
Antenna Composite Gain Test Report

1. Test Information

Equipment	satimo
Brand Name	Nokia
Model Name	Beacon3.1
Applicant	Nokia
Manufacturer	Nokia

2. Testing Location

Testing Location	
DZZ	ADD: No. 198, zhangheng Road,shanghai Province, China

Test Condition	Test Engineer	Test Environment (°C / %)	Test Date
Radiated	Longxiang Tong	20-24 / 45-60	09.08.2023~09.09.2023

3. Test Frequency

Band (MHz)	Test Frequency (MHz)
2400-2500	2400 / 2450 / 2500
5150-5850	5150 / 5550 / 5850

4. Antenna Information

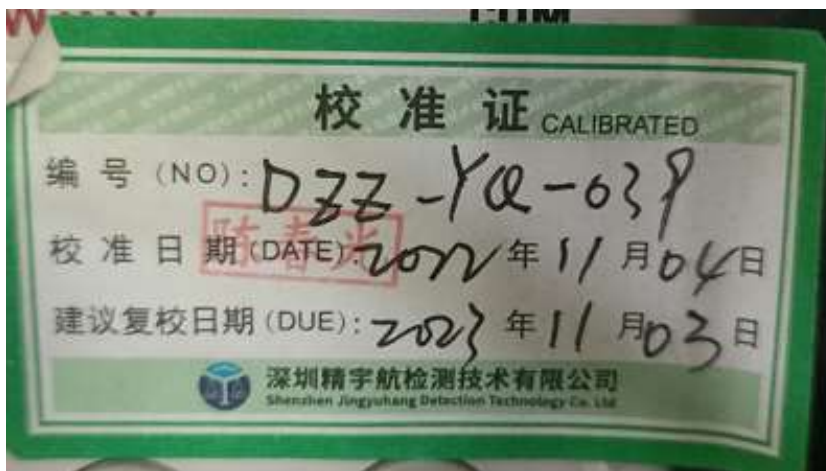
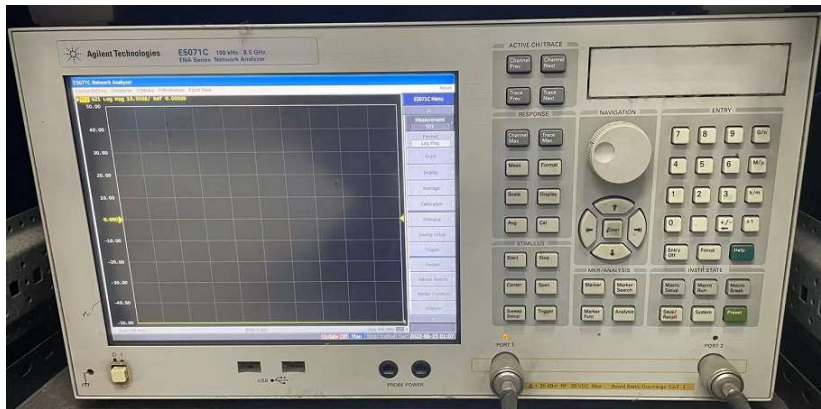
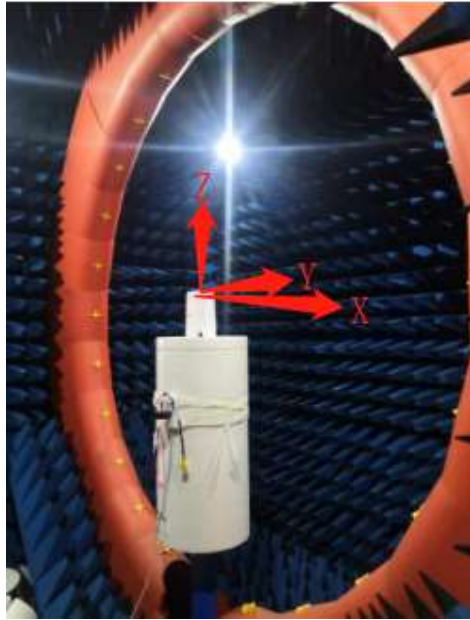
Ant. Position	Brand Name	Model Name	Ant. Type	Connector
Antenna 1 (2.4G)	Nokia		Dipole	I-PEX
Antenna 2 (2.4G)	Nokia		Dipole	I-PEX
Antenna 3 (2.4G)	Nokia		Dipole	I-PEX
Antenna 4 (5G)	Nokia		Dipole	I-PEX

Antenna 5 (5G)	Nokia		Dipole	I-PEX
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5. Test Configuration



6. Reference Calibration



7. Test Method

The antenna gain measurement method is gain comparison method, Calculation of gain by comparison with standard horn antenna, The standard horn antenna has been measured in the measurement institution.

8. Measured Values and Calculation of Correlated / Uncorrelated Gains

Antenna Peak Gain Table (Ant. Position: 2.4G Ant.1~3)

Band (MHz)	2400-2500		
Frequency (MHz)	2400	2450	2500
Ant.1 Max Gain (dBi)	2.45	2.54	2.49
Ant.2 Max Gain (dBi)	2.52	2.62	2.64
Ant.3 Max Gain (dBi)	2.39	2.34	2.34
Max Gain (dBi)	2.52	2.62	2.64

Antenna Peak Gain Table (Ant. Position: 5G Ant.4~5)

Band (MHz)	5150-5850		
Frequency (MHz)	5150	5550	5850
Ant.4 Max Gain (dBi)	2.64	2.84	2.76
Ant.5 Max Gain (dBi)	2.54	2.74	2.71
Max Gain (dBi)	2.64	2.84	2.76

Because the antennas are fixed in location within the device the directional antenna gain for MIMO is calculated over a sphere using the raw spatial data taken at 15 degree steps of theta and phi for each antenna using the equations from KDB 662911 D01. The raw antenna data is located in the appendix of this report.

The correlated antenna gain was calculated using KDB 662911 D01, F(2)(d)(i). The uncorrelated antenna gain was calculated using KDB 662911 D01, F(2)(d)(ii).

The uncorrelated and correlated gains were calculated for each point in the spatial data,

and the highest values reported.

Note :
KDB 662911 D01, F(2)(d)(i)

$$\text{Correlated Gain} = 10 \log \left[\left(10^{\frac{G_1}{20}} + 10^{\frac{G_2}{20}} + \dots + 10^{\frac{G_n}{20}} \right)^2 / N_{Ant.} \right] \text{ dBi}$$

KDB 662911 D01, F(2)(d)(ii)

$$\text{Uncorrelated Gain} = 10 \log \left[\left(10^{\frac{G_1}{10}} + 10^{\frac{G_2}{10}} + \dots + 10^{\frac{G_n}{10}} \right) / N_{Ant.} \right] \text{ dBi}$$

$N_{Ant.}$: Number of antenna
 G_n : Gain of antenna

Maximum Correlated / Uncorrelated Gain Calculation

(Ant. Position: 2.4G Ant.1~3)

Frequency (MHz)	2400	2450	2500
Ant.1 Gain (dBi)	2.45	2.54	2.49
Ant.2 Gain (dBi)	2.52	2.62	2.64
Ant.3 Gain (dBi)	2.39	2.34	2.34
Phi (°)	135	150	45
Theta (°)	180	15	165
Beamforming	3.89	3.98	4.06
≠ Beamforming (CDD MODE)	3.89	3.98	4.06

(Ant. Position: 5G Ant.4~5)

