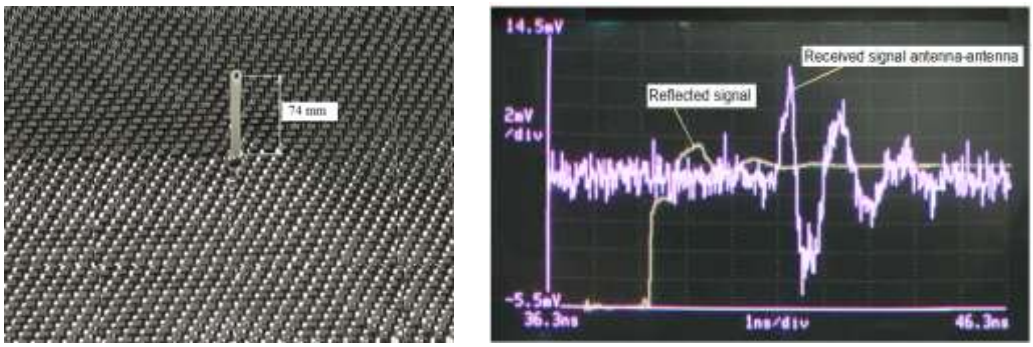
PULSE AND FREQUENCY CHARACTERISTICS OF MICROWAVE ANTENNA BASED ON CARBON FIBERS*

V.N. FEDOROV[1,2], N.D. MALYUTIN[2]
[1]*North-Eastern Federal University, Yakutsk, Russia*
[2]*Tomsk State University of Control Systems and Radioelectronics (TUSUR), Tomsk, Russia*

Carbon fibers make it possible to design various microwave elements due to the unique electrical and mechanical characteristics [1, 2]. Strip transmission lines based on carbon fibers were studied in [3] and the experimental results of researching the pulse and frequency characteristics of carbon strip lines were presented. Authors these and others works have shown the applicability of carbon fibers for design of the strip transmission lines.

In this paper, we examined the characteristics of "Ground Plane" type carbon antennas and presented their experimental pulse and frequency characteristics in the near field zone. The view of carbon fiber based antennas is shown in fig. 1a. The antenna itself is placed in a plastic tube. The antennas were excited by a pulse in the form of a voltage step with a front of about 40 ps. The measurements were performed in the time domain on a double-beam stroboscopic memory oscilloscope Tektronix 11801B. Fig. 1b shows the voltage at the input of the emitting carbon antenna with highlighting the reflected signal, and the amplified voltage at the output of the receiving antenna is shown in blue.



a) b)

Fig.1. Carbon antenna design with carbon base (a), voltages at the input of the receiving carbon antenna (blue color) and at the output of the radiating antenna (b) with highlighting the reflected signal.

The transition to the frequency domain is performed using the Fourier transform. The frequency dependences of the coefficients S_{11}, S_{21} scattering matrix are obtained. The effect on the transfer characteristics of the antennas was studied when replacing a metal base with a carbon base, as well as changing the carbon emitting element to copper. The frequency characteristics are studied by the classical method using a vector network analyzer.

It is shown that the impulse and frequency characteristics of carbon antennas obtained by two methods are well comparable. The placement of antennas above the surface of carbon materials leads to an increase in their broadband and in losses. The obtained results of the antenna's response to pulsed action make it possible to predict the electromagnetic radiation of structural elements from carbon materials, as well as the emission of metal elements over carbon surfaces.

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