

Antenna Design

Ubee U10C163

V2.09

Document Number	
1st Released Date	08/03/2021
Test date	05/31/2022
Test personnel	Wei
Review by	Yuan

Revised History

Date	Version	Revised Record
08/03/2021	1.01	Antenna simulation
08/10/2021	1.02	Improve isolation to -25 dB
08/30/2021	1.03	Machine sample test.(Sku1. Large heat sink)
08/30/2021	1.04	Machine sample test.(Sku2. Small heat sink)
09/29/2021	1.05	PCB add foolproof design, update S11
10/13/2021	1.06	Ant4 & Ant6 layout changed, update isolation & radiation pattern.
11/05/2021	2.07	Antenna test with pilot run sample
11/26/2021	2.08	Antenna fine tune for new specification
04/11/2022	2.08_1	Update cable length and cable loss
04/19/2022	2.08_2	Update cable length and cable loss(add exposed cable length)
05/31/2022	2.09	Update isolation test method

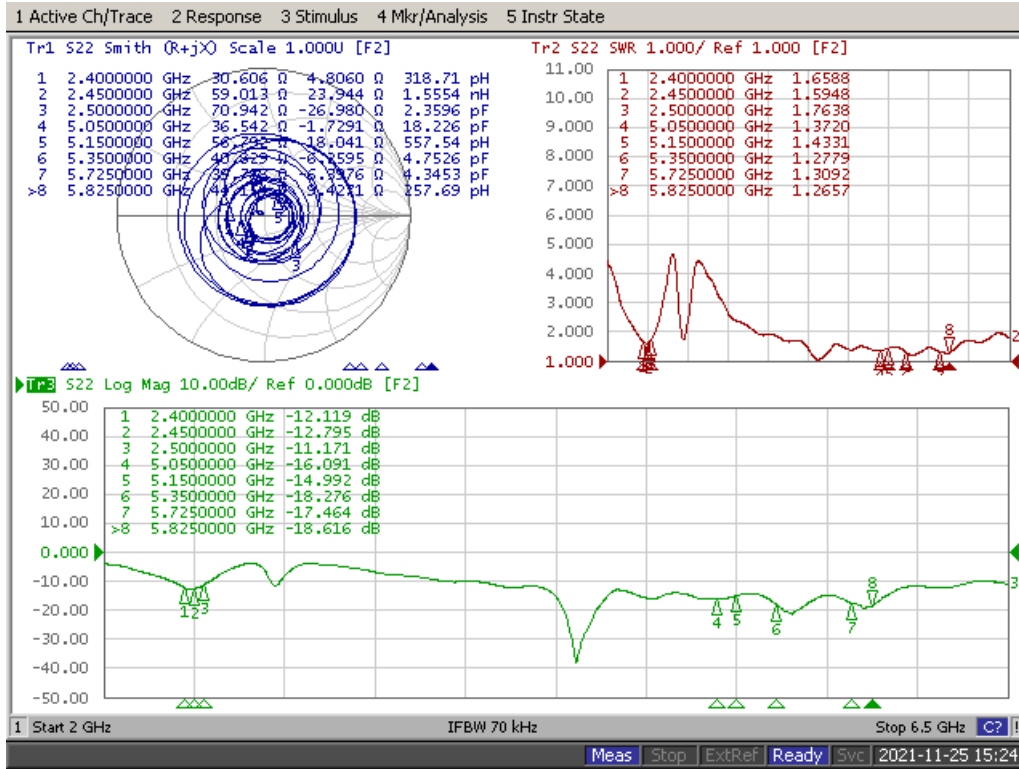
Specification

Rough description	Dual Band 2G/5G antenna*4 , WIFI 6E antenna *4	
Item	Initial Specification	
Dimensions	None	
Impedance	50Ω	
Test environment		
Spectrum		
Freq. Range	WIFI Dualband: 2.4~2.5GHz & 5.05~5.825GHz WIFI 6E: 5.925GHz ~ 7.125GHz	
Antenna type	Dipole	
Gain	2.4G < 3.5 dBi , 5G < 4 dBi , 6G < 3.5dBi	
VSWR	<1.92	
Radiation		
Polarization	Linear	
HPBW / H	None	
HPBW / E	None	
Rad. efficiency	None	
Connector type	I-Pex	
Cable type	1.13	
Cable length	None	
Isolation	<-20 dB	

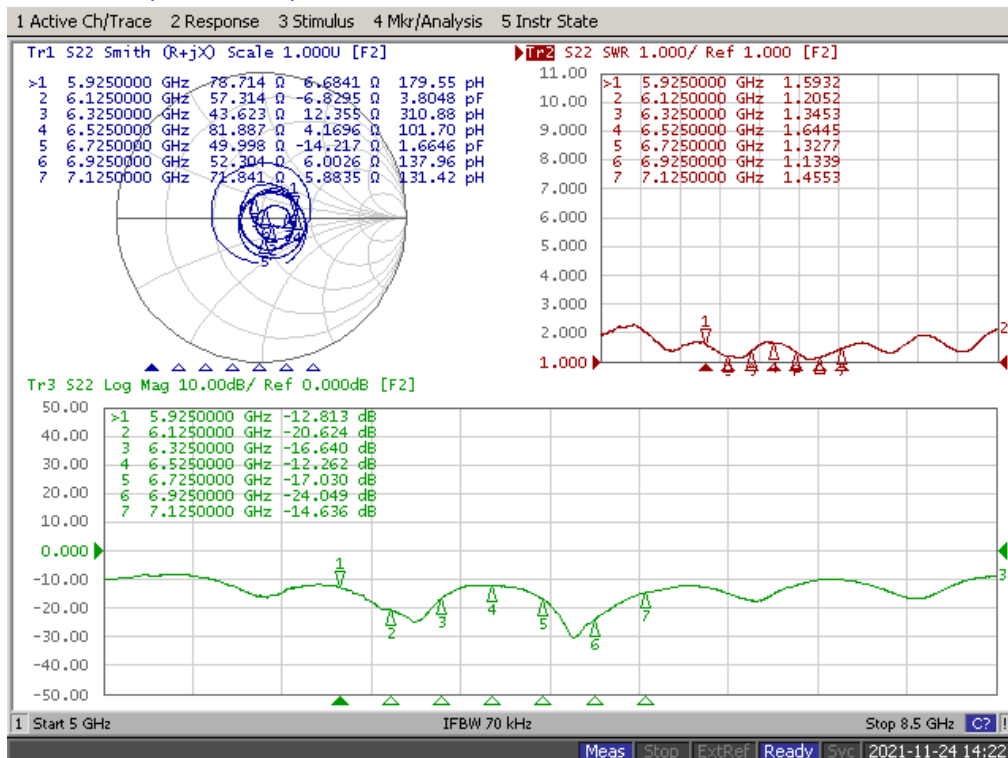
S-parameter test results

2.1 S11 test results

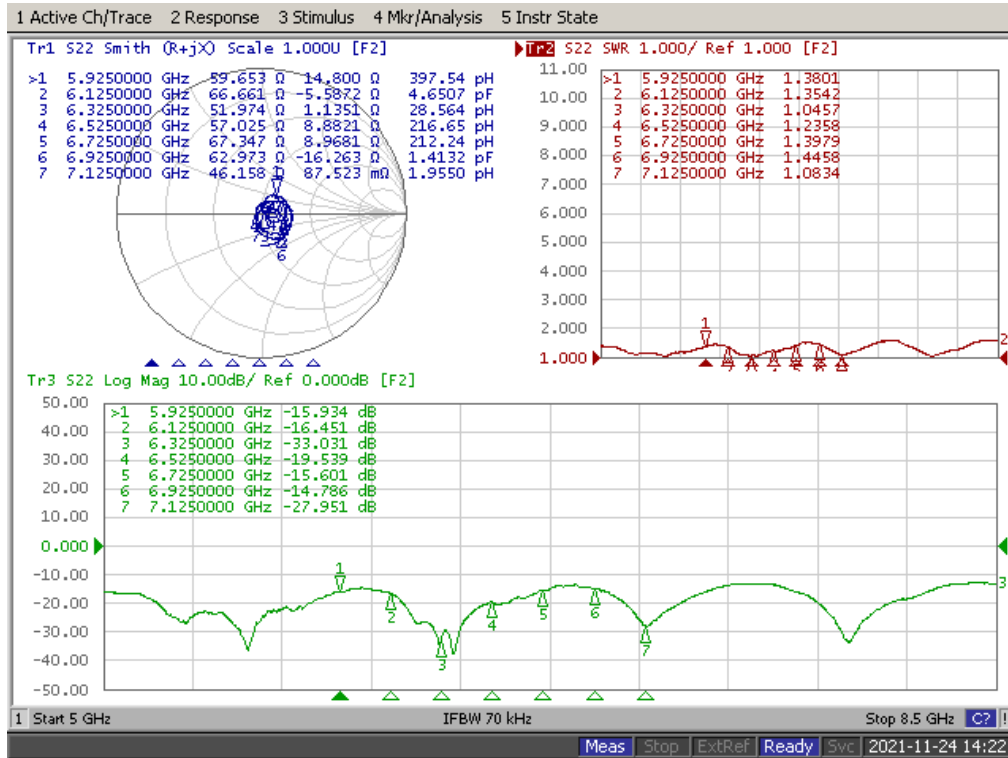
2.1.1 Ant_1 (Dual band)



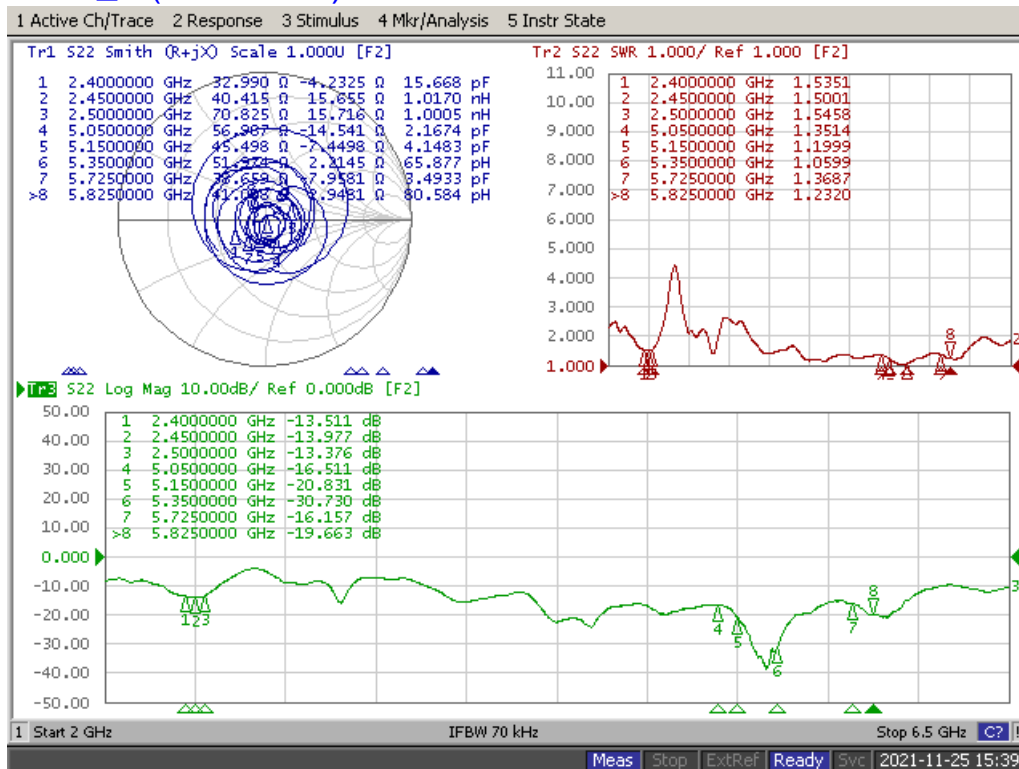
2.1.2 Ant_2 (WIFI 6E)



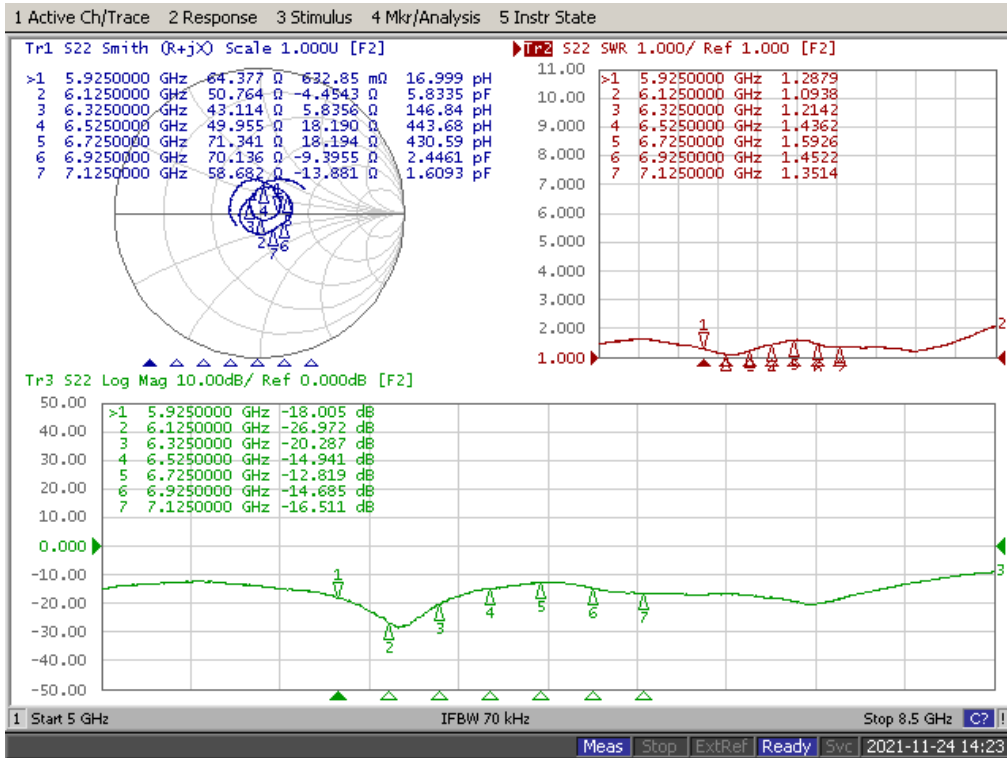
2.1.3 Ant_3 (WIFI 6E)



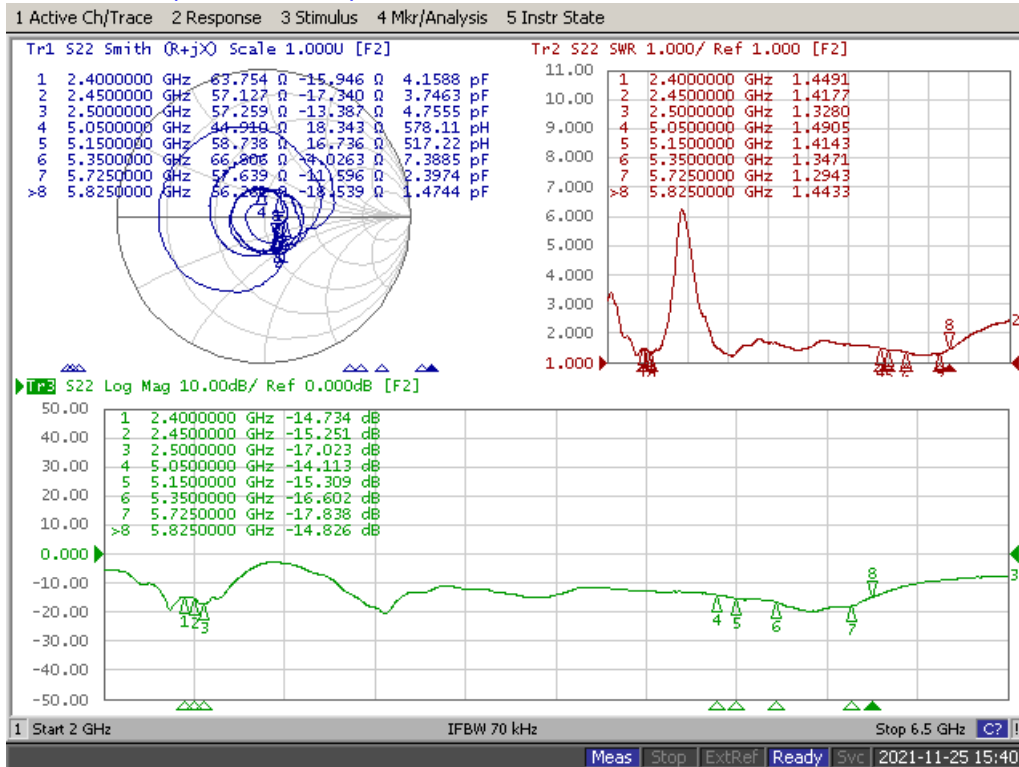
2.1.4 Ant_4 (Dual band)



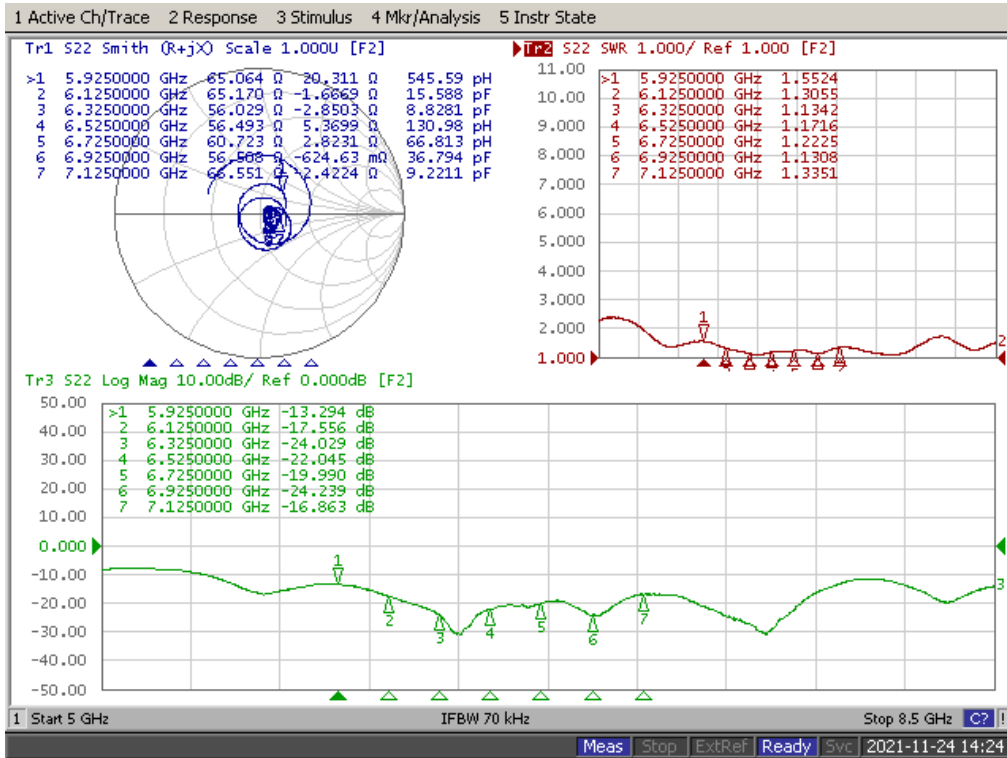
2.1.5 Ant_5 (WIFI 6E)



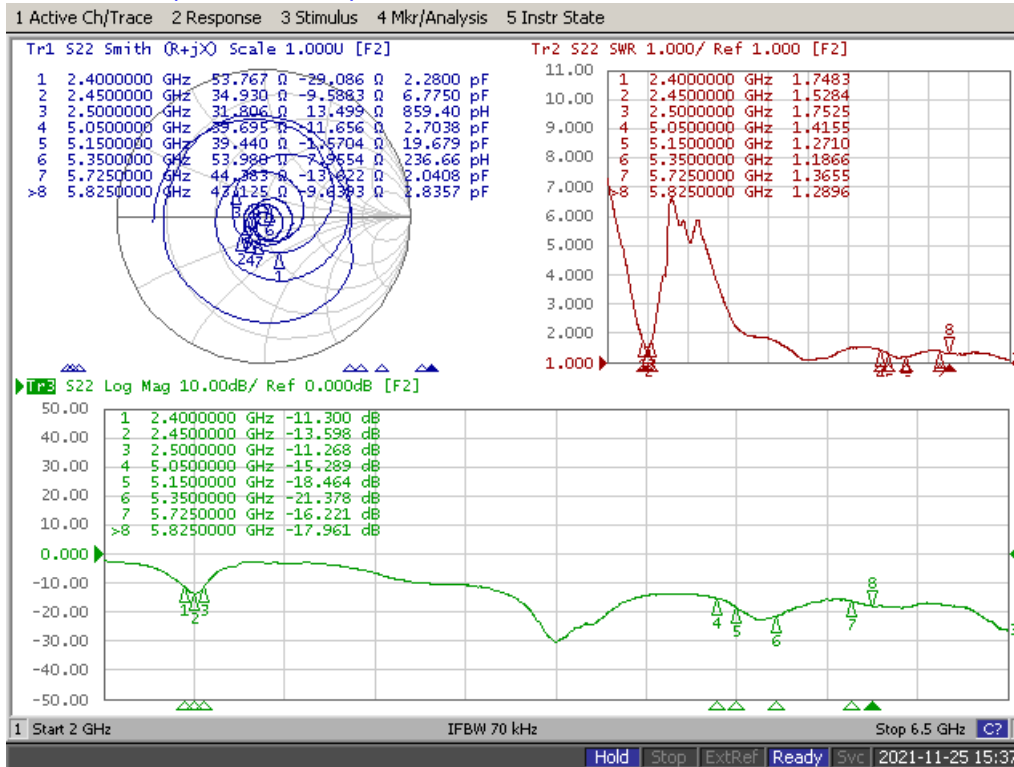
2.1.6 Ant_6 (Dual band)



