

Objekttyp: **FrontMatter**

Zeitschrift: **Bulletin des Schweizerischen Elektrotechnischen Vereins, des Verbandes Schweizerischer Elektrizitätsunternehmen = Bulletin de l'Association Suisse des Electriciens, de l'Association des Entreprises électriques suisses**

Band (Jahr): **72 (1981)**

Heft 2

PDF erstellt am: **22.07.2024**

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# BULLETIN

des Schweizerischen Elektrotechnischen Vereins  
de l'Association Suisse des Electriciens

des Verbandes Schweizerischer Elektrizitätswerke  
de l'Union des Centrales Suisses d'Electricité



**2/1981**

Zürich, 24. Januar 1981  
72. Jahrgang, Seiten 53...108  
Erscheint zweimal monatlich

Zurich, le 24 janvier 1981  
72<sup>e</sup> année, pages 53...108  
Paraît deux fois par mois

Elektrizitätswirtschaft – Economie électrique

11. Weltenergiekonferenz  
11<sup>e</sup> Conférence Mondiale de l'Énergie

# 8-1000 LITER WARMWASSERBEREITER

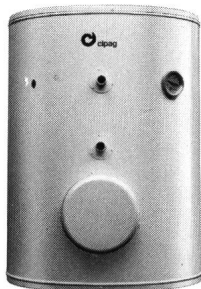


**CIPAG OFFERT DEN ELEKTRISCHEN UND KOMBINIERTEN BOILER, DER IN JEDEM FALL PASST**



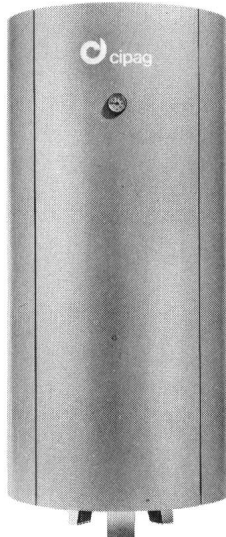
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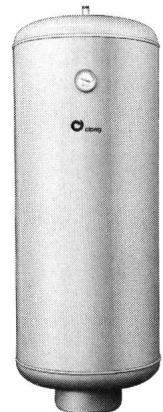
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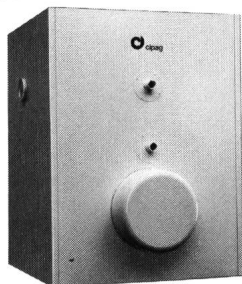
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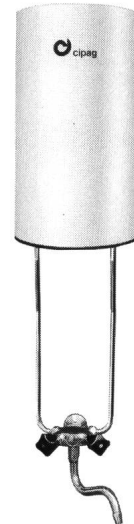
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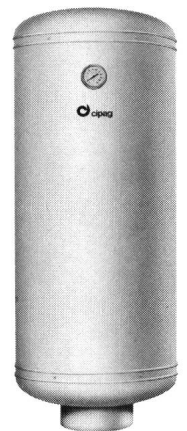
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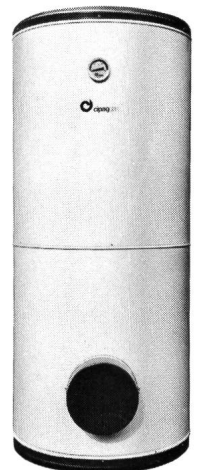
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# EMC Symposium & Exhibition, Zurich 1981 March 10-12

## TECHNICAL PROGRAM

### TUESDAY, MARCH 10

#### A. Spread Spectrum compatibility TUm

Chairman: Prof. Dr. G. R. Cooper

- A1 H. Ochsner, T. Dvorak, *Fed. Inst. of Technology Zurich, Switzerland*: Low tension power line as a fast digital data transmission channel.
- A2 H. P. Baer, *Fed. Inst. of Technology Zurich, Switzerland*: Effect of hard limiting in a PN Spread-Spectrum system.
- A3 A. A. Hernandez, *Harris Corp., Melbourne, FL*: Effect of direct sequence and frequency hopping interference on FDM/FM systems.
- A4 G. R. Cooper, *Purdue University, West Lafayette, IN*: Operation of a low-power Spread-Spectrum system in a strong interference environment.

