Agenda for Day 2 (04-May-2021)

03:00 PM BST UTC+6	Waiting and Recap
03:05 PM BST UTC+6	Understanding AP Parameters
04:40 PM BST UTC+6	Q&A?
03:50 PM BST UTC+6	AP sizing parameters for your Organizations needs
04:05 PM BST UTC+6	Q&A?
04:10 PM BST UTC+6	Break for 10 Minutes
04:20 PM BST UTC+6	Understanding on WIFI survey tools
04:25 PM BST UTC+6	Working with FortiPlanner (Fortinet WIFI survey tool)
04:30 PM BST UTC+6	Sample Survey using FortiPlanner
04:50 PM BST UTC+6	Q&A?
05:05 PM BST UTC+6	Wrap-up

WiFi Alliance Certification

Wi-Fi CERTIFIED™ is an internationally-recognized seal of approval for products indicating that they have met industry-agreed standards for interoperability, security, and a range of application specific protocols.

Wi-Fi CERTIFIED products have undergone rigorous testing by one of our independent Authorized Test Laboratories. When a product successfully passes testing, the manufacturer or vendor is granted the right to use the Wi-Fi CERTIFIED logo. Certification means that a product has been tested in numerous configurations with a diverse sampling of other devices to validate interoperability with other Wi-Fi CERTIFIED equipment operating in the same frequency band.

Certification is available for a wide range of consumer, enterprise, and operator-specific products, including smartphones, appliances, computers and peripherals, networking infrastructure, and consumer electronics. At retail, the Wi-Fi CERTIFIED logo gives consumers confidence that a product will deliver a good user experience. Service providers and enterprise IT managers specify Wi-Fi CERTIFIED to reduce support costs and ensure a product has met industry-agreed requirements.

A company must be a member of Wi-Fi Alliance® and achieve certification to use the Wi-Fi CERTIFIED logo and Wi-Fi CERTIFIED certification marks.

Wi-Fi Generations – IEEE 802 LANs

Generation/IEEE Standard	Maximum Link-rate	Adopted	Frequency
Wi-Fi 6E (802.11ax)	600 to 9608 Mbit/s	2019	6 GHz
Wi-Fi 6 (802.11ax)	600 to 9608 Mbit/s	2019	2.4/5 GHz
Wi-Fi 5 (802.11ac)	433 to 6933 Mbit/s	2014	5 GHz
Wi-Fi 4 (802.11n)	72 to 600 Mbit/s	2008	2.4/5 GHz
802.11g	6 to 54 Mbit/s	2003	2.4 GHz
802.11a	6 to 54 Mbit/s	1999	5 GHz
802.11b	1 to 11 Mbit/s	1999	2.4 GHz
802.11	1 to 2 Mbit/s	1997	2.4 GHz
(Wi-Fi 1, Wi-Fi 2, Wi-Fi 3, Wi-Fi 3E are unbranded, but have unofficial assignments)			

Types of AP (based on placement)

- Indoor AP

General all Wireless Access Points are Indoor AP. Indoor access point is designed for simple installation on the ceiling/wall and does not have the ruggedized features.

- Outdoor AP

For instance, a typical outdoor access point will be ruggedized for extreme temperatures and the elements.

- Inroom (indoor)

Indoor type with very small area/room coverage.

Types of AP (based on mounting)

Ceiling Mount (Indoor / Outdoor)	Wall Mount (Indoor)	Pole Mount (Outdoor)
		

Types of AP (based on Antenna)

Internal Antenna
(Indoor and Outdoor)

External Antenna
(Indoor and Outdoor)

