz	-18.82	1.27
5.85 GHz	-13.96	1.52

Note: the three green points represent the main data we want (i.e. 2.4, 2.45 and 2.5 GHz) both at each curve.

Main antenna: 2400 MHz

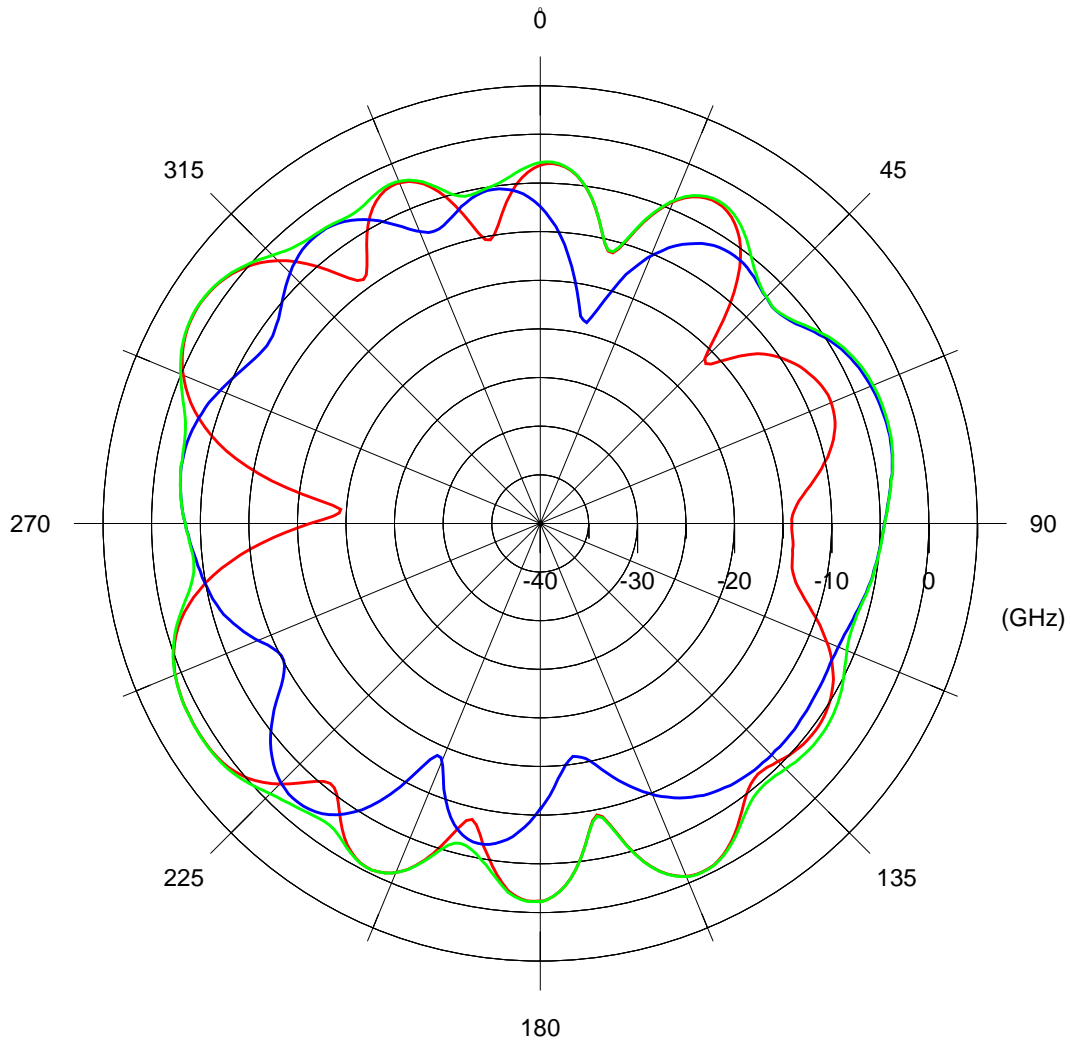


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-0.55</i>
<i>V Avg Gain (dBi)</i>	<i>-4.75</i>
<i>H Peak Gain (dBi)</i>	<i>2.62</i>
<i>H Avg Gain (dBi)</i>	<i>-3.61</i>
<i>Total Avg. Gain (dBi)</i>	<i>-1.93</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.67</i>

Main antenna: 2450 MHz

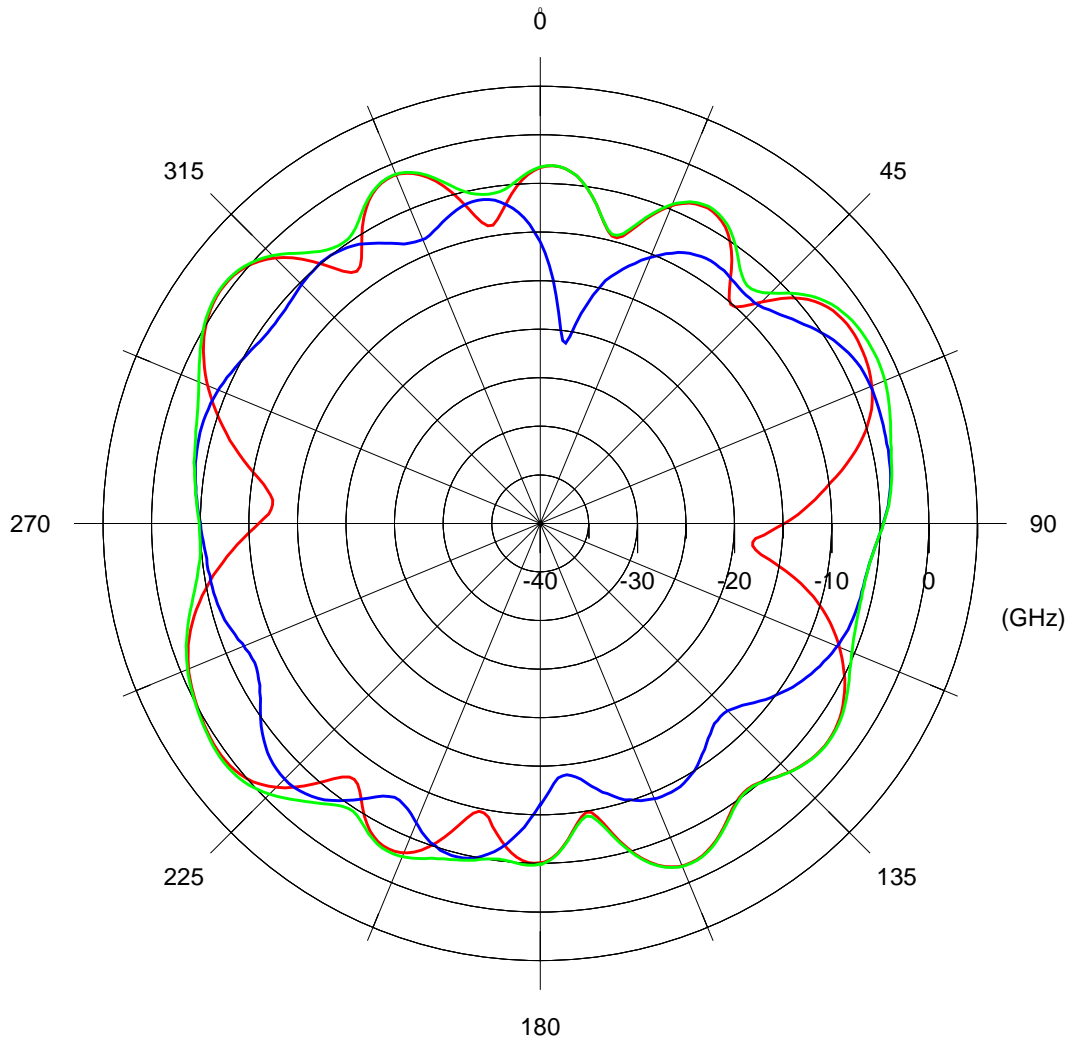


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.98</i>
<i>V Avg Gain (dBi)</i>	<i>-5.72</i>
<i>H Peak Gain (dBi)</i>	<i>1.69</i>
<i>H Avg Gain (dBi)</i>	<i>-3.61</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.43</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.74</i>

Main antenna: 2500 MHz

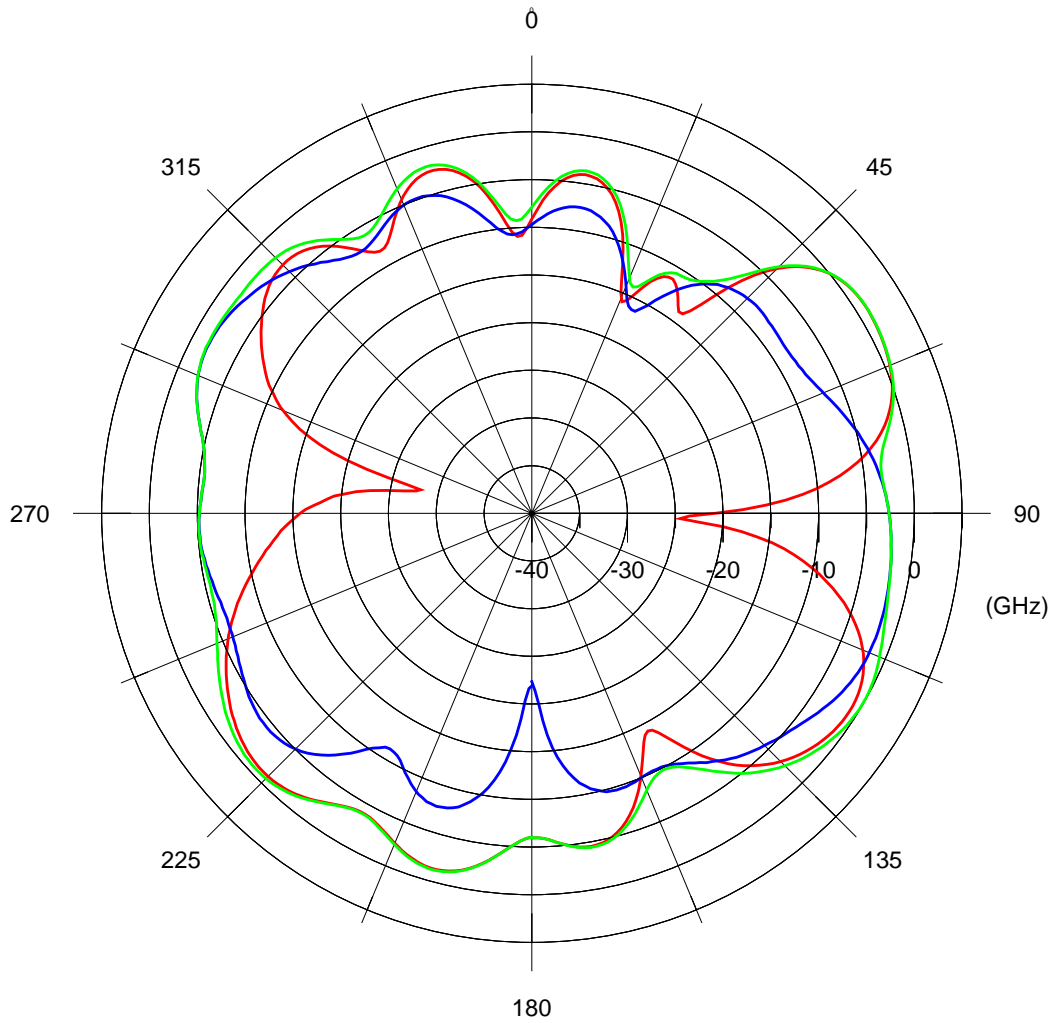


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-2.77</i>
<i>V Avg Gain (dBi)</i>	<i>-6.30</i>
<i>H Peak Gain (dBi)</i>	<i>0.73</i>
<i>H Avg Gain (dBi)</i>	<i>-3.98</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.02</i>
<i>Avg Peak Gain (dBi)</i>	<i>0.84</i>

