Antenna Composite Gain Test Report

1. Test Information

Equipment	EMT
Brand Name	Nokia
Model Name	B3.3
Applicant	Nokia
Manufacturer	Nokia

2. Testing Location

Testing Location	
AOT Kunshan Lab	ADD: 289 Jinghua Road,Shipai, BachengTown, Kunshan City, Jiangsu Province

Test Condition	Test Engineer	Test Environment (°C / %)	Test Date	Signature
Radiated	Changgan Lai	20-24 / 45-60	10.15.2025~10.16.2025	Changgan Lai

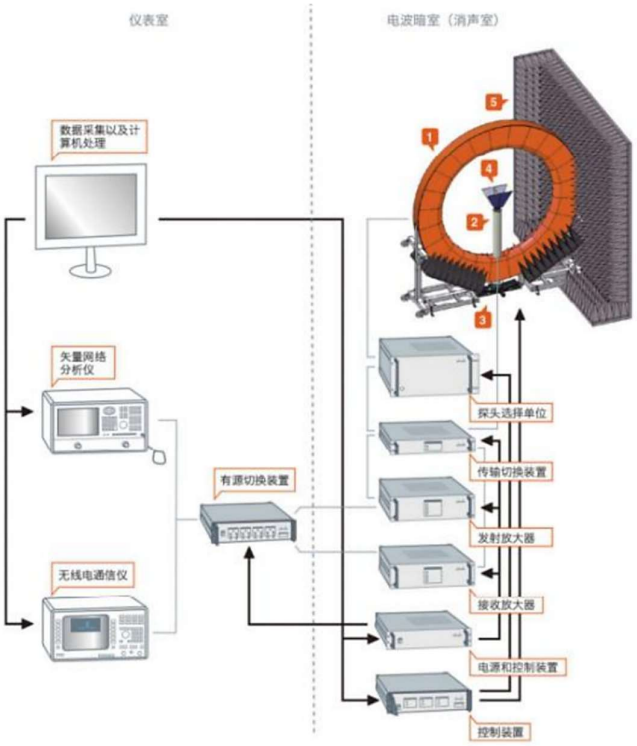
3. Test Frequency

Band (MHz)	Test Frequency (MHz)
2400-2500	2400/2450/2500
5150-5850	5150/5500/5850

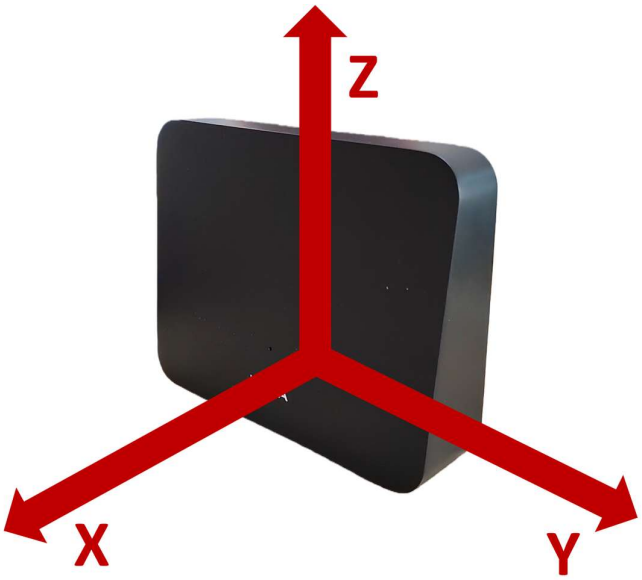
4. Antenna Information

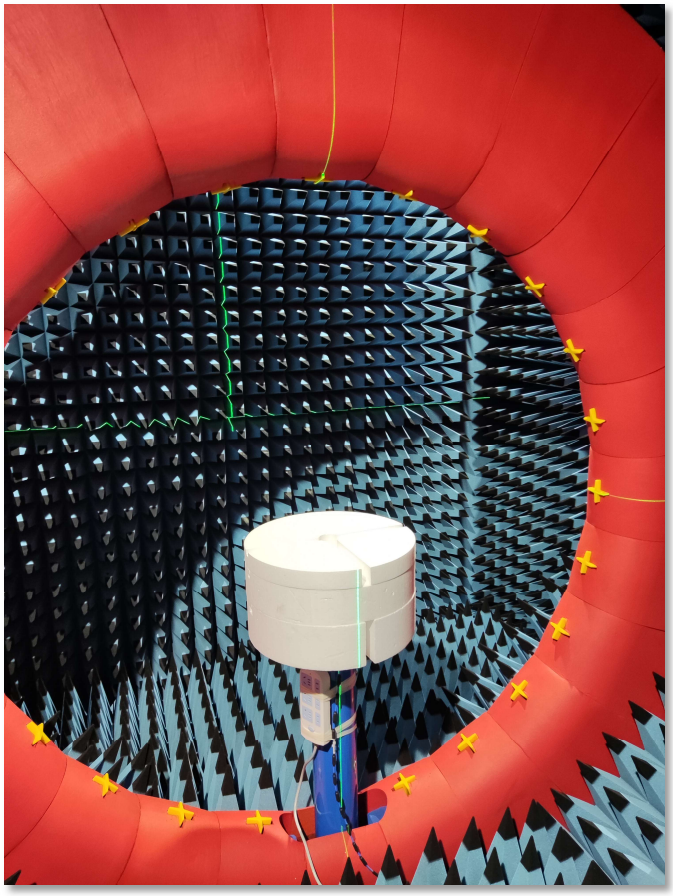
Ant. Position	Brand Name	Model Name	Ant. Type	Connector
Antenna 1 (5G)	Nokia	ANT-P5158-N32	Dipole	I-PEX
Antenna 2 (5G)	Nokia	ANT-P5158-N33	Dipole	I-PEX
Antenna 3 (2.4G)	Nokia	ANT-P2425-N41	Dipole	I-PEX
Antenna 4 (2.4G)	Nokia	ANT-P2425-N42	Dipole	I-PEX

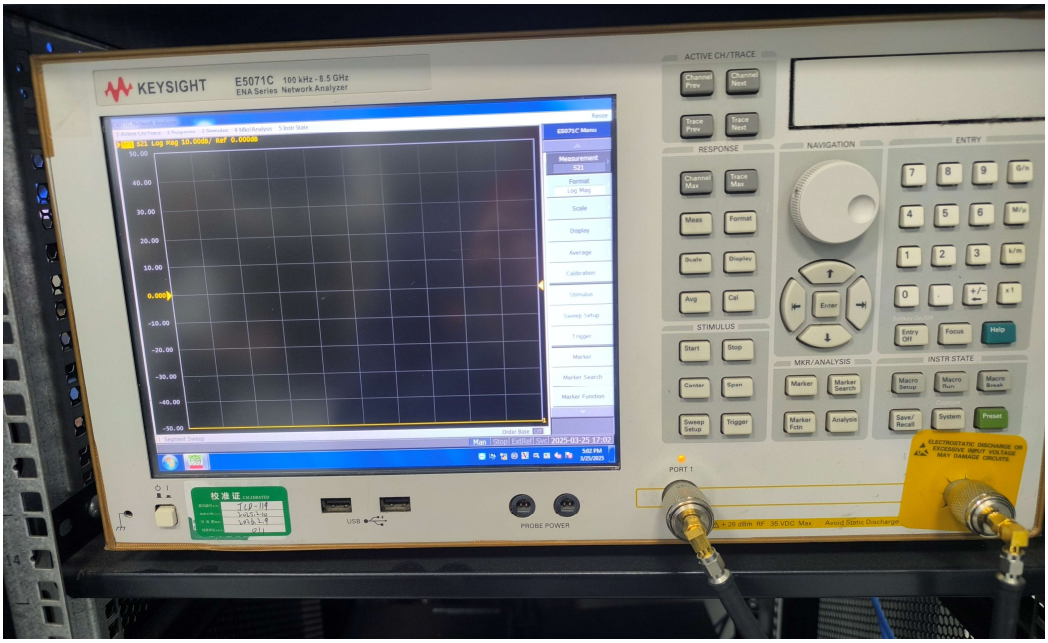
5. Test Configuration



6. Reference Calibration







CALIBRATION PASS
CAL.DATA: 2025.2.10
NEXT CAL.DATA: 2026.2.9

7. Test Method

The “great circle” cut method, whereby the Measurement Antenna remains fixed and the EUT is rotated about two axes in sequential order. The radiated RF performance of the Equipment Under Test (EUT) is measured by sampling the radiated transmit power of the mobile at various locations surrounding the device. A three-dimensional characterization of the 'transmit' performance of the EUT is pieced together by analyzing the data from the spatially distributed measurements.

