

## **4. TESTING PROTOCOL**

- **Most testing will be done in the same sound attenuated test booth in the Hough Ear Institute.**
- **Supervised by an OU Researcher and an audiologist from Hough.**
- **Some testing may be done at the AT&T Lab.**
- **Audiograms will be done on all subjects, including those with normal hearing.**
- **All hearing aids will be analyzed for performance on the Fonix hearing aid test box prior to testing on the patient.**

## 5. SUBJECTIVE TESTS

- Phone technologies

- PCS 1900 MHZ (J007)
- TDMA (D-AMPS) @800MHZ (IS-54)
- CDMA @800MHZ (IS-95)
- Phones with some shielding for EMI

- Hearing Aids

- Subject's own HA (BTE, ITE,ITC,CIC)
- One BTE with no shielding
- One BTE with inside shielding
- One BTE with outside shielding

- **Both "Passer-by and "HA-user" interaction problems will be evaluated.**
- **Subjects will rate the annoyance level.**
- **Tests will estimate**
  - (i) the greatest distance at which interference is perceived.**
  - (ii) point of maximum interference.**
  - (iii) interference level in the normal telephone position.**
- **Psychophysical approach will be used for the above tests.**
- **Variable parameters**
  - distance**
  - orientation of phone**
- **15 test conditions to be evaluated.**

## **Subjective Tests (Continued)**

**Five Test conditions for each phone technology  
(PCS @ 1900, TDMA @ 800, and CMDA @ 800)**

- a. Own HA in phone RF field**
- b. Own HA in RF field with phone shielded**
- c. BTE hearing aid and no shielding**
- d. BTE-HA with outside shielding**
- e. BTE-HA with inside shielding**

## **6. OBJECTIVE TESTS**

- **Speech intelligibility tests using a sound field speaker, and audio taped word lists (25 words per test condition).**
- **Speech intelligibility scores obtained for each test condition.**
- **Five speech intelligibility test conditions to be evaluated.**



## **Objective Tests (Continued)**

### **Five Speech Intelligibility Test Conditions**

- a. Own Hearing Aid and no RF field**
- b. Own Hearing Aid and PCS 1900 RF field**
- c. Own Hearing Aid and PCS 1900 with shielding**
- d. Own Hearing Aid and TDMA/CDMA RF field**
- e. Own Hearing Aid and TDMA/CDMA phone with shielding**

## **PROJECT STATUS    11/28/95**

- **Questionnaire designed and is being mailed to 500 HA users**
- **Preliminary trials are being done with OU Personnel now (some interesting results)**
- **Dec. 15, 1995: Selection of 65 Hearing Aid users for testing**
- **Dec. 20, 1995: Testing to begin at the rate of 10 patients per week**

## **TIME TABLE FOR RESULTS**

- **Jan. 15, 1996:** Partial results will be available from the first 20-25 patients
- **March 15, 1996:** Preliminary results on all 75 Human Subject tests
- **April 15, 1996:** Preliminary report on
  - **Extent of the interference problems for HA users**
  - **Effectiveness of existing or proposed short term solutions to Hearing Aid interaction problems**
- **Progress reviews bi-monthly, or sooner, as significant results appear**

**CENTER FOR THE STUDY OF WIRELESS  
ELECTROMAGNETIC COMPATIBILITY**

**UNIVERSITY OF OKLAHOMA**

**A. "RAVI" RAVINDRAN  
DIRECTOR, EMC CENTER  
PROFESSOR OF INDUSTRIAL ENGINEERING**

# **CHARTER**

**To serve as an independent center dedicated to the investigation of issues related to the Electromagnetic Compatibility of electronic equipment with wireless devices.**

