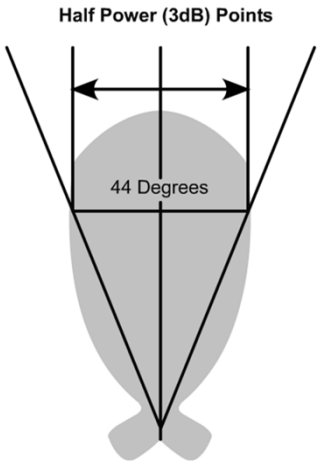
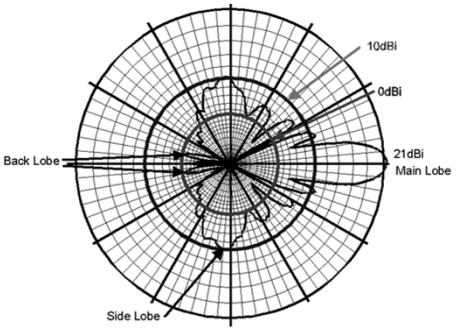
Antennas In-Depth

Beamwidth



Antenna Issues (cont.)

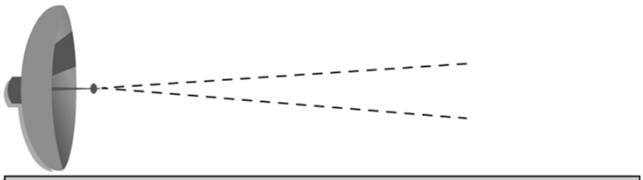
- Antennas have gain in particular directions
- Direction other than the main intended radiation pattern, are typically related to the main lobe gain



Antenna Gain

- If the gain of an antenna goes up, the coverage area or angle goes down
- Coverage areas or radiation patterns are measured in degrees
- Angles are referred to as beamwidth
  - Horizontal measurement
  - Vertical measurement

Beamwidth vs. Gain

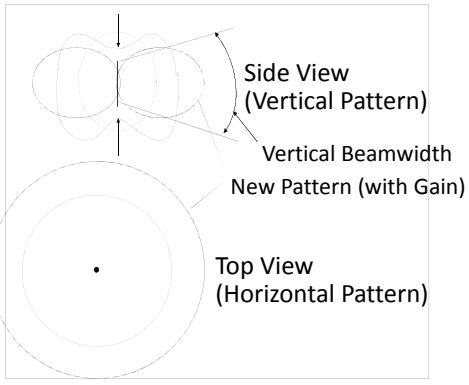


Higher-gain antennas have narrower beamwidths and less chance of receiving interference.

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

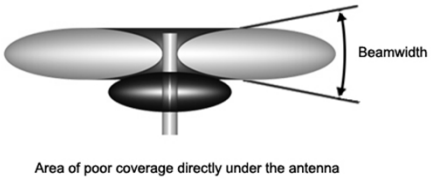
Antenna Theory- Dipole

- Energy lobes are 'pushed in' from the top and bottom
- Higher gain
  - Smaller vertical beamwidth
  - Larger horizontal lobe
- Typical dipole pattern



High Gain Omni-Directionals

- More coverage area in a circular pattern
- Energy level directly above or below the antenna will become lower



Area of poor coverage directly under the antenna

Optional 2.4GHz Antennas for Long Range

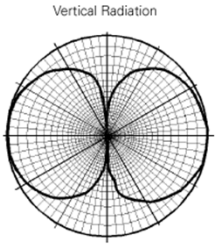
- 13.5 dBi Yagi
  Distances over
  - 7.3 miles @ 2 Mbps
  - 11.7 Km @ 2 Mbps
  - 3.6 miles @ 11 Mbps
  - 5.8 Km @ 11 Mbps

- 21 dBi Solid Dish
  For distances up to
  - 25+ miles @ 2 Mbps
  - 40+ Km @ 2 Mbps
  - 20.5 miles @ 11 Mbps
  - 33 Km @ 11 Mbps

Note: Distances include 50 feet of low loss cable and 10 dB fade margin

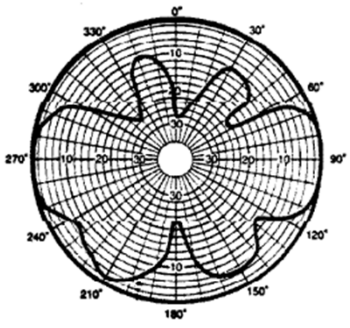
2.4 GHz Omni-Directional Antennas

- 2 dBi Dipole "Standard Rubber Duck"



