

# Multiband F-PIFA Fractal Antennas for the Mobile Communication Systems

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## Abstract

The fractals antennas are composed of repeated geometrical forms. Each form has single attributes. The Fractal Planar inverted F (F-PIFA) antenna, based on Koch Island form geometries, is proposed to facilitate multibands applications. The design is carried out by two software: CST Microwave Studio and HFSS. The obtained results for the various iterations allow a multiband operation finding its application in the various standards of mobile telecommunications.

**Keywords:** Koch Island form, fractal antenna, F-PIFA, Multibands, HFSS and CST Microwave Studio.

## 1. Introduction

The fractal geometry is an extension of the euclidean geometry. Its introduction constituted an opportunity for the antennists to discover new antennas configurations. Historically front even the discovery of the fractals by Mandelbrot, fractals antennas were already used. Indeed, during the 50 last years, antennas "with logarithmic periods", were used without one realizing that one handled the fractals.

The expression "**fractals antennas**" was published for the first time in 1994 by D.H. Werner [1]. Later, marge articles were published by Cohen [2, 3] where it presented an introduction on the application of these fractals geometries for antennas while being based on the fractals of dipole and curve type. The term "**fractal antenna**" is a language abuse. The studied antennas have just a pre-fractals forms: those are more or less high iterations whereas the fractal form is the result of iteration at the infinite. A part from their use in order to obtain multibands antennas, the fractals can also be used for the antenna miniaturization [4, 5].

According to **B Mandelbrot** [6], the fractal object (1975) is said of a geometrical figure or a natural object. The fractal term comes starting from the Latin adjective 'fractus', which means irregular or

broken. A fractal object must combine the following characteristics:

- Its parts have the same form or structure that the whole, even if it is a different scale or slightly deformed..
- Its form is, either extremely irregular, or extremely interrupted or split up, whatever the examination scale.

## 2. First Koch Island form multibands fractal antenna F-PIFA

The proposed antenna has a very simple structure fed with a 50 Ohms microstrip line. The total dimension of the ground plane is 70 X 70 mm<sup>2</sup>. The substrate permittivity chosen for this structure is of 2.1. The radiating patch is supported by a strip and a short-circuit plan. The figure 1 and the table 1 show the structure and detailed dimensions of the initial antenna according to the reference [7] and dimensions' of the modified antenna. The design of this antenna is carried out by CST Microwave Studio software to give the various electromagnetic properties of the F-PIFA antenna.

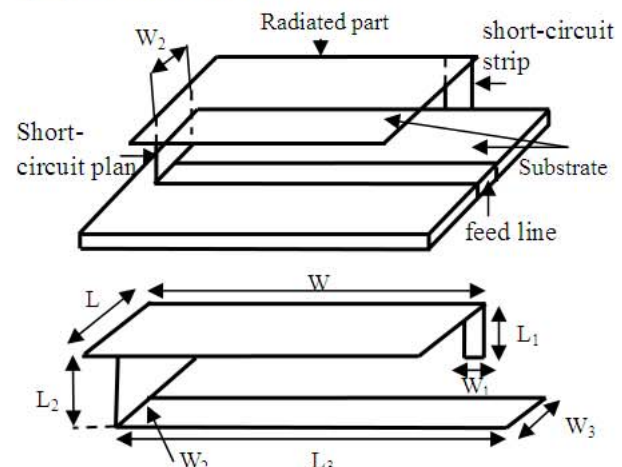


Fig. 1 : F-PIFA geometry proposed.