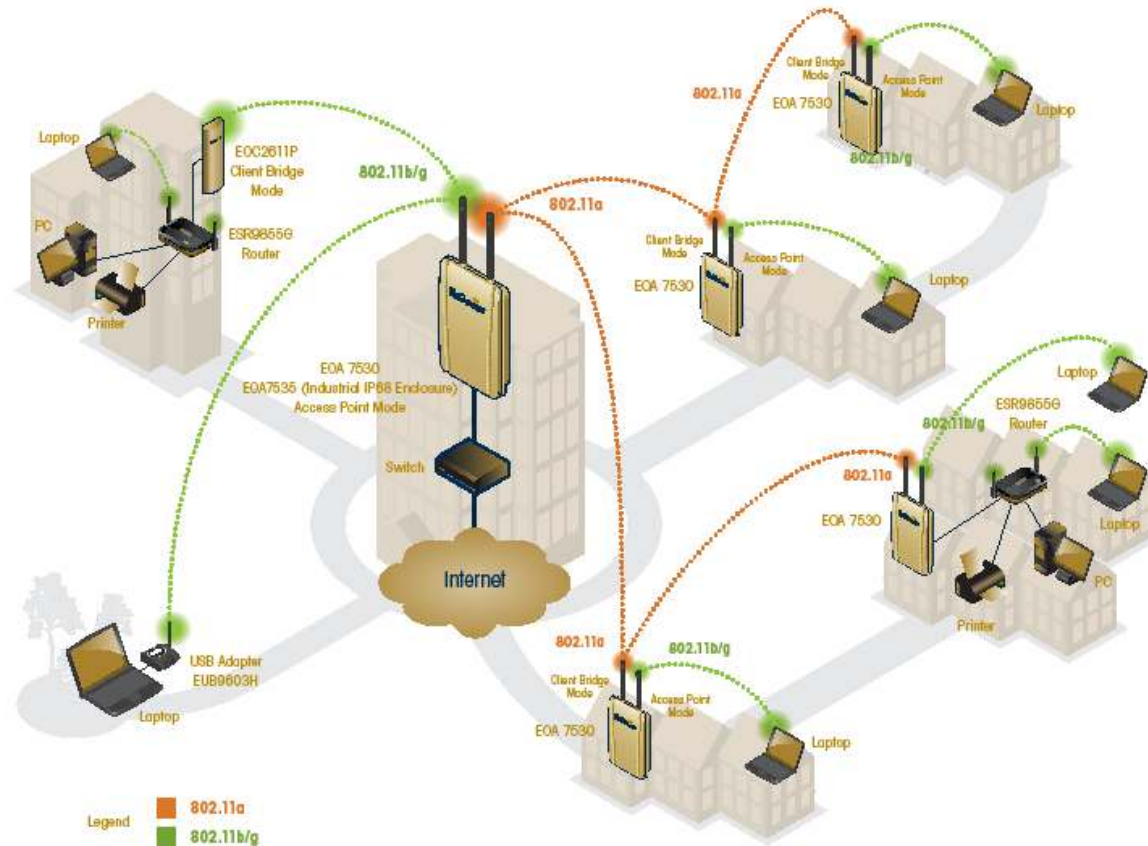


Welcome to EnGenius Versatile Wireless Networking Applications and Configurations - Part 1

Outdoor Wireless Networking Products



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Topics

About Engenius

Key Specifications

- 802.11 Standards

- IP Rating

- PoE

- Transmit Power

RF Basics

General Application Models

- Hotspot

- Point to Point Long Range

- CPE

- Dual Radio Repeater

- Campus

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About EnGenius

EnGenius® Technologies, Inc. is an industry expert in wireless communications and radio frequency (RF) technology. The company pioneered “Affordable Long-Range Wireless” communication solutions, and creates wireless voice and data products for home, SOHO and SMB use that are versatile, feature-rich, business-class and affordable. Our complete line of award-winning devices is designed to deliver long-range, fast speeds, robust security, and ease-of-use. Established in 1999, EnGenius Technologies, Inc. is a wholly-owned subsidiary of Senao Networks, a Taiwan RF communications manufacturing company.

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Key Specifications

- IEEE802.11a/b/g/n wireless standards
- IP55/IP68 rated enclosure (outdoor models)
- PoE (Power over Ethernet)
- Up to 600mW TX power
- WEP/WPA/WPA2 Encryption

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Wi-Fi Standards

- 802.11**b**
2.4GHz, 11Mbps throughput, DSSS modulation
- 802.11**a**
5GHz, 54Mbps throughput, OFDM modulation
- 802.11**g**
2.4GHz, 54Mbps throughput, OFDM modulation
- 802.11**n**
2.4GHz and 5GHz, 300Mbps throughput, MIMO and Spatial Multiplexing, 20-40MHz channels

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Understanding 802.11n

Higher data throughput achieved by adding:

- MIMO for Spatial Multiplexing
- 20-40MHz channels
- Can be 2.4GHz or 5GHz

Facts:

“Under the best conditions, many 802.11n routers deliver throughput between 100 Mbps and 120 Mbps near the router. However, speeds degrade quickly to about 45 Mbps in the 300- to 600-foot range”

“The truth about the 802.11n specification is that it does not really increase your wireless coverage area.”

