

Ansoft HFSS Antenna Design Kit Design Parameters

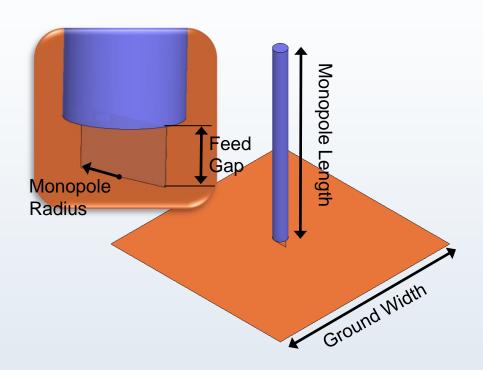


Arien Sligar

Wire Monopole Design Parameters



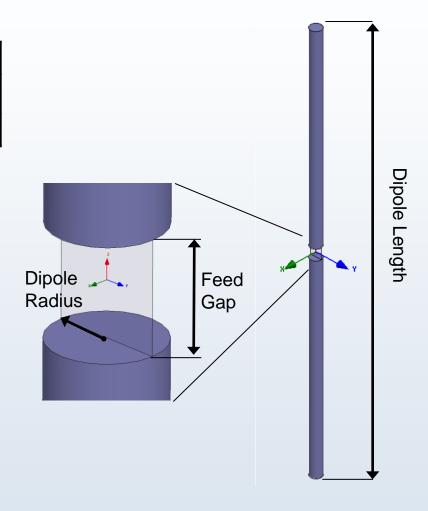
Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Narrow



Wire Dipole Design Parameters

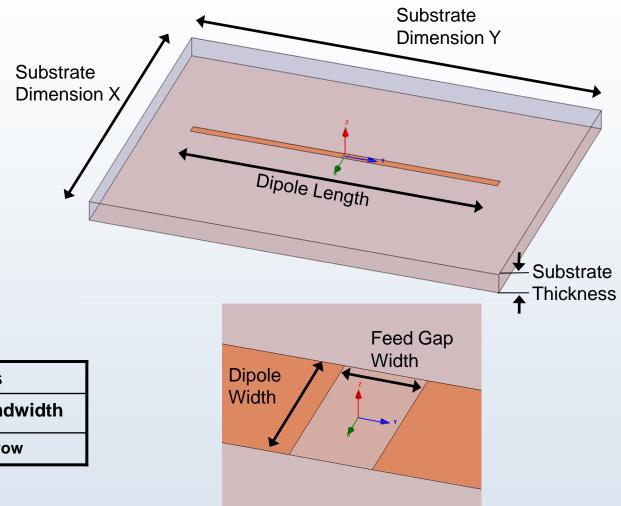


Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Narrow



Planar Dipole Design Parameters



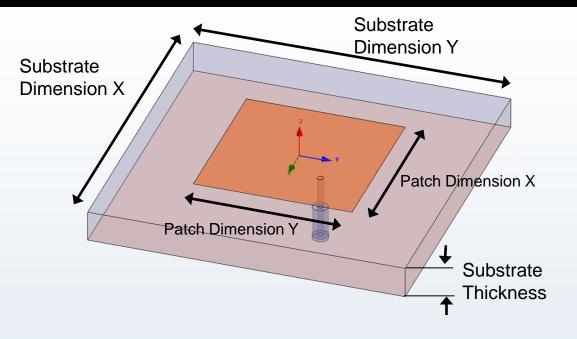


Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Narrow

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

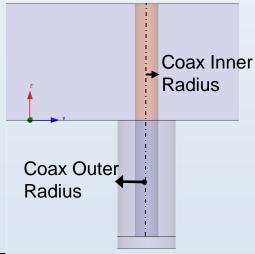
Rectangular Patch – Probe Fed Design Parameters





Feed Along X

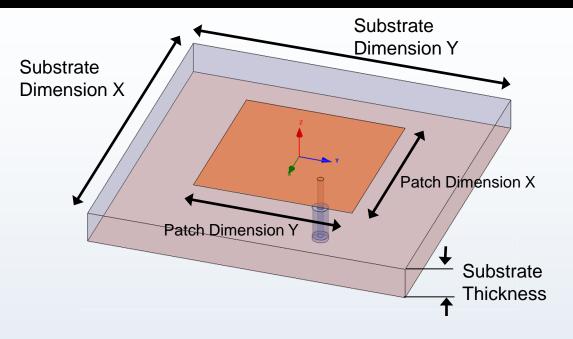
Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow



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

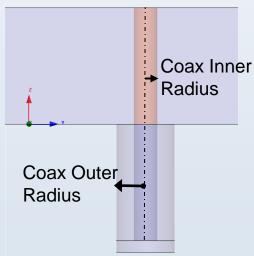
Rectangular Patch – Edge Fed Design Parameters