2.1.7 Ant_7 (WIFI 6E)

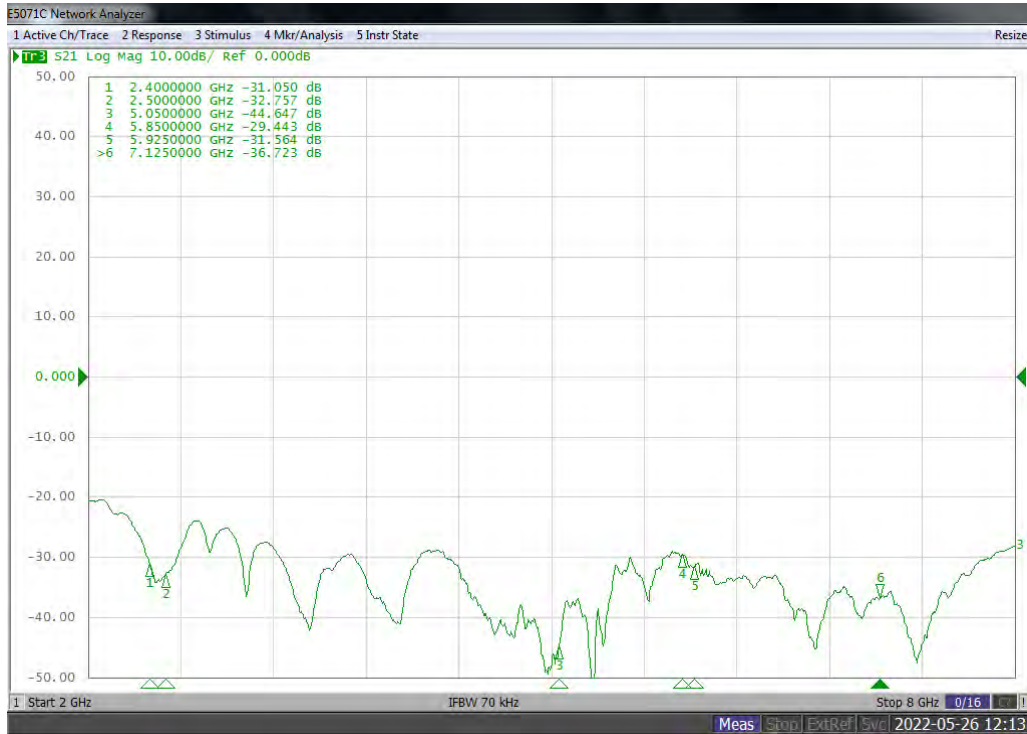


2.1.8 Ant_8 (Dual band)

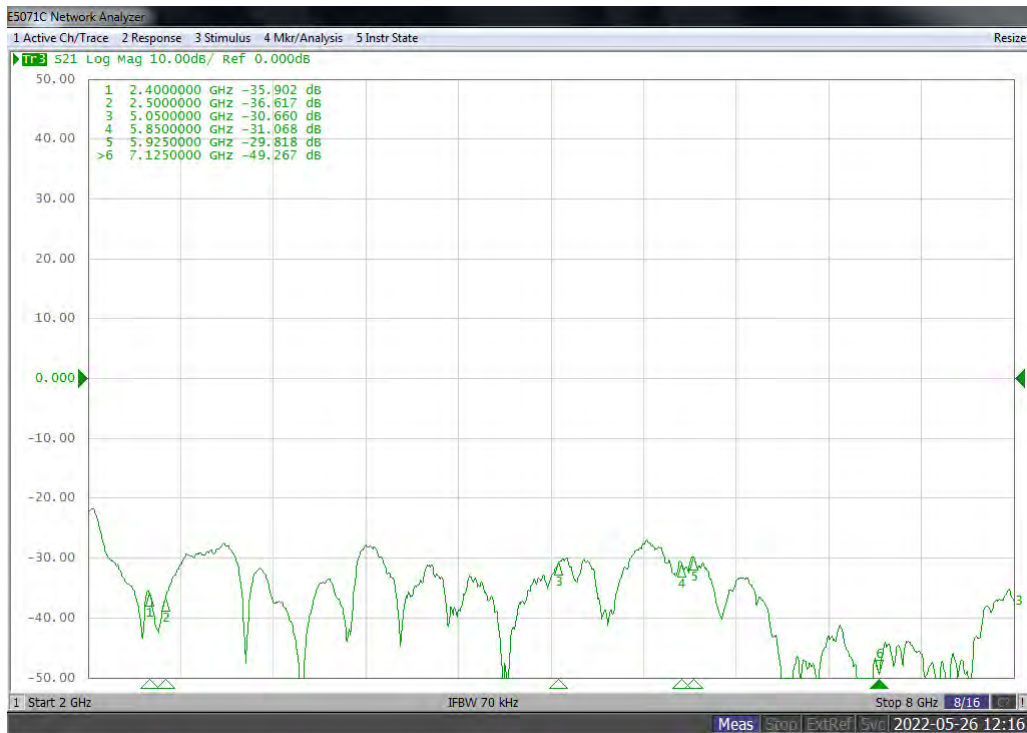


2.2 Isolation test results

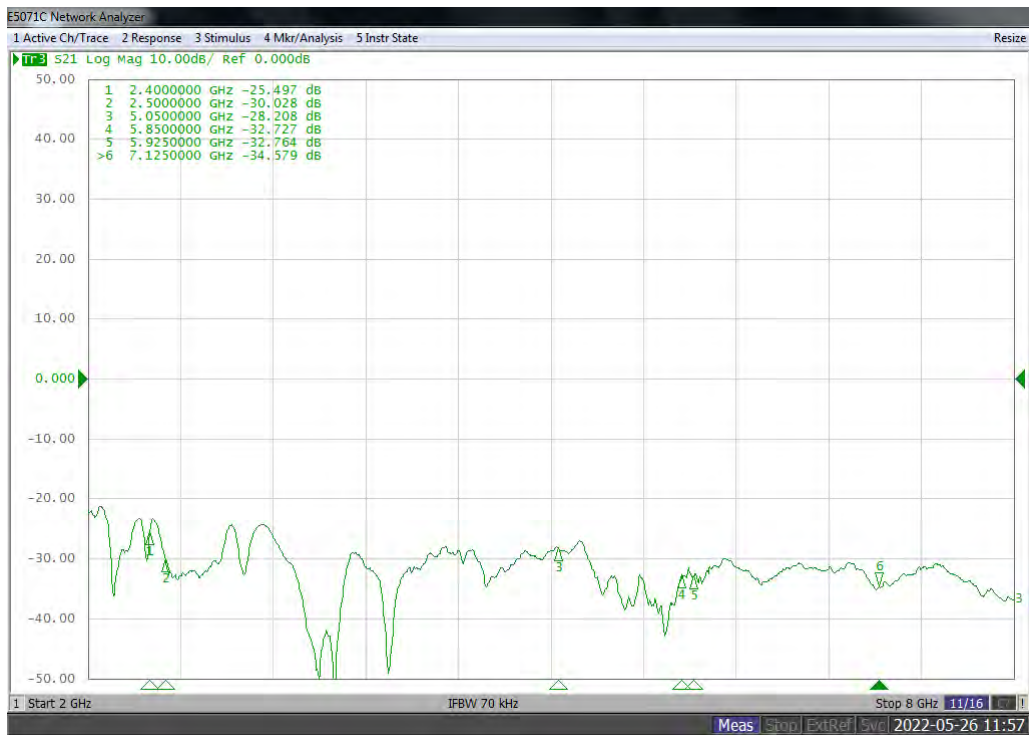
2.2.1 Ant_1 to Ant_2



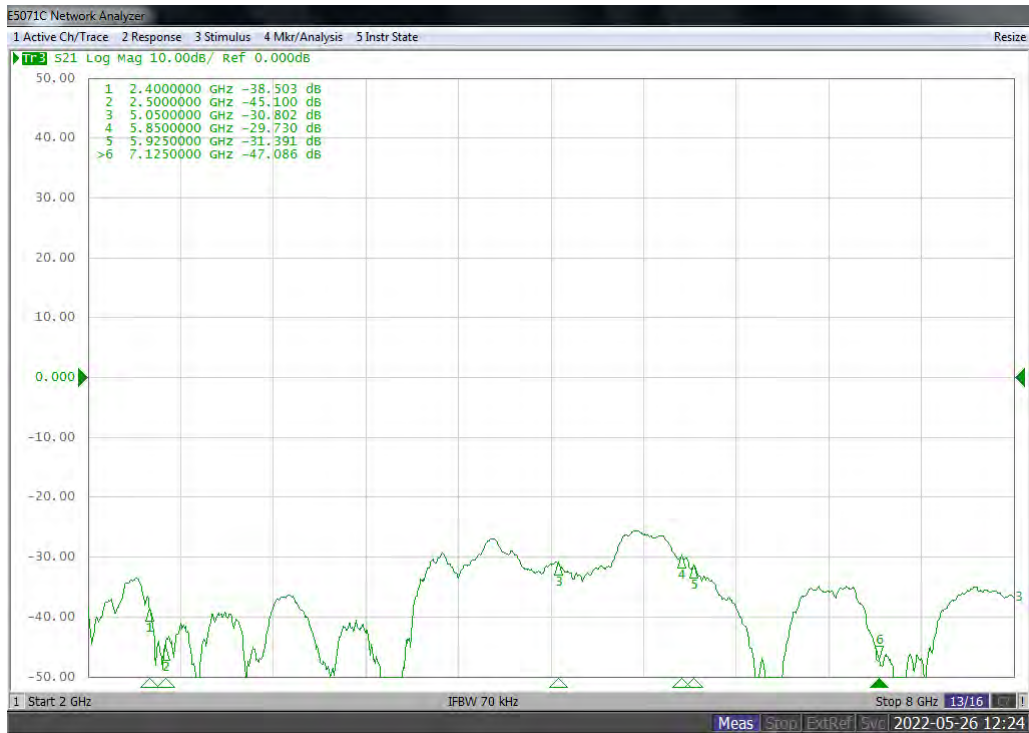
2.2.2 Ant_1 to Ant_3



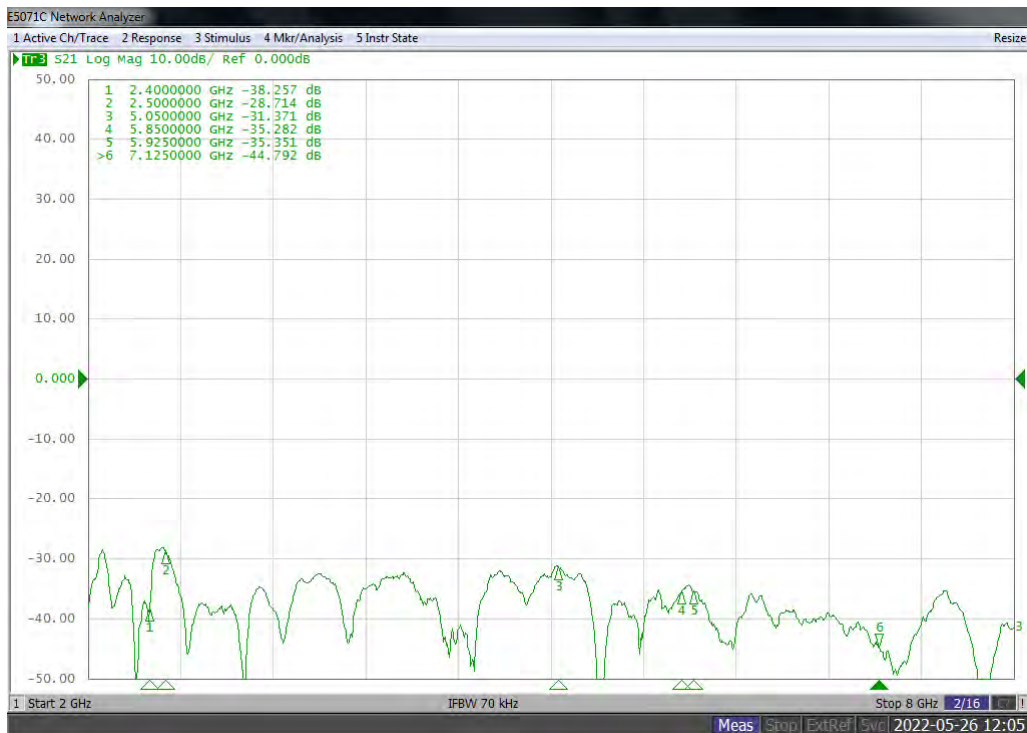
2.2.3 Ant_1 to Ant_4



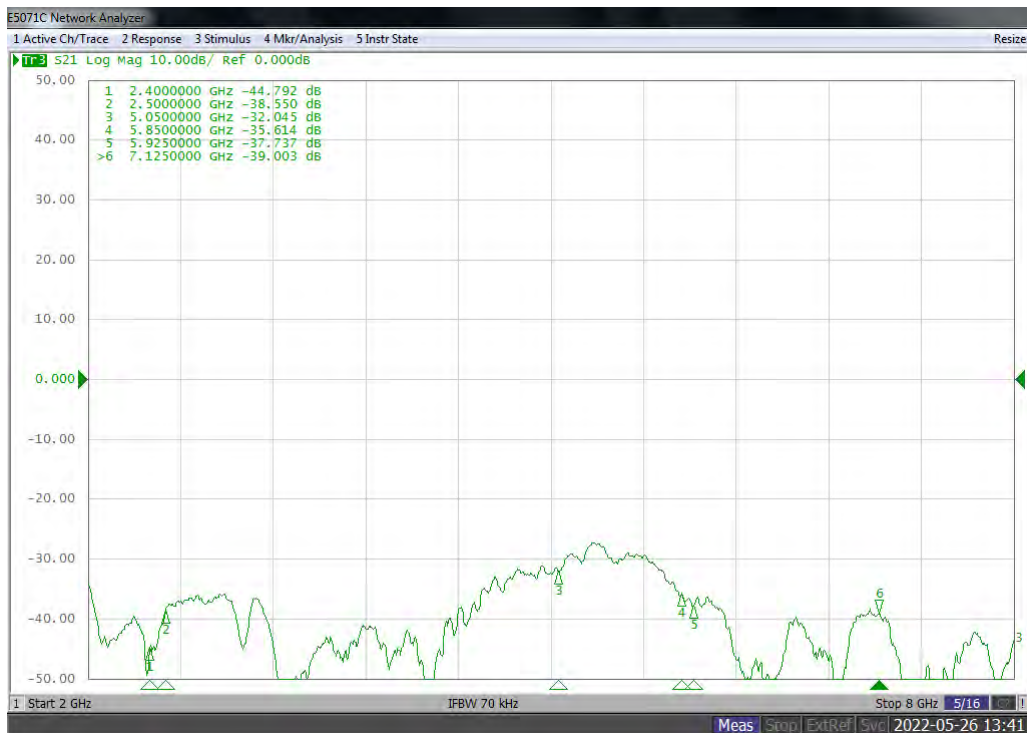
2.2.4 Ant_1 to Ant_5



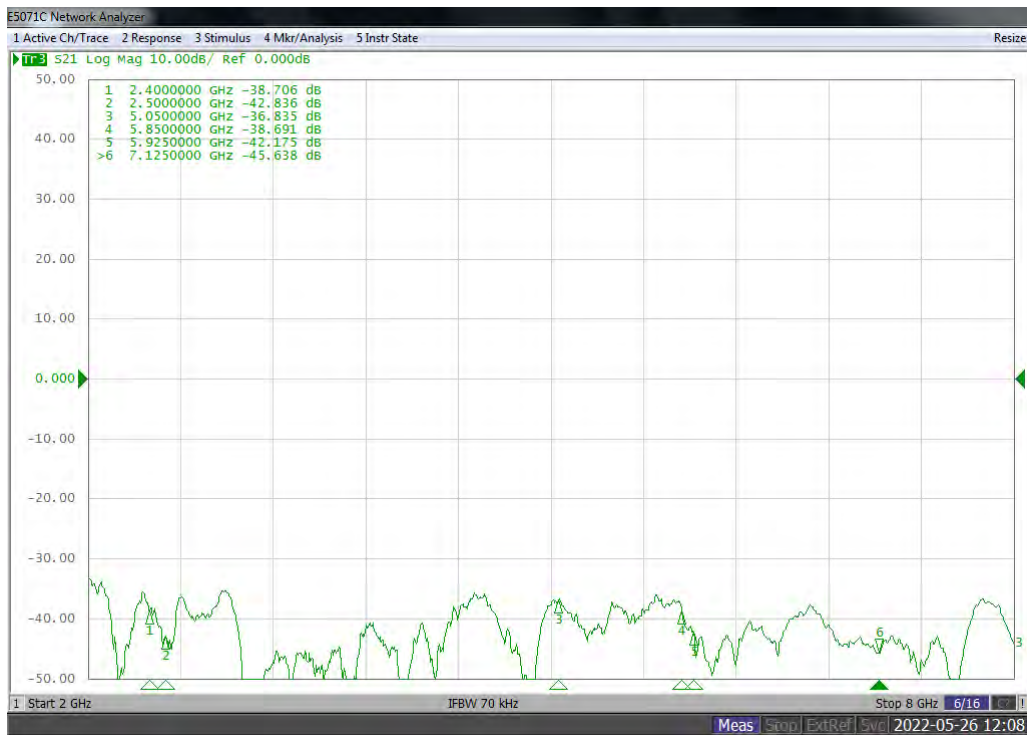
2.2.5 Ant_1 to Ant_6



2.2.6 Ant_1 to Ant_7



2.2.7 Ant_1 to Ant_8



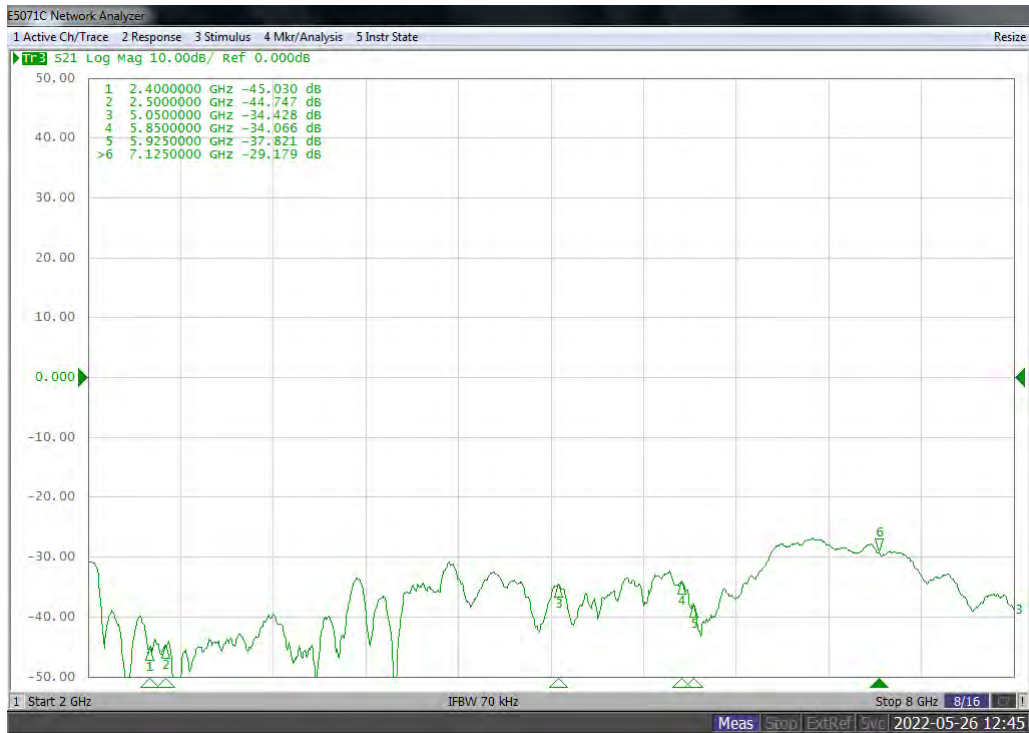
2.2.8 Ant_2 to Ant_3



2.2.9 Ant_2 to Ant_4



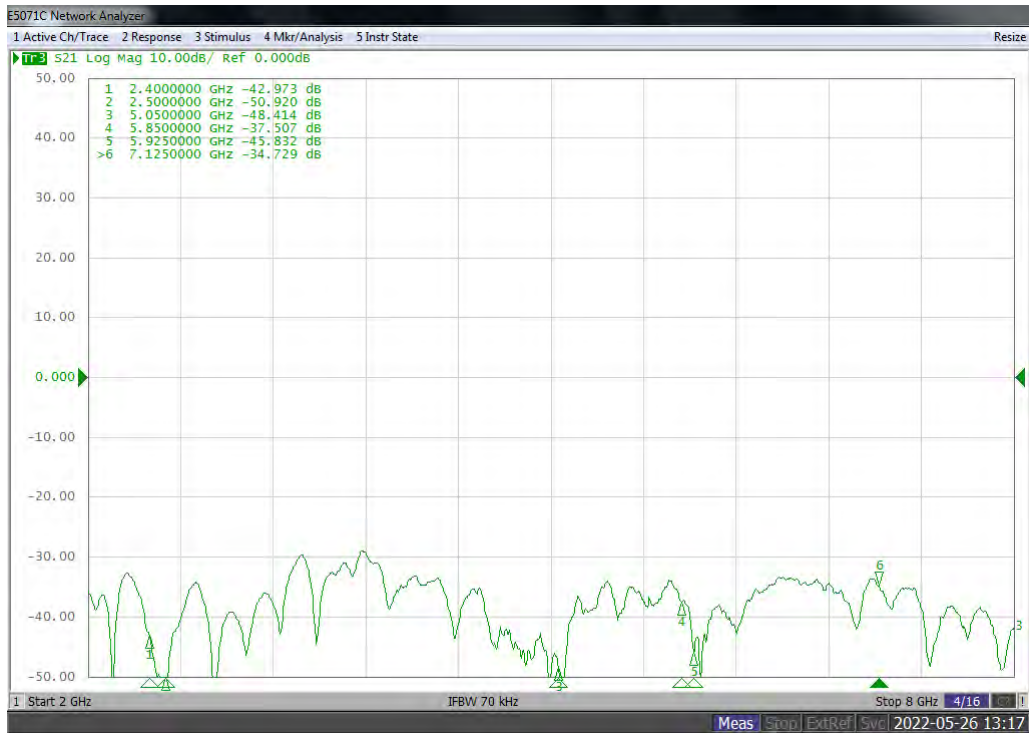
2.2.10 Ant_2 to Ant_5



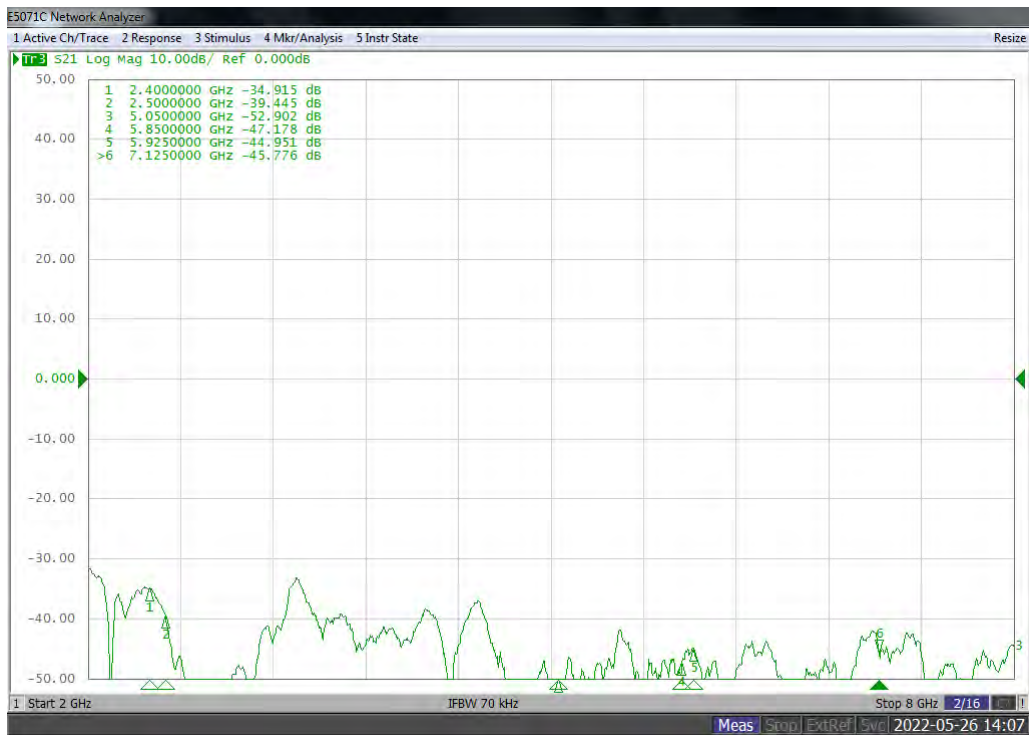
2.2.11 Ant_2 to Ant_6



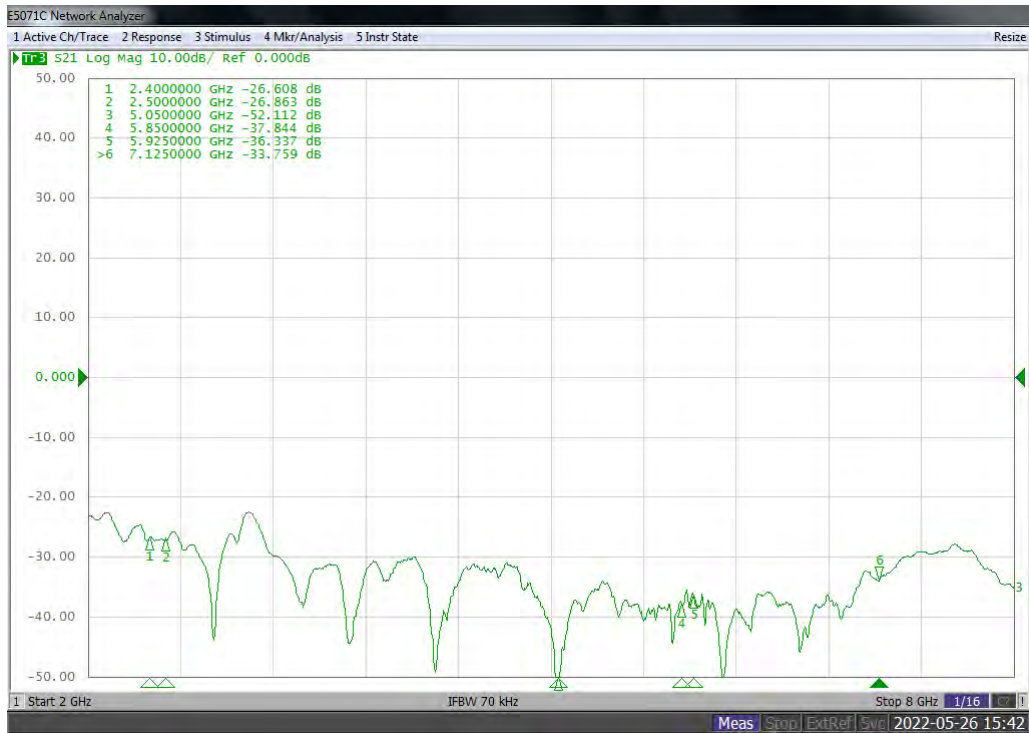
2.2.12 Ant_2 to Ant_7



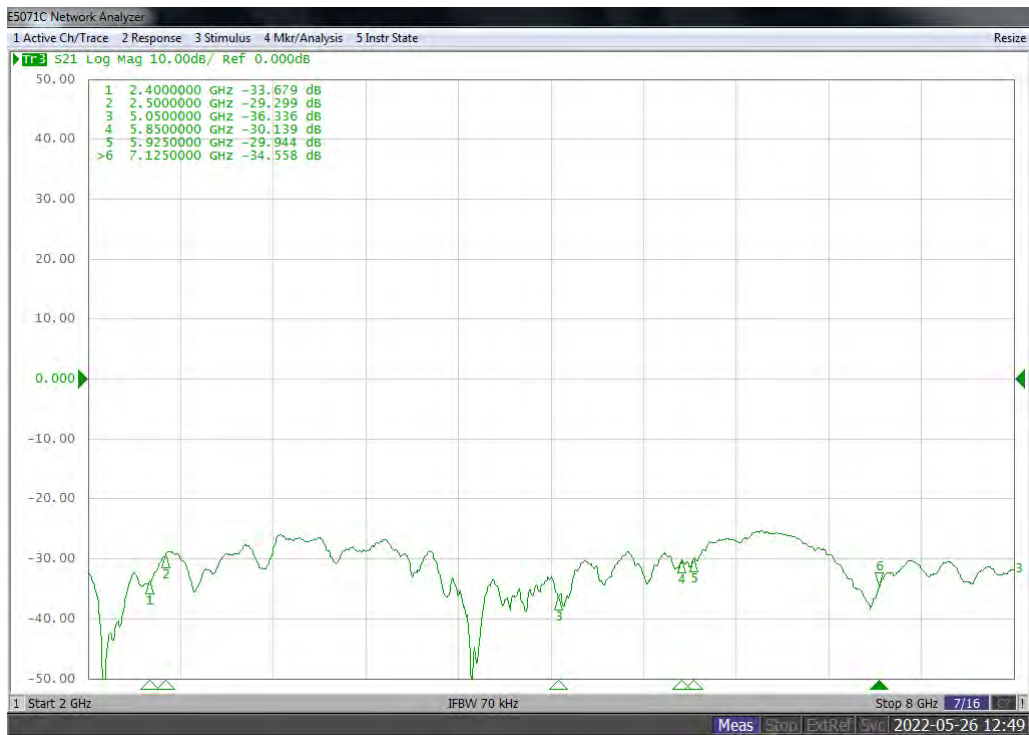
2.2.13 Ant_2 to Ant_8



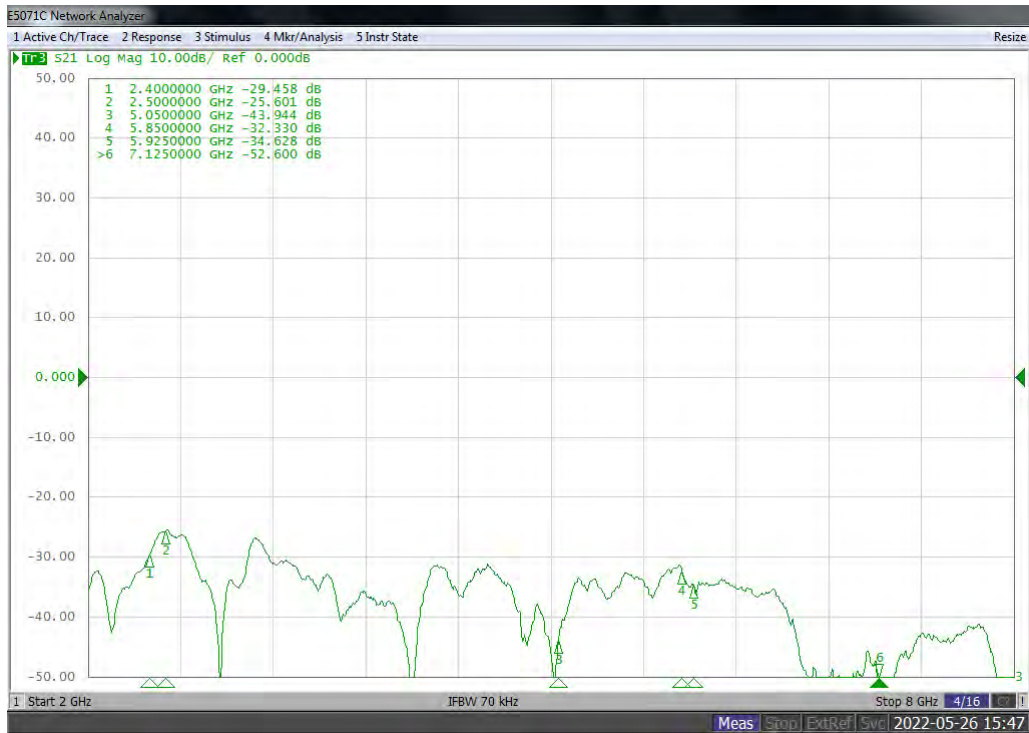
2.2.14 Ant_3 to Ant_4



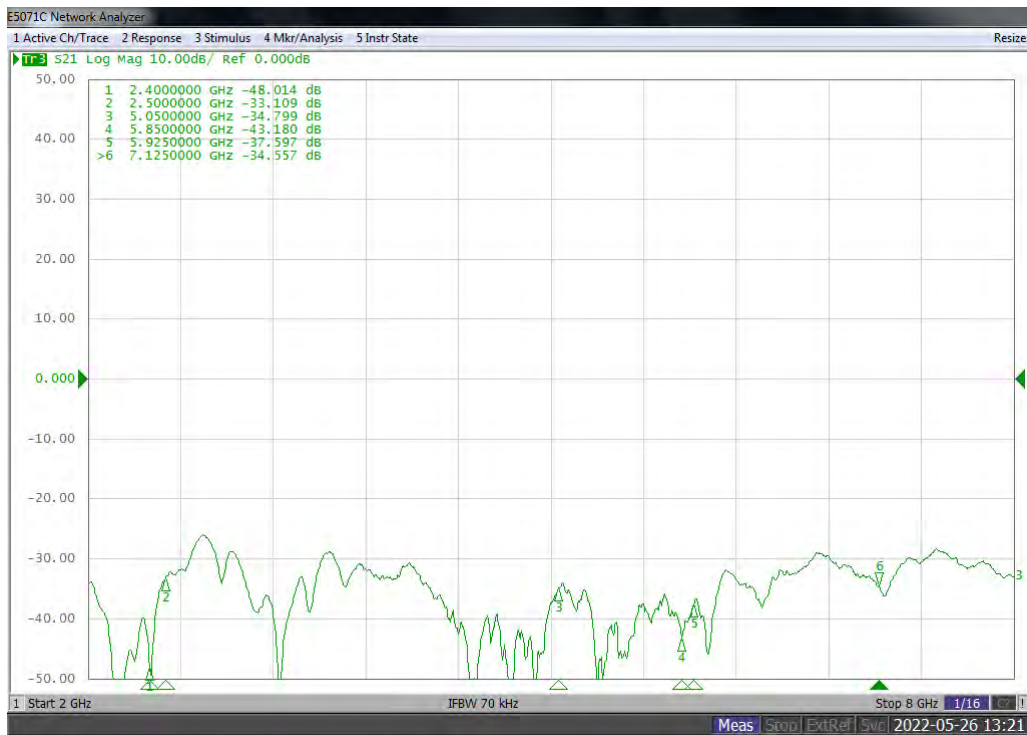
2.2.15 Ant_3 to Ant_5



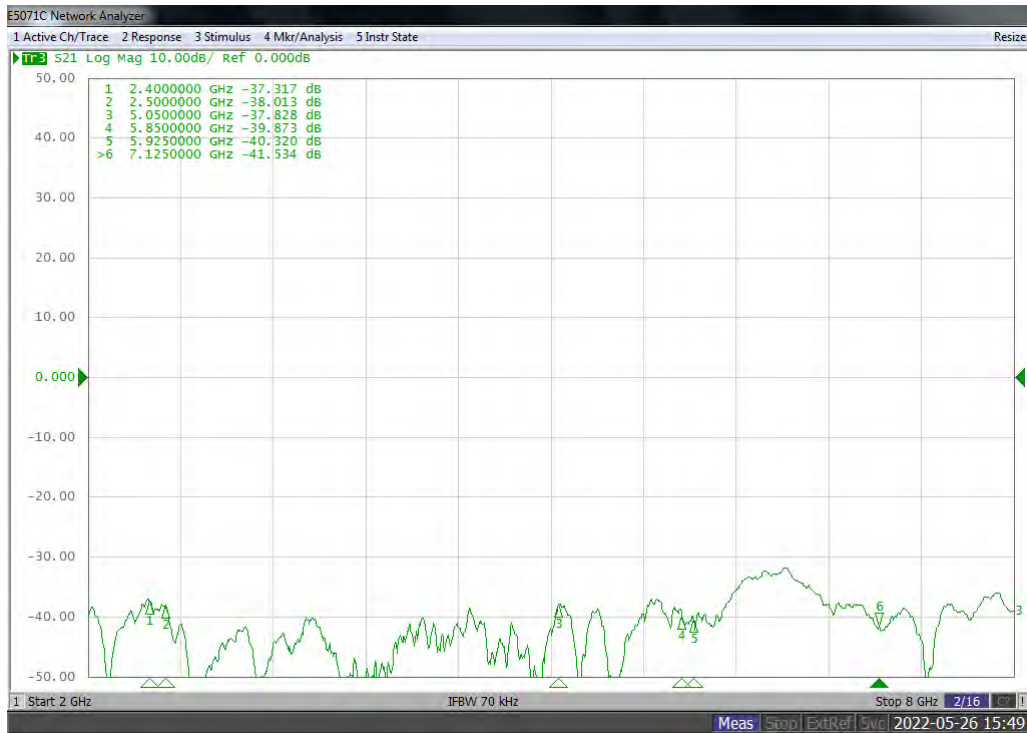
2.2.16 Ant_3 to Ant_6



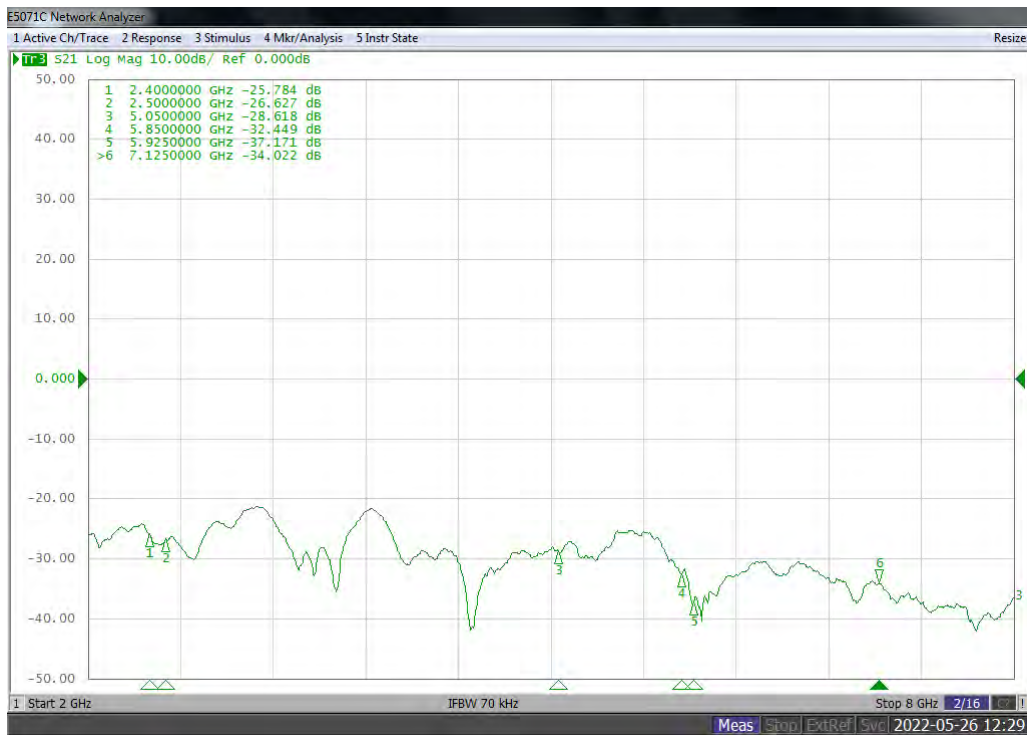
2.2.17 Ant_3 to Ant_7



2.2.18 Ant_3 to Ant_8



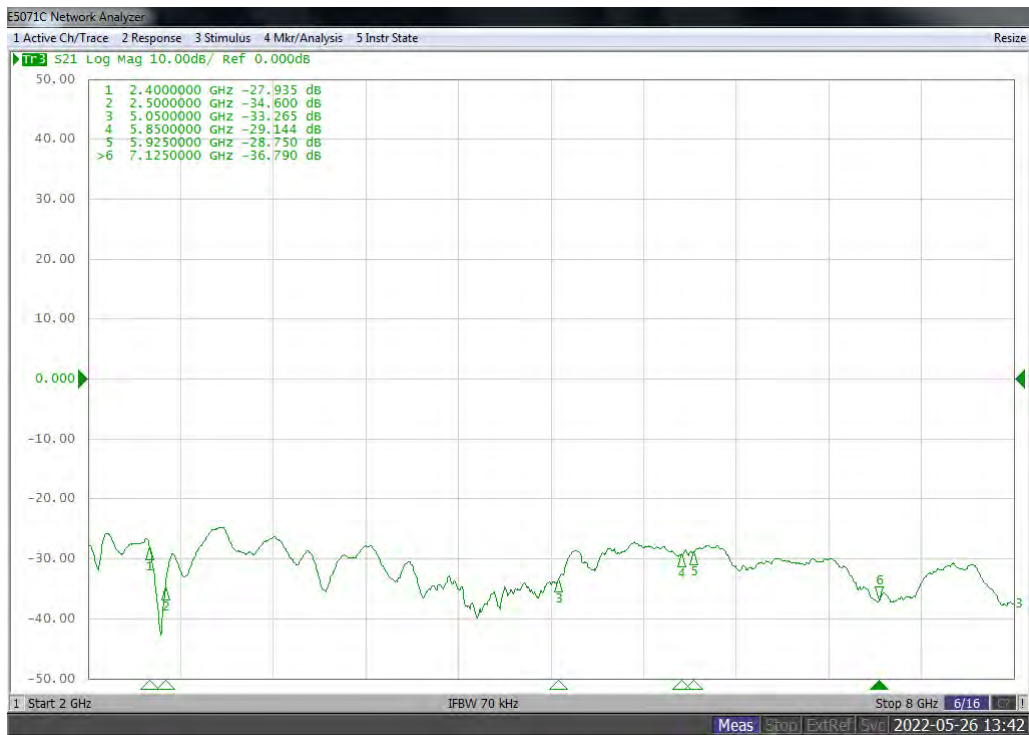
2.2.19 Ant_4 to Ant_5



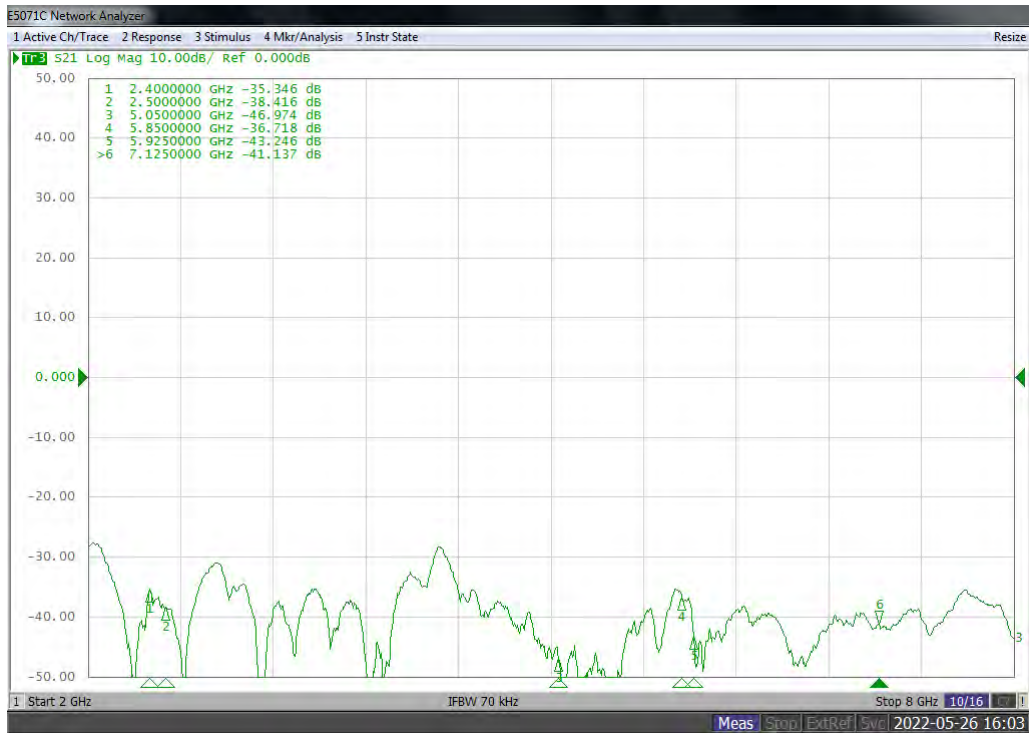
2.2.20 Ant_4 to Ant_6



2.2.21 Ant_4 to Ant_7



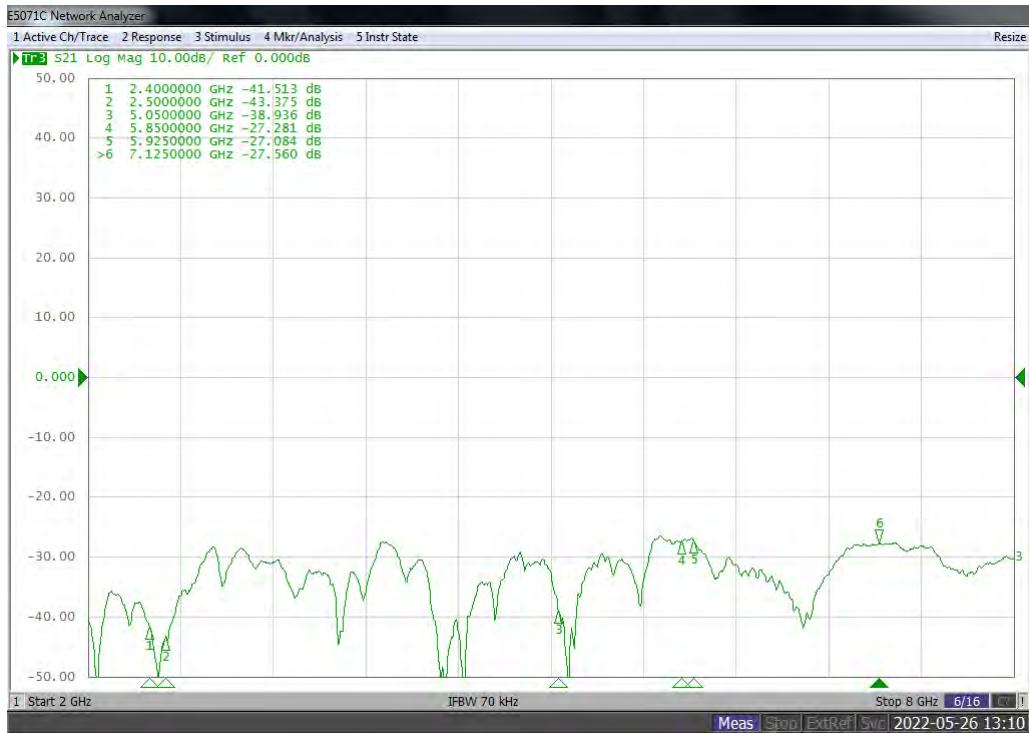
