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Human Body Shadowing Effect on Measurement of Personal RF Exposure Meter for Epidemiological Research on Children's Health

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An epidemiologic study is being conducted to consider the effects of radio wave exposure on child neurodevelopment [1]. The purpose of this study is to estimate the electromagnetic field near the human body using computer simulation to investigate the dosimetry protocol for radiofrequency exposure. In this study, we estimate the change in electric field strength due to human body blockage using the FDTD method. The numerical human body model used is that of a child approximately 11 years old. The six exposure frequencies used in this analysis were 0.8 GHz, 1.8 GHz, 3.7 GHz, 4.5 GHz, 2.4 GHz, and 5.2 GHz. Analysis was performed for each horizontal/vertical polarization in each frequency band. The evaluation point was 50 mm in front of the human abdomen. The blocking characteristics of the human body are evaluated by varying the direction of arrival of the plane waves in 10° increments from the back to the front of the human body. The difference in electric field strength caused by the presence or absence of the human body is calculated using the following equation and used as the BL [dB] index for evaluating the shielding effect.

$$BL\,[dB] = 20\log_{10}\frac{E_u}{E} \qquad (1)$$

E_u: Electric field strength subjected to shielding [V/m]
E : Electric field strength without shielding [V/m]

The results of the numerical analysis show that in each frequency band, BL is a negative value due to blockage when the plane wave arrives from the back of the human body. The BL value changed by a maximum of -27dB. In addition, when plane waves arrive from the front of the human body, BL is increased more than without human body blockage. The BL value increased up to 4.5 dB. This is because the plane waves are reflected by the human body when the radio waves arrive from the front. Also, the results of numerical analysis are different for each frequency. This is because the degree of diffraction by the human body changes depending on the difference in wavelength. In the future, we plan to evaluate the elevation angular characteristics to be measured when a plane wave arrives from different directions. Based on these estimation results, we plan to study protocols for statistical exposure dosimetry of large-scale data.

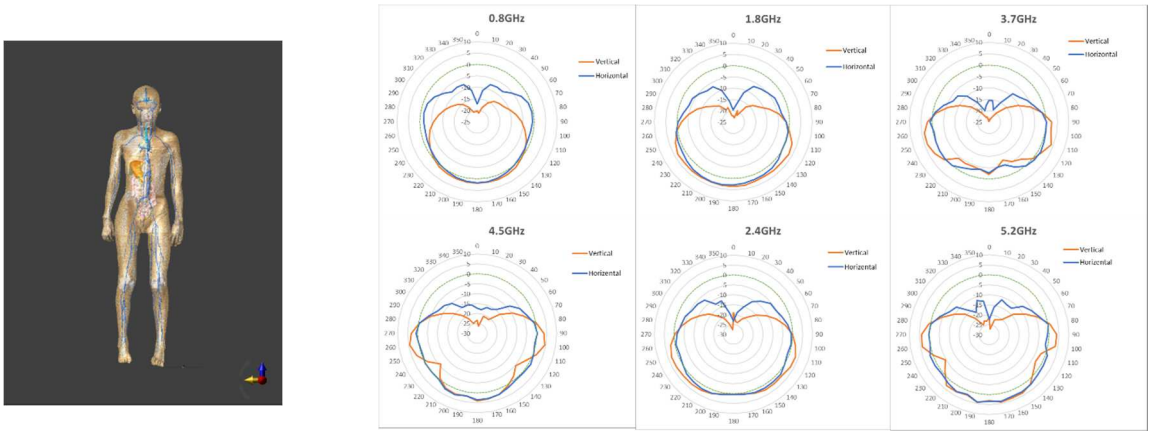

Figure 1. Numerical human model and estimation results of BL index

References

[1] Keiko Yamazaki et al., Environmental research, pp.114429-114429, Sep. 2022.

Acknowledgments

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