*

Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow



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

Rectangular Patch – Edge Fed Design Parameters

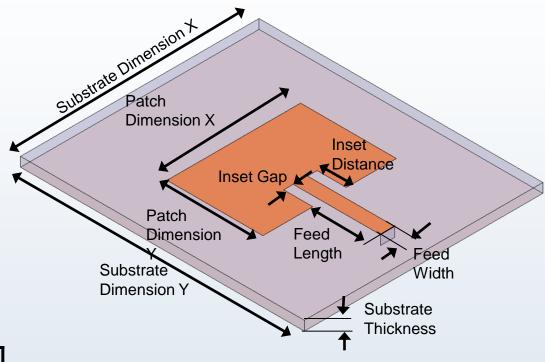


Substrate Dimension X		
E	dge Feed Vidth Edge Feed Length	Feed Length
Substrate Dimension		Feed Width Substrate Thickness

Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow

Rectangular Patch – Inset Fed Design Parameters

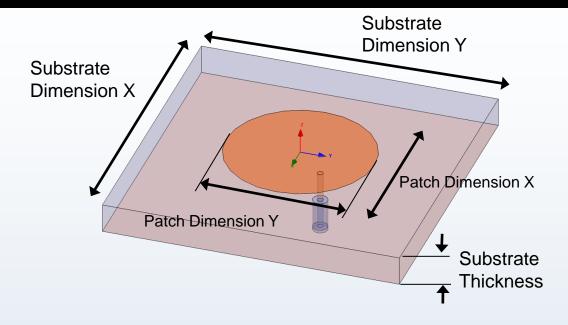


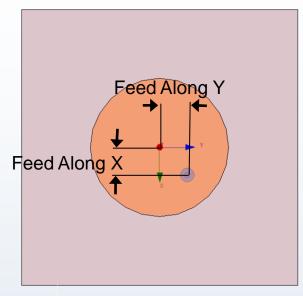


Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow

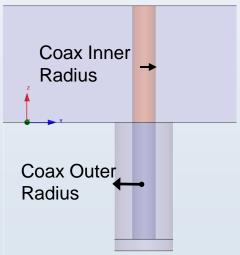
Elliptical Patch Design Parameters







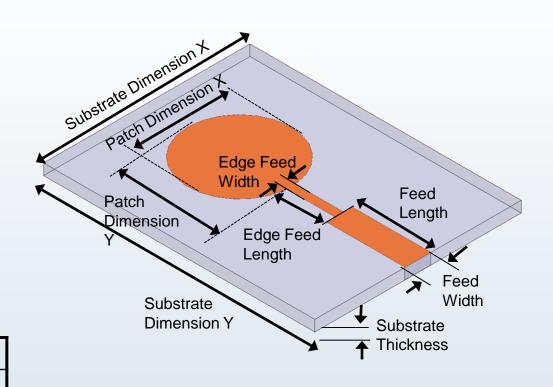
Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow



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

Elliptical Patch – Edge Fed Design Parameters

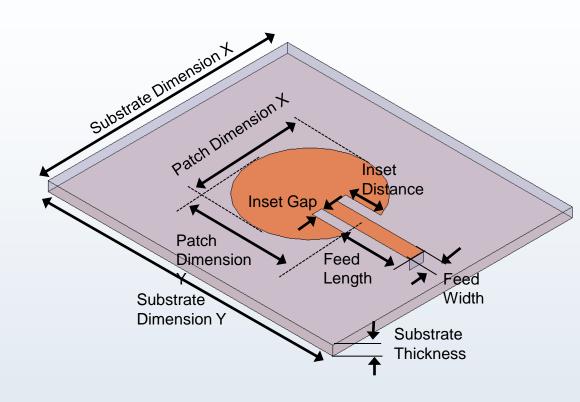




Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow

Elliptical Patch – Inset Fed Design Parameters





Antenna Characteristics				
Directivity	Directivity Polarization Bandwidth			
Medium	Linear	Narrow		

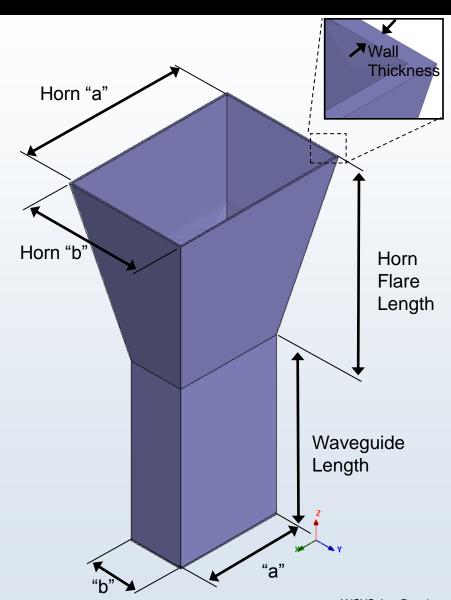
Ref: Balanis, Constantine. "Microstrip Antennas." Antenna Theory, 2nd Ed. New York, Wiley, 1997.

