Ansoft HFSS Antenna Design Kit
Design Parameters

Arien Sligar

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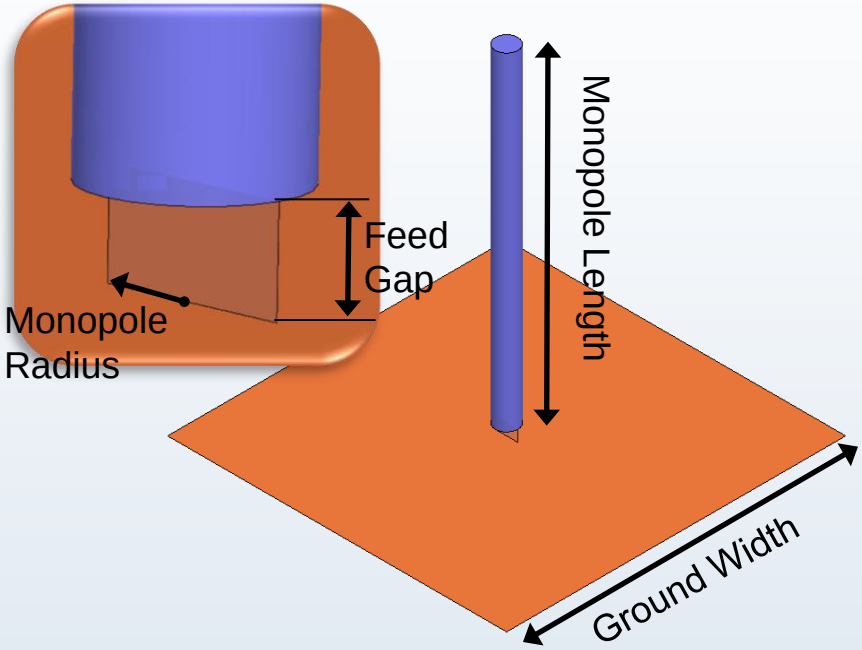
Wire Monopole Design Parameters

Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**



Ref: Balanis, Constantine. “Linear Wire Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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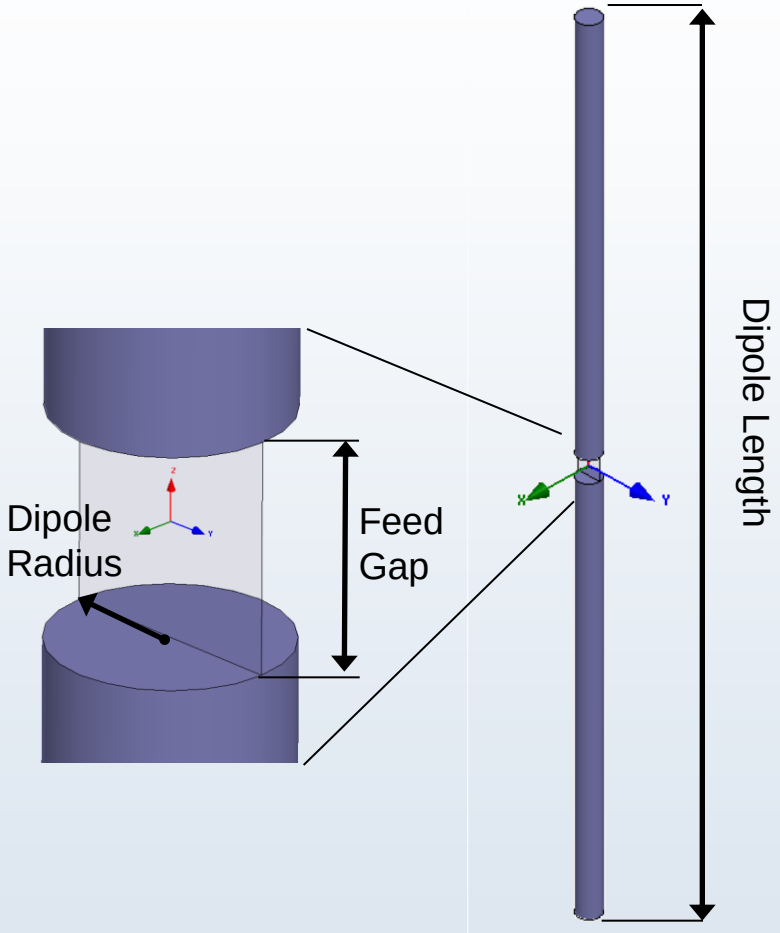
Wire Dipole
Design Parameters

Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**



Ref: Balanis, Constantine. “Linear Wire Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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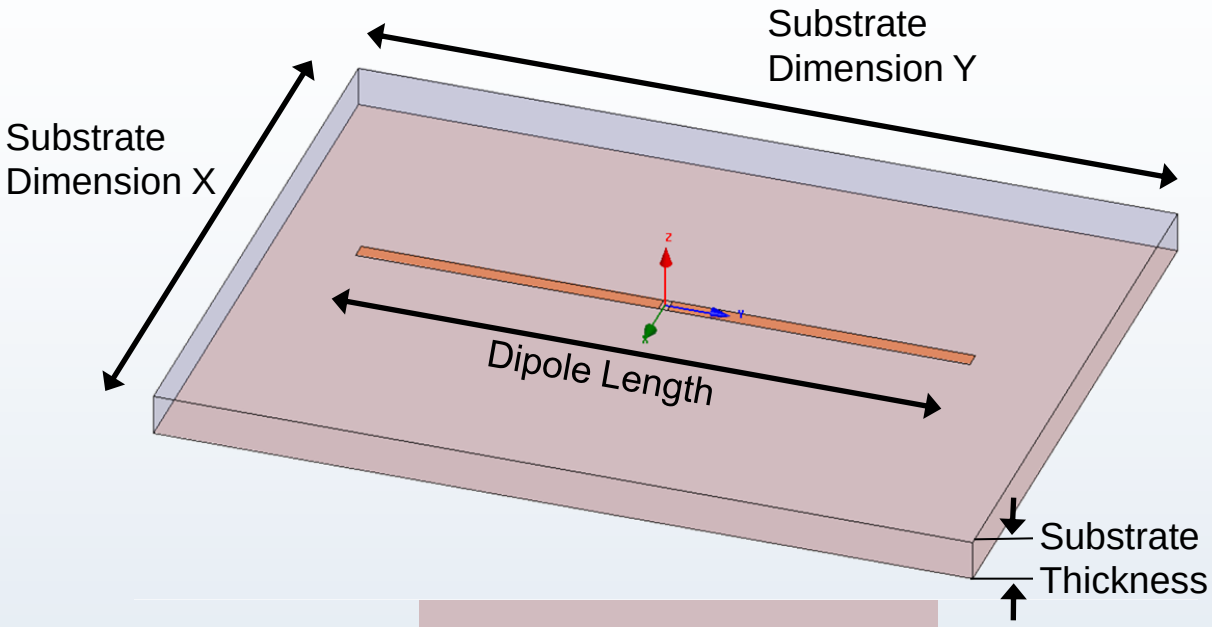
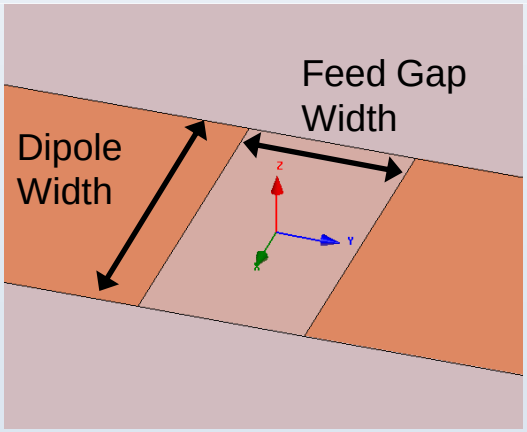
Planar Dipole
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Linear Wire Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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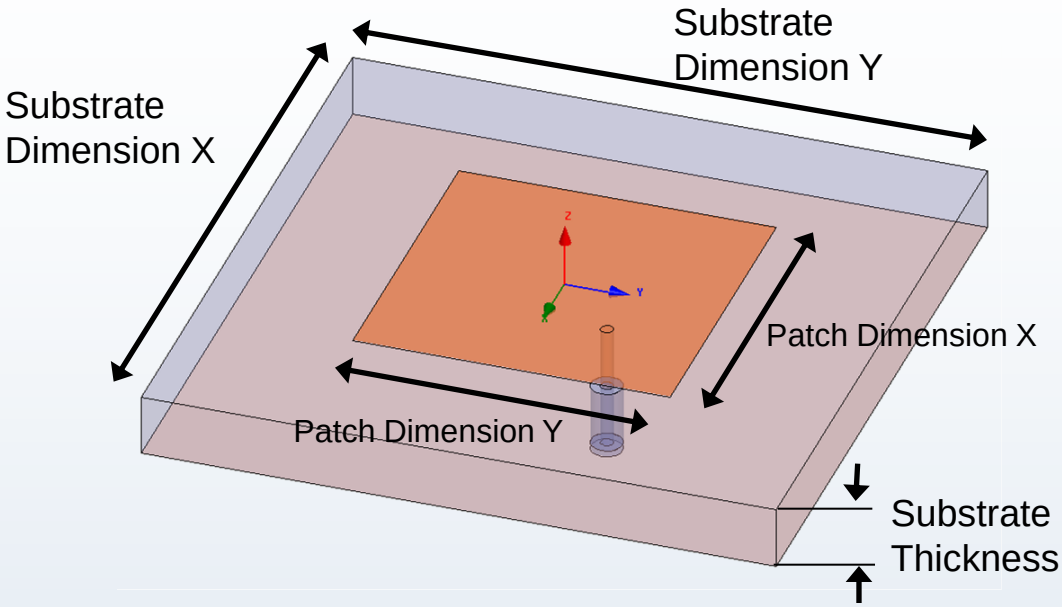
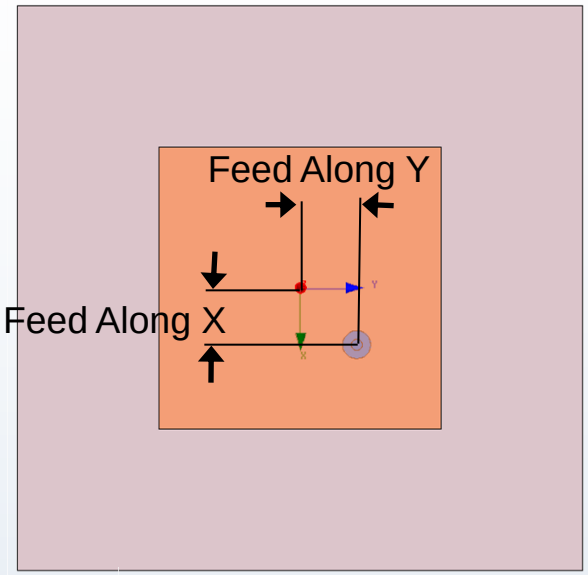
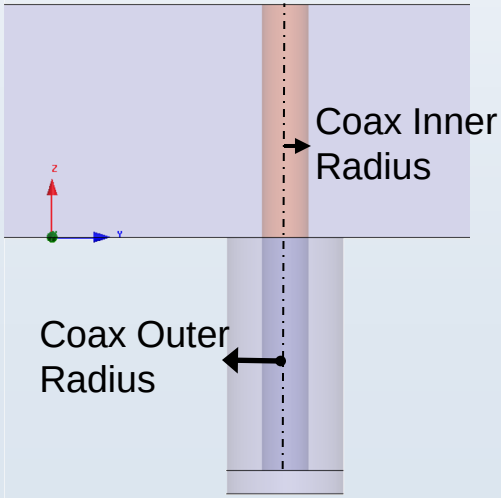
Rectangular Patch – Probe Fed
Design Parameters







Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. "Microstrip Antennas." Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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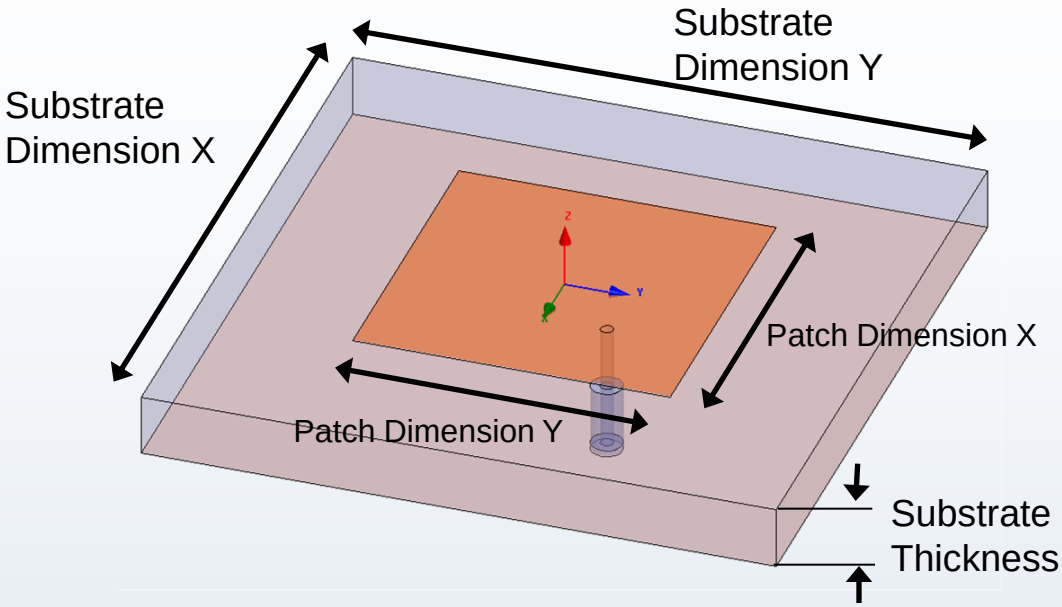
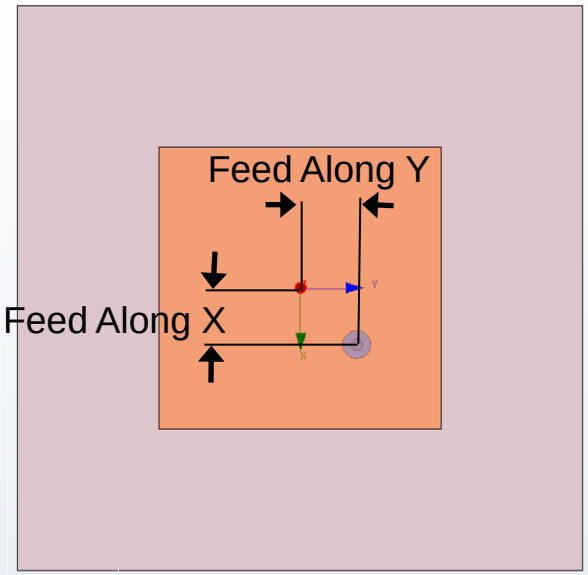
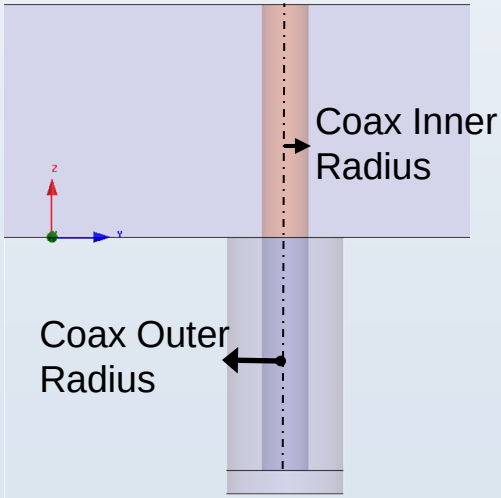
Rectangular Patch – Edge Fed
Design Parameters







Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. "Microstrip Antennas." Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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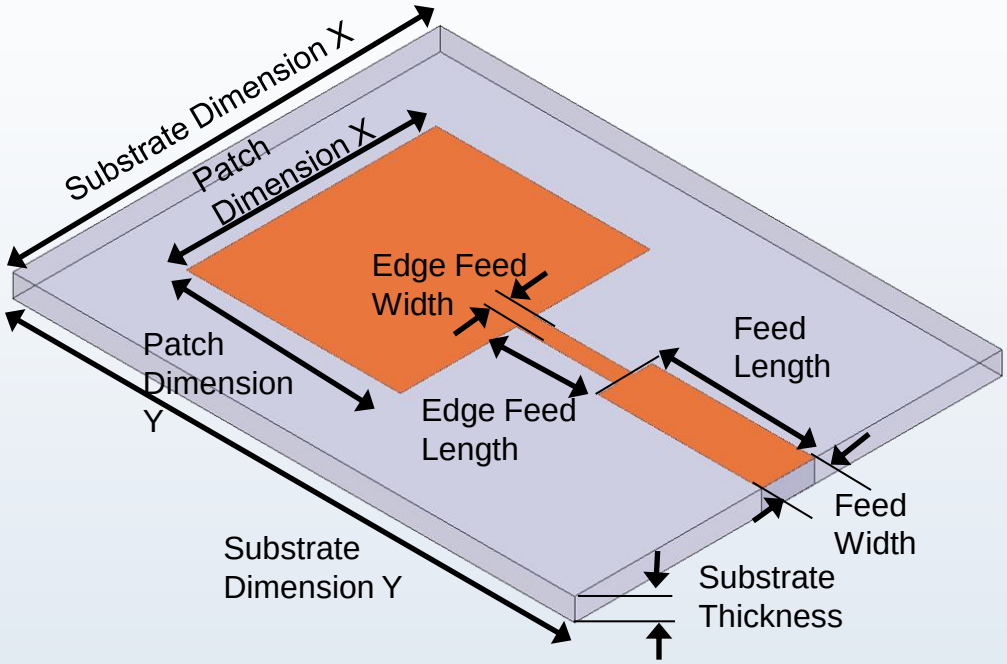
Rectangular Patch – Edge Fed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Microstrip Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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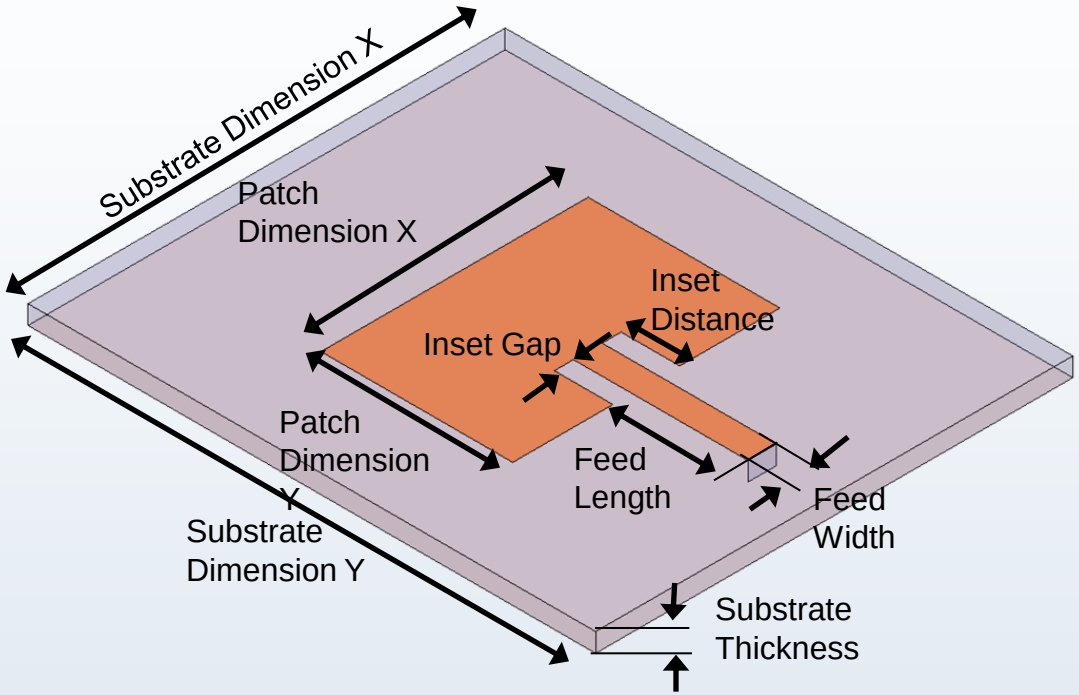
Rectangular Patch – Inset Fed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Microstrip Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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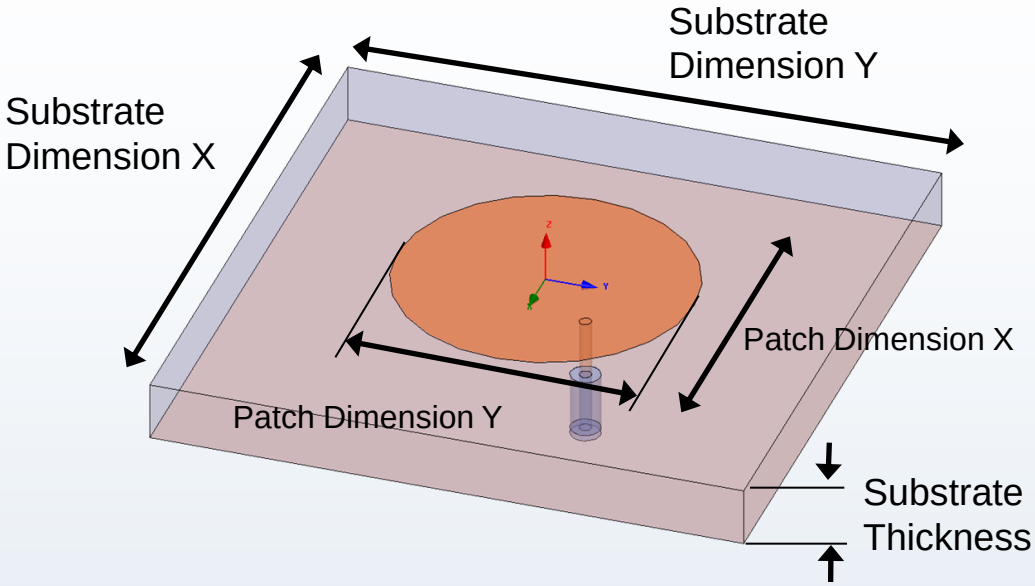
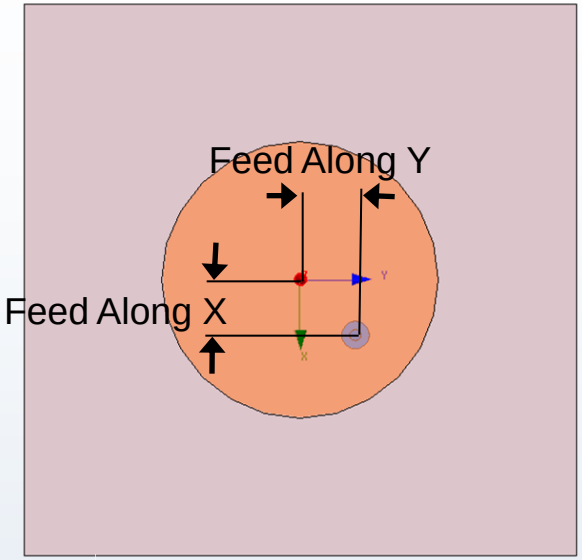
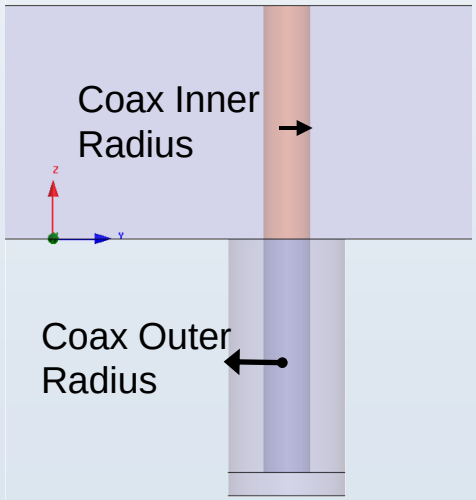
Elliptical Patch
Design Parameters







Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Microstrip Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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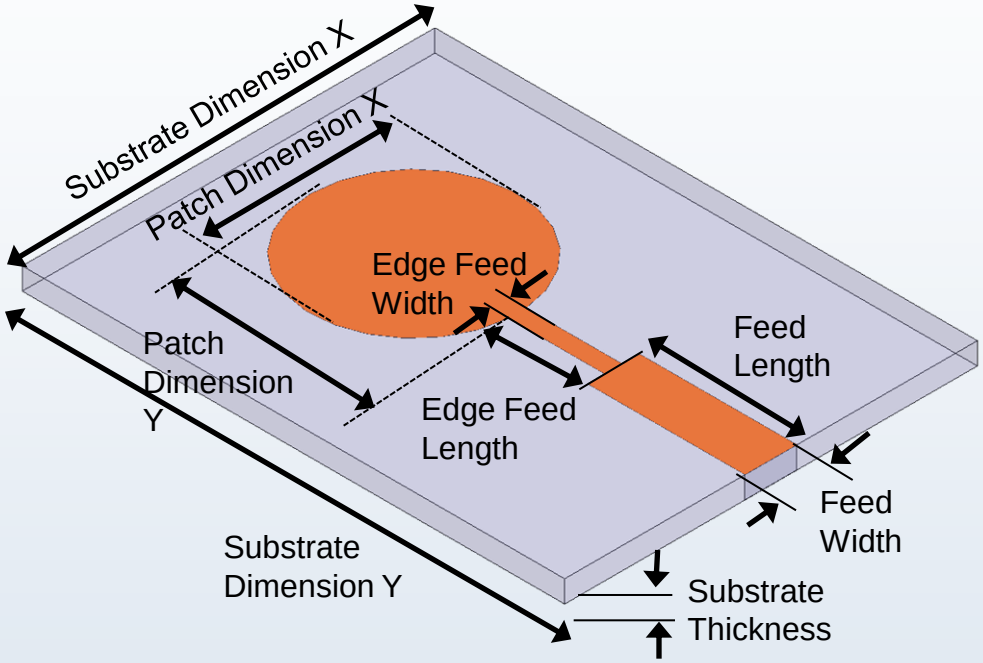
Elliptical Patch – Edge Fed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Microstrip Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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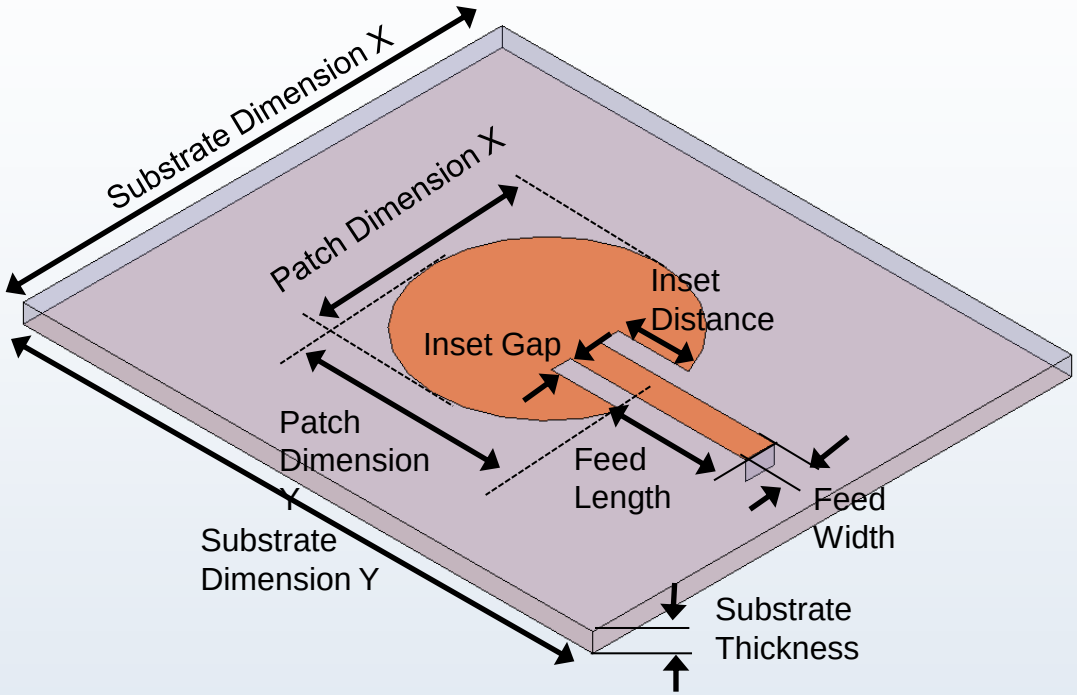
Elliptical Patch – Inset Fed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Balanis, Constantine. "Microstrip Antennas." Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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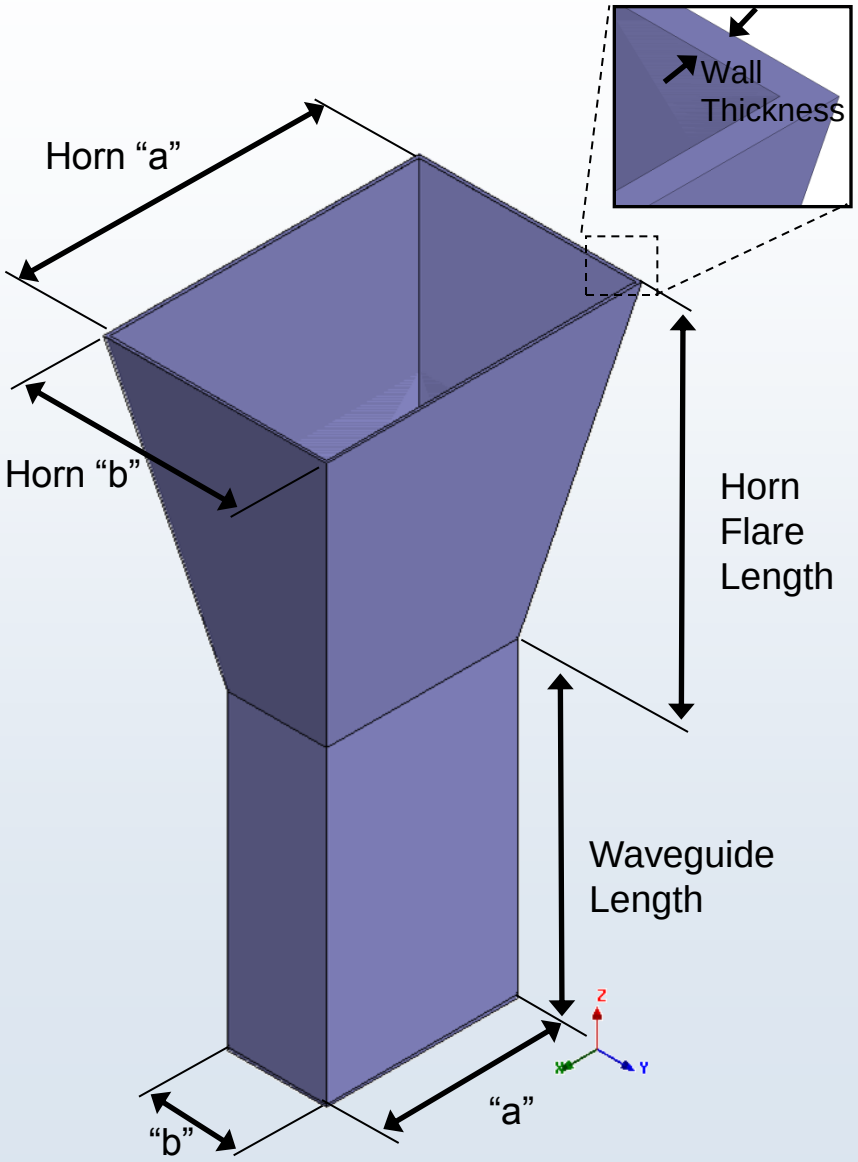
Pyramidal Horn
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Aperture Antennas: Analysis, Design, and Applications.” Modern Antenna Handbook. New York, Wiley, 2008.

