



# EMCABS

## EMC Abstracts

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or papers. If the library you visit does not own the source document, the librarian can probably request the material or a copy from another library through interlibrary loan, or for a small fee, you can order it from NTIS or DTIC. Recently it became clear that EMCABS were more timely than publications which were being listed in data files. Therefore, additional information will be included, when available, to assist in obtaining desired articles or papers. Examples are: IEEE, SAE, ISBN, and Library of Congress identification numbers.

As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base.

EMC



(From the right) Dr. Taka, Nagoya Institute of Technology; Dr. Sroka, EMC-Testcenter Zurich AG; Dr. Sowa, Wroclaw University of Technology; Professor Todd Hubing, Clemson University; Professor Francescaromana Maradei, University of Rome “La Sapienza”; Professor Shuichi Nitta, Salesian Polytechnic; Osamu Fujiwara, Nagoya Institute of Technology; and Professor Pignari, Politecnico di Milano, gathered during the welcome reception held in Kyoto, Japan on Tuesday, July 21, 2009.

### EMCABS: 01-11-2009

#### SAR MEASUREMENT PROCEDURE FOR MULTI-ANTENNA TRANSMITTERS

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 249–252.

*Abstract:* This paper proposes and verifies a SAR measurement procedure for a multi-antenna transmitter that requires the measurement of two-dimensional electric field distributions for the number of antennas and the calculation for obtaining the three-dimensional SAR distributions for arbitrary weighting coefficients of the antennas prior to determining the average

SAR. The proposed procedure is verified based on the FDTD calculation and the measurement using EO probes.

*Index terms:* Specific absorption rate (SAR), multi-antenna, electro-optic (EO) probe, equivalent theorem, image theory.

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#### EMCABS: 02-11-2009

#### COMPUTATIONAL UNCERTAINTY OF ELECTROMAGNETIC POWER ABSORPTION AND TEMPERATURE RISE IN THE EYES UNDER EXPOSURE TO PLANE WAVES FROM 1 TO 10 GHZ

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 253–256.

*Abstract:* Temperature rise in the eyes caused by exposure to radio-frequency electromagnetic waves is studied. An anatomically realistic male and female head voxel models with three different resolutions, 2 mm, 1 mm, and 0.5 mm, are used. This allows the studies of the uncertainty due to computational resolution, and high resolution allows the frequency range to be increased up to 10 GHz. Plane waves from various directions are used as the exposure source. Electromagnetic power absorption in the head is solved using the finite-difference time-domain (FDTD) method. The thermal model is based on the steady-state bioheat equation, which is solved with finite-difference method using geometric multigrid method for faster convergence. The results give empirical rules for sufficient resolution for computing SAR and temperature rise in the eyes, and show differences between open and closed eyes. It is also shown that eye-averaged SAR is a useful measure for the temperature rise in the lens only for frequencies smaller than 3 GHz.

*Index terms:* Finite-difference time-domain (FDTD), bioheat, specific absorption rate (SAR), eye temperature.

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#### EMCABS: 03-11-2009

#### A SIMPLE EXPRESSION FOR BIT ERROR PROBABILITY OF CONVOLUTIONAL CODES UNDER CLASS-A INTERFERENCE

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 261–264.

*Abstract:* In order to establish emission limits to protect radio systems, the effect of the non-Gaussian properties of interference on the performance of coded radio transmission systems should be taken into account. In this paper, a simple closed-form expression for the bit error probability (BEP) of convolutional codes is developed for coherent BPSK systems assuming that the interfering signal is expressed by Middleton's Class A formula, which is a commonly used model of non-Gaussian interference.

It is shown that the sum of identically distributed independent Class A random variables becomes a new Class A variable. Using this result, a simple expression for BEP is derived for Viterbi decoding with an unquantized soft decision. The validity of the expression is demonstrated by numerically simulating the BEP of a communication link. It is found that BEP after decoding under impulsive interference approaches that under Gaussian noise as the free distance of the code increases.

*Index terms:* Non-Gaussian interference, convolutional code, viterbi decoding, bit error probability.

