№110 A system with a fiber-optic communication line for measuring the parameters of active phased antenna arrays in the far zone in landfill conditions

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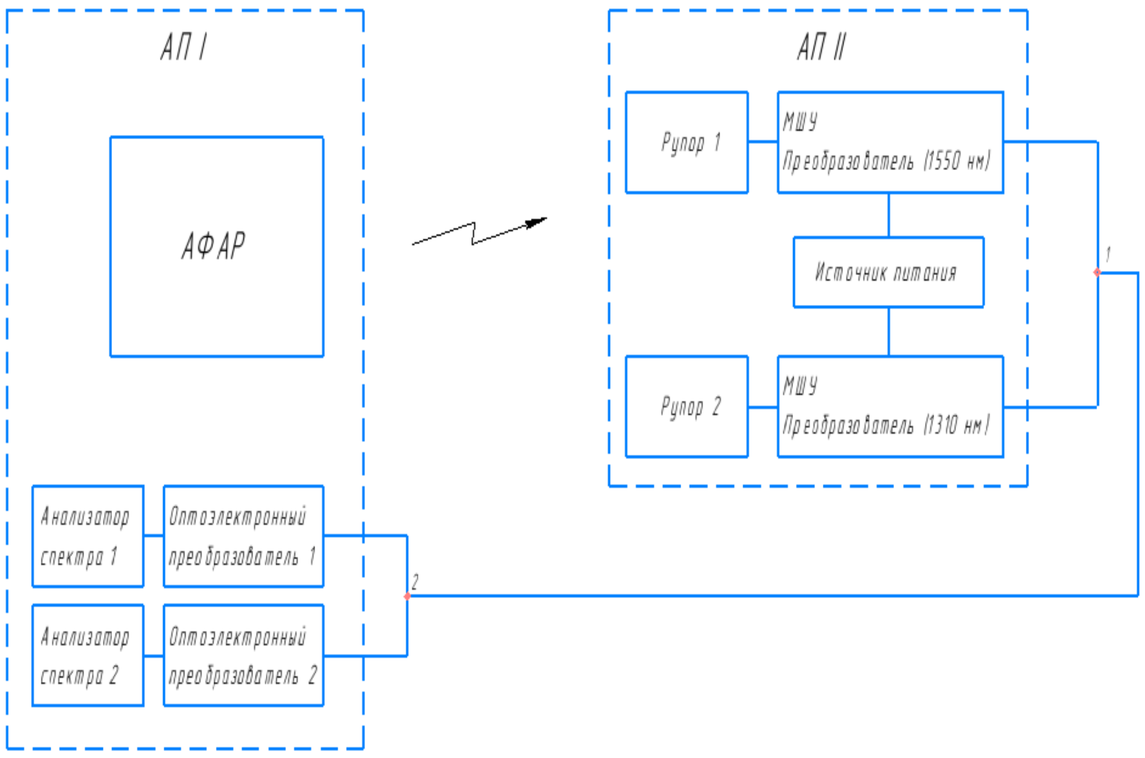
Introduction

One of the most difficult tasks of testing antennas is to set up various radar antenna systems in an enterprise environment. The greatest difficulties arise when setting up an air-based radar with APAA operating in review mode. In this mode, the accuracy of determining the radiation pattern is very important, especially in the far zone, which corresponds to a distance of more than 300 m. This creates big problems when setting up and testing the antenna in an anechoic chamber at the enterprise. Therefore, field tests are necessary. In the conditions of the polygon, the amount of interference of various kinds can be very large, which will lead to signal distortion and errors in the antenna setup. One of the solutions to this problem is the use of fiber-optic communication lines.

Desing of fiber-optic information transmition system

Figure 1 shows a block diagram of a system for measuring APAA parameters in the far zone in the “on transmission” mode.



Block diagram of the system.

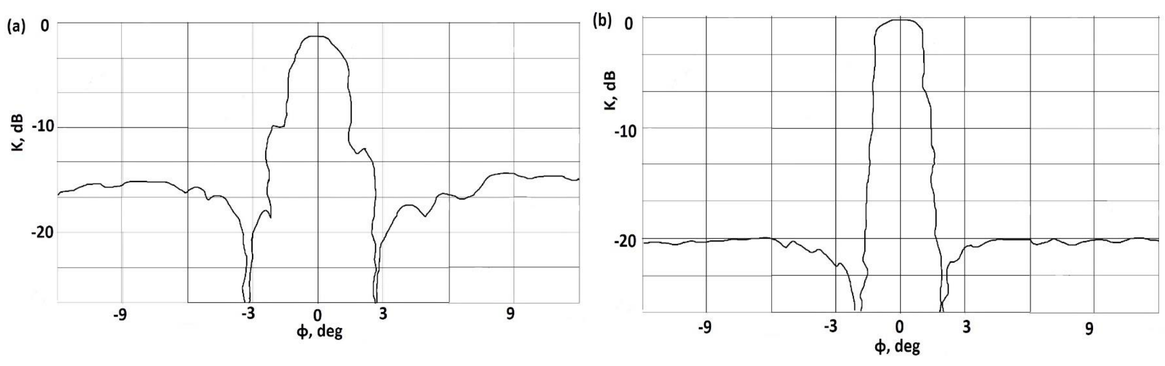
The system consists of two antenna posts:

- antenna post 1 (AP I) includes the studied APAA, optoelectronic converters (receivers) and spectrum analyzers.
- antenna post 2 (AP II) includes receiving antennas - horns 1 and 2, low-noise amplifiers, transmitters, as well as a power source.

