Cambium Networks™

USER GUIDE

cnVision HUB FLEXr, HUB 360r, CLIENT MAXr, CLIENT MINI, CLIENT MICRO

System Release 4.5.2

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Contents

Safety and regulatory information

This section describes important safety and regulatory guidelines that must be observed by personnel installing or operating cnVision equipment.

Important safety information

Warning To prevent loss of life or physical injury, observe the safety guidelines in this section.

Power lines

Exercise extreme care when working near power lines.

Working at heights

Exercise extreme care when working at heights.

Grounding and protective earth

cnVision devices and mounting structures must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with national regulations. In the USA, follow Section 810 of the *National Electric Code, ANSI/NFPA No.70-1984* (USA). In Canada, follow Section 54 of the *Canadian Electrical Code*. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. Other regulations may apply in different countries and therefore it is recommended that installation be contracted to a professional installer.

Powering down before servicing

Always power down and unplug the equipment before servicing.

Primary disconnect device

The cnVision devices' power supply is the primary disconnect device.

External cables

Safety may be compromised if outdoor rated cables are not used for connections that will be exposed to the outdoor environment.

RF exposure near the antenna

Strong radio frequency (RF) fields will be present close to the antenna when the transmitter is on. Always turn off the power to the cnVision devices before undertaking maintenance activities in front of the antenna.

Minimum separation distances

Install the cnVision devices so as to provide and maintain the minimum separation distances from all persons.

The minimum separation distances for each frequency variant are specified in Calculated distances and power compliance margins.

Important Regulatory Information

The cnVison product is certified as an unlicensed device in frequency bands where it is not allowed to cause interference to licensed services (called primary users of the bands).

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Radar avoidance

In countries where radar systems are the primary band users, the regulators have mandated special requirements to protect these systems from interference caused by unlicensed devices. Unlicensed devices must detect and avoid co-channel operation with radar systems.

The cnVision devices provide detect and avoid functionality for countries and frequency bands requiring protection for radar systems.

Installers and users must meet all local regulatory requirements for radar detection. To meet these requirements, users must set the correct country code during the commissioning of the cnVision equipment. If this is not done, installers and users may be liable to civil and criminal penalties.

Contact the Cambium helpdesk if more guidance is required.

Specific expertise and training required for professional installers

To ensure that the cnVision devices are installed and configured in compliance with the requirements of Industry Canada and the FCC, installers must have the radio engineering skills and training described in this section. This is particularly important when installing and configuring cnVision system for operation in the 5 GHz band (5150 – 5250 MHz – FCC only, 5250 – 5350 MHz, 5470 – 5725 MHz and 5725 – 5850 MHz).

Ethernet networking skills

The installer must have the ability to configure IP addressing on a PC and to set up and control products using a web browser interface.

Lightning protection

To protect outdoor radio installations from the impact of lightning strikes, the installer must be familiar with the normal procedures for site selection, bonding, and grounding. Installation guidelines for the cnVsion can be found in section Site planning.

Training

The installer needs to have basic competence in radio and IP network installation. The specific requirements applicable to the cnVision must be gained by reading this user guide and by performing sample setups at a base workshop before live installations.

About This User Guide

This guide describes the planning, installation, configuration and operation of the Cambium cnVison Series of point-to-multipoint and point-to-point wireless-based Video Surveillance systems. It is intended for use by the system designer, system installer and system administrator.

For radio network design, see:

- Product description
- System hardware
- Site planning
- Site Installation
- Using the Web User Interface
- Configuring VMS Integration
- General maintenance and troubleshooting
- Legal and reference information

General information

Contacting Cambium Networks

Support website:	http://www.cambiumnetworks.com/support
Main website:	http://www.cambiumnetworks.com
Sales enquiries:	solutions@cambiumnetworks.com
Address:	Cambium Networks Limited Unit B2, Linhay Business Park, Eastern Road Ashburton, United Kingdom, TQ13 7UP

Purpose

Cambium Networks cnVision documents are intended to instruct and assist personnel in the operation, installation, and maintenance of the Cambium cnVision equipment and ancillary devices. It is recommended that all personnel engaged in such activities be properly trained.