2.2.22 Ant_4 to Ant_8



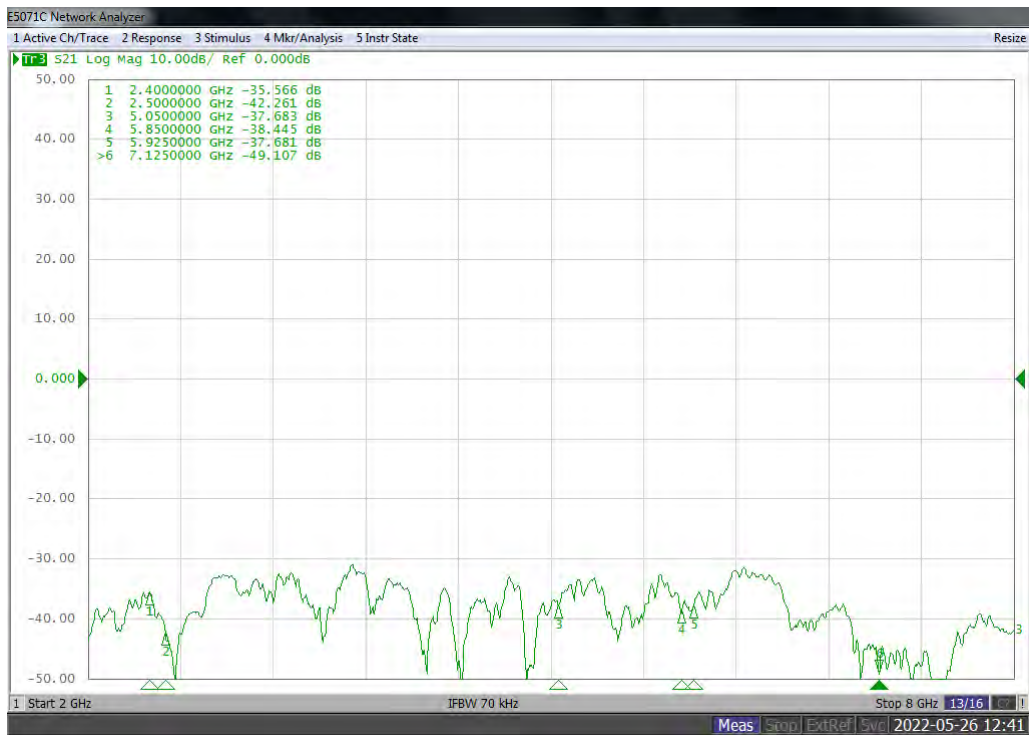
2.2.23 Ant_5 to Ant_6



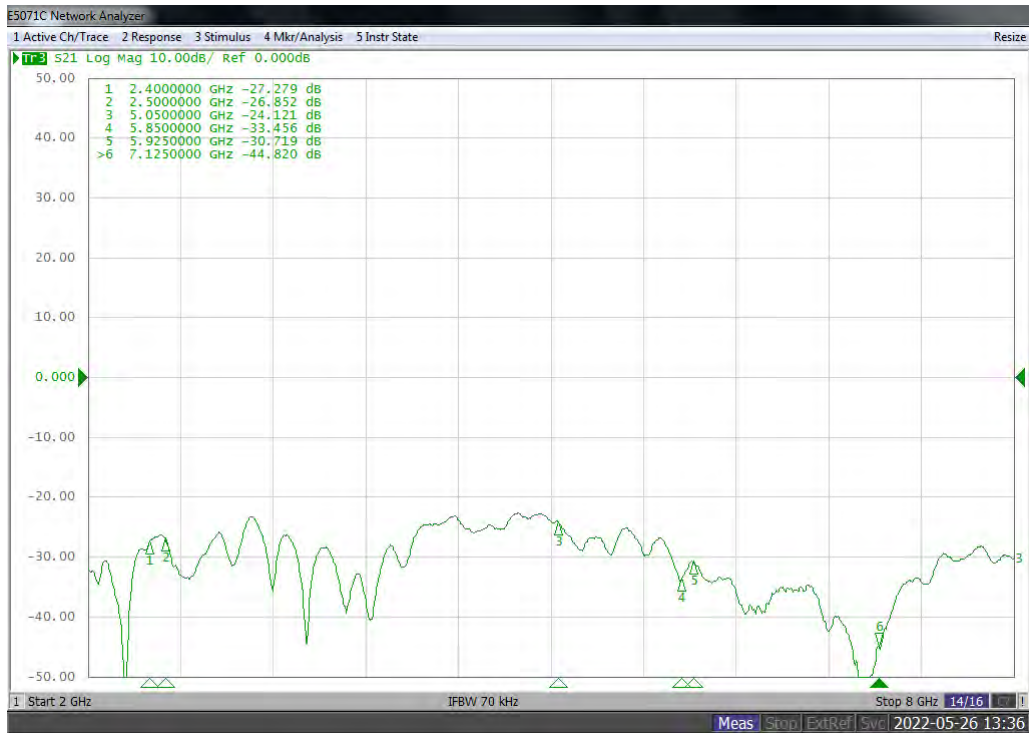
2.2.24 Ant_5 to Ant_7



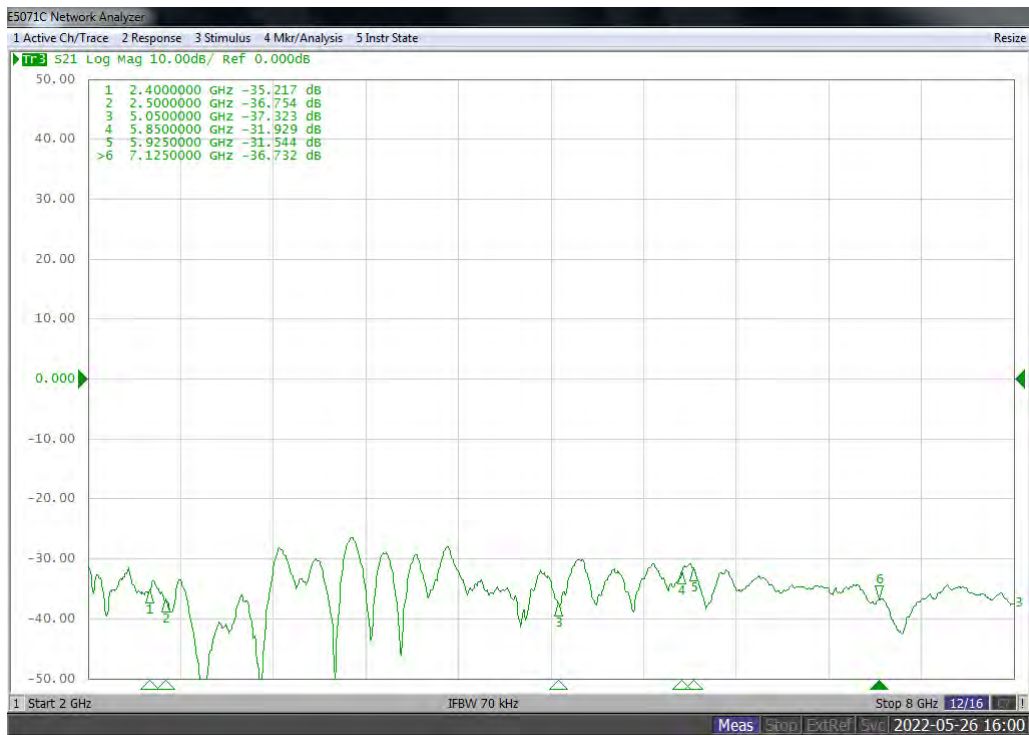
2.2.25 Ant_5 to Ant_8



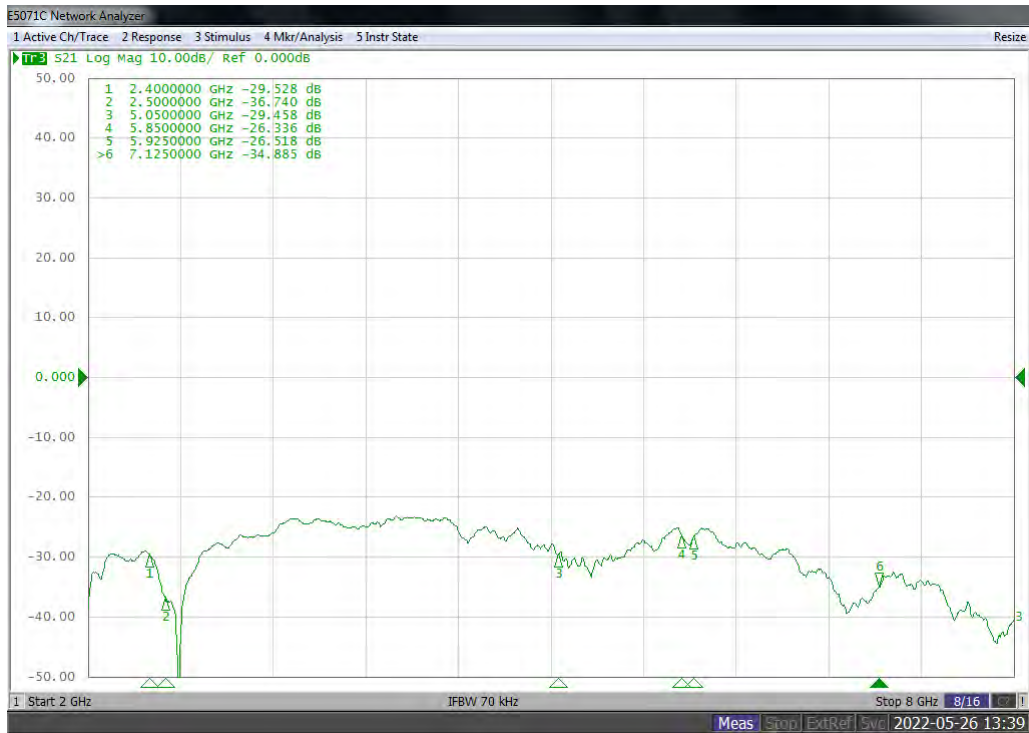
2.2.26 Ant_6 to Ant_7



2.2.27 Ant_6 to Ant_8



2.2.28 Ant_7 to Ant_8

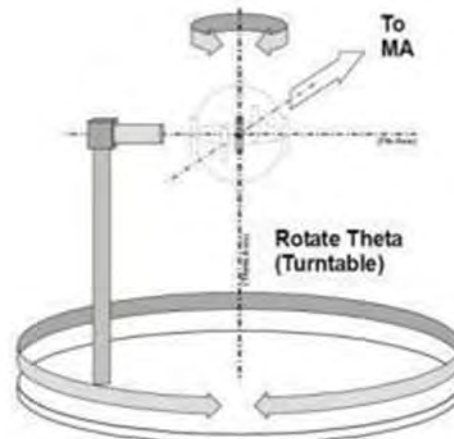
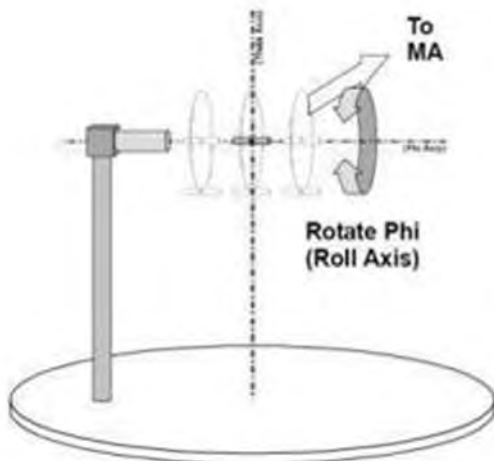
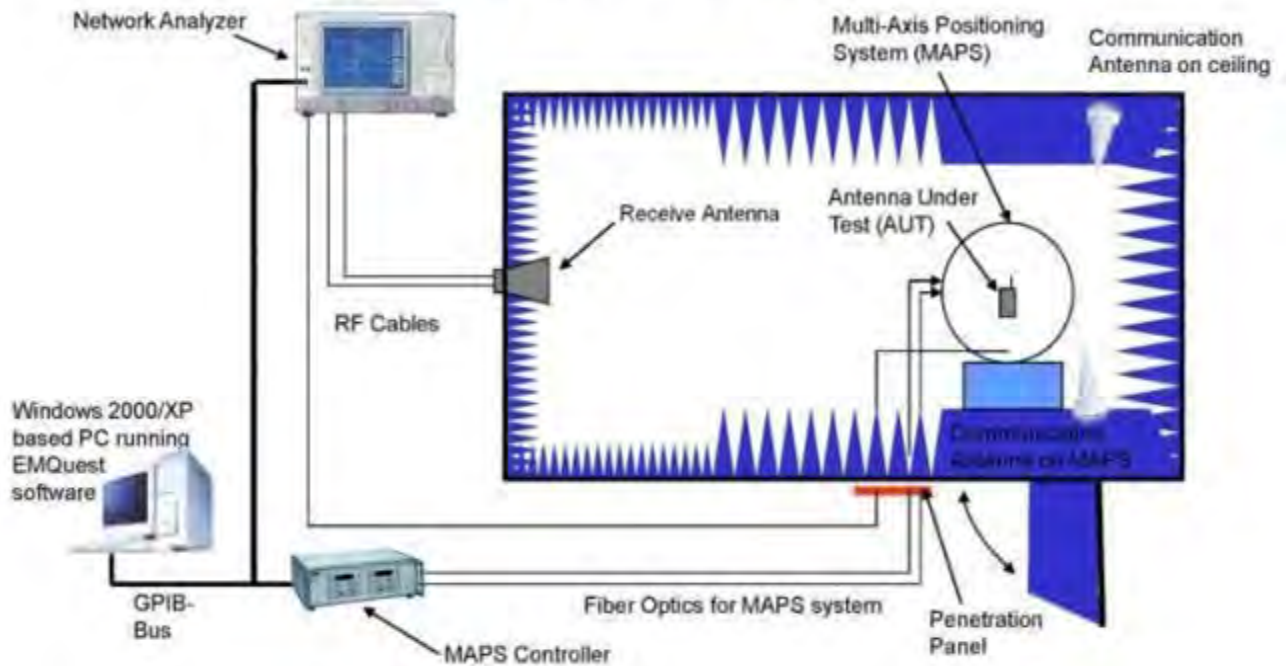


3. Gain & Patterns test results

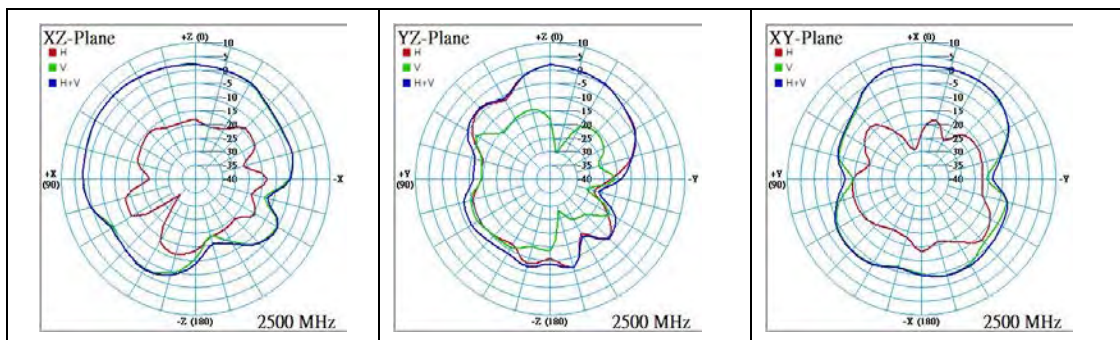
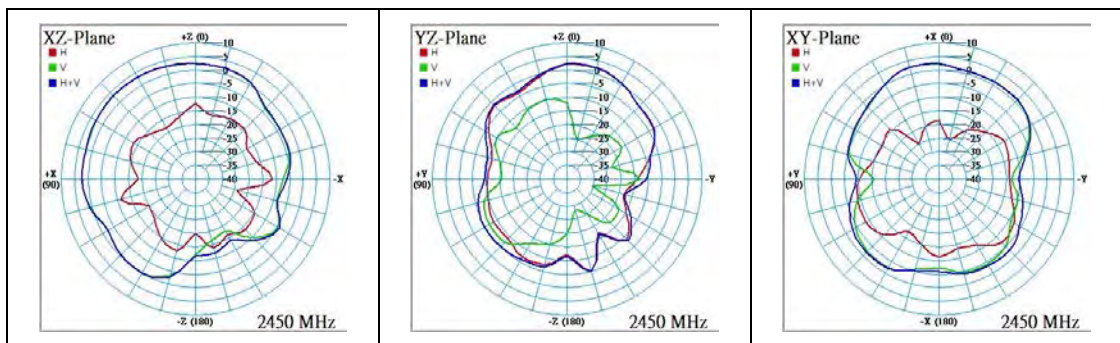
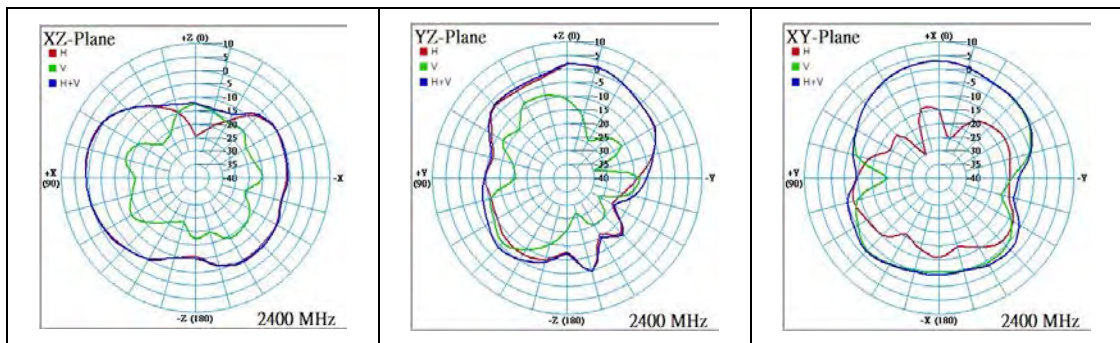
3.1 Lab information

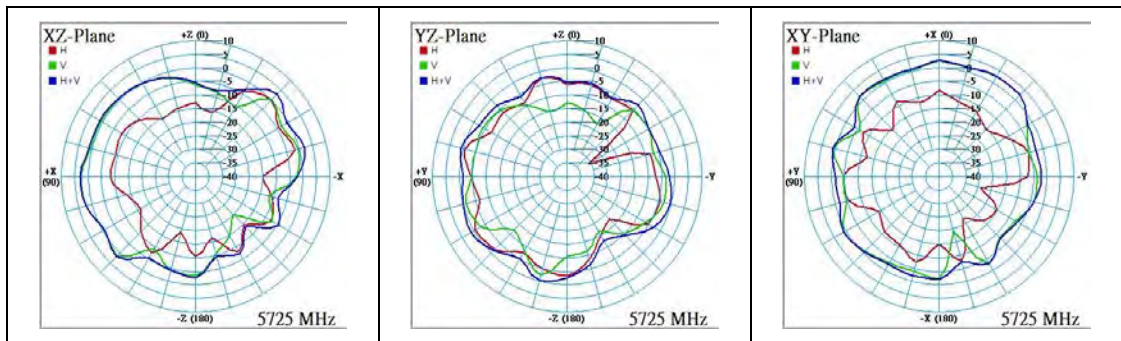
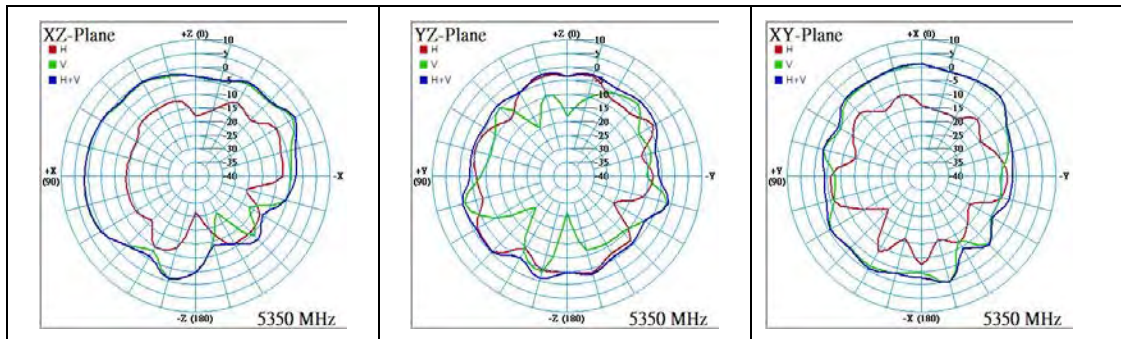
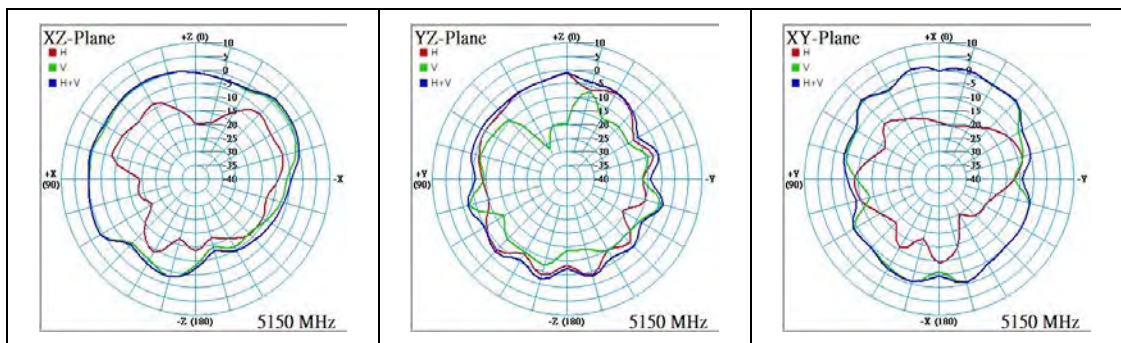
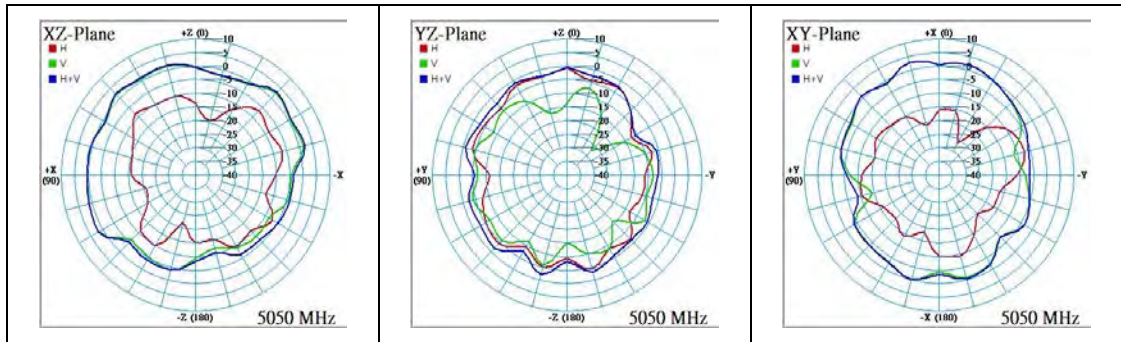
- ETS AMS-8500 Full-Size Rectangular
Serial No.: Euroshield-CT000114-1039
Date: 2009-11-13
- EMQuest EMQ-100 Pattern Measurement Software

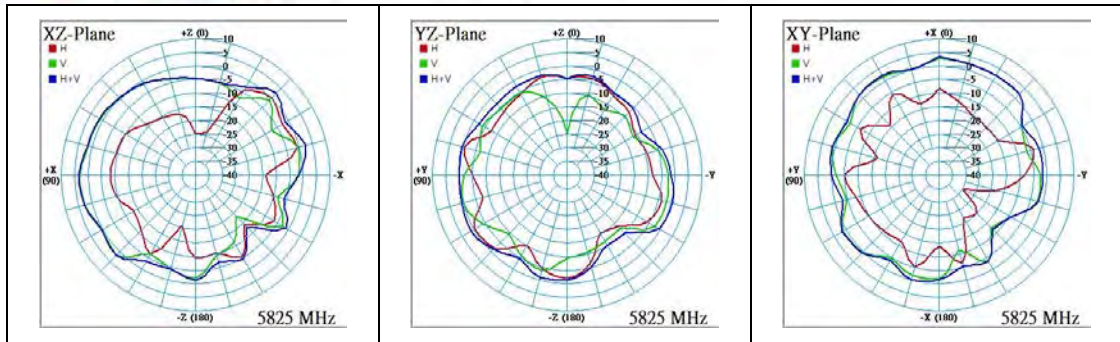
System Diagram



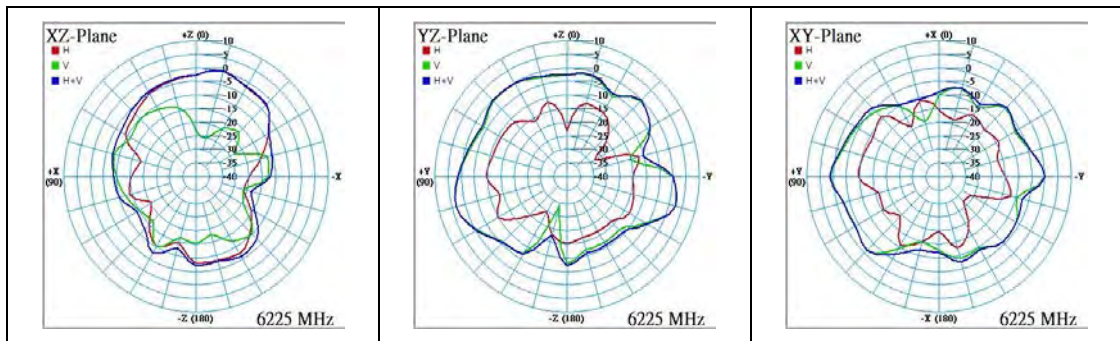
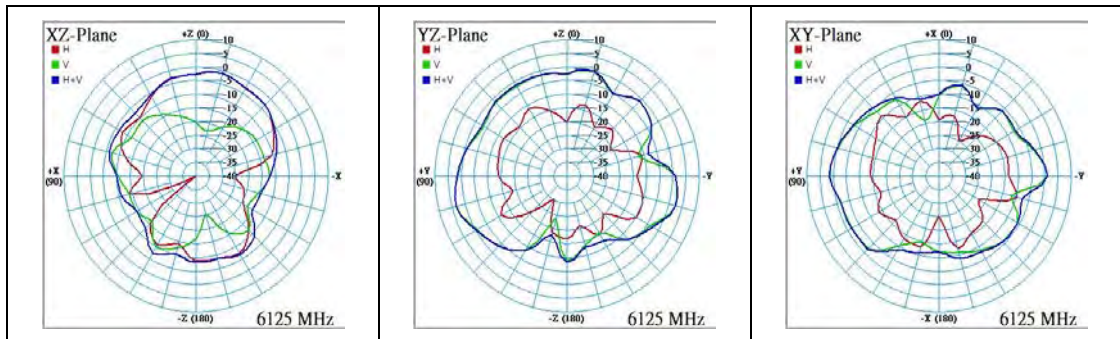
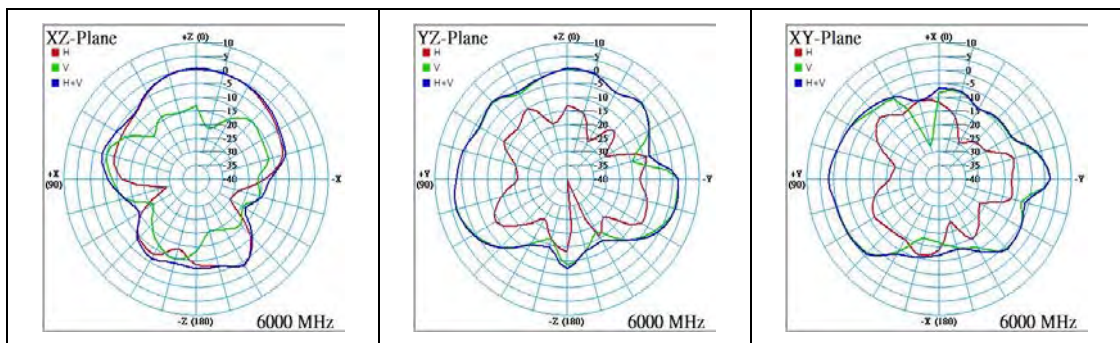
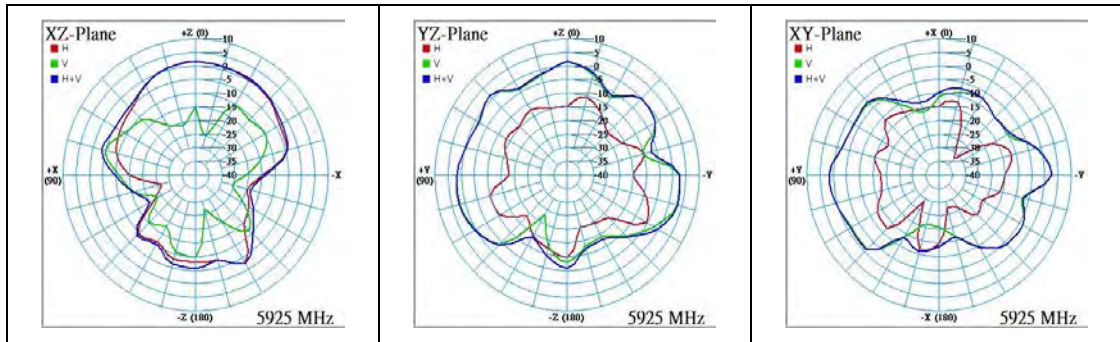
4.2 2D patterns

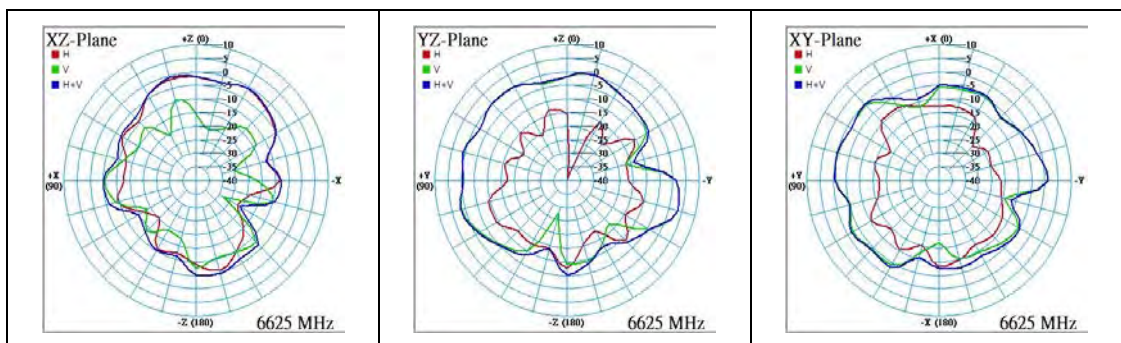
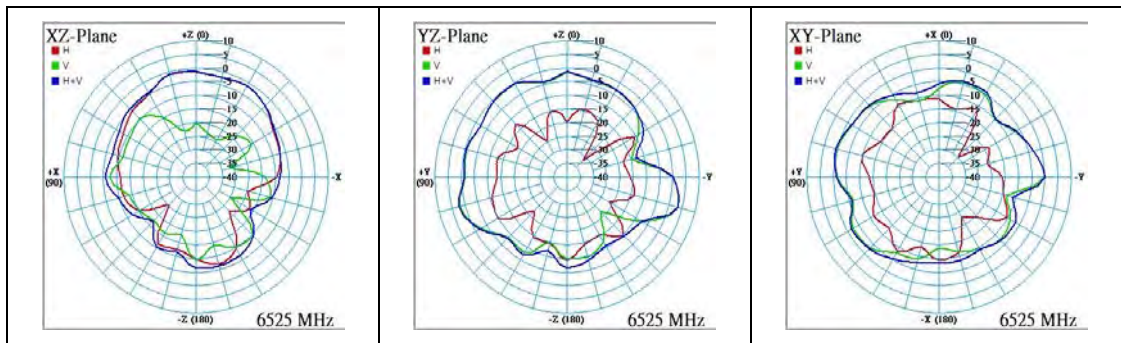
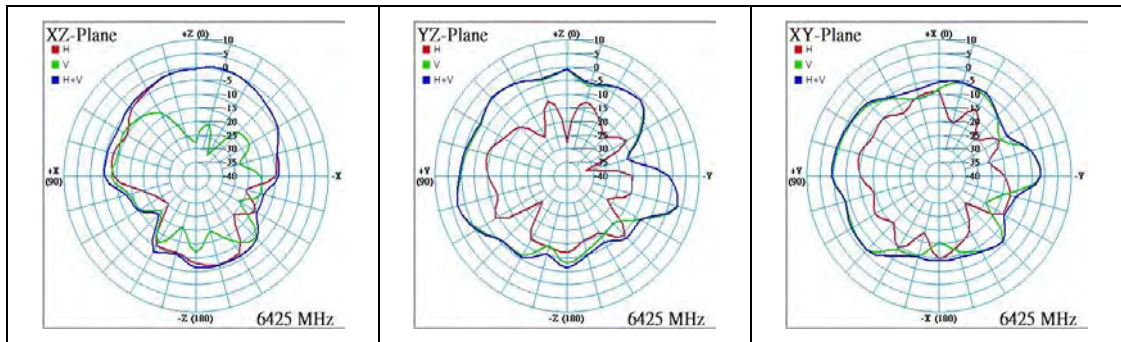
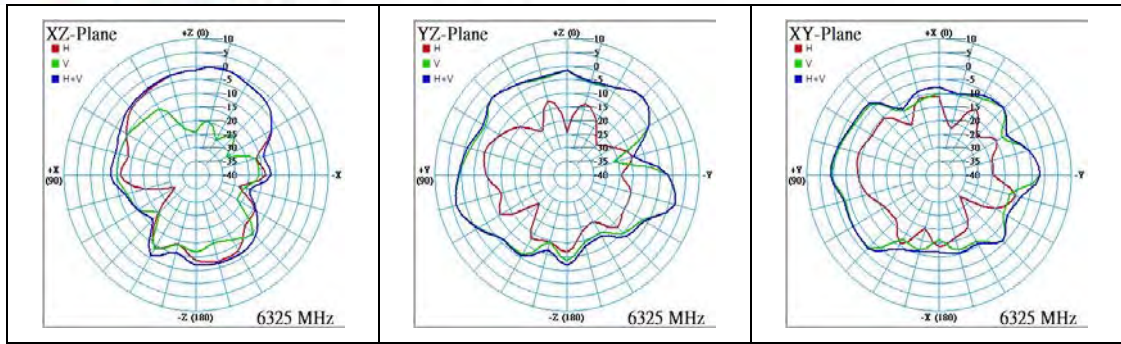


