

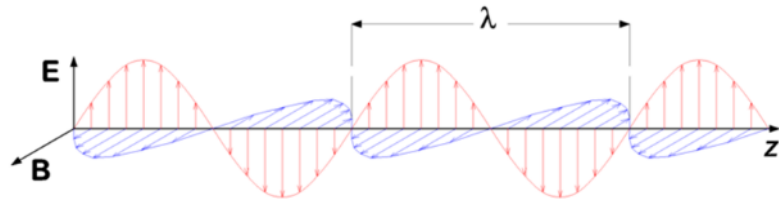
# Antenna Selection for Wi-Fi Deployments

## Topics:

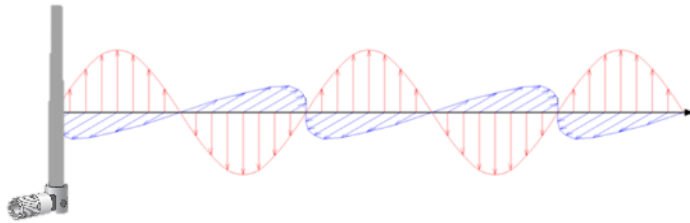
- Antenna functionality
- Antenna specifications
- Antenna types
- Internal vs. external
- Coverage patterns
- Bridge links



# Understanding Antennas



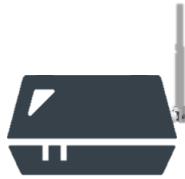
Electromagnetic Waves



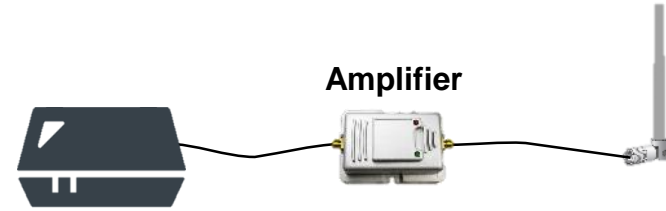
Antennas radiate electromagnetic waves into the air

Antennas both radiate and receive electromagnetic waves. They radiate the waves as the electromagnetic signal escapes from the antenna. They receive waves as the energy is captured by the antenna.

# Active vs. Passive Gain

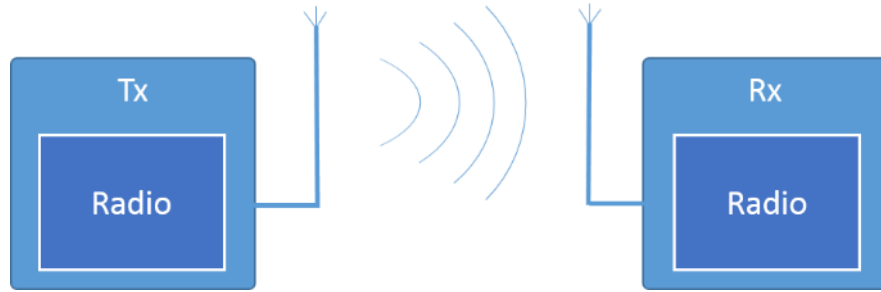


**Passive gain uses no extra amplification and relies fully on the directionality of the antenna for increased RF energy in a desired direction.**

