



emplus

# WAP388 Antenna design proposal

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V2.3  
Tim Chao  
2022/12/08

# Agenda

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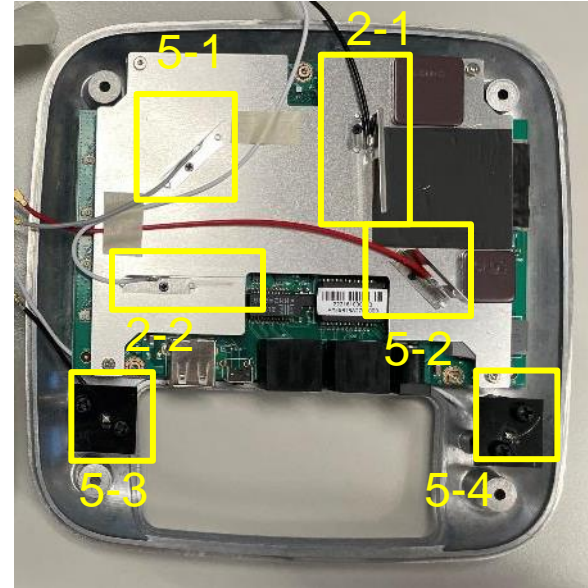
- History
- Antenna Placement
- Antenna pictures
- Return loss & Isolation
- Gain table
- 2D Radiation Pattern
- Combine Pattern

# History

Date	Description	Version
2021/07/12	2.4GHz*2, 5GHz*4, BT*1	V0.1
2021/11/16	Change to PCB BT antenna	V0.2
2021/12/27	Modify PIFA location for 1mm clearance to TOP cover	V0.3
2022/03/17	Mockup sample measurement	V1.0
2022/11/17	S3 housing, new BT location, thermal solution	V2.0
2022/11/21	Add antenna PN and picture	V2.1
2022/12/01	Add antenna size and remove BT for certification	V2.2
2022/12/08	Fix typo of gain table	V2.3

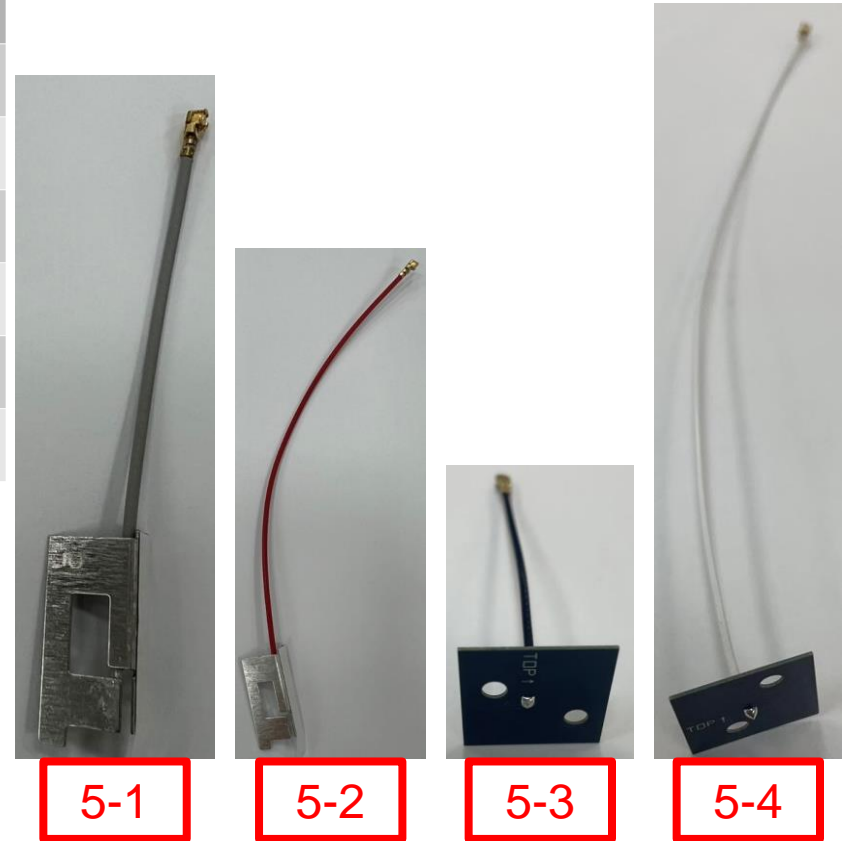
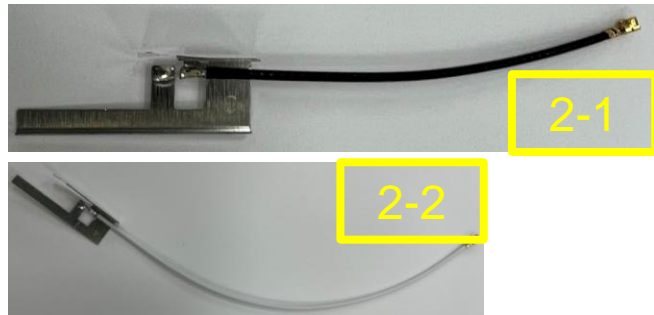
# Antenna Placement