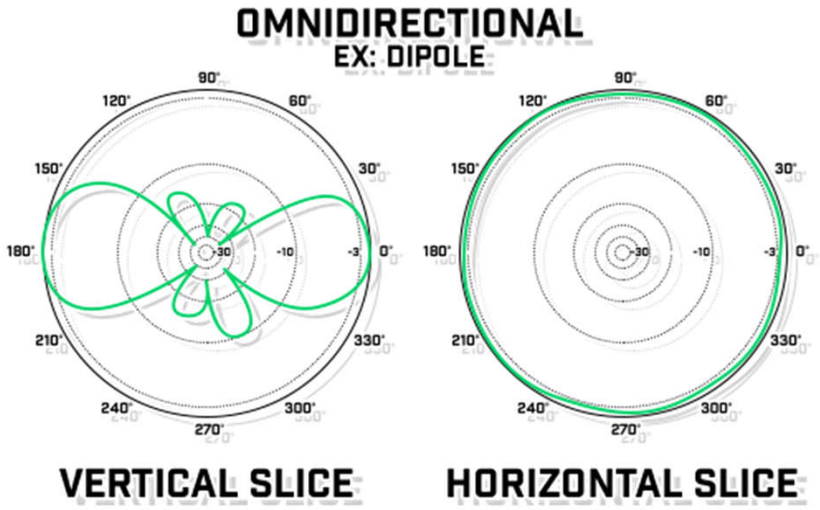
Types of AP (based on Antenna Direction)

Several varying types of antennas exist for WiFi, each with a specific purpose for how and when they should be used. Different types of antennas can be found anywhere from small office settings to outdoor camping grounds. While there are many types of antennas, all of them have the same purpose: producing radio waves to send information through the air. The three main antenna types are:

- Omnidirectional (360 Degree)
- Semi-directional
- Highly Directional

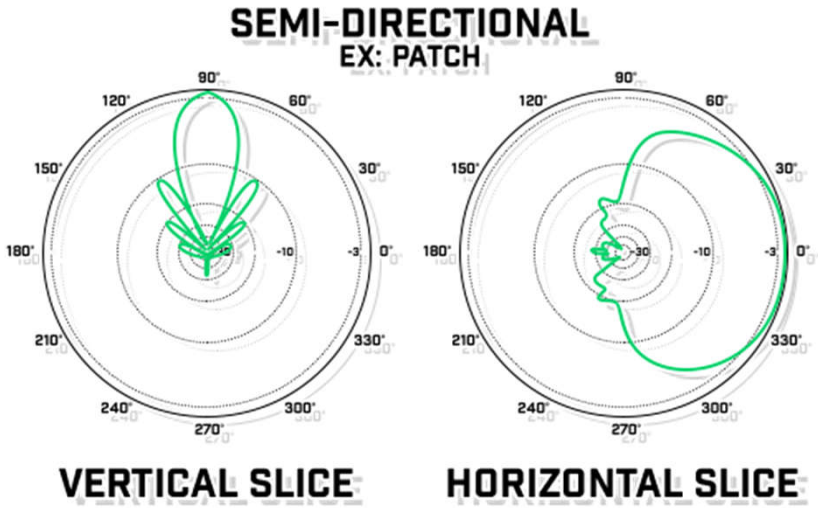
Types of AP (Antenna Direction) - Omnidirectional

Creates a 360-degree coverage pattern. Circular pattern covers wide areas. Ceiling or mast pole mounted.



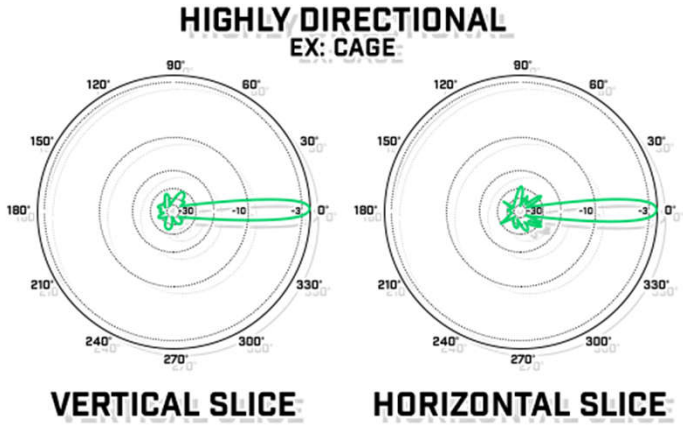
Types of AP (Antenna Direction) – Semi-directional

Semi-directional antennas are designed to direct the RF signal in a specific direction for point-to-point communication. Semi-directional antennas are used for short to medium distance communication indoors or outdoors. A good way to think of how the semi-directional antenna radiates RF is to think of it as a street-lamp shining down on the street. It is common to use semi-directional antennas in a campus like environment since they can provide a network bridge between two buildings.

