



## OO/UC3M/35- MULTIFREQUENCY AND MULTIFUNCTION ANTENNAS BASED ON SINGLE PRINTED TECHNOLOGY PARTIALLY FILLED WITH METAMATERIAL STRUCTURES

The Radiofrequency Group from the Escuela Politécnica Superior of the Carlos III University from Madrid have been working in printed antennas for a long time. Recently the new technology of metamaterials has opened new possibilities in the development of multifrequency antennas with different radiation patterns to be used simultaneously for several applications (i.e. different mobile services and GPS or Galileo).

### Description and special features

Multi-frequency microstrip patch antennas partially filled with metamaterials or Left-Handed (LH) structures are presented. In addition, the presence of LH structures also allows having miniaturized antennas. Thus, multifrequency, dual mode and miniaturized antennas based on single patches partially filled with LH structures have been obtained. An implementation based on microstrip patches partially filled with mushroom like structures is proposed. This approach is used in the design, manufacture and measurement of two multi-frequency patch antennas. The first one shows two dipolar (patch like) modes at 1.06 GHz and 2.16 GHz and a monopolar mode (null at broadside) at 1.45 GHz. The ratio between the resonant frequencies of both dipolar modes can be arbitrarily chosen (by means of a proper design of the patch and the LH structures) and, in this case, is 2.04. The second antenna is designed to work at closer frequencies. In this case the frequency ratio is dramatically reduced to produce a dual dipolar antenna working at 1.81 GHz and 2.20 GHz (giving a ratio of 1.21).

### Innovative aspects

- Multifrequency and multifunction antennas based on single printed technology (with one layer) for simultaneous mobile and/or GPS applications.
- Antenna miniaturization.
- Self-diplexed antennas (with the same technology) with high isolation between different frequencies (RFID application)

Points to be developed:

- Although it may be enough for the proposed applications, increase the antenna bandwidth.

Depending on the miniaturization degree, increase the antenna efficiency.

### Competitive advantages

- Multifrequency and multifunction antennas for conventional printed technology.
- Conventional planar technology (very cheap) for the design of antennas with several radiating modes.
- Antenna miniaturization.

### Technology Keywords

High frequency technology, microwaves; Printed circuits and integrated circuits; Wide band technologies; Narrow band technologies; Mobile communications; Satellite technology / systems / positioning / GPS communication – Global positioning system; Multifrequency and multifunction antennas; Metamaterials; Patch antennas; RFID; Self-diplexed antennas

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