#### B. Characterization of interference and noise and evaluation of system performance TUm

(Special session of URSI commission E)

Invited chairman: Dr. J. M. Morris

- B1 D. Middleton, *New York, NY*: New results in the development of canonical and quasi-canonical EMI probability models.
- B2 Z. McC. Huntoon, A. A. Giordano, *Sylvania-GTE, Needham Heights, MA*: RMS-to-average deviation ratio for interference and atmospheric noise.
- B3 A. D. Spaulding, *Institute for Telecommunication Sciences, Boulder, CO*: Voice communication system performance in the presence of automotive ignition noise.
- B4 J. M. Morris, *Office of Naval Research, Arlington, VA*: On worst-case additive interference for m-ary signalling and correlation receivers: Results for representative signal sets.

#### C. Intrasystem EMC TUm

Invited chairman: J. F. Spina

- C1 G. T. Capraro, *Rome Air Development Center, Griffiss AFB, NY*: The intrasystem EMC problem and future directions.
- C2 C. R. Paul, *University of Kentucky, Lexington, KY*: Adequacy of low-frequency, crosstalk prediction models.
- C3 S. J. Kubina, *Concordia University, Montreal, Canada*: EMC computer codes and the user: An adaptive symbiosis.
- C4 J. Shapira, R. Baron, M. Ruso, E. Milshtein, *RAFAEL-Armament Development Authority, Haifa, Israel*: Intrasystem EMC testing—a new concept.

#### D. Mathematical and computer methods in spectrum utilization TUa

Invited chairman: Prof. Dr. R. Struzak

- D1 G. De Couvreur, G. Chan, R. McCaughern, N. Ahmed, *Dep. of Communications, Ottawa, Canada*: The Canadian field trials of a computer assisted land-mobile licensing system.
- D2 G. De Couvreur, M. Drouin, R. McCaughern, N. Ahmed, *Dep. of Communications, Ottawa, Canada*: Acquisition and utilization of channel occupancy data in the shared frequency assignment process.
- D3 J. H. Causebrook, *BBC Engineering Research Dept., Tadworth, England*: The assignment of frequencies to a transmitter network in a broadcast band to avoid mutual interference.
- D4 R. G. Struzak, *Institute of Telecommunications, Wroclaw, Poland*: On some optimization problems in planning of transmitter networks.
- D5 V. N. Troitsky, *Ministry of Posts and Telecommunications, Moscow, USSR*: A method for determining statistical characteristics of SHF, UHF and VHF interfering signals over long distances in land and coastal areas.
- D6 Yu. M. Payansky, I. S. Povolotsky, *Ministry of Posts and Telecommunications, Moscow, USSR*: Some aspects of EMC in single carrier per channel systems.
- D7 P. H. Sawitz, *ORI Inc., Silver Springs, MD*: Radio Interference: The limiting factor in spectrum-orbit utilization.

#### E. Nuclear EMP I TUa

Invited chairman: Dr. C. Baum

- E1 F. M. Tesche, *LuTech Inc., Berkeley, CA*: Utilization of network theory for the solution of EMP interaction problems and system hardening.
- E2 J. Fontaine, A. Umbert, *Lab. d'Electronique et Resonance Magnetique, Aubiere*; B. Djebari, J. Hamelin, *Centre Nat. d'Etudes des Telecom., Lannion, France*: Ground effects in the response of a single-wire transmission line illuminated by an EMP.
- E3 K.-L. Groenhaug, *Norwegian Defence Research Establishment, Kjeller, Norway*: Calculations of current induced in long conductors by an exo-atmospheric EMP.

