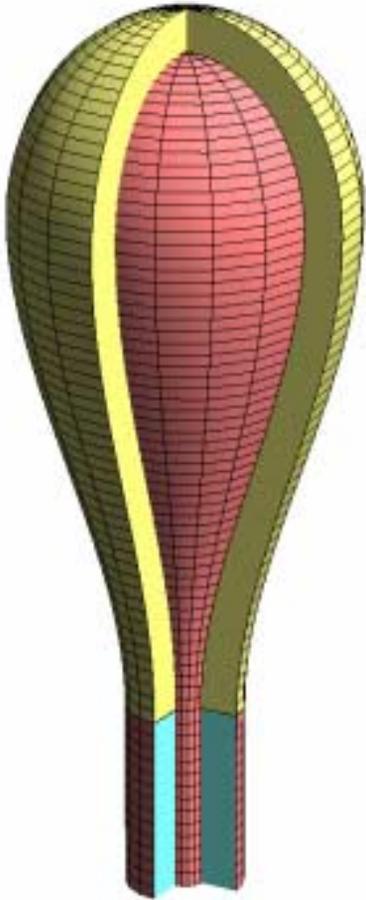


Pear-Shaped Metallic Antenna With Dielectric Layer

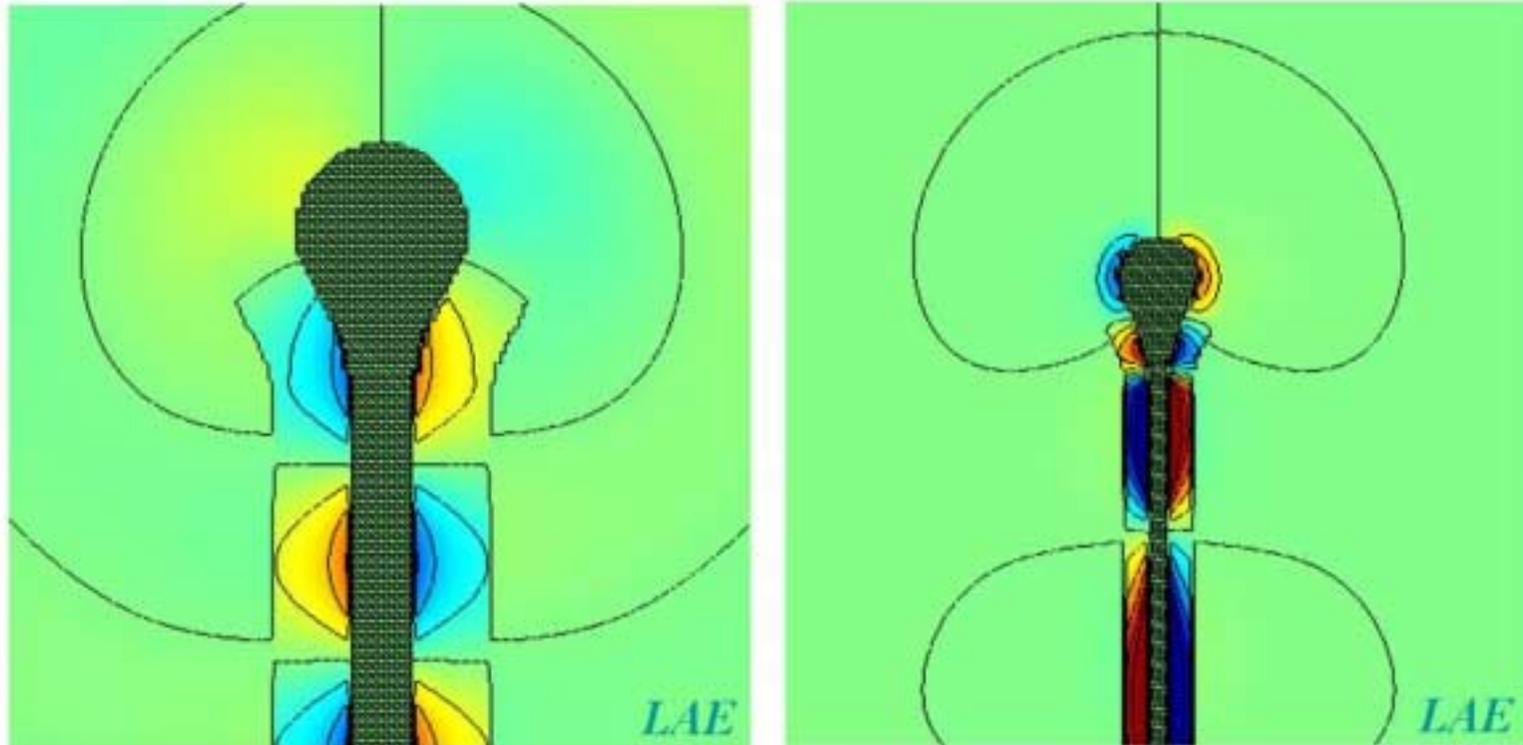


Solution of this complex EMC problem we started with the investigation of the different types of antenna together with the feeder in order to get high radiation efficiency and a well-matched system with open space. The next step was to direct the radiated field to the hemisphere in order to minimize interaction with objects in the vicinity, and then to consider lossy dielectric objects (IEEE standard head model) and then, the handset itself.

The modern communication systems need antenna structures with the improved characteristics. The requirements to the modern antennas are often contradictory. Particularly, an antenna must be compact, well matched with the feeding system and the free space and should operate in a wide frequency band. A pear shaped metallic antenna covered with a thin dielectric layer together with a quarter wavelength dipole was considered. The shape of this antenna proves to be effective in matching with the feeding cable and in having a wide radiation band. The covering thin dielectric layer helps to retain the small size of an antenna. Shielding the dielectric surface on one side helps to direct