

Antenas

Cisco Fundamentals of Wireless LANs version 1.2

Contenido

- Temas:
 - Antenas
 - Antenas direccionales
 - Antenas omnidireccionales
 - Cables y accesorios
 - Planeación
- Todo lo relacionado con antenas involucra un balance:
 - Si se desea un rango máximo la cobertura deberá ser sacrificada.



Antenas

Tipos de antenas

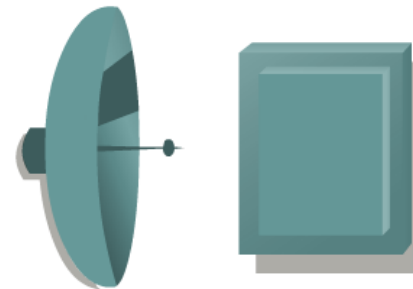


Omnidirectional

OMNI	
Type	Application
dipole	Indoor
Mast mount	Indoor/outdoor
Ceiling mount	indoor

Irradian energía de RF de manera equitativa en todas direcciones.

Omnidireccional



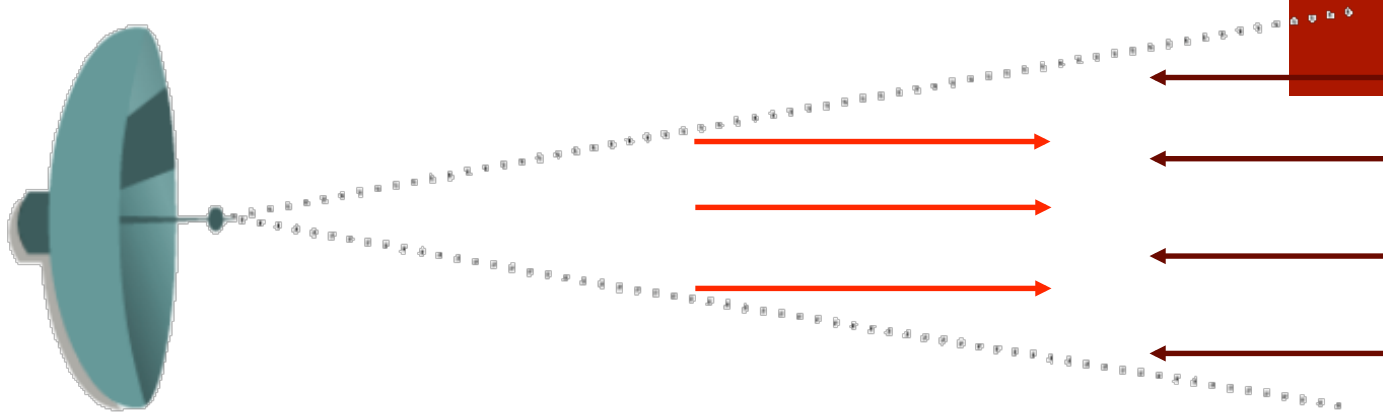
Directional

DIRECTIONAL	
Type	Application
Patch	Indoor
Yagi	outdoor P2P/P2MP
Dish	outdoor P2P/P2MP

Irradian energía de RF hacia una sola dirección.

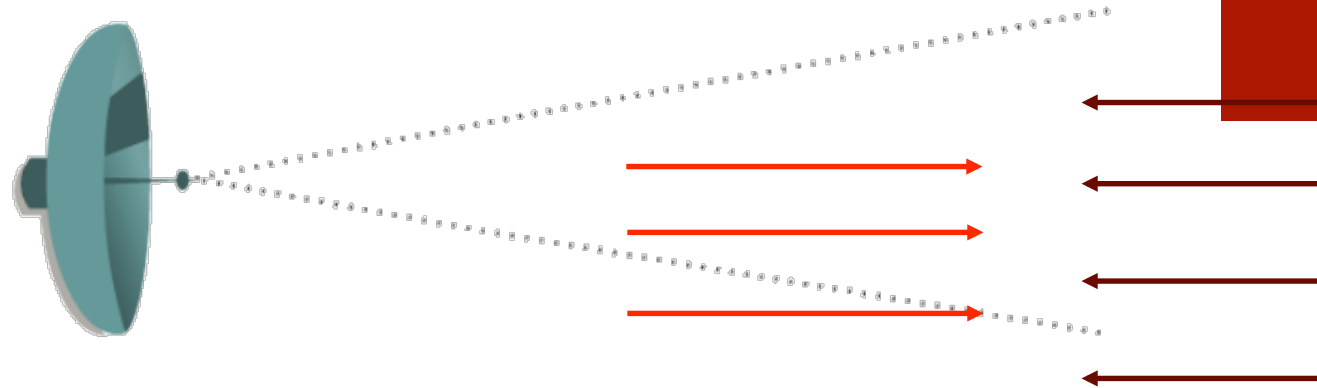
Direccional

Función de las antenas



- Las antenas utilizadas para WLAN tienen dos funciones:
 - **Recibir:**
 - Es el sink o terminación de una señal en un medio de transmisión.
 - In communications, it is a device that receives Information, control, or other signals from a source.
 - **Transmitir:**
 - Es la fuente u originador de una señal en un medio de transmisión.

Formas de comunicación



- Existen dos formas en las que se puede dar la comunicación en radio:
 - **FDD (Frequency Division Duplex)**
 - Full duplex
 - Una frecuencia diferente es usada en cada dirección.
 - Debe reservar dos espectros en dos bandas, una para cada dirección.
 - **TDD (Time Division Duplex)**
 - Half duplex
 - Utiliza el mismo canal o frecuencia pero con periodos alternos para la recepción y emisión.

Variables






- Las distancias máximas que una antena puede proveer pueda darse en kilómetros.
- La distancia máxima del enlace no es fácil de obtener y normalmente está regido por:
 - Potencia de transmisión máxima
 - Sensibilidad del receptor
 - Disponibilidad de un camino libre de obstrucciones
 - Ganancia máxima de la antena
 - Pérdidas del sistema (pérdida por cable y/o conectores)
 - Nivel de confiabilidad (disponibilidad) esperado del enlace

Antenna Variables

- Bandwidth
- Beamwidth
- Gain
- Polarization
- Diversity
- Power

Rangos

- Los rangos están optimizados para las mejores condiciones.
- La distancia de un enlace puede exceder distancias estándar link distance can exceed standard distances si las tasas de error son superiores.

	 Rubber dipole	 Pillar Mount	 Patch Wall	 Ceiling Mount	 Ceiling Mount High Gain
Type	omni	omni	Directional	omni	omni
Gain	2.15 dBi	5.2 dBi	8.5 dBi	2.2 dBi	5.2 dBi
Beamwidth	360° H 75° V	360° H 75° V	60° H 55° V	360° H 75° V	360° H 75° V
Indoor Range at 1Mbps	300' 91.4 m	497' 151.5 m	700' 213.4 m	350' 106.7 m	497' 151.5 m
Indoor Range at 11Mbps	100' 30.5 m	142' 43.3 m	200' 61 m	100' 30.5 m	142' 43.3 m
Cable Length	N/A	3' 0.9 m	3' 0.9 m	9' 2.7 m	3' 0.9 m

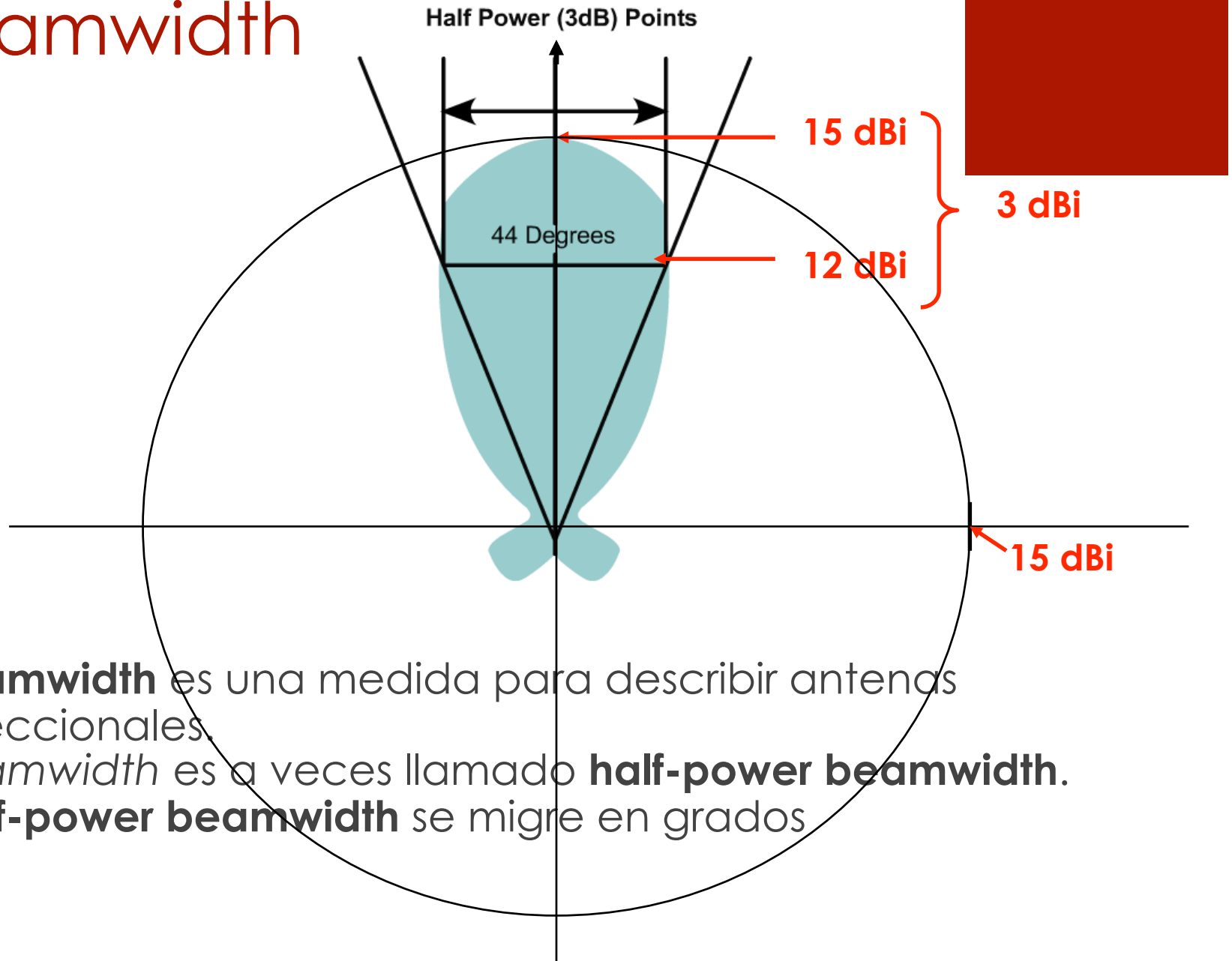
Ancho de banda de la antena: Rango de frecuencias

- (Existen varias definiciones para el termino de ancho de banda.)
- El ancho de banda de una antena es la **banda de frecuencias** sobre la cual se desempeña de manera satisfactoria.
- Mientras más ancho de la banda de frecuencias que comprende será también más amplio el ancho de banda de la antena.
- Las antenas son pre-sintonizadas de acuerdo a las peticiones del cliente.
- Una antena con un ancho de banda más amplio generalmente no tiene un buen desempeño en comparación con una antena de ancho de banda más angosto.

Percent Bandwidth is Defined as:

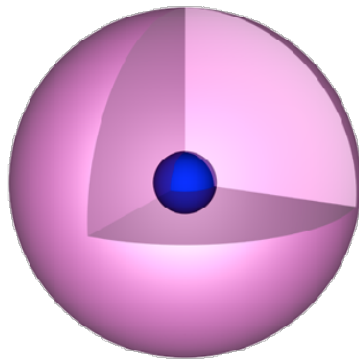
- $BW = 100 \frac{F_H - F_L}{F_C}$ where:
- F_H is the highest frequency in the band
- F_L is the lowest frequency in the band
- F_C is center frequency in the band $F_C = \frac{F_H + F_L}{2}$

Beamwidth



- **Beamwidth** es una medida para describir antenas direccionales.
- *Beamwidth* es a veces llamado **half-power beamwidth**.
- **Half-power beamwidth** se mide en grados

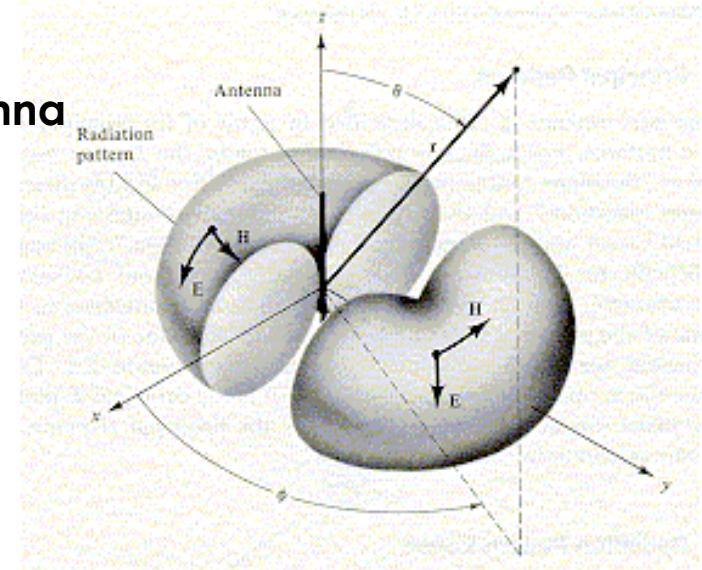
Ganancia



theoretical
isotropic antenna

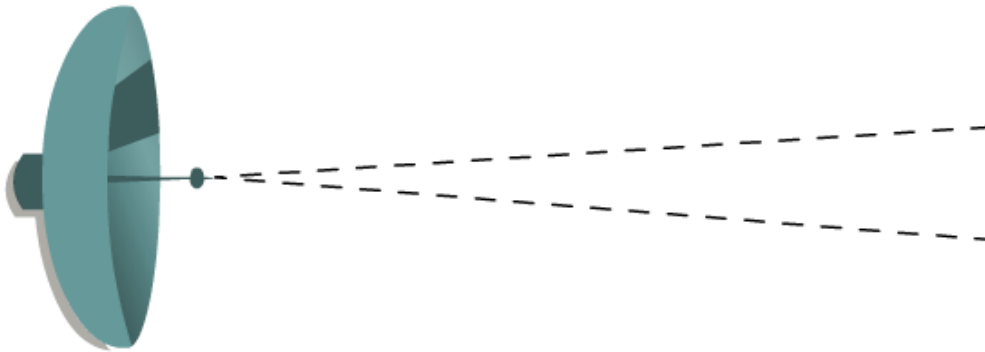
$$dBi = dBd + 2.14$$

Half-wave
dipole antenna

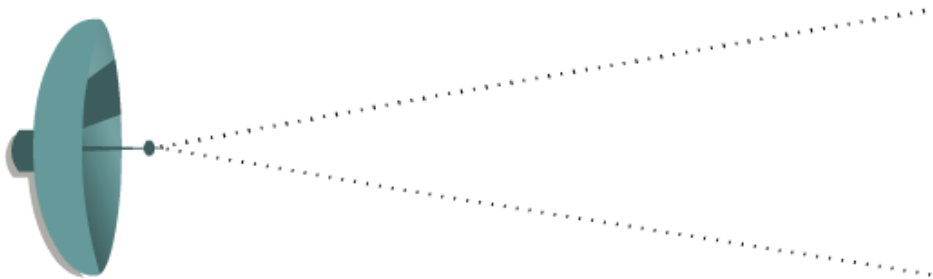


- La **ganancia** de cualquier antena es esencialmente una medida de qué tan bien la antena enfoca su energía de RF hacia una dirección en particular.
- Existen diferentes métodos para medirla.
- Cisco utiliza **dBi** para especificar ganancias.
 - Este método utiliza una antena **isotrópica** como punto de referencia.
- Algunas antenas son medidas en **dBd**, que utiliza una antena **dipolar**.
- Para convertir cualquier número de dBd a dBi, simplemente sumar 2.14 al número dBd.

Ganancia



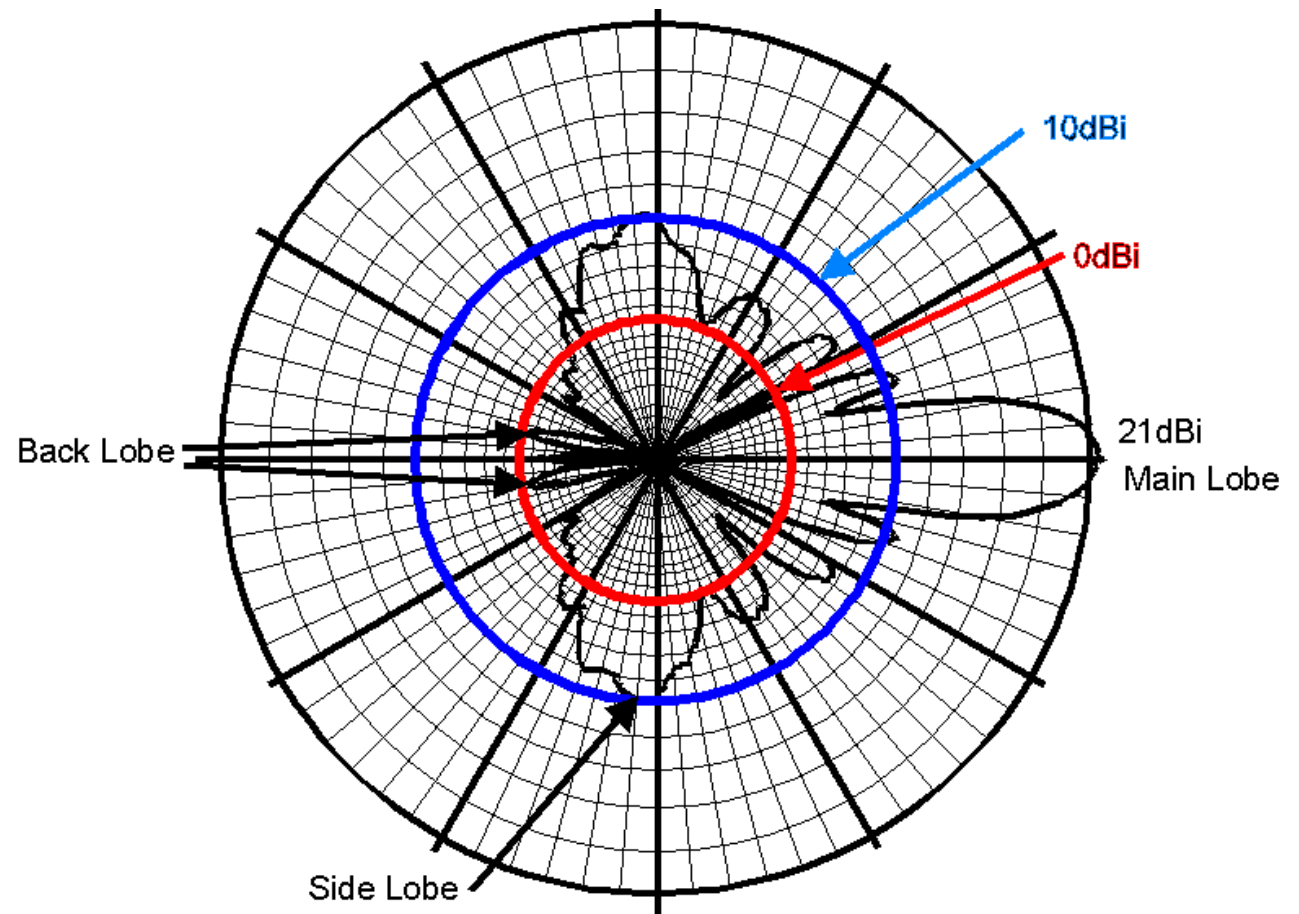
Higher-gain antennas have narrower beamwidths and less chance of receiving interference.