Data points taken every 2 degrees in the theta and in the phi axes are deemed sufficient to fully characterize the EUT's Far-Field radiation pattern and total radiated power All of the measured power values will be integrated.

8. Measured Values and Calculation of Correlated / Uncorrelated Gains

Antenna Peak Gain Table (Ant. Position：2.4G Ant.3,Ant.4)

Band (MHz)	2400-2500		
Frequency (MHz)	2400	2450	2500
Ant.3 Max Gain (dBi)	3.08	3.97	3.93
Ant.4 Max Gain (dBi)	2.51	2.55	2.67
Max Gain (dBi)	3.08	3.97	3.93

Antenna Peak Gain Table (Ant. Position：5G Ant.1~2)

Band (MHz)	5150-5850		
Frequency (MHz)	5150	5500	5850
Ant.1 Max Gain (dBi)	3.02	3.52	3.48
Ant.2 Max Gain (dBi)	3.27	3.35	3.32
Max Gain (dBi)	3.27	3.52	3.48

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 2 degree steps of theta and 10 degree of theta 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 D01F(2)(f)(ii) for CDD and KDB 662911 D01, F(2)(e)(ii) for TxBF.

The uncorrelated antenna gain was calculated using KDB 662911 D01F(2)(d)(ii) for SDM.

The correlated and uncorrelated gains were calculated for each point in the spatial data and the highest values reported.

(ii) If antenna gains are not equal, the user may use either of the following methods to calculate directional gain. provided that each transmit antenna s driven by only one spatial stream.

- Directional gain may be calculated by using the formulas applicable to equal gain antennas with Gur set equal to the gain of the antenna having the highest gain, or.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

If all transmit signals are completely uncorrelated, then

$$\text{Directional gain} = 10 \log[(10^{G_1/10} + 10^{G_2/10} + \ldots + 10^{G_N/10})/N_{ANT}] \text{ dBi}$$

Maximum Correlated / Uncorrelated Gain Calculation

Correlated Gain

(Ant. Position：2.4G Ant.3,Ant.4)

Frequency (MHz)	2400	2450	2500
Ant.3 Gain(dBi)	2.37	2.78	3.50
Ant.4 Gain(dBi)	2.51	2.51	2.02
Phi (°)	16	16	164
Theta (°)	70	72	-72
Correlated Gain	5.45	5.65	5.80

(Ant. Position：5G Ant.1~2)

Frequency (MHz)	5150	5500	5850
Ant.1 Gain(dBi)	2.42	2.22	2.51
Ant.2 Gain(dBi)	3.27	2.85	3.09
Phi (°)	10	2	6
Theta (°)	76	-120	-124
Correlated Gain	5.87	5.55	5.82

Calculation example

10 x log{{[10^(2.37dBi / 20)+10^(2.51dBi / 20)]^2}/ 2}=5.45dBi

Uncorrelated Gain

(Ant. Position：2.4G Ant.3,Ant.4)

Frequency (MHz)	2400	2450	2500
Ant.3 Gain(dBi)	2.37	2.78	3.73
Ant.4 Gain(dBi)	2.51	2.51	1.72
Phi (°)	16	16	166
Theta (°)	70	72	-72
Uncorrelated Gain	2.44	2.65	2.84

(Ant. Position：5G Ant.1~2)

Frequency (MHz)	5150	5500	5850
Ant.1 Gain(dBi)	2.42	2.22	2.51
Ant.2 Gain(dBi)	3.27	2.85	3.09
Phi (°)	10	2	6
Theta (°)	76	-120	-124
Uncorrelated Gain	2.87	2.55	2.81

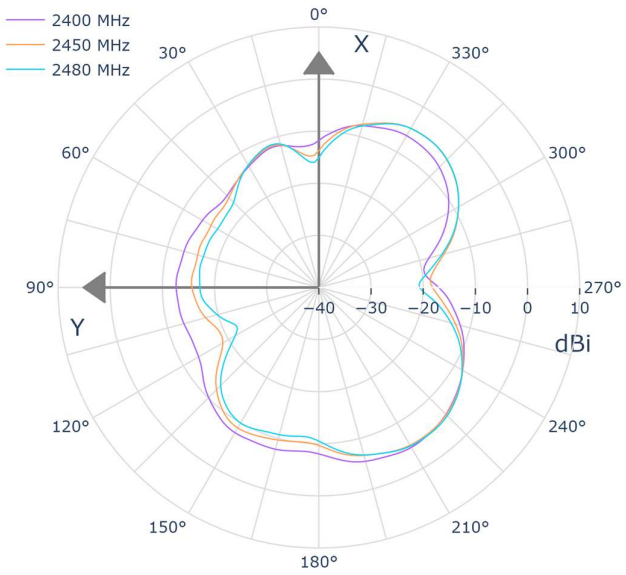
Calculation example

=10xlog10(((10^(2.37 dBi /10)+10^(2.51 dBi /10)))/2) =2.44dBi

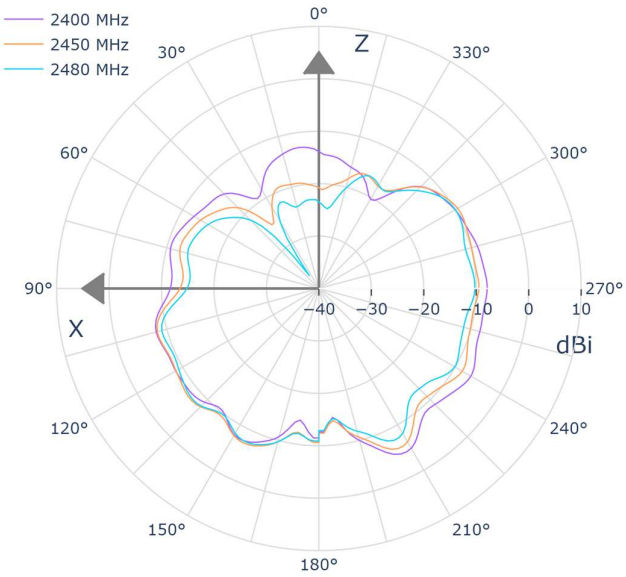
9. Radiation Pattern

Ant. Position：2.4G Ant.3, Ant4

XY_Pol._Phi_Ant.3@2.4G



XZ_Pol._Phi_Ant.3@2.4G



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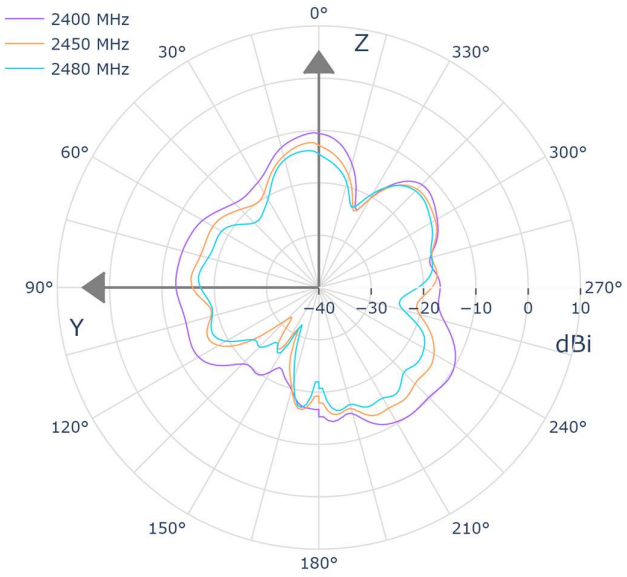
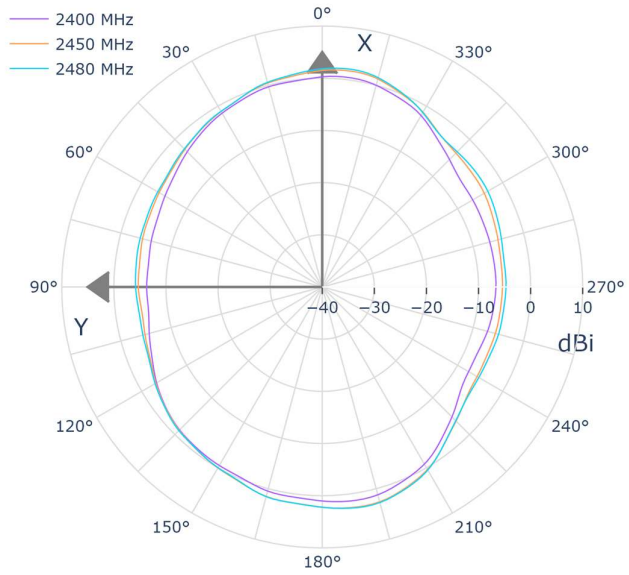
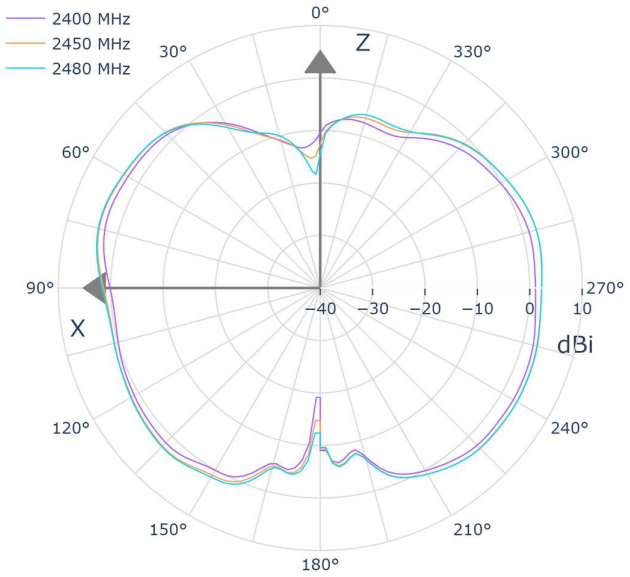