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#### EMCABS: 04-11-2009

#### EXPERIMENTAL STUDY OF IC EMI REDUCTION BY-SPREADING CLOCK-SIGNAL SPECTRUM

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 281–284.

*Abstract:* Clock circuits have been considered as major sources of EMI from an IC. Hence, the reduction of EMI from clock circuits has been an active research topic in recent years. In this study, a spread spectrum technique was employed to modulate clock signals so as to reduce the EMI level. A TI-offered evaluation board containing a TI CDCE906 clock synthesizer with a built-in FM triangular modulating function was used as the spread spectrum clock generator (SSCG). The output spectrum-spread clock (SSC) was in turn fed into a PIC18F4420 microchip test board. With the clock signal frequency modulated and the rise/fall time extended, measured results revealed that the emission levels of the microchip test board can be greatly reduced.

*Index terms:* Spread spectrum technology, electromagnetic interference (EMI), spectrum-spread clock.

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#### EMCABS: 05-11-2009

#### INFLUENCE OF ADJACENT METAL COVER PLANES ON EMC FILTER STRUCTURES

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 305–308.

*Abstract:* This paper deals with the influence of metal cover planes close to SMD filter structures. The low-pass structures are used for EMC purposes and work in a frequency range of

100 kHz to 4 GHz. It is shown by measurement and simulation that a close cover plane changes the filter behavior significantly in dependency of the filter component used. For low and high impedance filter structures, different influences are obtained; a parameter study was carried out in order to derive design rules.

*Index terms:* EMC, low-pass, conductive planes.

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#### EMCABS: 06-11-2009

##### DIFFERENCES IN THE COUPLING BEHAVIOR OF FAST TRANSIENT PULSES TO SHORT PCB TRACES

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 361–364.

*Abstract:* Ultra wideband (UWB) pulses cover a large frequency range up to several GHz, thus they are able to cause malfunctions or even destructions of complex electronic systems. Previous investigations of the coupling effects of fast transient pulses to complex electronic systems have shown that increasing the system dimensions leads to an increased coupling efficiency. This statement seems to be universally applicable for all electronic systems, but susceptibility measurements of a generic microcontroller board with UWB pulses show surprisingly different results. In this paper, this effect is investigated by measurements and numerical methods. Measurement results of the generic microcontroller board are presented as well as numerical results of the coupling behavior of different fast transient pulses to short PCB traces. Furthermore, the results of both measurement and numerical methods are compared to each other.

*Index terms:* Intentional electromagnetic interference (IEMI), UWB pulses, coupling to PCB traces

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#### EMCABS: 07-11-2009

##### COMPUTATIONAL DOSIMETRY ON CONTACT CURRENTS FROM CHARGED HUMAN BODY

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 465–468.

*Abstract:* Contact current, defined as indirect effects of electromagnetic fields, flows a human body when contacting with an object such as a metal structure at a different electric potential, and may stimulate the muscle and peripheral nerve. Thus, numerical analyses of electric fields induced by contact currents in a human body have been performed. Computational methods and evaluations of effects of the transient field associated with contact currents have not yet been understood sufficiently. In the present study, we have simulated induced electric field in a human body due to contact current with dispersive FDTD

method incorporated with a Japanese adult male model developed at the National Institute of Information and Communication Technology. We compared FDTD calculations of body surface magnetic fields caused by contact current with measurements to validate our FDTD modeling, and then calculated induced peak electric field. As a result, we found that calculated and measured result of body surface magnetic fields are in fair agreement, confirming the validity of our FDTD modeling. The induced electric field becomes higher around the arm, while relatively lower in the central nerve systems.

*Index terms:* Charged human body, contact current, FDTD simulation.

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#### EMCABS: 08-11-2009

##### EMI MODELING FOR CARDIAC PACEMAKER IN HUMAN BODY COMMUNICATION

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 469–472.