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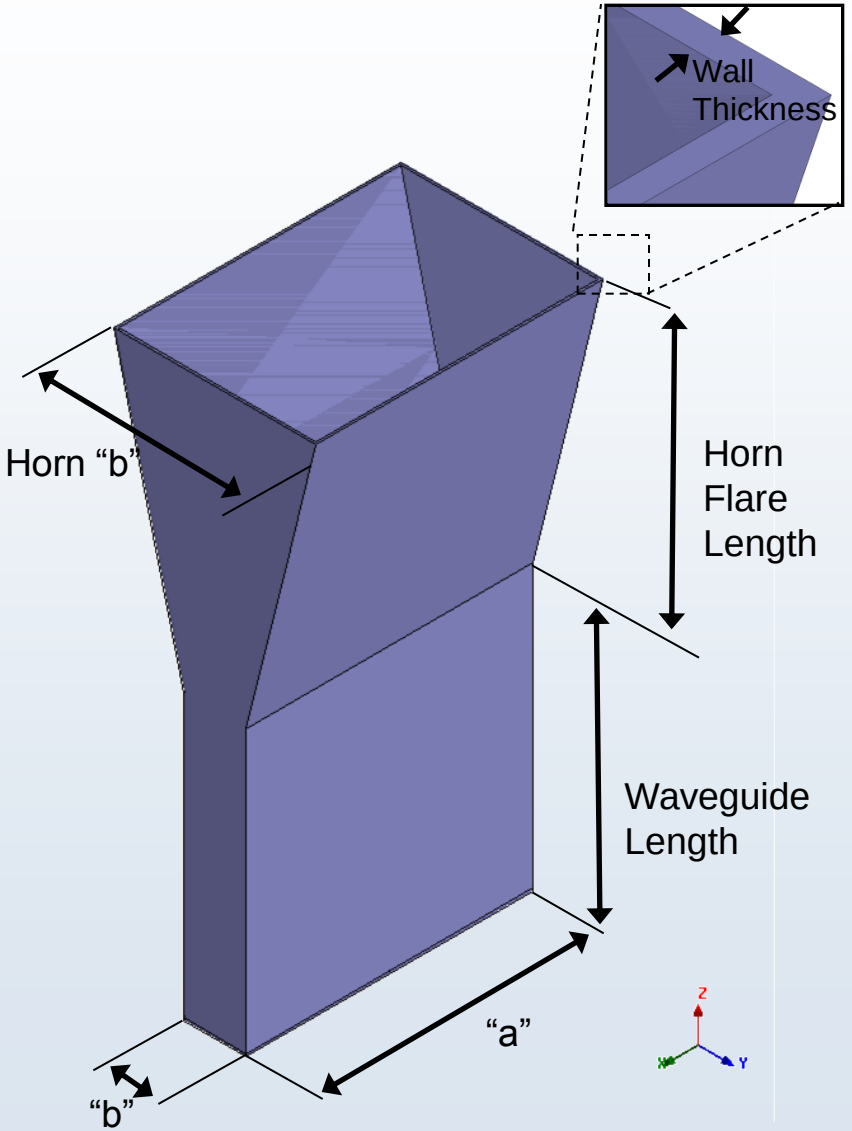
Sectoral Horn - E-Plane
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Moderate**

Ref: Balanis, Constantine. "Aperture Antennas: Analysis, Design, and Applications." Modern Antenna Handbook. New York, Wiley, 2008.

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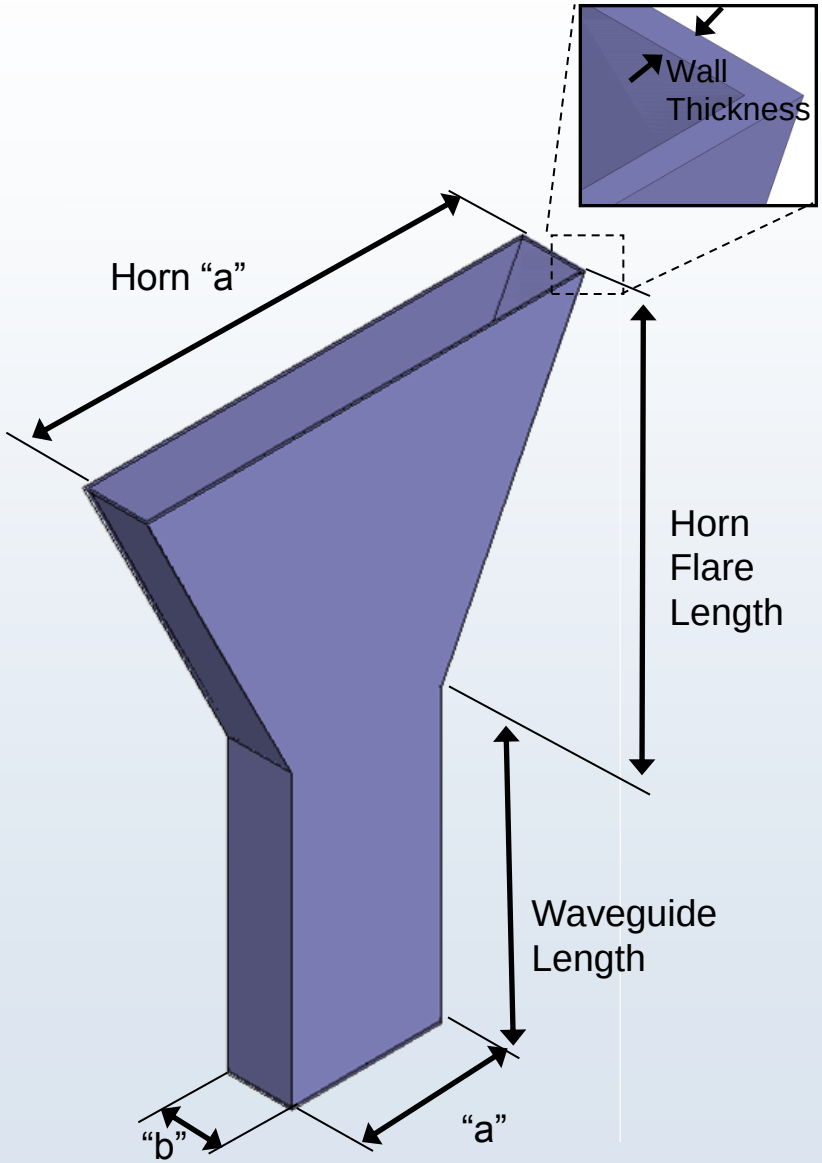
Sectoral Horn - H-Plane
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Aperture Antennas: Analysis, Design, and Applications.” Modern Antenna Handbook. New York, Wiley, 2008.

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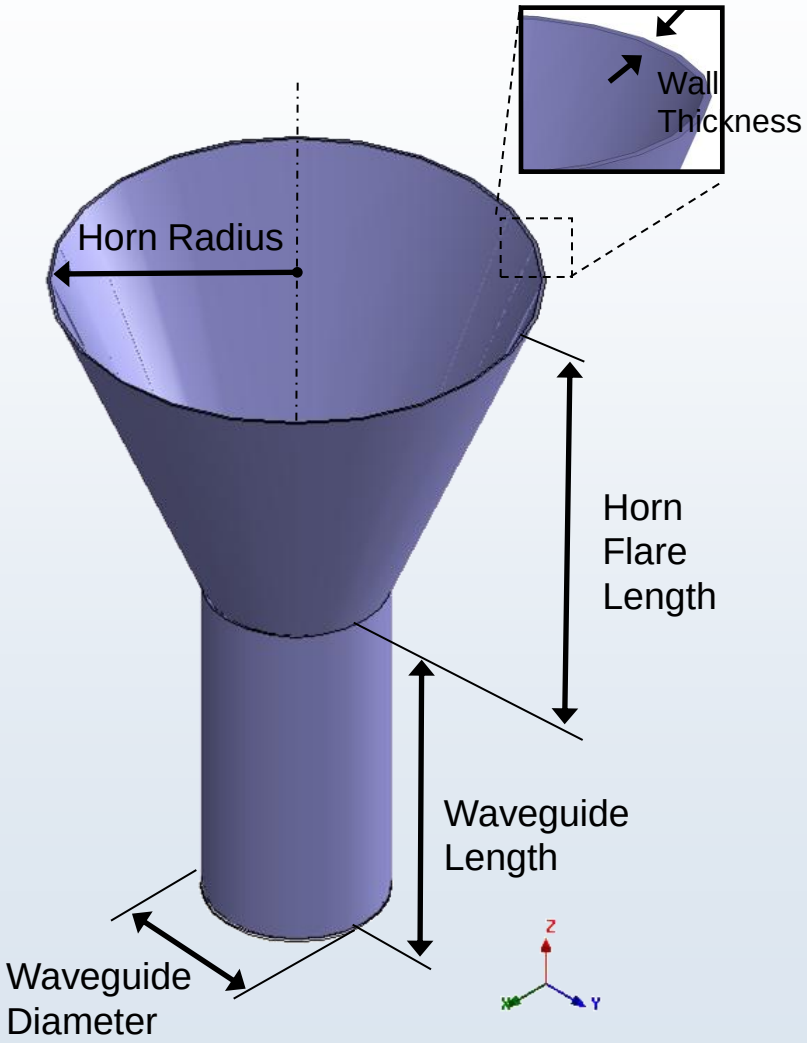
Conical Horn
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Circular/Linear**	**Moderate**

Ref: Balanis, Constantine. “Aperture Antennas: Analysis, Design, and Applications.” Modern Antenna Handbook. New York, Wiley, 2008.

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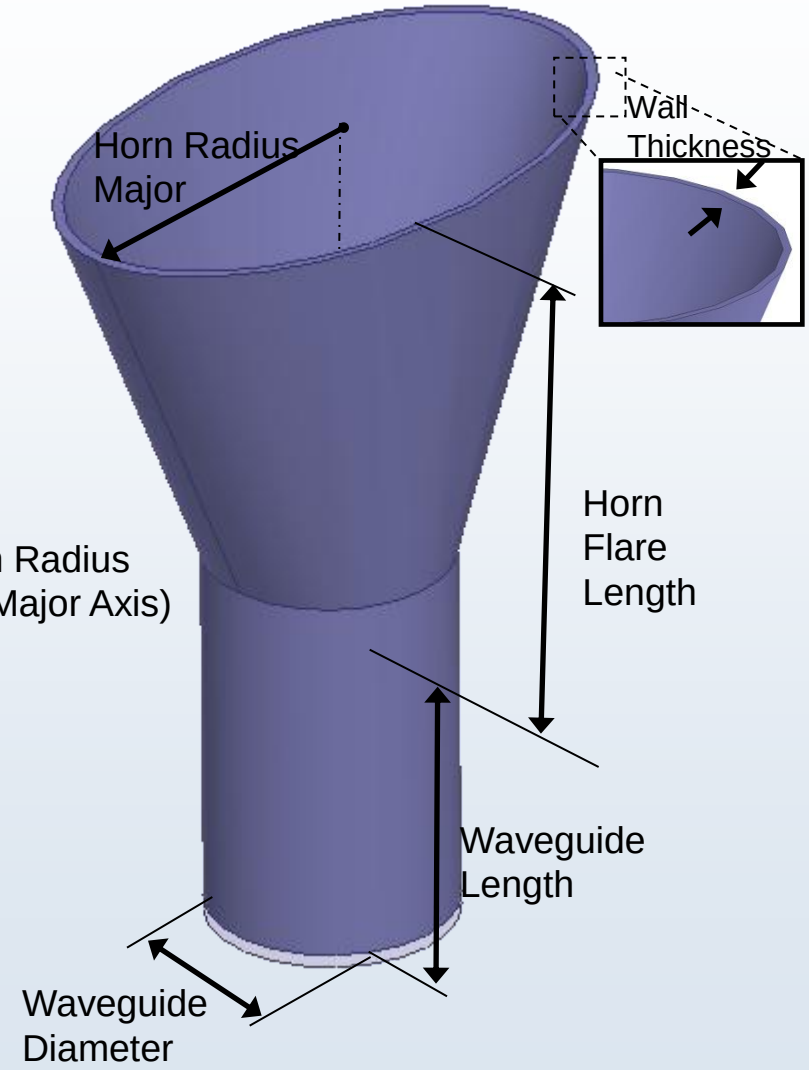
Elliptical Horn
Design Parameters



Ratio = Horn Radius
(Minor Axis/Major Axis)

Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Circular/Linear**	**Moderate**

Ref: Balanis, Constantine. “Aperture Antennas: Analysis, Design, and Applications.” Modern Antenna Handbook. New York, Wiley, 2008.

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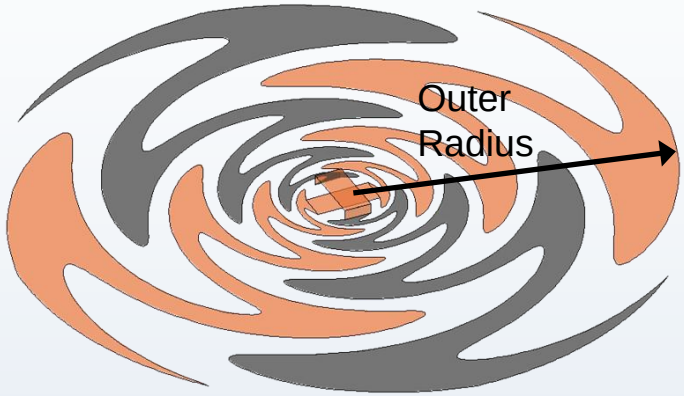
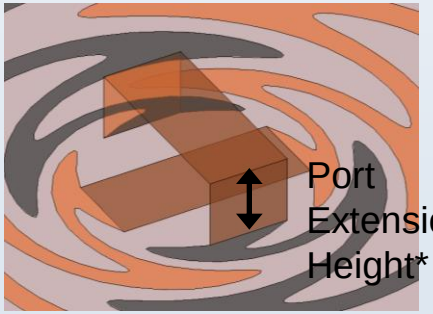
Planar Sinuous
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Dual-Circular**	**Wide**

Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

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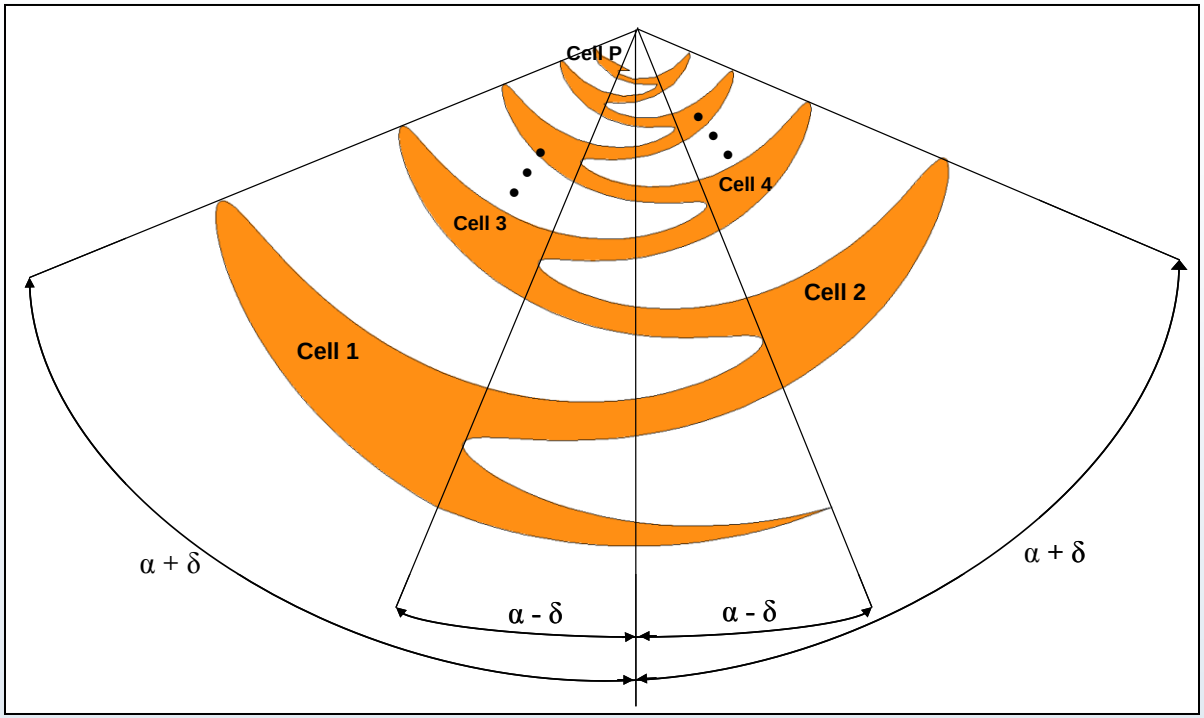
Planar Sinuous (cont.)
Design Parameters



$$\varphi = (-1)^P \alpha_P \sin\left[\frac{180 Ln(r/R_P)}{Ln(\tau_P)}\right] \text{ and } R_{P+1} \le r \le R_P$$

$$R_P = \tau_{P-1} R_{P-1}$$

Where φ and r are polar coordinates

P is the cell number and τ is the growth rate

Ref: Johnson, Richard. "Frequency Independent Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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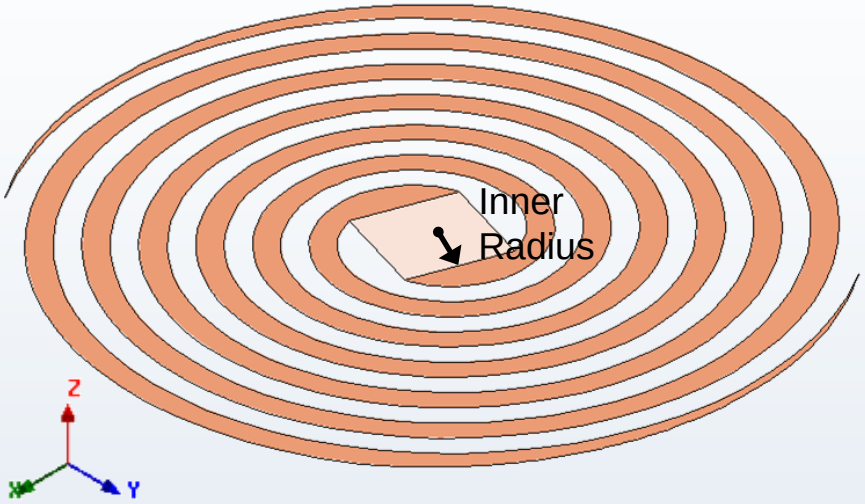
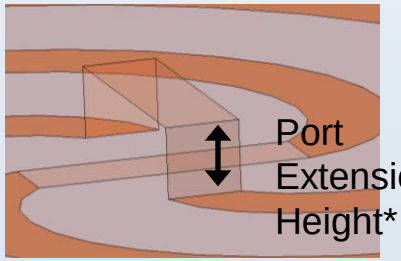
Planar Archimedean
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Circular**	**Wide**



Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

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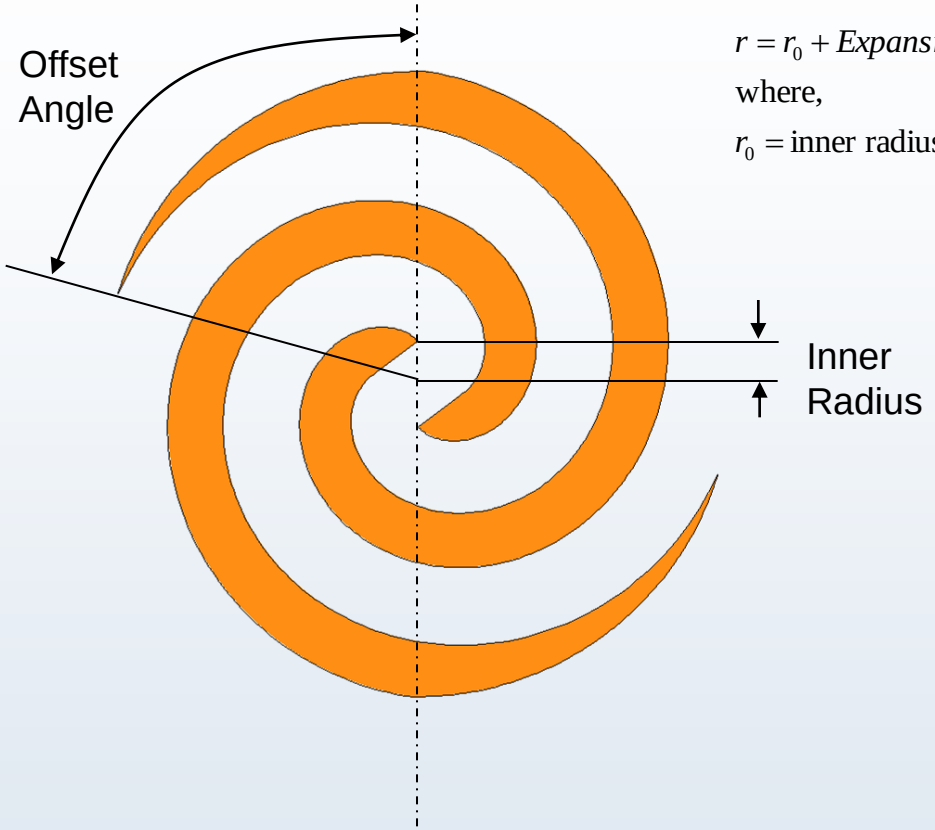
Planar Archimedean (cont.)
Design Parameters



$$r = r_0 + ExpansionCoefficient \cdot \phi^{(1/SpiralCoefficient)}$$

where,

r_0 = inner radius

SpiralCoefficient

1 for Archimedes' Spiral

2 for Fermat's Spiral… etc

Can be any positive value

Spiral Coefficient

1 for Archimedes' Spiral

2 for Fermat's Spiral… etc

Can be any positive value

Spiral Coefficient = 1 Spiral Coefficient = 2

Ref: Johnson, Richard. "Frequency Independent Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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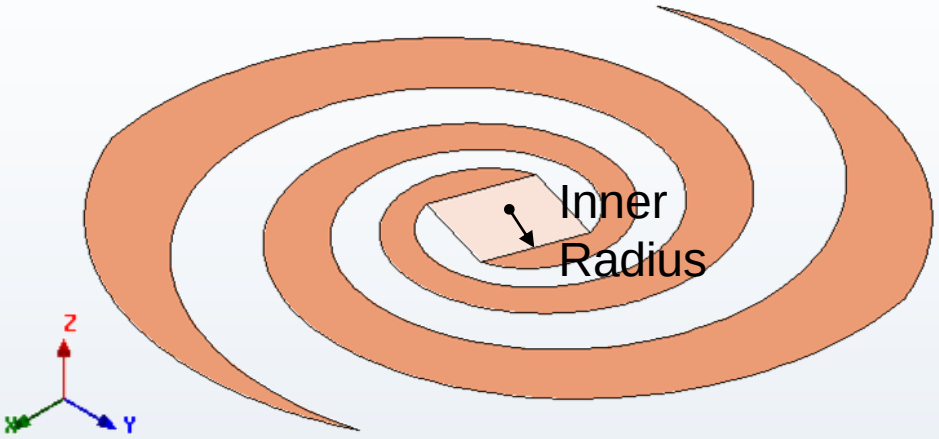
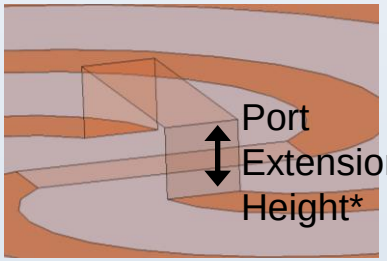
Planar Log-Spiral
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Circular**	**Wide**

Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

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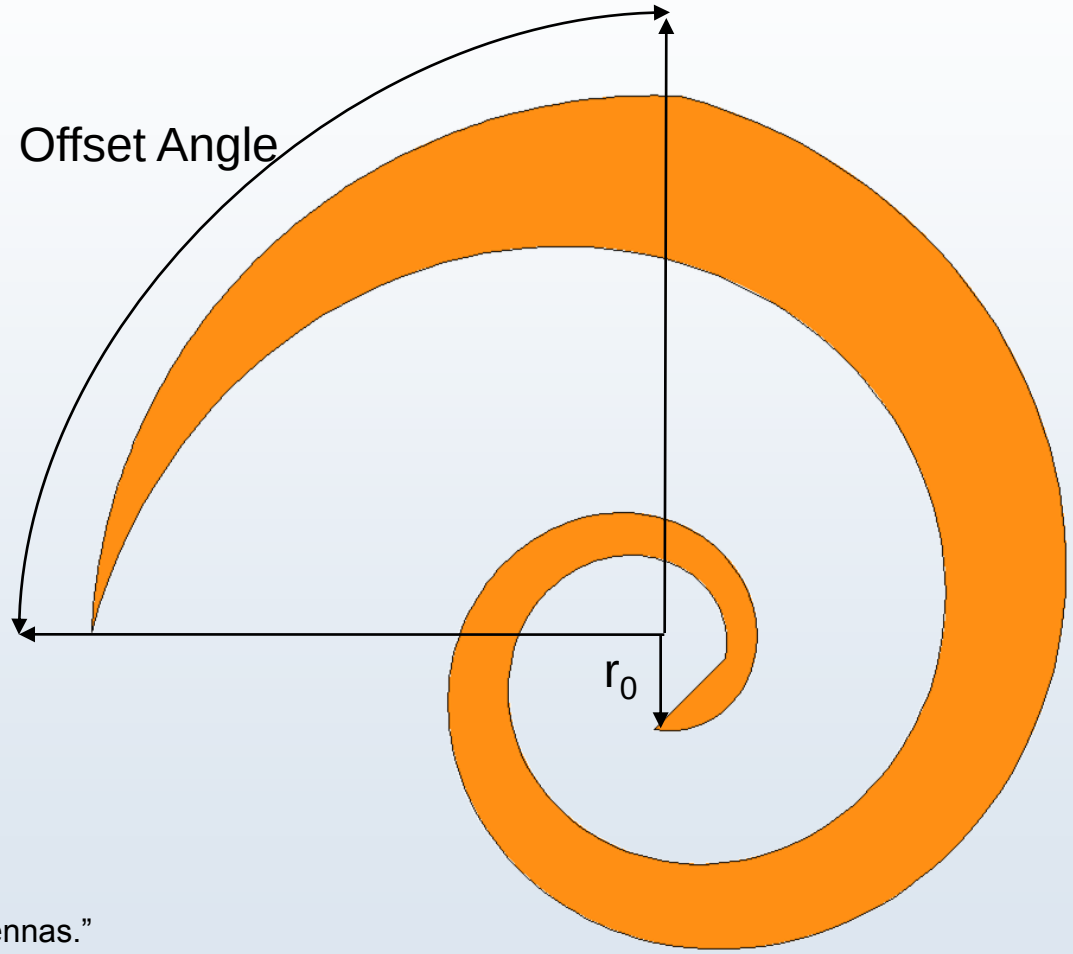
Planar Log-Spiral (cont.)
Design Parameters

$$r = r_0 e^{a\phi}$$

where,

r_0 = inner radius

$a = Ln(ExpansionRatio)/(2\pi)$



Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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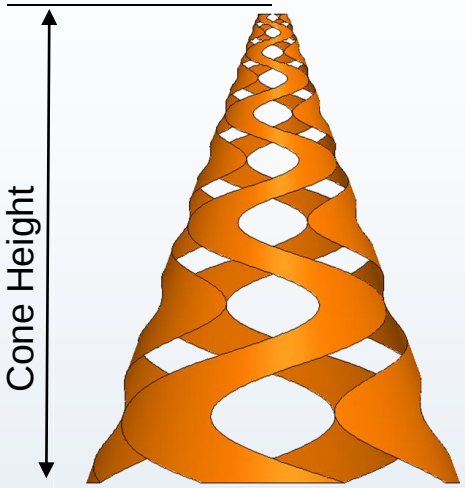
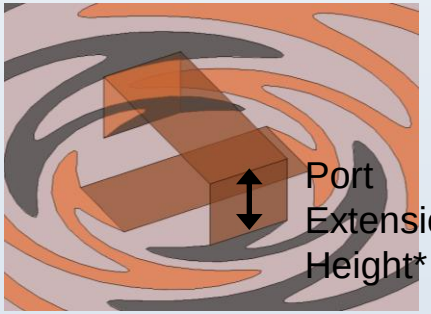
Conical Sinuous
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Dual-Circular**	**Wide**

Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

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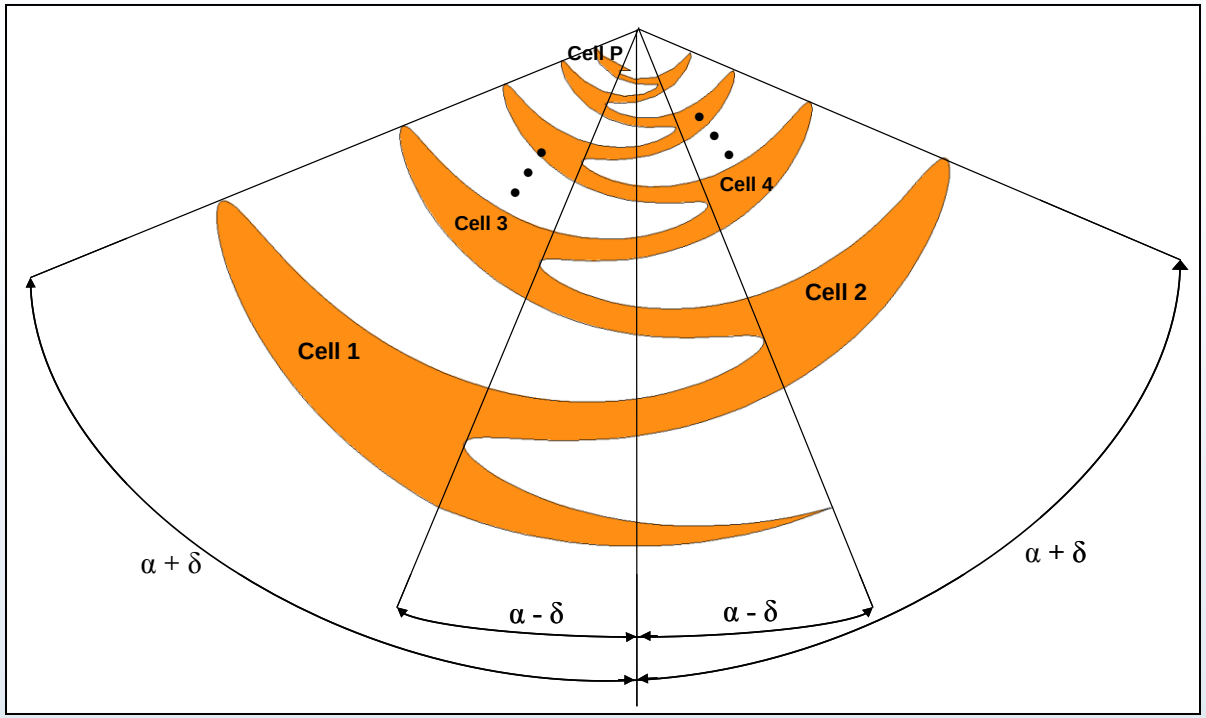
Conical Sinuous (cont.)
Design Parameters



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$$R_P = \tau_{P-1} R_{P-1}$$

Where φ and r are polar coordinates

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Ref: Johnson, Richard. "Frequency Independent Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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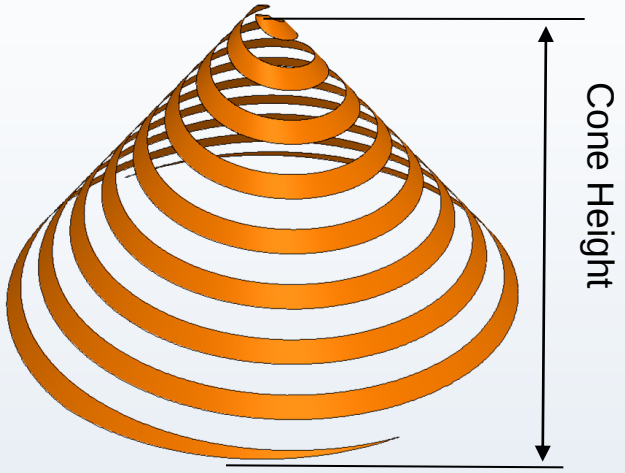
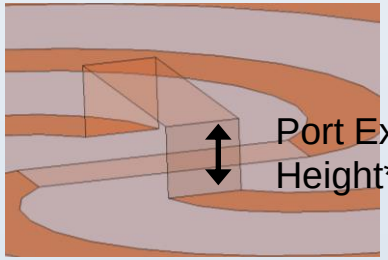
Conical Archimedean
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Circular**	**Wide**

Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

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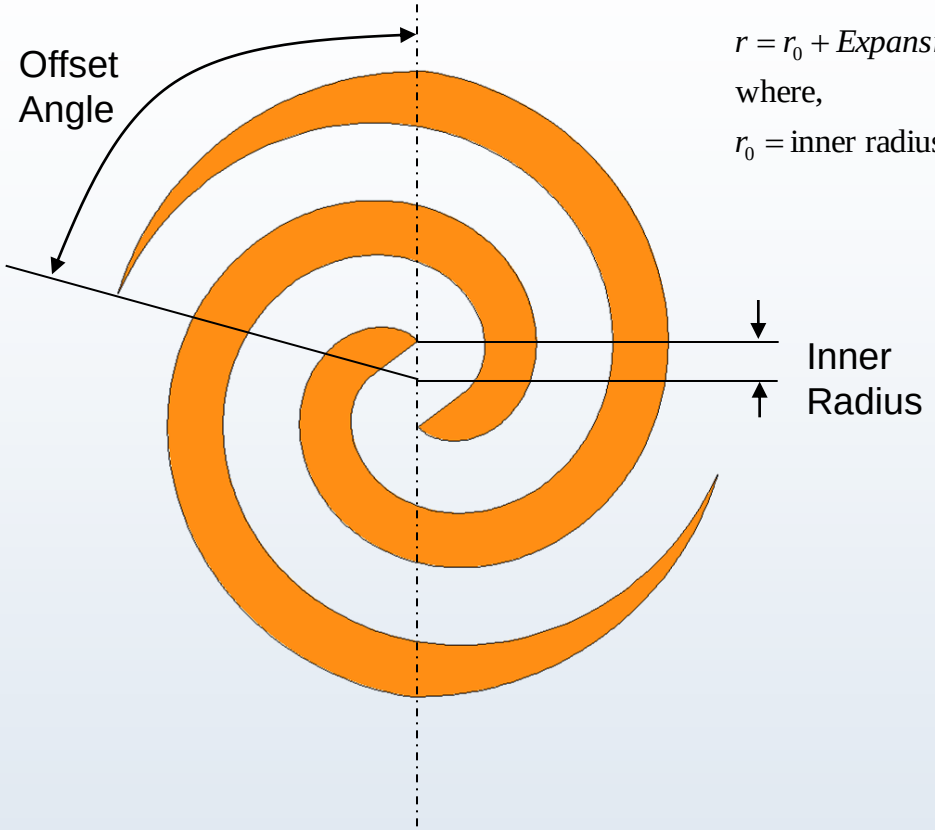
Conical Archimedean (cont.)
Design Parameters



$$r = r_0 + ExpansionCoefficient \cdot \phi^{(1/SpiralCoefficient)}$$

where,

r_0 = inner radius

SpiralCoefficient

1 for Archimedes' Spiral

2 for Fermat's Spiral… etc

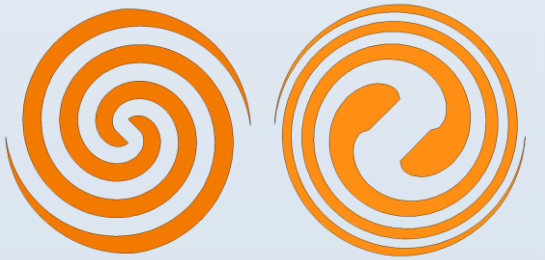
Can be any positive value

Spiral Coefficient

1 for Archimedes' Spiral

2 for Fermat's Spiral… etc

Can be any positive value



Spiral Coefficient = 1 Spiral Coefficient = 2

Ref: Johnson, Richard. "Frequency Independent Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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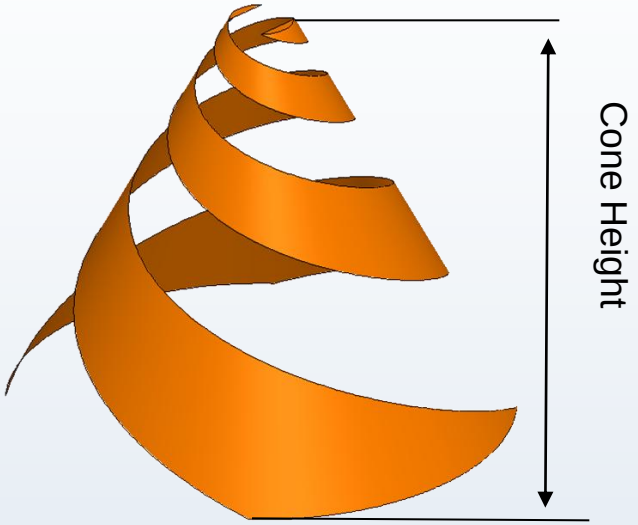
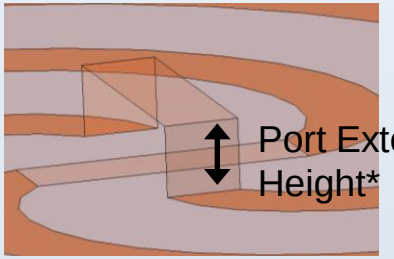
Conical Log-Spiral
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Circular**	**Wide**

* Port Extension Height only applicable to 4 arm spirals

** Spiral antenna only supports 2 or 4 arms

Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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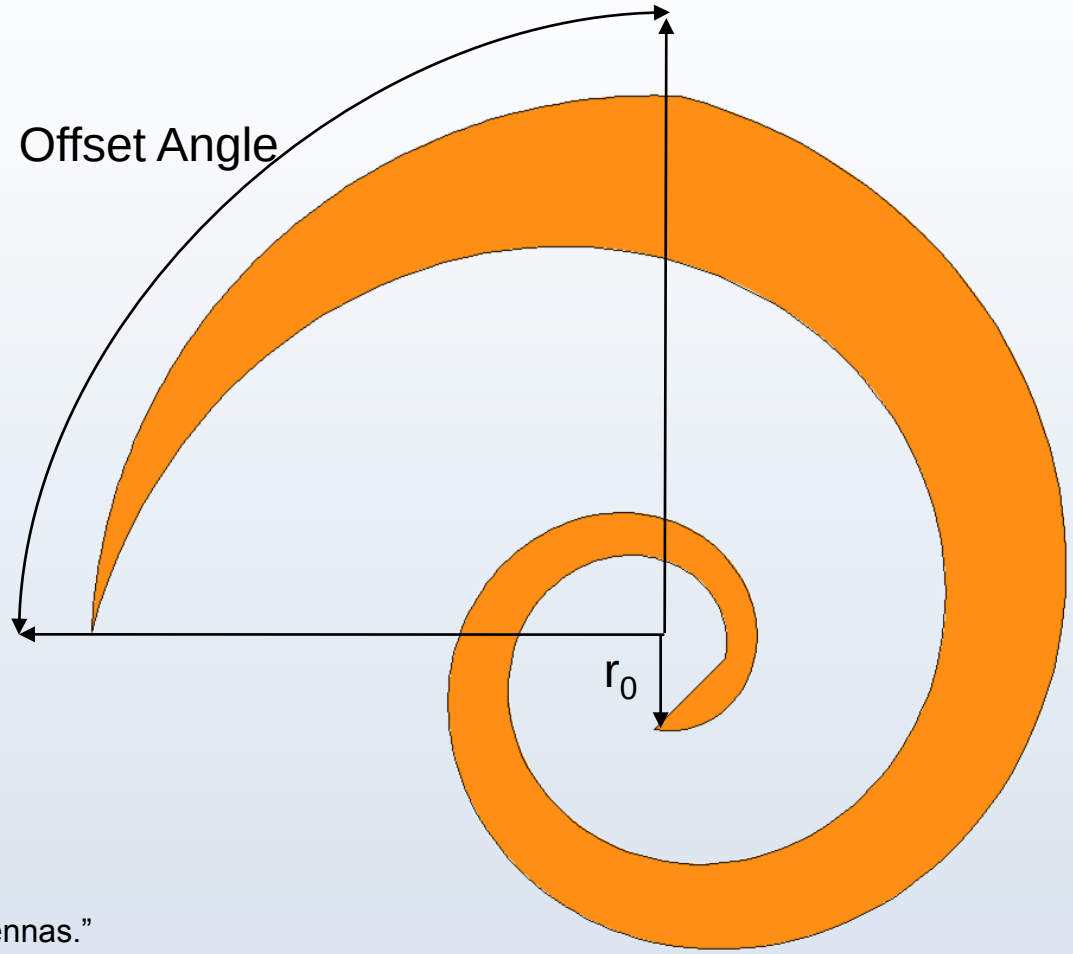
Conical Log-Spiral (cont.)
Design Parameters

$$r = r_0 e^{a\phi}$$

where,

r_0 = inner radius

$a = Ln(ExpansionRatio)/(2\pi)$



Ref: Johnson, Richard. “Frequency Independent Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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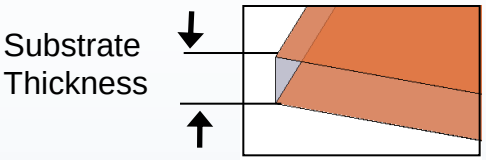
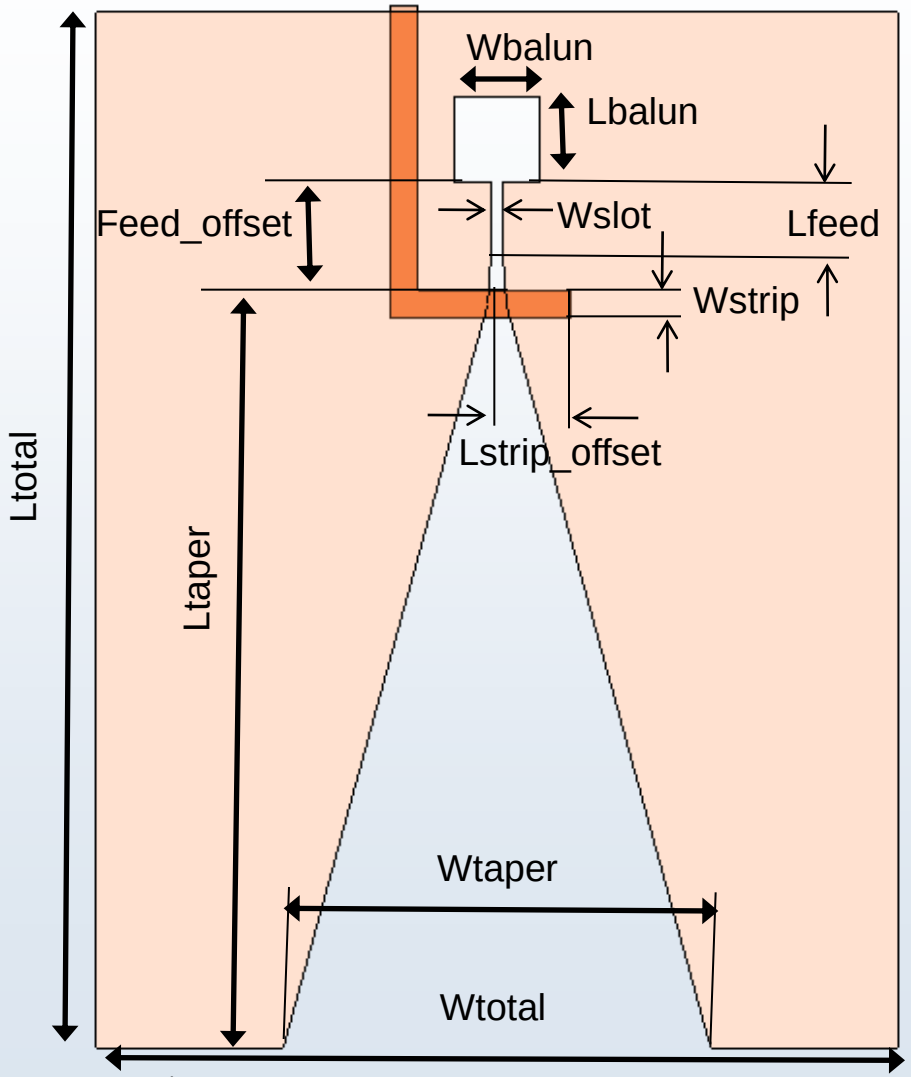
Linear Tapered Slot
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Linear**	**Wide**

Ref: Johnson, Richard. “Slot Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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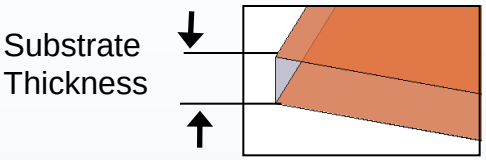
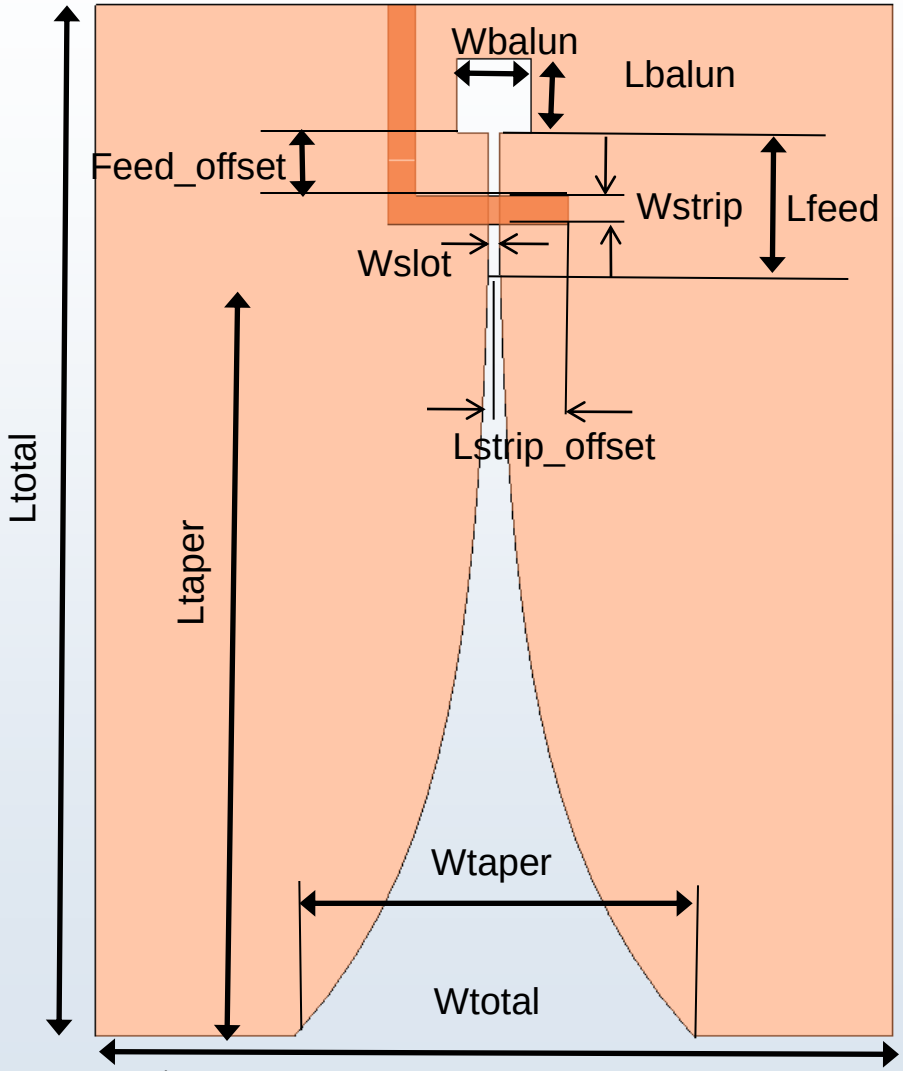
Vivaldi – Continuous
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Linear**	**Wide**