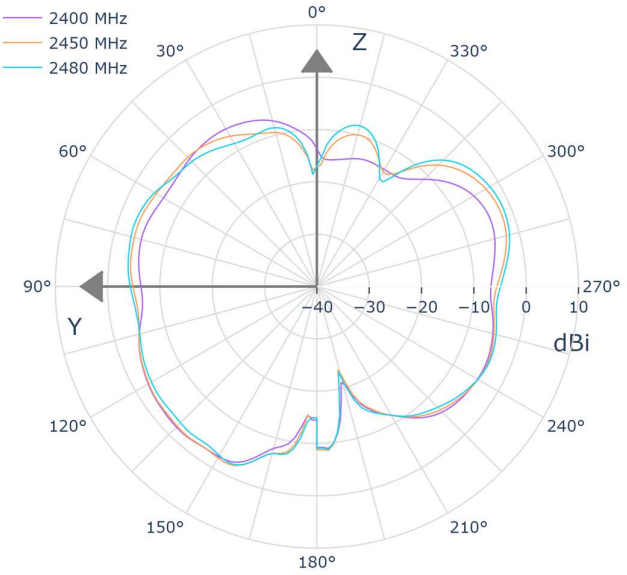
XY_Pol._Theta_Ant.3@2.4G



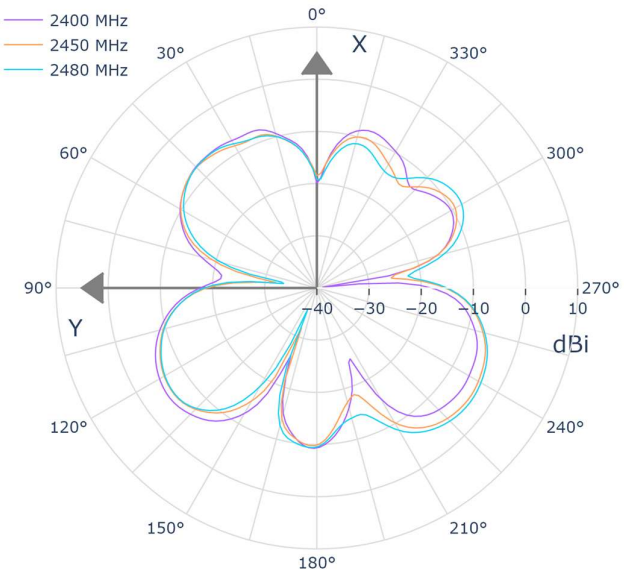
XZ_Pol._Theta_Ant.3@2.4G



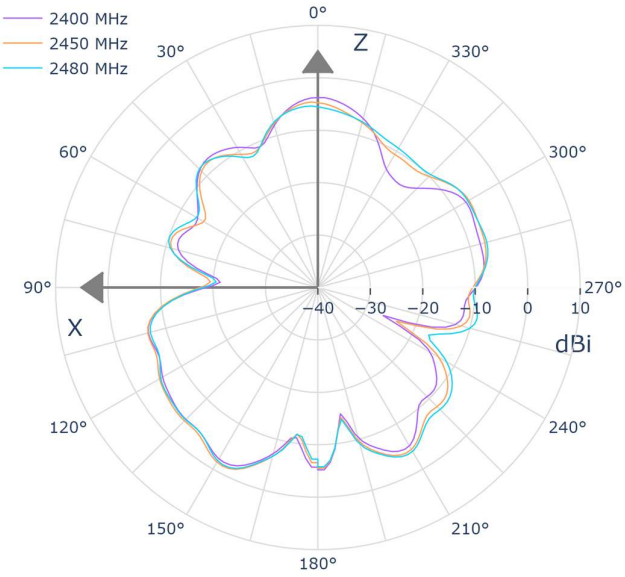
YZ_Pol._Theta_Ant.3@2.4G



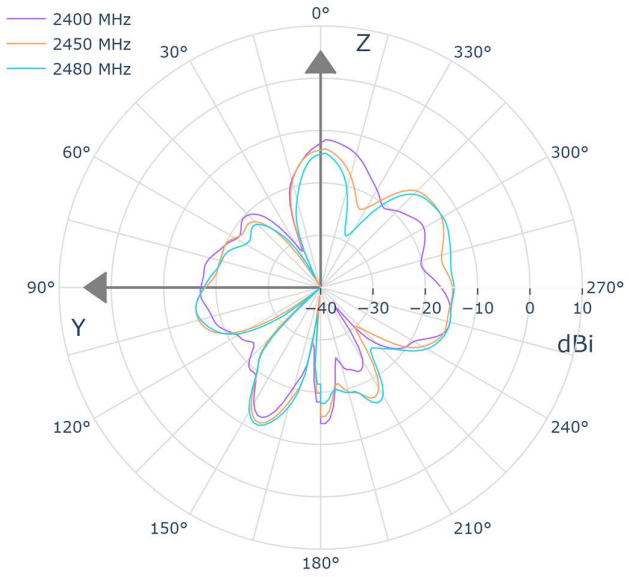
XY_Pol._Phi_Ant.4@2.4G



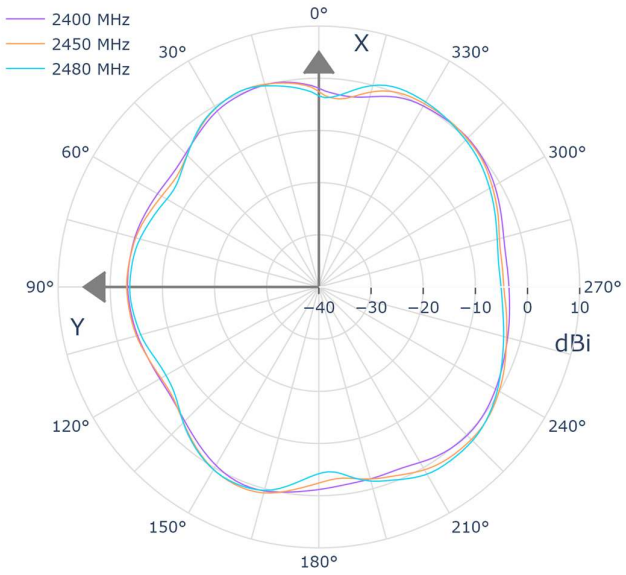
XZ_Pol._Phi_Ant.4@2.4G



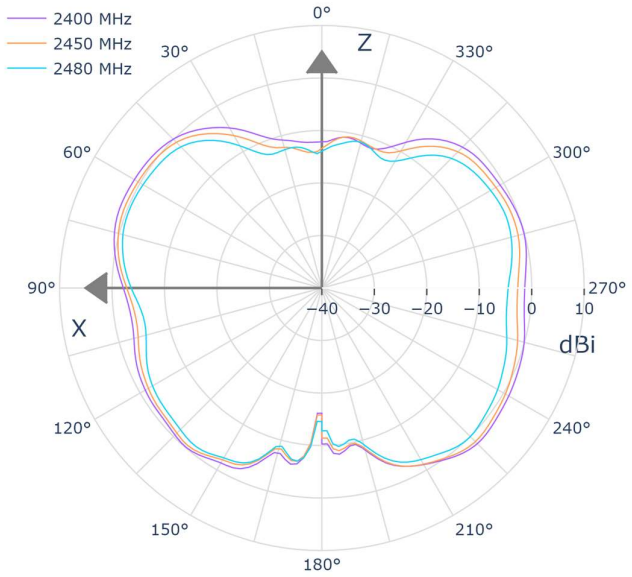
YZ_Pol._Phi_Ant.4@2.4G



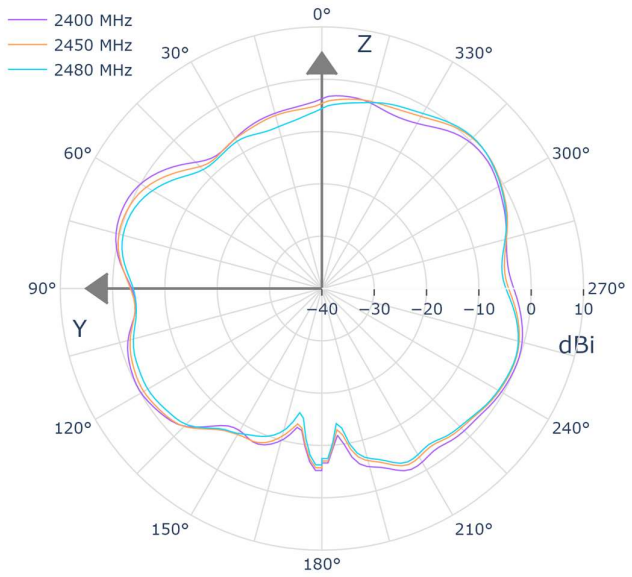