Pyramidal Horn Design Parameters



Antenna Characteristics		
Directivity	Polarization	Bandwidth
High	Linear	Moderate

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

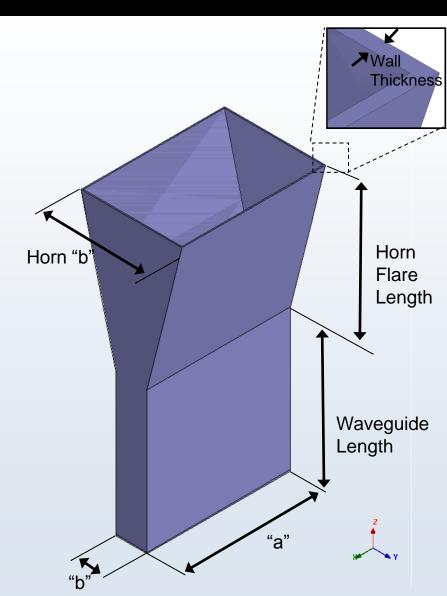


Sectoral Horn - E-Plane Design Parameters



Antenna Characteristics				
Directivity	Polarization Bandwidth			
Medium	Linear	Moderate		

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

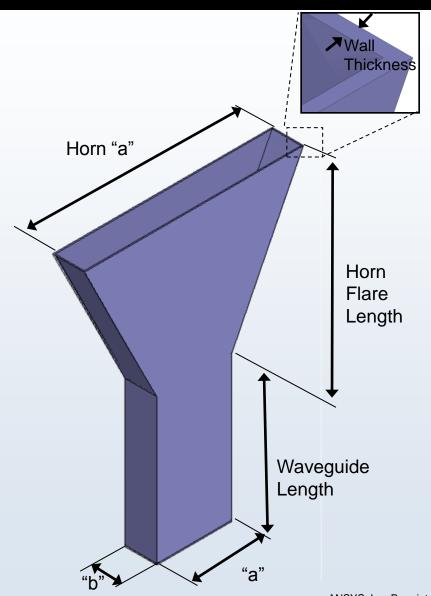


Sectoral Horn - H-Plane Design Parameters



Ante	nna Characteri	stics
Directivity	Polarization	Bandwidth
Medium	Linear	Moderate

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

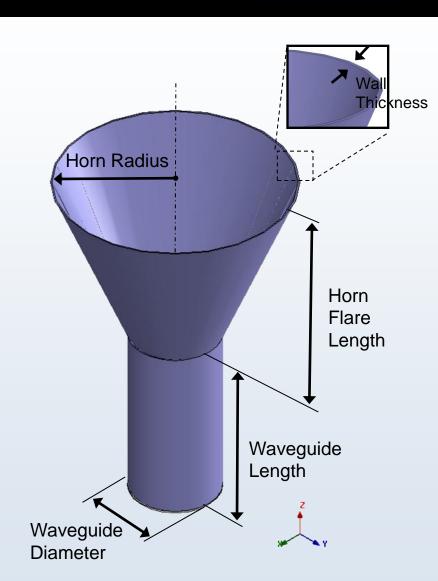


Conical Horn Design Parameters



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.



Elliptical Horn Design Parameters



.¦Wall-.

Thicknes

Anto	nna Characteris	vio a	Ratio = Horn Radius (Minor Axis/Major Axis)		Horn Flare Length
Directivity	Polarization	Bandwidth			aveguide
High	Circular/Linear	Moderate		Le	ength
: Balanis, Consta	ntine. "Aperture Ant	ennas: Analysis, [Waveguide Design, and Diameter		

Horn Radius

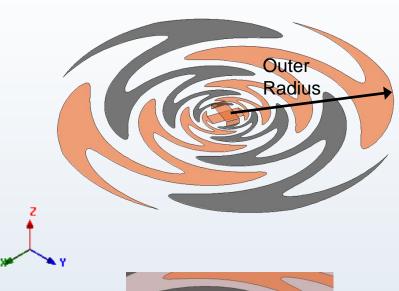
Major

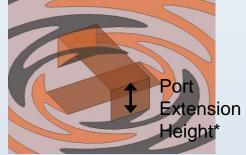
Ref: Balanis, Constantine. "Aperture Antennas: Analysis, Design, and Applications." Modern Antenna Handbook. New York, Wiley, 2008.

Planar Sinuous Design Parameters



Antenna Characteristics				
Directivity	ivity Polarization Bandwidth			
Medium	Dual-Circular	Wide		

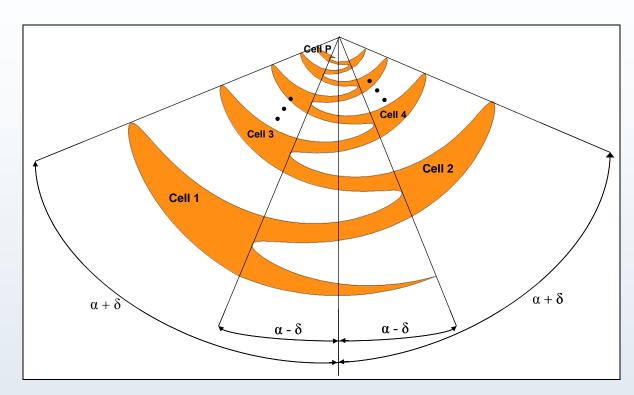




- * Port Extension Height only applicable to 4 arm spirals
- ** Spiral antenna only supports 2 or 4 arms