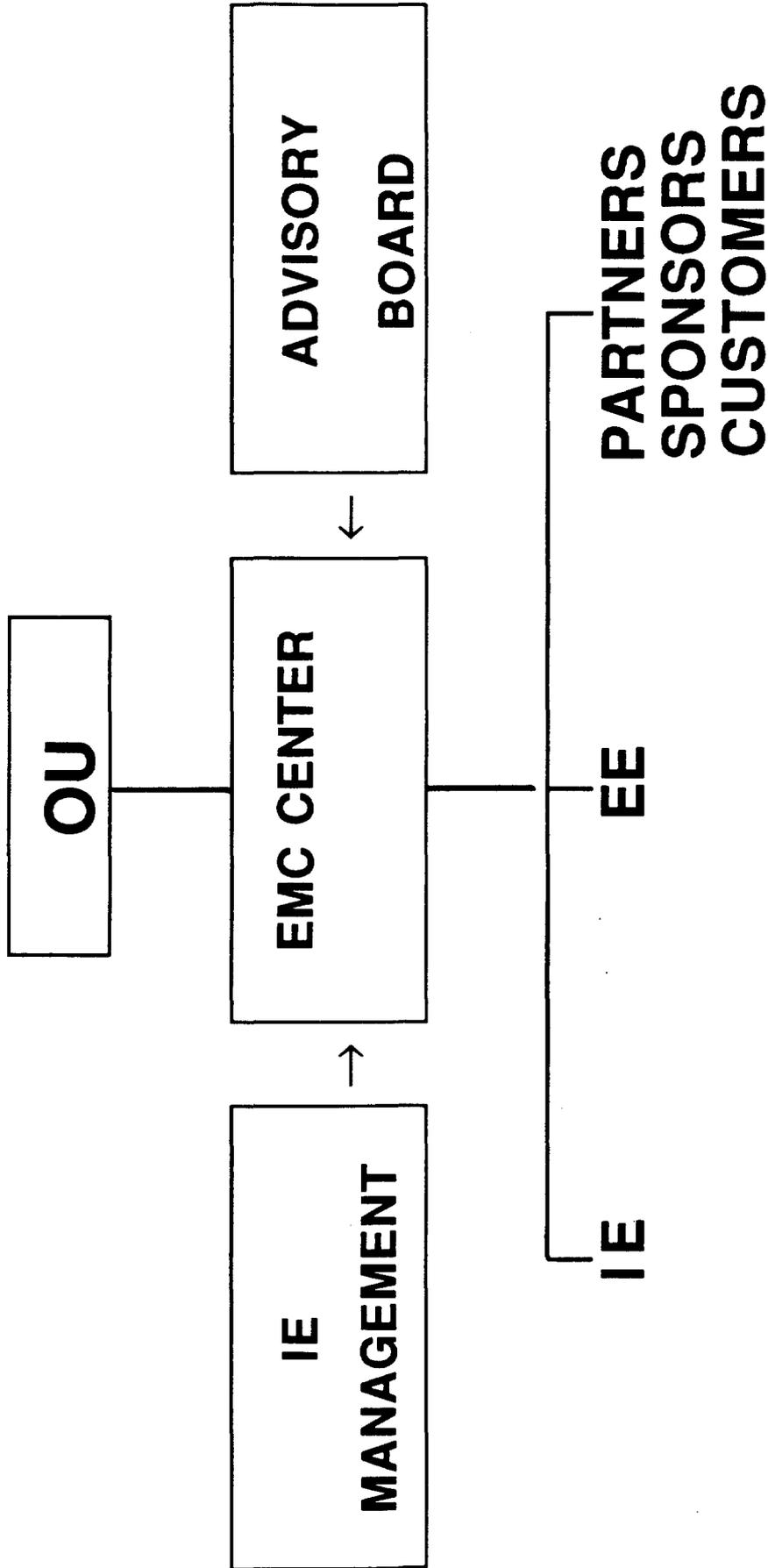
**The center will include capabilities to provide education to industry and wireless users, a clearing house to monitor the state of the art in trade organizations and standards committees, and research/test facility for wireless industry.**

**While the Center will initially focus on wireless devices, as opportunities arise, it may consider any device designed to radiate or suspected of radiation and the effects of these devices on other devices.**

# **SERVICES**

- o Provide linkage to the various societies and trade organizations which focus on EMC**
- o Serve as an interface and "Standards Watch" to the large variety of standards organizations which are working in EMC**
- o Provide educational services in EMC to users of devices which are concerned with interaction with cellular devices.**
- o Perform industry driven research in EMC**
- o Develop and Perform in house and on site test of devices and environments which are interested in EMC**
- o Organize and provide an annual Forum on EMC**