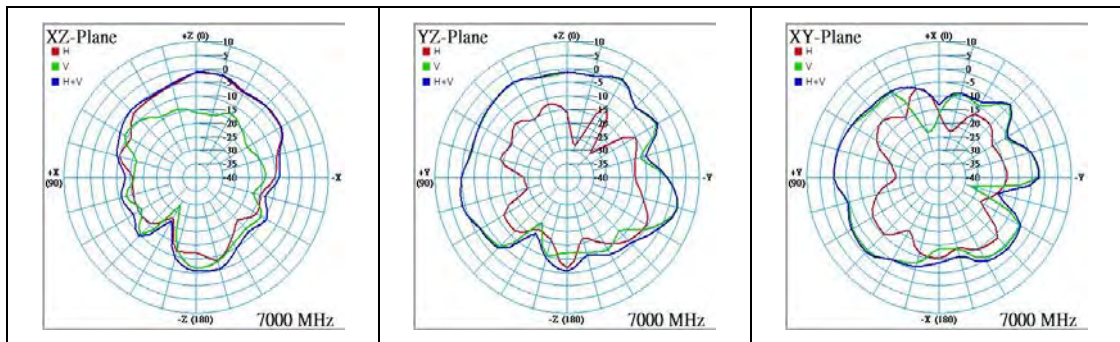
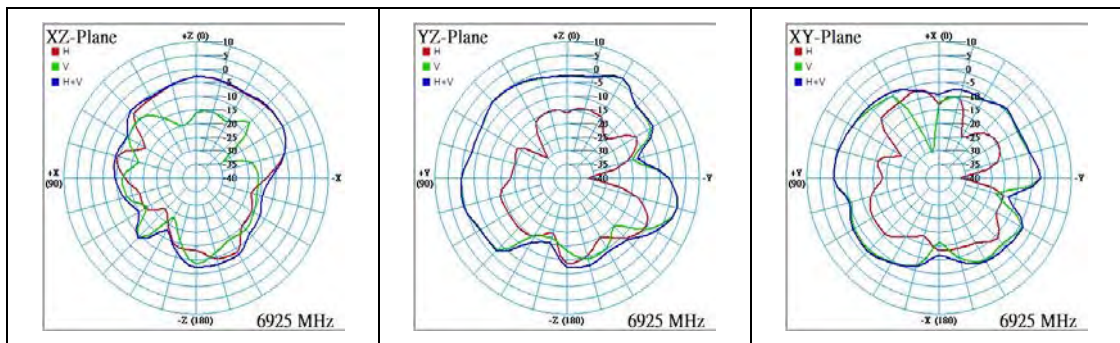
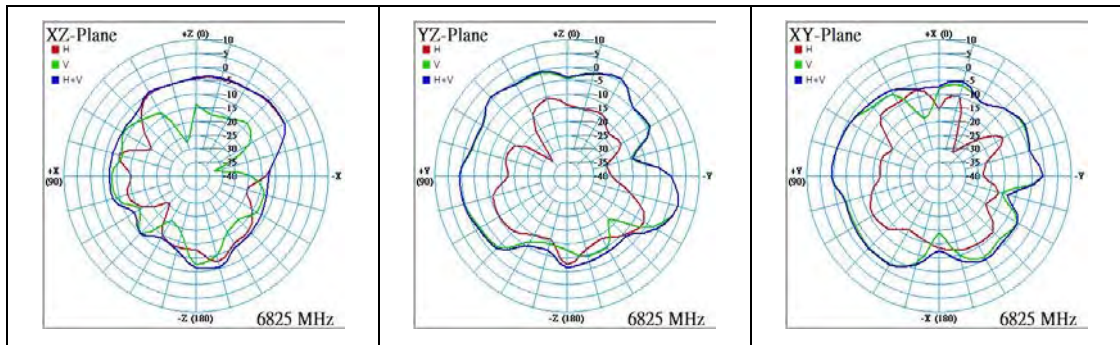
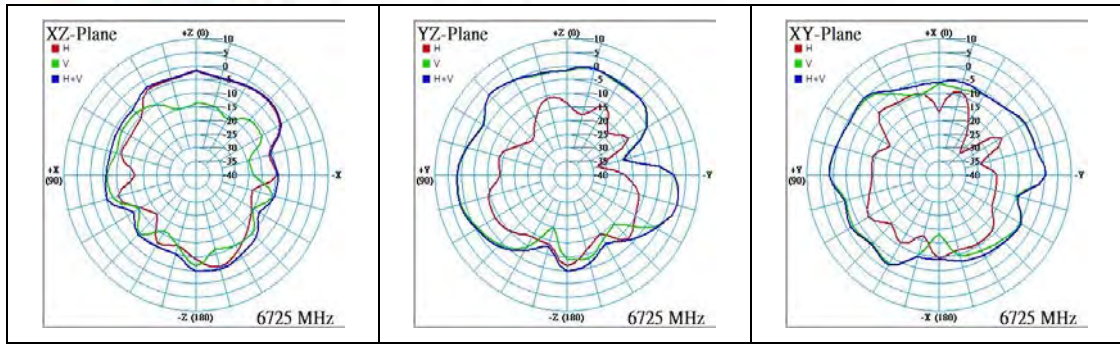


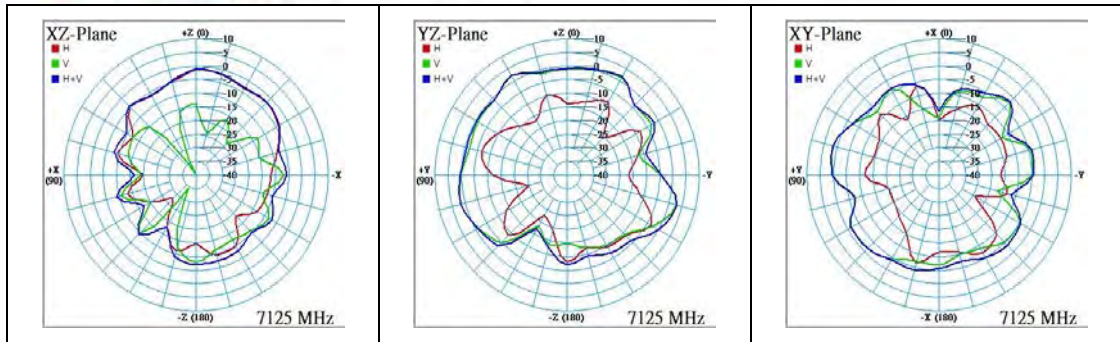


4.2.2 Ant_2 (Wi-Fi 6E)

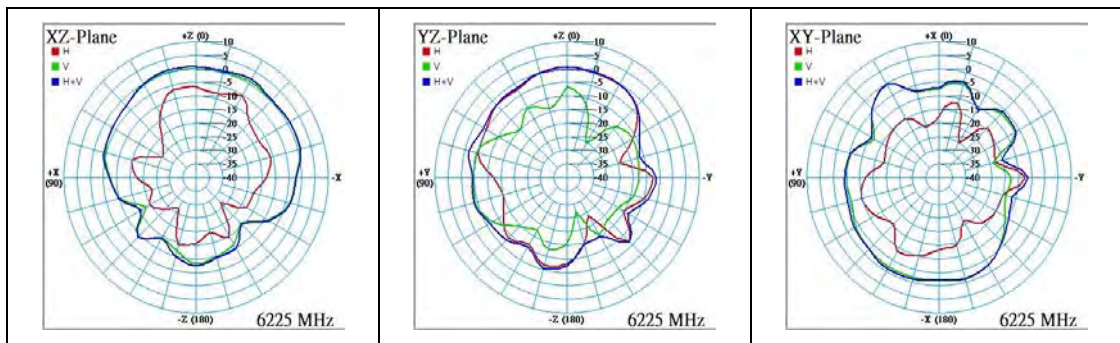
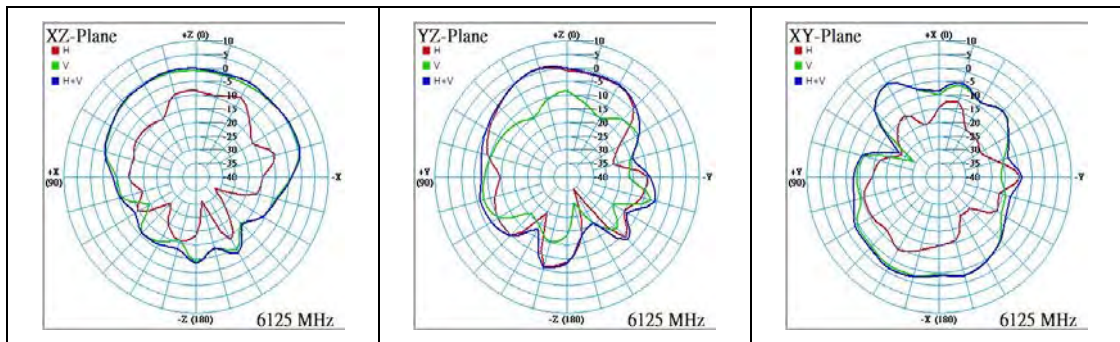
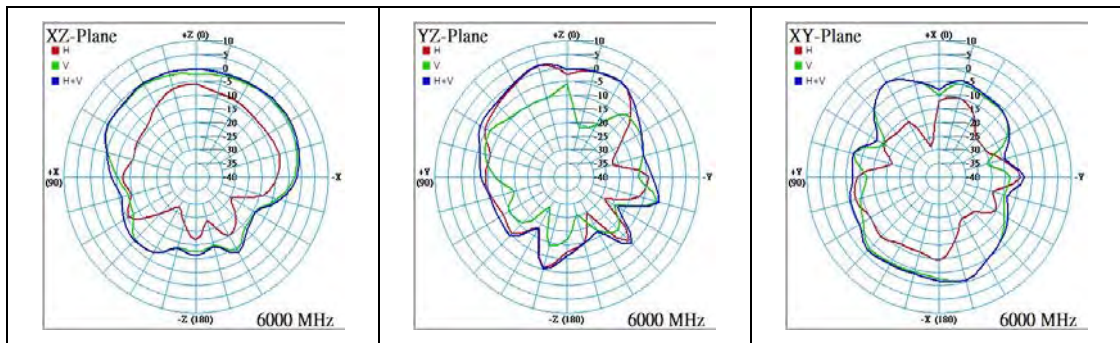
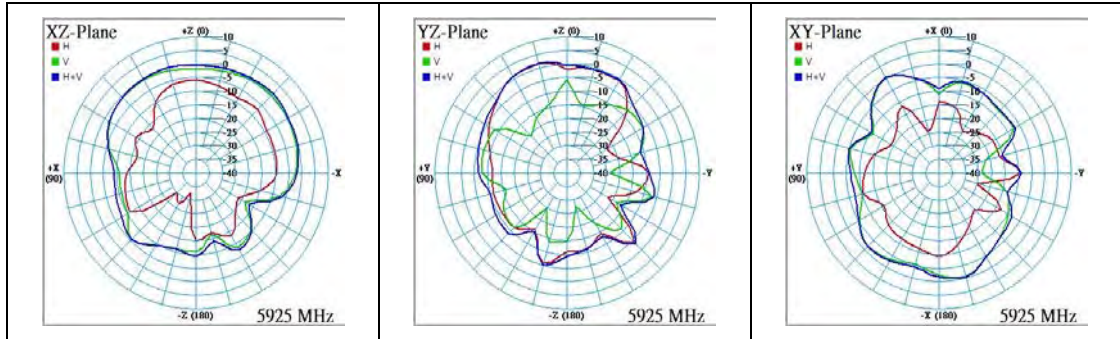


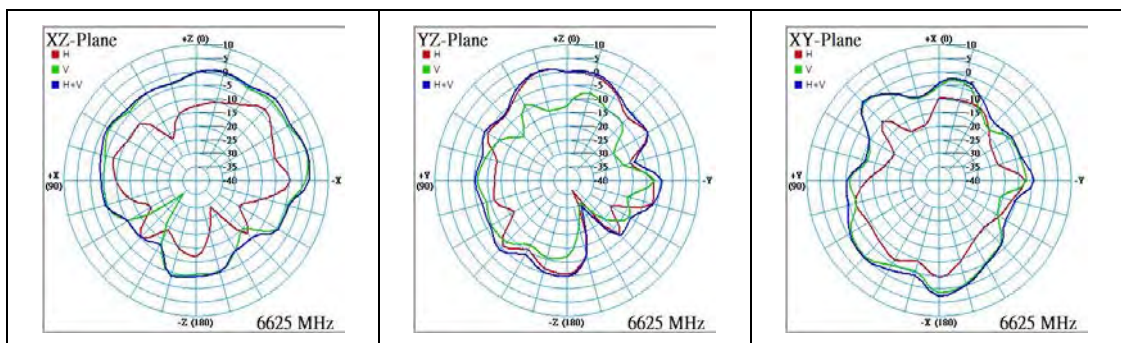
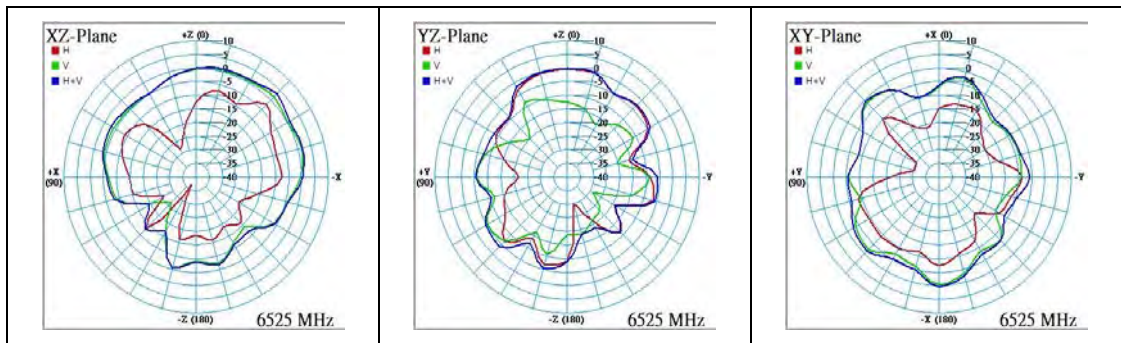
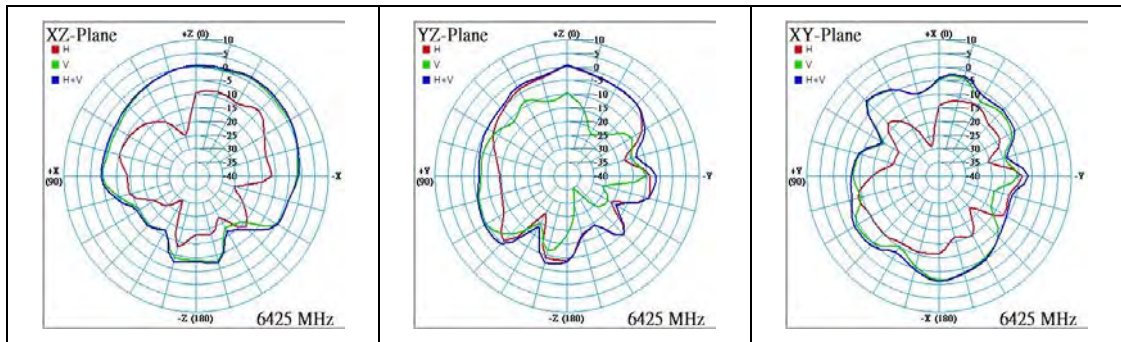
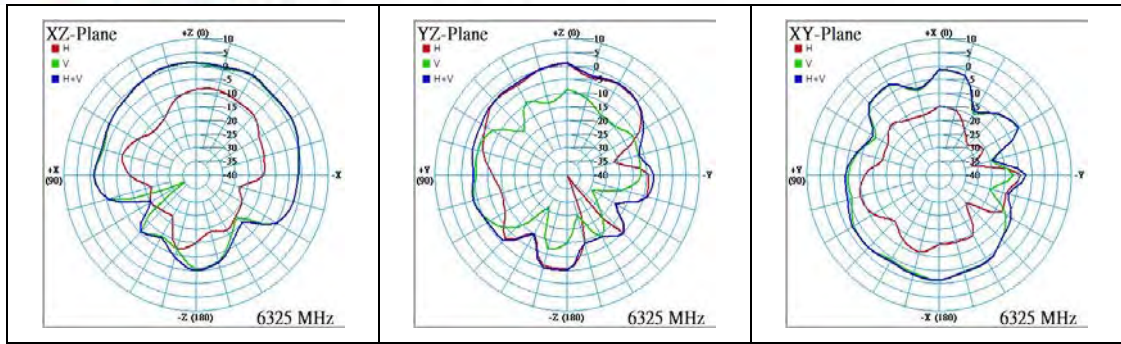


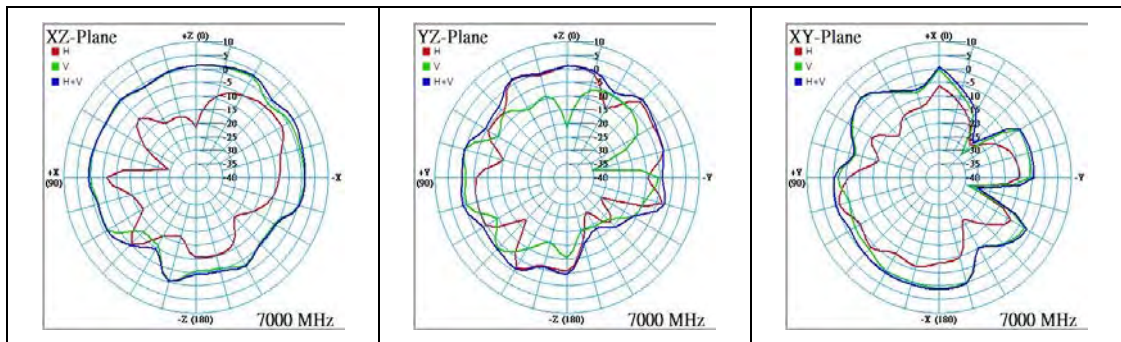
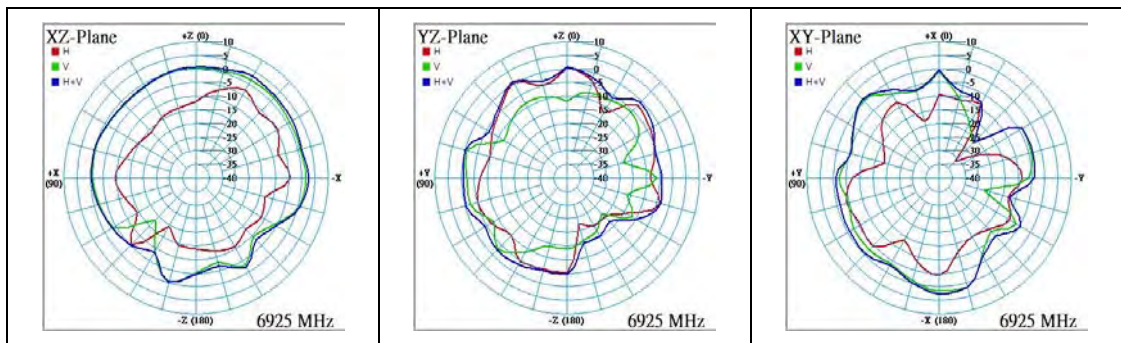
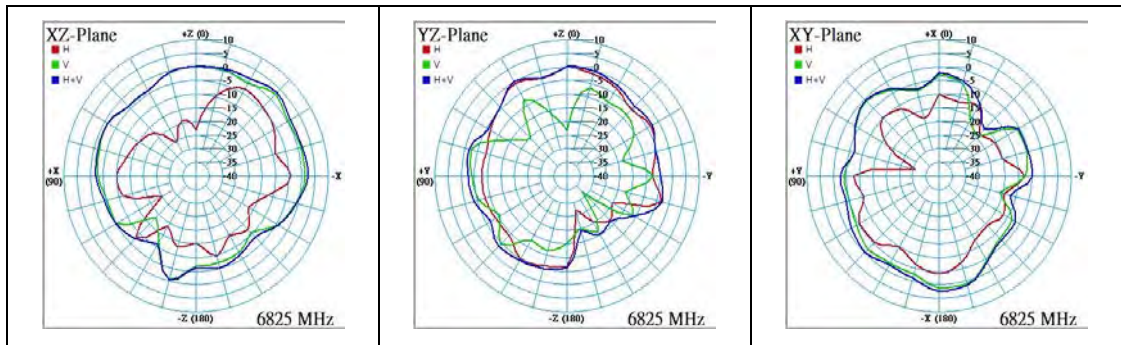
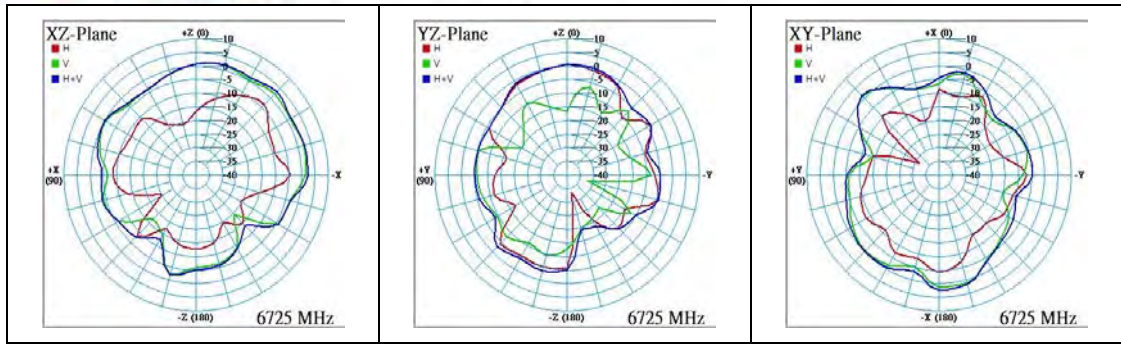


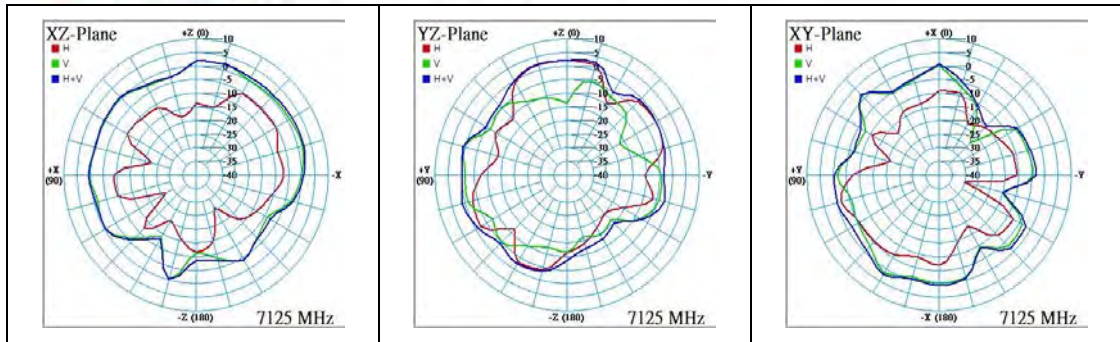


4.2.3 Ant_3 (Wi-Fi 6E)

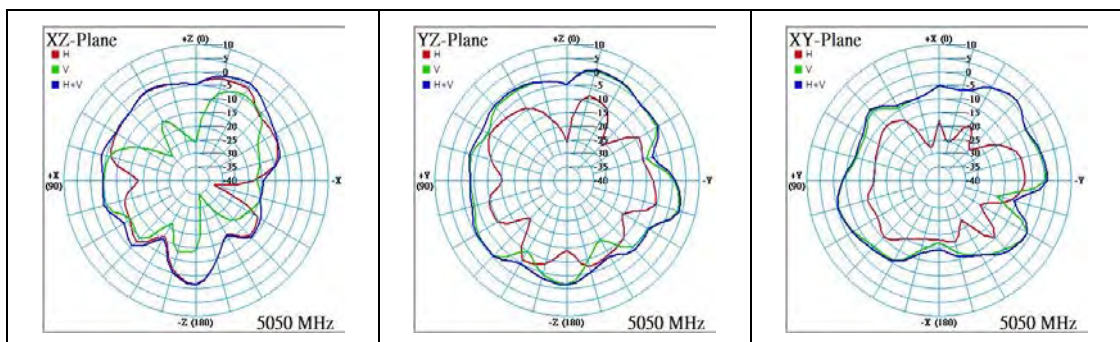
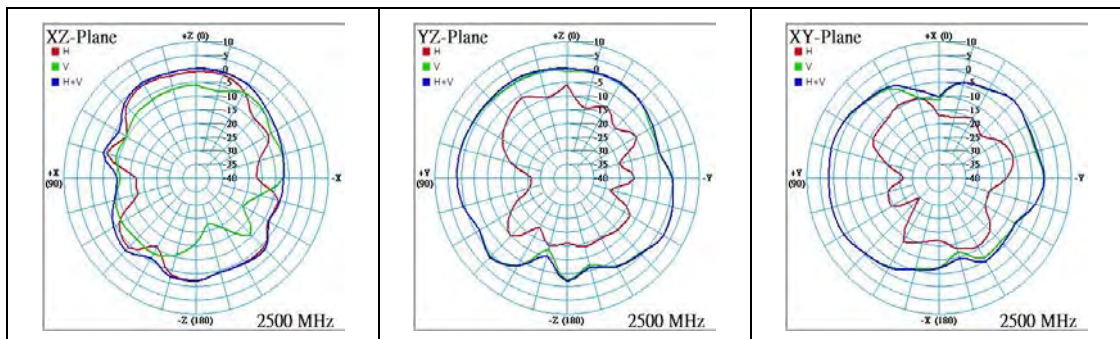
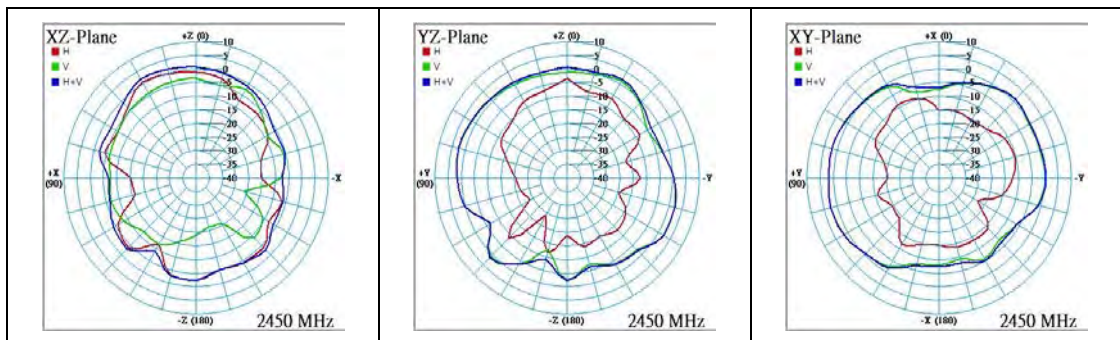
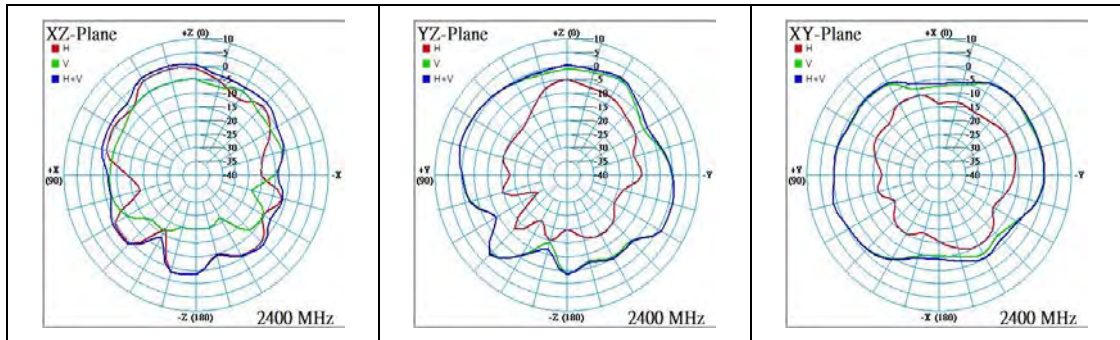


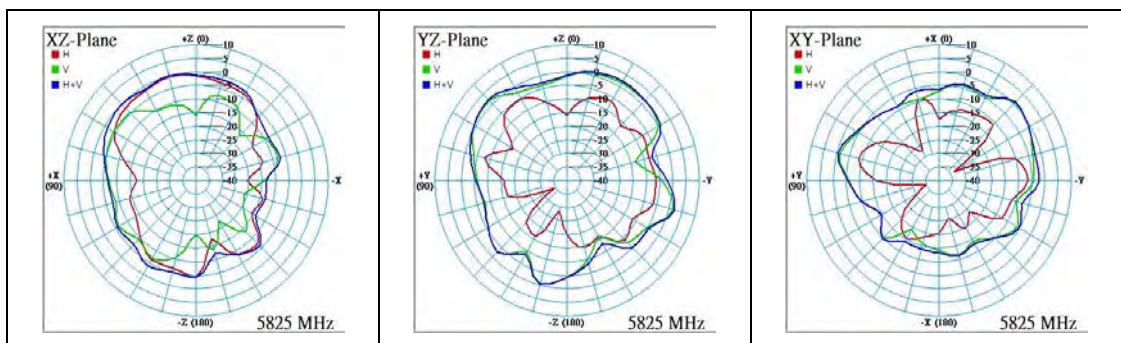
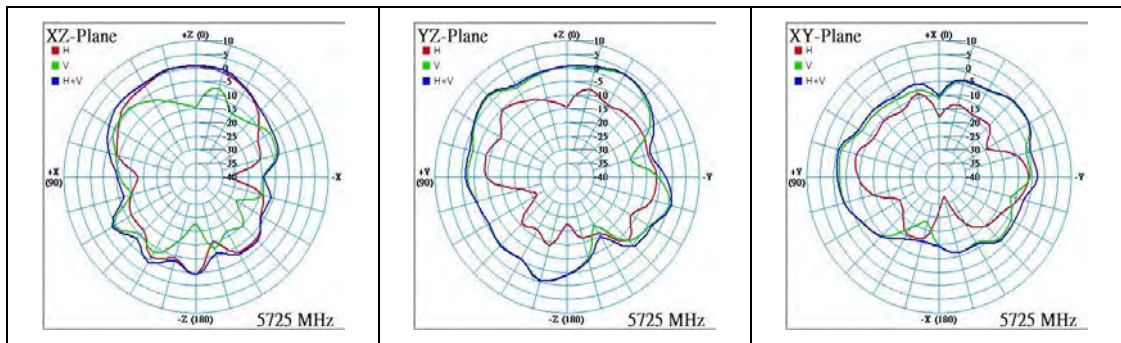
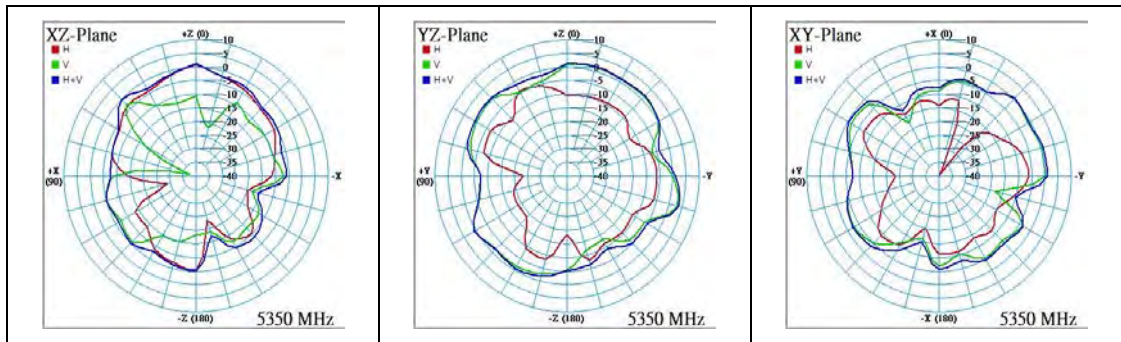
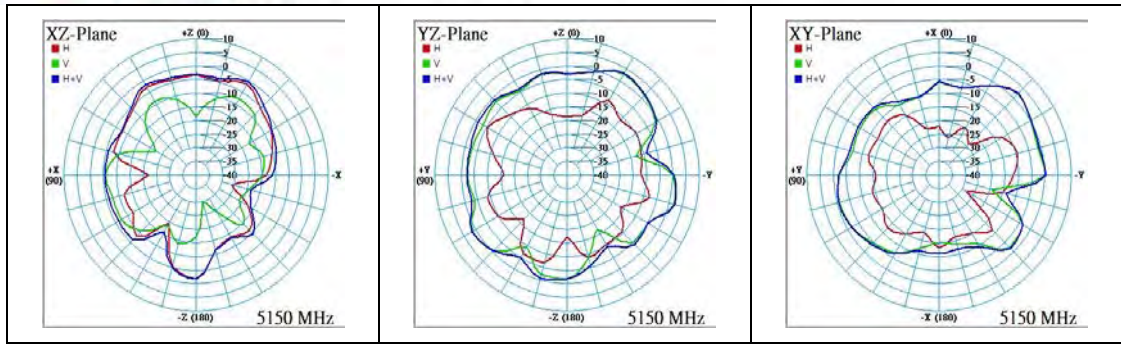