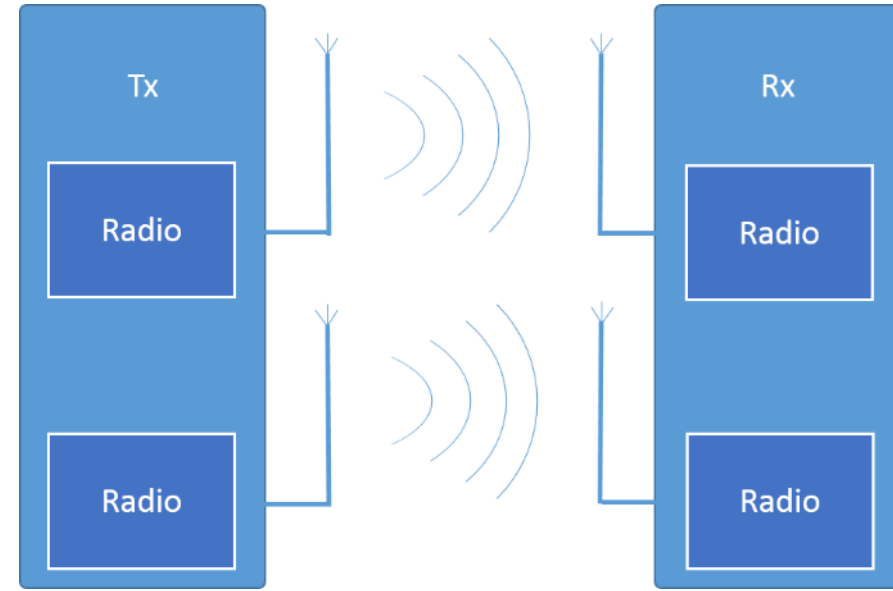


**Active gain uses an RF amplifier to increase the signal strength. The amplifier is placed in path between the AP and antenna or between the radio and antenna.**

