Designing and manufacturing of the extremely low frequency electromagnetic field generator and detector

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ABSTRACT

Electromagnetic fields (EMFs) are inevitable consequences of modern civilizations and the era of technology. Many investigations have been carried out in order to determine the effects of EMFs on biological organisms specially on human being. In one hand, most of the generators used in these kinds of experiment are not able to expose a large number of animals simultaneously and on the other hand, many environmental electromagnetic fields could be hazardous for exposing people while a portable, low cost and reliable electromagnetic detector is not commercially available. In this study, we introduced an ELF/EMFs generator capable of exposing a large experimental space and a detector of environmental ELF/EMFs which can define their spatial parameters and relevant biological effects.

Keywords: ELF/EMFs; generator; Detector; designing; manufacturing

INTRODUCTION

By changing the traditional societies to the modern civilizations, inevitable electromagnetic fields (EMFs) overwhelmed the contemporary human life. As become clear that some of these EMFs may have adverse impact on live organism including humans, the effects of these electromagnetic fields broadly ranges from a few Hertz to the giga Hertz became an interesting and also considering issue over the past few decades.
Many investigations have been carried out in vitro and in vivo in order to shed light on mechanism of interference of EMFs with biological organisms, from investigating its effects on cell cultures to follow up people exposed to these exposures [1-14], For instances, it is reported that following exposure to 50 Hz EMF, cognitive performance in attention, perception and memory is reduced [15]. Moreover, these exposures regarded as a factor that can cause some depressive state or metabolic disturbances [16]. In spite of many studies done by numerous investigators, the exact effects of ELF/EMFs is still ambiguous and some controversial results are reported partly due to the lack of standard exposing apparatuses and unique methods.

The first step in experiments in this issue is having a suitable and reliable electromagnetic magnetic field generator. Unfortunately, most of these generators are not able to expose a large number of animals simultaneously. On the other hand, many of environmental electromagnetic fields could be hazardous for exposing people while a portable, low cost and reliable electromagnetic detector is not commercially available. In this study, we present a low cost ELF/EMFs generator enable of exposing an extended experimental space and a detector capable of tracing environmental ELF/EMFs with their spatial parameters and relevant biological effects.

MATERIALS AND METHODS

ELF/EMF generator

The ELF/EMF generator is composed of a generator box and the radiating antenna. The generator box with approximate dimensions of 20cm×15cm×10cm can generate ELF/EMFs in the adjustable range of 1 Hz to 1000 Hz, changeable power of 1-5 watt. A 12 MHz carrier ELF is also applied which is modulated by the required ELF/EMF in the aforementioned range. In order to be able of simultaneous exposure of relatively large number of animals and covering a relative large space, a linear antenna is designed i.e., the antenna with a length of 6 meters is extended from the generator in a line form and the animals are placed in a constant distance from the antenna so each animal receive a homogenous desirable intensity of a radiated electromagnetic field.

ELF/EMF detector

The ELF/EMF detector apparatus consists of a central part which is designed to trace 3 separate electromagnetic field sources at as minimum intensities as mW with high resolution. In order to better hunting of the environmental ELF/EMFs, the detector is equipped with a 360 degree rotating 50 cm antenna shaped like an up-side-down L which is stand perpendicular to the base box and the horizontally rotating wave's hunter part. Received waves are transforming from the antenna to the base, separating according to their frequencies and then they are transmitting to the computer and analyzing by a software specifically designed for this purpose. Using this specific software, one can monitor the intensity and the direction of receiving signals on line in a 360 degree radar form plane. The software can connect to the pre-established intra data bank contains ELF/EMFs biological related information and display this information online, this feature enables the user to know the effects of the radiated ELF/EMFs simultaneous with its detection.

DISCUSSION

In contrast to commercially available ELF/EMFs generators that are usually can expose a very limited spatial area, the generator introduced in this study can produce a homogenous electromagnetic field in relatively large space using a linear antenna. This could be very useful specially when e.g. an investigator wants to exposing a large number of animals. In other word, this apparatus could help a very great time saving since a large number of laboratory animals can be exposed simultaneously.

By the aid of a rotating antenna, our detector enables individual to detect environmental electromagnetic fields by simply position it in the location without any need to change its direction by hand in order to determine and find the direction of possible existent ELF/EMFs. Furthermore, connecting to the pre-established data bank, even non-trained users can simply get aware of the biological effects of the emitting ELF/EMFs. So, this user-friendly detector can be an excellent choice for electromagnetic radiation protection e.g. in laboratories working on the related issues.

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