Planar Sinuous (cont.) Design Parameters





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

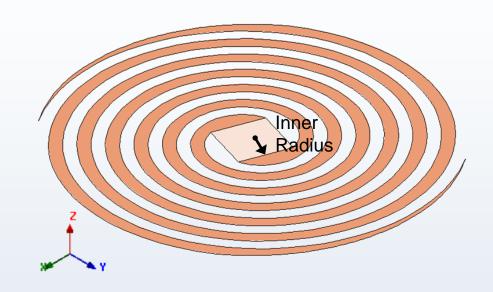
$$R_P = \tau_{P-1} R_{P-1}$$

Where ϕ and r are polar coordinates

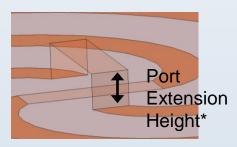
P is the cell number and τ is the growth rate

Planar Archimedean 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

Planar Archimedean (cont.) **Design Parameters**



 $r = r_0 + ExpansionCoefficient \cdot \phi^{(1/SpiralCoeficient)}$ Offset where, Angle $r_0 = \text{inner radius}$ 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



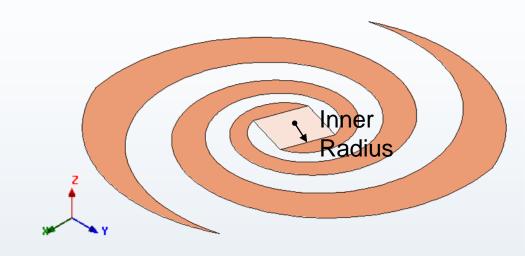
Spiral Coefficient = 1



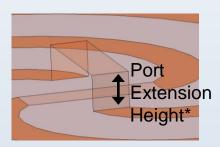
Ref: Johnson, Richard. "Frequency Independent Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

Planar 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

Planar Log-Spiral (cont.) Design Parameters

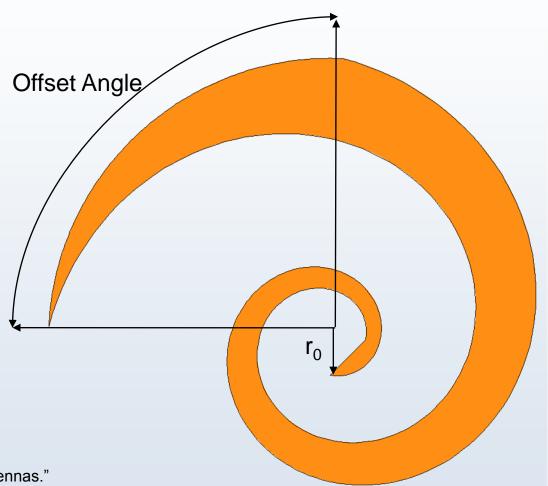


$$r = r_0 e^{a\phi}$$

where,

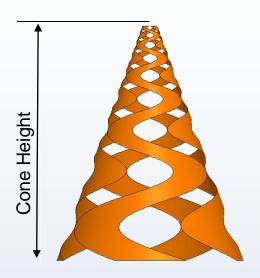
 r_0 = inner radius

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



Conical Sinuous Design Parameters





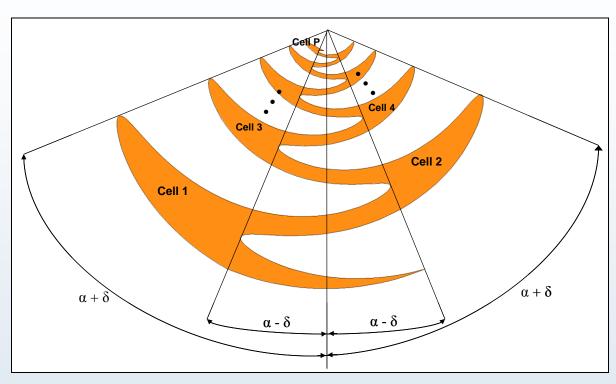


^{**} Spiral antenna only supports 2 or 4 arms

Antenna Characteristics			
Directivity Polarization Bandwidth			
Medium Dual-Circular Wide		Wide	

Conical 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

Conical Archimedean Design Parameters



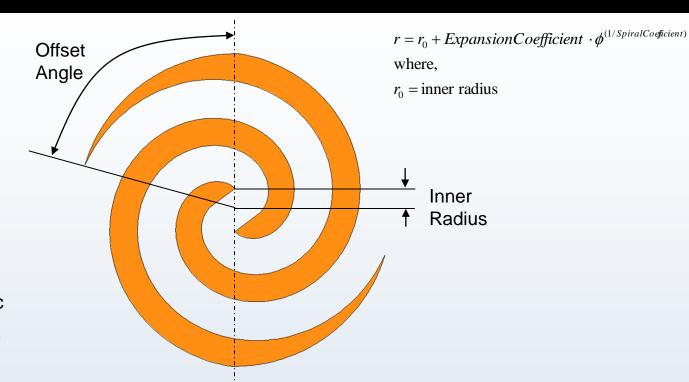
Port Extension Height*

- * Port Extension Height only applicable to 4 arm spirals
- ** Spiral antenna only supports 2 or 4 arms

Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Circular	Wide

Conical Archimedean (cont.) Design Parameters





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

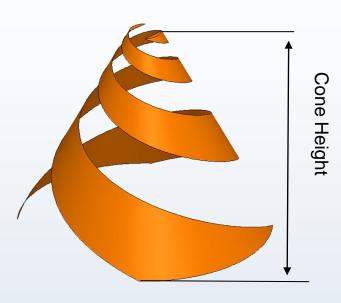


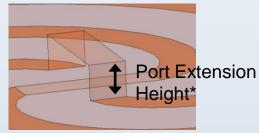
Conical Log-Spiral Design Parameters



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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Conical Log-Spiral (cont.) Design Parameters

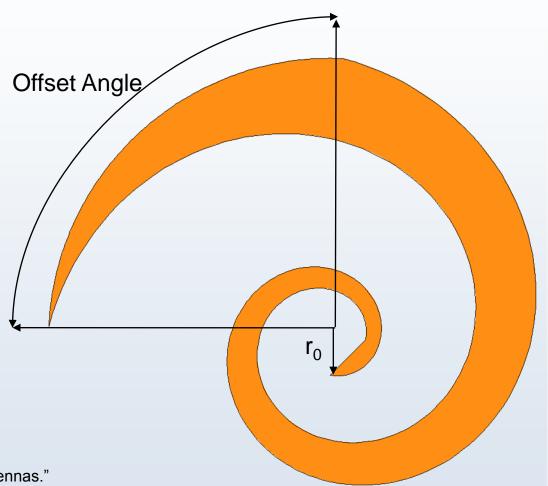


$$r = r_0 e^{a\phi}$$

where,

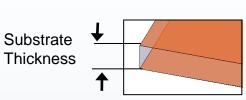
 $r_0 = \text{inner radius}$

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

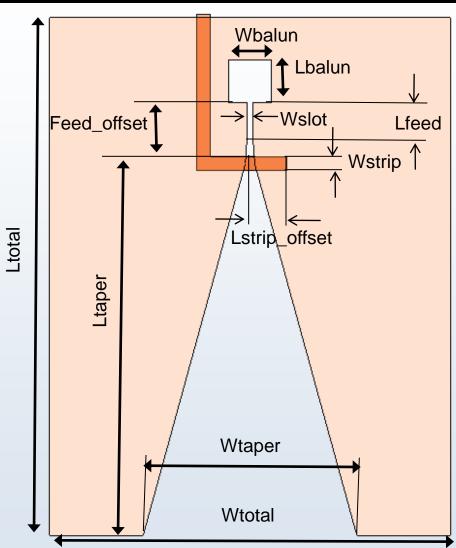


Linear Tapered Slot Design Parameters





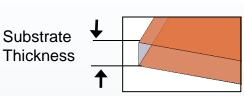
Antenna Characteristics		
Directivity	Polarization	Bandwidth
High	Linear	Wide



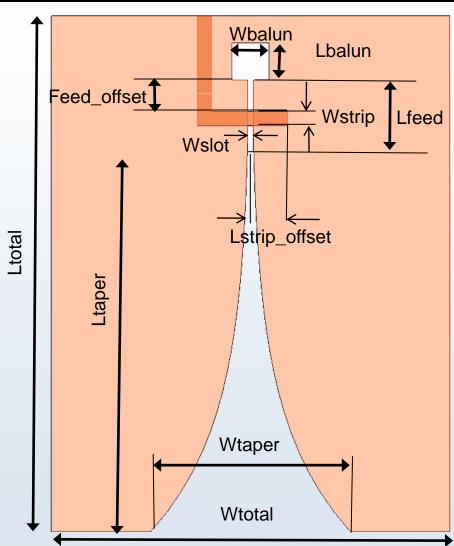
Ref: Johnson, Richard. "Slot Antennas." Antenna Engineering Handbook, 3rd Ed. New York, McGraw-Hill, 1993.

Vivaldi – Continuous Design Parameters





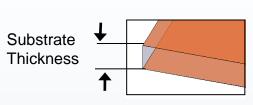
Antenna Characteristics		
Directivity	Polarization	Bandwidth
High	Linear	Wide