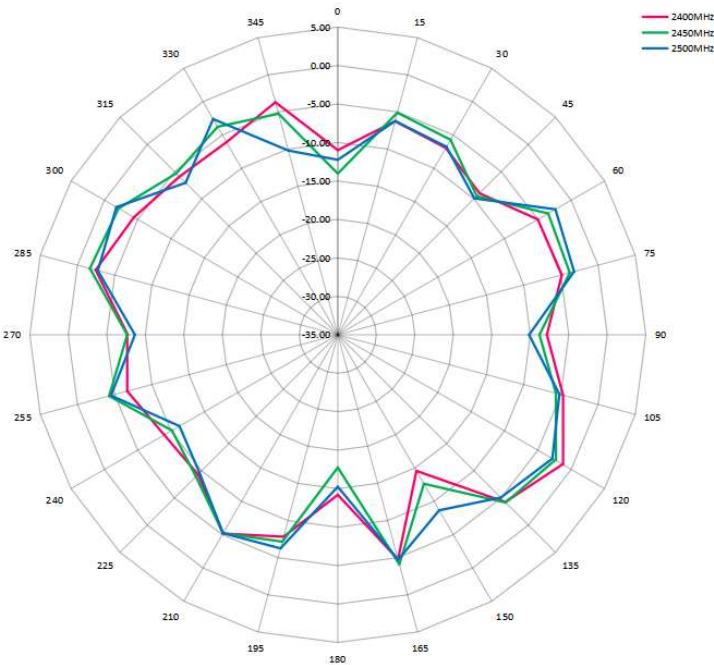
Frequency (MHz)	5150	5550	5850
Ant.1 Gain (dBi)	2.64	2.84	2.76
Ant.2 Gain (dBi)	2.54	2.74	2.71
Ant.3 Gain (dBi)	2.64	2.84	2.76
Phi (°)	180	165	150
Theta (°)	300	135	45