Cambium disclaims all liability whatsoever, implied or expressed, for any risk of damage, loss or reduction in system performance arising directly or indirectly out of the failure of the customer, or anyone acting on the customer's behalf, to abide by the instructions, system parameters, or recommendations made in this document.

Cross-references

References to external publications are shown in *italics*. Other cross-references, emphasized in blue text in electronic versions, are active links to the references.

This document is divided into numbered chapters that are divided into sections. Sections are not numbered but are individually named at the top of each page, and are listed in the table of contents.

Feedback

We appreciate feedback from the users of our documents. This includes feedback on the structure, content, accuracy, or completeness of our documents. Send feedback to support@cambiumnetworks.com.

Problems and warranty

Reporting problems

At Cambium Networks, we know what it takes to keep a growing network running optimally. We provide multiple layers of support including training, online documentation, technical support, information-sharing with an experienced community of users, software downloads, warranty services, and repair.

Through the Cambium Support Center portal at https://support.cambiumnetworks.com/ you can:

- Submit support requests
- Submit RMA request
- View support global contact numbers

Additional information including field service bulletins, license key information, warranty details, security advisories, Cambium Care program descriptions, regional codes for PTP solutions, and compliance requirements can be viewed at https://www.cambiumnetworks.com/support/.

Repair and service

If unit failure is suspected, obtain details of the Return Material Authorization (RMA) process from the support website.

Warranty

For products shipped after October 1st, 2018 Cambium's standard hardware warranty is for three (3) years from date of shipment from Cambium or a Cambium distributor. Cambium warrants that hardware will conform to the relevant published specifications and will be free from material defects in material and workmanship under normal use and service. Cambium shall within this time, at its own option, either repair or replace the defective product within thirty (30) days of receipt of the defective product. Repaired or replaced product will be subject to the original warranty period but not less than thirty (30) days.

To register cnVision products or activate warranties, visit the support website.

For warranty assistance, contact the reseller or distributor.

Attention Do not open the radio housing for repair or diagnostics; there are no serviceable parts within the housing.

Portions of Cambium equipment may be damaged from exposure to electrostatic discharge. Use precautions to prevent damage.

Security advice

Cambium Networks systems and equipment provide security parameters that can be configured by the operator based on their particular operating environment. Cambium recommends setting and using these parameters following industry-recognized security practices. Security aspects to be considered are protecting the confidentiality, integrity, and availability of information and assets. Assets include the ability to communicate, information about the nature of the communications, and information about the parties involved.

In certain instances Cambium makes specific recommendations regarding security practices, however, the implementation of these recommendations and final responsibility for the security of the system lies with the operator of the system.

Cambium Networks cnVision equipment is shipped with default web management interface login credentials. It is highly recommended that these usernames and passwords are modified prior to system installation.

Precautionary statements

The following describes how precautionary statements are used in this document.

Warning

Precautionary statements with the Warning tag precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:

Warning text and consequence for not following the instructions in the warning.

Attention

Precautionary statements with the Attention tag precede instructions that are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. An attention statement has the following format:

Attention text and consequence for not following the instructions.

Note

Precautionary statements with the Note tag indicate the possibility of an undesirable situation or provide additional information to help the reader understand a topic or concept. A note has the following format:

Note text.

Caring for the environment

The following information describes national or regional requirements for the disposal of Cambium Networks supplied equipment and for the approved disposal of surplus packaging.

In EU countries

The following information is provided to enable regulatory compliance with the European Union (EU) directives identified and any amendments made to these directives when using Cambium equipment in EU countries.

