

# Relatório de atividade

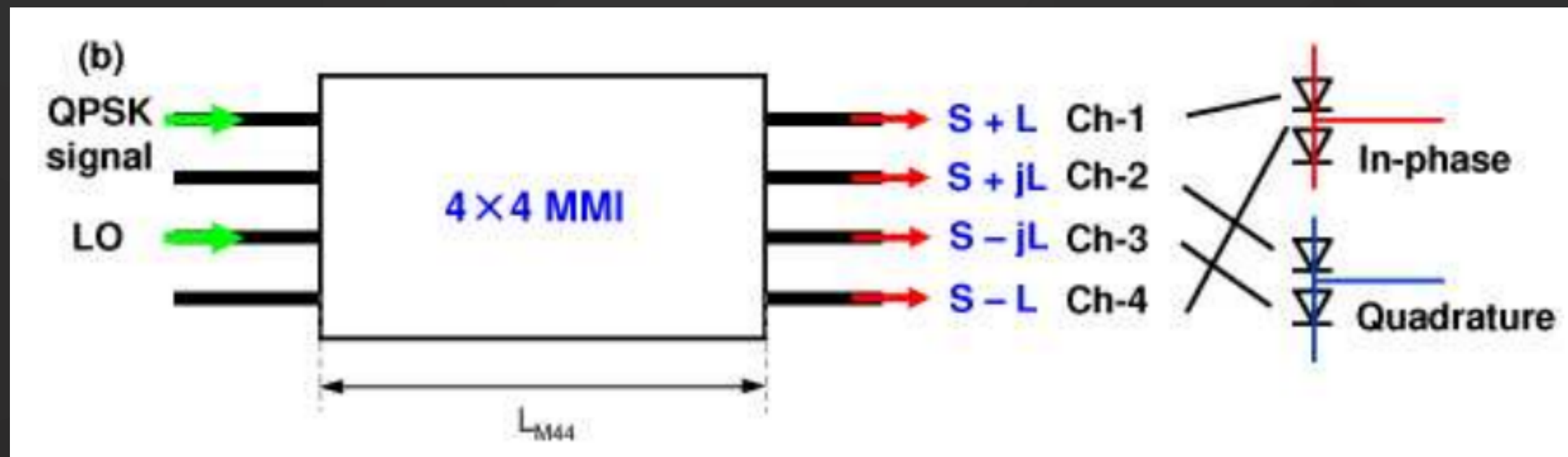
Híbrida MMI 4x4 - Geração 1

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Lucas de Oliveira Lobo

# Híbrida MMI 4x4

## Metas iniciais

- Banda C (1530nm - 1565nm)
- Imbalance < 0.5dB
- Excess loss < 0.75dB



# Híbrida MMI 4x4

## Supermodos calculados

- $N_{eff0} = 2.8306$
- $N_{eff1} = 2.8274$

$\Lambda_0 = 1.547.5\text{nm}$

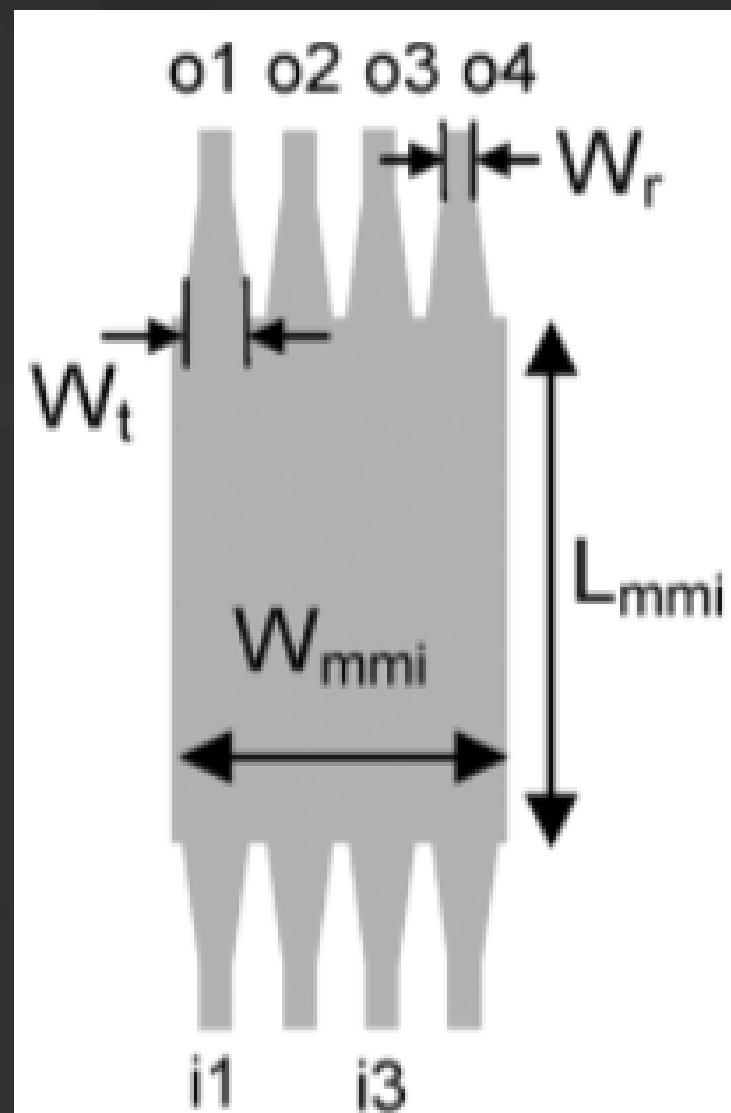


- $\beta_0 = 11493076.6$
- $\beta_1 = 11480213.9$

mode #	effective index	wavelength ( $\mu\text{m}$ )	loss (dB/cm)	group index	TE polarization fraction ( $E_y$ )	
1	2.830656	1.547	0.0000	3.766176	100	99
2	2.827488	1.547	0.0000	3.770390	100	99
3	2.822201	1.547	0.0000	3.777444	100	99
4	2.814781	1.547	0.0000	3.787386	100	98
-	-	-	-	-	-	-

# Híbrida MMI 4x4

## Comprimento do MMI



**Comprimento  
de batimento  
calculado:**

$$L_{\pi} = 244.24 \text{ um}$$

$$\frac{3}{4}L_{\pi} = 183.18 \text{ um}$$

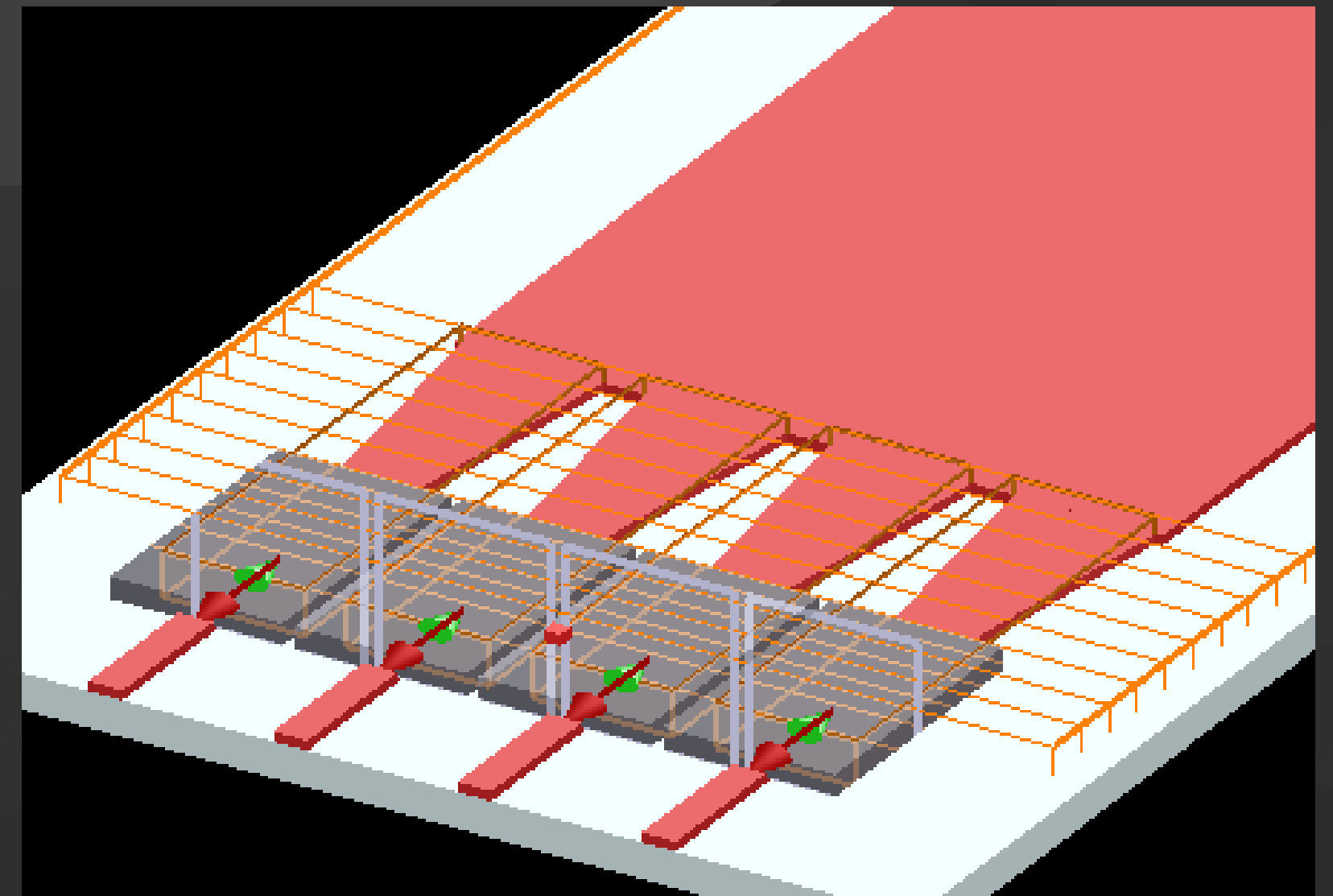
**Comprimento do  
MMI utilizado  
(pela referência):**