Beamforming	3.88	3.78	3.94
≠ Beamforming (CDD MODE)	3.88	3.78	3.94

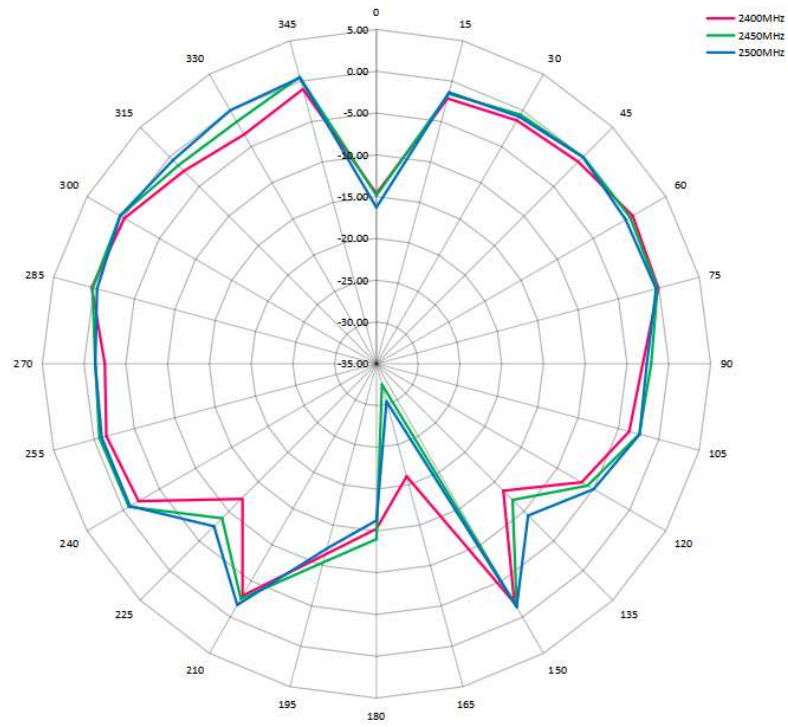
9. Radiation Pattern

Ant. Position: 2.4G Ant.1~3

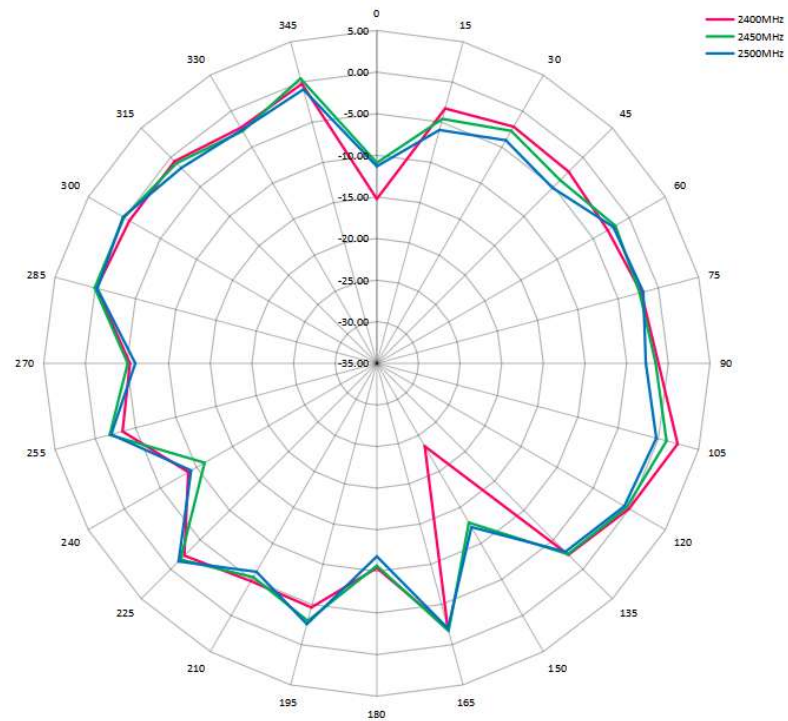
XY_Pol._Phi_Ant.1



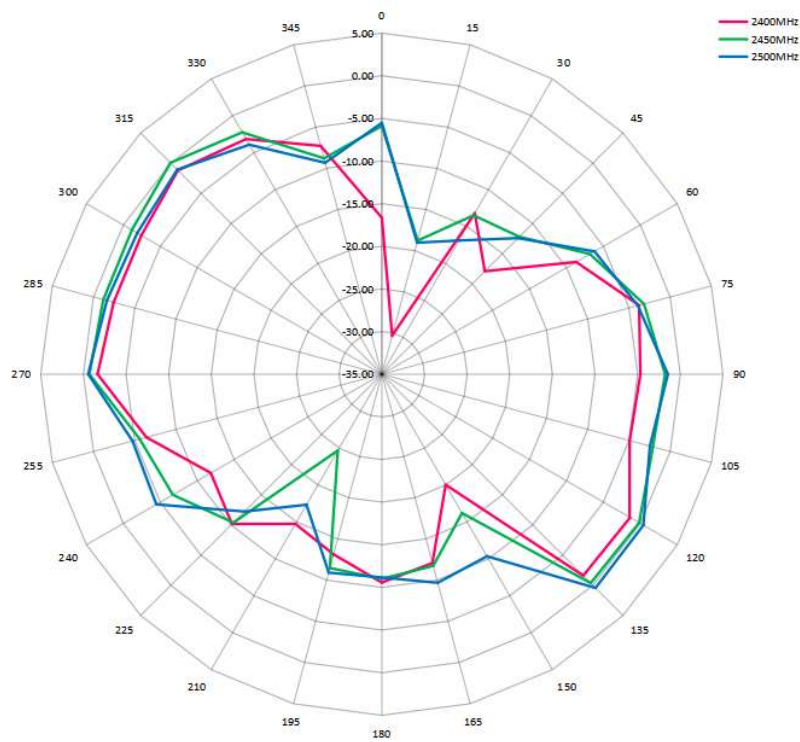
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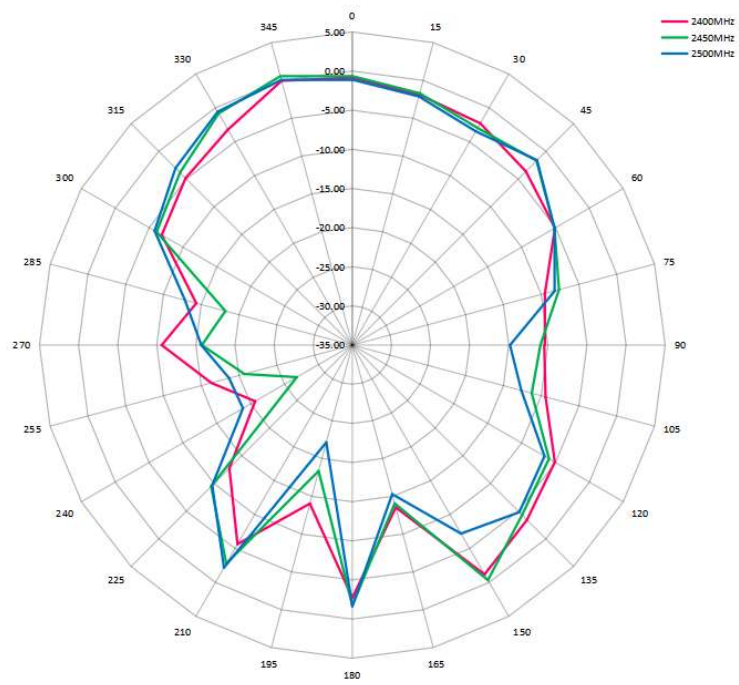
