



Guias retangulares metálicos e guias de substrato integrado

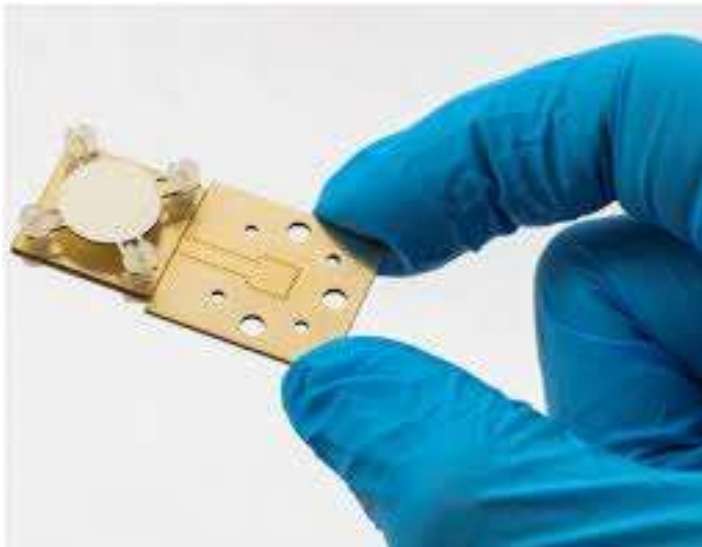
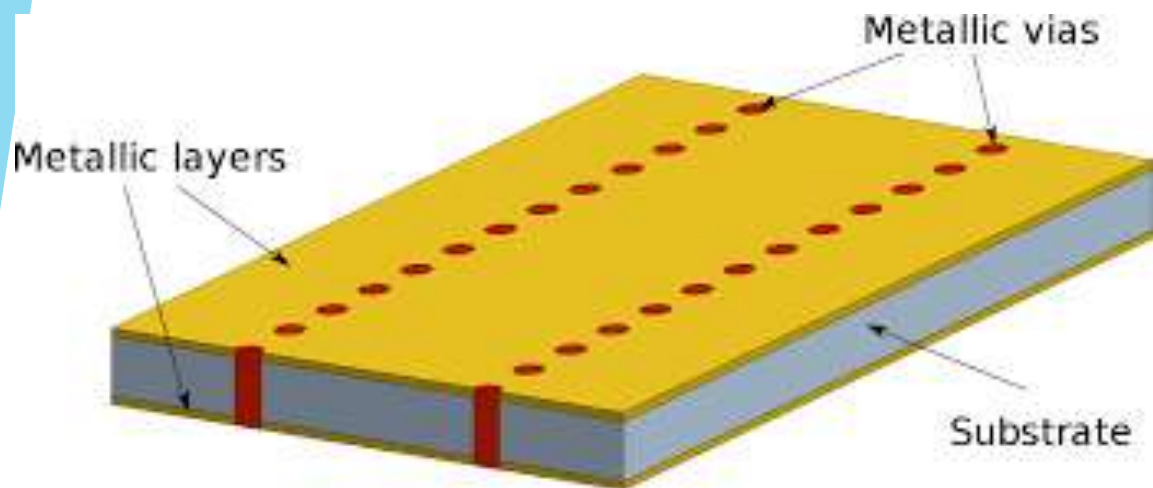
Estruturas guiantes

Professor: Adolfo Fernandes Herbster

Aluno: Lucivaldo Barbosa de Aguiar Júnior

Sumário

- ▶ Introdução;
- ▶ Metodologia;
- ▶ Equações;
- ▶ Guia retangular oco;
- ▶ Guia retangular com dielétrico;
- ▶ Guia SIW ;
- ▶ Comparação por meio da constante propagação;
- ▶ Conclusão;
- ▶ Referências.



Introdução

- ▶ Guias retangulares metálicos;
- ▶ Problema dimensional;
- ▶ Guias do tipo *S/W*.

Metodologia

- ▶ Reprodução dos resultados da referência utilizada [2];
- ▶ Método de simulação (HFSS);
- ▶ Obtenção e apresentação dos dados.

Equações

$$f_c = \frac{c}{2\sqrt{\epsilon_r\mu_r}} \sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2}.$$

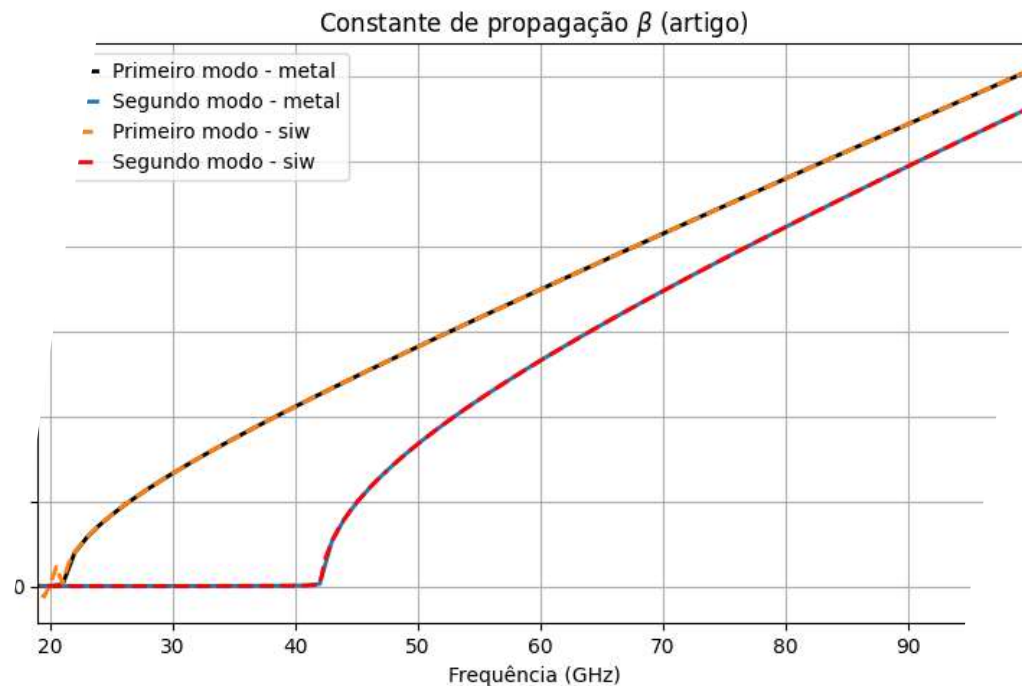
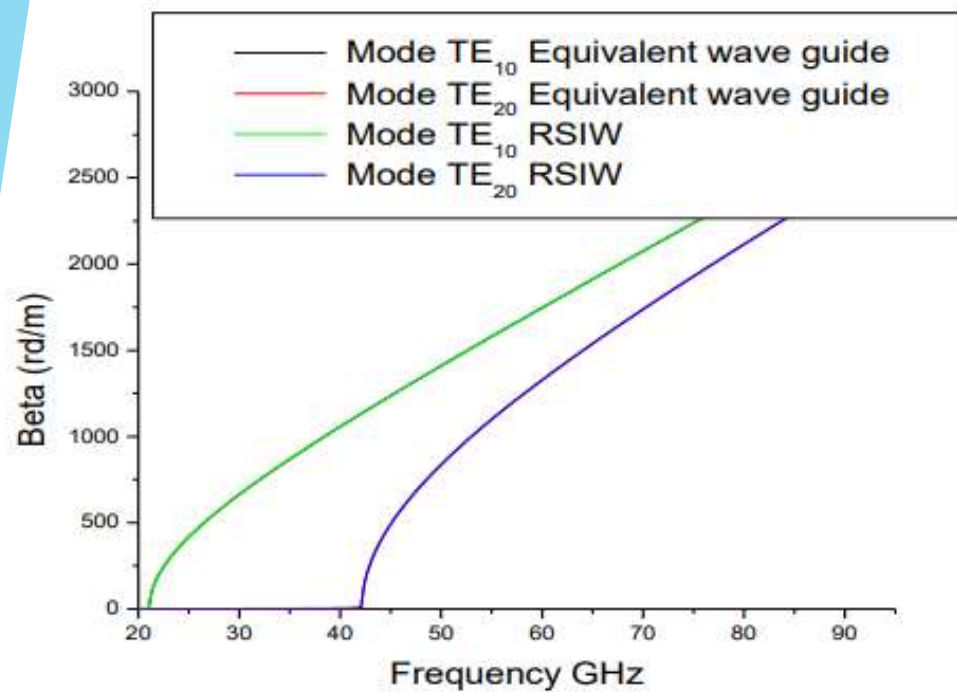
$$W_{eq} = W_{SIW} - \frac{d^2}{0.95p}$$

```
1 def get_cutOffFrequencias(a,b,p,epslion_r,mi_r):
2     """
3     :param a: largura do guia
4     :param b: altura do guia
5     :param p: numero de loops
6     :param epslion_r: permissividade
7     :param mi_r: permeabilidade
8     :return: lista com frequencias de corte
9     """
10    c_ = c/(np.sqrt(epsilon_r * mi_r))
11    lista = []
12    for m in range(0,p,1):
13        for n in range(0,p,1):
14            fc = ((c_/2)*np.sqrt( (m/a)**2 + (n/b)**2))
15            lista.append((m, n, fc / giga))
16    return lista
```

