A Verification of SAR Measurement for APD Evaluation at frequency 6 GHz to 10 GHz

Yuto Shimizu [(1)], Hiroshi Kawakami [(1)], and Tomoaki Nagaoka [(1)]
(1) National Institute of Information and Communications Technology,
4-2-1, Nukui-kitamachi, Koganei, Tokyo, Japan; e-mail: y_shimizu@nict.go.jp

In recent years, wireless communication devices have been widespread. Wireless communication devices used in close proximity to a human body need to be assessed for human exposure. For instance, in a frequency band used by the commercially smartphones (700 MHz to 6GHz), SAR (specific absorption rate) is used as the safety criteria [1]. The measurement procedure for the compliance test of wireless communication devices using SAR have been standardized by IEC (International Electrotechnical Committee) and IEEE (Institute of Electrical and Electronics Engineers) [2]. Recently, the compliance test method based on an APD (absorbed power density) at frequencies from 6 GHz to 10 GHz has been published as PAS (publicly available specification) by IEC [3]. This method obtains the APD using SAR that is measured based on the compliance test standard [2]. Specifically, 8 g averaged SAR is converted to 4 cm^2 averaged APD. Therefore, when APD is evaluated for the compliance test at the frequency from 6 GHz to 10 GHz, SAR measurement system is used. In addition, current compliance test standard using SAR [2] can be applied at the frequency including 6 GHz to 10 GHz. Therefore, to verify whether our SAR measurement system can obtain SAR based on the compliance test standard [2], 8 g averaged SAR was measured using the reference dipole antenna at the frequency range from 6 GHz to 10 GHz. Additionally, the uncertainty of the SAR measurement system was also evaluated.

Figure 1 shows the measurement setup. In this study, we used DASY 6 which is commercially SAR measurement system provide by Schmid & Partner Engineering AG. This measurement uses a flat phantom filled with the tissue equivalent liquid which dielectric property specified in the standard [2] and the dipole antenna whose length is specified for each frequency. The dipole antenna is spaced 5 mm apart at the bottom center of flat phantom. 8 g averaged SAR is measured with the input power of 22 dBm applied to the dipole antenna. In this study, 8 g averaged SAR is evaluated at frequency 6.5 GHz, 7 GHz, 8 GHz, and 9 GHz. The measured SAR was compared with the numerical reference calculated by the electromagnetic simulation. The uncertainty of the SAR measurement system was also evaluated according to the standard [2]. The difference between the measured and numerical 8 g averaged SAR was within 10 % in each frequency. It indicates the viridity of the SAR measurement at frequency 6 GHz to 10 GHz. The uncertainty evaluation confirmed that the expanded uncertainty over 6 GHz was larger than that below 6 GHz.

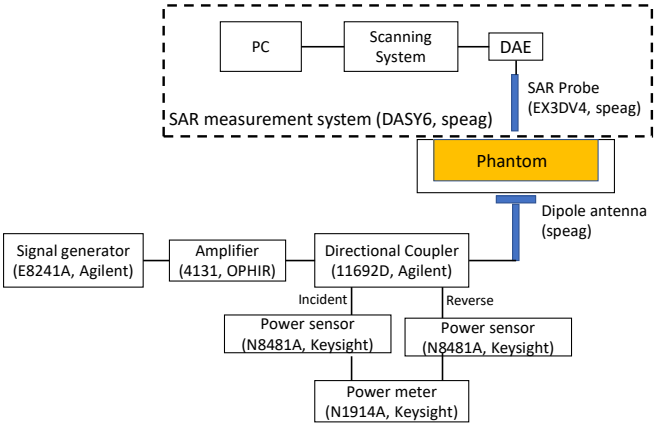

Figure 1. Setup for the system validation of the SAR measurement system.

Acknowledgement

This work was supported by the Ministry of Internal Affairs and Communications of Japan (JPMI10001).

References

[1] ICNIRP, *Health Phys.*, vol. 74, no. 10, pp. 494-522, 1998.
[2] IEC/IEEE 62209-1528, 2020.
[3] IEC PAS 63446, 2022.