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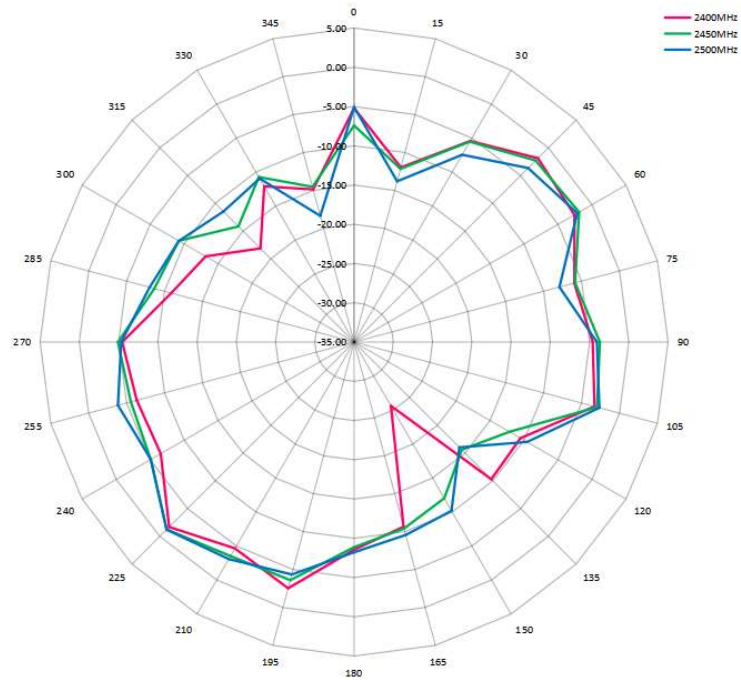
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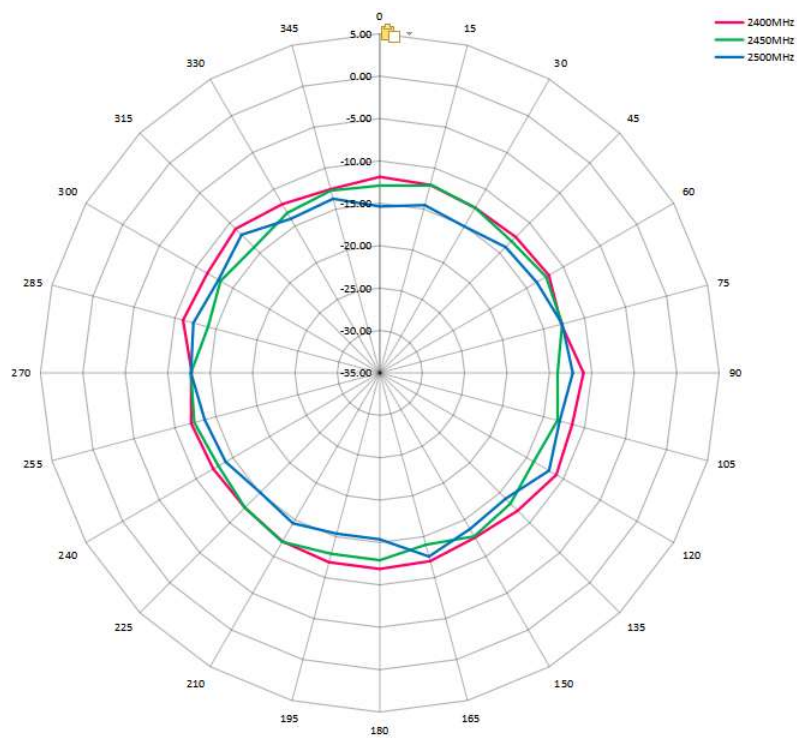
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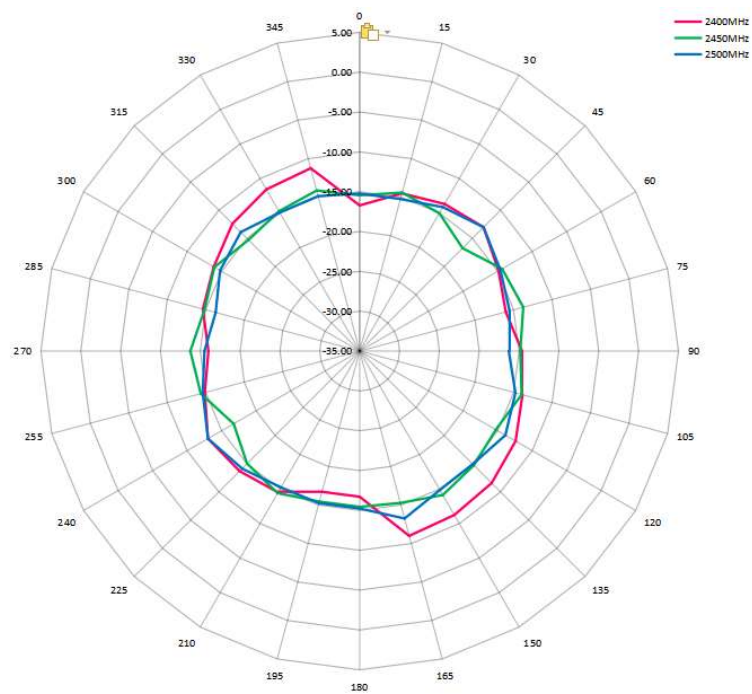
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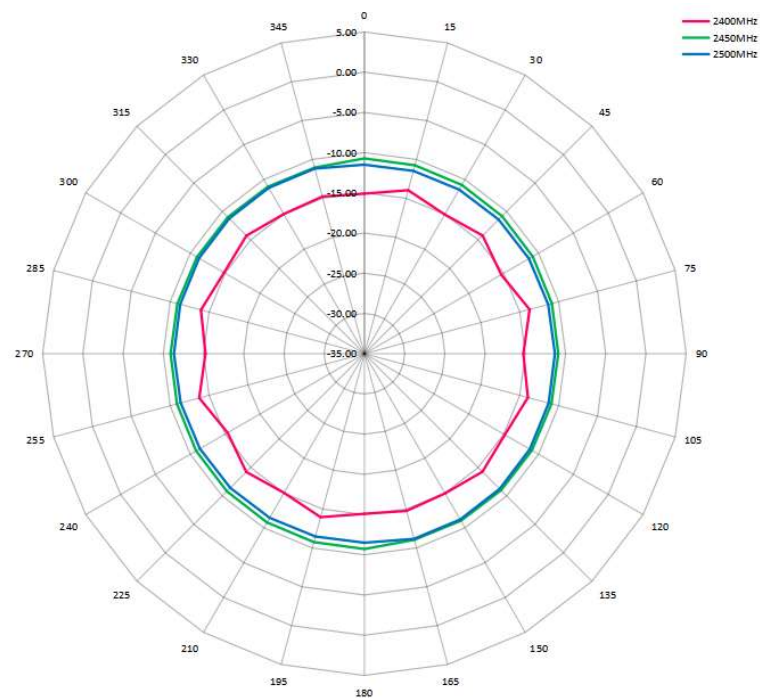
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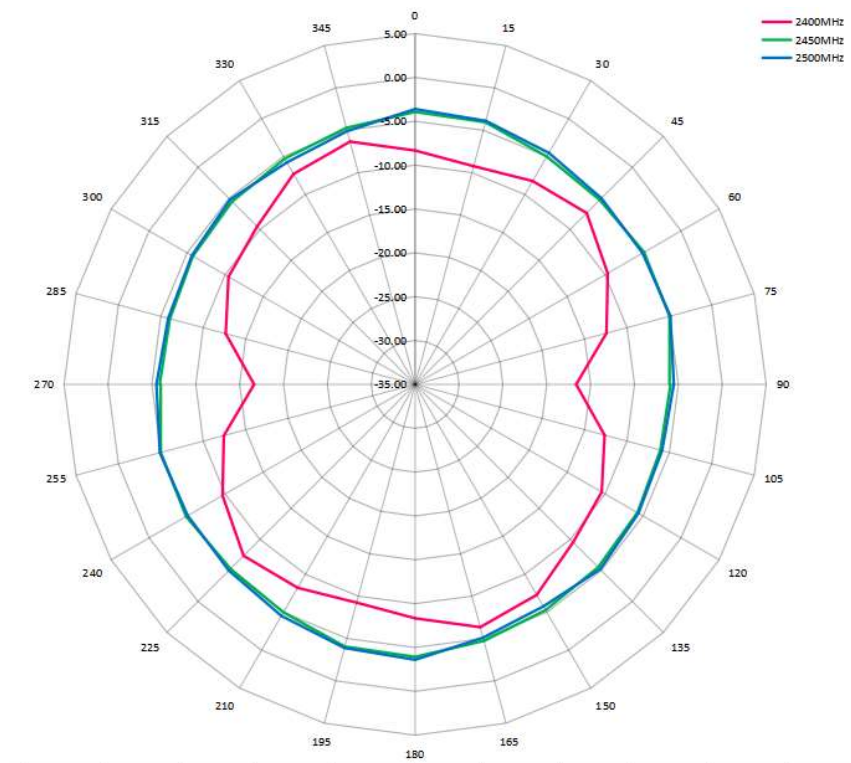
