

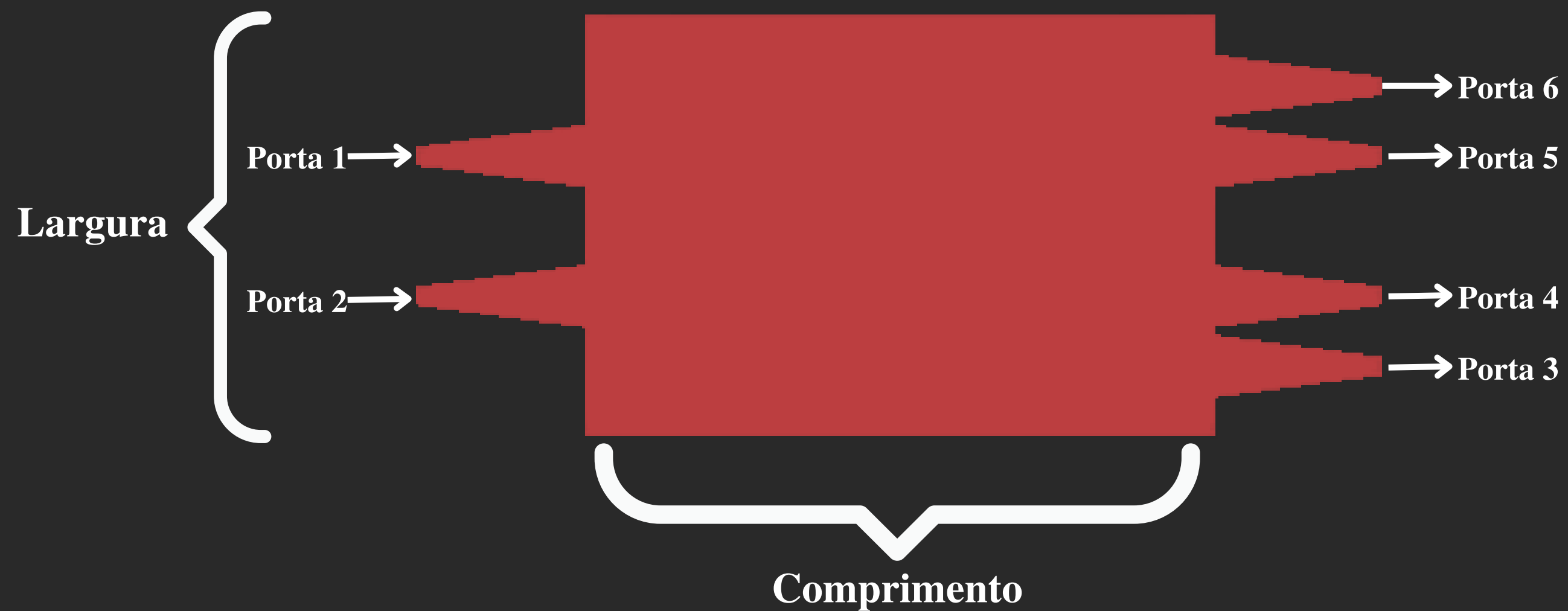
# DESIGN MMI

## 2 X 4

# SEMANA 1 E 2

# Estrutura

Dimensões dos guias: 0.45 x 0.22 (um)



# Solver

## EME

cell geometry

x min ( $\mu\text{m}$ )

number of cell groups

energy conservation

number of modes for all cell groups

☒ allow custom eigensolver settings

cell group definition

	group spans ( $\mu\text{m}$ )	cells	subcell method	modes	custom	cell range	start ( $\mu\text{m}$ )	stop ( $\mu\text{m}$ )
1	6	15	CVCS	10	default	[1 ... 15]	-6	7.10543e-15
2	59.5	1	none	40	default	[16]	7.10543e-15	59.5
3	6	15	CVCS	10	default	[17 ... 31]	59.5	65.5

☒ display cells

Clear settings for cell group 2

Custom settings for cell group 2

y ( $\mu\text{m}$ )

y min ( $\mu\text{m}$ )

y span ( $\mu\text{m}$ )

y max ( $\mu\text{m}$ )

z ( $\mu\text{m}$ )

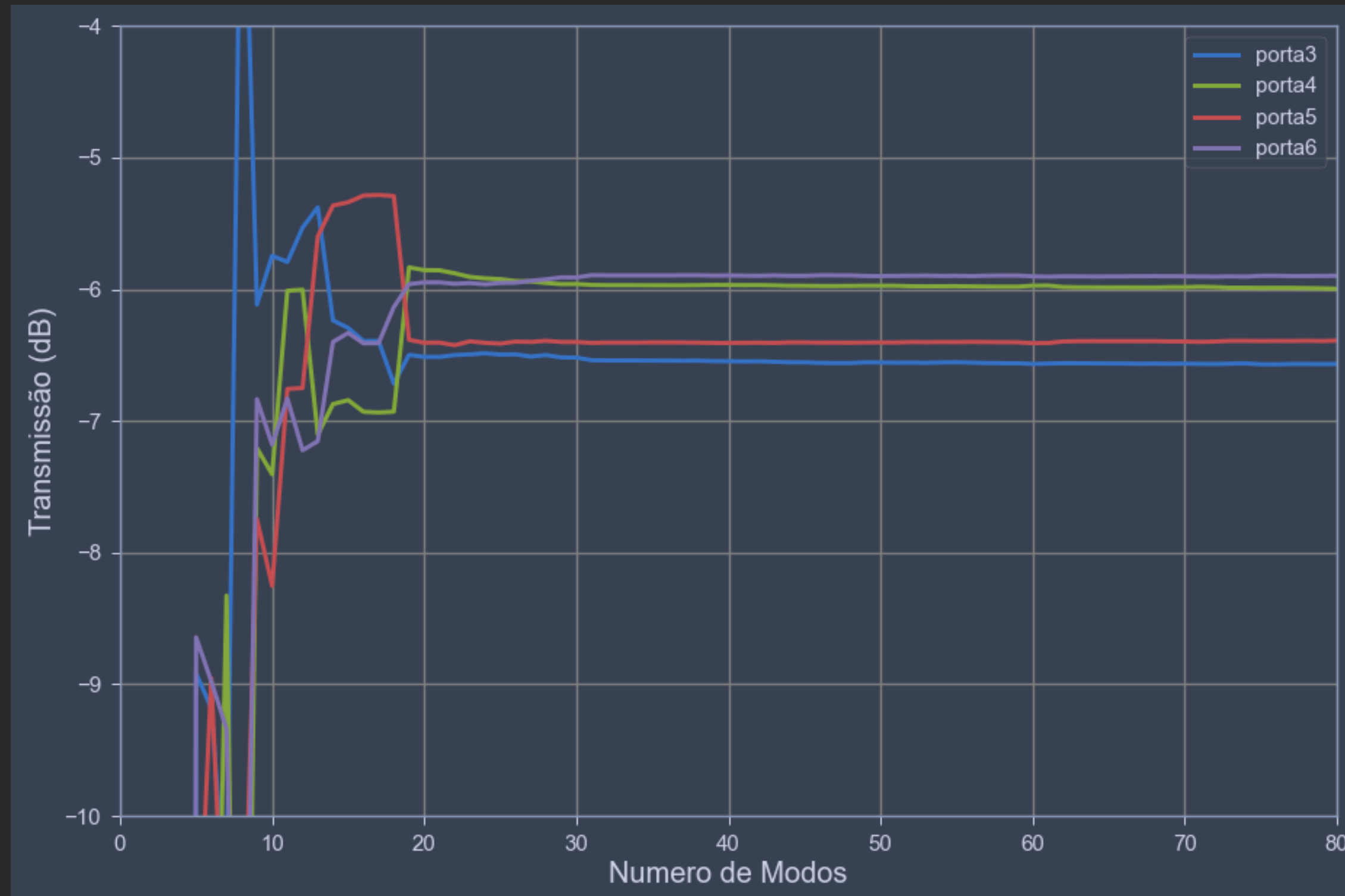
z min ( $\mu\text{m}$ )

z span ( $\mu\text{m}$ )

z max ( $\mu\text{m}$ )