-Quoted from Laptopmag.com

The same RF physics still apply, so the wireless connection will still drop out at the same signal levels.

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IP65/IP68 Rated Enclosure

- This IP rating is used to specify the strength of the enclosure that surrounds electronic equipment and is determined by specific tests.
- An IP65 rating means a device is totally protected against dust and against low pressure jets of water from all directions (limited ingress permitted).
- An IP68 rating means a device is totally protected against dust and against the effect of long periods of immersion under pressure.

(Outdoor models only)

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PoE (Power over Ethernet)

- EnGenius outdoor models come with proprietary PoE injectors
- Eliminates the need to run 110/220 VAC power to wireless access points and other devices.
- System installers need to run only a shielded CAT5 Ethernet cable that carries both power and data to each device.
- Allows greater flexibility in the locating of AP's and network devices and significantly decreasing installation costs in many cases.



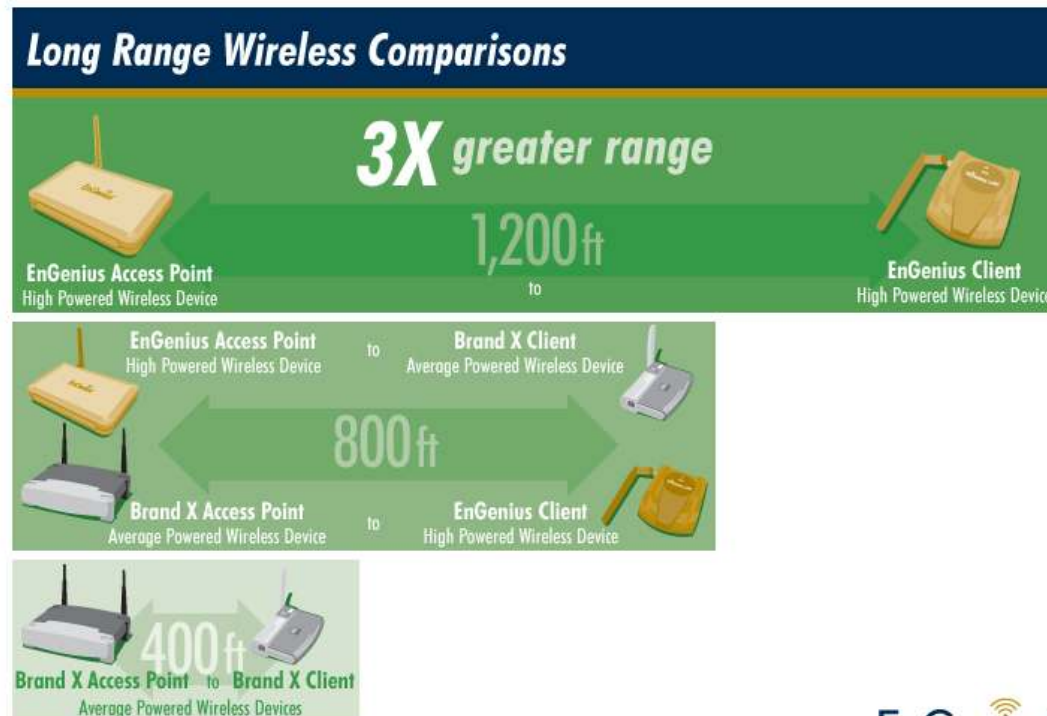
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Transmit Power

- Tx power is the amount of power a radio transmits
- Generally, the longer the distance, the more power needed
- High transmit power and receive sensitivity means less APs.



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Understanding dBm

- The dBm is an absolute power measurement.
 - The “m” stands for milliwatt, which is the reference point.
 - 0dbm is 1mW of power
 - 1dbm is 1dB stronger than 0dBm or 1dB stronger than 1mW (1.3mW)
 - -x dBm is power less than 1mW

0dBm = 1mW -3dBm = 0.5mW 3dBm = 2mW 10dBm = 10mW -10dBm = 0.1mW
28dBm = 600mW (approx.) 30dBm = 1000mW or 1 watt

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dBm to Milliwatts

dBm to Watt Conversion Table

dBm	Watts	dBm	Watts	dBm	Watts
0	1.0 mW	16	40 mW	32	1.6 W
1	1.3 mW	17	50 mW	33	2.0 W
2	1.6 mW	18	63 mW	34	2.5 W
3	2.0 mW	19	79 mW	35	3.2 W
4	2.5 mW	20	100 mW	36	4.0 W
5	3.2 mW	21	126 mW	37	5.0 W
6	4 mW	22	158 mW	38	6.3 W
7	5 mW	23	200 mW	39	8.0 W
8	6 mW	24	250 mW	40	10 W
9	8 mW	25	316 mW	41	13 W
10	10 mW	26	398 mW	42	16 W
11	13 mW	27	500 mW	43	20 W
12	16 mW	28	630 mW	44	25 W
13	20 mW	29	800 mW	45	32 W
14	25 mW	30	1.0 W	46	40 W
15	32 mW	31	1.3 W	47	50 W