Lower-gain antennas have wider beamwidths and a greater chance of receiving interference.

Ganancia

- Antenas tiene ganancia en direcciones particulares.



Antenas de Cisco Aironet 802.11b

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- FCC pide que TODAS las antenas sean vendidas por un distribuidor certificado en la radio que venderá.
- Todas las antenas Cisco Aironet 802.11b proveen cables, dispositivos de RF y las antenas tienen conectores RP-TNC (Reverse Polarity-TNC).
- Las antenas de Cisco Aironet cumplen con todas las reglas establecidas por la FCC.



Cisco Aironet 802.11a Antennas

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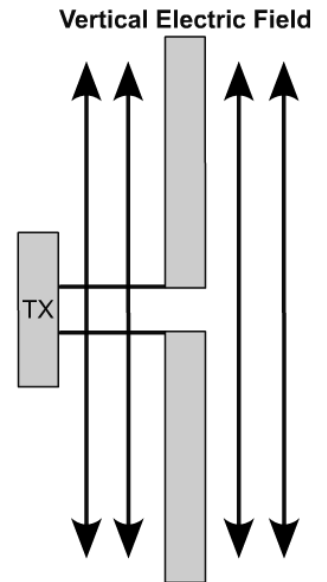
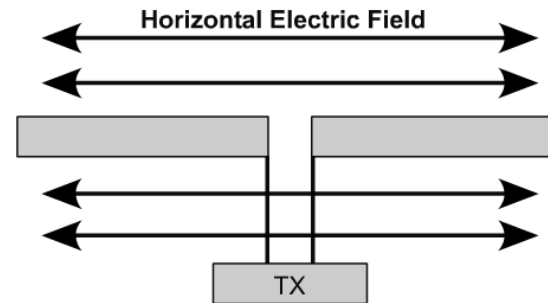


BAND	CHANNEL NUMBERS	FREQUENCY (GHz)	MAXIMUM OUTPUT POWER
U-NII lower band 5.15 to 5.25 GHz	36	5.180	40mW (2.5mW/MHz)
	40	5.200	
	44	5.220	
	48	5.240	
U-NII mid band 5.25 to 5.35 GHz	52	5.260	200mW (12.5mW/MHz)
	56	5.280	
	60	5.300	
	64	5.320	
U-NII upper band 5.725 to 5.825 GHz	149	5.745	800mW (50mW/MHz)
	153	5.765	
	157	5.785	
	161	5.805	

- **FCC pide** que todos los radios utilizando la banda UNII-1 (5.15 GHz – 5.25 GHz) deben tener antenas no removibles o integradas
- **FCC permite** radios utilizando la Banda UNII-2 (5.25 GHz – 5.35 GHz) tener antenas removibles o externas
- El radio de **Cisco Aironet 802.11a** utiliza **ambas bandas UNII-1 y UNII-2**, por lo que **no puede tener antenas externas o removibles**
- Antenas de Cisco 802.11a son integradas al módulo de radio
- **Radios de Cisco 1400 utilizan bandas UNII-2**, pueden tener **antenas externas o removibles**

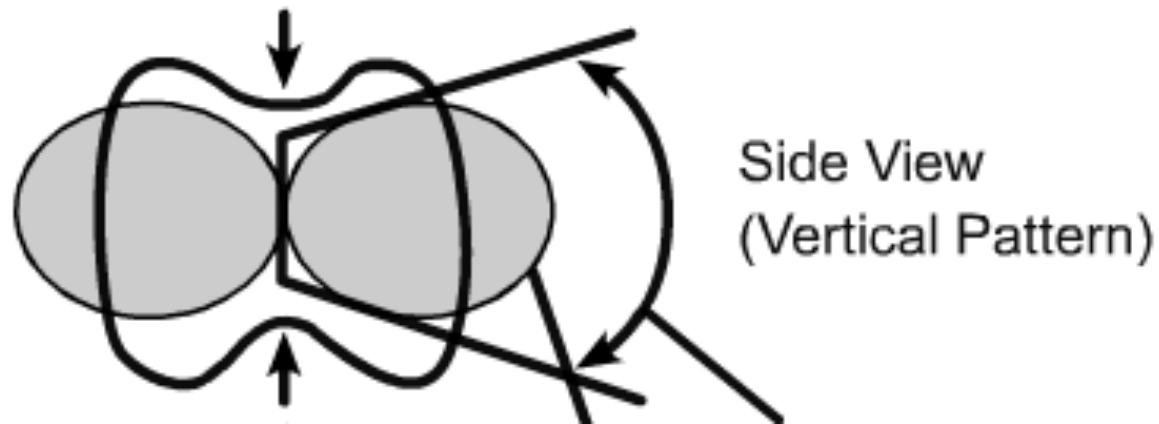
Polarización

Polarization Category	Polarization Sub-Category	Notes
Linear	Vertical or Horizontal	The vast majority of microwave or dish-type antennas are linearly polarized.
Circular	Right Handed or Left Handed	This is not encountered much in commercial data communications.



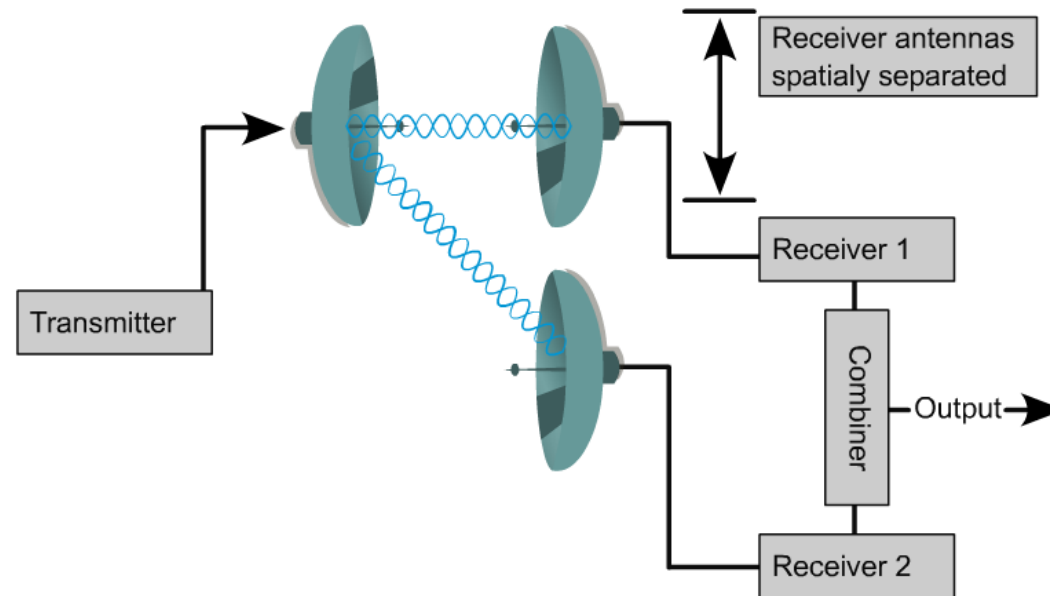
- Polarización es la orientación física del elemento de la antena que emite la energía RF.
- Una antena **omnidireccional** es usualmente una antena polarizada verticalmente.
- **Todas** las antenas de **Cisco** tiene polarización vertical.

Patrones de radiación



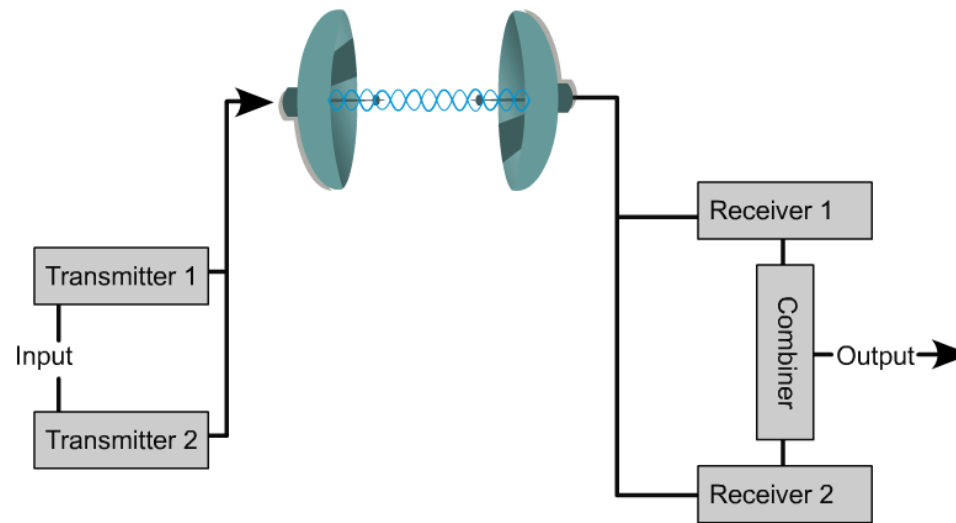
- Cubre más área en el patrón horizontal pero reduce el área de cobertura arriba y abajo.
- Esto permite una mayor ganancia en una cobertura horizontal

Space Diversity



- Con **space diversity**, el receptor de un radio de microondas acepta señales de dos o más antenas que están espaciadas por muchas ondas de radio.
- La señal de cada antena es recibida y después simultáneamente conectada a un combinador de diversidad.
- Dependiendo en el diseño, la función de un combinador es o seleccionar la mejor señal de sus entradas o unir las señales.

Frequency Diversity



- Con **frequency diversity**, la señal de información es simultáneamente transmitida por dos transmisores operando en dos frecuencias diferentes.
- Si la separación en frecuencias de dos transmisores es grande, la frecuencia selectiva que se está desvaneciendo tendrá probabilidad baja de afectar ambos caminos de la misma forma.
- Esto mejorará el desempeño del sistema.
- Los Aps pueden tener dos antenas conectadas a ellos.
 - Estas dos antenas son para la diversidad en la señal de recepción y, **no** para incrementar la cobertura.



Antenas Omni-
direccionales

Omni-directional Antennas

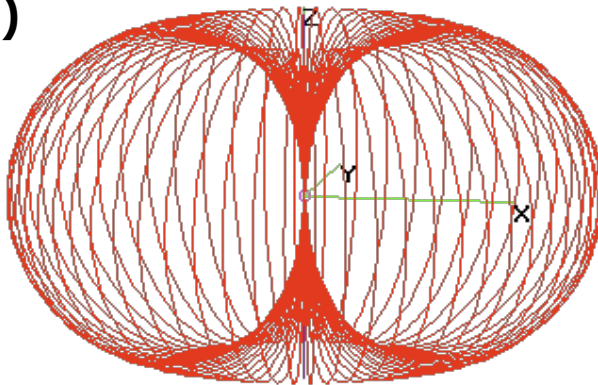


- An **omni-directional antenna** is designed to provide a 360 degree radiation pattern.
- This type of antenna is used when coverage in all directions from the antenna is required.
- Omni-directional antennas come in many different styles and shapes.
- **Most** operated in the 2.4 GHz ranges, whereas a **few** operate in the 5 GHz range.
- **Omni-directional antennas** include dipoles, mast mount, pillar, and patch antennas.
- The standard 2.14 dBi "Rubber Duck" is the most commonly used omni-directional antenna.

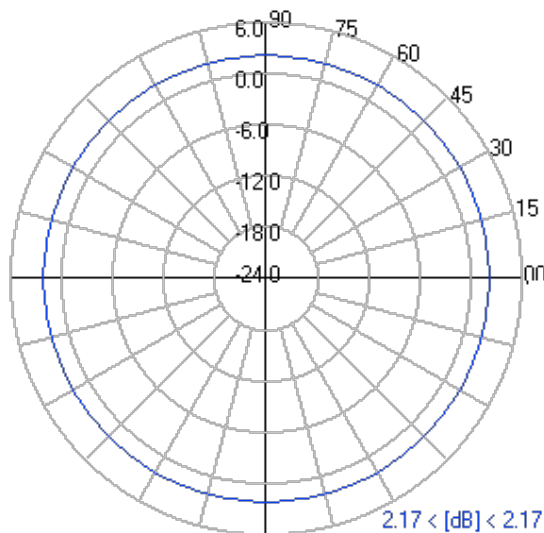
Dipole Antenna Radiation Pattern

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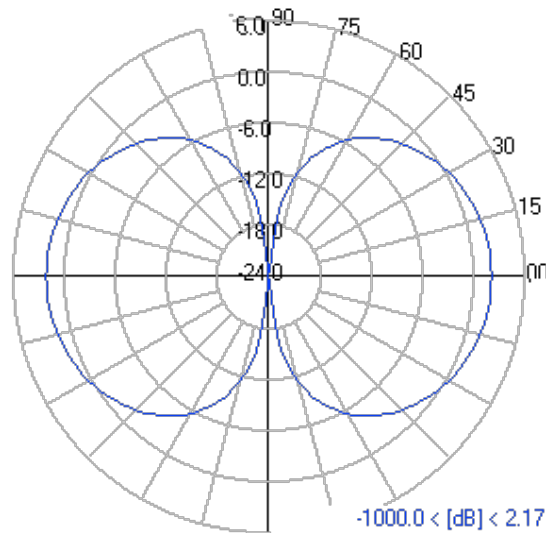
Side View (E)



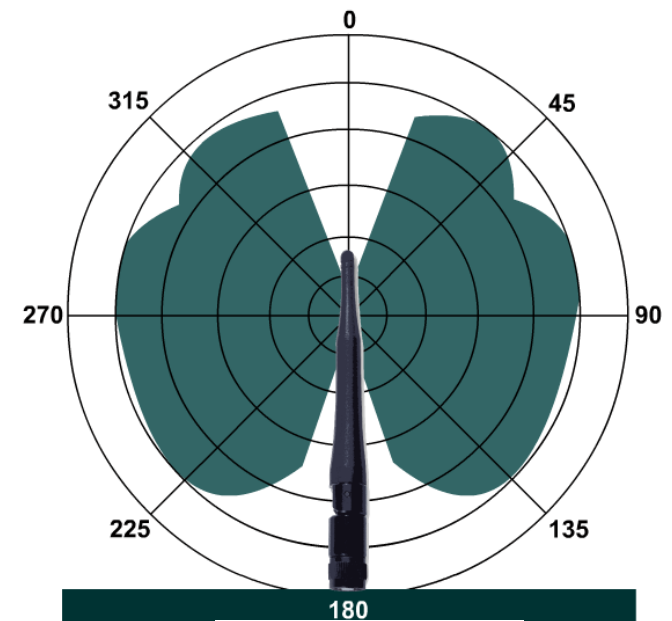
- The radiation patterns will be shown as a **horizontal, looking down (H-plane)** radiation pattern, an **Elevation, looking across (E-plane)**, or **Vertical** radiation pattern, or both.



