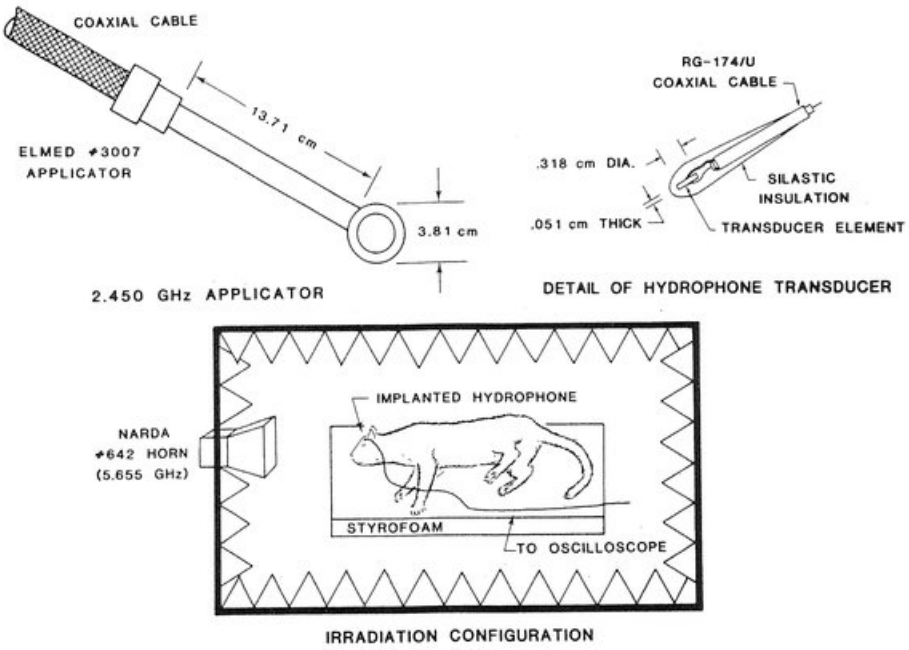

Fig. 1. Simplified representation of the 5.655 GHz exposure configuration. Also shown are details of one 2.450 GHz applicator and the miniature hydrophone transducer.

that was electroplated on each side. The disk elements (Channel Industries, Santa Barbara, CA) measured 3.18 mm in diameter with a thickness of 0.51 mm. Electrical connection to the hydrophone elements was made with approximately 2 m of RG-174/U coaxial cable soldered to the metallic surfaces of the disk. The disk and cable connections were sealed using Dow-Corning #891 clear silicone rubber. Calibration of the hydrophones was accomplished over the range of 50–200 kHz in a 76 X 33 X 37 cm tank of water using short bursts of acoustic energy emitted by a small spherical hydrophone (Model 6600, Edo Western Corp., Salt Lake City, UT). In the calibration process, electrical responses from the disk transducers were compared to those from a standard reference (Type E-27, Underwater Sound Reference Division, Naval Research Laboratory, Orlando, FL).

Two microwave irradiation systems were used to stimulate acoustical activity in the animals' heads. At 5.655 GHz, a radar transmitter, AN/SPS-5D, produced 0.5 μs wide pulses at a peak power of 200 kW. Pulse repetition rate for the radar transmitter was 2 Hz and 14 Hz for the evoked response and hydrophone measurements, respectively. Microwave energy was applied to the subjects via a Narda Model 643 standard gain horn inside a 1.25 X 1.25 X 2.5 m microwave-anechoic chamber. The heads of the animals were located on the centerline of the horn at at distance of 5-30 cm. In most experiments, the animal was placed in the prone position facing the horn. When a large artifact due to microwaves was seen in the transducer output, attempts were made to reduce the artifact by moving the animal farther away from the horn and/or positioning the animal perpendicular to the direction of irradiation.

At 2.450 GHz, an Epsco model PG5KB pulse generator was used to supply pulses at 3 kW peak power. This energy was applied to the cats and guinea pigs using an Elmed Model 15 applicator. In the rat experiments, an Elmed Model 3007 applicator and an open-ended WR-284 waveguide were used. The applicators were manually held against the heads of the animals or, in the case of the open-ended waveguide, the rat head was placed at the opening in the center of the waveguide. Fig. 1 shows some details of the experimental configurations. Pulse widths were 2.5 μs for the cat and guinea pig irradiations and 5-6 μs for the rat experiments. Pulse repetition rate for the 2.450 GHz energy was 2 Hz and 20 Hz for the evoked response and hydrophone measurements, respectively.

The hydrophone and evoked response signals were amplified and displayed on an oscilloscope (Tektronix 7633 mainframe with a 7A22 amplifier). For the rat experiments, an automatic spectrum analyzer (Tektronix 565 mainframe with a 3L5 spectrum analyzer) was connected to the buffered output connections (rear panel) of the Tektronix 7633 scope.

C. Procedure

The initial experiments used cats and guinea pigs and were performed without the benefit of the automatic spectrum analyzer. A disk hydrophone transducer was surgically implanted approximately 1.5 cm deep in the brain of a barbiturate-anesthetized animal through a hole drilled through the skull on the left side of the head near the top of the parietal bone. Dental acrylic glue was applied between the exiting coaxial cable and the skull to immobilize the transducer. Next, during continued anesthesia, the animal and hydrophone assembly, resting on a block of foamed polystyrene, were taken to the area of the microwave-anechoic chamber where comparisons of (5.655 GHz) microwave-induced and acoustic click-induced brainstem potentials were made. Both metallic and nonmetallic electrodes were used to acquire the brainstem potential, which was buffered by the oscilloscope, then averaged by the HP Fourier Analyzer.