the main part of the radiated field to the hemisphere that therefore should reduce the interaction with the user's head. The feeding of this antenna with the coaxial cable was simulated. A real antenna-cable system and interaction with vicinity lossy objects has been considered and some results of these calculations are discussed below. The created software package allows one to manipulate easily with the parameters of a system in order to find the optimal parameters of the system under study.

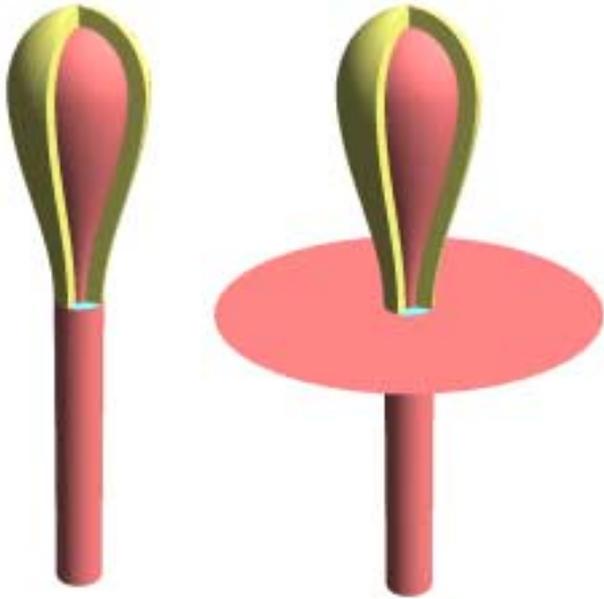
Some radiating properties depending on the antenna's shape and the dielectric parameters of the covering layer along with the experimental measurements of S_{11} parameter of a prototype designed according to calculated results.

Poorly & Good Matched Antenna



It's very important to choose good parameters of antenna for well matching with free space and feeding cable. In the right hand we can see a poorly matched antenna, when the antenna parameters are chosen incorrectly. In this situation in the feeding cable we get a reflected wave which turns back a great part of input energy. At the left one we can see a good matched antenna, when antenna parameters are chosen properly and all input energy is radiated in free space.