# SISO vs. MIMO

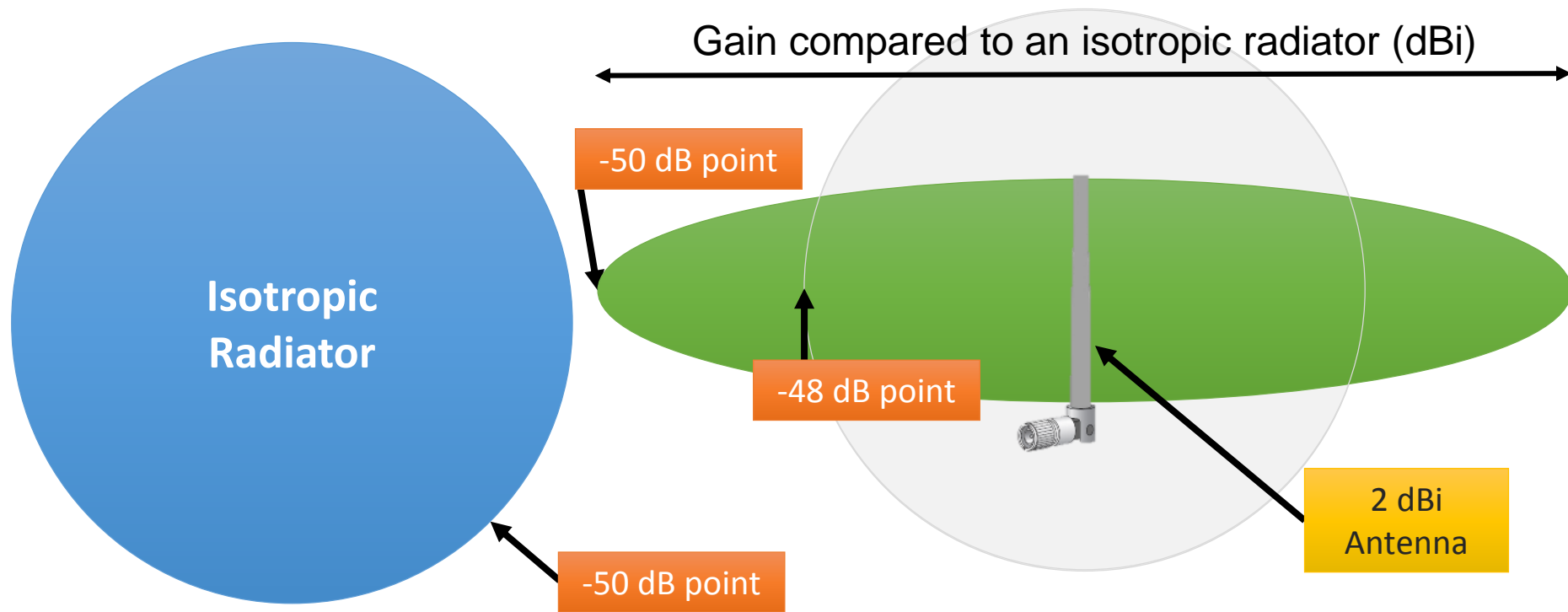


Single Input/Single Output



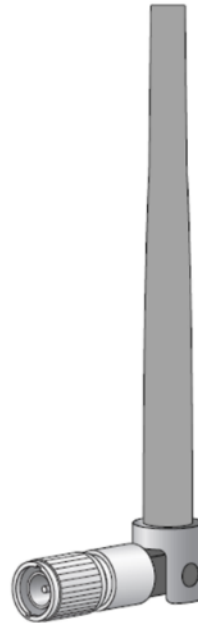
Multiple Input/Multiple Output

dBi



# Antenna Specifications

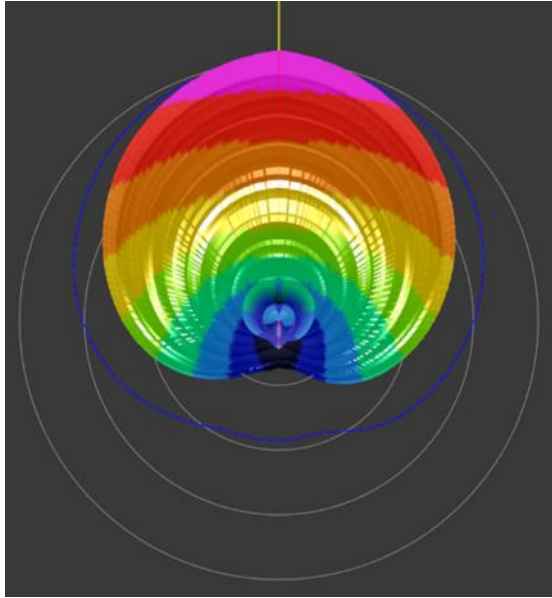
Antenna type	Dipole
Operating frequency range	2402-2495 MHz
Nominal input impedance	50 Ohms
2:1 VSWR bandwidth	2385 - 2515 Mhz
Peak gain	2 dBi
Polarization	Linear, vertical
E-Plane 3-dB beamwidth	70 degrees
H-Plane 3-dB beamwidth	Omnidirectional
Dimensions	5.5 in. (13 cm)
Weight	1 oz.
Connector type	RP-TNC plug
Environment	Indoor
Operating temperature range	32°F to 140°F (0°C to 60°C)



