

# WF 660

Customer: 剑桥

Designer: 邵卫

Date: 2023/09/14



Professional, Stringent & Innovation  
**Antenna Manufacturer**  
for WiFi WiMAX & RFID

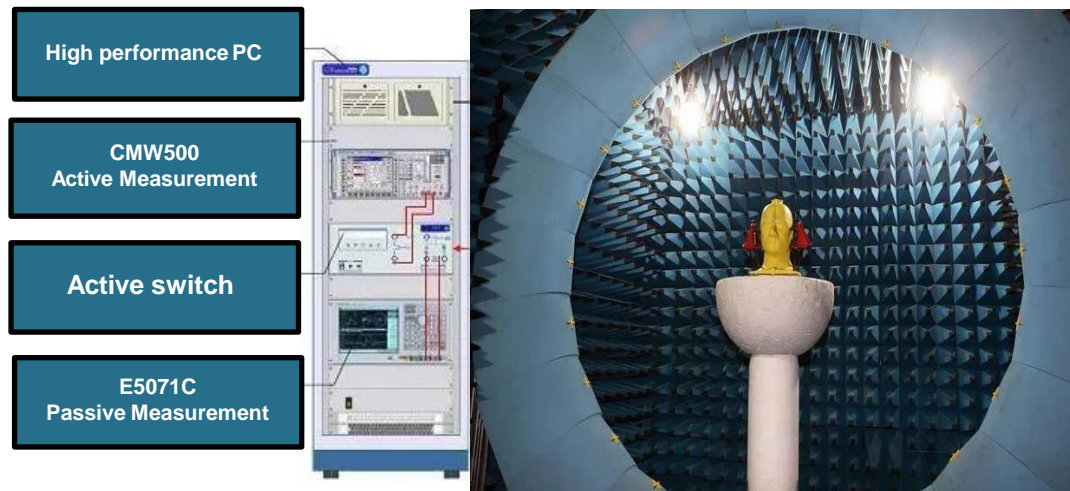


# OUTLINE

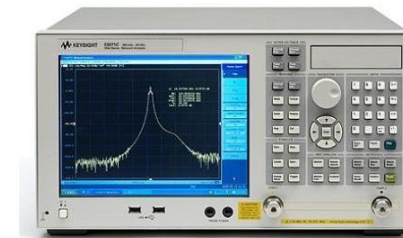
1. Benchmark
2. S-Parameters (VSWR&isolation)
3. Antenna Efficiency& Peak Gain
4. Radiation patterns
5. Summary

## JingHong 3D Chamber Structure

- EMT-24 Series System Components
- Chambers
- EMT Quest Software
- Positioning Systems
- Chamber Room Size: L\*W\*H=5\*5\*5M



VSWR were performed using a keysight S-parameter NetworkAnalyzer.



**E5071C**

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 15 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.

Test Condition	Test Engineer	Test Environment(° C/%)	Test Dste
Radiated	Lean.ni	20-24/45-60	07.17.2023
	Band(MHz)		Test Frequency(MHz)
	2400-2500		2400/2450/2500
	5150-5850		5150/5500/5850
Testing Location			
Galtronics	Shanghai,EM Testing		

Instrument	Manufacturer	Model NO.	Asset No	Cali.Interval	Cali.Due Date
ENA Network Analyzer	Keysight	E5071B	HLW-SC-19	1 Year	2024/2/27
RF Switch Box	EMT	NA	NA	NA	NA
EMT Chamber	EMT	EMT-24	HLW-SC-21	1 Year	2024/9/10
Horn Antenna	EMT	0.8-6GHz	NA	1Year	2024/9/10

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)

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

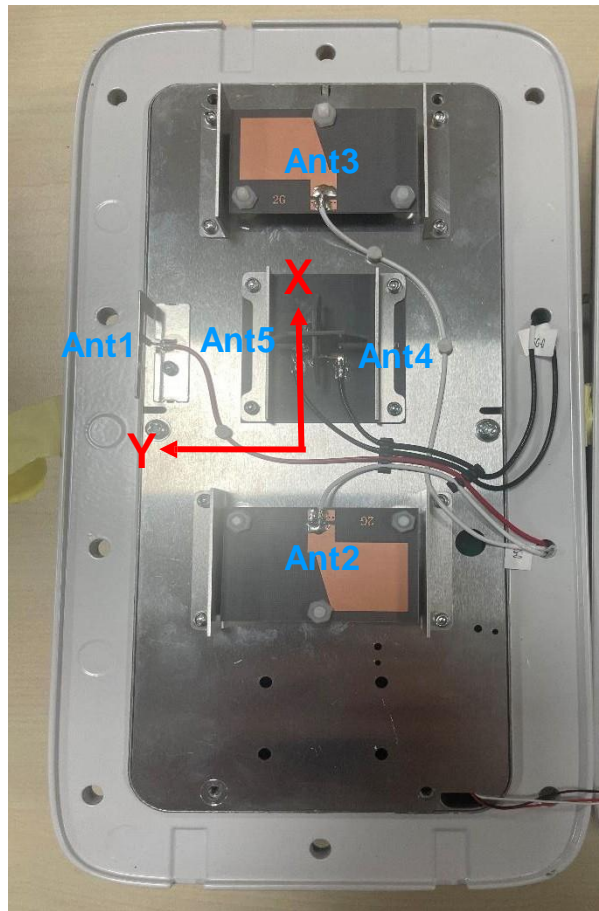
KDB 662911 D01, F(2)(d)(ii)

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

$N_{Ant.}$  : Number of antenna

$G_n$  : Gain of antenna

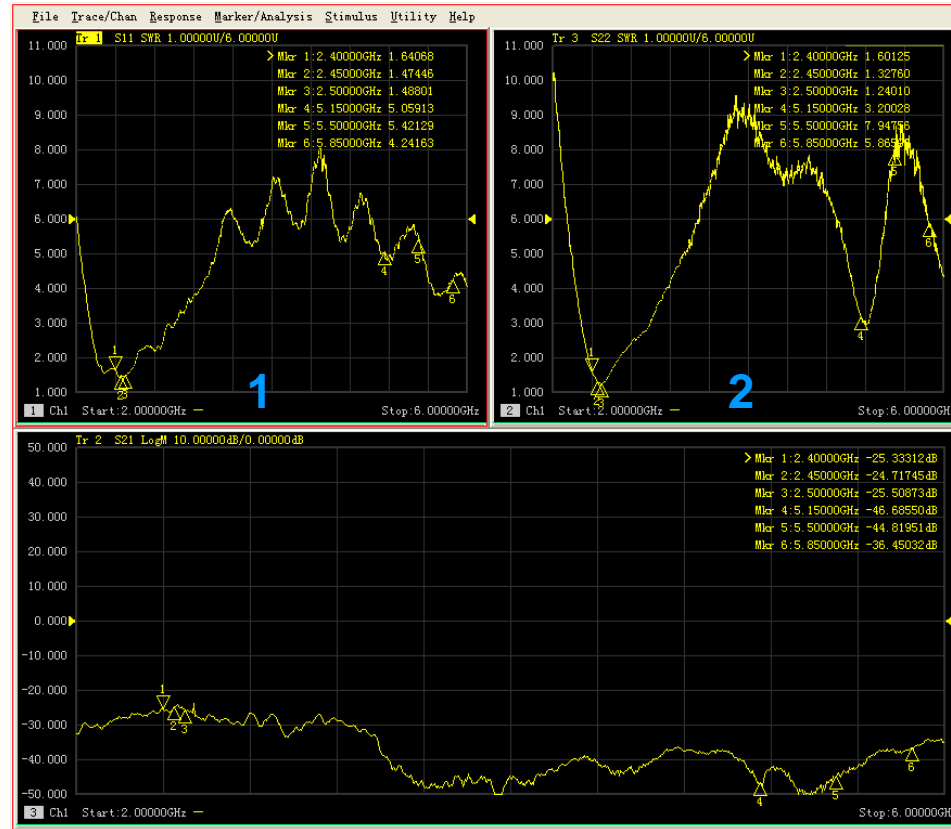
激活 Windows



Antenna Frequency(MHz)

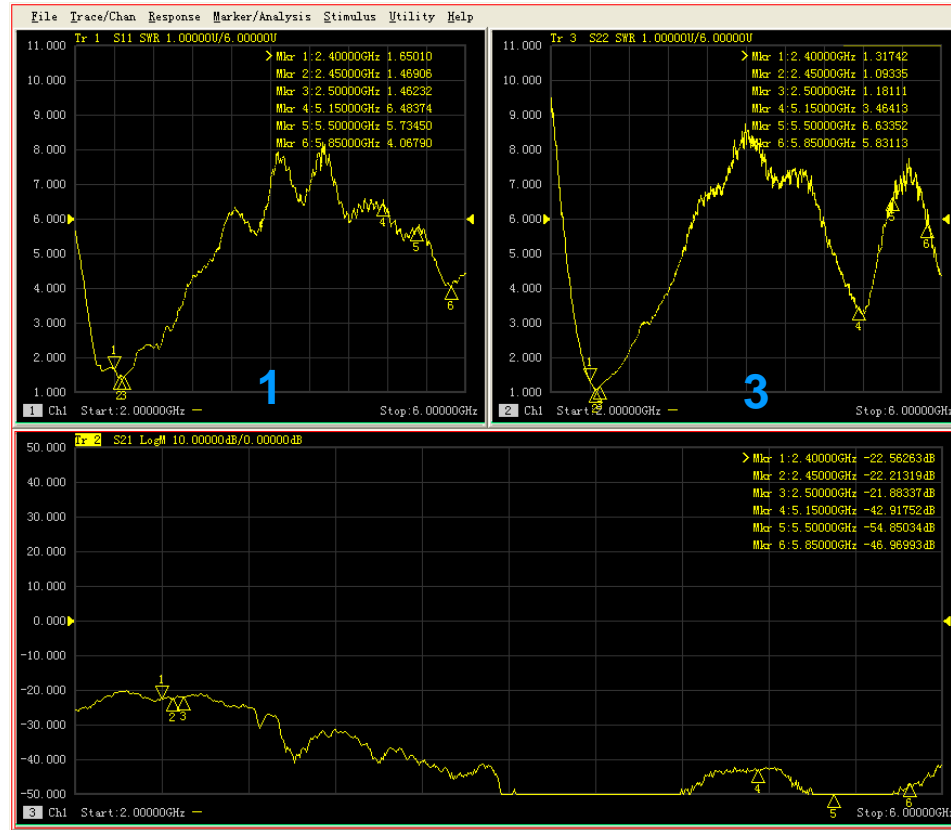
- Ant1: BLE 2400-2500MHz
- Ant2-3: wifi2.4G 2400-2500MHz
- Ant4-5: wifi5G 5150-5850MHz