Ref: Johnson, Richard. “Slot Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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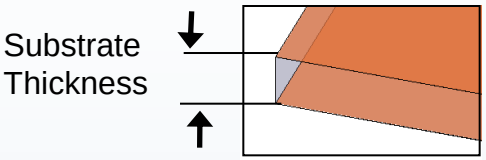
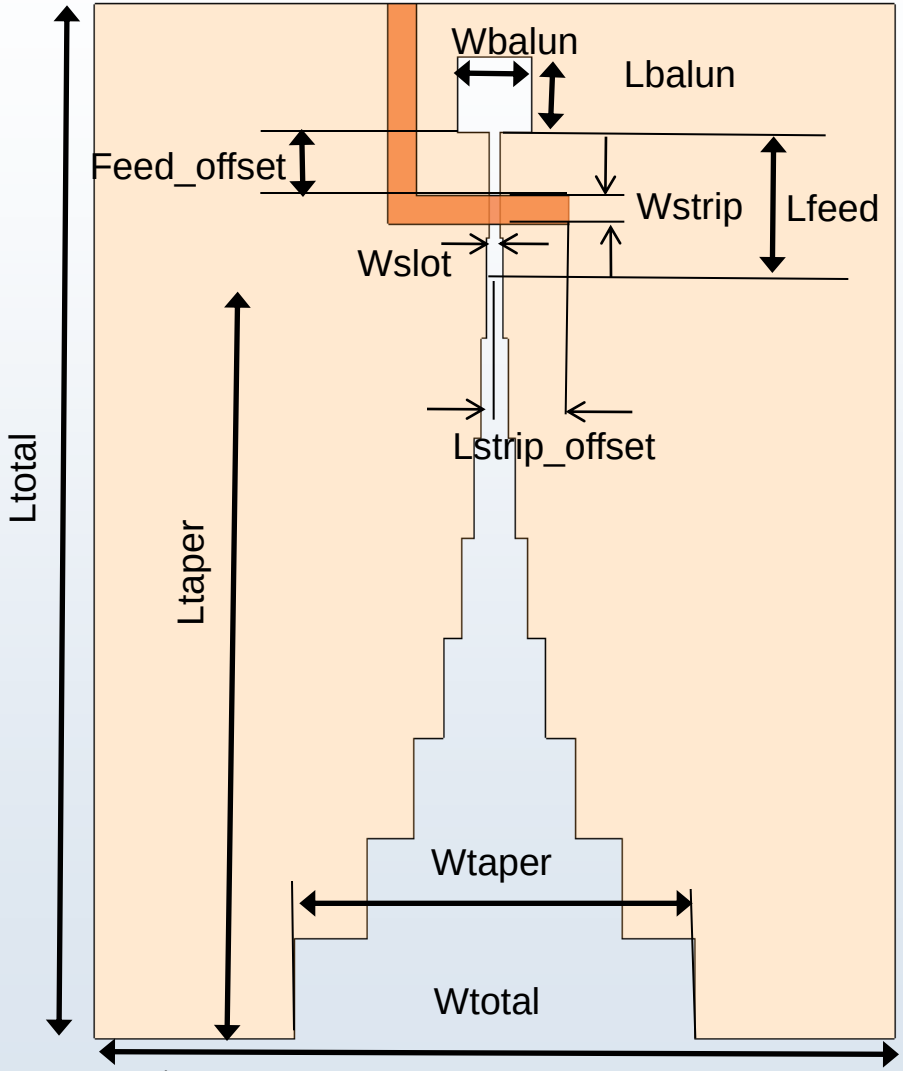
Vivaldi – Stepped
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High	**Linear**	**Wide**

Ref: Johnson, Richard. “Slot Antennas.” Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

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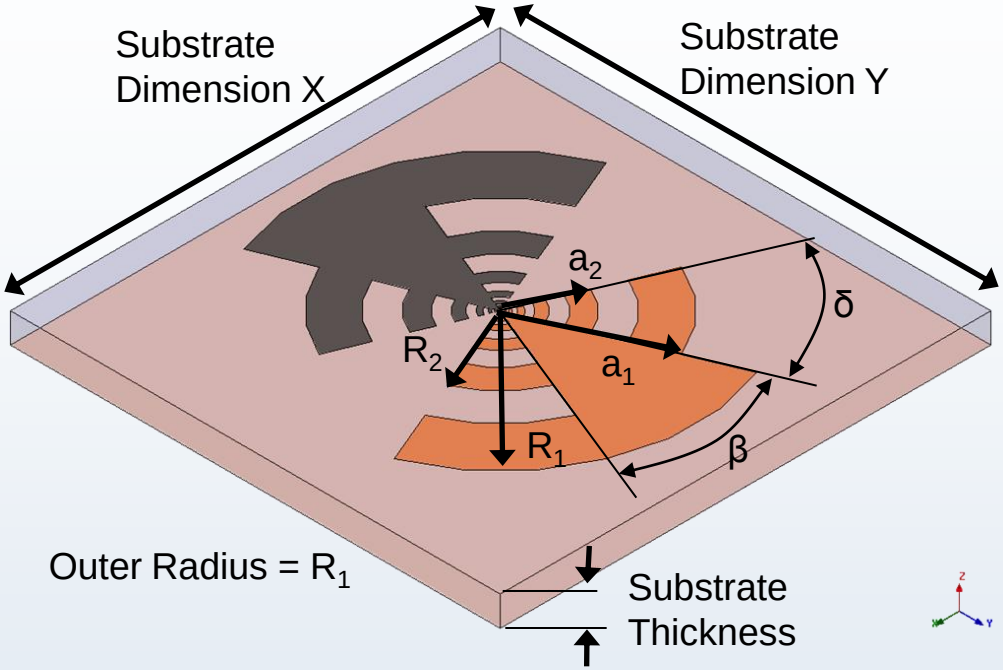
Log Periodic Toothed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Wide**

$$\tau = \frac{R_{n+1}}{R_n} < 1$$

$$\sigma = \frac{a_n}{R_n} < 1$$

Ref: Balanis, Constantine. “Frequency Independent Antennas: Spirals and Log Periodics.” Modern Antenna Handbook. New York, Wiley, 2008.

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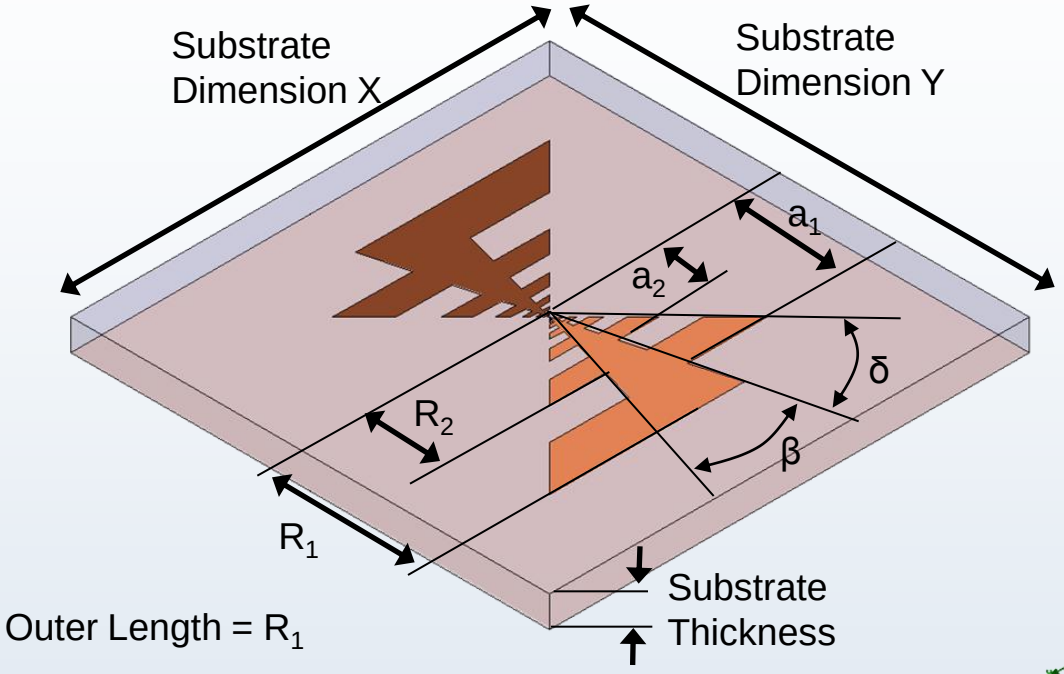
Log Periodic Toothed – Trapezoid
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Wide**

$$\tau = \frac{R_{n+1}}{R_n} < 1$$

$$\sigma = \frac{a_n}{R_n} < 1$$

Ref: Balanis, Constantine. “Frequency Independent Antennas: Spirals and Log Periodics.” Modern Antenna Handbook. New York, Wiley, 2008.

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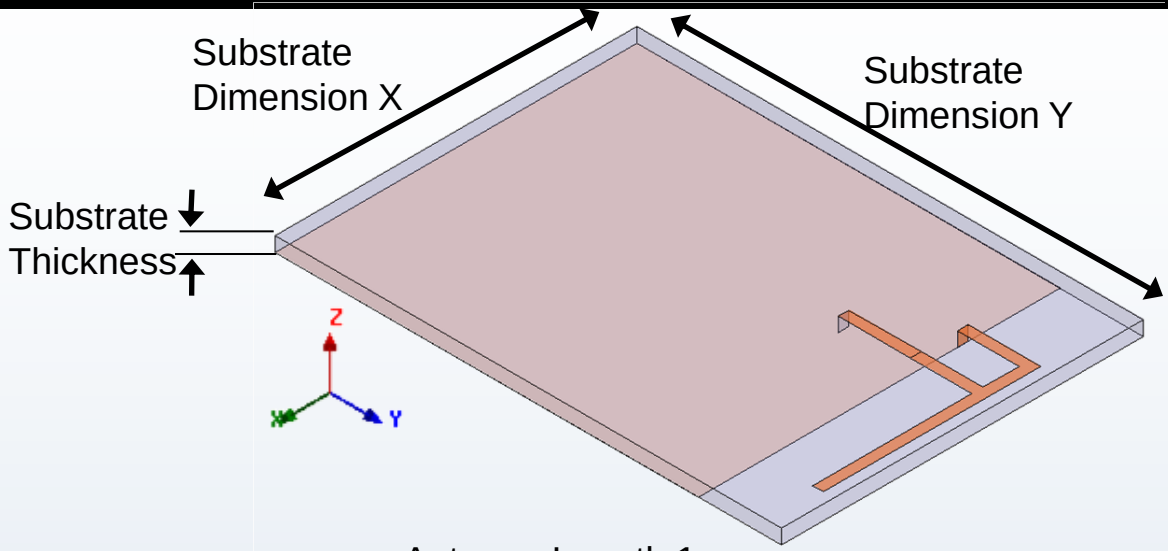
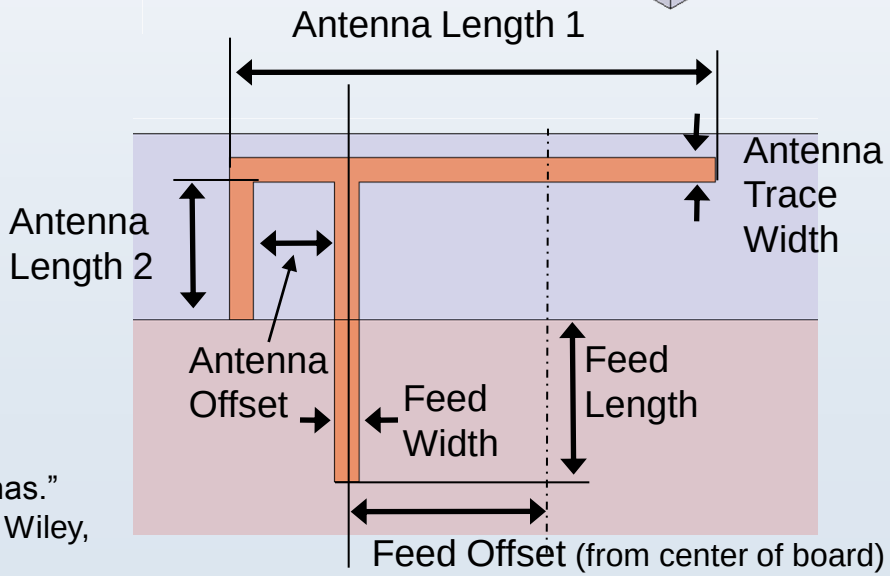
PIFA
Design Parameters





Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**

Ref: Wong, Kin-Lu. “PIFAs for Internal Mobile Phone Antennas.” Planar Antennas For Wireless Communications. New York, Wiley, 2003.

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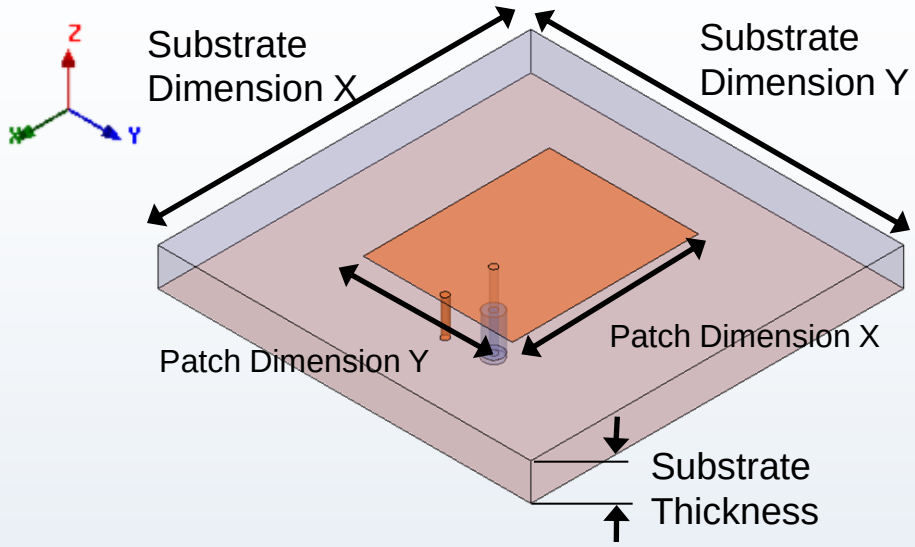
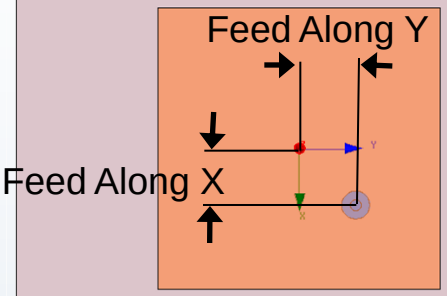
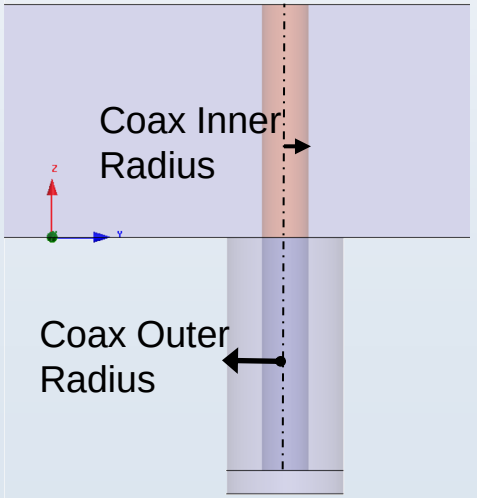
PIFA - Shorting Pin
Design Parameters





*Feed Along X and Y, and Shorting Pin Location Along X and Y is measured from center of patch



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Wong, Kin-Lu. “PIFAs for Internal Mobile Phone Antennas.” Planar Antennas For Wireless Communications. New York, Wiley, 2003.