XY_Pol._Theta_Ant.4@2.4G



XZ_Pol._Theta_Ant.4@2.4G

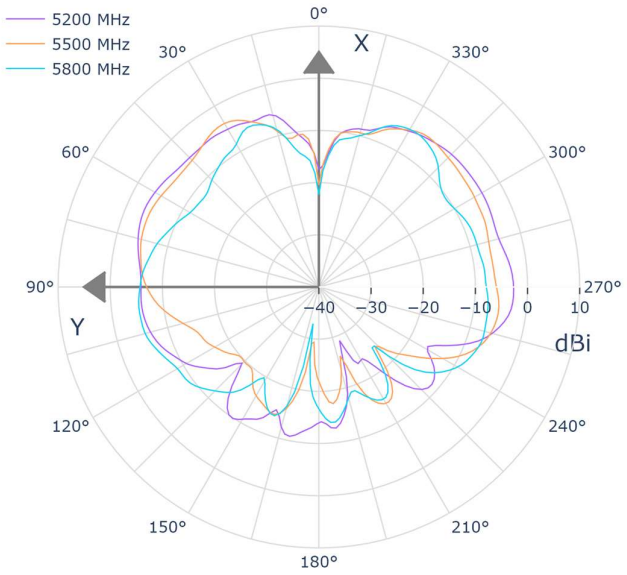


YZ_Pol._Theta_Ant.4@2.4G

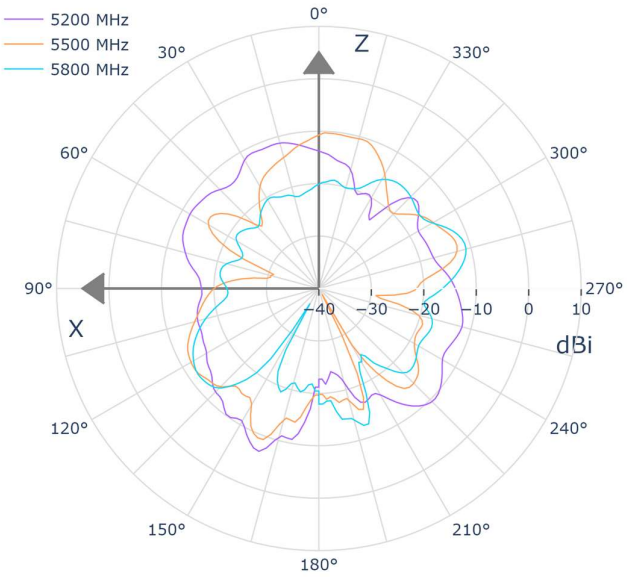


Ant. Position：5G Ant.1~2

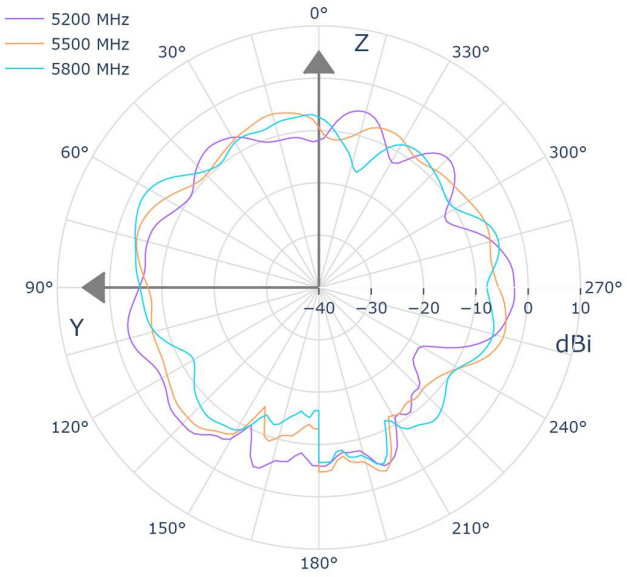
XY_Pol._Phi_Ant.1@5G



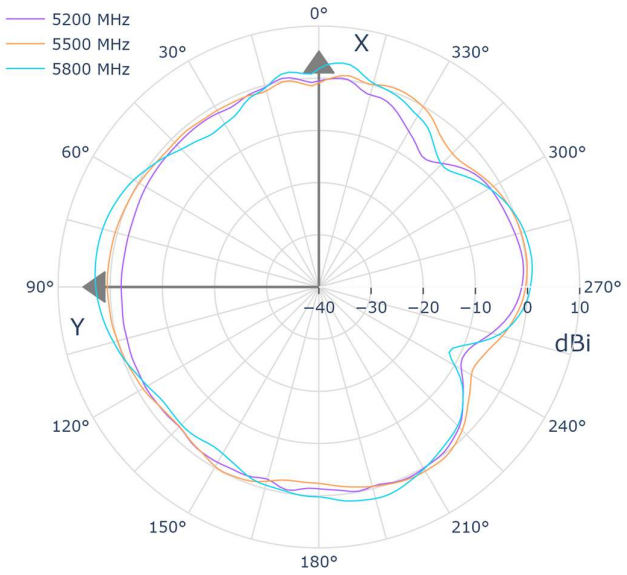
XZ_Pol._Phi_Ant.1@5G



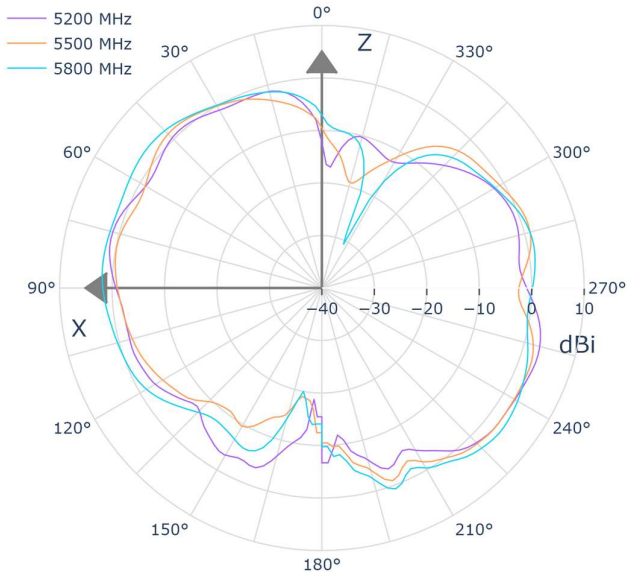
YZ_Pol._Phi_Ant.1@5G



XY_Pol._Theta_Ant.1@5G



XZ_Pol._Theta_Ant.1@5G