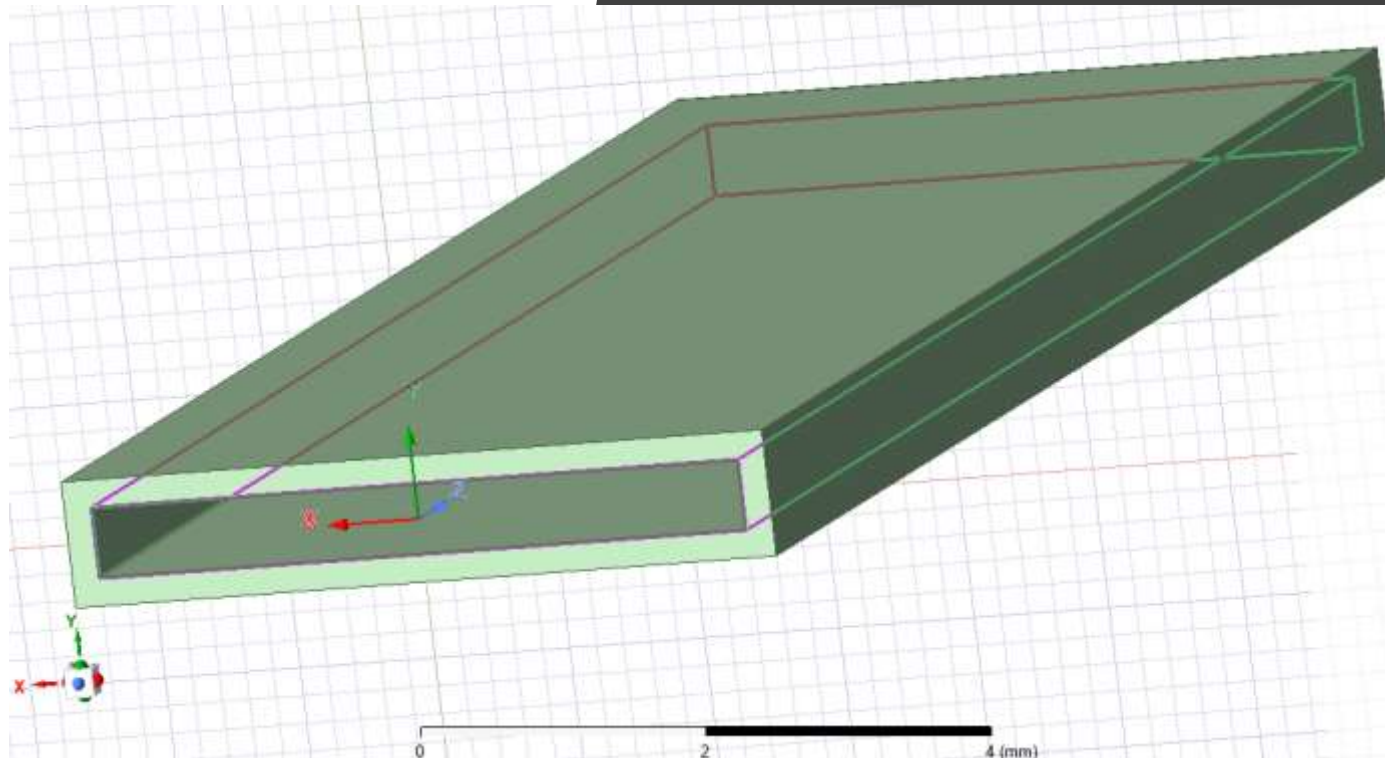
Reprodução dos dados do artigo

$a = 4.795\text{mm}$, $b = 0.508\text{mm}$,
 $\epsilon_r = 2.2$ e $\mu_r = 1$

m	n	$f_c(\text{GHz})$
1	0	21.08
2	0	42.15
3	0	63.23



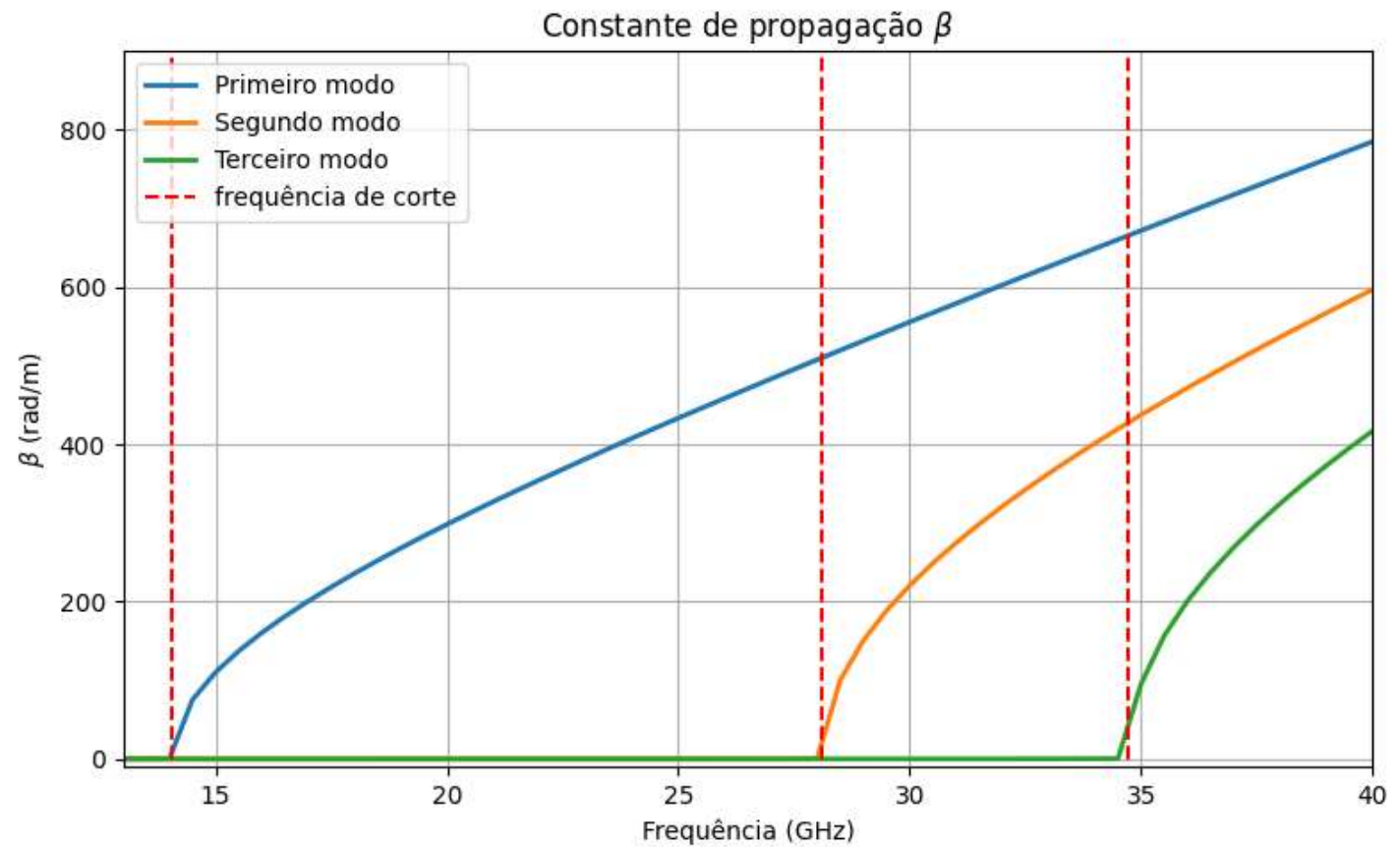
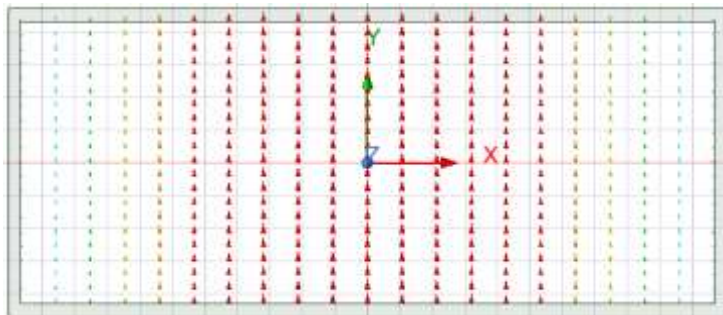
Guia retangular metálico oco



