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Abstract

A New Active Antenna Unit for Portable Microwave Bio-Dosimeters †

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Abstract: Today, the growing ecological contamination by microwave irradiation requires new devices and information systems to monitor dangerous situations, especially in big cities, and provide safety for the population. This work is focused on the design of anew antenna unit for advanced portable personal microwave dosimeters and irradiation monitoring systems.

Keywords: microwave contamination; personal dosimeter; miniature antenna; electromagnetic safety: bio-dosimetry; isotropic diagram; LTCC technology

1. Introduction

In the last two decades, the level of artificial microwave contamination and its territorial density has increased thousands of times in cities, and it is rapidly spreading to new territories. Today, a huge amount of data on the effect of microwaves on practically all physiological systems and psycho physiological parameters of any bio-object, including a human, have been collected and systematized [1]. This growing danger requires the creation of new portable monitoring devices and systems for ecological safety control, for basic research on the effect of microwave radiation on the health of an individual person, and for the evaluation of epidemiological situations in specific territories, connected with microwave irradiation. This report is dedicated to anew active antenna unit, designed as a miniaturized detector for perspective portable microwave dosimeters. The practical application of this antenna unit has been demonstrated by the new ecological system (GEO-DOSE), which has been developed to control of the microwave field distribution in the Moscow [2].

2. Design and Main Characteristics of Antenna Unit (Materials and Methods)

A photograph of the antenna unit is shown in Figure 1a; its placement on the electronics board of a "GEO-DOSE" dosimeter is shown in Figure 1b; and a photograph of a "GEO-DOSE" monitor is shown in Figure 1c. The antenna unit consists of a miniature dipole with a total length of 15 mm and a width of 1.25 mm and a detector chip. The LT5534 chip is an RF power detector. Its operating frequency range is from 50 MHz to 3 GHz. The minimum sensitivity is about minus 60 dBm. A high dynamic range of 60 dB is achieved by cascading RF detectors and limiters. Their outputs are summed to generate an accurate log-linear DC voltage proportional to the input RF signal in dB. The output is buffered by a low output impedance driver. The LT5534 provides excellent thermal stability (±1 dB typical output over the entire temperature range). Measurement of microwave radiation levels requires pre-calibration. The combination of several dipoles (most often three) is used to obtain an isotropic diagram [3]. In our case, a single dipole is located at an angle of 54.74° to the lower substrate and the system of three dipoles is located along the faces of triangular prisms. The LTCC technology for the fabrication of antenna boards allows improving the operating frequency range of the antenna unit.

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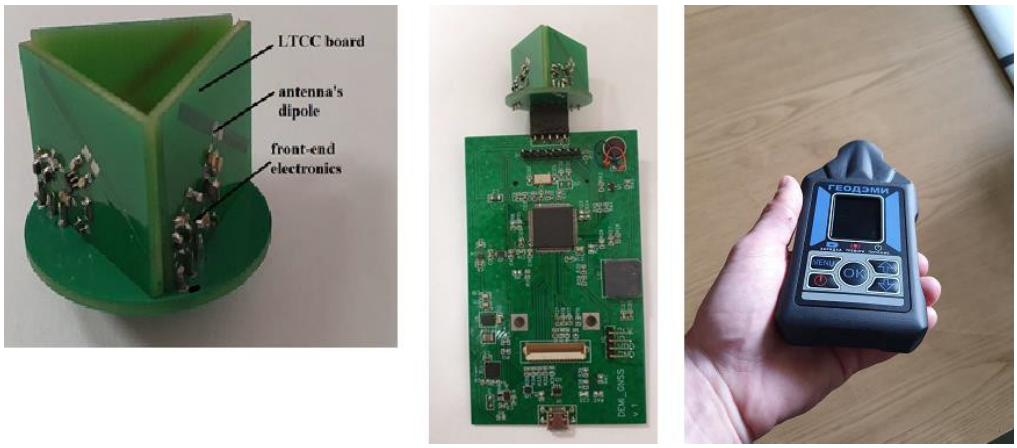

(**a**) (**b**) (**c**)

Figure 1. (**a**) Photograph of antenna unit; (**b**) antenna unit on electronic board of mobile GEO-DOSE dosimeter; (**c**) mobile dosimeter.

Metrological tests of the antenna unit were carried out on its composition in a GEO-DOSE monitor (dosimeter). This monitor has the following characteristics: (a) frequency range of the microwave radiation: 0.9 to 3 GHz; (b) dynamic range: from 10 μW/cm^2 to 1.6 mW/cm^2; (c) maximum SAR: 7.3 W/kg.

3. Discussion

So, the new active antenna unit, as part of the GEO-DOSE system allows simultaneously and continuously monitoring the microwave radiation doses, absorbed by a person, and determine his geographical position. So the new GEO-DOSE system is able monitoring electromagnetic safety in the Metropolis and other territories.

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