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Understanding dBi

- Dbi = The Db gain an antenna has as compared to a baseline “Isotropic radiator” type antenna. It’s simply a reference point.
 - The Isotropic radiator is a theoretical antenna where the signal is transmitted like a globe, equally in all directions.
 - Does not exist in real life. The design of any real antenna will cause the signal to favor one direction (even slightly) over another.
 - The physical laws of the conservation of energy says if you gain power in one direction, the other direction must be lost.
- To have antenna gain therefore means the signal pattern is changed to be favorable in a certain direction over another. The

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Calculating EIRP

- Dbm and Dbi – You can add or subtract them!
 - Dbm is power while Dbi is antenna gain.
 - The total power (transmitter, losses of cable, gain of antenna etc.) is called EIRP (Equivalent Isotropically Radiated Power)
Example: 28dbm + (-2db coax loss) + 6dbi antenna = 34dbm EIRP.
 - FCC limits EIRP for Omni-directional signals to 36dbm for 2.4GHz and 5GHz WiFi
 - For directional signals, for every 3db of antenna gain beyond 6dbi, transmitter power must be reduced by 1dbm.
30dbm +6dbi = 36dbm EIRP 29dbm +9dbi = 38dbm EIRP

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Up to 600mW Tx Power

- The typical leading brand AP has a Tx power of 17dBm or 50mW
Rule of thumb:
Outdoors - for every increase of 6 dB, the coverage distance doubles.
Indoors - for every increase of 9 dB, the coverage area doubles.
- An increase of 3dBm is double the power in mW.

Available Transmit Power
(Average):

IEEE 802.11g

28dBm @ 6~24Mbps

26dBm @ 36Mbps

24dBm @ 48Mbps

23dBm @ 54Mbps

IEEE 802.11b

28dBm @ 1~11Mbps

Receive Sensitivity (Typical):

IEEE 802.11g

-92dBm @ 6Mbps

-74dBm @ 54Mbps

IEEE 802.11b

-97dBm @ 1Mbps

-89dBm @ 11Mbps

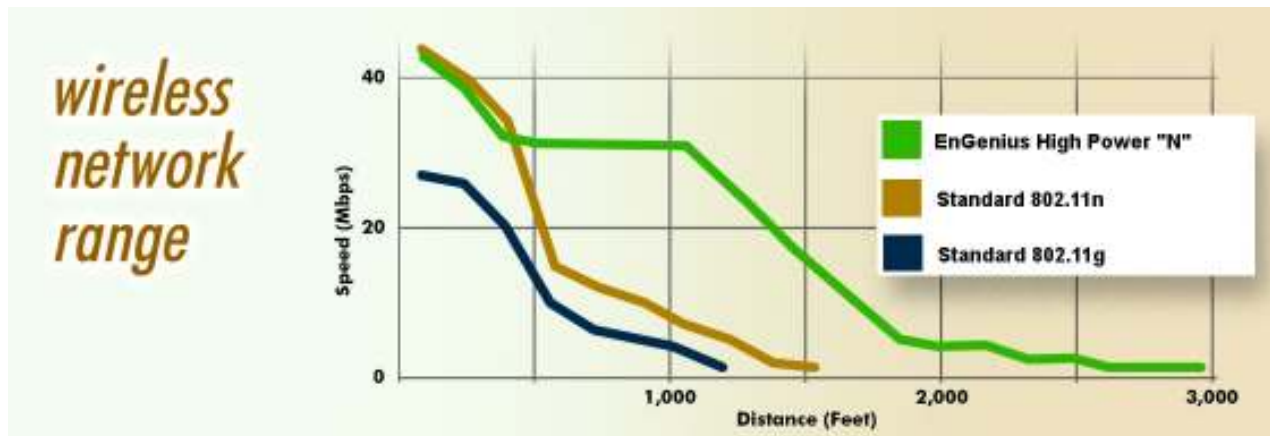
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EnGenius High Power 802.11n

Engenius high power N gives you both long range and higher data transmit rate.



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General Outdoor Applications

- Hotspots
- Point-to-point long distance
- CPE (WISP)
- Dual Radio Repeater
- Campus

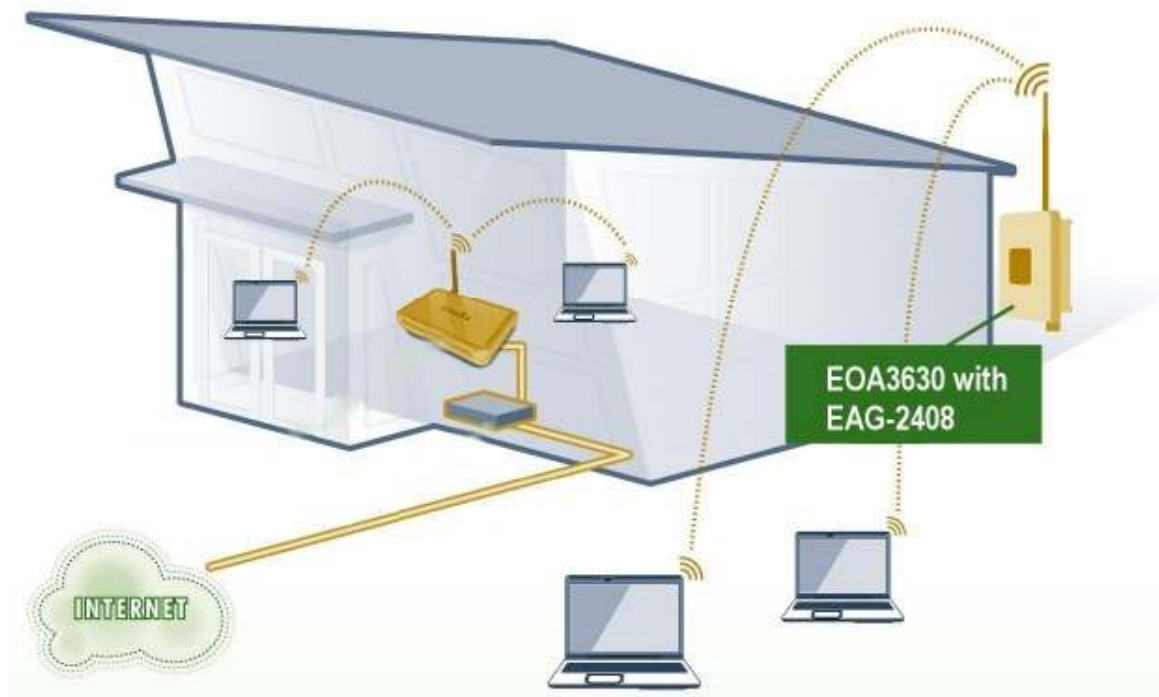
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Hotspot

