

COMMISSION K: ELECTROMAGNETICS IN BIOLOGY AND MEDICINE

(November 2020 – May 2023)

Introduction

In the field of radio science, various researches have been conducted on the relationship between radio waves and the human body. Portable wireless terminals have been widely used in the field of wireless communication, and magnetic resonance imaging devices and thermal cancer treatment devices have been put into practical use in the field of medical applications. In addition, in recent years, devices and equipment that use electromagnetic fields, such as wireless power supplies, sensor networks, and magnetic levitation trains, have become widely used. In addition, in the medical field, surgical devices using microwave energy, called microwave energy devices, and transcranial magnetic stimulators for the treatment of psychiatric and neurological disorders have been introduced. Therefore, there is a need to establish compatibility between the safety of human life and electromagnetic fields. The following is a summary of the activities of the Japanese URSI Commission K for 2022-2023.

We have held regular meetings of the Japanese URSI-Commission K and annual scientific symposia in this field, and have promoted activities in cooperation with various fields such as electrical and electronic engineering, medicine, and biology. In addition, we have conducted activities to gain international recognition for our research results through journal papers and scientific conferences.

BioEM is the world's largest conference on bioelectromagnetics, attracting academic and industrial participants from all over the world at all career stages, and is highly regarded. The BioEM 2022 (<https://www.bioem2022.org/>) was held in Nagoya, Japan as a hybrid conference, with about 300 participants, and core members of the Japanese Commission K attended this conference and also contributed as local organizing committee members.

1. Annual scientific symposium on Electromagnetics in Biology and Medicine in Japan (Co-operated by Japanese Society for Electromagnetics in Biology and Medicine)

Date: April 22, 2021

Six oral presentations and one special lecture were given with 38 participants.

Special Lecture: "Wide Band Body Area Communication for Wearable and Implant Robot Control" by Wang, J. (Nagoya Institute of Technology)

Date: April 20, 2022

Seven oral presentations and two special lectures were given with 38 participants.

Special Lecture 1: "Mathematical approaches to biomagnetic inverse problems: magnetoencephalography (MEG) and magnetic resonance electrical property tomography (MREPT)" by Nara, T. (The University of Tokyo.)

Special Lecture 2: "Electromagnetic environment and health ~Looking back on 40 years of research life~" by Miyakoshi, J. (Kyoto University.)

Date: April 27, 2023

Five oral presentations and one special lecture were given with about 40 participants.

Special Lecture: "Imaging of heat and mass transfer in living bodies using magnetic resonance imaging" by Kuroda, K. (Tokai University)

2. Awards related to the URSI (Winner related to Japanese URSI-Commission K)

Young Scientist Award at URSI GASS 2021

Dr. Sen Liu (National Institute of Information and Communications Technology) won the Young Scientist Award for his paper entitled "Incident Power Density Assessment of Smart Surfaces for Exposure Compliance."

Student Paper Competition at URSI-JRSM 2022

Mr. Y. Inoue (The University of Tokyo) won the third prize for his paper entitled "Proposal of a method for estimating the position of magnetic marker under conditions of enhanced magnetization by permanent magnet."

Young research excellent presentation awards at the Scientific Symposium of the Japanese Society for Electromagnetics in Biology and Medicine

Dr. Motofumi Fushimi (The University of Tokyo) won the young research excellent presentation award for his presentation entitled "Electrical Property-Imaging of Biological Tissues Using MRI.", 2021.

Mr. Naohiro Eda (The University of Tokyo) won the young research excellent presentation award for his presentation entitled "Reconstruction of the electrical properties in human bodies based on the estimation of the unmeasurable magnetic field.", 2022.

Mr. Toshiya Nakagawa (Chiba University) won the young research excellent presentation award for his presentation entitled "Microwave energy device equipped with dielectric wave guide.", 2023.