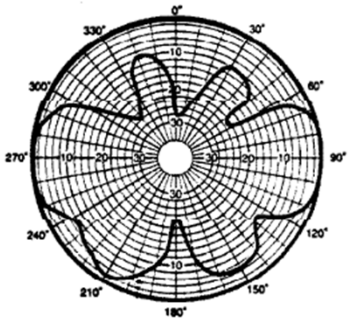
2.4 GHz Omni-Directional Antennas

- 5.2 dBi Mast Mount Vertical



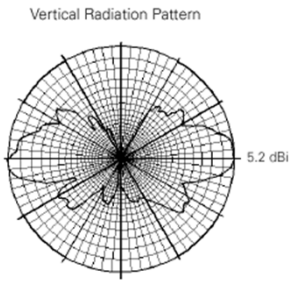
2.4 GHz Omni-Directional Antennas

- 5.2 dBi Ceiling Mount



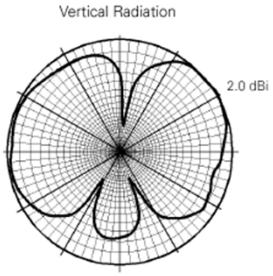
2.4 GHz Omni-Directional Antennas

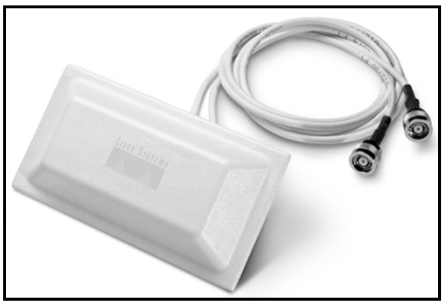
- 5.2 dBi Pillar Mount Diversity



2.4 GHz Diversity Omni-Directional Antennas

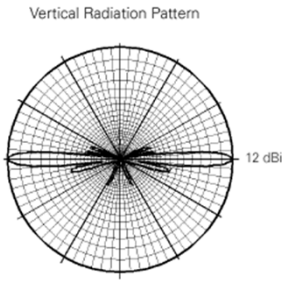
- 2 dBi Diversity Omni-Directional Ceiling Mount





2.4 GHz Omni-Directional Antennas

- 12 dBi Omni-Directional (Outdoor only)



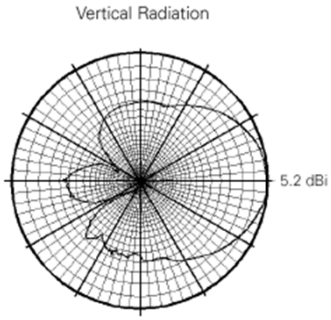
5 GHz Omni-Directional Antennas

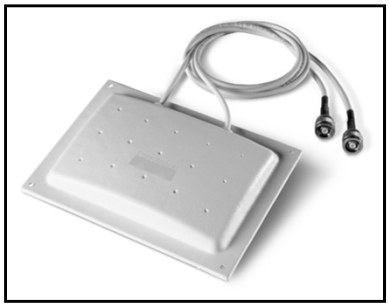
- 9 dBi omni (Vertical polarization)

Directional Antennas

2.4 GHz Diversity Antennas

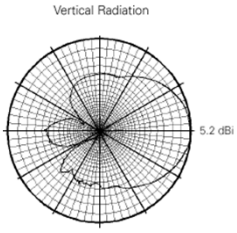
- 6.5 dBi Diversity Patch Wall Mount – 55 degree