Aux antenna: 2400 MHz



Note: horizontal polarization plots in the red line and vertical polarization in the blue one

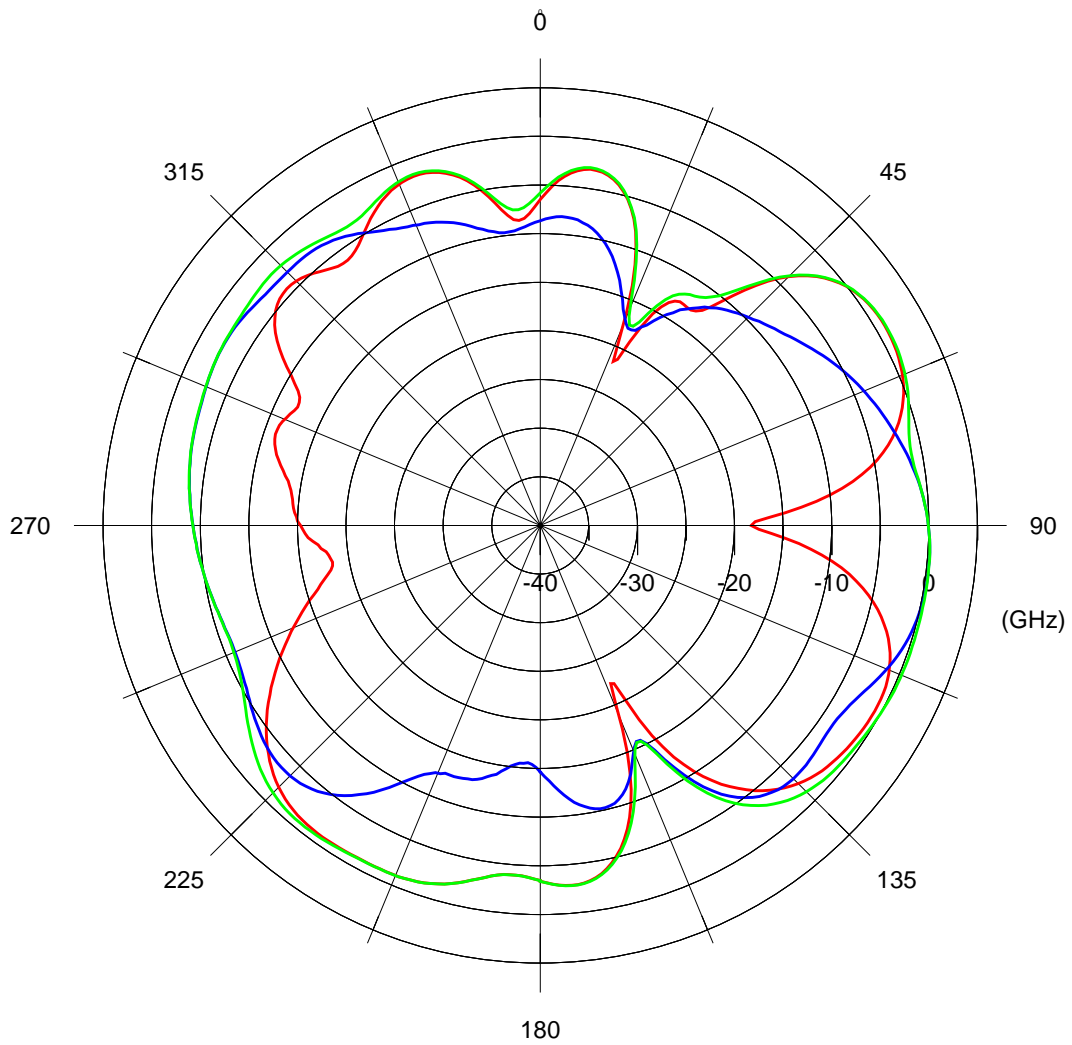
The green line means the average gain of vertical and horizontal polarization

Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.73</i>
<i>V Avg Gain (dBi)</i>	<i>-5.72</i>
<i>H Peak Gain (dBi)</i>	<i>1.11</i>
<i>H Avg Gain (dBi)</i>	<i>-4.32</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.94</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.14</i>

Aux antenna: 2450 MHz

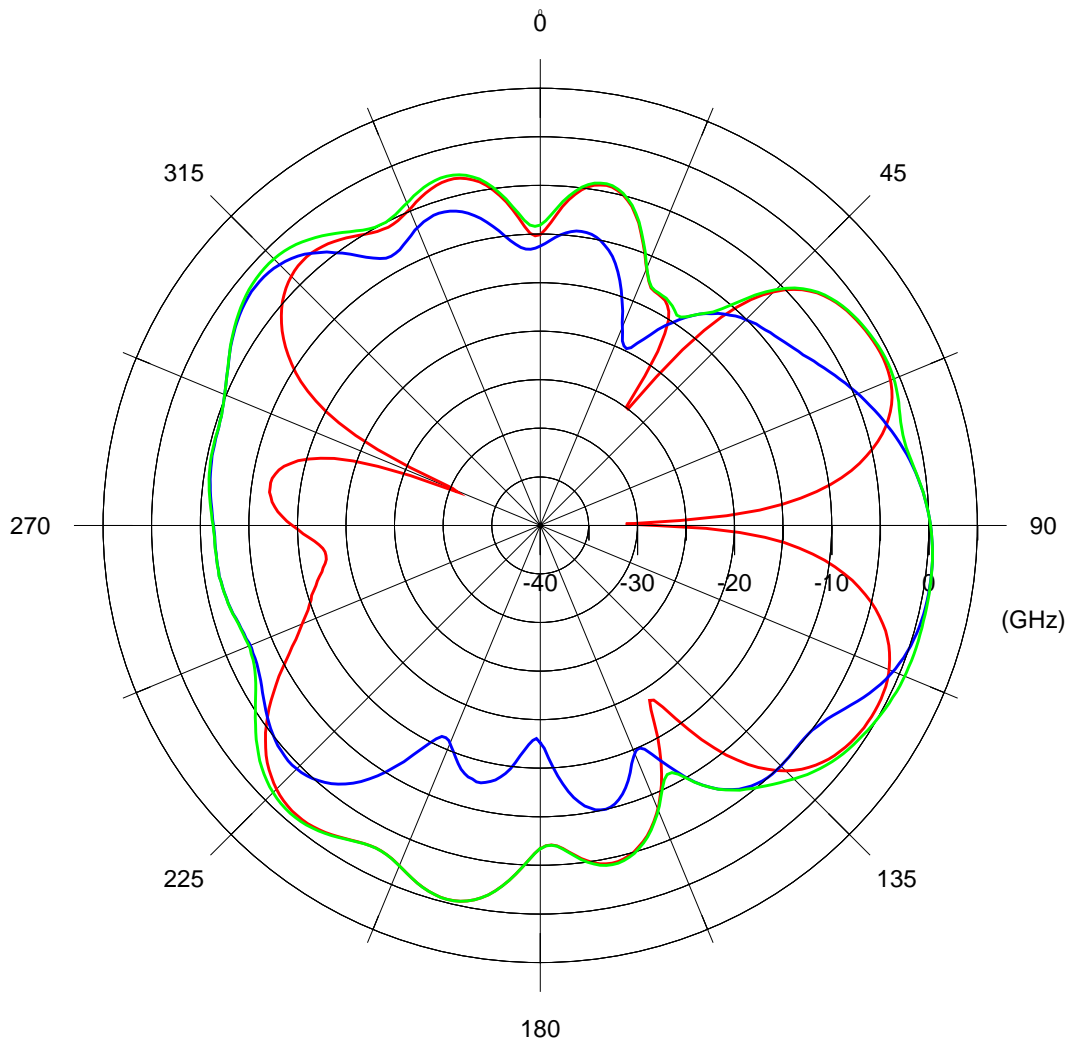


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>0.22</i>
<i>V Avg Gain (dBi)</i>	<i>-4.84</i>
<i>H Peak Gain (dBi)</i>	<i>0.96</i>
<i>H Avg Gain (dBi)</i>	<i>-4.18</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.43</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.06</i>

Aux antenna: 2500 MHz

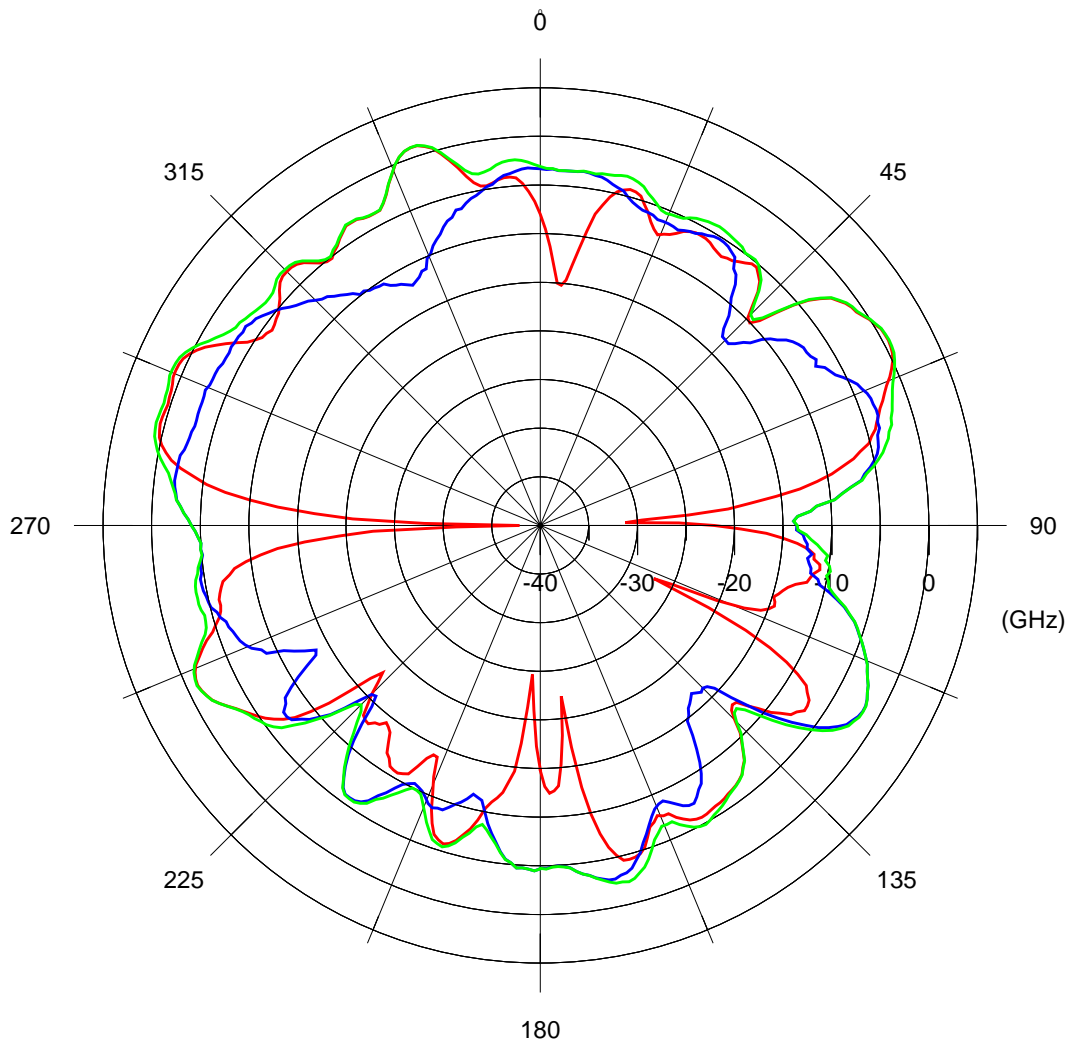


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>0.57</i>
<i>V Avg Gain (dBi)</i>	<i>-5.33</i>
<i>H Peak Gain (dBi)</i>	<i>-0.34</i>
<i>H Avg Gain (dBi)</i>	<i>-4.87</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.01</i>
<i>Avg Peak Gain (dBi)</i>	<i>0.68</i>

