Measurements for determining the radiant power balance of dipole radiators in reflection free environment

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The object of the following measurement proposal is to prove the validity of the theory described in the paper of ***János Vajda*** **"VIOLATION OF THE LAW OF ENERGY CONSERVATION IN WAVE FIELDS"** in practice with high precision measurements. More specifically this measurement will prove that when electromagnetic waves of identical frequency, polarization, and phase are superposed upon each other excess energy is gained form the system.

The validity of the above claim will be demonstrated by measuring the radiant power balance of a dipole antenna radiator of length $\lambda/2$, and another dipole radiator of length λ. By comparing the measurement results of the two antennas with each other, and also with the theoretical predictions presented in the mentioned paper, the validity of the claims can be unambiguously verified.

- On page 37. of the paper the energy balance of the half wave dipole has been derived. In this case the COP is practically $\xi = 1$, thus the law of energy conservation is valid for the half wave dipole. An important quotation from that page relevant to the following measurements is the following:

  "On the basis of this end result we can declare that the law of energy conservation is valid for the half wave dipole.
  It can be mentioned in advance that for the full wave dipole of length λ_0 fed at its middle (which – concerning energetics – is equivalent with two half wave dipoles placed directly above each other) the law of energy conservation is no longer valid."

- Which means, that if we want to gain excess energy from the system, we can chose either to place two identical half wave dipoles directly above each other (on the same axis), and by feeding them with identical input signals achieve the desired amplifying superposition of the radiated waves; or just use one single full wave dipole, which is identical with the two half wave dipoles. The relevant analysis can be found on page 41. in the study with the conclusion:

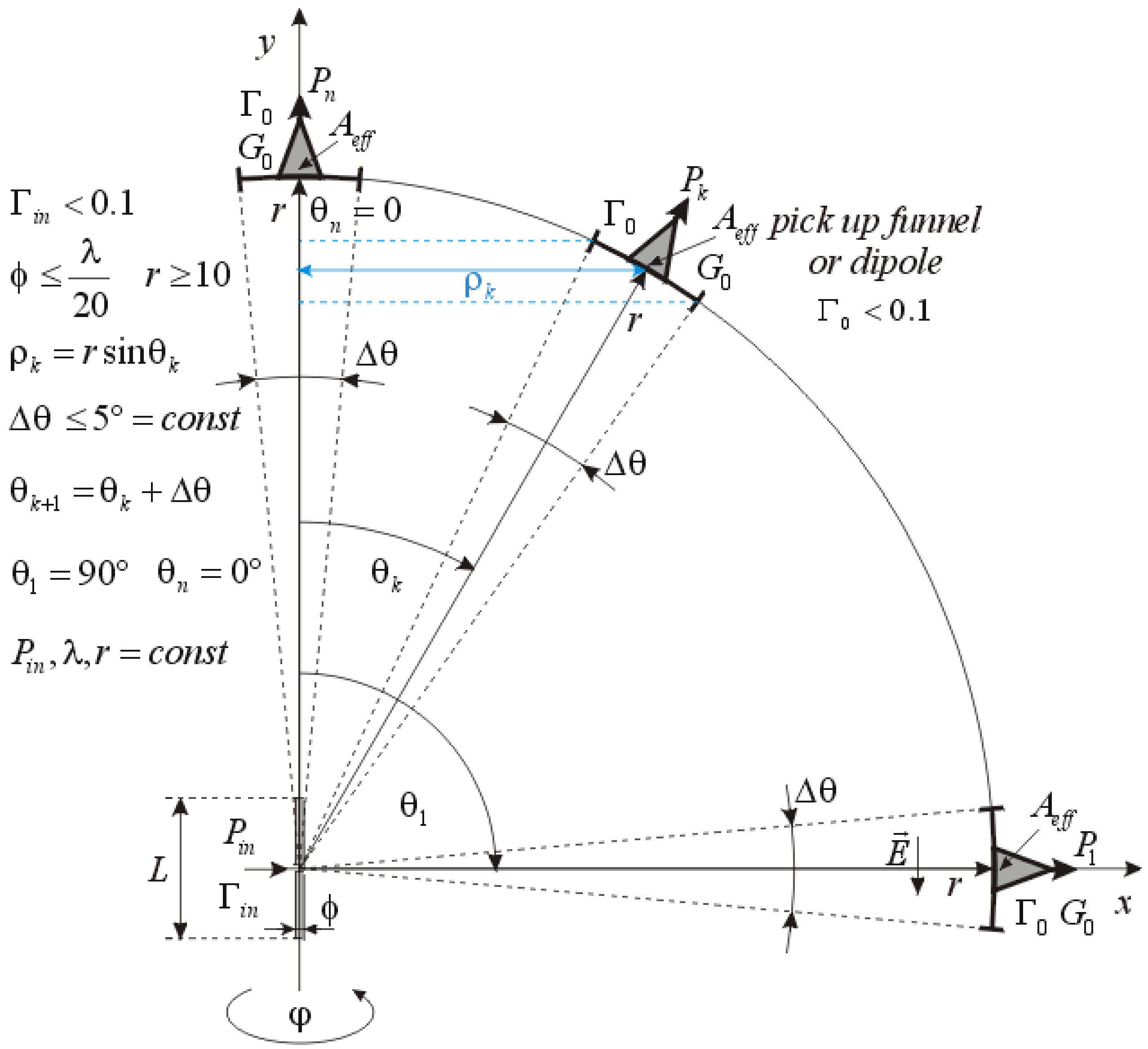
  "It is worth mentioning that when feeding the antennas with identical phase and power and placing them directly above each other, a significant ~36% excess of power and energy appears. As we have already mentioned, the 2 pieces of half wave dipoles radiating with identical phase is equivalent to 1 piece of whole wave dipole fed at the middle; thus the 36% of excess power is valid also for the whole wave dipole (fed at the middle)."