Commission K (Electromagnetics in Biology & Medicine) Activity Report
October 2020 – July 2021

July 30, 2021
Soichi Watanabe

1 Core members of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Chair: Soichi Watanabe (National Institute of Information and Communications Technology)

Vice chair: Satoshi Nakasono (Central Research Institute of Electric Power Industry)

Secretaries: Kazuyuki Saito (Chiba University), Masaki Sekino (The University of Tokyo), Tomoaki Nagaoka (National Institute of Information and Communications Technology), Sachiko Yoshie (Railway Technical Research Institute), Ikuyo Miwa (National Institute of Information and Communications Technology), Atsushi Saito (Central Research Institute of Electric Power Industry)

2 Activities

Preparatory meeting for the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: January 13, 2021

Place: Online

- Topics:
- 1) Allocation of roles between core members.
 - 2) Prospectus for the next Japanese URSI-Commission K.
 - 3) List of members of the next Japanese URSI-Commission K.
 - 4) Planning the next scientific symposium.
 - 5) URSI GASS 2021 at Rome.
 - 6) Hosting the 2022 Annual Meeting of BioEM in Japan.

1st Meeting of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: April 22, 2021

Place: Online

- Topics:
- 1) Result of election of the commission chair.
 - 2) Self introductions of the commission members.
 - 3) Finalizing the minute by the commission chair.
 - 4) Objectives and operation policy of the commission.

- 5) Information on the Japan National Committee of URSI.
- 6) URSI GASS 2021 and flagship meetings.
- 7) Hosting the 2022 Annual Meeting of BioEM in Japan.
- 8) Associated conferences.

Scientific symposium (Co-operated by Japanese Society for Electromagnetics in Biology and Medicine)

Date: April 22, 2021

Place: Online

Number of participants: 38

Six oral presentations and one special lecture were given to the participants.

- 1) “Development of a phantom for detecting the human body at 5.7 GHz” by K. Sato et al. (Chiba University)
- 2) “Fundamental studies on phantoms for modeling the skin tissues at terahertz bands” by T. Tomizawa et al. (Aoyama Gakuin University)
- 3) “Estimation of frequency dependence of the increased specific absorption rate associated with implanted mandibular plate with screw holes” by A. Ohtsuka et al. (Hokkaido University)
- 4) “Measurement of exposure to electromagnetic waves at broadcast band” by K. Tobita et al. (National Institute of Information and Communications Technology)
- 5) “Adaptive time domain average stochastic resonance method for magnetocardiographic detection at room temperature” by Z. Liao (The University of Tokyo)
- 6) “Imaging dielectric properties of biological tissues using MRI” by M. Fushimi (The University of Tokyo)

Special Lecture) Wide band body area communication for wearable and implant robot control by J. Wang (Nagoya Institute of Technology)

Core member meeting of the Japanese Commission K

Date: October 2, 2020, February 25, June 21, 2021,

Place: Online

Topic: Hosting the 2022 Annual Meeting of BioEM in Japan.

Hosting the 2022 Annual Meeting of BioEM in Japan

BioEM is the world's largest and most highly recognized bioelectromagnetics conference attracting academic and industrial participants at all career stages from all over the world. The core members of Japanese Commission K are preparing to host the BioEM 2022 in Nagoya.

<https://www.bioem2022.org/>

3 Awards

Young Scientist Award at URSI GASS 2021

- Dr. Sen Liu (National Institute of Information and Communications Technology) won the Young Scientist Award for his paper entitled “Incident power density assessment of smart surfaces for exposure compliance.”

A young research excellent presentation award at the Scientific Symposium of the Japanese Society for Electromagnetics in Biology and Medicine

- Dr. Motofumi Fushimi (The University of Tokyo) won the young research excellent presentation award for his presentation entitled “Imaging dielectric properties of biological tissues using MRI.”

4 Associated meetings

4.1 Past meeting

1. BioEM, Oxford, UK, 21 - 26 June 2020, canceled < <https://www.bioem2020.org/> >

4.2 Future meetings

1. BioEM, Ghent, Belgium, 26 September - 1 October 2021, < <https://www.bioem2021.org/> >
2. URSI GASS, Rome, Italy, 28 August - 4 September 2021, < <http://www.ursi2021.org/> >

Commission K (Electromagnetics in Biology & Medicine) Activity Report
July 2021 – May 2022

May 17, 2022
Soichi Watanabe

1. Activities

Commission K Business meetings during GASS 2021.

Date: August 30, September 1 and 3, 2021

Place: Online

Prof. Koichi Ito has been promoted as the new chair of Commission K. Dr. Kensuke Sasaki has continue the ECR of Commission K. Candidates of a new vice chair and another ECR have been elected.

