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## PLASMA ANTENNA-FEEDER DEVICES, SYSTEMS AND METASURFACES \*)

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The use of an ionized medium for transmitting and receiving electromagnetic waves dates back to experiments with a dipole and spark emitter conducted by G.R. Hertz in 1888. Although the concept of using an ionized medium (plasma) as an antenna was patented by J. Hettinger in the USA in 1919 (1917 application) [1], active research on plasma antenna-feeder devices was started at the end of the XX century [2-4]. Plasma in such devices can be used as a conductive element, as well as as a control element. If earlier the term "plasma antenna" included all devices using ionized gas (plasma) in telecommunication systems, now they include semiconductor devices with a variable concentration of charge carriers (solid-state plasma).

The main advantages of such antennas over traditional metal antennas are the ability to quickly turn on/off (low radar visibility) and electronically change parameters on a millisecond time scale: shape, frequency, radiation pattern and gain. The electrical control of the parameters and characteristics of the plasma antenna is carried out by changing the plasma parameters (concentration, collision frequency, length of the plasma column). Plasma is particularly appealing for the development of antenna arrays, which enable rapid beam control at a reduced cost compared to phased arrays.

Paper presents the physical foundations of the operation of plasma antenna-feeder devices, as well as the classification of types of plasma antennas and the features of their operation. Antennas and systems created in an open space, using gas-discharge tubes and semiconductor plasma antenna elements, are considered. The basic methods of creating, measuring and modeling this plasma in antenna devices and systems are described. Special attention in the review is paid to the issue of the influence of plasma sources and the heterogeneity of plasma parameters on the characteristics of plasma antenna-feeder devices. Promising areas of research of plasma antenna-feeder devices, including metasurfaces, are also considered.

## References

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