- Access Points can be added to an existing network to provide wireless connectivity to different network resources for laptops and handheld devices



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600mW G Solution EOA-3630

- 802.11b/g
- 600mW RF Output
- IP55 rated outdoor enclosure
- Type-N RF Connector
- 24V PoE
- Wall or mast bracket
- Multiple SSID (AP mode)



High Power N Solution ENH200 EXT

- 150Mbps N Technology
- 500mW RF Output
- IP55 rated outdoor enclosure
- SMA RF Connector
- 24V PoE
- Wall or mast bracket
- Multiple SSID (AP mode)



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Recommended Accessory

EAG-2408

- 2.4 GHz antenna
- Type N female connector
- 8 dBi gain
- Omni-directional



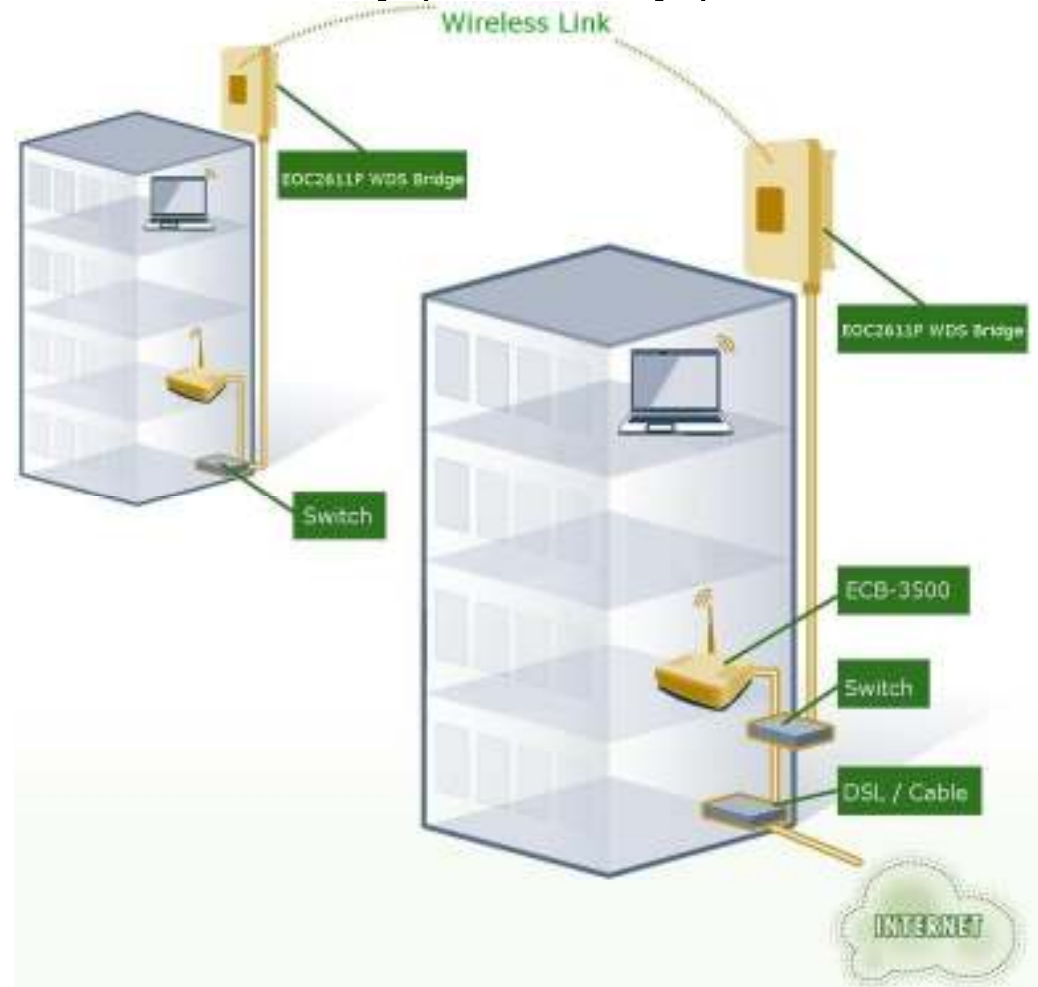
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Point-to-Point Long Range