Disposal of Cambium equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of Cambium equipment in landfill sites. For disposal instructions, see https://support.cambiumnetworks.com

Disposal of surplus packaging

Do not dispose of surplus packaging in landfill sites. In the EU, it is the individual recipient's responsibility to ensure that packaging materials are collected and recycled according to the requirements of EU environmental law.

In non-EU countries

In non-EU countries, dispose of Cambium equipment and all surplus packaging in accordance with national and regional regulations.

Chapter 1: Product description

This chapter provides a high-level description of the cnVision products. It describes the function of the product, the main product variants, and the typical installation. It also describes the main hardware components.

The following topics are described in this chapter:

- The key features, typical uses, product variants and components of the cnVision are explained in the Overview section.
- How the cnVision wireless link is operated, including modulation modes, power control, and security is described under Wireless operation.
- The cnVision management system, including the web interface, installation, configuration, alerts, and upgrades is described in System management.

Overview

Wireless based solutions can be the best and the most cost-effective options for video-based surveillance installations in situations where wired-based solutions can damage properties or be cost-prohibitive. Wireless solutions can also provide the flexibility to add cameras in difficult locations and to scale the system without quickly. Cambium Networks series of cnVision products are purpose-built video surveillance backhaul solutions designed to provide connectivity for mission-critical video transport.

cnVision Hardware Highlights

General

Easy to install and configure, leverages proprietary protocols, provides integration with Video Management Systems and camera detection via ONVIF. The cnVision solution is an ideal platform to use for connectivity needs in the video surveillance space using simple point-to-point or point-to-multipoint topology that can scale as multiple cameras are added.

Frequency Range (Country specific)	Wide Band operation 4910 -5970 MHz
Channel Width	5/10 (MAXr) 20/40/80
Ethernet Interface	10/100/1000 BaseT
Power Consumption	13.0 Watts Max
Channel Spacing	Configurable in 5 MHz increments
Environmental	Supports IP 55 and IP67, temperature range from -30°C to +60°C.

CCTV Performance

Losing a critical frame in your video transmission is unacceptable. With a deterministic protocol, high resiliency to interference and a built-in packet retransmission mechanism, cnVision ensures that those critical video frames arrive when they need to. Adapting to changing environments, cnVision can shift gears just like the transmission in a car to ensure the reliable delivery of critical video.

Adaptive Modulation	Adapt link quality based on dynamic conditions
Automatic Packet Retry	Lost frames due to interference are retransmitted to minimize frame loss.

Consistent and Low Latency	5 ~7ms roundtrip latency and consistency resulting in less jitter.
Typical Configuration	Speeds of 600Mbps can support upwards of 40 4K cameras in point to point or hub and spoke configuration.

Camera Management (ONVIF and Stream Detection Support)

With a built-in ONVIF client, cnVision products can detect and display camera hardware models and system information from ONVIF Conformant cameras. ONVIF provides customers the flexibility to select and use products and software from different vendors without being locked into a specific brand.

ONVIF	Camera detection via ONVIF discovery
Stream Display	Camera feed display in Hub/Client UI

Ease of Planning, Discovery, and Managing (Coming Soon)

With a comprehensive set of features under the cnVision Companion App, you can confidently plan your camera deployment and know exactly which cnVision products to choose and what capacity to anticipate. The Discovery component allows you to pre-stage the equipment and perform system maintenance and software upgrades.

Video Management System Integration

cnVision Hub and Clients can be integrated into major VMS platforms. Key parameters related to the device links and major events can trigger and display information from the VMS platform managing the cameras.

