Mathematical Model for Study Characteristics of Ultra-High Frequency Selective Electromagnetic Shields Based on Circular Helical Elements

Boiprav O. [1],

Bogush V. A.[1],

Abdaljlil S. A.,

Zerek A.

2023

[1]Belarusian State University of Informatics and Radioelectronics, 6 P. Brovki Street, Minsk 220013 Belarus

Keywords: capacitance, electromagnetic radiation, frequency selective, inductance, electromagnetic shield, helical element, ultra-high frequency.

Abstract: The mathematical model for determining the minimum points of the electromagnetic radiation transmission characteristics of ultra-high frequency selective electromagnetic shields based on circular spiral elements has been proposed and substantiated. The indicated points are the resonant frequencies of these shields. The proposed model is based on the following conditions: 1) equivalents of the circular helical elements are flat inductors; 2) the number of turns in circular helical elements is 2; 3) the ratio of the thickness of the conductor, on the basis of which the circular helical elements are made, to the sum of the thickness of this conductor and the distance between the turns of the indicated elements is 1/6; 4) the thickness of the conductor used to form the circular helical elements is 0.05 of the length of the electromagnetic wave at the resonant frequency; 4) equivalents of the gaps between

circular spiral elements are capacitors; 5) the width of the gaps between the circular helical elements is no more, than 0.4 of the length of the electromagnetic wave at the resonant frequency. Using the proposed model, the regularity of change of the resonant frequency values of ultra-high frequency selective electromagnetic shields depending on the diameter of the first turn of the circular helical elements, on the basis of which these shields made, have been obtained. In accordance to this regularity the resonant frequency values of ultra-high frequency selective electromagnetic shields changes corresponding to the inverse exponential law in the range [0.75 GHz; 0.5 GHz], if the diameter of the first turn of the circular helical elements, on the basis of which these shields made, changes in the range [0.015 m; 0.0825 m]. This regularity can be used in practice at the design stage of ultra-high frequency selective electromagnetic shields with the required resonant frequencies.

Mathematical Model for Study Characteristics of Ultra-High Frequency Selective Electromagnetic Shields Based on Circular Helical Elements / O. Boiprav [et al.] // IEEE AFRICON : conference materials, Nairobi, Kenya, September 20-23, 2023 / Institute of Electrical and Electronics Engineers. – USA, 2023. – P. 1–6.