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Magneto-Dielectric Material for Small Antenna System packaged within a metallic handset at VHF band

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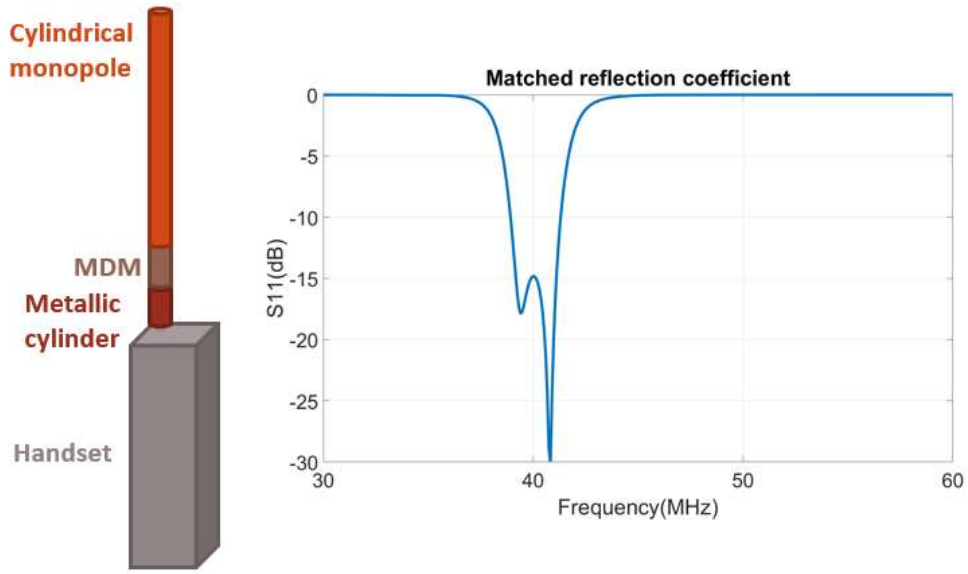
The design of antenna system within a metallic handset for radio communications is proposed. The main issue is antenna miniaturization at VHF band keeping satisfying radioelectric properties to enable the development of compact communication systems. For a λ/4 monopole antenna working at 40 MHz the size would be about 180 cm that would be too high for a portative application. Classical miniaturization techniques such as inductive loading, capacitive hat or antenna's folding are often used. The drawback using those techniques is the low percentage of size reduction in this frequency band and the introduction of additional losses in antenna structure leading to reduce its radiation performances. In this work, it is proposed to load a monopole antenna with a low loss Magneto-Dielectric Material (MDM) associated with a metallic parasitic element and a matching circuit. The objective is to achieve a monopole antenna operating at 40 MHz with a maximum height of 50 cm in a bandwidth of 10%. The MDM properties that have been developed for this application are: μr = 26; εr = 15.5; dielectric loss tangent = 0.03; magnetic loss tangent = 0.03.
An electrically small cylindrical monopole antenna has been designed (Figure 1a) where 1/5 of the antenna length is loaded with the MDM. So by only loading partially the antenna where the intensity of the surface current is maximum and adding a parasitic metallic cylinder, we can achieve an optimum miniaturization rate of 70% . The antenna's frequency response obtained by simulation meets the requirements such as 10% of bandwidth at -10 dB as shown in figure 1b in all the bandwidth. The gain is close to -15 dBi in all the bandwidth which is satisfactory considering the antenna size.



(a) **(b)**

Figure 1. Geometry of the optimized monopole antenna mounted on the handset (a), reflection coefficient in dB versus frequency (b)