E/O Probe Design for Exposure Assessment in Human Body for 85 kHz EV Charging System

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***Abstract*— An electric/optical (E/O) probe system for measurement of in-body field strength at 85 kHz is proposed. The proposed system uses an optical modulator in order to avoid interference of conducting cables. An impedance matching circuit between the optical modulator and probe in lossy human body is designed to enhance sensitivity of the system. The field strength in a liquid human phantom is measured by using the designed E/O probe system at 85 kHz. It is demonstrated the sensitivity of the probe increases by implementing the impedance matching circuit.**

Keywords—optical modulator; in-body; low frequency

I. INTRODUCTION

Human exposure to the field of a low frequency wireless power transfer (WPT) system should be assessed accurately in advance because the system deals with high power. In-body field strength is measured to assess the human exposure but the measurement is expected to suffer from low sensitivity of a probe at low frequency band and interference of a conducting cable.

In this paper, an electric/optical (E/O) probe system for measurement of in-body, low frequency field strength is proposed. The probe system is composed of an optical modulator, impedance matching circuit using toroidal coil, and dipole antenna. Field strength inside a human body phantom is measured by using the fabricated probe at 85 kHz and enhanced sensitivity of the probe is clearly demonstrated.

II. PROPOSED PROBE SYSTEM

The proposed probe system is shown in Fig. 1. The proposed probe system is composed of the optical modulator, toroidal coil, and dipole antenna. Owing to the optical modulator, no conducting cable is required [1]. Toroidal coil works as an impedance matching circuit and designed by conjugate impedance matching approach.

III. MEASUREMENT RESULT

In-body field strength was measured by using the fabricated probe at 85 kHz. As shown in Fig. 1, fabricated probe was inside a liquid human phantom filled with deionized water. Receiving power of the probe w/coil was

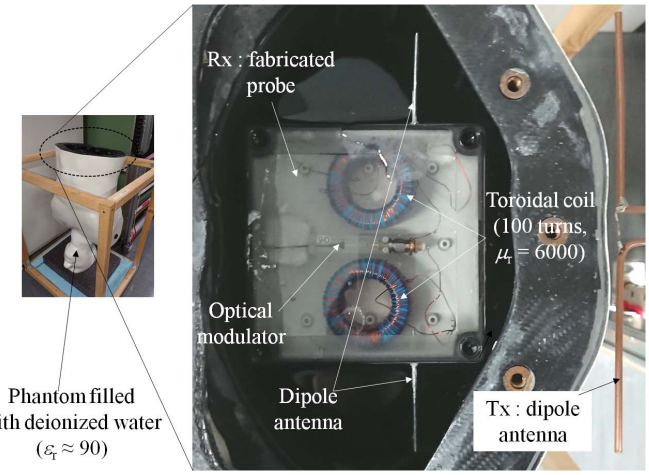

Fig. 1.Photograph of fabricated probe and experimental setup

—59 dBm while that w/o coil was —63 dBm. Enhanced sensitivity of the proposed system over conventional one has been demonstrated.

IV. CONCLUSION

In this paper, an E/O probe system for measurement of low frequency, in-body field strength has been proposed. The proposed system is composed of an optical modulator, toroidal coil, and dipole antenna. In-body field strength was measured by using the fabricated probe at 85 kHz. It has been demonstrated that the sensitivity of the probe is enhanced by implementing the impedance matching circuit.

ACKNOWLEDGMENT

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REFERENCES

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