- Directional antennas
- Clear line of sight



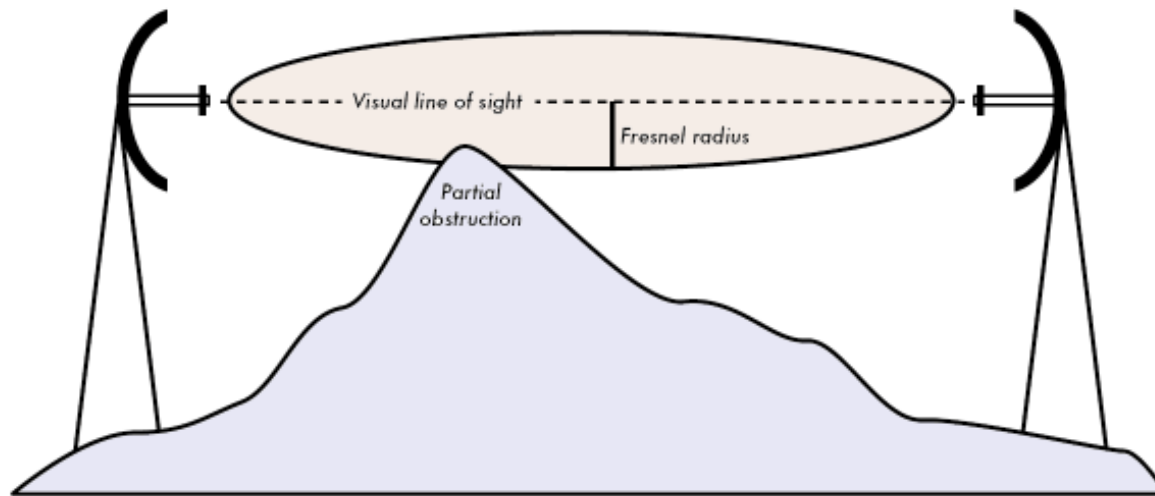
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RF line of sight

- 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.
- Free space loss and curvature of the earth must also be considered.
- Elevate antennas to get above the obstruction.



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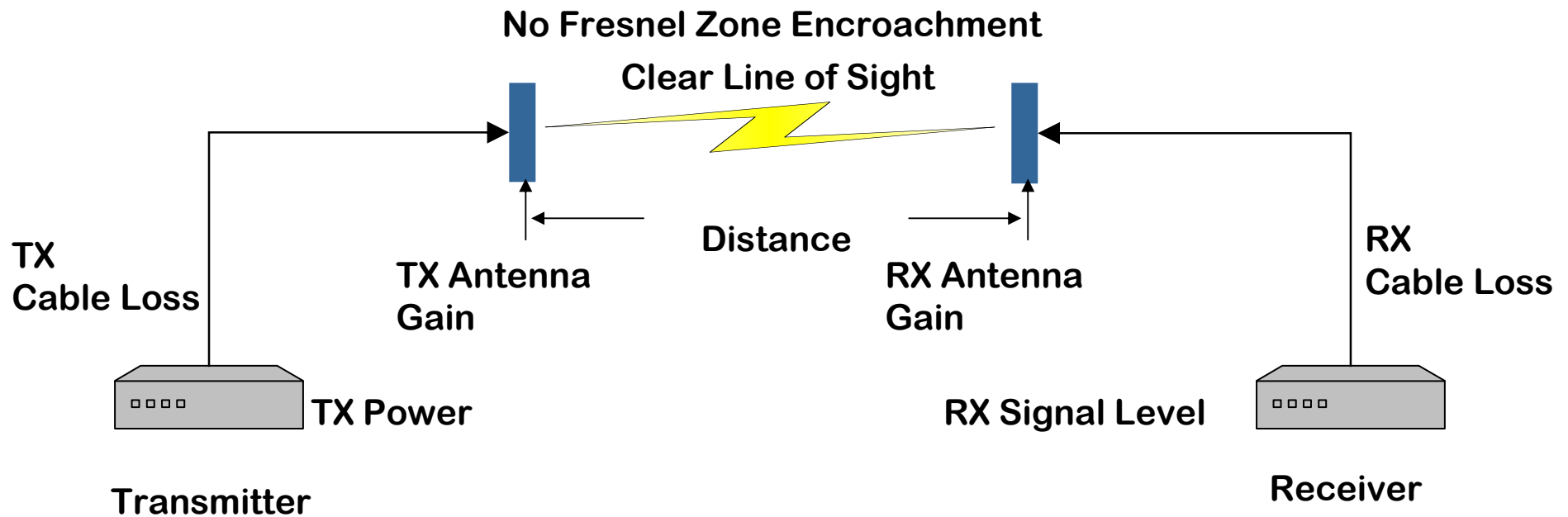
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Link Budget Calculation

- Line of sight is critical.
- Less than 30% obstruction of the Fresnel Zone.
- Proper antennas and alignment.
- Adequate Tx and Rx power on both ends.