- WAP388 have total six antennas as figure :
- 2.45GHz \* 2
- 5GHz \* 4
  
- Design criteria :
- Installation: Indoor/Wall mount
- Peak Gain: 2.4G:4.6 dBi, 5G: 5.9dBi
- Return loss:  $\leq -10\text{dB}$
- Isolation:  $\leq -20\text{dB}$
- Efficiency:  $\geq 60\%$

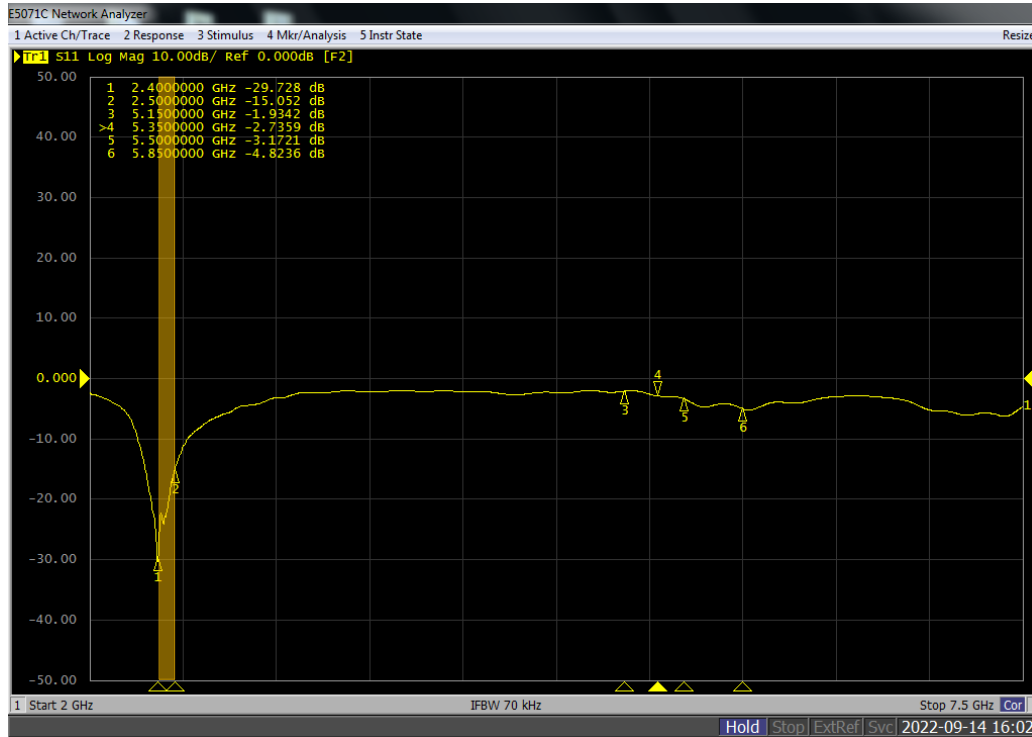


# Antenna pictures

	Size(mm)	Material	PN	Type
2-1	29x10x7	Metal	7102A0515000	PIFA
2-2	33.5x9.9x5.3	Metal	7102A0516000	PIFA
5-1	22x9.9x5.3	Metal	7102A0517000	PIFA
5-2	22x9.9x5.3	Metal	7102A0518000	PIFA
5-3	19.32x19.32x0.6	FR4	7102A0519000	Dipole
5-4	19.32x19.32x0.6	FR4	7102A0520000	Dipole