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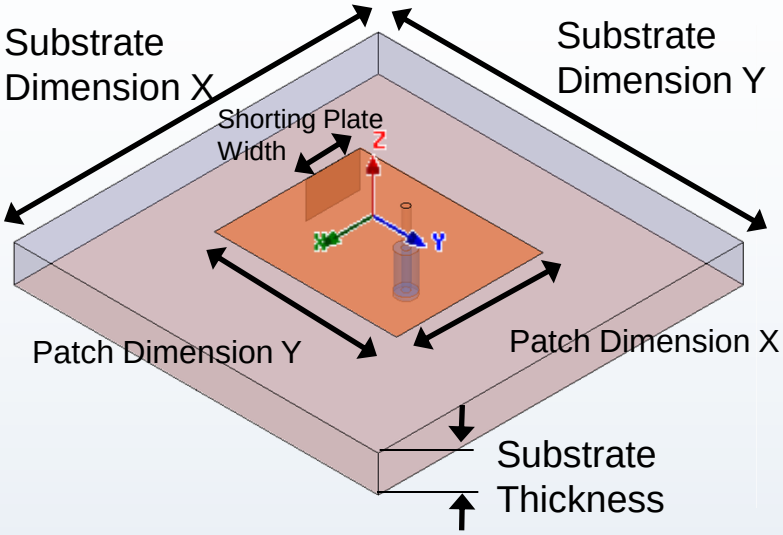
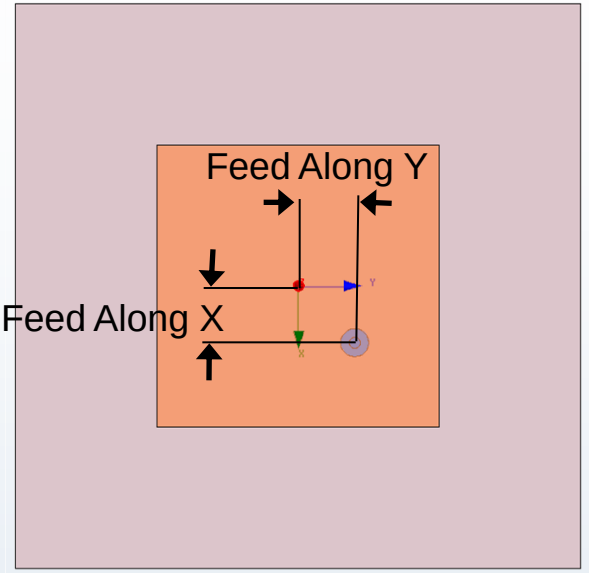
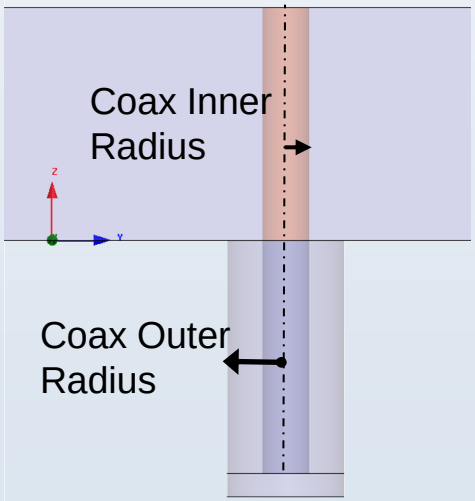
PIFA - Shorting Plate
Design Parameters





*Feed Along X and Y is measured from center of patch

**Shorting plate width is always measured from corner of patch



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Narrow**

Ref: Wong, Kin-Lu. “PIFAs for Internal Mobile Phone Antennas.” Planar Antennas For Wireless Communications. New York, Wiley, 2003.

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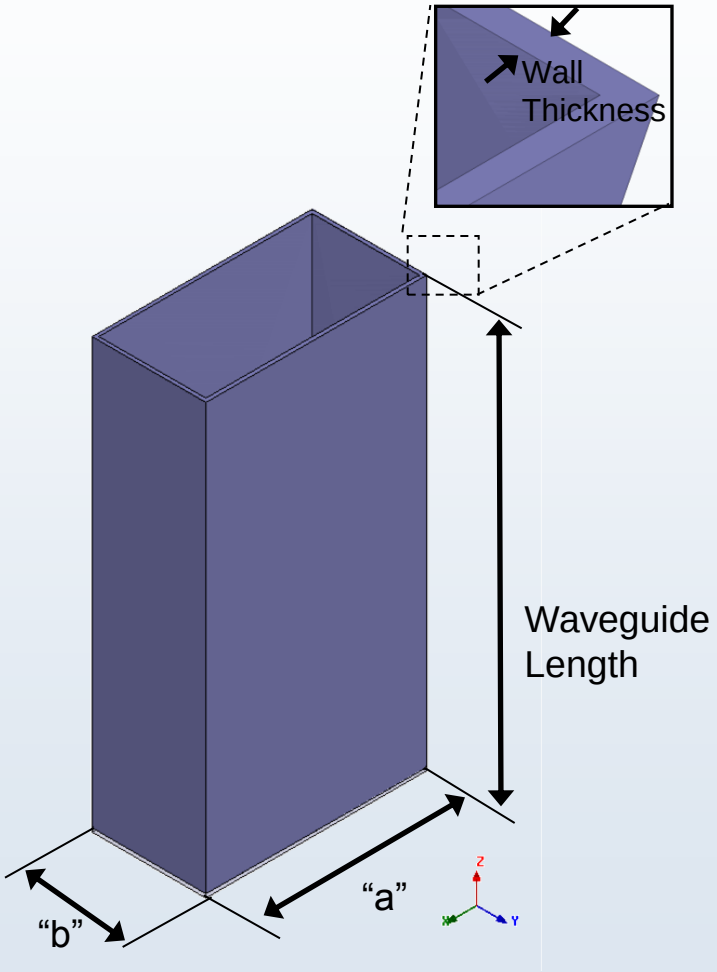
Rectangular Waveguide - Open Ended
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Linear**	**Moderate**

Ref: Balanis, Constantine. "Aperture Antennas: Analysis, Design, and Applications." Modern Antenna Handbook. New York, Wiley, 2008.

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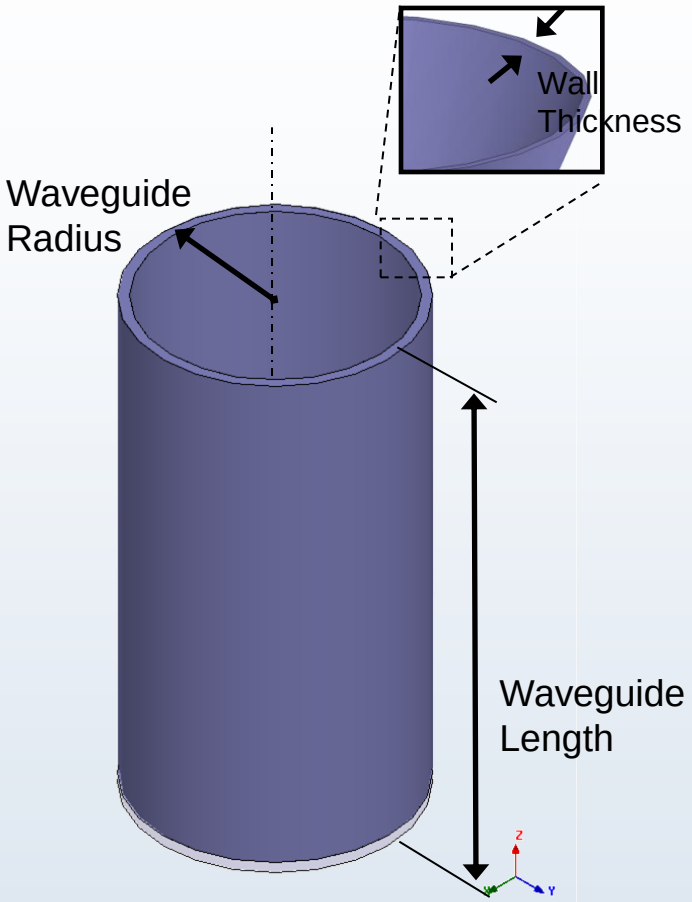
Circular Waveguide - Open Ended
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Medium	**Circular/Linear**	**Moderate**

Ref: Balanis, Constantine. “Aperture Antennas: Analysis, Design, and Applications.” Modern Antenna Handbook. New York, Wiley, 2008.