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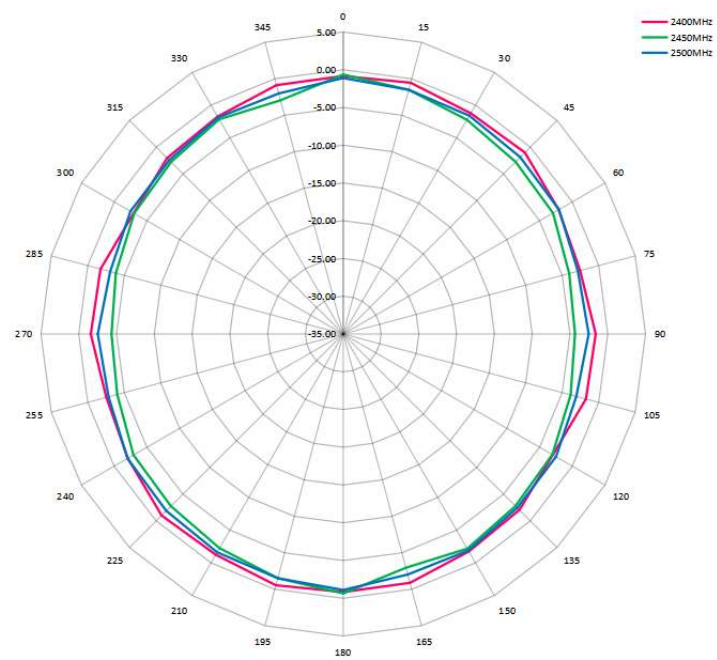
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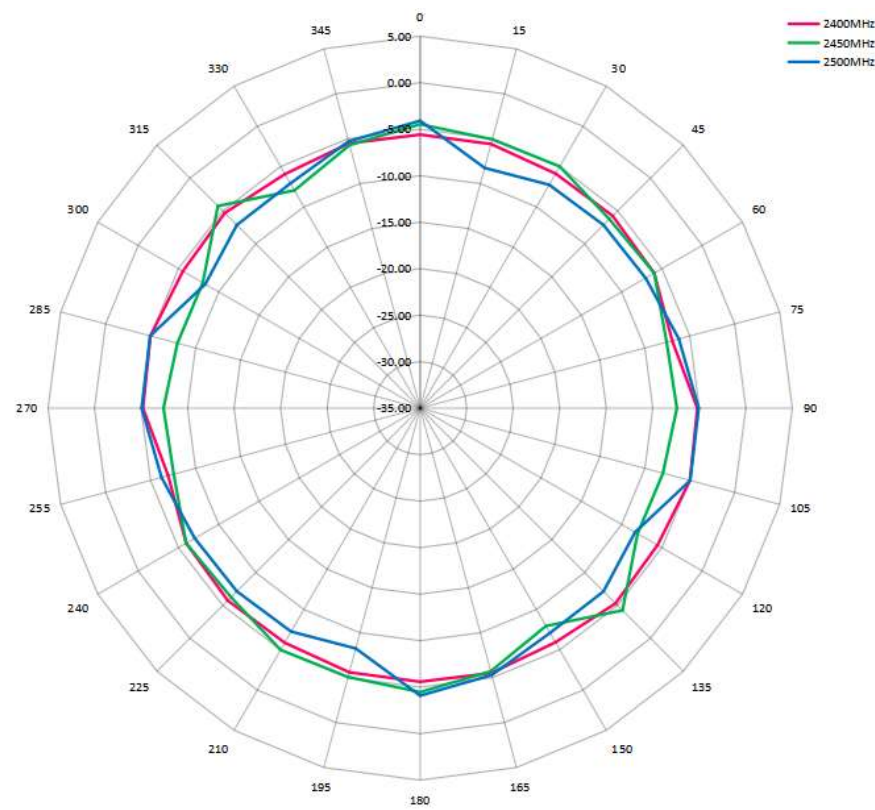
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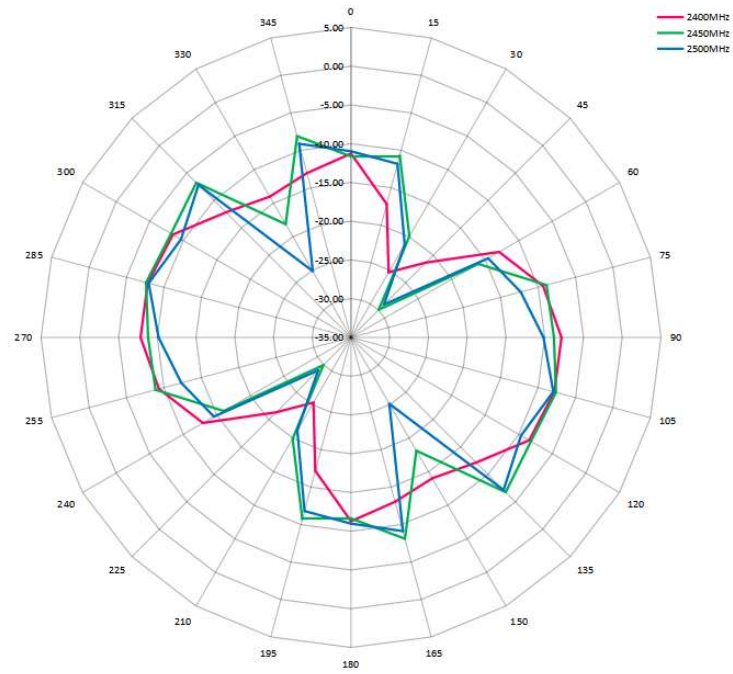
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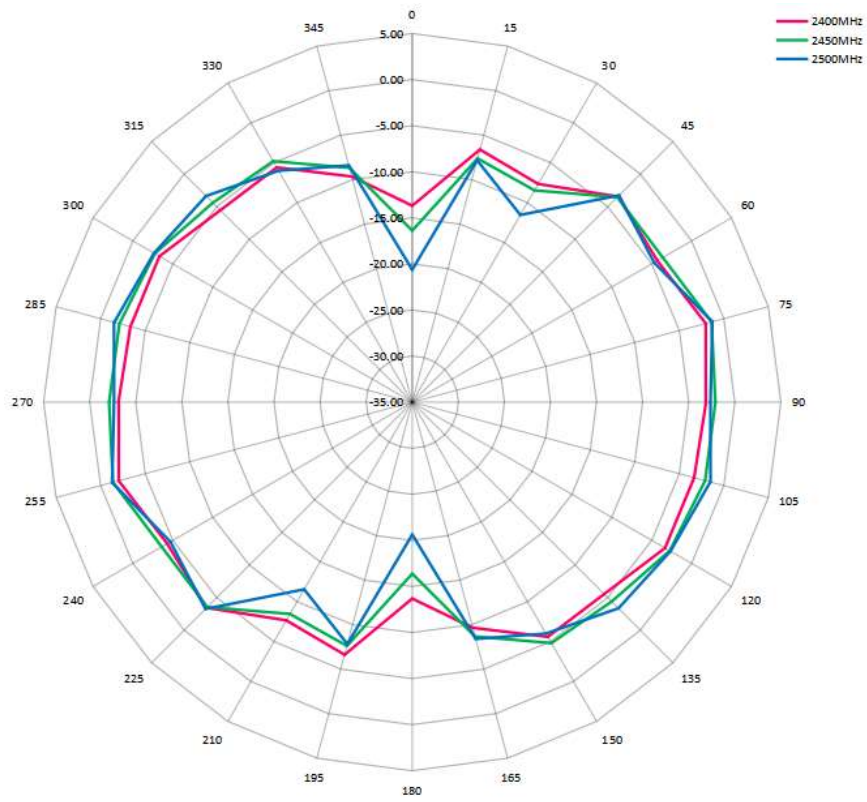
