Antennas and Physics

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Antennas are structures, which convert electrical oscillations of a line into radio waves in space, and respectively convert radio waves into electrical oscillations in a line.

In classical theory, an antenna is treated as a device, where an oscillating current flowing in a conductor produces a (electro) magnetic field (EM field), which converges into E and H field, to an electromagnetic wave (EM wave) travelling in space.
The exact cause of the EM wave is said to be **acceleration of electric charge**.
(See http://electron9.phys.utk.edu/optics421/modules/m1/production.htm)

This theory, concentrated on the "current in the wire", was leading to the development of the traditional antennas as: dipols, yagis, LPSs, verticals, loops and so on.

This theory is correct, however it does **not represent the full truth.**
Only one half of the physics is considered here, because **EM waves** are not only generated by time varying **magnetic** fields, but also by dynamically varying **electric** fields.
This fact became clear to me by studying the Maxwell equations, and by thoughts gained through quantum physics, especially through the behaving and the properties of photons.
(http://en.wikipedia.org/wiki/Maxwell's_equations
   http://en.wikipedia.org/wiki/Photon)

In the Maxwell equations you find the Gauss' law, the Maxwell-Faradays law of induction, and the expanded Ampère's circuital law. They describe the dynamic interaction of the curly electric and magnetic field, and the current.

Technical handbooks treat EM waves throughout as waves, generated by oscillating current in a conductor, where the radiation begins. Accordingly the formulas are established.
The frequently used antenna simulation program NEC (EZNEC) and its family does not (yet) allow to define and simulate my new antenna construction.

As a consequence, special „antenna rules" were createt, based on this one-side view.
As an example, a good antenna guide lists the following golden rules for antenna design:

1. Much wire in the air will bring the best results
2. As high as possible (antenna at ground level is bad)

3. Current radiates (ARRL Handbook: current produces the radiated signal)

Furthermore, most antenna books write, that antennas with the higher radiation resistance radiate more, and that short antennas generally have a very low efficiency.

All these rules are based on the experience gained during many years of work with traditional wire antennas.

Now I don't want to say, that these rules are wrong, but I have to **limit applicability** of them: They are only valid for antennas based on the physical law of wave generation by oscillating currents in a conductor.
Traditional antennas are based on this principle.

For antennas, based on the wave generation by dynamically changing electric fields (E field antennas), these rules do not apply.

The intention for my new antenna design was, to produce a maximum dynamic E field in the space around the antenna.
During the last 3 years I built such antennas and conducted many field tests, comparing this antenna with traditional wire antennas. The result was, that an antenna with 150cm radiator length (= 5 feet) at a wavelength of 40m produced constantly the same signal strength, and many times a stronger signal at the remote station by comparing with dipols, verticals, G5RV, FD3, and longwires.
The transmit power and the location were identical, and during the qso many switchovers between the test antenna and comparing antenna were made.
The hight above ground of the base of the new antenna was only 50cm to 150cm, while the comparing antenna was in its original hight!

Hundreds of tests were made from 10m to 160m wavelength, and always the same result was obtained. The length of the radiator on 160m was just 3m!
I published many of these tests in the internet under "New HF Antenna".

The following criterias apply for the "New HF Antenna":

- areas (planes) are used, which form in the space a capacity, in which the E field is produced.
- these areas have to be arranged in a special manner, open into space (a capacitor with two directly opposed plates produces practically no radiation).
- the feedline may not be part of the antenna. The line is not allowed to radiate.
- feeding of the antenna has to be floating, without reference to ground.
- the impedance has to be adjusted such, that the SWR is below 1.5
- the dimension of the areas **has to be small** in relation to the wavelength. (Length of the radiator < 7% of the wavelength, otherwise the phase difference of the E field is reducing the radiation efficiency).

In my realisation, feeding is made by the "varylink". This is part of the antenna structure and permits to obtain a SWR below 1.1 on each band.

This has the advantage, that the antenna does not require an antenna tuner.

Other realisations:
Others have also developed antenna types, which are using the principle of E field wave generation. E.g. Isotron, Microvert, EH-Antenna (Crossfield antenna CFA) and similars. All these realisations do not fulfill all criterias listed above, and therefore their efficiency is 8 db to 18 db less than the “New HF Antenna”.

Future:
Development of additional versions of this antenna continues.
The significance of this antenna will be important, due to many restrictions in available space, and regulations to errect traditional antennas with their large physical dimensions.