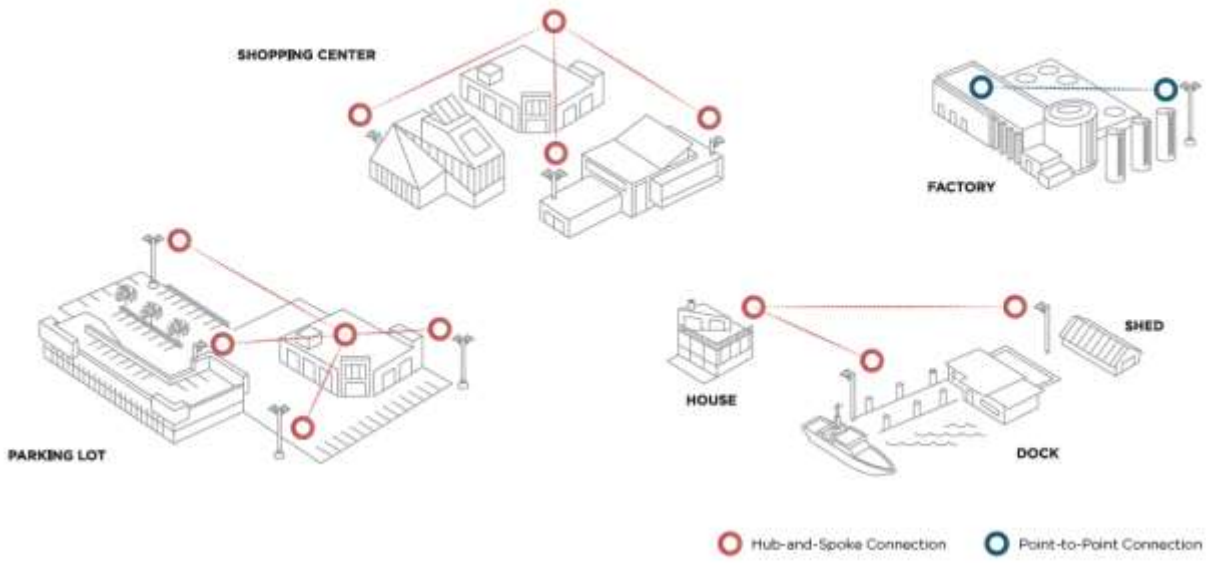
Security

cnVision solutions incorporate the latest encryption technologies and security practices. After all, you simply cannot compromise security when it comes to backhauling mission-critical video.

Encryption	128bit AES, 256bit AES (Optional)
Authentication	Radius, WPA2
Access	HTTPS, SSH
L2/L3	Firewall L2/L3 firewall rules to further control traffic flow.
Wireless MAC Filtering	Ability to filter by MAC address of wireless interfaces
User Security	Different login privileges

Typical Uses

Some common examples of the cnVision solution's flexibility and configuration options are ideal for wireless video-based surveillance implementations in environments such as parking lots, shopping centers, factories, farms and homes where a wired solution is not a viable option.

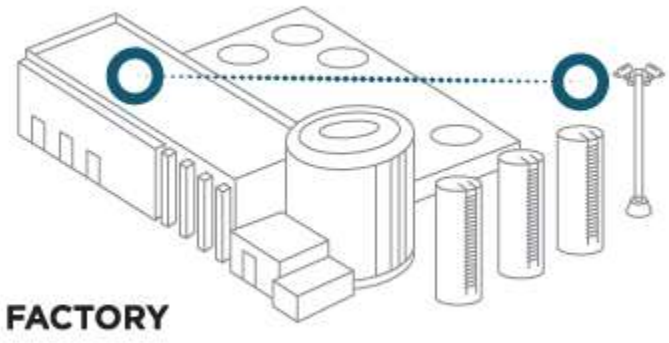


For more information about these components, including interfaces, specifications, and Cambium part numbers, see System hardware.

