A REVOLUTIONARY ANTENNA FOR HF
By

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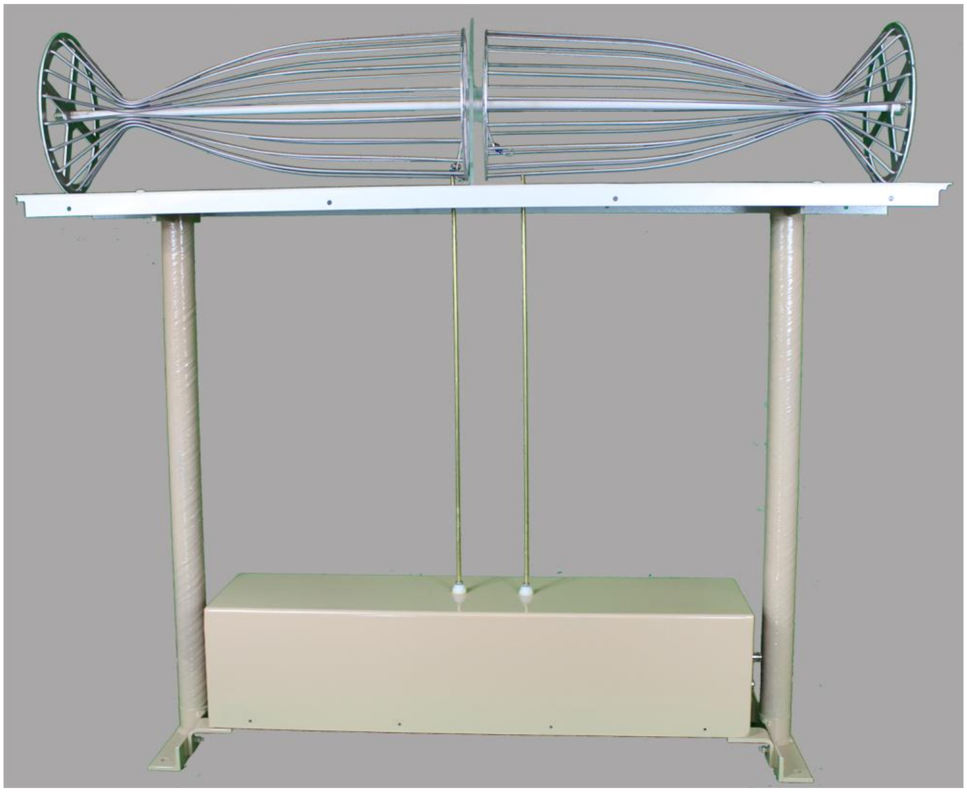
HF (High Frequency 3-30 MHz) communications require large antennas and need to have multiple lengths (antennas) or tuning capability as you change bands and use different channels (frequencies) in the same band. This requires 50 feet to 130 feet of space for the HF antenna. In the world of HF, no one frequency can be used to communicate from Point A to Point B reliably any time of the day or night. As the local time changes, day to night changes, years change, sunspot cycle change, and other factors change, you must choose appropriate bands (frequencies) to have a reliable working path for long or short range communications.

A concern with HF antennas is the directivity of the antennas. In some circumstances this is used to null out interference, however, occasionally the desired stations that you want to communicate with fall in this same null pattern. If you are using a horizontal dipole, then you have main lobes perpendicular to the direction of the antenna lines, and no signal towards the end of the lines. If you are using a vertical antenna, then you will have a good signal going towards the horizon in all directions, but little signal going straight up for close-range communications that bounces off of the ionosphere just above you called a NVIS path.

If you designed a perfect antenna, it would be an isotropic radiator with no nulls, able to work on multiple bands and have a wide bandwidth requiring no antenna changes as you change channels or bands. It would be compact in size (4 feet tall, 4 feet long and 1 foot wide) and not disturbed by metal or structures in close proximity to the antenna. Additionally, it would have a natural immunity to noise and other man-made interference.

That is precisely what the EH antenna by Alpha Cognetics does.



The Physics on How Antennas Work
On normal Hertz antenna, the antenna must be 25% of the wavelength for the “hot side” radiator, and another 25% for the ground side of the antenna. At 4 MHz, this translates to approximately 120 feet of space needed for the antenna radiator. In addition, the antenna must be above the ground by at least 25% of a wavelength which means that a 60 foot or taller tower must be part of the antenna system. The size of the antenna follows the formula:

WAVELENGTH = 468/FREQUENCY IN MHz

A conventional Hertz antenna develops the electric and magnetic fields 90 degrees apart in time. The E and H fields are very large and interact with close objects including ground. The unique design of the EH antenna insures the E and H fields develop simultaneously and are in phase with each other.

The EH antenna is unique. It’s instantanious bandwidth is larger than the conventional quarter or half wavelength antenna that it replaces. This means that the antenna does not have to be retuned as the channels are changed in the same band, and wider bandwidth modulation schemes will work properly with this type of antenna. In addition, objects that are in close proximity to the EH antenna do not detune the antenna and seriously degrade the signal path like a conventional antenna.

TESTING THE EH ANTENNA
A testing laboratory antenna range with conventional dipole antennas was constructed for 40 Meters, 60 Meters, and 75 Meters, a vertical antenna was set for the same three bands, and the EH antenna were all in the same location within 200 feet of each other. The results were as follows:

SETUP
The three dipole antennas, vertical antenna, and EH antenna were terminated into a 5-position antenna switch, then through a SWR meter, then into an ICOM Model IC720A multimode HF transceiver. The S-Meter on the transceiver was calibrated using a commercial model IFR1200S Communications Service Monitor so that each S-Unit was translated into an exact dBm reading.