Main antenna: 5150 MHz

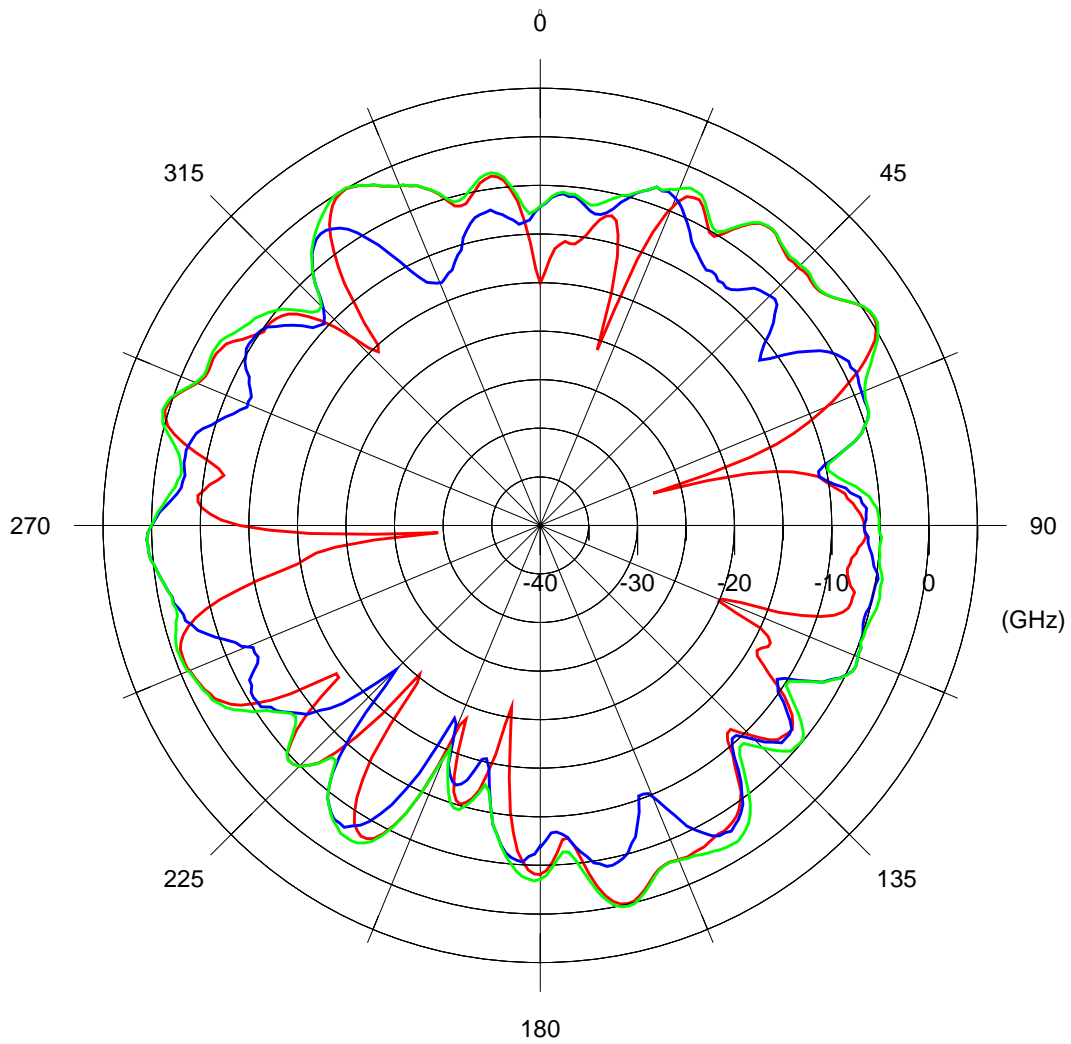


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.71</i>
<i>V Avg Gain (dBi)</i>	<i>-5.93</i>
<i>H Peak Gain (dBi)</i>	<i>1.05</i>
<i>H Avg Gain (dBi)</i>	<i>-5.06</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.49</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.14</i>

Main antenna: 5250 MHz

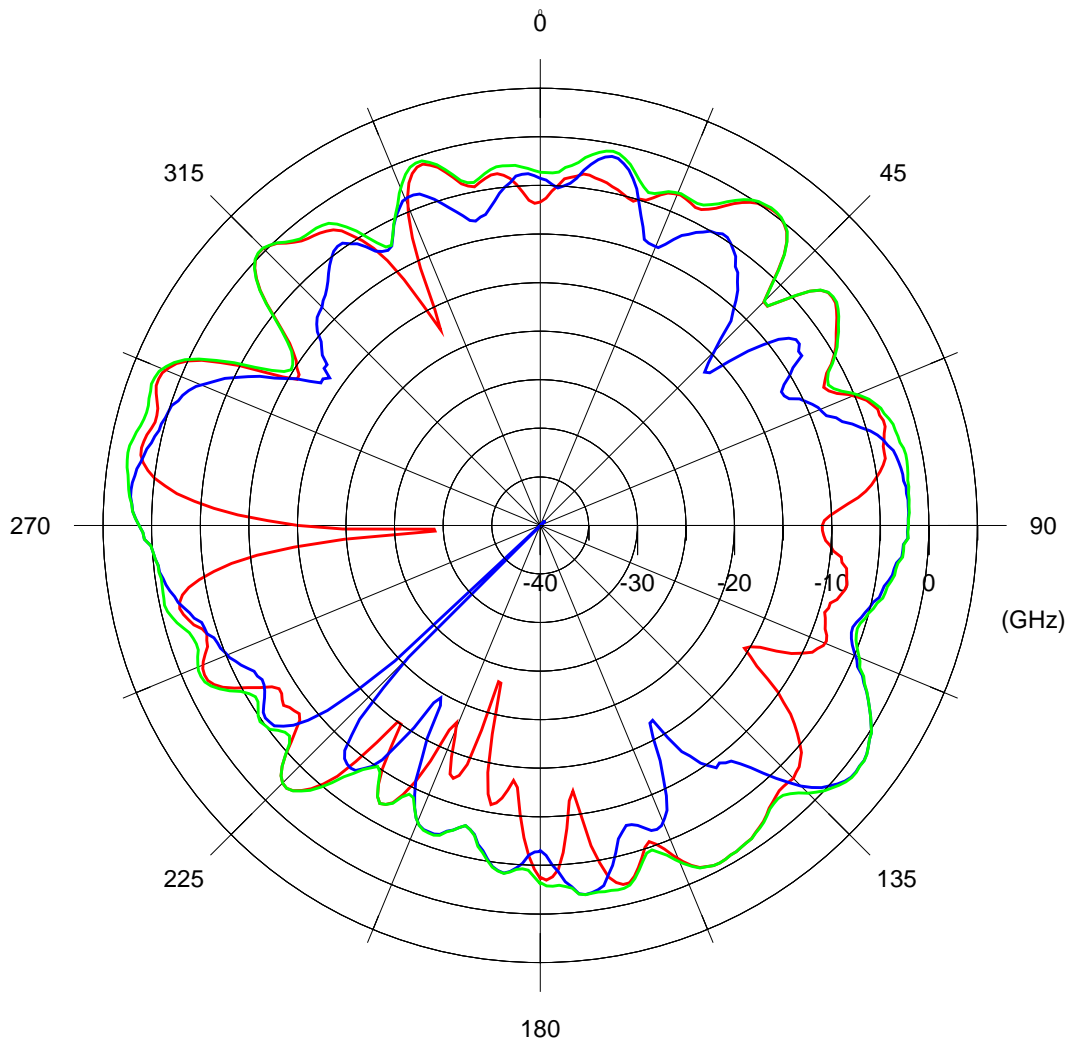


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>0.52</i>
<i>V Avg Gain (dBi)</i>	<i>-5.64</i>
<i>H Peak Gain (dBi)</i>	<i>0.47</i>
<i>H Avg Gain (dBi)</i>	<i>-4.73</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.17</i>
<i>Avg Peak Gain (dBi)</i>	<i>0.63</i>

Main antenna: 5350 MHz

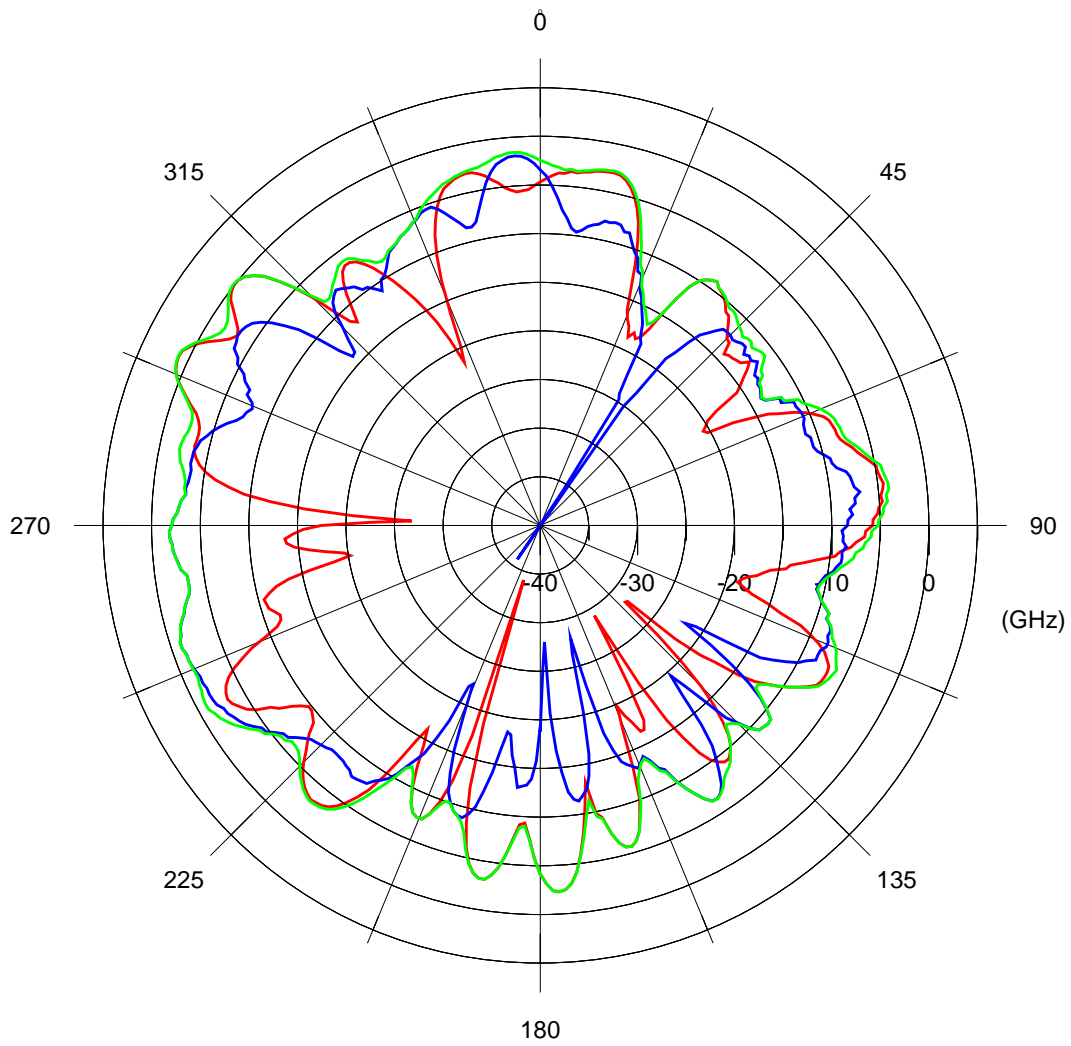


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>2.28</i>
<i>V Avg Gain (dBi)</i>	<i>-4.11</i>
<i>H Peak Gain (dBi)</i>	<i>2.08</i>
<i>H Avg Gain (dBi)</i>	<i>-3.87</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.00</i>
<i>Avg Peak Gain (dBi)</i>	<i>3.10</i>