#### E4 I. L. Gallon, *Atomic Weapons Res. Establishment, Aldermaston, England*: EMP coupling to extensive systems.

- E5 Ch. Braun, W. Graf, W. Ochs, H. U. Schmidt, *INT-Fraunhofer Gesellschaft, Euskirchen, GFR*: A frequency domain NEMP simulator for tests on scaled models.
- E6 F. Fruengel, H. Martinen, D. Ebeling, *Impulsphysik GmbH, Hamburg, GFR*: Practical measures at a water-Blumlein 500 kV EMP generator and its oscilloscopic measurements.
- E7 K. Feser, M. Modrusan, E. Haefely & Cie AG, *Basel, Switzerland*; K. H. Gonschorek, H. Singer, *Hochschule der Bundeswehr, Hamburg, GFR*: Mobile EMP-system with high flexibility.

#### F. EMI in microelectronics TUa

Invited chairman: Dr. J. J. Whalen

- F1 J. J. Whalen, *State University of New York at Buffalo, Amherst, NY*: Current status of determining EMI in microelectronics.
- F2 J. G. Tront, *Virginia Polytechnic Institute, Blacksburg, VA*: Using the modified Ebers-Moll model to predict EMI in active filters.
- F3 J. Alkalay, D. Weiner, *Syracuse University, NY*: Computer simulation of EMI effects in a 7400 TTL NAND Gate.
- F4 G. K. Chen, J. J. Whalen, K. N. Chen, *State University of New York at Buffalo, Amherst, NY*: Using macromodels to compare RFI in bipolar and FET-bipolar operational amplifiers.
- F5 C. A. Paludi, Jr., *Rome Air Development Center, Griffiss AFB, NY*: A methodology for EMC in microelectronics.
- F6 J. G. Olin, *General Motors Institute, Flint, MI*: EMC testing of automotive electronic control system.

### WEDNESDAY, MARCH 11

#### G. Biological effects WEm

Chairman: Prof. Dr. P. Bernardi

- G1 N. Dekleva, *Clin. Hospital, Zemun*; B. Beleslin, *Med. Faculty, Belgrade*; B. Stamenovic, *Inst. for med. Research, Belgrade*; V. Majic, *Technical University Belgrade, Yugoslavia*: Magnetic field and oxygen interaction in biological material.
- G2 J. Silyn, *Technical University Aachen, GFR*: Influence of low-frequency magnetic field (LMF) on the organism.
- G3 D. J. Bem, T. Wlecekowski, *Technical University of Wroclaw, Poland*: On the measurement of hazardous EM fields in lossy media using a small loop antenna.
- G4 R. Klimkiewicz, M. Macher, P. Tyrawa, *Institute of Telecommunications, Wroclaw, Poland*: EMC of transmitting antennas. The problem of spectrum density in the vicinity of high-power UHF TV antennas.
- G5 T. Smialkowski, A. Koperski, *National Radio Inspection, Warsaw, Poland*: Measurements of strong electromagnetic fields in the frequency range from 0.1 to 300 MHz.
- G6 B. Raufmann, *Institut für Rundfunktechnik, München, GFR*: Field strength measurements in the vicinity of LF, MF, and HF-transmitting aeriels.
- G7 P. A. Neukomm, R. Ballisti, G. Klaus, *Federal Institute of Technology Zurich, Switzerland*: The influence of the human body on the radiation characteristics of small, body-mounted antennas, especially in the resonance region from 50 to 200 MHz.

#### H. Nuclear EMP II WEm

Invited chairman: W. Joehli

- H1 C. E. Baum, *Air Force Weapons Laboratory, Kirtland AFB, NM*: Electromagnetic topology: A formal approach to the analysis and design of complex electrical systems.
- H2 E. F. Vance, *SRI International, Menlo Park, CA*: EMP hardening of systems.
- H3 M. Wik, *Defence Material Administration, Stockholm, Sweden*; A. Eggendorfer, W. H. Kapp, *Joslyn Electronics, Goleta, CA*; W. Joehli, W. Buchmann, *Forschungsinstitut fuer Militaerische Bautechnik, Zurich, Switzerland*: Measurement and application of secondary surge arrestors for NEMP protection.
- H4 L. Marin, *The Dikewood Corp., Santa Monica, CA*: External interaction problems made simple with the Singularity Expansion Method.
- H5 M. Ivanovic, *Federal Institute of Technology Lausanne, Switzerland*: Computer model and impulse current injections for optimum NEMP protection of cables.
- H6 F. Fornerod, *Cables Cortaillod S.A., Cortaillod, Switzerland*: Calculation and measurement of transfer impedance of cable sheaths.
- H7 B. Warnister, J. Bertuchoz, T. Ruedy, *AC-Laboratory Wimmis, Switzerland*: Calculation of NEMP-induced voltage in coaxial cables using transfer impedance.