Top View
(H)

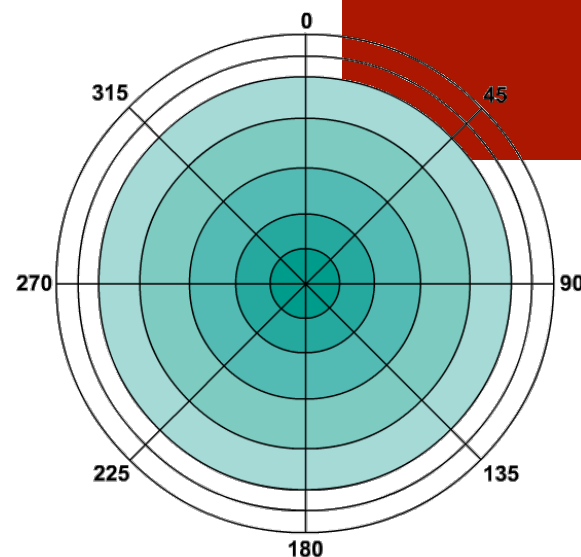
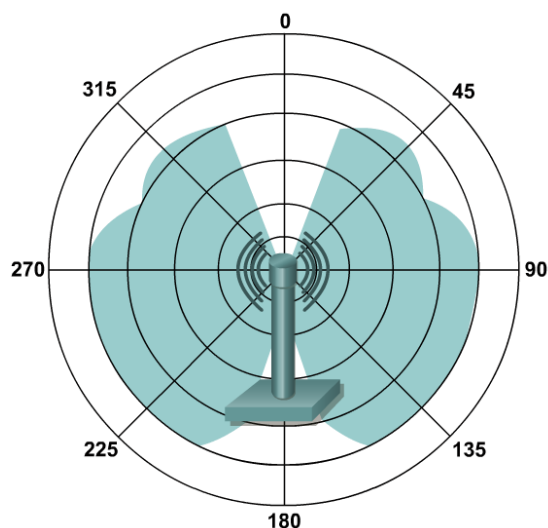


Side View
(E)



Side View
(E)

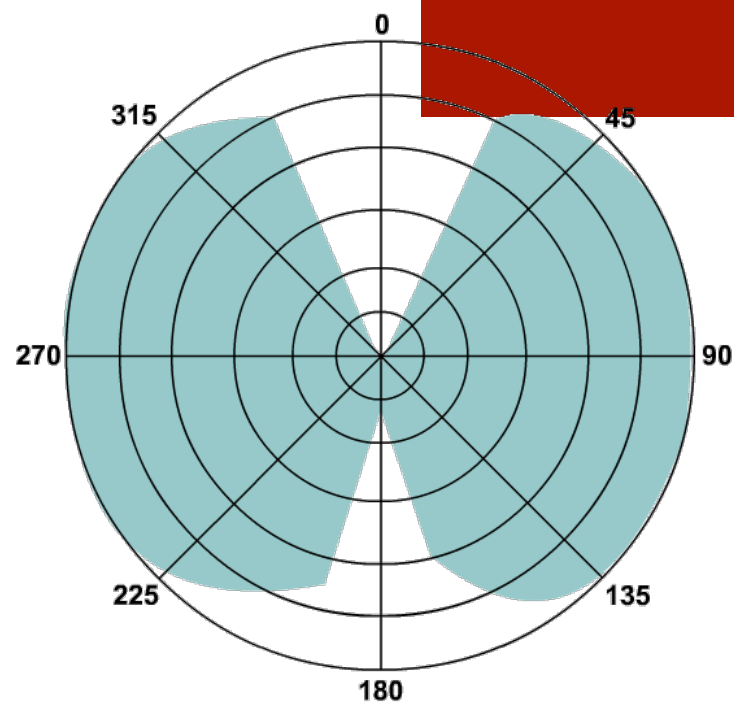
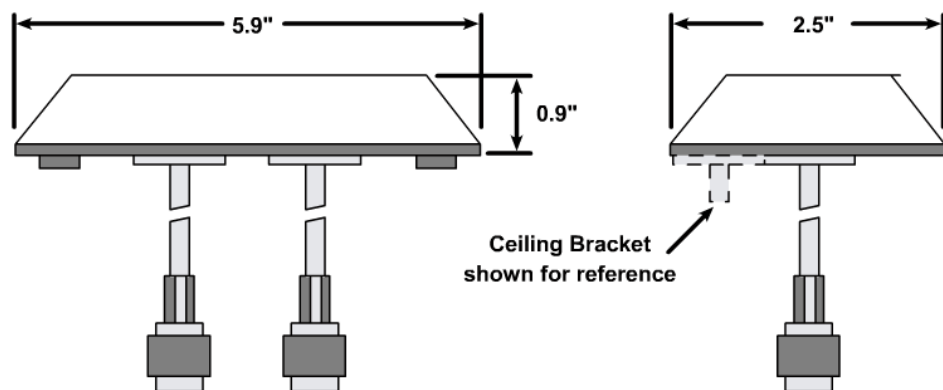
2.2 dBi Dipole “rubber duck” antenna(s) (AIR-ANT4941)



- Indoor diversity dipole antennas with a base are designed to extend the range of Aironet LMC client adapters and has two MMCX (2) connectors instead of the RP-TNC connector.

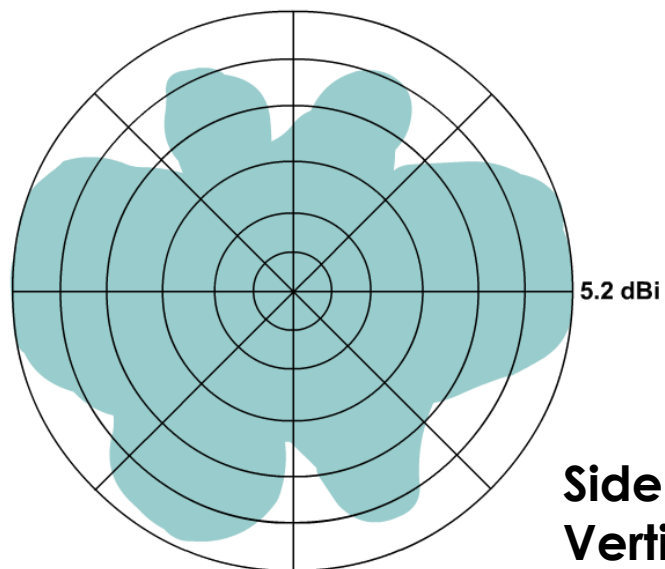


Cisco 2.2 dBi ceiling mount diversity patch antenna

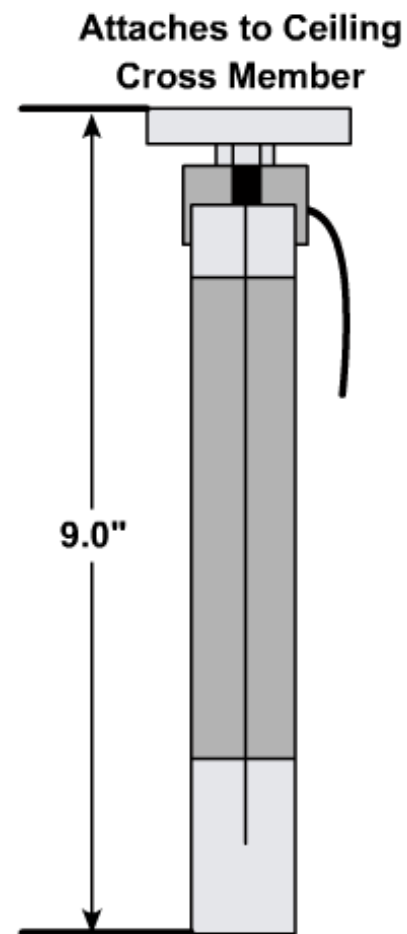


**Side View (E Plane)
Vertical Radiation**

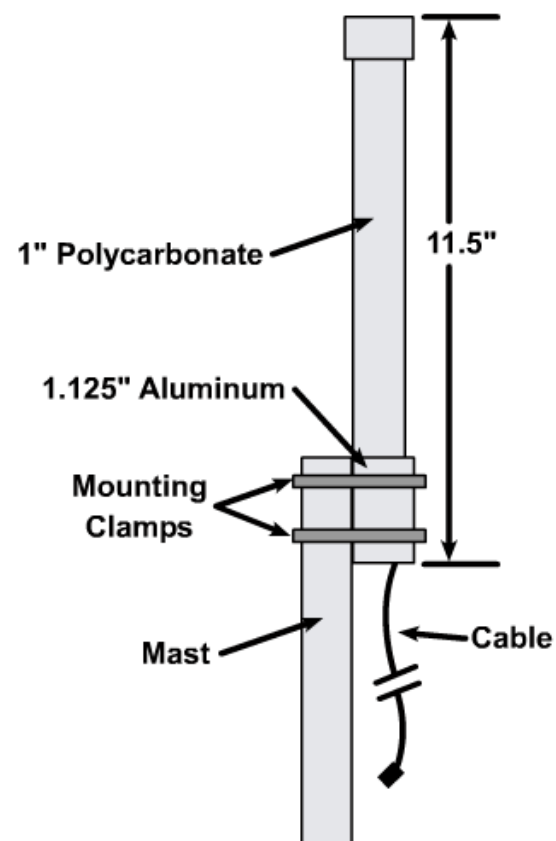
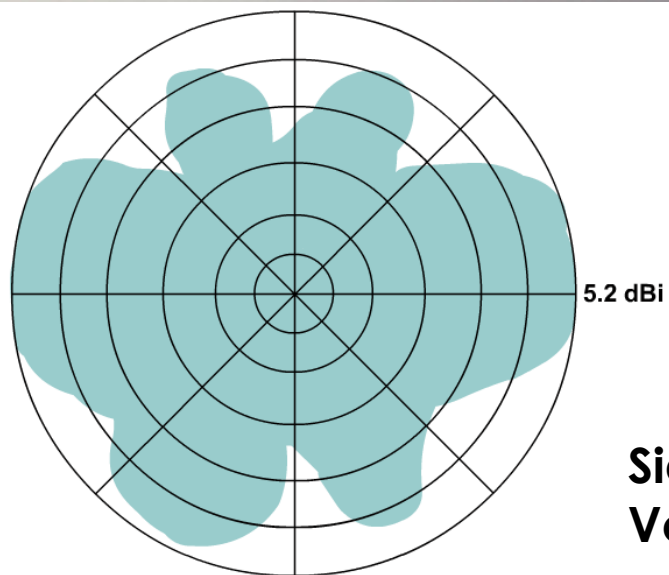
Cisco 5.2 dBi ceiling mount omni-directional antenna



**Side View (E Plane)
Vertical Radiation**

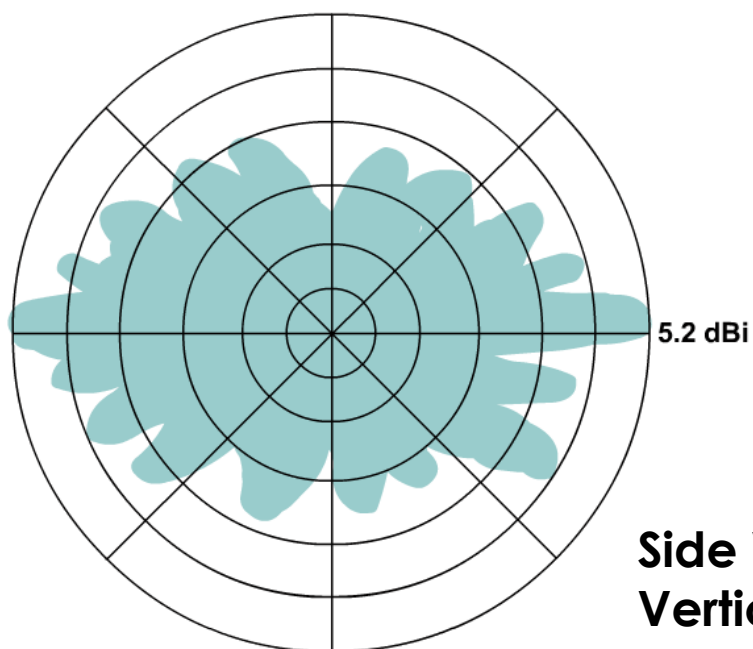


5.2 dBi Mast Mount Vertical Omnidirectional indoor/outdoor antenna



**Side View (E Plane)
Vertical Radiation**

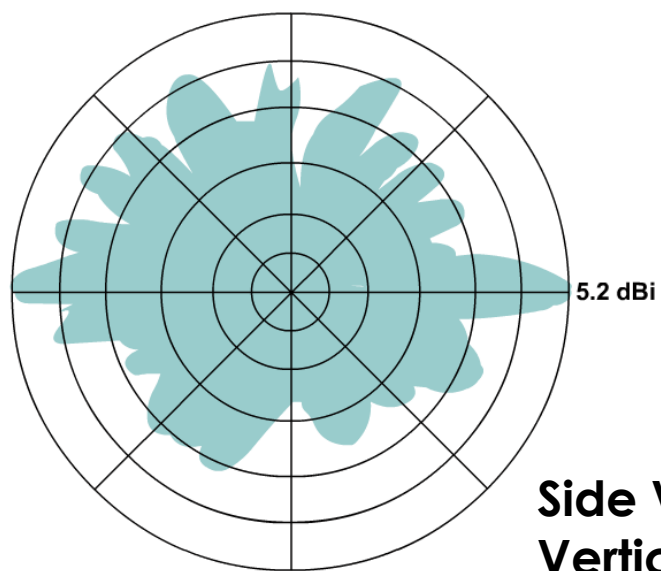
12 dBi Omnidirectional antenna (outdoor only)



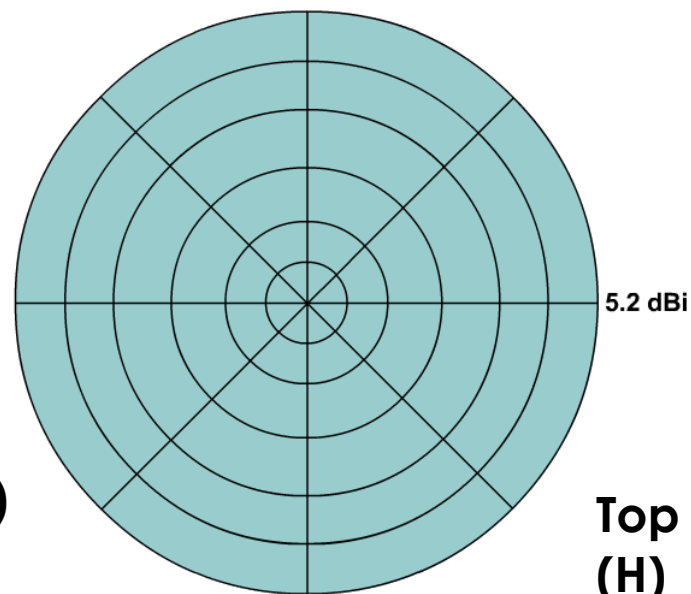
**Side View (E Plane)
Vertical Radiation**

5 GHz outdoor wireless bridge 9-dBi omnidirectional antenna

Used with
1400 Bridge



**Side View (E Plane)
Vertical Radiation**

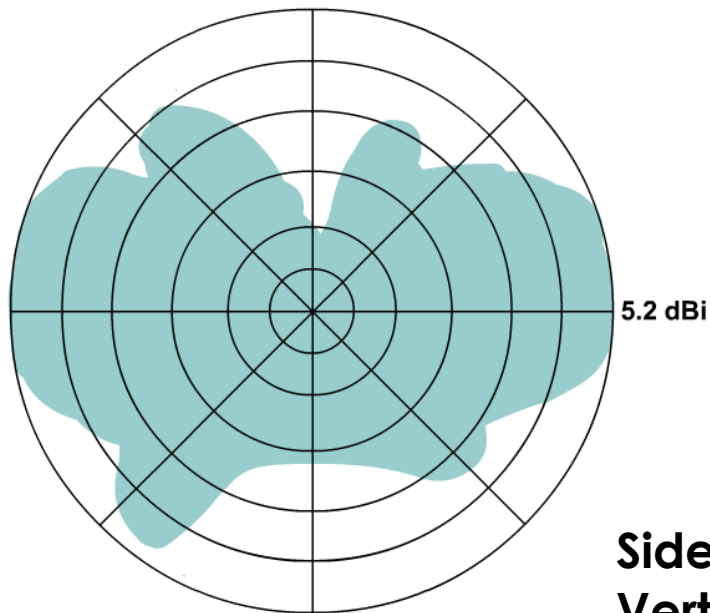


Top View (H)

5.14 dBi Pillar Mount Diversity Omni

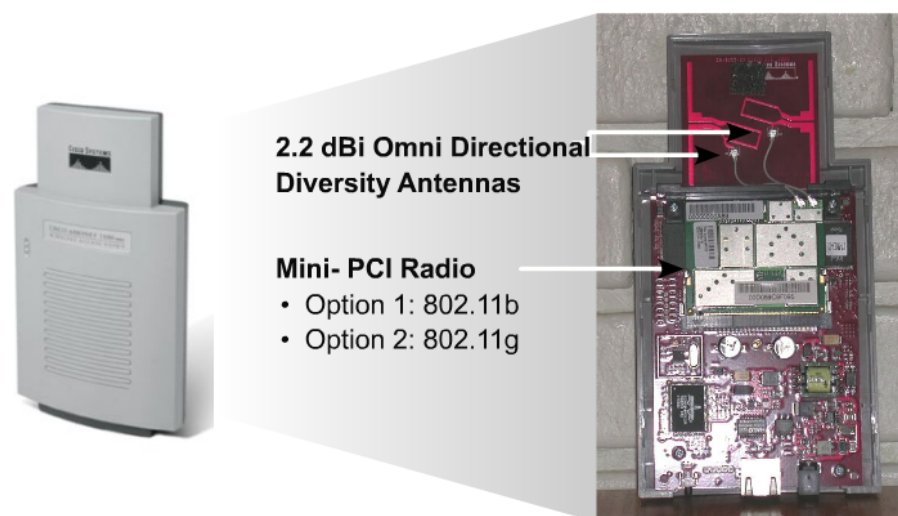


Designed to be mounted to the side of a pillar



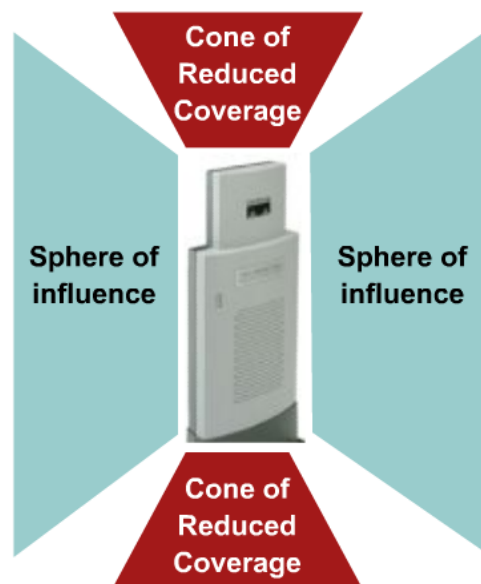
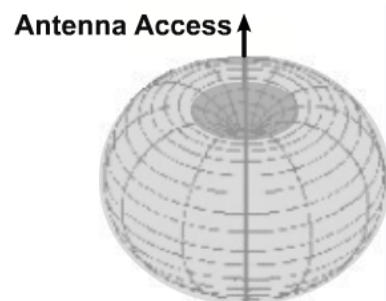
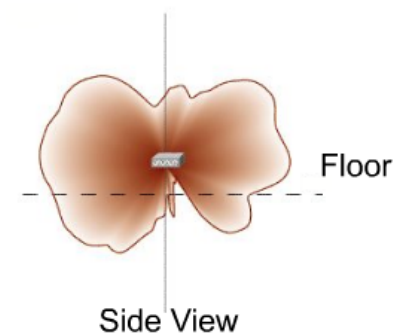
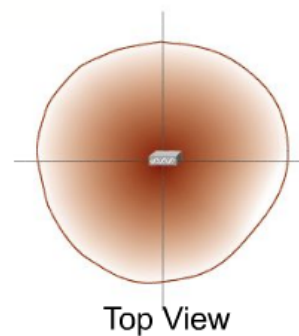
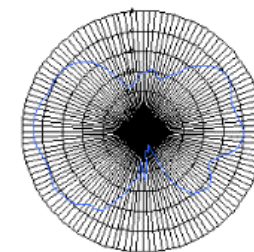
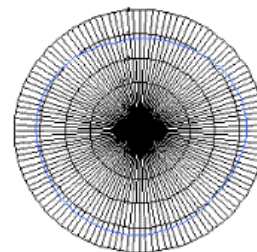
**Side View (E Plane)
Vertical Radiation**