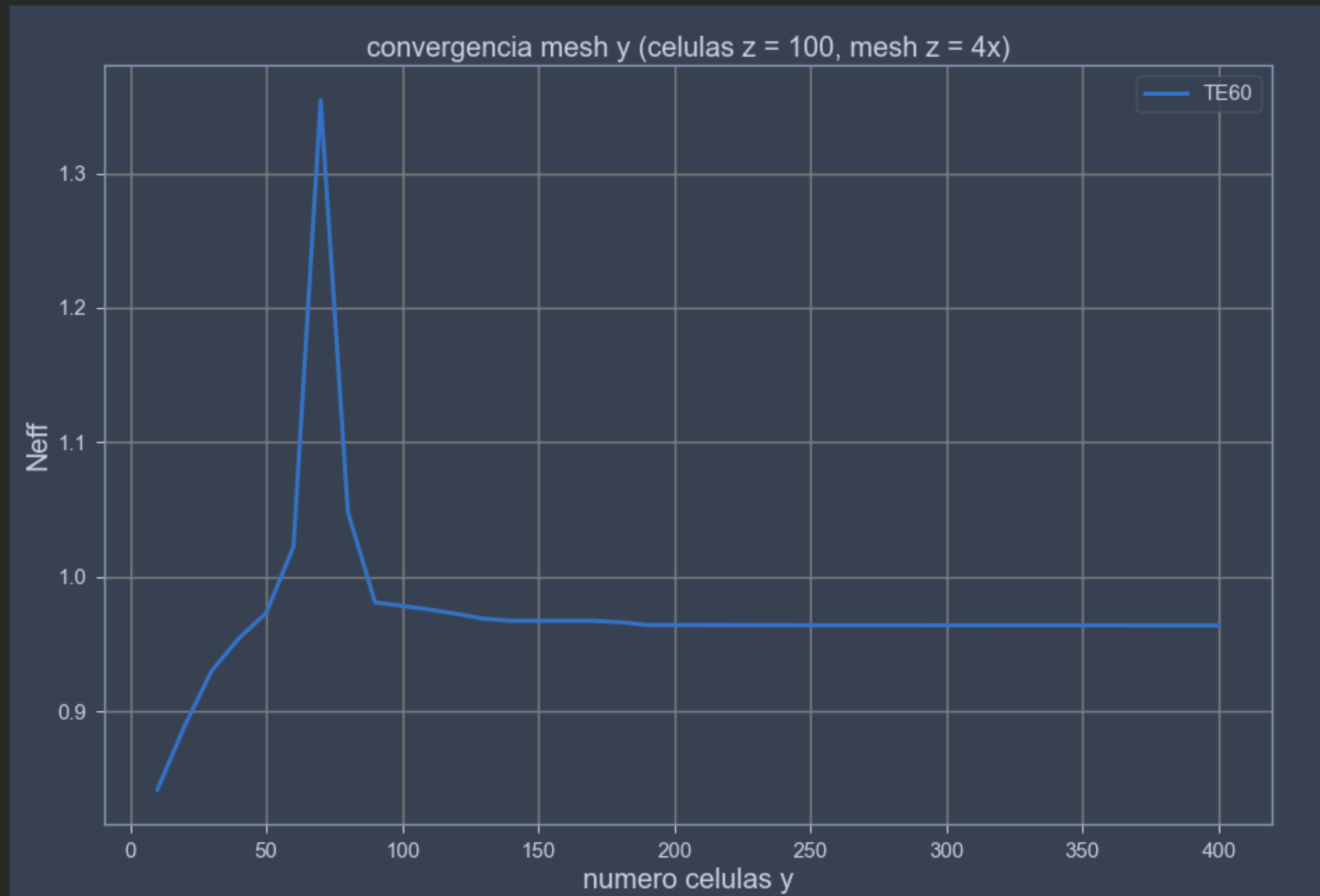
# Convergência

Número de modos MMI



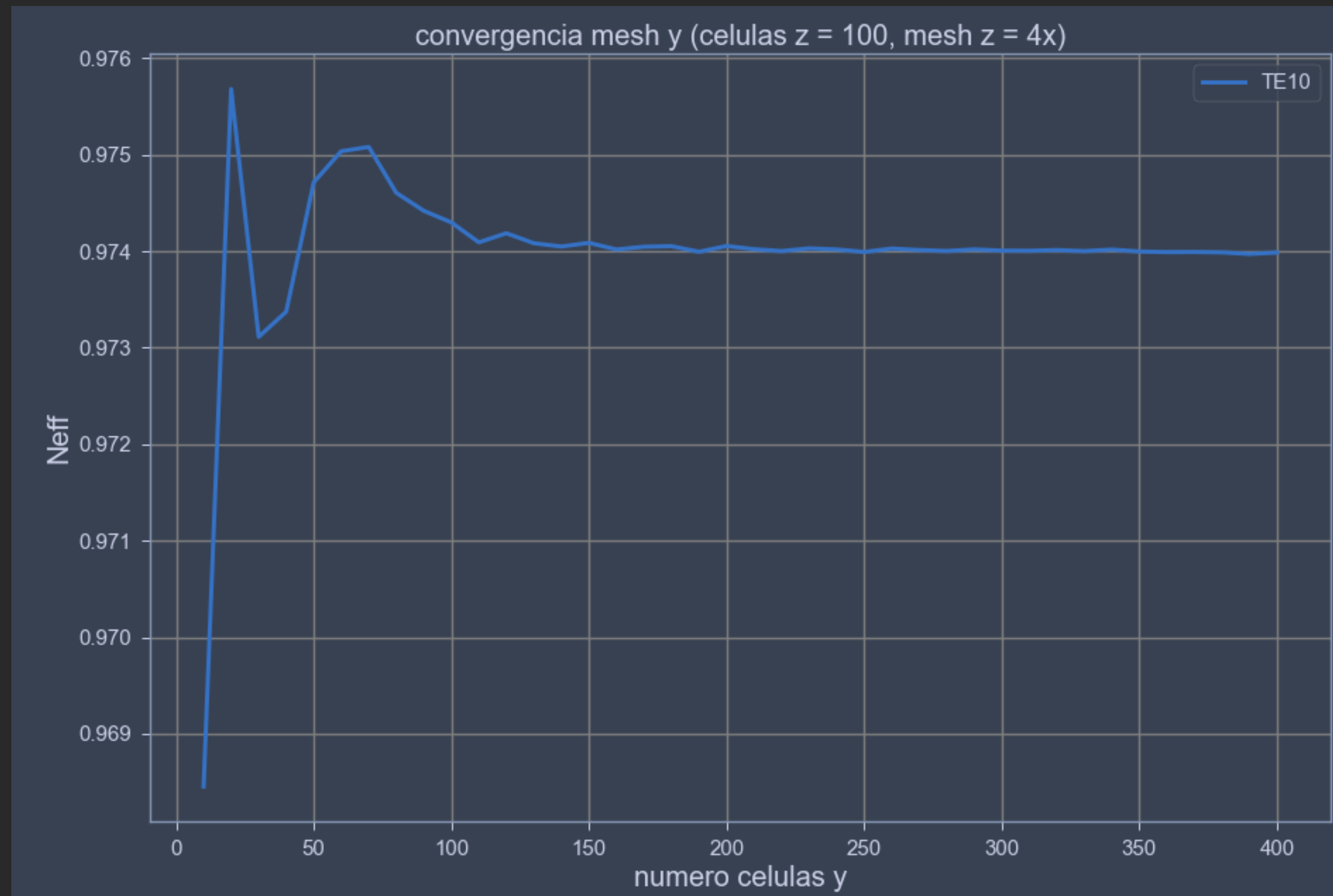
# Convergência

Número de células MMI



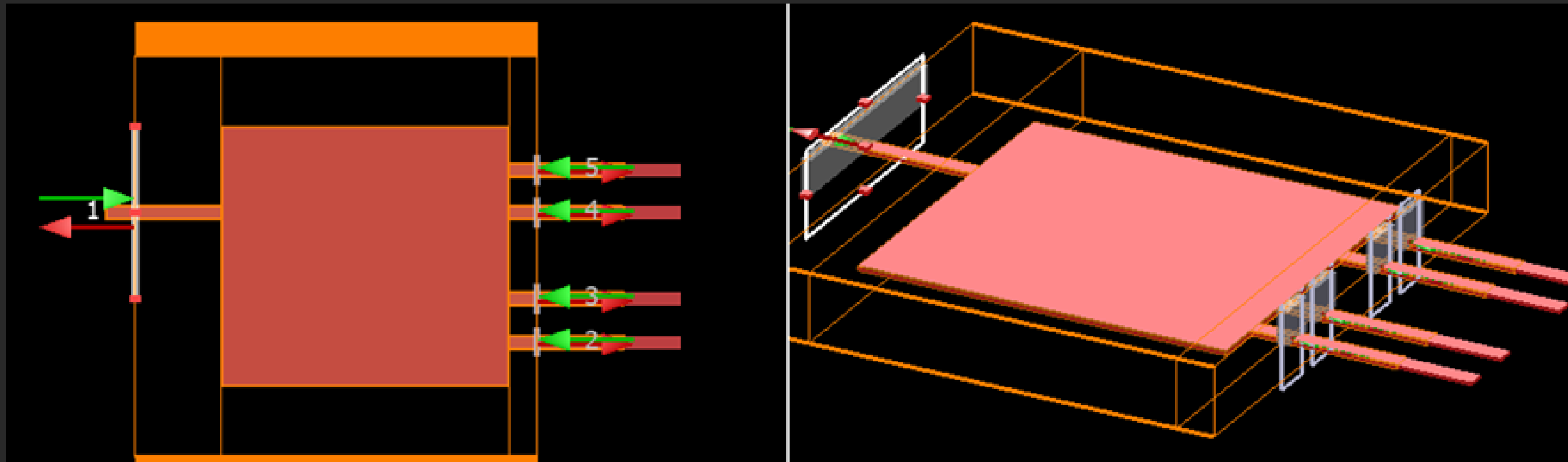
# Convergência

## Número de células Tappers



# Primeiro Design

MMI sem o uso de tappers

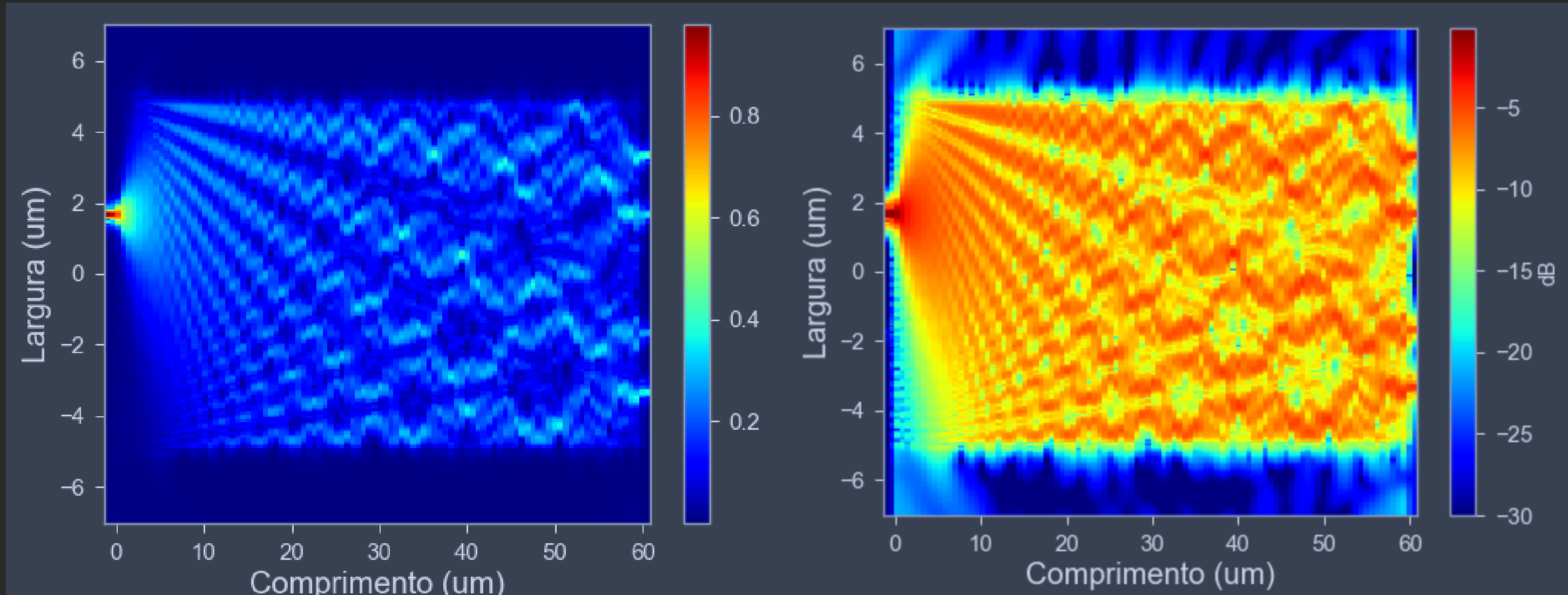


Largura do MMI: 8  $\mu\text{m}$

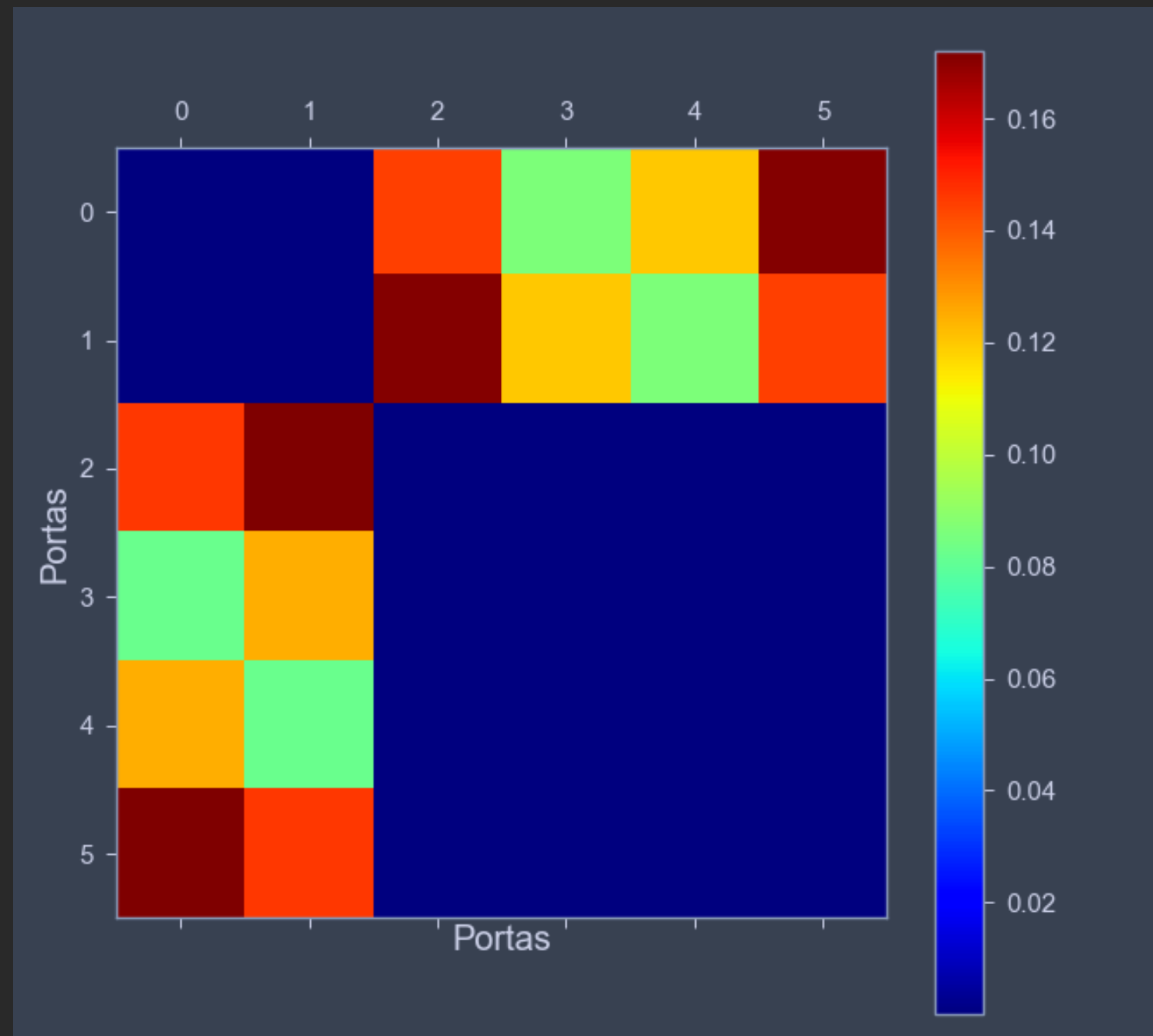
Comprimento do MMI: 37.3  $\mu\text{m}$



# Resultados

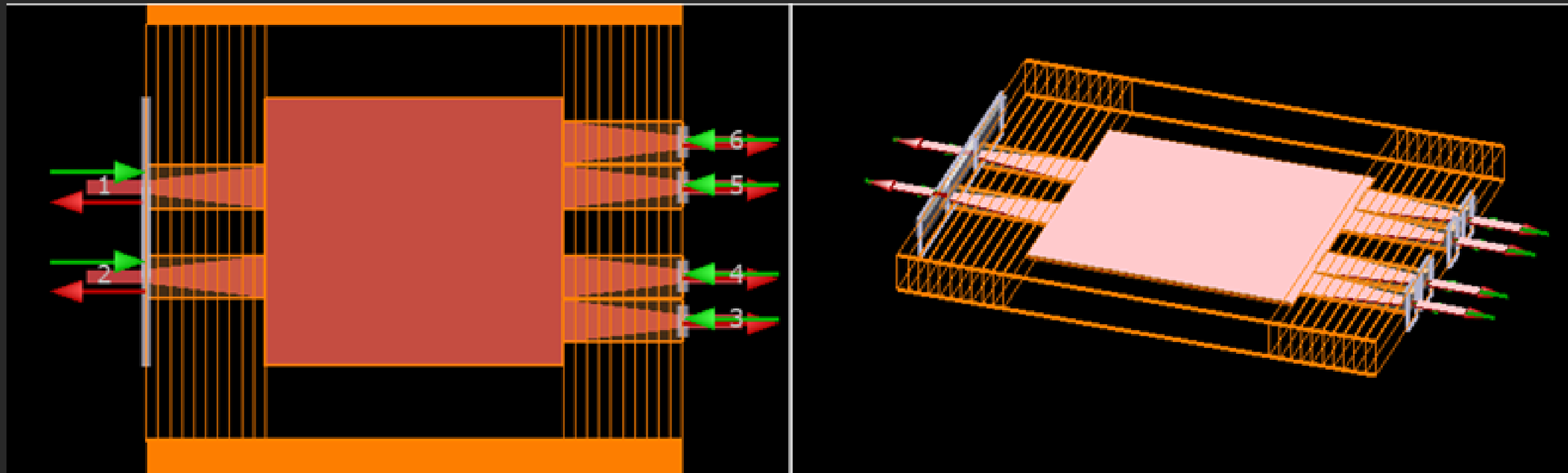


# Resultados



# Segundo Design

MMI com tappers

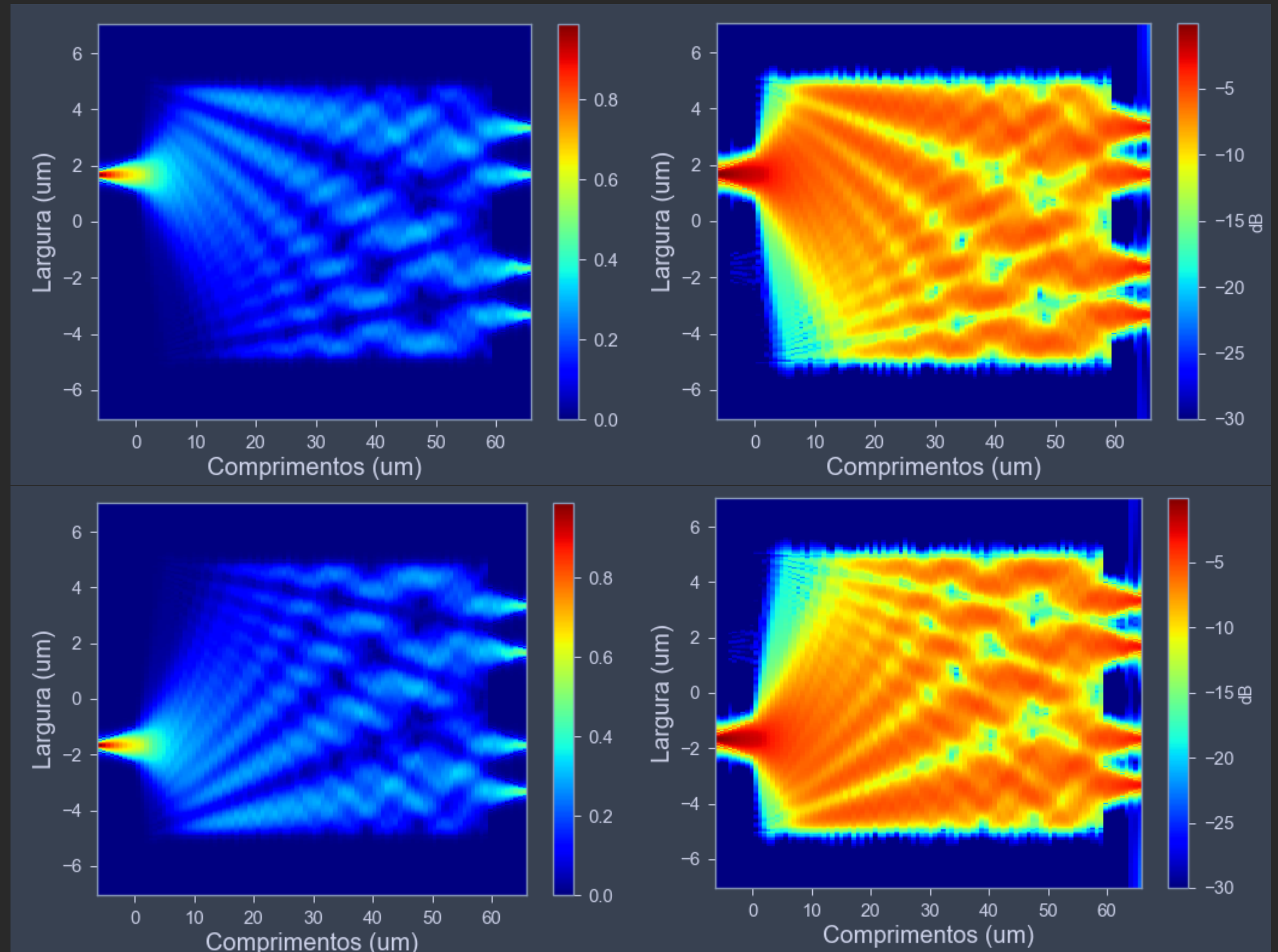


Largura: 8  $\mu\text{m}$

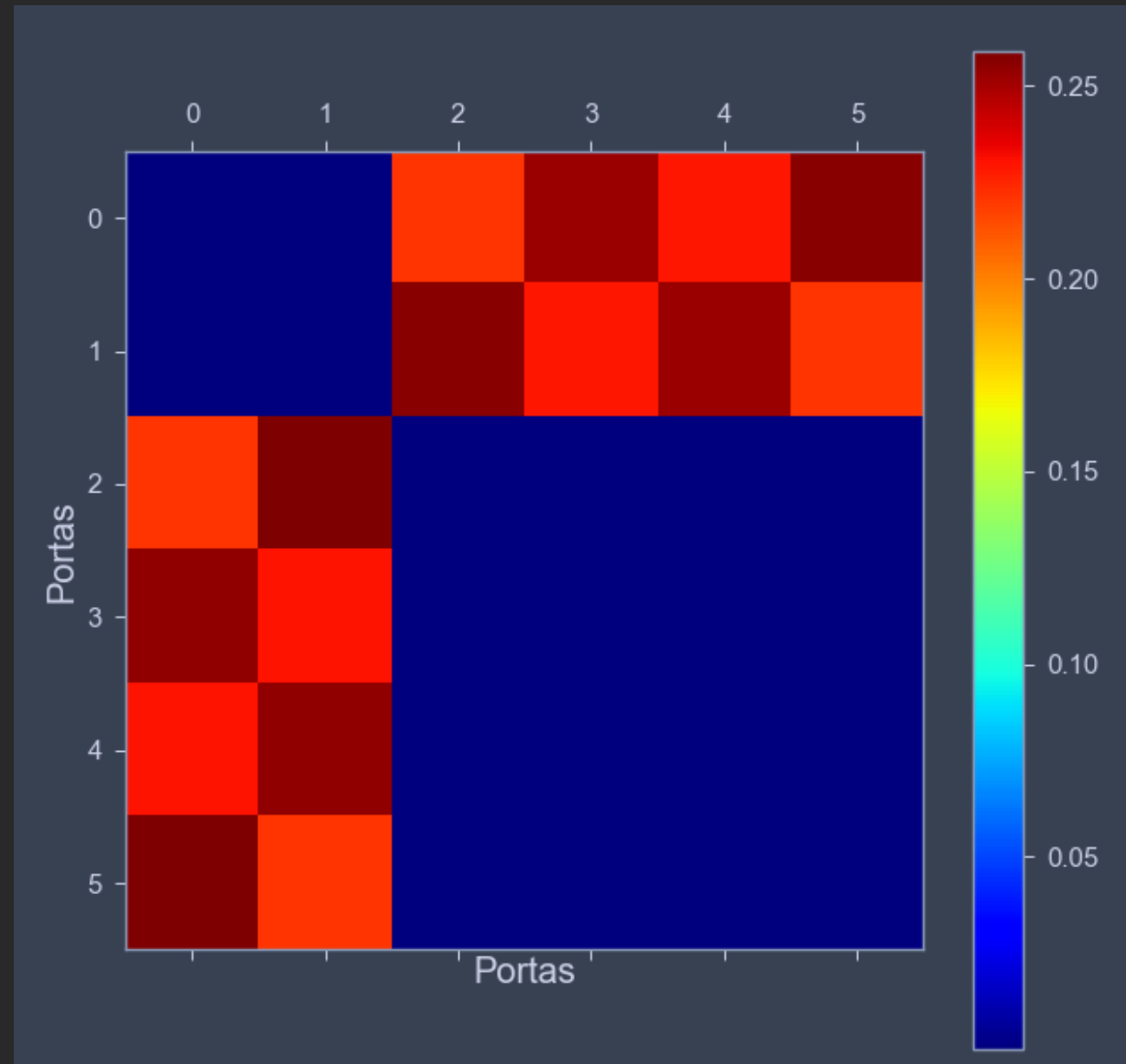
Comprimento do MMI: 37.3  $\mu\text{m}$

Espessurados Tappers: 1.3  $\mu\text{m}$

# Resultados



# Resultados



Transmissão	Porta 1	Porta 2
Porta 1	-46,63 dB	-52,36 dB
Porta 2	-52,36 dB	-46,63 dB
Porta 3	-6,72 dB	-6,01 dB
Porta 4	-5,82 dB	-6,88 dB
Porta 5	-6,88 dB	-5,82 dB
Porta 6	-6,01 dB	-6,716 dB
Perdas	-11,57 dB	-11,57 dB

# Otimizações

Largura do MMI: 10  $\mu\text{m}$

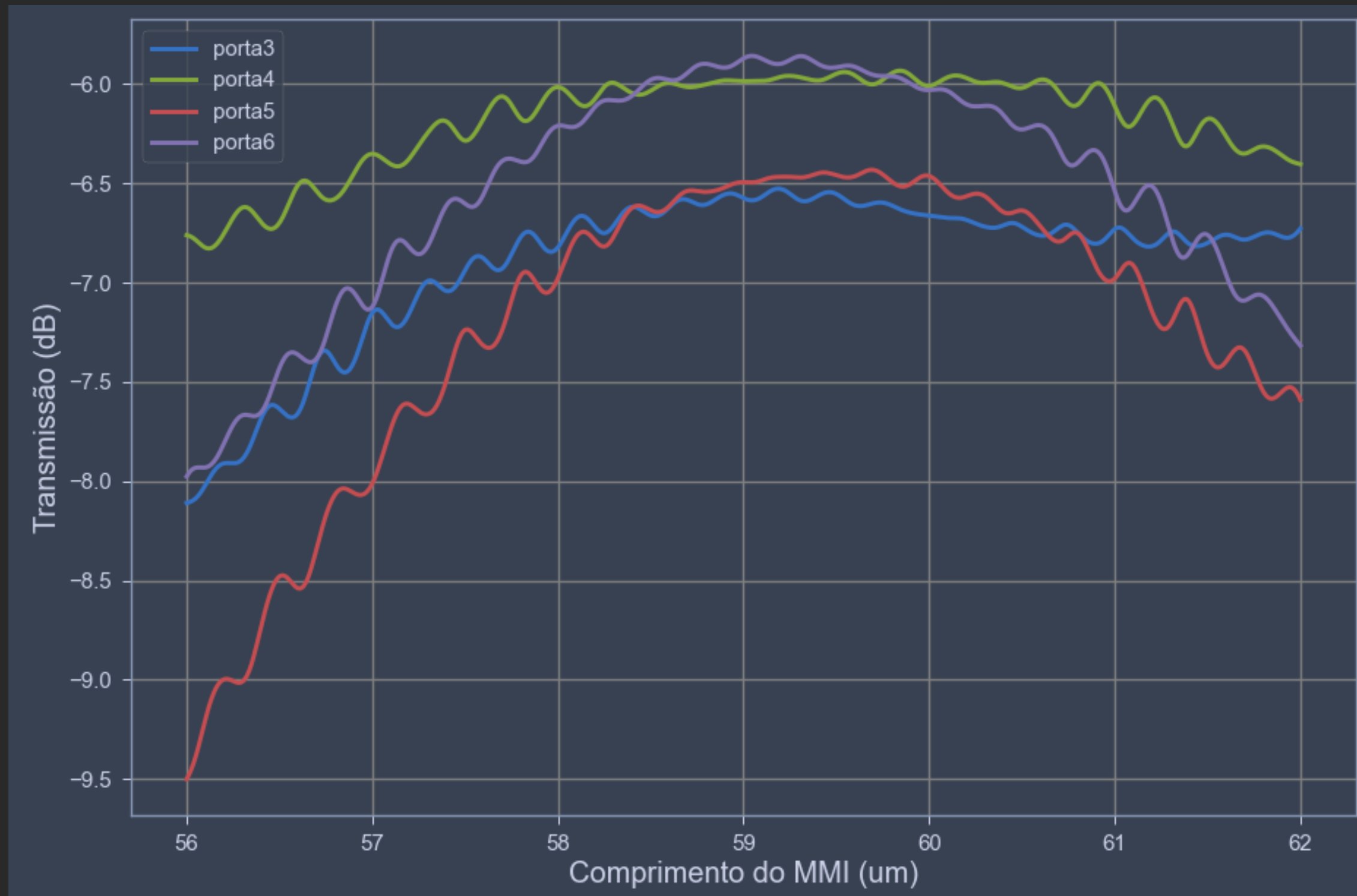
Espessura dos tappers: 1.5  $\mu\text{m}$

Comprimento teorico do MMI: 57.8  $\mu\text{m}$

Transmissão	Porta 1	Porta 2
Porta 1	-58.32 dB	-52,36 dB
Porta 2	-73.40 dB	-46,63 dB
Porta 3	-6.60 dB	-5.83 dB
Porta 4	-5.84 dB	-6.44 dB
Porta 5	-6.44 dB	-5.84 dB
Porta 6	-5.83 dB	-6.60 dB
Perdas	-14.92 dB	-14.92 dB

# Otimizações

## Análise experimental do comprimento

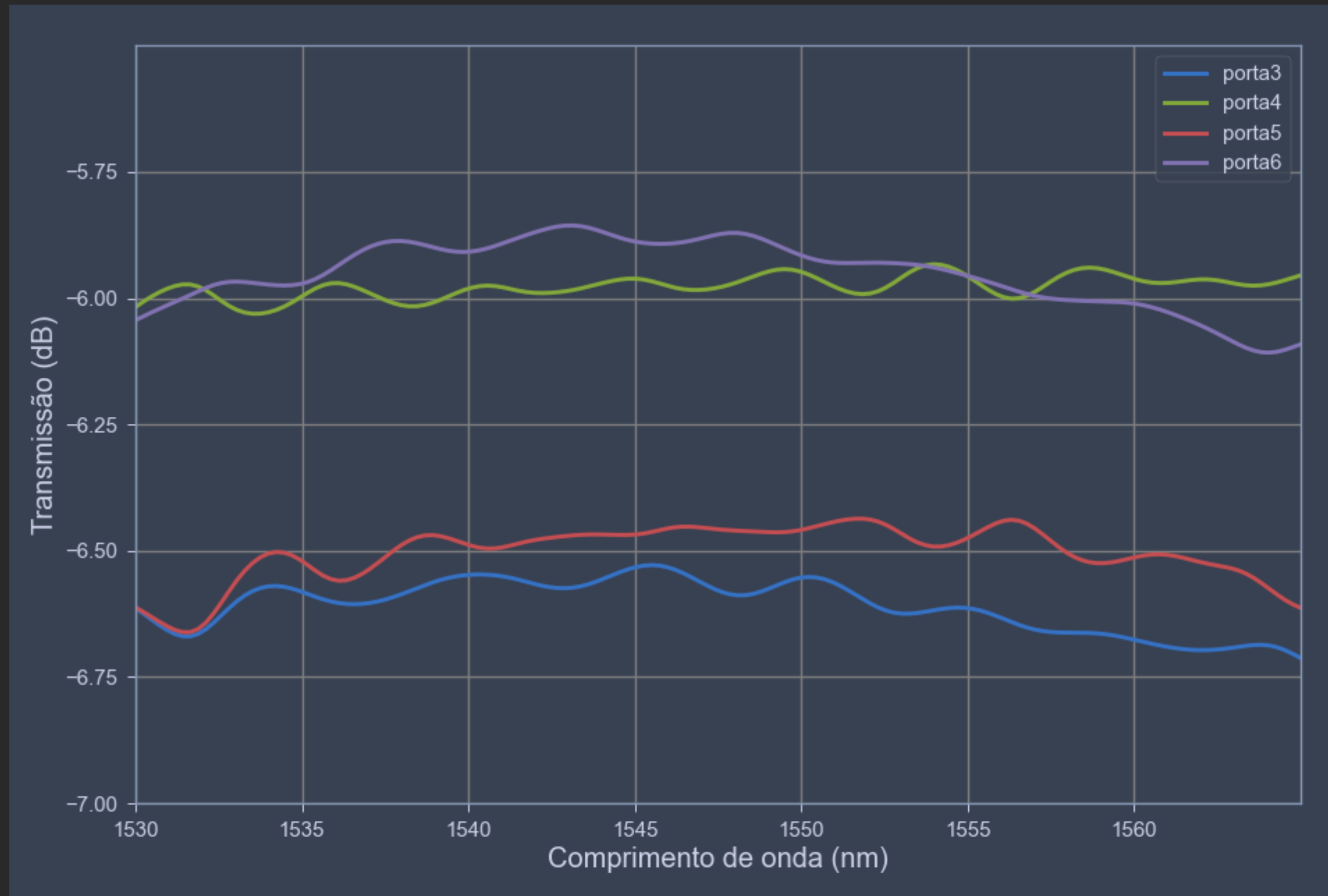


# Resultados finais EME

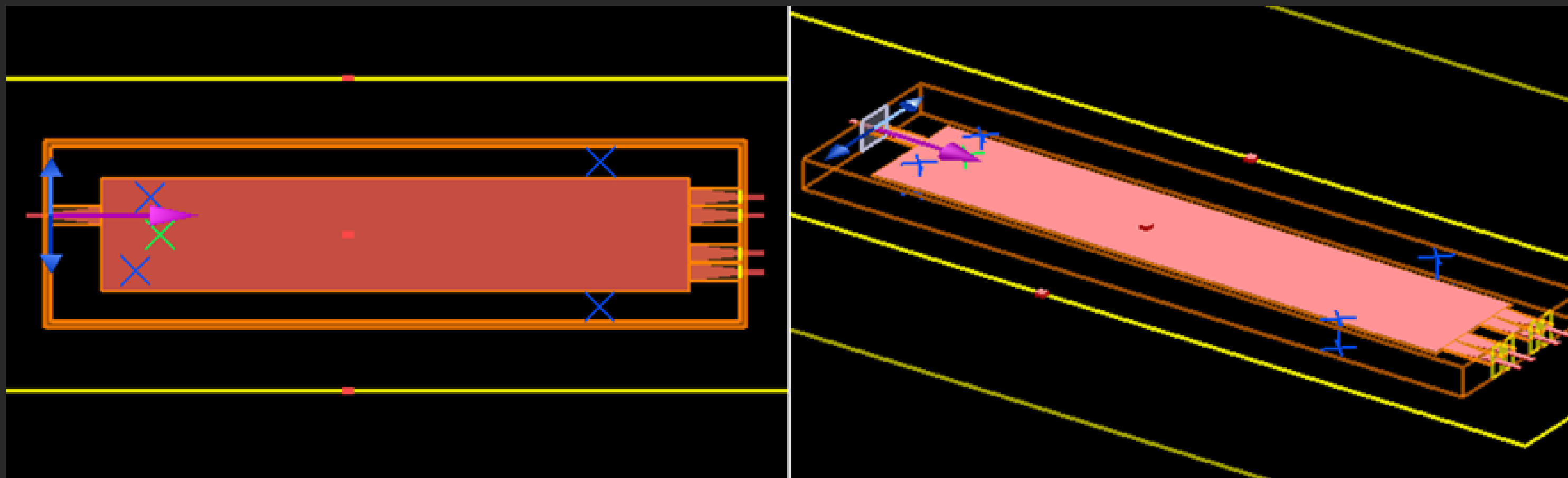
Transmissão	Porta 1	Porta 2
Porta 1	-52.53 dB	-52,36 dB
Porta 2	-59.84dB	-46,63 dB
Porta 3	-6.55 dB	-5.86dB
Porta 4	-5.94 dB	-6.37 dB
Porta 5	-6.37 dB	-5.94dB
Porta 6	-5.86 dB	-6.55 dB
Perdas	-14.49 dB	-14.49 dB