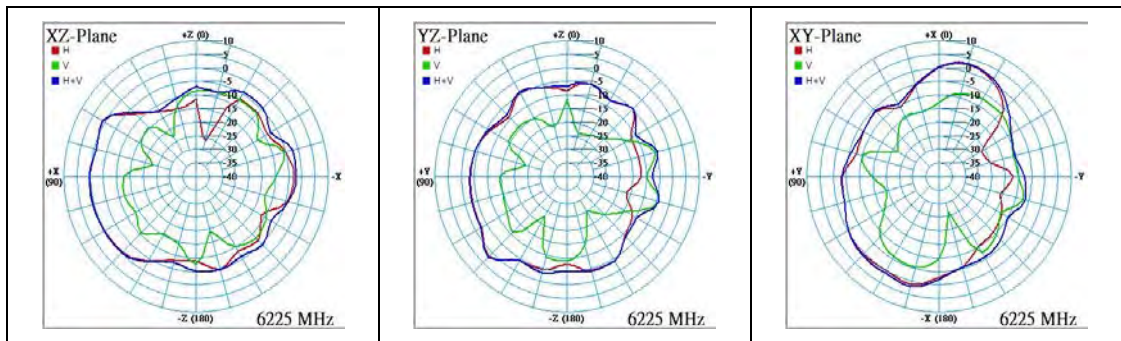
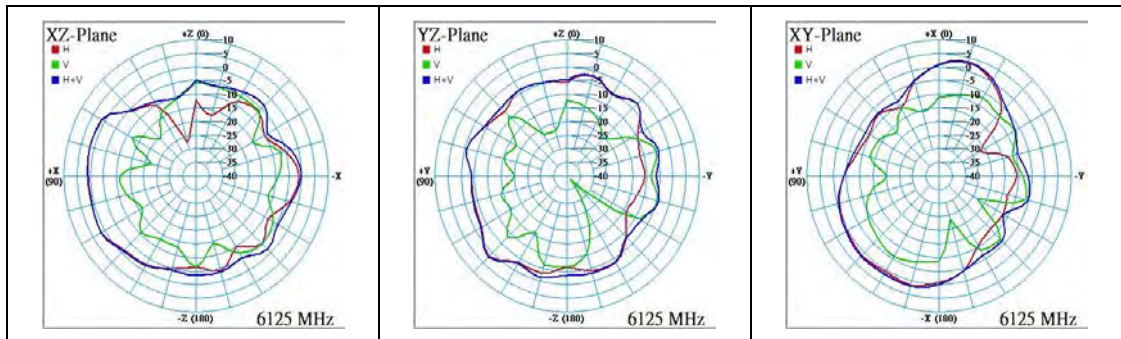
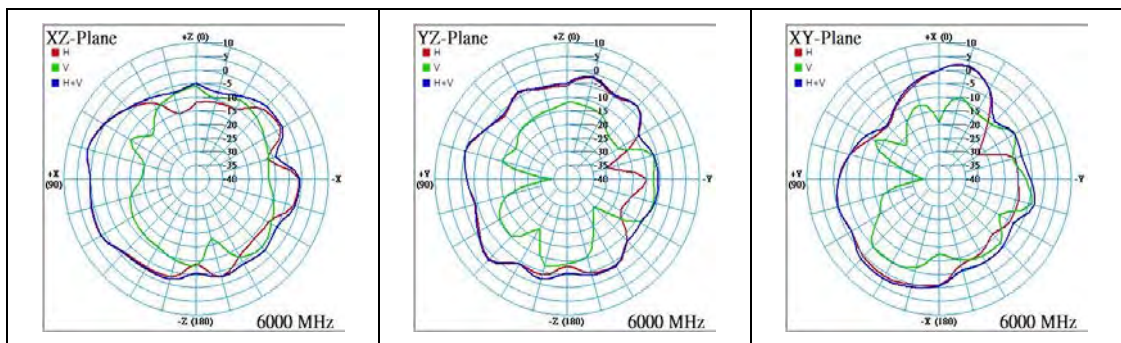
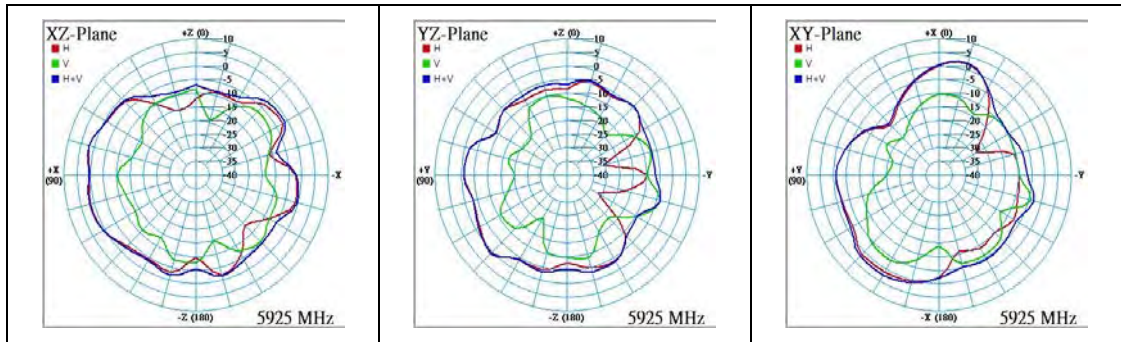


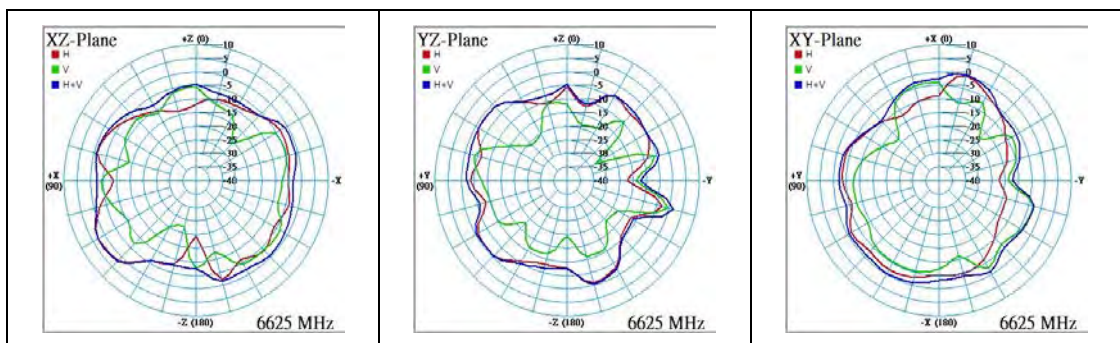
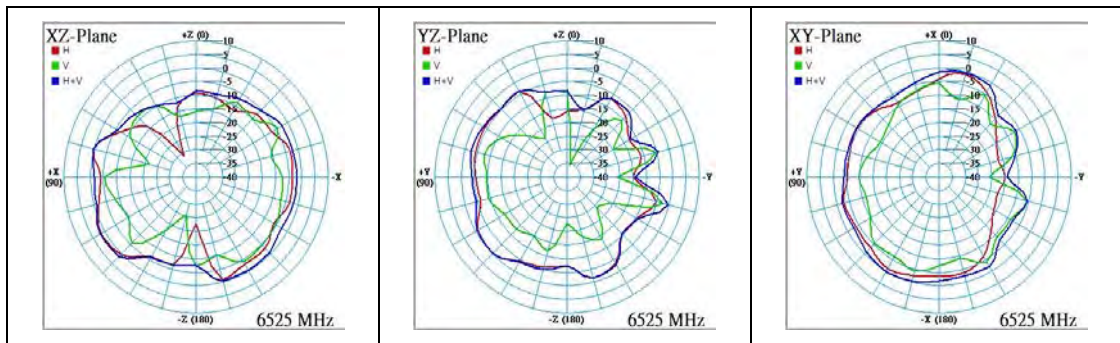
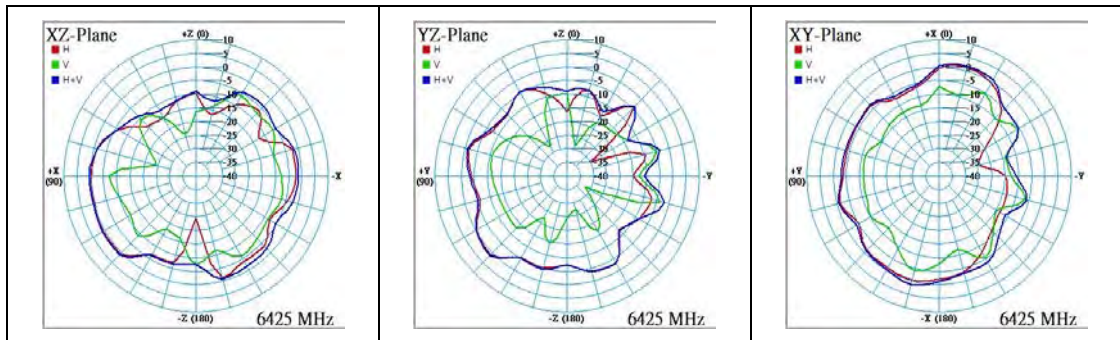
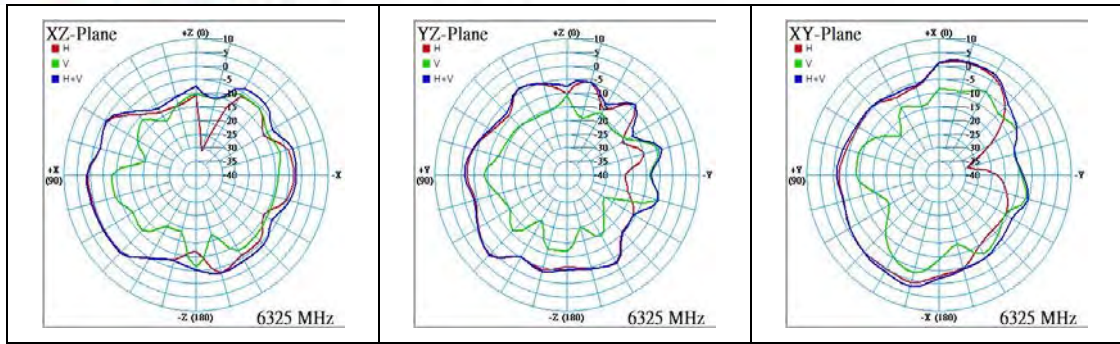
4.2.4 Ant_4 (Dual band)

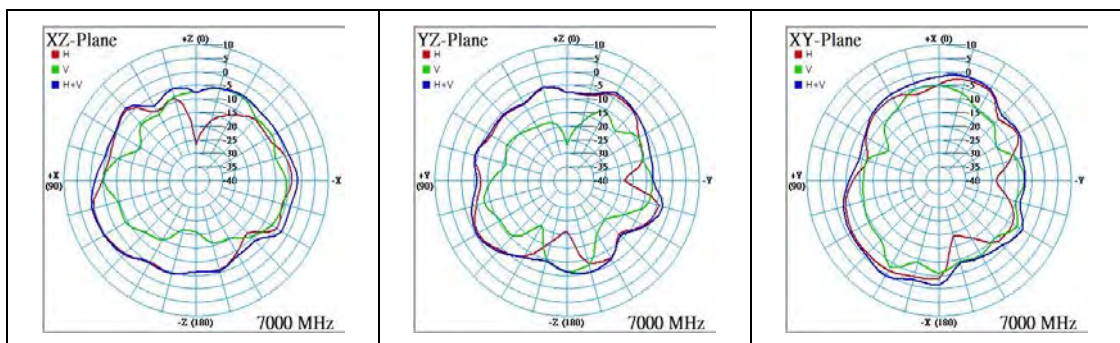
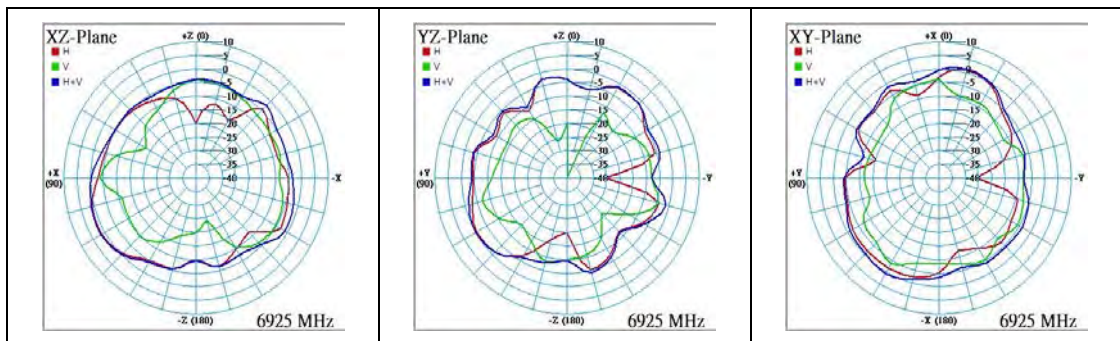
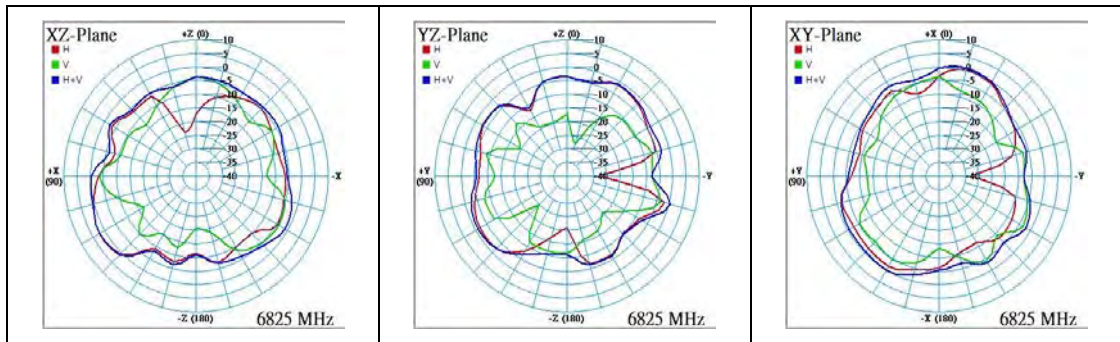
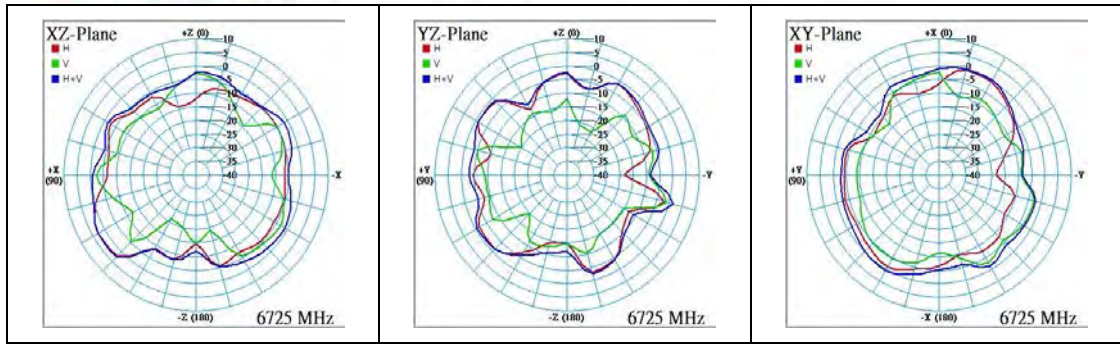


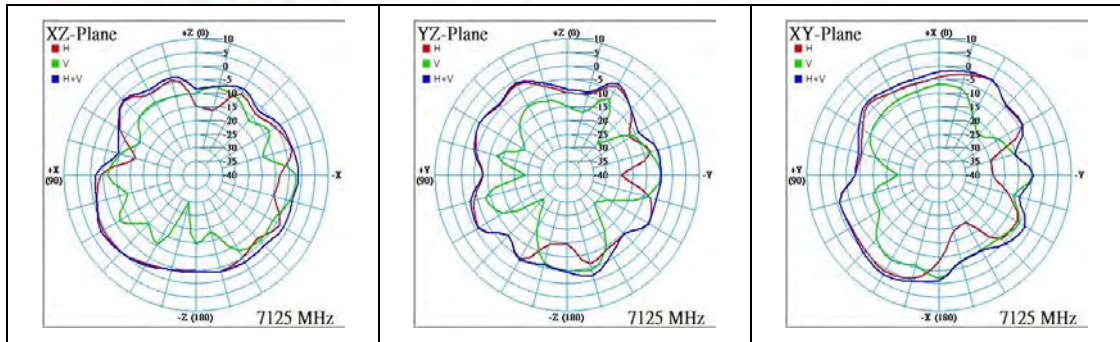


4.2.5 Ant_5 (Wi-Fi 6E)

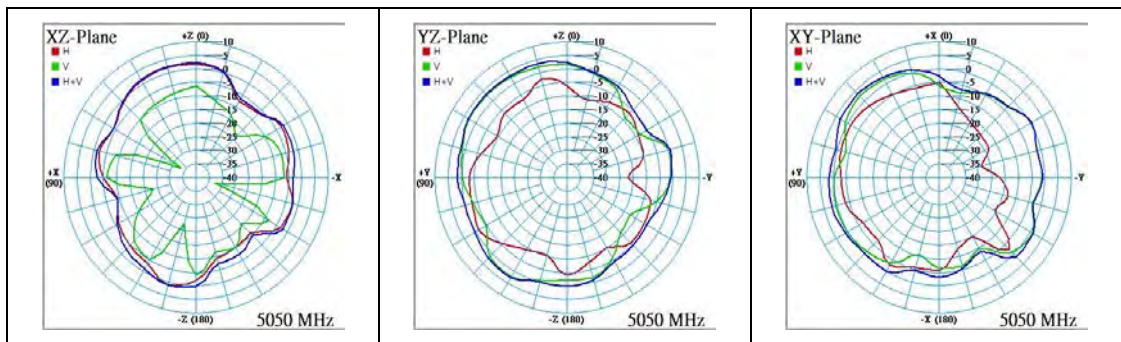
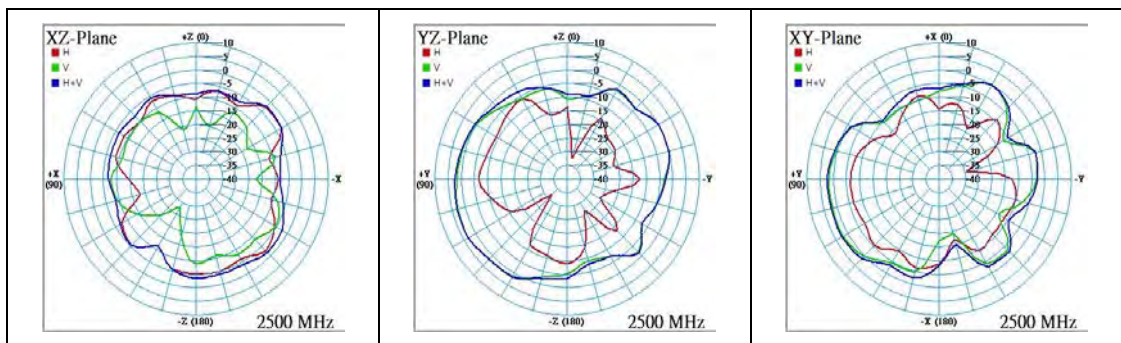
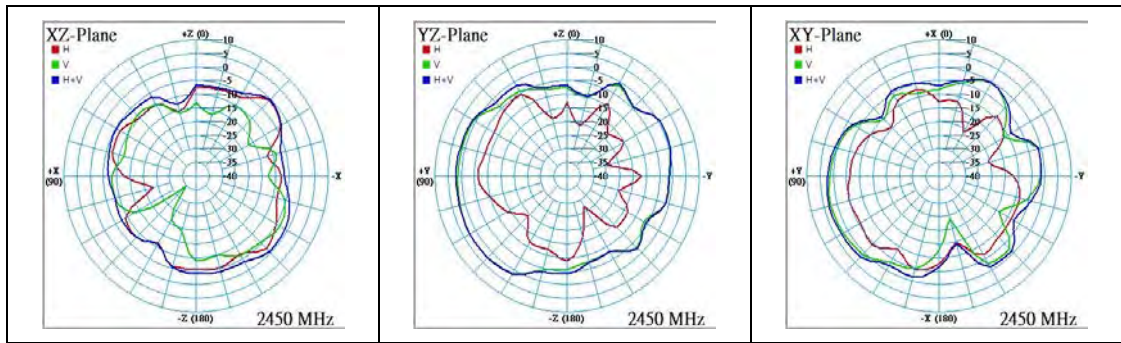
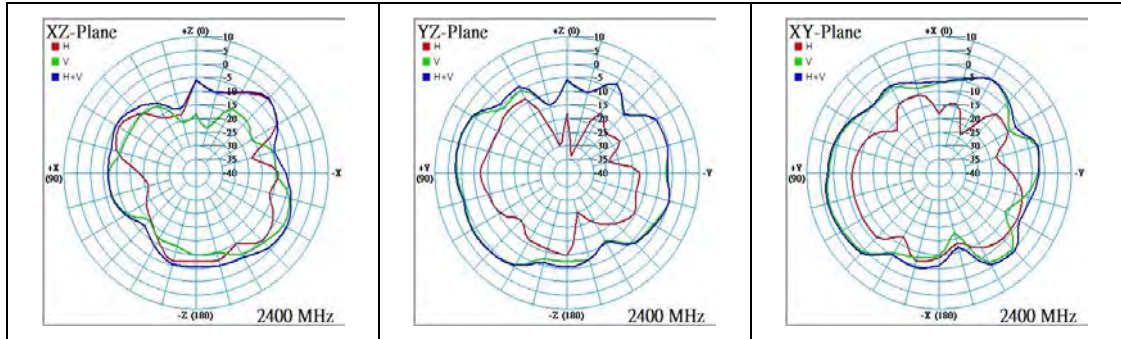


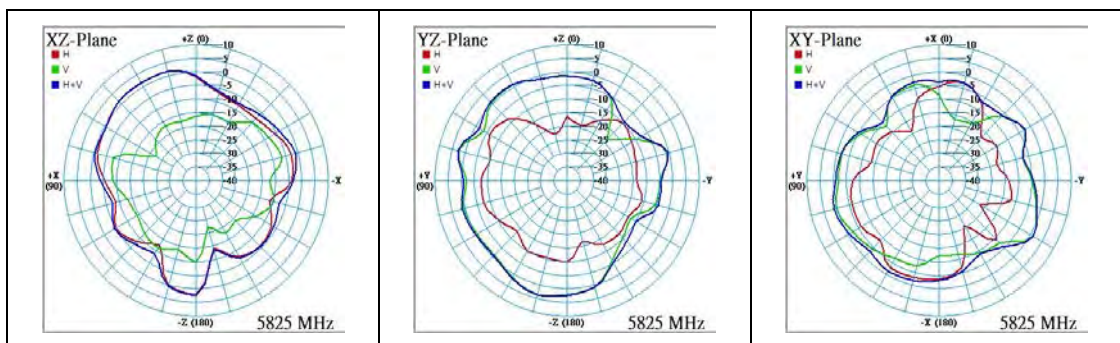
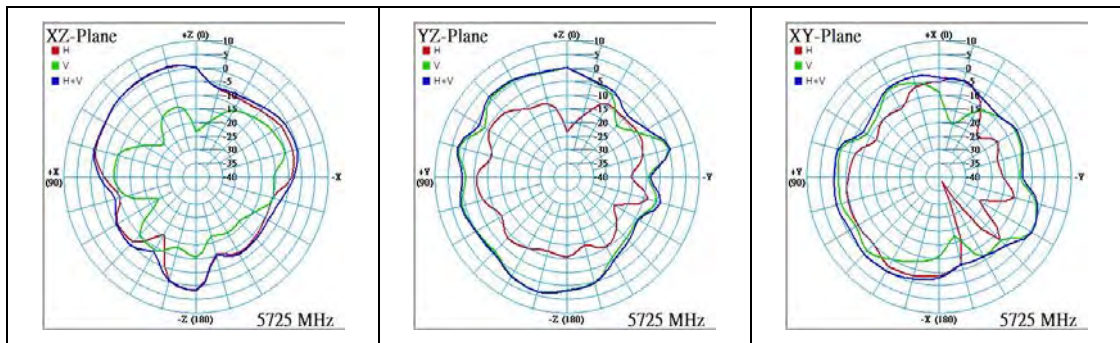
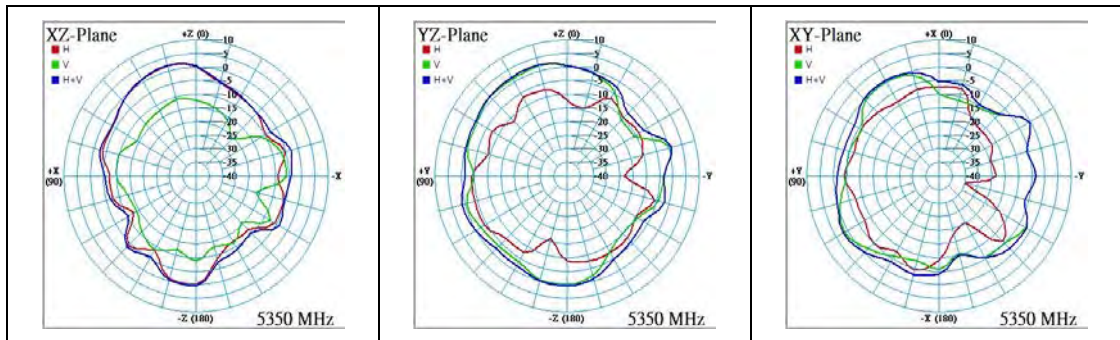
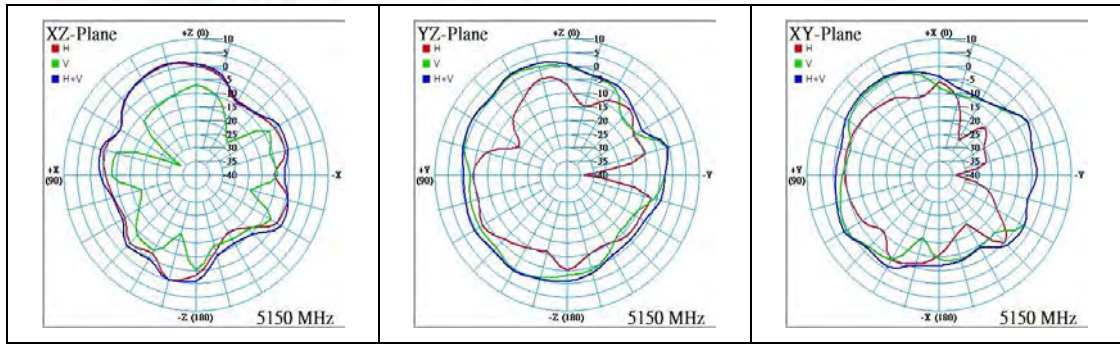




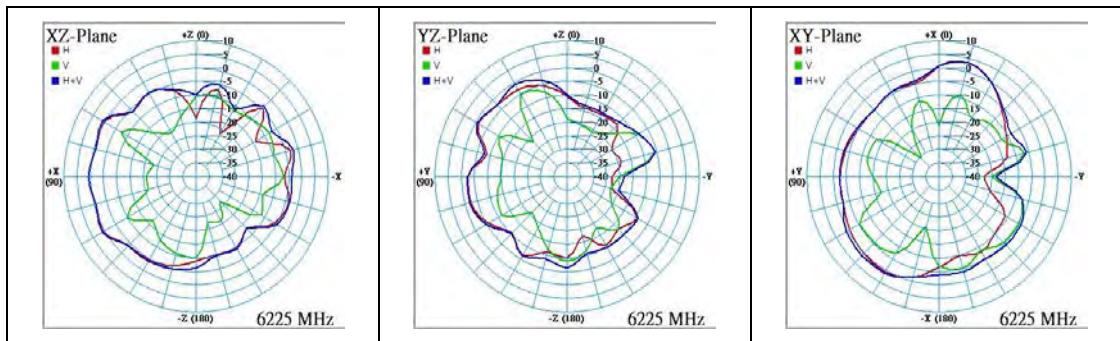
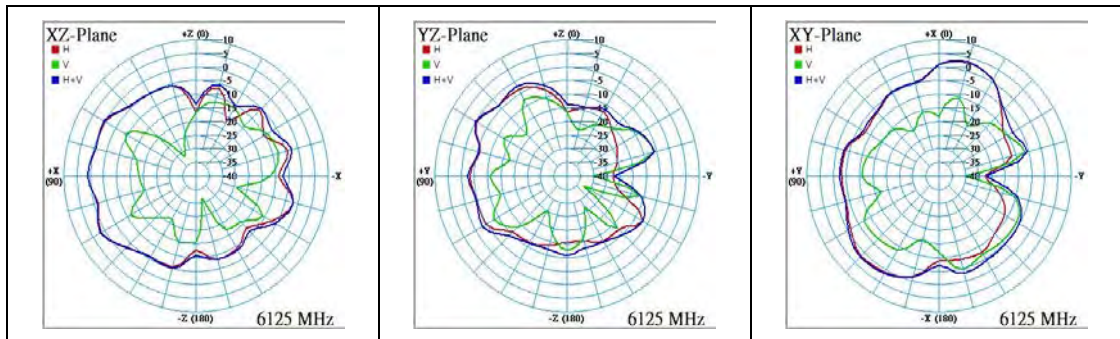
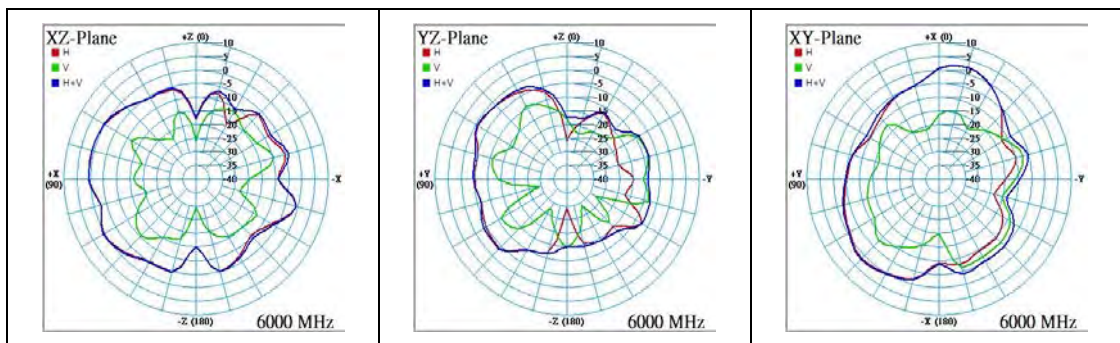
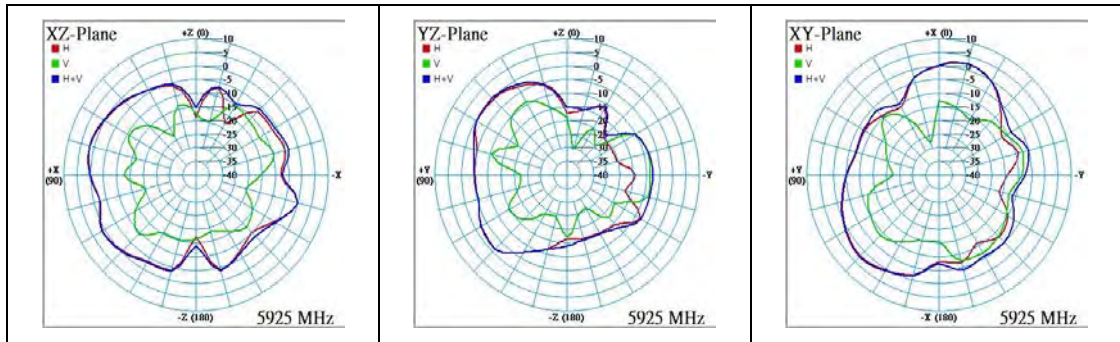


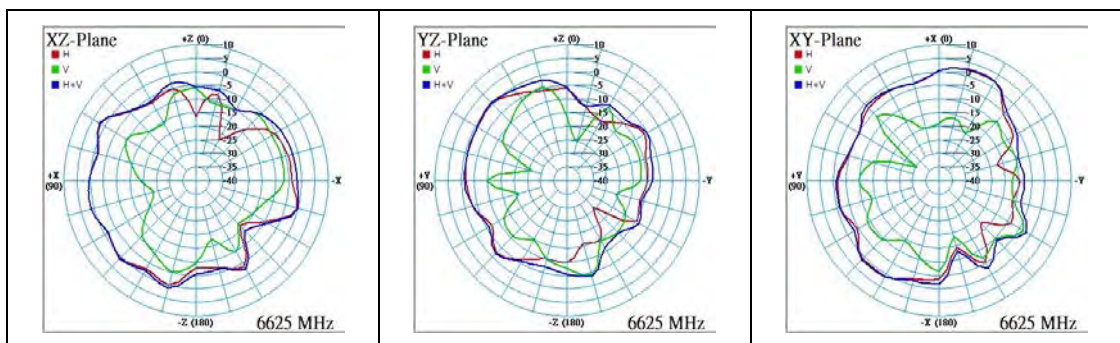
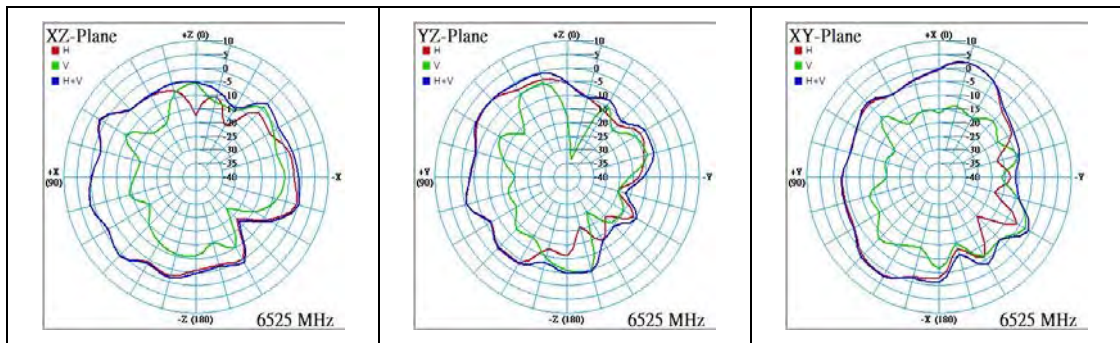
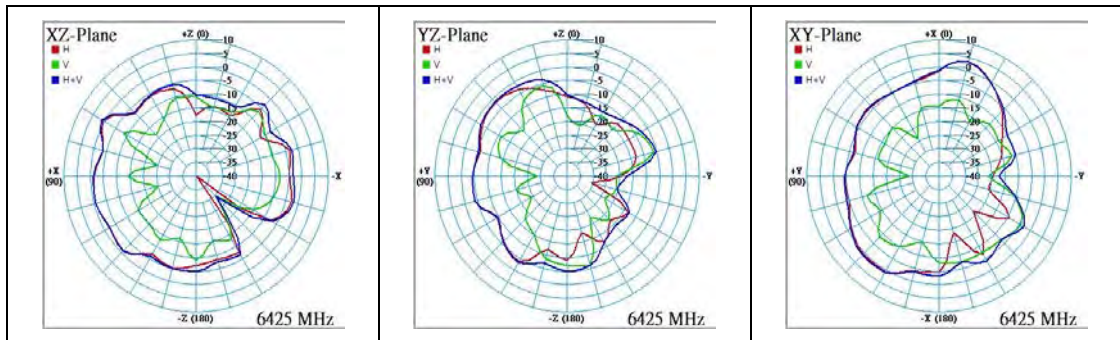
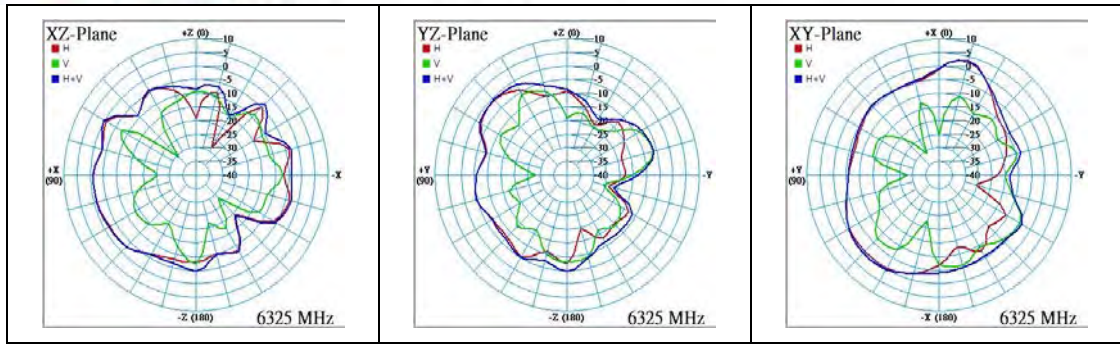
4.2.6 Ant_6 (Dual band)