$$L = 186 \text{ um}$$

# Híbrida MMI 4x4

## Dimensões gerais do MMI

- Comprimento = 186  $\mu\text{m}$
- Largura = 10  $\mu\text{m}$
- Largura dos tappers = 2  $\mu\text{m}$
- Comprimento dos tappers = 6  $\mu\text{m}$

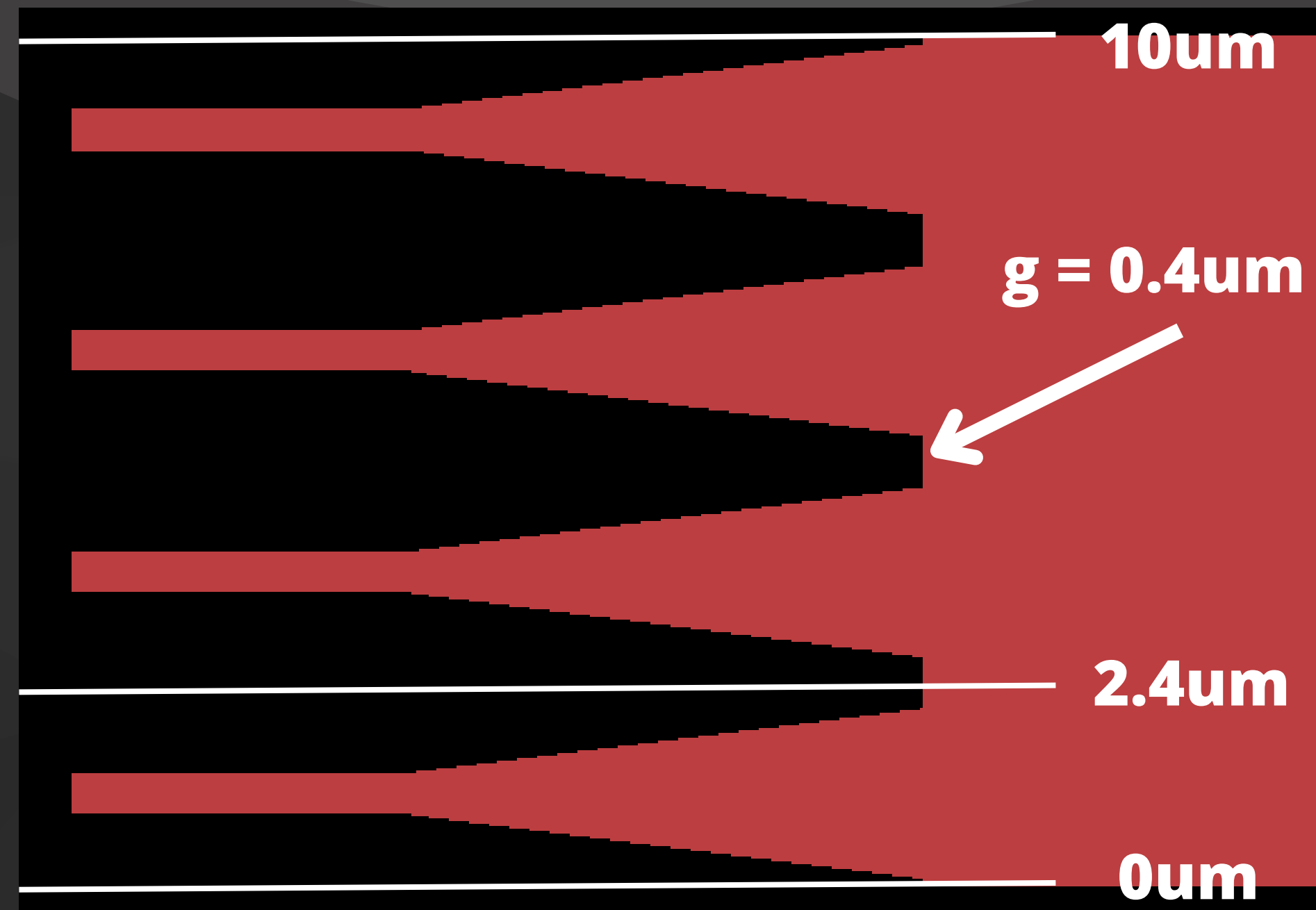


# Híbrida MMI 4x4

## Dimensões gerais do MMI

**Porta 1**

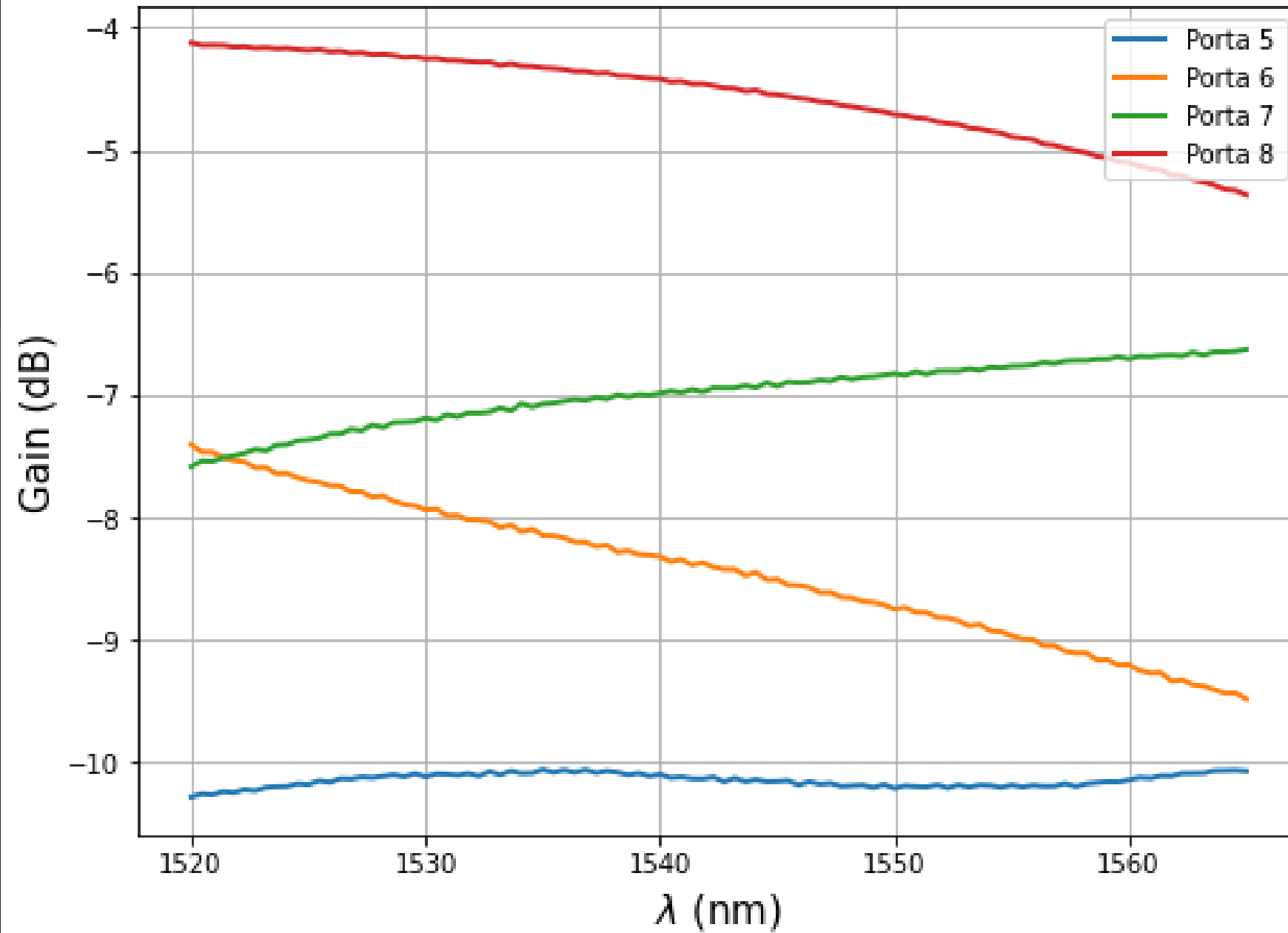
**Porta 2**



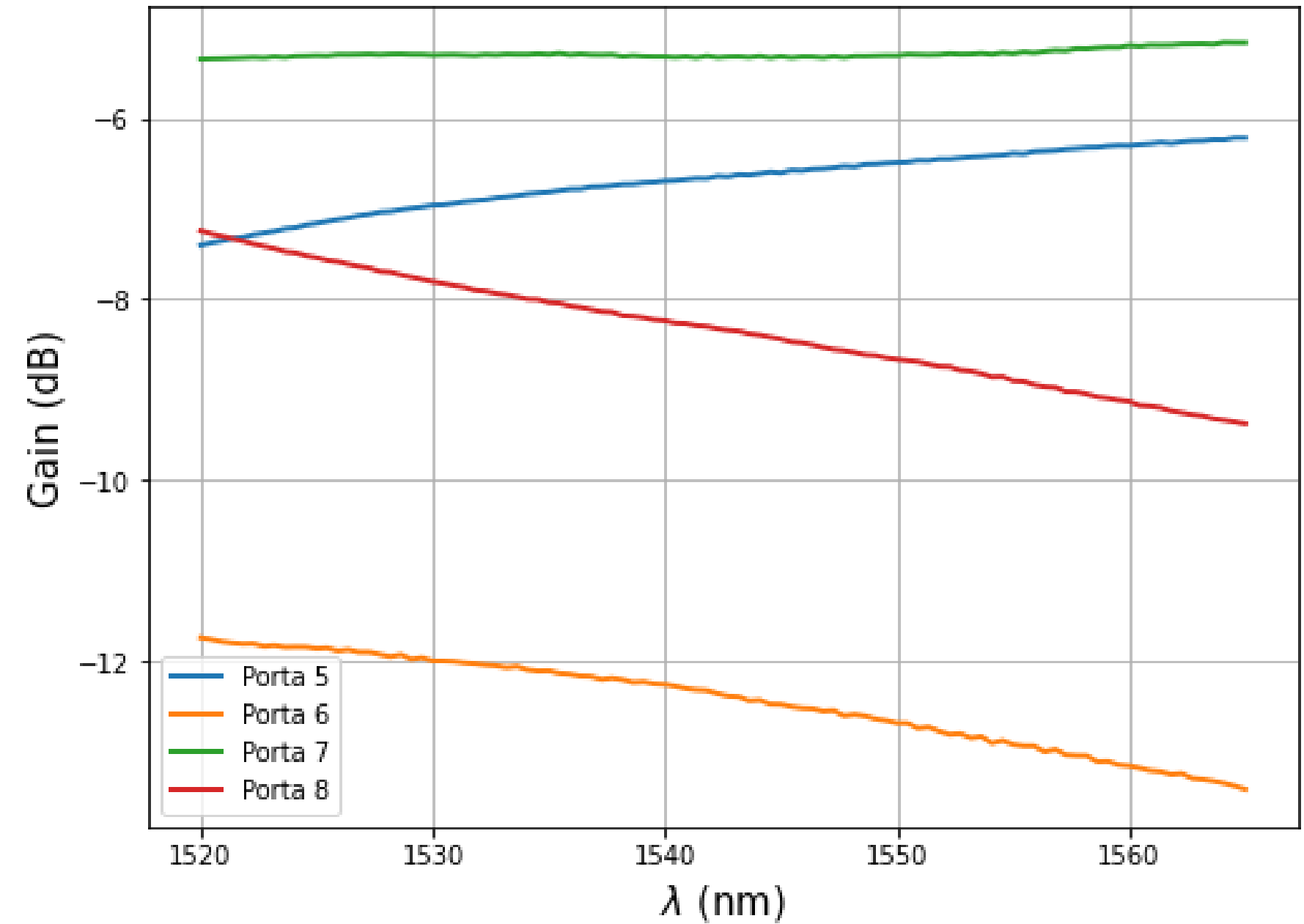
# Híbrida MMI 4x4

## Resultados

Ganho, Porta 1



Ganho, Porta 2