#### I. Coupling WEm

Invited chairman: J. F. Fischer

- I1 F. M. Tesche, T. K. Liu, *LuTech Inc., Berkeley, CA*: Recent developments in electromagnetic field coupling to transmission lines.
- I2 C. R. Paul, *University of Kentucky, Lexington, KY*: Coupling to twisted pair transmission lines.
- I3 W. L. Chadsey, J. E. Tigner, *Science Applications Inc., Vienna, VA*: System generated electromagnetic pulse coupling to cables.
- I4 G. T. Capraro, *Rome Air Development Center, Griffiss AFB, NY*; C. R. Paul, *University of Kentucky, Lexington, KY*: A probabilistic approach to wire coupling interference prediction.
- I5 A. Martin, *Raychem Corp., Menlo Park, CA*: The connector pin voltage of a shielded cable immersed in a radiation field.
- I6 S. A. Davidson, *Aeronautical Systems Div., Wright-Patterson AFB*; G. A. Thiele, *University of Dayton, OH*: A hybrid method of moments-GTD technique for computing electromagnetic coupling between two monopole antennas on a large cylindrical surface.
- I7 H. Ryser, *Hasler Ltd., Berne, Switzerland*: Coupling of fast transients from power supply lines into coaxial lines: Experimental and theoretical results.

#### J. Immunity WEa

Chairman: A. de Jong

- J1 R. Bersier, *Swiss PTT, Berne, Switzerland*: Measurement of the immunity of TV receivers to AM fields in the 3-30 MHz range, including the influence of connected cables.
- J2 H. Cichon, *IARU Reg. 1*; H. Trzaska, *Technical University of Wroclaw, Poland*: Susceptibility problems of general use electronic devices.
- J3 G. H. Schildt, *Siemens AG, Braunschweig, GFR*: Safety control systems interfered with by electromagnetic noise.
- J4 Y. M. Abramson, A. Y. Senchillo, *Radio Research Institute, Leningrad, USSR*; V. S. Akimov, *Ministry of Posts and Telecommunications, Moscow, USSR*: Protection of earth stations of satellite television broadcasting systems against man-made interference.
- J5 G. K. Boronichev, *Radio Research Institute, Leningrad, USSR*: Investigation and control of immunity of receptors to interference.
- J6 E. Corsaro, *RAI-Radiotelevisione Italiana, Torino, Italy*: A comprehensive proposal for radio devices immunity measurement methods.

#### K. EMC in communications WEa

Chairman: Prof. E. Paolini

- K1 V. A. Partenov, *Ministry of Posts and Telecommunications, Moscow, USSR*: Electromagnetic compatibility of high speed digital data transmission circuits and analog circuits in cables of local telephone networks.
- K2 L. Inzoli, S. Caniggia, G. Cardinai, *ITALTEL s.p.a., Milano, Italy*: EMI problems in the design of new telephone switching systems.
- K3 J. P. Mills, *GTE Automatic Electric, Northlake, IL*; D. R. J. White, J. D. M. Osburn, *Don White Consultants, Gainesville, VA*: EMC design of PCB's and backplanes.
- K4 V. B. Dikhtyar, K. I. Palatov, B. M. Paramonov, *USSR Academy of Sciences, Moscow, USSR*: Calculation of nonlinear amplifiers with single- and multifrequency input signals.
- K5 K. K. Venkuskas, *Merchant Marine Research Institute, Leningrad, USSR*: Improvement of EMC characteristics of HF and MF ship communication systems.
- K6 A. Wojnar, *Warsaw Academy of Technology, Poland*: On the probability of communication in radio systems.
- K7 M. A. Bykhovskiy, *Ministry of Posts and Telecommunications, Moscow, USSR*: EMC evaluation methods for line-of-sight radio relay links using different types of modulation.