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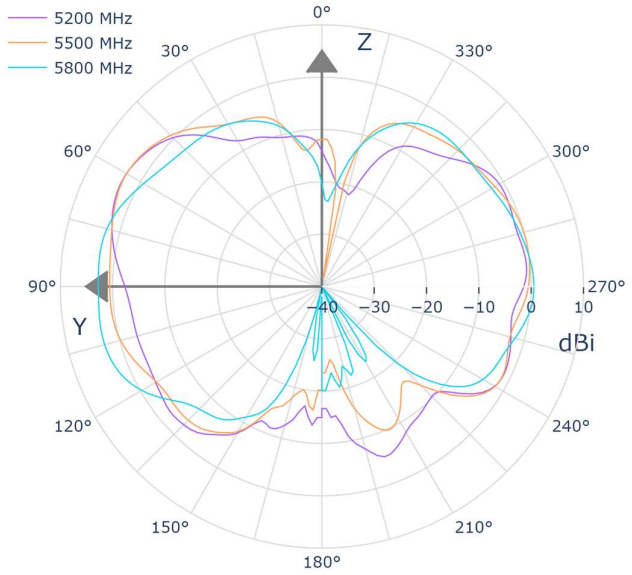
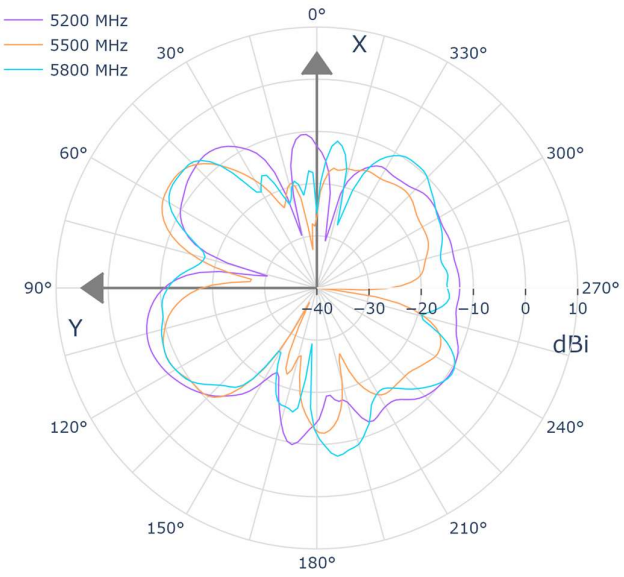
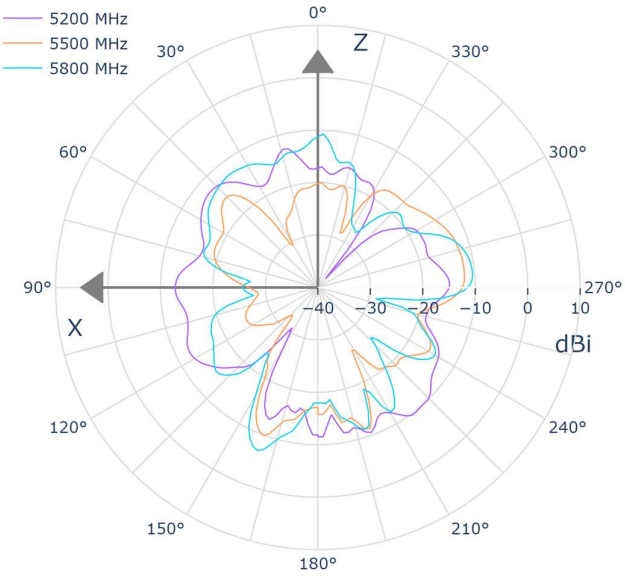


XY_Pol._Phi_Ant.2@5G



XZ_Pol._Phi_Ant.2@5G



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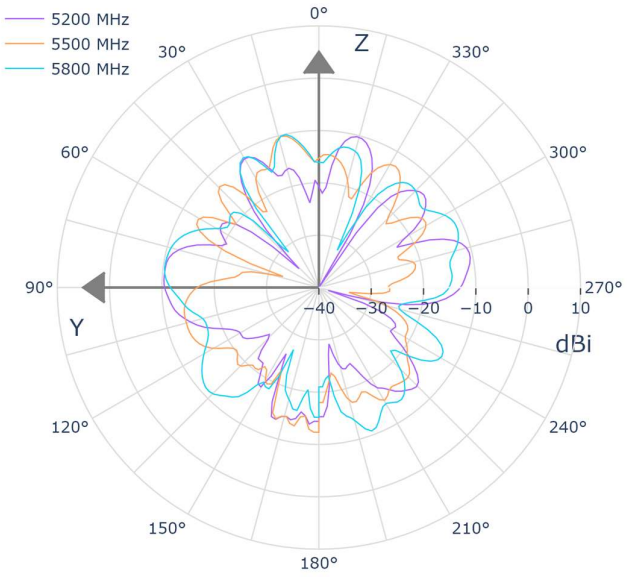
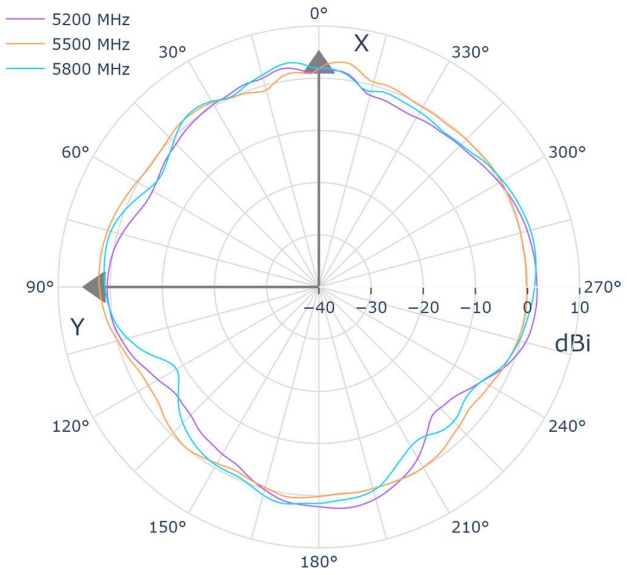


XY_Pol._Theta_Ant.2@5G



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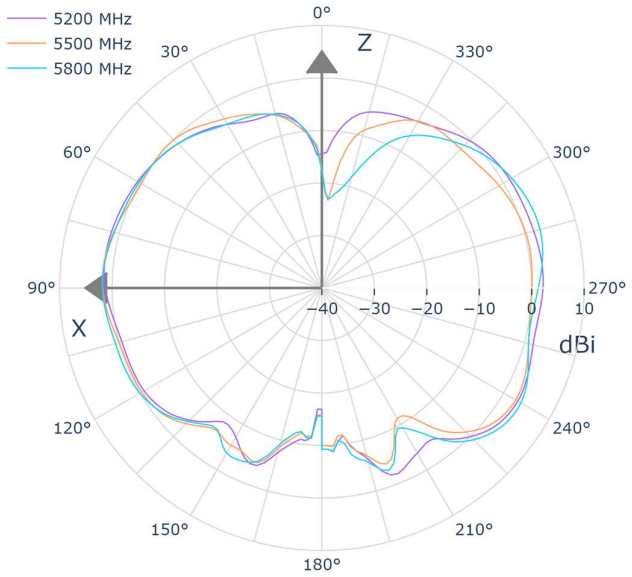

