

# **REPORT OF THE RF SAFETY COMMITTEE TO THE ARRL BOARD OF DIRECTORS**

January 2003

The RF Safety Committee has participated in the following areas over the past six months:

1. RF Safety Committee Activities.
2. Monitoring recent scientific studies regarding RF Safety.
3. Participation in the scientific RF Safety community.
4. Administrative issues.
5. Future Plans.

## **1 RF Safety Committee Activities**

- 1.1 The Committee was asked to review the RF Safety-related questions being proposed for the new Technician Question Pool. After examining a list of 116 questions, RFSC members identified 11 questions that were inaccurate. The Committee suggested rewording for all of these questions to correct the errors and so that they can be retained in the question pool.
- 1.2 The Committee reviewed a paper that was submitted to QST about calculating exposure relationships from an Amateur Radio repeater. Though few articles have been published on this subtopic, the conclusion was that this material was better handled in the FCC publication, OET 65B, and also that the paper contained several small errors that may indicate carelessness on the part of the author.
- 1.3 The Committee continues to receive questions from hams with pacemakers or implanted defibrillators. As the population of ham operators ages, questions about possible interactions between Amateur Radio transmitters and these devices appear to be on the increase. There has been considerable research into interactions between these devices and cellular telephones, but there is very little information about the frequencies and power levels used in the Amateur Radio Service. Pacemaker manufacturers perform electromagnetic compatibility studies but these are not made public. An industry standard for electromagnetic compatibility of medical equipment exists and will be reviewed by the Committee. Since this topic is of concern to both the RF Safety Committee and the Electromagnetic Compatibility Committee, a liaison from each committee was added to the email reflector of the other committee. Dr. Lapin is representing the RFSC on the EMCC.
- 1.4 A ham that questioned whether his unborn child would be safe if he operates his Amateur Radio station with a balcony-mounted antenna contacted the Committee. The Committee's consensus was that there has been very little published on the safety of the human fetus in the presence of RF fields, though there have been animals studies that have shown no ill effects on rat fetuses. The ham in question was informed of this and advised to make sure that his station meets the regulatory exposure limits, which are based on the best available science and incorporate significant safety factors below RF field levels that have been shown to have any effects on biological organisms.

- 1.5 Dr. Lapin met with the people at the Cellular Telecommunications and Internet Association (CTIA) who administer their RF Safety program. The discussion included the disposition of the research records from the CTIA's Wireless Technology Research (WTR) program. They were informed of the work of the RFSC and are willing to consider working together with the Committee on topics of mutual interest.
- 1.6 Dr. Lapin contacted Dr. Kenneth Cantor, the Principal Investigator of the NCI epidemiological study of radio amateurs, for a progress report. Dr. Cantor replied:
  - 1.6.1 *"As you may remember, we are doing both a cohort analysis - examining risk for all important causes of death - and case-control analysis within the cohort for selected causes of death. We have completed gathering the data for both arms of the study and are completing the last stages of data cleaning. I expect that data analysis will start in January. Unfortunately there are a number of high priority activities that are slowing the process... However I expect that we will have results that we can share with you in mid/late spring - perhaps just after our program review."*

## 2 Monitoring Scientific Studies

- 2.1 The committee discussed the issue of RF exposure to children. This was in response to an ARRL Web article written by Dr. Lapin, entitled, "Do We Need to Protect Children from RF?" and some news articles that reported a scientific opinion that children receive a greater dose of RF than adults. The conclusion of the Committee is that this is debatable, mainly due to differences in modeling techniques. Based in part on modeling work by Dr. Guy, the prevailing opinion among the Committee members is that children receive no more exposure from an RF source than adults.
- 2.2 The Committee received an article detailing FCC enforcement efforts with regard to the RF exposure regulations. At Mt. Wilson in southern California there are a large number of broadcasters who are not cooperating sufficiently to remove locations that exceed the RF exposure limits, particularly for workers on the transmitting towers. Many of the broadcasters were not taking their responsibilities under these regulations seriously and some of them refused to lower their transmitter power when work was being performed. Since this was a multiple transmitter situation the responsibility for maintaining safe exposure levels falls on all of them collectively. Though this situation has not yet affected hams it is conceivable that a repeater collocated with other transmitters will find itself responsible in part for keeping the total RF levels below safe exposure limits.
- 2.3 In the first monetary forfeiture of its kind, FM radio station KTMN of Cloudcroft, New Mexico was fined \$10,000 by the FCC for exceeding RF exposure limits in publicly accessible areas. FCC engineers measured fields in excess of 300% of the general public exposure limits with the transmitter operating at only 40% of its maximum power.
- 2.4 The state of California convened its own expert committee to study if there are dangers from "EMF" (power line frequencies). Their report can be seen at the following website: <http://www.dhs.cahwnet.gov/ehib/emf/RiskEvaluation/riskeval.html>. The Committee discussed this report and concluded that this study was more anecdotal than scientific. Three scientists were asked to rate their "gut feelings" on the relationship between RF and a number of diseases. This study suffers from a number of bias problems, including low sample number (3) and use of entirely anecdotal data.