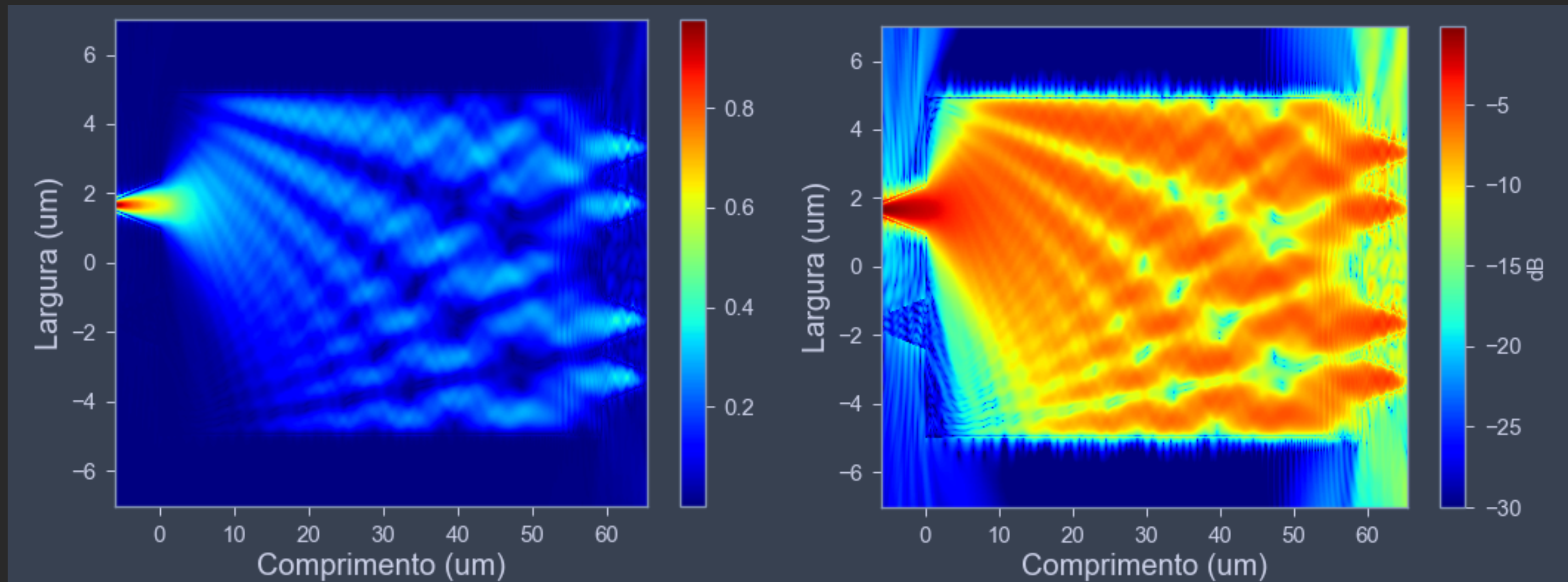
# Resultados finais EME



# Simulação VarFDTD



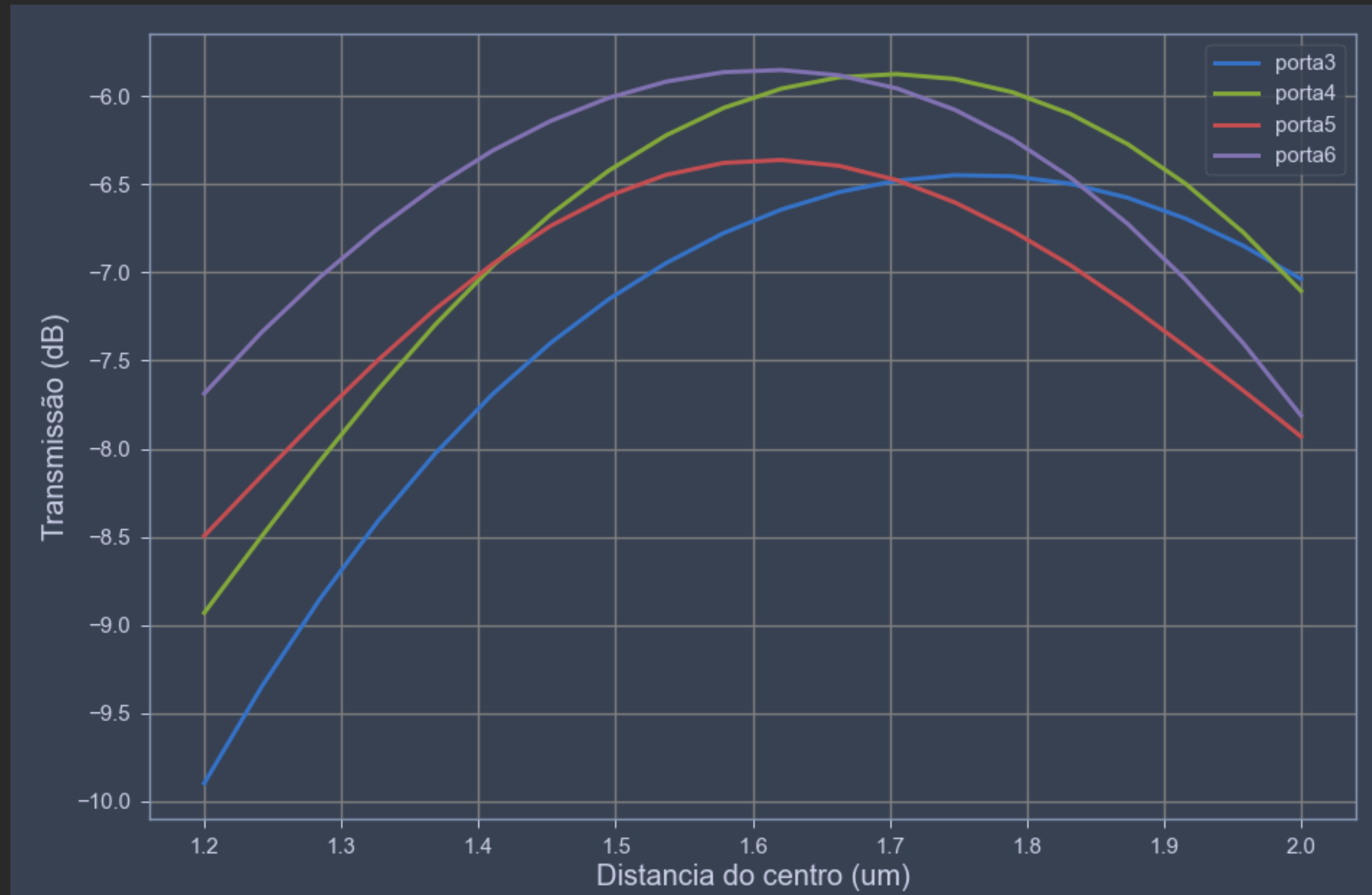
# Resultados



# SEMANA 3

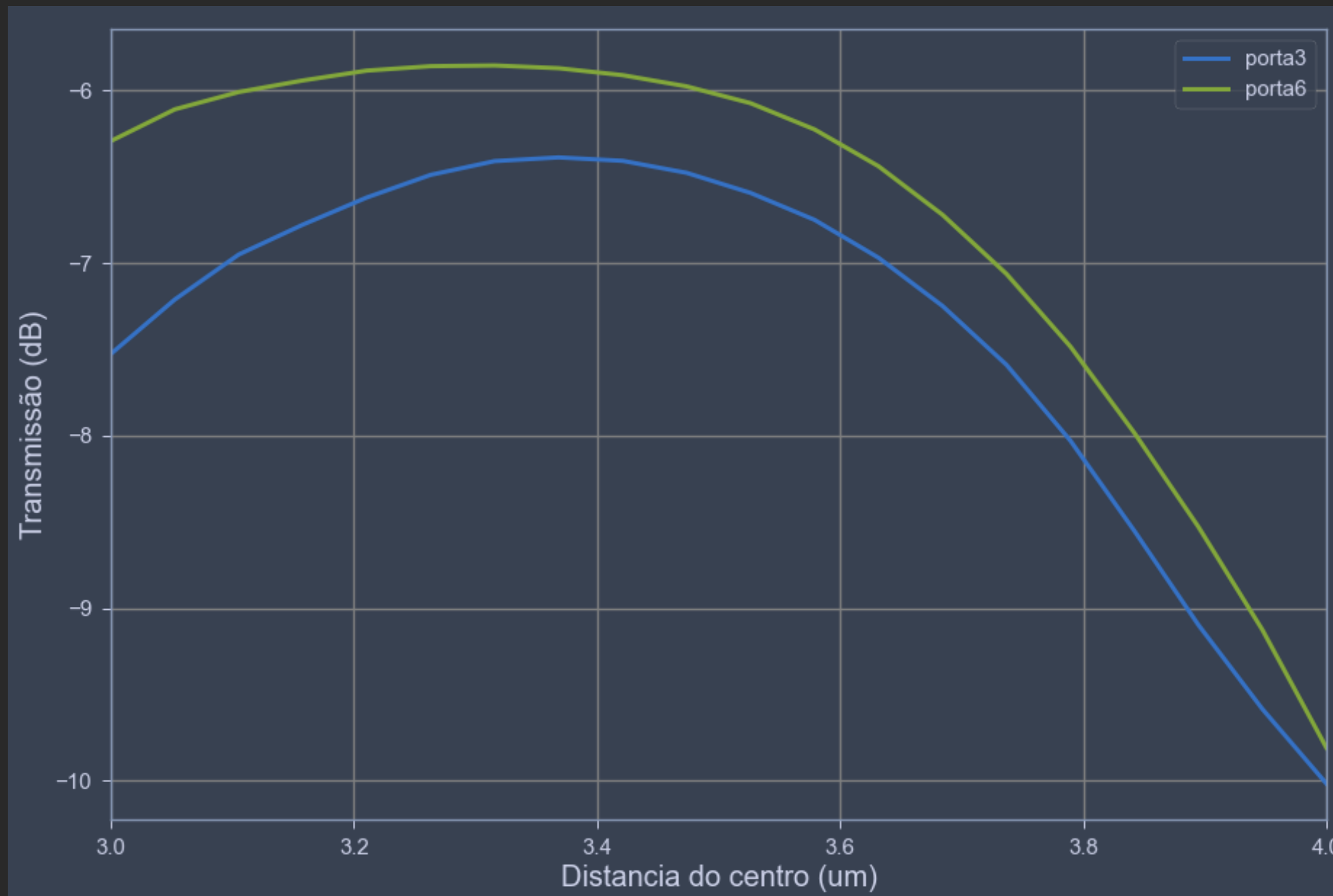
# Otimizações das portas

Entrada



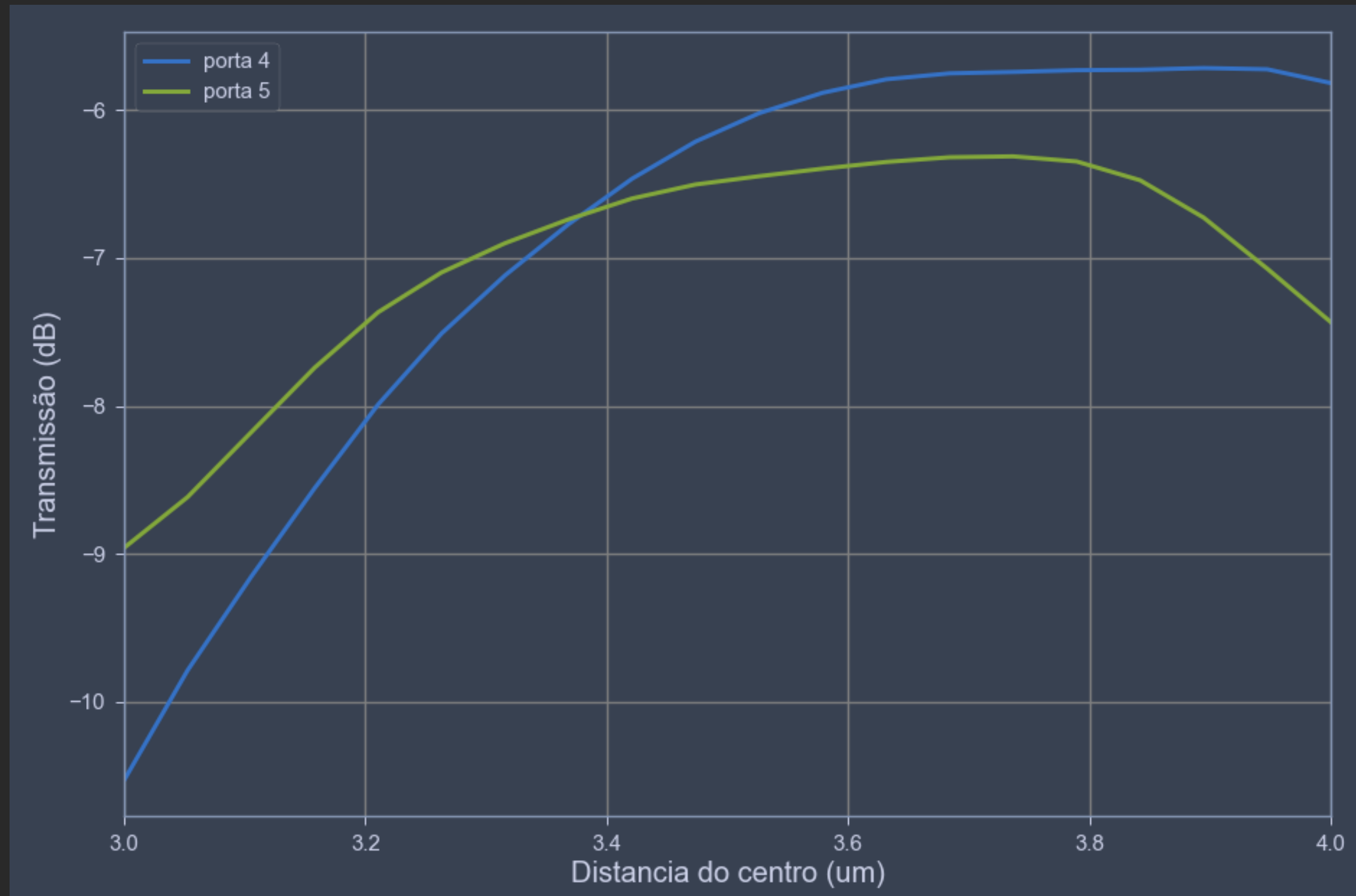
# Otimizações das portas

Portas 3 e 6



# Otimizações das portas

Portas 4 e 5



# Solução

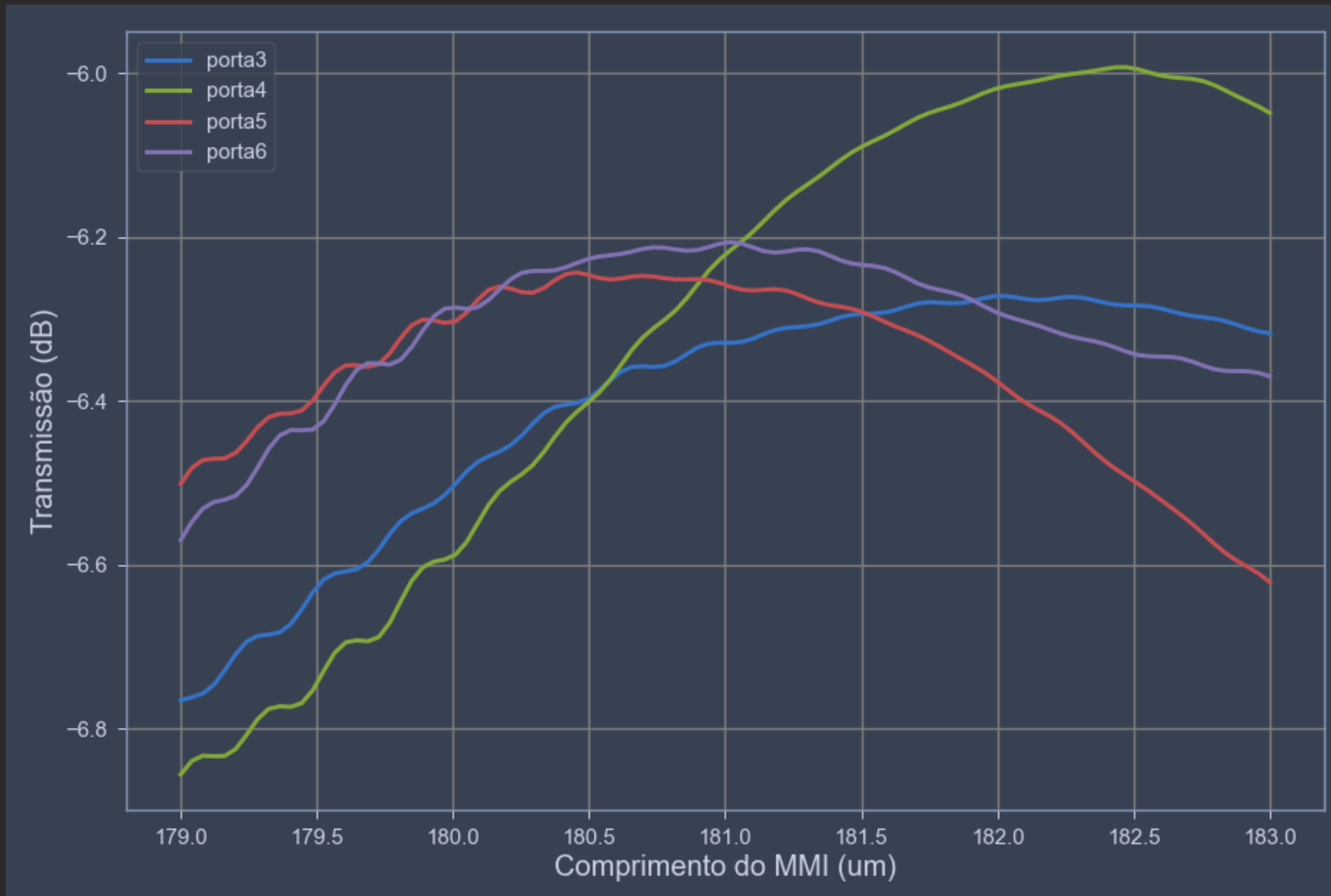
Novo design com interferência geral





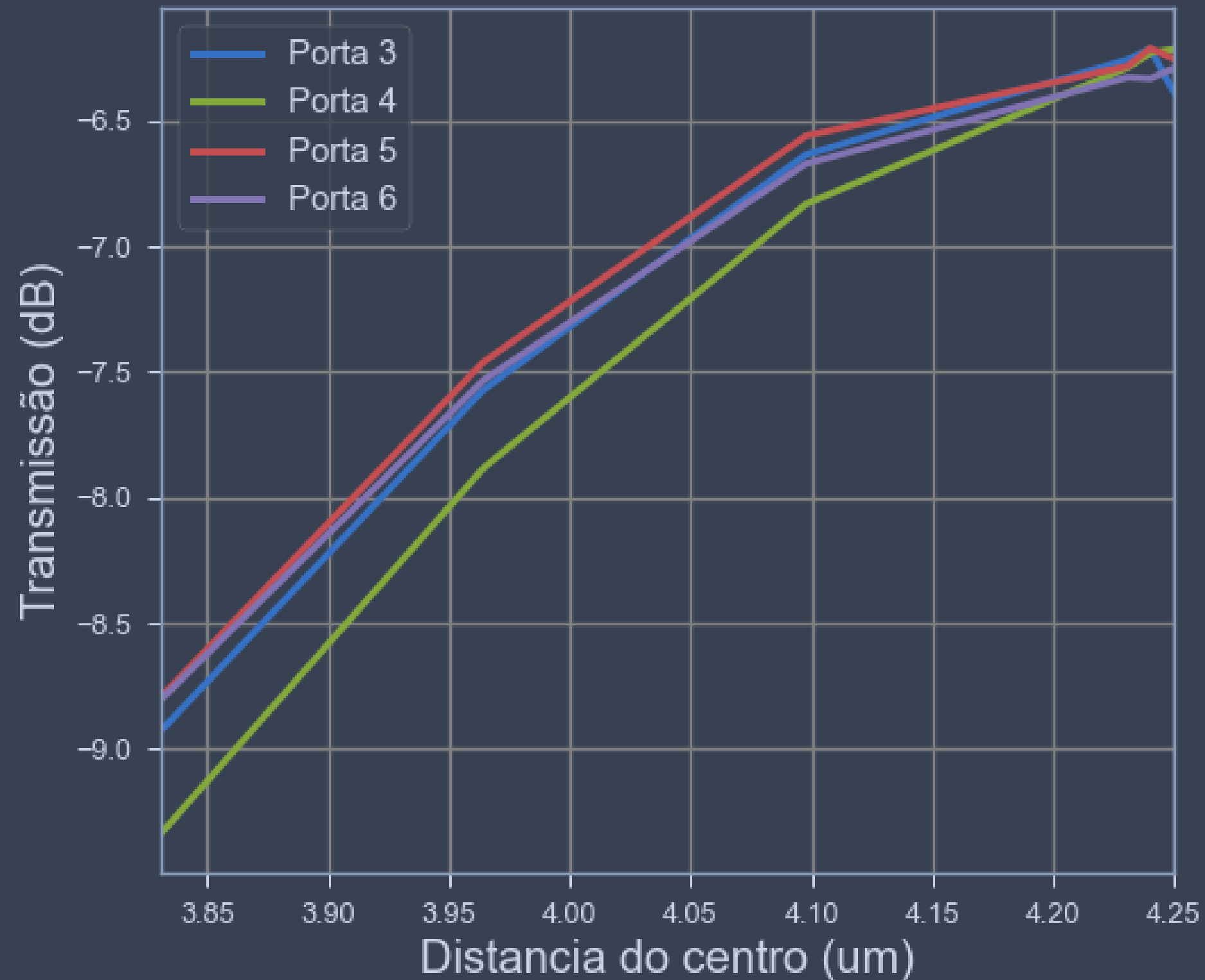
# Otimizações

Comprimento do MMI



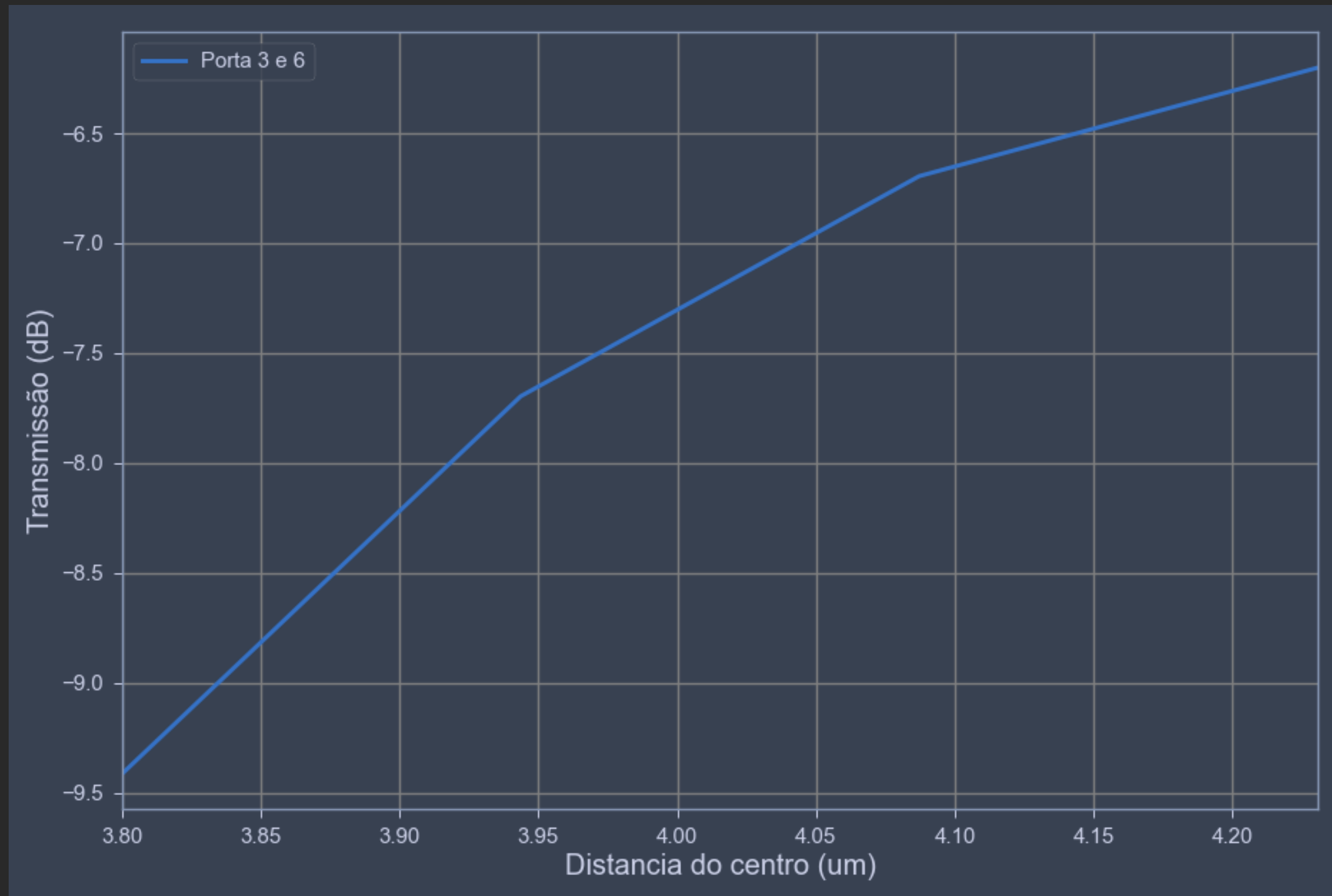
