CARBON MICROWAVE ELEMENTS[1]

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The expansion of the scope of application of microwave devices not only in special, but also in household electronic equipment has led to the need to manufacture cheaper and lighter devices, including through the use of a technology for creating carbon-containing materials new for microwave technology [1,2]. At the same time, the question of methods and approaches to determining the complex parameters of these microwave devices remained relevant.

The paper reports on the results of a study of the frequency characteristics of microwave elements under pulsed exposure: two-port strip transmission lines based on carbon fiber (Fig. 1); horn antenna manufactured using additive 3D technology with metallization of the structure over the carbon sublayer (Fig. 2). Frequency characteristics were measured on the basis of the TsKP “Impulse” TUCSR and JSC “NPF“ Mikran ”using a nonlinear reflectometer and an automated measuring system using an anechoic chamber.

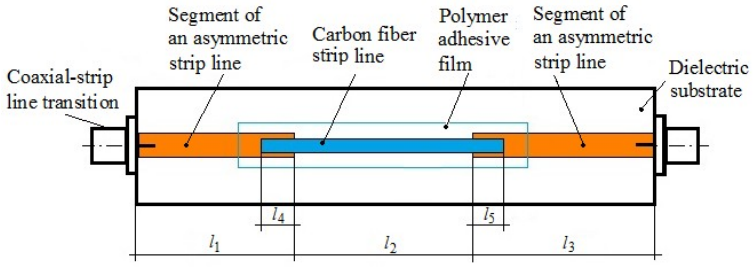

Fig.1. The segment of the strip transmission line based carbon fiber embedded into the interruption of the asymmetric strip line on the dielectric.

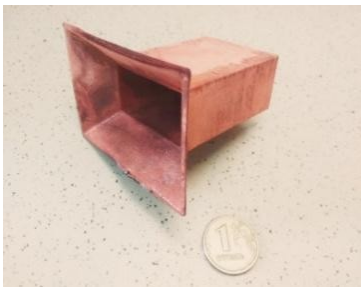

Fig.2. The appearance of carbon antennas

The frequency dependences of the transmission S 21 (f) coefficient of the carbon strip line segment are shown in Fig. 3. The frequency dependence of the SWR antenna measured under the influence of a pulse with a front of 40 ps is shown in Fig. 4. The antenna radiation pattern was measured at frequencies from 4 GHz to 8.5 GHz, in Fig. 5 shows a diagram at a frequency of 8.5 GHz.

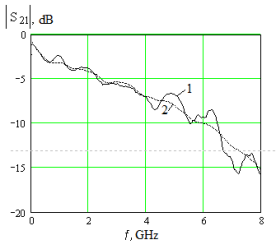

Fig.3.Frequency dependences of the insertion loss of the asymmetric strip line with an insert in the form of a CF-based strip line, with a width of the strip W=1,7 mm and a length l=62 mm: 1 – experimental; 2 – calculated

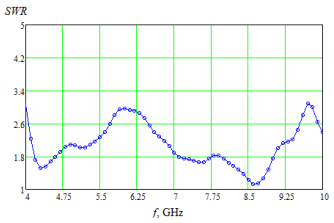

Fig.4.Frequency dependence of the SWR of a horn antenna manufactured using additive 3D technology

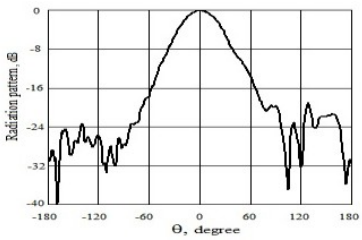

Fig.5.Radiation pattern of 3D printed antenna.

The measurement of the strip line parameters showed a satisfactory agreement between the experimental and theoretically calculated transmission coefficients (Fig. 3). Fig. 4 shows that the operating frequency of the antenna is 8.5 GHz. It is shown that measuring the characteristics of the antenna under pulsed exposure allows us to calculate the frequency characteristics (SWR and transmission coefficient) of elements of microwave devices made with the use of technology for creating composite carbon-containing materials.

REFERENCES

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