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

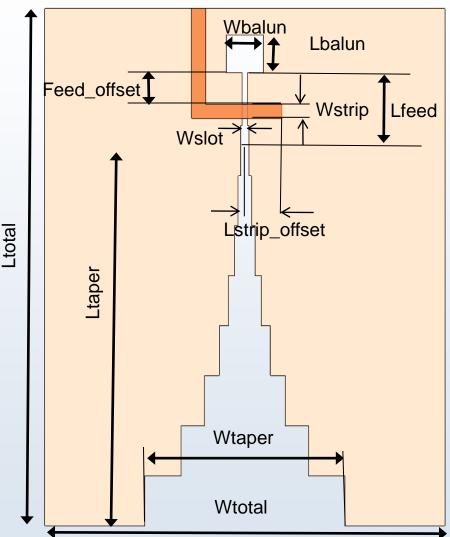
Vivaldi – Stepped Design Parameters





Ltotal

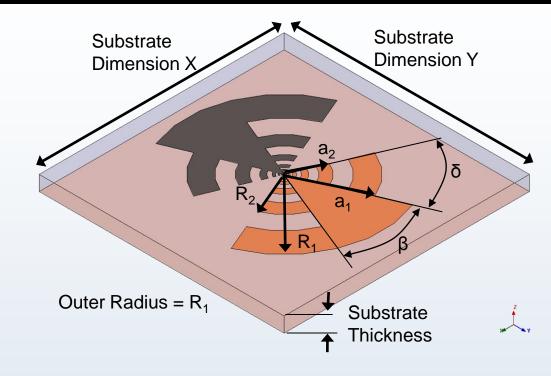
Antenna Characteristics		
Directivity	Polarization	Bandwidth
High	Linear	Wide



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

Log Periodic Toothed Design Parameters





Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Wide

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

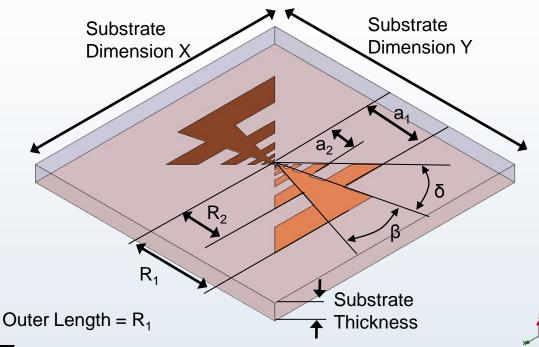
$$\sigma = \frac{a_n}{R_n} < 1$$

Port Gap

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

Log Periodic Toothed – Trapezoid Design Parameters





Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Wide

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

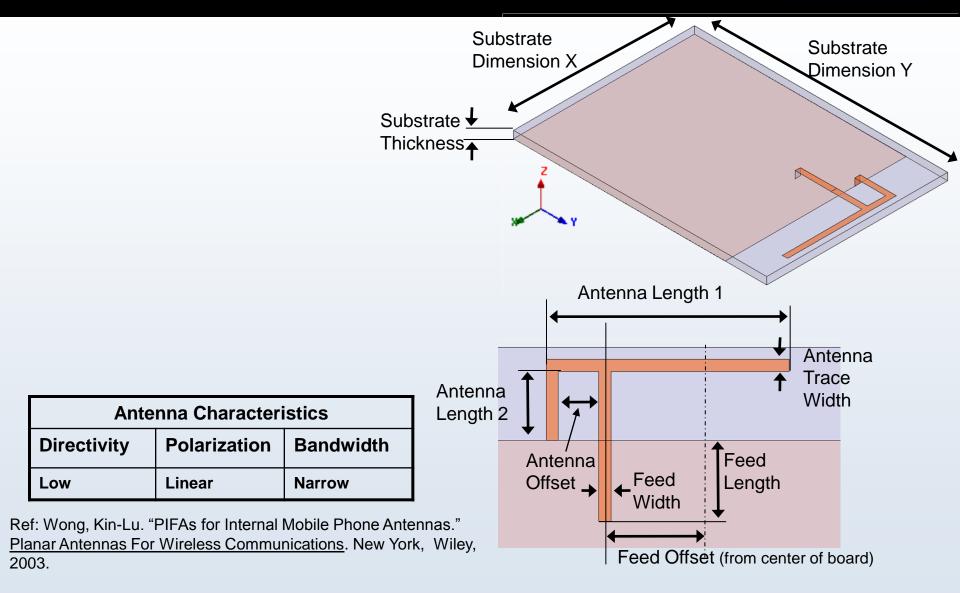
$$\sigma = \frac{a_n}{R_n} < 1$$



Ref: Balanis, Constantine. "Frequency Independent Antennas: Spirals and Log Periodics." <u>Modern Antenna Handbook</u>. New York, Wiley, 2008.

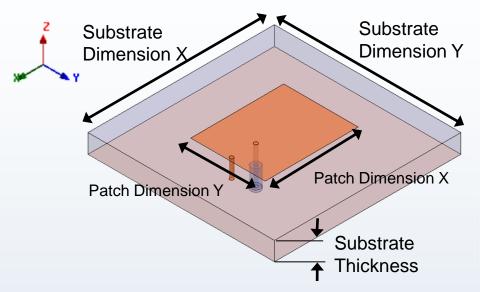
PIFA Design Parameters

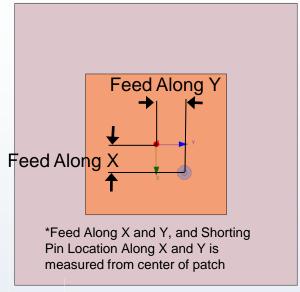




PIFA - Shorting Pin Design Parameters

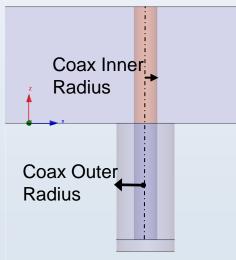






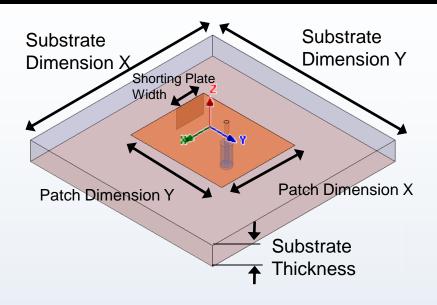
Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Narrow