#### L. Particular EMI sources WEa

Chairman: Prof. Dr. C. Egidi

- L1 Y. Amemiya, O. Fujiwara, *Nagoya University, Japan*: Effects of resistive plugs in suppressing ignition noise.
- L2 P. de Bruyne, *Fed. Institute of Technology Zurich, Switzerland*: Compatibility of graphic data input tables.
- L3 W. Hadrian, *Technical University of Vienna, Austria*: The magnetic field of three-phase transformers and bus-bars at considerable distances.
- L4 J. Simic, J. Rajda, *El. Inst. "Rade Koncar", Zagreb, Yugoslavia*: Disturbances of signalling-protective and telecommunication devices caused by diode- and thyristor-controlled locomotives.
- L5 H. S. Cabayan, *Lawrence Livermore Laboratory, Livermore, CA*: Electromagnetic emission from accelerators and electron beams.
- L6 J. M. G. A. Ouderling, J. T. A. Neessen, *Dr. Neher Laboratory PTT, Leidschendam, Netherlands*: Analysis of interference in telecommunication networks caused by power generating windmills.
- L7 L. P. Kozlova, V. A. Leonov, *Radio Research Institute, Leningrad, USSR*: On establishing limits for radio interference at mains terminals of TV receivers over the frequency band above 1,605 kHz.

THURSDAY, MARCH 12

**M. EMC measurements options for the future** THUm

Invited chairman: M. L. Crawford

- M1 M. L. Crawford, *National Bureau of Standards, Boulder, CO: Options to open-field and shielded enclosure EMC measurements.*
- M2 B. F. Lawrence, *Ray Proof, Norwalk, CN: A new generation of anechoic chambers.*
- M3 G. Benham, *British Aerospace, Filton, England: A new approach to anechoic chambers.*
- M4 M. Kanda, *National Bureau of Standards, Boulder, CO: The theoretical and experimental investigations of loading effects due to perfectly conducting rectangular cylinder in a transverse electromagnetic (TEM) cell.*
- M5 G. Meyer, *Federal Institute of Technology Zurich, Switzerland: The TEM measuring line—a critical overview.*
- M6 L. Bolla, M. Mensa, E. Rondi Totto, *Aeritalia, Torino, Italy: A wide-band measuring system intended for time domain measurements.*
- M7 M. A. Bridgwood, *Portsmouth Polytechnic, Hampshire, England: Some uses of electrolytic cells in the statistical study of electromagnetic interference.*

**N. Reliability, limits, measurements** THUm

Chairman: Prof. Dr. R. Zwicky

- N1 N. Ari, *Brown Boveri & Cie, Baden, Switzerland: Electromagnetic phenomena and reliability of electronic equipment and systems.*
- N2 A. Brenot, *Centre Nat. d'Etudes des Telecomm., Issy-les-Moulineaux, France: Comparison of EMC measuring methods and RFI limits.*
- N3 H. Sauvain, E. Vieux, *Condensateurs Fribourg S.A.; M. Aguet, Fed. Institute of Technology Lausanne, Switzerland; A. Geneux, Fribourg Condensateurs S.A., Noirefontaine, France: Characterization of interference caused by household apparatus.*
- N4 M. Borsero, *INGF, Torino; E. Nano, Politecnico di Torino, Italy: Comparison between calculated and measured attenuation of the site recommended by IEC for radiation measurements.*
- N5 K. Hausdorf, *Micafil AG, Zurich, Switzerland: Evaluation of EMC techniques for sensitive production tests.*
- N6 H. Knoller, *Lockheed-California, Burbank, CA: A new induction probe for high efficiency coupling.*
- N7 W. Moron, Z. Rymarowicz, R. Struzak, *Inst. of Telecomm., Wrocław, Poland: Results of MF composite urban radio noise survey in Poland.*