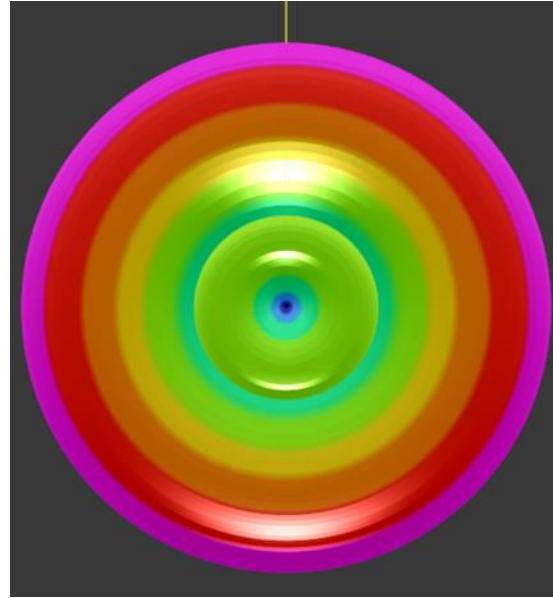
## Key Specifications

- Frequency
- Resistance (Ohms)
- Gain
- Connector type
- Beamwidth

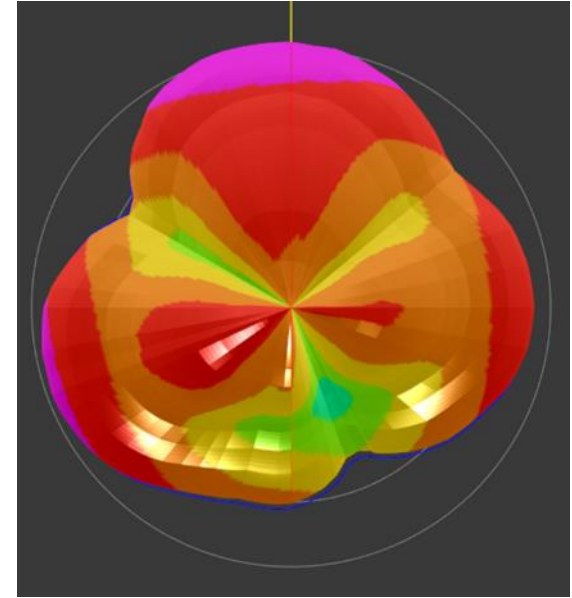
# RF Radiation Patterns



Patch Antenna

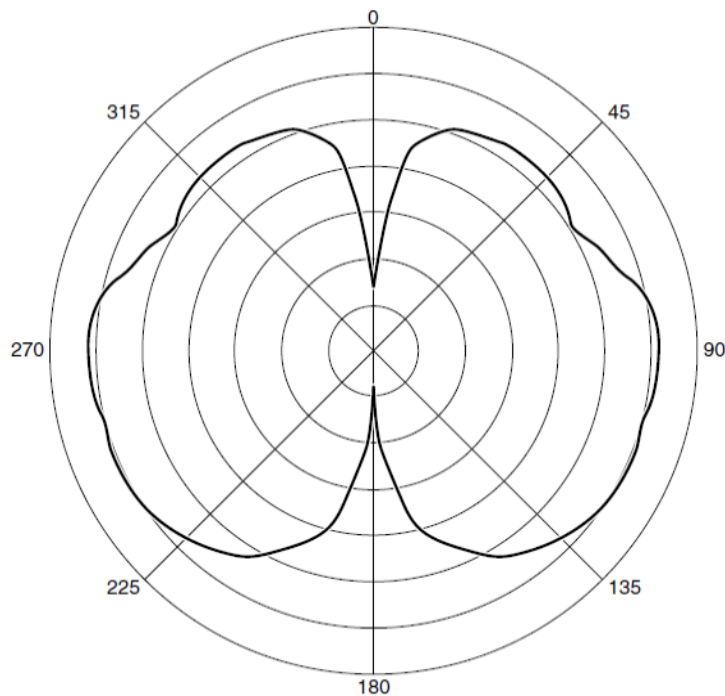


Omni Antenna

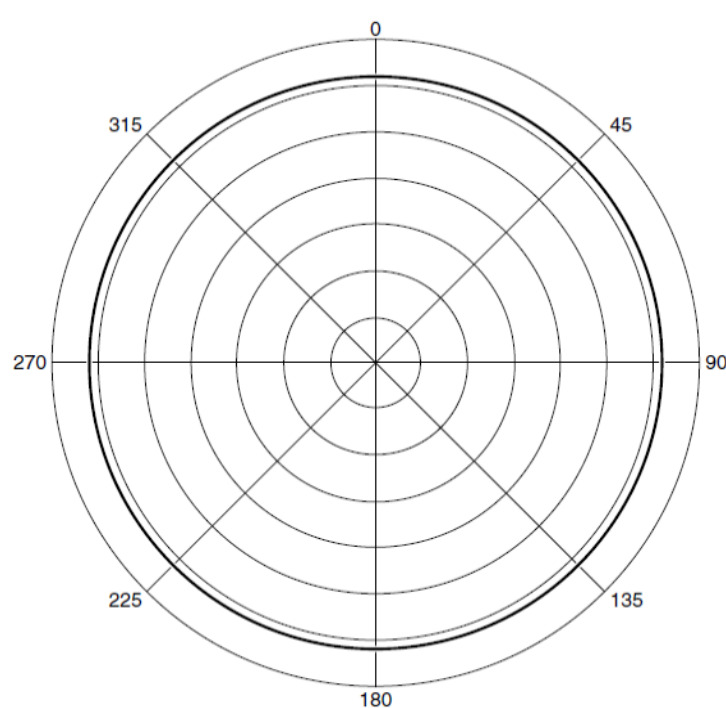


Internal AP  
Antenna

# Antenna Charts



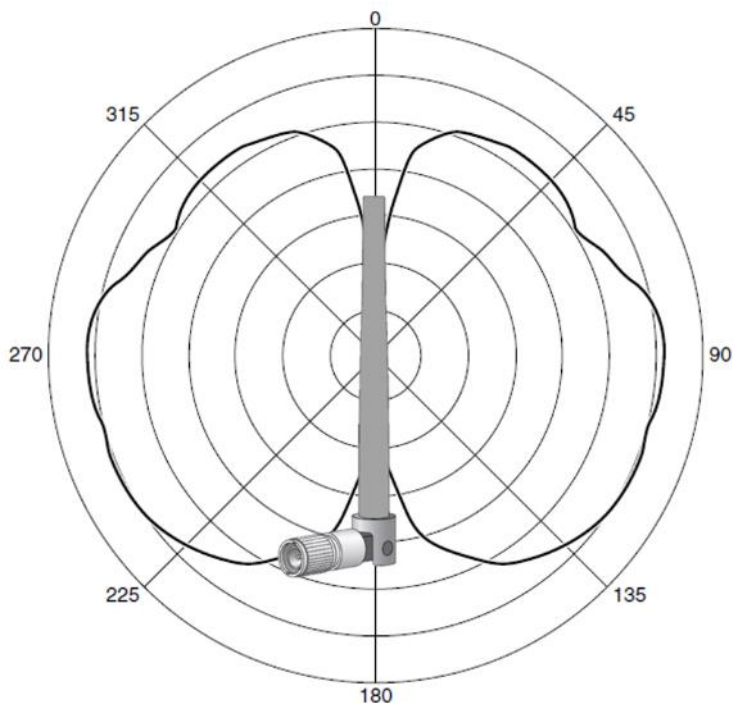
Elevation (Vertical)