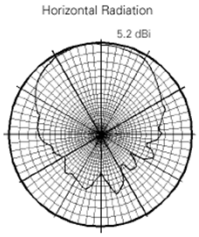


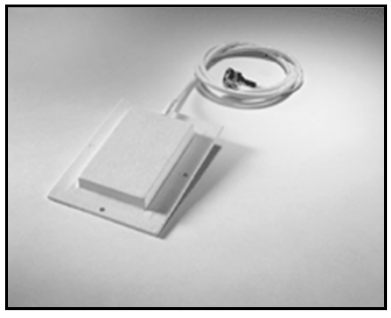


2.4 GHz Directional Antennas (cont.)

- 6 dBi Patch Antenna – 65 degree

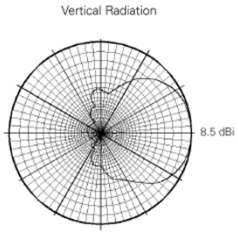


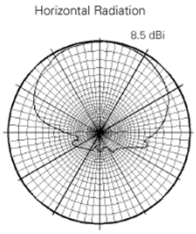


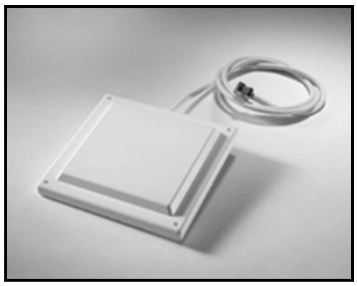


2.4 GHz Directional Antennas (cont.)

- 8.5 dBi Patch Antenna – 60 degree

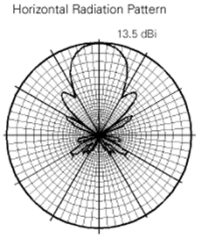


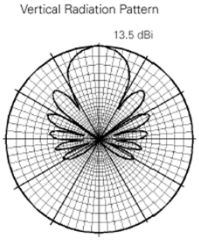




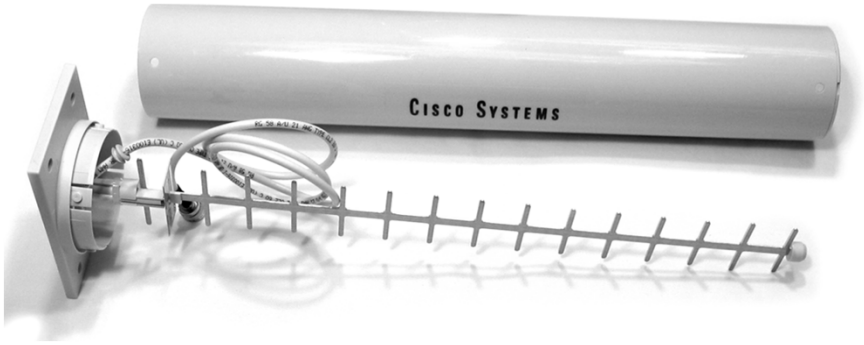
2.4 GHz Directional Antennas (cont.)

- 13.5 dBi Yagi Antenna – 25 degree



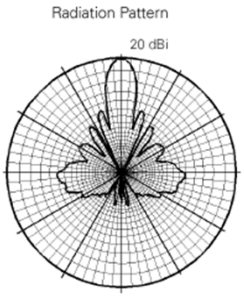


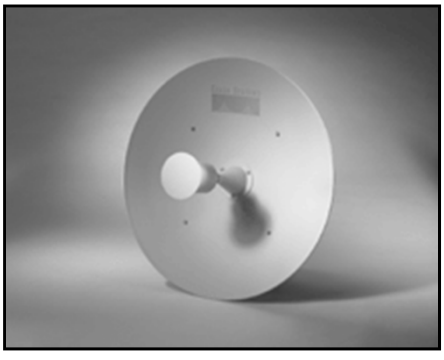
13.5 dBi Yagi Antenna—Inside view



2.4 GHz Directional Antennas (cont.)

- 21 dBi Parabolic Dish Antenna – 12 degree





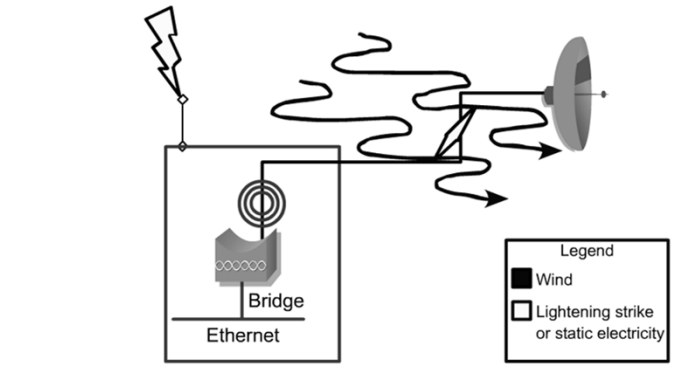
5 GHz Omni-Directional Antennas

– 28 dBi dish (H or V polarization)

