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- - 2008». , 25-27 , 2008 . ;
- , 3-5 2008 . ;
- , 27-28 , 2009 . ;
- VII « , » . , 3-4 2009 . ;
- 19- « - -2009». , , 14-18 2009 . ;
- 39th European Microwave Conference. Rome, Italy, 29 September–1 October 2009;
- 18th International Conference on Microwaves, Radar and Wireless Communications “MIKON–2010”. Vilnius, Lithuania, June 14–16 2010;
- 20- « - -2010». , , , 13-17 2010 . ;
- , 2010. « » 02.513.11.3058, « - 2007–2012 » , « » ((-415.2009.8), (11.G34.31.0030). 5 . , 19 , ; 13 , 1 . , , , . 150 , 97 , 140 .

$$\mathbf{T} = \begin{pmatrix} T[1,1] & T[1,2] \\ T[2,1] & T[2,2] \end{pmatrix} = \mathbf{T}'_N \cdot \prod_{i=1}^{N-1} (\mathbf{T}''_{i,i+1} \cdot \mathbf{T}'_i), \quad (1)$$

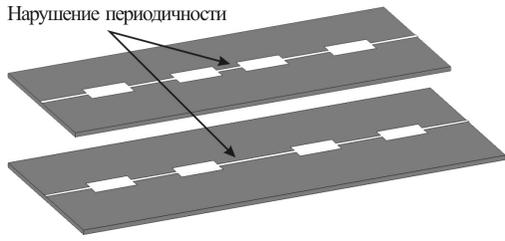
$$\mathbf{T}'_i = \begin{bmatrix} e^{\gamma_i d_i} & 0 \\ 0 & e^{-\gamma_i d_i} \end{bmatrix}, \quad (2) \quad \mathbf{T}''_{i,i+1} = \begin{bmatrix} (r_{i,i+1} + 1)/(2\sqrt{r_{i,i+1}}) & (r_{i,i+1} - 1)/(2\sqrt{r_{i,i+1}}) \\ (r_{i,i+1} - 1)/(2\sqrt{r_{i,i+1}}) & (r_{i,i+1} + 1)/(2\sqrt{r_{i,i+1}}) \end{bmatrix}. \quad (3)$$

$$\rho_i = 377 \cdot h_i / \left(\sqrt{\varepsilon_i} \cdot W_i \cdot \left(1 + 1,735 \cdot \varepsilon_i^{-0,0724} \cdot (W_i/h_i)^{-0,836} \right) \right) -$$

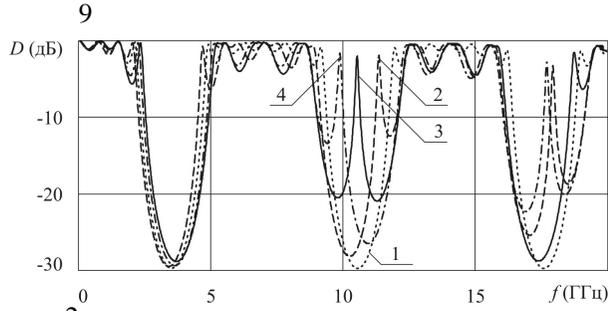
$$\mathbf{T}: \quad D = |T[1,1]|^{-2} \quad (4)$$

$$\varepsilon = 9,6 \quad 0,5 \quad 7,6$$

.2



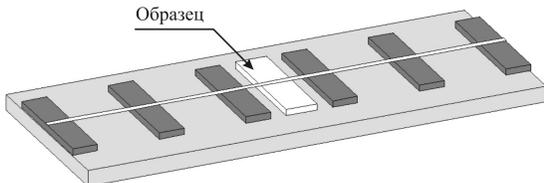
. 1.



. 2.

: 1 – 7,6 (),
 2 – 8,8 , 3 – 5,1 , 4 – 6,0

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 20 ,



. 3.