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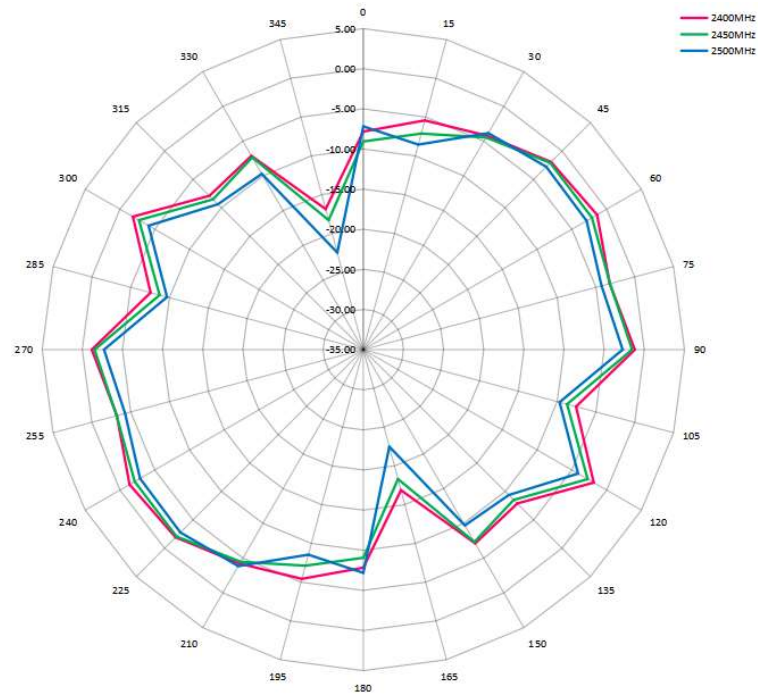
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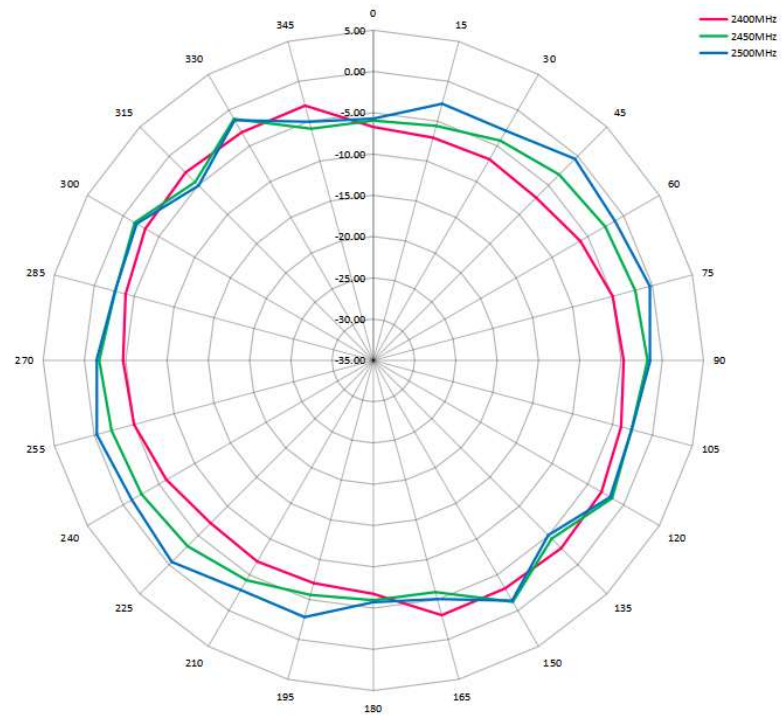
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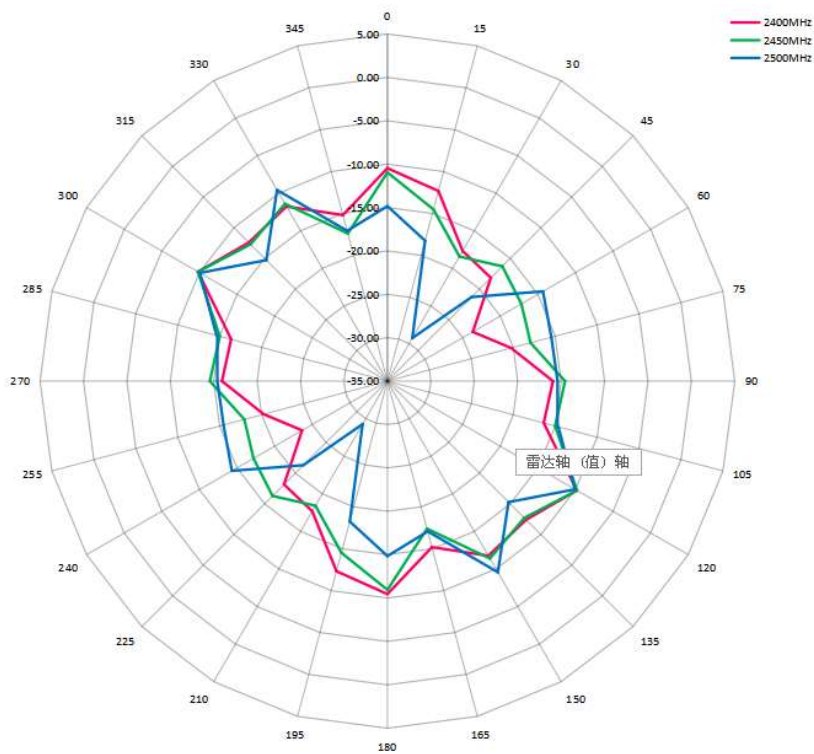
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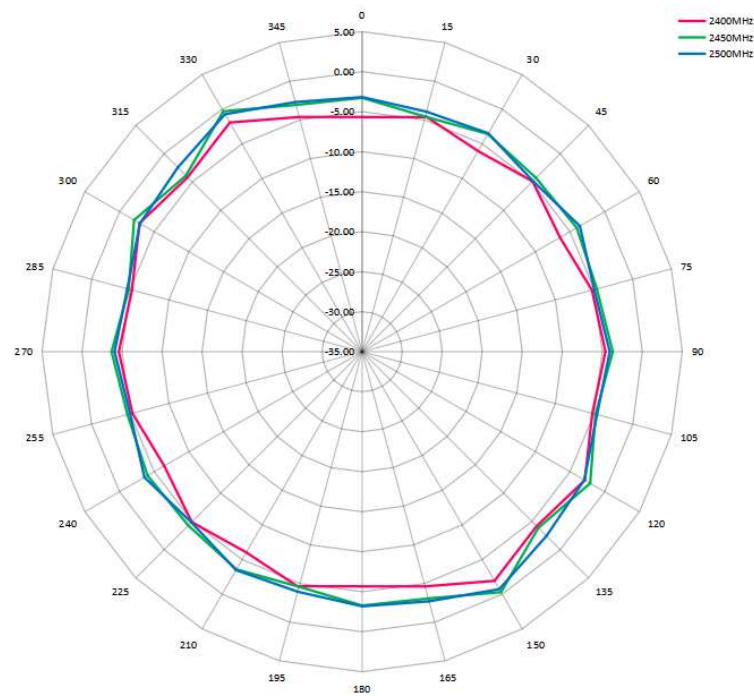
YZ_Pol._theta_Ant.1



