A Concept for High-Power Radiator Based on the Dipole-Reflector-Director Configuration

M. AlMenhali(1), H.AlYahyaee(1), A. AlEbri(1),
A. Al Ali(1) , H. AlHammadi(1), M. AlYousef(1),
M. AlKaabi(1), Y. AlNuaimi(1), H. AlKetbi(1),
S. AlDahmani(1), F. Vega (1), C. Kasmi(1)

(1) Direct Energy Research Center, Technology Innovation Institute, Abu Dhabi, United Arab Emirates
Mariam.almenhali@tii.ae

***Abstract*—**This paper proposes a High-Power radiator, composed of a feeding dipole, a reflector, and a director plate. The dipole is fed through a controlled high-voltage pulse generator. By varying the dimensions of the plates and the distances between the elements of the system the influence of the reflector and director on the spectrum were studied.

Keywords: High Power Electromagnetics, Dipole, Reflector based antenna, Director

I. EXPERIMENTAL SETUP AND SIMULATION PROCESS

High-power single dipole antennas, connected to spark gap switches have been used as a feeding element in parabolic reflector-based high-power radiators [1] and [2]. The approach presented here explores the compactness and simplicity of using a flat reflector and a flat director plate. This approach requires, however, a better understanding of the influence of the relative dimensions of the system along with the distances between them, on the overall performance of the radiator. This system is demonstrated in Figure. 1.

The system is fed through an IAS [2] which consists of two electrodes with a 100 kV double exponential signal connected to the two dipole arms. The analysis will be performed with a fixed dipole length. The E-field produced by the system without the reflector and director was ~ 40 kV/m at 1 m.

The relative distances between the elements and the sizes of the plates were optimized based on the influence on the spectrum and the radiated field. The influence on the bandwidth was of interest and is shown in Figure. 2 for two different cases with a variation in L1 and L2. A soft computing algorithm will be used as an optimization tool.

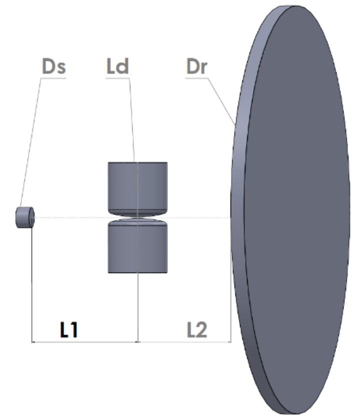

Figure 1 Proposed layout. The parameters L1, L2, Ld, Dr and Ds were optimized in order to maximize the radiated signal in boresight

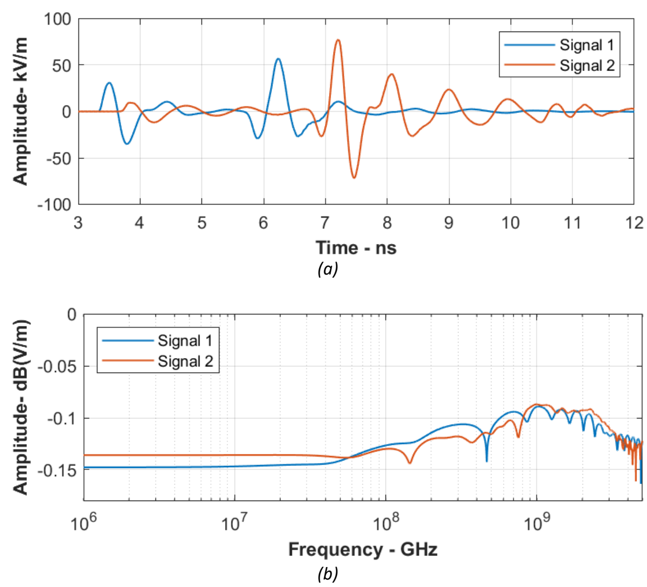

Figure 2 In signal 1, Dr and L2 are 10 mm and 360 mm respectively whereas in signal 2, they are 130 mm and 510 mm, L2 and Ds were kept constant in this case. (a) Time domain signal at 1 m, the amplitude of the radiated field is increased by approximately 25% due to the change in the dimensions listed above. (b) Moreover, the spectrum has changed due to the variation in dimensions, as shown above, the energy is more distributed in signal 2, whereas the bandwidth seems to be narrower in signal 1.

REFERENCES

[1] J. Ryu, J. Lee, H. Chin, J. Yeom, H. Kim, H. Kwon, S. Han and J. Choi,"A high Directive Paraboldial Reflector Antenna for High far Voltage in an Ultra Wideband Source System," *IEEE Trans. Plasma Sci.*, vol. 41, no. 8, pp. 2283–2290, Aug. 2013.

[2] J. Ryu and J. Lee, "An integrated antenna-source system of very high ultra wide-band gain for radiating high power wide-band pulses," *IEEE Trans. Plasma Sci.*, vol. 40, no. 4, pp. 1019–1026, Apr. 2011.