Aux antenna: 5150 MHz

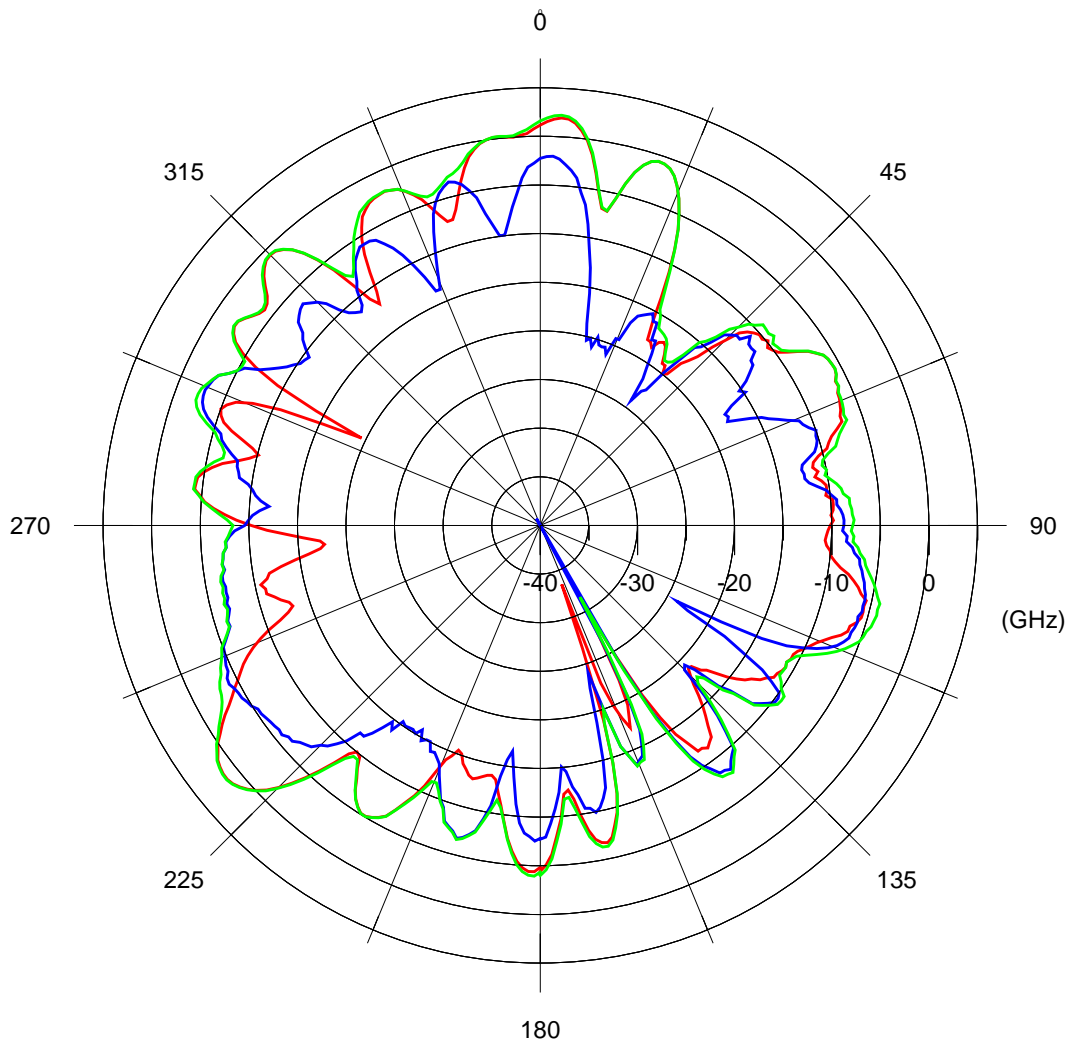


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.03</i>
<i>V Avg Gain (dBi)</i>	<i>-7.15</i>
<i>H Peak Gain (dBi)</i>	<i>1.07</i>
<i>H Avg Gain (dBi)</i>	<i>-6.50</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.74</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.13</i>

Aux antenna: 5250 MHz

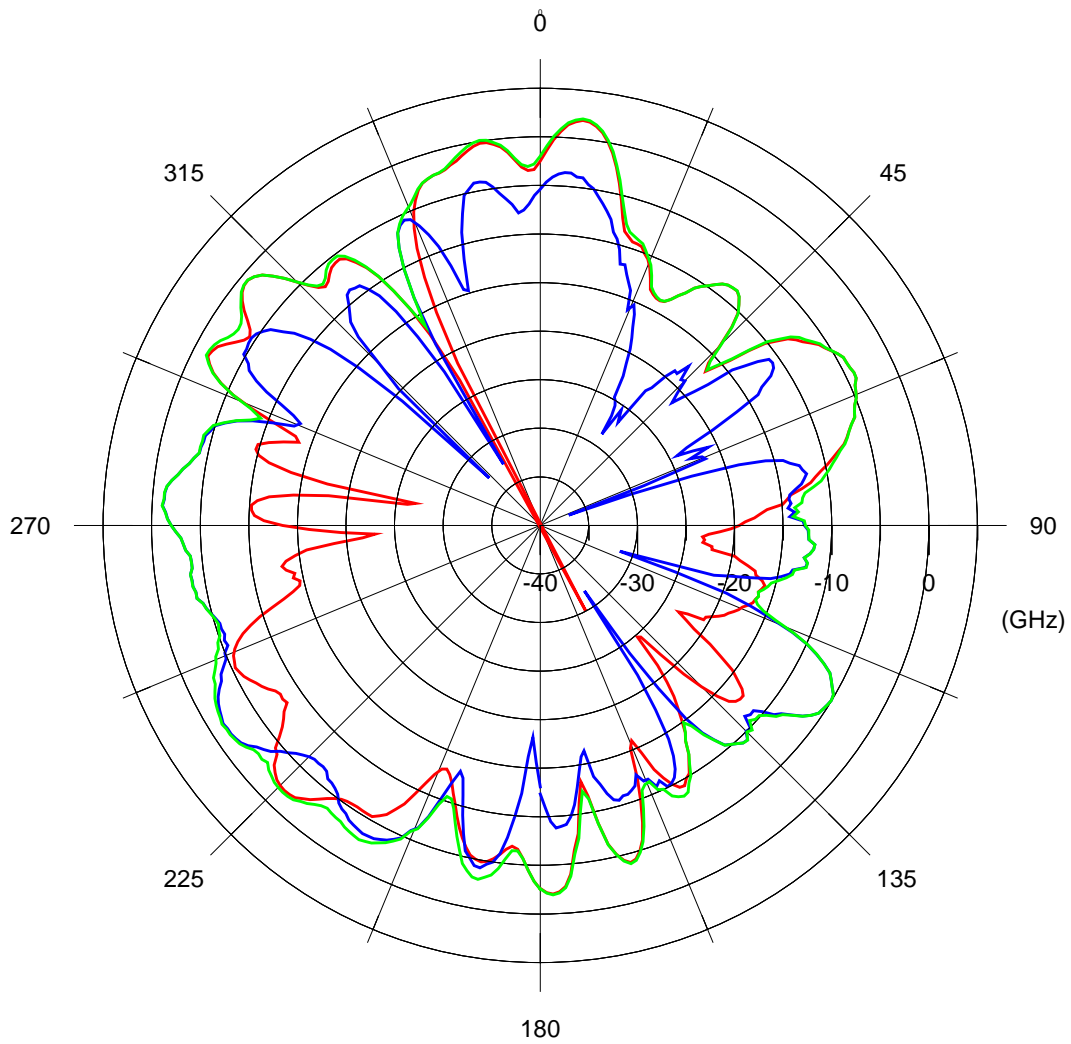


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-2.03</i>
<i>V Avg Gain (dBi)</i>	<i>-8.43</i>
<i>H Peak Gain (dBi)</i>	<i>1.93</i>
<i>H Avg Gain (dBi)</i>	<i>-5.48</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.65</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.22</i>

Aux antenna: 5350 MHz

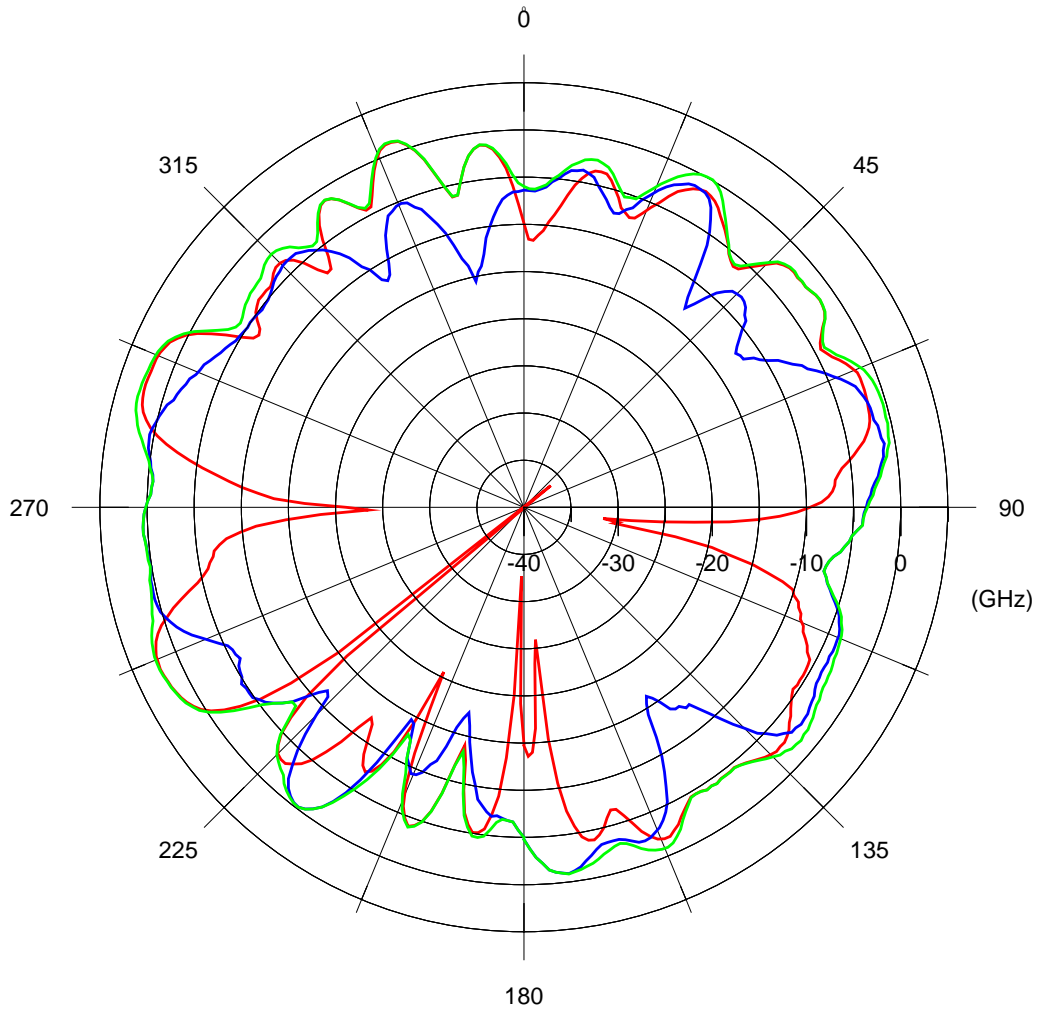


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.05</i>
<i>V Avg Gain (dBi)</i>	<i>-7.27</i>
<i>H Peak Gain (dBi)</i>	<i>1.92</i>
<i>H Avg Gain (dBi)</i>	<i>-6.18</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.57</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.06</i>