<http://www.wirelessconnections.net/calcs/BudgetCalc.asp>

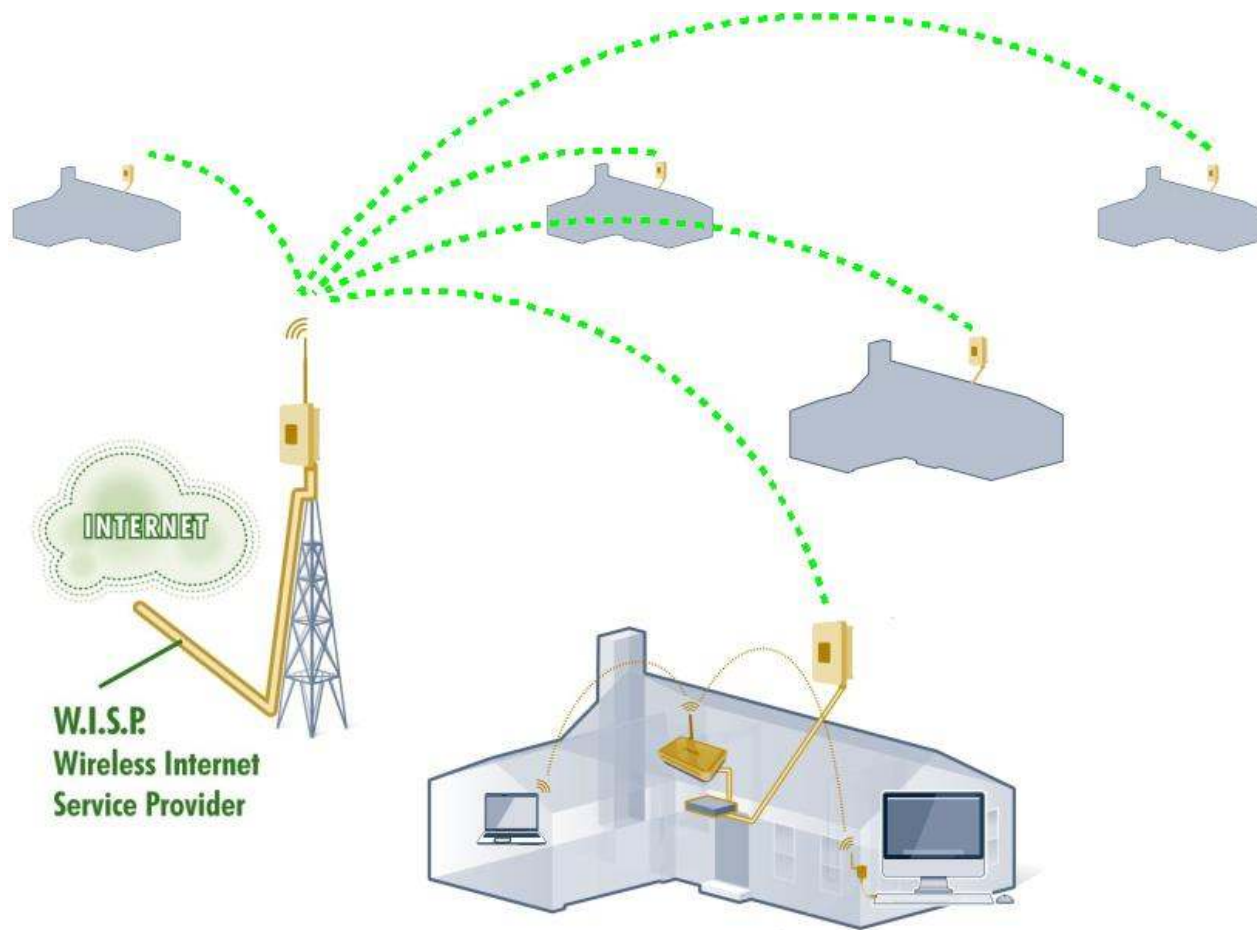


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CPE (Customer Premises Equipment)