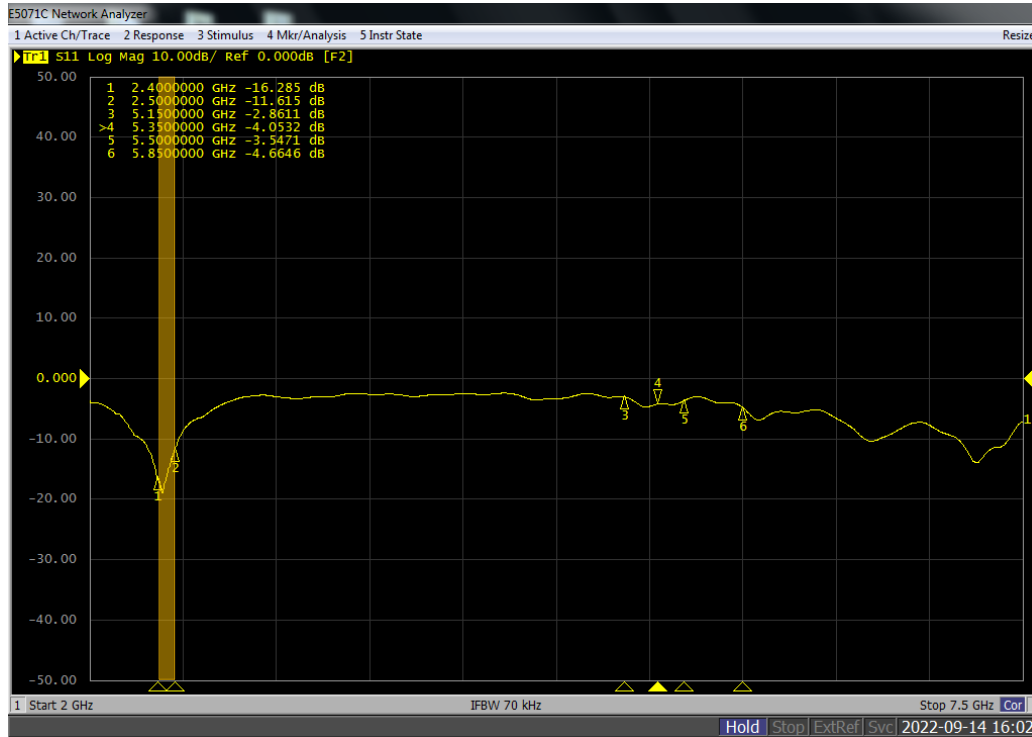


# Return Loss : 2-1



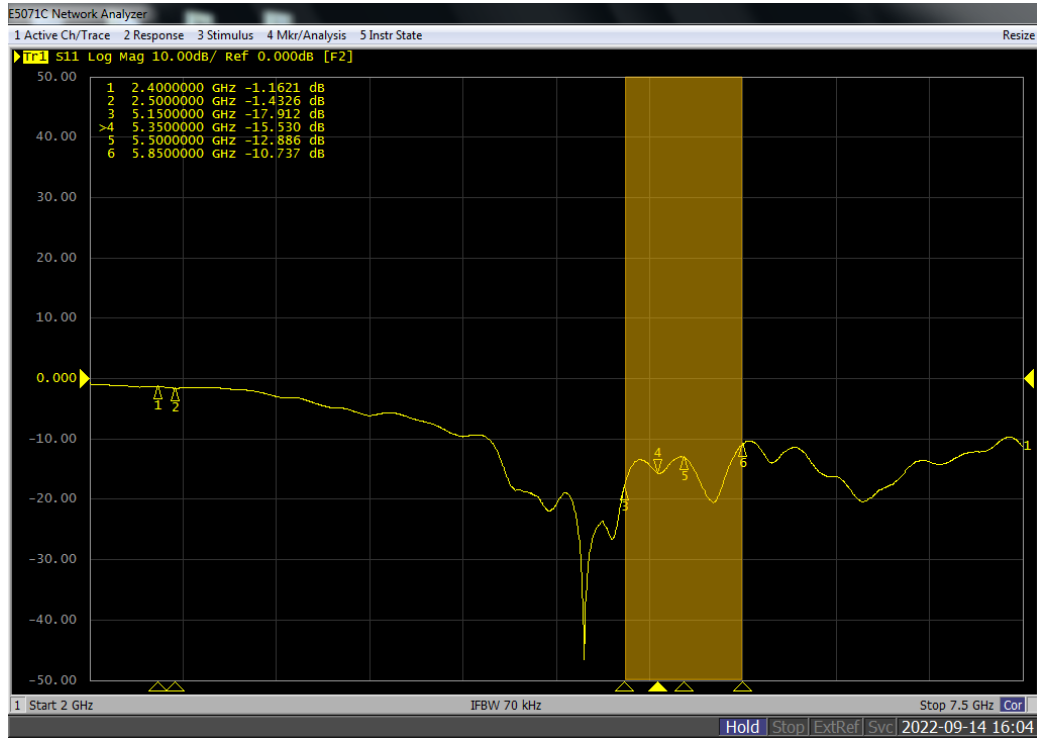
Criteria :  $\leq -10\text{dB}$

# Return Loss : 2-2



Criteria :  $\leq -10\text{dB}$

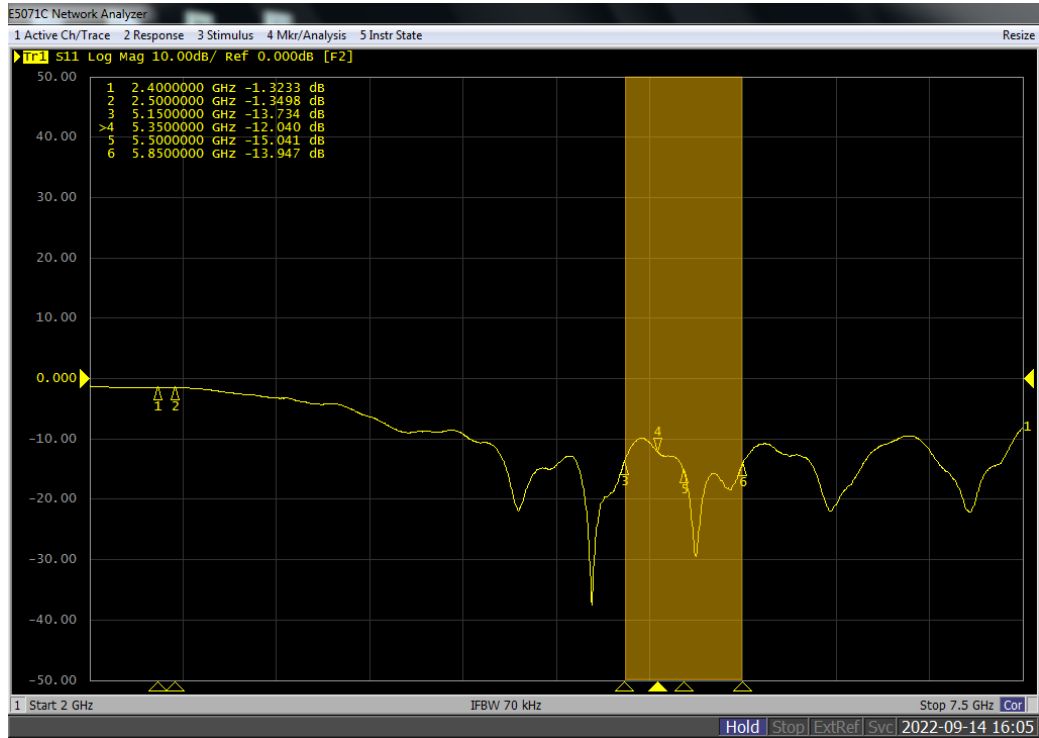
# Return Loss : 5-1



Criteria :  $\leq -10\text{dB}$

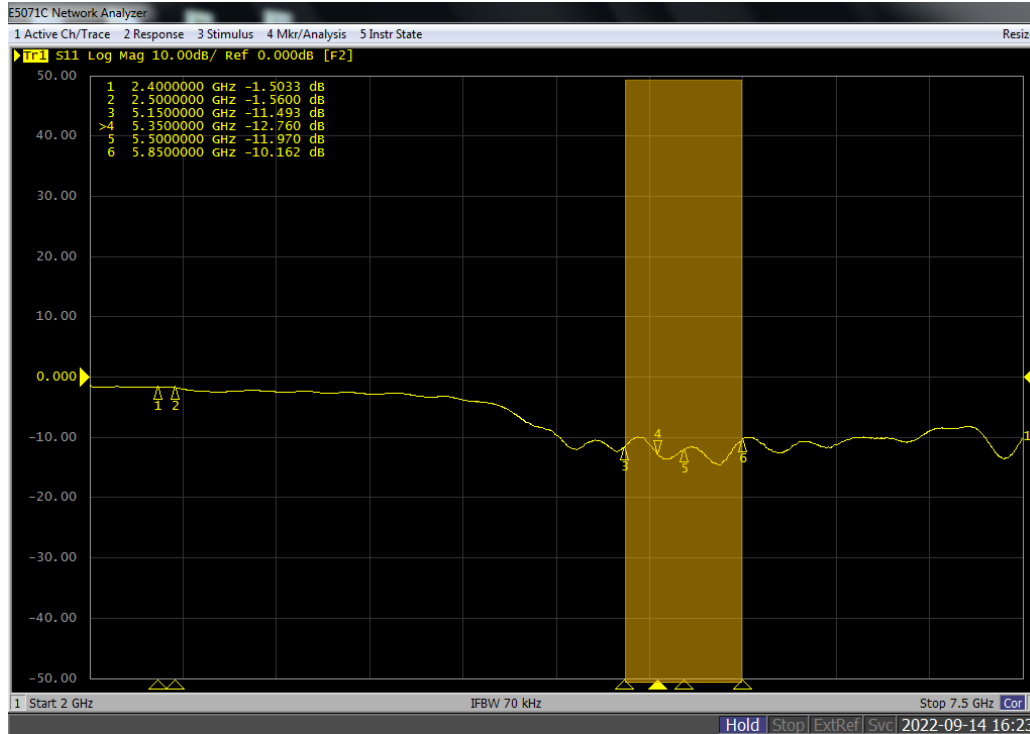


