Pre-Fractal Resonant Rings for Compact Spiral Antennas

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Introduction

Energy harvesting
Wireless Power Transmission

Use of UWB antennas required

Issue: Antenna sizes for low frequency applications

Objective: Miniaturized UWB antennas

State of Art

An innovative architecture for miniaturization of UWB antenna is reported in [1].

Antenna with stacked crenelated metallic rings

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Principal:

Lowest operating frequency of such an antenna depending on:
- Number of stacked metallic rings
- Unfolded length L of the ring’s contour (or \( f_{ws} \))
- Position of different rings above the spiral

37% reduction of the antenna
No degradation of the radiating performances

/ antenna thickness (height=\( A/25 \))

Limitation in \( f_{ws} \) & miniaturization with crenel profile

Time-consuming EM simulation (difficult optimization)

Choice of Profile

The choice of the most suitable profile in a given application is the result of a trade-off between two criteria

Primary criteria

For a given \( L \), a compromise needs to be made between:
- lowest \( Q \)
- lowest \( f_{ws} \)

Application criteria

In a given application, a profile needs to be realizable and limit the computation time. We will choose a profile with:
- lowest fractal iteration
- lowest number of replicas

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Measures

Gain (dB)

\( \phi=0^\circ \)

\( \phi=90^\circ \)

Lowest frequency

1.8 GHz

3 GHz

5 GHz

Measures of an antenna with the selected profile:
9% diminution of the lowest operating frequency without deteriorating the radiation performances
Greater reduction expected with more stacked rings

Conclusion

- Characterization of new profiles
- Comparison of their resonant frequency and quality factor to the crenel
- Definition of criteria to choose the most suitable profile depending on the application