



Center for the Study of Wireless Electromagnetic Compatibility

University of Oklahoma

Working with industry, government, and business to investigate and resolve interaction between wireless phones and electronic devices such as hearing aids and pacemakers

A National Science Foundation Industry/University Cooperative Research Center since 1997

Center Mission and Rationale

The growth of the wireless phone industry has been phenomenal. It is expected to continue to accelerate and exceed that of the personal computer industry in the 1980s. Cellular phones, personal communication devices, pagers, and other wireless products will proliferate as people continue to fold these products into their everyday lives. As their numbers and mobility increase, there will be more opportunities for these devices to contact and interact with other electronic devices.

There is a need for an independent center to investigate, study, and provide education concerning the use of these devices and their compatibility with other electronic products. The Center for the Study of Wireless Electromagnetic Compatibility (Wireless EMC Center) was created at the University of Oklahoma to address these needs.

Our goal is to serve as an independent center dedicated to the investigation of issues related to the electromagnetic compatibility of electronic equipment with wireless devices. The Center will provide education to industry and wireless users, a clearinghouse to monitor the activities of trade organizations and standards committees, and research/test facilities for products.

The Center offers six primary services:

- **Educational Services** – Provides educational services to users and manufacturers of devices that may interact with wireless devices.
- **Investigative Research** – Examines new products and potential cases of electromagnetic interference.



Sample of test phones

- **Interaction Testing** – Testing is done to help in the design of new products and to develop industrywide protocols and standards.
- **Clearinghouse** – Maintains an information clearinghouse for use by EMC Center members.
- **Standards Watch** – Provides information to organizations that develop EMC guidelines.
- **Forums** – Hosts national forums to discuss EMC issues and research.

Research Program

• Avionics

Phase I - A Preliminary Study:

- This study was a preliminary investigation of the possible interference of spurious emissions from wireless phones on aircraft navigation and communication equipment. Six wireless phone technologies were investigated over the frequency ranges, which covered the receiving ranges of five aircraft systems (VOR, LOC, VHF, GS, and GPS).

Phase II - A Detailed Examination:

- The study was a detailed investigation of the possible interference of spurious emissions from wireless phones on aircraft navigation and communication equipment. Two wireless phone technologies were investigated over the frequency ranges, which covered the receiving ranges of five aircraft systems (VOR, LOC, VHF, GS, and GPS). This study was conducted in conjunction with NASA Langley.



Base station simulators



Hearing aid Phase III subjective testing

• **Hospital Electromagnetic Interference—
Healthcare Resource Manual:**

- Provides important information to assist in managing EMC issues in hospitals.
- Contains articles and information on recent research activities in the area of EMC in healthcare.

Hospital Report:

- Addressed to hospital administrators and clinical engineers concerned with the effects of EMI of wireless devices with medical devices.

• **Medical Devices**

Phase I - Wireless Phones:

- Defined the maximum separation distance of the wireless phone and pacemaker needed to avoid interaction.

Phase II - Height Testing:

- Investigated the minimum planar separation distance between wireless phones and pacemakers needed to avoid interaction.

ICDs and Wireless Phones:

- Investigated and characterized the interaction between Implantable Cardioverter Defibrillators (ICDs) and wireless phones.

• **Hearing Aids**

Phase I - Clinical Study:

- Characterized interference between hearing aids and wireless phones and evaluate solutions.

Phase II - Research Program:

- *Phase II-A:* Developed repeatable laboratory acoustic measurements.
- *Phase II-B:* Determined acceptable speech-to-interference ratio.
- *Phase II-C:* Waveguide testing of hearing aid immunity.

Phase III - C63.19 Validation:

- Objective and subjective validation of the EMC standard regarding compatibility between hearing aids and wireless communication devices.

Center Headquarters

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