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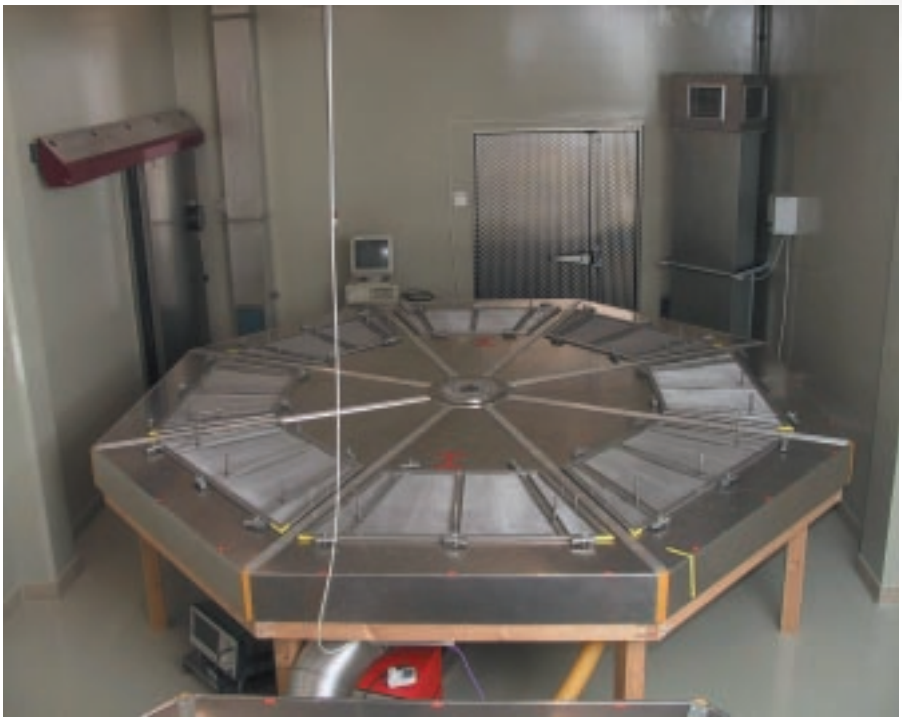
Study of the effects of exposure to a higher power flux

Effects of pulsed radio-frequency EMF on selected physiological parameters of rats



Background

The use of mobile radio phones has greatly developed in recent years,and the future application of UMTS technology will further increase this trend. Nonetheless, the question whether and if so at what intensities, modulations, and frequencies, fields could be health damaging has not until now been sufficiently investigated.

The first study of the ITA, performed in 1998, examined the effects of exposure of rats to a GSM field on the offspring during gestation. In this study a field strength equivalent to the limit value for humans was applied.

This study could not give proof of any influence on the maternal or embryonic parameters considered (see also ITA Annual Report 1999, ITA newsletter, February 2000).