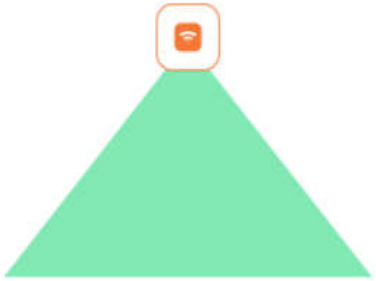
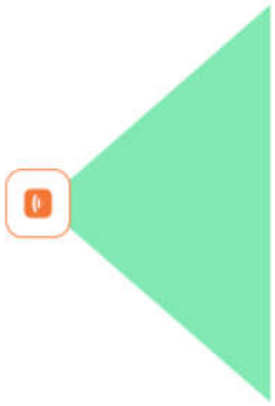
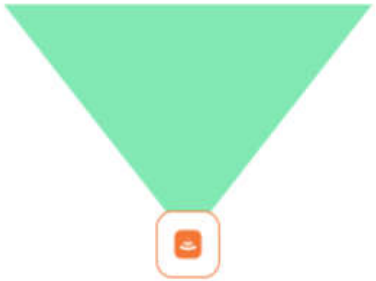


Types of AP (Antenna Direction) – Highly Directional

Highly directional antennas are used for long distant point-to-point communication. They are used to bridge networks between two buildings that are far apart. Because these antennas are high gain, they provide the most focused and narrow beam width. Instead of a street light shining down, it is more of a spotlight shining in a specific direction. The two main highly directional antennas are Parabolic (Dish) and Grid. Dish antennas look similar to the TV dish antennas that you would find in a home but are often much larger in size. Grid antennas can also vary in size, but they look like a grill and are designed for outdoor environments with higher winds.



Proper AP Mounting

Ceiling Mount		Excellent for Office spaces 8-10 foot ceilings space for wiring easily mounted to ceiling tiles
Wall Mount		Excellent for spaces with high ceilings or inaccessable ceilings end of hallways inaccessable ceilings
Floor Mount		Excellent for outdoor venues with no walls or ceilings stadium seating with no other mount available Open areas where wires cannot be run

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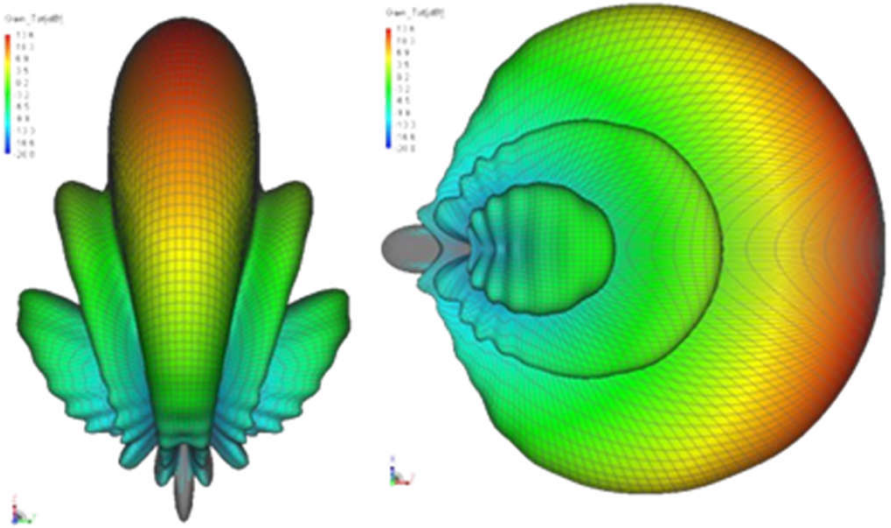
What is antenna gain (peak antenna gain)?

Peak gain is a measure of input power concentration in the main beam direction as a ratio relative to an isotropic antenna source. It is determined as the ratio of the maximum power density in the main beam peak direction, at a defined input power, compared to the power density of a loss less isotropic radiator with the same input power. It is defined in the far-field of the antenna.