# Otimizações

Posição da entrada



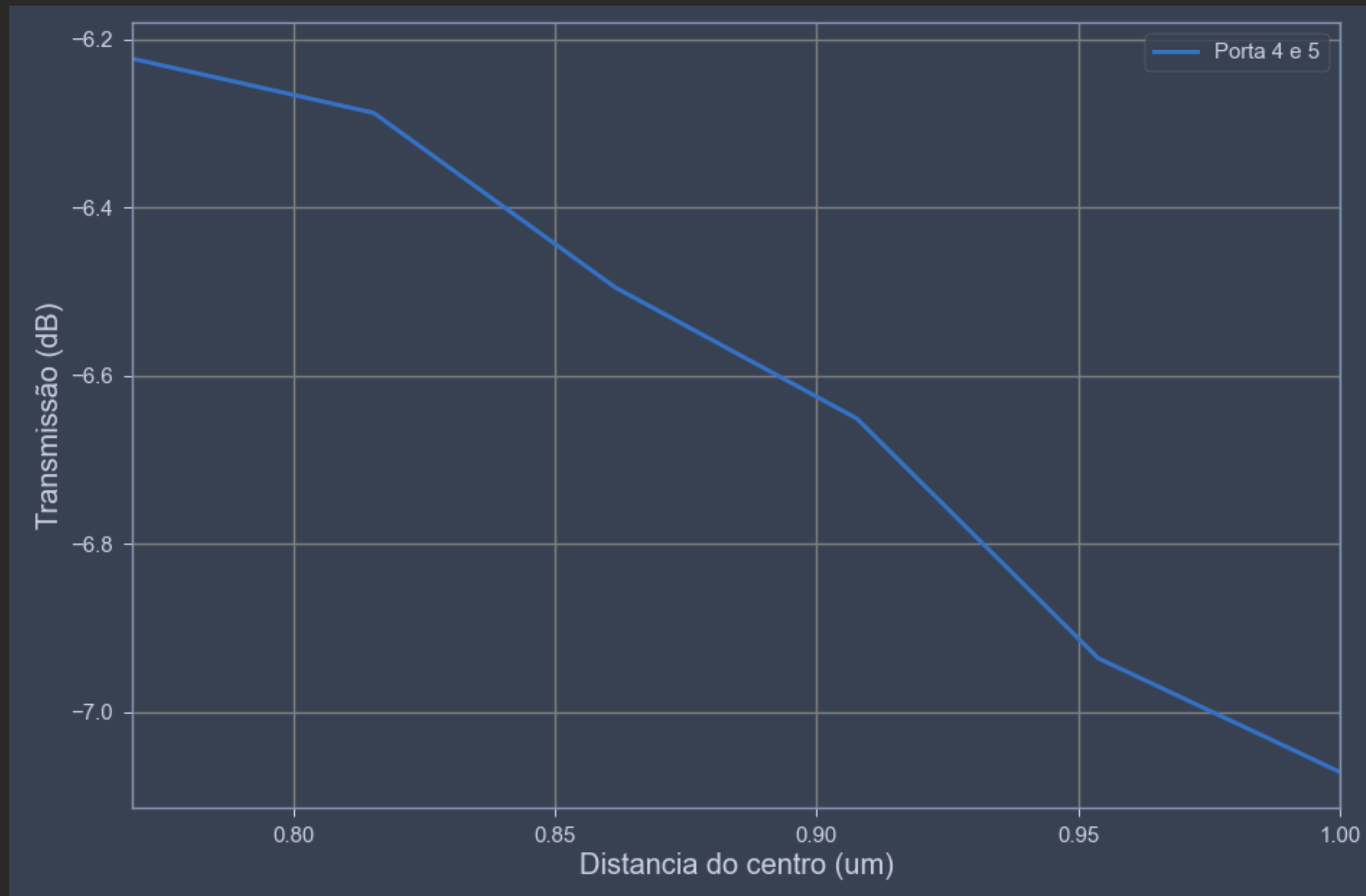
# Otimizações

Posição das portas 3 e 6

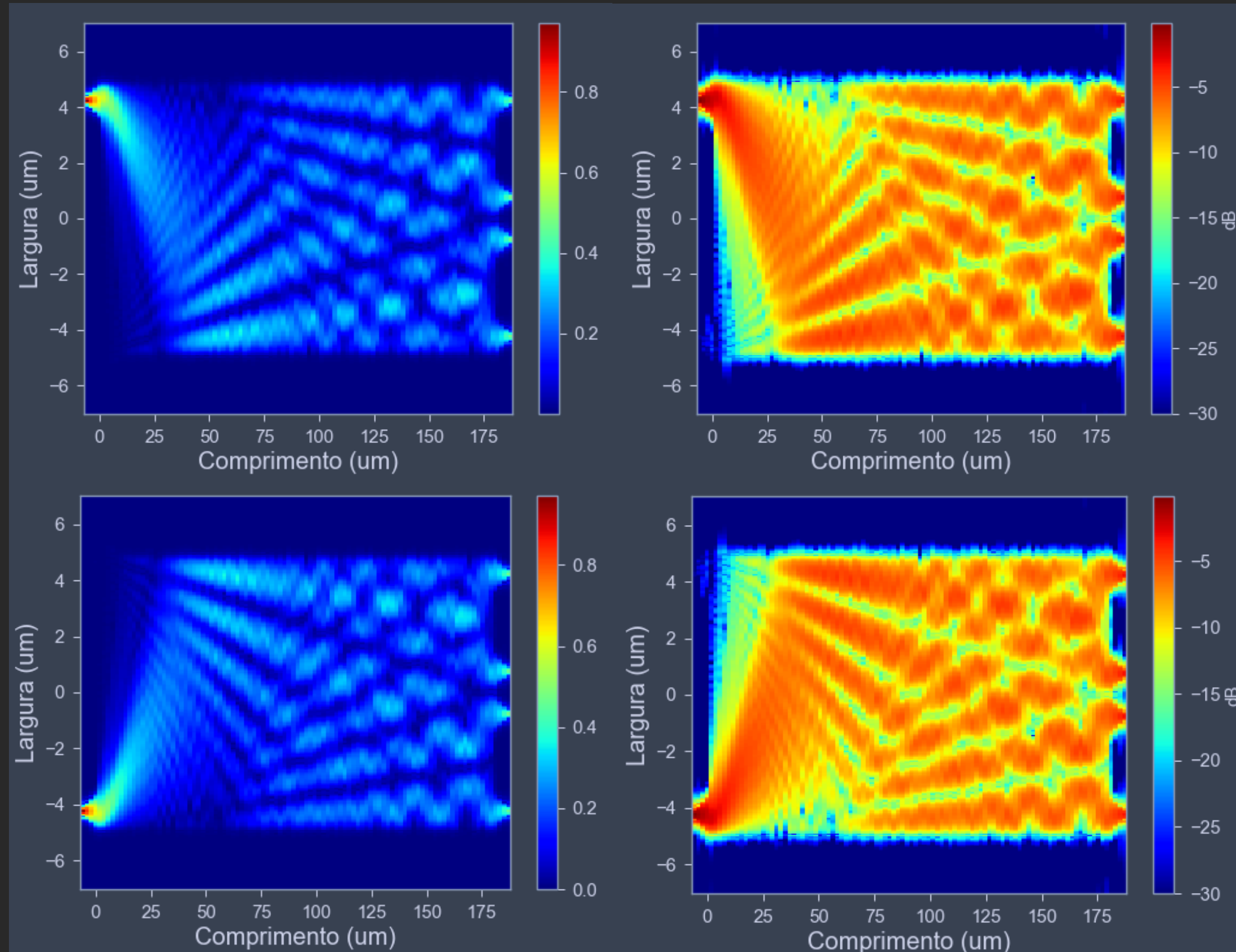


# Otimizações

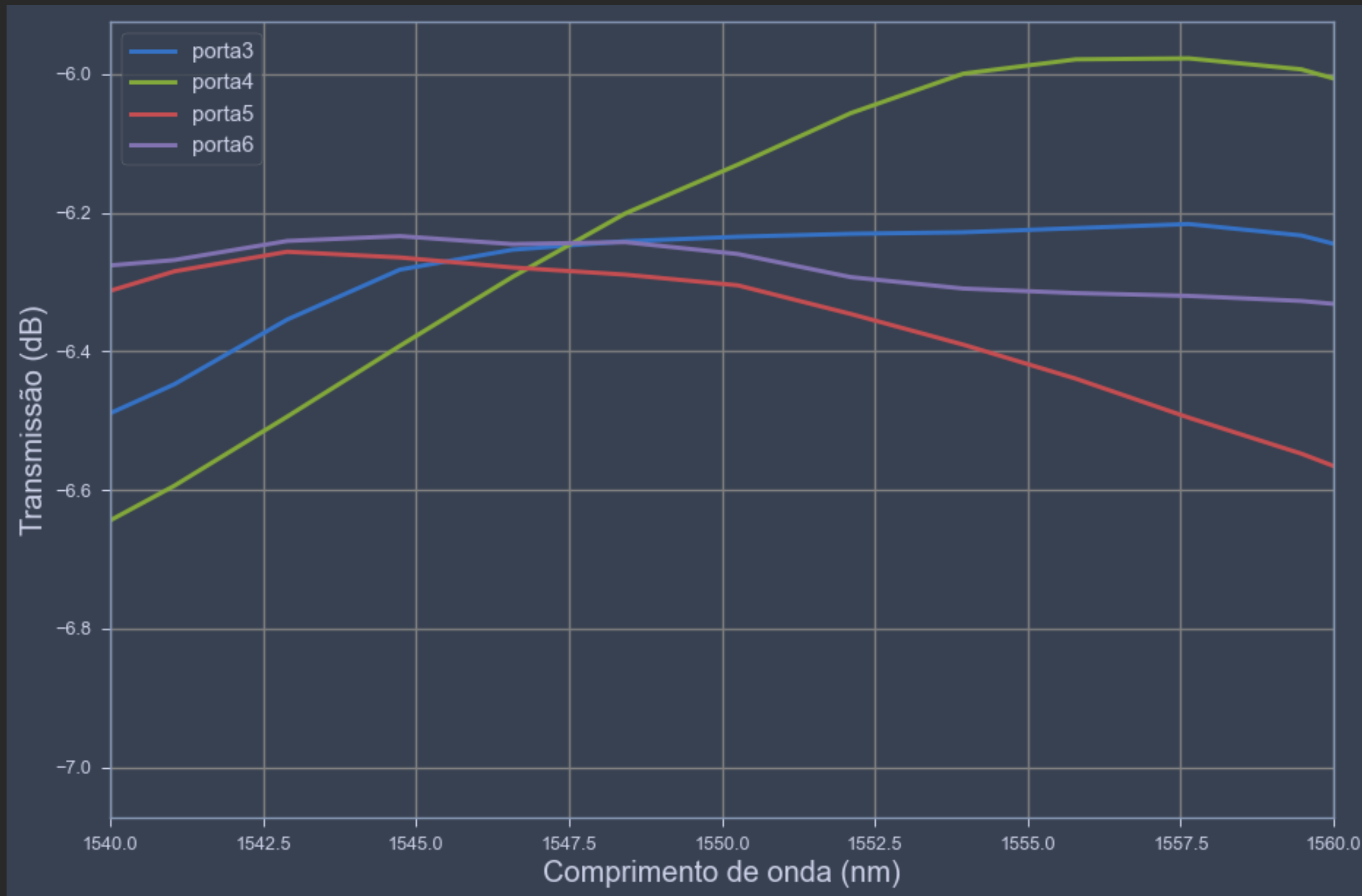
Posição das portas 4 e 5



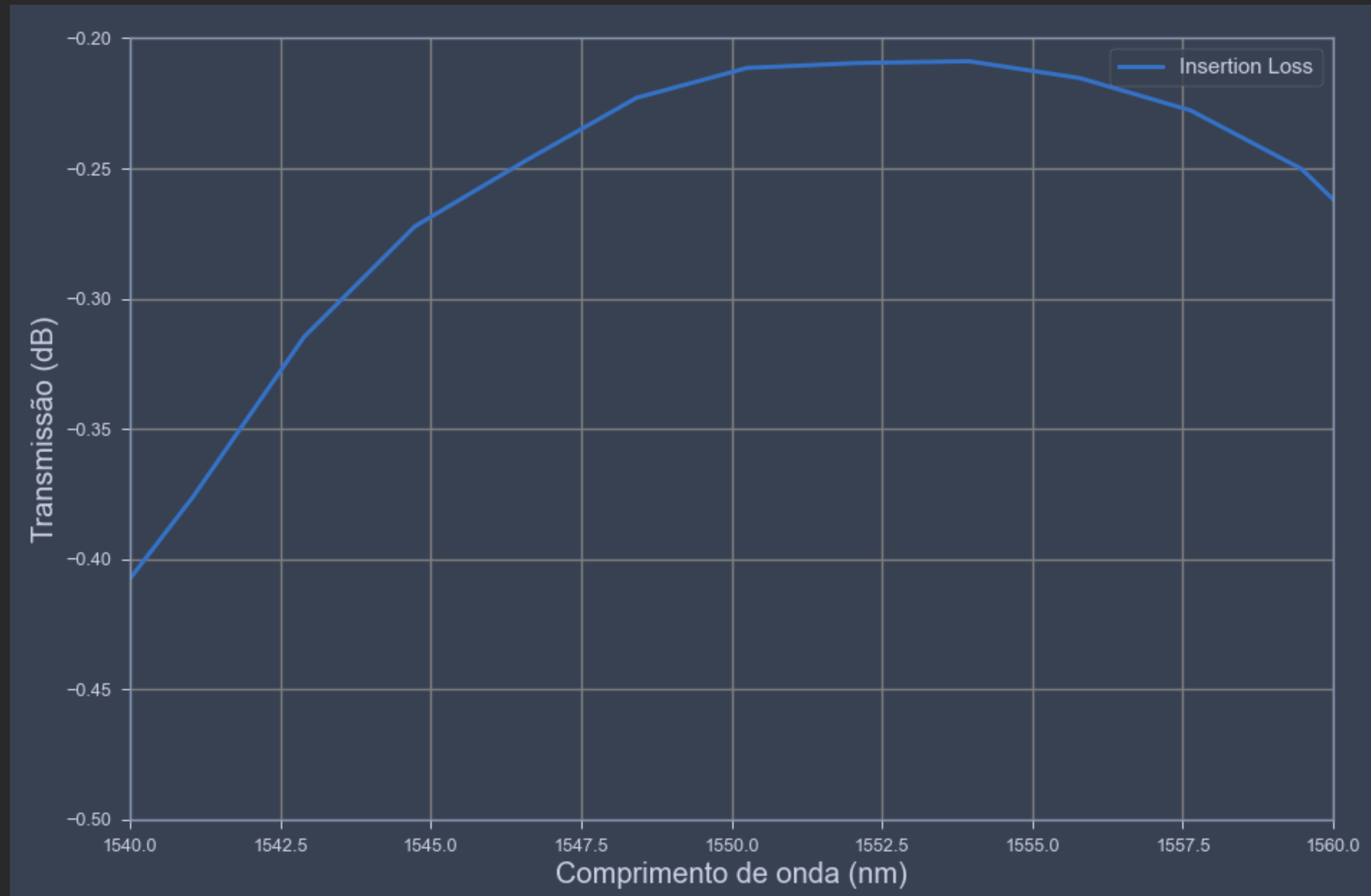
# Resultados



# Resultados



# Resultados



# Resultados EME

Comprimento de 1547 nm

Transmissão	Porta 1	Porta 2
Porta 1	-49.14 dB	-46.84 dB
Porta 2	-46.84 dB	-49.11 dB
Porta 3	-6.32 dB	-6.21 dB
Porta 4	-6.21 dB	-6.25 dB
Porta 5	-6.25 dB	-6.21 dB
Porta 6	-6.20 dB	-6.31 dB