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 ($\epsilon = 9,6$)
 ($\epsilon = 1$).

$$\varepsilon = 6$$

$$S(\varepsilon) = \sum (D - D(f, \varepsilon))^2, \quad (5)$$

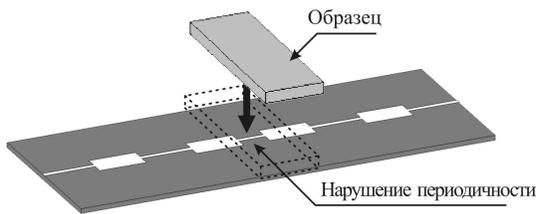
$$\frac{\partial S(\varepsilon)}{\partial \varepsilon} = \frac{\partial (\sum (D - D(f, \varepsilon))^2)}{\partial \varepsilon} = 0, \quad (6)$$

$$\pm 0,4 \quad \pm 0,1 \% (\pm 5) \quad \varepsilon = 6,0$$

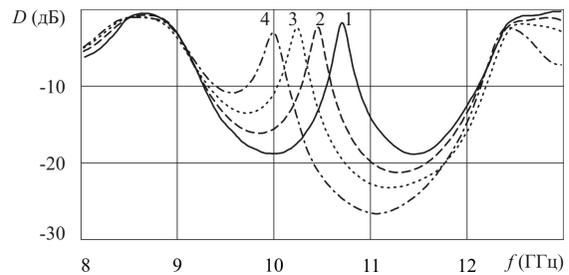
$$\pm 0,2 \%$$

(. . . 4).

AWR Microwave Office.



. 4.



. 5.

: 1 - $\varepsilon=1$ (), 2 - $\varepsilon=4$,
3 - $\varepsilon=7$, 4 - $\varepsilon=10$

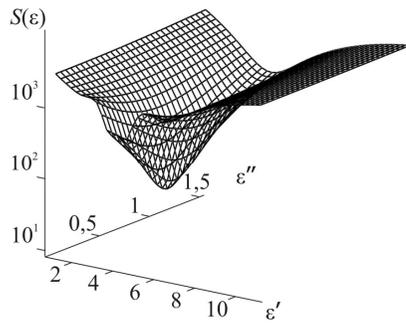
74 / .ε.

1
 (ε = 9,6)
 (ε = 1).
 32
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 ε = 9,6

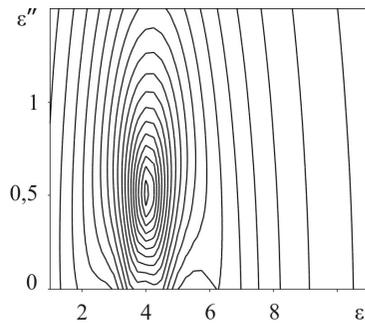
ε = 4 - j0,5, ± 0,1 % (± 5) ± 0,2

(5), . 6, S(ε), (ε', ε'', S(ε)),

ε = 4,002 - j0,494



(6).



. 6.

ε' ε'' ()
 ε = 4,002 - j0,494

ε = 40 - j6,0,

1 .

± 0,06 %,

± 1,24 %.

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(9–12)

ϵ .

. 6.

Agilent PNA-L Net-

work Analyzer N5230A 10 MHz–40 GHz.

$$\epsilon = \epsilon' - j \cdot \epsilon''$$

$D(f)$

(6),

$S(\epsilon)$

(5).

$$f = f$$

. 7

()

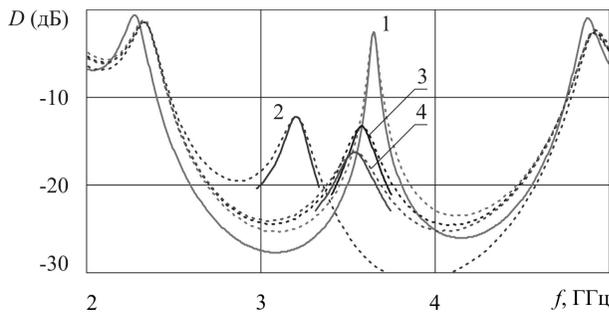
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(4)

(6).