Guia retangular metálico oco

$a = 10.668\text{mm}$, $b = 4.31\text{mm}$,
 $\epsilon_r = 1$ e $\mu_r = 1$

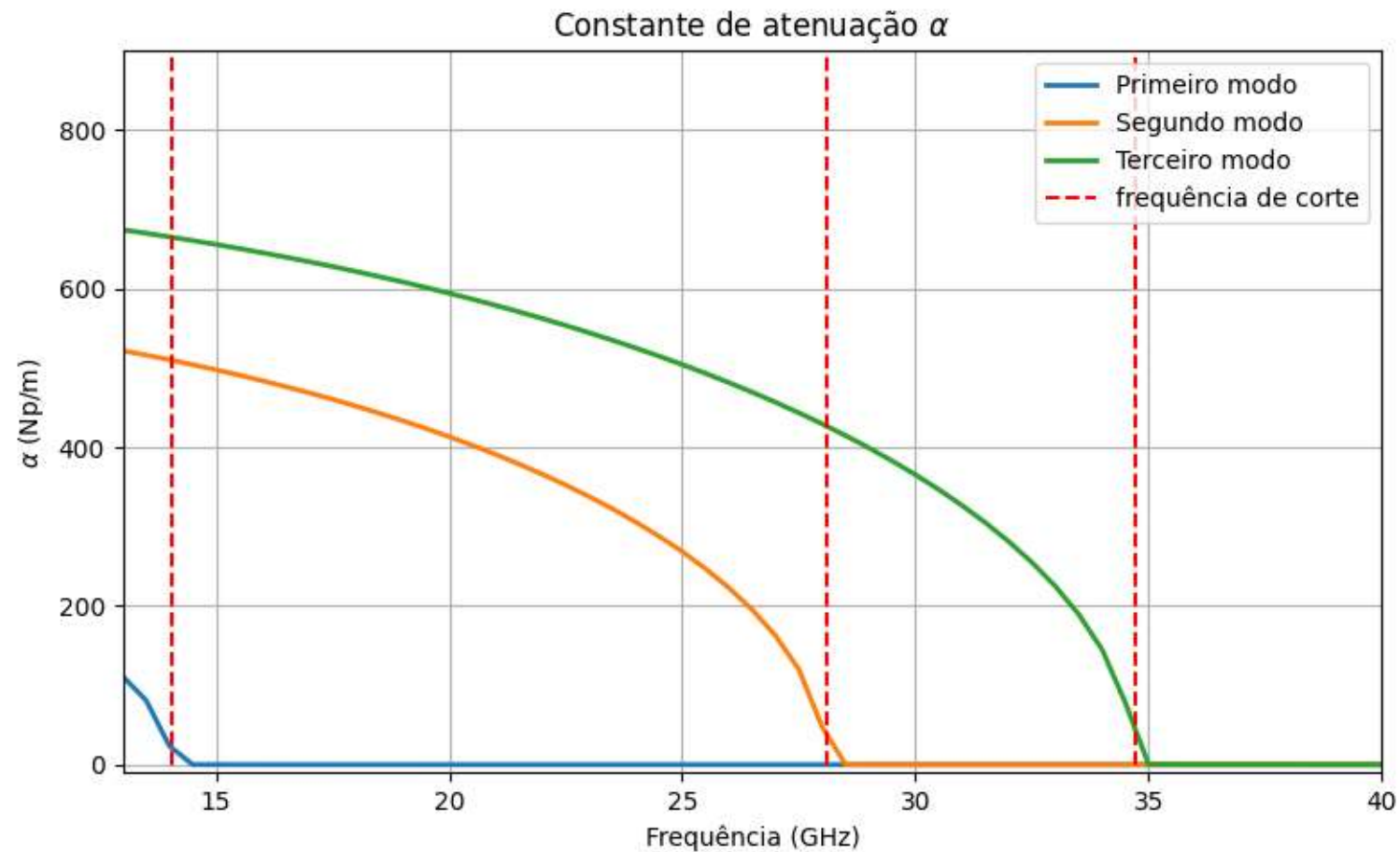
m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.10
0	1	34.71



Guia retangular metálico oco

$a = 10.668\text{mm}$, $b = 4.31\text{mm}$,
 $\epsilon_r = 1$ e $\mu_r = 1$

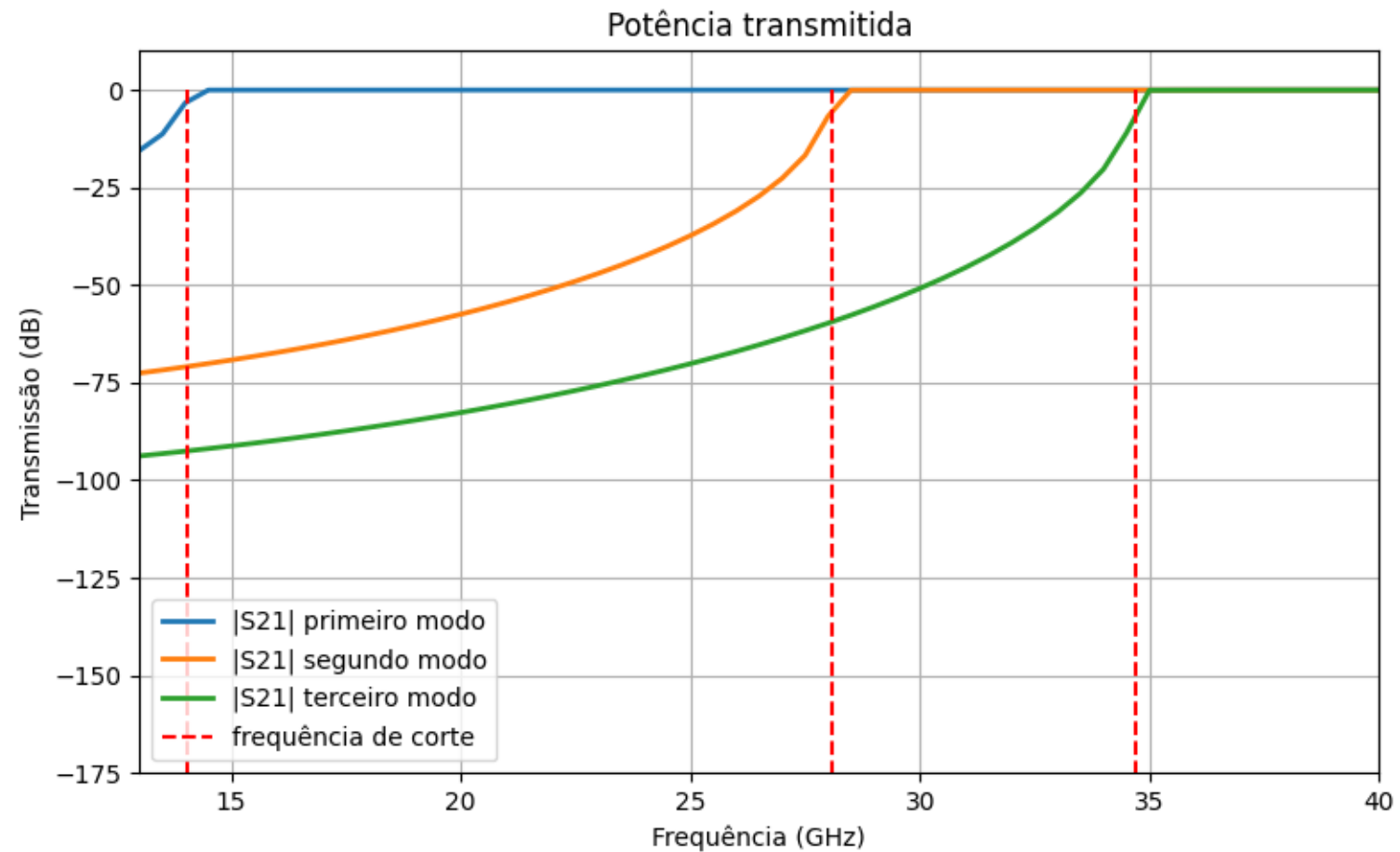
m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.10
0	1	34.71



Guia retangular metálico oco

$a = 10.668\text{mm}$, $b = 4.31\text{mm}$,
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1	0	14.05
2	0	28.10
0	1	34.71

