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Microwave News is conducting a survey of microwave-related litigation. If you have already received our questionnaire, please return your completed form as soon as possible. If you would like to participate, please contact us for more information. Survey results will appear in the newsletter this spring.

Microwave Oven Cataract Trial Adjourned—All Parties Silent

After one day of a jury trial, in which two legal secretaries sought damages for radiation-induced cataracts from an Amana microwave oven, the attorneys for both sides agreed to an adjournment. None of the parties would comment on the resolution of the case.

According to the clerk at the US District Court in Providence, RI, a "consent decree was entered for the defendant on March 22, and the case was dismissed." But no further details on the nature of the agreement could be discovered.

Mark Decof of Decof and Grim in Providence, RI, representing the plaintiffs, refused to discuss the case. Steve Gustafson, general counsel for Amana Refrigeration Co. in Amana, IA, would only say that it was "company policy not to discuss litigation, especially litigation of this type."

Dolores Delsesto and Lynn Spinella had been seeking \$3 million from Amana; they claimed they had developed cataracts from microwave radiation leaking from a Radarange oven. (See *MWN*, November 1981.) Delsesto had two cataracts and Spinella one. Dr. Milton Zaret, an ophthalmologist in Scarsdale, NY, had concurred with another diagnosis that the cataracts had been caused by "radiant energy."

The two women, both in their 30's, worked as legal secretaries for the firm of Adler, Pollack and Sheehan in Providence. The lunch room at the office had an Amana oven, Model RR-4D operating at 2450 MHz and purchased in 1975. The employees had assigned seats in the room, with Delsesto and Spinella closest to the oven.

The oven was tested for leaks by Dr. Marc Richman of the mechanical engineering department at Brown University. His measurements indicated

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NMR Indicates Rabbit's Lens May Be Wrong Model for Human Lens

The biochemistry of the rabbit's eye is significantly different from that of the human eye, according to recent studies of phosphorus-containing metabolites in the lens. The findings could have a profound impact on the study of cataract formation due to microwave radiation.

Using phosphorus-31 nuclear magnetic resonance (NMR), researchers from the Chicago College of Osteopathic Medicine have studied the enzymatic processes that regulate the metabolism of the lens. They conclude: "Overall results indicate that the cat and dog lenses most closely resemble the human lens in that they have the fewest number of significant metabolite differences, four and three respectively, relative to the human. The rabbit and cow lenses are the least similar to the human with 10 and 12 significant metabolite differences, respectively."

Rabbits' lenses have long been used to study cataract formation in humans. Drs. Stephen Kopp, Thomas Glonek and Jack Greiner report in the March 26 *Science* that their previous studies had indicated a pronounced difference between rabbit and human lenses—greater than they had anticipated—and

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HIGHLIGHTS

OSHA Stops Enforcement of RF/MW Hazards

According to new enforcement guidelines, Occupational Safety and Health Administration (OSHA) inspectors can no longer issue citations to companies for exposing their workers to radiofrequency and microwave (RF/MW) fields of greater than 10 mW/cm².

New instructions, dated March 17, from OSHA's Office of Compliance Programming and approved by OSHA Administrator Thorne Aucther specify that the general duty clause "may not be used to enforce 'should' standards." The 10 mW/cm² RF/MW standard was found to be an "advisory" or a "should" standard in the *Swimline Corporation* case (decided in 1975 and affirmed in 1977) and, as such, was ruled unenforceable. Occupational standards for RF/MW are therefore in limbo; the 10 mW/cm² standard is unenforceable and OSHA will not enforce the standard under the general duty clause.

The general duty clause is Section 5(a)(1) of the Occupational Safety and Health Act, which provides that each employer shall furnish employees with a work place that is free of recognized hazards.

Officials at OSHA confirmed that the enforcement of non-ionizing radiation standards was now "up in the air." Harold Engel of the Solicitor's Office said that OSHA was in the process of deleting all "should" standards and that the effort could be accomplished in about a year. Work on a new standard continues; a spokesman from the Office of Physical Agents Standards said that the estimated schedule for publishing an advanced notice of proposed rule making in the *Federal Register* is now the early fall.

Massachusetts Proposed Standard Delayed

The Massachusetts ad hoc committee on radiofrequency/microwave radiation has delayed issuing its draft guideline for general public exposures. At a March 26 meeting, the committee extended the peer review period for its working draft 90 days to June 15 and cancelled a public hearing scheduled for April 29. Release of an official draft is now tentatively set for late August, with public hearings to follow in the fall.

The guideline sets a 200 uW/cm² limit for public exposure to 30-300 MHz radiation, more stringent by a factor of five than the new ANSI standard. Like its ANSI counterpart, the Massachusetts draft is frequency dependent, with higher exposure limits at other frequencies. (See *MWN*, March 1982.)

According to Robert Watkins of the state's Radiation Control Program, the 20 or so comments received so far are generally favorable. The Canadian Department of Health and Welfare has suggested a safety factor of 10, while a couple of reviewers have recommended adopting ANSI's 1 mW/cm² limit. The largest number of comments have addressed registration and exemption issues.

In a telephone interview, Professor A.W. Guy of the University of Washington, Seattle, said that the Massachusetts plan for combining a lower exposure limit with a longer averaging time for measuring exposures was a "clever" way of dealing with the chronic exposure problem. Guy chaired the panel that drafted the new ANSI standard.

Several experts contacted by *Microwave News* feared that the Massachusetts action was part of a trend toward independent state and local regulation which could create problems for manufacturing and communications companies. In fact, Arizona has begun work on a guideline that, said the

director of the state's Radiation Regulatory Agency, Charles Tedford, "won't necessarily be the same as Massachusetts'."

Guidelines for Exposure to NMR Systems

The Bureau of Radiological Health (BRH) has issued guidelines to help evaluate the risks from nuclear magnetic resonance (NMR) devices in clinical trials. Exposure below the following levels is believed to be free of unacceptable risk. *Static (DC) Magnetic Fields:* Whole or partial body exposures of 2 tesla. *Time-Varying Magnetic Fields:* Whole or partial body exposures of 3 tesla/second. *Radiofrequency Electromagnetic Fields:* Exposure to RF fields that result in a specific absorption rate (SAR) that exceeds 0.4 W/Kg as averaged over the whole body or 2 W/Kg as averaged over any one gram of tissue.

Under Food and Drug Administration (FDA) rules, medical devices can qualify for an investigational device exemption (IDE) for use in trials if they do not present a "significant risk." By meeting these new BRH guidelines, NMR devices can win exemption from a local institutional review board. A finding of significant risk does not mean the device is too hazardous for clinical trials, only that an IDE must be submitted to the FDA for approval.

BRH's Dr. Whit Athey explained that the guidelines "are not meant to be general safety standards." They simply indicate permissible levels for clinical trials, he said.

The guidelines are modeled after those recently published by Professor Thomas Budinger of the University of California, Berkeley ("Nuclear Magnetic Resonance (NMR) *In Vivo* Studies: Known Thresholds for Health Effects," *Journal of Computer Assisted Tomography*, 5, 800, 1981), and by the National Radiological Protection Board (NRPB) ("Exposure to Nuclear Magnetic Resonance Clinical Imaging," *Radiography*, 47, 258, 1981). The BRH proposal for time varying magnetic fields is more stringent than that of the NRPB, which recommends a limit of 20 tesla per second for pulses of 10 msec or less. BRH's Athey explained that the bureau had opted to set one level to cover all contingencies, including variations in waveforms and repetition rates.

The guideline for partial body exposure to RF fields is stricter than the new ANSI standard which specifies an allowable SAR of 8 W/Kg. BRH notes that the ANSI standard is "based on the assumption that the far-field or near-field exposure produces a localized maximum in SAR." But in the case of NMR coils, "the peak SAR is deposited regionally in a layer of near-surface tissue that extends completely around the body. Therefore, a lower level of 2 W/Kg was chosen as the limit on peak SAR to prevent overloading the thermoregulatory system in any region of the body."

A number of NMR clinical trials are underway across the country. To date, there have been no reports of unanticipated effects from use of the machines.

For a copy of the guidelines contact: Robert Phillips, HFX-460, BRH, Rockville, MD 20857, (301) 443-3426. See also: 47 *FR* 11972, March 19, 1982.

Bioeffects Literature Digest Published

The National Telecommunications and Information Administration (NTIA) has resumed publication of its quarterly compilation of the bioeffects literature, *Biological Effects of Non-Ionizing Electromagnetic Radiation: A Digest of Current Literature*. This issue, Volume VI No. 1, covers July-

September 1981 and is the first to appear since work on the digest was suspended in September 1980 (after Volume V No. 1) because of lack of funds. A catch-up volume for the intervening period, ending June 1981, is at the printer now and should be available soon. Volume 6 No. 2 is due out in June.

The digest includes full citations and abstracts for current research as well as author and subject indexes. Continued publication of the series, which began in 1974, is very uncertain. There are no funds for it in the present NTIA budget.

The new volume is available from the National Technical Information Service (NTIS), Springfield, VA 22161. At press time its NTIS accession number and price had not been assigned, but it can be ordered by its NTIA number, NTIA-CR-81-15. For more information contact: Eugene Zucker, acting executive secretary of ERMAC, NTIA, 1325 G Street, NW, Washington, DC 20005, (202) 724-3323.

Power Line Studies Chosen in NY

The New York State Overhead Power Lines Project's Scientific Advisory Panel has recommended funding 15 studies on the health effects of power line radiation. These two- and three-year studies will receive the bulk of the project's \$3.5 million research budget.

The panel will initiate two other efforts to confirm and to replicate Dr. Nancy Wertheimer's epidemiological study that found a correlation between 60 Hz magnetic fields and the incidence of childhood cancer. ("Electrical Wiring Configurations and Childhood Cancer," *American Journal of Epidemiology*, 109, 273, 1979.) First, \$25,000 will be allocated to put Wertheimer's data into a machine-readable format suitable for re-analysis. Second, the state will soon issue a request for proposals* for a replication study slated to cost about \$500,000.

The advisory group has chosen three engineering experts to assist with the dosimetry in the various studies. They are: Dr. Don W. Deno of General Electric Co., Pittsfield, MA; Dr. Stephen D. Umans of MIT, Cambridge, MA; and Dr. Anthony R. Valentino of Argonne National Laboratory, Argonne, IL.

Dr. Maria Reichmanis, the scientific research coordinator for the project, resigned as of April 1. Michael Rampola of the state's Department of Health will fill in until a replacement is found.

Recommended Awards

Genetic, Cytogenetic, Teratogenic and Reproductive Studies: Dr. Maimon M. Cohen; University of Maryland School of Medicine, Baltimore, MD; \$162,813; 2 years; *In Vitro* Genetic Effects of Electromagnetic Fields. Dr. Gordon K. Livingston; University of Utah Medical Center, Salt Lake City, UT; \$151,088; 2 years; Reproductive Integrity of Mammalian Cells Exposed to 60 Hz Electromagnetic Fields. Dr. Arland L. Carsten; Brookhaven National Laboratory, Upton, NY; \$384,864; 3 years; Mutagenicity and Toxicity of Electric and Magnetic Fields.

Cell and Organ Culture Studies: Dr. Wendell D. Winters; University of Texas Health Science Center, San Antonio, TX; \$125,668; 2 years; Biological Functions of Immunologically Reactive Human and Canine Cells Influenced by *In Vitro* Exposures to Electric and Magnetic Fields. Dr. Ross W. Gundersen; University of Wisconsin-Parkside, Kenosha, WI; \$122,374; 3 years; Effects of 60 Hz Electromagnetic Fields on Calcium Efflux and Neurotransmitter Release. Dr. Prasanta K. Basu; University of Toronto, Toronto, Ontario; \$134,380; 2 years; Biological Effects of Extremely Low Frequency Electric and Magnetic Fields on the Ocular Tissues; An *In Vitro* Study. Dr. Gideon A. Rodan; University of Connecticut Health Center School of Dental Medicine, Farmington, CT; \$106,513; 2 years; Effect of 60 Hz Electric and Magnetic Fields on Neural and Skeletal Cells in Culture.

In Vivo Animal Physiology and Pathophysiology: Dr. Frank M. Sulzman; State University of New York at Binghamton, Binghamton, NY; \$134,161; 3 years; Effects of Electromagnetic Fields on Circadian Rhythms.

Animal and Human Neurobiology: Dr. Amos G. Gona; University of Medicine and Dentistry of New Jersey, Newark, NJ; \$118,306; 3 years; Effects of 60 Hz Electric and Magnetic Fields on the Developing Rat Brain. Dr. Jonathan R. Wolpaw; New York State Department of Health, Albany, NY; \$251,785; 3 years; Chronic Effects of 60 Hz Electric and Magnetic Fields on Primate Central Nervous System Function. Dr. Klaus-Peter Ossenkopp; University of Western Ontario, London, Ontario; \$32,993; 2 years; ELF Low Intensity Magnetic Fields and Epilepsy.

Animal and Human Behavior: Dr. John R. Thomas; Naval Medical Research Institute, Bethesda, MD; \$110,390; 2 years; Investigation of Potential Behavioral Effects of Exposure to 60 Hz Electromagnetic Fields. Prof. Kurt Salzinger; Polytechnic Institute of New York, Brooklyn, NY; \$199,365; 3 years; Biological and Behavioral Effects of ELF.

Multidisciplinary Human Studies with Controlled Exposure Conditions: Dr. Charles Graham; Midwest Research Institute, Kansas City, MO; \$375,000; 2 years; Influence of 60 Hz Fields on Human Behavior, Physiology and Biochemistry.

Epidemiology of Human Populations: Dr. Samuel D. Kaplan; SRI International, Menlo Park, CA; \$280,958; 2 years; Historical Cohort Mortality Study of Electric Utility Workers Exposed to Strong Electromagnetic Fields.

Miscarriage Cluster in Toronto

A cluster of miscarriages among employees in Toronto's Old City Hall is being investigated by the Ontario government. In 1980-1981, 10 out of 19 pregnant women working for the provincial Ministry of the Attorney-General had miscarriages; the 10 included all four of the pregnant women working in an office with two video display terminals (VDTs). All of the women used two photocopy machines located in a separate room. The ministry employs approximately 150 women in the office complex.

At the attorney-general's request, the Ontario Ministry of Health will soon appoint Dr. John Harkins, a physician at the University of Toronto, to determine if the ratio of miscarriages to pregnancies is statistically significant and if further investigation is necessary. Meanwhile, the Ministry of Labor has tested the VDTs for radiation leaks and has collected air samples from the offices to check for abnormal levels of ozone and toners and other potentially hazardous substances. According to a spokesman for the Ministry of Labor, Harkins could finish his investigation by early May.

Union officials are not satisfied with the government action. Robert DeMatteo of the Ontario Public Service Employees Union has called for a "thorough and truly independent investigation to resolve office safety issues," rather than a "statistical manipulation" that could dismiss a potential problem. At the Communications Workers of Canada, Gary Cwitco agreed that an epidemiology is needed, adding that "at this point simply testing the VDTs is not conclusive proof of their safety." US and Canadian government experts are of the opinion that the five other recently reported clusters of pregnancy problems among clerical workers were probably statistical quirks. (See *MWN*, November 1981 and January/February 1982.)

Dr. Anthony Muc of the labor ministry's Radiation Protection Service reported that the radiation levels from the two

VDTs "conform to levels seen in all other responsible testing." He said, "There is no adequate indication, and I don't think there will be, of any link between alleged clusters and something in the working environment."

The government's investigation began after minority party members of the provincial legislature questioned Labor Minister Russell Ramsay and Attorney-General Roy McMurtry on March 15 about the miscarriages. The situation, which has received national television coverage in Canada, has prompted the legislature's Richard Johnson to reintroduce his VDT safety bill, which failed to reach committee earlier this year. (See *MWN*, December 1981.)

According to DeMatteo, workers first told a supervisor at the ministry about the miscarriages last November. At the same time, the workers complained that using the photocopy machines, located in an unvented room, caused respiratory problems.

BRH Reorganization Moves Forward

The reorganization of the Division of Biological Effects (DBE) at the Bureau of Radiological Health (BRH) has taken another step forward with the announcement that four new branches have been approved by the parent agency, the Food and Drug Administration (FDA). Last year BRH revealed that it would transform DBE into the Division of Risk Assessment to reflect a greater emphasis on risk analysis (see *MWN*, December 1981). This change requires approval from FDA's parent, the Department of Health and Human Services, and is not expected until the end of the year.

In a shift from past practice, the four branches are arranged by radiation type rather than by biological or medical area. The new branches and their chiefs, who are expected to be named soon, are: Electromagnetic Radiation, Dr. Mays Swicord; Light, Dr. Elizabeth Jacobson; Ionizing Radiation: Dr. Richard Chiacchierini; and Ultrasound, Dr. Melvin Stratmeyer.

The electromagnetics branch will have responsibility for non-ionizing radiation with a staff of 10-12 professionals—significantly larger than before. The ultrasound program has also been increased.

EISs Out for Proposed Satcom Stations

RCA

A draft environmental impact statement (EIS) for RCA's proposed satellite communications station on Bainbridge Island, WA, has been released for public review. The facility would relay commercial communications to and from the Seattle area.

The two-volume document, prepared at RCA's expense by CH2M Hill, Inc., in Seattle, contains lengthy discussions of the bioeffects of microwave radiation prepared by Professor A.W. Guy of the University of Washington, Seattle, Dr. Don Justesen of the VA Medical Center in Kansas City, MO, and the Battelle Human Affairs Research Center in Seattle.

The maximum public radiation exposure next to the 7.9 acre site is estimated to be 4.14 $\mu\text{W}/\text{cm}^2$ with 14 transponders on each of three antennas in use. RCA wants to start with only two 12-meter parabolic antennas, each with three transponders in use, though, which drops potential exposure to 0.228 $\mu\text{W}/\text{cm}^2$.

Comments on the EIS are due by April 14. Officials at the Kitsap County Department of Community Development hope to publish a final EIS around mid-May. The county hearing examiner and the Board of County Commissioners will then hold public hearings before the board issues a final

ruling. Rick Kimball of the development department said a decision could come as early as mid-August. Either side could then appeal the decision to the courts.

A draft EIS for an alternative site in a forest north of Bainbridge Island was released on March 31, with comments due by May 5. RCA opted to process two separate proposals simultaneously after the Bucklin Hill Neighborhood Association, led by Jerome Hellmuth, delayed construction plans for Bainbridge by successfully arguing that the county should require an EIS. (See *MWN*, October 1981.)

Copies of both draft EISs are available from CH2M Hill. After initial supplies are gone, the company will charge ten cents per page. Contact: Signe Gilson, CH2M Hill, Bellevue, WA 98105, (206) 453-5000.

Hughes Aircraft

The National Satellite Services, Inc., a subsidiary of Hughes Aircraft Co., has filed a draft EIS with the City of New York on its proposal to build a satcom station in the Spring Creek section of Brooklyn, NY. The draft EIS, released March 5, was prepared for Hughes by Fred Hart Associates of New York, NY, and has already been favorably reviewed by the city's Department of Environmental Protection and Department of Health.

The Hughes station would be part of its \$20 million domestic communications satellite network known as the "Galaxy System." The Brooklyn proposal calls for building a total of seven 33-foot antennas operating at 6 GHz (with a 4 GHz downlink), though only two would be built initially.

According to an analysis by Hughes, public exposures to electromagnetic radiation from the station will never exceed 1-2 $\mu\text{W}/\text{cm}^2$. The power density study was performed by E. Villaseca and R. Berchtold of Hughes' Communications and Radar Division. They used Geometric Theory of Diffraction which, they claim, "provides precision computation of the fine structure of the antenna patterns." The calculations were validated by Dr. Samuel Koslov of the Johns Hopkins University's Applied Physics Laboratory.

Hughes also contracted with Dr. Herbert Pollack for an evaluation of the health implications of the station. Pollack concluded: "The power density at ground level and the nearest buildings from the proposed [station] will be in the very low microwatt level. . . . In no area of the world is this considered a health hazard."

The site will have a microwave link with a relay facility on the roof of Two World Trade Center in downtown Manhattan. An interference analysis by Spectrum Planning of Richardson, TX, indicates that the station is compatible with Kennedy airport, local TV stations and other RF sources. A 40-foot wall will be built, however, to "improve interference margins."

According to Mira Ledman, director of the city's Office of Environmental Impact, a monitoring procedure will be set up once the station becomes operational to check ambient radiation levels. If the levels exceed some still to be determined level, mitigation measures will be initiated, she said.

The EIS is now being reviewed by Community Board No. 5 in Brooklyn. The board held a hearing on the proposal on March 24; neighborhood residents approved of the plan in concept, but wanted more information on the health effects of microwaves. Another hearing is scheduled for April 28. If it is approved by the board, the proposal will be the subject of a joint hearing by the city's Department of Environmental Protection and Department of City Planning this summer.

For information on the availability of the EIS contact: James Coyle at Fred Hart Associates, (212) 840-3990.

Hyperthermia Systems Under Study

Five teaching hospitals are in the process of evaluating hyperthermia systems for the National Cancer Institute (NCI). Each institution will be testing at least two systems. (See *MWN*, November 1981.) At the request of *Microwave News*, NCI has released a list of the types of equipment avail-

able at each medical center. The table given below is a modified and updated version of the NCI data.

The deadline for proposals in NCI's hyperthermia quality assurance program—a second and separate initiative—has been extended to April 30 and a pre-proposal conference was held on March 17 at NCI in Bethesda, MD.

Institution and Principal Investigator	Type of Equipment					
	Interstitial	RF Capacitive	RF Inductive	Microwave	Phased Array	Ultrasound
University of Arizona Medical Center Dr. Michael Manning, (602) 626-6723	✓*	✓*	✓+&*	✓*	✓*	
M.D. Anderson Hospital, University of Texas Dr. Peter Corry, (713) 792-3292	✓*	(✓*)	✓*			✓*
MIT-New England Deaconess Hospital Dr. Padmakar Lele, (617) 253-5235		✓†	✓+		✓‡‡	✓*
Stanford University Medical Center Dr. Malcolm Bagshaw, (415) 497-5650	✓*			✓‡	✓‡‡	✓*
University of Utah Medical Center Dr. J. Robert Stewart, (801) 581-8793			✓+	✓‡	✓‡‡	

* = in-house design; + = Henry Radio Magnetron; † = IIMS System; ‡ = BSD-1000; ‡‡ = BSD Phased Array;
(✓*) = rarely used; IIMS = International Institute for Medical Sciences.

UPDATES

Biological Effects....Some 35 scientists and engineers participated in the March 16-19 *Workshop on the Behavioral Effects of Microwave Radiation Absorption*. Workshop organizer Professor John D'Andrea said he was pleased with its outcome: "It gave everyone an opportunity to hash out controversial subjects." The proceedings, papers and excerpts from the discussions will be edited by D'Andrea and BRH's John Monahan and should be available next February.... Dr. William Morton's study correlating RF/MW levels with cancer among Portland, OR, residents (see *MWN*, January/February 1982) has been circulated for peer review by EPA.... The AF's School of Aerospace Medicine at Brooks AFB will issue an RFP at the end of April for research on the physics of RF/MW interactions with biological systems. The AF wants to develop data on mechanisms. For more information contact: Dr. David Erwin, (512) 536-3582, cite PMRN 82-95.... Drs. Przemyslaw Czerski and Ewa Manikowska's paper on their recent work, which we said last month would be covered in this issue, has been delayed at the typist. We hope to report on it next month.... Drs. Robert Becker and Andrew Marino's new book *Electromagnetism and Life* has just been published by the State University of New York Press in Albany, NY (cloth: \$33.50, paper: \$10.95). And John Ott's *Light, Radiation, & You* will soon be released by Devin-Adair Co. of Old Greenwich, CT (cloth: \$14.50). We will review both books in a forthcoming issue.

Communications....Local opposition could hold up the World Christian Broadcasting Corp.'s plans for a 100 kW shortwave (5.9-17.9 MHz) radio station near Anchor Point, AK. An informal objection filed with the FCC by a citizen's group last November has prompted the commission to ask EPA to analyze radiation levels from the proposed Alaskan station.... Another community group, in Scotts Mills, OR, has hired a lawyer in its fight against an existing KECH-TV broadcasting tower that it fears might pose health risks.... The FCC has published its notice of proposed rule making to bring RF/MW hazards under its environmental protection rules in the February 25 *Federal Register* (47 FR 8214). (See *MWN*, March 1982.) Note the correction for a formula footnoted in the original notice (47 FR 10871, March 12).... The commission is seeking comments in preparation for the 1984/1986 WARC on the use of the HF bands allocated to the broadcasting service.... Five companies must compete for the new AM stereo market. Broadcasters and receiver manufacturers had hoped the FCC would approve a single system in its final rules for AM stereo broadcasting (47 FR 13152).... On the cellular communications front, Western Union has entered the arena

by acquiring an interest in Cellular Communications Inc. of New York City and by joining a venture with three other companies to get franchises for mobile telephone networks.... Meanwhile, Millicom Inc. plans to begin testing its mobile telephone system in the Raleigh-Durham, NC, area this month.... The FCC published its final rules for the new cellular service on March 9 (47 FR 10018).... Up to 4,000 new low-power television stations are expected to spring up in the next few years. The FCC is bracing itself for as many as 18,000 new license applications for the stations, which received final approval on March 4.... At the request of Marti Electronics Inc., the commission has released a notice of proposed rule making for microwave boosters, a relay device that receives and retransmits a signal at the same frequency.

Compatibility and Interference.... "Do radio broadcasts and radar transmissions pose a threat to chemical plant safety? The answer is yes, according to a small body of experts, who now suspect that large metal structures can act as receiving antennas for wave energy. Under the right conditions, they say, this energy can be converted into sparks of static electricity strong enough to cause explosions of flammable gases." So begins a special report on RFI in the chemical and oil industry in the March 8 *Chemical Engineering* magazine. According to the article, while no one has yet linked a disaster with electromagnetic energy, the UK and West Germany will soon issue guidelines for the joint siting of antennas and chemical plants. The authors refer to the case of a local AM station in Scotland which will have to move to make way for a tanker-loading terminal. They quote a British expert's view that loop-shaped structures like cranes and piping are the most efficient absorbers at frequencies below 30 MHz; radar at higher frequencies is also a threat due to its high energy pulses. An accompanying editorial advocates regulation before an accident happens "that would put vast areas of the country off-limits to the builders of new plants."... The space shuttle's third mission was hailed as a success despite problems with the mechanical arm and radio transmitters. The *Washington Post's* Thomas O'Toole reported on a less publicized disturbance: every time the spacecraft flew north toward the Soviet Union, the astronauts heard loud static noises. Engineers at the Johnson Space Center in Houston speculated that the interference was caused by the Soviet's "Woodpecker" over-the-horizon radar at Rostov.... The FCC has decided that anyone applying to build a new TV station on channel 14 or 69 (or modify an existing one) will have to protect against "objectionable interference to existing land mobile facilities in the 460-470 MHz (channel 14) or in

the 806-816 MHz (for channel 69) band prior to program test authorization."...The National Association of Broadcasters released a report on interference to US AM radio stations from Cuban transmitters to a House Foreign Affairs Committee hearing on March 4. The administration wants to set up a 50 kW station, Radio Marti, at 1040 kHz to broadcast news to Cuba. Some fear that Cuba will retaliate by building more interfering transmitters. At the mark up of HR 5427, which allocates funds for Radio Marti, Congressman Dante Fascell (D-FL) added a provision that would compensate AM stations for Cuban RFI. For a copy of the NAB report call (202) 293-3557.... A team from Japan reports on an experimental study of noise generated by microwave oven magnetrons in the December 1981 *Journal of Microwave Power*.

EMP....William Broad continues to report on the potentially crippling effects of electromagnetic pulse (EMP) radiation in the March 12 *Science*. In his article, "A Fatal Flaw in the Concept of Space War," he writes that a single nuclear blast in outer space "would instantly set up an electric pulse of up to a million volts per meter in hundreds of satellites and battle stations.... A 2-megaton blast just outside the earth's atmosphere would set up a pulse in objects as far away as geosynchronous orbit, some 36,000 kilometers above the earth." Such pulses could knock out laser weapons that DoD is developing at a cost of \$300 million a year. Broad attributes part of the snafu to the lack of coordination between the Defense Advanced Projects Agency (DARPA) and the Defense Nuclear Agency (DNA). DARPA is responsible for the laser program and DNA for radiation effects.... In contrast to Broad's article, William Scott writes in the March 15 *Aviation Week and Space Technology* that recent test data from DNA indicate that satellite hardening techniques currently in use are "more effective than predicted initially."...With respect to the vulnerability of electronics on earth, the February *Microwave Systems News* quotes James Wade, the deputy under secretary of defense for research and engineering, as telling a closed session of the House Armed Services Committee's r&d subcommittee that he favors an above ground nuclear test to gauge the impact of EMP on hardened electronics.... In contract news, the air force at Kirtland AFB, NM, has awarded the Dikewood Corp. of Albuquerque, NM, more than \$6 million for "EMP hardening and hardness assurance development." And the Naval Surface Weapons Center in Silver Spring, MD, is negotiating with Rockwell International of Anaheim, CA, for EMP testing of Tacamo aircraft.

Government....The Senate Judiciary Committee's subcommittee on agency administration will hold a hearing on the *Feres* doctrine on April 14. Under the doctrine, the federal government is not liable for injuries to members of the armed services on active duty. A suit is possible, however, if Congress passes a "private release bill." Spokesmen from DoD, the VA and Justice will address such bills at the hearing. In addition, Senator Claiborne Pell (D-RI) will testify on the Charles Day case. Day died under mysterious circumstances while in the Navy—some people suspect microwaves were involved. (See *MWN*, December 1981.) Christopher Scanlan has written a long piece on the case for the *Providence Sunday Journal Magazine* (March 28): "What Killed Chuck Day? His parents blame malnutrition, malpractice and microwave radiation. The Navy won't talk about it."... BRH has announced the names of the new members of the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC). They are: Dr. Thomas Budinger, University of California, Berkeley; Janice Gordon, International Union of Electrical, Radio and Machine Workers; David Janes, Environmental Protection Agency; Maurice Neuweg, Illinois Department of Nuclear Safety; David Sliney, US Army Environmental Hygiene Agency; and Dr. Max Weiss, Bell Laboratories. For more information contact: BRH's Dr. Zory Glaser, (301) 443-3429.... DOE is planning to prepare an EIS on the construction and operation of an overhead, 450 kV powerline, which will run between a Hydro-Quebec substation in Sherbrooke, Quebec, and a New England Power Pool facility in Grafton County, NH. For more information contact DOE's Linda Desell at (202) 252-6374 and see 47 *FR* 8619, March 1.

Litigation....A trial date of May 10 has been set in the case of Leo and Muriel Schuerman v Pacific Telephone and Telegraph Co. in

Superior Court of California, County of Riverside (No. 136703). Pacific Telephone is building a line of sight microwave relay system between Los Angeles and San Diego with seven 55-watt transmitters. The Schuermans own property that lies beneath the proposed microwave beam. In their complaint (filed September 16, 1980, and amended August 5, 1981), they charge Pacific Telephone with nuisance and trespass as well as conducting an "ultra hazardous activity." Dr. A.W. Guy and Don Justesen are scheduled to testify for Pacific Telephone. The Schuermans, represented by Joseph Aklufi of Redwine and Sherrill in Riverside, want the telephone company to buy their property and are seeking punitive damages.

Medical Applications....There is a new association for those interested in NMR: *The Society of Magnetic Resonance in Medicine*. Its president, Dr. Paul Lauterbur of SUNY, Stonybrook, is being assisted by Dr. Gerald Pohost of Mass General Hospital (MGH). The new group was incorporated on the first of the year, and has already received some 500 inquiries about membership. Its first meeting is scheduled for August 16-18 in Boston; see conference calendar on p. 8 for details.... On April 21, Professor Robert E. Steiner of Hammersmith Hospital, London, UK, will deliver the 15th Aubrey O. Hampton Lecture at MGH and NMR and its clinical applications. Contact Dr. Juan Taveras at MGH for details (617) 726-8344.... The meeting on the *Application of Optical Instrumentation in Medicine*, scheduled for New Orleans, LA, May 9-12, will feature two sessions on NMR. For more information contact the Society of Photo-Optical Instrumentation Engineers in Bellingham, WA 98227, (206) 676-3290.... Yet another popular article on NMR ran in the April *Discover*.... Dr. Betty Siskin of the University of Kentucky, Lexington, was this month's participant at the ONR seminar series in Bethesda, MD. She spoke on "Electrical Stimulation of Nerve Growth in Vitro and Limb Regeneration in Vivo."... Recent studies of hyperthermia applicators (operating at 2450 and 434 MHz) by a team of French scientists demonstrate "the necessity of surface cooling and the advantage of 'cross-fire' configuration in localized hyperthermia." Their report appears in the most recent issue of the *Journal of Microwave Power*, December 1981.... And a group from the University of Utah is working on models to determine the optimal arrangement of dipoles in regional and whole-body applicators. See the March *Proceedings of the IEEE*.

Military Systems....The Wisconsin state senate did not pass a resolution calling for the dismantling and removal of the Project ELF antenna on March 23. The vote was 19-13 with one abstention.... Dr. Thomas Amlie, the former technical director (1968-70) of the Naval Weapons Center at China Lake, CA, has caused quite a stir with an article in the April *IEEE Spectrum*: "Radar: Shield or Target? Costly radar being developed by the US may give an opponent a decisive advantage by broadcasting the position and makeup of forces." Before the issue reached the IEEE membership, it was front page news in the *Washington Post*, and the next day a feature story in the *New York Times*. Amlie does not want to eliminate radar but to reduce its vulnerability. He cites the case of an American Shrike missile homing in on a US destroyer's radar in the gulf of Tonkin.... The navy's development of a laser submarine communications system continues: the Naval Ocean Systems Center is negotiating a contract with W.J. Schafer Associates of Wakefield, MA, for research on operational concepts; the Naval Electronic Systems Command in Washington, DC, has signed a \$1.3 million contract with GE's Space Systems Division in Philadelphia, PA, for a conceptual design study; and ONR is negotiating with the Westinghouse R&D Center in Pittsburgh, PA, for work on the blue-green laser itself.... The army's Electronics R&D Command in Fort Monmouth, NJ, has contracted with Hughes Aircraft Co. of Fullerton, CA, for 12 AN/TPQ-37 artillery-locating radar systems at a cost of \$59.7 million.

Occupational Health....Two congressmen have introduced bills which would move NIOSH out of CDC and into NIH. After holding hearings before the subcommittee on labor and HHS of the House Appropriations Committee on February 25, Congressman David Obey (D-WI) sponsored HR 5914, which would reorganize the Public Health Service, with NIOSH becoming one of the institutes under the NIH umbrella. Congressman Henry Waxman (D-CA), chairman of

the health and environment subcommittee of the Committee on Energy and Commerce, introduced HR 5919 on March 22, which, among other provisions, would have the same effect on NIOSH. Hearings on the Waxman proposal are scheduled for April 23. . . . The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) at the University of Utah is sponsoring a course on *Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation*, September 8-10 and again February 9-11, 1983. Robert Curtis, a clinical instructor at RMCOEH and a senior industrial hygienist with OSHA, will teach the course. For more information contact: Ms. K. Blosch, RMCOEH, Bldg. 512, University of Utah, Salt Lake City, UT 84112, (801) 581-5710.

Ovens. . . . Worries about the spread of trichonosis from the incomplete cooking of infected pork in microwave ovens cropped up again last month when newspapers picked up some comments by Dr. Peter Schantz of CDC. The Department of Agriculture had warned customers about the possibility of non-uniform heating of pork in microwave ovens and the attendant risk of failing to kill any *Trichinella* larvae last year (see *MWN*, June 1981). Schantz wrote up the USDA report for CDC's *Veterinary Public Health Notes*; this was picked up by the Atlanta papers and by others across the country. The message remains the same as last year: be sure to heat *all* parts of the pork to above 137° F (58.3° C). Or at least about the same. USDA had recommended that the pork reach 170° F. Schantz's warning appeared in the last issue of the *Notes*; CDC stopped its publication due to budget cuts. . . . Factory shipments of microwave ovens were down again in February in relation to both January and February 1981. The Association of Home Appliance Manufacturers' statistics show that 261,800 ovens were produced or imported in February, compared with 333,900 in February 1981 and 304,000 in January 1982.

Satellite Communications. . . . *NASA Space Communications Program*, February 1982, a report on the 30/20 GHz project, is now available from the House Committee on Science and Technology. . . . NASA has scheduled its third industry briefing on the 30/20 GHz program for April 20-21 in Cleveland, OH. . . . Comsat is building a satcom station with a 61-foot dish antenna near Lenox, WV, to serve as a backup for its Etam facility 22 miles away. . . . The company is also building an earth station at Palau, Micronesia, the first of seven Intelsat earth stations planned for island communications. . . . The first international teleconferencing service could start this year. Intercontinental Hotels Corp. and Comsat plan to link New York and London in December. . . . The FCC has received many unfavorable responses to its proposed reduction of satellite spacing to 2° from 4°. Both the March 29 *Electronic News* and the March 15 *Broadcasting* review the comments on the plan. . . . The National Association of Broadcasters has come out against quick approval of direct broadcast satellite (DBS) service. In a recent policy statement, the NAB favored developing high definition television in the 12 GHz band over DBS, which would not provide a new service. . . . But the FCC's broadcast bureau chief, Larry Harris, has said the commission will authorize DBS this summer or earlier, according to a report in *Broadcasting*, March 22. . . . United Satellite Television is ready for this move. The company plans to offer four channels of programming via DBS next year. . . . Britain has already approved the service, which could begin there in 1986. . . . European worries over DBS are explored in the March 22 *Wall Street Journal*. . . . The RCA transponder saga continues: the FCC approved RCA's plans to lease transponders on its new Satcom IV satellite at a price reflecting market demand. A suit filed by UTV Cable Network and Kentucky Educational TV temporarily blocked the scheme, but then a federal appeals court freed the company to offer transponders at \$13 million each.

Short Courses. . . . • April 27-29: *Electromagnetic Radiation Hazards and Medical Applications* by Dr. L. Larsen and J. Jacobi of Walter Reed Army Institute of Research at Georgia Institute of Technology, Atlanta, GA, fee \$400. Contact: (404) 894-2400. . . . • May 17-18: *Hazardous Electromagnetic Radiation and its Biological Effects* by Dr. Bernhard Keiser at George Washington University (GWU), Washington, DC, fee \$530. Contact: (202) 676-6106 or (800) 424-9773. . . . • August 9-13: *Laser, Microwaves, Ultraviolet and Ultrasound: Biophysical and Biological Basis, Applications, and Hazards in Medicine and Industry* by Dr. P. Lele at MIT, Cambridge,

MA, fee \$775. Contact: Director of Summer Sessions, Room E19-356, MIT, Cambridge, MA 02139. In addition, GWU sponsors a host of other courses on radar, spectrum management, remote sensing, and microwave and millimeter technology. Contact GWU for details. See also occupational health update.

Standards. . . . ANSI is making a last minute effort to reach consensus on its new RF/MW standard, which is already in galleys. ANSI asked Allan Eckhaus of Consumers Union to reconsider his negative vote; it would have settled for an abstention. In a March 12 letter, Eckhaus stood firm; he still could not agree with ANSI's six-minute averaging time for measuring exposures (see *MWN*, May 1981). It's not clear what action, if any, ANSI will now take. . . . There will be a session on state regulations for non-ionizing radiation on May 26 at the *Conference on Radiation Control*; see conference calendar (p. 8) for details.

Technology. . . . Microwave landing systems are beginning to be installed at airports across the country. With them come citizen apprehension over radiation risks; FAA officials are attempting to reassure them that there are no hazards. . . . The FAA's 20-year, \$10 billion program to modernize and automate the national airspace system is described in the March 8 *Aviation Week & Space Technology* and the April *Technology Review*. . . . The March 1 *Aviation Week* reports that Westinghouse has successfully demonstrated a railgun that fired a projectile at more than 13,000 feet per second. The launcher will now be moved to the Picatinny Arsenal, NJ, where tests will resume in August. . . . Microwaves continue to dominate the *Wall Street Journal's* weekly "Technology" column: on March 12, the *Journal* reported that Ideal Research Inc. of Rockville, MD, has developed a device that can measure the thickness and growth rate of ice on a plane's surface—ice changes the principal frequency of the beam. There is one hitch, though: the instrument does not work too well if there is water mixed with the ice. On March 19, the *Journal* ran a piece about a radar system developed by the Canadian government for use on satellites to gather data on ice fields in shipping lanes. . . . *Science* ran a two-part series on the first ten years of Landsat in its March 26 and April 2 issues. . . . A three-day international conference on *Electrotechnologies in Industry* is scheduled for May 25-27 in Montreal, Canada. There will be a number of sessions on the use of RF energy. Contact: Sandra Wilkins, MITRE Corp., 1820 Dolley Madison Blvd., McLean, VA 22102, (703) 827-6211.

VDTs. . . . The Massachusetts legislature will consider a VDT safety bill during its 1982 session. House bill 2910, introduced by Rep. John Driscoll, a Republican from Northbridge, MA, includes a number of ergonomic requirements for VDT work stations and calls for periodic rest breaks and annual eye exams for operators. . . . Bell Canada tested several hundred of its VDTs for X-ray radiation between July and November of last year. According to the company's regional director of safety, Jim Allan, "nothing came up to cause any concern whatsoever, so we don't plan to do more testing." . . . An Australian Postal and Telecommunications Union's report on VDTs (or VDUs), *VDUs and Ill-Health: The Evidence*, found "a sufficiently large body of evidence to cast grave doubts on the claim that [VDTs] are completely safe." Its concluding policy statement calls for a three-day week for full-time operators until more is known about the terminals. Contact: G. Slater at the union, PO Box 208, Carlton South, Victoria, 3053, Australia. . . . David Eisen of the Newspaper Guild and William Murray of NIOSH have called for research on the low-level, low-frequency radiation emitted by VDTs. According to an article in the March 12 *Guild Reporter*, both men noted the complete absence of knowledge about 15-125 kHz radiation at the American Industrial Hygiene Association seminar on VDTs, March 1-2 in Denver. . . . A summary of the National Academy of Sciences' August 1981 symposium on VDTs and vision will soon be published in *Behavior and Information Technology*. In their abstract, authors Barbara Brown and Key Dismukes of the NAS Committee on Vision and Edward Rinalducci of the Georgia Institute of Technology recommend "properly designed epidemiological studies comparing the incidence of visual problems in VDT operators with that of non-VDT workers."

Etc. . . . Professor James Gould of Princeton University has published "The Map Sense of Pigeons," in the March 18 *Nature*, and

Thomas Maugh II reviews the implications of recent findings that species ranging from humans to algae contain magnetic material in "Magnetic Navigation and Attractive Possibility," in the March 19 *Science* . . . Could quartz-bearing rock emit radio waves before an earthquake? If so, they could become the basis of a warning system. See the March 20 *Science News* for details . . . IMPI's membership directory is now available to the institute's members for \$10. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna, VA 22180 . . . Dr. Vernon Riley died of a sudden heart attack on March 30 while attending the American Cancer Society meeting in Daytona Beach, FL. Riley had been affiliated with the Hutchison Cancer Research Center and the University of Washington Medical School in Seattle. He was well known for his work on the relationship between stress and cancer.

Microwave Oven Trial (continued from p. 1)

that the oven met the Bureau of Radiological Health's 1970 emission standard, which specifies a maximum leakage of 5 mW/cm², five centimeters from the external surface of the oven after purchase.

Zaret, who was scheduled to testify at the trial, said that he thought the adjournment of the case was a "form of censorship," placing the cataract case out of reach of the medical community. "There is no reason in the world to settle," he added, "if the cataracts were not caused by the oven."

Others scheduled to participate at the trial were Leo Birenbaum of the Polytechnic Institute of New York in Brooklyn, NY, for the plaintiffs and Drs. Przemyslaw Czernski of BRH, A. William Guy of the University of Washington, Seattle, and John Osepchuk of the Raytheon Co. for the defendant. Amana is a subsidiary of Raytheon.

In the first and only day of the jury trial, Leonard Decof made the opening statement for the secretaries, followed by their testimony and cross-examination. Before the trial could resume the next day, both parties agreed to call it off.

Rabbit's and Human Lenses (continued from p. 1)

that they had undertaken the present work to identify the type of mammal whose lens most resembles the human one.

Speaking from the NMR Laboratory at the college, Kopp warned that the rabbit's eye should not be used as a surrogate for the human eye. "We need to reassess the animal models we are using," he said.

Most experts on the effects of microwaves on the eye contacted by *Microwave News* had not had a chance to review the paper. All agreed, however, that the rabbit's eye had been the preferred experimental system to study microwave-induced cataracts because of its size, its general anatomical similarity to the human lens and because rabbits are cheap and easy to work with. Professor Stephen Cleary of Virginia Commonwealth University pointed out that research to date indicates the rabbit is one of the species most sensitive to cataract development.

Kopp and his co-workers found that, "generally, the rank order of lens metabolism from most to least similar to human is: cat > dog > pig > rat > sheep > rabbit > cow."

See also: J.V. Greiner *et al.*, "Organophosphates of the Crystalline Lens: A Nuclear Magnetic Resonance Spectroscopic Study," *Investigative Ophthalmology & Visual Science* (St. Louis), 21, 700, 1981; and S.J. Kopp *et al.*, "Analysis of Intact Lens Metabolites by P-31 NMR Spectroscopy," *Current Eye Research* (London), 1, 375, 1981.

Microwave News invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.

CONFERENCE CALENDAR

- May 24-27: 14th Annual *National Conference on Radiation Control*, Holiday Inn, Portland, ME. Contact: Wallace Hinckley, Maine Dept. of Human Services, 157 Capitol St., Augusta, ME 04333.

- May 24-28: *International IEEE/APS Symposium, National Radio Science Meeting and Nuclear Electromagnetic Pulse Meeting*, University of New Mexico, Albuquerque, NM. Contact: Dr. Kendall F. Casey, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.

- June 3-8: *International Symposium on Electromagnetic Effects*, University of Ottawa, Canada. Contact: Dr. Patrick Babin, 1982 Learned Societies Conference, University of Ottawa, 65 Halsey Street, Ottawa, Ontario, Canada K1N 6N5.

- June 15-17: *IEEE MTT-S International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067. On June 18 immediately after the conference, there will be a one-day workshop on *Medical Applications of Electromagnetic Energy*. Contact: Dr. Gordon Short, BSD Medical Corp., 420 Chipeta Way, Salt Lake City, UT 84108.

- June 28-July 1: *Conference on Precision Electromagnetic Measurements*, University of Colorado, Boulder, CO. Contact: Robert Kamper, National Bureau of Standards, Boulder, CO 80303.

- June 28-July 2: 4th Annual *Bioelectromagnetics Society Meeting*, Beverly Wilshire Hotel, Beverly Hills, CA. Contact: BEMS, 1 Bank Street, Suite 307, Gaithersburg, MD 20878.

- July 20-22: *IEEE Annual Conference on Nuclear and Space Radiation Effects*, Caesars Palace, Las Vegas, NV. Contact: A. Ochoa, Jr., Div. 2144, Center for Radiation-Hardened Microelectronics, Sandia National Laboratory, Albuquerque, NM 87185. This meeting will be followed on July 23 by the *Hardened Electronics and Radiation Technology Conference* hosted by the Defense Nuclear Agency. A Secret security classification is required to attend. Contact: Director, DNA, Attn: ISSO/Barbara Perkins, Washington, DC 20305.

- July 25-30: 17th Annual Symposium of the *International Microwave Power Institute*, Town and Country Hotel, San Diego, CA. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna, VA 22180.

- August 11-13: 4th Annual *Satellite Communications Users Conference*, Regency Inn, Denver, CO. Contact: Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

- August 16-18: 1st Annual *Meeting of the Society of Magnetic Resonance in Medicine*, Boston, MA. Contact: Deedee Correia, NMR Laboratory, Research 501, Massachusetts General Hospital, Boston, MA 02114.

- September 5-11: *World Congress on Medical Physics and Biomedical Engineering*, including the 13th *International Conference on Medical and Biological Engineering* and the 6th *International Conference on Medical Physics*, Congress Center, Hamburg, Germany. Contact: MPBE 82, Congress Organization, PO Box 302360, D-2000 Hamburg 36, Federal Republic of Germany.

- September 6-10: 7th *Colloquium on Microwave Communication*, Budapest, Hungary. Contact: Secretariat of the 7th Microcoll, H-1525, Budapest 114, POB 15, Hungary.

- September 8-10: *International Symposium on Electromagnetic Compatibility*, Marriott Hotel, Santa Clara, CA. Contact: Dr. Andrew Nalbandian, 20617 Debbie Lane, Saratoga, CA 95070.

- September 13-17: 12th *European Microwave Conference*, Helsinki, Finland. Contact: Prof. M. Tiuri, Helsinki University of Technology, Radio Lab, Otakaari 5A, 02150 Espoo 15, Finland.

- September 20-21: 4th Annual *Conference of the IEEE Engineering in Medicine and Biology Society*, Marriott Hotel, Philadelphia, PA. Contact: Dr. Alfred R. Potvin, Department of Biomedical Engineering, PO Box 19138, University of Texas, Arlington, TX 76019.

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