## 2. S-Parameters(VSWR&isolation)

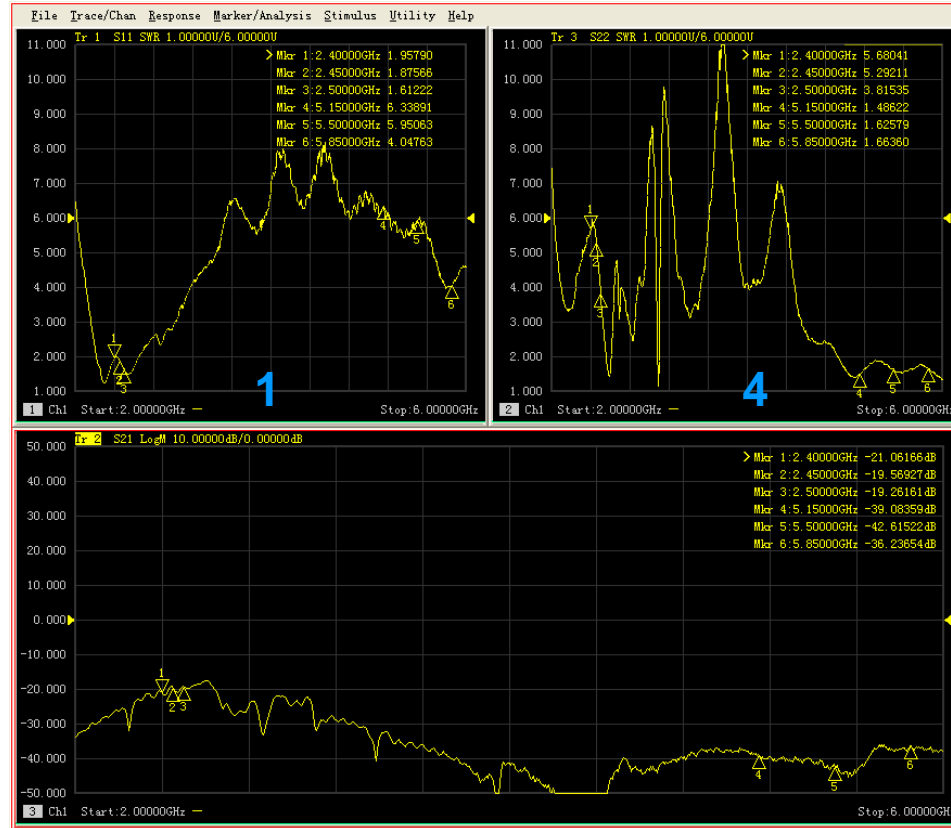




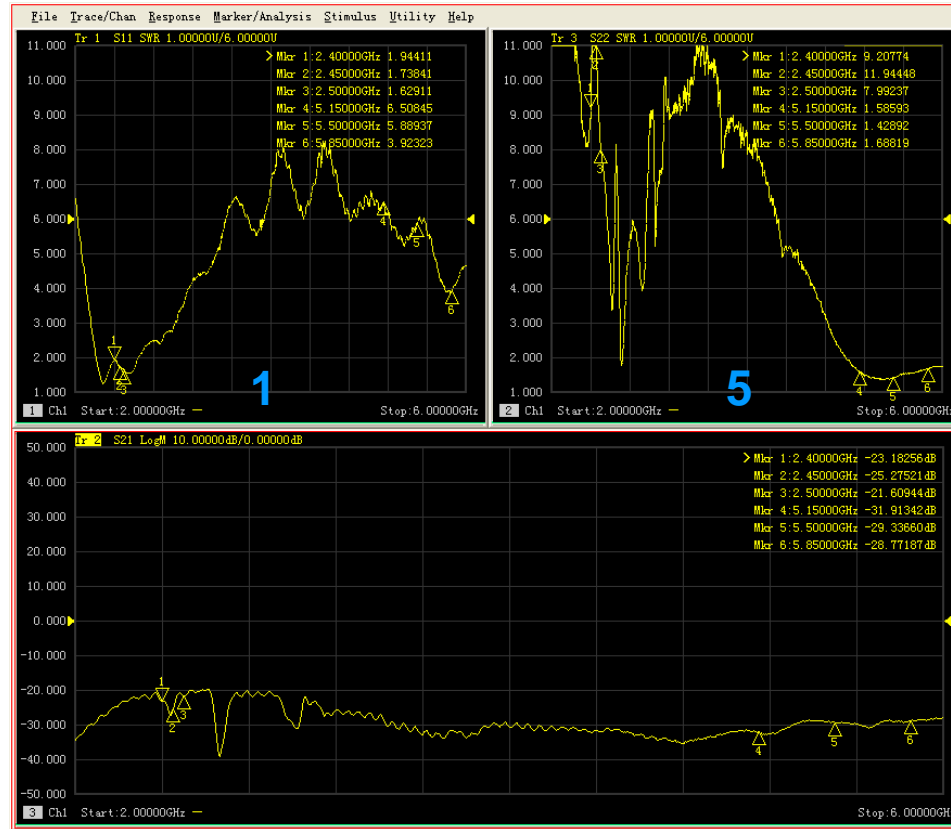
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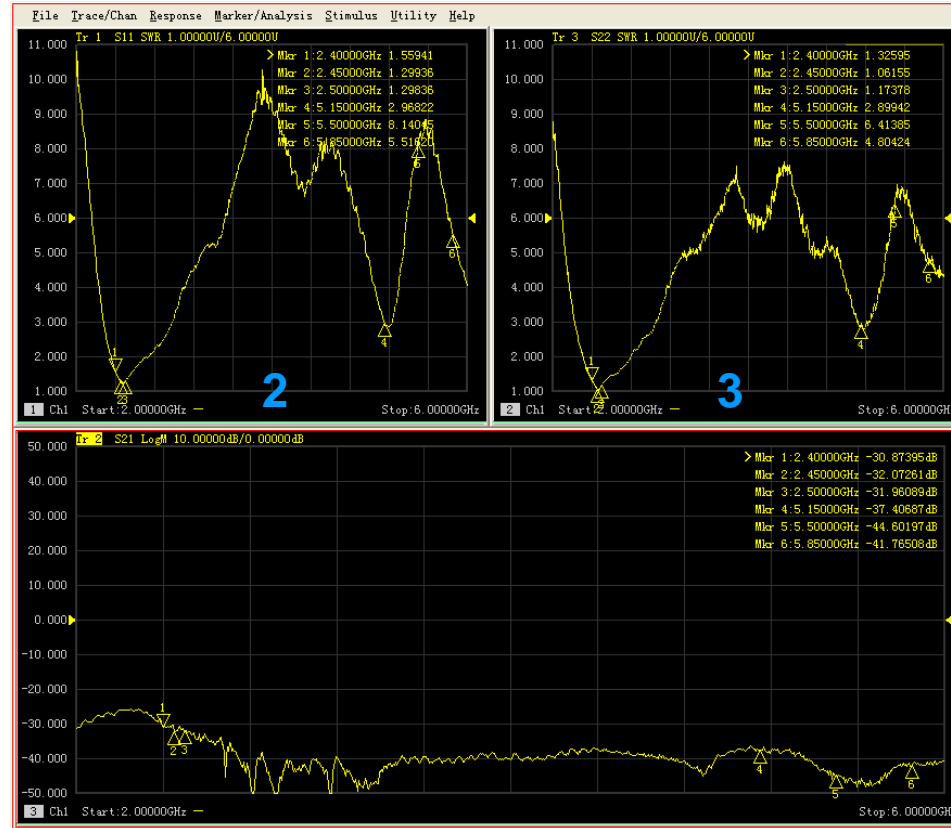
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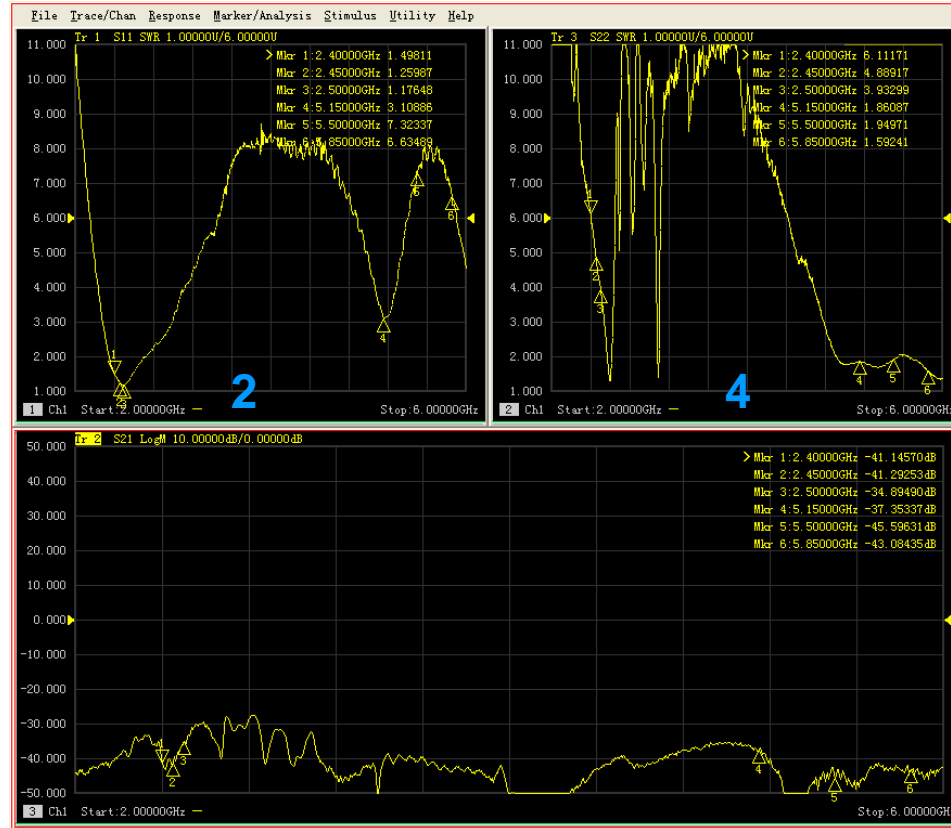
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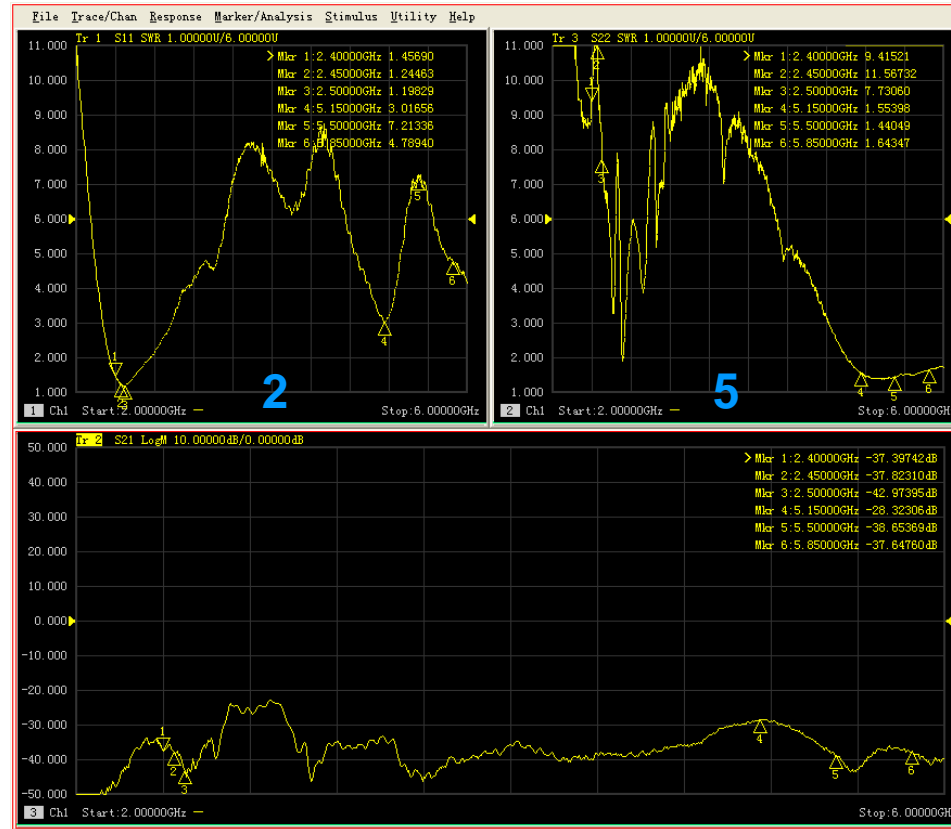
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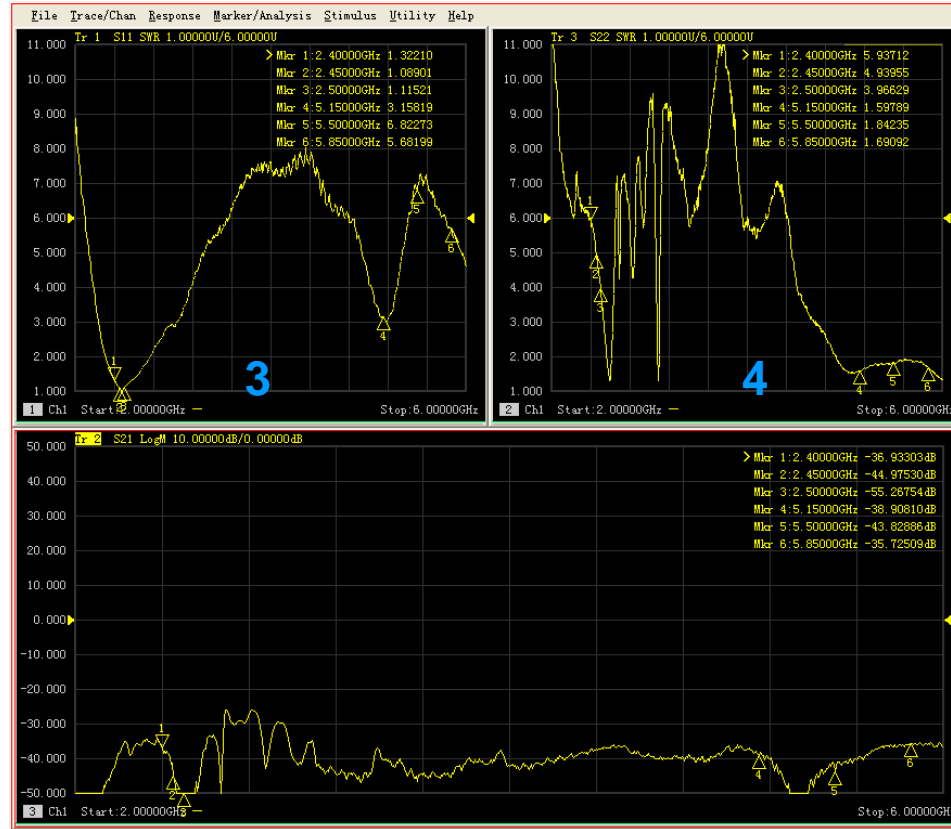
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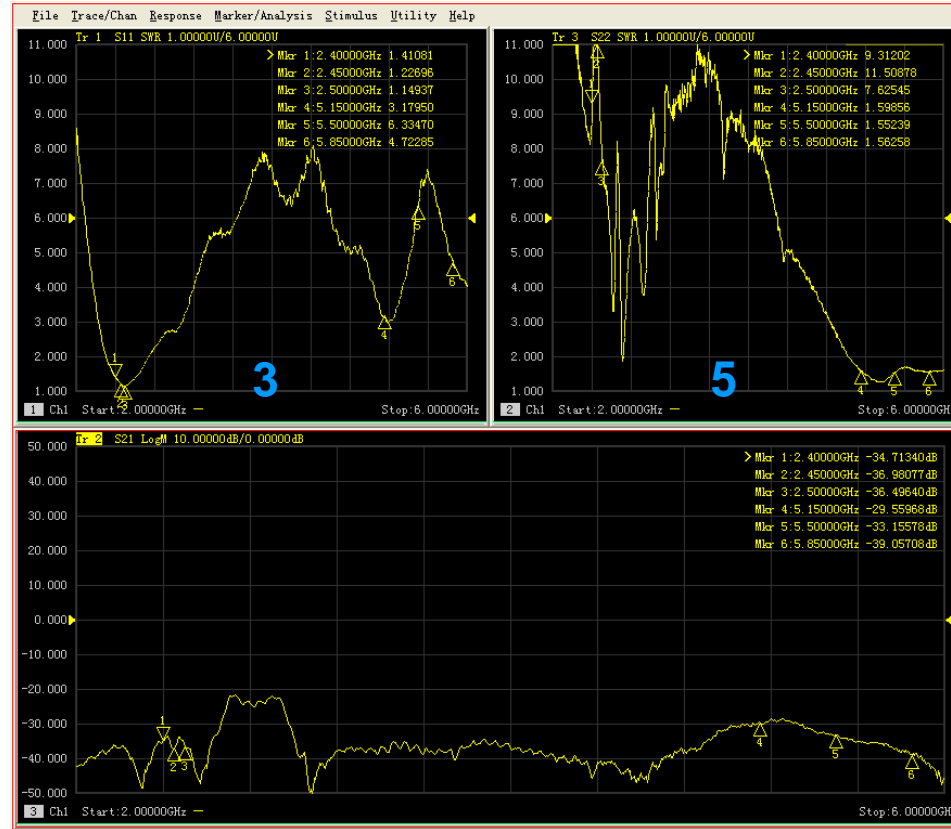
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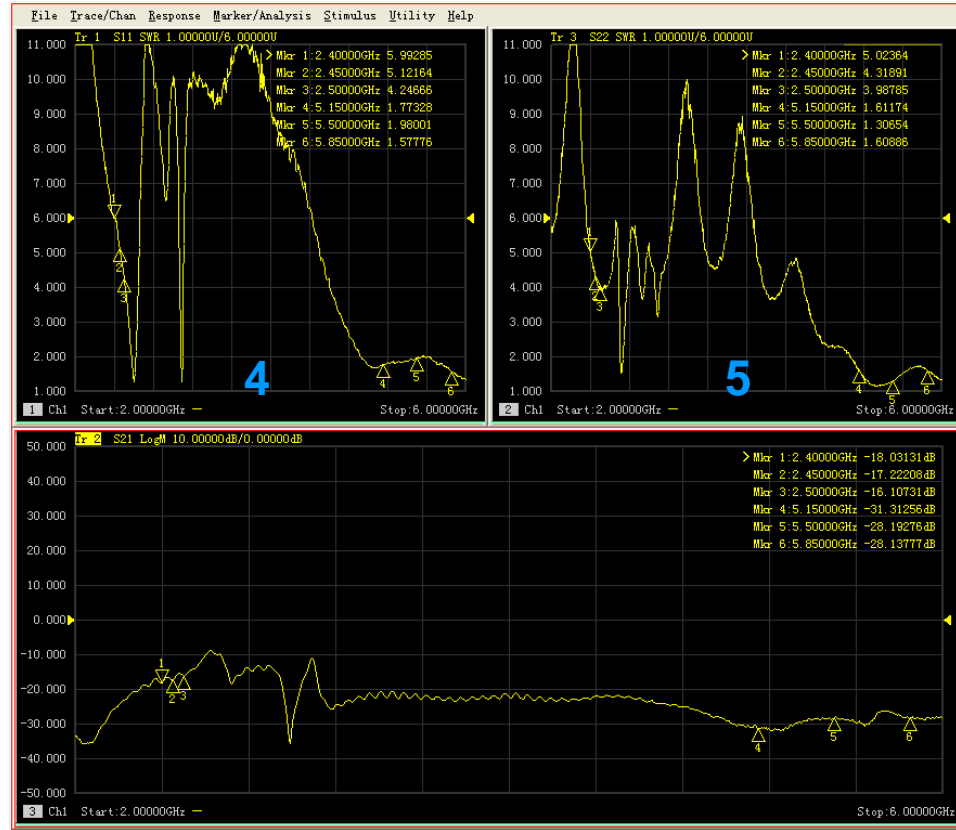