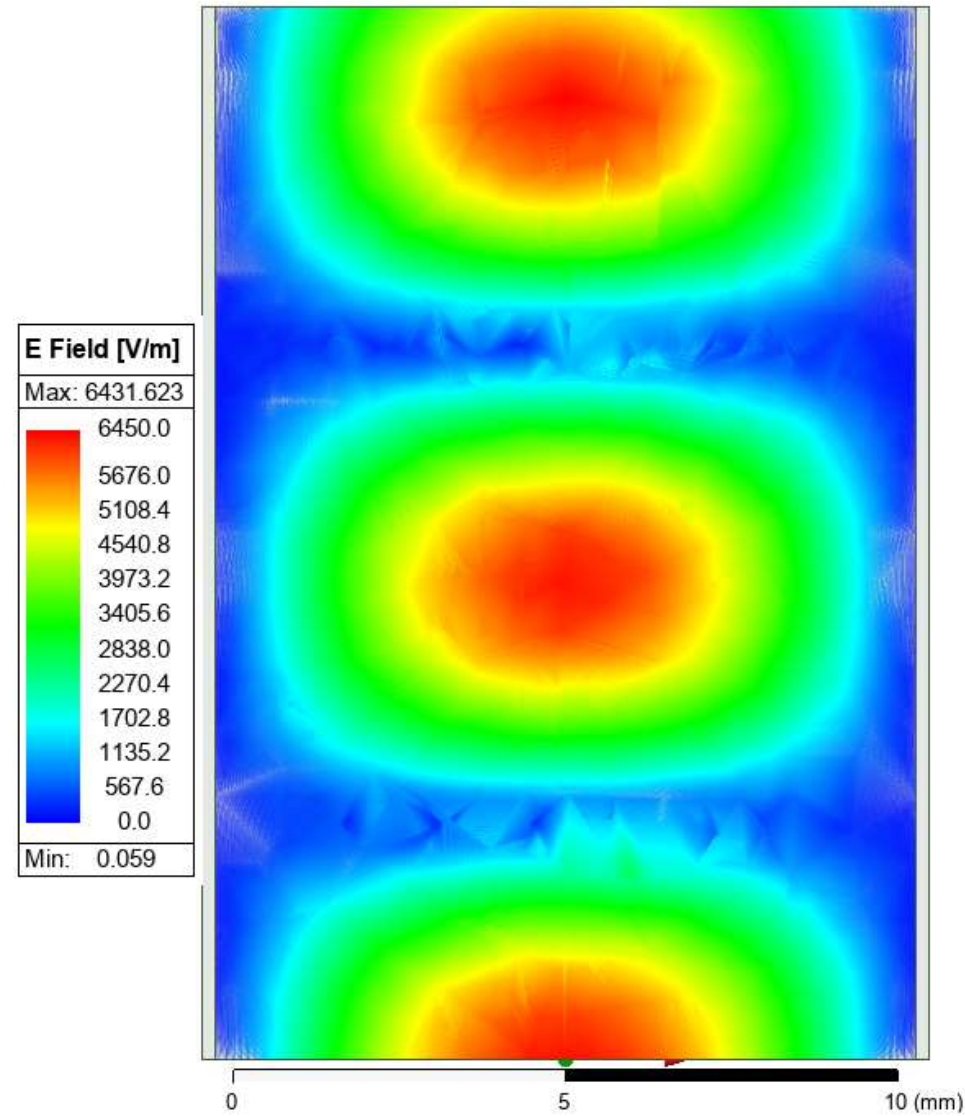


Guia retangular metálico oco

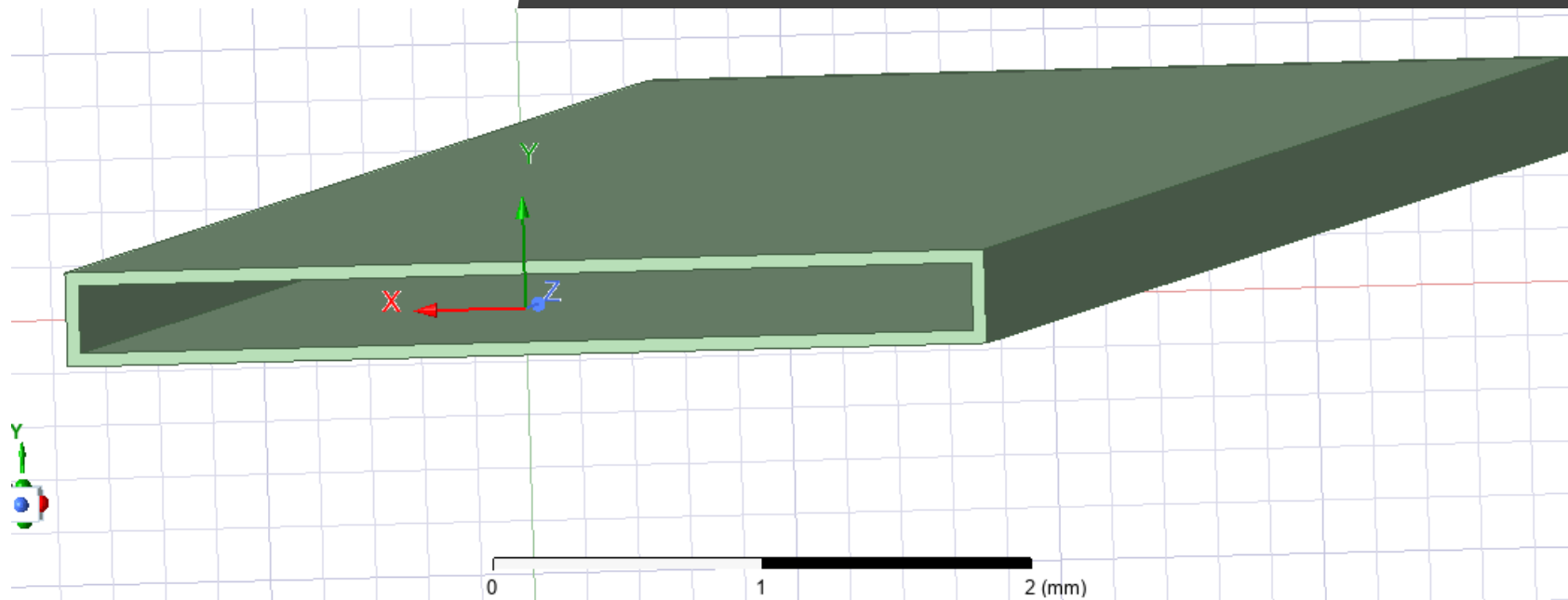
$a = 10.668\text{mm}$, $b = 4.31\text{mm}$,
 $\epsilon_r = 1$ e $\mu_r = 1$