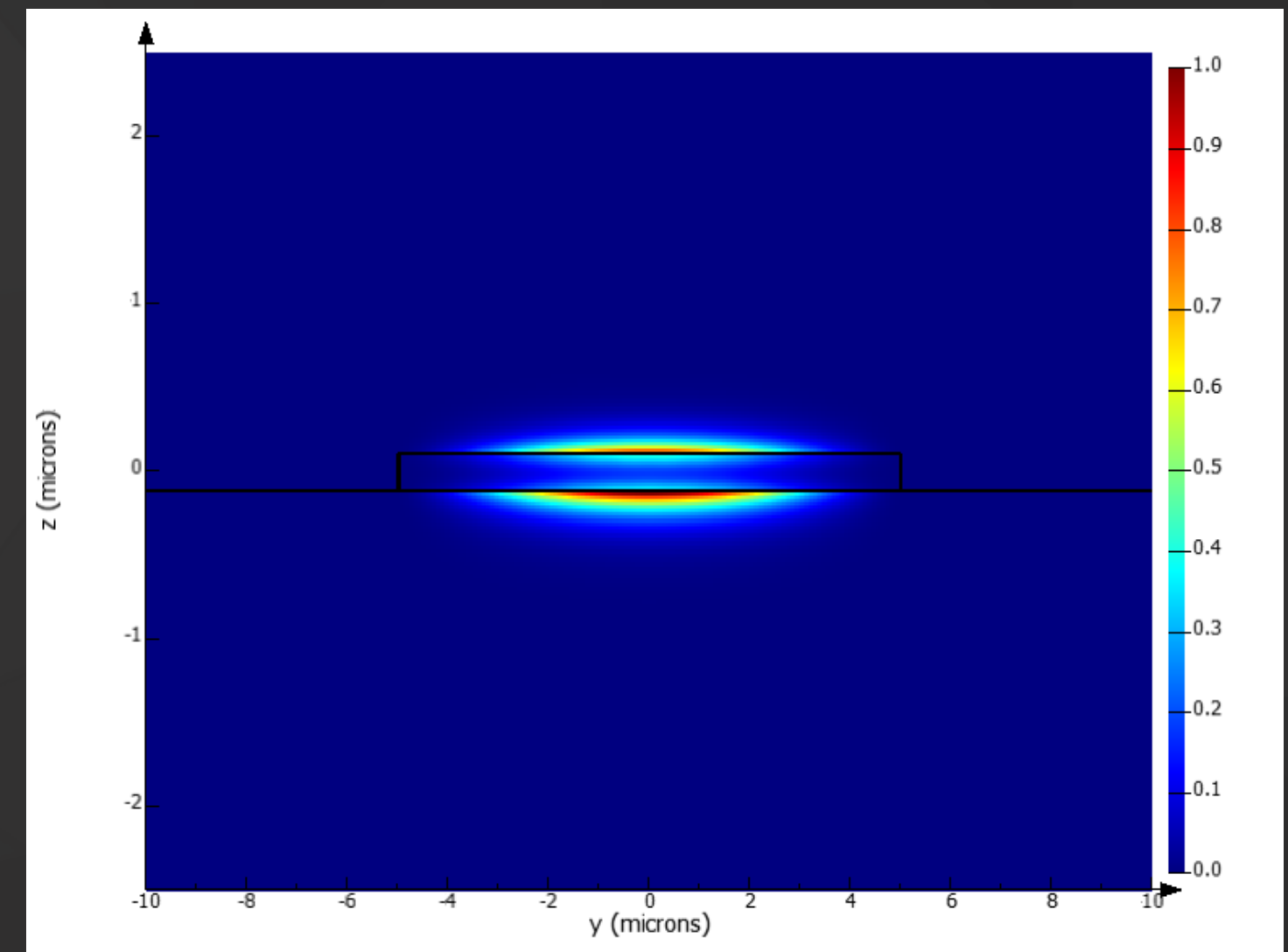


# Híbrida MMI 4x4

## Analise Numero de modos

### Caixa MMI

mode #	effective index	wavelength (μm)	loss (dB/cm)	group index	TE polarization fraction (Ey)	waveguide TE/TM fraction (%)	effective area (μm <sup>2</sup> )
27	1.919413	1.547	0.0000	5.521021	99	46.88 / 90.18	3.05663
28	1.905413	1.547	0.0000	4.188298	0	58.23 / 99.85	3.65237
29	1.900830	1.547	0.0000	4.199008	0	58.41 / 99.38	3.65956
30	1.893221	1.547	0.0000	4.213484	1	58.74 / 98.64	3.68288