Integrated antennas - 1100

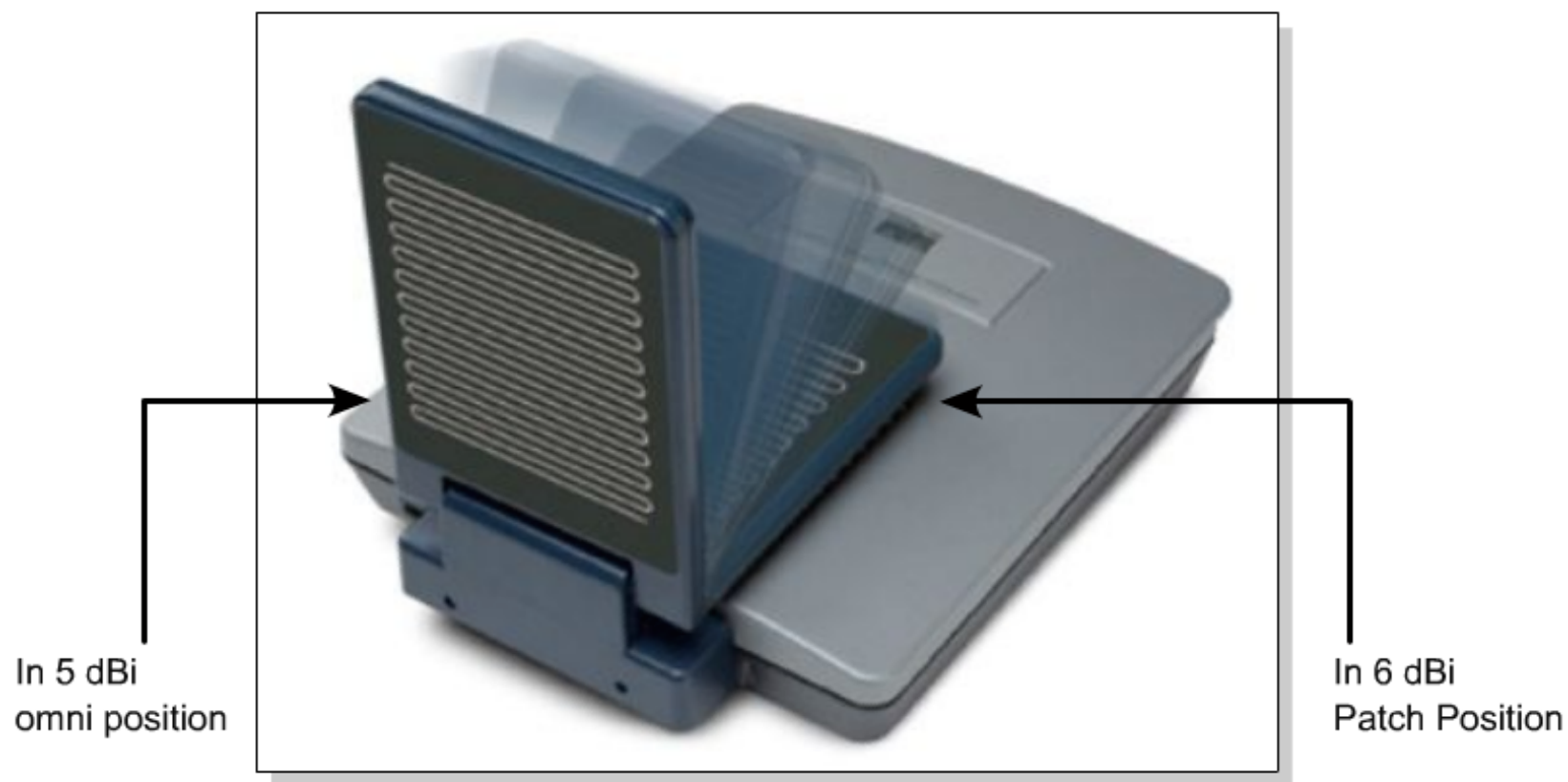


Horizontal Plane (H-Plane)

Elevation Plane (E-Plane)



Integrated Antennas - 1200



5 GHz Integrated Antenna

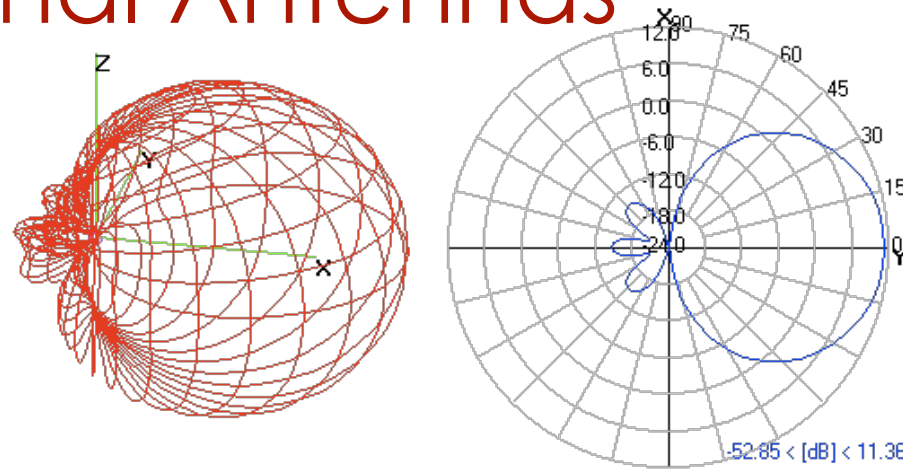
Innovative 5GHz Combo Antenna:

- Wall mount: fold antenna flat against access point housing for 6dBi gain patch antenna
- Ceiling mount: fold antenna out at 90° angle for 5dBi gain omni antenna



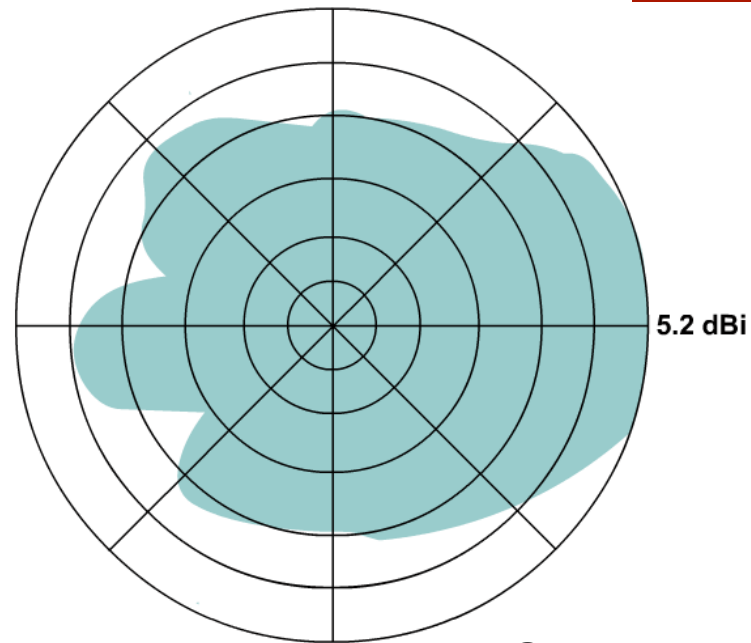
Antenas
direccionales

Directional Antennas



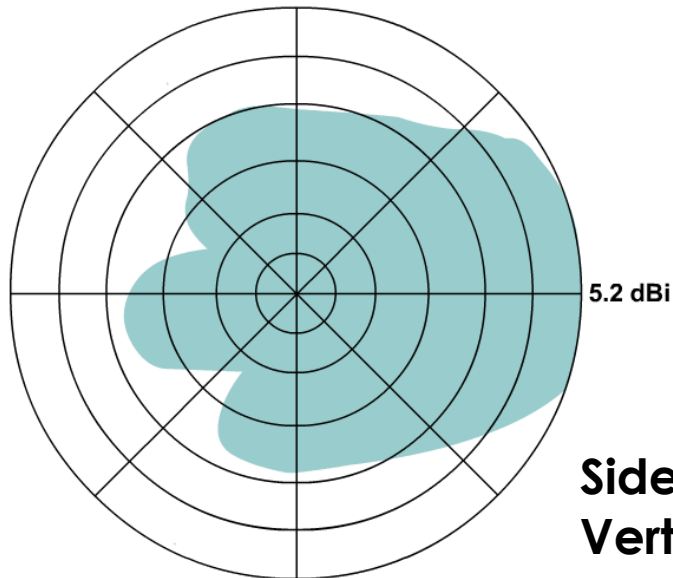
- **Directional antennas** do not offer any added power to the signal, and instead simply redirects the energy it received from the transmitter.
- By redirecting this energy, it has the effect of providing more energy in one direction, and less energy in all other directions.
- As the gain of a directional antenna increases, the angle of radiation usually decreases, providing a greater coverage distance, but with a reduced coverage angle.
- **Directional antennas** include Yagis, patch antennas, and parabolic dishes.
- **Parabolic dishes** have a very narrow RF energy path and the installer must be accurate in aiming these at each other.

Cisco 6 dBi patch antenna



**Side View (E Plane)
Vertical Radiation**

6 dBi diversity patch antenna

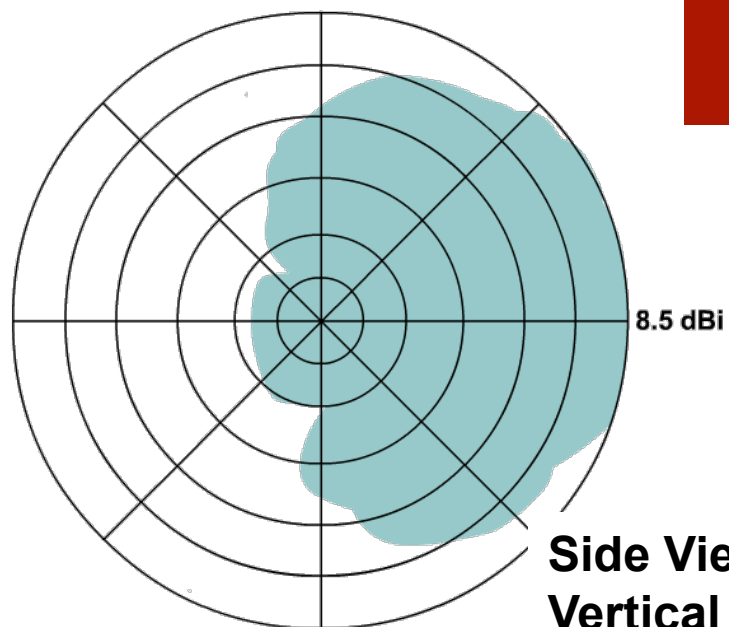
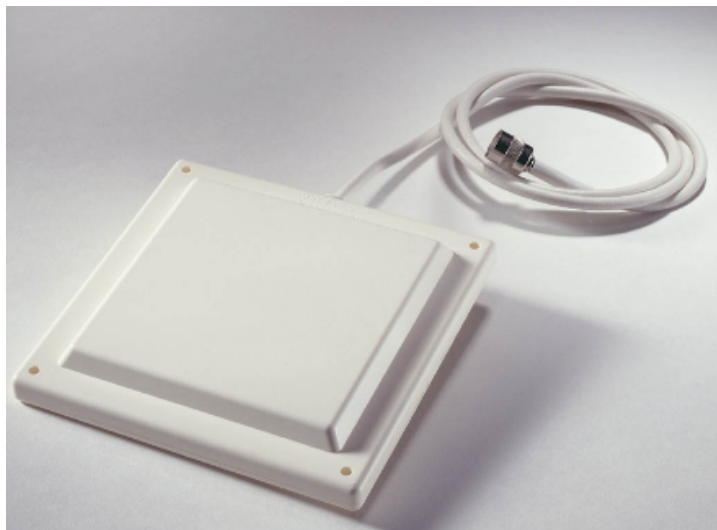


**Side View (E Plane)
Vertical Radiation**

Indoor/outdoor antenna with two RP-TNC connectors.

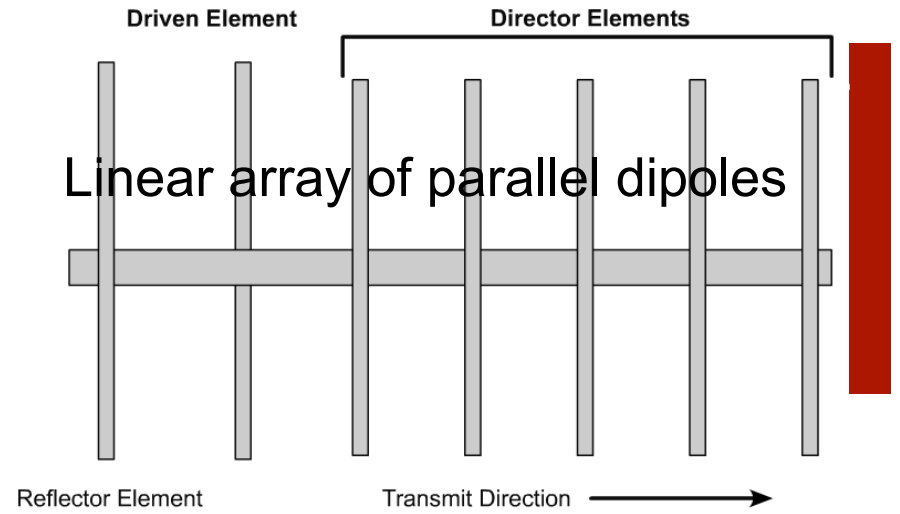
It is similar to the above patch, but providing diversity antennas in the same package for areas where multipath problems exist

Cisco 8.5 dBi antenna



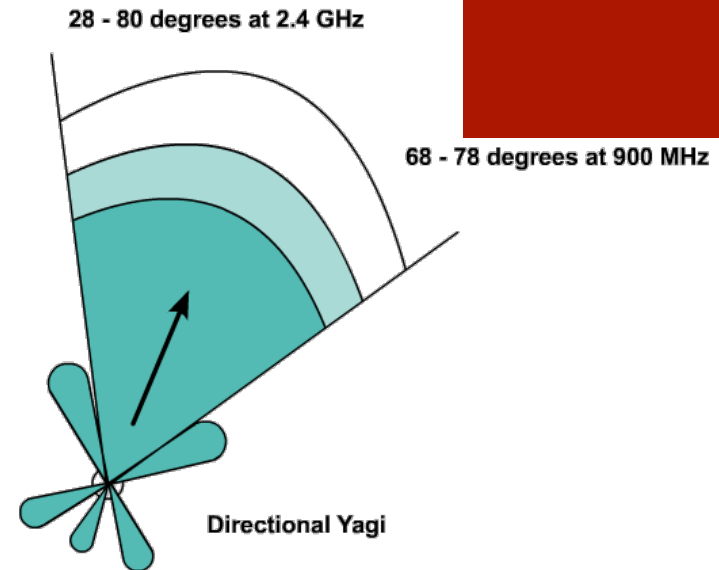
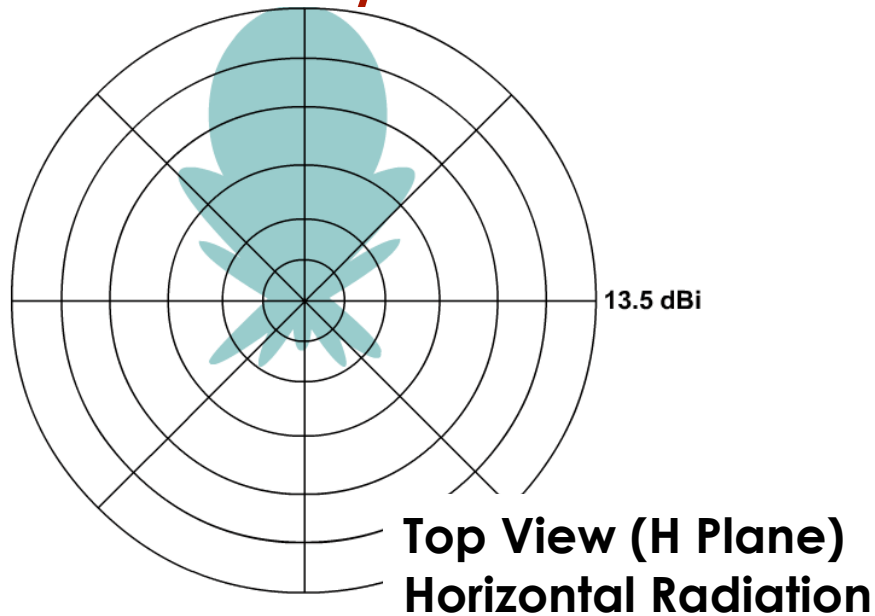
**Side View (E Plane)
Vertical Radiation**

13.4 dBi Yagi (outdoor/ indoor)



- The Yagi is constructed of at least three elements, which are metal bars that supplement the wave energy transmitted.
- In a Yagi antenna, there is at least one driven element, one reflector element, and usually one or more director elements.
- The Yagi antenna is also known as a linear end-fire antenna or a Yagi-Uda array, has a linear array of parallel dipoles.
- Yagi antennas are directional and designed for long distance communication.

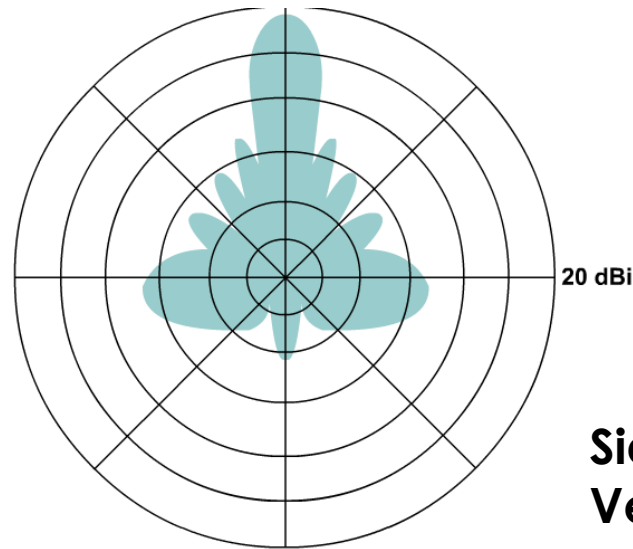
13.4 dBi Yagi (outdoor/ indoor)



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- The Cisco Yagi provides 13.5 dBi of gain and features a range of up to 10 km (6.5 miles) at 2 Mbps, and 3.2 km (2 miles) at 11 Mbps.
- Most Yagi antennas are mounted with U-bolts, to a sturdy mast.