$\epsilon = \epsilon$,



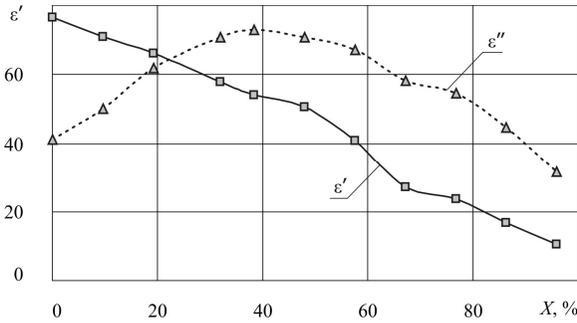
. 7. ()

(1)

: 2– , 4–

$$f = f$$

0% () 96%.



X

76,6 10,5.

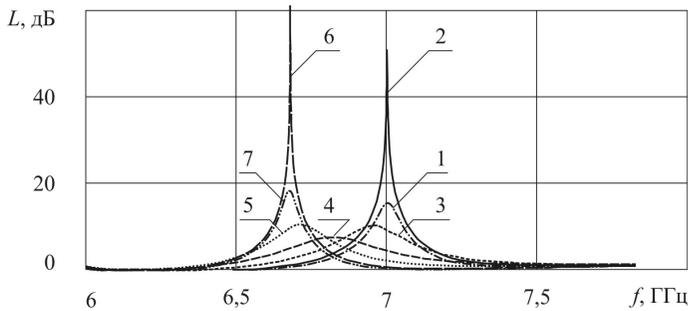
~ 40%.

p-i-n-

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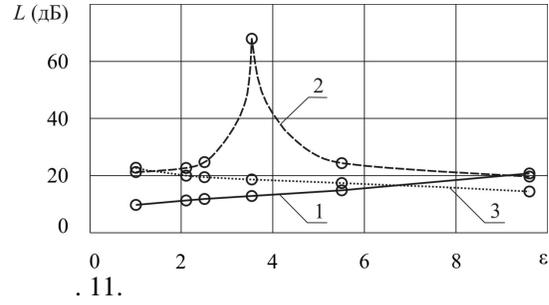
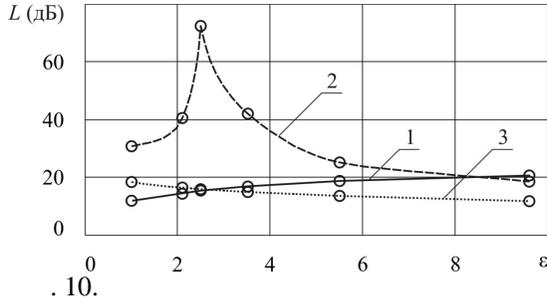
. 9.

p-i-n-

I:

1 - 0,2 - 0,45 , 3 - 0,2 ,
4 - 0,5 , 5 - 1,2 , 6 - 6,4 ,
7 - 200

p-i-n-



$f = 5,35$
 : 1 - $I = 0,4$, 2 - $I = 0,641$,
 3 - $I = 1$

$f = 5,33$
 : 1 - $I = 0,5$, 2 - $I = 0,69$,
 3 - $I = 1,2$

. 10 11

$f = 5,35$

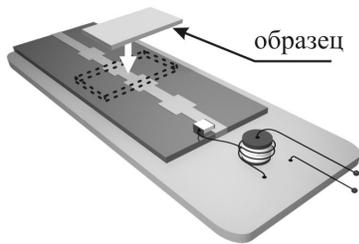
$f = 5,33$

ε (. . 10 11, 1),
 ε (2)

3).

$p-i-n-$

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$p-i-n-$

$p-i-n-$

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3,2 0 96 %
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p-i-n-

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