5 GHz Antenna

– 9.5 dBi sector (H or V polarization)

Lightning

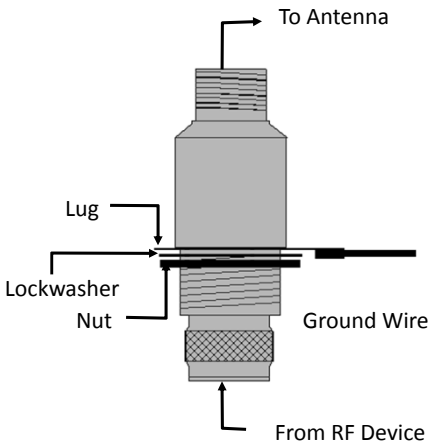


Static Electricity
- Wind
- Nearby Strikes

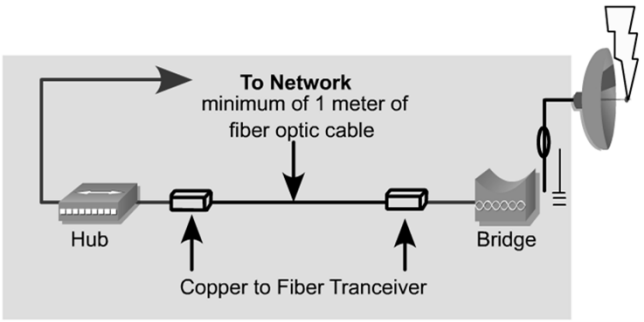
Lightning Arrestor

Lightning Arrestor

- Designed to protect LAN devices from static electricity and lightning surges that travel on coax transmission lines
- RP-TNC connectors used on all Cisco Antennas



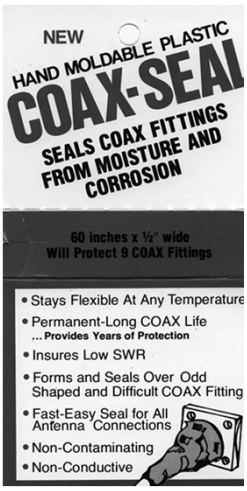
Direct Strike Protection



Protection from a direct strike
- 1 meter fiber optic cabling
- Electricity will not travel over fiber
- Transceivers require power

Coax Connection Sealing

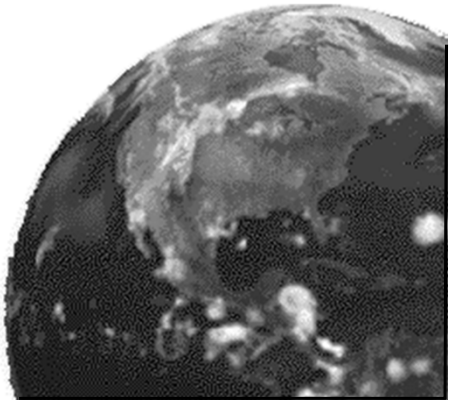
- Number one problems with bridges - water in the connectors
- Proper sealing is important
- Coax Seal is one product that is inexpensive and works great