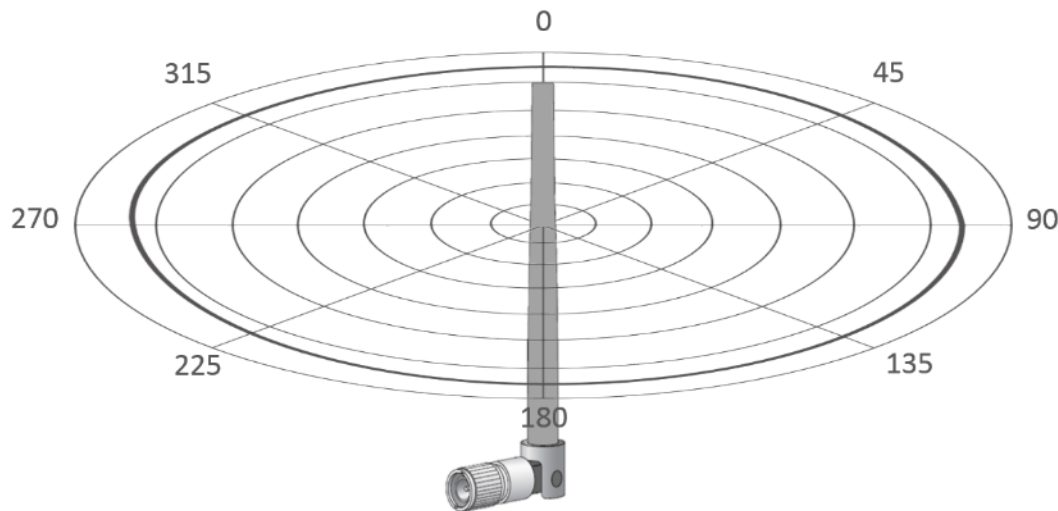
Azimuth (Horizontal)



# Elevation and Azimuth Charts Illustrated



Elevation (Vertical)



Azimuth (Horizontal)