*Abstract:* In this paper, we have proposed a two-step approach to model the electromagnetic (EM) interference voltage on an implanted cardiac pacemaker. In the first step, we calculate the input voltage of the analogue sensing circuit of the pacemaker using an EM field analysis tool by considering the pacemaker as a receiving antenna. In the second step, we employ a nonlinear operational amplifier model with Volterra series representation to predict the output voltage of the sensing circuit which consists of an amplifier and a low-pass filter. Comparison between the predicted result and the measured result in literature has shown the validity of the approach. Application of the approach to a user certification situation has demonstrated that the output voltage of the pacemaker sensing circuit is much smaller than the sensing threshold under usual signal intensity of on-body communications.

*Index terms:* Electromagnetic interference, human body communication, implanted cardiac pacemaker, nonlinear operational amplifier.

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#### EMCABS: 09-11-2009

##### A CMOS OPAMP IMMUNE TO EMI WITH NO PENALTY IN BASEBAND OPERATION

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 533–536.

*Abstract:* In this paper, a novel CMOS Operational Amplifier input stage which is robust to high power electromagnetic interference (EMI) without any significant penalty in baseband performance is presented and its operation principle is discussed.

An opamp which includes the new input stage is proposed and it is compared in terms of immunity to EMI with a standard opamp circuit on the basis of computer simulations and experimental results.

*Index terms:* CMOS operational amplifier, high power EMI, robust, simulations, experiments.

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#### EMCABS: 10-11-2009

##### ELF ENVIRONMENTAL EXPOSURE OF THE POPULATION: A CASE STUDY IN A SMALL CITY, SOUTH OF PARIS, FRANCE

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 619–622.

*Abstract:* Environmental issues are a more and more important aspect of everyday life. Science and technology may be able to improve the knowledge of the exposure to various physical or chemical agents. This paper summarizes one aspect of a large environmental study dedicated to many factors. This specific part is dedicated to ELF exposure. A small town located south of Paris has been selected to conduct this study because it is at the border of many highways, close to the Paris-Orli airport runways, and has a number of overhead powerlines crossing the area. This paper presents the results of the magnetic field exposure measurement that were carried out from January to May 2008, first on a sample of the population, second at some particular fixed points and finally, all around the town.

*Index terms:* 50 Hz ELF, overhead powerlines, exposure.

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#### EMCABS: 11-11-2009

##### A REMOTE MONITORING SYSTEM OF HIGH FREQUENCY ELECTROMAGNETIC FIELD IN A MAGNETIC CONFINEMENT FUSION TEST FACILITY

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 629–632.

*Abstract:* A remote and continuous high frequency electromagnetic-field monitoring system using EMC-300EPs with 3-axes probes in a magnetic confinement fusion test facility is developed. The required frequency range of the measurement system is from 25 MHz to 100 MHz. The outputs of each measurement instrument received with the probes are measured simultaneously by original software using a laptop type personal computer connected with a local area network. The measurement values of the electromagnetic-field strength can be transferred using local area network system and are monitored in fusion device control room a point about 200 m away from a fusion device building. An example is shown of the measurement data on the periphery of a high-frequency generator and amplifier used as an auxiliary heating system for a magnetic confinement fusion test device using this monitoring system.

*Index terms:* Remote monitoring system, local area network, high frequency electromagnetic field, magnetic confinement fusion test facility, ion cyclotron range of frequency heating

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#### EMCABS: 12-11-2009

##### A HIGHLY MINIATURIZED AND LOW IMPEDANCE ON-CHIP WILKINSON POWER DIVIDER EMPLOYING PGS ON MMIC

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Proceedings of 2009 International Symposium on Electromagnetic Compatibility, Kyoto, Japan, July 20–24, 2009, pp. 717–719.

*Abstract:* In this work, we propose a low-impedance and highly miniaturized on-chip Wilkinson power divider on MMIC, which was fabricated by a microstrip line structure employing periodic ground structure (PGS) with single-sided via holes. Using the microstrip line with PGS, a miniaturized 13 power divider was fabricated. The size of the power divider was 0.110 mm<sup>2</sup>, which was 6 % of a conventional one.

*Index terms:* Periodic ground structure (PGS), microstrip line, Wilkinson power divider.

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