Link Engineering and RF Path Planning

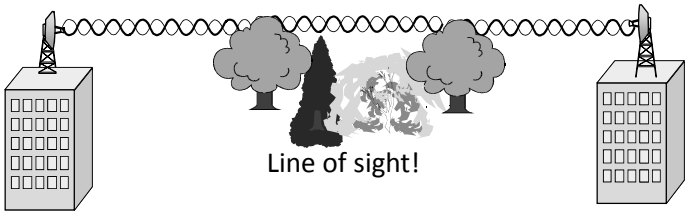
Path Considerations

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



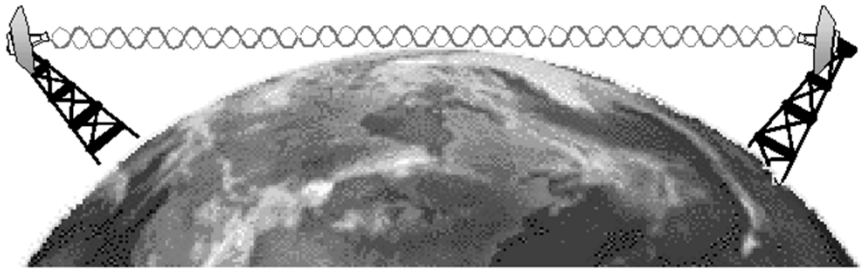
Line of Sight

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

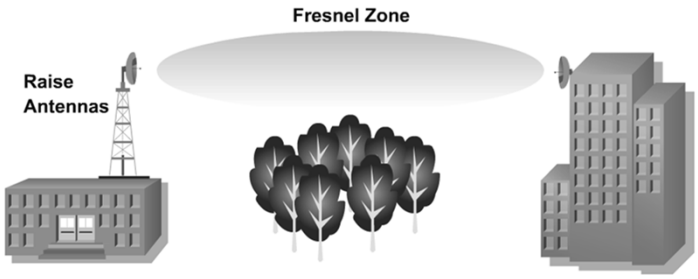


Longer Distances

- 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

Improving Fresnel Effect

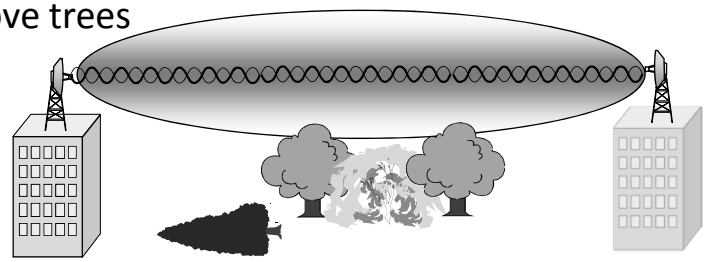
Raise the antenna

New structure

Existing structure

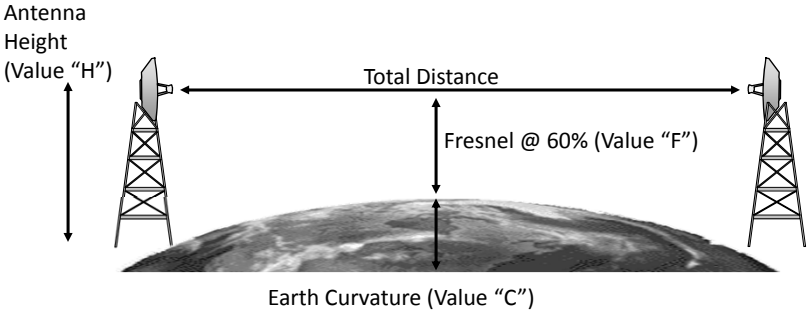
Different mounting point

Remove trees



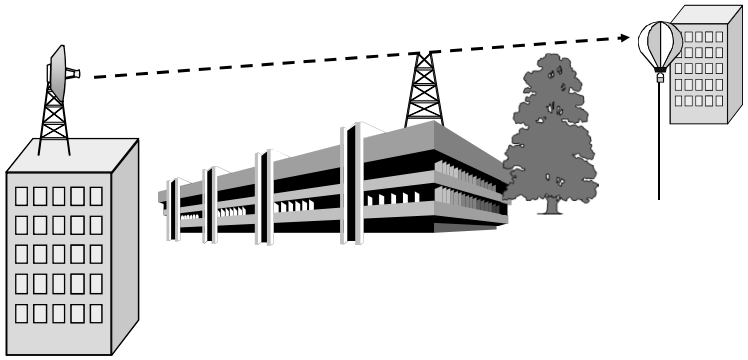
Site to Site Fresnel Zone