Main antenna: 5470 MHz

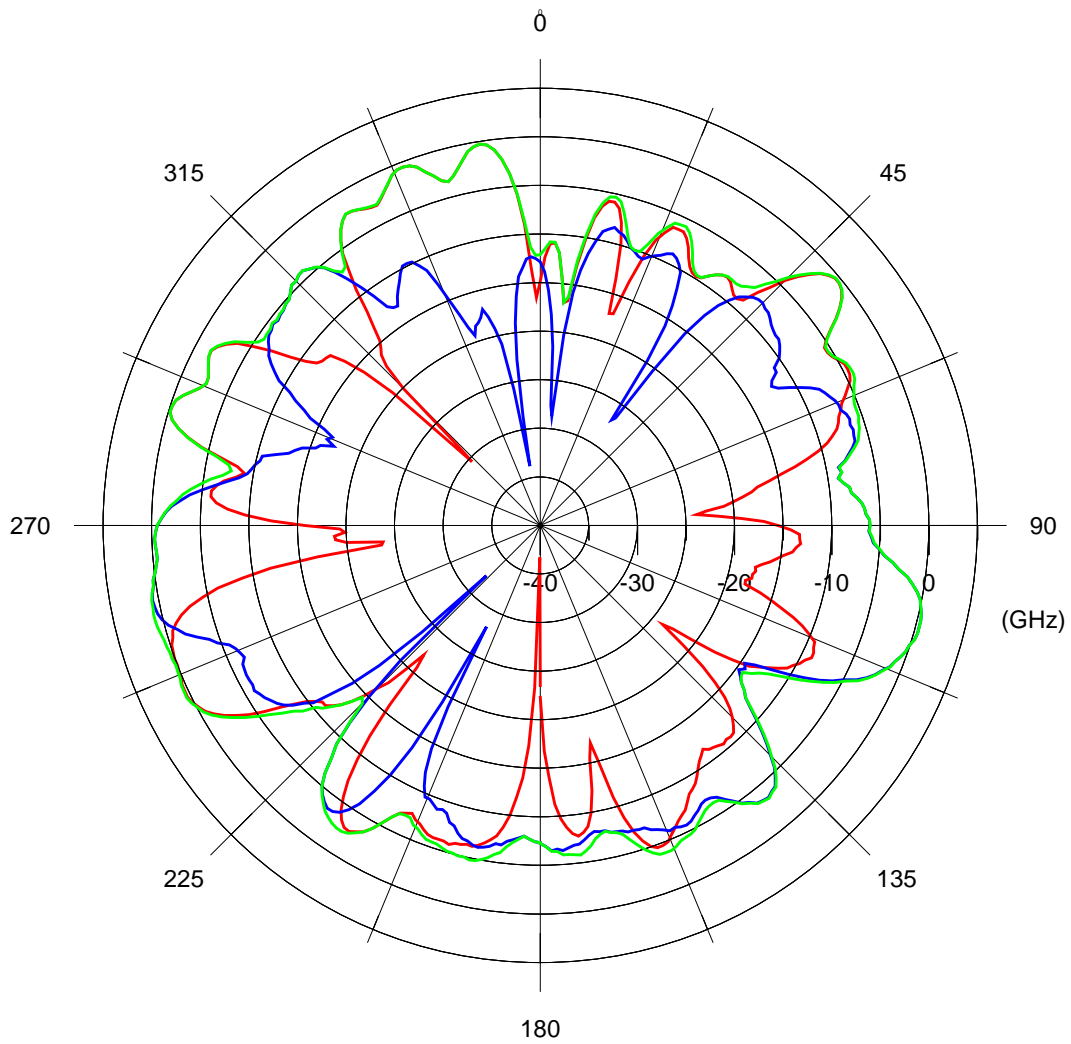


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>0.47</i>
<i>V Avg Gain (dBi)</i>	<i>-4.06</i>
<i>H Peak Gain (dBi)</i>	<i>2.22</i>
<i>H Avg Gain (dBi)</i>	<i>-3.52</i>
<i>Total Avg. Gain (dBi)</i>	<i>-1.81</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.64</i>

Main antenna: 5590 MHz

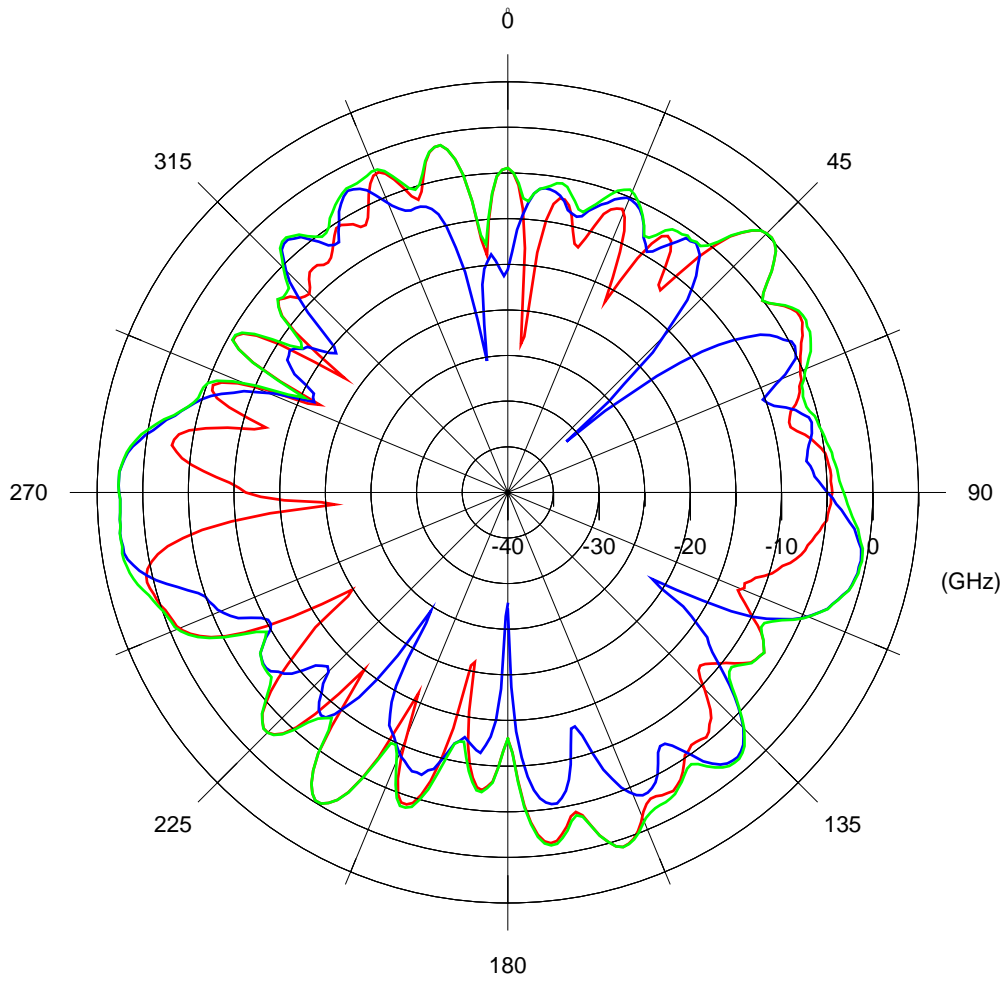


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	0.64
<i>V Avg Gain (dBi)</i>	-6.18
<i>H Peak Gain (dBi)</i>	0.38
<i>H Avg Gain (dBi)</i>	-5.85
<i>Total Avg. Gain (dBi)</i>	-3.72
<i>Avg Peak Gain (dBi)</i>	0.84

Main antenna: 5725 MHz

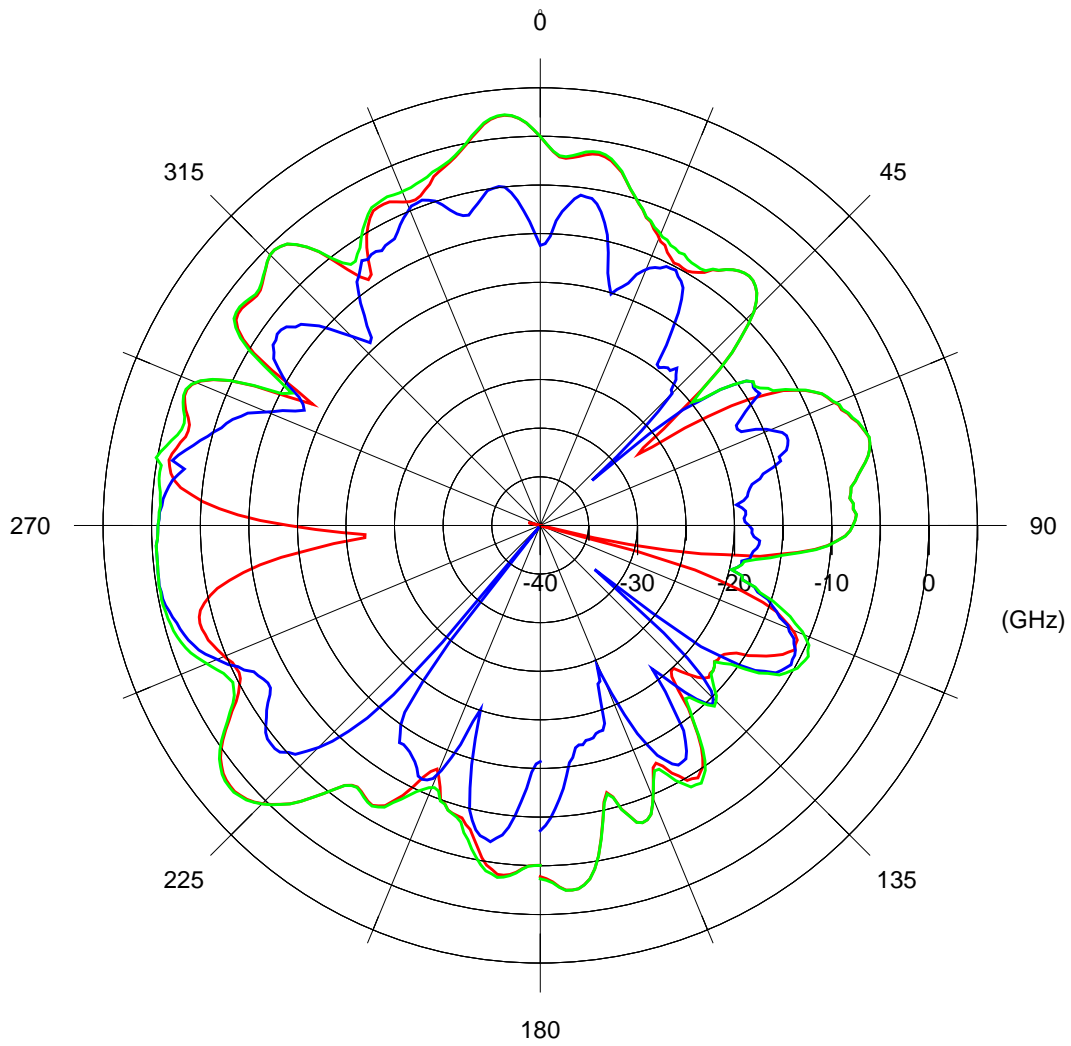


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>2.73</i>
<i>V Avg Gain (dBi)</i>	<i>-5.06</i>
<i>H Peak Gain (dBi)</i>	<i>0.84</i>
<i>H Avg Gain (dBi)</i>	<i>-5.06</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.95</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.80</i>