Thus, since it is more practical and convenient to use one full wave dipole than two pieces of half wave dipoles, the measurement will consist of two series of measurements. One using a half wave dipole radiator, and another using a full wave radiator.

Measurement setup

- In the first series of measurements a half-wave dipole is fed with an input signal having constant wavelength λ and input power P_{in}. The power source, cables, and the antenna radiator should be precisely matched (calibrated) so that the reflection Γ_{in} should be less than 0.1. The diameter of the dipole ϕ should be less than or equal with $\lambda/20$. The radiator is placed into a deaf room (for EM waves) which has walls coated with EM wave absorbing material. The room should be empty except for the radiator, receiving antenna, and the connecting cables. Preferably even the cables, the backside of the funnel antenna, and other necessary objects should be coated with absorbent material. The **resultant** reflection of the ambient within the room should be less than –20dB. Since the diameter of the antenna should be less than $\lambda/20$, it is advisable to choose a frequency about 3GHz to avoid the problems of impractically thin antennas.

The power density of the waves that pass through a closed spherical surface is preferably measured with a small funnel antenna placed at a constant distance of at least $r \geq 10\lambda$ from the radiator. Instead of a funnel antenna one can use a dipole antenna as well. The resultant reflection caused by the receiver antenna, the connected cables, and other associated objects should be $\Gamma_0 < 0.1$. The secondary reflection should be also minimized as much as possible. The measurement setup is shown on the following figure *(note that the starting position and the referent direction of the θ angle measurement is different from the usual mathematical convention)*:



The power is measured by the receiver antenna that can be moved around ¼ circle. For each $\Delta\theta \le 5°$ angle increment one measurement should be recorded. This angle increment $\Delta\theta$, the radius *r,* the wavelength λ, and the input power P_{in} should be kept constant for a complete series of measurements. The accuracy of the measurement can be increased by increasing the number of the angle increments *n* (i.e. decreasing $\Delta\theta$), the radius *r*, and the unwanted reflections in the measurement setup. In one series of measurements the powers $P_1, P_2, P_3, \ldots, P_n$ are measured at the angles $\theta_1, \theta_2, \theta_3, \ldots \theta_n$.