The 2nd Meeting of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: November 12, 2021

Place: Online

- Topics:
- 1) Approval of the minute of the 1st meeting.
 - 2) Report of the Japanese National Committee of URSI.
 - 3) Report of the Commission Coordinating Activities Meeting.
 - 4) Relationship between the flagship conferences of URSI and other related conferences.
 - 5) Progress report of URSI GASS 2023, AT-AP-RASC 2022, and BioEM 2022.
 - 6) Report of other societies and meetings.
 - 7) Other businesses.

The core member meeting of secretaries of the Japanese URSI-Commission K.

Date: January 17, 2022

Place: Online

- Topics
- 1) Activity plan of the Japanese URSI-Commission K in FY2022.
 - 2) Next symposium on Electromagnetics in Biology and Medicine.
 - 3) Promotion for the submission to BioEM 2022.
 - 4) URSI
AT-AP RASC 2022, URSI GASS 2023
JRSM 2022
 - 5) Other businesses

The 3rd Meeting of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: April 20, 2022

Place: The University of Tokyo and online (hybrid)

- Topics:
- 1) Approval of the minute of the 2nd meeting.
 - 2) Report of the Japanese National Committee of URSI.
 - 3) Report of the international activities of the Commission K.
 - 4) Progress report of URSI GASS 2023, AT-AP-RASC 2022, and JRSM 2022.
 - 5) Progress report of BioEM 2022.
 - 6) Report of other societies and meetings.
 - 7) Other businesses.

Scientific symposium (Co-operated by Japanese Society for Electromagnetics in Biology and Medicine)

Date: April 20, 2022

Place: The University of Tokyo and online (hybrid)

Number of participants: 38

7 oral presentations and 2 special lectures were given to the participants.

- 1) “Measurement of exposure levels to electromagnetic fields around broadcast transmit towers” by K. Tobita et al. (NICT)
- 2) “Temperature measurement in a tissue-equivalent phantom by a fluorescent thermoprobe” by S. Yamazaki et al. (NICT)
- 3) “Approximating Temperature Rise in Transcatheter Renal Denervation Using Machine Learning” by A. Rakhmadi et al. (Chiba University)
- 4) “Numerical Estimation of Human Body Blockage Characteristics at Cellular and Wireless LAN Frequency Bands for Epidemiologic Research on Children’s Health” by K. Yamamoto et al. (Hokkaido University)
- 5) “A Basic Study of EEG Detection in Hand Closing Movement” by R. Shoji et al., (Nagoya Institute of Technology)
- 6) “Reconstruction of the electrical properties in human bodies based on the estimation of the unmeasurable magnetic field” by N. Eda, et al., (The University of Tokyo)
- 7) “Analysis of the head induced electric field during the magnetic-particle imaging”, S. Liu et al., (The University of Tokyo)

Special Lecture 1) Mathematical approaches to biomagnetic inverse problems: magnetoencephalography (MEG) and magnetic resonance electrical property tomography (MREPT) by T. Nara (The University of Tokyo)

Special Lecture 2) Electromagnetic environment and health ~Looking back on 40 years of research life~ by J. Miyakoshi (Kyoto University)

Hosting the 2022 Annual Meeting of BioEM in Japan

BioEM is the world's largest and most highly recognized bioelectromagnetics conference attracting academic and industrial participants at all career stages from all over the world. Many members of Japanese Commission K are preparing to host the BioEM 2022 in Nagoya.

<https://www.bioem2022.org/>

3 Awards

Young Scientist Award at URSI GASS 2021

- Dr. Sen Liu (National Institute of Information and Communications Technology) won the Young Scientist Award for his paper entitled “Incident power density assessment of smart surfaces for exposure compliance.”

A young research excellent presentation award at the Scientific Symposium of the Japanese Society for Electromagnetics in Biology and Medicine

- Mr. N. Eda with the University of Tokyo “Reconstruction of the electrical properties in human bodies based on the estimation of the unmeasurable magnetic field”

4 Associated meetings

4.1 Past meeting

1. BioEM, Ghent, Belgium, 26--30 September 2021, <<https://www.bioem2021.org/>>

4.2 Future meetings

1. BioEM, Nagoya, Japan, 19—24 June, 2022, < <https://www.bioem2022.org/> >

Commission K (Electromagnetics in Biology & Medicine) Activity Report
May 2022 – June 2023

June 8, 2023
Soichi Watanabe

1. Activities

Hosting the 2022 Annual Meeting of BioEM in Nagoya, Japan

BioEM is the world's largest and most highly recognized bioelectromagnetics conference attracting academic and industrial participants at all career stages from all over the world. Many members of Japanese Commission K attended this conference and also contributed as local organizing committee members.