$f = 25\text{GHz}$

m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.10
0	1	34.71



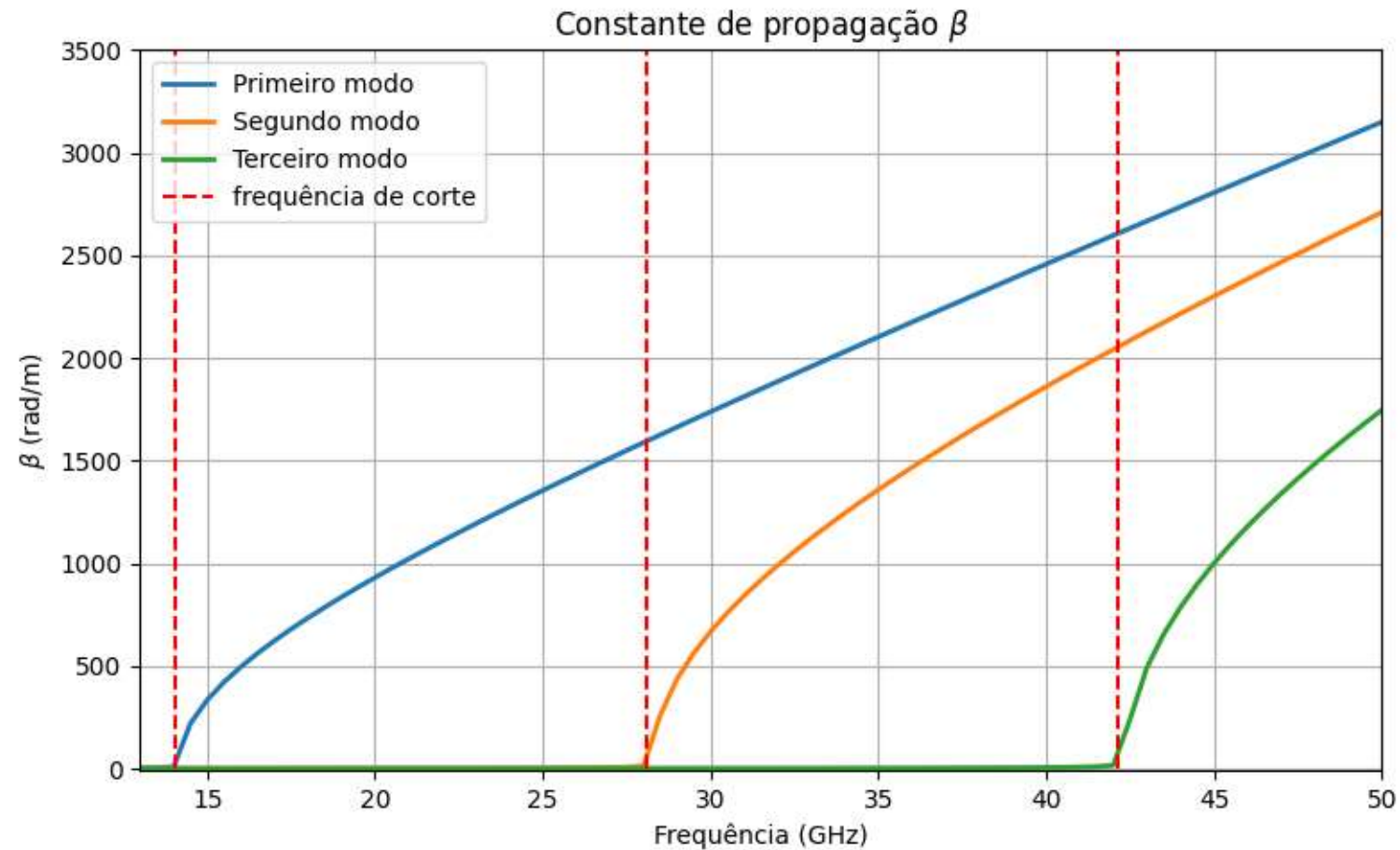
Guia retangular metálico com dielétrico



Guia retangular metálico com dielétrico

$a = 3.39\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

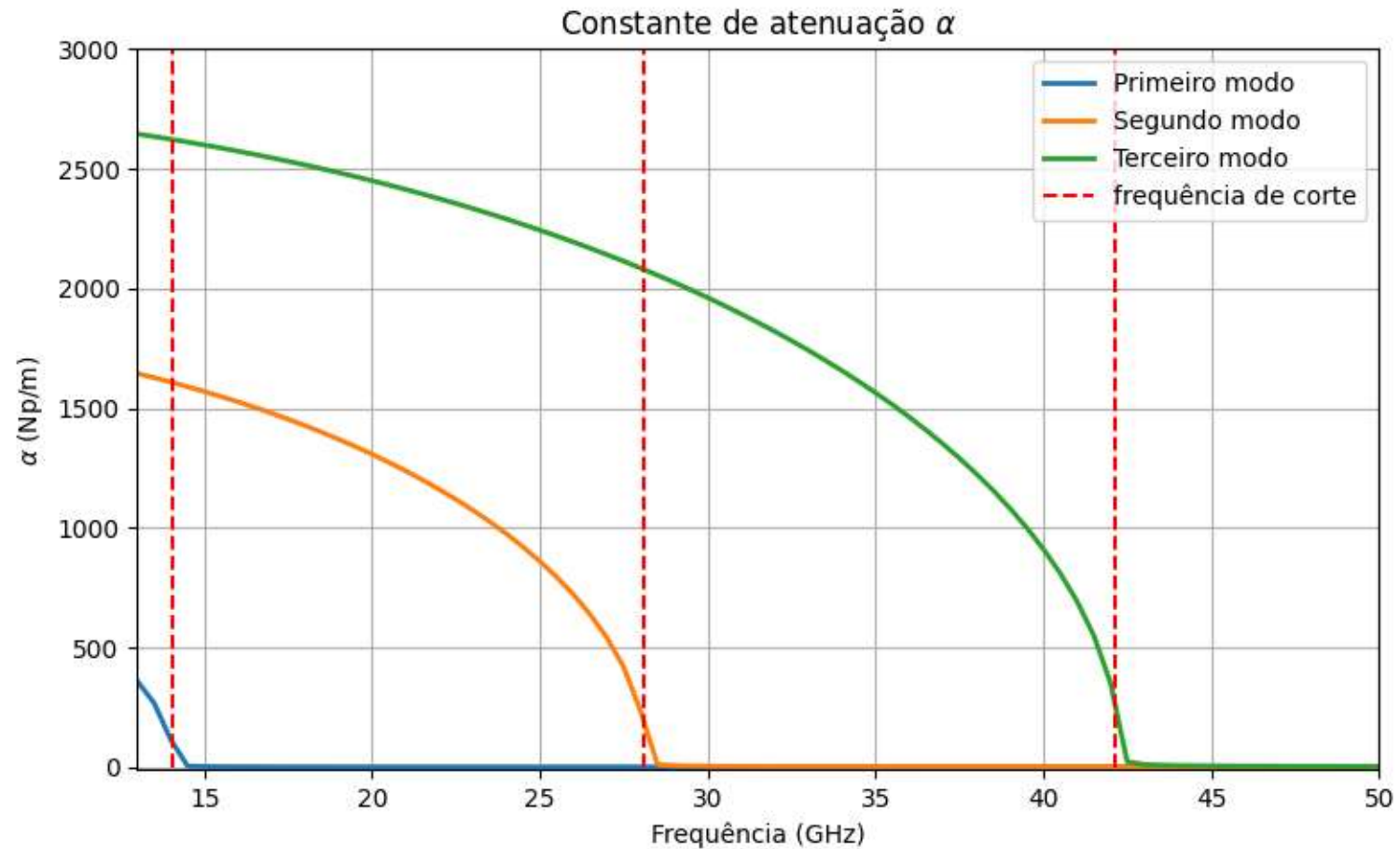
m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.11
3	0	42.16



Guia retangular metálico com dielétrico

$a = 3.39\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

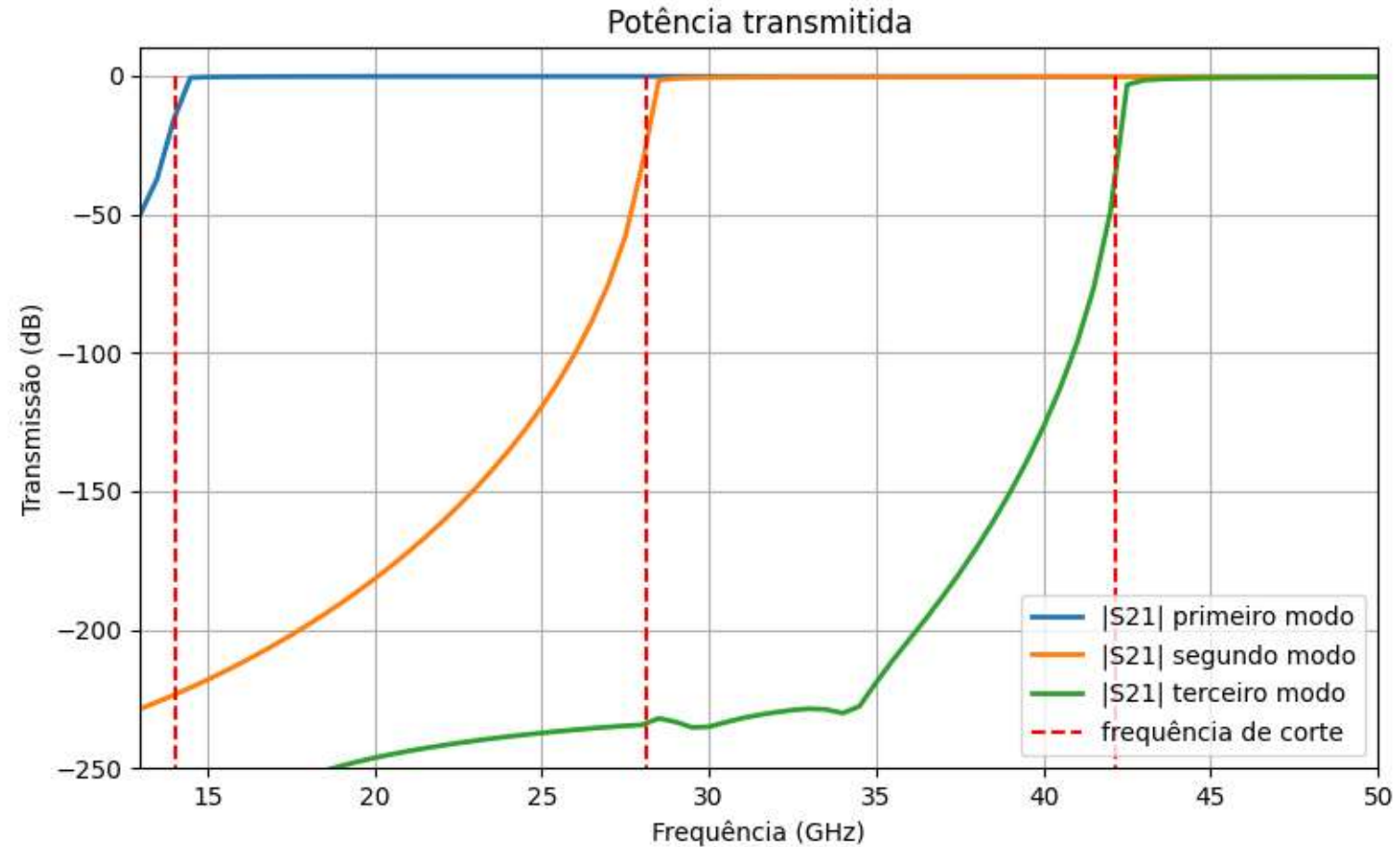
m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.11
3	0	42.16