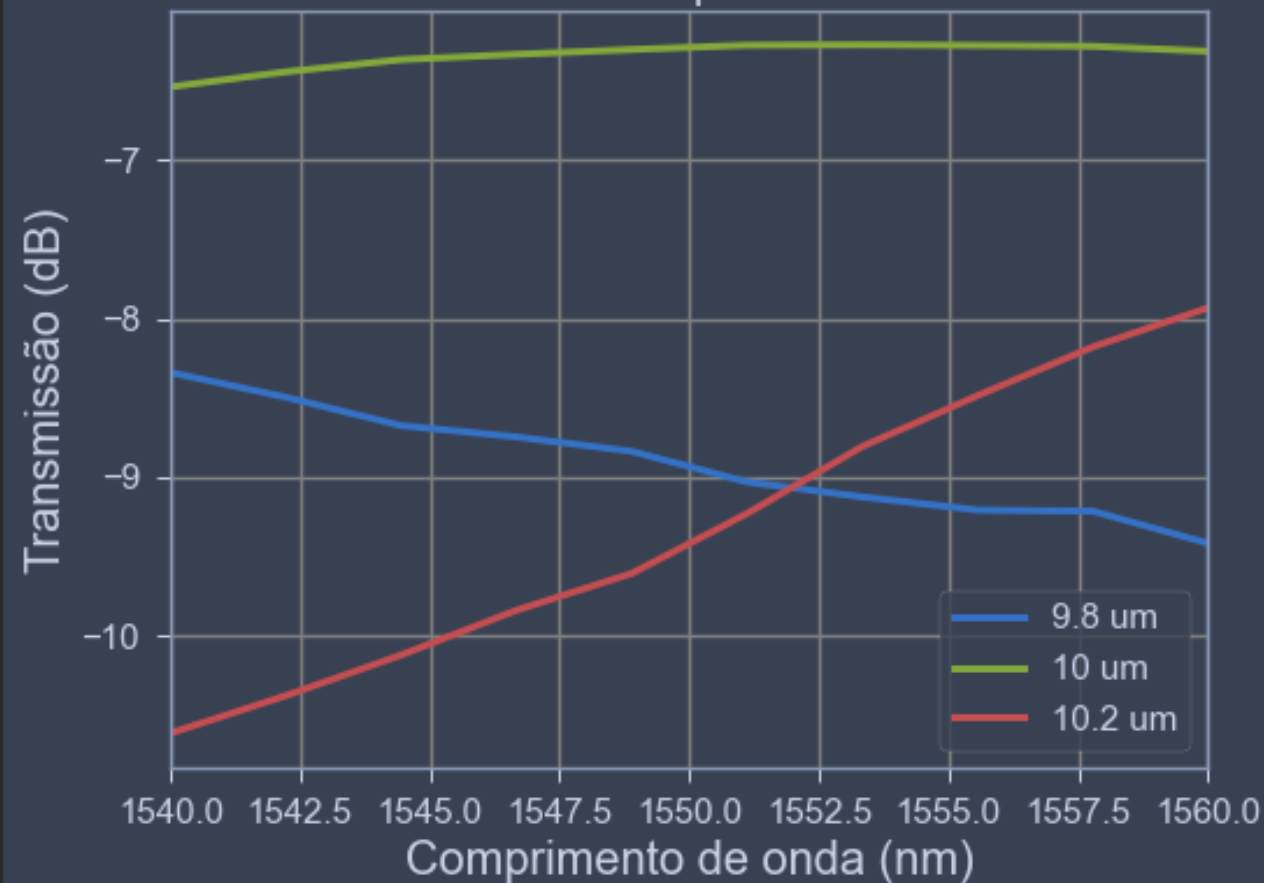
Insertion Loss	Porta 1	Porta 2
	-0.23 dB	-0.22 dB



