Wireless IP Surveillance Using AirLive Outdoor Solution

Introduction

In this technology white paper, we will discuss about the wireless technology and bandwidth requirements to deploy a wireless IP Surveillance network.

Bandwidth Requirement

You can find the bandwidth requirement using the attached program. It varies by resolution, frame rate, codec, and compression. According to the equation, please find the calculated values below. If multiple streams are used, please add up the sum of the streams.

Bandwidth Requirements		
Resolution\Codec	H.264	MPEG-4
D1 NTSC(720x 480) at 30fps	1.286 mbps	2 mbps
D1 PAL(720 x 576) at 30fps	1.543 mbps	2.4mbps
MegaPixel(1280 x 1024) at 30fps	4.179 mbps	6.5 mbps
2 MegaPixel(1920x1080) at 30fps	6.171 mbps	9.6 mbps

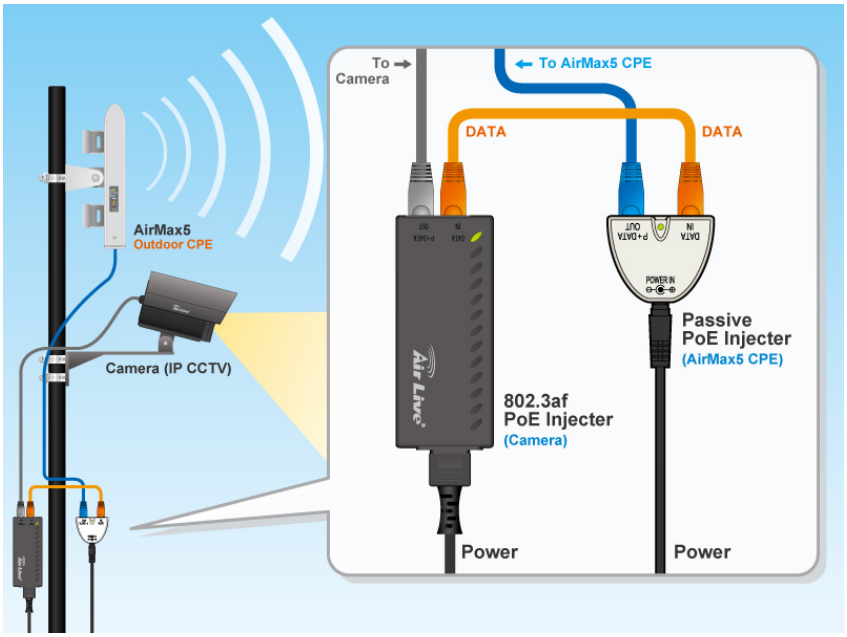
Wireless Bandwidth

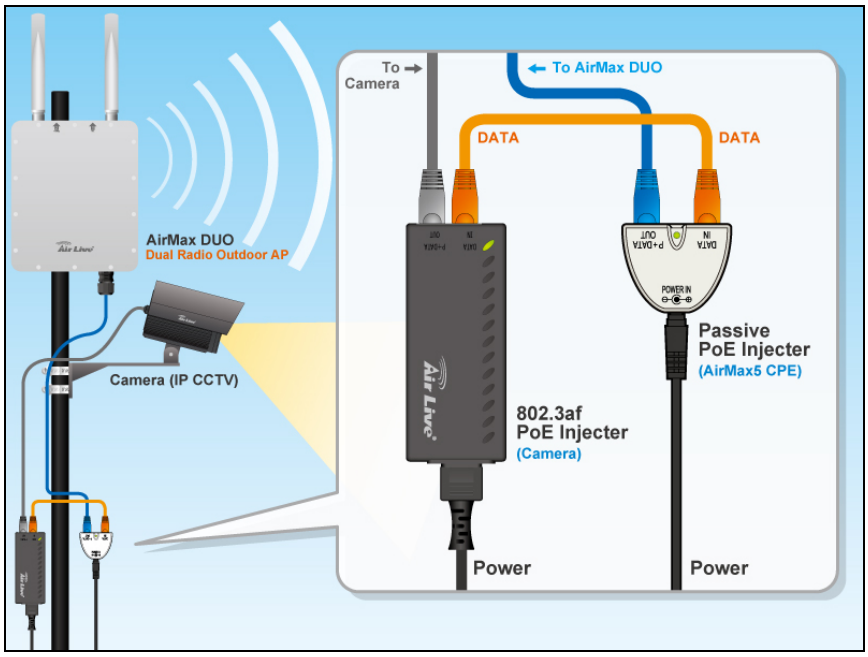
The wireless bandwidth depends on the distance and wireless standard. In general, the 5GHz frequency spectrum has less interference which provides more stable bandwidth for mission critical applications such as IP Surveillance. *The following table shows wireless bandwidth tested at foggy conditions. Snow and heavy rain can reduce the bandwidth by half.* In general, the 11a/Super-A/Super-A with Static Turbo holds the bandwidth better over longer distance and in bad weather conditions. The advantage for 11n disappears after 1km and in bad weather.