The principle of operation is as follows: the microwave signal received by the horn goes to a broadband low-noise amplifier, then the amplified microwave signal goes to an optical modulator and modulates the light beam coming from the laser module. From the modulator, the modulated optical signal is transmitted via a fiber-optic line to the optoelectronic receiving module, in which the light signal is converted back into a microwave signal with minimal distortion. Then the converted microwave signal is sent to the measuring receiver for further processing, after which it is sent to the spectroanalyzer.

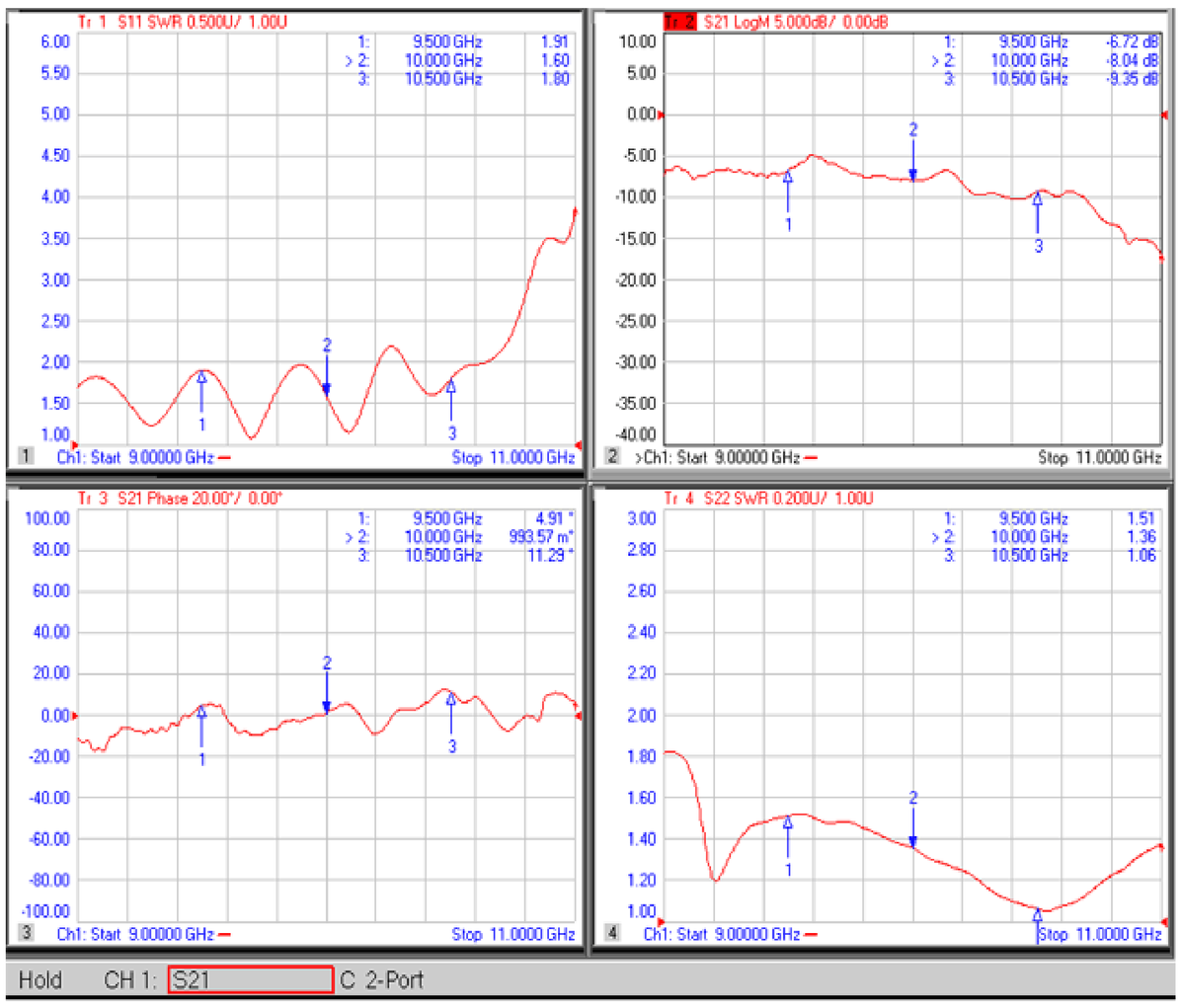
Results of FOCL performance and discussion

An analysis of experimental studies shows that the obtained radiation pattern using the FOCL allows an approximation to be performed to assess the stable APAA radar survey zone. Allows you to adjust the APAA to the maximum suppression of the side lobes in order to reduce the impact on the accuracy of determining the coordinates.