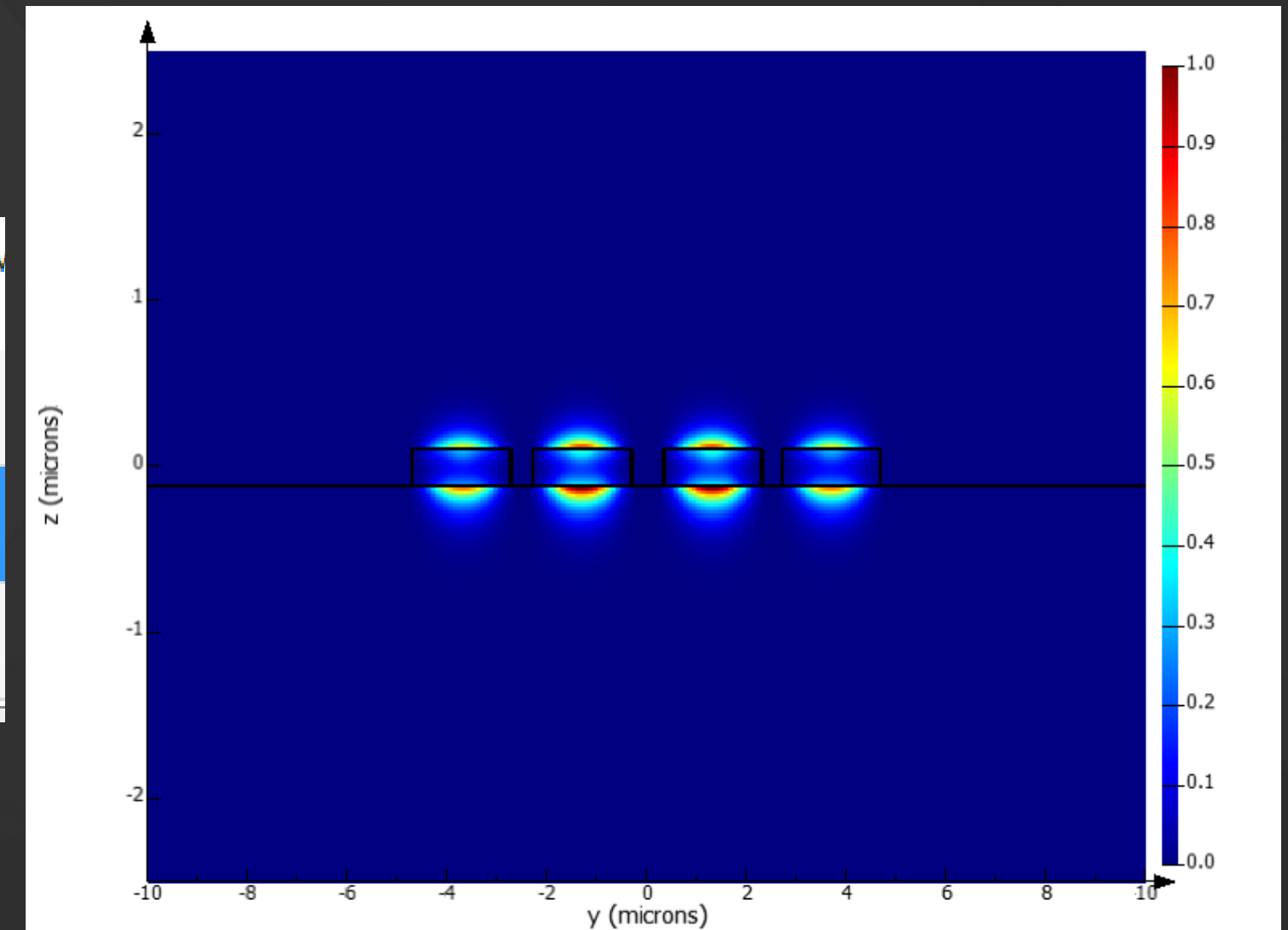


# Híbrida MMI 4x4

## Analise Numero de modos

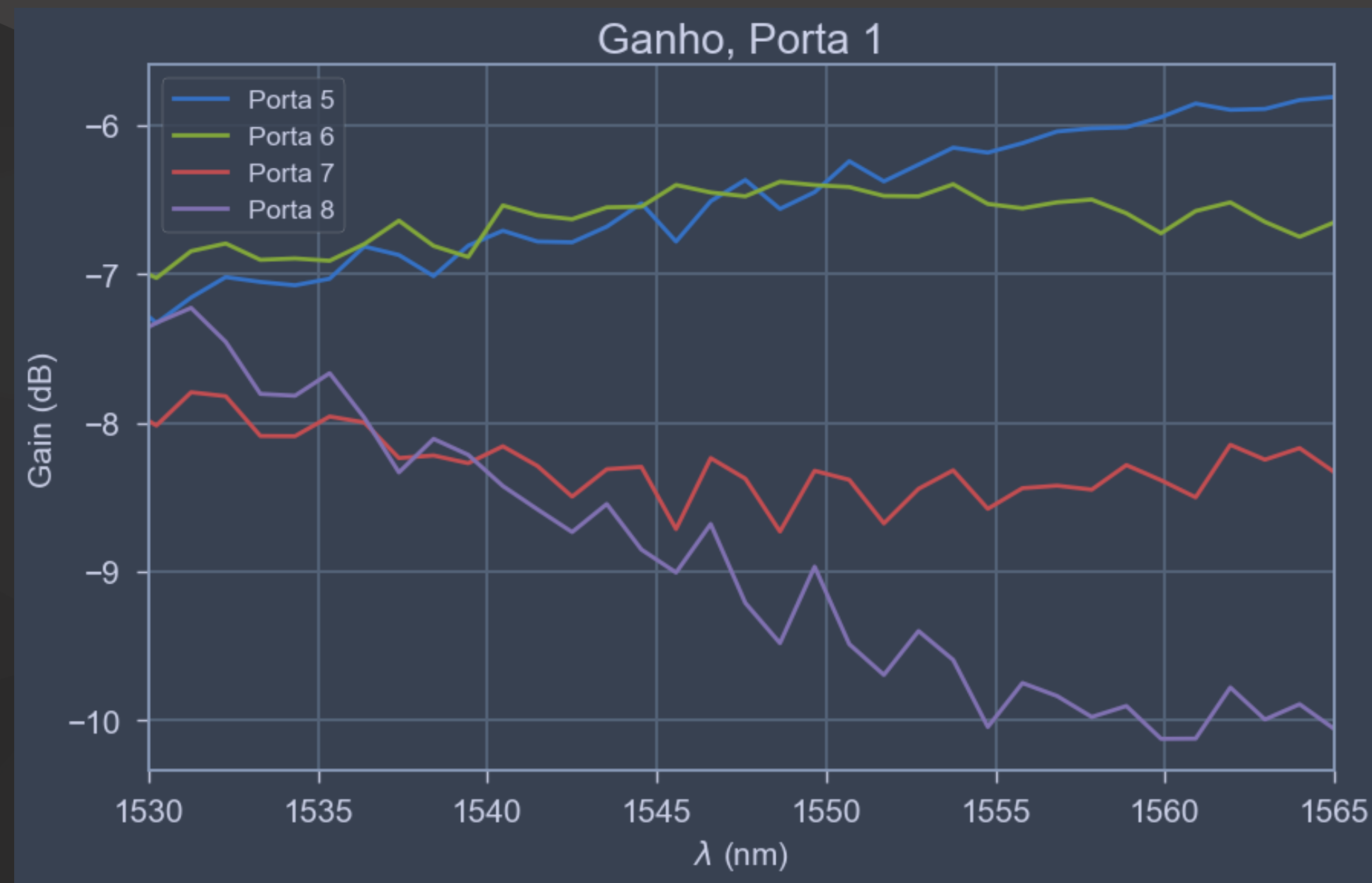
## Tappers Saída

mode #	effective index	wavelength (μm)	loss (dB/cm)	group index	TE polarization fraction (Ey)	waveguide TE/TM fraction (%)
20	2.059062	1.547	0.0000	5.119087	98	54.82 / 87.83
21	1.872984	1.547	0.0000	4.224884	2	59.37 / 97.44
22	1.872856	1.547	0.0000	4.227188	2	59.36 / 97.41



