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Shorted Patch Antenna for 26.5 GHz Electromagnetic Wave Local Exposure System for Animal Experiments

Takuji Arima*, Yasutaka Murakami, and Toru Uno
Tokyo University of Agriculture and Technology Tokyo, Japan

In recent year, 5th-generation mobile communication system is developed. In the system, 24-28 [GHz] frequency will be used. Mobile devices such as smartphone are used in the vicinity of a head in a talking mode; therefore, some EM wave exposure to a human head will be localized. In order to evaluate the positive effect of human health, animal experimental studies are necessary. In order to realize local exposure during smartphone using for the animal experiments, local exposure antennas[1][2] are required. In this research, local exposure antenna is proposed. The working frequency of this research is 26.5 [GHz].

The proposed antenna is shown in Figure 1. This antenna is shorted patch antenna. It is well known that the original patch antenna has a zero voltage are in the patch. In the shorted patch antenna, the patch is shorted at the zero voltage area as shown in Figure 1. The reflection characteristic of the antenna is important parameter of the antenna. The reflection coefficient of the antenna is -20 [dB] at 26.5 [GHz]. Therefore, almost EM power are radiated. Next, the SAR distributions in the rat model are investigated. The rat model at 2 weeks age is used in this study. The rat model is developed by X-ray computed tomography images. The resolution of the model is 0.125 mm. This model consists of five tissues (brain, eye, bone, muscle, and internal air). The electric property is in referred to ref. [3]. The antenna is placed 4 mm above of the rat head. The target area in the rat is a brain just under the antenna of rat which diameter is 4mm. In this study, the purpose is to make local EM field in the vicinity of target area. Therefore, the ration between target area SAR (TA-SAR) and whole body SAR (WB-SAR) is important. The ratios are shown in Table 1. Table 1 indicated that the shorted antenna can be made quite localized EM field on the target. The ratio of SAR between the target area (brain) and the whole body is greater than 500 for the 2-week rat model. Therefore, the proposed exposure system using a shorted patch antenna is effective to make small EM field for rat head at 26.5[GHz] frequency range.

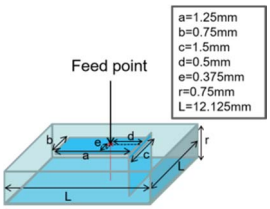

Figure1.Proposed Antenna

Table 1 Calculated SAR in the rat model

	Original patch antenna	Shorted patch antenna
TA-SAR	687.4[w/kg]	1271.4[w/kg]
WB-SAR	2.00[w/kg]	2.88[w/kg]
Ratio (TA-SAR) /(WB-SAR)	343.9	555.3

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