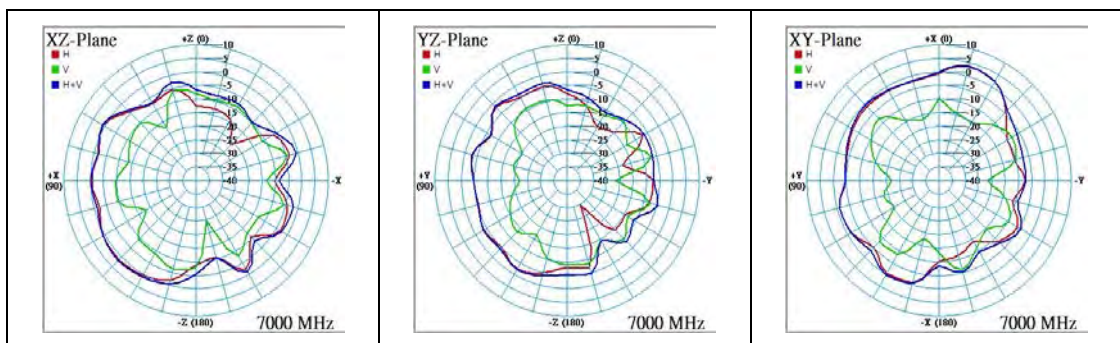
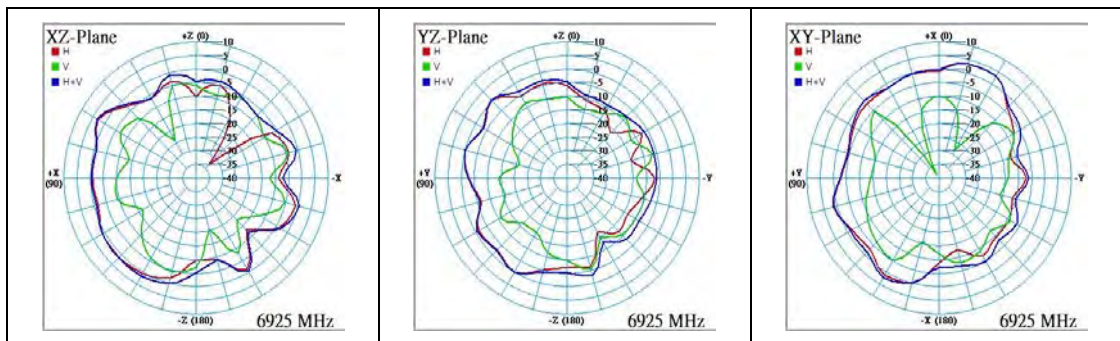
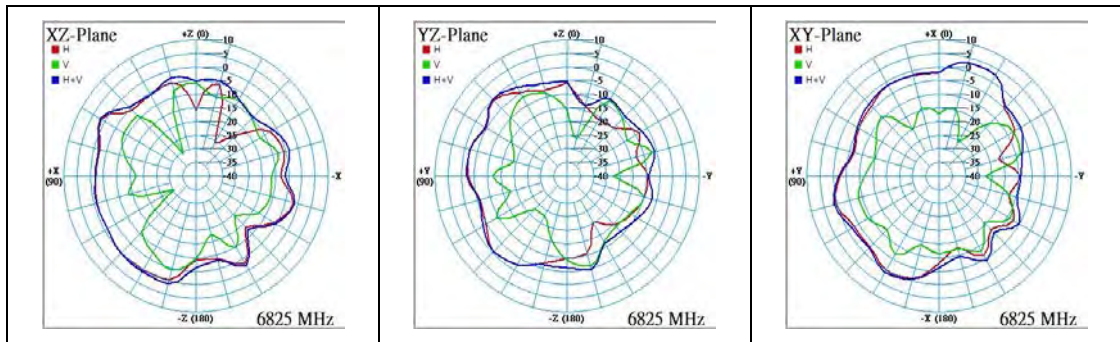
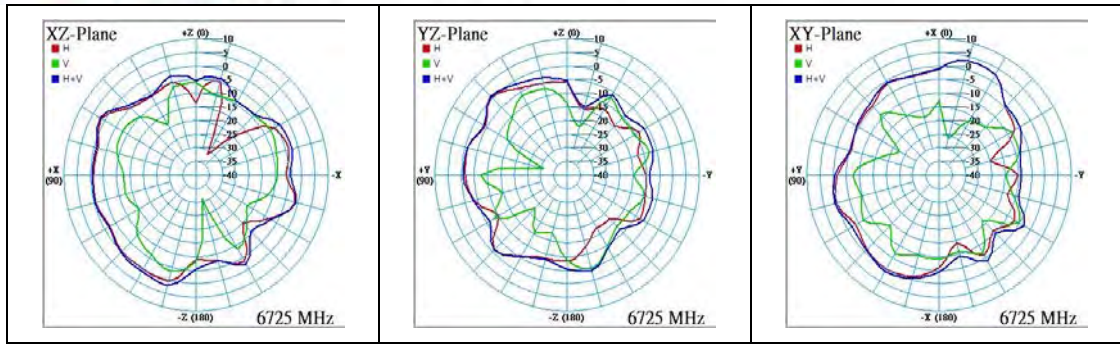


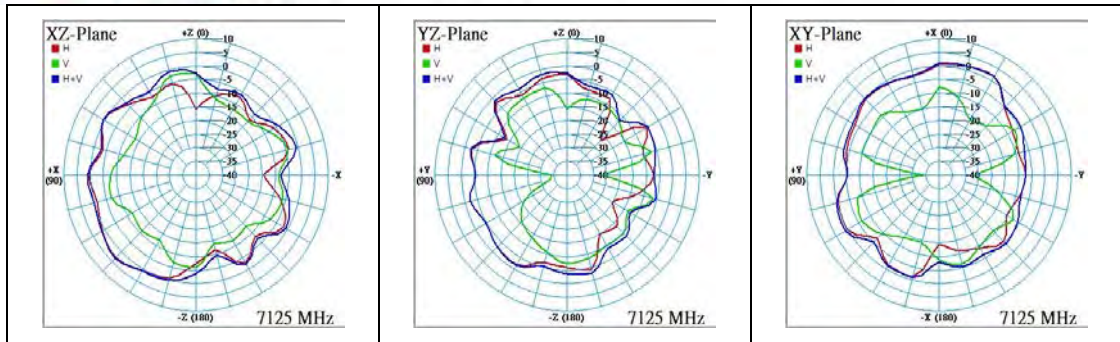


4.2.7 Ant_7 (Wi-Fi 6E)

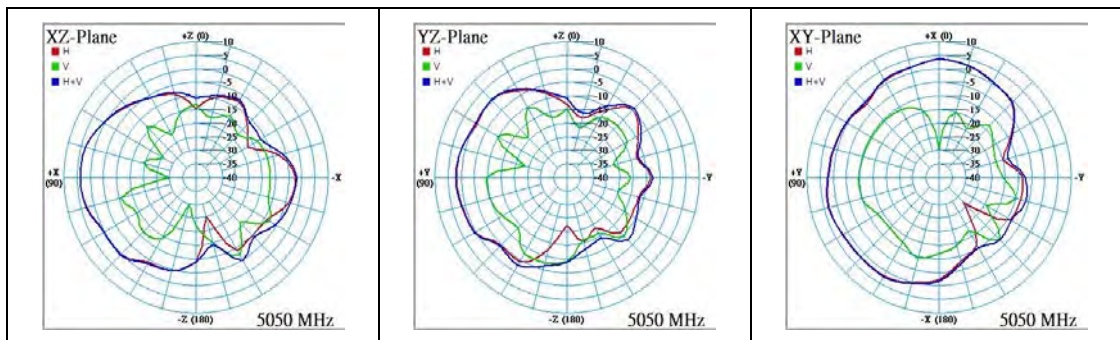
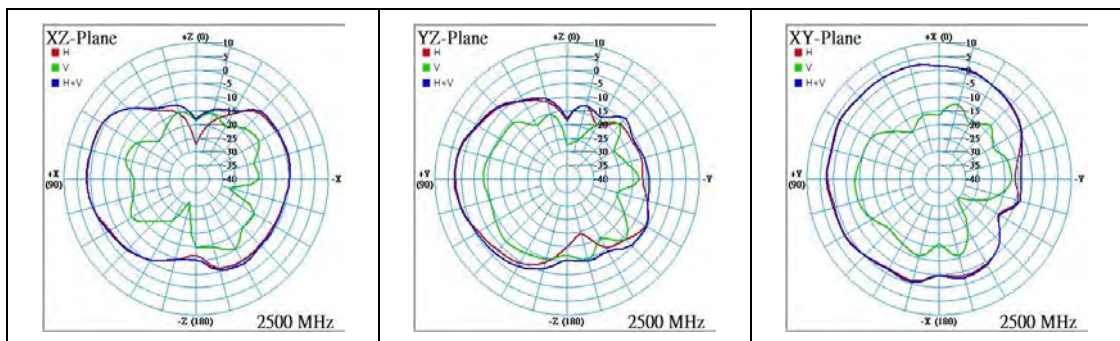
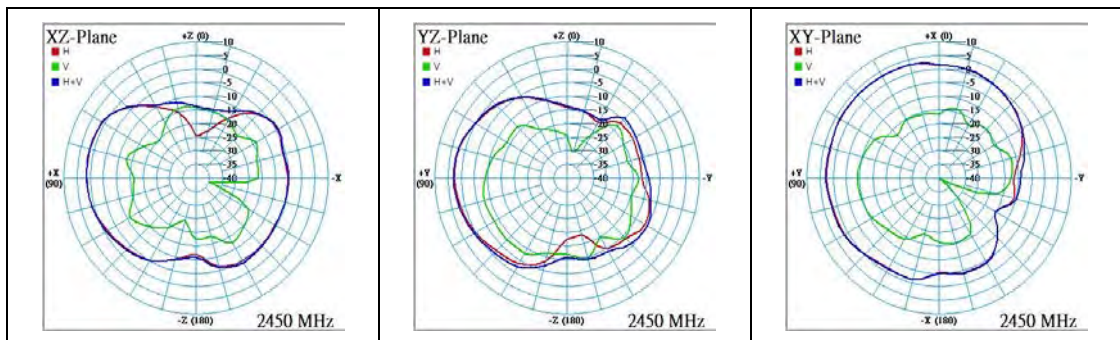
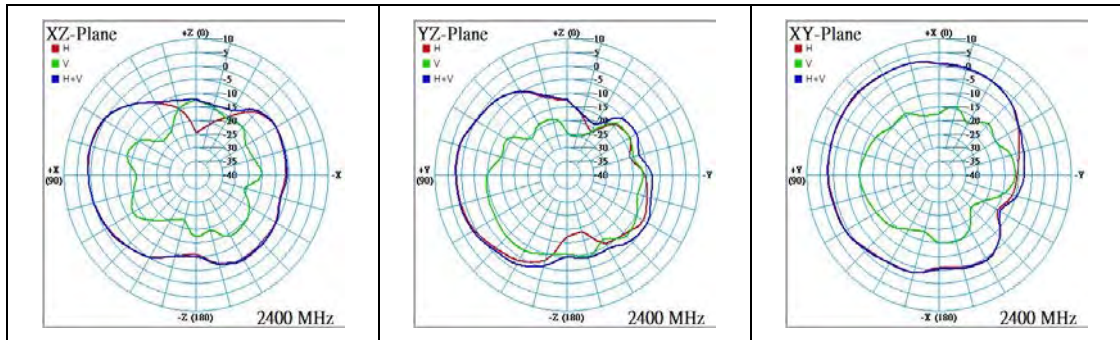


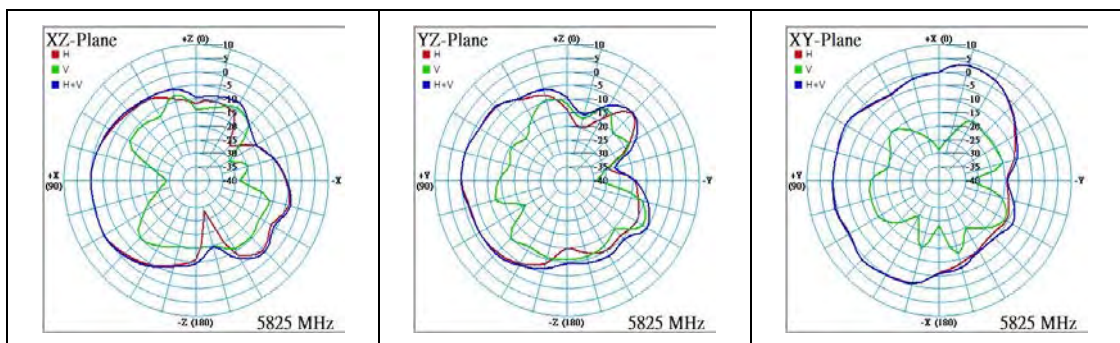
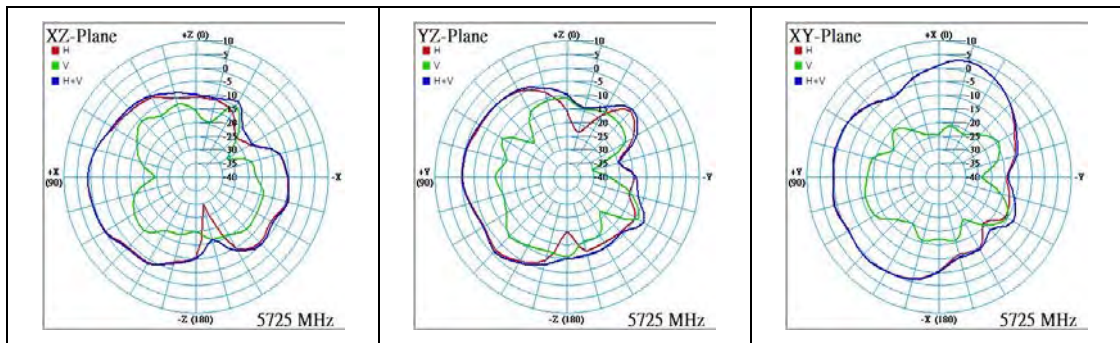
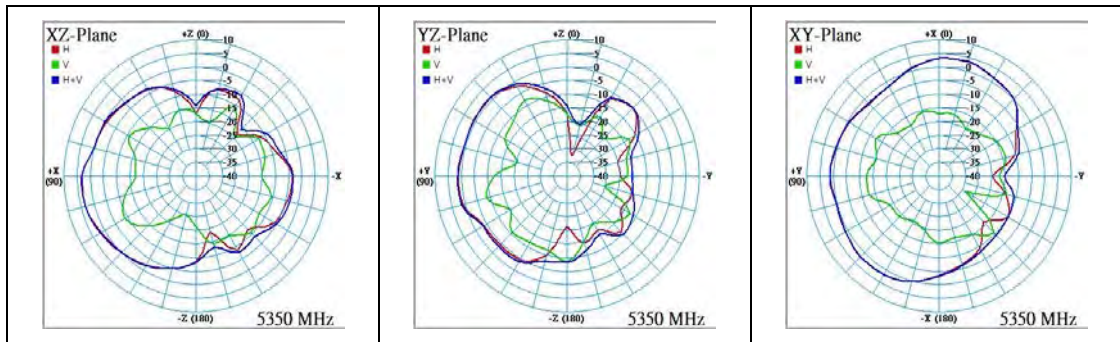
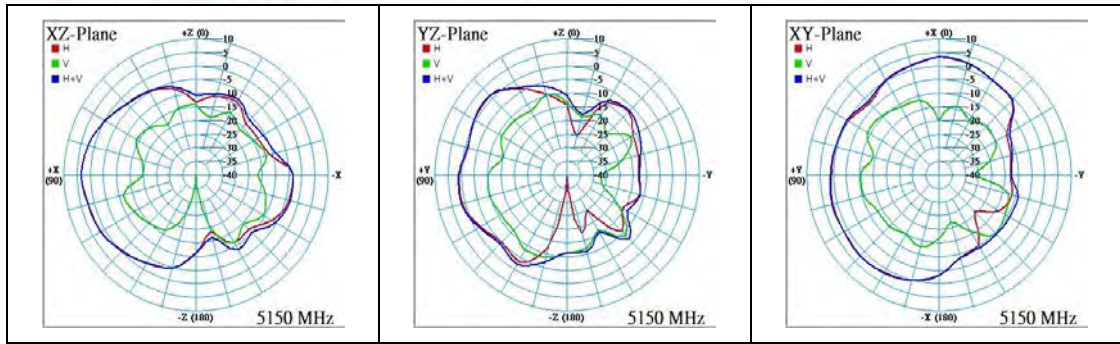






4.2.8 Ant_8 (Dual band)





5. Summary

5.1 Return Loss

WIFI Dual band

Frequency	Ant_1 (dB)	Ant_4 (dB)	Ant_6 (dB)	Ant_8 (dB)
2400 MHz	12	13	14	11
2450 MHz	12	13	15	13
2500 MHz	11	13	17	11
5050 MHz	16	16	14	15
5150 MHz	14	20	15	18
5350 MHz	18	30	16	21
5725 MHz	17	16	17	16
5825 MHz	18	19	14	17

WIFI 6E

Frequency	Ant_2 (dB)	Ant_3 (dB)	Ant_5 (dB)	Ant_7 (dB)
5925 MHz	12	15	18	13
6125 MHz	20	16	26	17
6325 MHz	16	33	20	24
6525 MHz	12	19	14	22
6725 MHz	17	15	12	19
6925 MHz	24	14	14	24
7125 MHz	14	27	16	16

5.2 Isolation

Frequency	Ant_1 & Ant_2	Ant_1 & Ant_3	Ant_1 & Ant_4	Ant_1 & Ant_5	Ant_1 & Ant_6	Ant_1 & Ant_7	Ant_1 & Ant_8
2G Isolation(dB)	31.0	35.9	22.5	38.5	28.7	38.5	38.7
5G Isolation(dB)	29.0	28.6	28.2	26.7	31.4	28.0	36.8
6G Isolation(dB)	31.5	29.8	-	31.3	-	37.7	-

Frequency	Ant_2 & Ant_3	Ant_2 & Ant_4	Ant_2 & Ant_5	Ant_2 & Ant_6	Ant_2 & Ant_7	Ant_2 & Ant_8
2G Isolation(dB)	-	27.6	-	28.5	-	34.9
5G Isolation(dB)	-	22.0	-	32.0	-	42.0
6G Isolation(dB)	22.0	23.9	27.0	37.9	34.0	42.0

Frequency	Ant_3 & Ant_4	Ant_3 & Ant_5	Ant_3 & Ant_6	Ant_3 & Ant_7	Ant_3 & Ant_8
2G Isolation(dB)	26.6	-	29.5	-	37.3
5G Isolation(dB)	35.0	-	31.0	-	37.0
6G Isolation(dB)	32.0	26.0	34.0	29.0	32.0

Frequency	Ant_4 & Ant_5	Ant_4 & Ant_6	Ant_4 & Ant_7	Ant_4 & Ant_8
2G Isolation(dB)	25.7	21.6	27.9	35.3
5G Isolation(dB)	25.0	25.0	27.0	35.0
6G Isolation(dB)	30.0	-	27.0	-

Frequency	Ant_5 & Ant_6	Ant_5 & Ant_7	Ant_5 & Ant_8
2G Isolation(dB)	21.4	-	35.5
5G Isolation(dB)	31.0	-	33.0
6G Isolation(dB)	26.5	27.0	32.0

Frequency	Ant_6 & Ant_7	Ant_6 & Ant_8	Ant_7 & Ant_8
2G Isolation(dB)	26.8	33.0	29.5
5G Isolation(dB)	24.1	30.0	25.0
6G Isolation(dB)	30.0	-	25.0

5.3 3D total Peak Gain & Efficiency

WIFI Dual Band

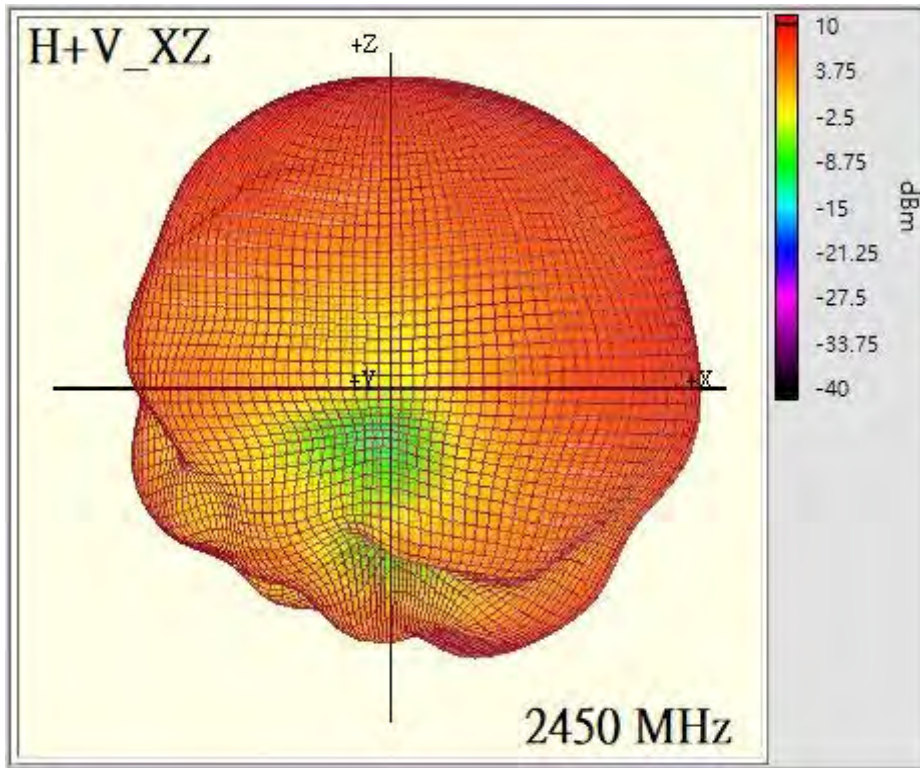
Frequency	Ant_1		Ant_4		Ant_6		Ant_8	
	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)
2400 MHz	3.12	71	3.39	74	3.49	75	3.31	81
2450 MHz	3.21	72	3.16	72	3.26	75	3.39	80
2500 MHz	3.48	70	2.73	71	3.31	75	3.33	75
5050 MHz	3.40	73	3.97	73	3.96	77	3.79	78
5150 MHz	3.05	72	3.79	71	3.55	75	3.47	75
5350 MHz	3.48	73	3.68	72	3.89	74	3.94	75
5725 MHz	3.31	70	3.67	70	3.62	76	3.93	76
5825 MHz	3.41	70	3.96	70	3.82	73	3.93	76

WIFI 6E

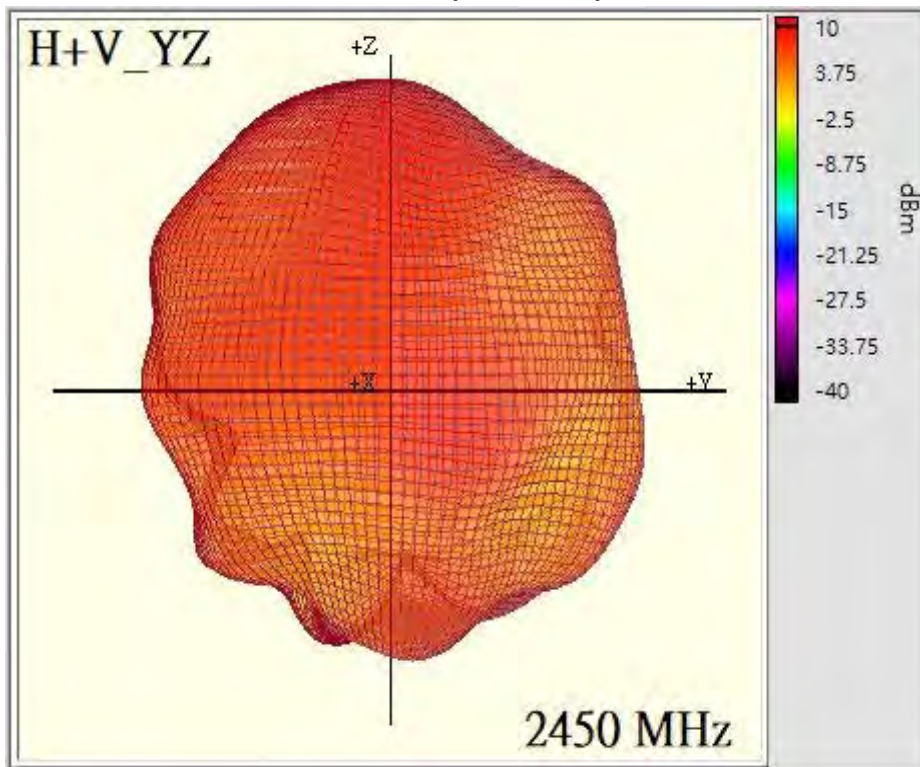
Frequency	Ant_2		Ant_3		Ant_5		Ant_7	
	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)
5925 MHz	3.20	72	3.28	74	3.48	77	3.17	76
6000 MHz	3.24	70	3.26	71	3.29	76	3.25	75
6125 MHz	3.41	73	3.30	71	3.35	72	3.26	71
6225 MHz	3.45	73	3.40	73	3.19	73	3.47	71
6325 MHz	3.34	74	3.43	74	3.39	74	3.37	72
6425 MHz	3.30	73	3.33	75	3.46	74	3.37	74
6525 MHz	3.43	72	3.12	72	3.50	73	3.48	74
6625 MHz	3.45	71	3.43	74	3.31	72	3.33	72
6725 MHz	3.17	74	3.18	74	3.42	73	3.35	72
6825 MHz	3.30	75	3.37	75	3.30	75	3.11	74
6925 MHz	3.14	74	3.13	74	3.18	73	3.41	73
7000 MHz	3.20	75	3.41	75	3.45	73	3.49	76
7125 MHz	3.13	74	3.46	72	3.49	73	3.20	72

6. 3D Pattern

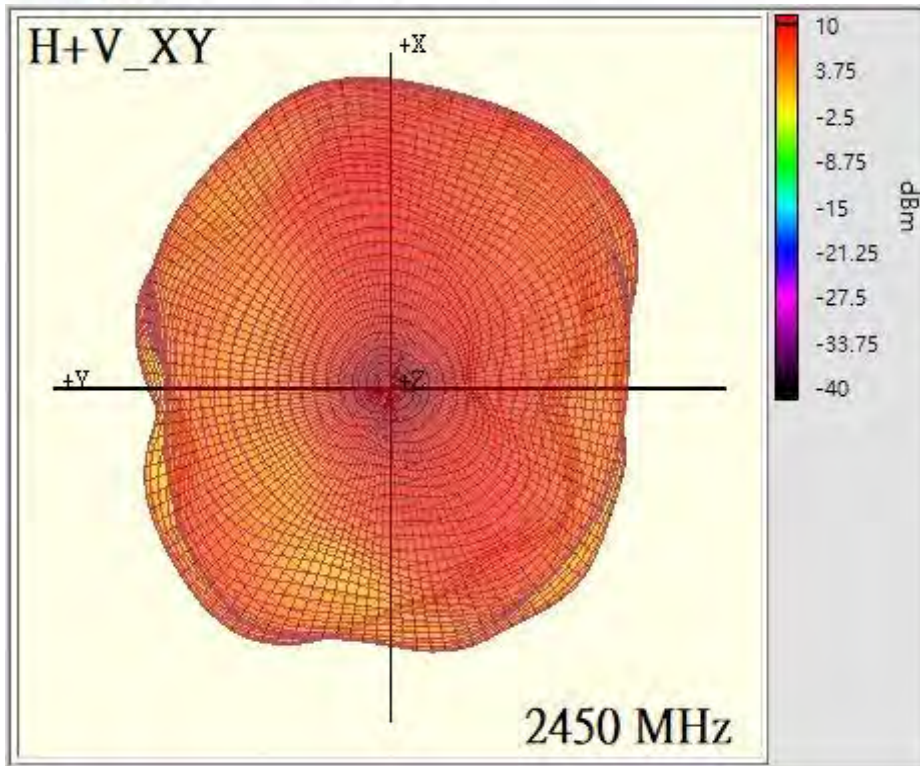
Ant_1 (Dual band) :



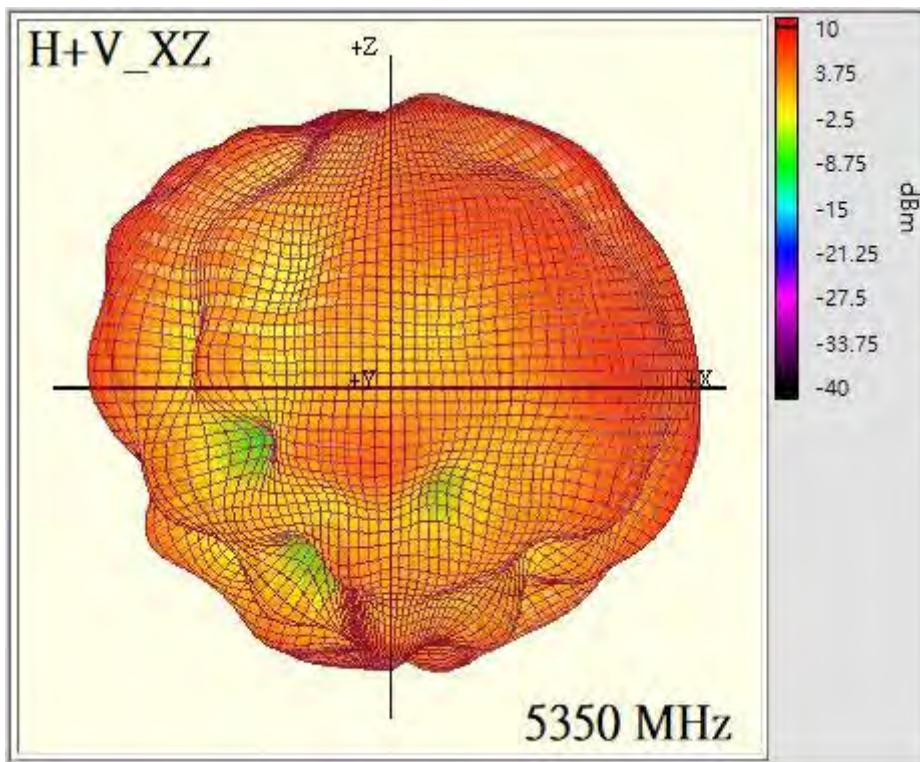
XZ Plan(2450MHz)



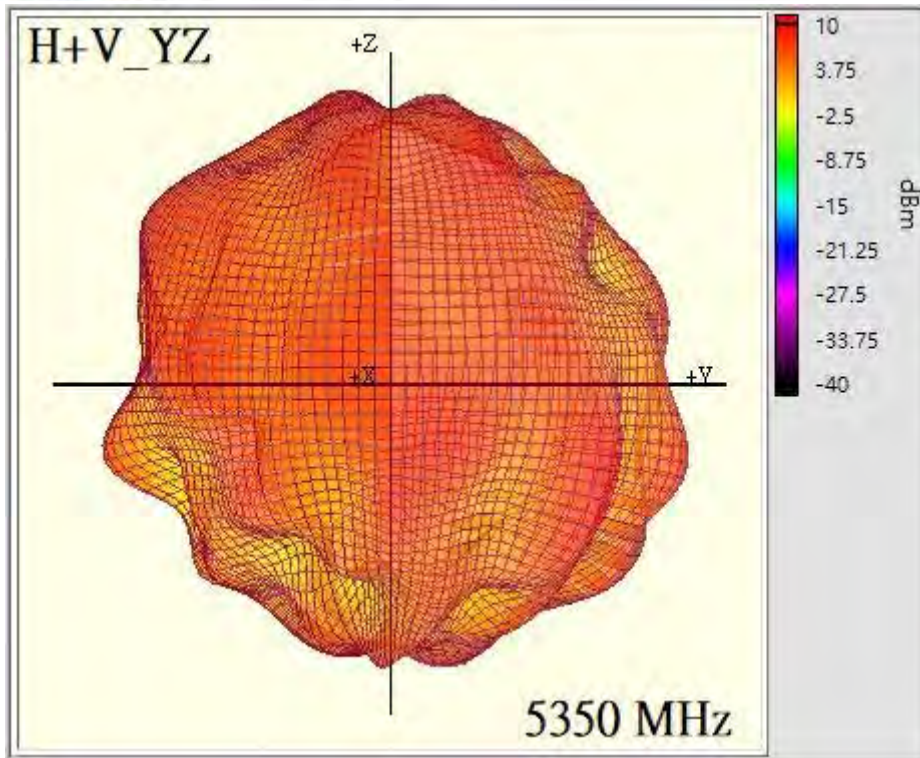
YZ Plan(2450MHz)



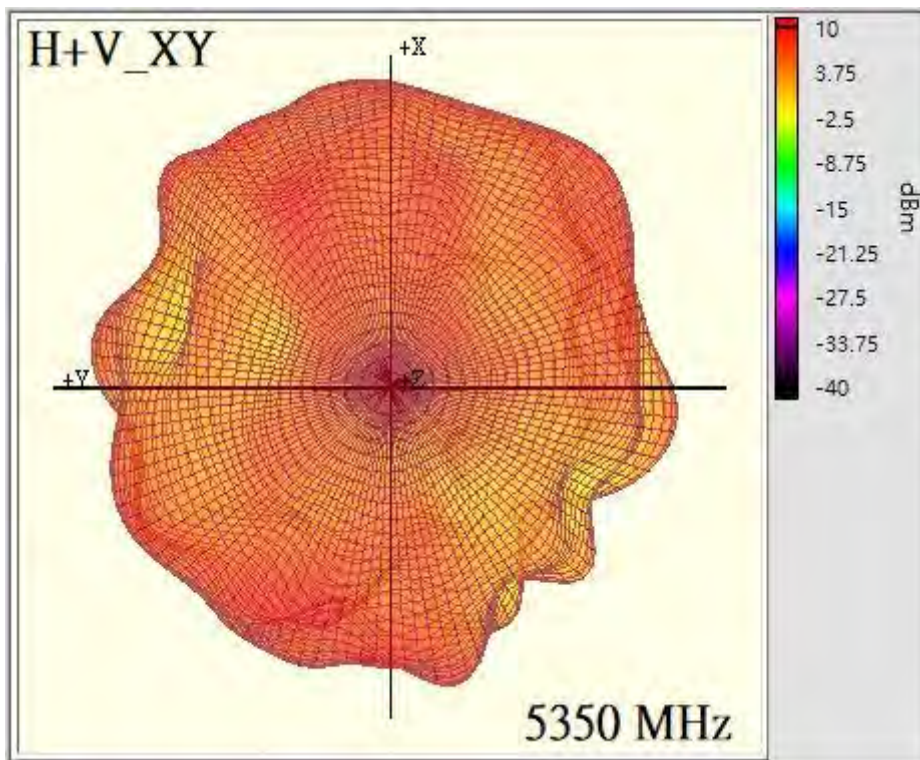
XY Plan(2450MHz)