- 2.5 The Committee was given a paper that was published in a new online journal that claimed to show a mechanism for ELF fields to lead to potential cancer-causing mutations. The paper used cells growing in a dish that had been first exposed to ionizing radiation to change their replication process in such a way that unwanted mutations would not be automatically caught and dealt with. The authors claimed to show that when exposed to a very strong ELF field, thousands of times stronger than anything that one would be exposed to in the home or in nature, DNA mutations were allowed to complete the replication process. The Committee's opinion of this work was highly skeptical, in part because it was being publicized through press releases before publication and because no one was sure of the peer-review process for this new online journal. Also, the content of the paper was not in the standard format of a scientific paper, with quite a bit of editorializing about the impact of such a study and not so much about the science itself. It was also pointed out that similar studies have been reported periodically over the past two decades but virtually none of them were successfully replicated. With all of the variables and complexity in these types of laboratory studies, independent replication of the results is virtually a prerequisite for acceptance of the work.
- 2.6 The Committee received an email from a ham that claimed to have an allergic reaction to RF energy. He related how the morning after working in a station with a kW amplifier he would wake up with cherry-red cheeks. This kind of allergic reaction has been reported before in scientific studies and such people are said to be "electrosensitive." A detailed report of this condition can be found at the Swedish website:  
[http://www2.niwl.se/forlag/pdf\\_ah/1997-19.pdf](http://www2.niwl.se/forlag/pdf_ah/1997-19.pdf)
- 2.7 The Committee received communication from a radio technician who is also a ham in Luxemburg. He compared the RF Exposure regulations for European broadcasters and cellular telephone installations with the limits for European hams. It appears that hams must get special permission from the Ministry of Environmental Protection to transmit more than 100 W EIRP, while the cellular telephone installations must limit exposure to 3 V/m and broadcast installations commonly emit 8 MW EIRP.
- 2.8 The Committee received an article about an epidemiological study that claimed to link the Vatican radio station to an increase in cancer. The study was based on a very small number of people and did not quantify exposure; in short it was very poorly performed and its results were of no use. In addition, the authors made the mistake of assuming that an apparent association between people getting cancer and proximity to the transmitter implied a causal link. Such a conclusion is not possible with the type of data that was collected and would not even have been possible if the study was performed well.
- 2.9 The Committee noted two recent laboratory studies that failed to replicate adverse effects of RF exposure claimed by studies performed in 1997 and 1998. One study identified an experimental error in an earlier study that claimed to show increased blood pressure in cellular telephone users. The other study failed to show that mice with a gene making them prone to lymphoma would get the cancer when exposed to RF more than similar mice that were not exposed. The original study was criticized for poor control of exposure and failure to work with multiple levels of exposure to attempt to show a dose-response relationship.
- 2.10 The Committee received a communication from Paul Rinaldo questioning whether proposed increases in power limits for WiFi cards would be allowable under the FCC

Regulations regarding RF exposure. There was not enough information about the proposed configuration to be able to make a determination, however, it was pointed out that there are several possibilities for the WiFi manufacturers to make this work. For instance, a warning in the User Manual or on a label is acceptable to the FCC as a method of complying with environmental requirements for some low power spread spectrum devices. The classification of “portable” or “mobile” makes a big difference in the way a device is evaluated, and the Committee felt that these devices would most likely be classified in the more lenient “mobile” category. In this case the exposure would be averaged over the whole body, which would make it more likely that a low power device would be under the limits.

- 2.11 The Committee received an article that appeared in the New York Times, which suggested that the Hardell study, which claimed to show an epidemiology link between brain cancer and the use of old analog cell phones, but no link for modern digital cell phones, would actually help companies like Motorola in current lawsuits against them. The Committee discussed this and concluded that the Hardell study was faulty and so full of errors that the entire premise was unreliable. The most egregious example of bias in this study is that Hardell asked people with brain tumors on one side of their head which side of the head they held their cell phones. The recall bias of this type of question has been well documented, though the high correlation between the side of the head with a tumor and the recall of phone use on the same side is Hardell’s main argument. Without this factor, his study showed no increased correlation between brain tumor occurrence and cell phone usage.
- 2.12 In related news, the Newman lawsuit (a neurologist with a brain tumor on the same side of the brain as he claimed to hold his cell phone) against Motorola was dismissed by the judge in October. The plaintiff’s main medical expert was Lennart Hardell. The judge’s statement regarding the scientific basis of the plaintiff’s case was that “no sufficiently reliable and relevant scientific evidence [to] support either general or specific causation has been proffered by the plaintiffs.”
- 2.13 Levi Strauss and Co. introduced “anti-radiation” pants, with shielding lining the pockets. The company claimed that they were not taking advantage of the public’s fear of radio waves, but they offered no better explanation.
- 2.14 A Norwegian company introduced a “Mobile Cap” that is lined with a thin layer of woven silver and has earflaps that allow sound to pass but not RF energy. It is designed to protect cell phone users from RF radiation from their phones. *(This may replace the hardhat with a rubber duck mounted on the top at Dayton next year!)*

