

# Study of Electromagnetic Risk Analysis in Hospitals

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**Abstract** — Widespread usage of electrical devices has increased the focus on the necessity to assess and regulate electromagnetic radiation in especially sensitive areas like hospitals and health clinics. These sensitive places are where both patients and also staff are uncontrollably exposed to negative effects of electromagnetic radiation due to intensive diagnosis and treatment appliances operating in clinic environment. In this regard, European countries established the standard EU2004/40 to regulate electromagnetic environment assessment. This study mainly focuses on electromagnetic field assessment by conducting both low and high frequency electromagnetic field measurements in a selected hospital in Turkey. Then the measurement results will be discussed in the scope of EU 2004/40 directive to achieve satisfactory preventive measures.

**Keywords**- electromagnetic radiation; hospital; risk; analysis

## I. INTRODUCTION

In order to characterize the electromagnetic fields in hospitals, it is necessary to determine the locations and specifications of indoor appliances, electrical installations and wiring, and also outdoor electromagnetic radiation sources, such as base stations, high voltage transmission lines and transformers. Hospital areas near corridor intersections, emergency rooms, operating rooms, vicinity of MRI appliances, diathermy units are hot spots in terms of electromagnetic radiation intensity.

Due to rapid increase in mobile telecommunication adaptation, mobile phone signals in the hospitals create interference for biomedical appliances [1, 2]. That is why there has been restrictive guidance for GSM frequency electromagnetic radiation levels by ICNIRP. In this study, both high and low frequency electromagnetic fields are measured in a city hospital, where indoor antennas present and 380kV high voltage power transmission lines are in the vicinity by 20-30 meters.

## II. MEASUREMENTS AND METHODOLOGY

Due to hospital's intense working conditions, measurements are carried out in different places of the hospital, with high focus on patient comfort and hygienic conditions. Wide band high frequency measurements are carried out with PMM8053 and 100 kHz–3 GHz probe; while frequency selective measurements are realized with Advantest 9 kHz–3 GHz spectrum analyzer and other appropriate antennas. Holaday HI3604 model 30 Hz–2000 Hz field meter is used in low frequency measurements.

In Fig. 1, electromagnetic field measurement near the diathermy machine in hydrotherapy room is presented. Figure 2 illustrates magnetic field strength measurements, together with extreme values, obtained at 38 different spots in the first building. Therefore, these figures not only reveal the electromagnetic effect of 380kV power transmission lines which are at a distance of 20-30 meters to the hospital buildings, but also the EM fields created during medical appliance operations.

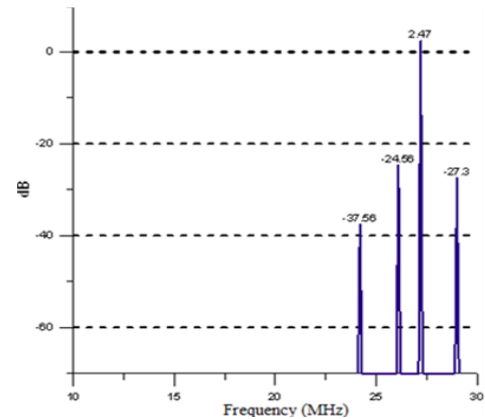


Figure 1. Hydrotherapy room measurements from 1m distance

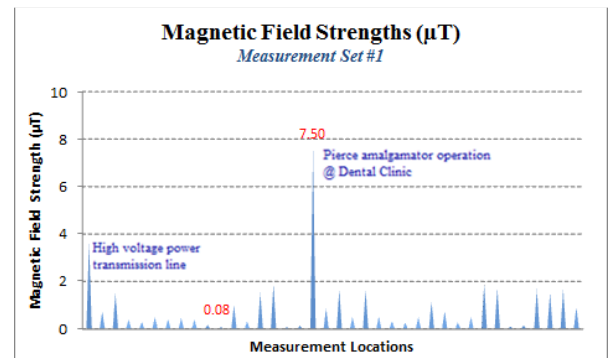


Figure 2. Electromagnetic field measurements in the hospital building #1

## III. DISCUSSIONS AND CONCLUSION

It has been observed through the analysis of ELF and HF electromagnetic field measurements that the results are within the ICNIRP limits (for high voltage transmission lines 5000V/m, for GSM frequencies 42-61V/m). The 380kV high voltage power transmission lines outside the hospital create ELF magnetic field whose value is found to be quite larger than 1 $\mu$ T. The measurement results due to high voltage power transmission lines around the hospital exceed the ICNIRP safety values. For this reason, a corridor of 30m on both sides of the transmission line should be prevented from human presence for example with fences etc. to minimize unintended electromagnetic radiation exposure. Additionally, keeping other patients away from the diathermy device operating in the hydrotherapy room would be useful to minimize unwanted radiation exposure.

## REFERENCES

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