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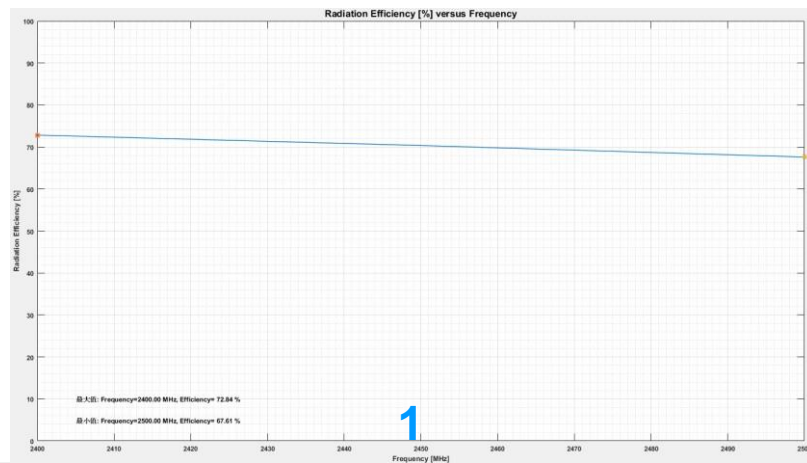




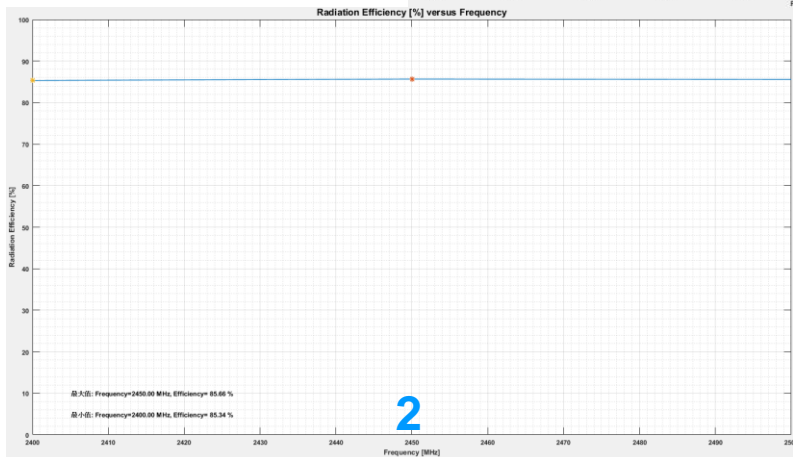
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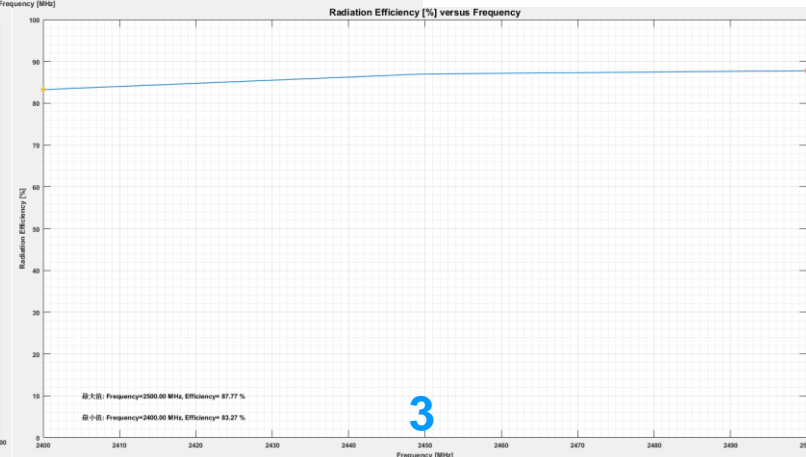
# 3. Antenna Efficiency(2G)



1

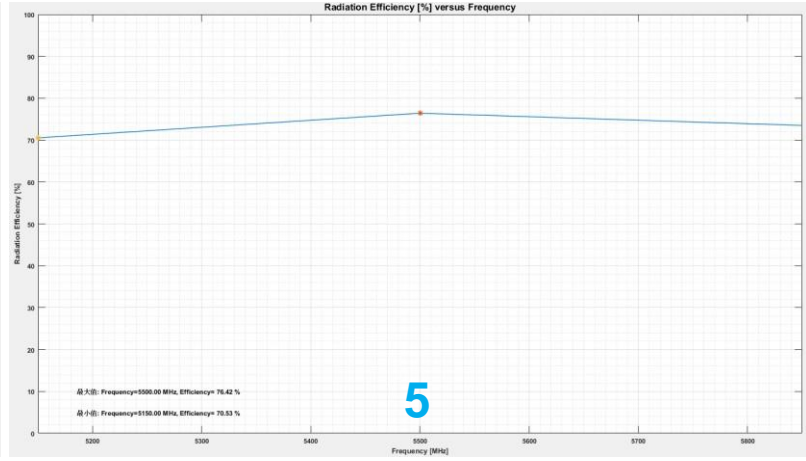
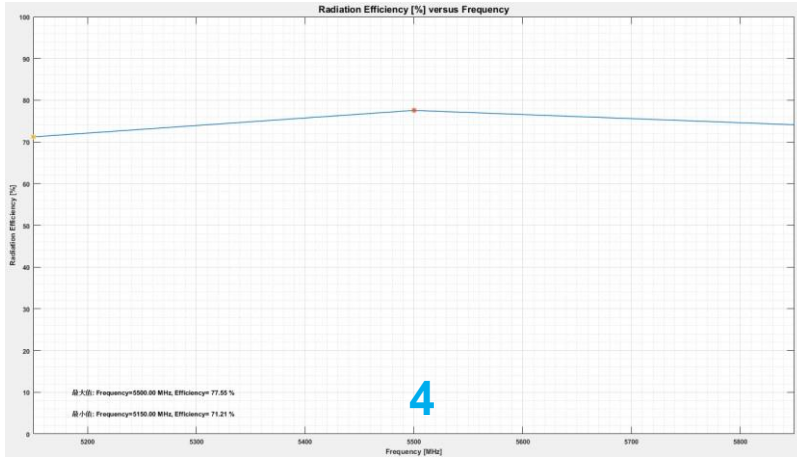