**O. Available computer programs for the EMC engineer** THUm

Invited chairman: Prof. J. Perini

- O1 J. D. Nordgard, *Georgia Institute of Technology, Atlanta, GA; C. L. Chen, Purdue University, Lafayette, IN: A cable coupling code.*
- O2 A. T. Adams, J. Luzwick, E. Ngai, *Syracuse University, Syracuse, NY: Computer programs for linear and planar arrays of thin-wire dipoles.*
- O3 B. J. Strait, *Syracuse University, Syracuse, NY: Available computer programs based on the method of moments.*
- O4 D. J. Bem, J. Janiszewski, R. Zielinski, *Technical University of Wrocław, Poland: Computer analysis of electromagnetic compatibility of VHF-FM broadcasting systems.*
- O5 P.-A. Merz, *Siemens-Albis, Zurich, Switzerland: Lightning and NEMP surges on gas arrestors. A computation procedure for the transient response.*
- O6 G. Gerbi, C. Anro, *Aeritalia, Torino, Italy: ACAP: Antenna coupling analysis program.*
- O7 D. J. Bem, M. Kiajn, *Technical University of Wrocław, Poland: Power flux density in the near field of TV transmitting antennas.*

**P. Shielding and grounding** THUa

Chairman: G. A. Jackson

- P1 P. J. Madle, *TRW Inc., Redondo Beach, CA: Contact resistance and porpoising effects in braid cables.*
- P2 B. Demoulin, P. Degauque, M. Cauterman, *Lille University, France: Shielding effectiveness of braids with high optical coverage.*
- P3 G. Chandesis, *Centre Nat. d'Etudes des Telecomm., Issy-les-Moulineaux; B. Demoulin, P. Degauque, Lille University, France: Effect of ground connection on the coupling of disturbing signals to a coaxial line.*
- P4 L. Borek, *Vacuumschmelze GmbH, Hanau, GFR: Heavily magnetically shielded room for measurements of extremely weak magnetic fields.*
- P5 D. A. Bull, G. A. Jackson, *ERA Technology Ltd., Leatherhead, England: Assessment of screening effectiveness of low conductivity panels.*

**Q. Lightning and power lines** THUa

Chairman: Prof. Dr. J. Wiesinger

- Q1 F. D. Martzloff, *General Electric Corp., Schenectady, NY: Transient overvoltage protection: The implications of new techniques.*
- Q2 B. Djebari, J. Hamelin, C. Le Tenturier, *Centre Nat. d'Etudes des Telecomm., Lannion; J. Fontaine, Clermont University, France: Comparison between experimental measurements of the electromagnetic field emitted by lightning and different theoretical models—influence of the upward velocity of the return stroke.*
- Q3 A. Courty, R. Nanquette, *Thomson-CSF, Malakoff, France: Optical link for EMP and EMC measurements.*
- Q4 A. Beuret, *Fed. Institute of Technology Lausanne, Switzerland: An optical fibre link for lightning stroke current measurements.*
- Q5 T. Yoshino, I. Tomizawa, *University of Electro-Communications, Tokyo, Japan: Rocket and balloon observation of power line radiation over Japanese islands.*
- Q6 L. Jermendy, *Res. Inst. for Electrical Energy, Budapest, Hungary: Radio interference experiences with a 750 kV transmission line.*
- Q7 H. Schaffner, *Schaffner AG, Luterbach, Switzerland: The propagation of fast interference pulses along the power cord.*

