

RADIATION OF HIGH-POWER LINEARLY POLARIZED ULTRAWIDEBAND PULSES OF SUBNANOSECOND DURATION BY A HYBRID ANTENNA *

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A high-power source of ultrawideband (UWB) radiation with a hybrid antenna has been developed. The hybrid antenna is an offset reflector, in the focus of which there is an antenna array-feeder. The elements of the antenna array are combined antennas designed to be excited by bipolar pulses with a duration of 0.5 ns. The transverse dimensions of the antennas are $65 \times 60 \text{ mm}^2$. The choice of the position of the antennas in the array based on numerical calculations is justified in the paper [1]. Figure 1 shows the position of the antennas in the array-feeder. The antennas are oriented the same way and have linear vertical polarization. The modes of operation of the hybrid antenna are implemented when the elements of the antenna array are synchronously excited by bipolar voltage pulses and when the elements of the array are excited with a time delay of 1 ns between pulses — the mode of the wave beam scanning. The combined antennas used in the work and their characteristics are given in the paper [2].

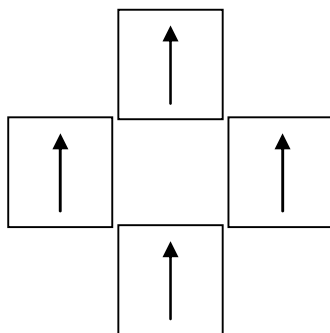


Fig.1. Position of antenna elements in the array-feeder.

Studies of radiation characteristics of a hybrid antenna at low and high voltages pulses have been carried out. Measurements at a low voltage level were carried out using a low-voltage bipolar pulse generator. The directivity characteristics of the hybrid antenna were measured in different operating modes. Measurements at high voltage were carried out using a four-channel generator of bipolar voltage pulses, which allows applying pulses with an amplitude of up to 65 kV to the input of each antenna element at a repetition rate of up to 100 Hz. In the mode of synchronous excitation of the array-feeder elements, high-power pulses of UWB radiation of a hybrid antenna were obtained. The product of the peak electric field strength at a distance (4.5 m) was at least 500 kV and at least 200 kV in the mode of discrete scanning by a wave beam with a time delay of 1 ns between high-voltage bipolar pulses at the pulse repetition frequencies up to 100 Hz.

REFERENCES

- [1] Yu.I. Buyanov, E.V. Balzovsky, V.I. Koshelev, E.S. Nekrasov, "Radiation characteristics of an offset reflector antenna excited by a combined antenna array," *Rus. Phys. J.*, vol. 62, no. 7, pp. 1214–1219, July 2019.
- [2] E. Balzovsky, Y. Buyanov, V. Koshelev, E. Nekrasov, "Compact combined antenna for high-power ultrawideband radiation sources with subnanosecond pulse duration," *Microw. Opt. Technol. Lett.*, vol. 63, pp. 2866–2869, July 2021.

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