YZ_Pol_theta_Ant.2

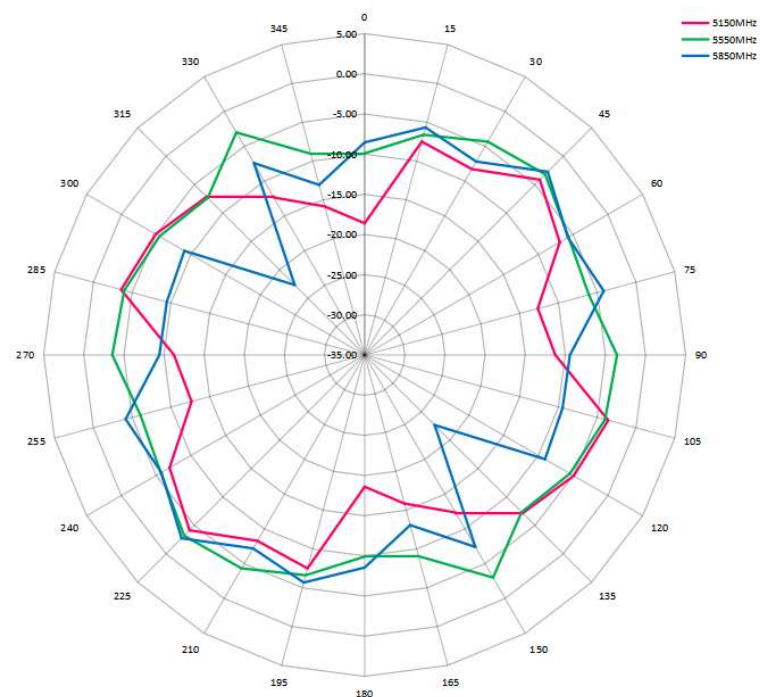


YZ_Pol._theta_Ant3

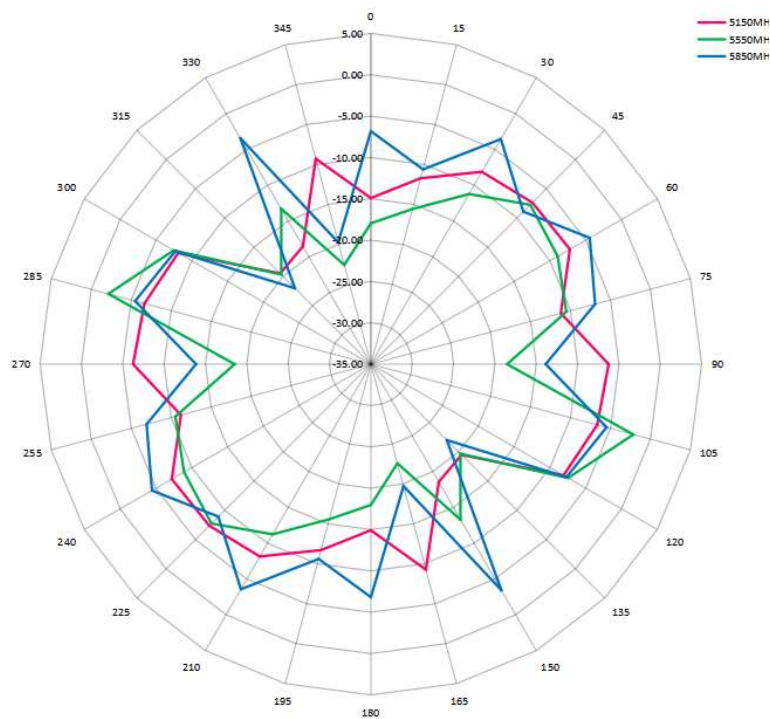


Ant. Position: 5G Ant.4~5

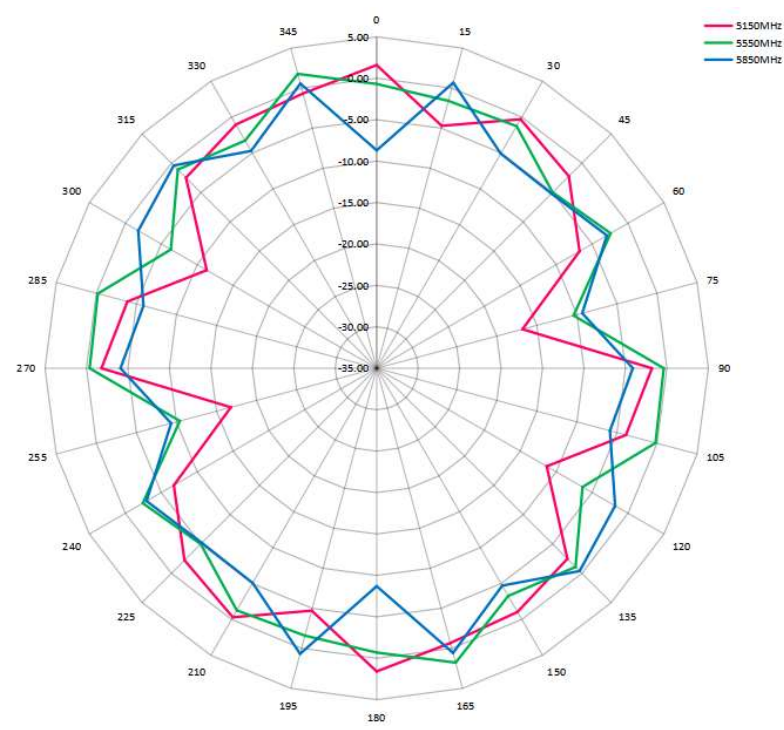
XY_Pol._Phi_Ant.4



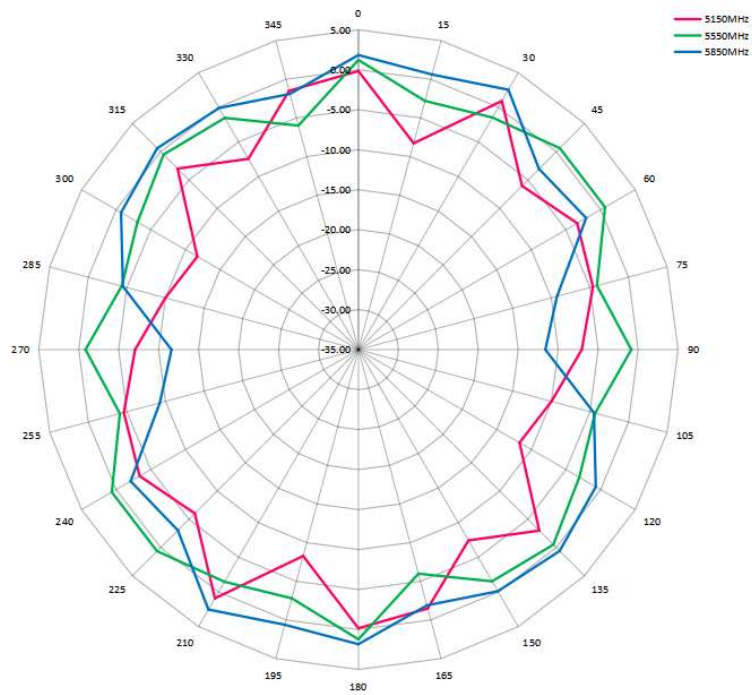
XY_Pol_Phi_Ant.5



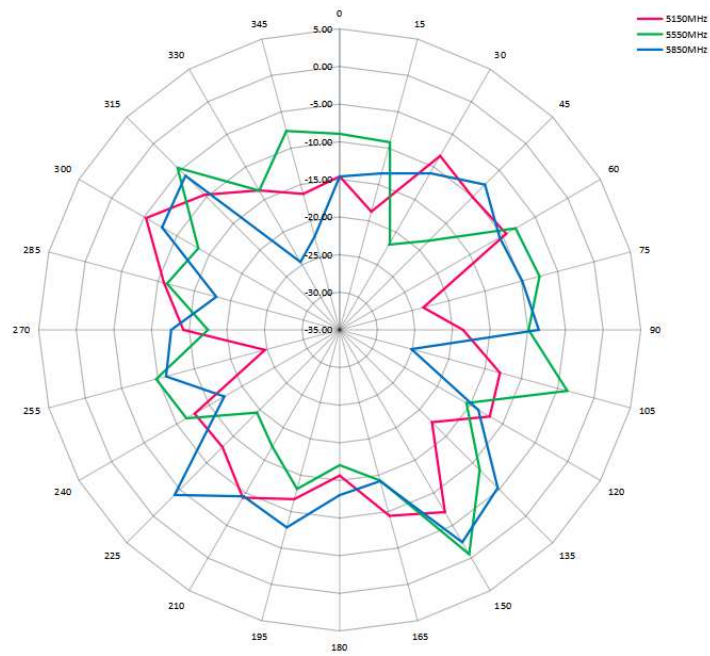
XY_Pol._theta_Ant.4



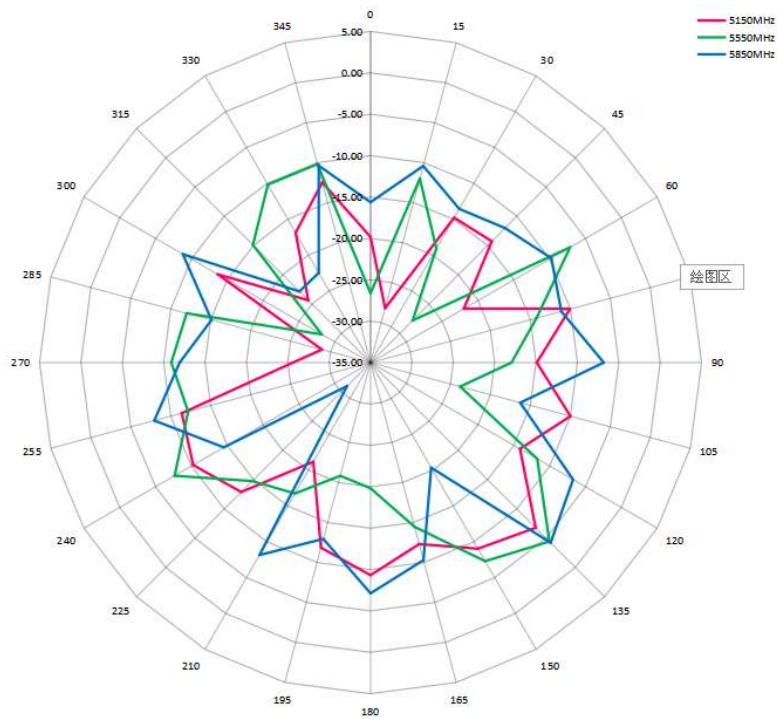
XY_Pol._theta_Ant.5



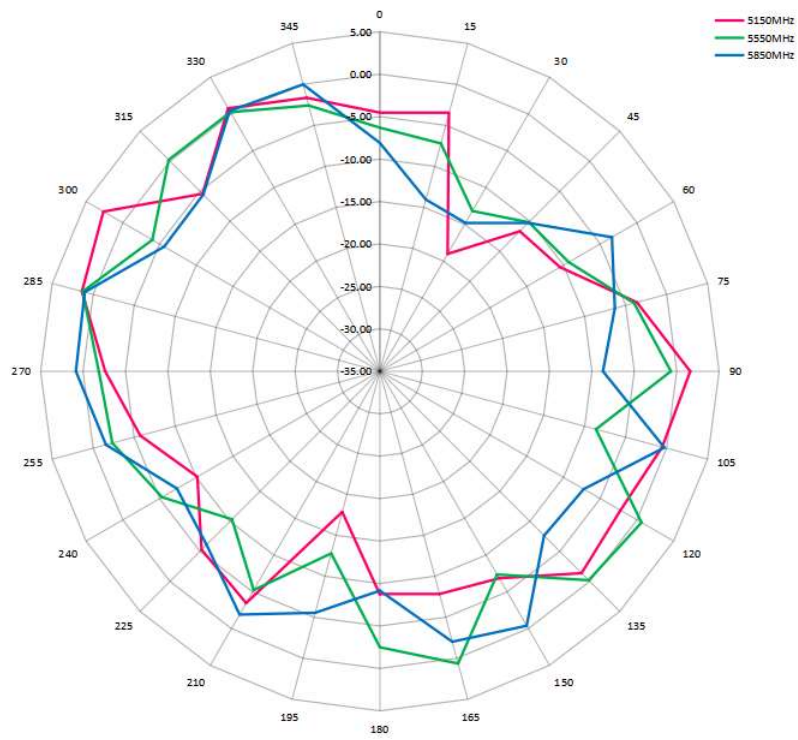
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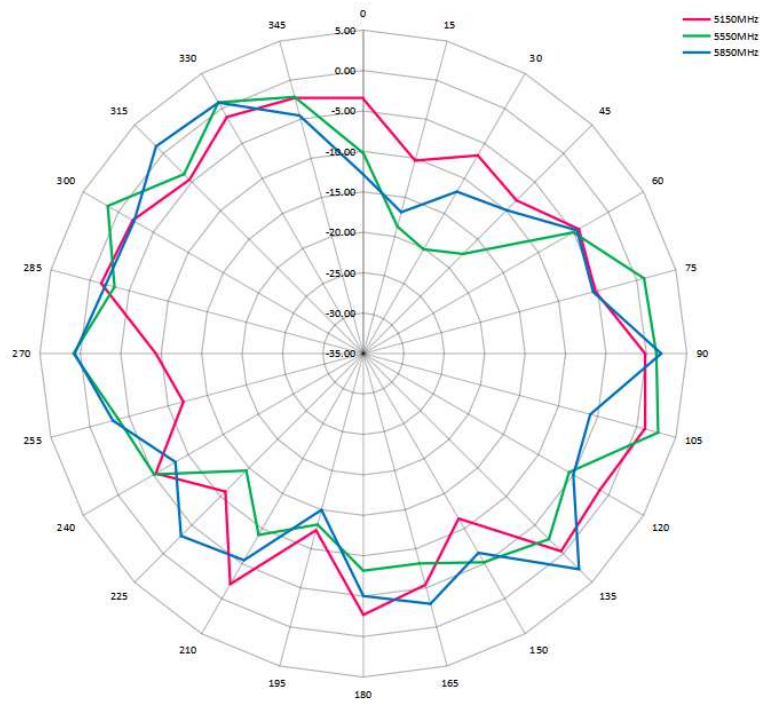