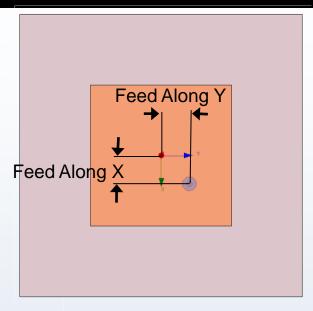
Ref: Wong, Kin-Lu. "PIFAs for Internal Mobile Phone Antennas." <u>Planar Antennas For Wireless Communications</u>. New York, Wiley, 2003.



PIFA - Shorting Plate Design Parameters





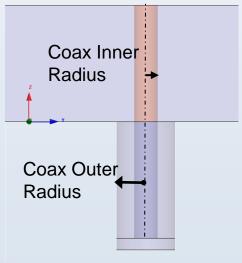


*Feed Along X and Y is measured from center of patch

**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." <u>Planar Antennas For Wireless Communications</u>. New York, Wiley, 2003.



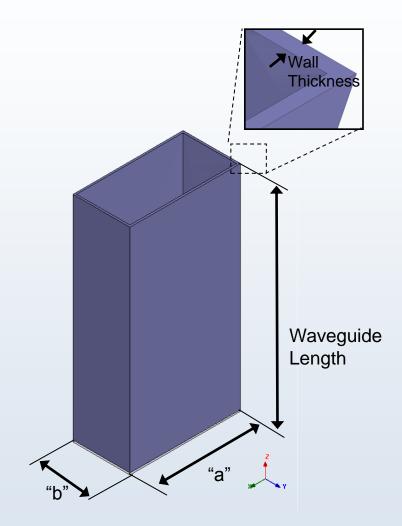
ANSYS, Inc. Proprietary

Rectangular Waveguide - Open Ended Design Parameters



Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Linear	Moderate

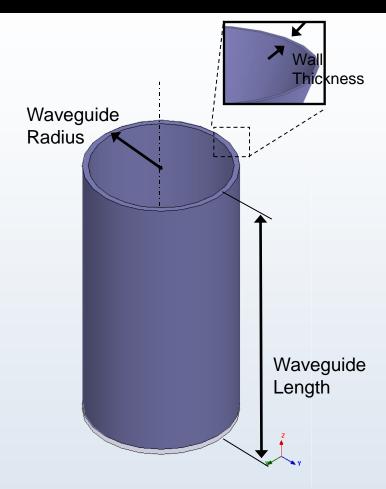
Medium Linear Moderate



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

Circular Waveguide - Open Ended Design Parameters



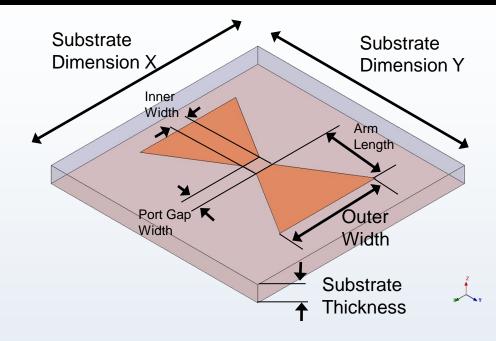


Antenna Characteristics		
Directivity	Polarization	Bandwidth
Medium	Circular/Linear	Moderate