Aux antenna: 5470 MHz

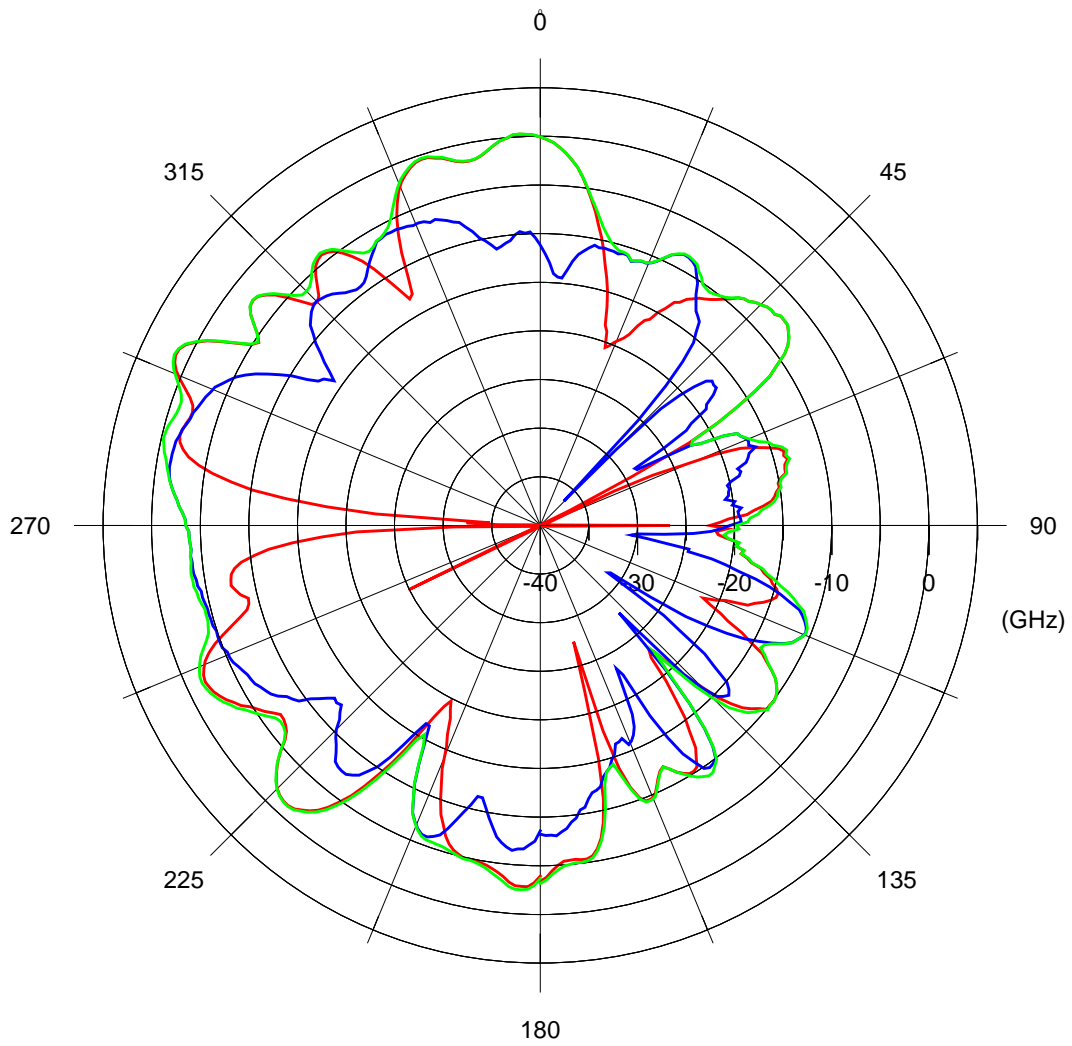


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-0.28</i>
<i>V Avg Gain (dBi)</i>	<i>-7.88</i>
<i>H Peak Gain (dBi)</i>	<i>2.32</i>
<i>H Avg Gain (dBi)</i>	<i>-4.66</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.82</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.38</i>

Aux antenna: 5590 MHz

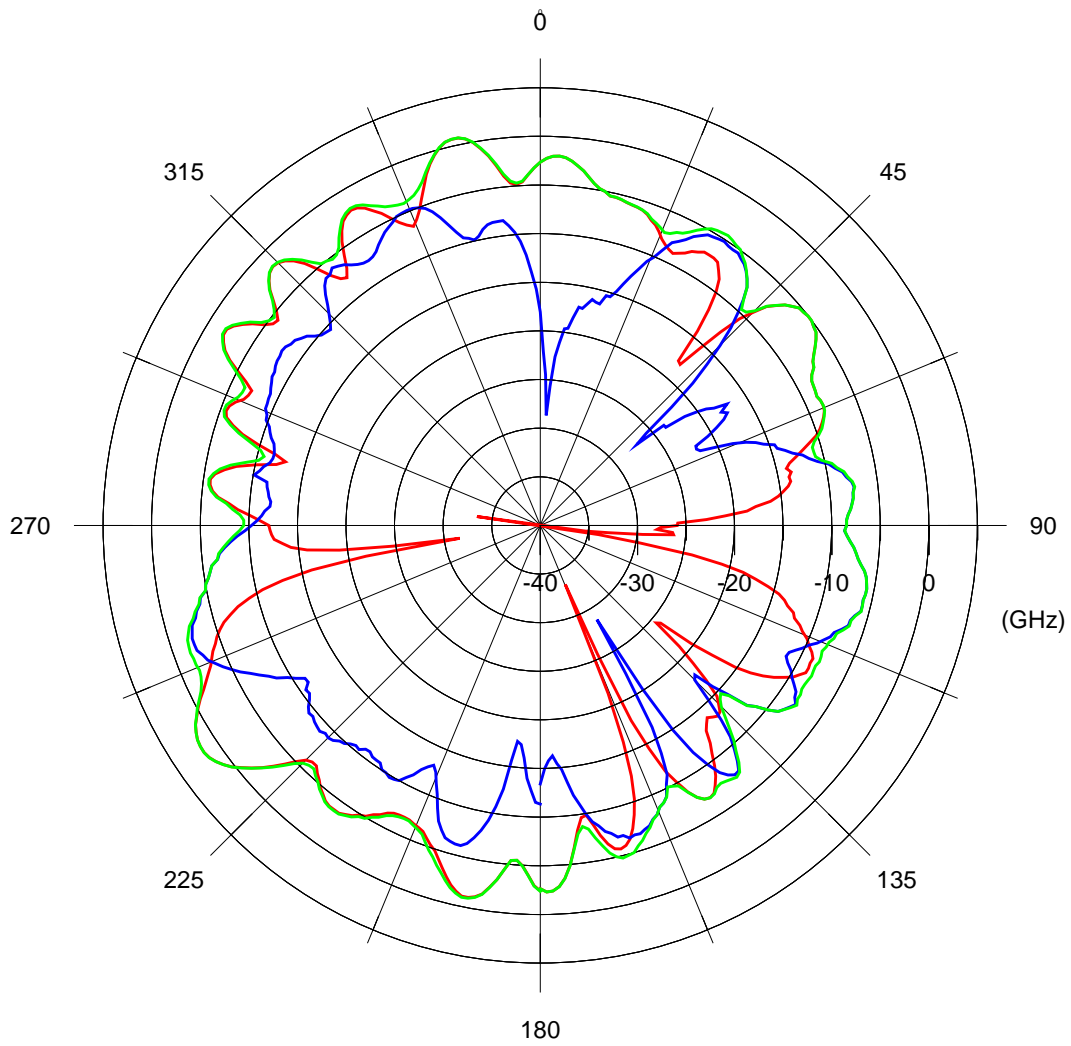


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-1.35</i>
<i>V Avg Gain (dBi)</i>	<i>-8.55</i>
<i>H Peak Gain (dBi)</i>	<i>1.42</i>
<i>H Avg Gain (dBi)</i>	<i>-5.90</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.92</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.55</i>

Aux antenna: 5725 MHz

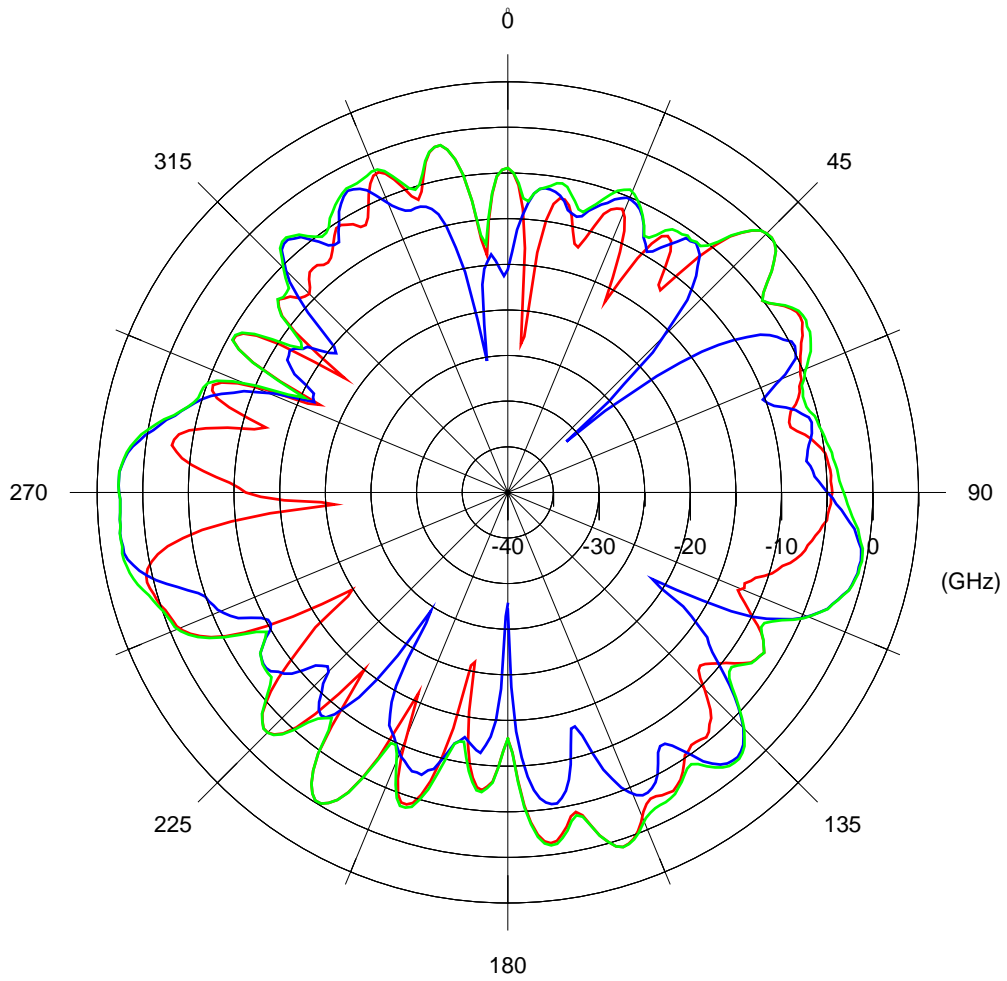


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-2.31</i>
<i>V Avg Gain (dBi)</i>	<i>-8.67</i>
<i>H Peak Gain (dBi)</i>	<i>1.73</i>
<i>H Avg Gain (dBi)</i>	<i>-5.33</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.47</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.74</i>