Peak gain can also be referred to as Directivity, the key difference however is that directivity neglects antenna losses such as dielectric, resistance, polarization, and VSWR losses.

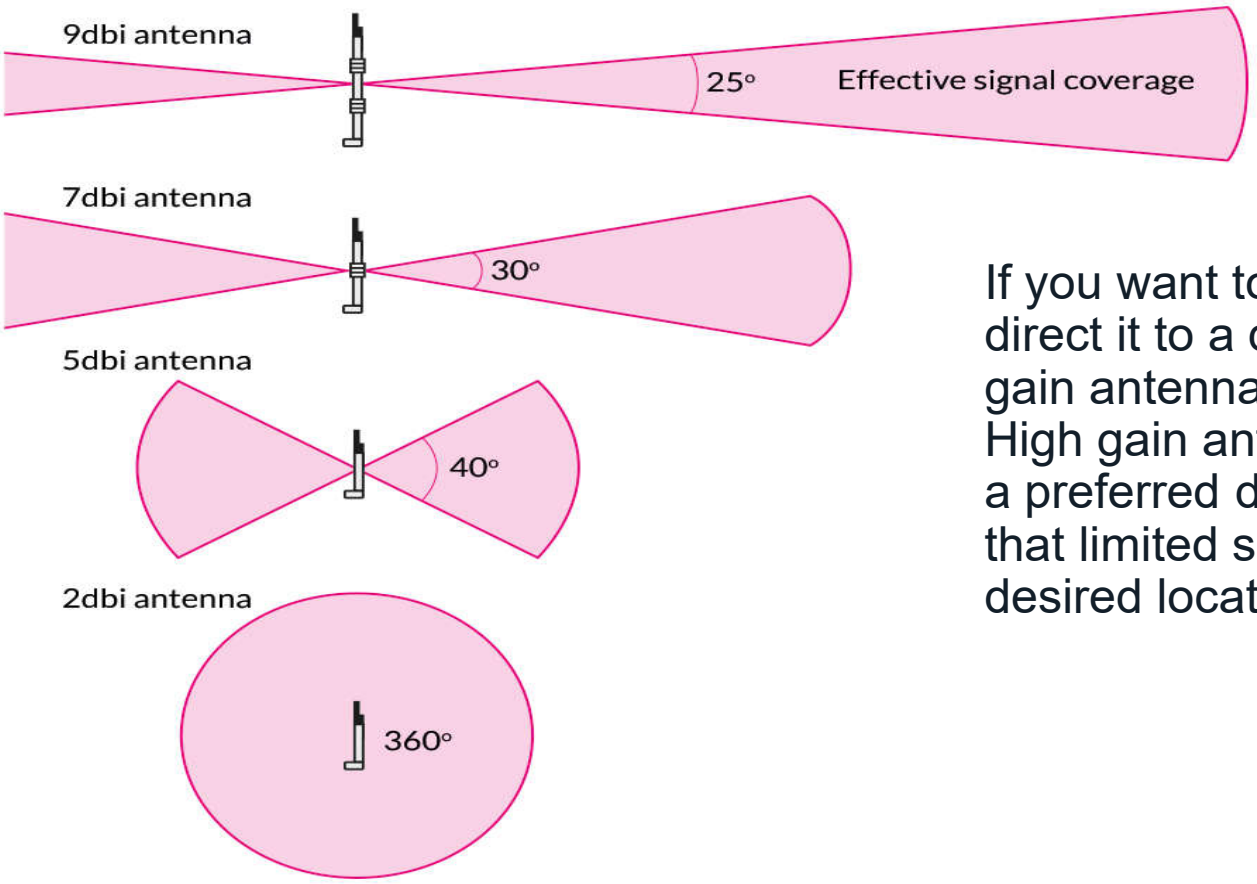


What is antenna gain?