XZ Plan(5350MHz)

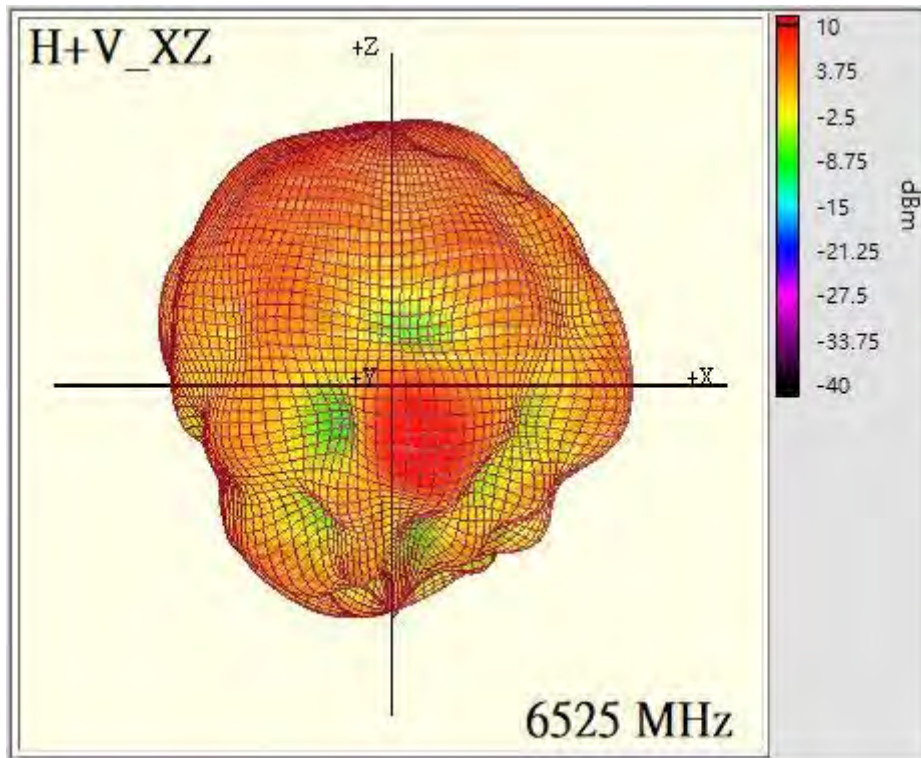


YZ Plan(5350MHz)

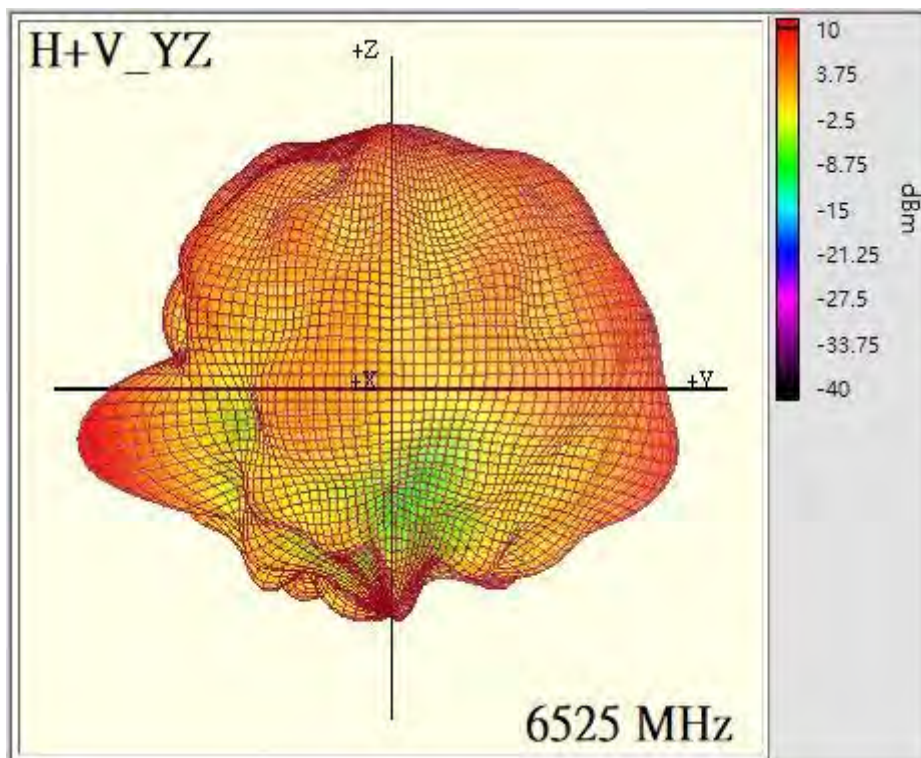


XY Plan(5350MHz)

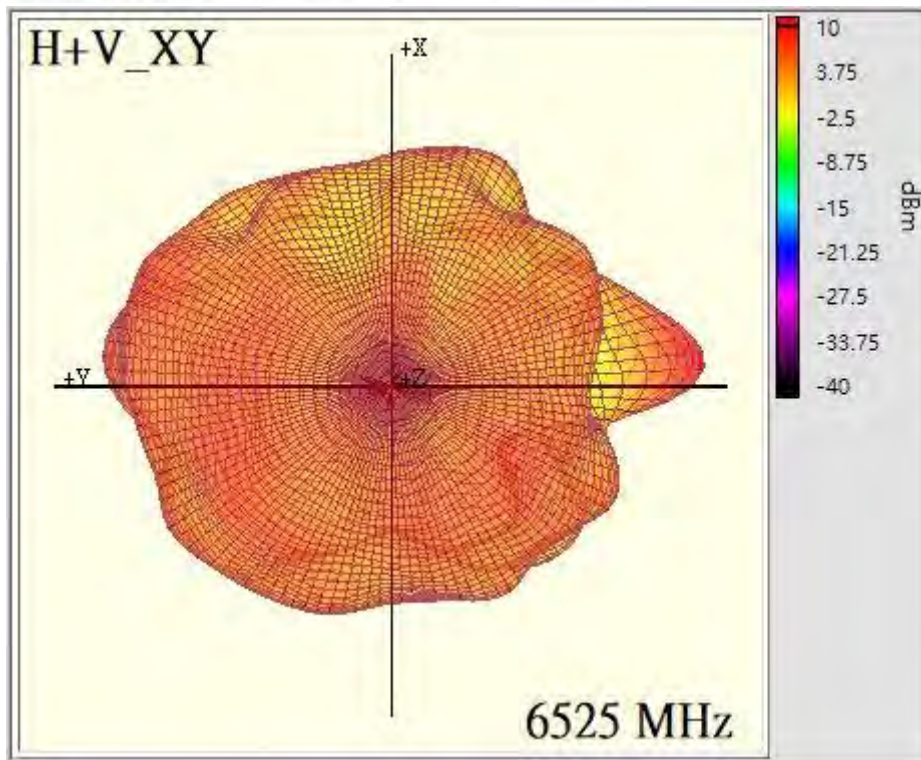
Ant_2 (WIFI 6E):



XZ Plan(6525MHz)

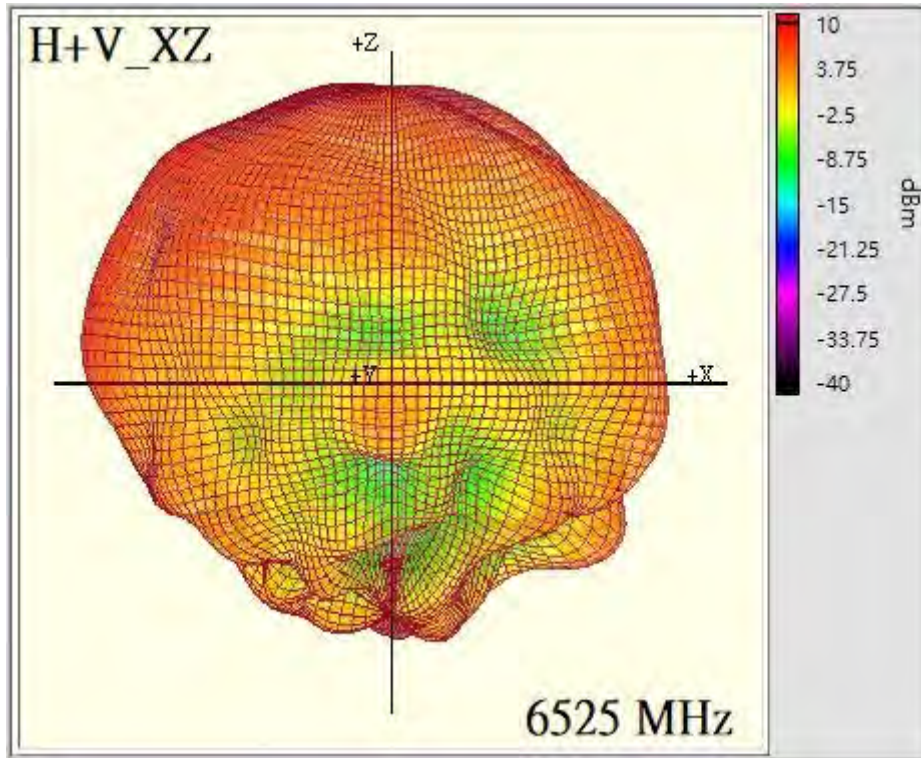


YZ Plan(6525MHz)

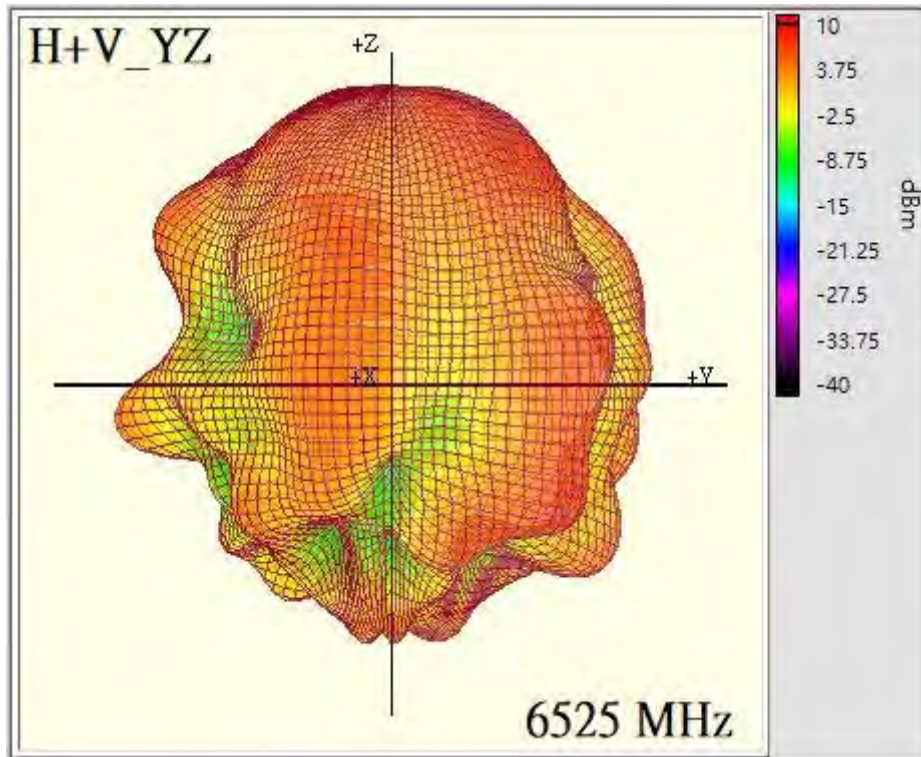


XY Plan(6525MHz)

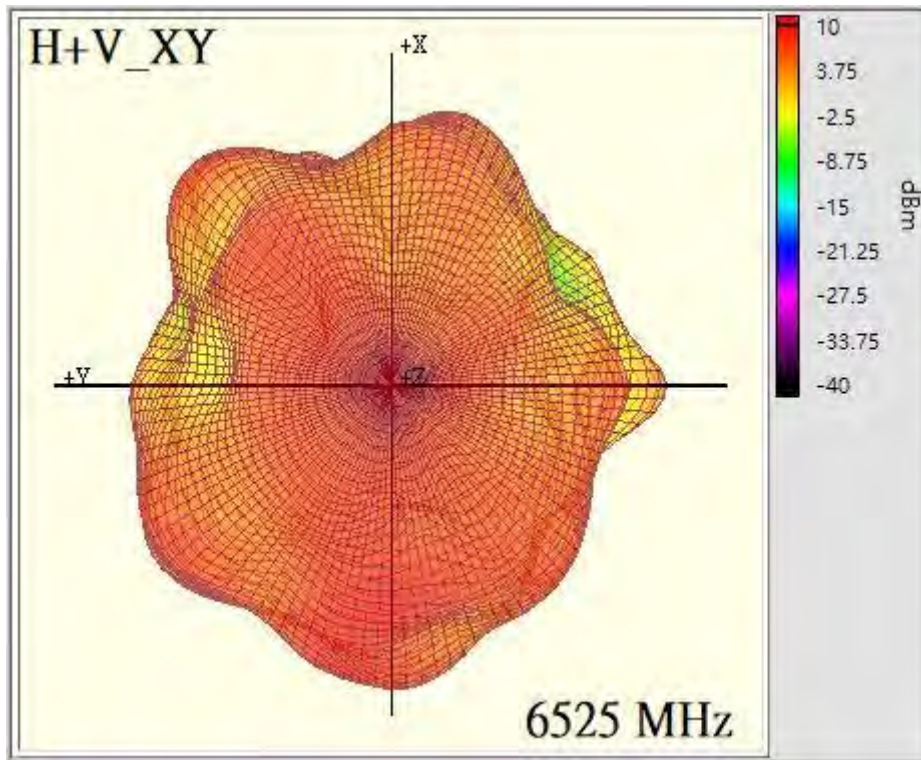
Ant_3 (WIFI 6E) :



XZ Plan(6525MHz)

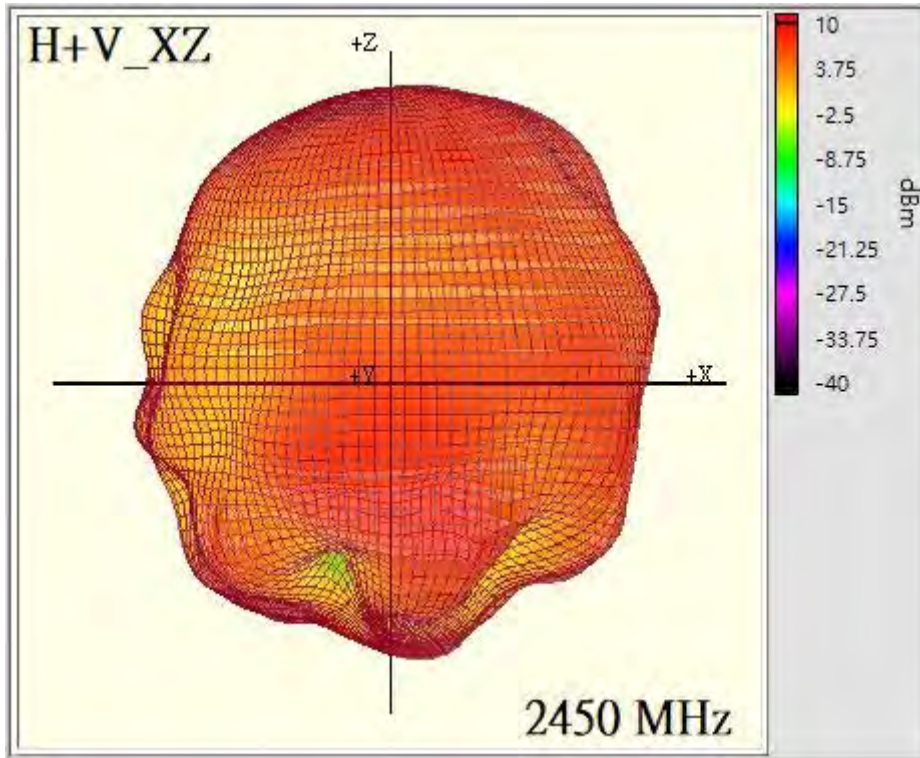


YZ Plan(6525MHz)

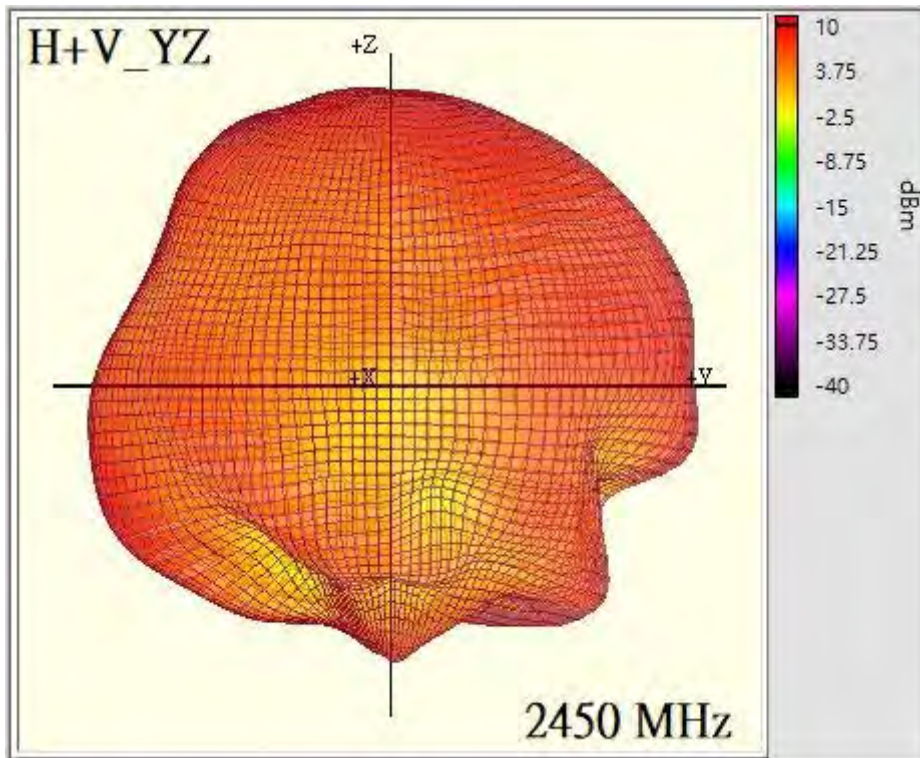


XY Plan(6525MHz)

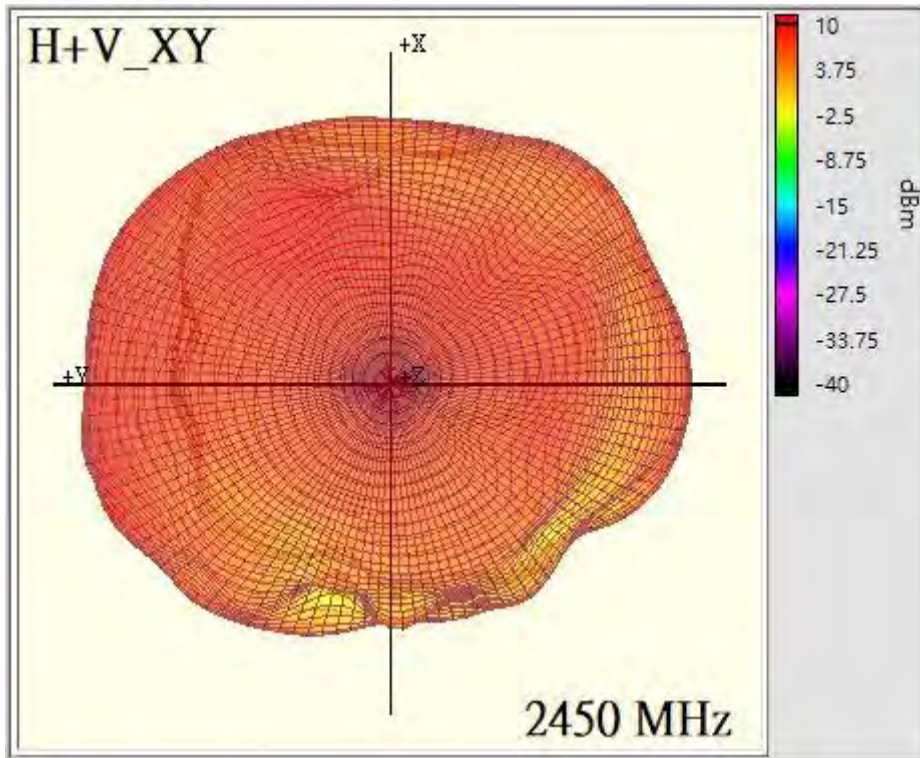
Ant_4 (Dual band):



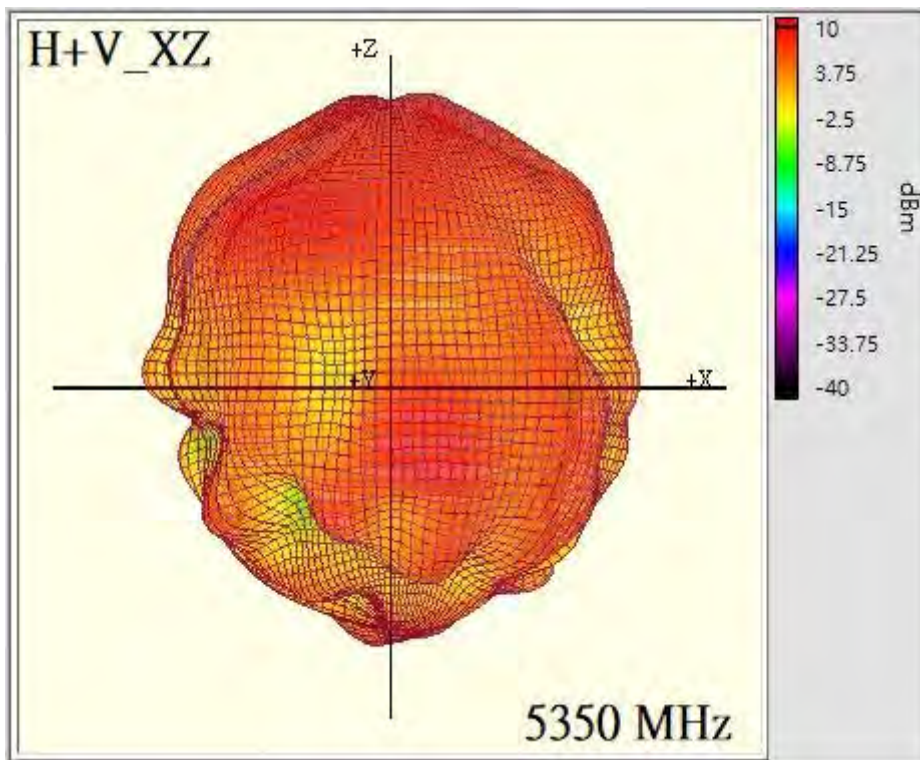
XZ Plan(2450MHz)



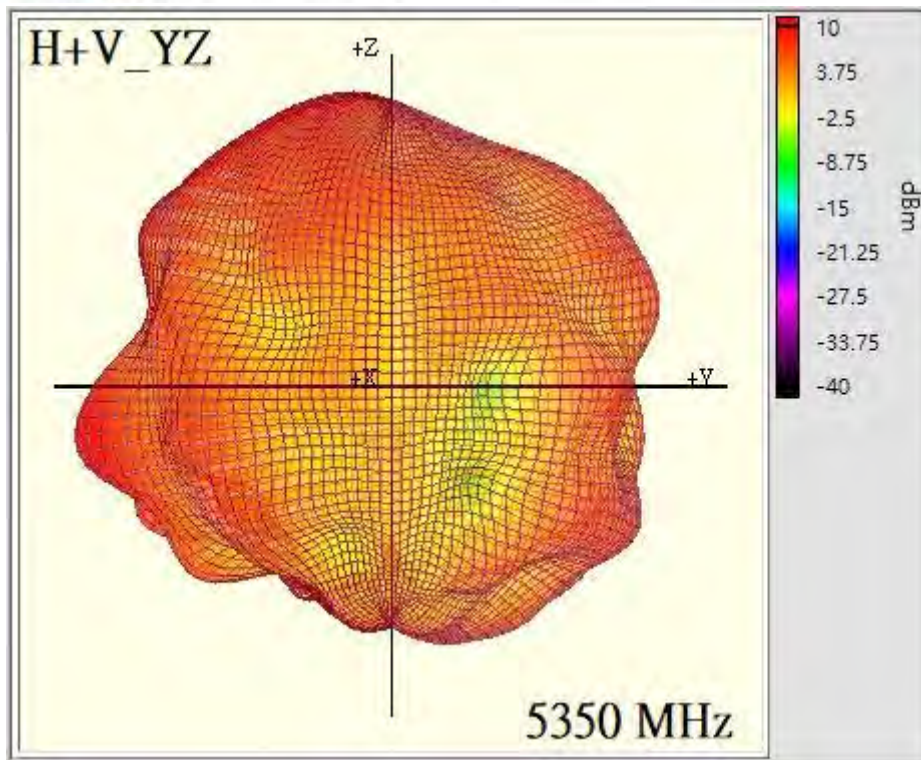
YZ Plan(2450MHz)



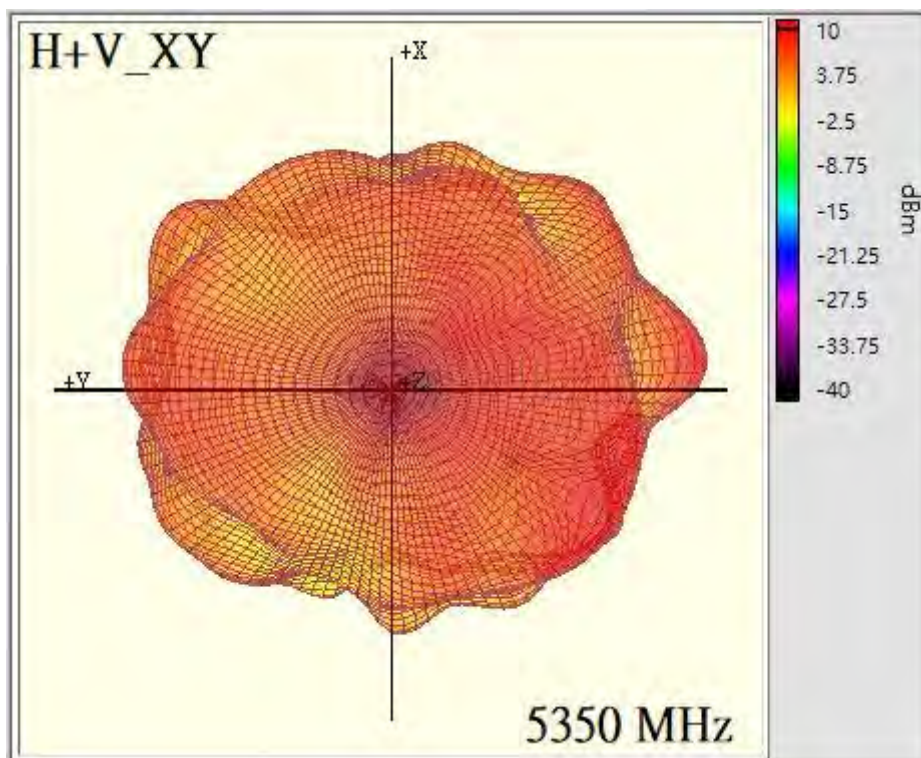
XY Plan(2450MHz)



XZ Plan(5350MHz)

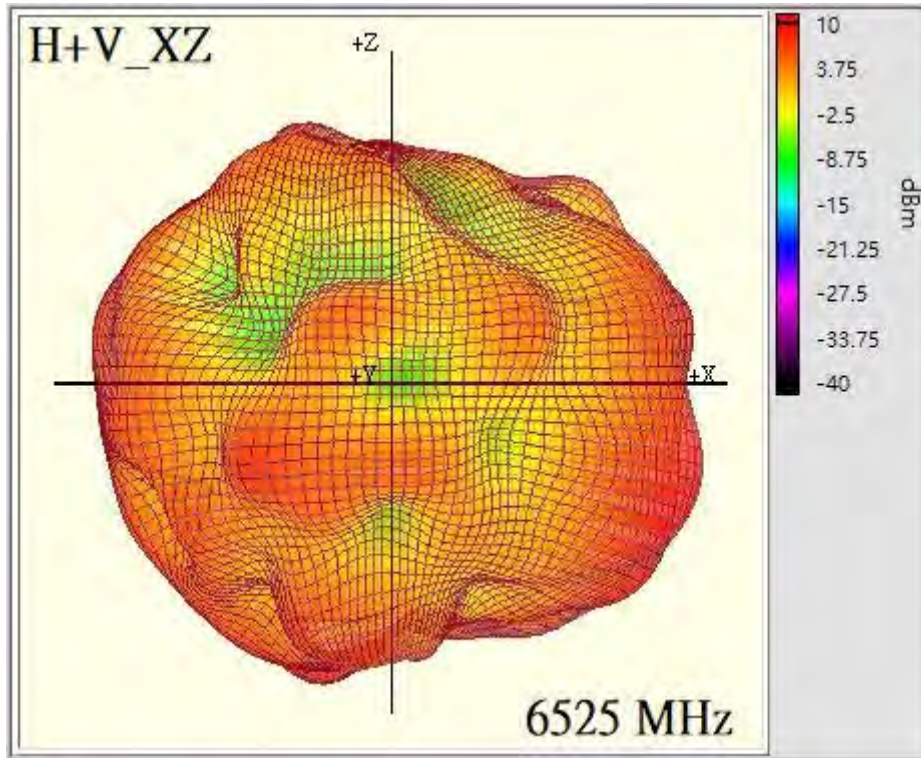


YZ Plan(5350MHz)

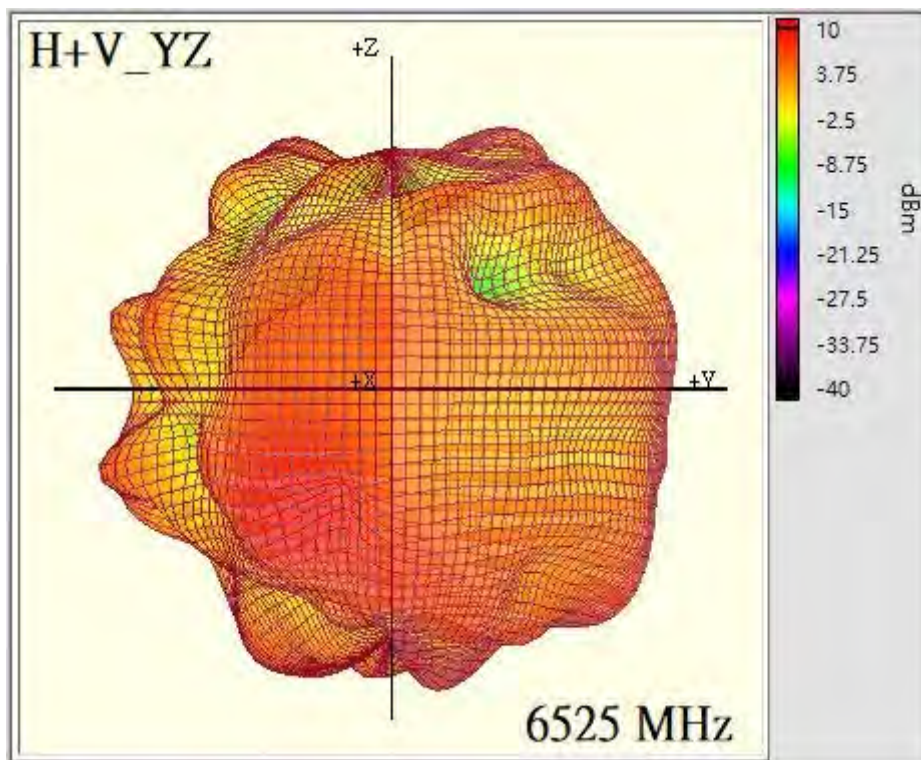


XY Plan(5350MHz)

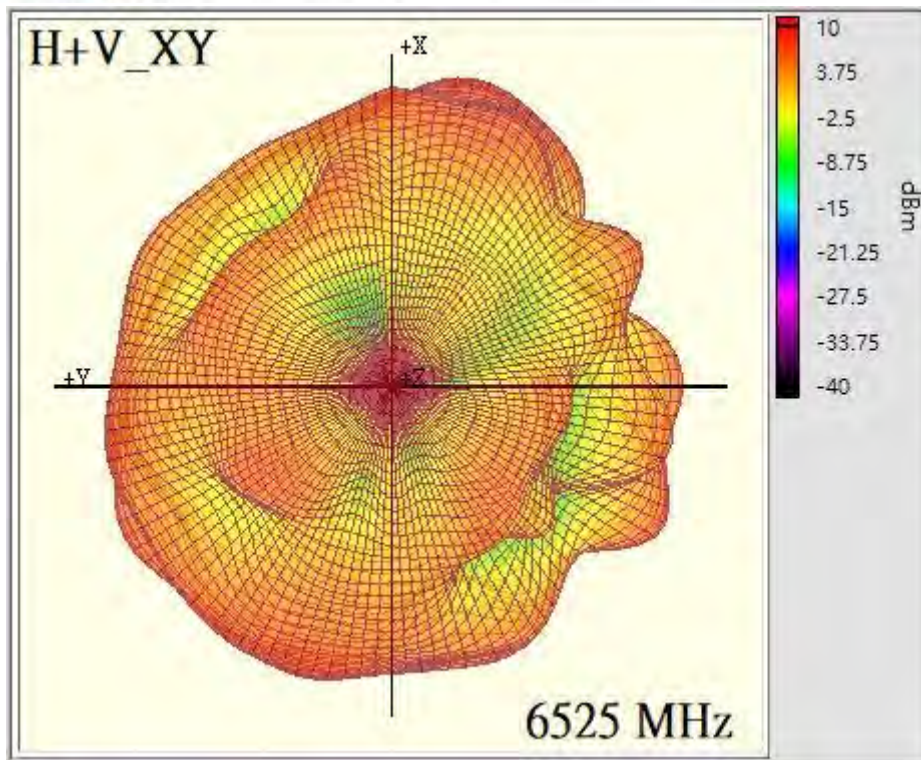
Ant_5 (WIFI 6E):