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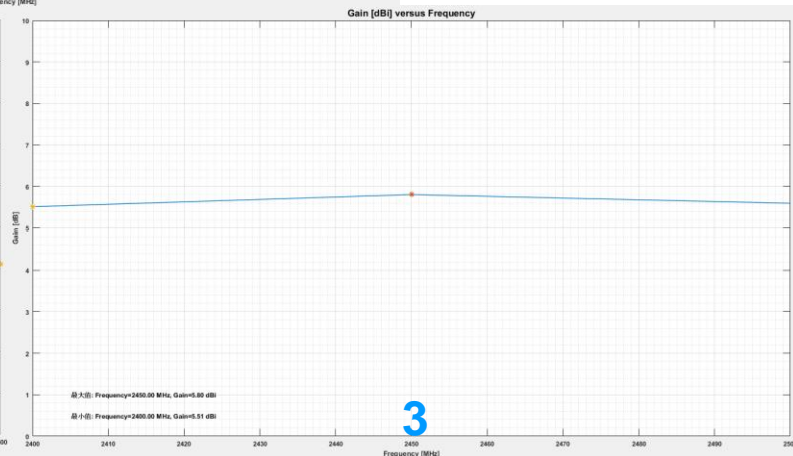
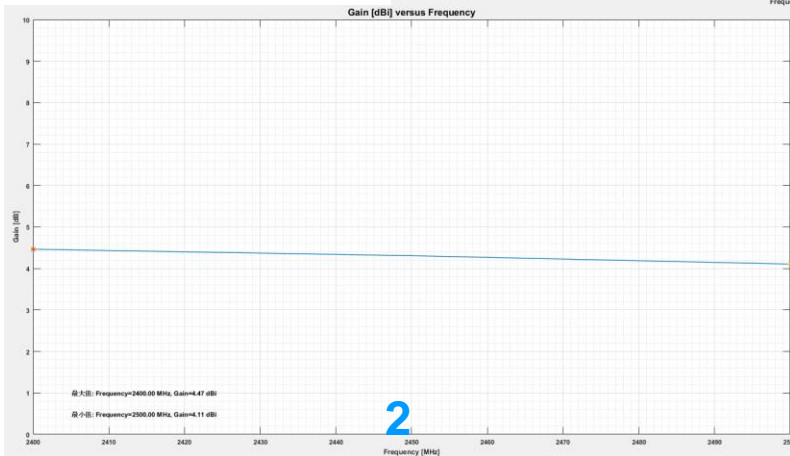
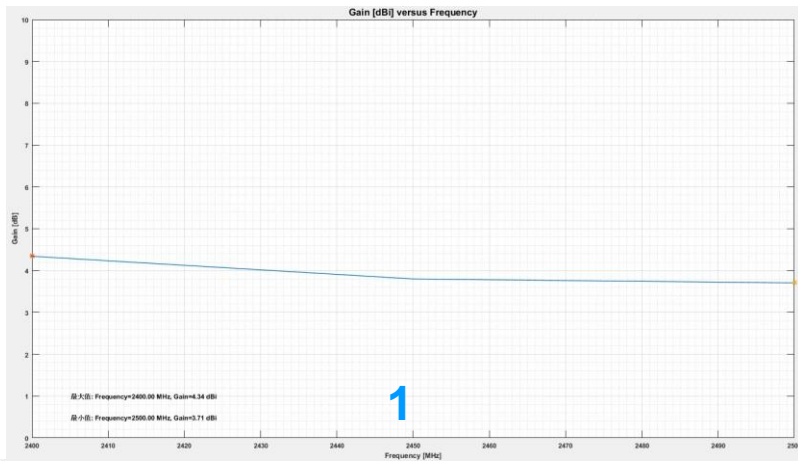


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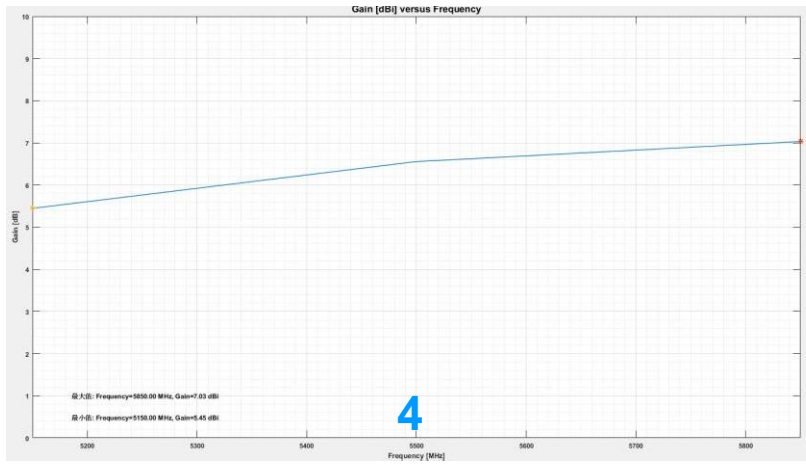
# 3. Antenna Efficiency(5G)



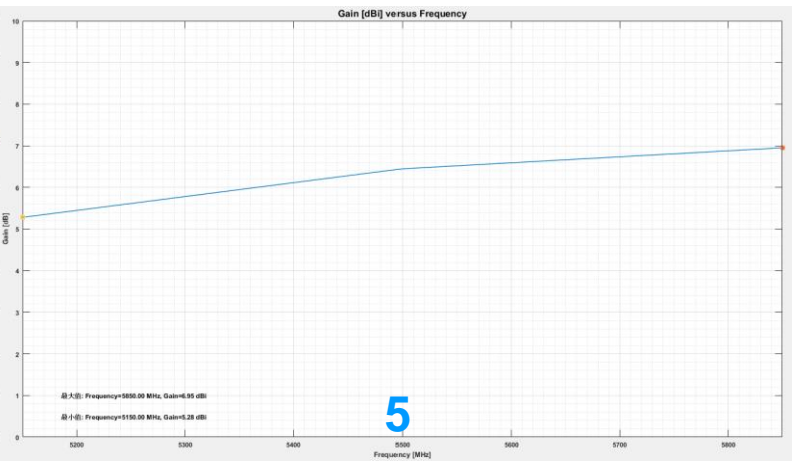
### 3. Peak Gain(2G)



# 3. Peak Gain(5G)

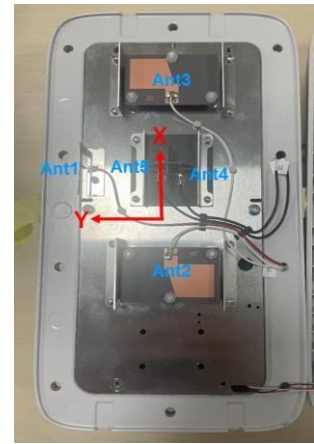
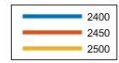
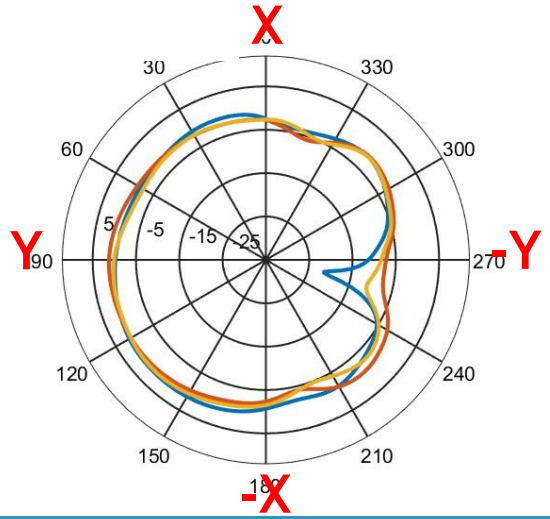
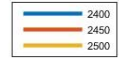
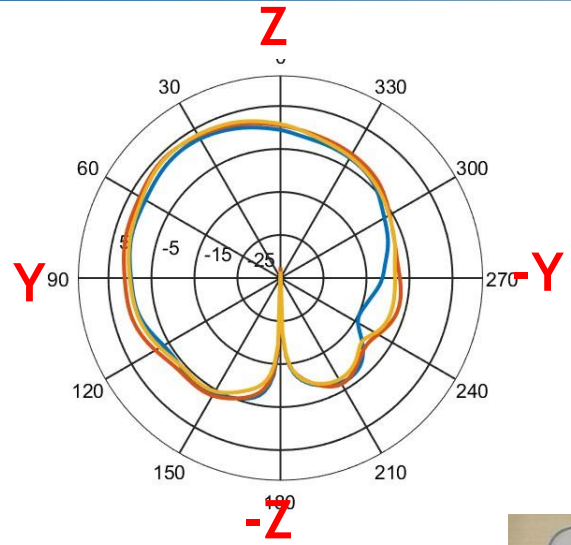
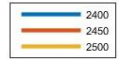
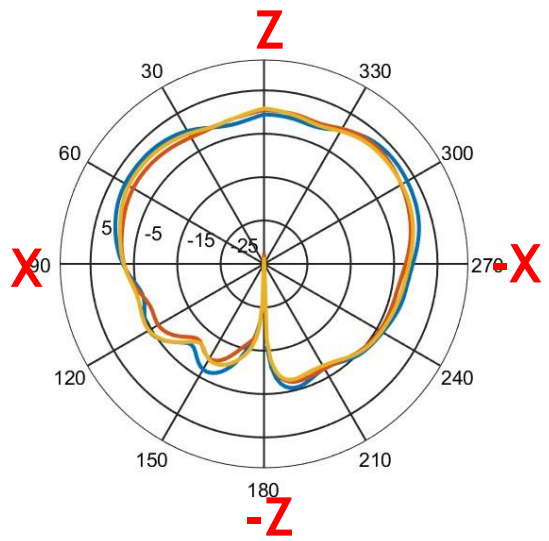


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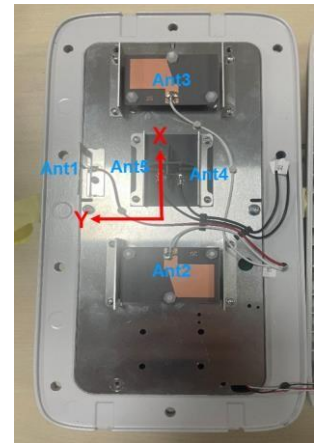
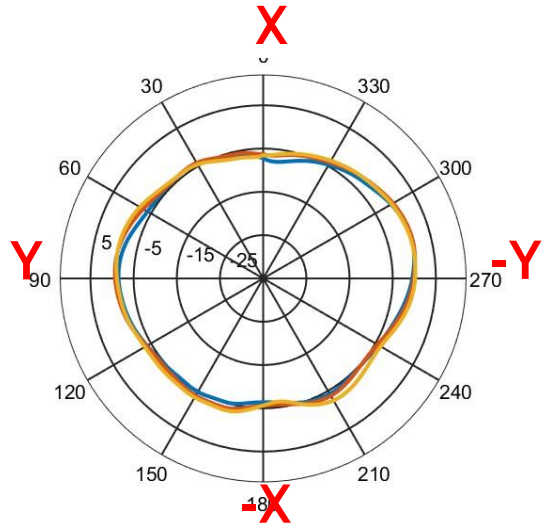
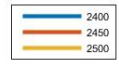
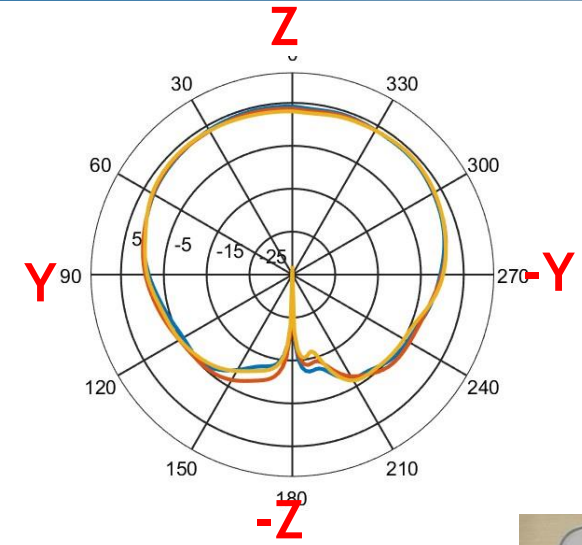
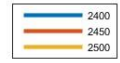
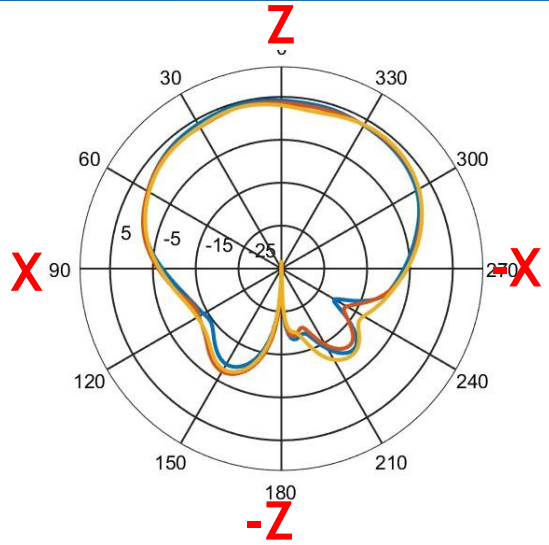