Guia retangular metálico com dielétrico

$a = 3.39\text{mm}$, $b = 0.254\text{mm}$,
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1	0	14.05
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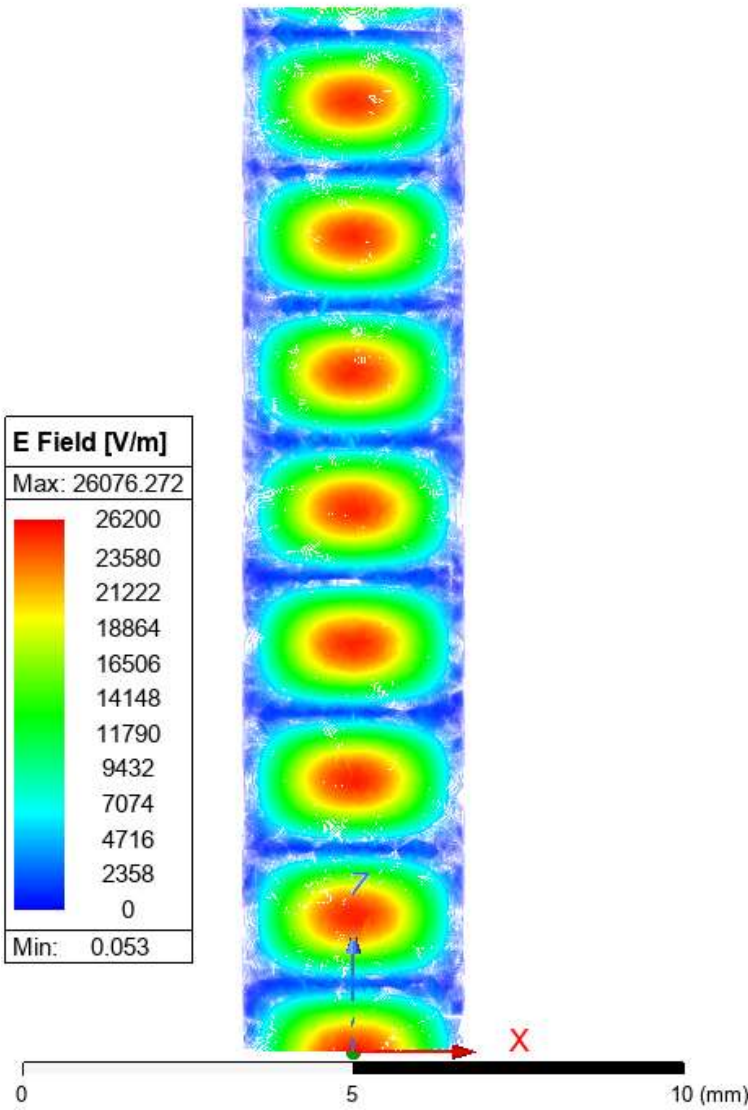
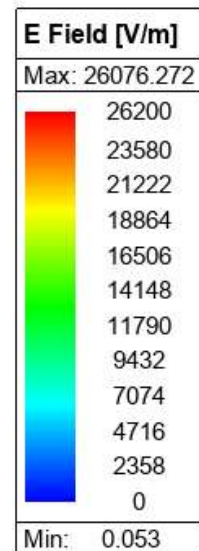


Guia retangular metálico com dielétrico

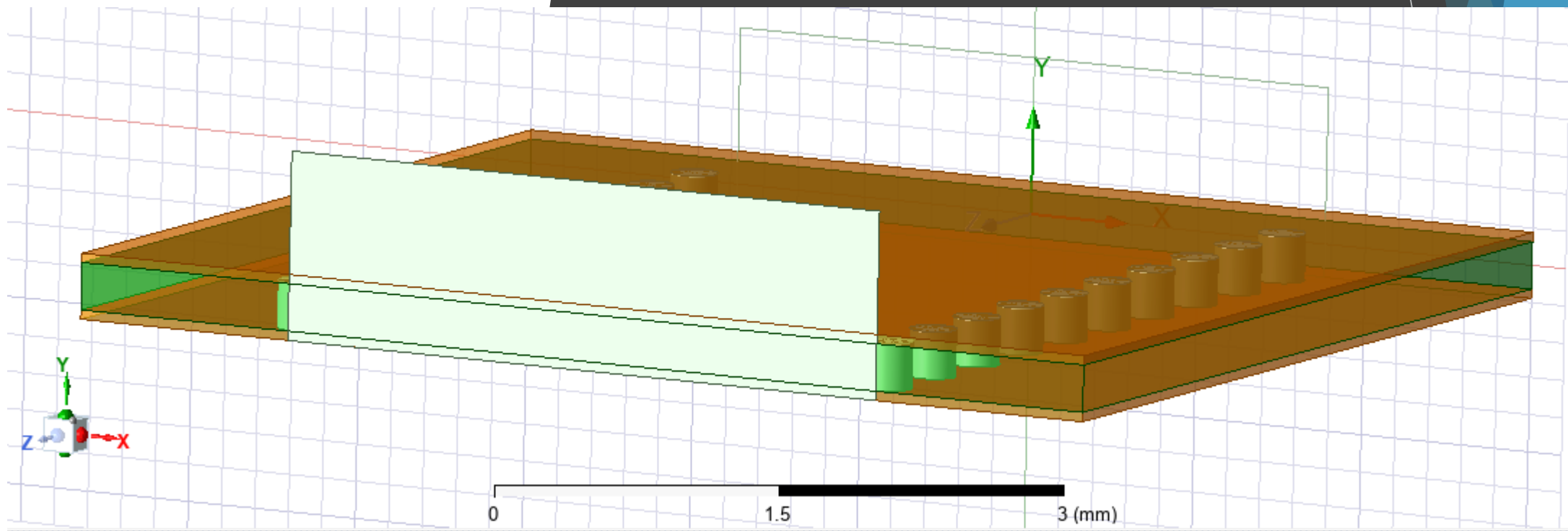
$a = 3.39\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