XZ Plan(6525MHz)

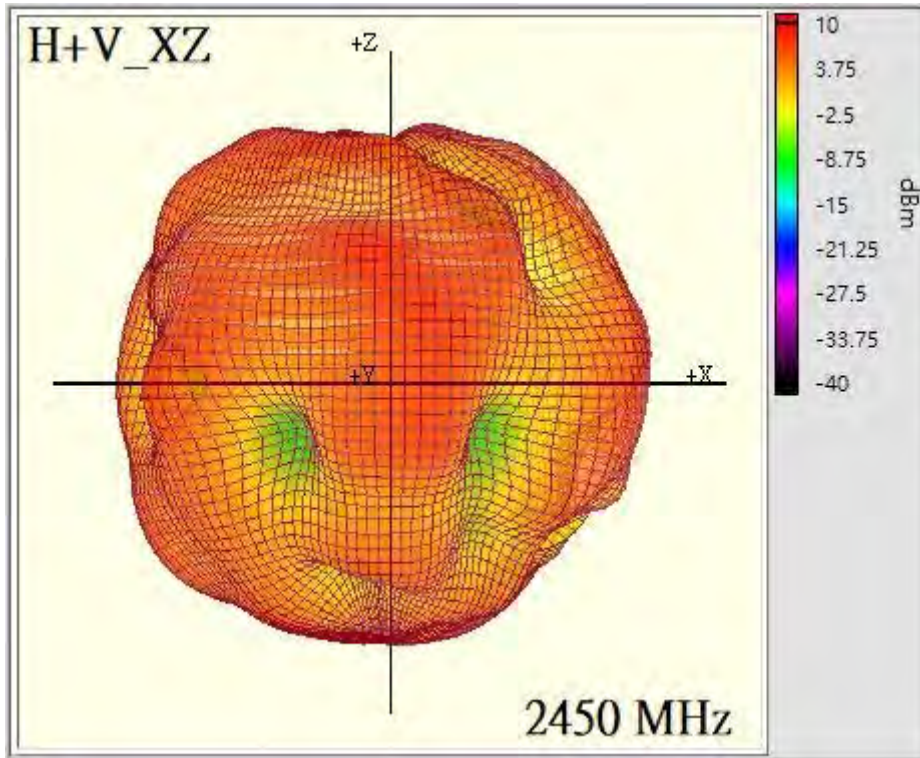


YZ Plan(6525MHz)

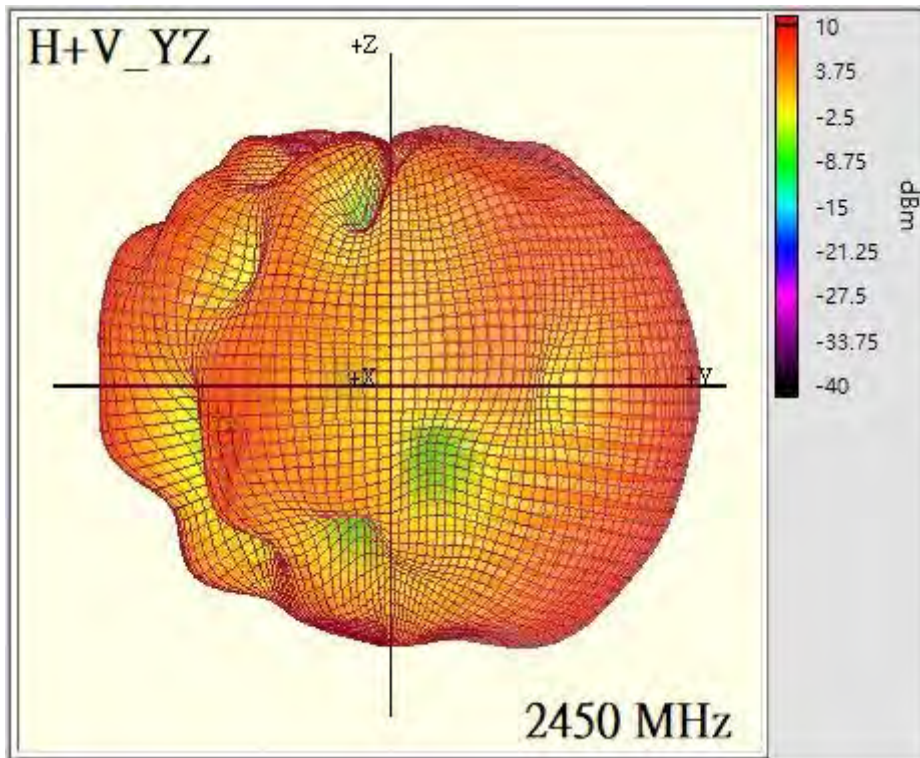


XY Plan(6525MHz)

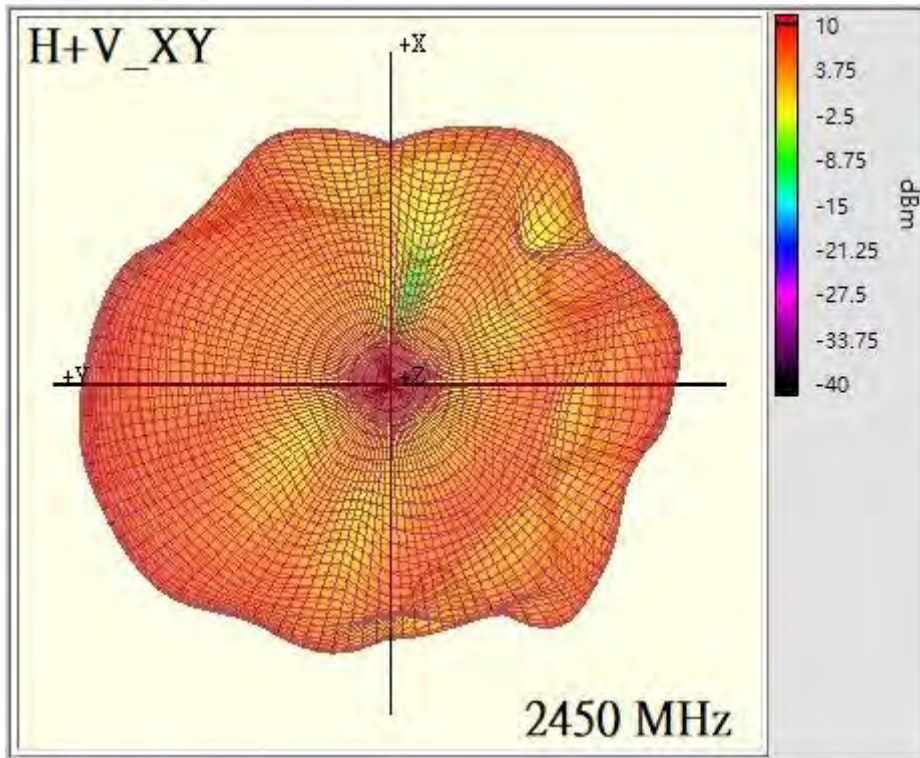
Ant_6 (Dual band):



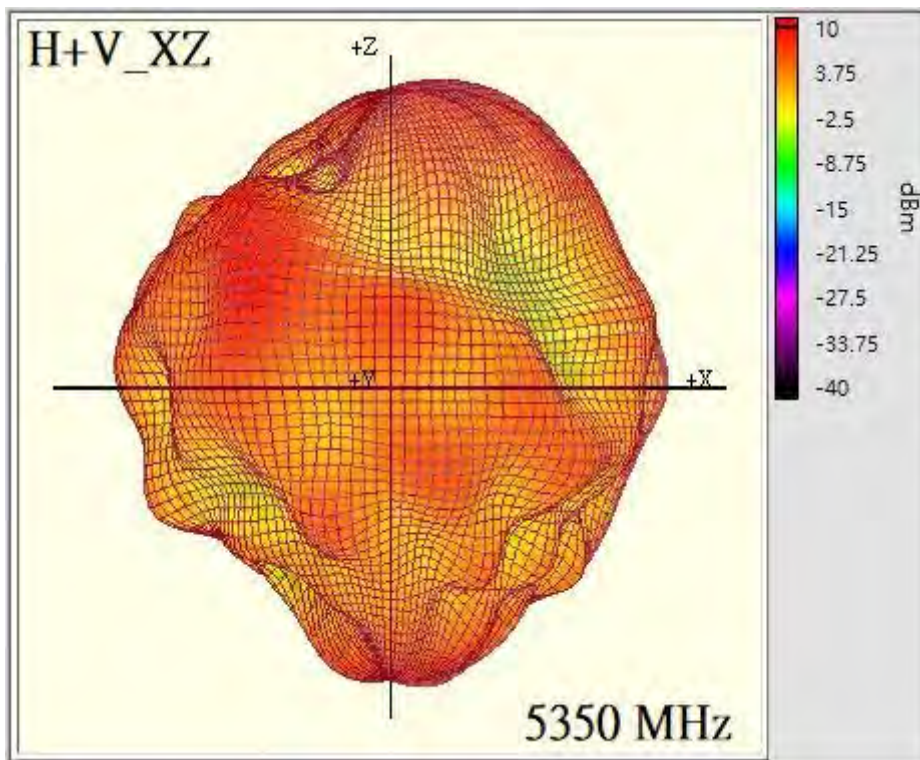
XZ Plan(2450MHz)



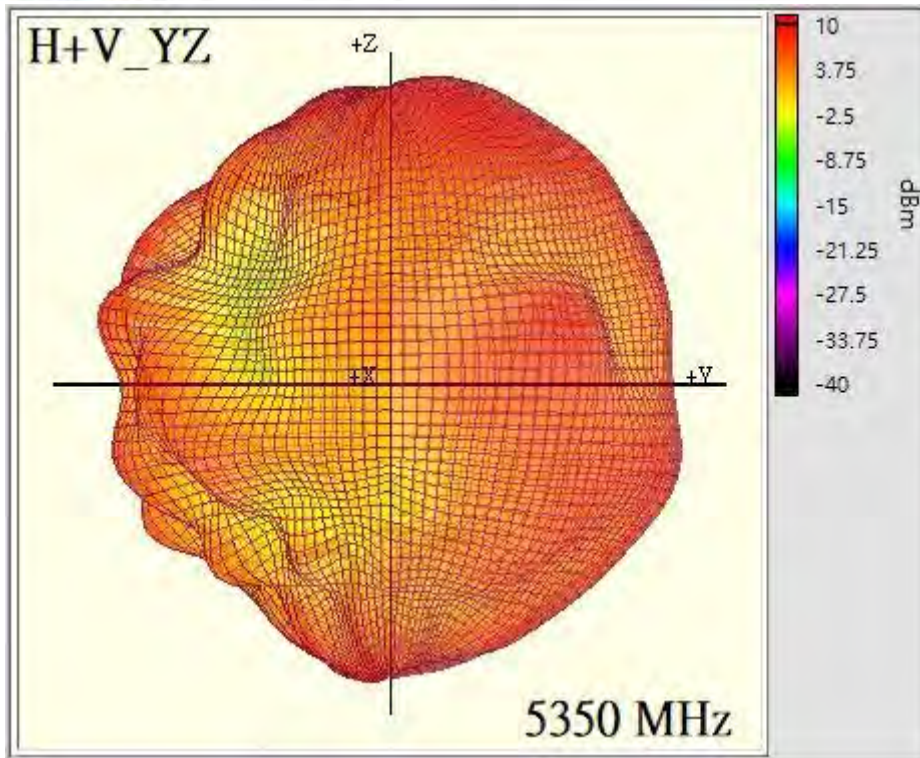
YZ Plan(2450MHz)



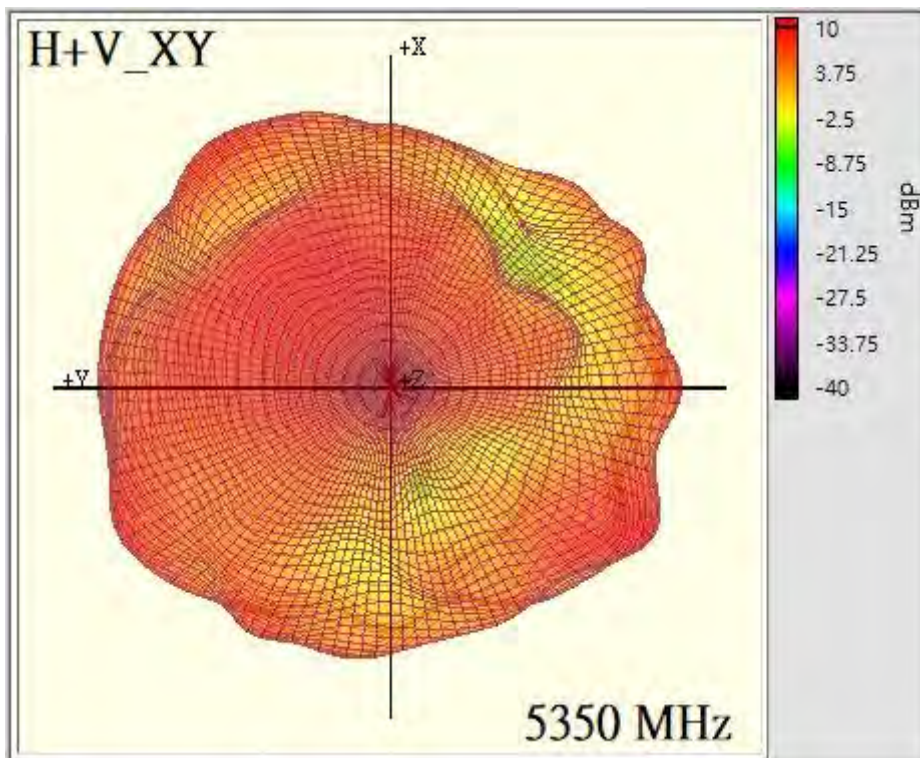
XY Plan(2450MHz)



XZ Plan(5350MHz)

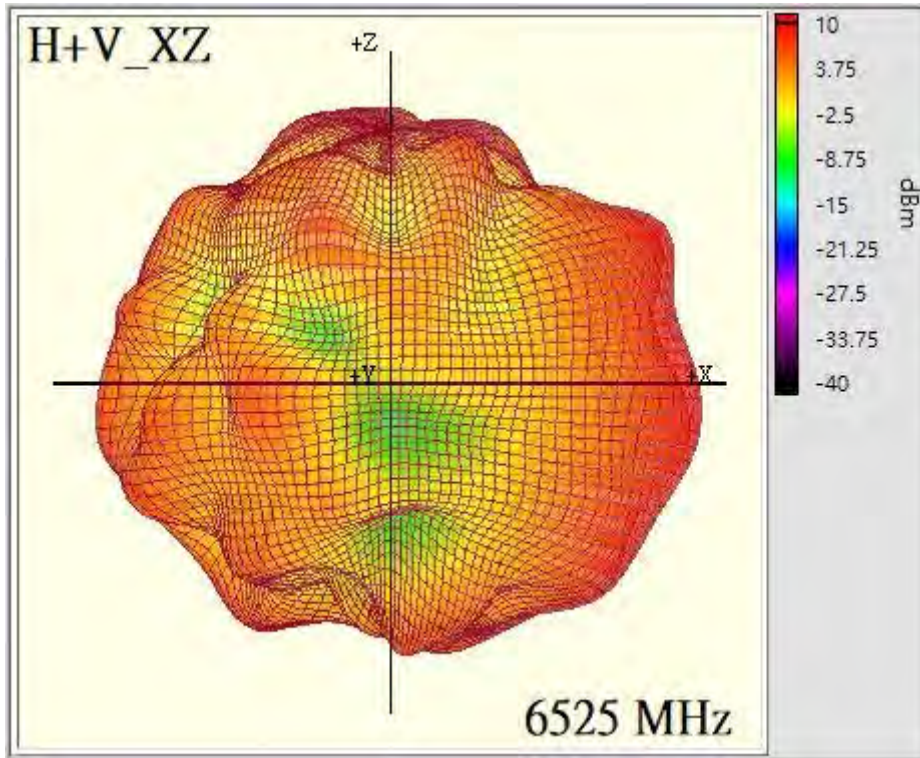


YZ Plan(5350MHz)

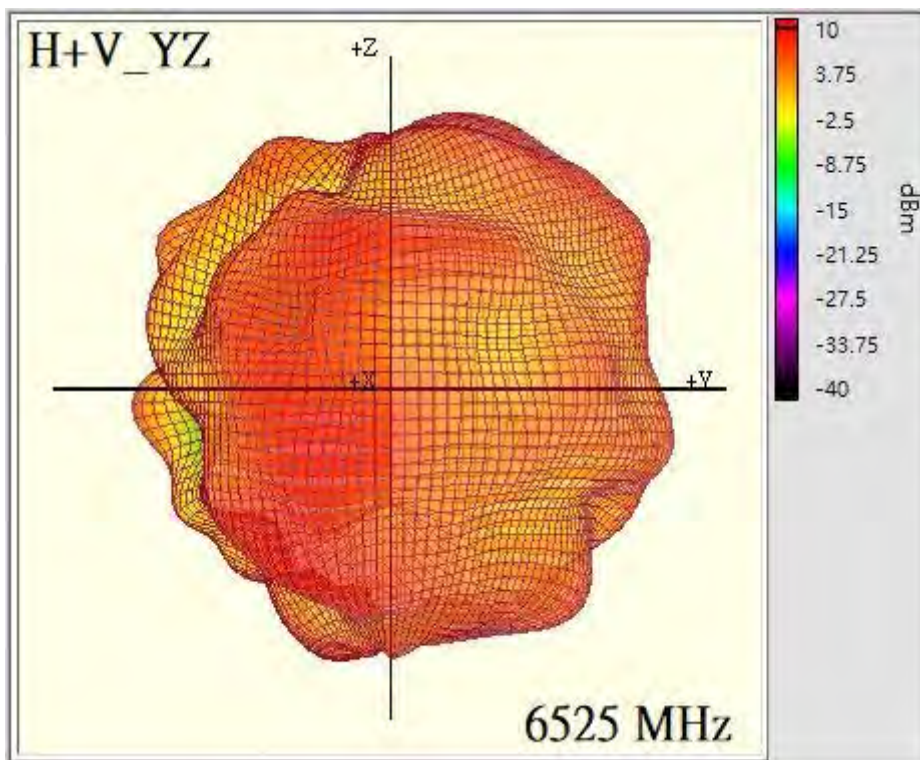


XY Plan(5350MHz)

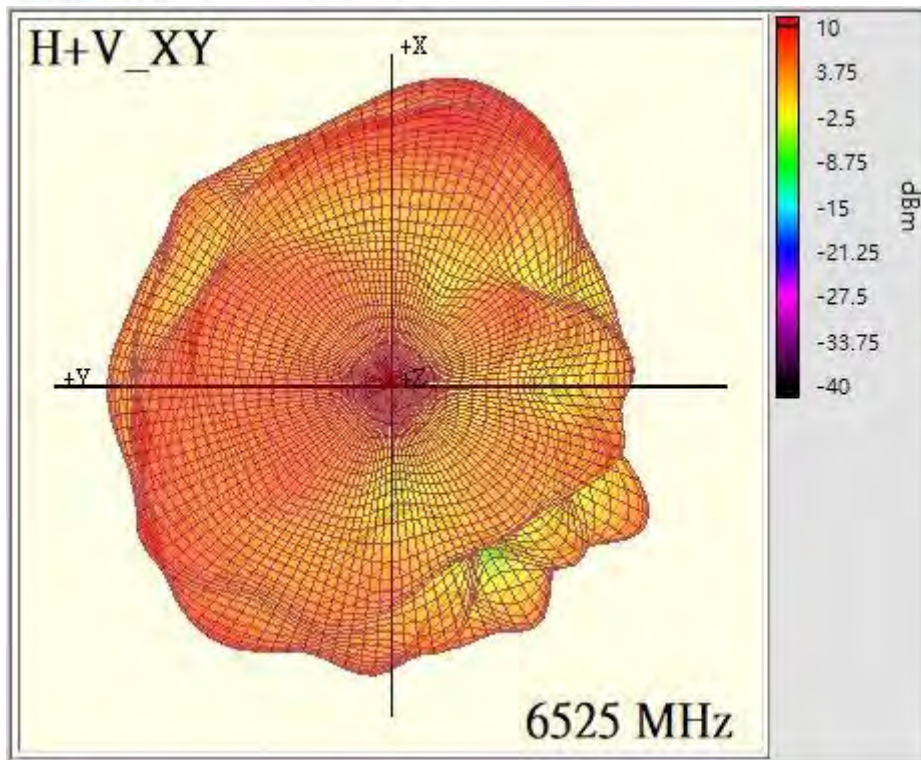
Ant_7 (WIFI 6E):



XZ Plan(6525MHz)

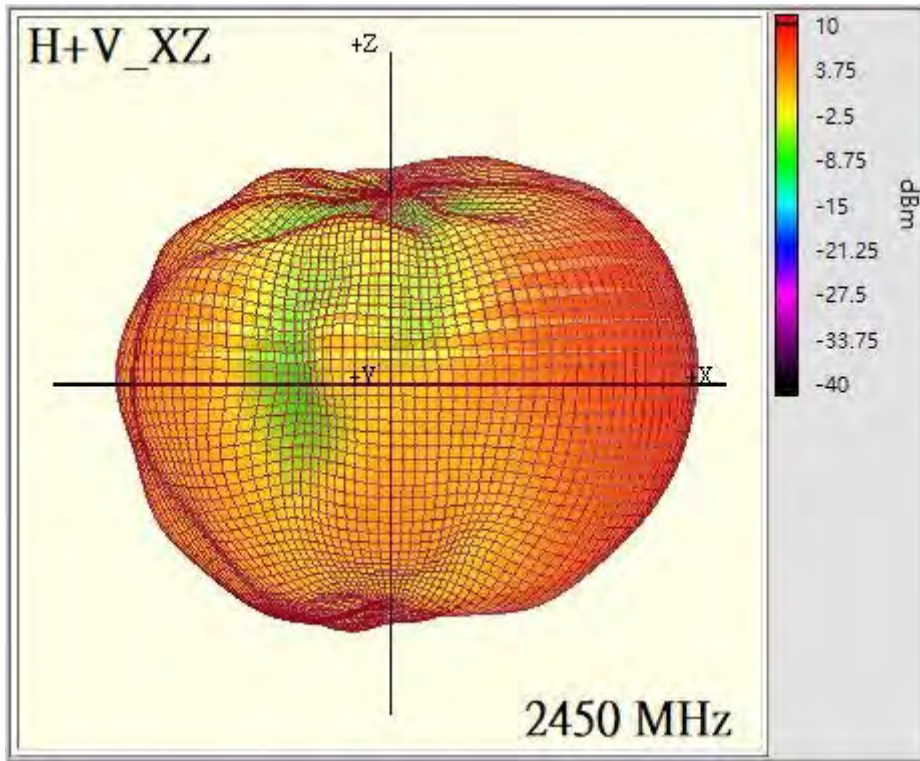


YZ Plan(6525MHz)

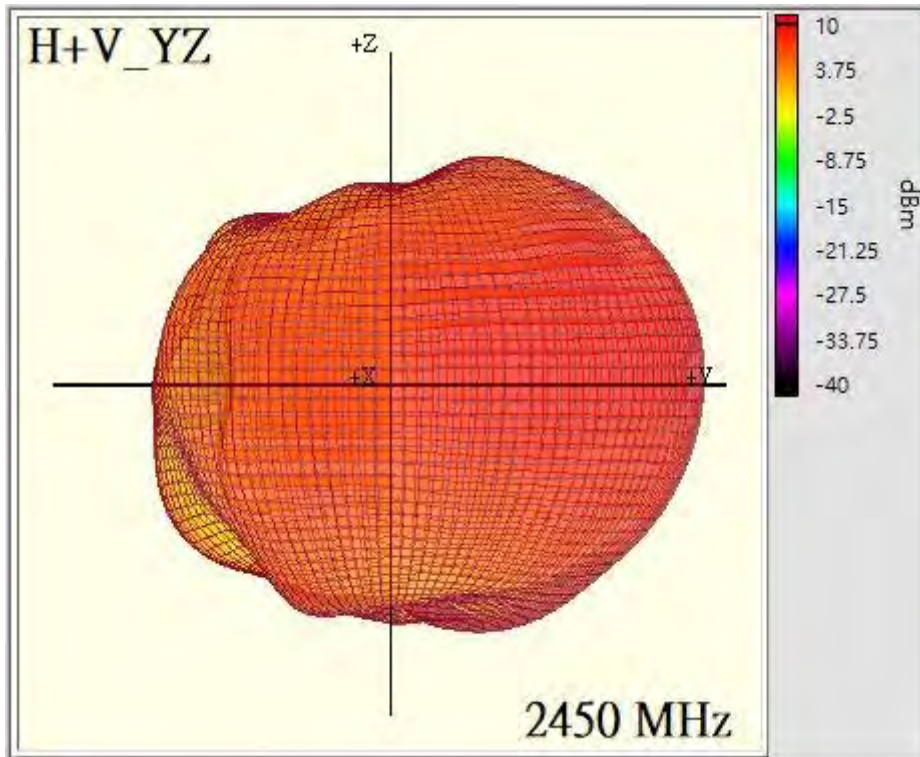


XY Plan(6525MHz)

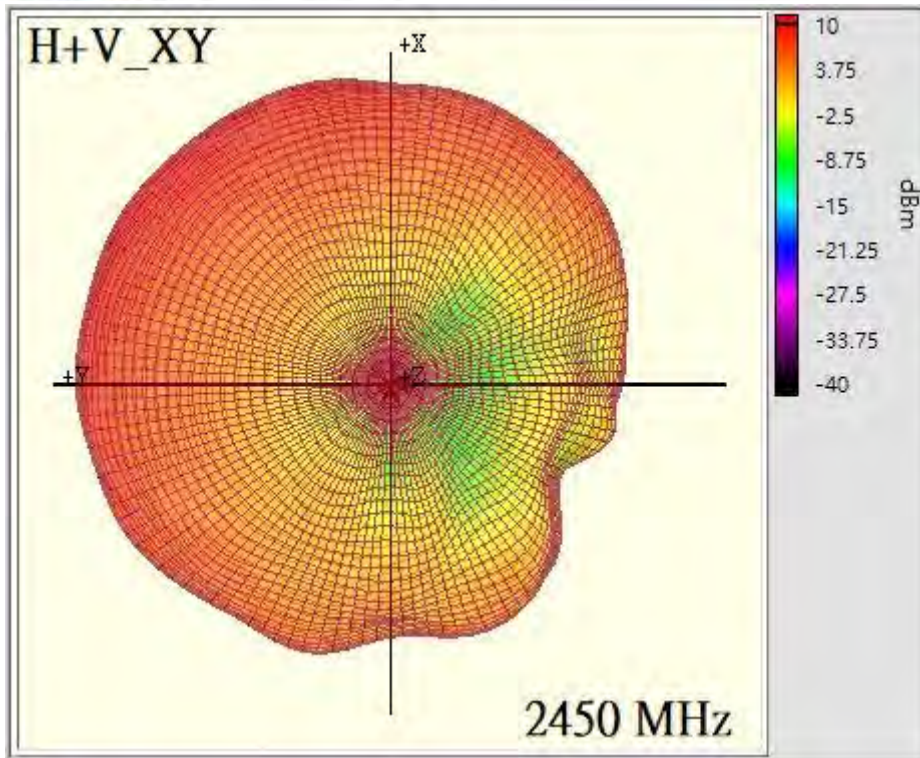
Ant_8 (Dual band):



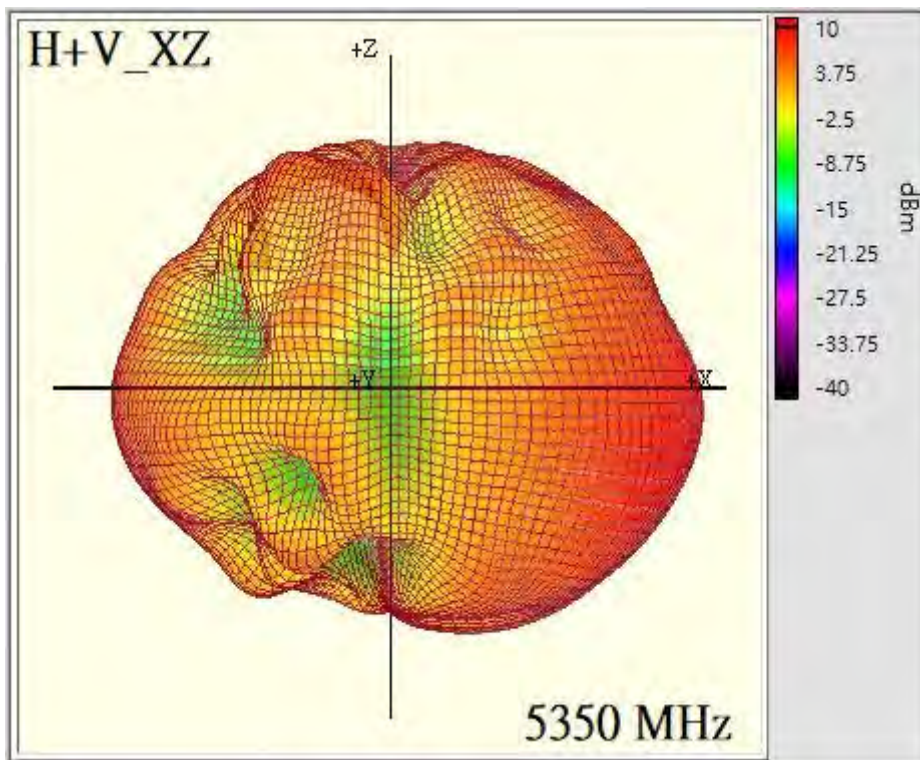
XZ Plan(2450MHz)



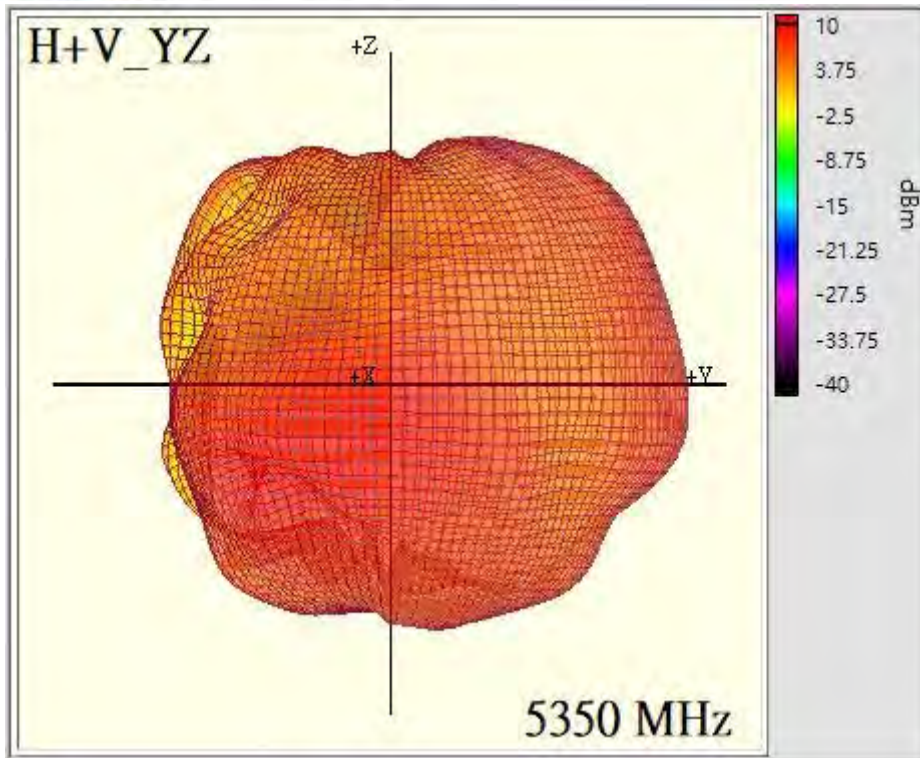
YZ Plan(2450MHz)



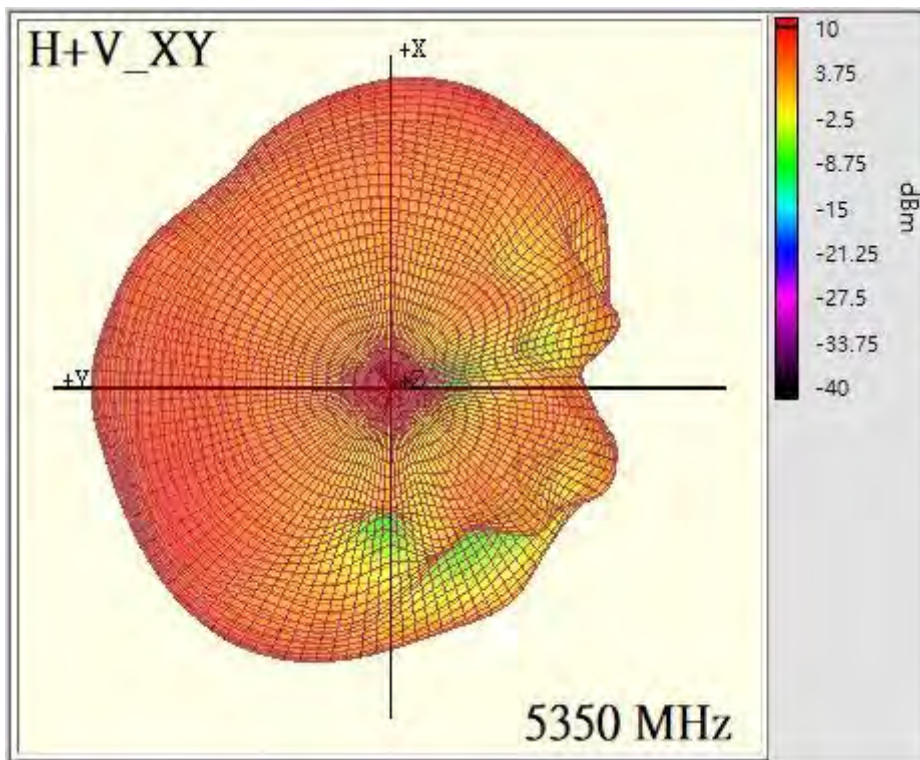
XY Plan(2450MHz)



XZ Plan(5350MHz)



YZ Plan(5350MHz)



XY Plan(5350MHz)