Wireless Throughput(Cloudy weather with 80% humidity)			
Radio Mode\ Distance	5 meter	1km	2.5km
11a	22 mbps	20Mbps	17Mbps
Super-A	30 mbps	28Mbps	25Mbps
Super-A with Static Turbo	50 mbps	45Mbps	35Mbps
11a/n 1T1R	75mbps	55Mbps	21Mbps
11a/n 2T2R	120mbps	70Mbps	25Mbps

Connecting IPCAM/IP CCTV with AirLive Outdoor AP/CPE

When mounting the IP Camera/IP CCTV with AirLive outdoor AP/CPE, the PoE “Data” port should be connected together at the base as shown in the diagram below:





Mesh or No Mesh?

Mesh provides auto bridging and self-healing features. It seems ideal at first for wireless IP surveillance or IP CCTV applications. In reality; however, the MESH network performance decreases as the network size increases. In a larger wireless environment with interference or bad weather conditions, the MESH network has difficulty guarantee bandwidth for mission critical applications such as IP surveillance and IP CCTV. In sum, you have advantage of self forming and healing at the cost of bandwidth planning.

Recommended Wireless Topology

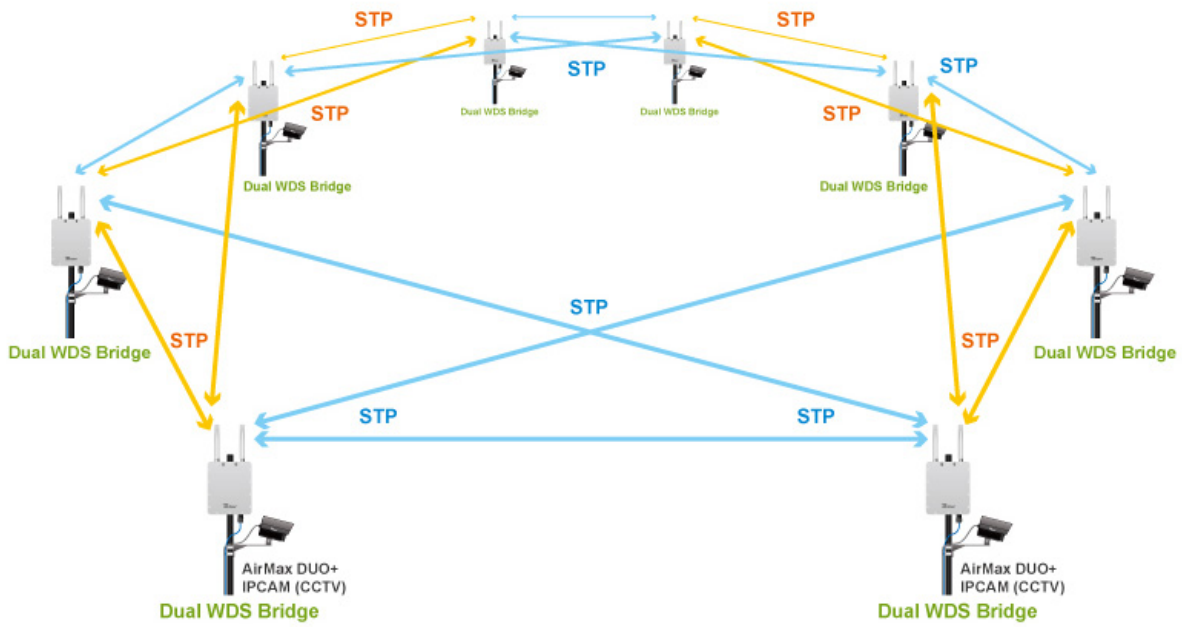
The recommended wireless connection topology can be divided into 2 scenarios. The first is using the star topology, the second is by using WDS Bridge topology. Both scenarios can be implemented in the same wireless network.