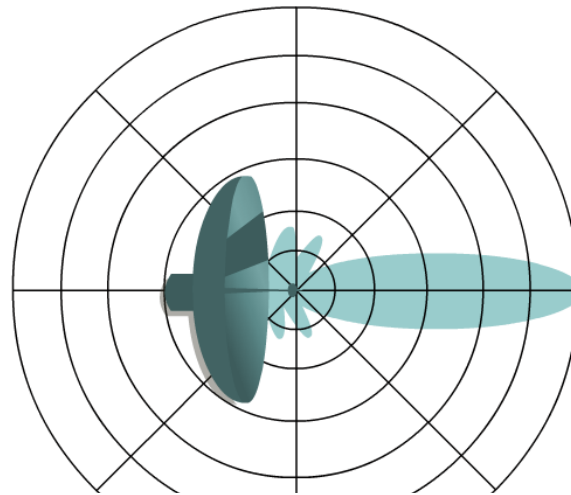
21 dBi Parabolic Dish



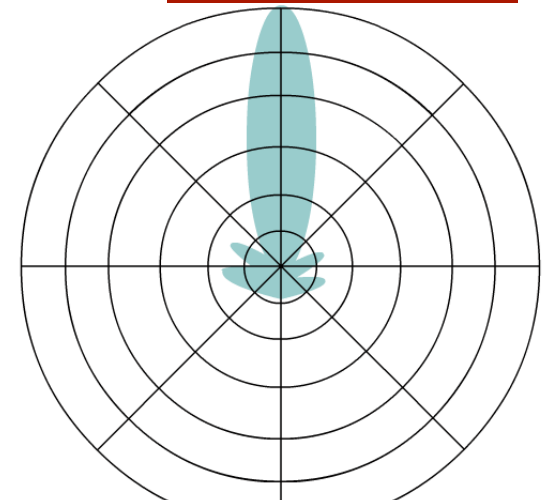
**Side View (E Plane)
Vertical Radiation**

- Distances of up to 40 km (25 miles) may be possible.
- It is important to evaluate how well the dish will withstand icy conditions and high winds.
- Equally important is the sturdiness of the mast and tower the antenna will be mounted on.
- The Cisco high gain parabolic dish is designed to be used as a bridge antenna between two networks or for point-to-point communications

5 GHz 28-dBi dish antenna



**Side View (E Plane)
Vertical Radiation**

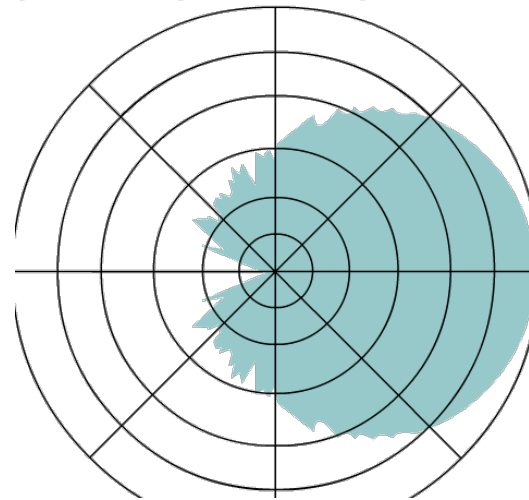
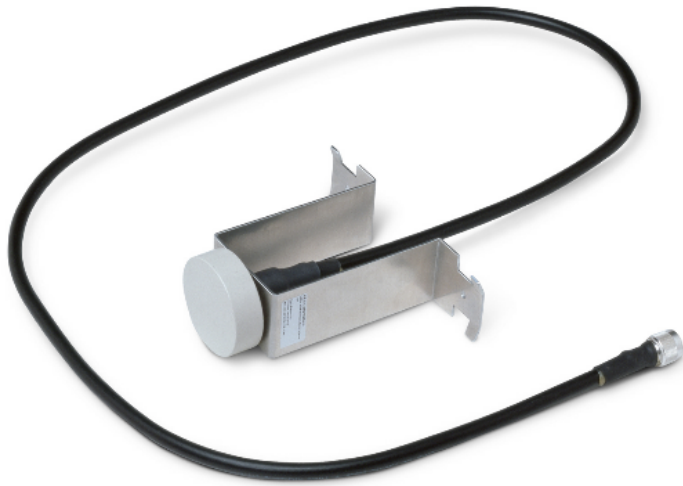


**Top View (H Plane)
Horizontal Radiation**

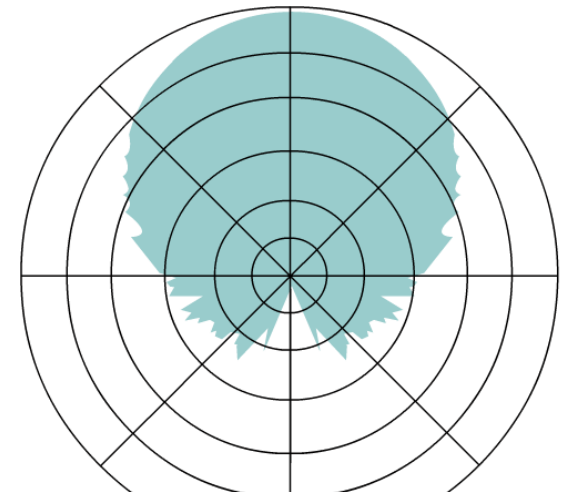
40

- Operates in the UNII-3 band (5725 to 5825 MHz)
- Can be extended up to 12.9 miles (20.7 kilometers) at 54 Mbps.

9.5-dBi sector antenna



**Side View (E Plane)
Vertical Radiation**



**Top View (H Plane)
Horizontal Radiation**

- Used with the Cisco Aironet 1400 Series Outdoor Wireless Bridge
- The antenna is not compatible with other Cisco Aironet radio products operating in the 5-GHz frequency band.



Cables y accesorios

Antenna Cables

Foam and Air Dielectric



- It might be possible to use existing coaxial cable. This determination will depend on the quality of the cable and whether it meets the following three specifications:
 - Impedance must be 50 ohms.
 - Total loss at 400 MHz, for the entire run length, must be 12 dB or less.
 - The cable center conductor size must be #14 AWG, or larger.

Cable loss

Cable Type	400 MHz Loss (dB/100 ft.)	2.5 GHz Loss (dB/100 ft.)	5.8 GHz Loss (dB/100 ft.)
LMR 400	2.6	6.8	10.8
LMR 600	1.62	4.45	7.25
1/2" Heliax	2.25	5.7	10.5

- The amount of energy lost in the cable is called **cable loss**.
- The use of coaxial cable to carry RF energy, always results in some loss of signal strength.
- The **amount of loss** depends on the four factors below:
 - **Length** - Long cables lose more power than short cables.
 - **Thickness** - Thin cables lose more power than thick cables.
 - **Frequency** - Lower frequencies of 2.4 GHz lose less power than higher frequencies of 5 GHz, as shown in Figure .
 - **Cable materials** - Flexible cables lose more power than rigid cables.
- Cable loss does not depend upon which direction the signal travels. Transmitted signals lose the same percentage of strength as received signals.
- Lost energy is wasted as heat.
- Interestingly, the low power levels of WLANs make cable heating almost undetectable.

Cable connectors and splitters

45

50-ohm RP-TNC Plug and Jack



■ **Connector**

- Cisco antennas use the Reverse-polarity TNC (RP-TNC) connector.

■ **Splitters**

- A splitter allows a signal to be used with two antennas at once.
- Using two antennas with a splitter may provide more coverage.
- Using a splitter adds approximately 4 dB of loss.

Amplifiers



- FCC has laws that limit the use of amplifiers with a WLAN.
- An amplifier may only be used, if it is sold as part of a system.
- This means that the AP, amplifier, extension cable, and antenna are all sold as a system.
- These laws help to ensure that amplifiers are tested with certain products and legally marketed and sold.
- Be aware of the local laws and of other systems in the area, which may be affected by an amplifier.

Lightning arrestor



- A lightning arrestor is designed to protect WLAN devices from static electricity and lightning surges.
- It is similar in function to a safety valve on a steam boiler.
- A lightning arrestor prevents energy surges from reaching the equipment by shunting the current to the ground.



Link Engineering and RF Path Planning

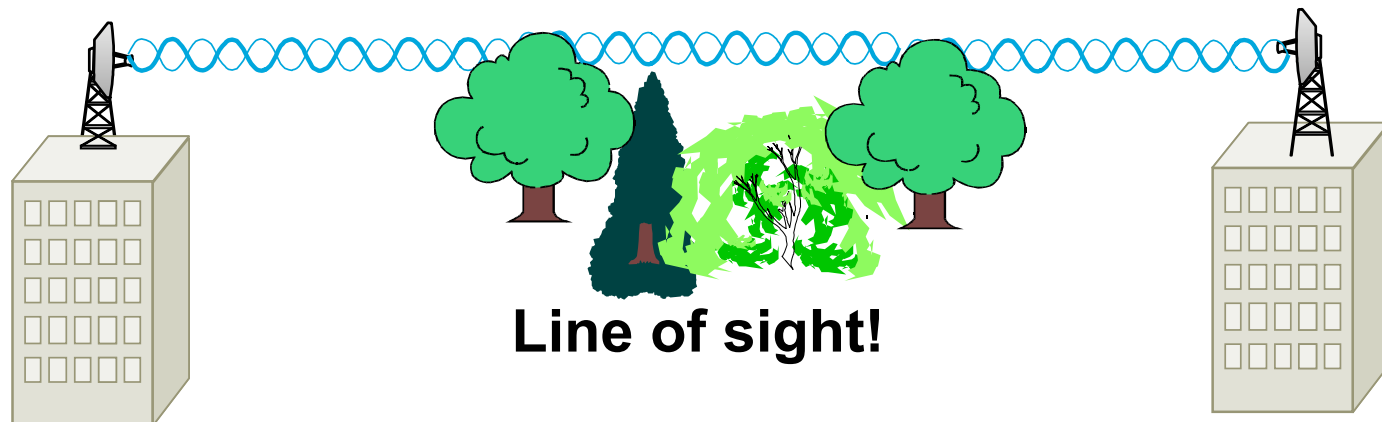
Path Considerations

- Radio line of sight
- Earth bulge
- Fresnel zone
- Antenna and cabling
- Data rate

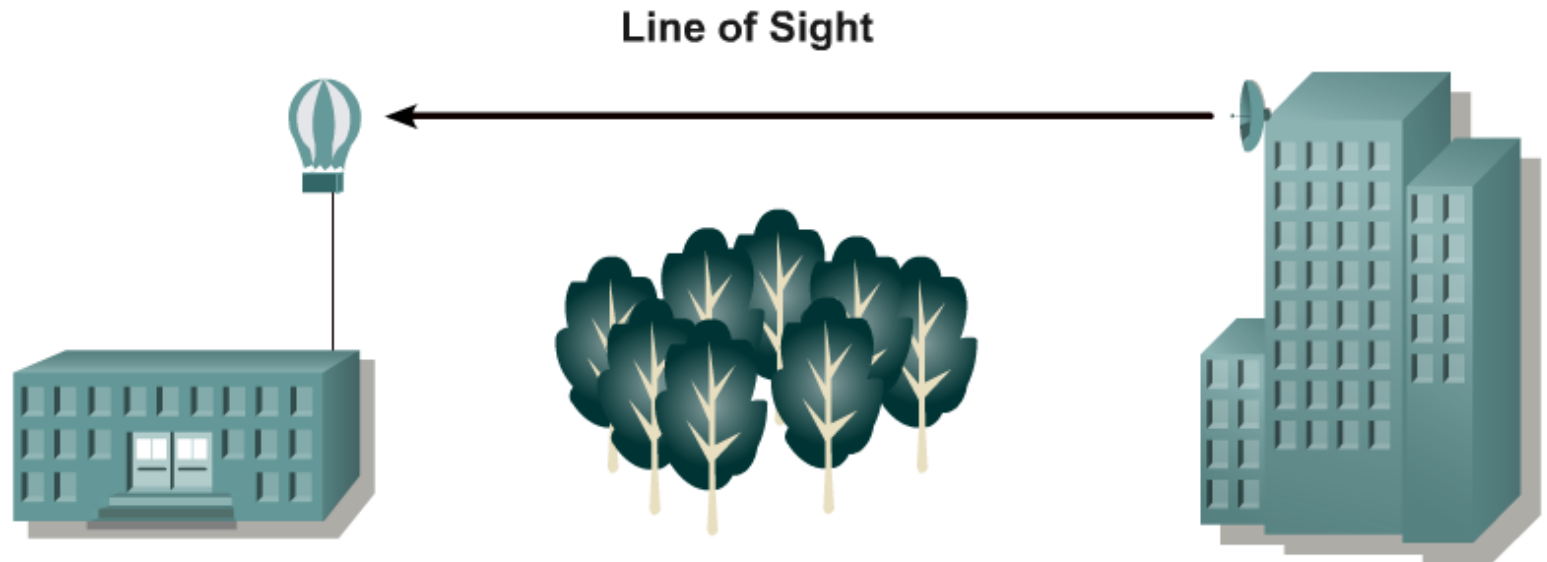


Line of Sight

- The following obstructions might obscure a visual link:
 - Topographic features, such as mountains
 - Curvature of the Earth
 - Buildings and other man-made objects
 - Trees



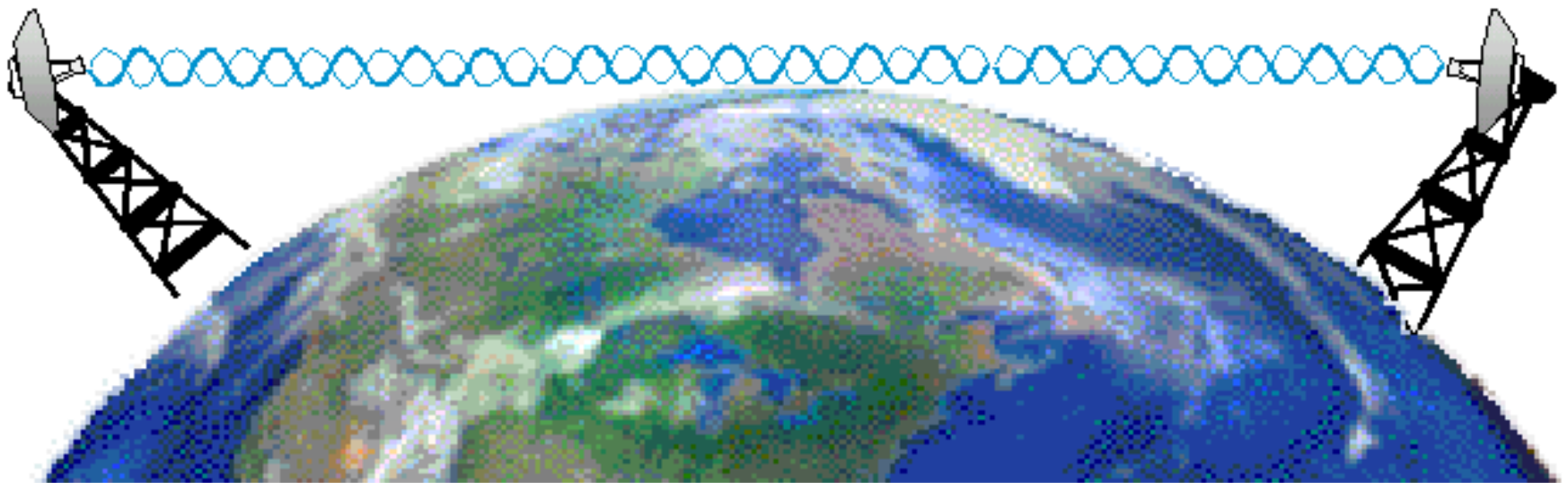
Tools



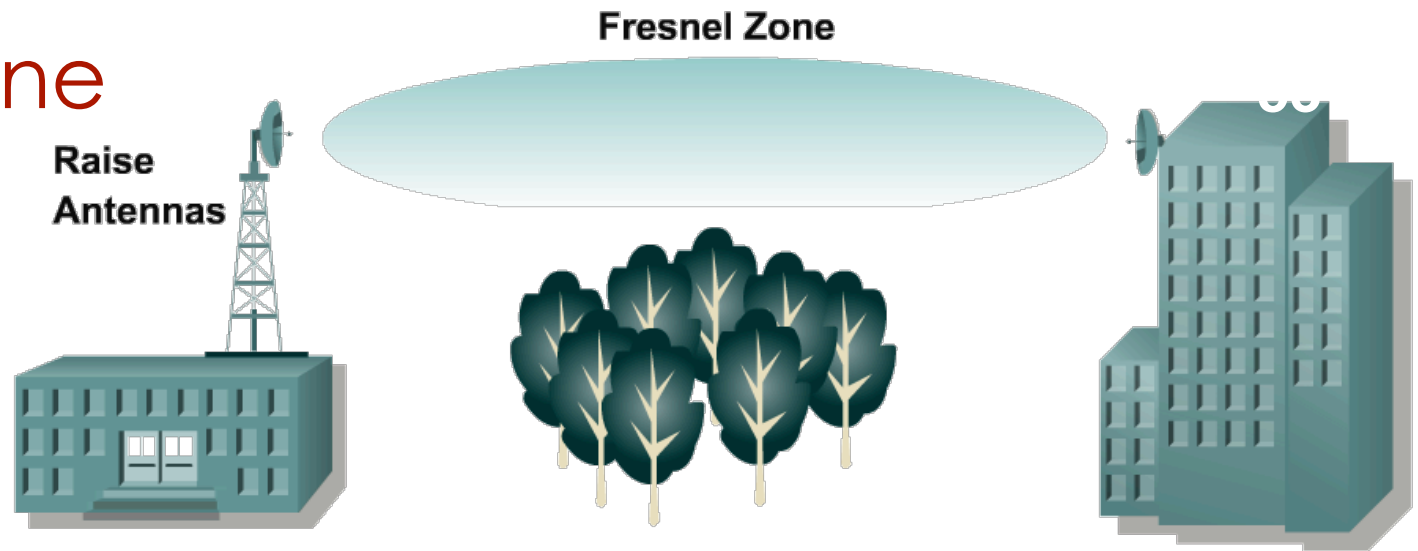
- The following tools can be helpful in making an accurate alignment:
 - **Balloon** - The tether should be marked at three meter (ten feet) intervals, so a height can be established. This value will help determine the overall height of the tower or mast needed.
 - **Binoculars or a telescope** - These are needed for the more distant links. Remember that the balloon must be visible from the remote site.
 - **GPS** - For very distant radio links, this tool allows the installer to aim the antennas in the correct direction.
 - **Strobe light** - This can be used instead of the balloon. Use this at night to determine where to align the antenna and at what height.

