

Short Communication

The measurement of radiation dose around base-stations

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The radiation dose base station has been measured around different base stations using a portable NaI (TI) detector. The radiation dose around base stations ranged from 52 - 115 mR/h.

Key words: Radiation dose, base station.

INTRODUCTION

The technological developments, includes using of radio-frequency (RF) spread out in the telecommunications, radars, radio, and television broadcast, medical and industrial applications, have been very important in modern life and this might cause many different health problems. Although mobile communication networks have operated in various forms for more than 50 years, there has been a dramatic increase in mobile phone usage in recent years especially with the falling cost. Consequently, mobile phone base stations have become a common sight around cities. A mobile phone sends and receives information (voice messages, fax, computer data, etc) by radio communication. RF signals are transmitted from the phone to the nearest base station and incoming signals (carrying the speech from the person to whom the phone user is listening) are sent from the base station to the phone at a slightly different frequency. Base stations link mobile phones to the rest of the mobile and fixed phone network.

The cellular radio communication uses microwaves at 900, 1800 or 2200 MHz using two different technologies, Global system for Mobile (GSM) and Universal Mobile Telecommunication System (UMTS). The GSM is the international, pan-European operating standard for the current generation of digital cellular mobile communications. It enables mobile phones to be used across national boundaries. The UMTS is the next generation of mobile phone technology, expected to result in wide-spread use of video phones and access to multimedia

information and this technology operates in 2 GHz region. As shown in Figure 1, the base stations produce RF radiation that is part of the electromagnetic radiation spectrum. RF radiation in the environment is also produced in varying amounts by radio and television towers, as well as cordless phones and some remote controlled devices.

In tissue, the Specific Absorption Rate (SAR) of RF energy absorbed per unit mass is proportional to the square of the internal electric field strength. The SAR values measures of how much radio wave energy your body receives from a phone and they depend on the following factors (Repacholi, 2001):

1. The incident field parameters, that is, the frequency, intensity, polarization, and source-object configuration (near field or far field).
2. The characteristics of the exposed body, that is, its size, internal and external geometry, and the dielectric properties of the various tissues.
3. Reflection absorption and scattering effects associated with the ground or other objects in the field near the exposed body.

It is well known that the human body is particularly sensitive to RF electromagnetic fields as in that case, it may absorb a significant amount of the radiated energy, as the dimensions of organs become comparable to the wavelength of the incident field. Therefore, the principal biological effect of RF has been considered to be dominantly thermal in nature (Adair et al., 2003; Hirrata et al., 2003; ICNIRP, 1998). On the other hand, a calculation of maximum temperature has been done and it was expected that the temperature in the head from RF

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Table 1. The characteristics of the base stations located around Isparta regions (there is a TV antenna with ST 2 and 1 other base station around the ST 3).

Station no.	Station name	Must height (m)	Max. power (W)	Number of station in the area	Frequency (MHz)
ST 1	Fatih	22	17	2	900
ST 2	Halikent	15	10	1 + TV	900
ST 3	Mavikent	25	7.9	1 + 1	900
ST 4	Davraz	15	10	1	900

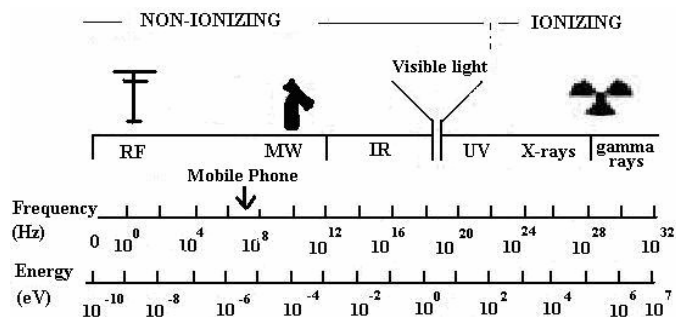


Figure 1. Electromagnetic spectrum shows from ionizing to non-ionizing radiation.

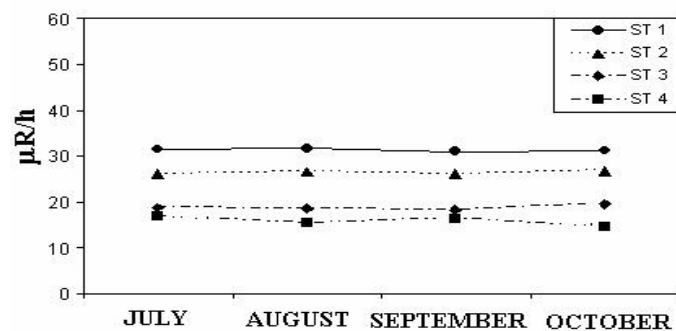


Figure 2. The radiation dose obtained for all stations.

exposure during mobile phone use suggest increases of not more than 0.1 °C (Van Leeuwen et al., 1999).

In this paper, the variation of radiation exposure rate around some base stations located in the city of Isparta (Turkey) has been measured.