Star Topology(Infrastructure network)

In a wireless network, the bandwidth is shared among nodes in the network. The star topology means using one Access Point as the center hub for the network. It is recommended to use a Dual Radio Access Point such as our AirMax DUO so you can continue to expand the start topology using another radio. The advantage for star topology is that you can control and manage precisely the bandwidth for each node.

WDS Bridge Topology

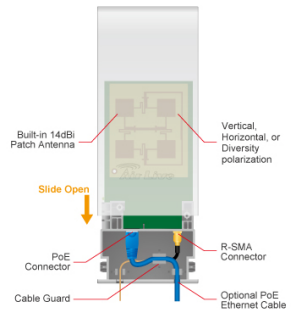
In WDS network, each node connects with another WDS Bridge independently. Up to 8 nodes can be connected from one single point. In addition, 802.1d Spanning Tree Protocol can be implemented to provide redundancy should one link failed. Below is an example diagram for IPCamera (IP CCTV) networks using WDS Bridge Topology.



Recommended AirLive Equipments

AirMax5: 802.11a Wireless CPE

	Features	Comments
	Radio Mode: ■ 11a ■ Super-A ■ Super-A with Static Turbo	Better performance in interference environment and bad weather conditions

	Multiple Wireless Modes	Can work as an AP, Client, or Bridge.
	Super Channels Support	Can use 4.9GHz and 6.1GHz frequency band to avoid interference and radar scan.
	Bandwidth Control	Control the bandwidth of each device
	Hi Output Power+ External Antenna connector	Capable of achieving up to 10km using built-in antenna. Able to use external antenna

AirMax DUO: Dual Radio Dual Band Outdoor Base Station

	Features	**Comments**
	Dual Radio Hi-Power: Maximum 27dBmPeak	Longer Distance and Wider Coverage
	Radio Mode: ■ 11a ■ Super-A ■ Super-A with Static Turbo	Better performance in interference environment and bad weather conditions
	Super Channels Support	Can use 4.9GHz and 6.1GHz frequency band to avoid interference and radar scan.
	14 Wireless Mode	Adaptive to the operating environment.
	IP-67 Enclosure	Dust and waterproof, better heat dissipation in summer.

Example Deployment

- Deployment of IP Camera with D1 resolution using H.264 codec
- Equipment Used: AirMax5 and AirMax DUO
- Average Distance 1Km
- Weather conditions: worse case is heavy rain with snow in the winter.

In this example, we will use AirMax5 and AirMax DUO to form a hybrid topology using both Star and WDS Bridge topologies.

Bandwidth Calculation

Using D1 resolution single stream, the bandwidth requirement is 1.543Mbps using H.264 codec. At 1km distance in heavy rain, the available bandwidth using Super-A with Static turbo is about 45Mbps divided 2 which is about 22Mbps. Theoretically,

each network can sustain about 14 cameras. In reality, at least 50% of the bandwidth should be reserved for interference and obstructions in first Fresnel zone. Therefore, about 7 cameras per network is appropriate for outdoor installations.

In this deployment, we will use the AirMax DUO to form the backbone and AP network, and AirMax5 as the CPE links. The backbone will use WDS links with 802.1d Spanning Tree for redundancy. Please check the graphics below: