field strengths in the region of 100 V/m and electric fields during thunderstorms produces up to 20,000 V/m"

- As mentioned previously, the European solution was to propose increased immunity of body-worn devices to 10 V/m. The European Hearing Instruments Manufacturers Association is also investigating how to measure interference in an increasingly dynamic electromagnetic environment and how to design hearing aids that have sufficient immunity levels. Similar work is underway in Australia.

- A fact sheet issued in October 1994 by the Royal National Institute for Deaf People concludes:

  "Hearing aids do not last forever, and it is hoped that new hearing aids will be less affected by interference. Several organizations, including hearing aid manufacturers, are investigating the problem, and hearing aid manufacturers are working towards designing hearing aids that pick up less of the interference. That is why it is important to have a standard way of measuring the immunity of hearing aids. This standard is being developed as quickly as possible so it will be possible to compare hearing aids, and hearing aid purchasers will be able to buy hearing aids with high immunity."

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Center for the Study of Wireless Electromagnetic Compatibility

GSM Phones & Hearing Aids

The Center for the Study of Electromagnetic Compatibility at the University of Oklahoma was established in early 1994 with seed money from the wireless industry. The Center is developing research on compatibility between hearing aids and wireless telecommunications, as well as other inter-industry electromagnetic compatibility issues.

The academic independence of the Center for the Study of Electromagnetic Compatibility at the University of Oklahoma assures that every industry and business will have equal access to its services and that government agencies will have an independent resource for information and expertise.

The Center serves six major functions:

- Provide testing to assure that electronic devices are properly designed and installed to resist unintended interaction with external electromagnetic sources.
- Host forums to address electromagnetic compatibility issues.
- Perform research to evaluate and resolve electromagnetic compatibility issues.
- Educate consumers and users about electromagnetic compatibility considerations.
- Coordinate the activities of industries and organizations involved in setting electromagnetic compatibility standards.

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- Assist societies and trade organizations to address inter-industry electromagnetic compatibility issues.

The Center is located on the campus of the University of Oklahoma and is managed by the School of Industrial Engineering with a strong research partnership with the School of Electrical Engineering.

The Center also has access to AT&T's 70 acre, multi-million dollar Open Area Test Site (OATS) EMC Lab in Oklahoma City, the premier facility of its kind in the nation.

The Center has an industrial advisory board and a group of founding companies that provided the initial startup funds. Companies may participate in a variety of ways by becoming sponsors of the center and/or users of the services offered by the center. The strategy is to include a variety of companies from the wireless, medical, automotive and aviation industries. One of the Center's first research projects is to analyze cardiac pacemaker and defibrillator compatibility with the wireless technologies proposed for operation in North America. CTIA members stand behind the efforts of the Center, but this is not the only effort underway to address electromagnetic compatibility issues.

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Key Facts

GSM Phones & Hearing Aids

- World wide, the predominant source of reported interference to hearing aids has been from non-radio devices. In America, reported hearing interference is predominantly from non-radio electronic equipment, such as florescent lights and computers.

- Outside the United States, most digital systems use GSM modulation. The GSM Memorandum of Understanding (MoU) has 118 GSM radio operators in 69 countries serving over five million subscribers. Reported hearing aid interference has been limited, and typically associated with older, poorly shielded units. Interference studies by regulatory authorities, operators and the GSM MoU have demonstrated that cost effective hearing aid shielding ensures user access to digital phones and eliminates interference from other non-radio sources.

- European Telecommunications Standards Institute (ETSI) studies of potential interference indicated personal audio equipment and hearing aids were most susceptible to interference from GSM. Similarly, early evaluations of digital radio in the U.S. and Canada --including CDMA, TDMA, and GSM equipment -- indicate personal audio equipment and hearing aids are most susceptible to interference.

- Efforts by industry and standards bodies are directed at promoting compatibility in the changing electromagnetic environment. Electromagnetic compatibility is the ability of a product or device to operate in its intended electromagnetic environment without receiving interference and without being a source of interference.

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- An unshielded device, for instance, will sometimes malfunction or not perform optimally after picking up signals from other sources. In order to avoid this degradation in service, device manufacturers provide a certain level of electromagnetic immunity (shielding) in their equipment.

- In Europe, the generic immunity standard specifies that domestic equipment must be immune to interference from RF electromagnetic fields of 3 volts per meter (3 V/m). In light of the rapid spread of digital equipment in Europe -- including phones that employ digital modulation -- ETSI is considering increasing the level of immunity from 3 V/m to 10 V/m. There are no generic immunity standards in the United States although much equipment meets the 3 V/m level.

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Observations

GSM Phones & Hearing Aids

"FDA has the primary federal responsibility for overseeing EMI with medical devices. FDA must ensure that medical devices manufactured and sold in the United States are both safe and effective. According to officials from FDA's Center for Devices and Radiological Health, such 'interference can best be prevented by using design and construction techniques that protect or shield medical devices from reasonably expected interference, specific standards are determined on a device-by-device basis.'"

General Accounting Office/Resources, Community and Economic Development Division report to Ranking Minority Member, House of Representatives Subcommittee on Government Management, Information and Technology, March 17, 1995

"In my little country of Denmark, over 250,000 people (4.8 % of the population) are currently using GSM telephones on two competitive, nationwide networks and not one single complaint has been received by the Danish Telecom inspector from hearing aid users, car owners, hospitals, airports, medical equipment suppliers, consumer protection agencies, etc."

Ole Lauridsen, Professor, MSc. E.E., Corporate Director R&D, Tele Danmark, Tele Danmark Research Letter to FCC Chairman Reed Hundt, March 26, 1995

"My father got the idea to standardize and have a repeatedly-producible radio for a car. He found a couple of real bright young people to put together his idea. And they packaged the radio that could now be mass produced. In the Twenties, a few radios were put in cars one at a time by taking a radio out of a table model cabinet. Now

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that was a revolutionary idea. It must seem rather elementary to us today. They finally got a few of these radios made up. And my father thought it would be a good idea if he installed one in the car of the bank president who helped him just down the street – a little bank in Chicago. He thought it would be an important thing that the banker understood that there was promise to this business and he was helping my father with a hundred dollars here and a few thousand dollars there to just meet the payroll. Also, it would be nice if the banker was in effect a sample user. So they asked the banker to drop his car off. They put a radio in it for him and he did. It took a long time, very complex to even install a standard radio because there were wire mesh antennas that went into the roof of the car, etc.

"They kept the car running and it was reliable and it was working fine. They called the banker and told him he could come and pick up his car. It was a proud moment. The first customer drove away with the first mobile car radio. Everybody went back up into the building. The whole space of the company was about the area that I'm standing here.

"One of the people happened to stay outside for a few minutes. Within about five minutes, the fire engines started whizzing past our plant. This fellow watched just out of idle curiosity and discovered they stopped only a block and a half away. And they didn't go in a building. They stayed right out on the street. A car was on fire. The radio had interfered with the sparkplug action of the car. In fact, we had to put sparkplug suppressers on radios in those days. And the manner in which they did it just plain overheated and there was a minor explosion that started a fire in the engine compartment of the car....

"The message I want to leave with you is that there will never be a more challenging electromagnetic compatibility problem to solve vis-à-vis the resources that were available to solve it than that one. You will never have a problem as major as that one. I don't mean technically. Almost anybody in the room here today that is technically oriented could solve that problem. But for the next few weeks, those two or three people who were the only people in the world who could focus on the issue were just up against the wall. They solved it!

"I have never seen any problem in our company that has been near as challenging as that. And we've had a lot of them. We're putting systems up in satellites now. All the great things that are being done with geographic sharing of the spectrum, etc. Whatever problems we face, I assure you they will all yield to very objective, sincere, cooperative work between us. And it is that promise and that opportunity that brings me here and sends me home from here with another large measure of increased hope and promise for our respective industries."

Robert W. Galvin, Chairman of the Executive Committee, Motorola, Inc. Remarks at Electromagnetic Compatibility Challenge Forum, Sept. 29, 1994, Dallas, Texas

"Although operators and manufacturers cannot know when a particular device and a particular transmission will intersect, we do know the broad range of powers and frequencies on which the vast array of modern communications devices operate. Therefore, medical devices can be designed, shielded, or filtered to make sure that they will operate with increased immunity in the electromagnetic spectrum we encounter as a matter of course in our modern world. This is a realistic and workable solution to minimizing EMC problems in most, if not all, cases. It is worth noting that even where we know the exact source of interference, as where a nearby radio station transmitter interferes with a homeowners telephone, the principal solution is to place a filter on the phone. Similarly, when CB radios were found to be interfering with truck breaking mechanisms, the problem was solved by appropriate shielding of the braking systems.

"In solving EMC problems generally, the transmission can rarely be altered, except by turning it off: the passive device, however, can generally be made less susceptible to EMC problems. Precisely for these reasons, the European Community responded to concerns about EMC and medical devices by addressing the susceptibility of the devices rather than attempting to restrict communications services. Medical devices sold in Europe must now meet immunity standards for electromagnetic compatibility.

"With respect to stationary medical facilities, it has been suggested that EMC problems could be prevented by managing radio transmissions within and around the medical facility. Prohibitions on certain transmitting sources such as cellular telephones, pagers, or hand-held radios within given distances of certain critical hospital areas have been decreed in some hospitals. We believe that this response ought to be regarded as a measure of last resort. ...

"Again, the more comprehensive, long term and practical solution to the EMC problem in most cases, whether the medical devices are mobile or stationary, in a home or in a hospital, is to make the medical devices more immune to undesired transmissions. Research is underway in this area and we do not believe that regulation will be necessary if the medical device industry will adopt and adhere to voluntary standards..."

Dr. Thomas P. Stanley, Chief Engineer, Office of Plans and Policy, Federal Communications Commission. Remarks before the Subcommittee on Information, Justice, Transportation and Agriculture, Committee on Government Operations, U.S. House of Representatives on Electromagnetic Compatibility and Medical Devices, October 5, 1994