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

Bowtie Design Parameters

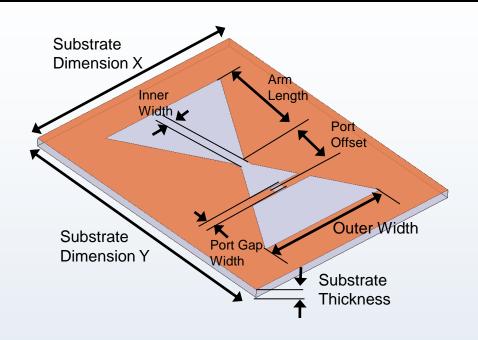




Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Moderate

Bowtie - Slot Design Parameters

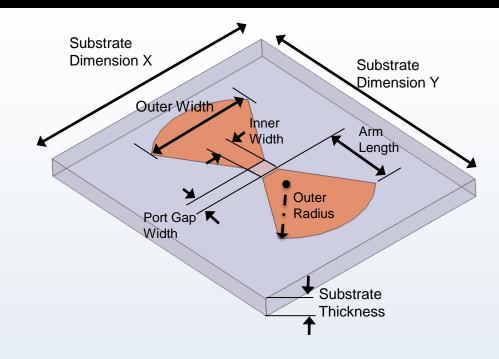




Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Moderate

Bowtie - Rounded Design Parameters

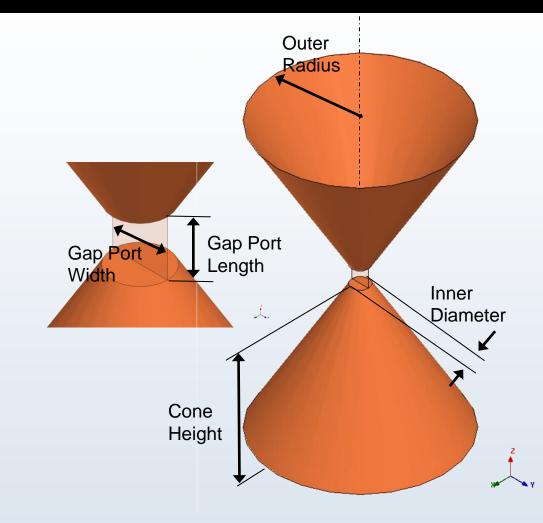




Antenna Characteristics		
Directivity Polarization Bandw		Bandwidth
Low	Linear	Moderate

Bicone Design Parameters



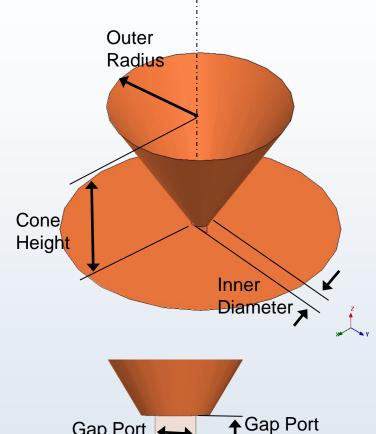


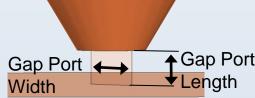
Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Moderate

Discone Design Parameters



Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Linear	Moderate





Helix – Axial Mode Design Parameters



Helix Spacing	Wire Diameter
	↓ Feed Pin Height
	1
Ground Plane Width	

Helixi Diameter

Antenna Characteristics		
Directivity Polarization Bandwidth		Bandwidth
High/Moderate	Circular	Moderate

Helix – Axial Mode – Continuous Taper Design Parameters



Wire

Diameter

Antenna Characteristics		
Directivity	Polarization	Bandwidth
High/Moderate	Circular	Moderate

Feed Pin Height Helix Diameter **Ground Plane** Width

Helix

Spacing

Helix – Normal Mode Design Parameters



Helix Spacing	Wire
	↓ Feed Pin Height
Ground Plane Width	T

Helix Diameter

Antenna Characteristics		
Directivity	Polarization	Bandwidth
Low	Circular	Low

Helix – Quadrifilar Shorted Design Parameters



	nelix Diameter
Helix Height = Helix Spacing * Number of Turns	→ Wire Diameter
	Port Height
Ground Plane Width	

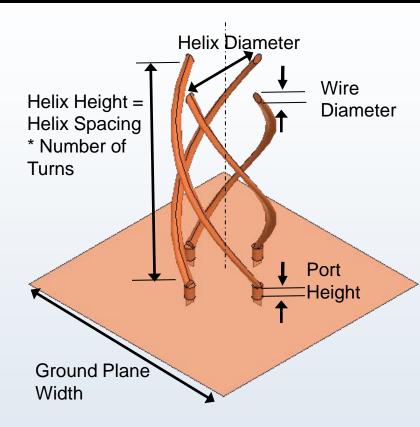
Haliy Diameter

Antenna Characteristics			
Directivity	Polarization	Bandwidth	
Moderate	Circular	Moderate	

Helix – Quadrifilar Open Design Parameters



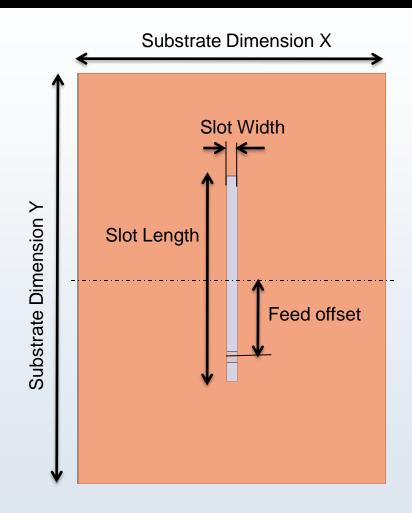
Antenna Characteristics			
Directivity	Polarization	Bandwidth	
Moderate	Circular	Moderate	



Slot Antenna Design Parameters



Antenna Characteristics			
Directivity	Polarization	Bandwidth	
Low	Linear	Narrow	



Slot Antenna – Microstrip Feed Design Parameters



Antenna Characteristics			
Directivity	Polarization	Bandwidth	
Low	Linear	Narrow	

