TIME-DEPENDENT THREE-DIMENSIONAL ELECTROMAGNETIC FIELDS GENERATED BY A REFLECTOR IRA

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Abstract The reflector Impulse Radiating Antenna (IRA) produces an extremely large impulse radiated electric field on bore-sight at distances of the order of kilometers when the driving voltage source has a finite but extremely short risetime. For the ideal step function source a delta function radiated electric field is produced on axis. The radiated component varies as (1/r )while the induction and electrostatic components vary inversely as the radius squared and cubed respectively. There are also other components of a reflector IRA that exist (e.g., the pre-pulse), but these are not considered in this paper. Users of an IRA need to be concerned with collateral effects at distances to the antenna where the induction and electrostatic components could be important. There is indeed a paucity of information in this arena in understanding how these fields affect systems. We have taken the first step in assessing collateral effects by deriving time dependent equations for the components of electric field in powers of (1/r ). We have developed explicit expressions for the fields as a function of polar angles, time, antenna dish size and source voltage waveform. From these results we can assess the ranges where unwanted collateral effects are important. For specified values of coordinates the electric field will be a function of time, and during the course of the transient will have a maximum value. From these results we develop three dimensional contours of range versus peak field. Parametric results as a function of risetime of the source voltage are presented.

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