$f = 25\text{GHz}$

m	n	$f_c(\text{GHz})$
1	0	14.05
2	0	28.11
3	0	42.16



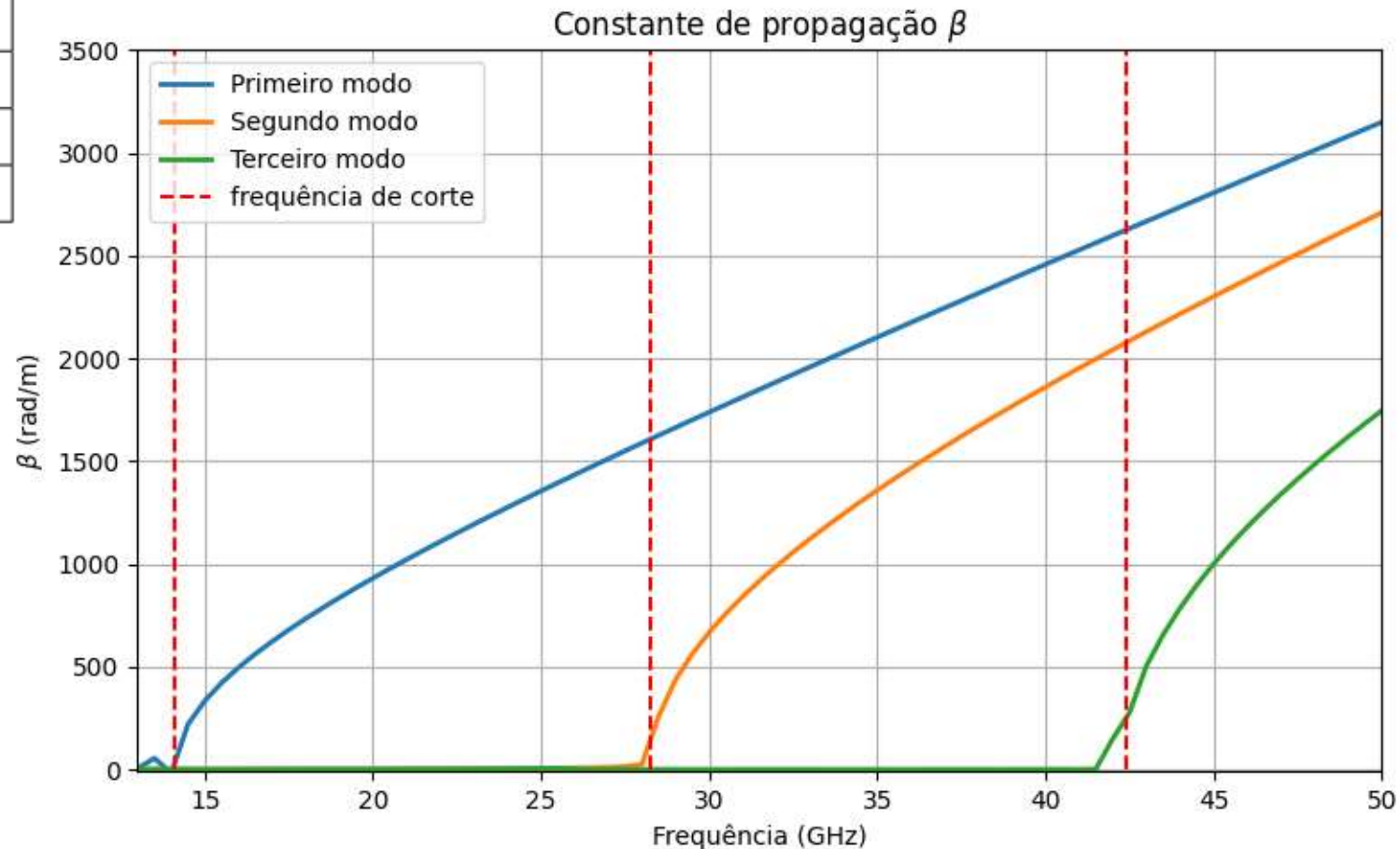
Guia com substrato integrado *SIW*



Guia com substrato integrado

$W_{siw} = 3.52\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

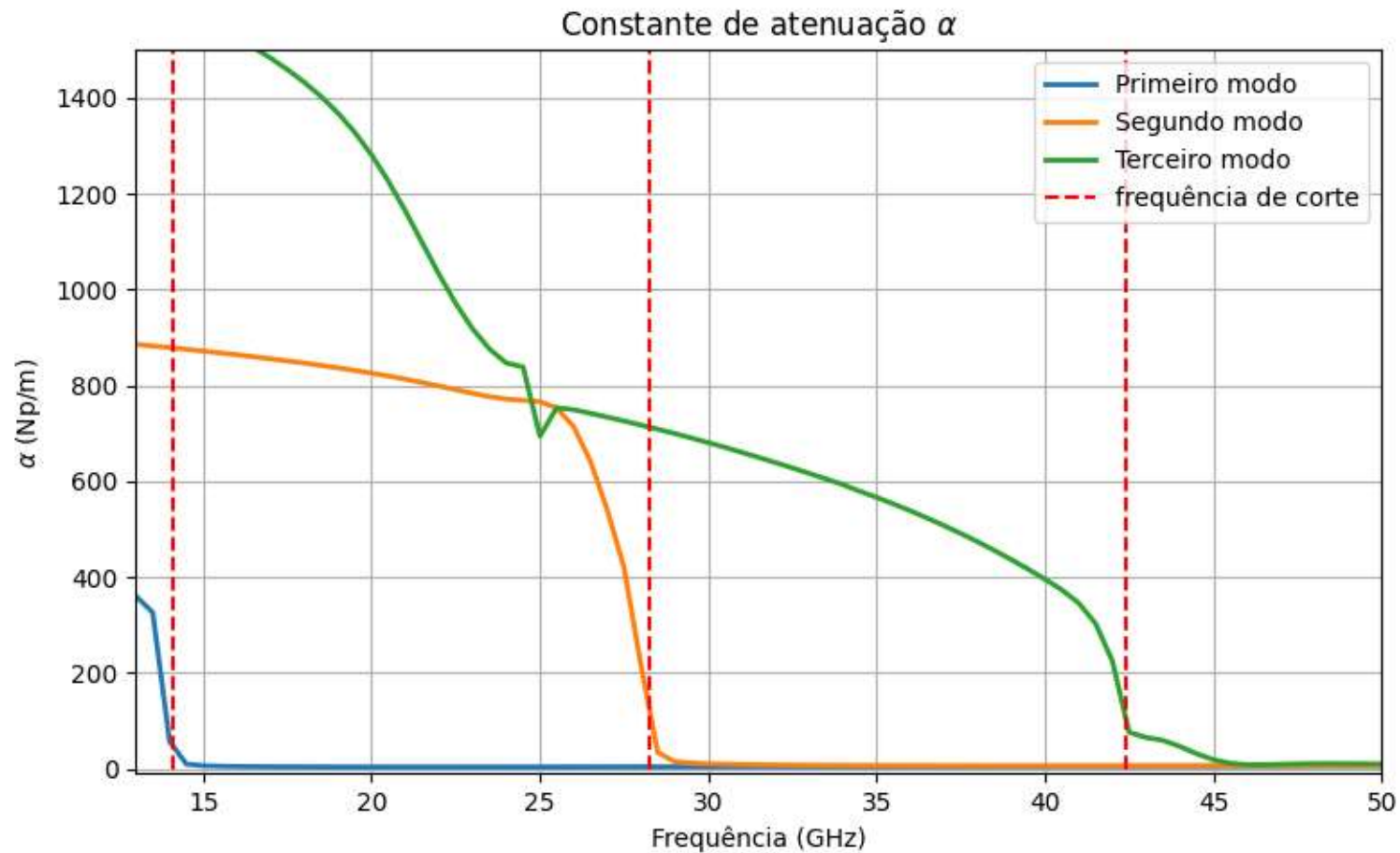
m	n	$f_c(\text{GHz})$
1	0	14.08
2	0	28.16
3	0	42.23



Guia com substrato integrado

$W_{siw} = 3.52\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

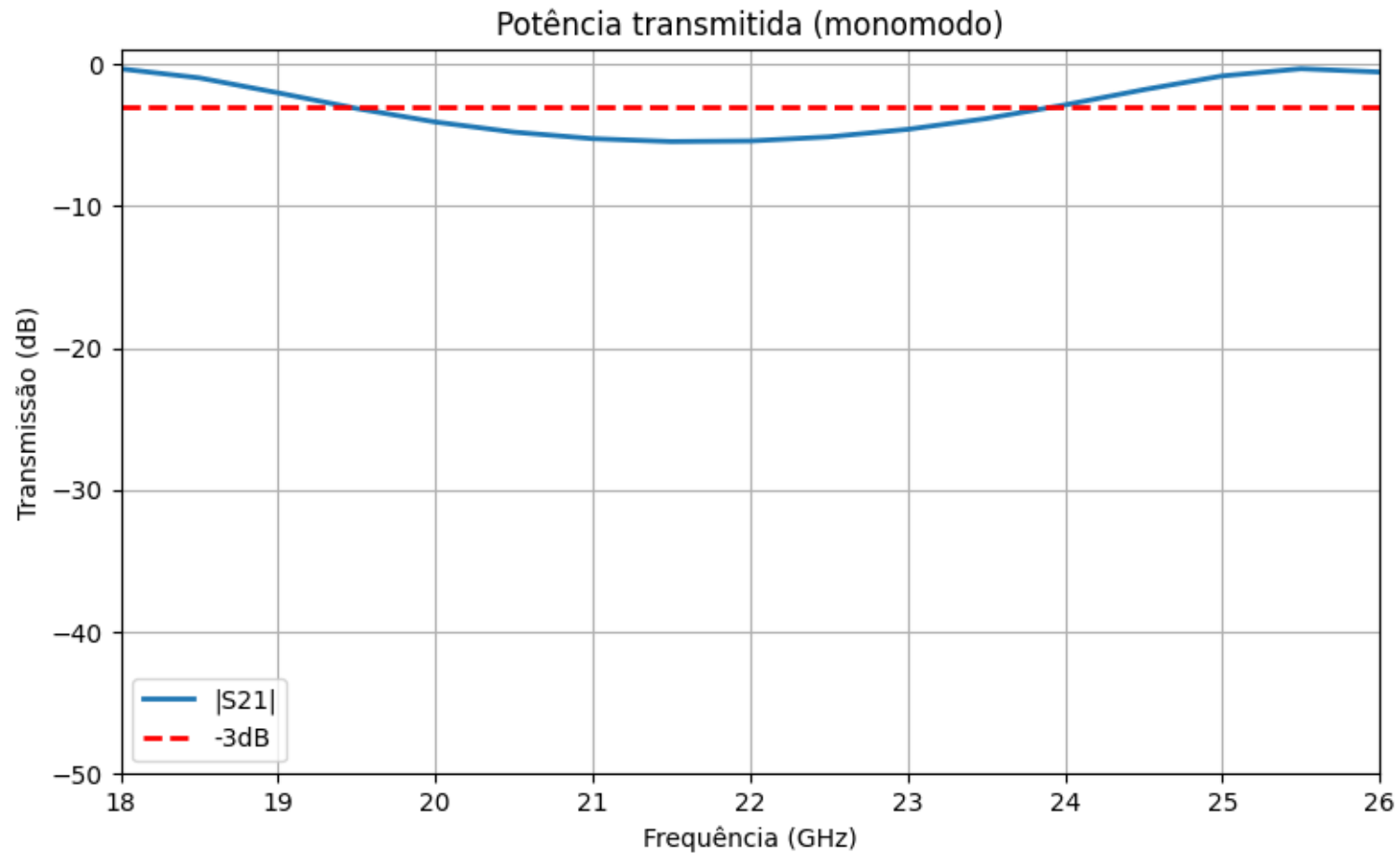
m	n	$f_c(\text{GHz})$
1	0	14.08
2	0	28.16
3	0	42.23