Longer Distances

- Line of Sight disappears at 6 miles (9.7 Km) due to the earth curve



Fresnel Zone



- Raise the antenna mounting point
- Build a new structure i.e. a radio tower, tall enough to mount the antenna
- Increase the height of an existing tower
- Locate a different mounting point, for the antenna
- Cut down problem trees

- The **Fresnel zone** is an elliptical area immediately surrounding the visual path.
- It varies, depending on the length of the signal path and the frequency of the signal.
- The Fresnel zone can be calculated, and it must be taken into account when designing a wireless link.

Fresnel Zone



- Obstructions that can interfere with visual line of sight can also interfere with radio line of sight.
- But one must also consider the Fresnel effect.
- If a **hard object**, such as a mountain ridge or building, is too close to the signal path, it can damage the radio signal or reduce its strength.
- This happens even though the obstacle does not obscure the direct, visual line of sight.
- The Fresnel zone for a radio beam is an elliptical area immediately surrounding the visual path.
- It varies in thickness depending on the length of the signal path and the frequency of the signal.
- The necessary clearance for the Fresnel zone can be calculated, and it must be taken into account when designing a wireless links.

Fresnel Zone



- As shown in the picture above, when a hard object protrudes into the signal path within the Fresnel zone, *knife-edge diffraction* can deflect part of the signal and cause it to reach the receiving antenna slightly later than the direct signal.
- Since these deflected signals are out of phase with the direct signal, they can reduce its power or cancel it out altogether.
- If **trees or other 'soft' objects** protrude into the Fresnel zone, they can attenuate (reduced the strength of) a passing signal.
- In short, the fact that you can see a location does not mean that you can establish a quality radio link to that location.

Improving Fresnel Effect

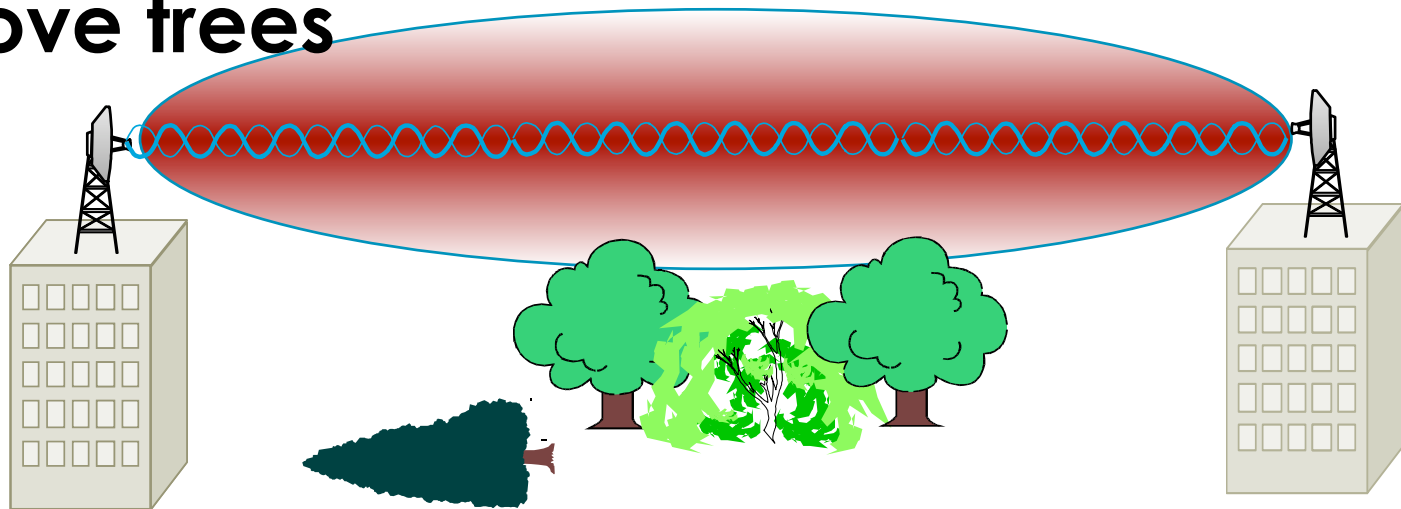
Raise the antenna

New structure

Existing structure

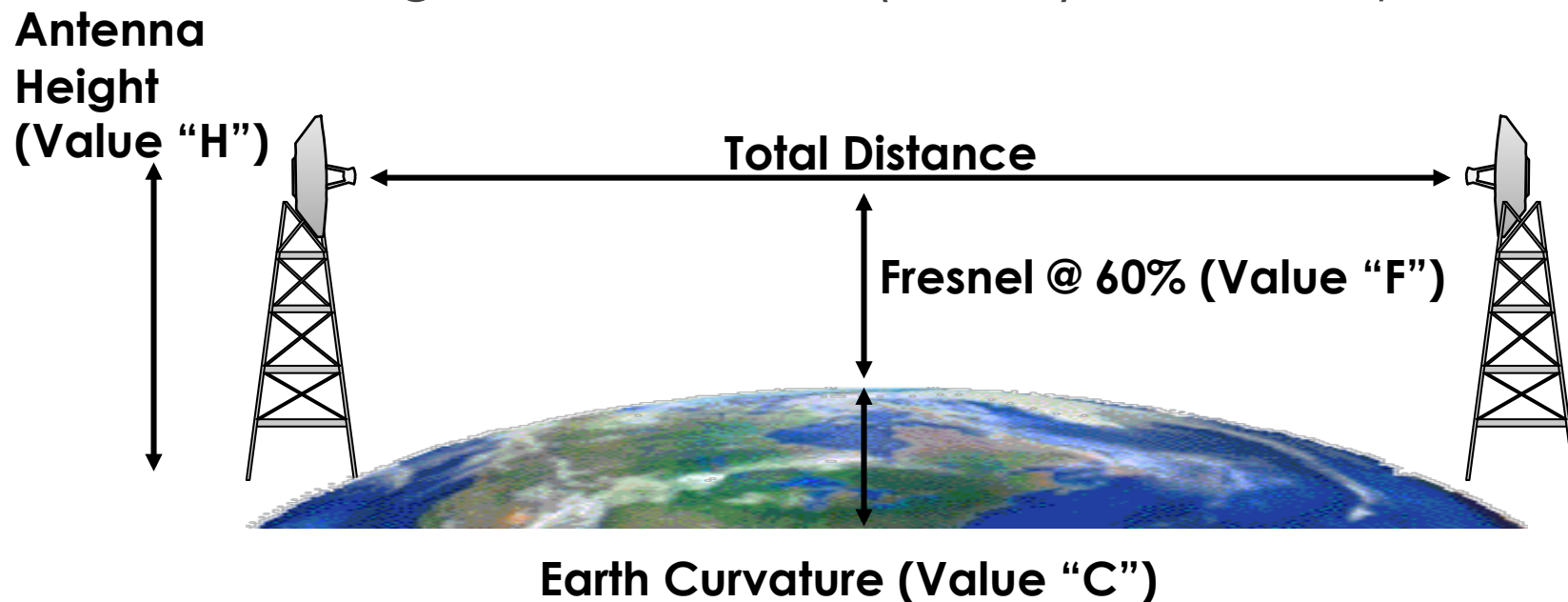
Different mounting point

Remove trees



Site to Site Fresnel Zone

- Antenna Height
 - Fresnel zone consideration
 - Line-of-Sight over 25 miles (40 Km) hard to implement



- Earth curvature becomes a concern for links longer than 11 km (7 miles).
- Line of sight disappears at 25 km (16 miles).
- Therefore, the curvature of the Earth must be considered when determining the antenna mounting height.

Site survey and path profiling

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Antenna Site Survey Planning Tasks

- Topography of the path
- Possible obstructions
- Proximity of site to airports
- Building or tower heights
- General site layout
- Site access
- Antenna location and mounting antenna height
- Lightning grounding
- Cable path to equipment
- Distance between antenna and indoor equipment
- Equipment room layout
- Power availability
- GPS coordinates of the sites

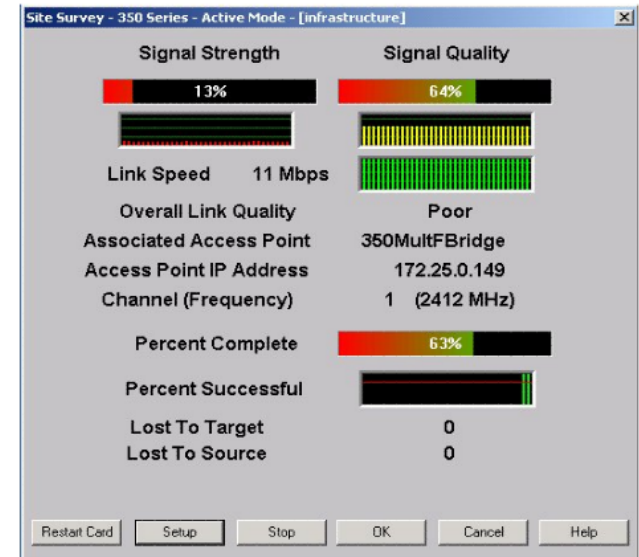
Path Profiling to Find Possible Obstructions

- Plot the coordinates on a topological map or enter them in path profiling software with terrain database for the region.
- Check for any possible obstructions in the path.
- Calculate the distance between the sites.
- Possibly ride along the path to look for obstructions.
- Get the coordinates of the obstruction.

Ensure Reliable Operation with Path Analysis

- Determine the theoretical system performance along the proposed path.
- Consider wind, rain, fog, and atmospheric absorption.
- Select proper antenna and coaxial cable for required fade margin and availability.

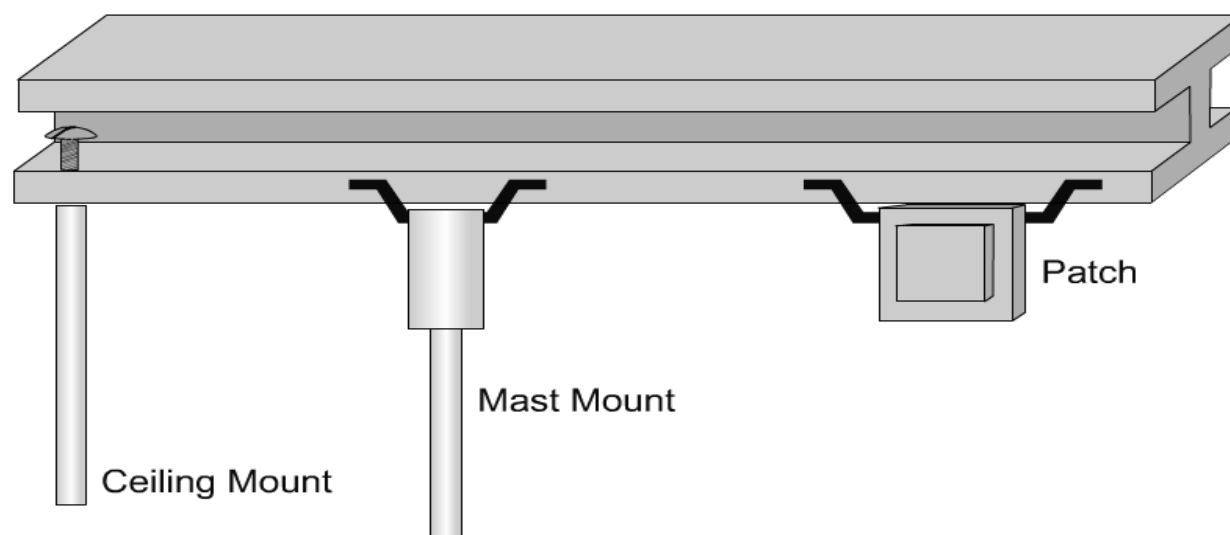
Alignment and interference



Client signal strength and link quality indicators help determine whether interference may be a problem.

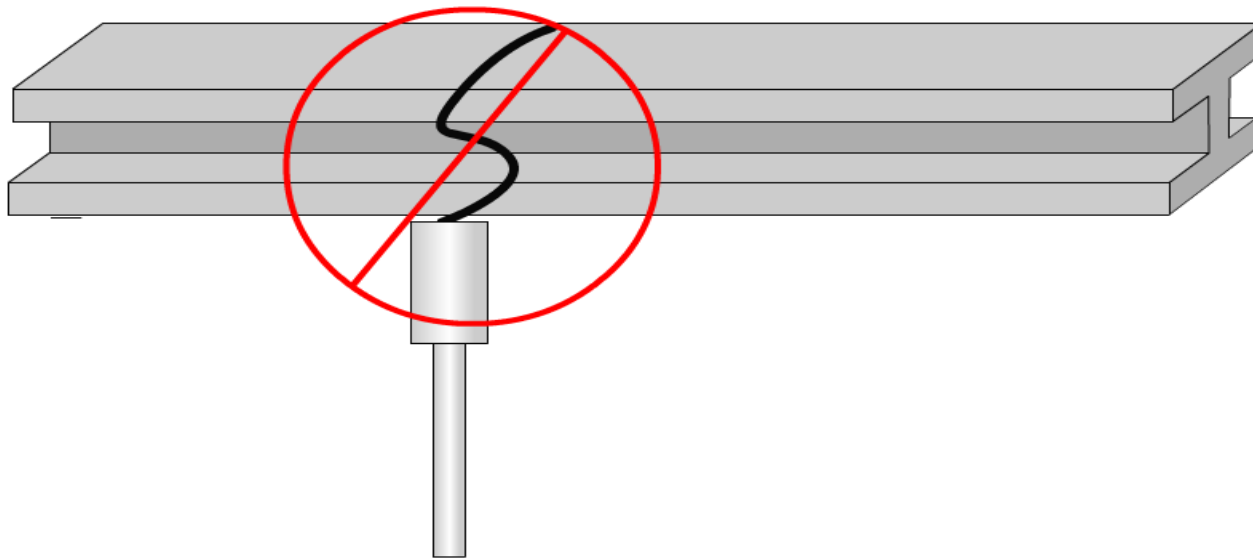
- When aligning antennas, be sure that the two antennas for the link are not cross-polarized.
- Next, ensure that each antenna is pointed or aligned to maximize the received signal level.
- A signal strength tool is provided, which gives a reading of the received signal level.
- At one end of the link at a time, the antenna pointing direction is carefully adjusted to maximize or peak the reading on the signal-indicator tool.
- After this is done for both ends, it is very important to obtain the actual received signal level, in dBm.

Antenna Mounting



- Some antennas are not shipped with mounting brackets
- Modify brackets to fit your needs
- Modified brackets can be used with a variety of antennas
- Be creative

Mounting (Cont.)



- Make sure the antennas mount is solid and secure
- Do not hang antenna by its cable
- Cable can break or become damaged
- Antenna can sway and provide a "moving cell"

Interference

- Carrier Detect Test (Spectrum Analyzer)
 - Built into Bridge
 - Run from Console Menu

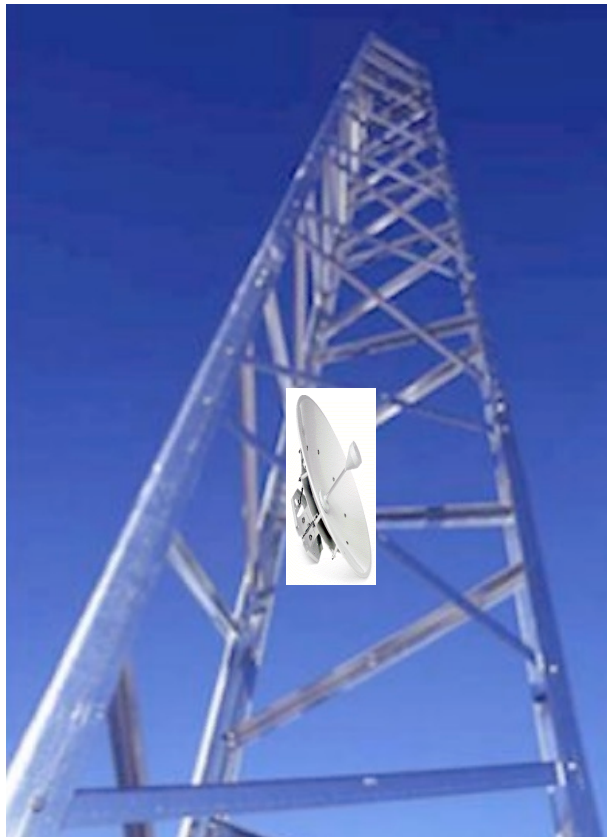
```

1%|* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
   |* * * * *
1 1 2 2 3 3 4 4 5 5 6
2 7 2 7 2 7 2 7 2 7 2
Carrier Busy
  
```

```

0dBm|* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
     |* * * *
1 1 2 2 3 3 4 4 5 5 6
2 7 2 7 2 7 2 7 2 7 2
Noise Value
  
```

Antenna Installation



Towers and antennas may require permits and must meet local regulations

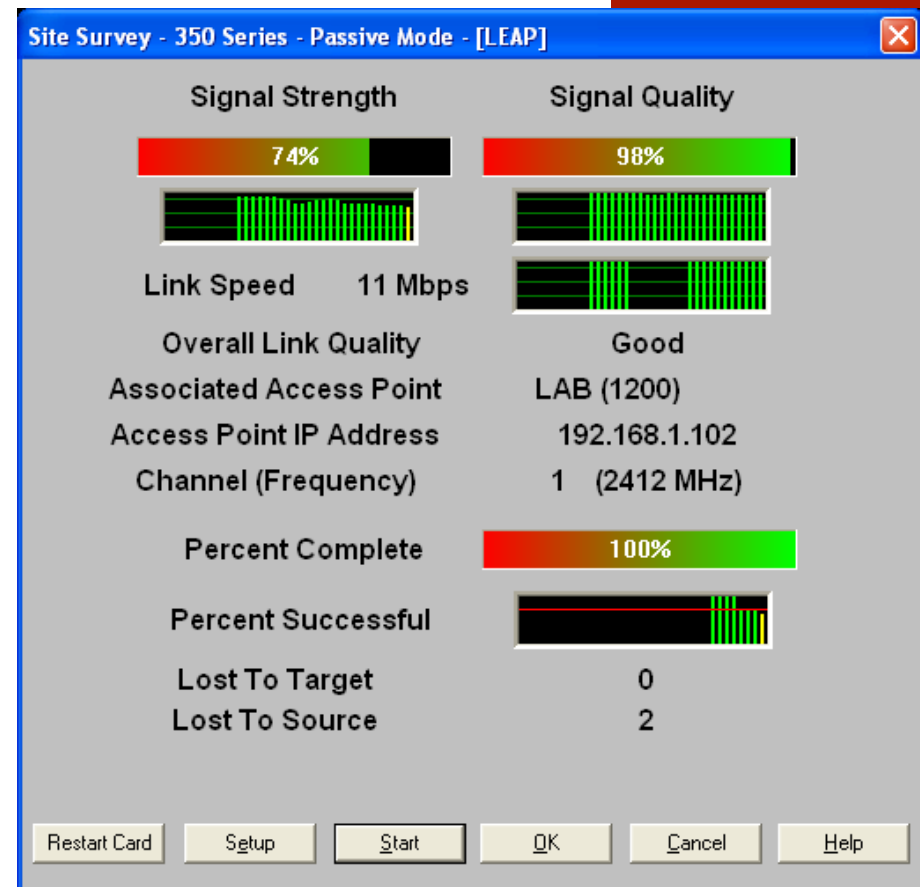
Antenna Installation (cont.)