The measurements for each band were made during daylight hours and repeated into the night. The 40 Meter signals during the day were mainly a NVIS path, meaning that the signals received were bouncing off of the ionosphere almost directly above the receive site. This translates to signals on the horizontally polarized dipole that would be 20 dB to 40 dB stronger on the dipole over the vertical. The 60 meter signals were coming in at a much lower angle, and were comparable between the vertical and the dipole. The 75 meter signals were not present during the daylight hours, but were present at night. The directivity of the dipole(s) factored into the readings as well as the angle of the signal coming into the different antennas. These matched known theory of antenna patterns previously published in numerous books and articles.

BANDWIDTH
A measurement was made on each antenna as to how broad the antenna was when tuned and the SWR was below the 1.5:1 level.

BAND CHANGE SPEED
On the vertical and the EH antenna, the time required to allow the antenna to achieve resonance was noted. A second transmission was made to see if the antenna did remember the previous settings and the tuner immediately returned to the previous settings.

RESULTS

SIGNALS
The received signals between the dipoles and the EH antenna were within 3 to 6 dB of each other as long as the angles were within the range of the dipole radiation angles. In directions were the dipole would have a null pattern, the EH antenna performance was significantly superior and more than 20 dB stronger than the dipole antennas. The vertical antenna did not work well during the daylight hours due to the null pattern for vertical antennas directly above them. The dipoles and the EH antennas were far superior to the vertical antenna during the daylight hours, but the vertical antenna did start performing once the paths came from a lower angle.

NOISE
The EH antenna had a much lower noise floor than the other antennas by a factor of 10 to 20 dB.

CHANGING FREQUENCIES IN SAME BAND
As long as the signals were inside of the frequencies that the dipoles were tuned to, the signals were comparable to each other. When signals were received outside to the tuned frequency and bandwidth for the dipoles, the dipoles efficiency dropped dramatically, to the range of negative 10 to negative 30 dB each. The EH antenna had

superior signals throughout the tuned range of the antenna, which was from 3.5 MHz to 11.0 MHz.

CHANGING BANDS
As the bands were changed, the EH antenna automatic tuner would activate, as evidenced by the current being drawn from the power supply (approximately 3 amps), the noise from the antenna tuner, and the reduction of SWR as measured by the SWR meter. The tuner was able to go from one band to another in less than ~20 seconds on the first transmission on a given band.

PROPAGATION
The EH antenna has a spherical antenna pattern. Imagine an antenna pattern like a globe or ball. Some of the other characteristics of the EH antenna include the fact that the antenna works the same, whether it is 3 feet above ground level or 300 feet above ground level, is not disturbed by metal objects or structures over 3 feet from the antenna, and the SWR is below 1.5:1 over the entire range of the antenna, from 3.5 MHz to 11.0 MHz

WHAT IS NOT NEEDED WITH THE EH ANTENNA

Large antennas, concerns about nearby metallic structures, tall antenna supporting structures are not needed for the EH antenna to work. The space required for the EH antenna is minimal. Because the antenna works so well in all directions, directivity in installation is not a concern. A normal Hertz antenna has nulls in the radiation pattern, and a Power Amplifier is sometimes used to overcome these nulls. With the EH antenna, powerful amplifiers and their associated power supplies are not needed as there are no nulls in the EH antennas pattern. The unique design of the EH antenna allows the antenna tuner to be powered from the exiting coax feeding the antenna, eliminating additional wiring or retrofit of cabling.

Talented electronics technicians and engineers, expensive installations, and books on antenna theory are not required for installation.

Turning these non-needed items into money saved by not needing the peripherals named above; the amount saved approaches $5,000 to $50,000. These savings include:

- TOWER $4,000 TO $250,000
- ROTATOR $500 TO $2,500
- POWER AMPLIFIER $2,000 TO $5,000
- BOOK ON ANTENNA THEORY $30 TO $200

The EH antenna works, and works well.

CONCLUSION

The EH antenna has so many significant advantages it is the ideal antenna for fixed, portable, mobile and rapid response emergency communications applications. The savings in physical space required, the ability to work well without a tower, rotator, power amplifier, or having to have an engineering degree to install it creates a unique and ultimate antenna for HF applications. An additional benefit is the ability to install the EH antenna in areas that require zoning permits or have zoning, deed, and other restrictions that prohibit the erection of the towers required of the conventional antennas to perform correctly on the HF bands. The perfect antenna has been invented and it is available for use right now. You might visit their website www.AlphaCognetics.com for more information.

AUTHOR BIOS

Ira Wiesenfeld, P.E., CETsr, is a consulting engineer who has been involved in the radio communications business since 1966. He has a BSEE; a FCC General Radiotelephone Operators License; is a Senior Member of IEEE and is a licensed professional engineer in the state of Texas. He has been a licensed amateur radio operator since 1963, and currently holds an Extra Class license. Ira has provided service for the broadcast, public safety radio, mobile telephone, paging, manufacturing, military, and education markets, and also provides training; and has written a book on installation standards, along with numerous magazine articles. Ira can be reached at iwiesenfel@aol.com.

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