### 3 Participation in the Scientific RF Safety Community.

- 3.1 Dr. Lapin serves as a member of the IEEE Committee on Man and Radiation (COMAR).
- 3.2 Mr. Hare and Dr. Guy continue to serve on the IEEE Standards Coordinating Committee 28 on Non-Ionizing Radiation, which develops the standards for human exposure to RF energy. Mr. Hare maintains a list server for communications among members of this committee, and occasionally cross-pollinates pertinent issues between the RFSC and SCC-28 list servers.

- 3.3 Dr. Small presented RF Safety lectures to the following ham clubs: the Lancaster Amateur Radio Club, Lancaster, NY, the Pioneer Radio Operators Society, Sardinia, NY, the Radio Association of Western New York, Tonawanda, NY, the Buffalo Area Radio Repeater Association, Tonawanda, NY, the Western New York DX Association, Williamsville, NY, and the Amateur Radio Association of the Tonawandas, North Tonawanda, NY.
- 3.4 Dr. Guy performed an FDTD analysis of the SAR patterns in human heads exposed to a 16 patch antenna array operating at 3.5 GHz used for wireless communication.
- 3.5 Dr. Gold worked with three hams to perform RF Safety analyses of their stations, which were running legal limit on 144 and 440 MHz.
- 3.6 Dr. Kaune was an author or co-author on the following papers:
  - 3.6.1 Kaune, W.T., M.C. Miller, M.S. Linet, E.E. Hatch, R.A. Kleinerman, S. Wacholder, A.H. Mohr, R.E. Tarone. 2002. Magnetic fields produced by hand-held hair dryers, stereo headsets, home sewing machines, and electric clocks. *Bioelectromagnetics* 23:14-25.
  - 3.6.2 Kaune, W.T. 2002. Estimating the magnitude of the sum of two magnetic fields with uncertain spatial orientations, polarizations, and/or relative phase: Error analysis. *Bioelectromagnetics* 23:59-67.
  - 3.6.3 Banks, R.S., W. Thomas, J.S. Mandel, W.T. Kaune, S. Wacholder, R.E. Tarone, M.S. Linet. 2002. Temporal trends and misclassification in residential 60-Hz magnetic field measurements. *Bioelectromagnetics* 23:196-205.
  - 3.6.4 Kaune, W.T., T. Dovan, R.I. Kavet, D.A. Savitz, R.R. Neutra. 2002. Study of high- and low-current-configuration homes from the 1988 Denver Childhood Cancer Study. *Bioelectromagnetics* 23:177-188.
  - 3.6.5 Kaune, W.T. 2002. Thermal noise limit on the sensitivity of cellular membranes to power-frequency electric and magnetic fields. *Bioelectromagnetics* 23:622-628.

#### 4 Administrative Issues

- 4.1 Mr. Hare continues to administer the RF Safety Committee email reflector, which handles correspondence between committee members. Other ARRL staff members and some former committee members monitor traffic over the reflector and we occasionally receive helpful comments from them. We have the capability to review things that were discussed in the past and search for keywords. In the second half of this year, 106 messages were posted on the RFSC reflector.
- 4.2 Dr. Lapin continues to serve as a member of the FCC Technological Advisory Council, representing ARRL and its RFSC on that body. He attended meetings at the FCC Portals Building in Washington, DC on September 18 and December 4, 2002.
- 4.3 Copies of the 2003 editions of the ARRL Handbook and the ARRL Antenna Book were sent to all Committee members in preparation for updating the RF Safety text, as well as a perusal of any potential RF Safety issues that are contained in other topics contained in those books.
- 4.4 Mr. Hare purchased a copy of the ANSI/AAMI 60601-1-2:2001 standard, "Medical electrical equipment -- Part 1-2: General requirements for safety -- Collateral Standard: Electromagnetic compatibility -- Requirements and tests." This standard document will be

shared between members of the RFSC and the EMCC as a reference for the type of testing that should be performed by manufacturers on pacemakers and implantable defibrillators.

## 5 Future Plans

- 5.1 The Committee continues to consider restructuring of the RF Safety text that appears in all ARRL publications.
- 5.2 The Committee, through its contacts in the biomedical industry, will attempt to contact pacemaker manufacturers to see if electromagnetic compatibility testing of pacemakers and implantable defibrillators can be made public to aid in a safety determination for users of these devices who would like to use amateur radio transmitters with different power levels and on various bands.
- 5.3 The Committee is attempting to obtain a discounted copy of the XFDTD Bio-Pro software package, which would allow us to model various exposure situations of interest to the committee. The package runs on PC-compatible computers and comes highly recommended by Dr. Guy, who uses it in his research and consulting work.

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