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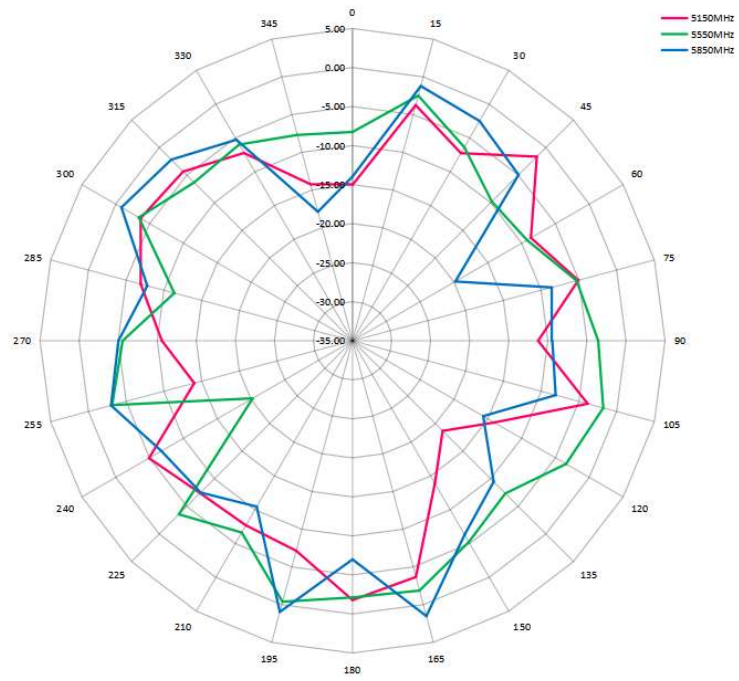
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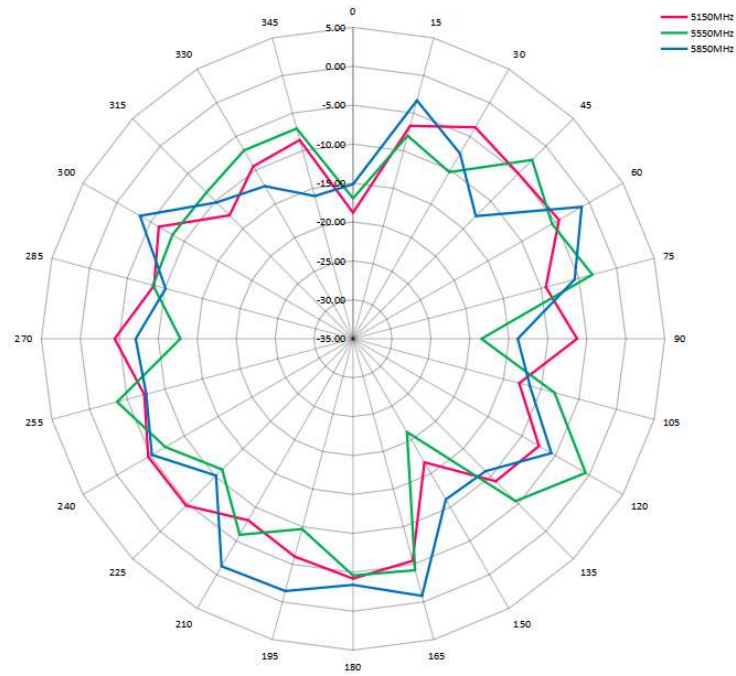
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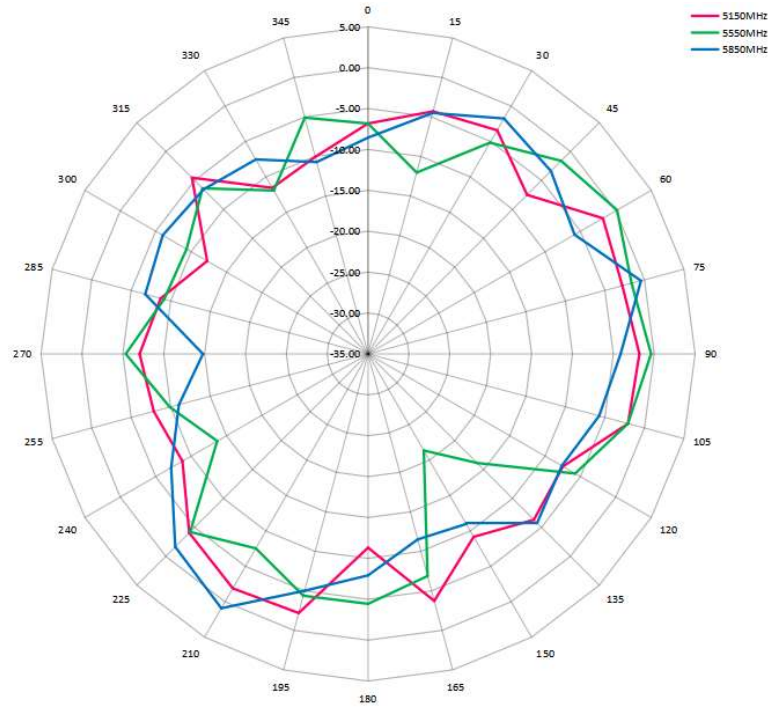
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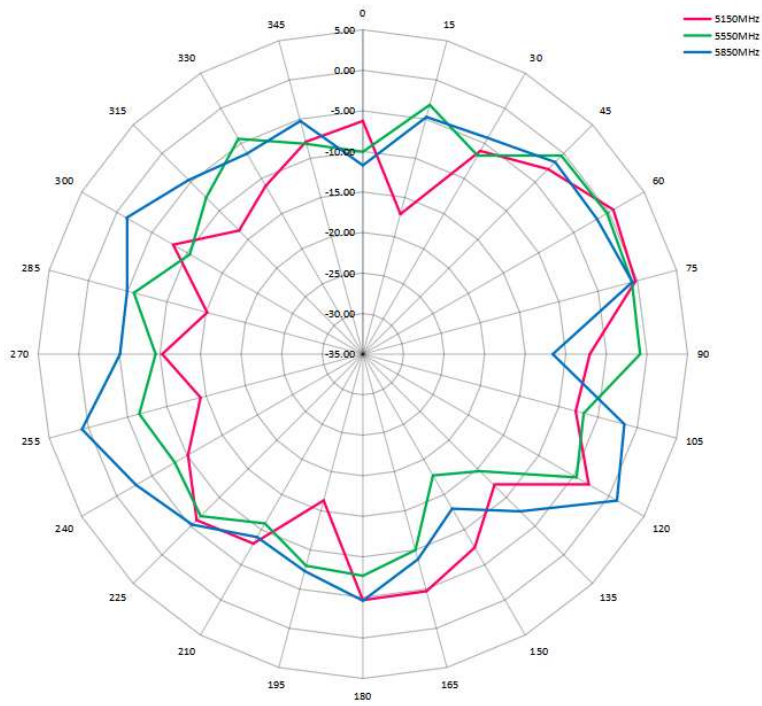
YZ_Pol._Phi_Ant.5



YZ_Pol._theta_Ant.4



YZ_Pol._theta_Ant.5



Ant. Position: 2.4G Ant.2_GAIN PHI

Ant. Position: 2.4G Ant.3_GAIN PHI

Ant. Position: 5G Ant.4_GAIN PHI

Ant. Position: 5G Ant.5_GAIN PHI