# Híbrida MMI 4x4

## Resultados

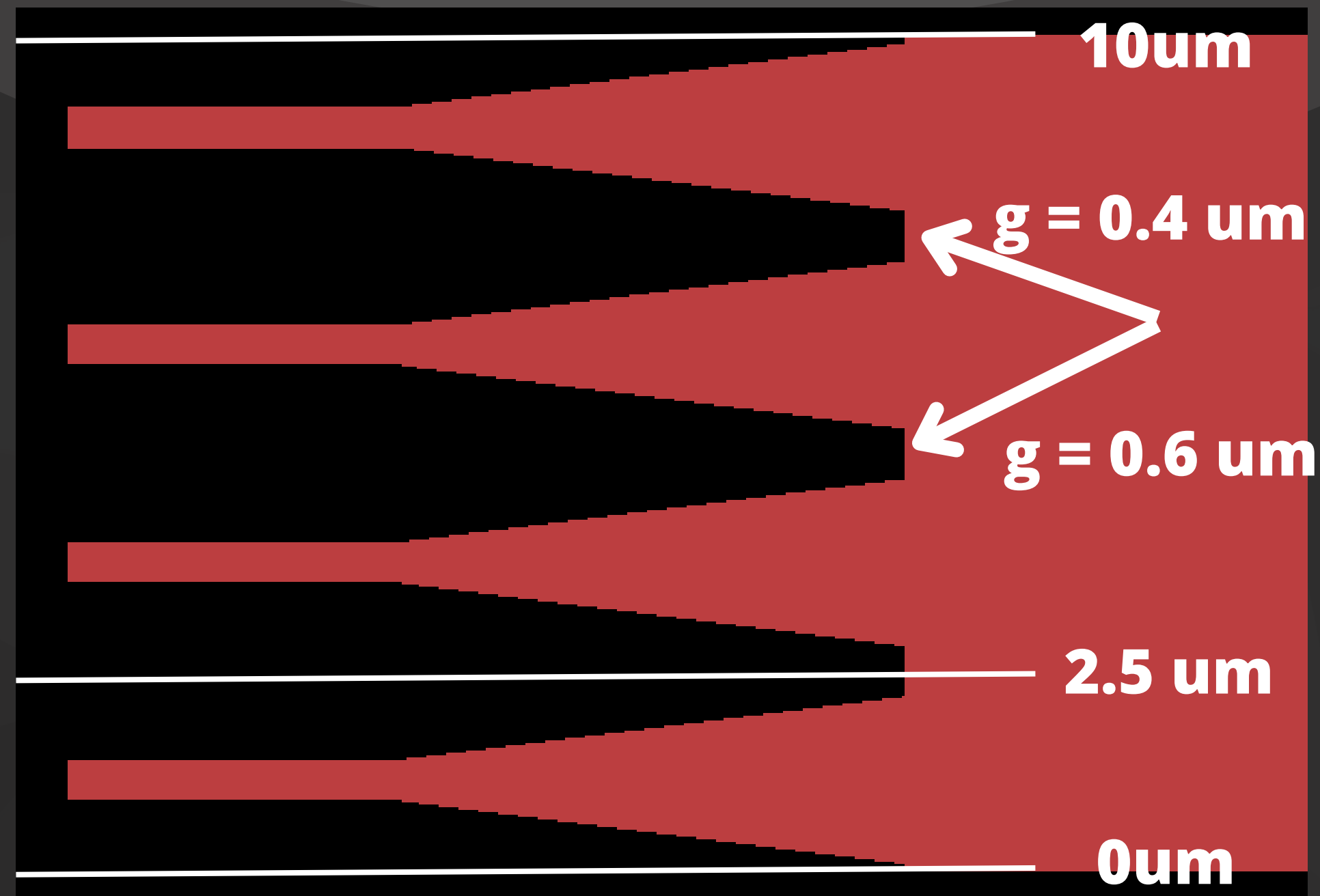


# Híbrida MMI 4x4

## Modificações no MMI

**Porta 1**

**Porta 2**



# Híbrida MMI 4x4

## Analise Comprimento do dispositivo



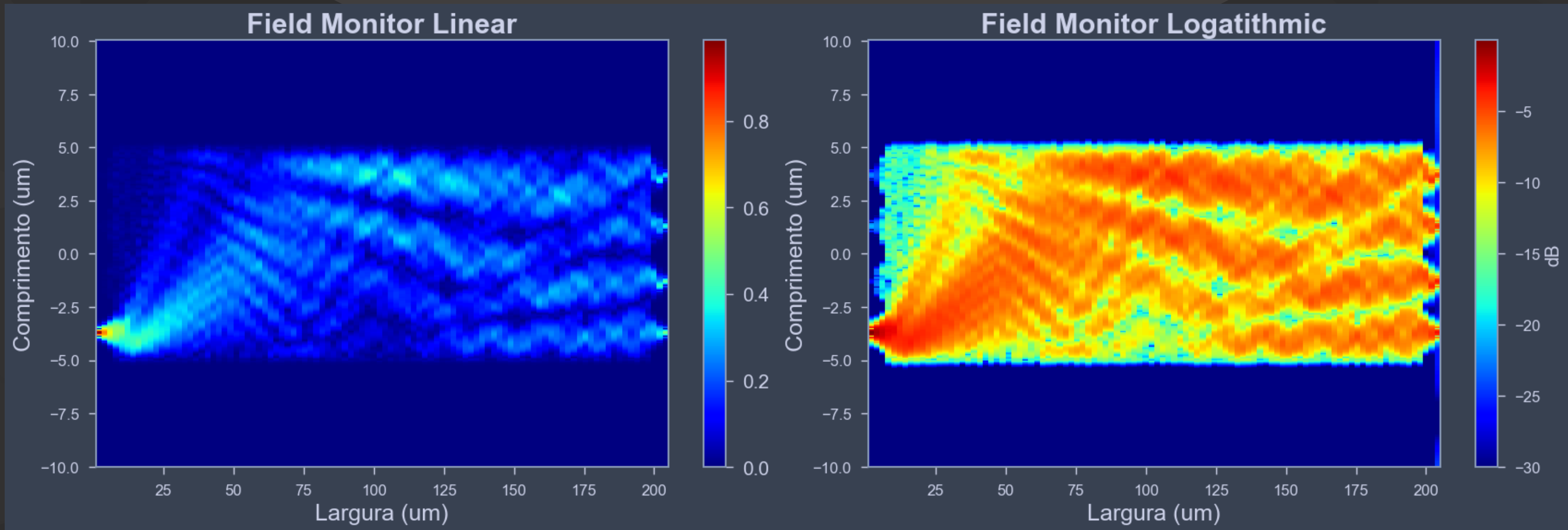
# Híbrida MMI 4x4

## Modificações finais do EME

	group spans (μm)	cells	subcell method	modes	
1	6	20	CVCS	10	d
2	178	1	none	28	d
3	6	20	CVCS	21	d