AFAR directional pattern: (a) - a coaxial cable is used to transmit the microwave signal, (b) - FOCL is used to transmit the microwave signal.

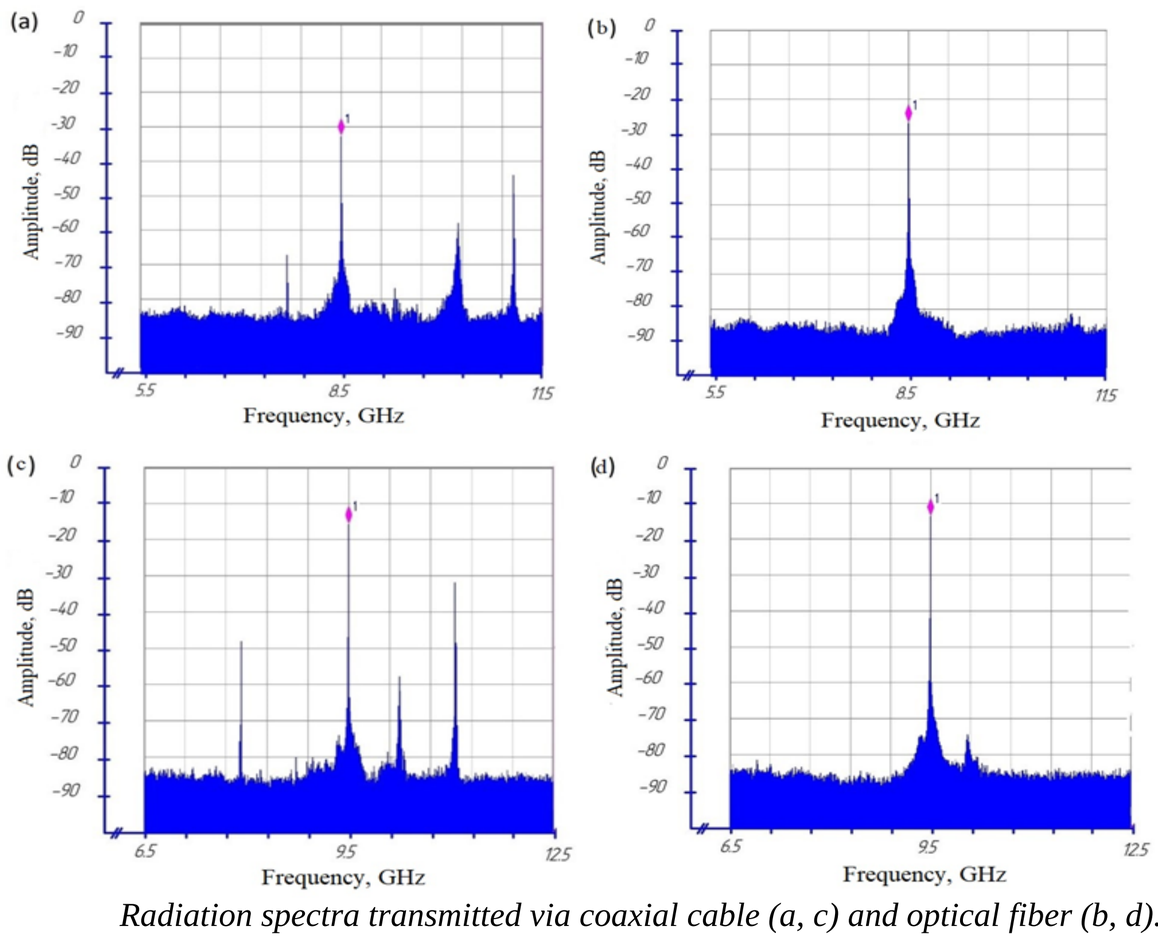
The figure below shows the frequency characteristics of the stand measured by the analyzer.



Frequency characteristics of the experimental stand.

The use of the developed FOCL made it possible, as experiments have shown, to study, in addition to the radiation spectrum of the entire APAA in various operating modes, as well as the radiation spectra of its single active elements. These studies were previously not possible due to the presence of interference and noise in the transmission path.

The figure below shows the emission spectra of a single active element of the APAA transmitted to the control sector from the microwave signal recording device via a coaxial cable and the perceived.



Radiation spectra transmitted via coaxial cable (a, c) and optical fiber (b, d).

Conclusion

The results obtained show that the use of the FOCL developed by us makes it possible to make insignificant the effect of distortion when transmitting a microwave signal over the territory of the landfill over long distances to the equipment for subsequent processing. This also makes it possible to identify various defects in the design of APAA elements that cannot be established when using feeder paths for transmitting a microwave signal.