A High Power Wideband Radiator with a Paraboloidal Reflector Illuminated by an Integrated Antenna-Source

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***Abstract*— This paper presents a high power wideband radiator with a paraboloidal reflector illuminated by an integrated antenna-source (IAS). The reflector is employed to obtain very intensive electric fields because the paraboloidal reflector dramatically increases directivity of the radiated field. The proposed radiator was designed by using a transient analysis of the reflector and an electromagnetic simulation. It is demonstrated by experiments that the proposed radiator has an electric field strength of 52.5 kV/m at a distance of 40 m.**

Keywords-High Power Wideband Radiator, Integrated Antenna-Source, Far Voltage, Paraboloidal Reflector

I. INTRODUCTION

High power wideband radiators (HPWRs) have been investigated for a number of applications such as electromagnetic car stopper, counter improvised-explosive-devices (IEDs). In order to study effects of high power wideband pulses on vehicles and IEDs which are located at a long distance, the radiators with far voltage of megavolt range are required.

In a previous work [1], we developed an autonomous, compact, and robust integrated antenna-source (IAS) system. Because paraboloidal reflectors are capable of achieving high directivity, we apply the paraboloidal reflector as a directive antenna to the IAS. We analyzed the proposed radiator based on a theoretical transient analysis. In addition, the radiated electromagnetic fields are calculated by using an electromagnetic simulation. It was demonstrated by experiments that the far voltage of the radiator is 2.1 MV.

II. DESIGN

Fig. 1 shows the proposed radiator which consists of a high-voltage power supply, a Marx generator, an IAS and a paroboloidal reflector. The transient response of the reflector and the optimum ratio of the focal point to the diameter are analyzed by transient electromagnetic analysis. Based on the analysis, we designed the radiator by an electromagnetic simulation. The diameters of the reflector and the IAS are 1.5 m and 15 cm, respectively.

Fig. 1. Proposed high power wideband radiator.

III. MEASUREMENT

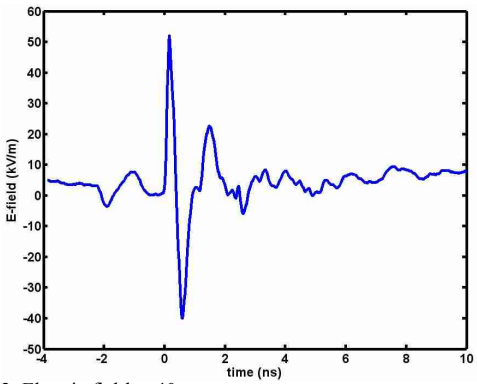

Fig. 2. Electric field at 40 m.

Fig. 2 shows the electric field radiated from the proposed radiator at a distance of 40 m. The peak electric field strength in Fig. 2 is 52.5 kV/m and the peak-to-peak electric field strength of 92 kV/m is obtained from experiments.

REFERENCES

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