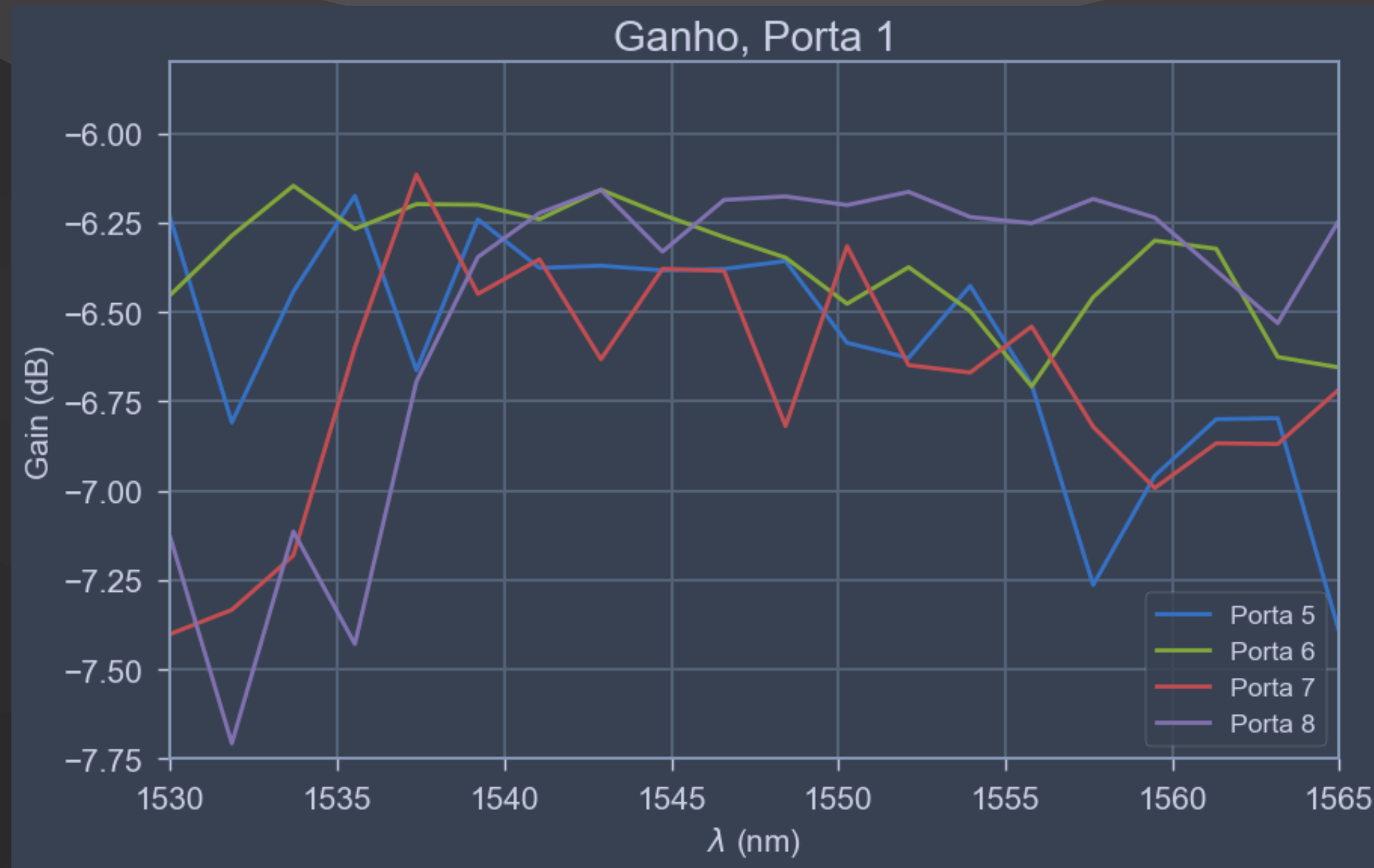
# Híbrida MMI 4x4

## Resultados



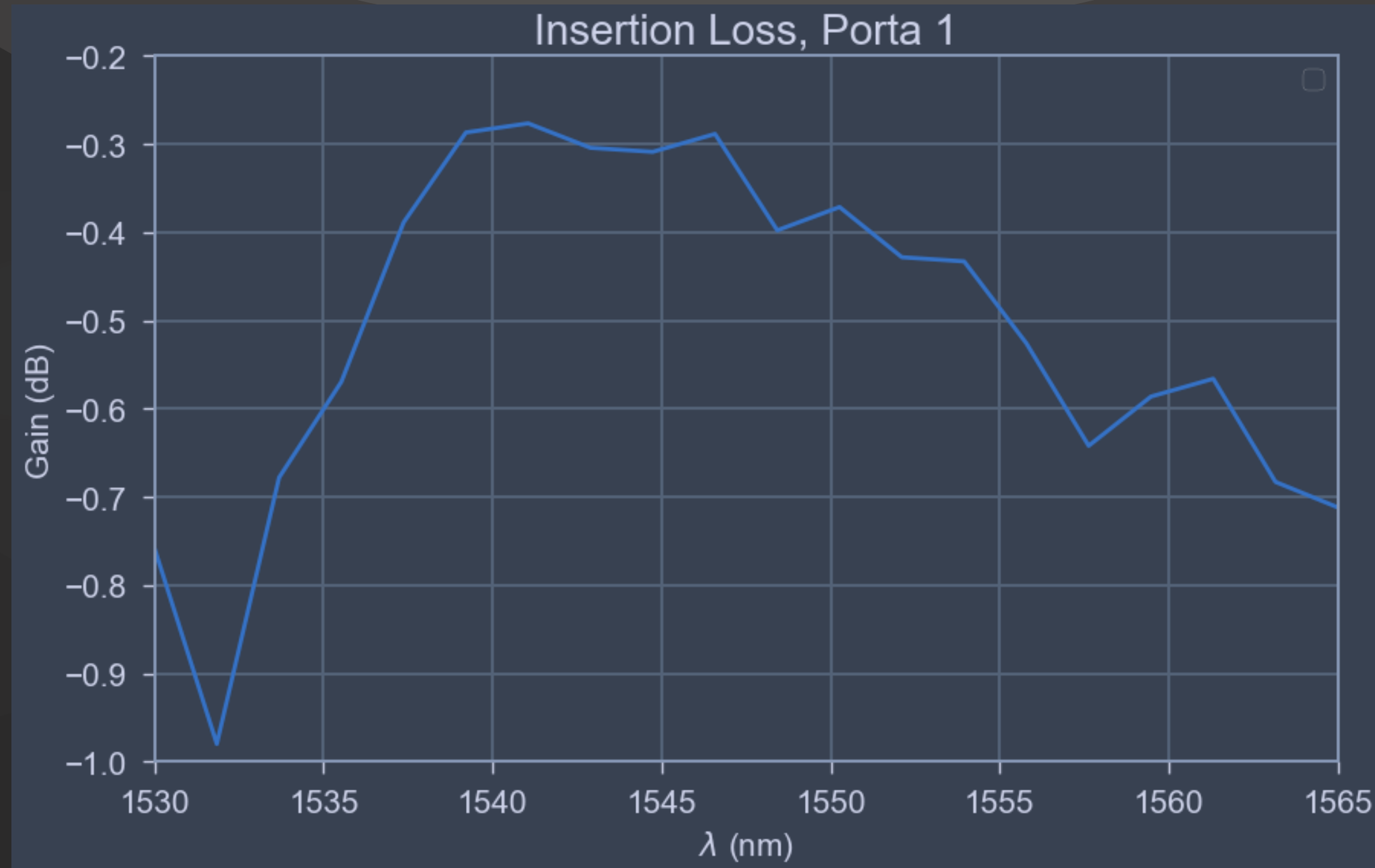
# Híbrida MMI 4x4

## Resultados



# Híbrida MMI 4x4

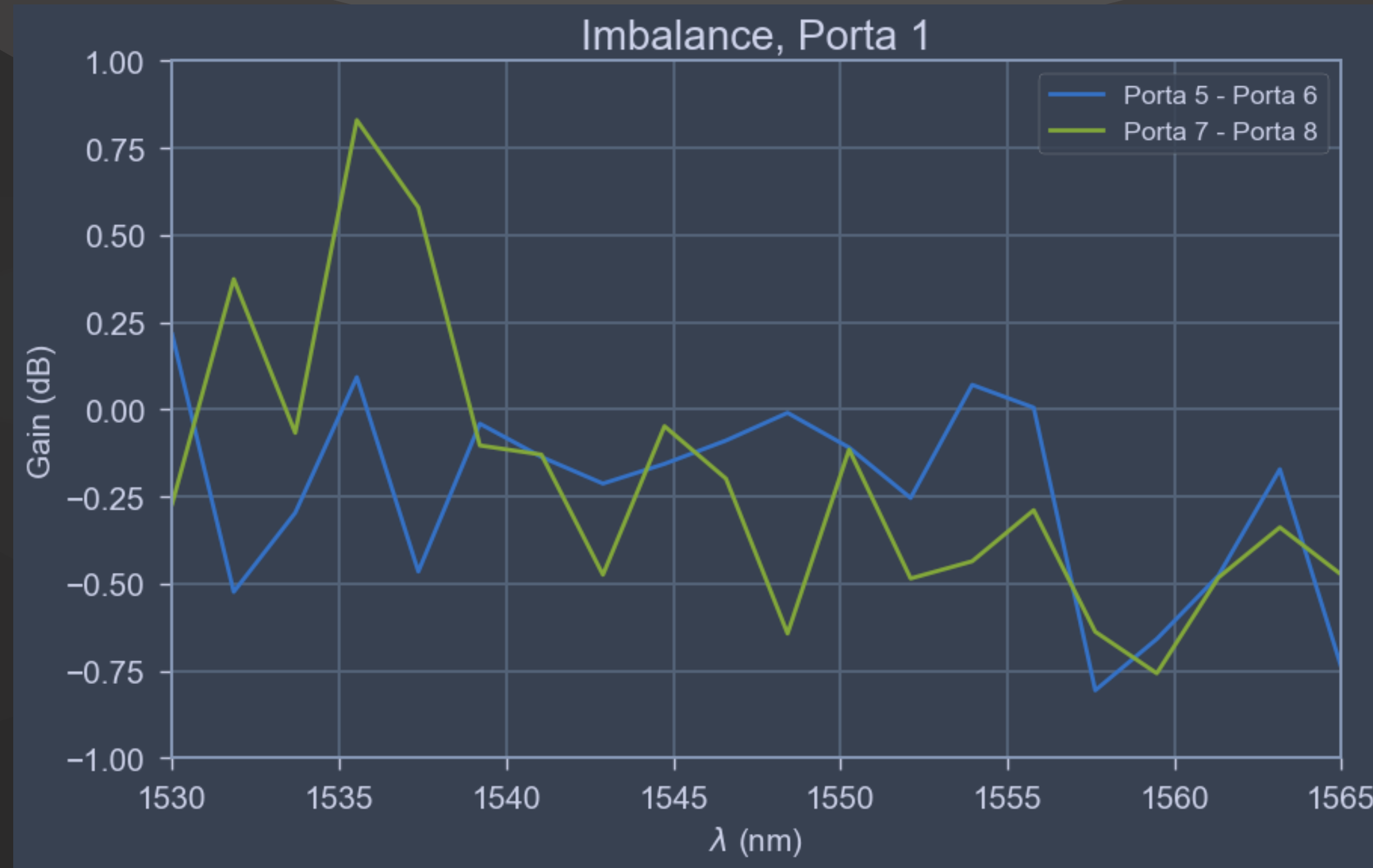
## Resultados





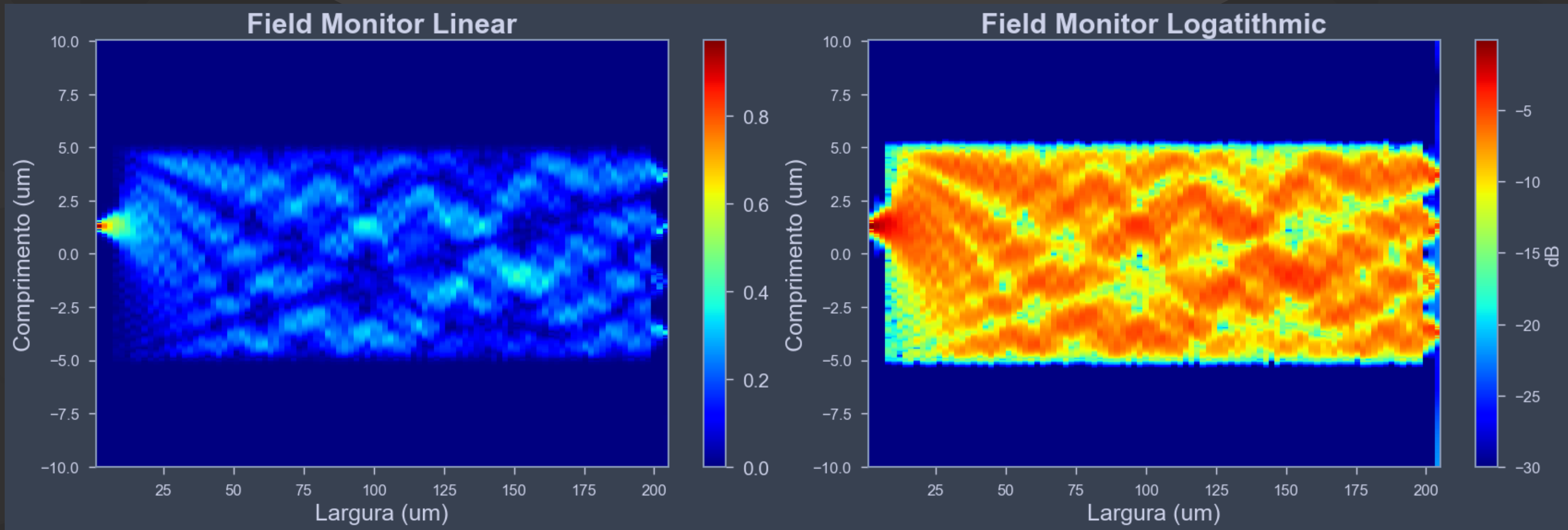