5

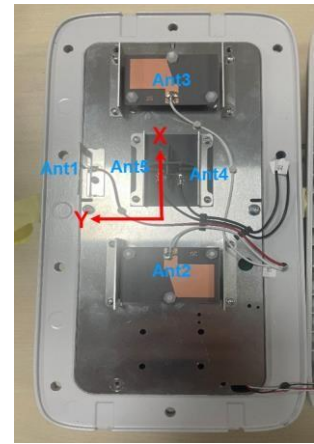
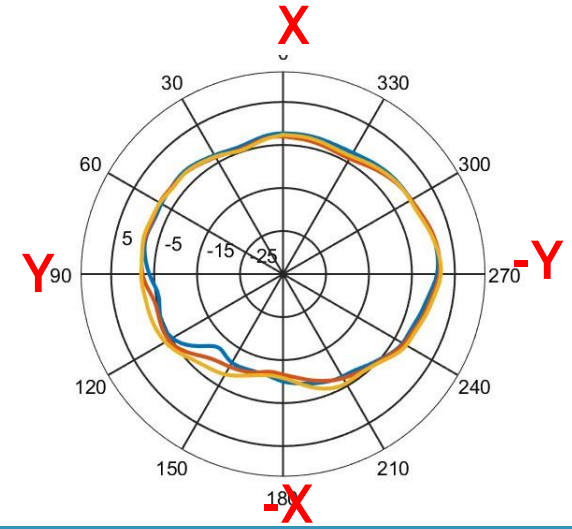
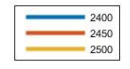
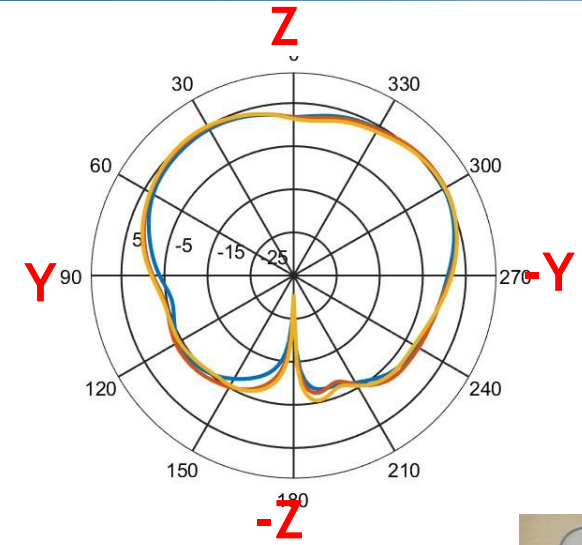
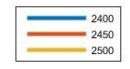
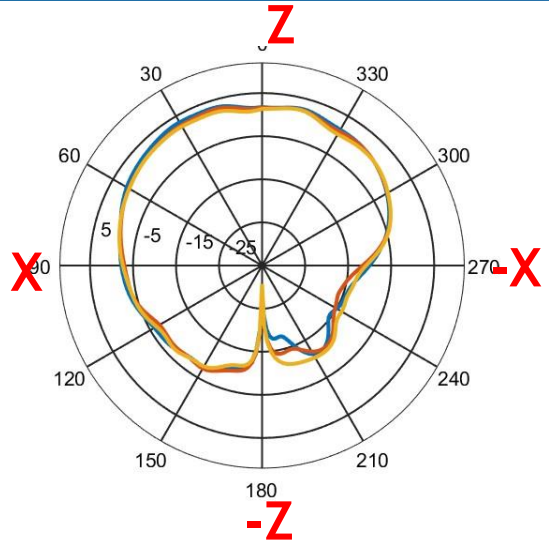
# 4. Radiation patterns (1-2G)



# 4. Radiation patterns (2-2G)

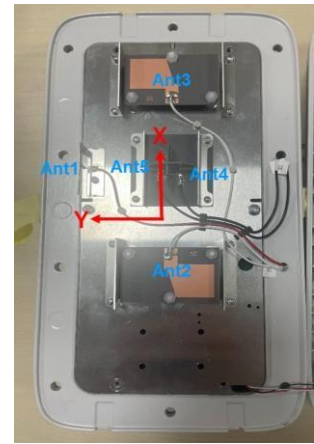
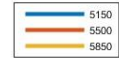
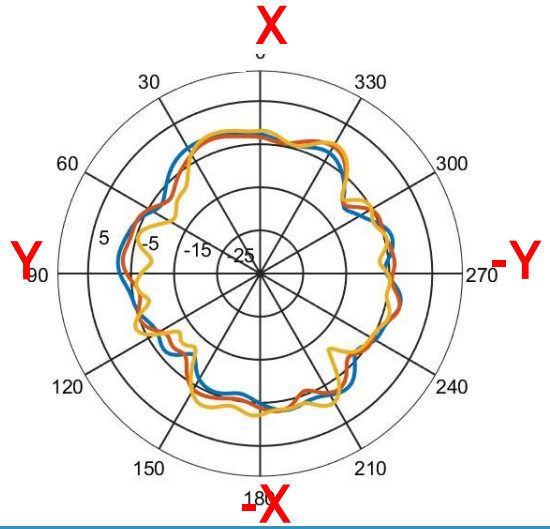
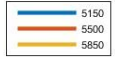
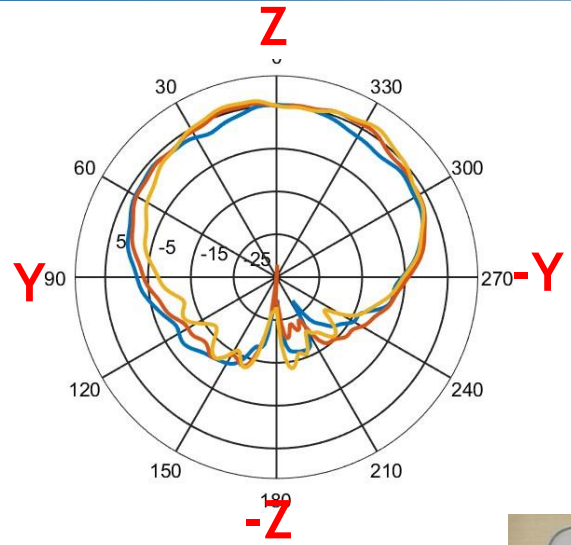
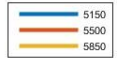
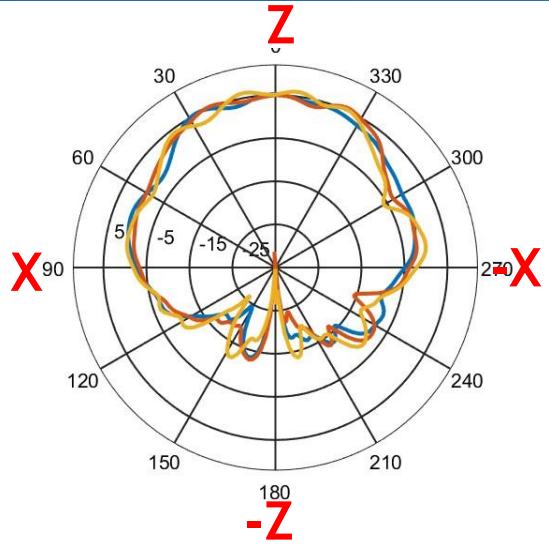


# 4. Radiation patterns (3-2G)

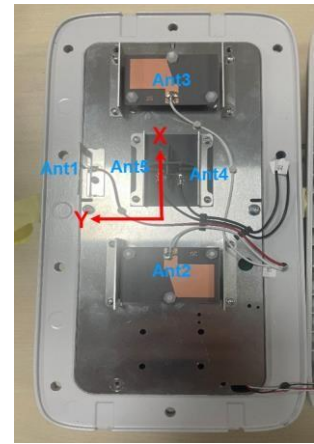
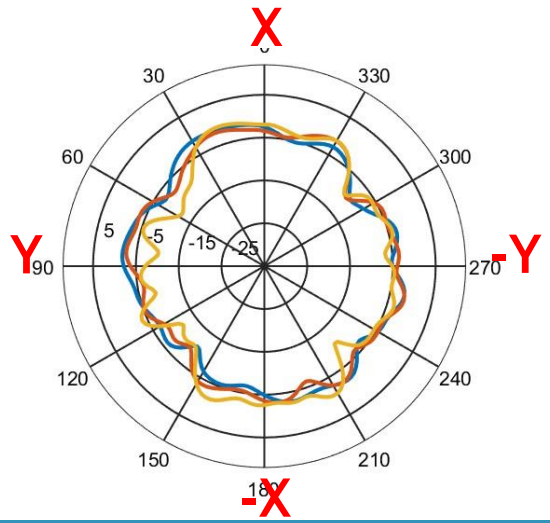
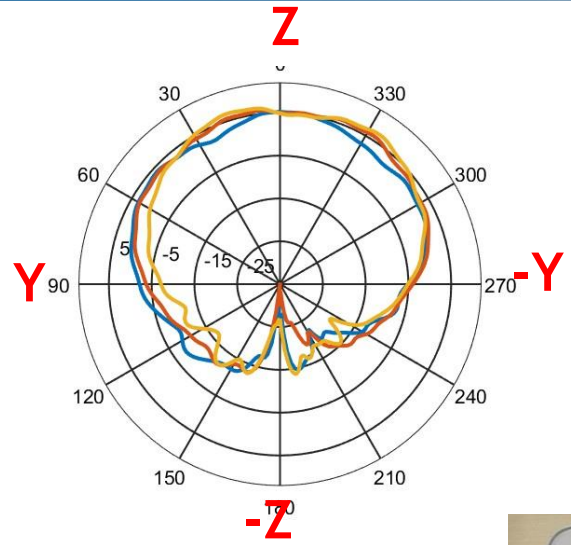
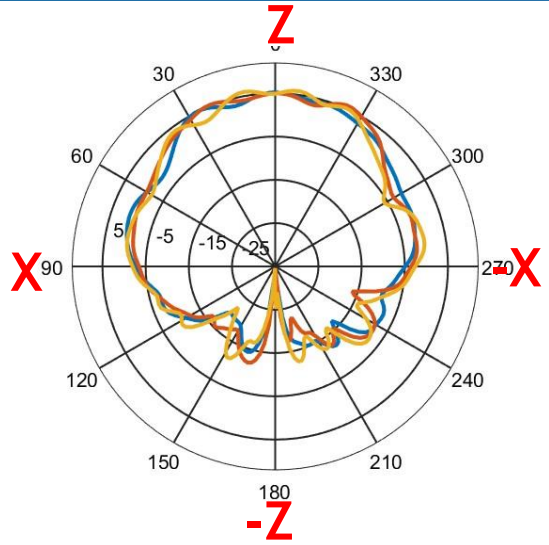