MATERIALS AND METHODS

The radiation dose around base stations which operates using GSM technology, for four different station were measured using a portable scintillator detector of NaI(Tl). The detector has 2 × 2 inch dimensions size and was connected to ASP/2e counter developed by Eberline (1995). The energy response of the detector is 60 keV to 2 MeV which is suitable for environmental γ-ray dose measurement, covering the majority of significant γ-ray emission from

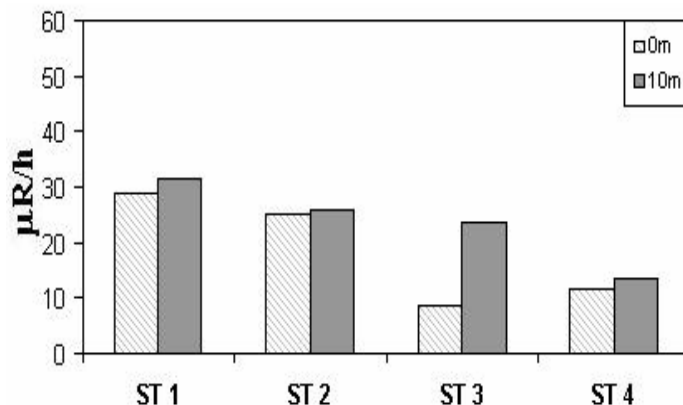


Figure 3. The radiation measurements depending with the distance from stations.

terrestrial and cosmic sources and also from base stations. The all measurement has been performed at 1 m above the ground. In Table 1, the parameters about stations were tabulated.

RESULTS AND DISCUSSION

In this study, the radiation dose around base-station was measured to investigate the radiation exposed by the contribution of base-station to the background radiation in Isparta (Turkey). The radiation exposure rate around the base station has been measured in four different stations for four different months. This is displayed in Figure 2 where it can be seen that the highest value has been found in the ST 1 and the lowest value for ST4. This is an expected result as it relates with the number of station (Table 1) and could also be the result of other effect such as geological structure or other technological contribution such as TV antenna etc. It is also clearly seen from Figure 2 that there is no significant variation with the month for all stations.

In Figure 3, the radiation dose was measured at the bottom of station must (0 m distance from must) and 10 m away from must to investigate the direction of radiation emitted from must head. It can be seen from Figure 3 that most of the radiation from head of the station does not go horizontally to the bottom. It is important to know the distribution of radiation around base station. For this

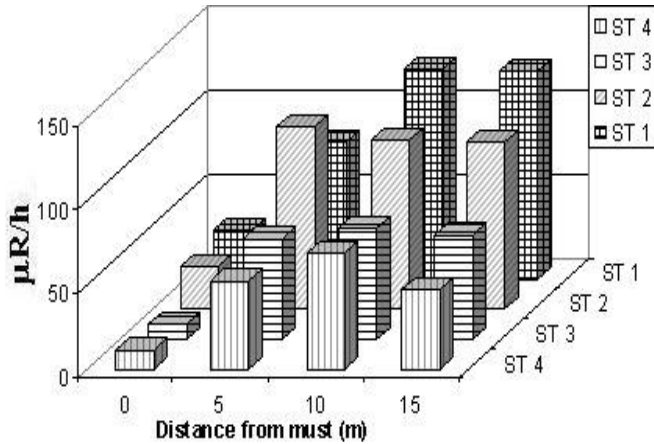


Figure 4. The comparison of radiation dose measured around base station (Davraz) and without base station

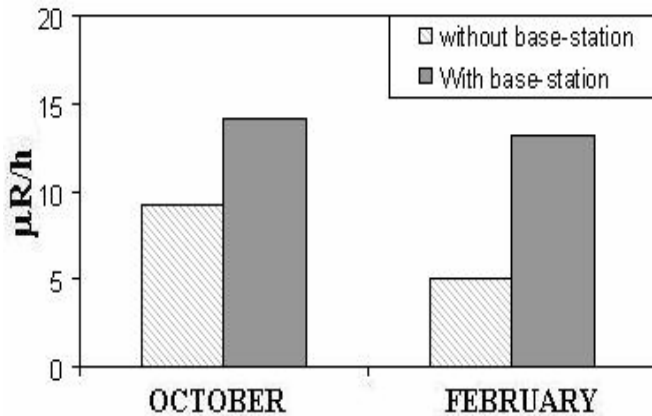


Figure 5. The comparison of radiation dose measured around base station (Davraz) and without base station

purposes, the radiation dose was measured as a function of distance from station must and this is displayed in Figure 4. It can be seen from Figure 4 that the radiation is lower at the bottom and it increased with the distance.

The results obtained in this study are in good agreement with the conclusion of the emission of the Electromagnetic radiation from base-station antenna.

To investigate the contribution of base station to the ambient, γ -radiation dose level obtained around base station were compared with the background measurement (Sevin, 2002). This is displayed in Figure 5 for measurement performed in October and February. The contribution of the base-station to the ambient can be clearly seen from Figure 7.

It can be concluded from this work that there is clear radiation contribution to the background radiation and it should be noted that people would not spend more time around those of stations.

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