**R. EMC analysis and modeling** THUa

Chairman: Dr. A. D. Spaulding

- R1 V. P. Pevnitsky, Y. V. Polozok, *Radio Research Institute, Leningrad, USSR: On the agreement of two methods of construction of stochastic models of cumulative interference-processes.*
- R2 R. A. Orlov, *Radio Research Institute, Leningrad, USSR: Matrix formulation of electromagnetic compatibility problems.*
- R3 L. T. Remizov, *USSR Academy of Sciences, Moscow, USSR: Measurement of fluctuation noise characteristics in the presence of impulsive interference.*
- R4 V. A. Morozov, *USSR Academy of Sciences, Moscow, USSR: An order algorithm of two-channel reception of binary signals with interference of unknown intensity.*
- R5 J. Holownia, *Technical University of Wrocław, Poland: General characteristics of impulsive noise caused by the operation of a switch.*
- R6 J. de Reffye, *Centre Nat. d'Etudes des Telecomm., Issy-les-Moulineaux, France: Modeling of impulsive noise bursts.*

Explanation of symbols:  
 TUm, TUa ..... Tuesday morning/afternoon  
 WEm, WEa ..... Wednesday morning/afternoon  
 THUm, THUa ..... Thursday morning/afternoon

**WORKSHOPS**

Workshop organizer:  
 Herb K. Mertel, *EMACO Consultants, San Diego, CA*

**W1. EMC Diagnostics**  
 (Tuesday, March 10, 1981, 14.00-17.00)

Chairman: H. K. Mertel  
 Offered by SAE AE-4 Group on EMC and the following speakers:  
 H. K. Mertel, *EMACO EMC Consultants, San Diego, CA*  
 J. F. Fischer, *XEROX Corp., Los Angeles, CA*

- Topics:
- How can EMC problems be recognized?
  - What is EMC?
  - What are the EMC design parameters?
  - What are the elements of EMC design?
  - What are the EMC diagnostic tools?

**W2. EMP Hardening of Electronic Systems**  
 (Wednesday, March 11, 1981, 14.00-17.00)

Chairman: Dr. F. M. Tesche, *LuTech Inc., Berkeley, CA*  
 Speakers: Dr. L. O. Marin, *The Dikewood Corp., S. Monica, CA*  
 E. F. Vance, *SRI International, Menlo Park, CA.*

- Topics:
- Present background of EMP and topological shielding concept
  - Methodology for determining degree of hardness, based on source, shielding surface, system penetration mechanism, and susceptibility
  - Presentation of design example
  - Question - answer period

**W3. Applications of Programmable Calculators and Computers for EMI Prediction and EMC Design (Updated course Rotterdam 1980)**  
 (Thursday, March 12, 1981, 14.00-17.00)

Chairman and speaker: D. R. J. White  
 Offered by Don White Consultants, Inc., *Gaithersburg, MD*

- Topics:
- Input of low-price, 200 step hand-held calculators, 2,000 step desk-top types and minicomputers
  - New EMC design methodology and calculator/computer demonstrations
  - Discussion and critique of models, programs, exchange of views on user-oriented problems

**TECHNICAL EXCURSIONS**

Excursions organizer:  
 J. Ørum, *Zurich*

- Following technical visits are planned:
- A. Tour of the Federal Institute of Technology at Zurich. (Technical facilities of the Institute and selected laboratories)
  - B1. Visit to Siemens-Albis AG, Zurich. (EMC measures in transmission equipment and military units, Siemens-Albis PCM module for IFS switching system, modern electronic private branch exchanges)
  - B2. Visit to Brown, Boveri & Cie, Baden. (Control systems for power and communication networks. Data transmission, radio telephones, radio relay links, large transmitters)
- Tour A is planned for Friday morning and includes a light lunch, in the afternoon either visit B1 or B2 may be chosen. All excursions are at no cost for the participants.

**PROVISIONAL LIST OF EXHIBITORS**  
 (As per August 20, 1980)

- AILTECH, GFR/USA
- Vacuumschmelze GmbH, GFR
- Amplifier Research, USA
- High Voltage Test Systems, Switzerland
- Impulsphysik GmbH, GFR
- Pötschke GmbH & Co. KG, GFR
- Ray Proof, USA
- Condensateurs Fribourg S.A./EMC, Switzerland
- Schaffner AG, Switzerland
- Thomson-CSF, France
- Feller AG, Switzerland
- Don White Consultants, USA
- Raychem, Switzerland/England
- Rohde & Schwarz, GFR

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