Specification and Definition of Peak Antenna Gain

- Gain is a mean value (also referred to as nominal).
- Gain is specified in dBi (decibel isotropic).
- Gain is specified as a mean value for the specific low, mid, and high down tilt angles of the specified tilt range for each sub-band.
- In addition, the “over all tilts” gain is specified as a mean value plus a tolerance of +/- 1.5 standard deviations for each sub-band. All tilt angles are included in the calculation (in measurement intervals of 1°).
- Gain validation is statistically determined (per methodology listed below).
- The gain specification is based on the mean value as measured on all relevant ports, over the specified frequency ranges, and at the specified tilt settings. Sub-bands of the full frequency range of a broadband antenna must be specified.
- The standard frequencies of gain data points averaged, will include all the low, mid, and high common frequencies in the Tx/Rx bands within the band, or sub-band, over which the gain is specified.
- The repeatability margin associated with a specified mean gain is that the value measured on all samples, at all times, on all calibrated test ranges shall not be more than 0.8 dB lower than the specified value.

Which Antenna and Gain Do I Need?



If you want to focus all of the signal to direct it to a distant target, then the high gain antenna is definitely the best choice. High gain antennas need to be pointed in a preferred direction to send RF signal so that limited signal can be intensified in desired location

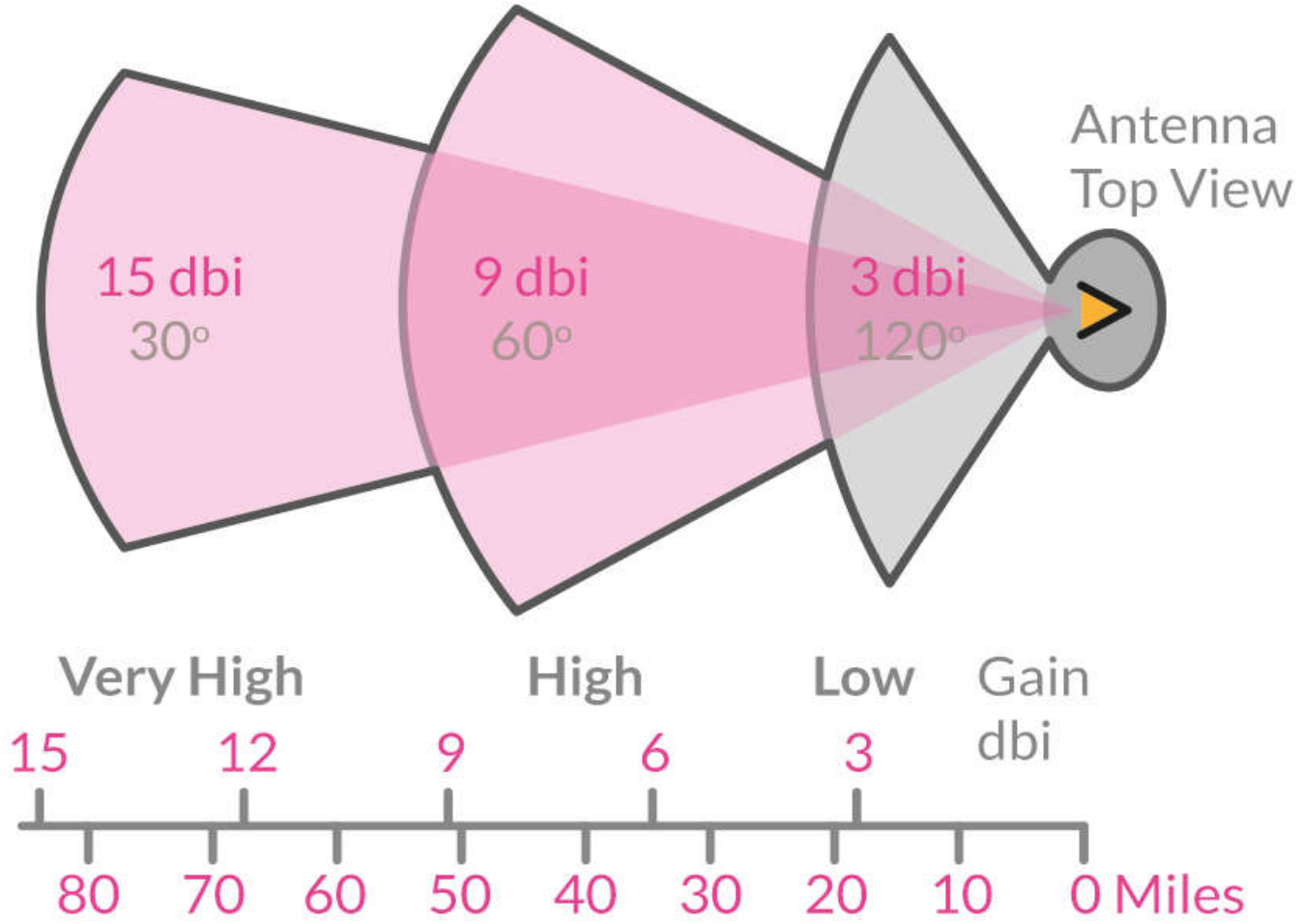
Antenna Gain requirement for Applications uses