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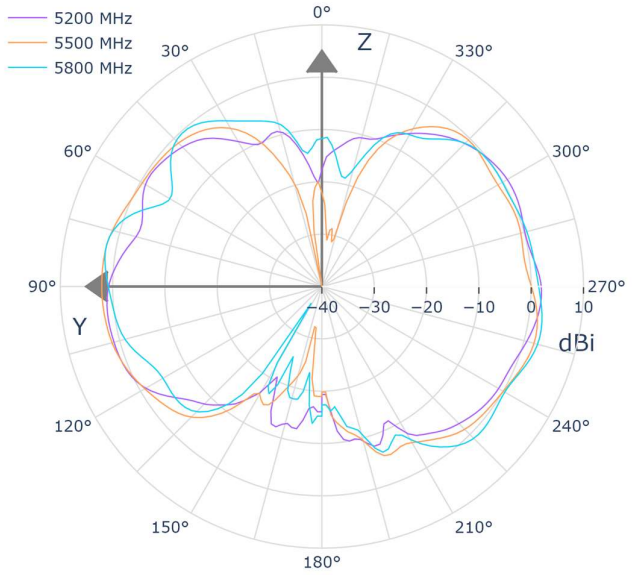
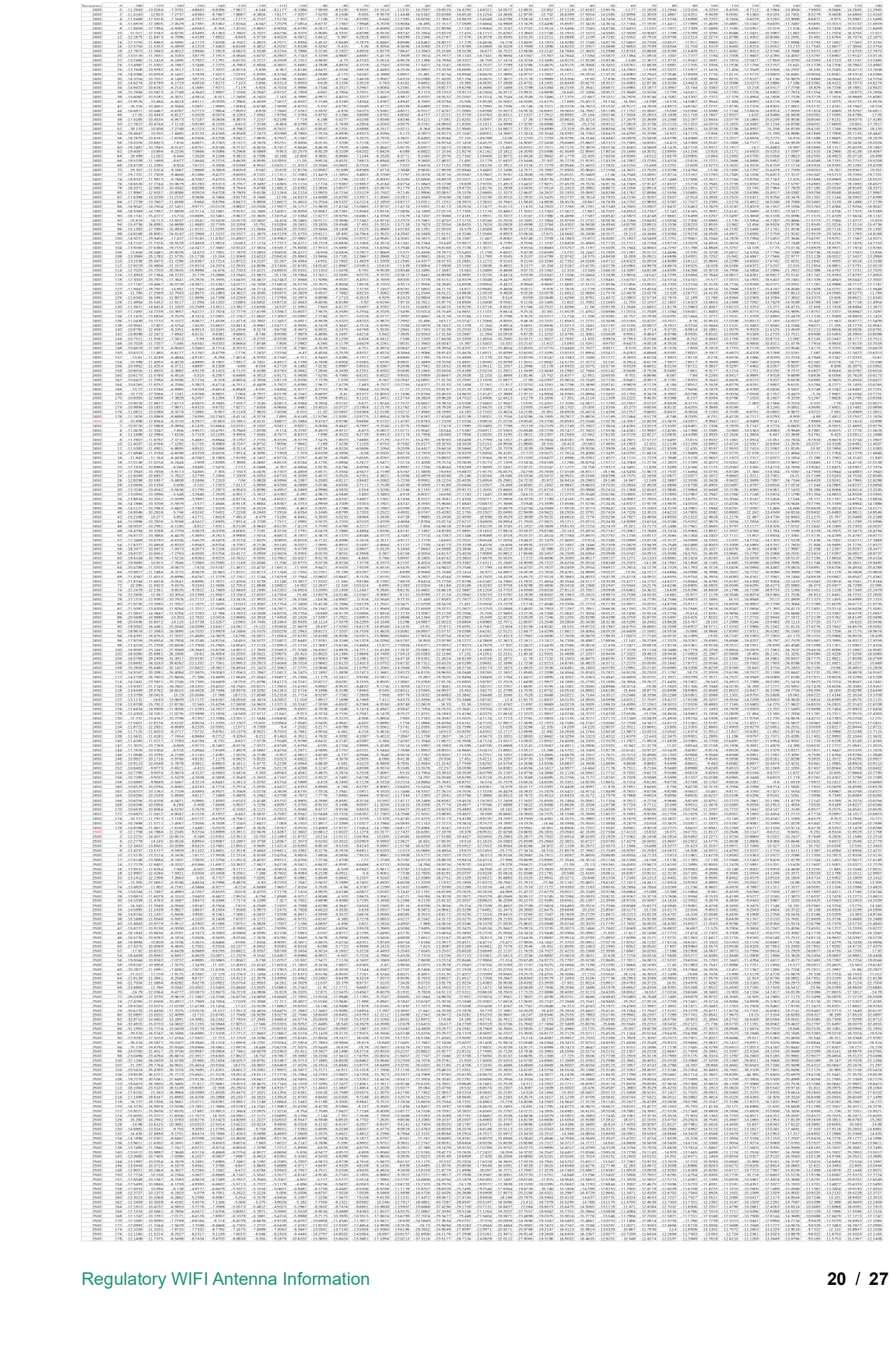
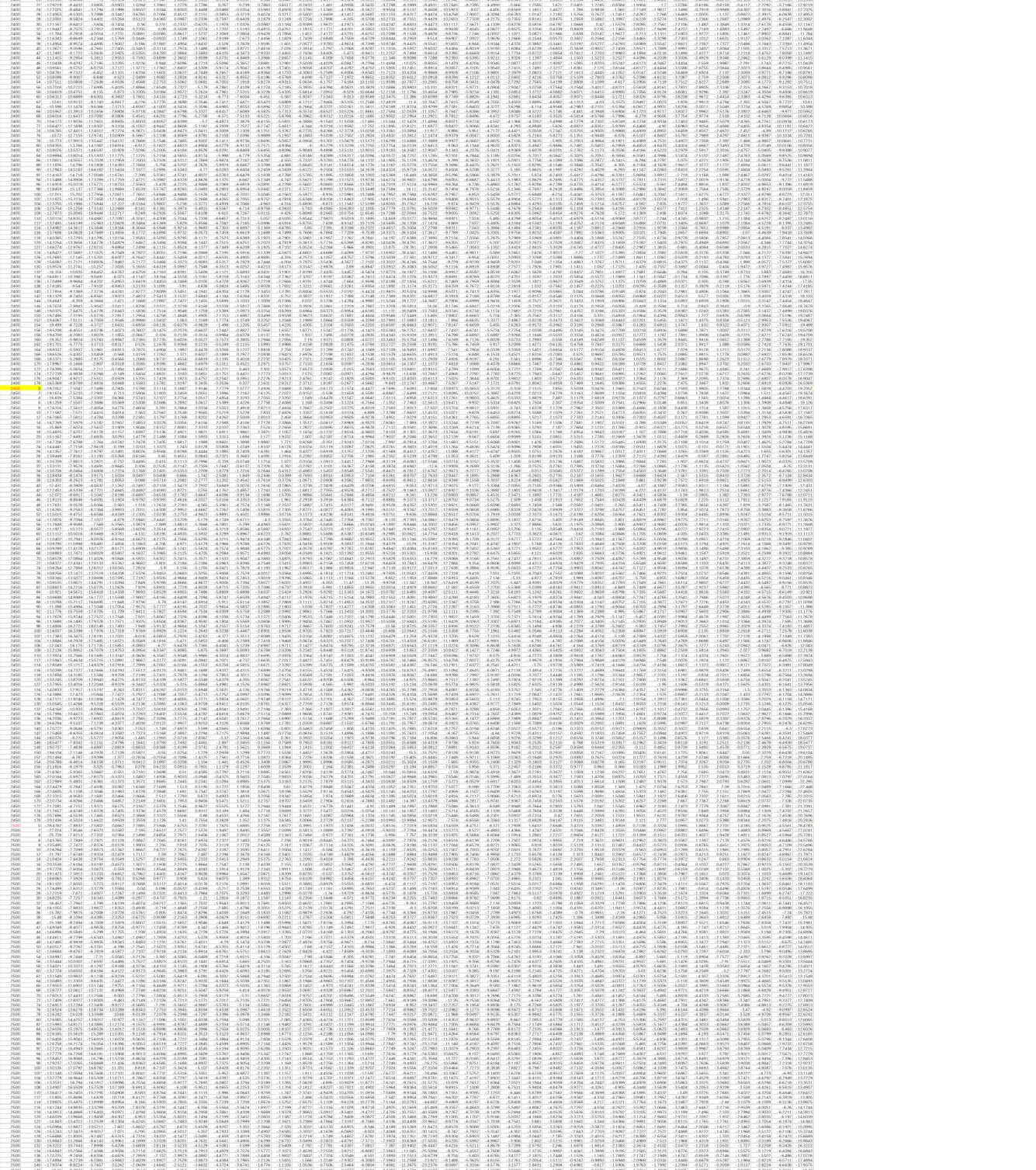