Main antenna: 5725 MHz

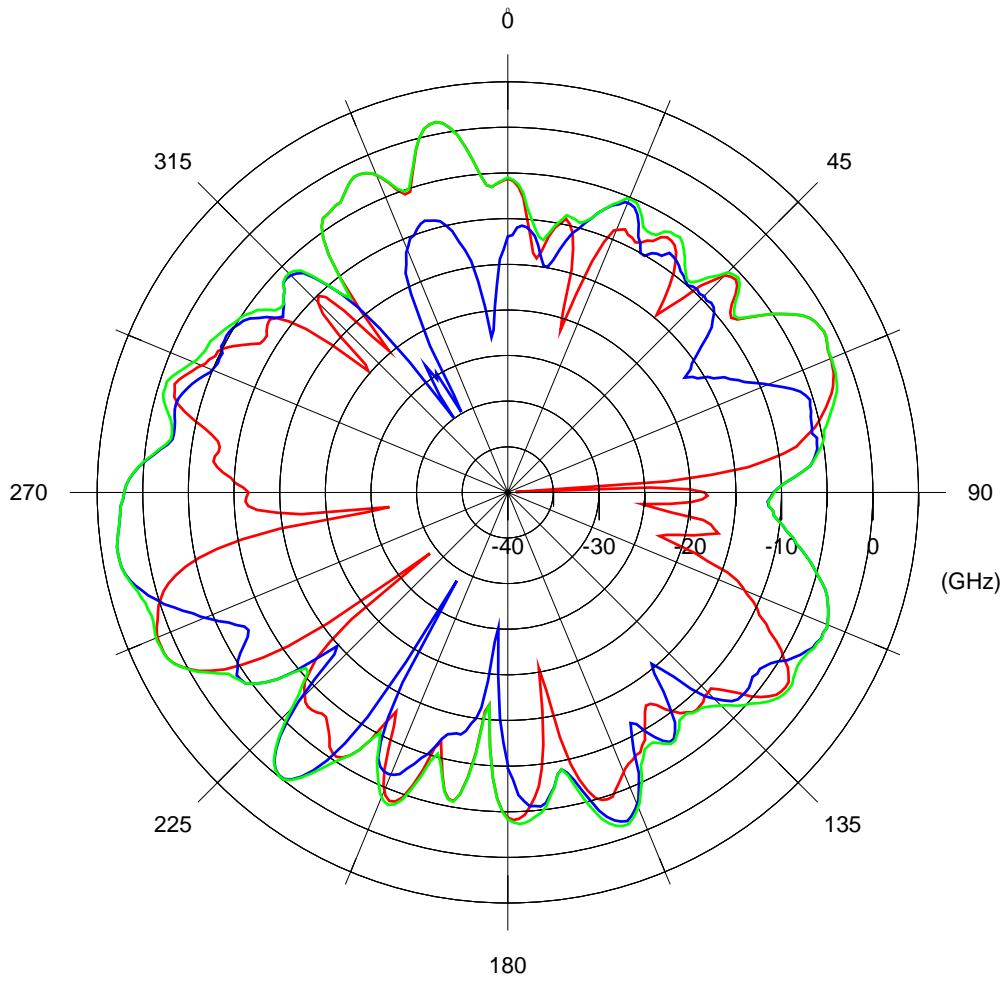


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>2.73</i>
<i>V Avg Gain (dBi)</i>	<i>-5.06</i>
<i>H Peak Gain (dBi)</i>	<i>0.84</i>
<i>H Avg Gain (dBi)</i>	<i>-5.06</i>
<i>Total Avg. Gain (dBi)</i>	<i>-2.95</i>
<i>Avg Peak Gain (dBi)</i>	<i>2.80</i>

Main antenna: 5785 MHz

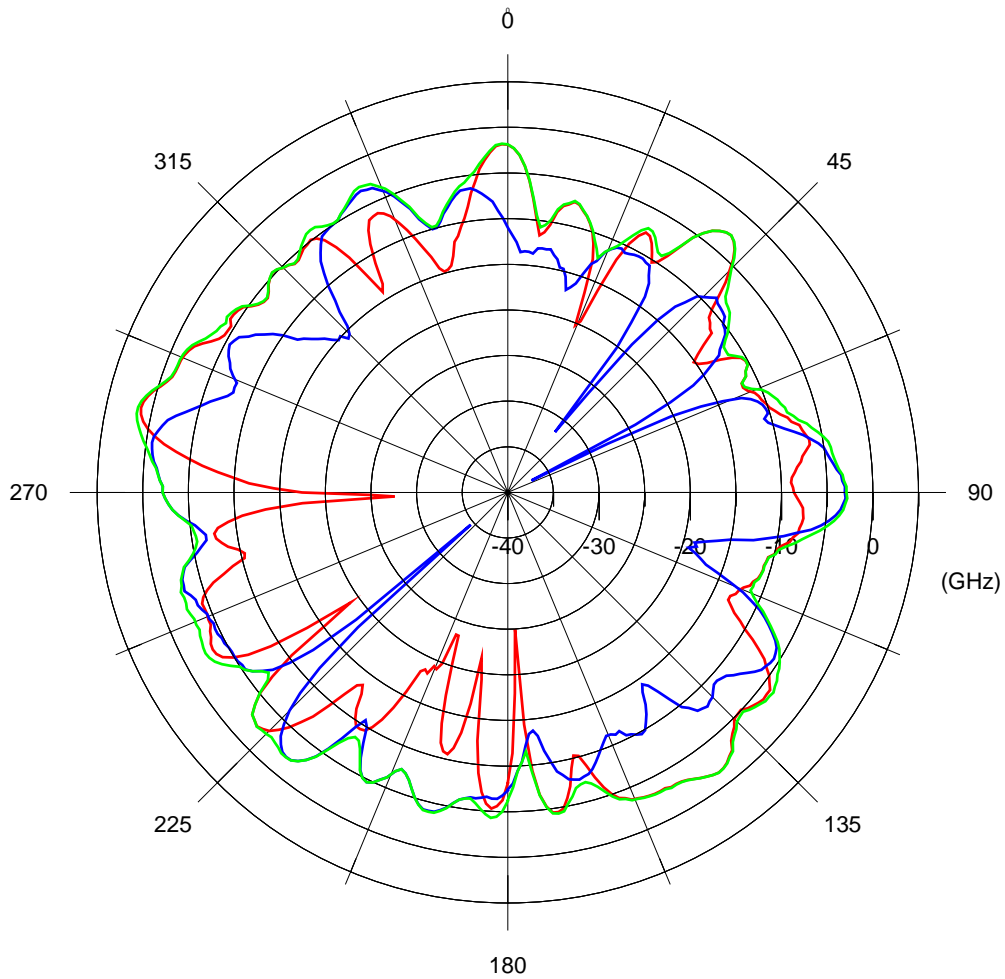


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>3.25</i>
<i>V Avg Gain (dBi)</i>	<i>-5.14</i>
<i>H Peak Gain (dBi)</i>	<i>1.58</i>
<i>H Avg Gain (dBi)</i>	<i>-5.57</i>
<i>Total Avg. Gain (dBi)</i>	<i>-3.15</i>
<i>Avg Peak Gain (dBi)</i>	<i>3.25</i>

Main antenna: 5850 MHz

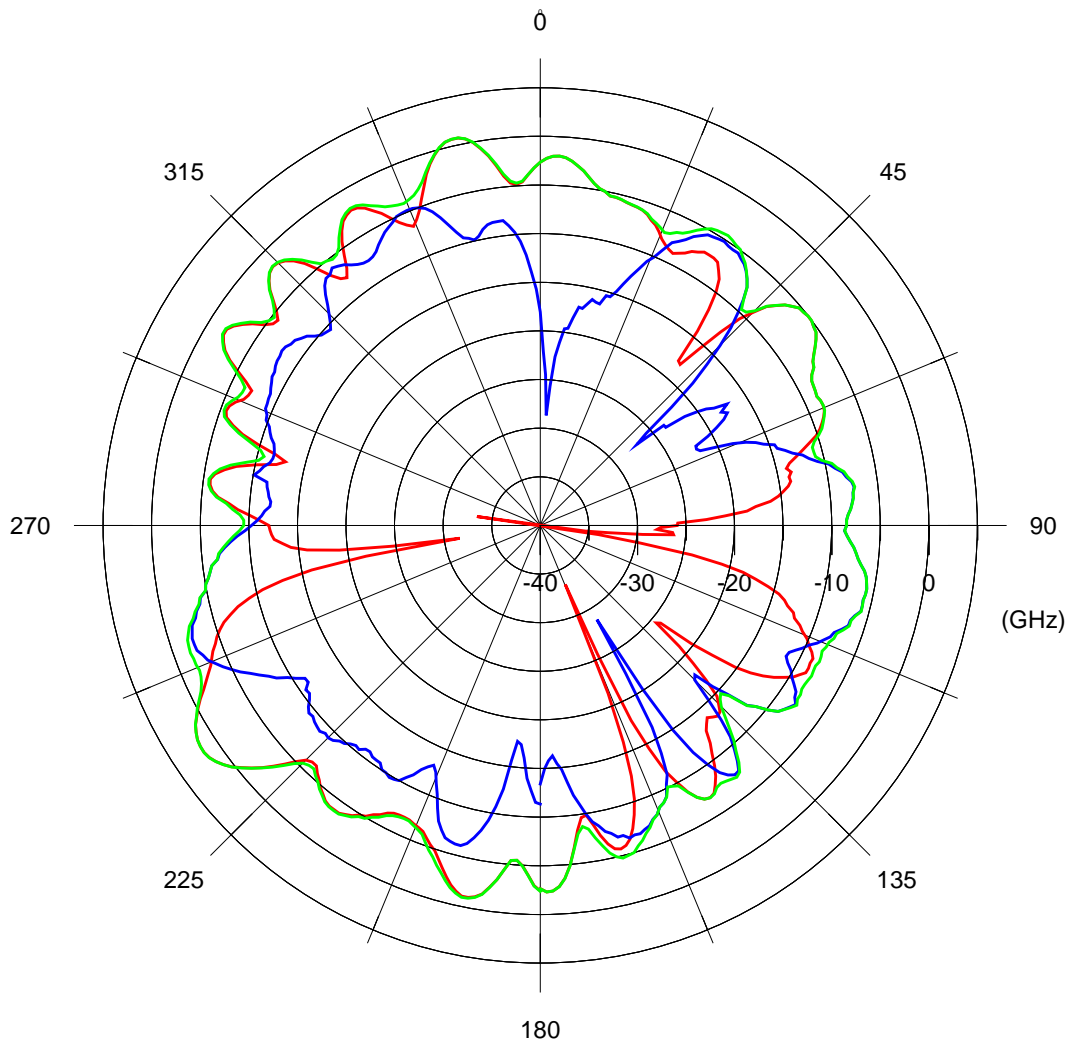


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-0.62</i>
<i>V Avg Gain (dBi)</i>	<i>-6.85</i>
<i>H Peak Gain (dBi)</i>	<i>1.23</i>
<i>H Avg Gain (dBi)</i>	<i>-6.09</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.42</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.58</i>