Guia com substrato integrado

$W_{siw} = 3.52\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

m	n	$f_c(\text{GHz})$
1	0	14.08
2	0	28.16
3	0	42.23

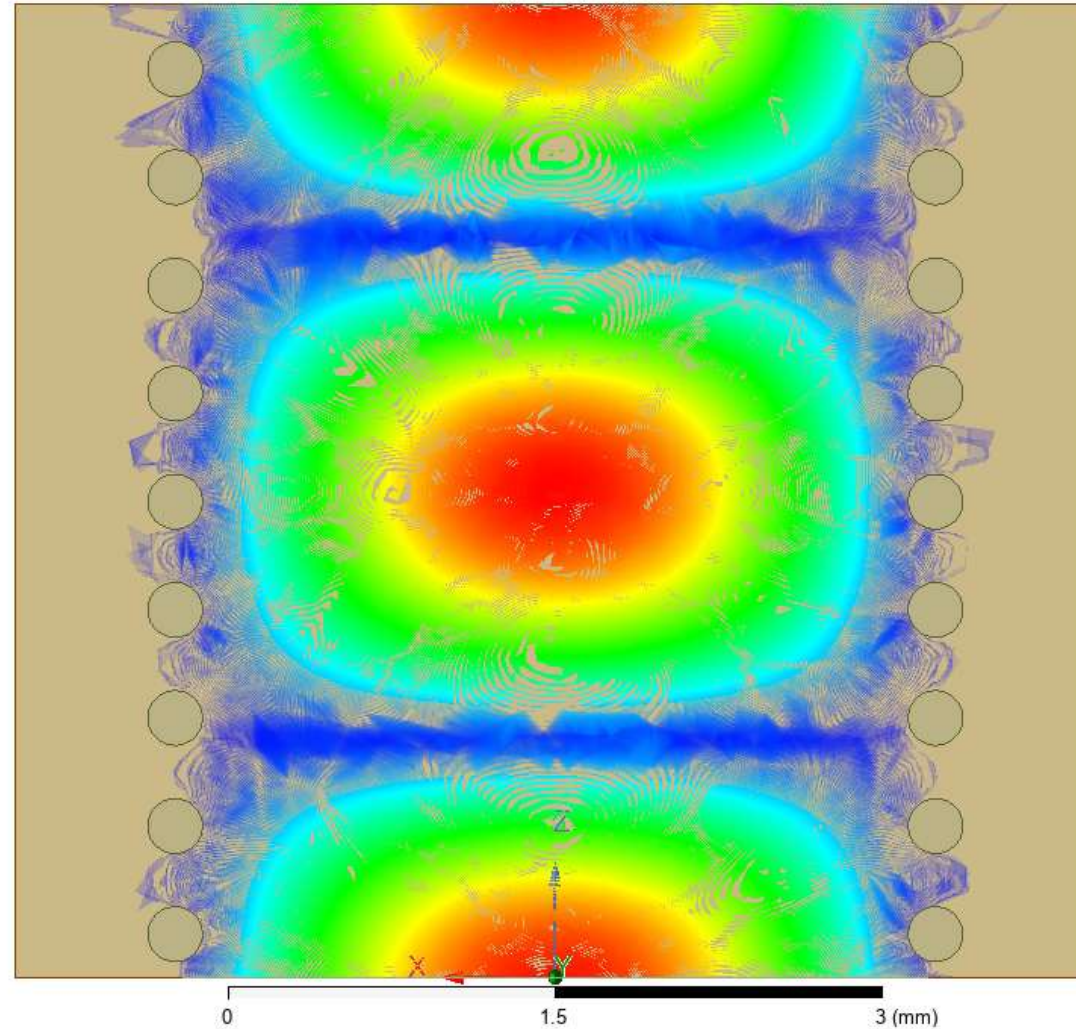
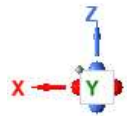
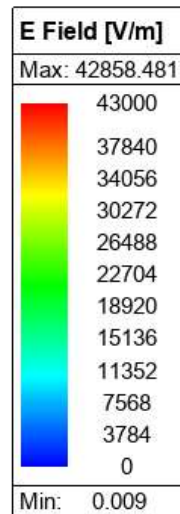


Guia com substrato integrado

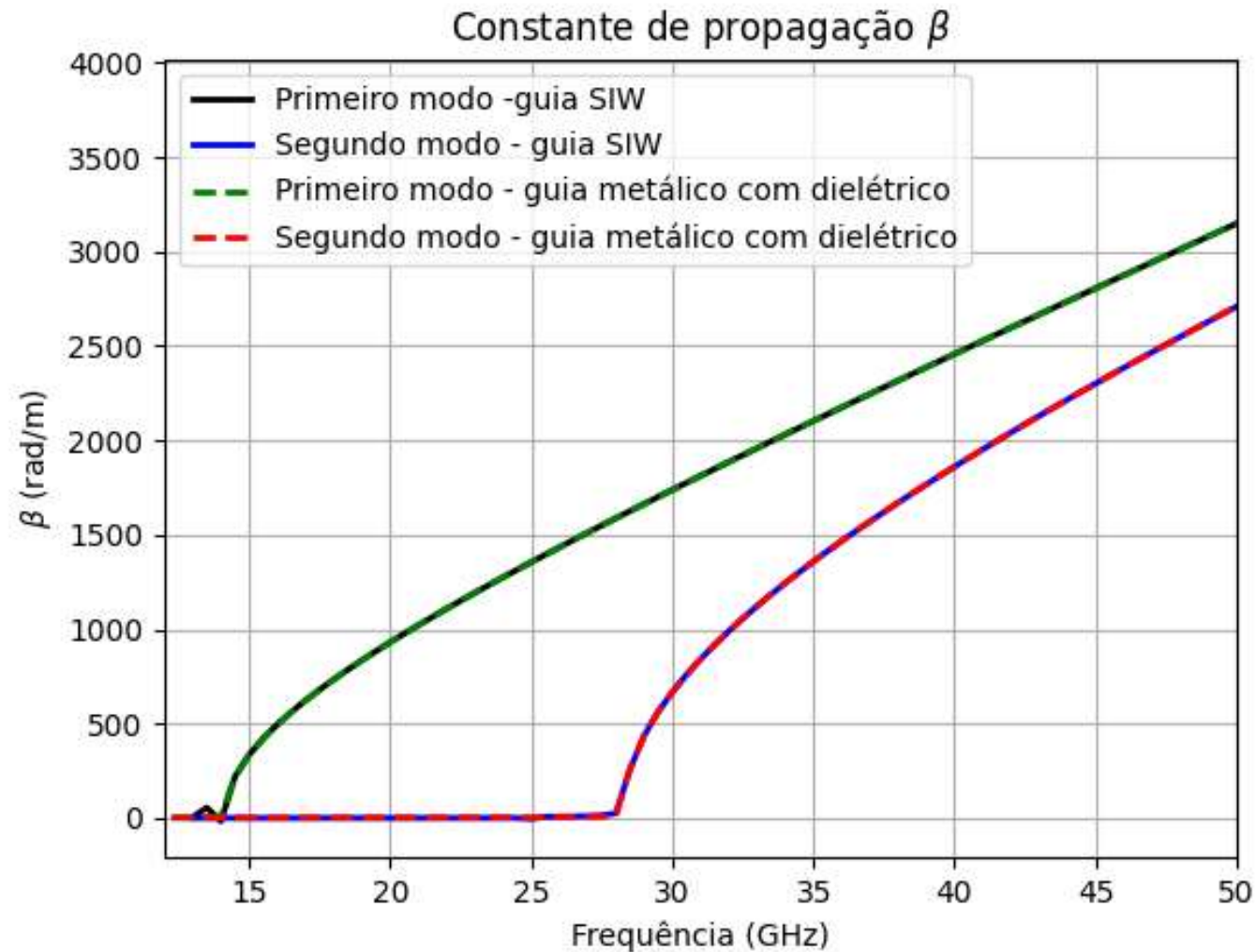
$W_{siw} = 3.52\text{mm}$, $b = 0.254\text{mm}$,
 $\epsilon_r = 9.9$ e $\mu_r = 1$

$f = 25\text{GHz}$

m	n	$f_c(\text{GHz})$
1	0	14.08
2	0	28.16
3	0	42.23



Comparação – metálico com dielétrico e *S/W*



Conclusão

- ▶ Validação da teoria;
- ▶ Compreensão dos parâmetros modais;
- ▶ Importância da metodologia;
- ▶ Compreensão dos modos refinada através de recursos computacionais.

Referências

- [1] M. Bozzi, A. Georgiadis, and K. Wu. Review of substrate-integrated waveguide circuits and antennas. IET Microwaves, Antennas & Propagation, 5(8):909-920, 2011. Special Issue on RF/Microwave Communication Subsystems for Emerging Wireless Technologies. Received: 15 Sep 2010, Revised: 6 Dec 2010.
- [2] Bouchra Rahali, Mohammed Feham, and Junwu Tao. Design of ka-band substrate integrated waveguide bend, power divider and circulator. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 5(7):44, December 2015. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). Retrieval Number: G2242125715/15©BEIESP.