DISTRIBUTION OF ENERGY RADIATED FROM BROADCASTING STATIONS[1]

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Aside from the known directional effects of certain types of transmitting antenna, there are many peculiar variations in the distribution of energy radiated from certain broadcasting stations. The cause of these variations is the object of this investigation. In order to make the investigations in a space free from reflections or distortions of the waves and yet large enough to explore the region for many wavelengths from the transmitter, very short waves, 3.6 meters, were used.

Vertical waves are radiated from a simple antenna having one turn and two rods extending vertically upward and downward from it.

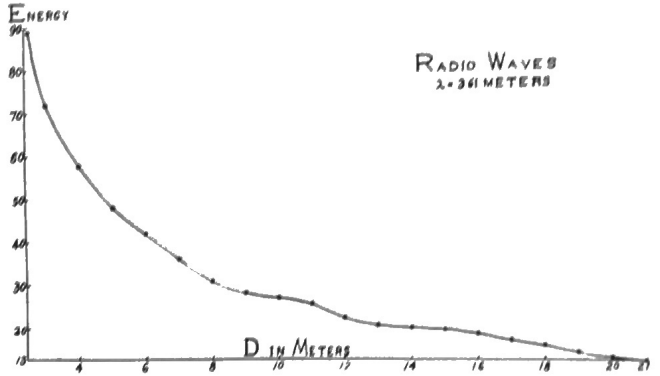

Fig. 1. The Relation Between Distance and Energy Radiated With Radio Waves of 3.61 Meters.

The center of the transmitter was about 2 meters from the ground. The receiver consisted of a thermocouple galvanometer placed in the center of a receiving antenna of two vertical rods timed to resonance. Brick walls or vertical conductors within 100 feet of the transmitter produced noticeable effects on the receiver. A human body within 30 feet of the receiver produced an effect and in some positions would nearly double the readings. Therefore all observations were taken through field glasses about 40 feet from the receiver.

The distance curves (Fig 1) indicate that some energy was reflected from the ground, so that no simple law for variation of energy with distance is discernible. A long horizontal insulated wire, 12 meters long, stretched from a point near the transmitter and about

[1]Read before the Tennessee Academy of Science at the Memphis meeting, April 22, 1932.

80 centimeters above the ground picked up considerable energy and reradiated it from various resonant positions. Resonant positions were found all along the wire about 1.8 meters (½ λ) apart. The energy field around such a wire radiating from so many places is very complicated and many more hundreds of observations will be necessary to give an adequate plot of the real distribution of energy. However, enough observations have now been taken to indicate some rather important characteristics, which might be tabulated as follows: (1) Waves of this size or frequency (83 millions per sec. = 83,000 Kc) are very readily reflected from brick or stone walls and to a less extent from ordinary dry ground which is perpendicular to the electric displacements. (2) Vertical conductors approximately tuned to the frequency of these waves absorb and reradiate more than 100 times as much energy as one would expect from the ordinary wave theories. A single resonator several meters from the transmitter may reradiate enough energy to nearly double the energy in the receiver or reduce it

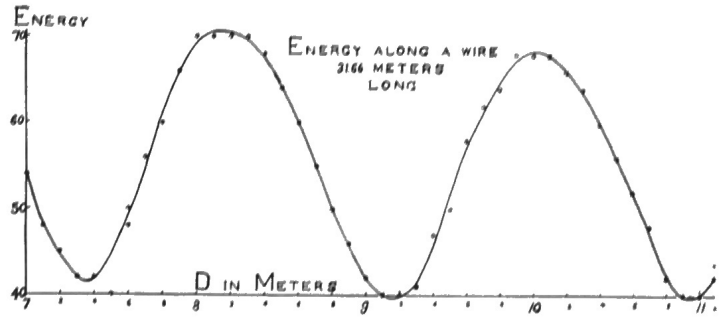

Fig. 2. The Relation Between Distance and Energy Along a Wire 31.66 Meters Long.

to one-half when moved half a wave length away. (3) Vertical conductors, not at the resonance length, may absorb and reradiate considerable energy. A person walking toward a receiver will make its deflections fluctuate above and below its normal value each half wave length change in distance. (4) A horizontal insulated wire near the transmitter will direct considerable energy along its direction and will reradiate most of it from the farther end, but it will also radiate energy from certain other positions throughout its length, especially if its length is a definite number of half wave lengths. (5) A receiver near such a wire and moved parallel to it will show maximum and minimum values each half wave length. (6) Such a wire stretched across the path of these waves seems to have very little effect on them when the angle between their path and the wire is over 20°. (7) If a horizontal wire be grounded at various points, it will also show the effects of standing waves and radiation from resonance points. (8) Such a horizontal wire grounded near the receiver will divert practically all the energy from the receiver.

An energy survey of the territory for 10 miles around Station WSM shows instances of each of the last five points as shown on the map made by Nis Hansen as part of his master's thesis at George Peabody College for Teachers.