# Return Loss : 5-2



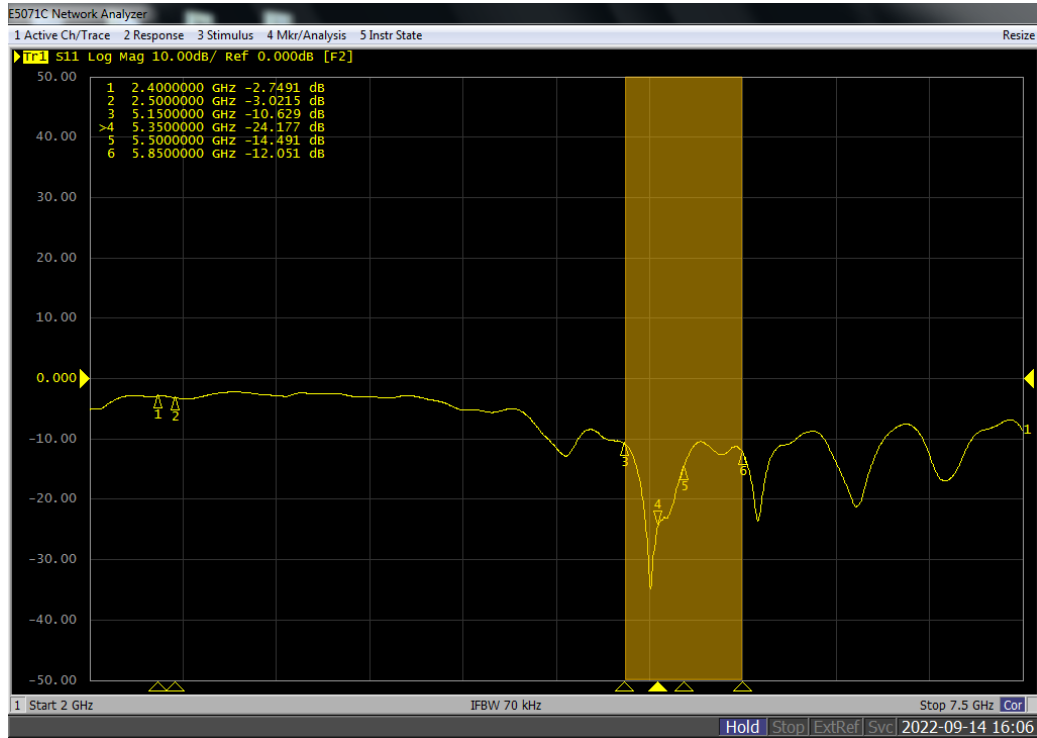
Criteria :  $\leq -10\text{dB}$

# Return Loss : 5-3



Criteria :  $\leq -10\text{dB}$

# Return Loss : 5-4



Criteria :  $\leq -10\text{dB}$

# Return loss table

S11(dB)	2.4GHz	2.5GHz	5.15GHz	5.35GHz	5.5GHz	5.85GHz
2-1	-29	-15				