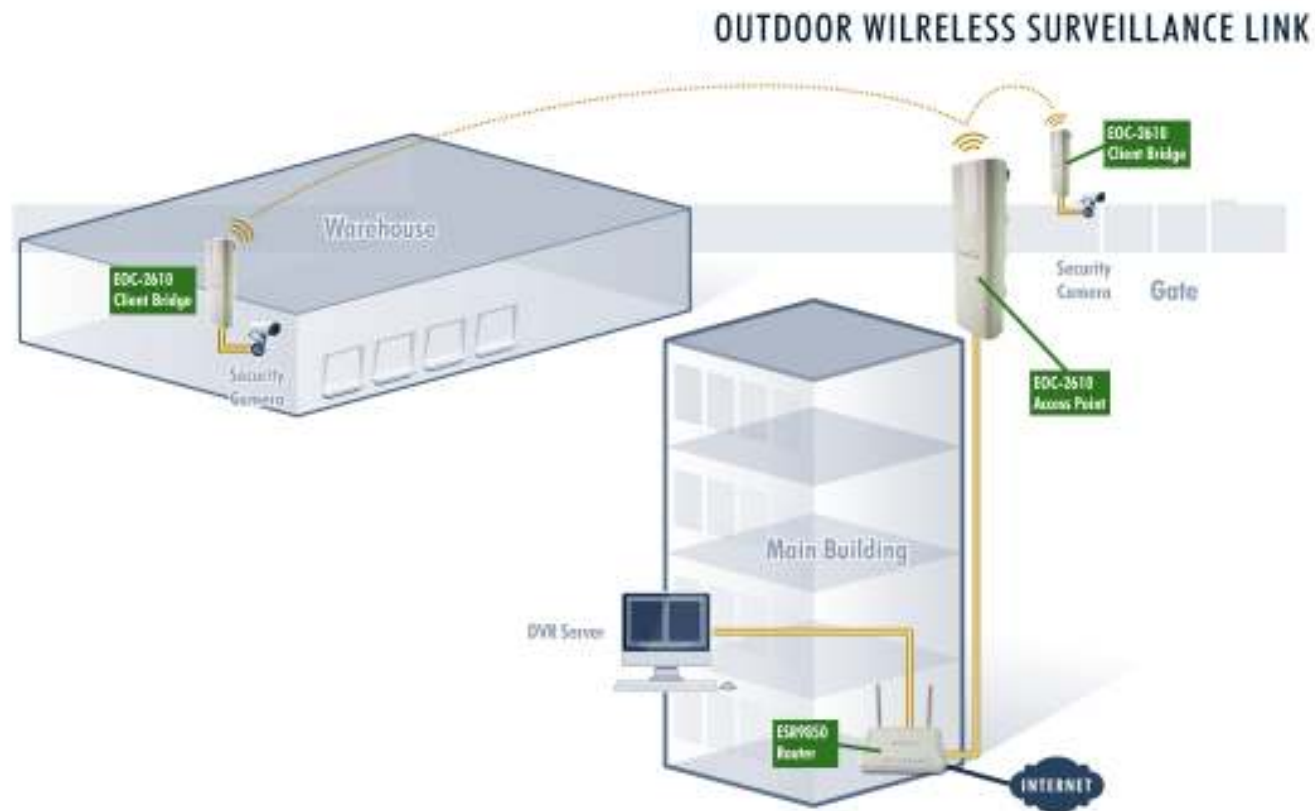


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IP Security Cameras

- Client bridge application enabling long range wireless connectivity for security cameras.



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600mW 2.4GHz Solution EOC2611P

- 802.11g
- IP55 rated outdoor enclosure
- 600mW RF output
- 24V PoE
- 10dBi Selectable Vertical or Horizontal Polarity
- RP-SMA external antenna connector (hardware switch)
- Metal clamp for mounting



600mW 5GHz Solution EOC5611P

- 802.11a/g
- IP55 rated outdoor enclosure
- 600mW RF output
- 13dbi 5GHz Selectable Vertical or Horizontal Polarity
- 24V PoE
- RP-SMA external antenna connector (hardware switch)
- Metal clamp for mounting



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High Power N Solution ENH200

- 150Mbps N Technology
- 802.11b/g backwards compatible
- 10/100 Ethernet main and auxillary port.
- High Power 27dBm
- Integrated 10dBi Antenna with dual polarization
- IP55 Water proof design
- 24V PoE support



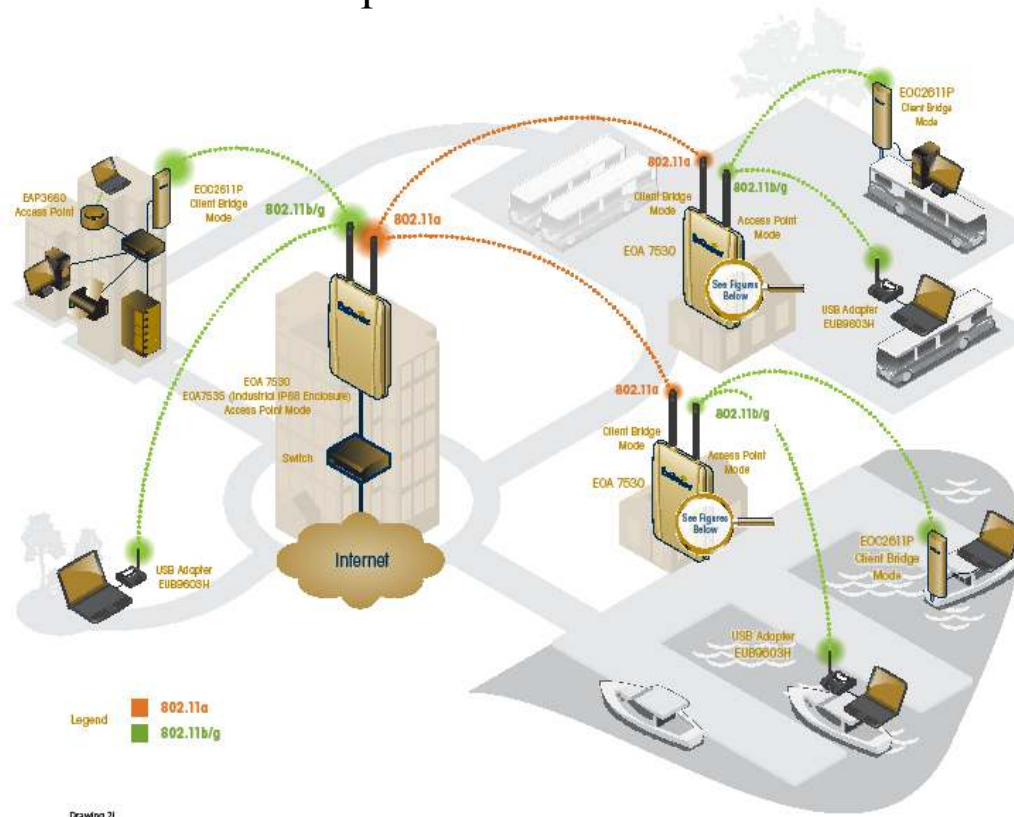
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Dual Radio Repeater

- RV Parks, Marinas, Campuses
- 5GHz Backbone, 2.4GHz for client devices
- Running data cables is not an option.