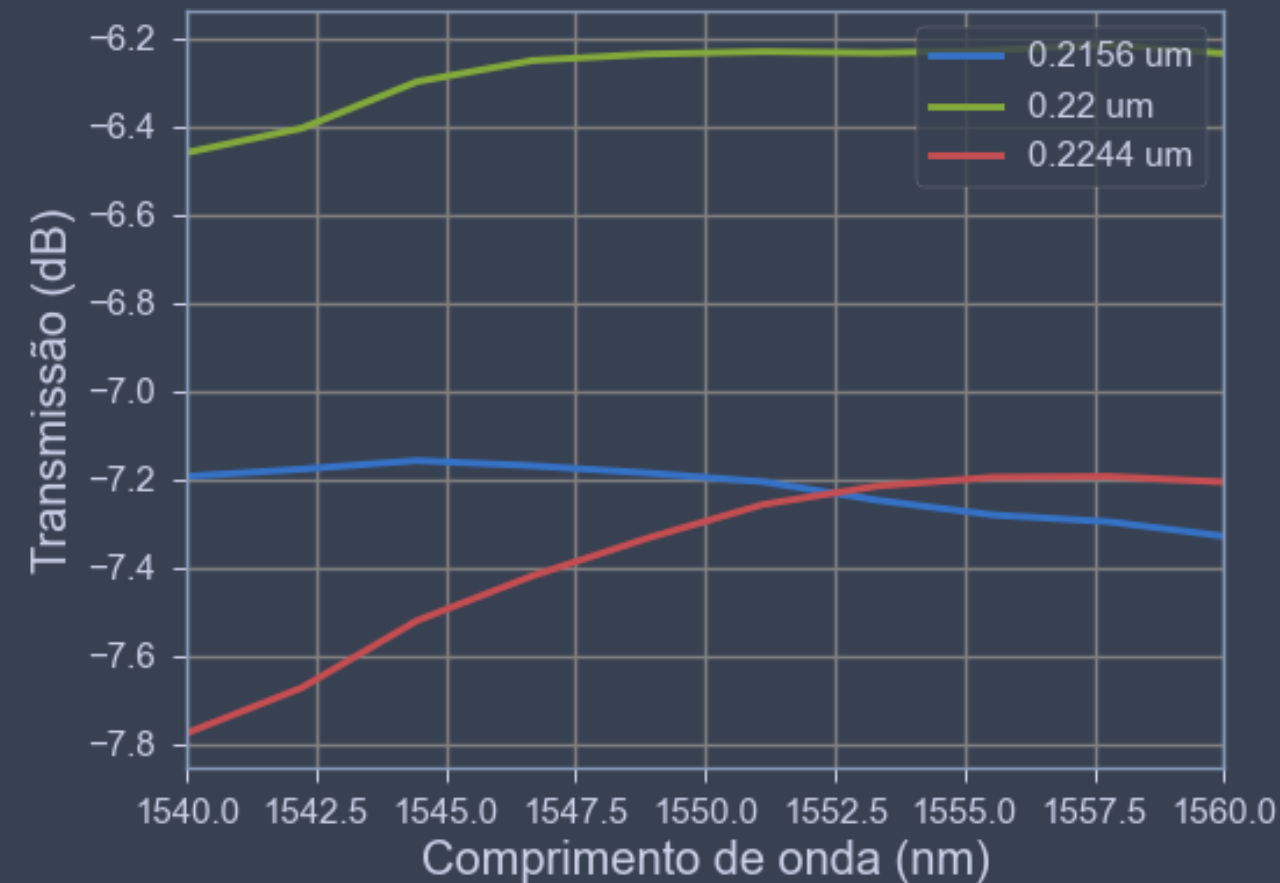
# Analise de tolerancia

## Porta 3

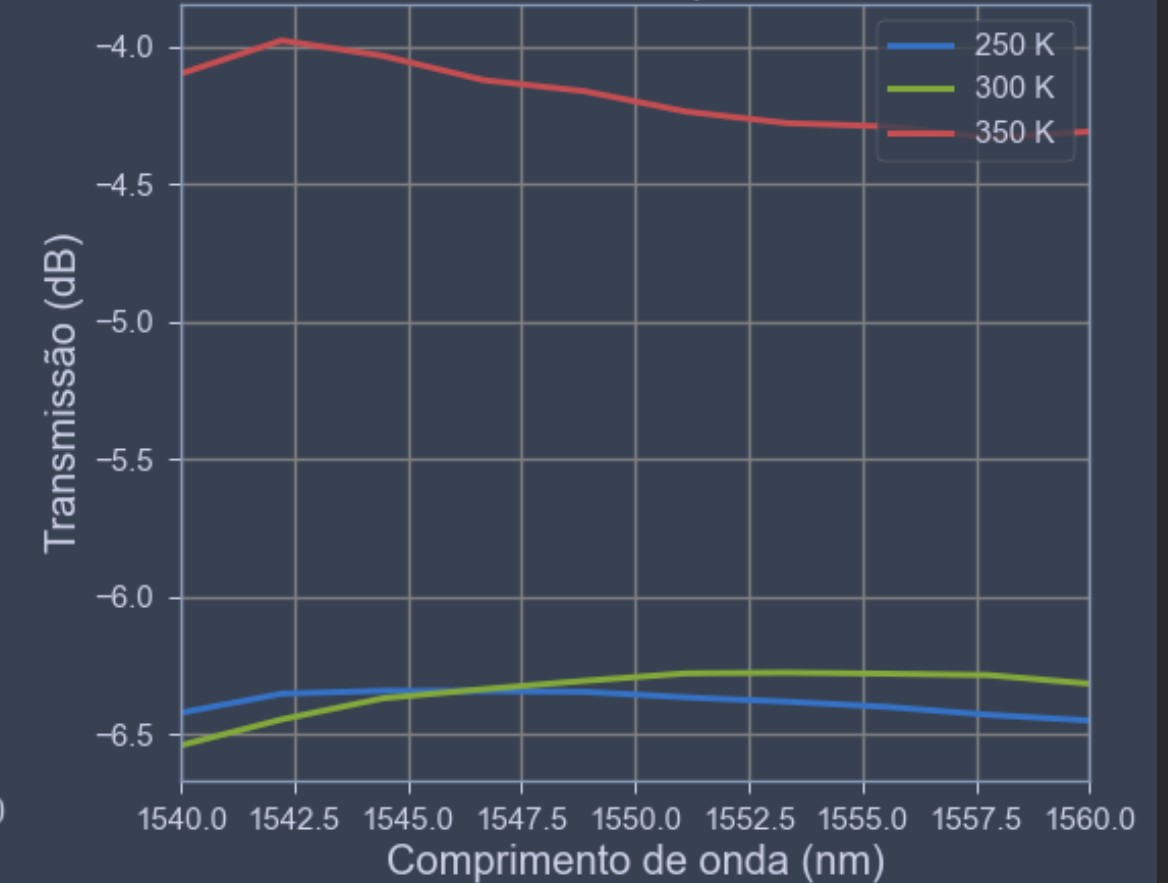
Tolerancia espessura MMI



Tolerancia altura MMI



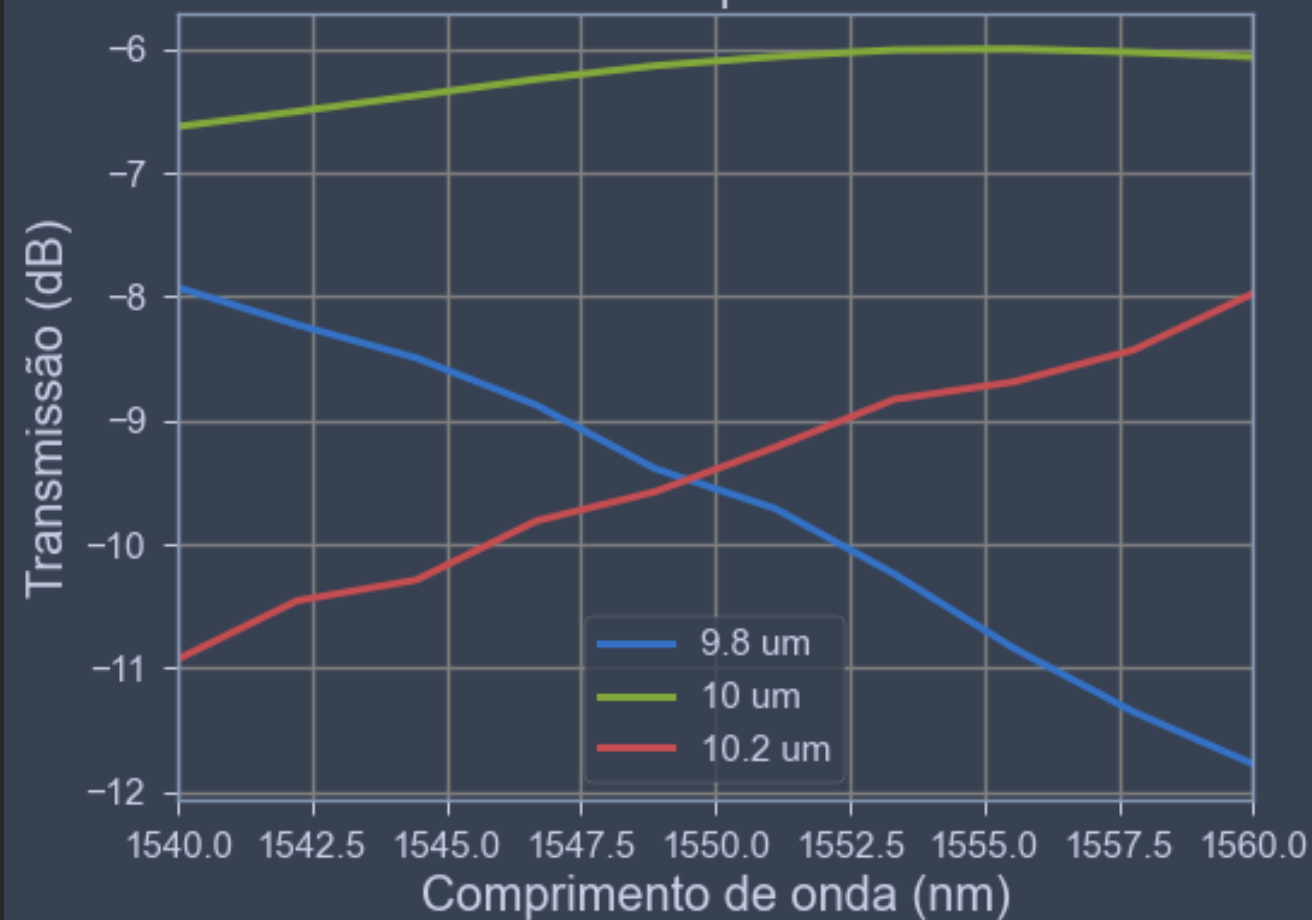
Tolerancia temperatura



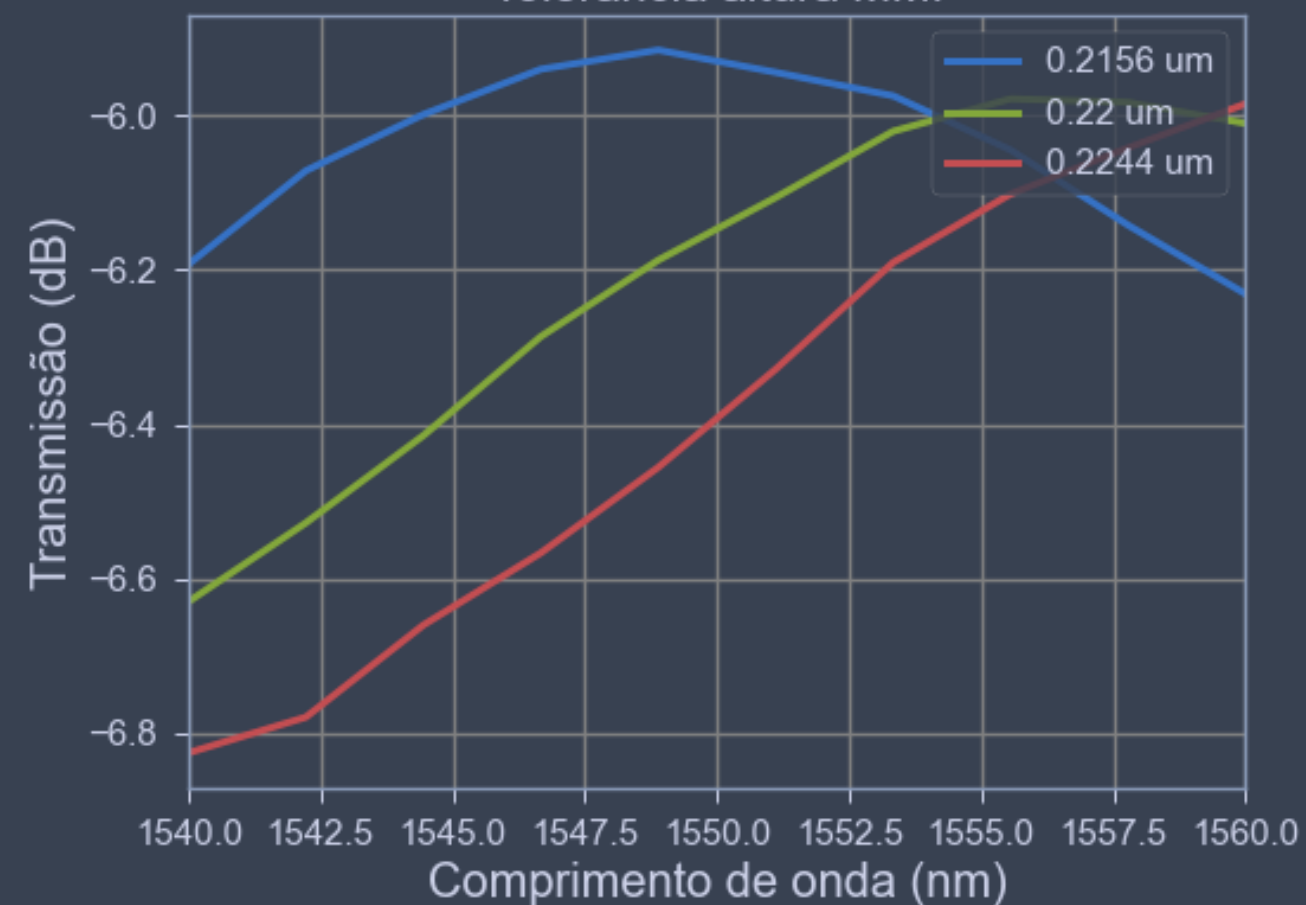
# Analise de tolerancia

## Porta 4

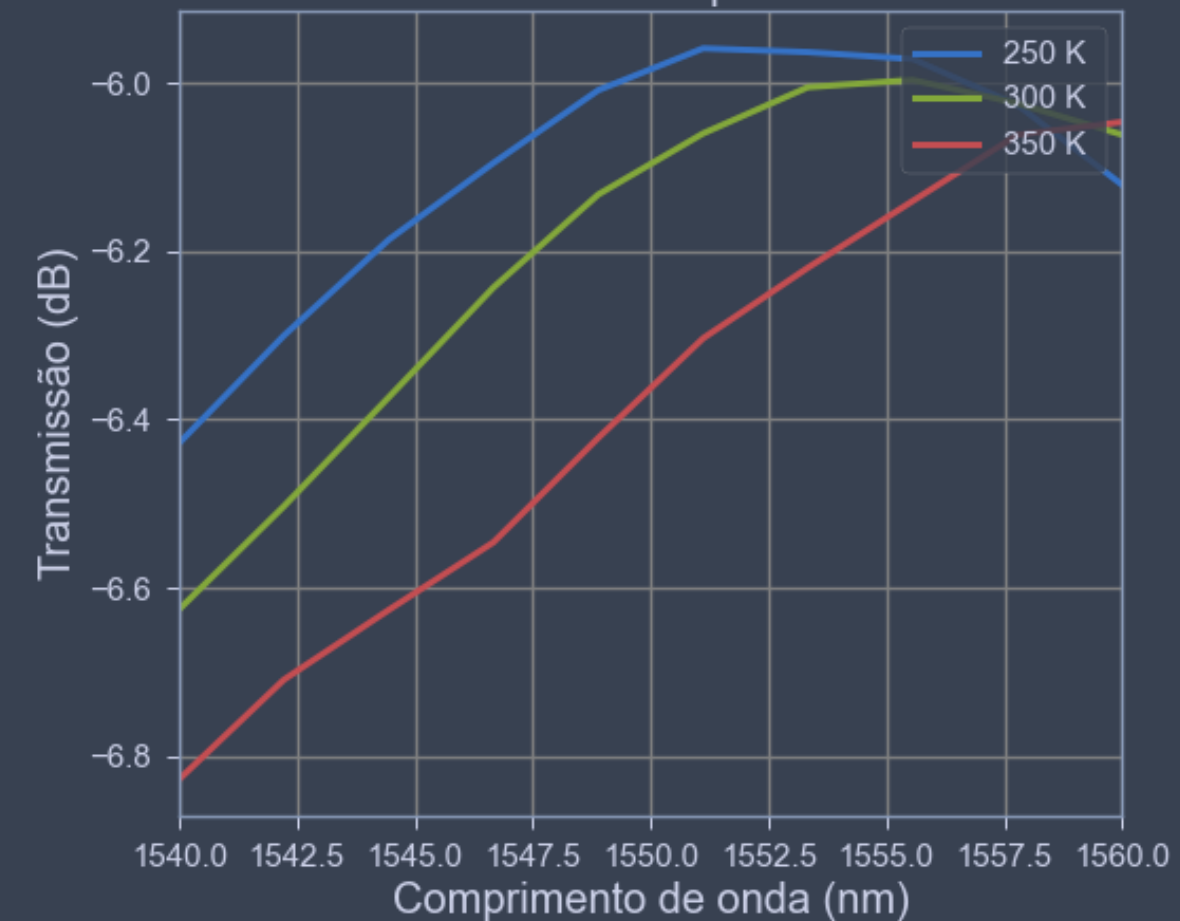
Tolerancia espessura MMI



Tolerancia altura MMI

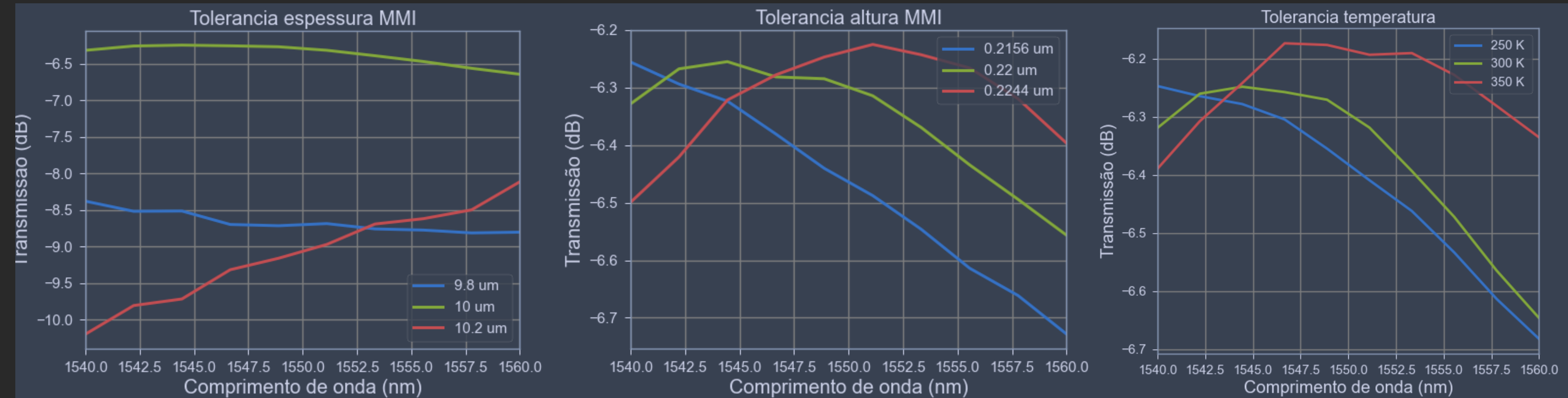


Tolerancia temperatura



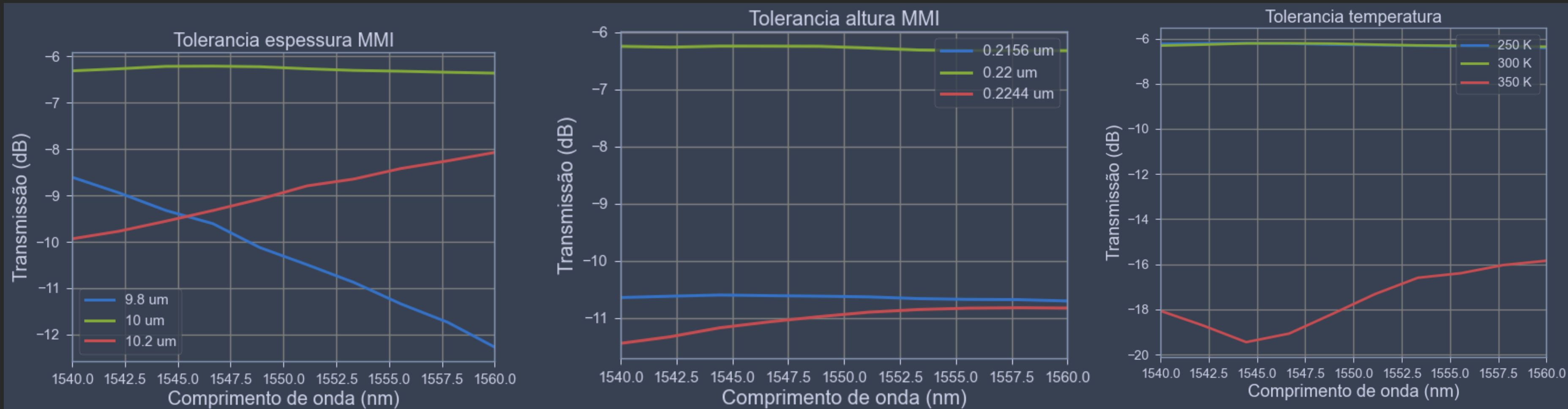
# Analise de tolerancia

## Porta 5



# Analise de tolerancia

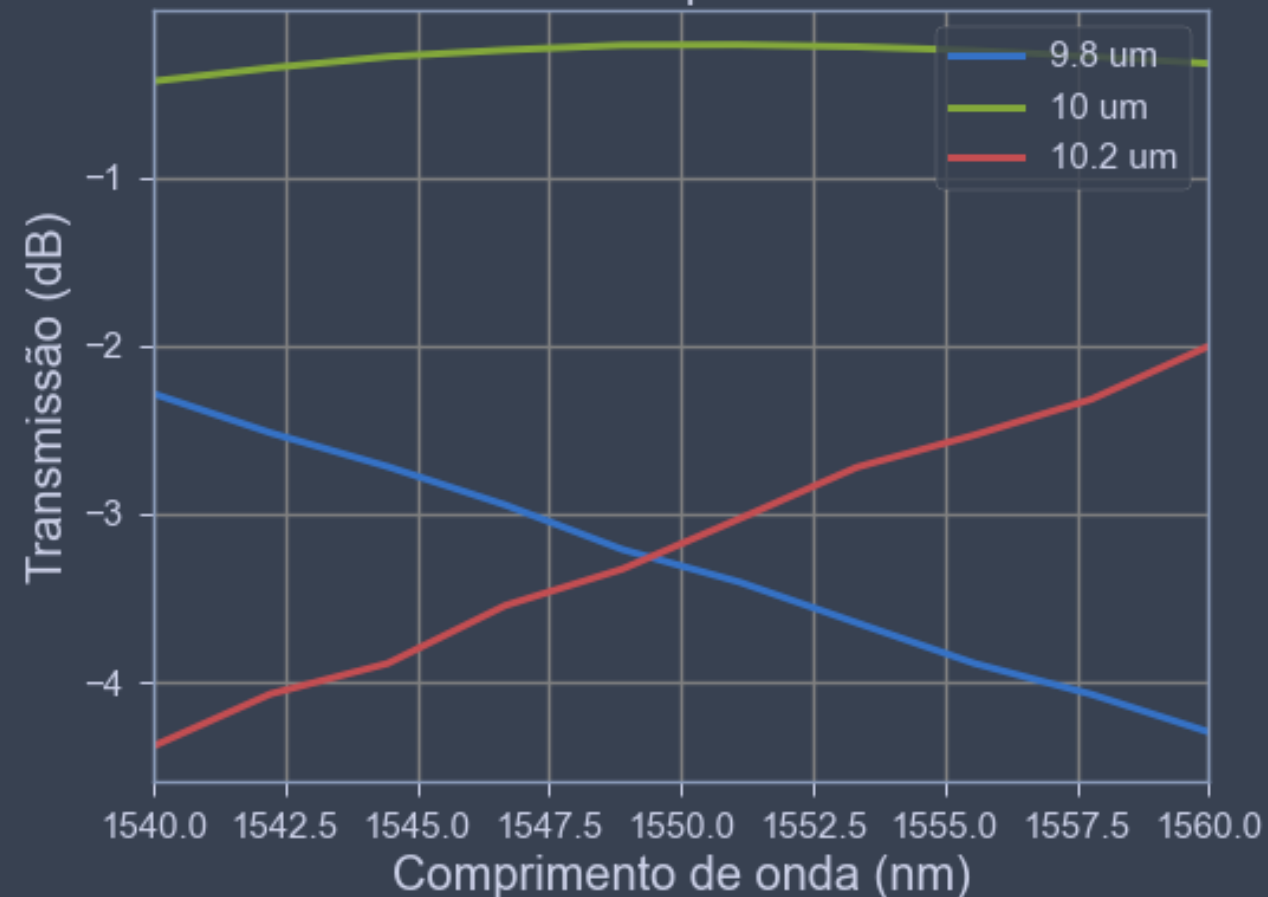
## Porta 6



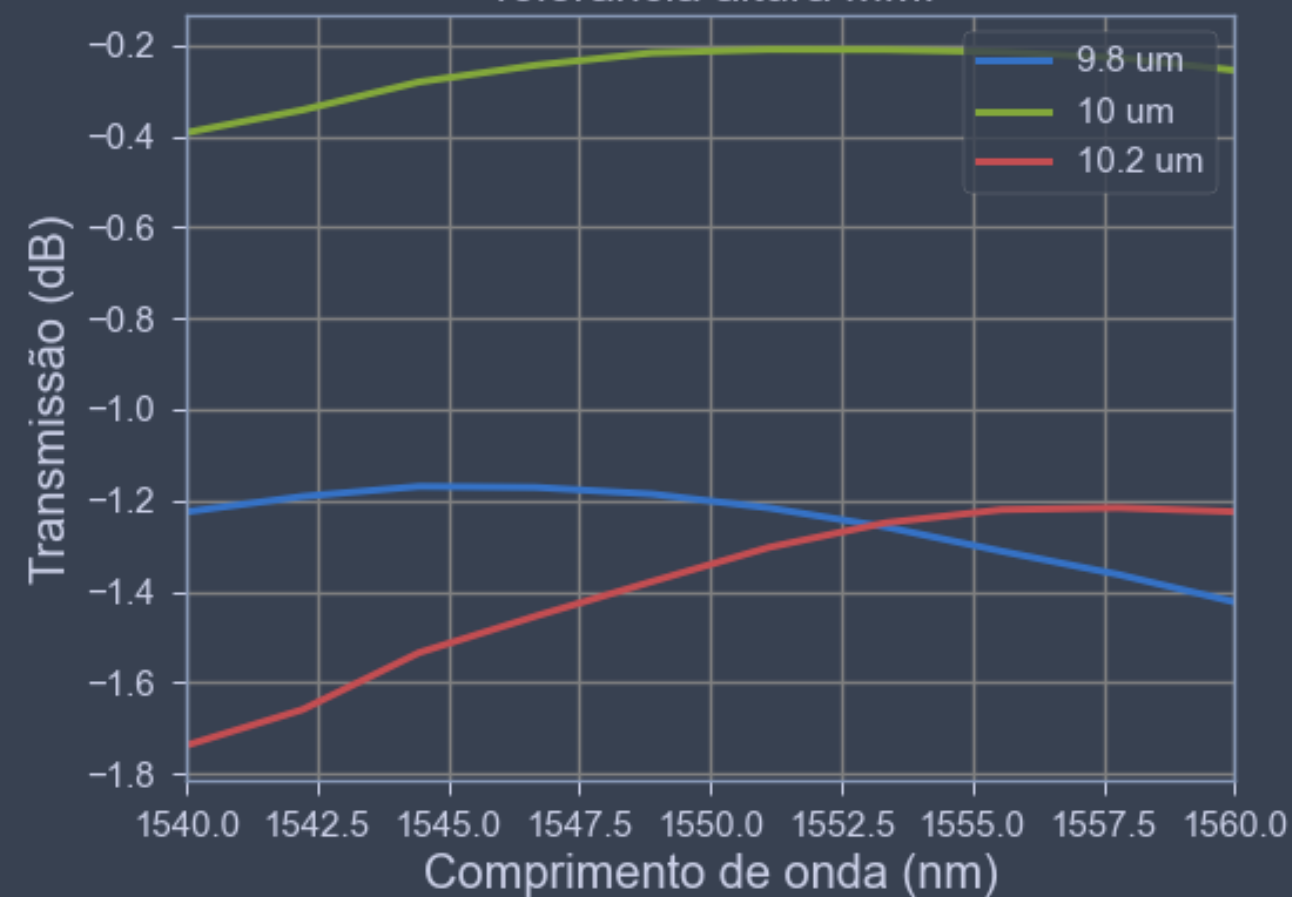
# Analise de tolerancia

## Insertion Loss

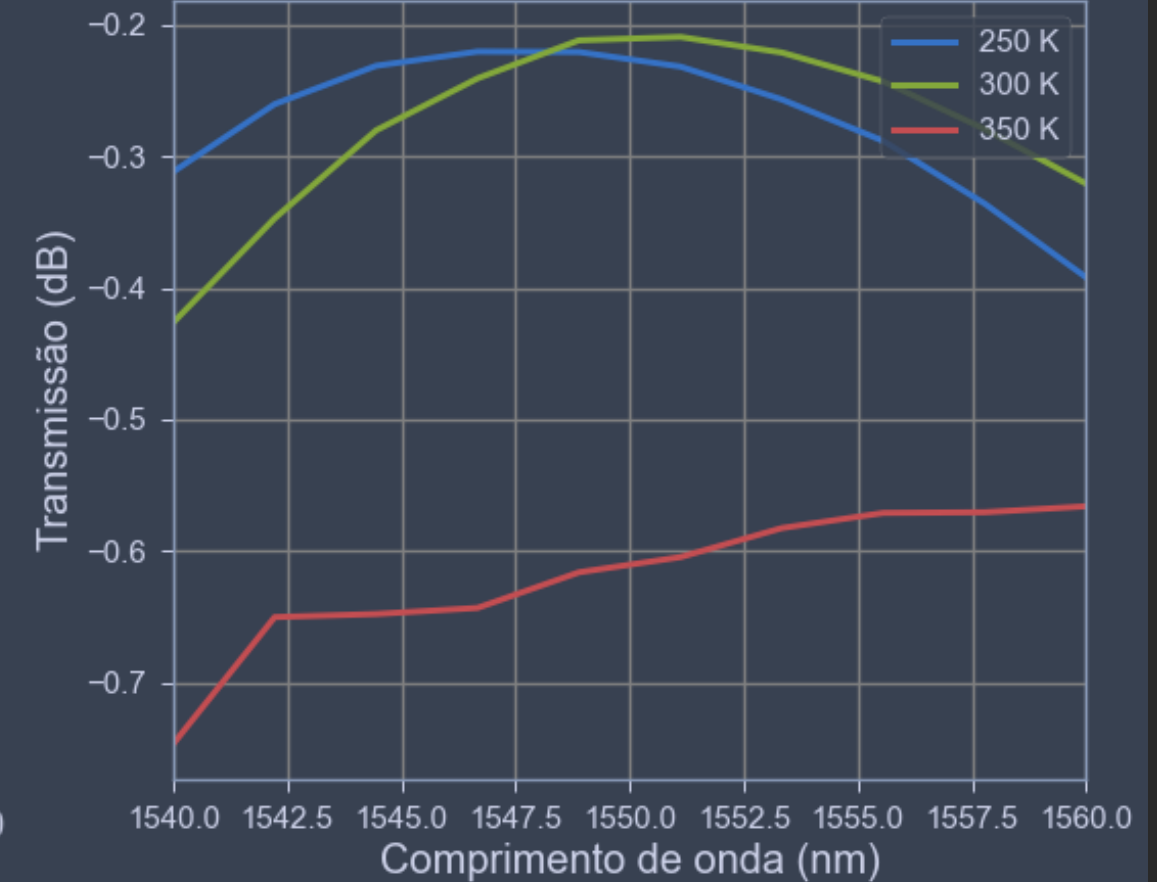