# Híbrida MMI 4x4

## Resultados



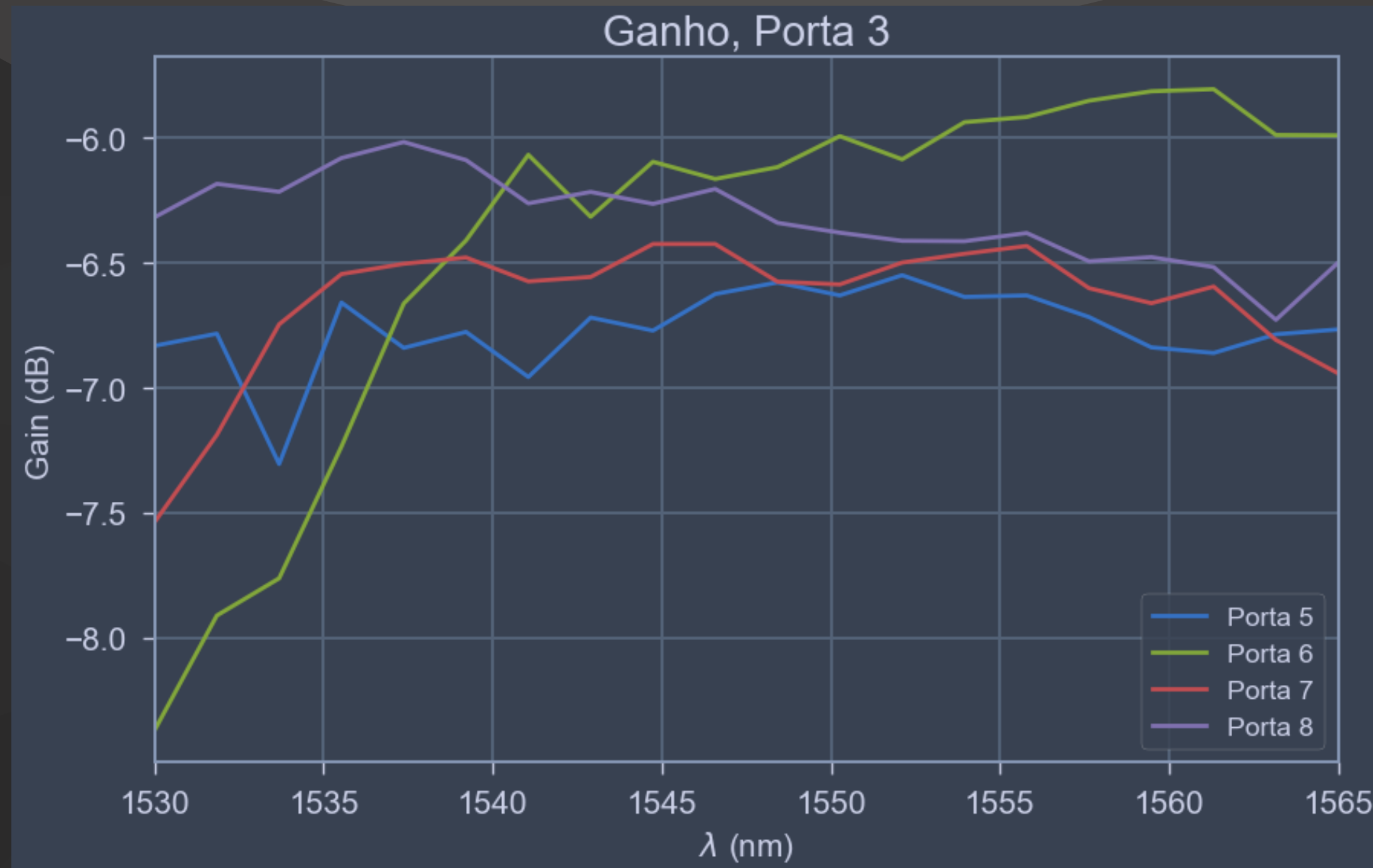
# Híbrida MMI 4x4

## Resultados



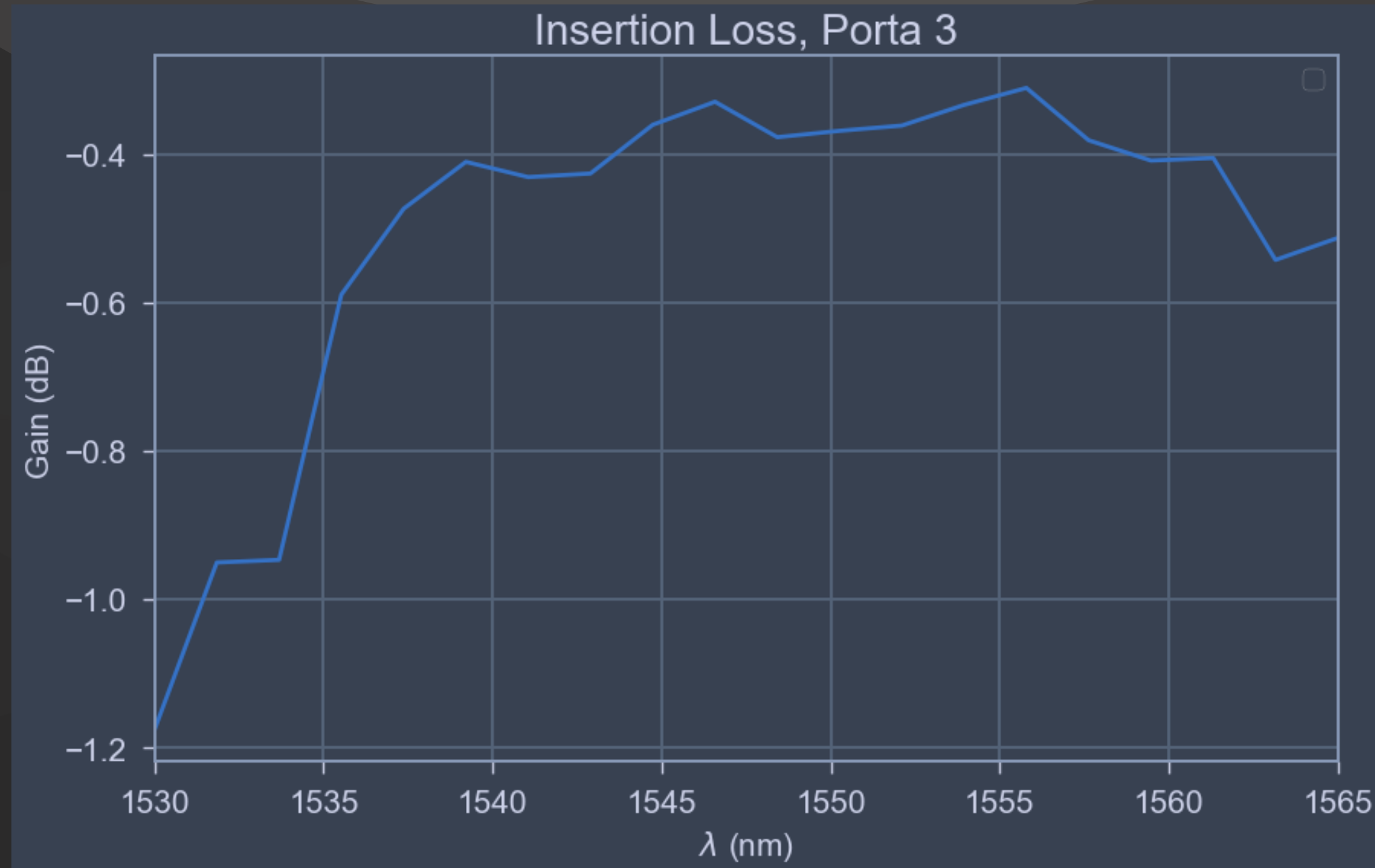
# Híbrida MMI 4x4

## Resultados



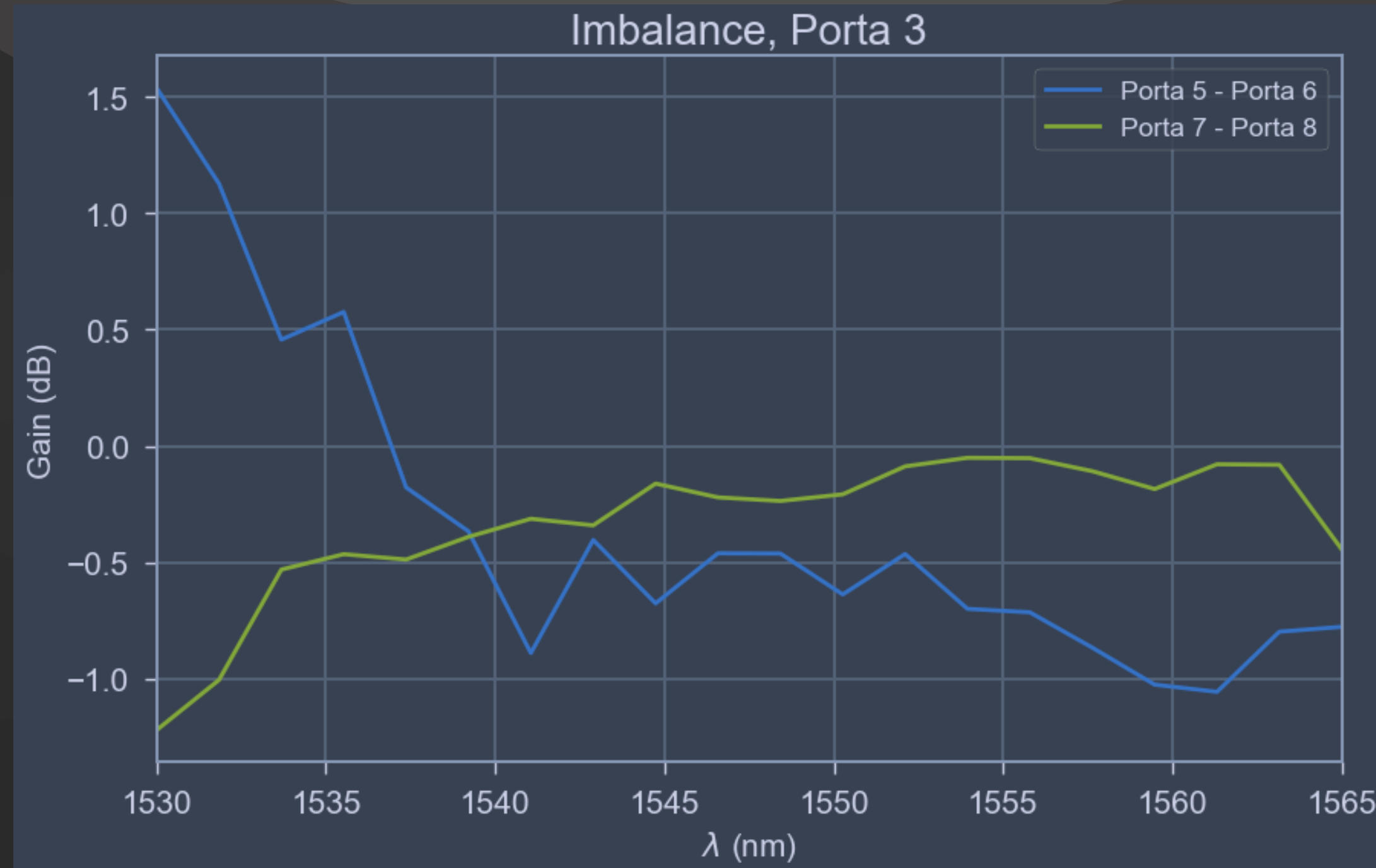
# Híbrida MMI 4x4

## Resultados



# Híbrida MMI 4x4

## Resultados



# Híbrida MMI 4x4

## Múltiplas Simulações

Comprimento Central

1525.5

1536.5

1547.5

1558.5

1569.5

1520

1531

1542

1553

1564

1575

Limites da simulação

# Híbrida MMI 4x4

## Múltiplas Simulações