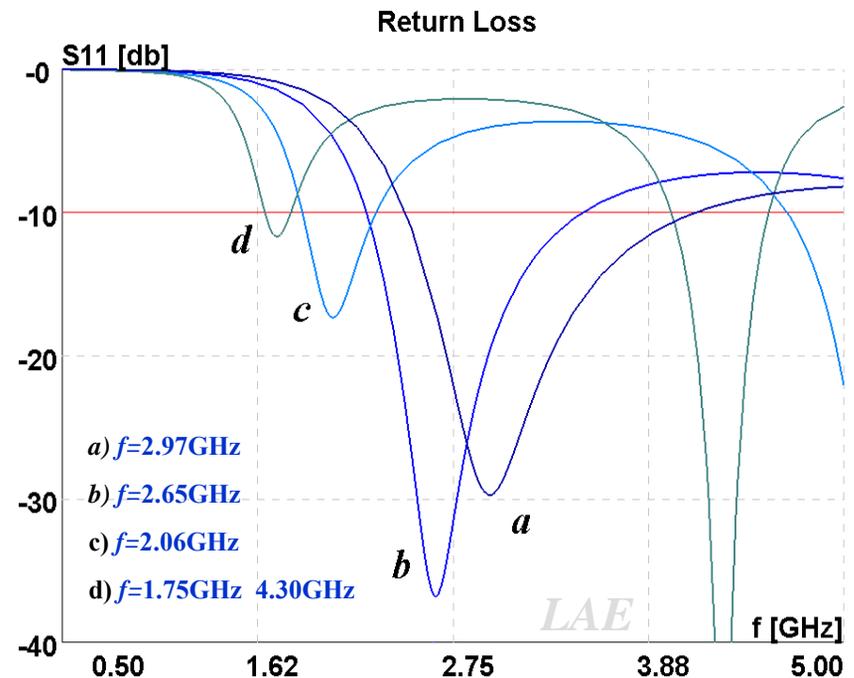
Numerical Experiments

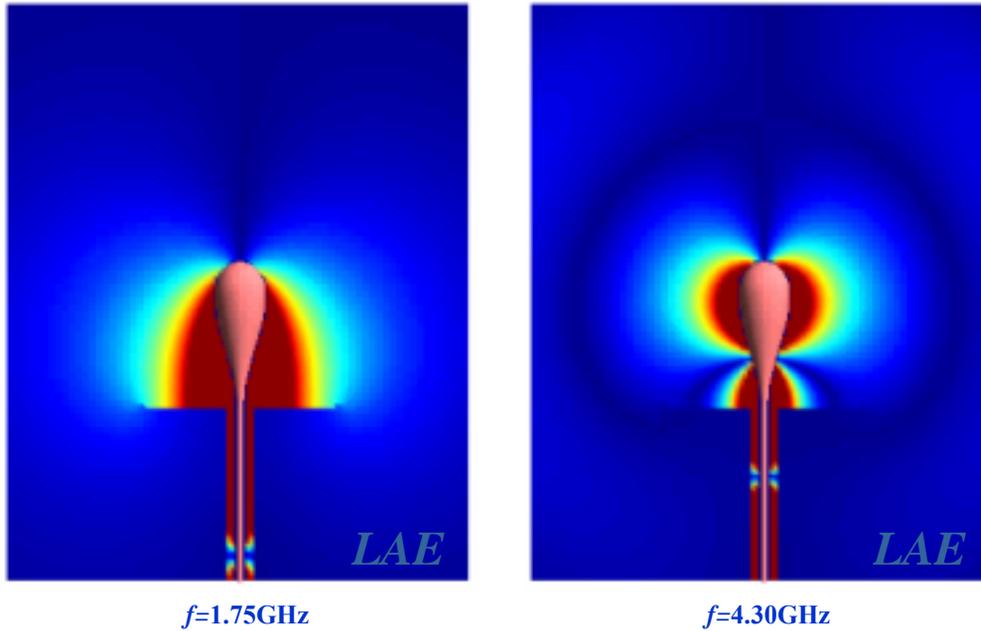


The numerical experiments have shown that with the increase of antenna's width the radiation band increases but the radiation efficiency diminishes. Under the certain optimal choice of antenna shape starting from feeding cable and dielectric layer characteristics, it is possible to increase the radiation efficiency as well as radiation band.

In order to fit the band of the current standards for mobile communications (0.9÷2.8GHz) the electrical size of antenna must be enlarged. This is possible by covering the antenna with the thin dielectric layer of high permittivity.

This picture presents the resonance curves for different values of the dielectric parameters of layer. In order to achieve a dielectric layer well matched with the free space it is necessary for the corresponding wave impedance at the surface of the antenna to be equal to that of the free space. This can be achieved by selecting suitable material parameters of the layer. Modern technology is able to provide a material with a negative permittivity. This software allows such media to be simulated. The numerical investigations of the possibility to improve the antenna properties using such materials have also been conducted.



 $f=1.75\text{GHz}$ $f=4.30\text{GHz}$

Radiated Pattern is presented at the resonance frequency at the same case at $f=1.75\text{GHz}$ and $f=4.30\text{GHz}$.

The near zone field is presented at the resonance frequency for the case $e=5$, $m=5$ at $f=1.75\text{GHz}$ and $f=4.30\text{GHz}$. As one can see, the antenna is also well matched with the cable and free space.