Higher gain is not automatically better – it depends on the application. If you don't intend to point your antenna in a particular direction, then you don't need much gain.

For example, say you want to set up a wireless network in an outdoor beer garden of a pub. For this application you would want an Omni-directional antenna to provide 360° signal coverage for every customer.

Using a 15 dBi Omni-directional antenna, the high gain will project the WiFi signal way above the required 400 ft coverage, and will give better signal for people far outside the garden. Users within the 400 ft will actually see lower speeds and poorer signal quality. For this application, a lower gain antenna such as a 6 or 8 dBi would provide better signal quality and coverage for the pub's customers. Additionally, a high gain antenna will not reach users sat down as the wireless signal is projected better horizontally rather than vertically. The lower dBi antenna will provide more of a round shaped signal pattern, which will then project the WiFi signal lower to the ground with better vertical reach, as illustrated in the diagram below.

Antenna Gain requirement for Applications



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WIFI MIMO

Multiple-Input Multiple-Output (MIMO) is a wireless technology that uses multiple transmitters and receivers to transfer more data at the same time. All wireless products with 802.11n support MIMO. The technology helps allow 802.11n to reach higher speeds than products without 802.11n.

Commonly used MIMO:

1. 1x1 MIMO
2. 2x2 MIMO
3. 3x3 MIMO
4. 4x4 MIMO

…

8. 8x8 MIMO

AP Power Source

Usually, AP’s gets power from 3 different power sources:

1. POE Switch (POE/POE+/UPOE)
2. POE Injector (AC/DC converted to POE)
3. AC/DC Power Adapter (direct)

Property	PoE	PoE+	UPoE
Power available	12.95 W	25.50 W	51W
Maximum power delivered	15.40 W	30.0 W	60W
Minimum cable type	Category 3	Category 5	Category 5+

Access Point Sizing Parameters

Design Considerations – Campus Network

Type	Applications	Device mix	User and device amount	Wireless monitoring
K-12 Schools / High School	Social media, video, email, data sharing, web browsing	Laptop, mobile devices	50 users per access point	Spectrum
Universities	Social media, video, email, data sharing, web browsing	Laptop, mobile devices	50 users per access point	Spectrum
Corporate Headquarters	Email, data sharing, web browsing, printing	Laptops, mobile devices, Internet of things	50 – 100 users per access point	Security and spectrum
Hospitals / Healthcare	Email, data sharing, voice over WiFi	Medical equipment, laptops, mobile devices	30 – 50 users per access point	Security and spectrum
Indoor / Outdoor Stadium	Generic, social media	Mobile devices, point of sale, ticket scanners	30 users per access point	Spectrum

Network Applications Used

Applications	Low	Mid	High	Highest
Cloud Applications	Up to 750 kbps	1.2 Mbps	2.5 Mbps	>2.5 Mbps
Web Browsing and Streaming	300 kbps	700 kbps	1.2 Mbps	>2.5 Mbps
Collaboration and videoconferencing	640 kbps	1.2 Mbps	2.5 Mbps	>2.5 Mbps

Hope it will help…

If you need more info and help on sizing APs for your organization, please discuss with CONSULTANT or WIFI Experts

Additional Tips:

Consider one-fourth (1/4) percentage of performance numbers what is mentioned in company datasheet.