<https://www.bioem2022.org/>

URSI - Japan Radio Science Meeting

Date: September 1-2, 2022

Place: Chuo University

Dr. Andrey Andrenko gave a keynote lecture on "Wireless power transfer: Technology review, standardization and human body RF exposure assessment."

Dr. Maya Mizuno gave an invited lecture on "Spectroscopic analysis in terahertz frequency region for electromagnetics in medicine and biology."

The commission K had the following three regular sessions.

- Oral 1 : Recent Research Trends of Electromagnetics in Medicine and Biology (1)
- Oral 2 : Recent Research Trends of Electromagnetics in Medicine and Biology (2)
- Poster

The 4th Meeting of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: September 1, 2022

Place: Chuo University and online (hybrid)

- Topics:
- 1) Approval of the minute of the 3rd meeting.
 - 2) Report of the Japanese National Committee of URSI.
 - 3) Report of the international activities of the Commission K.
 - 4) Preparing URSI GASS 2023 and report of AT-AP-RASC 2022.
 - 5) Report of BioEM 2022.
 - 6) Report of other societies and meetings.

7) Other businesses.

URSI-Japan Centennial Celebration Symposium 1922-2022: Progress in Radio Science Research in Japan and the 100 Years Activities of the Japan National Committee of URSI

Date: November 12, 2022

Place: Science Council of Japan and online (hybrid)

Prof. Koichi Ito gave a special lecture entitled "Therapeutic technologies of electromagnetic fields for cancer treatment."

Prof. Koichi Ito, Dr. Kensuke Sasaki, Prof. Shoogo Ueno, Prof. Masao Taki, and Dr. Soichi Watanabe contributed to this meeting as executive committee members.

The 5th Meeting of the Japanese URSI-Commission K for the 25th term of the Science Council of Japan

Date: April 27, 2023

Place: The University of Tokyo and online (hybrid)

- Topics:
- 1) Approval of the minute of the 4th meeting.
 - 2) Schedule of FY 2023.
 - 3) Report of the Japanese National Committee of URSI.
 - 4) Report of the international activities of the Commission K.
 - 5) Progress report of URSI GASS 2023.
 - 6) Report of other societies and meetings.
 - 7) Other businesses.

Scientific symposium (Co-operated by Japanese Society for Electromagnetics in Biology and Medicine)

Date: April 27, 2023

Place: The University of Tokyo and online (hybrid)

5 oral presentations and 1 special lecture were given to the participants.

- 1) "Microwave energy device equipped with dielectric wave guide" by T. Nakagawa et al. (Chiba University)
- 2) "Measurement of temperature distributions in biological-tissue-equivalent phantom using temperature-sensitive fluorescent probe" by S. Yamazaki et al. (NICT)
- 3) "Size of phantom in measuring electric fields induced by a 85kHz WPT system" by Y. Yanaga et al. (Tokyo University of Agriculture and Technology)
- 4) "Numerical analysis of brain stimulation in exposure to low-frequency electromagnetic fields" by J. Gomez-Tames et al. (Chiba University)

5) “Awareness survey on electromagnetic waves in daily life based on online questionnaire” by K. Kamegai et al., (NICT)

Special Lecture: Imaging of heat and mass transfer in living bodies using magnetic resonance imaging by K. Kuroda (Tokai University)

2 Awards

URSI-JRSM 2022 Student Paper Competition

- Mr. Y. Inoue (The University of Tokyo) won the third prize for his paper entitled “Proposal of a method for estimating the position of magnetic marker under conditions of enhanced magnetization by permanent magnet.”

A young research excellent presentation award at the Scientific Symposium of the Japanese Society for Electromagnetics in Biology and Medicine

- Mr. T. Nakagawa of Chiba University “Microwave energy device equipped with dielectric wave guide”

3 Associated meetings

3.1 Past meeting

1. BioEM, Ghent, Belgium, 26-30 September 2021, <<https://www.bioem2021.org/>>

3.2 Future meetings

1. BioEM, Oxford, UK, 18-23 June, 2023, < <https://www.bioem2023.org/> >