2-2	-16	-11				
5-1			-17	-15	-12	-10
5-2			-13	-12	-15	-13
5-3			-11	-12	-11	-10
5-4			-10	-24	-14	-12

Criteria :  
S11 < -10dB  
Result : PASS

# Isolation at 2.45GHz

	2-1	2-2
2-1	NA	-20.1
2-2	NA	NA

Criteria :  $\leq -20\text{dB}$

Result : PASS

# Isolation at 5.5GHz

	5-1	5-2	5-3	5-4
5-1	NA	-23.3	-38.5	-33.4
5-2	NA	NA	-40.5	-34.1
5-3	NA	NA	NA	-36.2
5-4	NA	NA	NA	NA

Criteria :  $\leq -20\text{dB}$

Result : PASS

# Gain table


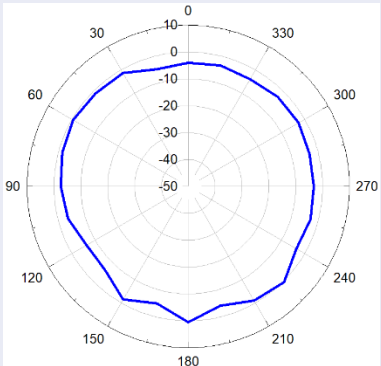
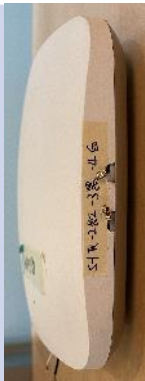
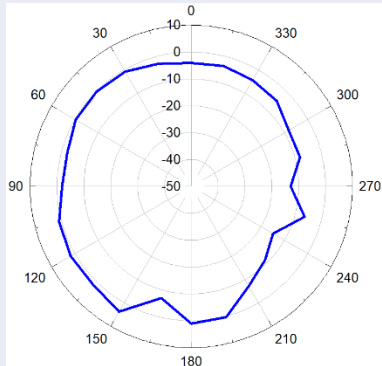

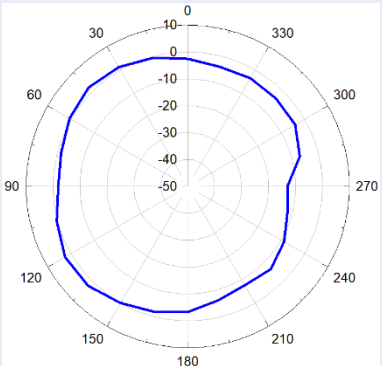
Criteria : 2.45GHz > 4dBi  
5.5GHz > 5dBi