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

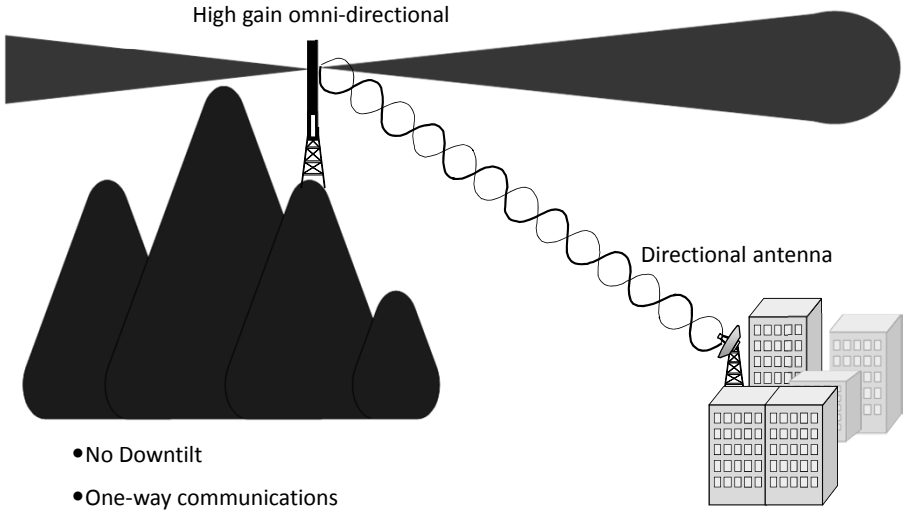


Antenna Alignment

Line of Sight

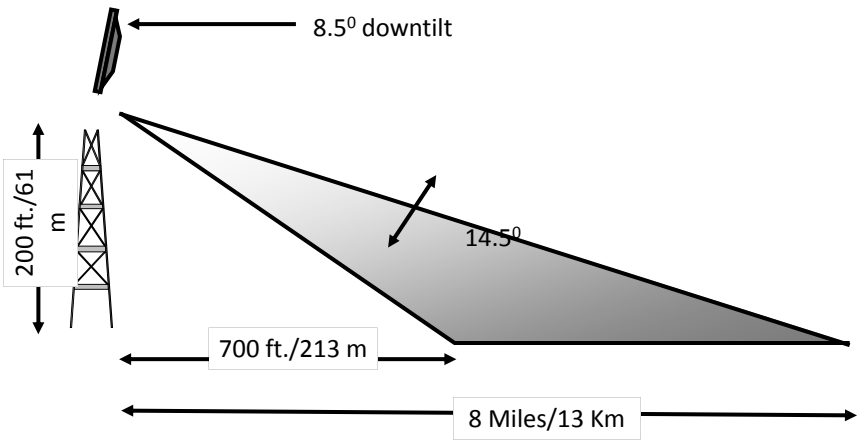


Antenna Issues



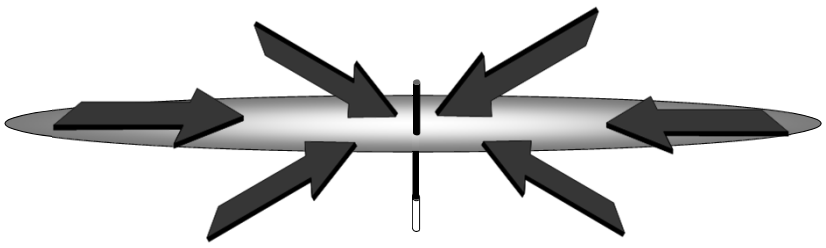
- No Downtilt
- One-way communications

Antenna Issues (cont.)



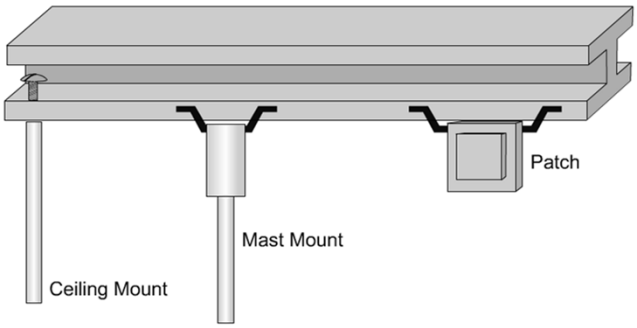
Antenna Issues (cont.)

- Omni-directional antennas provide 360^0 coverage
- Also accepts interference from all directions



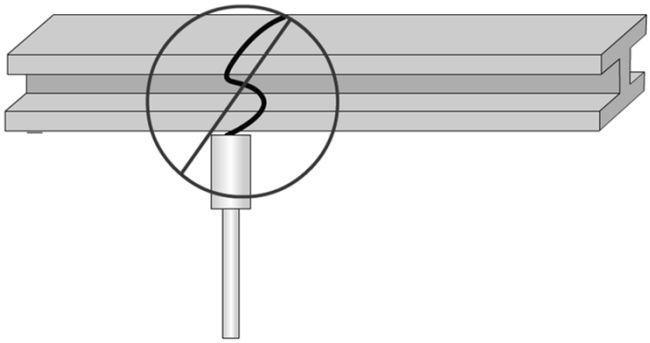
Antenna Installation

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"

Antenna Installation

Towers and antennas may require permits and must meet local regulations