# ORGANIZATION

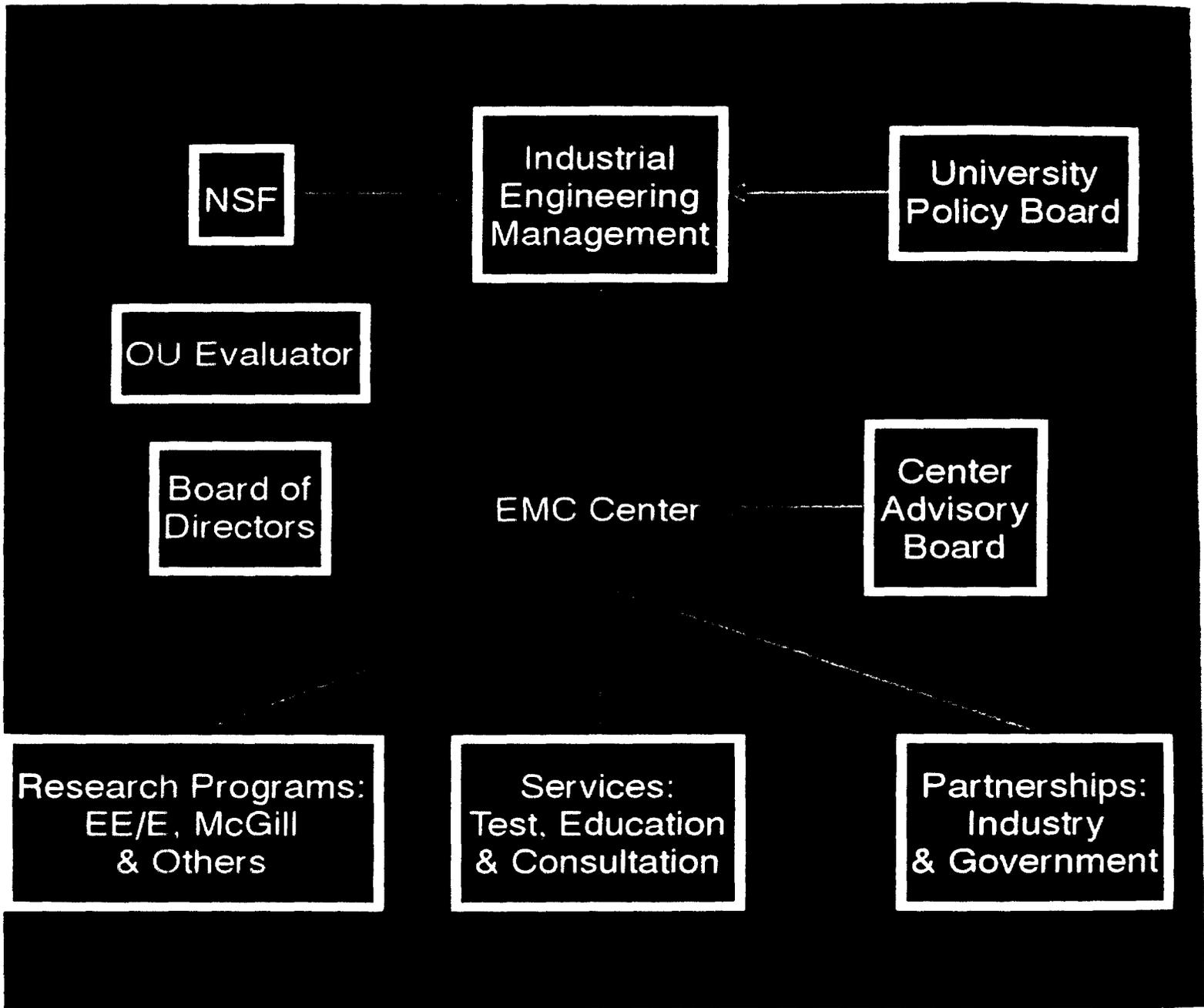


# **FACILITIES**

- **U of OK COLLEGE OF ENGINEERING**
- **U of OK HEALTH SCIENCES CENTER**
- **ENERGY CENTER at U of OK**
- **AT&T TEST FACILITY**

