

TRANSMIT POWER DISCONTINUITY DUE TO DIFFERENT EMF EXPOSURE METRICS AROUND 6 GHz

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Recently, international safety standards/guidelines, like IEEE C95.1 [1] and ICNIRP [2], have been updated in the radiofrequency range (i.e., above 6 GHz) to protect from excessive electromagnetic field (EMF) exposures. At this transition frequency, the exposure metric has been changed from specific absorption rate (SAR) to absorbed power density (APD). At the same time, due to several measurement limitations or some regulatory requirements, the incident power density (IPD), rather than APD, is still used in practice. Under these circumstances, the maximum allowed output power needed to ensure exposure compliance depends on the used metric and can yield to a power discontinuity below and above 6 GHz, even for different channels of the same technology, as is the case of Wi-Fi@6E/7. Such a non-physical discrepancy brings unnecessary costs for both manufacturers and consumers. Therefore, it becomes necessary to quantify the transmit power discontinuity due to different EMF exposure metrics around the transition frequency of 6 GHz.

To assess this issue, the UnivAQ Research Group, together with Intel Labs, has carried out some numerical and experimental analyses on a representative Wi-Fi platform placed at several distances from a body phantom [3]-[4]. The assessment was based on the comparison between maximum power values obtained while remaining compliant with SAR, APD, and IPD limits for the same exposure conditions. The results showed that the IPD is the most conservative metric for all distances and that a significant power discontinuity between SAR and APD (around 3-5 dB) can be obtained. Though a favourable reduction of about 6 dB has been found in the power discontinuity from limits provided by ICNIRP 1998 to 2020, this range of 3-5 dB power discontinuity still encountered in the current ICNIRP limits brings attention to address this issue in the future.

References

- [1] IEEE-C95.1, *IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz*. NY, USA, 2019.
- [2] ICNIRP, "Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz)," *Health Phys.*, vol. 118, pp. 483–524, 2020.
- [3] W. El Haj, J. Roman, Z. Yao, R. Paxman, and V. De Santis, "Investigation of power levels related to different EMF exposure metrics at 6 GHz," *IEEE Access*, vol. 11, pp. 62174-62179, 2023.
- [4] W. El Haj, J. Roman, Z. Yao, R. Paxman, B. Lavenant, and V. De Santis, "Transmit power influence due to different EMF metrics around 6 GHz," *IEEE Journal of Microwaves*, accepted for publication.