Configuration Options

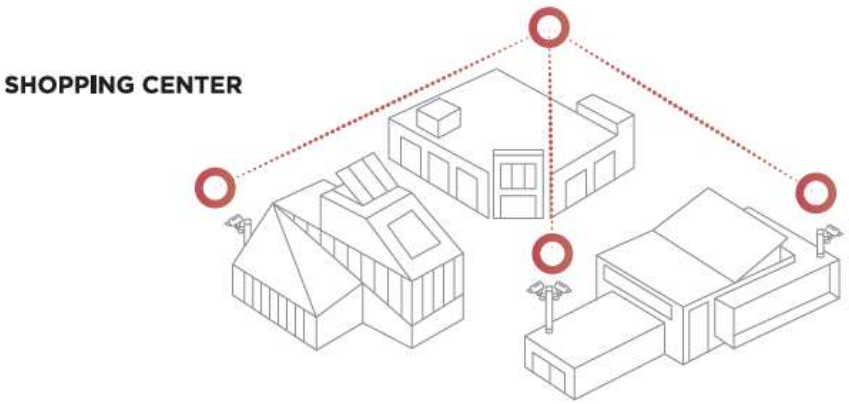
Point-to-Point

In point-to-point configuration, a single client radio is connected to a hub connected to the surveillance network. A typical use for this configuration is ideal for situations where you need to monitor a specific area such as a barn on a farm using a single camera.



Point-to-Multipoint

The point-to-multipoint configuration is where multiple cameras and clients must be installed around the area with each camera sending video data to the main hub. An Omnidirectional hub such as the HUB 360r, or the HUB FLEXr with wide-angle directional antennas (such as sectors) is ideal for this type of configuration depending on camera locations.



Wireless operation

Wireless networks allow users to connect to local area networks through wireless connections that transmit data using high-frequency radio waves.

Radar avoidance

In regions where protection of radars is part of the local regulations, cnVision must detect interference from radar-like systems and avoid co-channel operation with these systems.

To meet this requirement, cnVision implements the following features:

- The equipment can only transmit on available channels, of which there are none at initial power-up. The radar detection algorithm will always scan a usable channel for 60 seconds for radar interference before making the channel an available channel.
- This compulsory channel scan will mean that there is at least 60 seconds service outage every time radar is detected, and that the installation time is extended by at least 60 seconds even if there is found to be no radar on the channel

There is a secondary requirement for bands requiring radar avoidance. Regulators have mandated that products provide a uniform loading of the spectrum across all devices. In general, this prevents operation with fixed frequency allocations. However:

- ETSI regulations do allow frequency planning of networks (as that has the same effect of spreading the load across the spectrum).
- The FCC does allow channels to be avoided if there is actually interference on them.

Note When operating in a region that requires DFS, ensure that the AP is configured with alternate frequencies and that the SM is configured to scan for these frequencies to avoid long outages.

Encryption

cnVision supports optional encryption for data transmitted over the wireless link. The encryption algorithm used is the Advanced Encryption Standard (AES) with a 128-bit key size. AES is a symmetric encryption algorithm approved by U.S. Government organizations (and others) to protect sensitive information.

Country codes

Some aspects of the wireless operation are controlled, enforced or restricted according to a country code. cnVision country codes represent individual countries (for example Denmark) or regulatory regions (for example FCC or ETSI).

Country codes affect the following aspects of wireless operation:

- Maximum transmit power
- Radar avoidance (future release)
- Frequency range

Attention To avoid possible enforcement action by the country regulator, always operate links in accordance with local regulations

System management

This section introduces the cnVision management system, including the web interface, installation, alerts, and upgrades, configuration, and management software.

Management agent

cnVision devices are managed through an embedded Web User Interface (Web UI). Management workstations, network management systems or PCs can be connected to this agent using the module's Ethernet port, over the air (Clients connection via Hub) or by using the device WiFi management interface.

The management agent supports the following interfaces:

- Hypertext Transfer Protocol (HTTP)
- Hypertext Transfer Protocol Secure (HTTPs)
- Simple Network Management Protocol (SNMP)
- Network Time Protocol (NTP)
- System logging (Syslog)
- Dynamic Host Configuration Protocol (DHCP)
- Secure Socket Shell (SSL)

Web server

The cnVision management agent contains a web server. The web server supports access via the HTTP and HTTPs interfaces.