- Antenna Alignment Tool

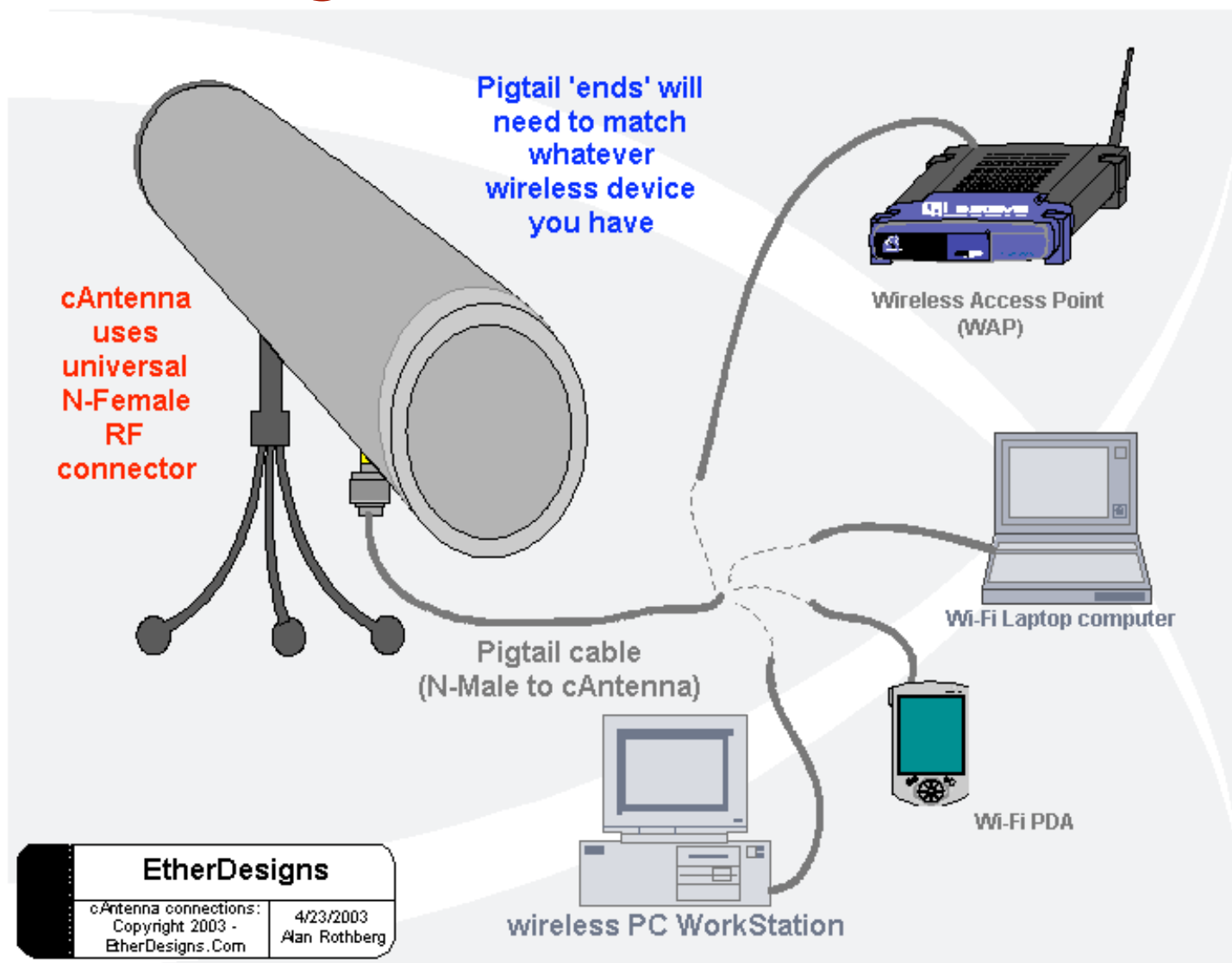
Id	Name	Address	Signal Strength	Signal Quality
18	Cisco Bridge #1	00409644fd35	100% -10 dBm	100%
17	Cisco Bridge #1	00409644fd35	100% -10 dBm	100%
16	Cisco Bridge #1	00409644fd35	45% -73 dBm	100%
15	Cisco Bridge #1	00409644fd35	38% -77 dBm	100%
14	Cisco Bridge #1	00409644fd35	100% -10 dBm	100%
13	Cisco Bridge #1	00409644fd35	58% -67 dBm	100%
12	Cisco Bridge #1	00409644fd35	38% -77 dBm	88%
11	Cisco Bridge #1	00409644fd35	63% -64 dBm	100%
10	Cisco Bridge #1	00409644fd35	100% -10 dBm	96%
9	Cisco Bridge #1	00409644fd35	45% -73 dBm	91%

Antenna Installation (cont.)

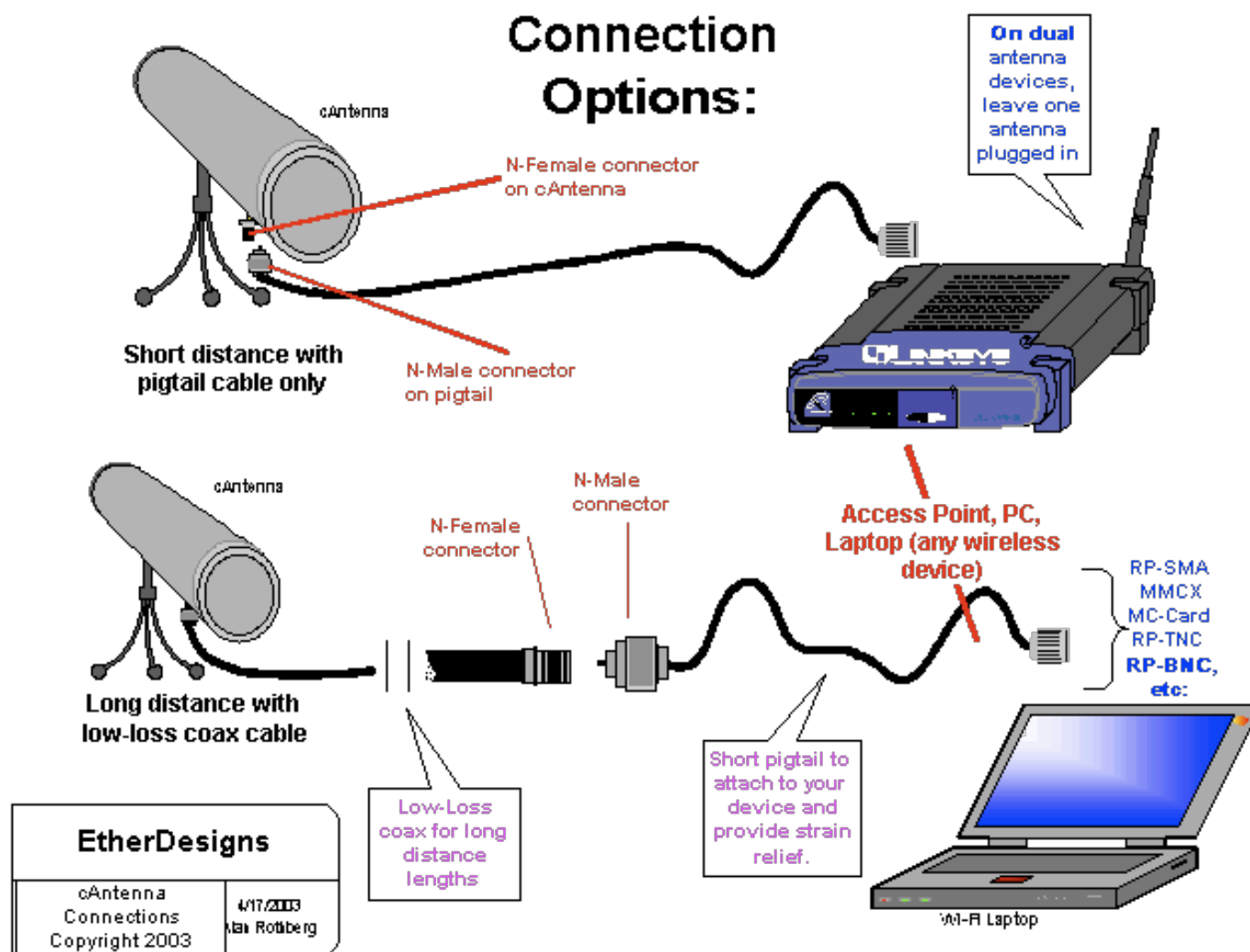
- Aironet Client Utility
- Site Survey Utility for antenna alignment



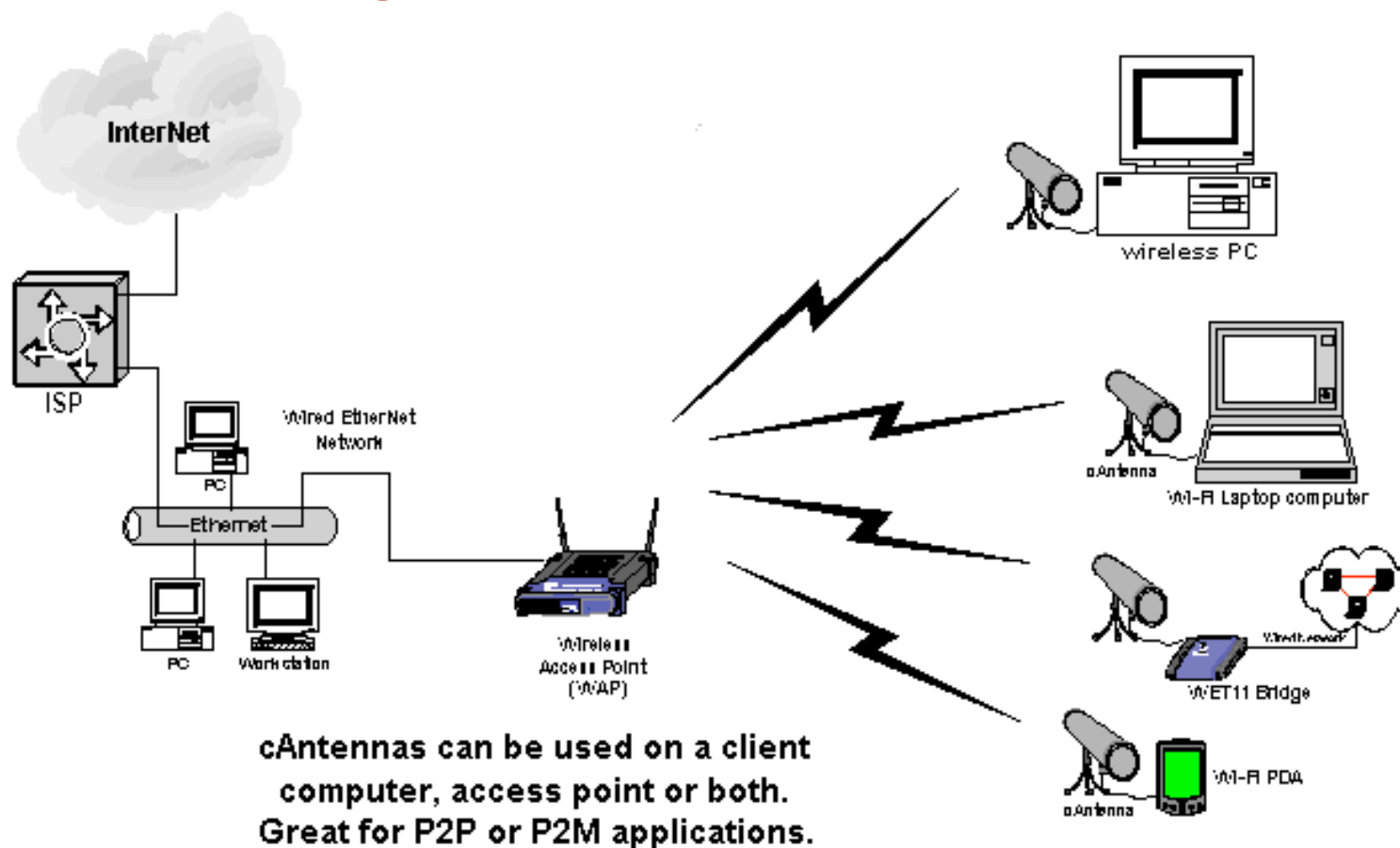
Examples from EtherDesigns.com



Examples from EtherDesigns.com



Examples from EtherDesigns.com



EtherDesigns

Simple Remote Client
Copyright 2003 -
EtherDesigns.Com

4/16/2003
Alan Rothberg

Examples from EtherDesigns.com



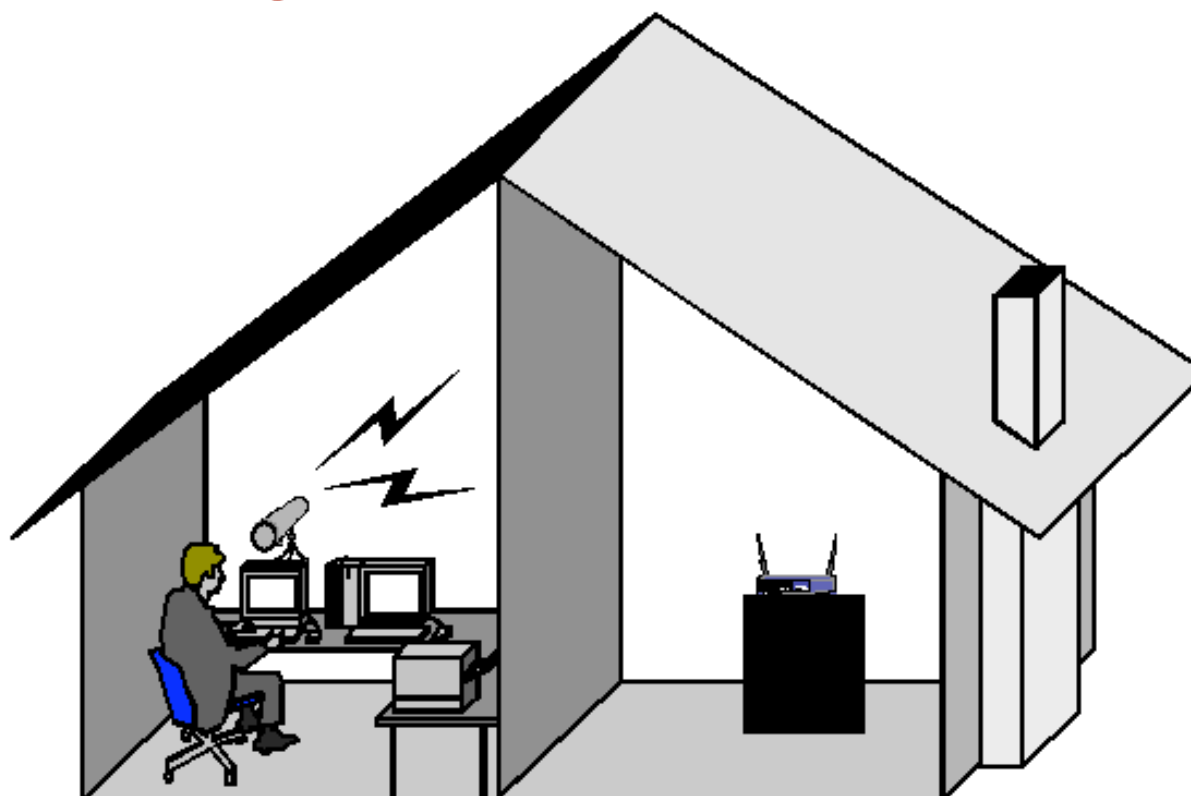
**Using a cAntenna on your access point
to beam through walls to other rooms.**

EtherDesigns

Inside-AP-1
Copyright 2003

4/15/2003
Alan Rothberg

Examples from EtherDesigns.com



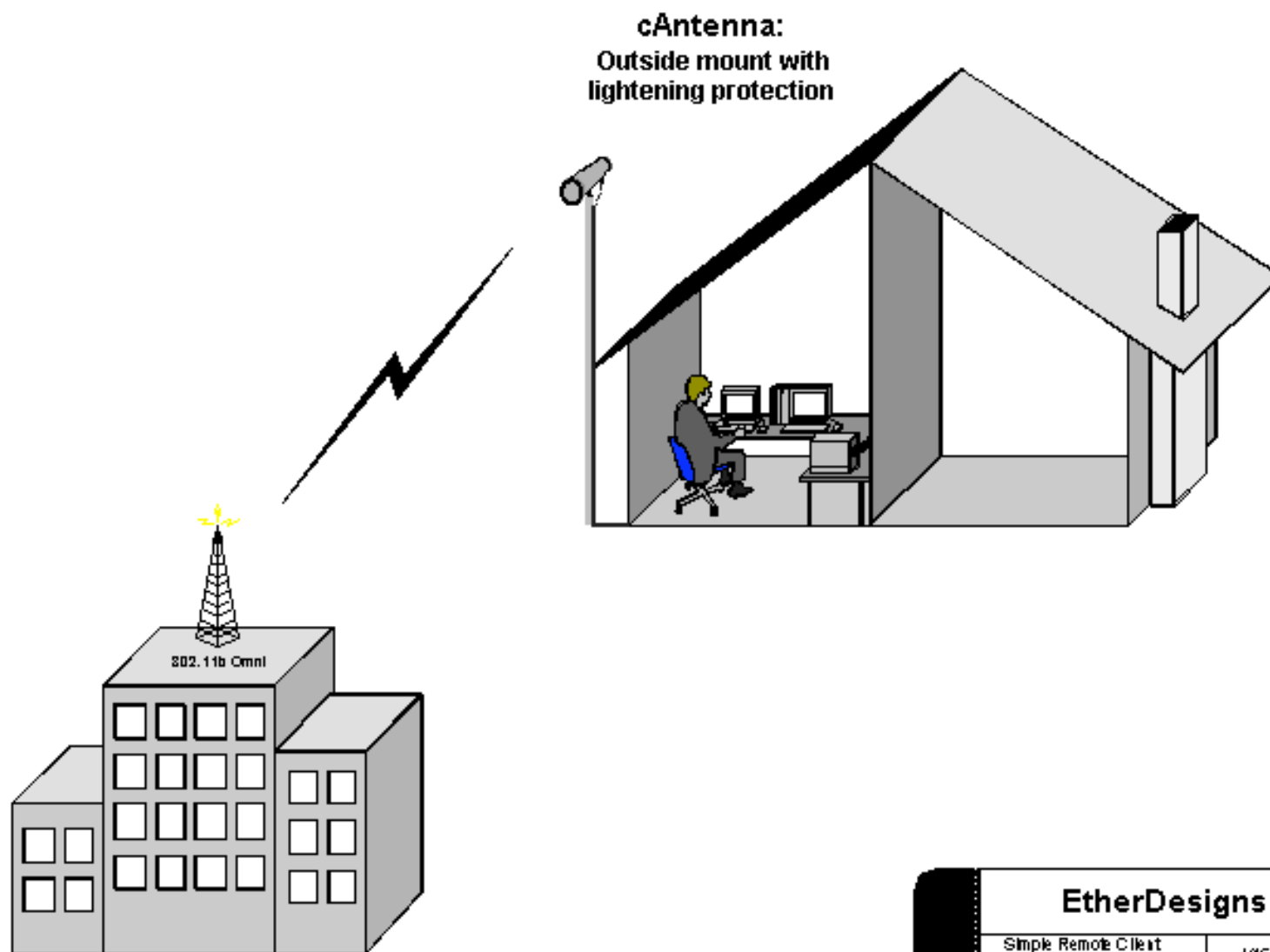
Using a cAntenna on your remote client
to beam through walls to other rooms.