Aux antenna: 5725 MHz

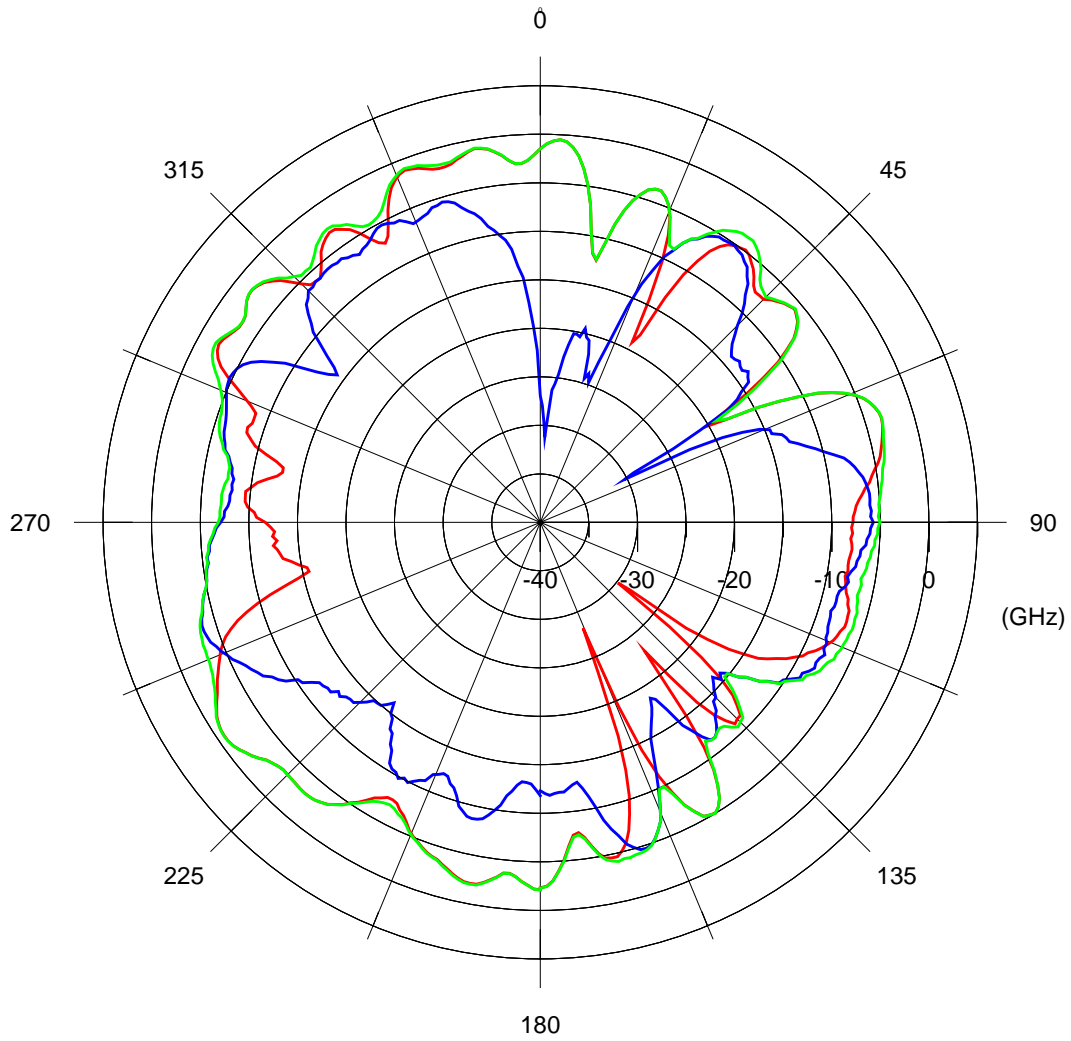


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-2.31</i>
<i>V Avg Gain (dBi)</i>	<i>-8.67</i>
<i>H Peak Gain (dBi)</i>	<i>1.73</i>
<i>H Avg Gain (dBi)</i>	<i>-5.33</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.47</i>
<i>Avg Peak Gain (dBi)</i>	<i>1.74</i>

Aux antenna: 5785 MHz

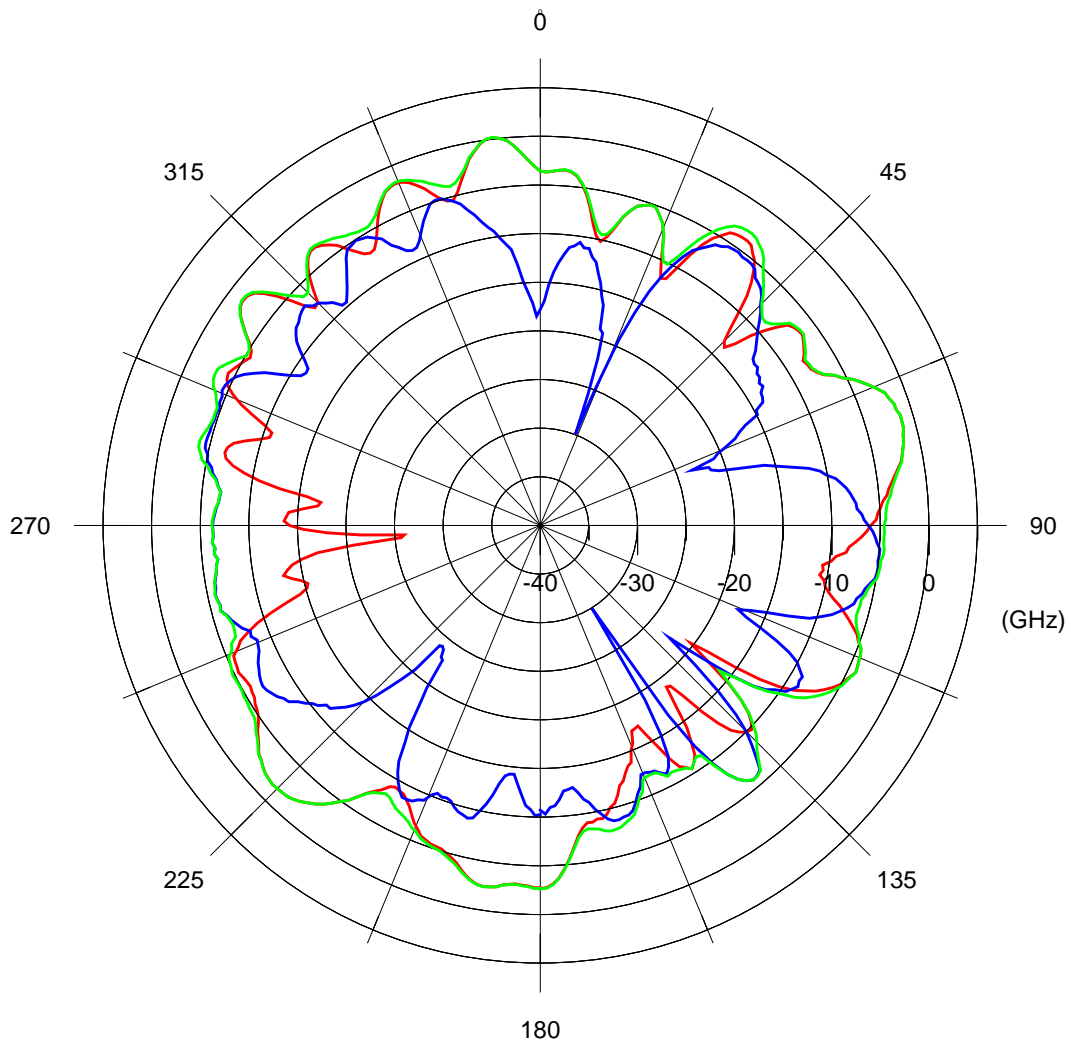


Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-3.59</i>
<i>V Avg Gain (dBi)</i>	<i>-8.50</i>
<i>H Peak Gain (dBi)</i>	<i>-0.49</i>
<i>H Avg Gain (dBi)</i>	<i>-5.14</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.35</i>
<i>Avg Peak Gain (dBi)</i>	<i>-0.49</i>

Aux antenna: 5850 MHz



Average Gain And Peak Gain (On Azimuth Plane)

X-Y Plane

<i>V Peak Gain (dBi)</i>	<i>-4.43</i>
<i>V Avg Gain (dBi)</i>	<i>-8.65</i>
<i>H Peak Gain (dBi)</i>	<i>0.17</i>
<i>H Avg Gain (dBi)</i>	<i>-5.45</i>
<i>Total Avg. Gain (dBi)</i>	<i>-4.60</i>
<i>Avg Peak Gain (dBi)</i>	<i>0.18</i>

Appendix

- VSWR :* Voltage standing wave ratio on a transmission line in an antenna system. The ratio of the forward to reflected voltage on the line, and not a power ratio. A VSWR of 1:1 occurs when all parts of the antenna system are matched correctly.
- Return Loss :* When the load is mismatched, then, not all of the available power from the generator is delivered to the load. This 'loss' is called Return loss (RL).
- Radiation pattern :* The radiation characteristics of an antenna as a function of spatial coordinates. Normally, the pattern is measured in the far-field region and is represented graphically.
- Polarization :* The sense of the wave radiated by an antenna. This can be horizontal, vertical, elliptical, or circular (left or right hand circularity), depending on the design and application. The polarization of the antenna is based on the orientation of the electric or E field component. The polarization must be matched between two antennas to receive the maximum field intensity. Dependent on the antenna type, it is possible to radiate linear, elliptical and circular polarizations.
- Gain value :* The increase in effective radiated power in the desired direction of the major lobe.
- Peak gain :* The highest gain value in 360 degrees, which means the antenna efficiency at this angle is the best.
- Cable loss :* When RF signal transmitting in the coaxial cable, due to the material of the cable, the power may dissipate into the air in the form of heat. So when we try to measure the gain of an antenna, we have to offset the cable loss. The power loss of coaxial cable ($\Phi=1.13$ mm) at 2.4~2.5 GHz is 3dB per 1000 mm and 5dB per 1000 mm at 5.15~5.35 GHz. In this case, the cable length of the main antenna is about 315, so the cable loss when RF signal transmitting at 2.4~2.5 GHz is about 2.30 dB. For the same reason, the cable length of the left antenna is about 175 mm, so the cable loss when RF signal transmitting at 2.4~2.5 GHz is about 1.70 dB. Which means we have to offset the cable loss to the gain value that we measure from the radiation pattern and that is the true antenna gain (G_a) we want.