Half-Wavelength Dipole Antenna

This model is also discussed in the following post on the COMSOL Blog:
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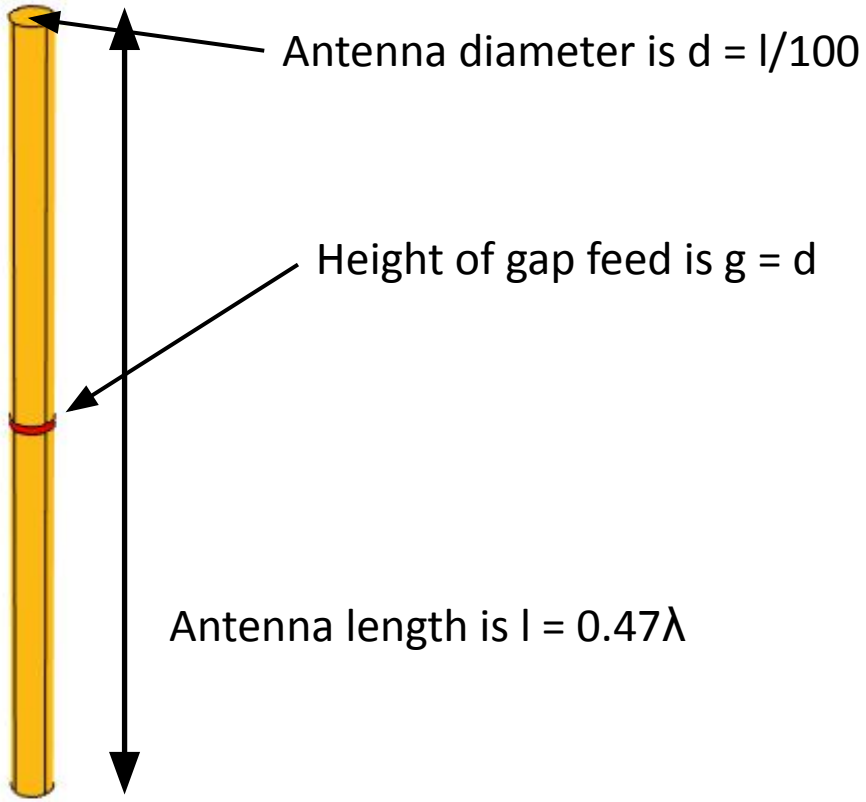
Simulation Geometry and Setup



The antenna is a Perfect Electric Conductor.

It is surrounded by a spherical air domain, and a Perfectly Mated Layer has been added to the exterior of the air sphere to absorb the outgoing radiation.

A Lumped Port is applied to the gap.

Note that image is not to scale.

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Antenna Reciprocity

- To demonstrate reciprocity, two studies are performed.
  - In Study 1, a voltage is applied to the Lumped Port, similar to the dipole antenna model discussed in https://www.comsol.com/model/dipole-antenna-8715.
  - In Study 2, the Lumped Port excitation is turned off, and a background field study is used, similar to the model discussed in https://www.comsol.com/model/detecting-orientation-of-a-metallic-cylinder-embedded-in-a-dielectric-shell-19871.
- The gain and antenna impedance from Study 1 are used to calculate the power this antenna would receive if it was illuminated with a 1 V/m plane wave in (1,0,0).
- Study 2 directly calculates the power received when illuminated with a 1 V/m plane wave in (1,0,0).
- Both methods return 2.6 µW.

Comparison with Theory

- Theory used is for a infinitely thin antenna, found in any standard antenna text.
  - Maximum directivity is 1.64
  - Impedance is ≈ 73 Ω
- Note that real antenna parameters vary substantially with finite antenna radius, and the geometry here was intentionally chosen to be close the theoretical results.
  - Simulated impedance is 73 + 3j Ω
  - This agrees well with published values http://ieeexplore.ieee.org/document/1696826/