# Broadband Antenna for Spectrum Monitoring

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## INTRODUCTION

Broadband antennas have emerged in the last decade as a possible solution to replace multiple antennas in Radio Frequency (RF) systems that only cover specified frequencies. By using this type of antenna, it is possible to reduce costs, size, and improve performance. Additionally, this type of arrangement opens up possibilities for achieving better transmission rates. Furthermore, these settings could allow for new applications in radar, sensing systems, and meet all requirements. The most common broadband antenna designs include log-periodic antennas, patch antennas, spiral antennas, and complementary antennas. However, there are some challenges with the configurations, with the most well-known being their pattern radiation, interface and manufacturing process.

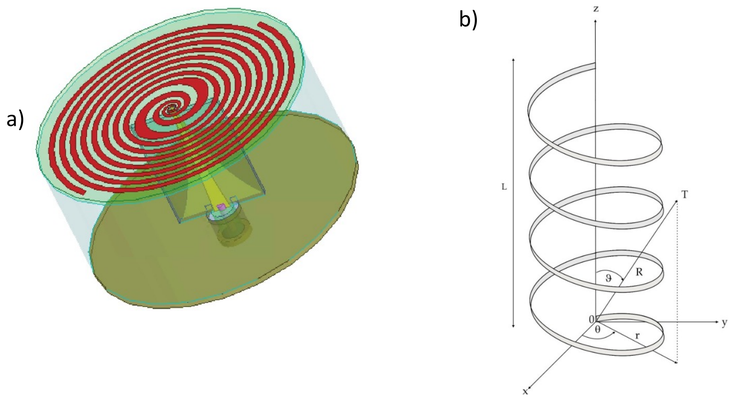


Figure 1. Example of broadband antennas. a) Spiral antenna, b) Helical antenna in satellite radio channel.

## METHODS AND MATERIALS

In this project we have designed and simulated 4 Ultrawideband antennas to cover wide frequency range from 1 to 6 GHz. The antenna must meet the requirements of a type of polarization, radiation pattern stability as a function of frequency, size and cost. Additionally, it is important to point out the antenna will be used in a phased array or in a distributed sensor network with close neighbors.

The first antenna designed is a spiral antenna. In this configuration, the termination of the antenna is with a resistance and without a cavity. The second is similar but with a cavity wall. For both, the cavity radius is 41 mm. In the same (Figure 2c and d), the design corresponds to a combination of a Log-spiral and power spiral antenna. One modification of this version is also shown. This antenna is fed by a parasitic element.

Furthermore, in Figure 2e, a monopole antenna was designed, which is fed by a microstrip line with a defected ground plane

## RESULTS

In Figure 3.b, the return loss for the first proposed antenna can be observed. It exhibits good behavior in the frequency range of 1 to 6 GHz, particularly from 1 to 2.4 GHz. A slight decoupling is observed from 2.5 to 5 GHz, but beyond this frequency, the S11 shows a similar result as described in the initial range. The gain exceeds 3 dB at some frequencies (3 GHz), with the maximum value being 8.4 dB at a theta of 30°.