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5GHz Backbone with 2.4GHz AP

The screenshot displays the EnGenius configuration interface for a Wireless Outdoor Access Point/Client Bridge. The interface is divided into a left sidebar and a main configuration area.

EnGenius Wireless Outdoor Access Point/Client Bridge

WDS Bridge/AF

Management

- Operation Mode
- Status
- Log
- Time Zone
- Diagnosis
- Upgrade Firmware
- Save/Reload Settings
- Password

TCP/IP

- LAN
- DHCP info
- SNMP

5GHz Wireless

- WDS Link
- Advanced Settings

2.4GHz Wireless

- Client List
- Basic Settings
- Advanced Settings
- Security
- Access Control List

Configuration Form:

Dual Mode Separate Mode

Please choose the Operation Mode.(5G)

- Access Point Mode
- Client Bridge Mode
- Client Router Mode
- WDS Bridge Mode

Please choose the Operation Mode.(2.4G)

- Access Point Mode
- Client Bridge Mode
- Client Router Mode
- WDS Bridge Mode

Please Choose Country/Region.

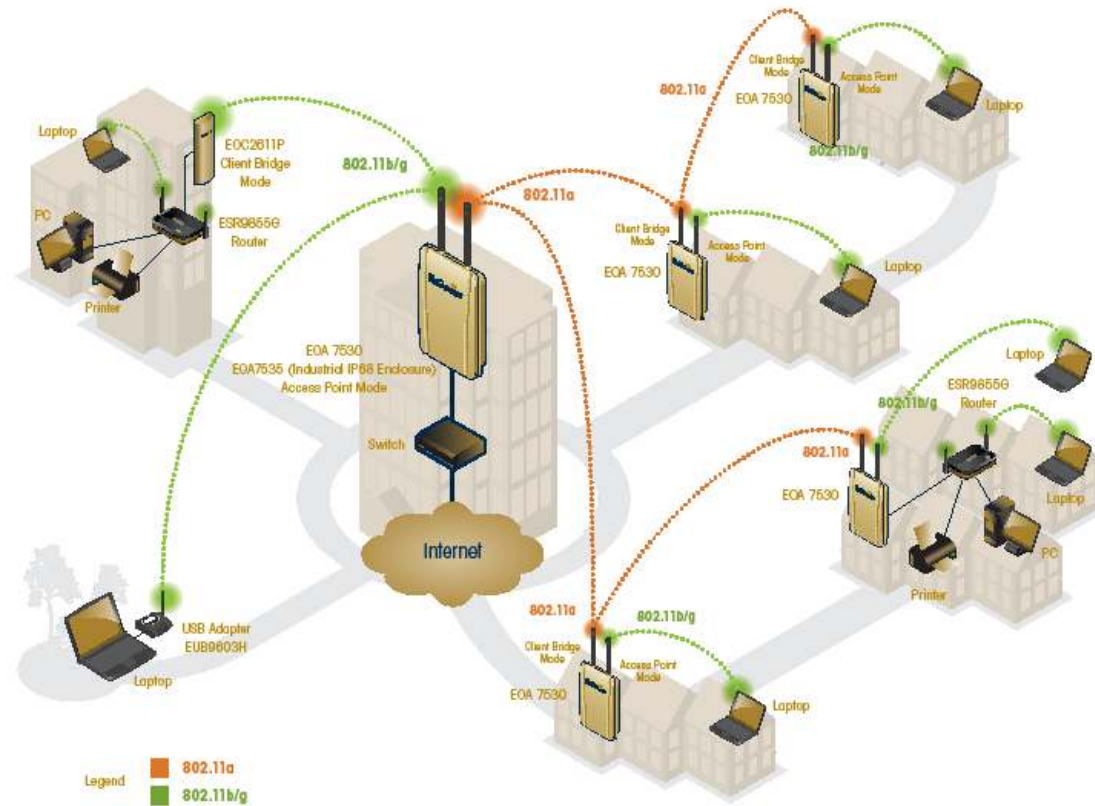
United States

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Dual Radio Campus

- Add APs where power is available.
- Up to 3 hops.



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EOA7530

- IP55 rated outdoor enclosure
- Radio 1
 - 5GHz 600mW
 - Type-N Connector
- Radio 2
 - 2.4GHz 600mW
 - Type-N Connector
- 48V PoE
- Wall or mast bracket



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EOA7535

- IP68 rated outdoor enclosure
- Radio 1
 - 5GHz 600mW
 - Type-N Connector
- Radio 2
 - 2.4GHz 600mW
 - Type-N Connector
- 48V PoE
- Ethernet Surge Arrestor
- RF Lightning Protector
- Wall or mast bracket



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Questions

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