Web-based management offers a convenient way to manage the cnVision equipment from a locally connected computer or from a network management workstation connected through a management network, without requiring any special management software. The web-based interfaces are the only interfaces supported for installation of cnVision, and for the majority of cnVision configuration management tasks.

SNMP

The management agent supports fault and performance management by means of an SNMP interface. The management agent is compatible with SNMP v2c using one Management Information Base (MIB) file which is available for download from the Cambium Networks Support website (https://support.cambiumnetworks.com/files/cnVision_cnVision).

Network Time Protocol (NTP)

The clock supplies accurate date and time information to the system. It can be set to run with or without a connection to a network time server (NTP). It can be configured to display local time by setting the time zone and daylight saving in the Time web page.

If an NTP server connection is available, the clock can be set to synchronize with the server time at regular intervals.

cnVision devices may receive NTP data from a CMM module or an NTP server configured in the system's management network.

The Time Zone option is configurable on the **Configure** > **System** page and may be used to offset the received NTP time to match the operator's local time zone.

Account Management

When identity-based user accounts are configured, a security officer can define from one to four user accounts, each of which may have one of the four possible roles:

- ADMINISTRATOR (default username/password "admin"), who has full read and write permission.
- INSTALLER (default username/password "installer"), who has permission to read and write parameters applicable to unit installation and monitoring.
- HOME (default username/password "home"), who has permission only to access pertinent information for support purposes
- READ-ONLY (default username/password "readonly"), who has permission to only view the Monitor page.

Camera Management

cnVision hubs and clients are conformant with ONVIF, which allows interoperability between network products and ONVIF compliant camera devices regardless of the manufacturer. ONVIF compliant cameras can be managed via the web interface (**Status** > **cnVision Detected Cameras**).

Software upgrade

Software upgrades may be issued via the radio web interface (**Tools** > **Software Upgrade**. For software upgrades, see https://support.cambiumnetworks.com/files/cnVision_cnVision.

Chapter 2: System Hardware

This chapter describes cnVision hardware and supporting components.

- This section provides details about the cnVision Hubs and Clients including descriptions, specifications, part numbers, and package contents.
- The power supply section provides details about the power supplies included with the devices and installation precautions.
- This section provides details about Ethernet Cabling and the importance of selecting and using the correct types for installations.
- This section provides details about the Surge Suppression Units and the importance of protecting the equipment.

System Hardware

cnVision Hubs and Clients

HUB-FLEXr

The HUB FLEXr is a flexible and ruggedized device ideal for long-range requirements. It can be attached to various antenna types such as a Cambium Networks Omnidirectional for 360 degrees, 90/120-degree sector, or third part horn antennas from companies such as RF-Elements for 45-60-degree coverage.

This device is compatible with all clients and boasts GPS synchronization capabilities that allow for frequency re-use in congested radio frequency environments. In most cases, the HUB FLEXr should be used with narrow degree antennas to mitigate interference.

Figure 2-1 HUB FLEXr configuration options

HUB 360r

The HUB 360r in an innovative Hub solution with an integrated ruggedized housing and a 9dBi Omni antenna. The Omni configuration of this unit takes the guesswork out of aligning the Hub as you can connect clients in a 360-degree direction.

Figure 2-2 HUB 360r configuration options

CLIENT MAXr

The CLIENT MAXr is a ruggedized client providing support for long-distance deployments (up to 8 miles). With a 19dBi antenna, an IP67 ingress protection rating, and 4.9 MHz support, this is the ideal client unit for mission-critical deployments in the public safety arena.

CLIENT MINI

The CLIENT MINI is an ideal solution for mid-range requirements (up to 4 miles). The CLIENT MINI can also be configured as a hub. With horizontal orientation and a small form factor, this unit is resilient to interference and offers a compelling value proposition.

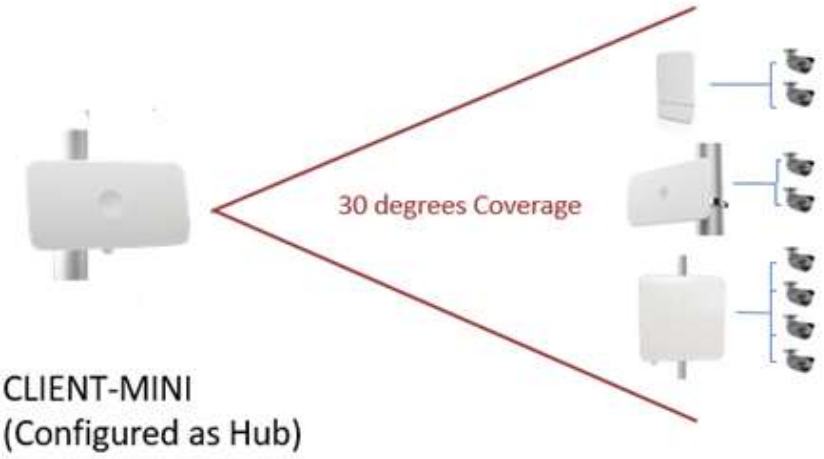


Figure 2-3 CLIENT MINI configuration options

CLIENT MICRO

The CLIENT MICRO is a small form-factor device ideal for short-range based requirements (up to 1 mile). Similar to the CLIENT MINI, it can also be configured as a hub.

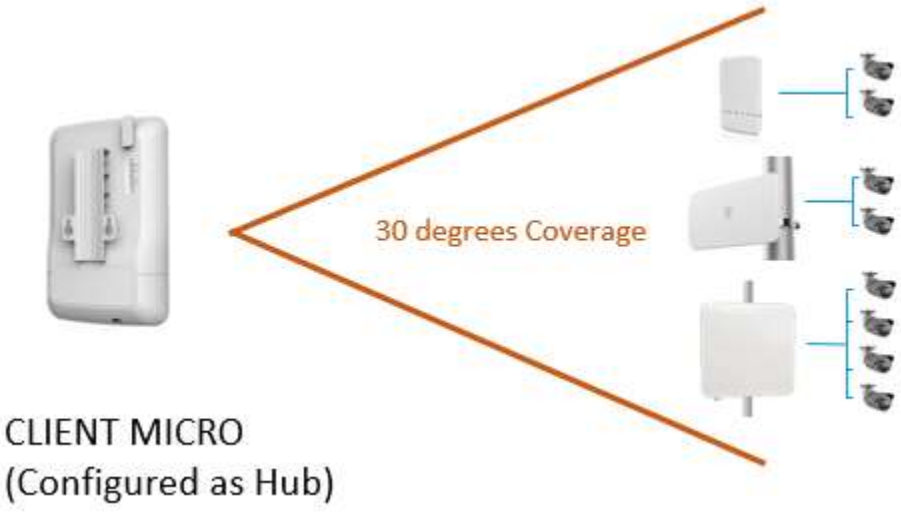
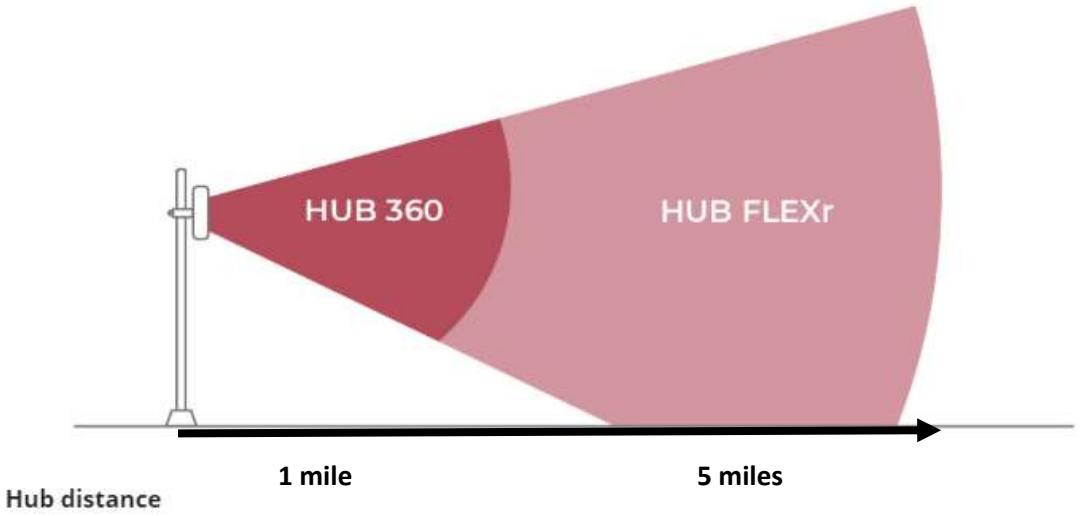