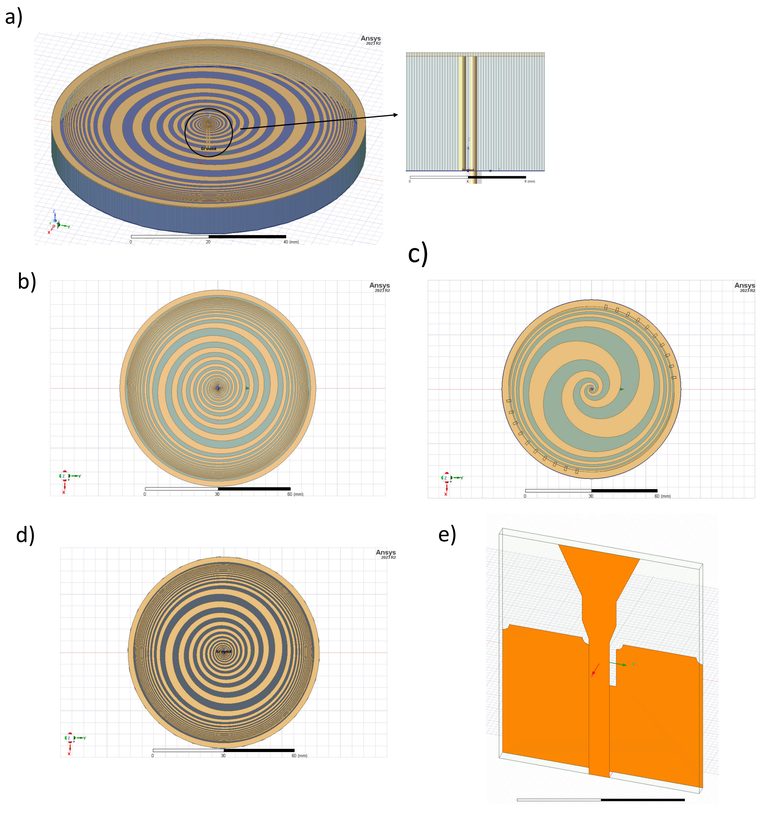


Figure 2. Model of broadband antennas. a) Spiral antenna (no cavity), b) Spiral antenna (with cavity). c) Cavity wall, resistor termination, fed without balun d) Fed by a parasitic element. e) Monopole antenna.

For the case with a cavity wall, the $S_{11}$ exhibits good behavior from 1 to 4 GHz. Only in the range of 4-5 GHz does the S11 approach approximately -8 dB, but beyond 5 GHz, the antenna yields its best results. These results coincide with the gain, as the gain varies from 1.8 up to 8.1 dB at most angles. Contrary to the previous cases, the antenna did not show good results. Only in a narrow range the return loss exhibited good coupling.

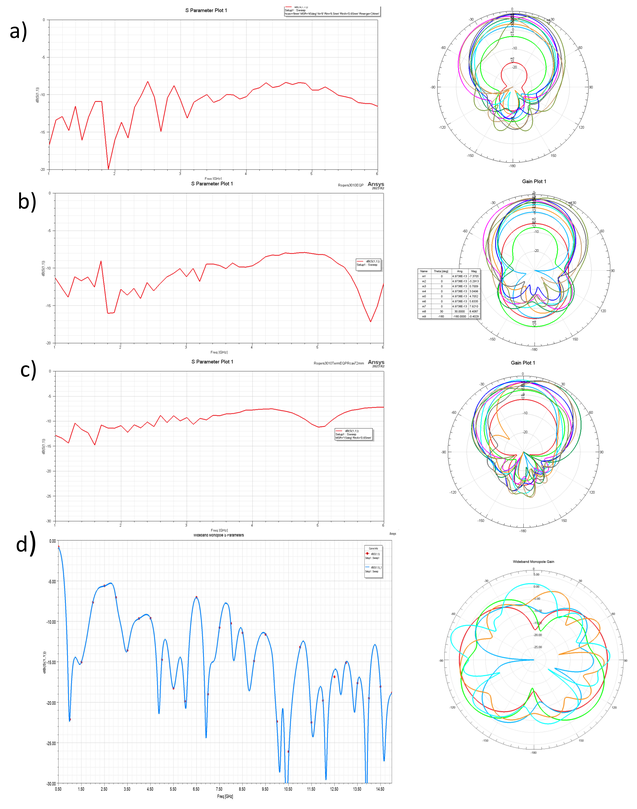


Figure 3. Simulated $S_{11}$ and Gain of. a) Spiral (no cavity, no termination, N=6) b) Spiral antenna (cavity, resistor termination, N=2) c) Spiral (cavity, resistor termination, N=6). d) Monopole antenna.

## CONCLUSIONS

- Simulations of $S_{11}$ of spiral antenna showed a good behavior in the most frequency range.
- The best results were found with spiral antenna with cavity.
- The Gain of the antenna was in the range from 1 to 8 dB.

## ACKNOWLEDGMENTS

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## REFERENCES

[1] Zhao, Yang-yi and Wei-dong Hu. “Desing of a UWB unidirectional radiation compound spiral antenna.”2015 IEEE 6th International Symposium on microwave, Antenna, Propagation, and EMC Technologies(MAPE).