Short pulse characteristics of new wide band planar dipoles – both transmission and reception

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There have recently been numerous applications of ultra wide-band antennas in the field of communications and sensor areas. For narrow band application the conventionally defined electrical properties (like input impedance, S-11 parameters, VSWR etc..) of the antenna can be analyzed at the center frequency of the antenna and can be used to determine the quality of the antenna. But for wide-band applications more meaningful insight would be obtained in studying the short-pulse characteristics of the antennas with respect to the designing of a full UWB system. The transient antenna transmitting and receiving characteristics ought to be stable and should exhibit low distortion.

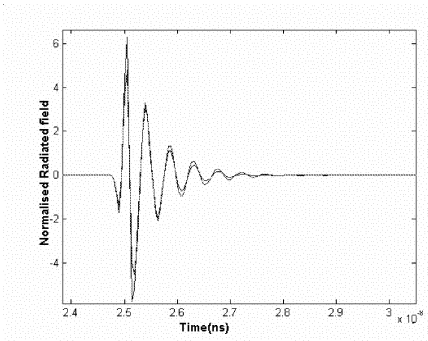

Fig1: Radiated field

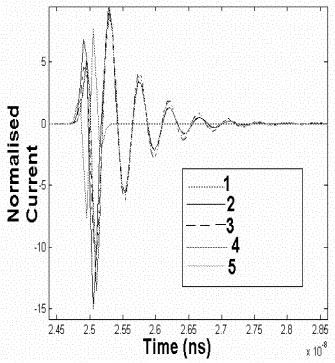

Fig2: Driving point Current

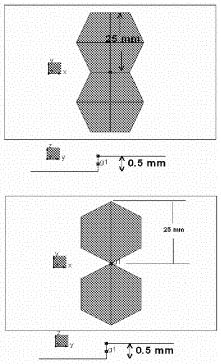

Fig3: Antenna Geometries

In this paper we present two new planar wideband dipole configurations which exhibits wide bandwidth, small size, and conformality. The planar surface is hexagonal metal plate and two different feedings are considered as shown in Fig.3: - A) at the mid-point of the edge. and B) at the vertex. The antennas were simulated and optimized using a Method-of-Moment based solver WIPL-D (B.M.Kolundzija, J.S.Ognjanovic and T.K.Sarkar WIPL-D, Artech House, Norwood, Mass 2000). The time domain responses were computed with respect to a monocycle (the first derivative of the Gaussian) of pulse-width of 0.1 nano-seconds which has a bandwidth well within 10 GHz.

The (normalized) radiated field at the broad-side direction (i.e. $\theta = 90^0$) due to the monocycle is shown in Fig.1 with blue and red indicating the field due to the antennas A and B. 1 of Fig.2 shows the second derivative of the incident wave with which the current response looks similar. 2 and 3 shows the normalized transient current at the port of antenna A and B respectively during radiation while 4 and 5 denotes the induced currents at the port of antenna A and B when the antennas operate in receiving mode irradiated by a similar monocycle pulse wave incident from the broad-side direction. There are obviously many distortions due to multiple reflections at the different ends of the antenna which can be reduced by resistively loading the antennas at the expense of considerable loss of radiation efficiency. The performance of antenna A is slightly better than B having as can be seen from the time-domain responses.