# Antenna Types



Omnidirectional



Patch  
Semi-Directional



Dish  
Highly Directional

# Internal vs. External Antennas

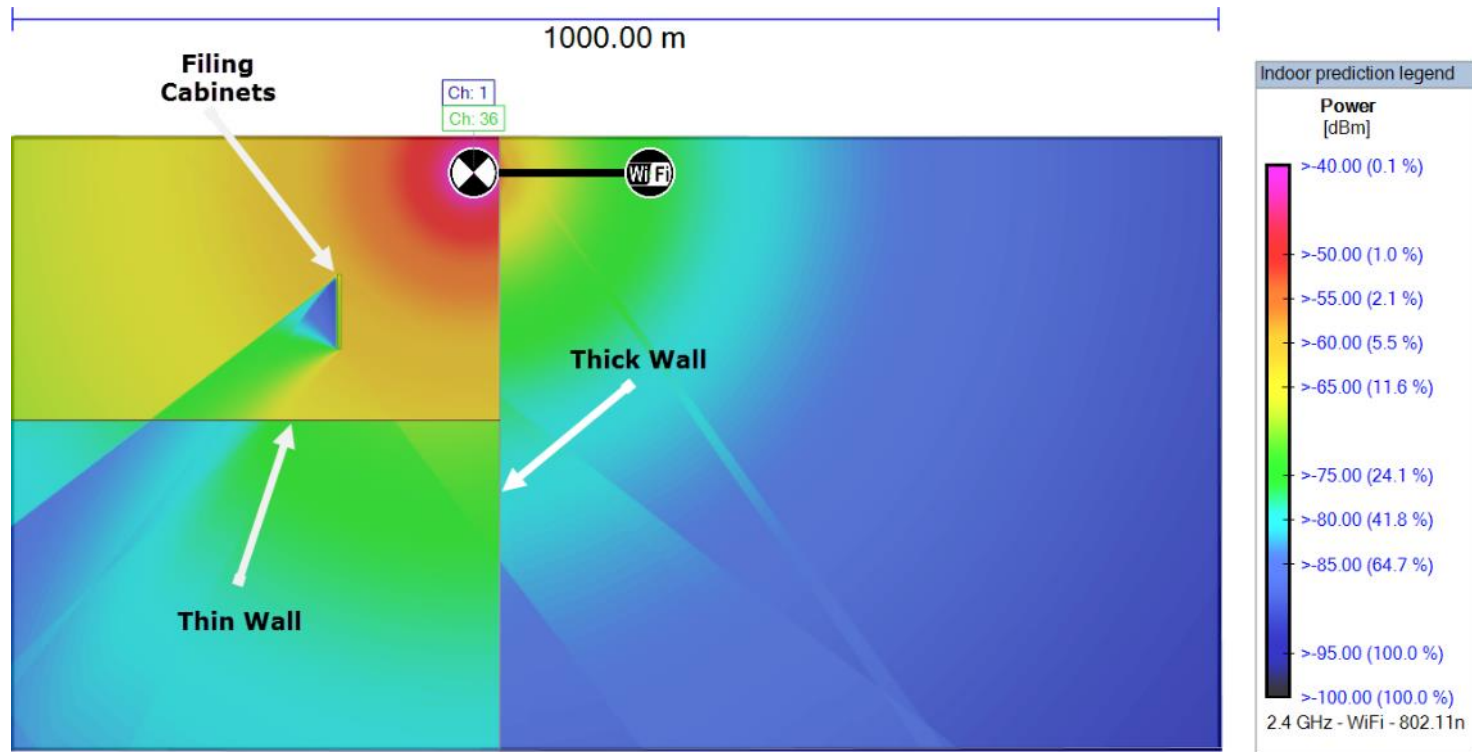
Internal antennas work well for common office space deployments.



External antennas work well for coverage of large areas or when directionality is needed.

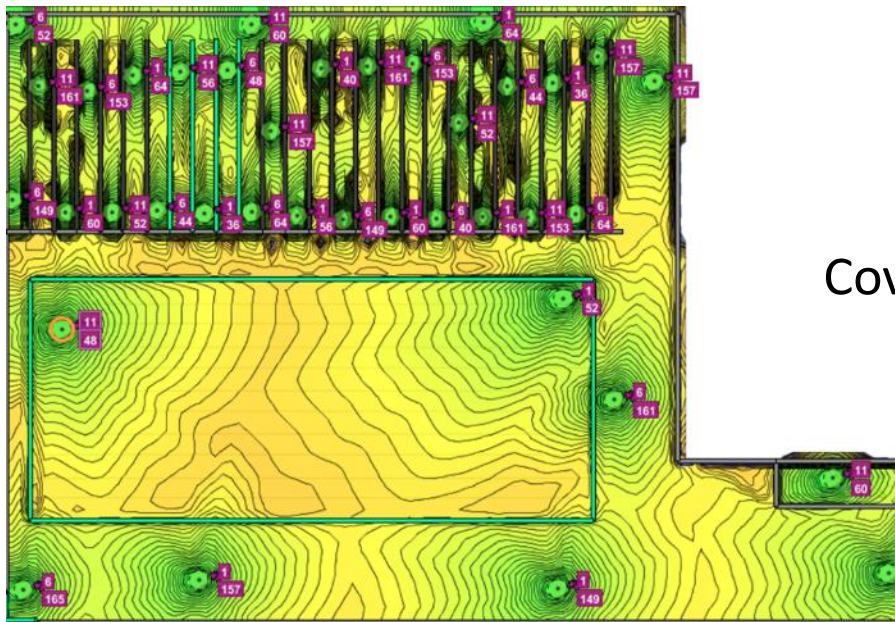
# Environmental Impact on Radiation Patterns

Materials and objects in the environment will change the radiation pattern in actual space from that specified for the antenna.



# WLAN Coverage

# Warehouse Coverage



## Office Coverage



## Coverage factors:

- Radiation patterns
- Output power
- RF behaviors



# Outdoor Coverage



Semi-directional antennas are used in this case to radiate out from the building.

# Bridge Links

## Factors:

- Link Budget
- Required Data Rate
- Link Quality