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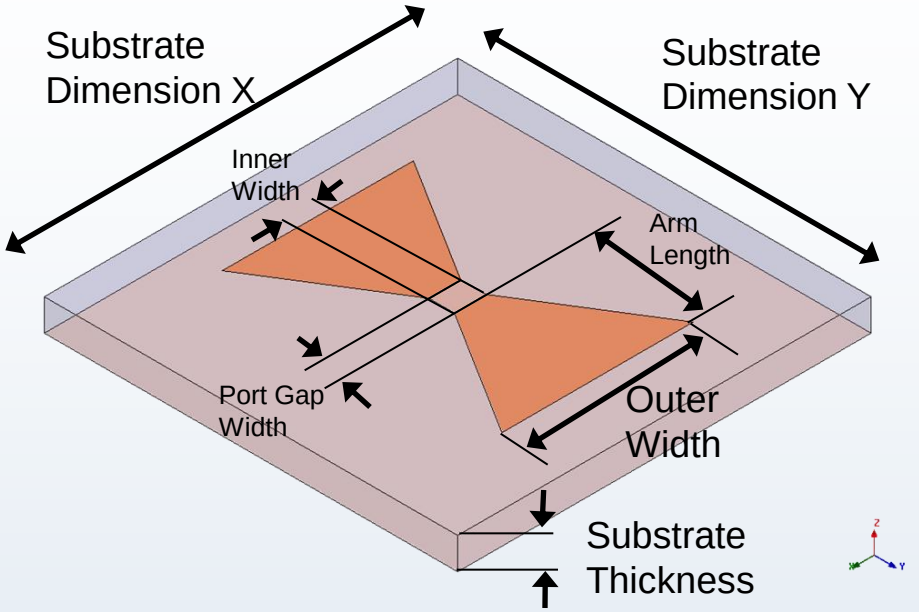
Bowtie
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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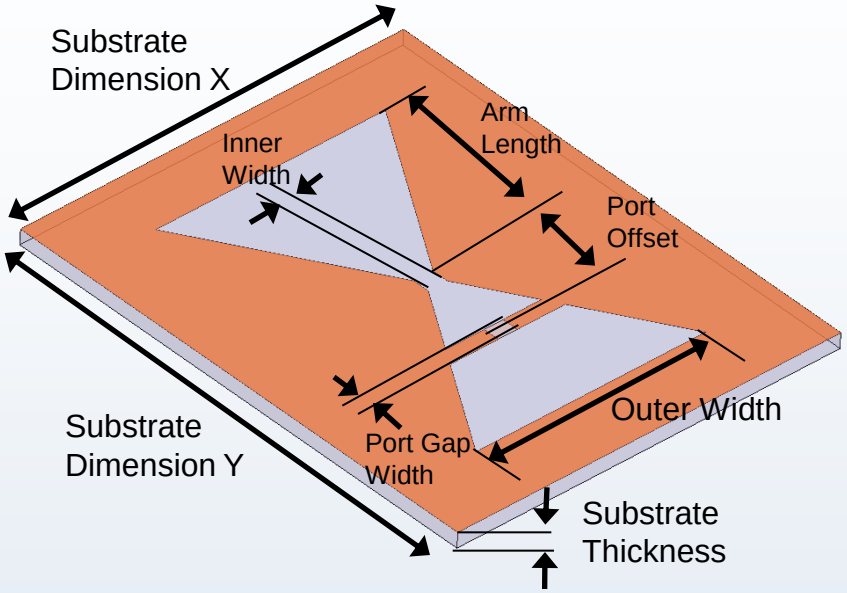
Bowtie - Slot
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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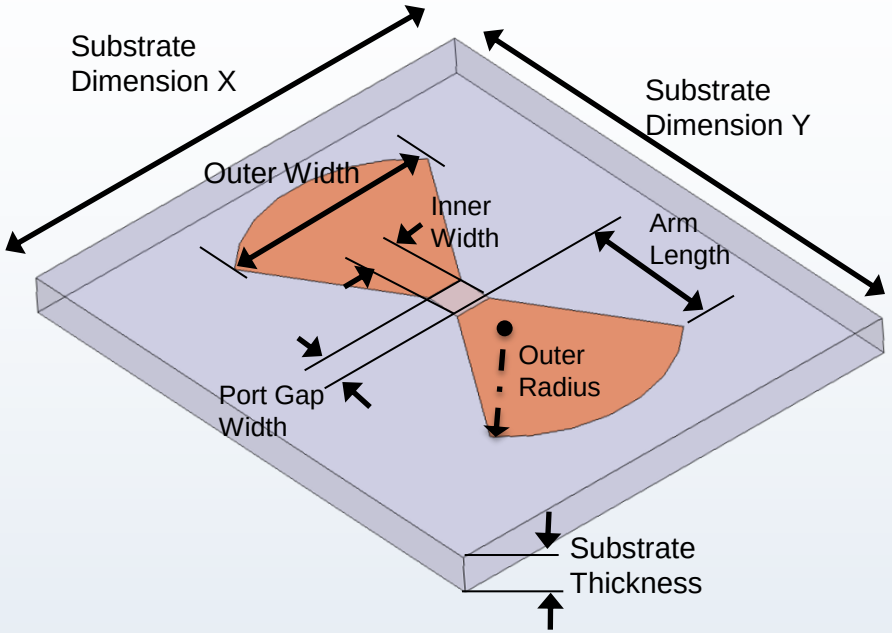
Bowtie - Rounded
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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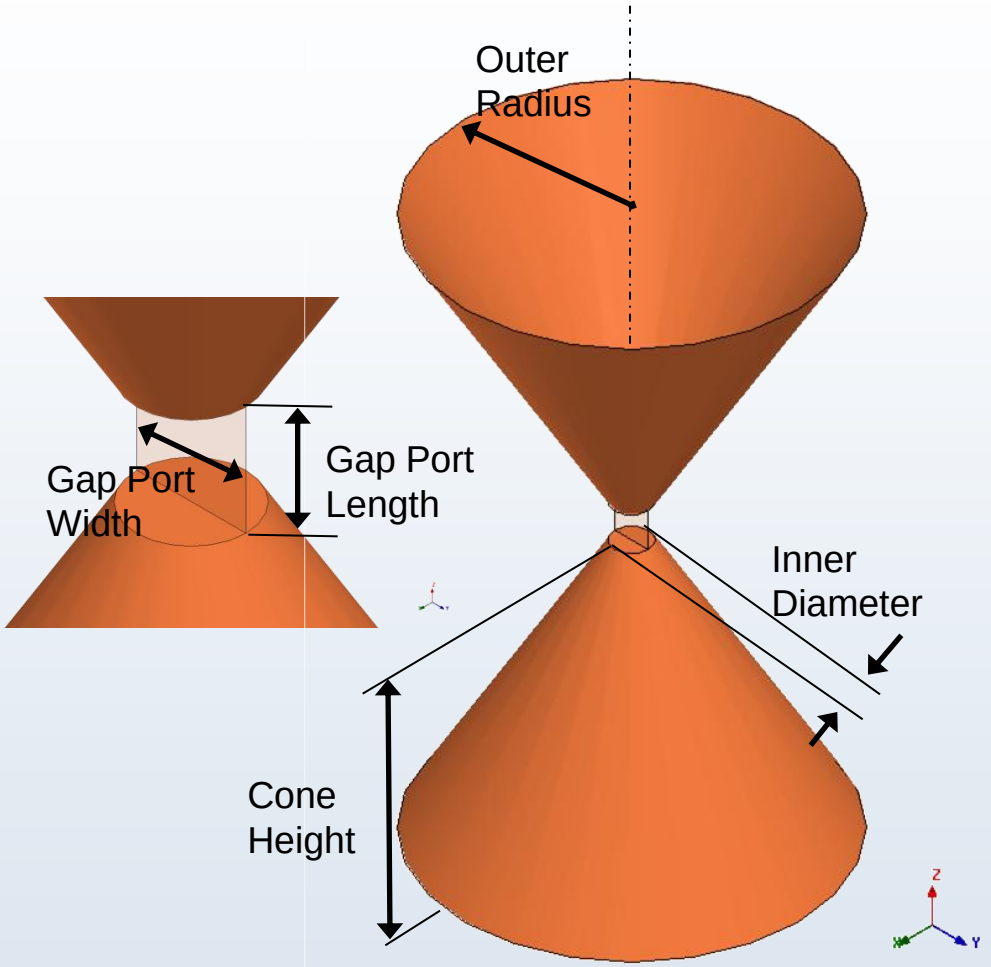
Bicone
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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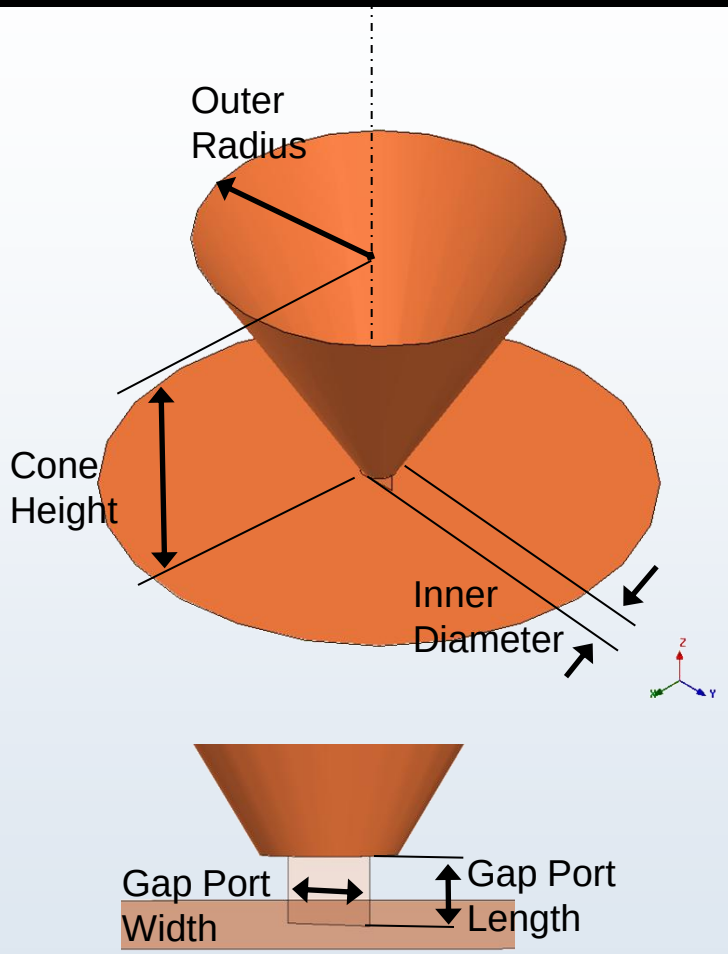
Discone
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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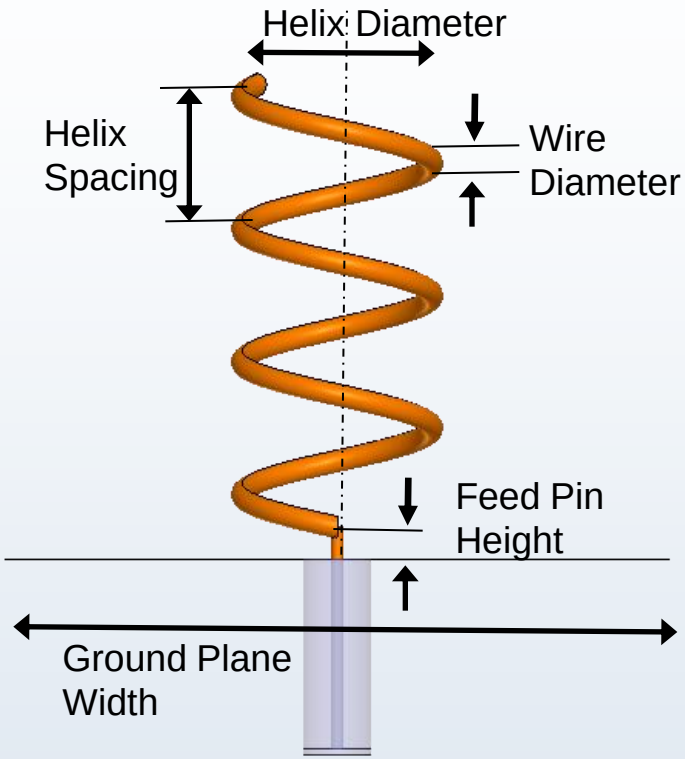
Helix – Axial Mode
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High/Moderate	**Circular**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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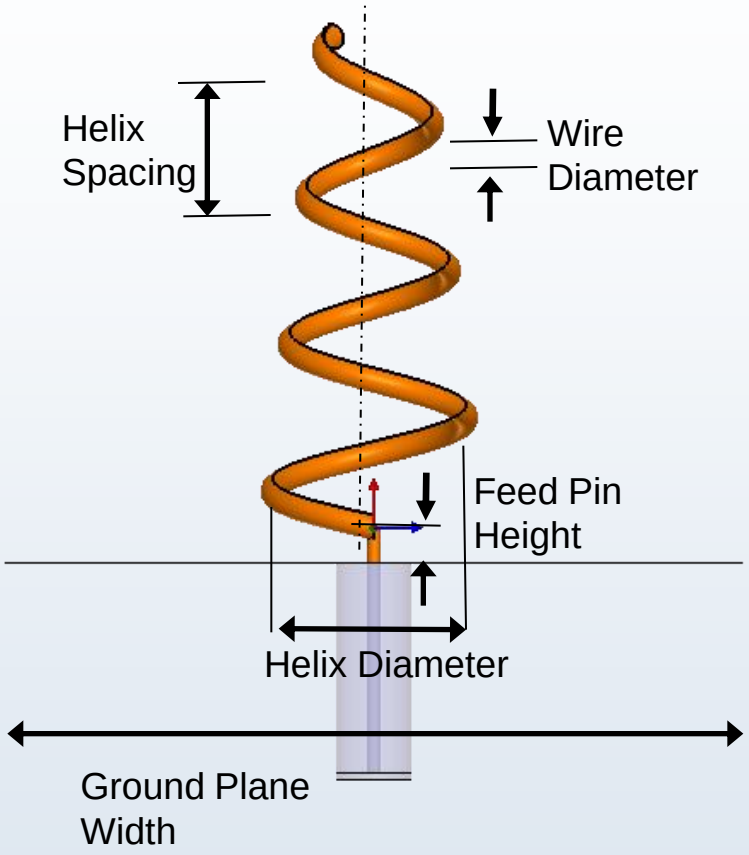
Helix – Axial Mode – Continuous Taper
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
High/Moderate	**Circular**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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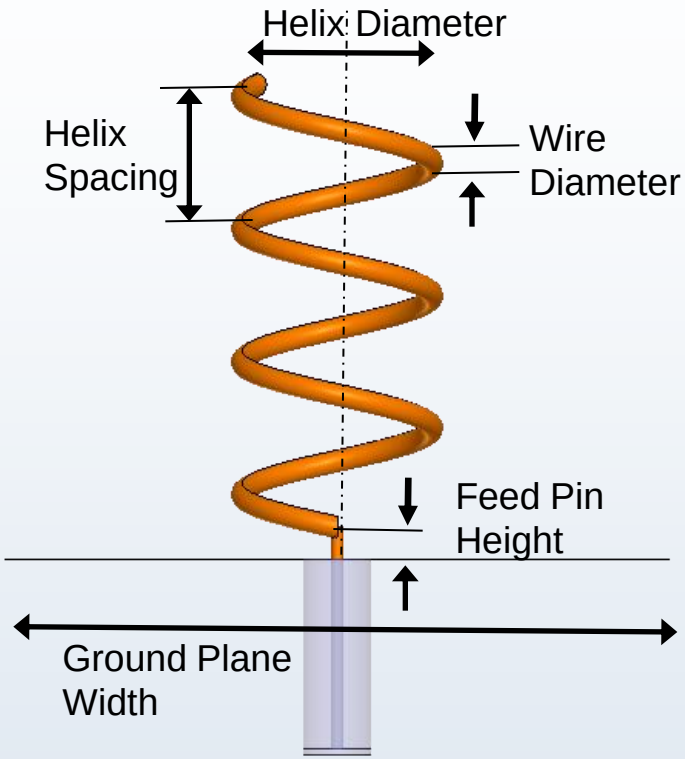
Helix – Normal Mode
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Circular**	**Low**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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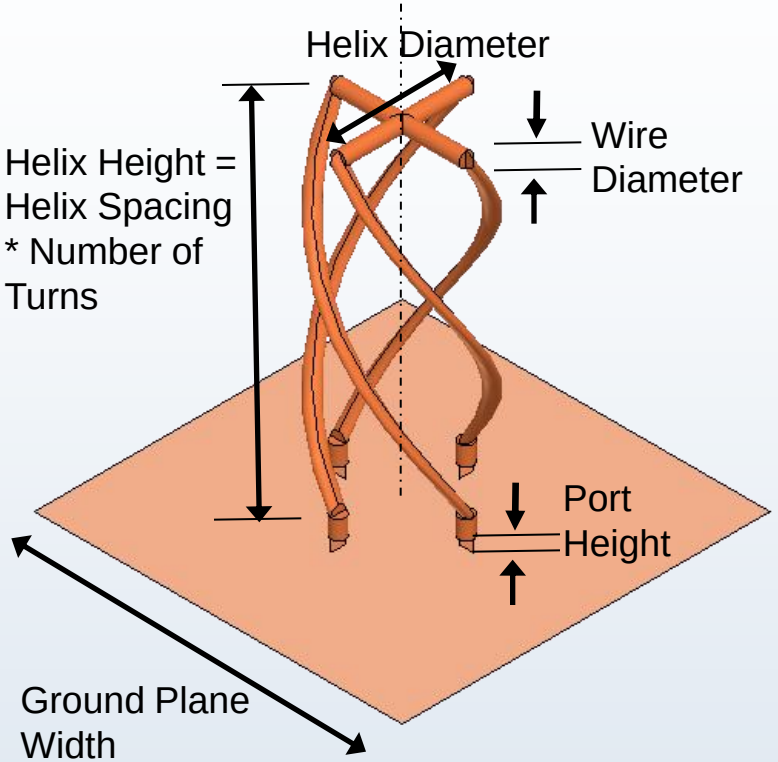
Helix – Quadrifilar Shorted
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Moderate	**Circular**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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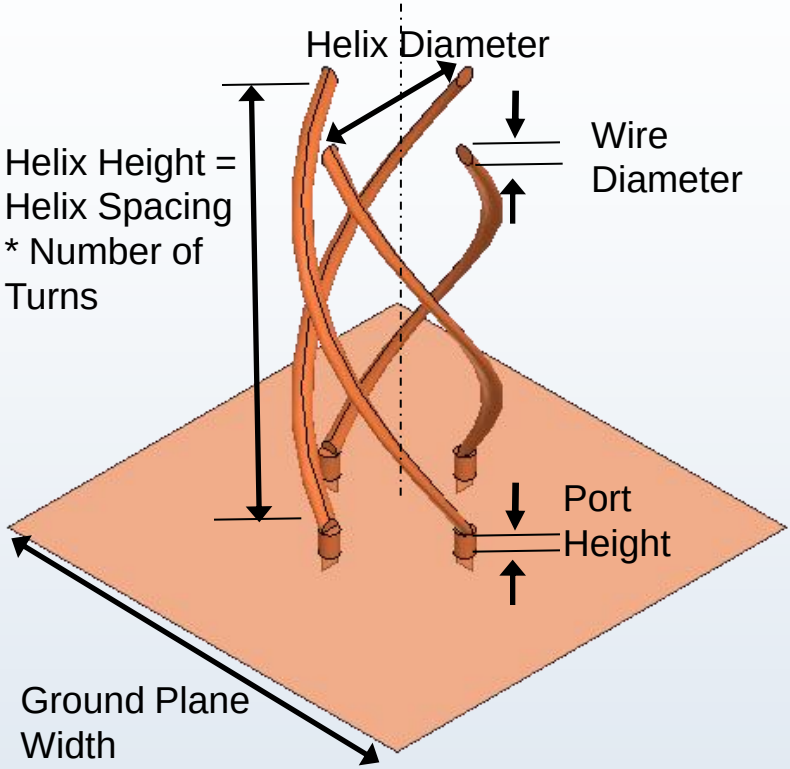
Helix – Quadrifilar Open
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Moderate	**Circular**	**Moderate**

Ref: Balanis, Constantine. “Wideband and Traveling-Wave Antennas.” Modern Antenna Handbook. New York, Wiley, 2008.

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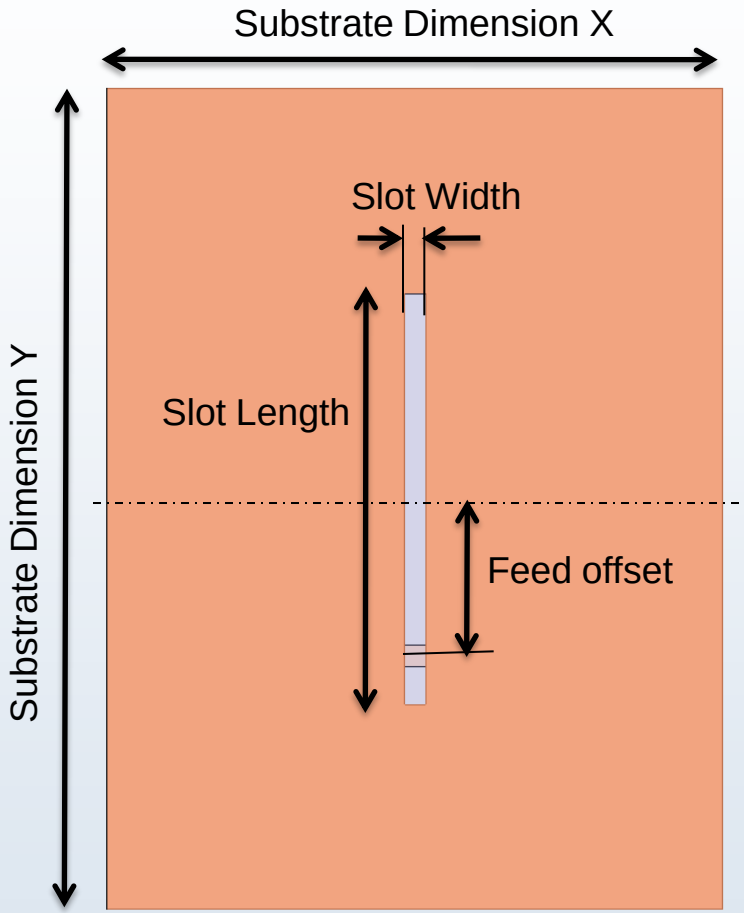
Slot Antenna
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Linear Wire Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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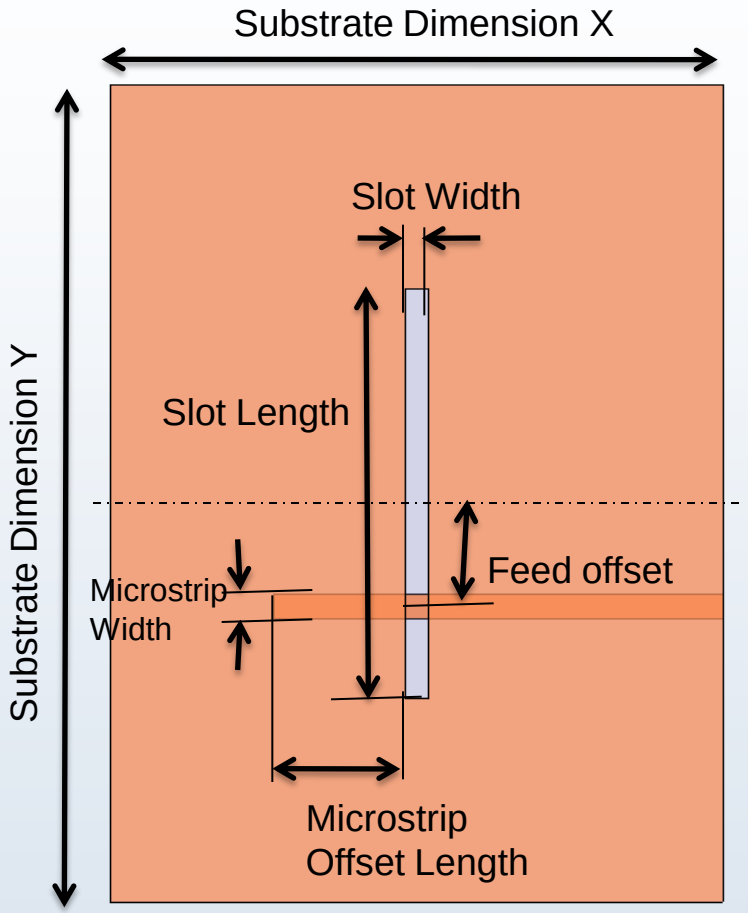
Slot Antenna – Microstrip Feed
Design Parameters



Antenna Characteristics		
Directivity	**Polarization**	**Bandwidth**
Low	**Linear**	**Narrow**

Ref: Balanis, Constantine. “Linear Wire Antennas.” Antenna Theory, 2nd Ed. New York, Wiley, 1997.

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