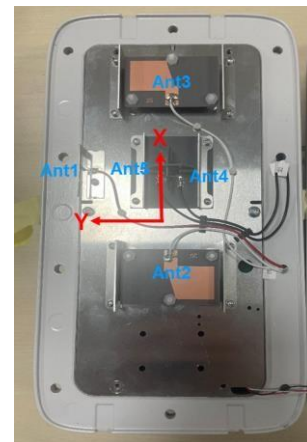
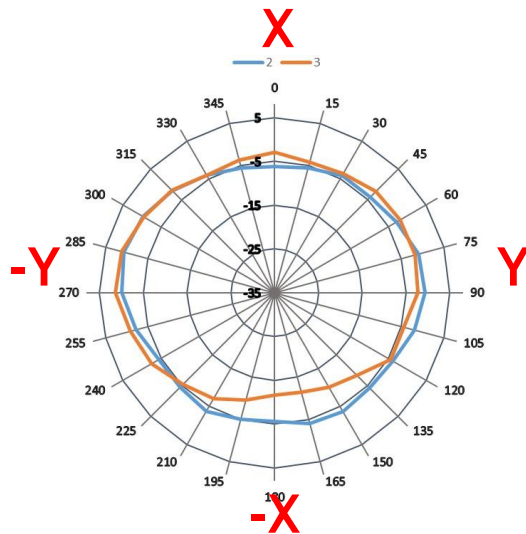
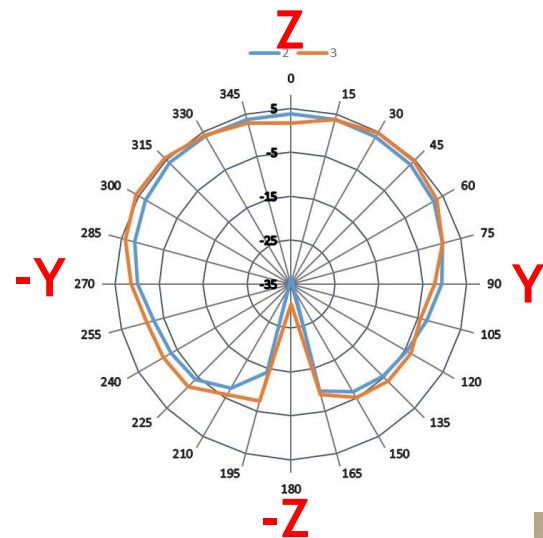
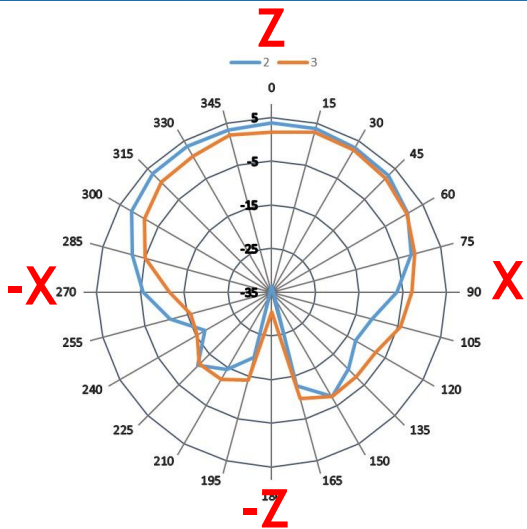
# 4. Radiation patterns (4-5G)



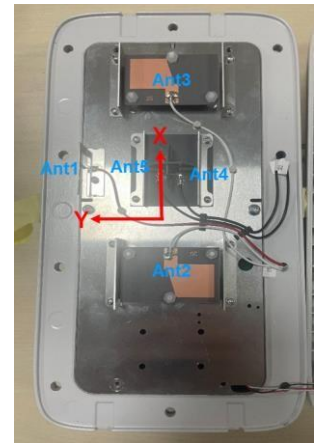
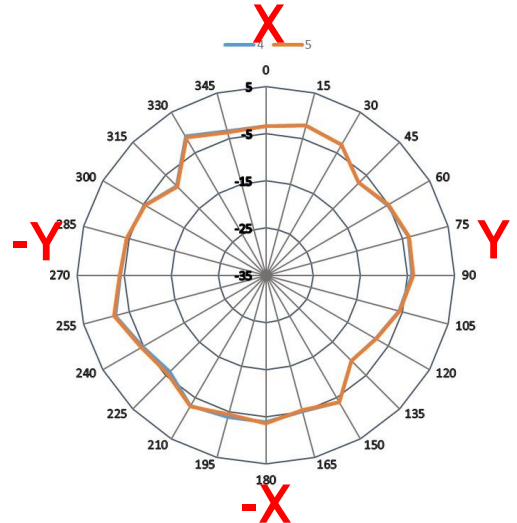
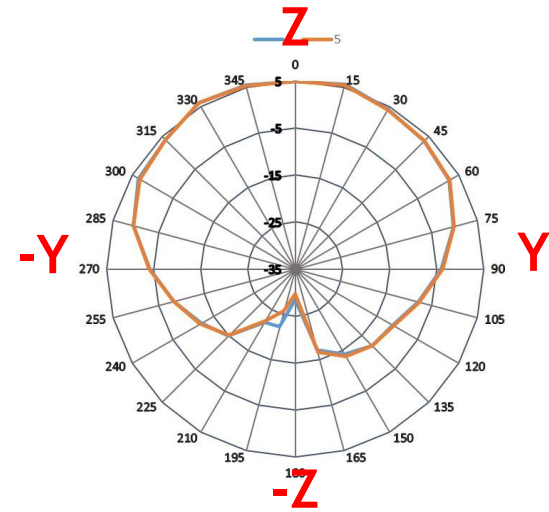
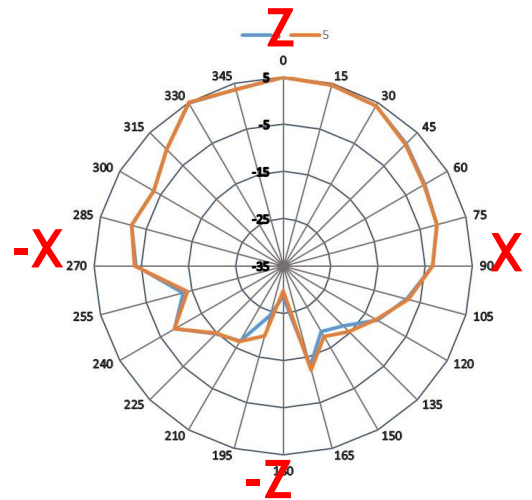
# 4. Radiation patterns (5-5G)



# 4. Radiation patterns (2&3 system coverage 2.45GHz)



# 4. Radiation patterns (4&5 system coverage 5.5GHz )



## 5. Summary

### 1.The measurements are as follows:

	2G					
Frequency(MHz)	Gain(dBi)			Efficiency(%)		
	1	2	3	1	2	3
2400	4.34	4.47	5.51	72.84	83.27	85.34
2450	3.80	4.31	5.80	70.37	87.00	85.66
2500	3.71	4.11	5.59	67.61	87.77	85.56

	5G			
Frequency(MHz)	Gain(dBi)		Efficiency(%)	
	4	5	4	5
5150	5.45	5.28	71.21	70.53
5500	6.56	6.45	77.55	76.42
5850	7.03	7.34	74.11	73.50

## 5. Summary

1.The measurements are as follows:

Frequency (MHz) <sup>5</sup>	Degree		Gain(dBi)		Correlated Gain(dBi)	Uncorrelated Gain(dBi)
	Theta(°)	Phi(°)	2	3		
2400	98	-48	4.10	5.39	7.78	4.79
2450	92	-48	4.07	5.67	7.92	4.95
2500	88	-52	3.87	5.49	7.73	4.75

Frequency (MHz)	Degree		Gain(dBi)		Correlated Gain(dBi)	Uncorrelated Gain(dBi)
	Theta(°)	Phi(°)	4	5		
5150	108	-6	5.32	5.28	8.31	5.30
5500	28	-28	6.56	6.41	9.49	6.48
5850	88	-34	7.03	7.34	10.00	6.99

## 5. Summary



1.The measurements are as follows:

	Frequency (MHz)	2400	2450	2500	5150	5500	5850
Ant1	FUSLL (dB)	0.73	-1.09	0.23			
Ant2		3.86	3.02	3.13			
Ant3		3.36	2.59	2.24			
Ant4					4.98	4.25	4.04
Ant5					4.52	4.17	3.92

**Tips:** FUSLL此处表示仰角大于30° 的最大增益

## 5. Summary

1.The measurements are as follows:

Frequency (MHz) <sup>5</sup>	Degree		Gain(dBi)		Correlated Gain(dBi)	Uncorrelated Gain(dBi)
	Theta(°)	Phi(°)	2	3		
2400	35	65	3.86	3.36	6.62	3.61
2450	32	67	3.02	2.59	5.81	2.81
2500	31	59	3.13	2.24	5.70	2.70

Frequency (MHz)	Degree		Gain(dBi)		Correlated Gain(dBi)	Uncorrelated Gain(dBi)
	Theta(°)	Phi(°)	4	5		
5150	38	72	4.34	3.78	7.07	4.07
5500	42	75	3.97	3.87	6.93	3.92
5850	41	82	3.74	3.81	6.78	3.77

**Tips:** 此处相关性增益和非相关性增益为仰角30° ----90° 的值



# 6. Ant data(Ant1 –BLE 2400MHz)



f=2400MHz E\_total

Phi(deg)	Theta(deg)																								
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180
0	-39.71	-7.97	-5.00	-5.27	-3.07	-2.09	-0.70	0.20	0.95	1.37	0.63	-1.97	-3.91	-4.24	-4.80	-5.43	-6.91	-11.72	-10.12	-7.54	-7.60	-9.11	-9.65	-14.39	-39.71
15	-39.71	-8.45	-5.21	-5.72	-5.02	-4.91	-3.15	-1.74	-1.71	-1.67	-2.17	-3.35	-3.91	-3.85	-5.20	-8.14	-12.60	-12.29	-9.96	-8.33	-10.67	-11.80	-10.61	-15.68	-39.71
30	-39.71	-9.20	-5.56	-4.55	-3.97	-4.21	-3.79	-2.11	-2.22	-3.24	-4.26	-4.35	-3.91	-3.49	-4.65	-4.85	-4.54	-5.14	-5.71	-6.79	-8.92	-14.08	-12.92	-16.38	-39.71
45	-39.71	-10.88	-7.55	-5.36	-3.16	-2.60	-1.95	-1.37	-1.90	-3.61	-5.07	-4.89	-3.91	-2.95	-3.28	-1.91	-0.59	-1.30	-3.11	-6.58	-9.27	-7.28	-9.72	-16.69	-39.71
60	-39.71	-13.35	-11.43	-9.72	-6.56	-5.57	-2.99	-1.84	-1.81	-3.32	-4.78	-4.94	-3.91	-2.36	-2.10	-1.65	-1.45	-2.56	-3.78	-5.83	-11.04	-7.42	-9.25	-16.18	-39.71
75	-39.71	-16.36	-14.39	-11.57	-9.96	-6.92	-4.32	-2.67	-2.06	-3.71	-4.84	-4.96	-3.91	-1.62	-0.54	-0.49	-1.76	-5.16	-8.28	-11.06	-10.56	-10.29	-11.00	-14.58	-39.71
90	-39.71	-15.70	-9.83	-7.49	-9.07	-6.28	-3.62	-2.22	-1.33	-3.24	-5.54	-5.18	-3.91	-0.97	0.86	0.99	-0.29	-2.75	-5.15	-7.93	-8.97	-12.58	-10.72	-12.89	-39.71
105	-39.71	-12.92	-7.24	-6.01	-7.37	-5.88	-2.89	-1.10	-0.08	-2.31	-6.68	-5.59	-3.91	-0.35	2.09	2.05	0.56	-2.21	-4.52	-5.84	-5.91	-8.53	-7.38	-11.12	-39.71
120	-39.71	-11.35	-7.40	-7.32	-5.48	-2.66	-0.58	0.36	0.37	-2.33	-7.08	-5.81	-3.91	0.01	2.85	2.66	1.31	-1.12	-3.25	-4.91	-4.81	-6.09	-5.09	-9.77	-39.71
135	-39.71	-10.85	-9.23	-7.05	-5.63	-2.98	-1.00	-0.47	-0.17	-2.27	-5.98	-5.67	-3.91	0.11	3.37	3.32	2.24	0.40	-1.24	-2.73	-4.22	-4.99	-3.79	-8.54	-39.71
150	-39.71	-11.43	-13.42	-6.55	-4.42	-3.63	-2.77	-1.72	-0.45	-1.89	-4.86	-5.24	-3.91	-0.16	3.36	3.86	3.28	1.82	0.47	-0.99	-3.67	-4.58	-3.58	-7.91	-39.71
165	-39.71	-12.92	-14.67	-12.25	-8.64	-7.92	-6.94	-4.54	-2.22	-2.90	-4.48	-4.66	-3.91	-0.93	2.44	3.42	3.25	2.18	1.02	-0.43	-2.61	-4.44	-4.22	-7.75	-39.71