Tolerancia espessura MMI



Tolerancia altura MMI

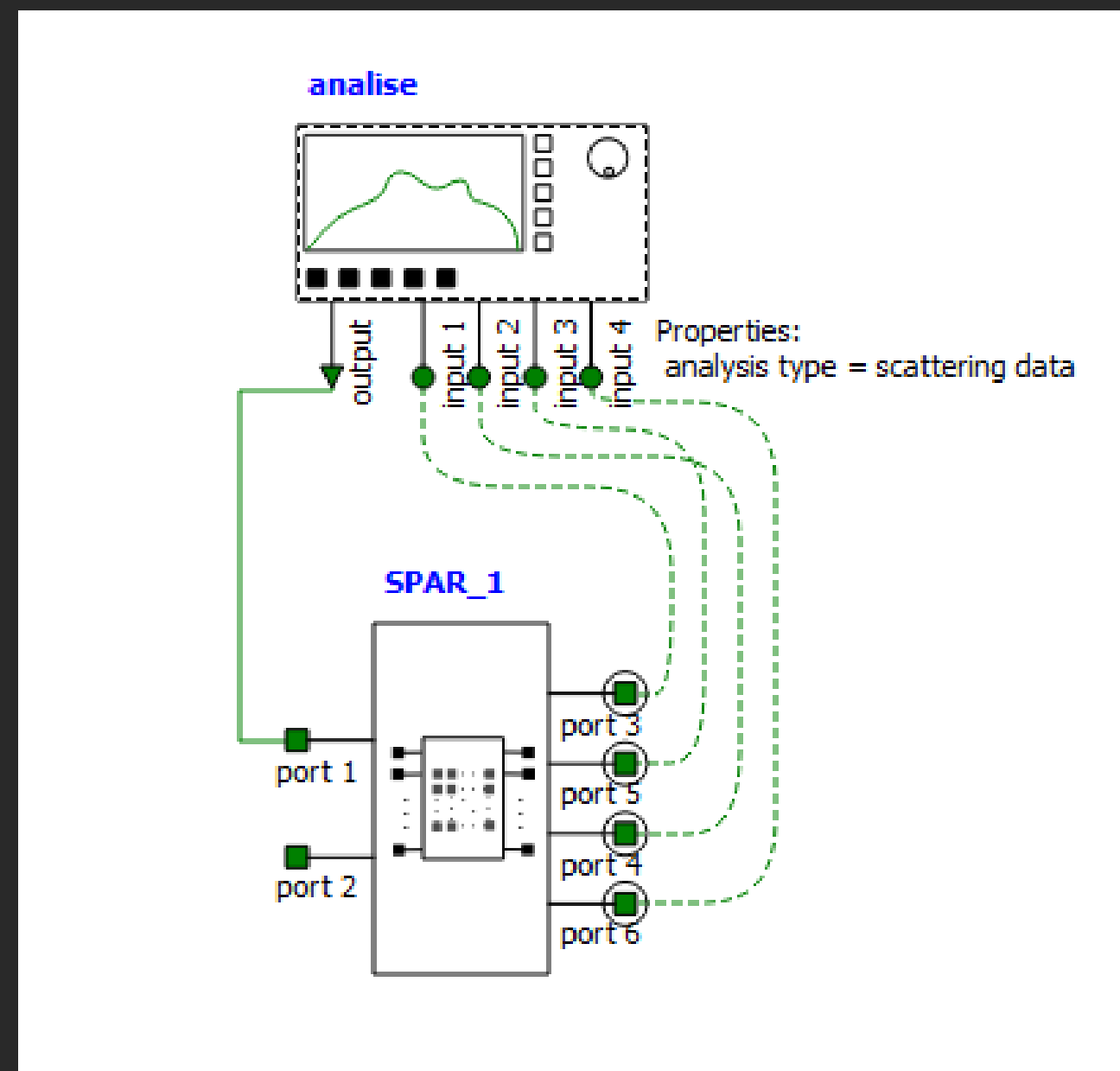


Tolerancia temperatura



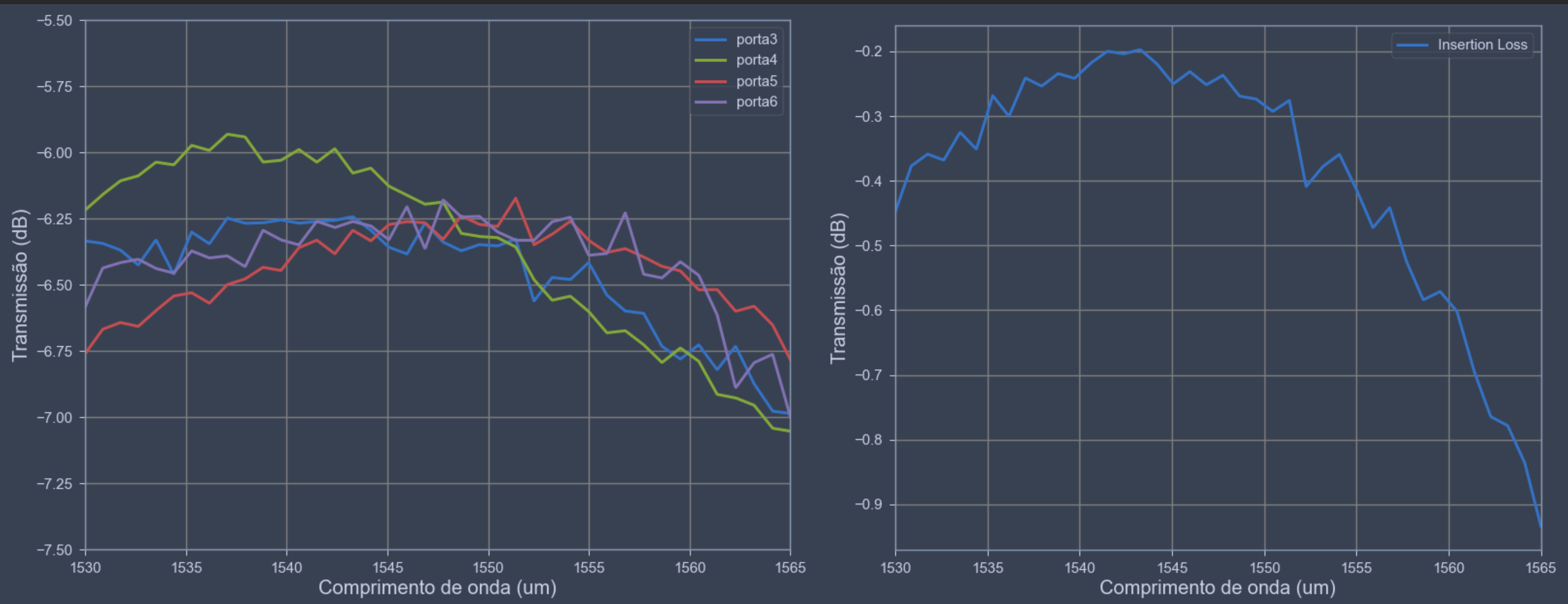
# Simulação interconnect

Banda C - 40 pontos de frequencia



# Simulação interconect

Resultados porta 1





# Simulação interconect

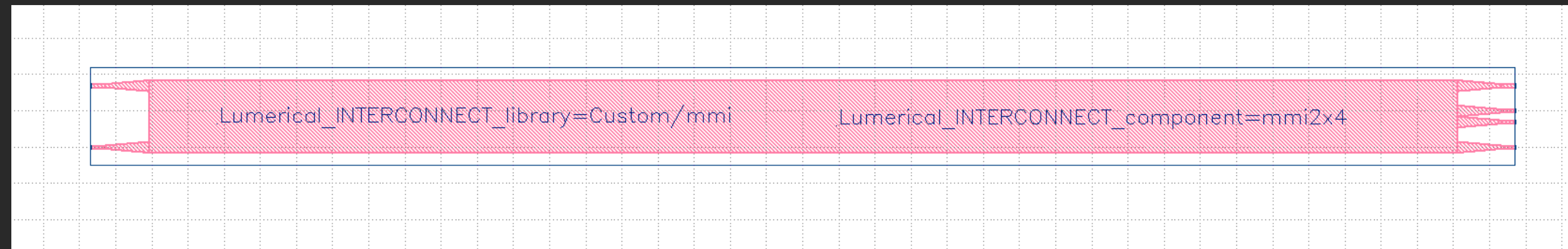
Resultados porta 2



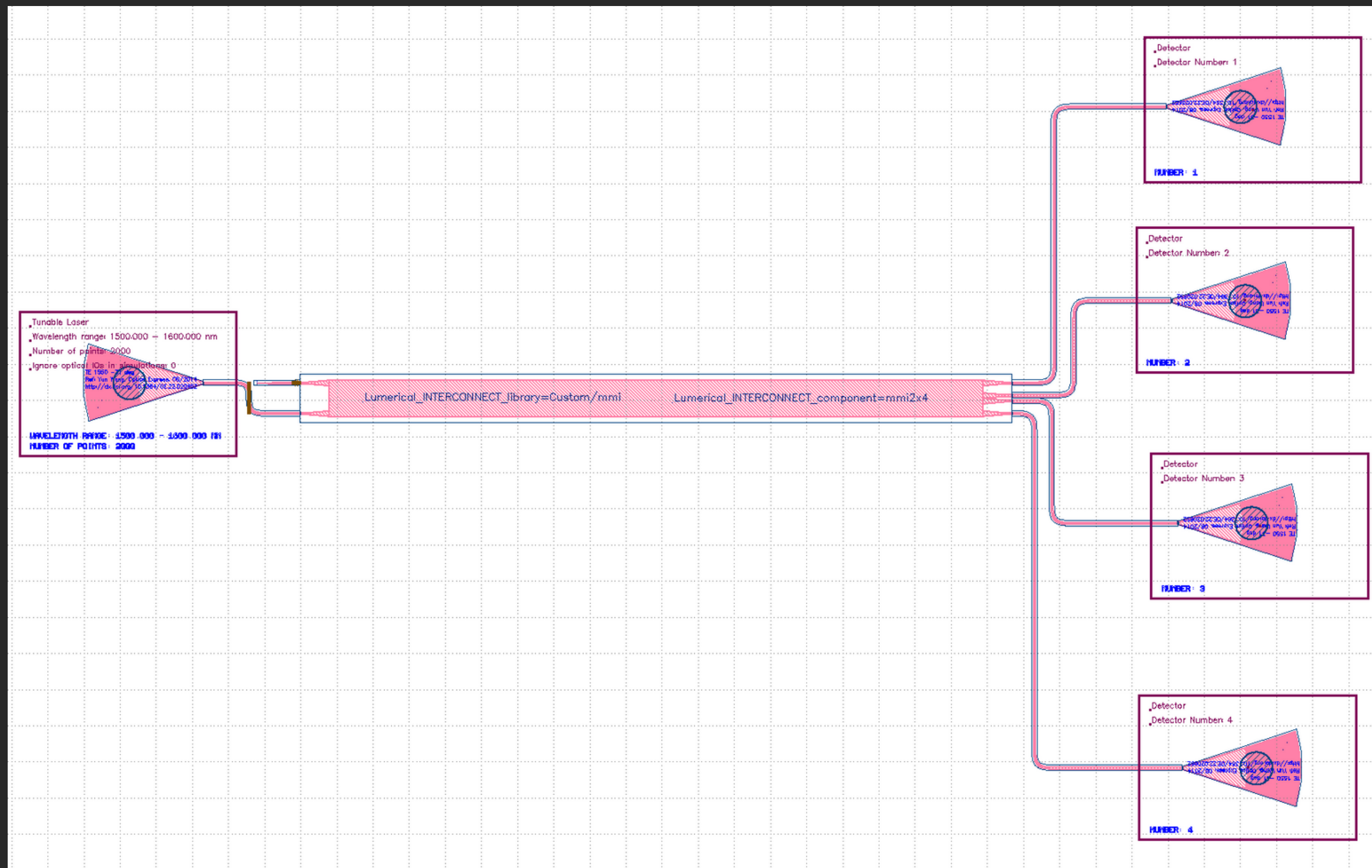


# SEMANA 4 E 5

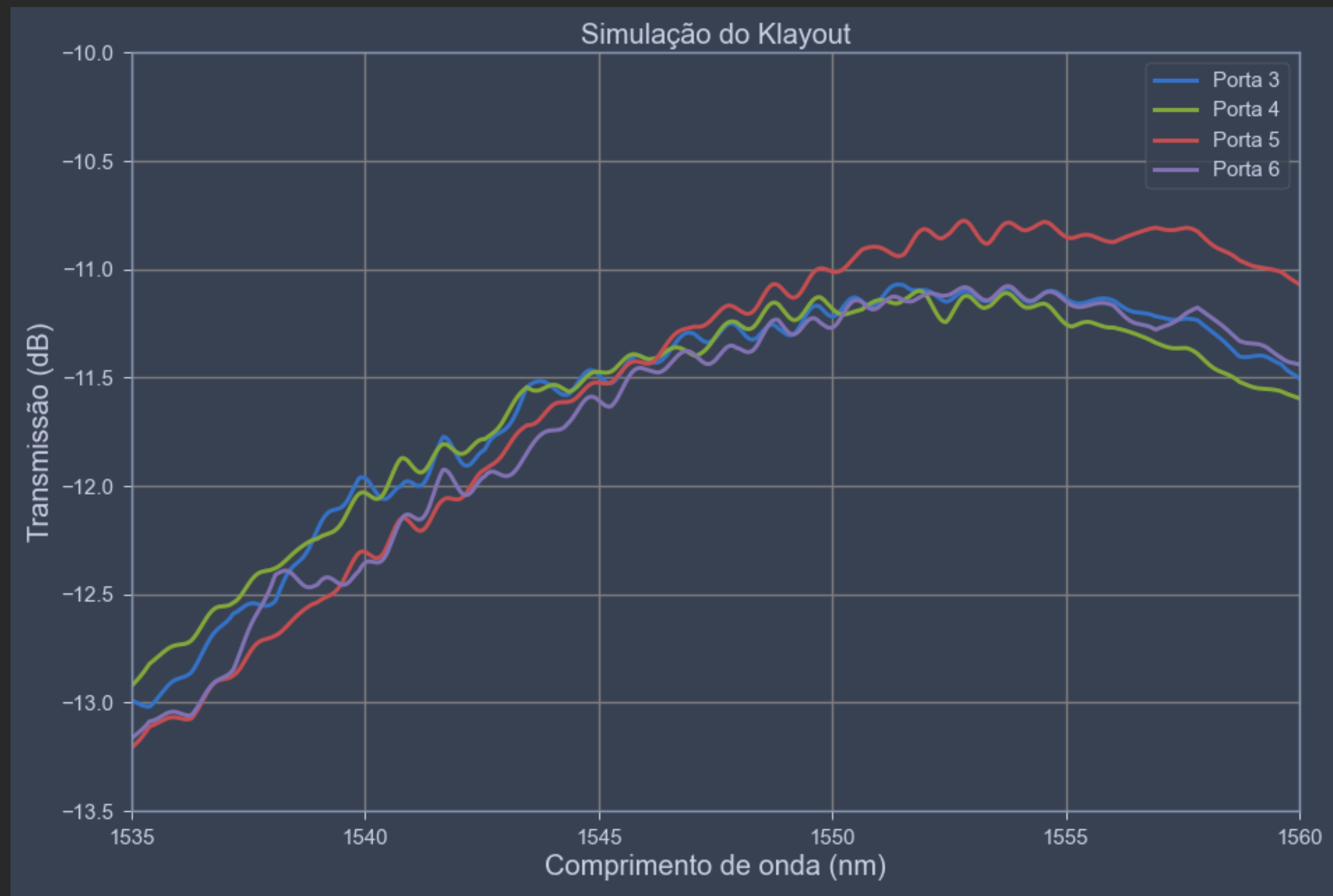
# Exportação do dispositivo para o Klayout



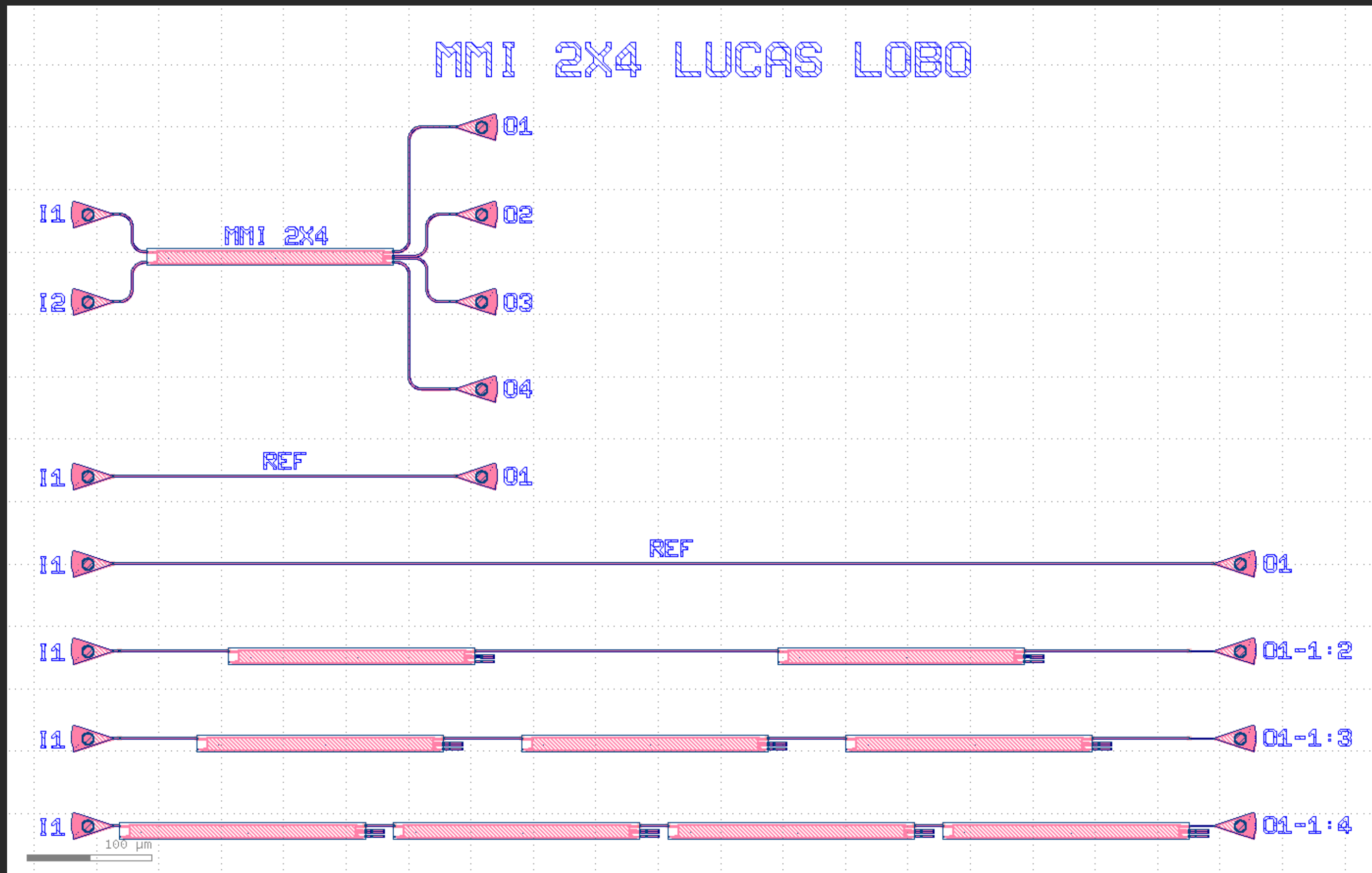
# Circuito de teste



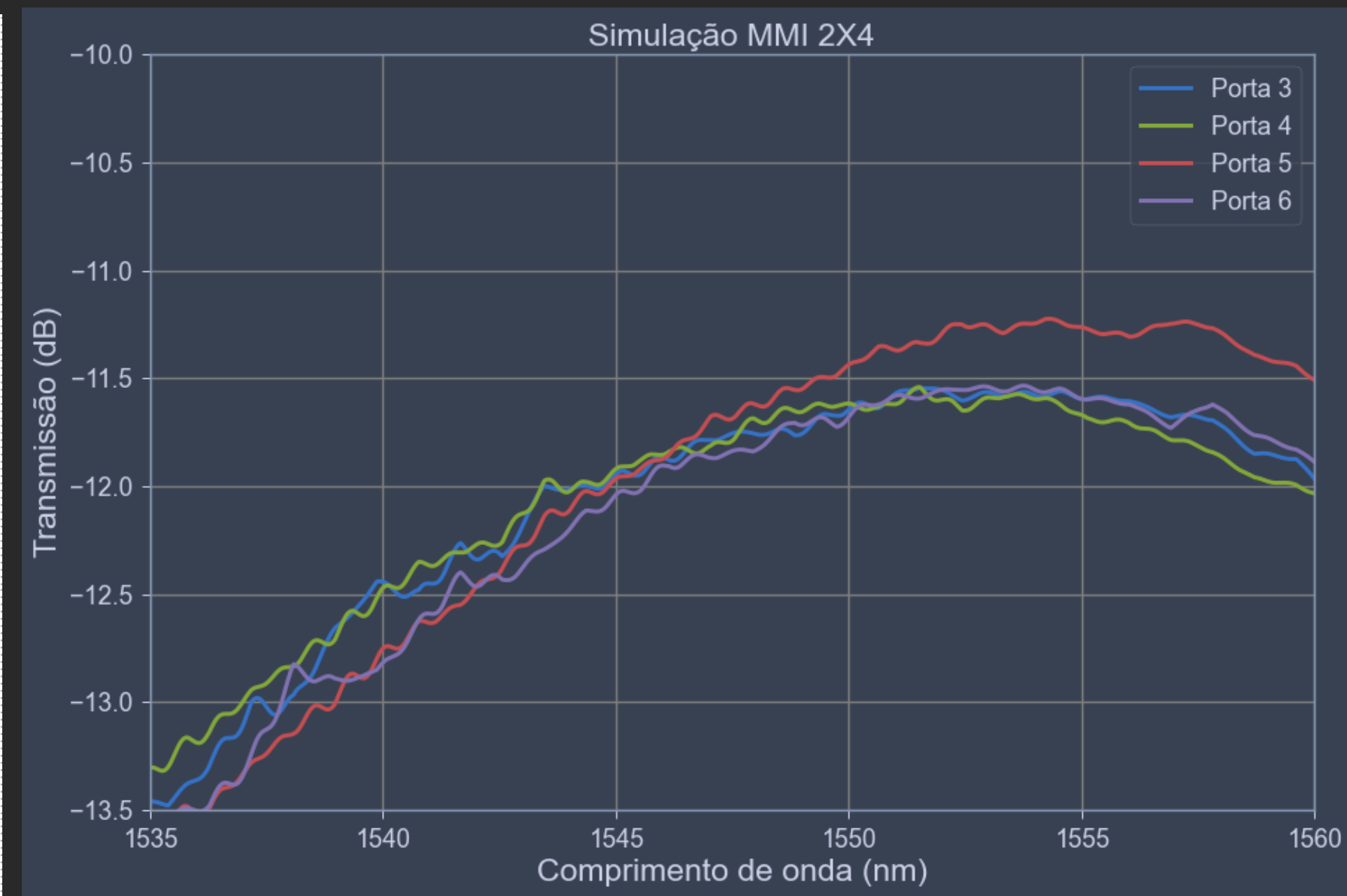
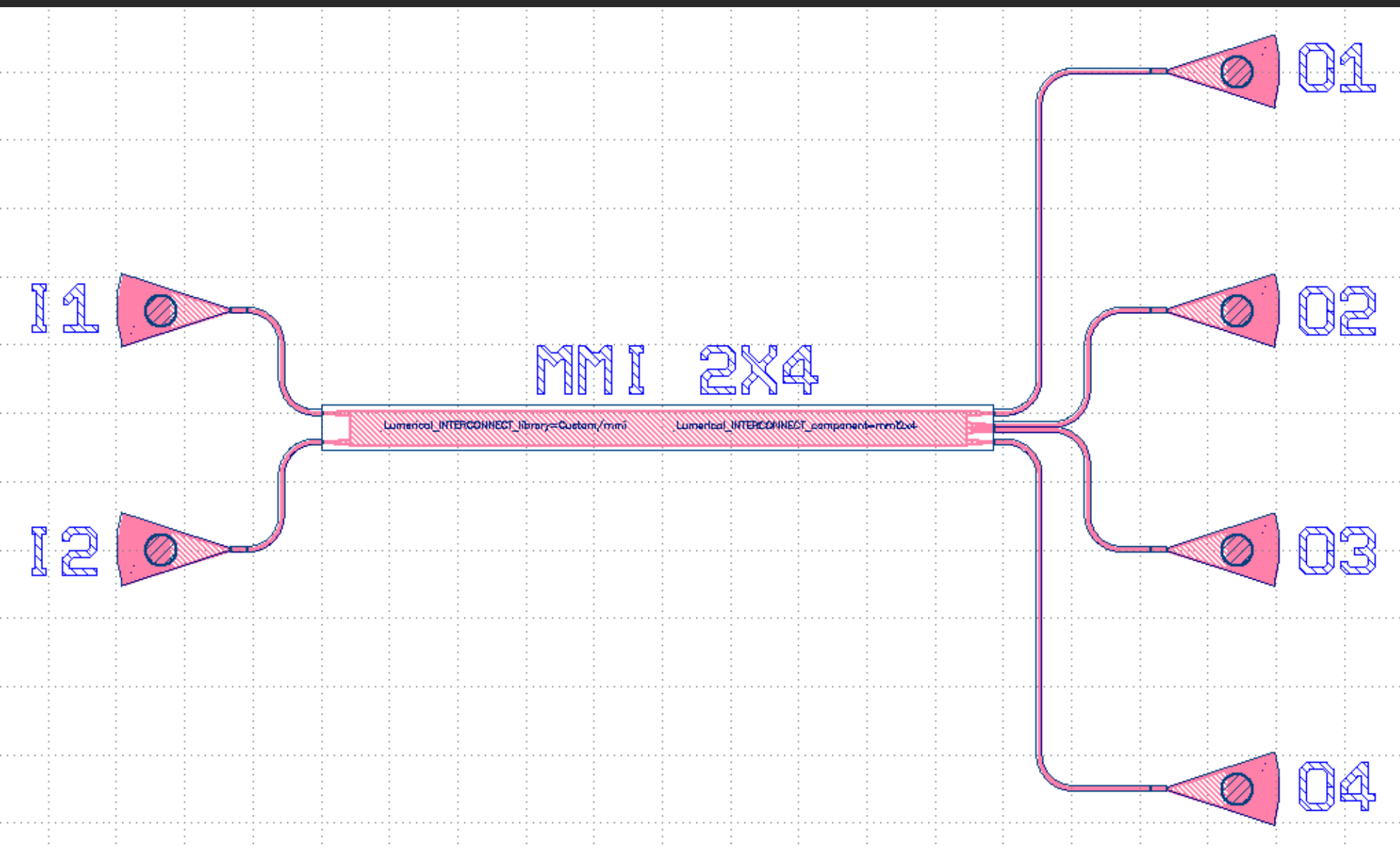
# Resultado do circuito