For faster and easier measurement the setup can be modified so as to keep the receiver antenna at a fixed position, and mount the radiator on a special motorized positioner, through which one can adjust the angle of the radiator relative to the receiver through a remote controller from outside the room.

- In the second series of measurements the half wave dipole radiator is replaced with a full wave dipole and the same series of measurements are repeated.

<u>Calculating the COP of the two different systems</u>

After having the recorded measurement data, the COP of the two systems can be calculated, and then compared with each other and with the theoretical expectations. Let us use the index *L1* to signify the case of the half wave dipole when $L=\lambda/2$, and index *L2* for the full wave dipole when $L=\lambda$. The parameters: A_{eff}, n, $\Delta\theta$, θ_k, P_{in}, λ are kept constant for both series of measurements, $\theta_{k+1}=\theta_k-\Delta\theta$, and G_0 – is the pick up antenna gain, S – is the power density per surface area. Then the total power passing through the closed spherical surface and the corresponding COP factors can be calculated as follows:

$$A_{eff} = \frac{\lambda^2}{4\pi} G_0 \qquad \rightarrow \qquad S_k = \frac{P_k}{A_{eff}}$$

$$\rho_k = r\sin\theta_k \qquad \theta_n = 0 \qquad \theta_1 = \frac{\pi}{2} \qquad \rho_n = 0 \qquad \rho_1 = r$$

$$(P_s)_L \cong 2\sum_{k=1}^{n} (S_k)_L \; r\,\Delta\theta\,\rho_k\; 2\pi - (S_1)_L\; r\,\Delta\theta\, r\, 2\pi$$

$$(P_s)_L \cong \frac{4\pi r^2 \Delta\theta}{A_{eff}} \sum_{k=1}^{n} (P_k)_L \sin\theta_k - 2\pi r^2 \Delta\theta \frac{(P_1)_L}{A_{eff}}$$

$$(P_s)_L \cong \frac{2\pi r^2 \Delta\theta}{A_{eff}} \left[2\sum_{k=1}^{n} (P_k)_L \sin\theta_k - (P_1)_L \right]$$

1) $$L_1 = \frac{\lambda}{2} \rightarrow \quad (\eta_s)_{L1} \cong \frac{(P_s)_{L1}}{P_{in}} = \frac{2\pi r^2 \Delta\theta}{P_{in} A_{eff}} \left[2\sum_{k=1}^{n} (P_k)_{L1} \sin\theta_k - (P_1)_{L1} \right]$$

$$\boxed{\lim_{\Delta\theta\to 0}(\eta_s)_{L1} = 1}$$

2) $$L_2 = \lambda \to \quad (\eta_s)_{L2} \cong \frac{(P_s)_{L2}}{P_{in}} = \frac{2\pi r^2 \Delta\theta}{P_{in} A_{eff}} \left[2\sum_{k=1}^{n} (P_k)_{L2} \sin\theta_k - (P_1)_{L2} \right]$$

$$\boxed{\lim_{\Delta\theta\to 0}(\eta_s)_{L2} = 1.36}$$

3) $$\xi \cong \frac{(\eta_s)_{L2}}{(\eta_s)_{L1}} = \frac{2\sum_{k=1}^{n} (P_k)_{L2} \sin\theta_k - (P_1)_{L2}}{2\sum_{k=1}^{n} (P_k)_{L1} \sin\theta_k - (P_1)_{L1}} \quad \to \quad \lim_{\Delta\theta\to 0} \xi = 1.36 = 1.33\, dB$$

Conclusion:

- If according to reliable measurements the calculated value of $\xi > 1$ is obtained, then in the case of $L_2 = \lambda$ full wave dipole an excess energy is generated in the space compared to the input energy.
- In the case of $L_1 = \lambda/2$ half wave dipole no excess energy appears, and in this case the law of energy conservation remains valid.

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