# **PARTNERSHIPS**

- **AT&T**
- **McCAW**
- **SW BELL MOBILE SYSTEMS, INC.**
- **MOTOROLA**
- **ERICSSON**
- **NOKIA**
- **NORTHERN TELECOM**
- **HEWLETT PACKARD**
- **BELL SOUTH WIRELESS, INC.**



## **CENTER BOARD OF DIRECTORS**

### **15 MEMBERS**

- **Cellular Telecommunications Industry Association (CTIA)**
- **Medical Trade Organization (HIMA/AAMI)**
- **Automotive Trade Organization**
- **Aviation Trade Organization**
- **Scientists/Researchers in EMI (2)**
- **Industry Advisory Board Member (1)**
- **Social Economist**
- **Regulatory Agencies (4) (FDA, FAA, FCC, and DOT)**
- **Chair of the Scientific Advisory Group (SAG) on Cellular Telephone Research**
- **Director of School of Industrial Engineering (Chairman of the Board)**
- **Director of the EMC Center**

## **EMC CENTER MEMBERSHIPS**

- **For companies/divisions/groups of companies**
- **Three types of memberships**
  - **Charter Member**
  - **Full Member**
  - **Associate Member**

**Current Charter Members: AT&T, McCaw, Motorola, Southwestern Bell Mobile, Bell South, Ericsson, Hewlett Packard, Nokia, and Nortel**

## **Charter Member**

### **1. Requirements:**

- **Sales > \$300 million/year (may also be joined by smaller companies)**
- **First year payment \$35,000**
- **Assessments up to \$35,000 for subsequent years**

### **2. Benefits:**

- **Membership in Industry Advisory Board that meets at least twice a year**
- **Attend Center Review Meetings (semi-annual)**
- **Vote on Proposed Center Projects**
- **Free access to Center Reports and EMC Clearinghouse**
- **In-House Presentations**
- **Access to OU Consulting**
- **Attend Center Seminars and Courses at 50% discount**
- **50% Discount on all product testing**

## **Full Member**

### **1. Requirements:**

- Sales between \$50 and \$300 million/year (may also be joined by smaller companies)
- First year payment of \$15,000
- Assessments up to \$15,000 for subsequent years

### **2. Benefits:**

- Attend Center Review Meetings (semi-annual)
- Free access to Center Reports and EMC Clearinghouse
- Access to OU Consulting
- 50% Discount on product testing
- Attend Center Seminars and Courses at 50% discount

## **Associate Member**

### **1. Requirements:**

- **Primarily for small companies with sales up to \$50 million/year**
- **First year payment of \$5,000**
- **Assessments up to \$5,000 for subsequent years**

### **2. Benefits:**

- **Attend Center Review Meeting (semi-annual)**
- **Free access to Center Reports and EMC Clearinghouse**

## **EMC CENTER ACTIVITIES**

### **RESEARCH PROJECTS**

- **Interference between cellular phones and pacemakers**
- **Interference between cellular phones and hearing aids**

### **EDUCATION AND TRAINING PROJECTS**

- **EMC Information on World Wide Web**
- **Wireless - Medical Industry Forum**
- **EMC Clearinghouse**
- **Short Courses and Seminars**
- **EMC Newsletters**

## **OTHER PROJECTS**

- **Establish an NSF/IUCRC Center for Wireless EMC Issues at OU**
- **Standards Watch**
  - **Member of ANSI/C63 Standards Committee on EMC**
  - **Member of AAMI - EMC Committee**
- **Expand Industry Partners**

# THE UNIVERSITY OF OKLAHOMA

## The School of Industrial Engineering

### The Center for the Study of Wireless Electromagnetic Compatibility



[EMC Center Main Menu](#)

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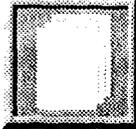
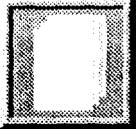
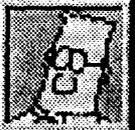
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 <a href="#">General Information</a>	 <a href="#">Current Projects</a>	 <a href="#">Standard and Regulation</a>
 <a href="#">People</a>	 <a href="#">Location</a>	 <a href="#">Related Internet Resources</a>
 <a href="#">Industry Sponsors</a>	 <a href="#">Membership Policy and Benefits</a>	 <a href="#">Conferences and Courses</a>

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