# Placa Final

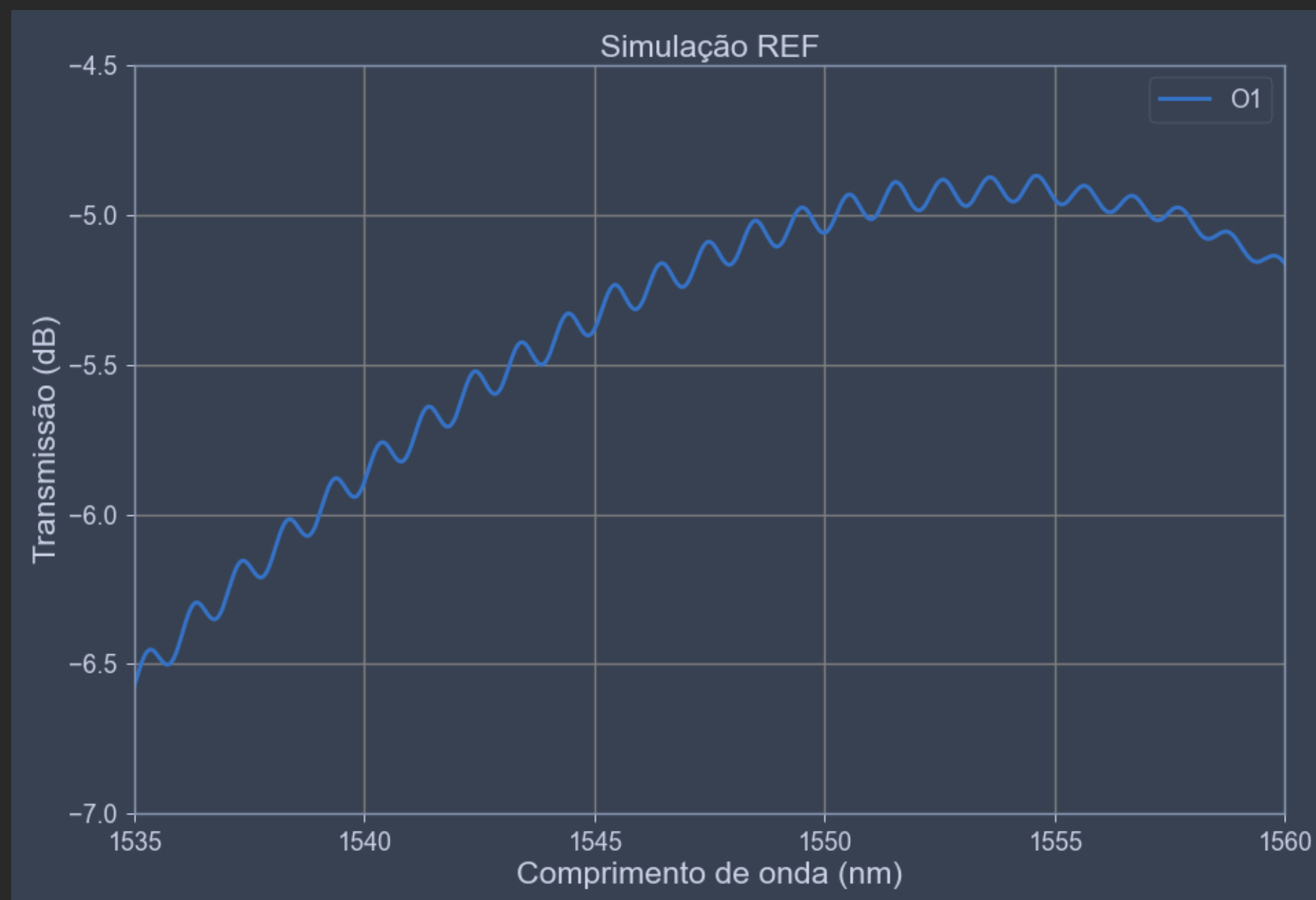
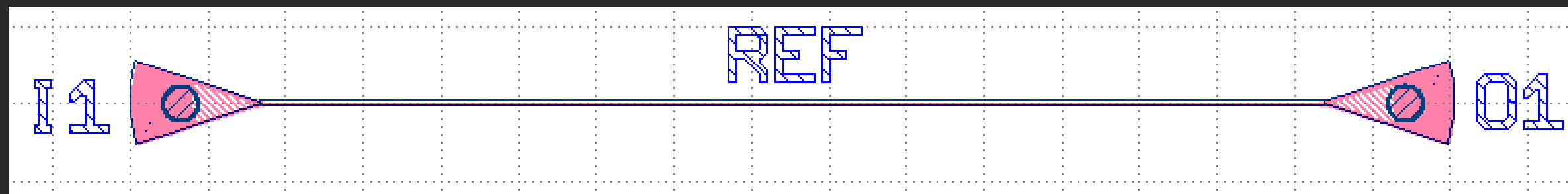


# Resultados De simulações

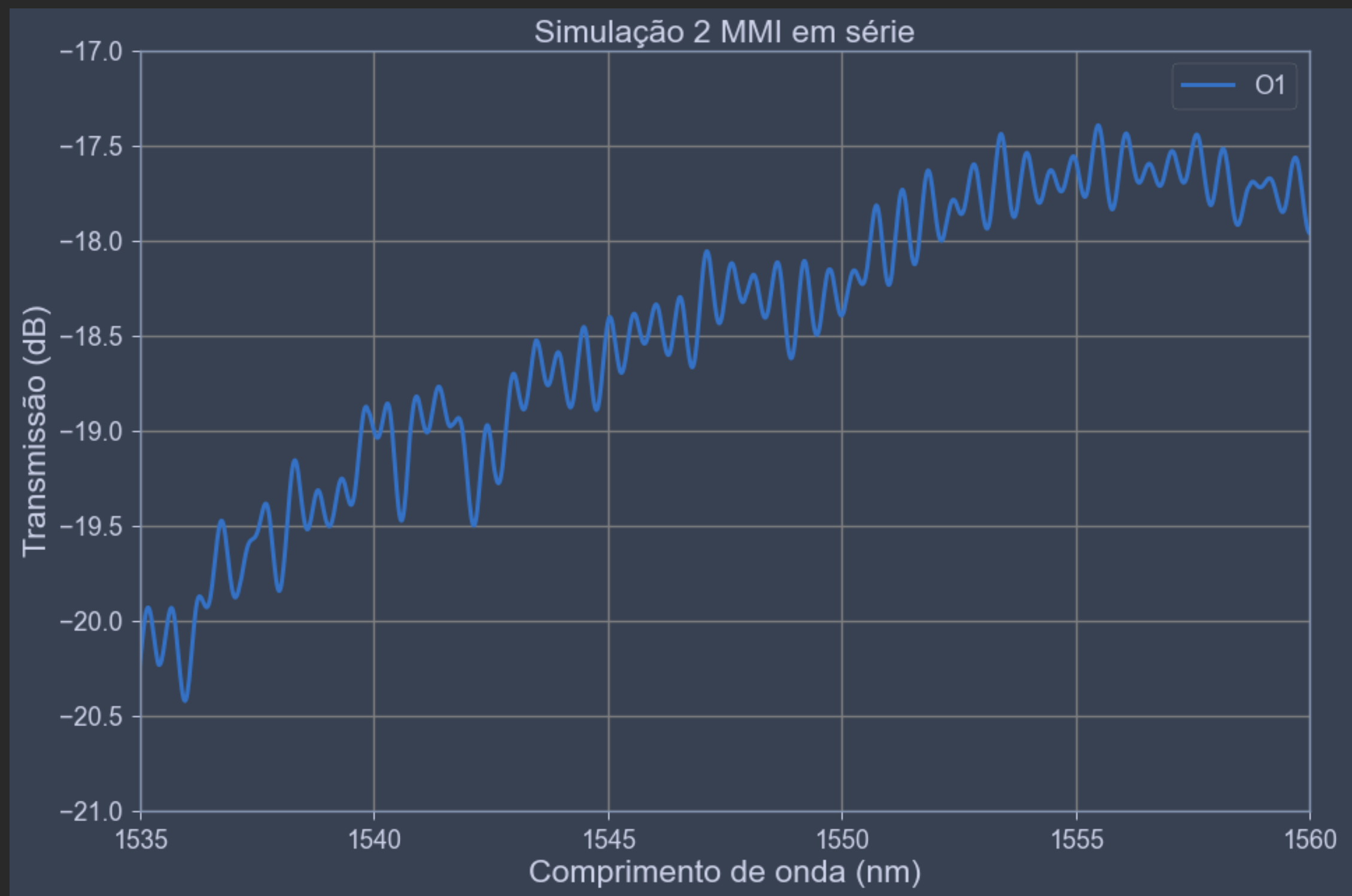




# Resultados De simulações

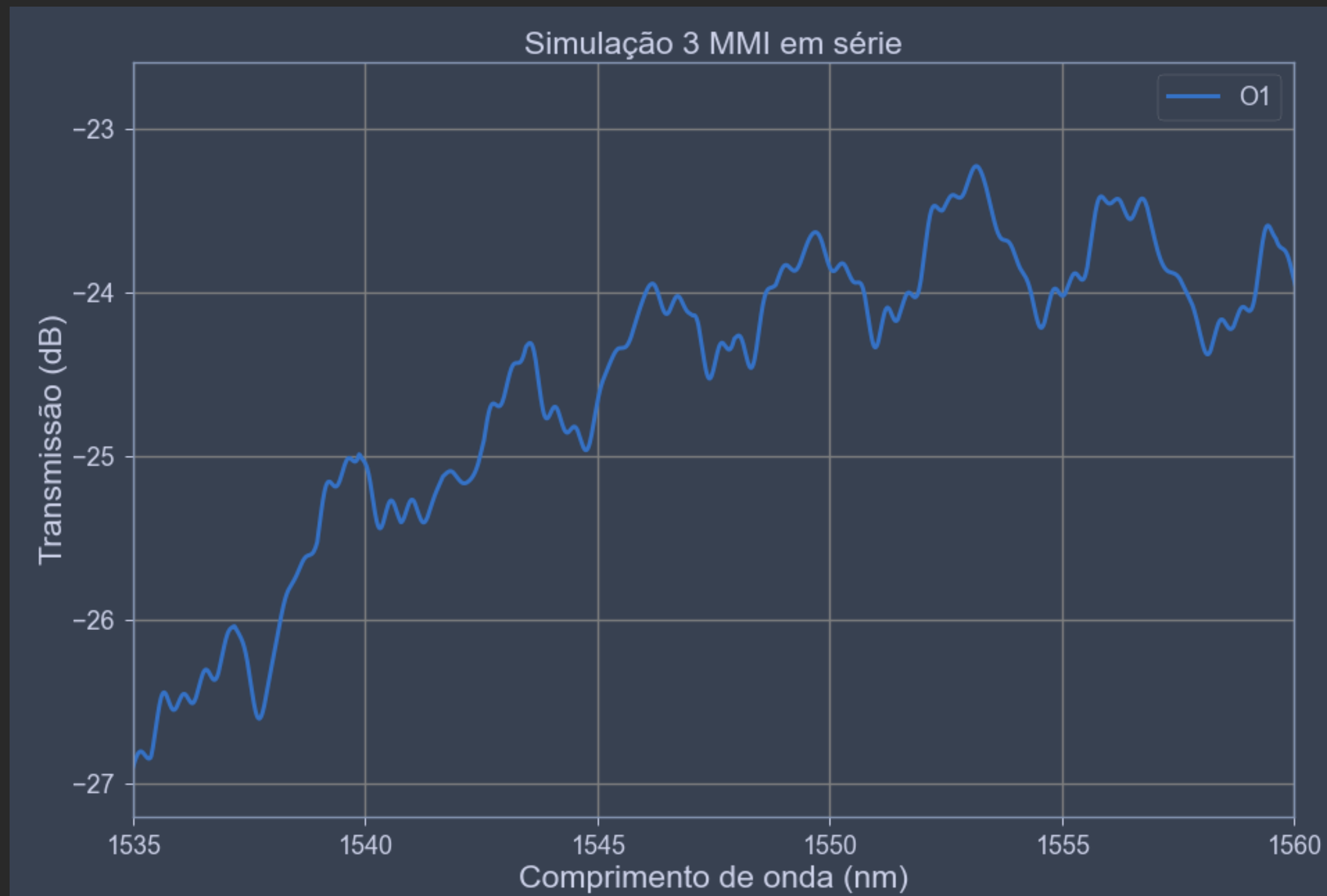


# Resultados De simulações

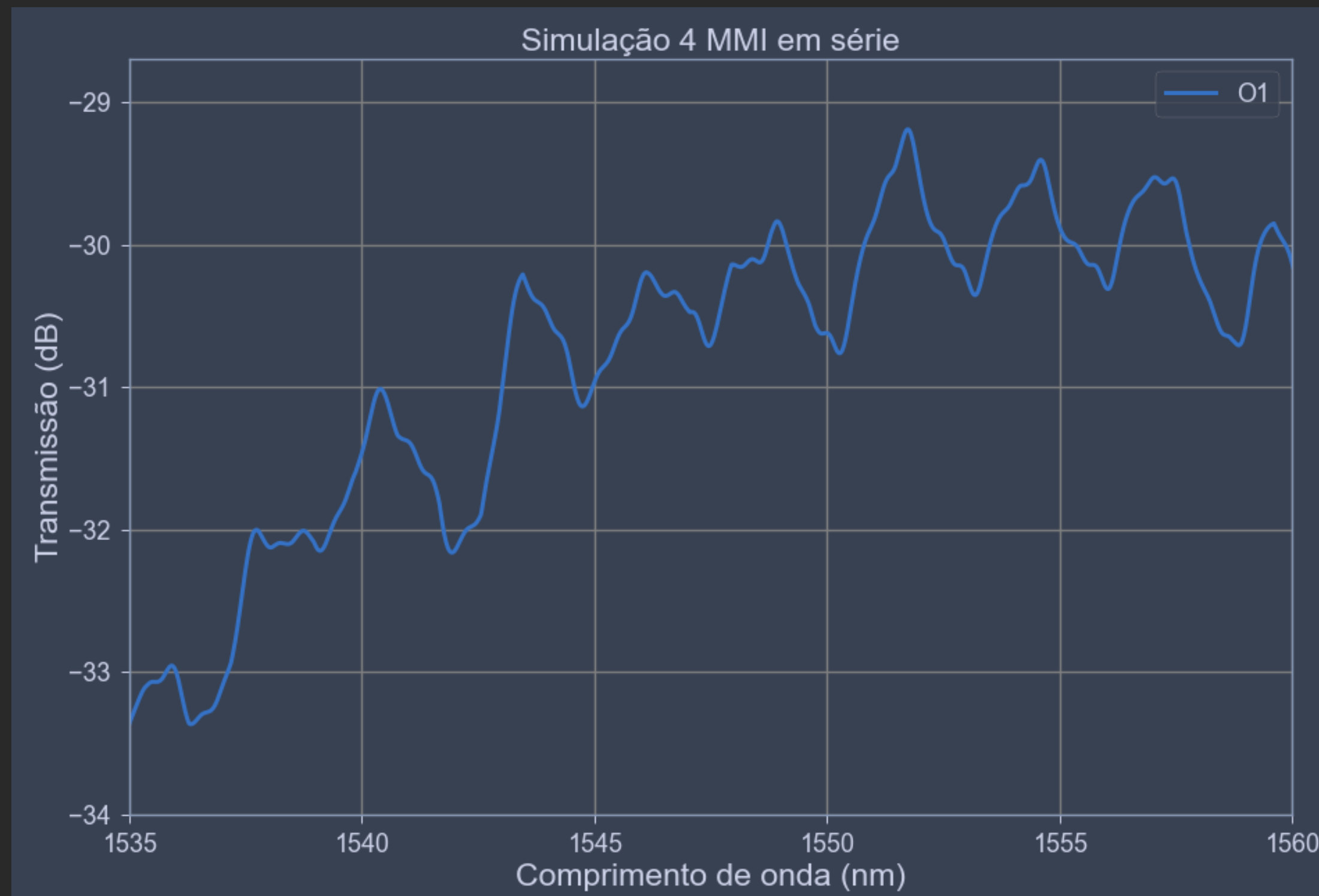
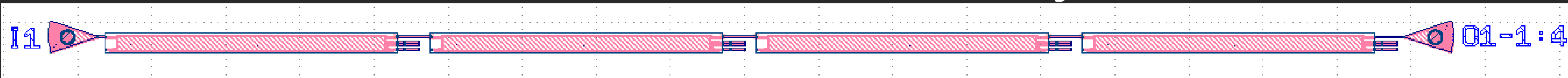




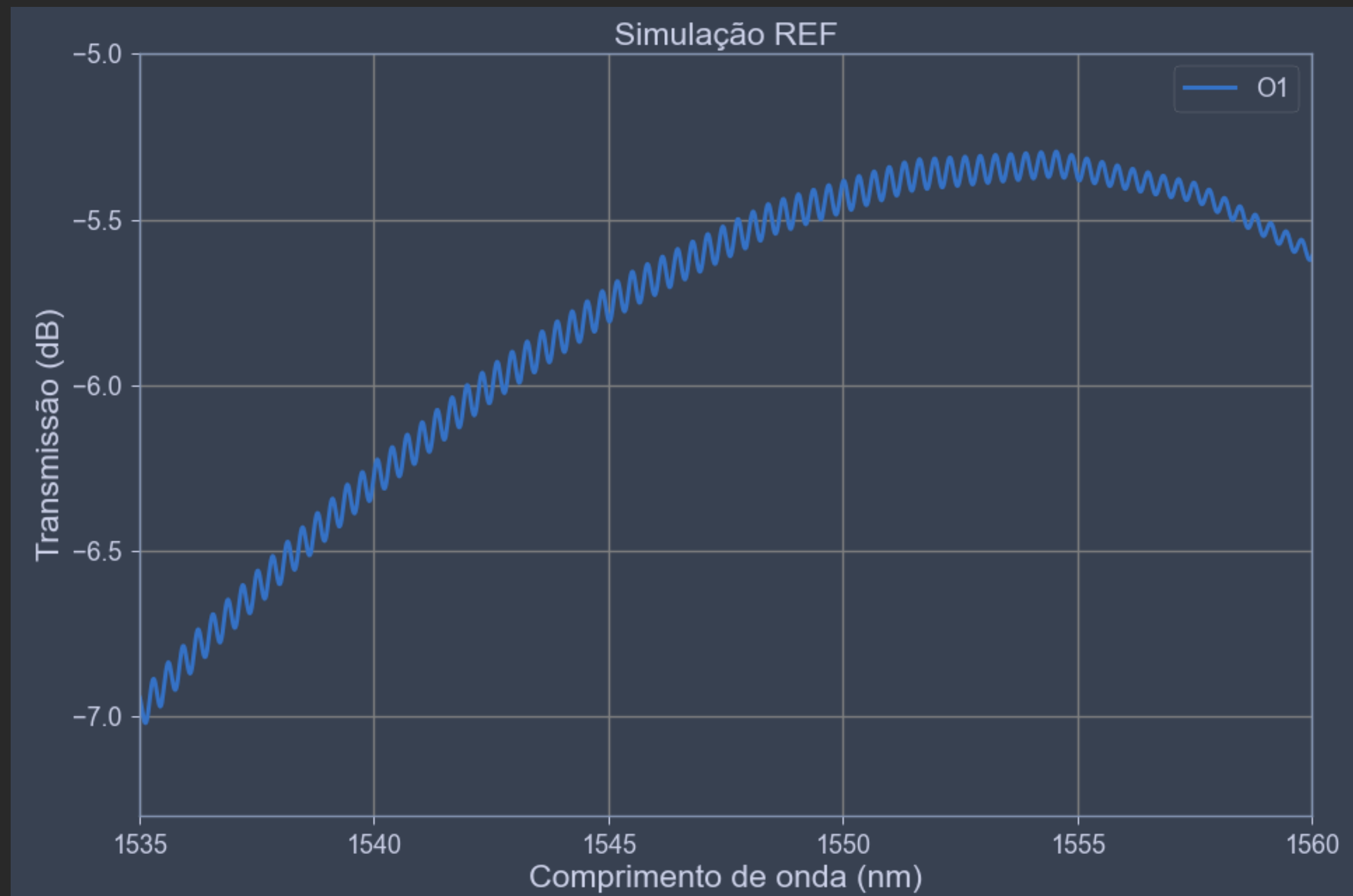
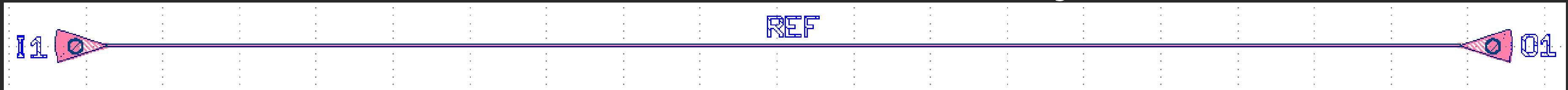
# Resultados De simulações



# Resultados De simulações



# Resultados De simulações



# Bibliografia

- Planar Monomode Optical Couplers Based on Multimode Interference Effects Lucas B. Soldano, Frank B. Veerman, Meint K.. Smit, Bastiaan H. Verbeek, Alain H. Dubost, and Erik C. M. Pennings
- Overlapping-image multimode interference couplers with a reduced number of self-images for uniform and nonuniform power splitting M. Bachmann, P. A. Besse, and H. Melchior