Appendix _Radiated Total Gain Result

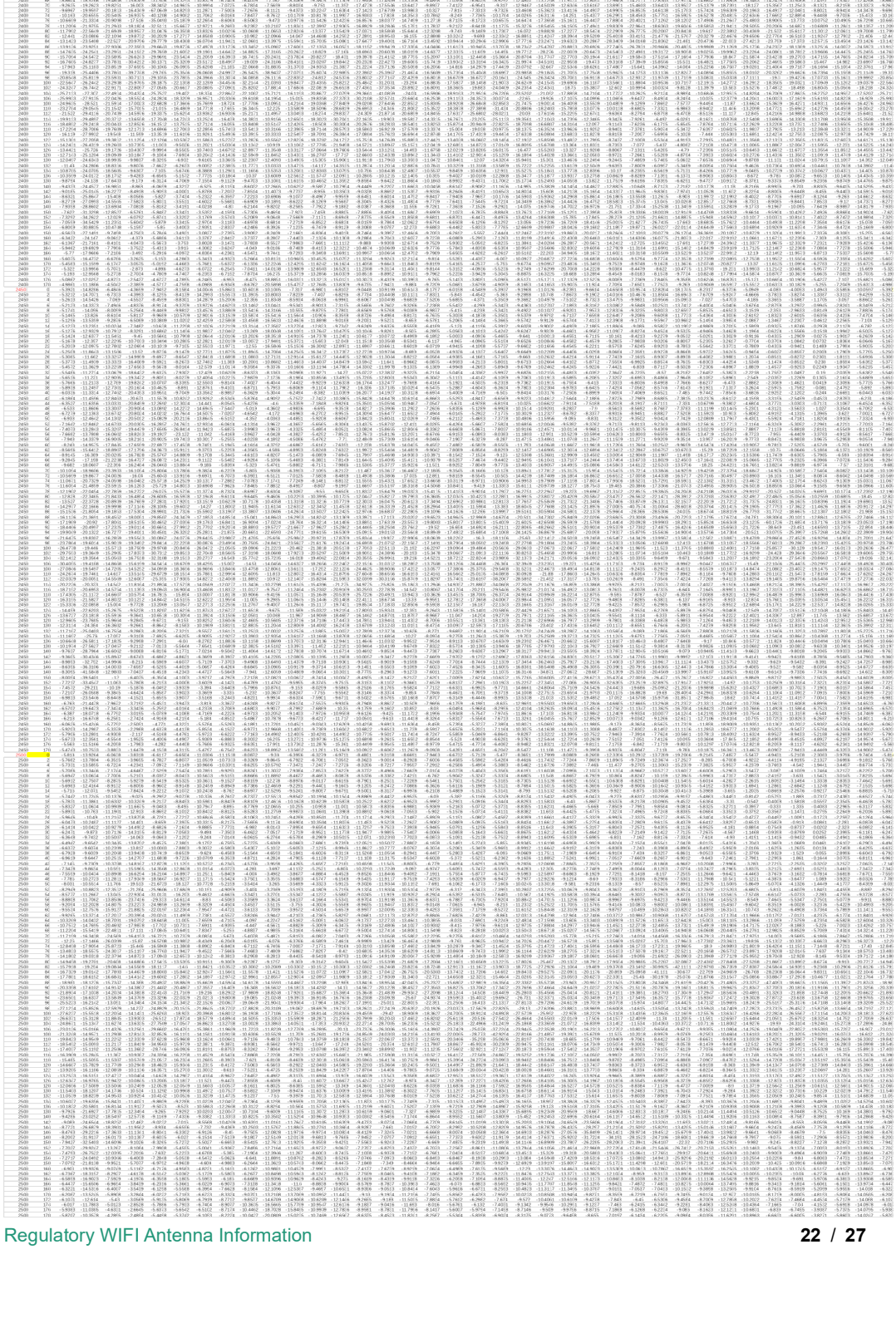
Ant. Position：2.4G Ant.3_GAIN PHI



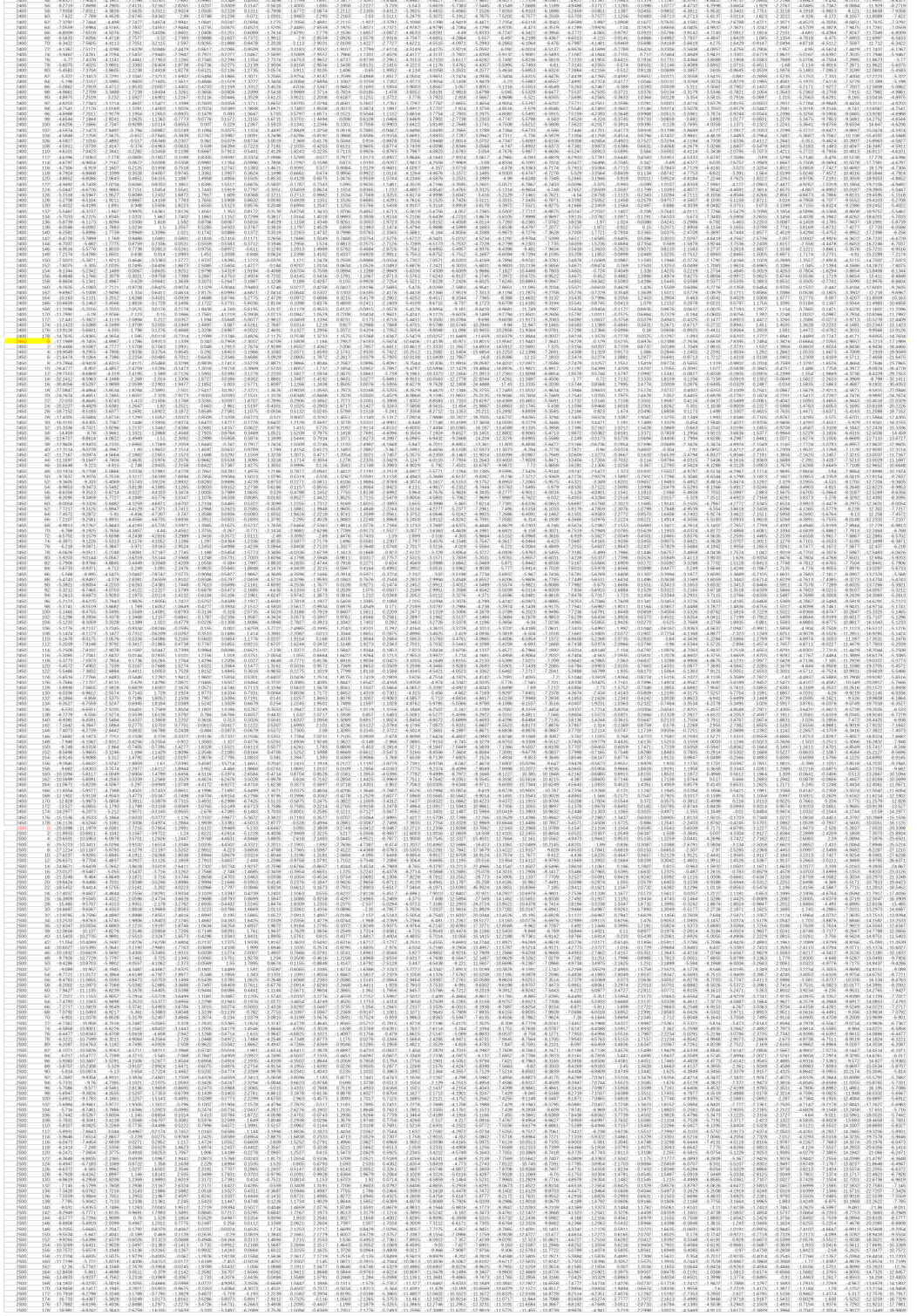
Ant. Position：2.4G Ant.3_GAIN THETA



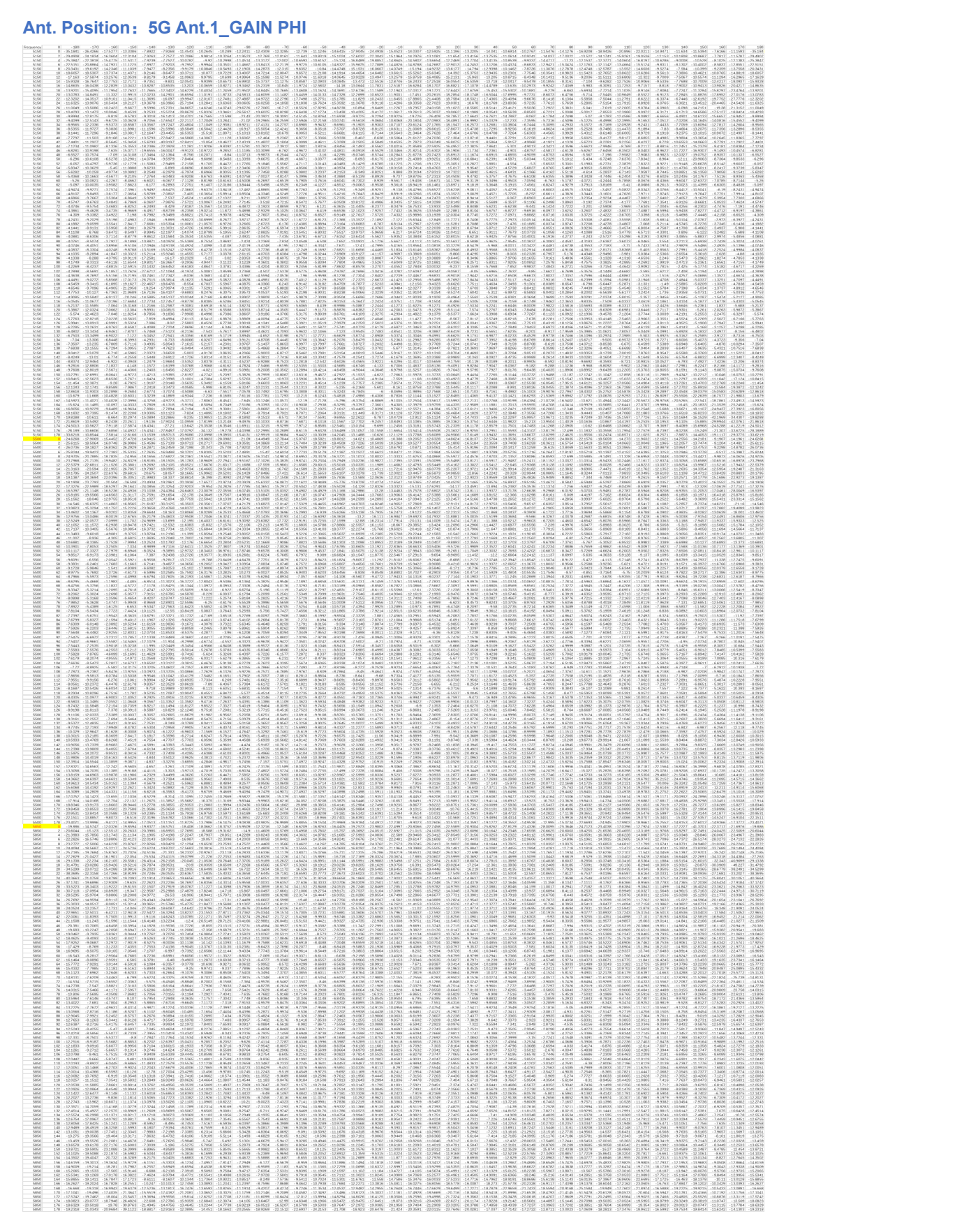
Ant. Position：2.4G Ant.4_GAIN PHI