# 6. Ant data(Ant1 –BLE 2450MHz)



f=2450MHz E\_total

Phi(deg)	Theta(deg)																								
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180
0	-39.71	-7.97	-5.00	-5.27	-3.07	-2.09	-0.70	0.20	0.95	1.37	0.63	-1.97	-3.91	-4.24	-4.80	-5.43	-6.91	-11.72	-10.12	-7.54	-7.60	-9.11	-9.65	-14.39	-39.71
15	-39.71	-8.45	-5.21	-5.72	-5.02	-4.91	-3.15	-1.74	-1.71	-1.67	-2.17	-3.35	-3.91	-3.85	-5.20	-8.14	-12.60	-12.29	-9.96	-8.33	-10.67	-11.80	-10.61	-15.68	-39.71
30	-39.71	-9.20	-5.56	-4.55	-3.97	-4.21	-3.79	-2.11	-2.22	-3.24	-4.26	-4.35	-3.91	-3.49	-4.65	-4.85	-4.54	-5.14	-5.71	-6.79	-8.92	-14.08	-12.92	-16.38	-39.71
45	-39.71	-10.88	-7.55	-5.36	-3.16	-2.60	-1.95	-1.37	-1.90	-3.61	-5.07	-4.89	-3.91	-2.95	-3.28	-1.91	-0.59	-1.30	-3.11	-6.58	-9.27	-7.28	-9.72	-16.69	-39.71
60	-39.71	-13.35	-11.43	-9.72	-6.56	-5.57	-2.99	-1.84	-1.81	-3.32	-4.78	-4.94	-3.91	-2.36	-2.10	-1.65	-1.45	-2.56	-3.78	-5.83	-11.04	-7.42	-9.25	-16.18	-39.71
75	-39.71	-16.36	-14.39	-11.57	-9.96	-6.92	-4.32	-2.67	-2.06	-3.71	-4.84	-4.96	-3.91	-1.62	-0.54	-0.49	-1.76	-5.16	-8.28	-11.06	-10.56	-10.29	-11.00	-14.58	-39.71
90	-39.71	-15.70	-9.83	-7.49	-9.07	-6.28	-3.62	-2.22	-1.33	-3.24	-5.54	-5.18	-3.91	-0.97	0.86	0.99	-0.29	-2.75	-5.15	-7.93	-8.97	-12.58	-10.72	-12.89	-39.71
105	-39.71	-12.92	-7.24	-6.01	-7.37	-5.88	-2.89	-1.10	-0.08	-2.31	-6.68	-5.59	-3.91	-0.35	2.09	2.05	0.56	-2.21	-4.52	-5.84	-5.91	-8.53	-7.38	-11.12	-39.71
120	-39.71	-11.35	-7.40	-7.32	-5.48	-2.66	-0.58	0.36	0.37	-2.33	-7.08	-5.81	-3.91	0.01	2.85	2.66	1.31	-1.12	-3.25	-4.91	-4.81	-6.09	-5.09	-9.77	-39.71
135	-39.71	-10.85	-9.23	-7.05	-5.63	-2.98	-1.00	-0.47	-0.17	-2.27	-5.98	-5.67	-3.91	0.11	3.37	3.32	2.24	0.40	-1.24	-2.73	-4.22	-4.99	-3.79	-8.54	-39.71
150	-39.71	-11.43	-13.42	-6.55	-4.42	-3.63	-2.77	-1.72	-0.45	-1.89	-4.86	-5.24	-3.91	-0.16	3.36	3.86	3.28	1.82	0.47	-0.99	-3.67	-4.58	-3.58	-7.91	-39.71
165	-39.71	-12.92	-14.67	-12.25	-8.64	-7.92	-6.94	-4.54	-2.22	-2.90	-4.48	-4.66	-3.91	-0.93	2.44	3.42	3.25	2.18	1.02	-0.43	-2.61	-4.44	-4.22	-7.75	-39.71

# 6. Ant data(Ant1 –BLE 2500MHz)



f=2500MHz E\_total

Phi(deg)	Theta(deg)																									
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180	
0	-37.52	-6.96	-4.97	-4.98	-3.32	-2.15	-0.92	0.04	1.16	1.99	1.56	0.15	-1.92	-2.50	-2.83	-3.34	-4.25	-7.75	-9.65	-10.36	-9.28	-9.34	-9.61	-11.93	-37.52	
15	-37.52	-6.80	-5.28	-5.94	-5.13	-3.94	-1.79	-0.32	0.56	1.10	0.25	-0.65	-1.92	-2.33	-3.45	-6.00	-9.42	-14.66	-10.97	-8.22	-9.03	-10.26	-11.43	-14.34	-37.52	
30	-37.52	-6.84	-5.36	-4.91	-4.23	-2.98	-1.46	0.27	0.82	0.63	-0.92	-1.48	-1.92	-2.10	-3.45	-6.01	-6.80	-7.21	-6.71	-7.02	-7.80	-13.29	-15.06	-17.53	-37.52	
45	-37.52	-7.32	-6.21	-4.46	-2.51	-1.38	-0.34	0.73	0.77	-0.18	-2.28	-2.43	-1.92	-1.51	-1.83	-2.41	-2.27	-3.13	-4.19	-6.19	-7.83	-7.09	-8.90	-18.05	-37.52	
60	-37.52	-8.16	-8.20	-6.48	-3.81	-2.32	-0.06	1.27	1.12	-0.88	-3.46	-3.20	-1.92	-0.83	-0.23	-0.42	-1.27	-4.19	-5.75	-6.96	-10.22	-7.65	-7.62	-15.08	-37.52	
75	-37.52	-9.16	-10.97	-7.53	-5.61	-3.53	-0.38	1.54	1.67	-1.32	-4.67	-3.92	-1.92	-0.11	1.18	1.83	1.28	-1.56	-4.25	-7.60	-7.90	-10.97	-8.52	-12.55	-37.52	
90	-37.52	-9.48	-10.56	-5.80	-4.80	-2.70	-0.52	1.09	1.31	-1.81	-5.64	-4.37	-1.92	0.36	2.03	2.86	2.24	-0.28	-2.70	-4.49	-5.40	-9.38	-7.96	-11.32	-37.52	
105	-37.52	-9.18	-8.20	-5.84	-5.82	-3.43	-1.25	-0.14	-0.39	-3.39	-6.67	-4.61	-1.92	0.72	2.62	3.16	2.28	-0.38	-3.28	-4.73	-5.16	-6.50	-5.86	-10.45	-37.52	
120	-37.52	-9.00	-7.14	-7.81	-7.47	-3.93	-1.86	-1.24	-1.92	-5.13	-7.18	-4.50	-1.92	0.92	2.90	3.21	2.36	0.19	-2.05	-4.30	-5.00	-5.23	-4.50	-9.67	-37.52	
135	-37.52	-9.31	-7.81	-7.74	-7.88	-5.33	-3.08	-3.27	-2.88	-5.77	-6.44	-4.00	-1.92	1.03	3.06	3.33	2.71	1.30	-0.09	-1.85	-3.73	-4.75	-3.88	-8.61	-37.52	
150	-37.52	-9.93	-11.16	-7.50	-5.59	-5.76	-4.72	-4.18	-2.54	-4.91	-4.85	-3.39	-1.92	0.97	3.01	3.50	3.21	2.26	1.18	-0.31	-3.06	-4.75	-3.97	-7.79	-37.52	
165	-37.52	-10.81	-13.59	-15.72	-11.79	-13.60	-9.54	-5.87	-2.85	-3.59	-3.26	-2.80	-1.92	0.66	2.48	3.04	2.72	1.84	0.77	-0.64	-2.92	-4.57	-4.46	-7.22	-37.52	



# 6. Ant data(Ant2-2450MHz)



f=2450MHz E\_total

Phi(deg)	Theta(deg)																								
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180
0	-45.01	-11.18	-9.04	-4.97	-3.86	-2.50	-0.73	1.19	3.14	3.83	3.90	3.73	3.79	3.43	3.45	3.39	2.92	0.54	-1.63	-4.21	-5.08	-6.72	-7.20	-17.95	-45.01
15	-45.01	-10.91	-9.97	-6.97	-3.94	-3.53	-1.64	0.28	2.56	3.48	3.35	3.33	3.79	3.69	3.51	2.92	2.01	-0.72	-2.64	-3.62	-5.37	-8.81	-10.59	-16.45	-45.01
30	-45.01	-10.73	-11.25	-10.78	-5.79	-5.22	-2.88	-0.76	1.96	3.54	3.40	3.11	3.79	3.97	3.70	2.71	0.82	-1.81	-3.65	-4.20	-7.18	-11.49	-16.20	-14.99	-45.01
45	-45.01	-11.08	-12.40	-10.52	-7.40	-6.30	-3.67	-0.93	2.00	3.75	3.69	3.12	3.79	4.16	3.81	2.66	0.14	-2.63	-5.12	-6.51	-11.28	-12.86	-14.11	-14.43	-45.01
60	-45.01	-11.86	-12.55	-11.28	-8.88	-6.99	-3.54	-0.54	2.16	3.95	3.99	3.21	3.79	4.32	3.78	2.44	-0.71	-4.62	-8.38	-11.69	-17.99	-12.24	-11.19	-14.34	-45.01
75	-45.01	-12.30	-10.99	-16.19	-11.45	-8.47	-4.36	-0.83	1.98	3.85	4.04	3.25	3.79	4.41	3.66	2.20	-0.74	-5.03	-10.19	-17.57	-16.20	-11.85	-11.18	-14.24	-45.01
90	-45.01	-12.16	-9.54	-13.13	-11.69	-9.64	-5.81	-2.17	1.43	3.41	3.84	3.19	3.79	4.50	3.50	1.72	-0.40	-3.13	-6.51	-10.61	-12.28	-10.99	-12.03	-13.42	-45.01
105	-45.01	-11.81	-9.89	-10.59	-7.30	-5.64	-4.22	-2.42	0.94	2.98	3.59	3.08	3.79	4.58	3.51	1.21	-0.70	-2.36	-4.24	-7.80	-11.59	-10.58	-11.55	-12.17	-45.01
120	-45.01	-11.78	-10.52	-9.43	-4.86	-3.69	-2.97	-1.63	1.10	3.02	3.43	2.94	3.79	4.67	3.98	1.69	-0.98	-3.30	-4.16	-5.93	-7.00	-10.73	-10.28	-10.91	-45.01
135	-45.01	-12.54	-9.06	-7.94	-3.85	-3.35	-2.11	-0.10	2.20	3.55	3.44	2.90	3.79	4.70	4.68	3.49	1.52	-1.24	-3.02	-4.44	-5.95	-9.31	-8.77	-10.36	-45.01
150	-45.01	-14.61	-6.68	-6.18	-3.87	-4.00	-1.51	1.29	3.32	4.04	3.51	2.98	3.79	4.56	5.15	5.07	4.11	1.92	-0.47	-3.43	-6.08	-5.62	-7.57	-10.47	-45.01
165	-45.01	-11.18	-9.04	-4.97	-3.86	-2.50	-0.73	1.19	3.14	3.83	3.90	3.73	3.79	3.43	3.45	3.39	2.92	0.54	-1.63	-4.21	-5.08	-6.72	-7.20	-17.95	-45.01

# 6. Ant data(Ant2-2500MHz)



f=2500MHz E\_total

Phi(deg)	Theta(deg)																										
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180		
0	-48.70	-11.10	-7.37	-3.17	-3.95	-2.24	0.16	2.62	4.25	4.77	4.46	3.63	2.91	2.68	3.50	3.92	3.48	1.91	-0.65	-3.50	-4.13	-4.65	-4.97	-14.71	-48.70		
15	-48.70	-11.81	-8.41	-3.88	-3.85	-3.34	-1.22	1.43	3.43	4.15	3.78	3.22	2.91	2.77	3.37	3.36	3.03	1.14	-1.27	-4.41	-5.35	-6.11	-6.36	-16.33	-48.70		
30	-48.70	-11.75	-9.18	-6.28	-4.64	-4.49	-2.19	0.48	2.96	4.01	3.55	2.96	2.91	2.87	3.19	2.65	2.17	-0.30	-2.46	-4.12	-5.71	-8.35	-10.21	-15.79	-48.70		
45	-48.70	-11.29	-10.30	-9.66	-6.08	-5.71	-3.26	-0.73	1.99	3.73	3.59	2.84	2.91	2.99	3.11	2.30	1.19	-1.70	-3.40	-4.34	-7.29	-11.74	-18.49	-14.36	-48.70		
60	-48.70	-11.10	-11.18	-10.08	-7.30	-6.69	-4.07	-1.07	1.68	3.60	3.63	2.84	2.91	3.09	3.19	2.42	0.58	-2.63	-4.81	-6.09	-11.38	-13.94	-14.37	-13.64	-48.70		
75	-48.70	-11.08	-10.93	-10.89	-8.15	-6.51	-3.56	-0.62	1.76	3.61	3.62	2.86	2.91	3.20	3.33	2.52	-0.11	-4.43	-7.83	-9.97	-13.65	-10.29	-10.23	-13.98	-48.70		
90	-48.70	-10.97	-9.05	-12.90	-10.69	-8.19	-4.24	-0.74	1.68	3.46	3.51	2.84	2.91	3.33	3.42	2.51	-0.21	-4.88	-10.01	-14.92	-13.48	-9.84	-10.13	-15.28	-48.70		
105	-48.70	-10.65	-7.70	-10.61	-10.06	-8.52	-5.53	-1.69	1.37	3.06	3.28	2.78	2.91	3.52	3.48	2.28	-0.16	-3.68	-7.20	-10.03	-11.12	-10.50	-11.77	-16.41	-48.70		
120	-48.70	-10.37	-8.01	-9.38	-6.31	-4.79	-3.59	-1.58	1.16	2.69	3.10	2.71	2.91	3.72	3.67	2.13	-0.07	-2.80	-4.63	-6.84	-9.29	-10.15	-11.48	-14.79	-48.70		
135	-48.70	-10.39	-8.23	-7.53	-4.09	-3.37	-2.41	-1.13	1.50	2.86	3.09	2.64	2.91	3.94	4.21	2.90	0.75	-1.85	-3.10	-4.50	-5.82	-8.90	-9.13	-12.11	-48.70		
150	-48.70	-11.00	-7.16	-5.59	-2.82	-2.72	-1.61	0.16	2.45	3.49	3.27	2.61	2.91	4.02	4.75	4.21	2.68	0.63	-1.17	-2.90	-4.93	-7.16	-7.31	-10.74	-48.70		
165	-48.70	-12.64	-5.55	-4.66	-3.08	-2.65	-0.92	1.63	3.40	4.00	3.48	2.63	2.91	3.91	4.90	5.02	4.19	2.39	0.14	-2.43	-5.09	-4.35	-6.66	-10.50	-48.70		