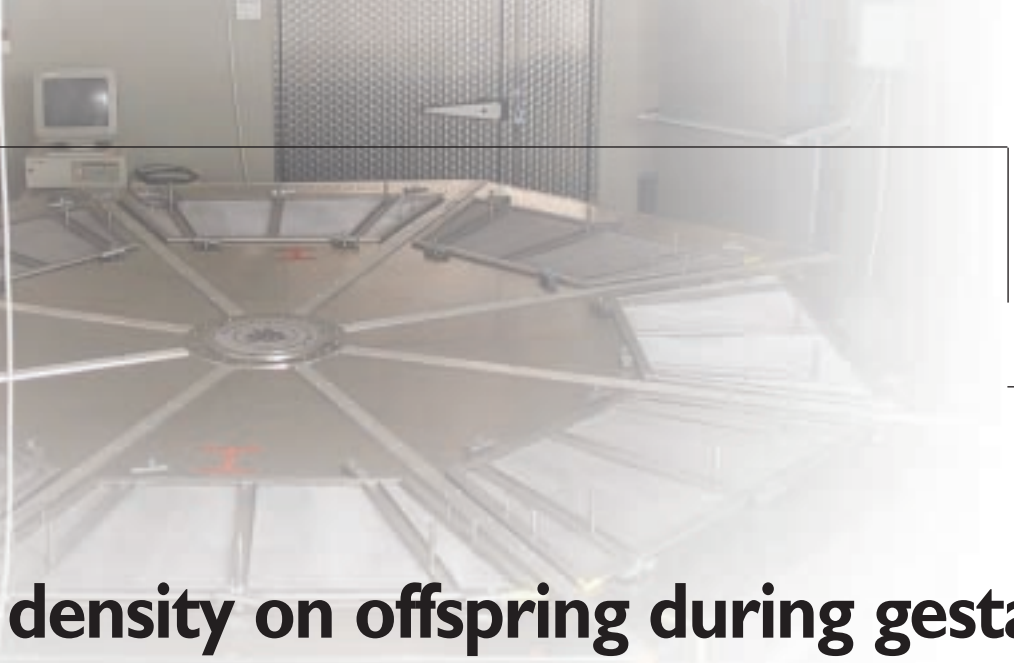
Implementation of study

On the basis of these results, a second study was performed applying a significantly higher, but still athermal power flux density.

To conduct this study, the necessary technical set-up for exposure had first to be implemented at the Fraunhofer ITA in cooperation with the Department of Theoretical Electrical Engineering of the Bergische Universität Gesamthochschule Wuppertal. For exposure special waveguides were designed, each containing 24 Makrolon type III cages with plastic lids. Water was fed into them from bottles placed outside the waveguides and connected to the cages by special vents. To prevent possible heating of the cage environment, the waveguides were covered by wire-mesh lids. In addition, a central ventilator connected to each single cage site provided an efficient air circulation between the waveguides and the outside.

Project description and performance

During the study the effects of a typical GSM signal at a field strength of 60 W/m² (human limit value 4.5 W/m²) with respect



density on offspring during gestation

to possible damaging effects on the foetus were examined.

This field strength was determined by pretests, where the value of 60 W/m² was the highest power flux density not showing an increase of rectal body temperature immediately after exposure of male rats.

During the main experiment pregnant female Wistar rats, Crl: (WI)BR, were exposed to the above mentioned field from day 0 through 20 post conception (p.c.) for 20 hs per day.

On day 20 p.c. all pregnant rats were delivered by section and examined concerning a potential prenatal toxicologic effect of exposure. The test was performed in accordance with the OECD guideline 414 "Teratogenicity."

For the exposed group and the control group two electromagnetic fields waveguides completely shielded from each other were used. Both exposure units were identical in size, ventilation, cage positions and cable connections. This means that the study was conducted as a double-blind study.

Results

The results obtained can be summarised as follows:

The animals showed no clinical symptoms during exposure; there were no mortalities, abortions or premature births caused by exposure. A macroscopic examination of the mother animals' organs showed no evidence of pathological alterations.

No statistically-significant effect of field exposure on the body weight development of maternal animals could be proved; however, all values were lower in the exposed group than in the control group.

Exposure to the power flux density used had no statistically-significant impact on the number of implants and living foetuses, on pre- and post-implant losses and on placenta and foetus weights (except a significant weight decrease of male foetus placentas). However, here too all values of the exposed group were below those of the control.

As also the corresponding values of the control group were at the lower margin of historical control values, an effect of holding conditions distinguished by cage position inside the waveguides from those of guideline studies can not be excluded. In this case, the slight differences between the two groups also could result from an interaction between holding conditions and the onset of the first nonspecific effects of field exposure, with a field strength near the thermal threshold affecting prenatal development of the exposed animals.

No increased occurrence of single external, visceral and skeleton anomalies was found. The number of litters with such foetuses was not affected by the exposure. The only exception was an increase of the number of litters and foetuses with slightly expanded ureter in the exposed group. However, this finding is sporadically observed in the foetuses of this rat stem. The frequency in the exposed group also remained within the margin of historical control data.

Apart from one complex deformity in the control group (ectopic umbilical hernia, oligodactyly and missing diaphragm) the findings can not be classified as malformation, but as sporadically-occurring variations. All variations were observed in both groups including the control group and/or they occurred with a frequency being characteristic for the used rat stem.

Also the number of ossification bone nuclei as well as of ossification defects was not affected by exposure, and were in both groups characteristic for 20-days'-old foetuses of the used rat stem.

Conclusion

Consequently, we can summarise the results as follows: an exposure of pregnant Wistar rats [Crl;(WI)BR] from day 0 through 20 p.c. to a GSM typical far field of 890 MHz at a field strength of 60 W/m² did not show any statistically-significant impact on the maternal or embryonic parameters examined. No distinct teratogenic, abortive or development-retarding effects were observed. The identified (statistically non-significant) effects (mainly on maternal body weight increases, pre- and post-implant losses as well as foetus and placenta weights) however may reflect the onset of nonspecific effects of exposure to a field strength very near to the thermal threshold affecting prenatal development.

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