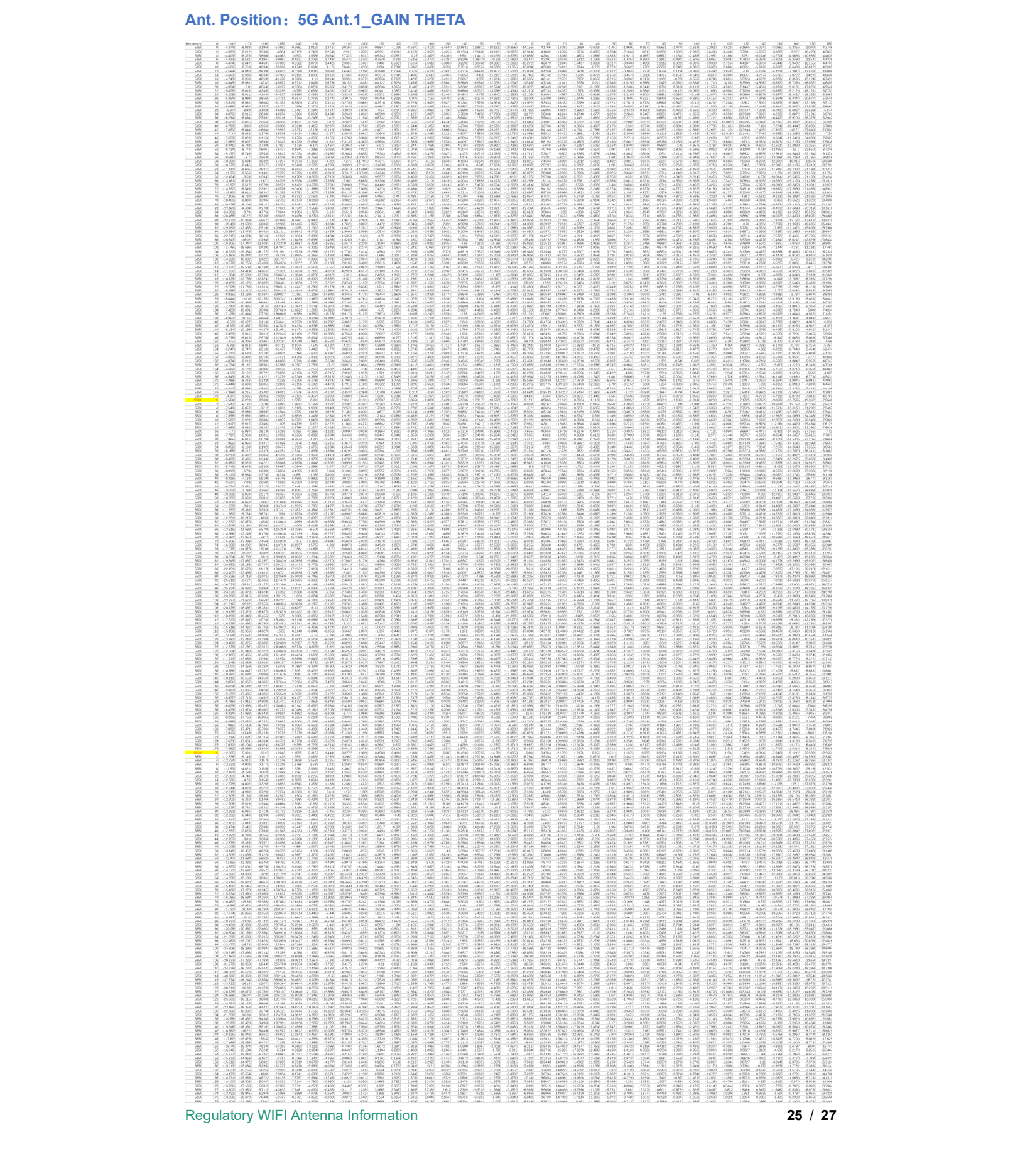
Ant. Position：2.4G Ant.4_GAIN THETA



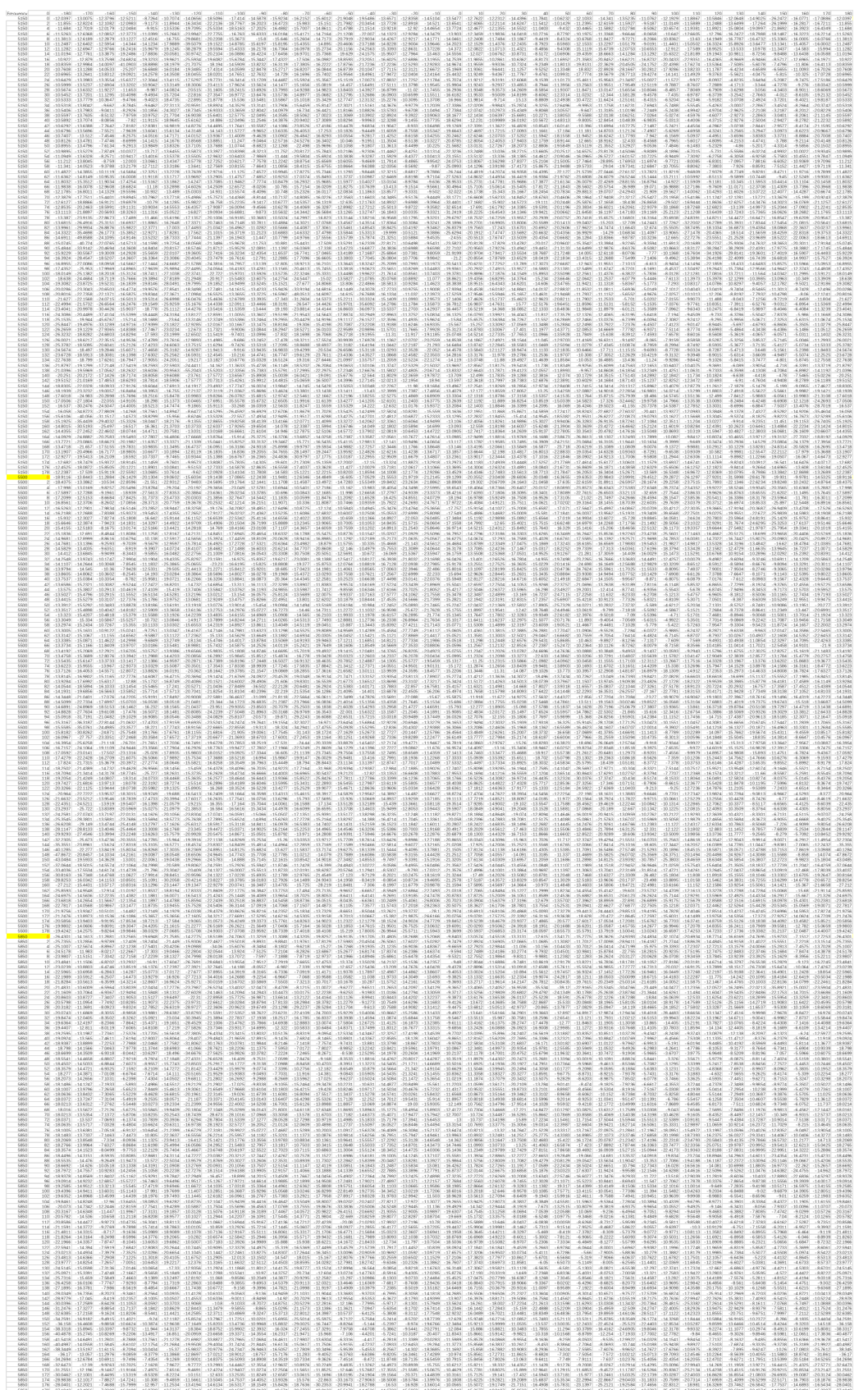
Ant. Position：5G Ant.1_GAIN PHI



Ant. Position：5G Ant.1_GAIN THETA



Ant. Position：5G Ant.2_GAIN PHI



Ant. Position：5G Ant.2_GAIN THETA