Criteria :  
Efficiency > 60%

Result : PASS

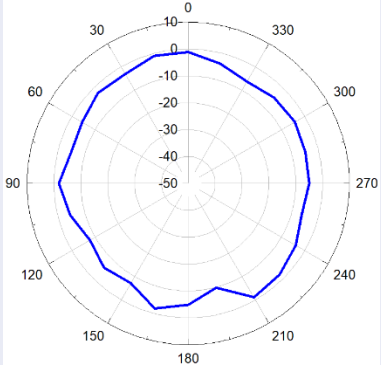

Antenna		2400~2483.5MHz	5150~5250MHz	5250~5350MHz	5470~5725MHz	5725~5850MHz
2-1	Peak Gain (dBi)	4.5				
	Effi.(%)	75.5				
2-2	Peak Gain (dBi)	4.6				
	Effi.(%)	63				
5-1	Peak Gain (dBi)		5.8	5.0	5.4	5.4
	Effi.(%)		70.6	72	73.8	73.5
5-2	Peak Gain (dBi)		4.6	5.0	5.2	5.2
	Effi.(%)		62.4	66	71.2	68.1
5-3	Peak Gain (dBi)		5.9	5.8	5.3	5.3
	Effi.(%)		62.5	67.8	76.6	76.6
5-4	Peak Gain (dBi)		5.3	5.6	5.8	5.8
	Effi.(%)		64	72.8	72.7	69.4

# 2D pattern : 2-1




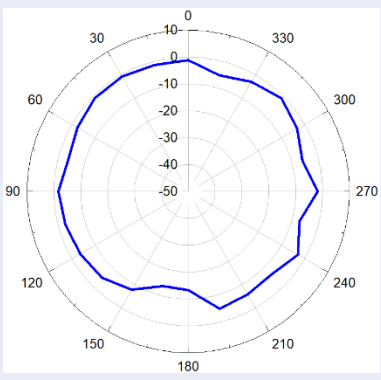
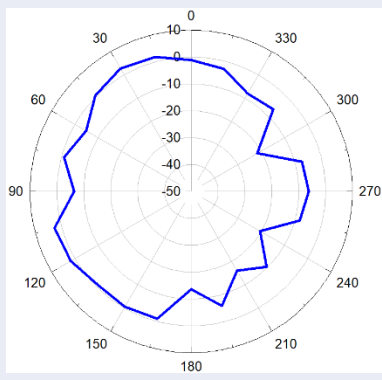
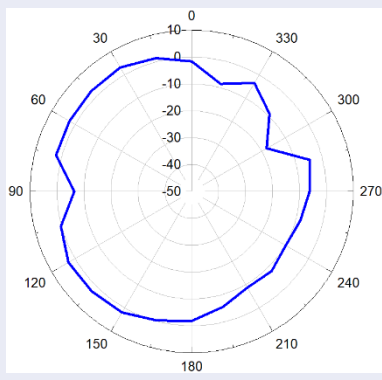
Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
2.45GHz	 	 	 




# 2D pattern : 2-2

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
2.45GHz	 	 	 


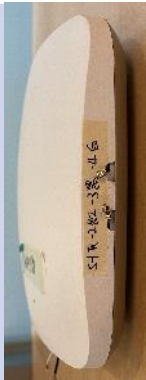

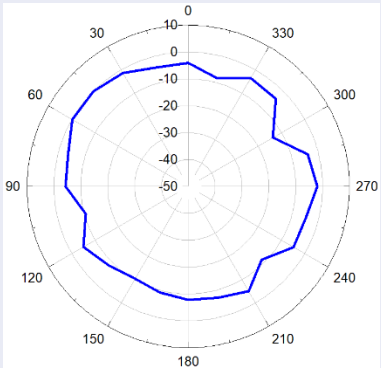
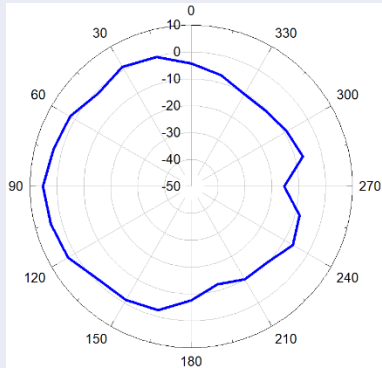
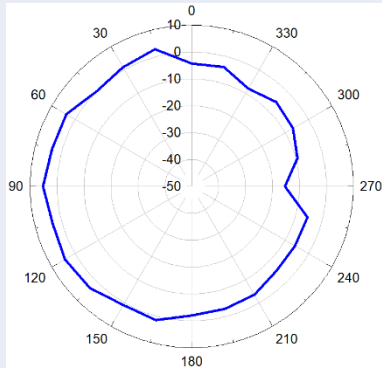
# 2D pattern : 5-1

