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IH WORKPLACE PRACTICES-ENGINEERING CONTROLS

M MISCELLANEOUS

SECONDARY SUBJECT HEADINGS: AN HU AT IH M

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“Do you hear what I hear?”

Harvey J. Hindin
Contributing Editor

“My ears are buzzing—somebody is talking about me,” may have to be changed to “I hear a buzz—someone is transmitting.” Why? Because field tests with radar have indicated that humans perceive low-power, pulse-modulated energy in the 0.3 to 3 GHz band. The effect is not acoustical, but electromagnetic in nature. Even deaf people can hear rf “sounds.” The “buzzes” and “hisses” perceived were dependent primarily on peak power and secondarily on pulse width. Average power was a second-order effect. In addition, pitch and timbre effects could be stimulated by varying the modulation.

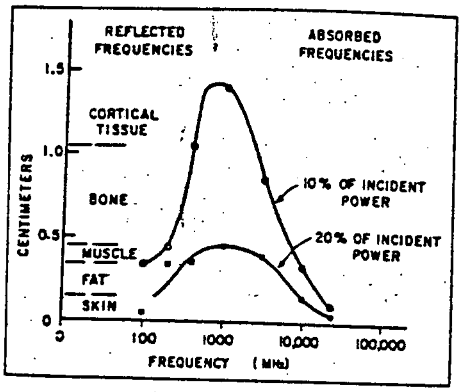
This phenomena has been observed in experiments conducted by Allan H. Frey and Rodman Messenger, Jr. of Randomline, Inc., Willow Grove, PA, under a U.S. Office of Naval Research and U. S. Army contract. Frey, the senior investigator, has been doing work on the psychophysical effects of low-power microwave radiation for many years. His experiments were performed with humans placed in an rf anechoic chamber. Typical data was taken at 1.245 GHz. The energy was conveyed from the transmitter to a waveguide-to-coaxial adapter and then to a standard gain horn placed inside the chamber. The pulse repetition rate was chosen so that the test subjects reported the perception of a sound like “buzzing.”

Rf energy measurements, Fig. 1, were made with a half-wave dipole (connected to an rf power meter) placed where the subject's head would normally be. Vertical polarization was used, but horizontal polarization gave the same results. During the test, cables and supporting structures were arranged for minimum field disturbance. The field distortion of the measuring instruments and the human head were taken into account as much as possible. “All you saw, if you looked inside the chamber, was a person sitting with nothing attached at all,” Frey says.

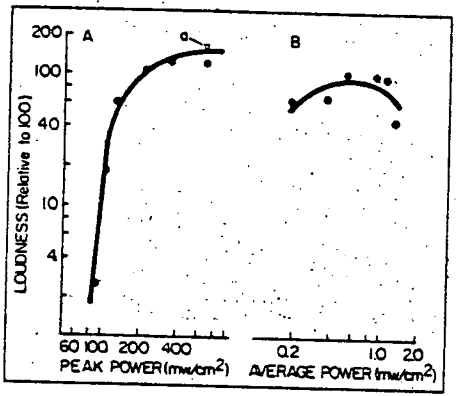
It sounds like—

Test persons were chosen with normal hearing and were trained to estimate the perceived “loudness” of the buzz heard. All data was referenced to an arbitrary loudness of 100 for a given known rf signal. A radomized order of peak power, average power, pulse width and pulse repetition rates were used and all precautions were taken to eliminate false data. The results in Fig. 2 represent average response from many tests.

“It's interesting to note,” says Frey, “that once a minimum pulse width is achieved, perceived loudness is a function of peak power only. When pulse width is held constant and average power changes by varying the PRF, the “sounds” perceived vary in timbre and pitch.”



1. **Power absorption chart** shows the calculated penetration of microwave energy into the head as a function of frequency. Resonance effects and multiple reflection were neglected. The curves indicate only the overall trends.



2. **The data for each subject** consisted of three repetitions for each particular set of rf parameters. In (A), average power was held constant. In (B), pulse width was increased with peak power held constant.

The threshold for perception in the rf chamber was a peak power of about 80 mw/cm².

Understanding the mechanism

“Unfortunately, we mostly know what the mechanism isn't,” claims Frey. The results indicate there is no transduction from microwave to acoustic energy by teeth fillings. Nor does the data support the idea of radiation pressure against the skin conveyed by bone conduction to the ear. Radiation pressure against the ear's tympanic membrane can also be dismissed.

“Much of our work is concentrated on understanding just how the sound arises since the results obtained can be related to other reports of sensory and behavioral phenomena associated with incident low-level microwaves.”

It's important to understand just what is going on because properly modulated microwave energy may be useful in understanding the human nervous system. The brain is stimulated by the functioning of neurons—those ubiquitous conductors of everything electrical. One theory holds that the brain may well be the detection mechanism. Evidence has been presented concerning the existence of electrostatic and magnetic fields around neurons. It is reasonable to suspect that the microwave electromagnetic field could interact with the neural field.

What's to be done?

Much work has been done in establishing the phenomena is real and of biological significance. Remaining questions include the examination of what types of deafness preclude hearing the sounds (some do—some don't), the mechanism of detection by the human and test animals, other possible (harmful?) effects of low-level microwave radiation and so on.

Frey notes that “the phenomena has a number of implications which might be of significance in several fields. For example, it might provide us with information that could be of use in communications systems or it could provide information on techniques for helping the deaf. Also, research could lead to advances in our understanding of the functioning of the nervous system.”