# 6. Ant data(Ant3-2400MHz)



f=2400MHz E\_total

Phi(deg)	Theta(deg)																								
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180
0	-36.20	-9.55	-7.37	-3.59	-2.72	-4.11	-1.35	1.30	3.58	4.60	4.50	3.85	2.94	4.25	5.01	4.97	3.88	1.57	-0.76	-2.41	-1.92	-3.86	-6.53	-10.44	-36.20
15	-36.20	-9.03	-7.43	-4.89	-4.93	-4.83	-2.96	0.47	2.82	4.32	4.59	3.98	2.94	4.14	4.84	4.65	3.85	1.09	-0.96	-3.82	-3.24	-4.87	-6.40	-9.23	-36.20
30	-36.20	-8.65	-7.69	-7.01	-8.30	-7.57	-5.30	-1.01	1.89	3.36	4.11	4.00	2.94	4.00	4.50	4.04	3.07	0.37	-1.64	-4.17	-5.44	-7.59	-7.78	-8.78	-36.20
45	-36.20	-9.18	-10.37	-12.91	-9.61	-9.71	-8.19	-3.68	0.08	1.93	3.19	3.97	2.94	3.77	3.99	3.49	2.47	-0.09	-2.90	-6.02	-7.34	-9.94	-9.29	-9.21	-36.20
60	-36.20	-10.95	-14.87	-11.60	-7.85	-7.54	-7.20	-3.01	0.03	1.61	2.59	3.93	2.94	3.54	3.44	3.07	2.13	-0.27	-3.16	-7.19	-8.87	-9.75	-8.37	-10.33	-36.20
75	-36.20	-15.12	-16.99	-10.80	-11.59	-11.36	-7.50	-1.88	1.18	2.43	2.61	3.94	2.94	3.26	2.75	2.35	1.26	-0.61	-2.69	-5.01	-7.57	-9.26	-6.98	-12.03	-36.20
90	-36.20	-20.53	-16.46	-13.31	-16.49	-12.91	-7.34	-1.67	1.66	3.00	2.94	3.99	2.94	3.05	2.22	1.60	0.49	-1.14	-2.81	-4.40	-6.73	-9.44	-6.78	-12.98	-36.20
105	-36.20	-18.48	-15.11	-10.82	-8.48	-9.70	-6.65	-1.53	1.69	3.07	3.24	4.07	2.94	2.92	1.89	1.20	0.34	-1.92	-4.37	-6.52	-9.31	-11.65	-8.17	-12.48	-36.20
120	-36.20	-14.88	-13.52	-10.22	-5.42	-6.01	-4.07	-1.25	1.39	2.77	3.44	4.16	2.94	2.92	1.91	1.40	0.74	-1.89	-5.75	-9.84	-10.84	-11.06	-10.83	-11.25	-36.20
135	-36.20	-12.97	-10.57	-10.23	-7.02	-6.19	-4.06	-1.98	1.16	2.63	3.79	4.24	2.94	3.09	2.19	1.61	0.92	-1.16	-5.22	-7.03	-7.30	-8.24	-12.62	-10.08	-36.20
150	-36.20	-12.32	-8.46	-6.13	-6.84	-5.32	-4.03	-1.04	1.95	3.20	4.26	4.28	2.94	3.33	2.78	2.01	1.03	-0.83	-3.18	-4.46	-6.09	-7.15	-10.04	-9.63	-36.20
165	-36.20	-11.57	-7.35	-4.18	-3.30	-2.60	-1.57	1.15	3.22	4.42	4.81	4.29	2.94	3.64	3.82	3.60	2.75	0.62	-1.38	-4.63	-4.87	-4.86	-7.71	-9.61	-36.20

# 6. Ant data(Ant3-2450MHz)



f=2450MHz E\_total

Phi(deg)	Theta(deg)																										
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180		
0	-36.20	-9.55	-7.37	-3.59	-2.72	-4.11	-1.35	1.30	3.58	4.60	4.50	3.85	2.94	4.25	5.01	4.97	3.88	1.57	-0.76	-2.41	-1.92	-3.86	-6.53	-10.44	-36.20		
15	-37.64	-9.56	-7.37	-4.48	-3.27	-4.19	-1.31	1.66	4.13	5.22	4.80	3.39	1.84	3.49	4.67	4.73	3.80	1.43	-0.69	-3.10	-3.87	-5.01	-7.01	-9.65	-37.64		
30	-37.64	-9.39	-6.69	-4.98	-4.99	-5.60	-3.23	0.04	2.76	4.24	4.57	3.56	1.84	3.33	4.20	3.93	2.94	0.26	-2.28	-3.72	-5.03	-6.44	-8.38	-9.20	-37.64		
45	-37.64	-9.47	-8.48	-9.18	-9.68	-9.28	-5.52	-2.15	1.09	2.73	3.78	3.66	1.84	3.07	3.59	3.43	2.84	0.59	-2.87	-5.98	-6.85	-8.04	-10.05	-9.59	-37.64		
60	-37.64	-10.62	-12.98	-13.62	-8.60	-8.78	-6.15	-2.64	0.54	2.00	3.10	3.73	1.84	2.77	3.08	3.24	2.53	0.20	-2.84	-7.01	-9.48	-9.30	-9.14	-10.61	-37.64		
75	-37.64	-13.53	-17.91	-11.91	-9.54	-11.44	-7.58	-2.48	0.73	1.95	2.68	3.81	1.84	2.40	2.52	2.74	1.69	-0.71	-3.00	-5.41	-7.28	-9.43	-7.60	-11.95	-37.64		
90	-37.64	-17.22	-19.24	-13.95	-16.52	-13.14	-7.86	-2.19	0.79	2.07	2.56	3.86	1.84	2.11	2.06	2.09	0.88	-1.35	-3.14	-4.69	-6.17	-9.09	-7.13	-12.40	-37.64		
105	-37.64	-18.21	-18.55	-12.82	-9.61	-11.83	-7.82	-2.33	0.68	2.02	2.59	3.88	1.84	1.91	1.73	1.68	0.48	-1.99	-4.36	-6.22	-8.68	-10.94	-8.07	-11.47	-37.64		
120	-37.64	-15.61	-14.96	-12.54	-5.49	-7.24	-5.31	-2.33	0.47	1.82	2.81	3.87	1.84	1.88	1.67	1.82	0.96	-1.61	-4.67	-8.70	-12.15	-10.81	-10.57	-9.96	-37.64		
135	-37.64	-13.46	-9.40	-10.04	-7.81	-7.29	-5.23	-2.78	0.31	2.10	3.36	3.83	1.84	2.04	1.77	2.00	1.62	-0.40	-3.52	-7.70	-8.39	-7.98	-13.97	-8.48	-37.64		
150	-37.64	-12.55	-6.76	-5.12	-7.07	-5.41	-4.42	-1.38	1.37	3.18	4.00	3.78	1.84	2.30	2.14	2.14	1.53	-0.45	-3.46	-5.66	-6.41	-7.17	-10.78	-7.86	-37.64		
165	-37.64	-11.79	-6.42	-3.72	-3.03	-3.00	-1.67	0.78	3.30	4.60	4.64	3.70	1.84	2.71	3.17	3.27	2.04	0.05	-2.27	-4.14	-5.53	-5.63	-7.67	-8.12	-37.64		



# 6. Ant data(Ant3-2500MHz)



f=2500MHz E\_total

Phi(deg)	Theta(deg)																								
0	-180	-165	-150	-135	-120	-105	-90	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120	135	150	165	180
0	-36.81	-9.14	-6.55	-3.86	-3.59	-3.49	-1.13	1.62	3.57	4.43	3.70	2.35	1.18	3.09	4.41	4.76	4.01	1.87	-0.49	-2.92	-2.62	-3.95	-6.68	-9.91	-36.81
15	-36.81	-10.51	-6.72	-4.13	-3.87	-3.53	-0.87	2.33	4.15	4.99	4.43	2.59	1.18	2.93	3.95	3.92	3.12	0.66	-1.57	-3.12	-4.22	-4.68	-6.51	-8.84	-36.81
30	-36.81	-10.48	-7.09	-5.04	-4.40	-5.49	-2.42	1.00	3.35	4.37	4.37	2.73	1.18	2.79	3.67	3.74	3.08	1.01	-2.17	-3.72	-5.97	-6.64	-7.68	-8.49	-36.81
45	-36.81	-10.50	-9.14	-10.92	-8.15	-8.84	-5.10	-2.15	1.51	2.86	3.61	2.80	1.18	2.62	3.44	3.78	2.96	0.77	-2.16	-6.31	-8.58	-8.77	-8.80	-9.09	-36.81
60	-36.81	-11.70	-11.52	-12.18	-8.60	-9.40	-5.37	-2.29	1.12	2.15	2.89	2.82	1.18	2.43	3.14	3.34	2.37	-0.27	-2.95	-6.13	-11.06	-10.61	-8.48	-10.32	-36.81
75	-36.81	-14.55	-13.21	-10.20	-9.89	-12.56	-6.65	-2.12	1.21	2.20	2.53	2.86	1.18	2.20	2.72	2.49	1.38	-1.46	-3.44	-4.86	-7.39	-8.67	-7.73	-11.68	-36.81
90	-36.81	-16.44	-15.00	-12.95	-18.22	-12.21	-6.92	-2.53	0.90	2.07	2.46	2.92	1.18	2.01	2.38	1.76	0.57	-2.53	-4.08	-5.32	-6.92	-7.91	-7.57	-11.69	-36.81
105	-36.81	-14.41	-16.18	-11.03	-8.40	-12.17	-7.29	-2.64	0.70	1.60	2.46	3.01	1.18	1.85	2.13	1.64	0.59	-2.61	-5.48	-7.19	-10.90	-10.88	-8.56	-10.19	-36.81
120	-36.81	-12.11	-13.56	-10.95	-5.21	-7.21	-5.08	-2.21	0.43	1.25	2.70	3.10	1.18	1.77	2.04	2.25	1.54	-1.30	-4.56	-7.43	-13.19	-11.81	-10.93	-8.57	-36.81
135	-36.81	-10.78	-8.98	-8.90	-7.21	-6.80	-5.30	-2.67	0.46	2.04	3.36	3.19	1.18	1.80	1.95	2.81	2.51	0.21	-2.41	-5.81	-7.76	-8.24	-14.07	-7.24	-36.81
150	-36.81	-10.61	-7.40	-5.67	-5.77	-5.17	-3.97	-0.94	2.17	3.52	4.04	3.23	1.18	1.92	2.03	2.75	2.24	0.42	-2.11	-4.85	-7.56	-7.78	-10.88	-6.89	-36.81
165	-36.81	-10.60	-7.35	-4.73	-3.53	-3.37	-1.27	1.60	4.00	4.78	4.51	3.20	1.18	2.13	2.74	3.19	2.06	0.16	-2.54	-5.16	-7.04	-5.28	-7.29	-7.64	-36.81













***Thanks!***