EtherDesigns

Inside-AP-2
Copyright 2003

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Alan Rothberg

Examples from EtherDesigns.com

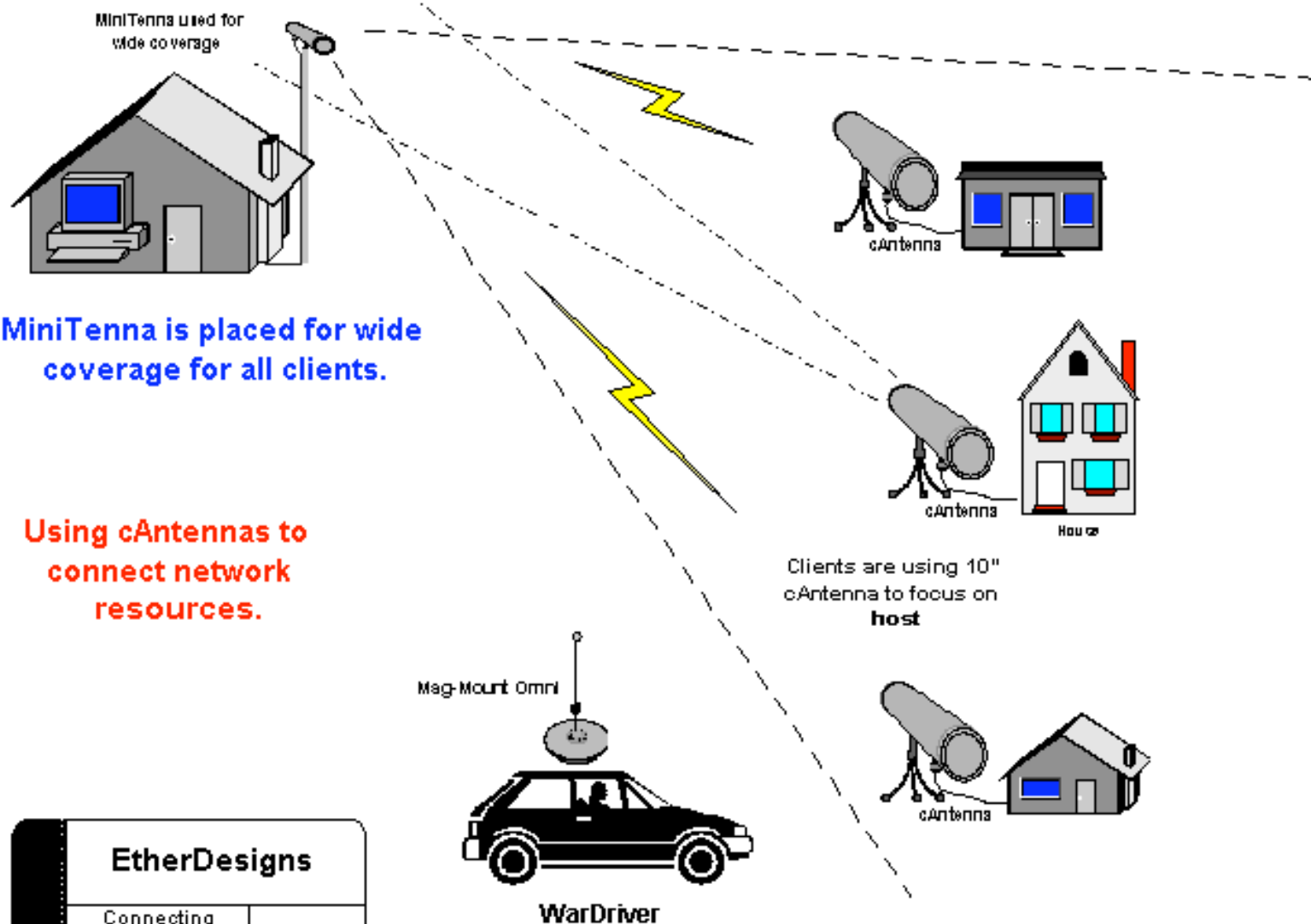


EtherDesigns

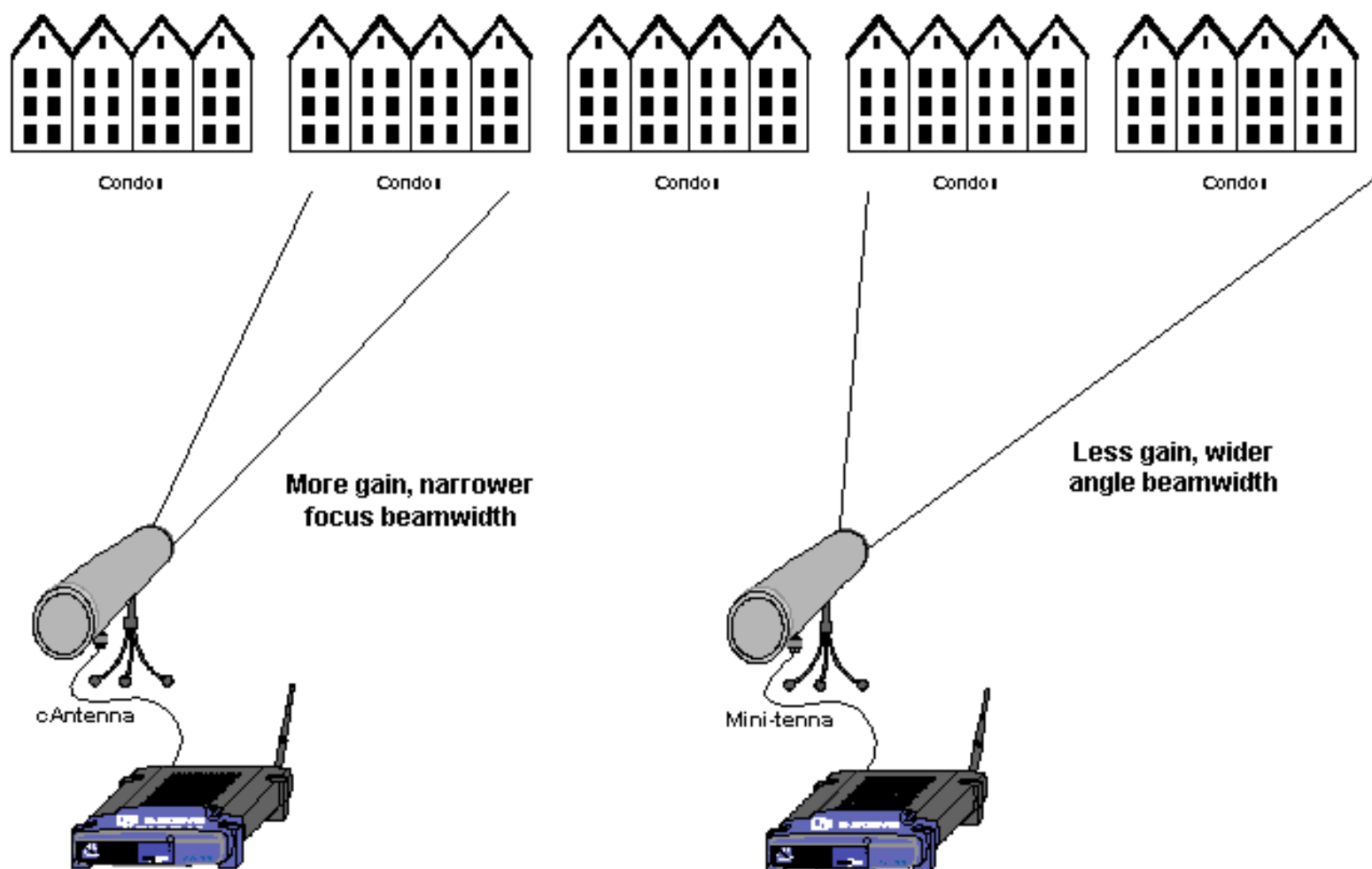
Simple Remote Client
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EtherDesigns.Com

4/15/2003
Alan Rotenberg

Examples from EtherDesigns.com



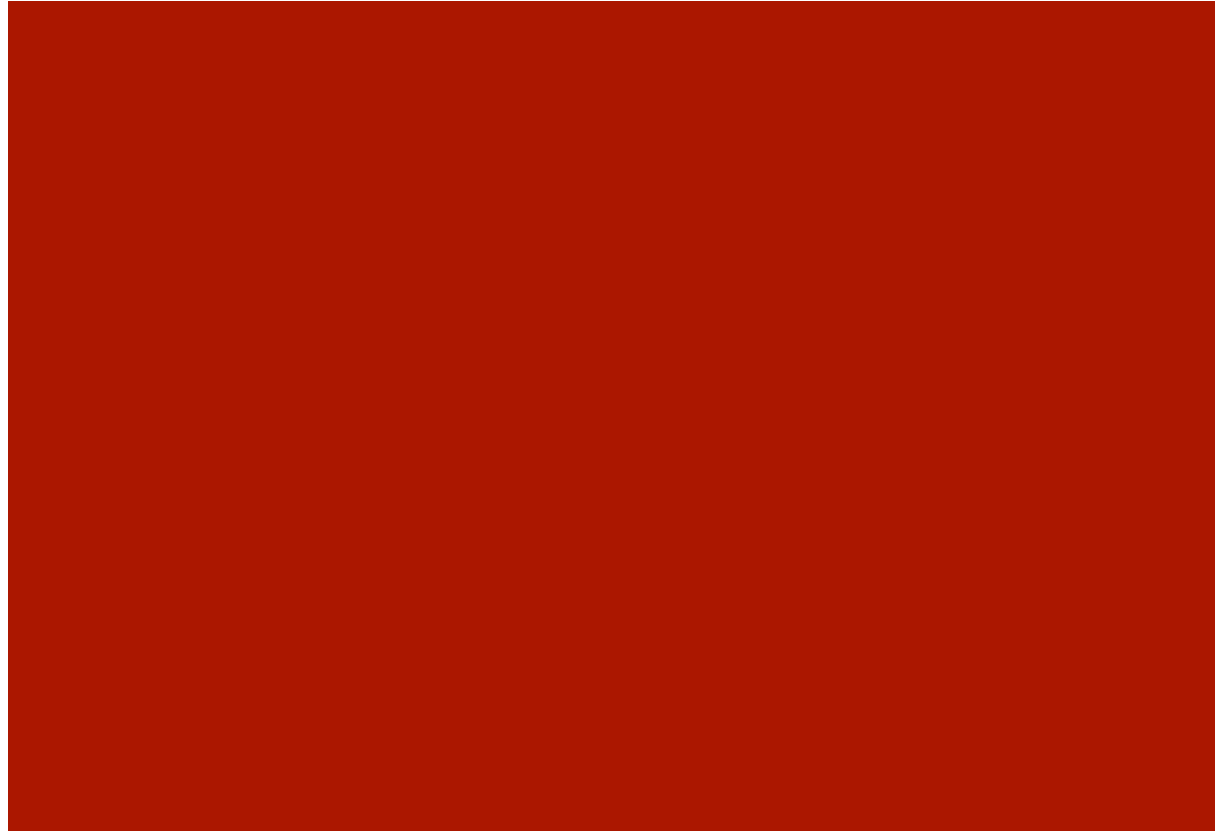
Examples from EtherDesigns.com



Ladder Safety








Choose a ladder of the appropriate size. If the ladder is too high, the range of movement is restricted. If the ladder is too low, there is a risk of stepping off.








Summary




Summary

					
	Rubber dipole	Pillar Mount	Patch Wall	Ceiling Mount	Ceiling Mount High Gain
Type	omni	omni	Directional	omni	omni
Gain	2.15 dBi	5.2 dBi	8.5 dBi	2.2 dBi	5.2 dBi
Beamwidth	360° H 75° V	360° H 75° V	60° H 55° V	360° H 75° V	360° H 75° V
Indoor Range at 1Mbps	300' 91.4 m	497' 151.5 m	700' 213.4 m	350' 106.7 m	497' 151.5 m
Indoor Range at 11Mbps	100' 30.5 m	142' 43.3 m	200' 61 m	100' 30.5 m	142' 43.3 m
Cable Length	N/A	3' 0.9 m	3' 0.9 m	9' 2.7 m	3' 0.9 m

Summary

					
	Patch Wall	Mast Mount	High Gain Mast Mount	Yagi Mast	Solid Dish
Type	Directional	omni	omni	Directional	Directional
Gain	8 dBi	5.2 dBi	12 dBi	13.5 dBi	21 dBi
Beamwidth	60° H 55° V	360° H 75° V	360° H 7° V	30° H 25° V	12.4° H 12.4° V
Approximate Range at 1Mbps	2.0 Miles 3.2 km	5000' 1.5 km	4.6 Miles 7.4 km	6.5 Miles 10.5 km	25 Miles 40.2 km
Approximate Range at 11Mbps	3390' 1 km	1580' 0.5 km	1.4 Miles 2.3 km	2.0 Miles 3.2 km	11.5 Miles 18.5 km
Cable Length	3' 0.9 m	3' 0.9 m	1' 0.3 m	1.5' 0.5 m	2' 0.6 m

Summary

			
	Mast Mount	Sector Antenna	Dish antenna
Type	Omni-directional	Directional	Directional
Application	Outdoor short-range point-to-multipoint applications	Outdoor medium-range point-to-point and point-to-multipoint applications	Outdoor long-range directional connections
Gain (including supplied jumper cable)	9.0 dBi	9.5 dBi	28.0 dBi
Beam width	360° H, 60° V	60° H, 60° V	5.7° H, 6° V
Polarization	Vertical	<ul style="list-style-type: none"> • Vertical or horizontal • Field configurable 	<ul style="list-style-type: none"> • Vertical or horizontal • Field configurable
Approximate range at 9 Mbps	8 miles (13 km) (with 22.5 dBi captive antenna on the remote site)	8 miles (13 km) (with 22.5 dBi captive antenna on the remote site)	23 miles (37 km) (with 28 dBi antennas on each end)
Approximate range at 54 Mbps	2 miles (3 km) (with 22.5 dBi captive antenna on the remote site)	2 miles (3 km) (with 22.5 dBi captive antenna on the remote site)	12 miles (19 km) (with 28 dBi antennas on each end)
Weight	2.0 lb. (0.9 kg)	1.25 lb. (0.6 kg)	9.5 lb. (4.3 kg)

Non-Cisco Antenna



Other Vendors getting in the market


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It's important to keep your identity secret



Distance Calculations for Bridges

A		B	C	D	E	F	G	H	X	Y	
1	Cisco Systems		Cisco Systems								
2			For Cisco Aironet 2.4GHz Outdoor Links ONLY								
3	Models Supported- Cisco Aironet BR350, BR340, BR500, WGB350, WGB340, PCI350 and PCI340										
4											
5	Regulatory Domain-----	North America/FCC	Select this from Power Regulatory Domain page								
6											
7	Site 1					Site 2					
8											
9	Select Product #1 ----->	AIR-BR350	Select Product #2 ----->	AIR-BR350							
10											
11	Select Power level----->	100	Select Power level----->	100							
12											
13	Select Datarate----->	11Mbps									
14											
15	Select Antenna 1 here-----	13.5dBi Yagi	Select Antenna 2 Here----->	13.5dBi Yagi							
16											
17	For other Antenna- Enter	13.5dBi Yagi	For other Antenna- Enter Gain Here--	6							
18		12dBi Omni									
19	Select Cable 1----->	6dBi Patch	Select Cable 2----->	100ft ULTRA LOW loss							
20		5.2dBi Omni									
21	For 'OTHER' Cable	Other	For 'OTHER' Cable								
22	Enter Cable Loss/100 ft here-----	4.4	Enter Cable Loss/100 ft here-----	4.4							
23	Enter in Length Here-----	100	Enter in Length Here-----	100							
24											
25	Effective Isotrpoc Radiated Power--	29.1	Effective Isotrpoc Radiated Power--	29.1							
26											
27											
28											
29	Max Distance (w/ 10dB Fade Margin)----->	2.8	Miles	4.6	Kilometers						
30											

Navigation: Cover- Guidelines | Range Calculations | Power Regulatory Domains