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
5.5GHz			
			


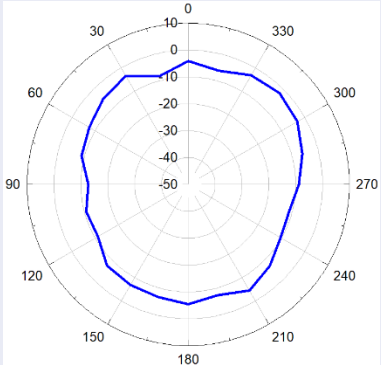
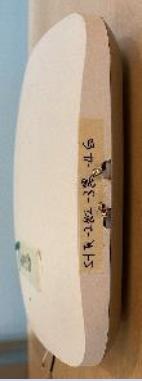
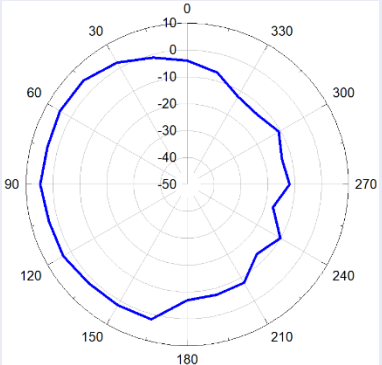

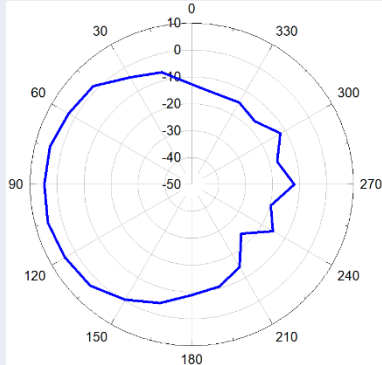
# 2D pattern : 5-2

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
5.5GHz			
			

# 2D pattern : 5-3

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
5.5GHz			
			


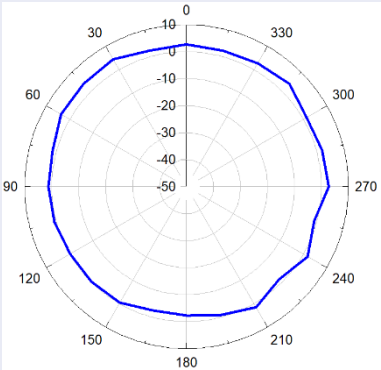
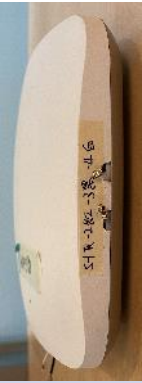
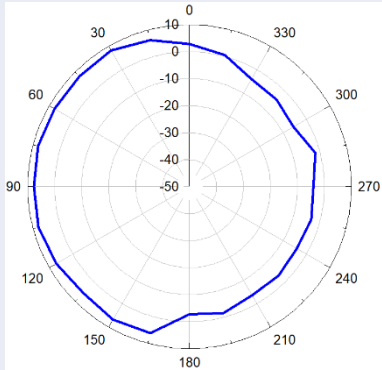

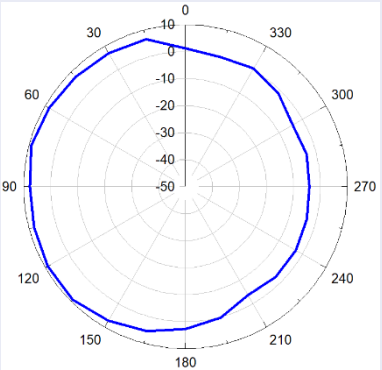
# 2D pattern : 5-4

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
5.5GHz	 	 	 

# Combine pattern : 2.45GHz

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
2.45GHz	 	 	 

# Combine pattern : 5.5GHz

Frequency	XZ Plane	YZ Plane	XY Plane (Azimuth)
5.5GHz	 	 	 

The logo for 'emplus' is centered in the image. It features the word 'emplus' in a lowercase, sans-serif font. The 'e' and 'm' are a light blue color, while the 'p' and 'l' are a darker blue, and the 'u' and 's' are a light blue. The background is a large, abstract graphic of two overlapping circles filled with a low-poly, geometric pattern of various shades of blue. The overall aesthetic is clean and modern.

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