

Health risk assessment due to TETRA telecommunication system

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INTRODUCTION

Police forces, modern soldier, member of forces for civil protection, fireman teams, rescue and disaster relief, workers in the center for information and any other member of administration is during her or his duty and mission occupationally exposed to TETRA telecommunication system where a chance of a high EMF exposure (overexposure) can occur. Many studies show that EMF exceeding a certain threshold magnitude could negatively impact human health.

TETRA base stations and terminals are source of EMF since they operate as transmitter and receiver of EMF. In literature there were reports on health hazards associated with pulsed modulated frequency of 17.6 Hz. Before such an equipment is transferred to the hands of the end user there is a strong need to make a health risk assessment that includes numerical and experimental dosimetric techniques. With such an approach we could get very useful information on individual exposure including potential health risks. The principal goal of the project is to identify the workplaces and professions characterized by high risk of EMF overexposures due to newly adopted TETRA system in Slovenia with respect to the action values and exposure limits as defined by the Directive 2004/40/EC of the EU and the ICNIRP guidelines (1998).

MATERIALS AND METHODS

In Slovenia, occupational EMF exposures have not been subject to regulation and adequate control so far. The action values and limits for such exposures are defined by the Directive 2004/40/EC of the EU and the guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) from 1998, which require the employers to provide a safe and healthy working environment to the employees. We assessed the exposure levels by means of *in situ* measurements and numerical dosimetry, taking into account the existing international standards [1, 2]. We investigated radiation pattern and EMF exposure in the vicinity of a TETRA base station operating at 392 MHz with peak transmitted power of 48 W and terminal equipment with peak transmitted power of 1 W.

For *in situ* measurements we have used calibrated spectrum analyser Anritsu MS 2711 with biconical antenna with total uncertainty of ± 3.30 dB and Narda EMR 300 with E field probe type 18 with total uncertainty of ± 3.42 dB.

For modeling and simulations, we used the SEMCAD X software package from Schmid & Partner Engineering AG, the SAM (Standard Antropomorphic Model) head model and Virtual family adult man model [3].

RESULTS

Results of selective in broadband measurements shows that occupational exposure around the TETRA base station is more than one order of magnitude lower than limit values introduced by EU Directive.

distance	height	Selective (392.43 MHz) E (V/m)	Bradband (0.1 MHz – 3 GHz) E (V/m)
10 m	in front of antenna (h=0 m)	0.680	1.18
115 m	On the ground level (h=25 m)	0.130	0.41

Tabel 1: Selective and broadband E field measurements of around the TETRA base station 1.5 m above the ground level.

Results of numerical simulation that take into account only a few generic exposure condition by using TETRA terminal equipment of average output power of 0.25 W (peak output power 1 W) shows compliance with EMF Directive.

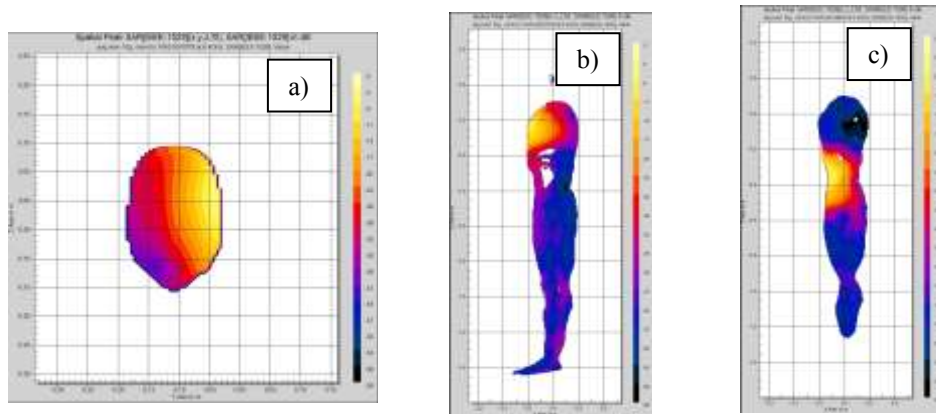


Figure 2: SAR values in SAM head model (a) and Virtual family adult man model (b and c) due to EMF exposure of TETRA terminal equipment with the average output power of 0.25 W. SAR values are normalized with reference levels for occupational exposure in EMF Directive 2004/40/EC (10 W/kg). Tetra terminal is positioned close to the head (a), close to chest (b) and front in special jacket (c).

CONCLUSIONS

Health risk assessment showed:

- That hand held TETRA terminals in worst case conditions do not exceed SAR limit values. Thus, no special restrictions due to the use of the equipment are necessary.
- That hand held TETRA terminals built in the vehicle could exceed the SAR limit values close to the antenna. This is particularly true for terminals with power above 3 W. For terminal with lower power that 3 W no restrictions due to the use of the equipment are necessary.
- That TETRA base stations could exceed the occupational EMF limit values up to 0.5 m in the front of the antenna.

Finally, we have prepared the draft version of the fact sheet on TETRA and health that could be used for the risk communication and risk management issues for users of the newly introduced TETRA technology in Slovenia.

REFERENCES

- [1] EN 50383 (2002): Basic standard for the calculation and measurement of human exposure to electromagnetic fields from radio base stations and fixed terminal stations for wireless telecommunication systems (110-40000 MHz)
- [2] EN 50384 (2002): Product standard to demonstrate the compliance of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic field
- [3] Christ A, Kainz W, Hahn E G, Honegger K, Zefferer M, Neufeld E, Rascher W, Janka R, Bautz W, Chen J, Kiefer B, Schmitt P, Hollenbach H P, Shen J X, Oberle M, Kuster N: The Virtual Family – Development of anatomical CAD models of two adults and two children for dosimetric simulations