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EXPERIMENTAL INVESTIGATION OF PROPAGATION OF RADIO WAVES OF VHF AND MICROWAVE RANGE INSIDE BUILDINGS

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The paper presents the data and analysis of full-scale measurements of the levels of relative attenuation of radio waves of VHF and microwave range in various premises of a multistory building depending on their location with respect to the room with the transmitting antenna. For the microwave range of radio waves the paper presents data of laboratory measurements of coefficients of wave penetration through bricks, asbestos cement slabs, and wooden boards.

The results of investigations of radio wave propagation inside buildings and, first of all, estimating the attainable levels of radio wave attenuation between premises located on the same or different floors of the building represent important initial data in treatment of many present-day applied problems. Particularly, this is necessary in order to ensure the information security and electromagnetic compatibility of radioelectronic equipment installed in the same building. This is also essential when designing wireless computer networks, at arrangement of micro- and pico-cellular communication systems, and in organization of local (within a single building) radio suppression of mobile communication systems during antiterrorist operations.

Unfortunately, theoretical calculations in this field cannot satisfy practical needs in full measure. The only method able to provide reliable data concerning attenuation levels and to give insight into peculiarities of indoor radio wave propagation consists in performing the appropriate experiments. Some information in the form of statistically processed results concerning the levels of radio wave attenuation is found in [1–6]. However, these data are limited while the empirical relationships derived on their basis have a narrow field of application and, moreover, are characterized by large errors. So the purpose of this work is to present and discuss the results of full-scale and laboratory measurements of attenuation levels of radio waves of VHF and microwave range propagating inside a multistory office-type building.

As has been shown by physical analysis, the resulting field in the point of reception inside a building with cellular structure of premises, separated by a single common corridor, includes three major components:

(a) the penetrating one (due to penetration of the wave through obstacles such as walls, ceilings or floors, and doors);

(b) the diffraction one (due to wave advancement along a twisted “broken” path, for example: “transmitting antenna — window aperture of one room — path along the outer wall of the building — window aperture of the other room — receiving antenna in this room”); and

(c) the waveguide one (propagation along corridors, staircases, elevator wells).

The dominating contribution of particular components depends on mutual arrangement of the rooms with the transmitting and receiving antennas. Here we may expect that in the rooms adjacent to the transmitter the penetrating component will dominate. In the rooms located far from each other but having a common outer wall the diffraction component is largest. Accordingly, for the rooms adjacent to different walls of the building the waveguide component will

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