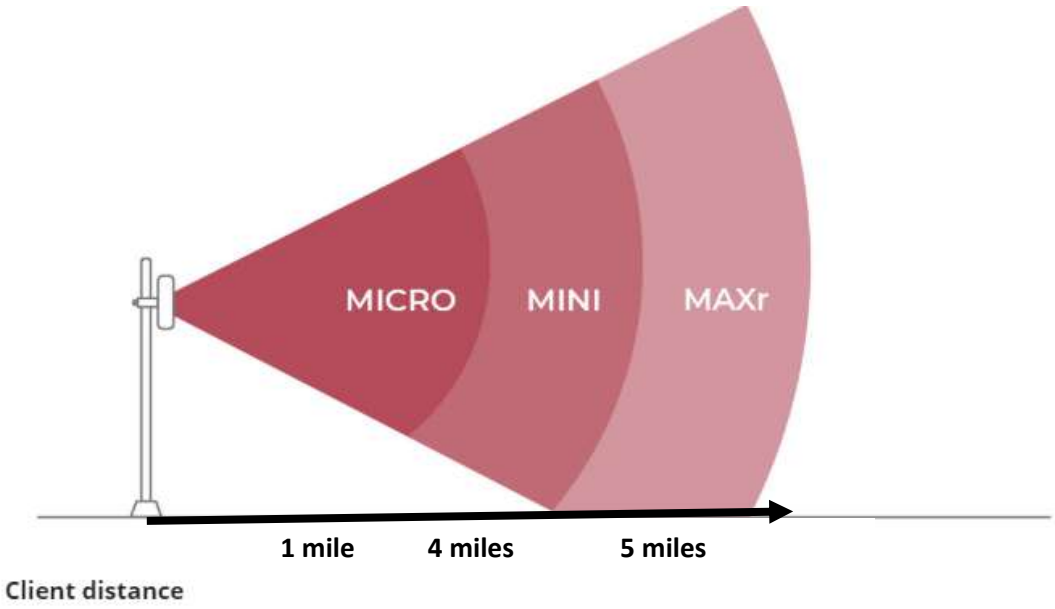
Figure 2-4 CLIENT MICRO configuration options

Distance Coverage

The HUB 360r provides up to 1-mile 360-degree coverage. The HUB FLEXr provides up to a 5-mile range depending on the antenna being used.



The CLIENT MICRO provides up to 1-mile coverage and can act as a Hub. The CLIENT MINI extends the distance up to 4-miles and can also act as a hub. The cLIENT MAXr extends the range up to 5 miles.



cnVision Hubs and Clients Portfolio

Table 2-1 cnVision Hubs and Clients portfolio

					
	Dedicated Hubs		**Long Range Client**	**Dual Purpose Hardware - Hub or Medium-Range Client**	
	HUB 360r	**HUB FLEXr**	**CLIENT MAXr**	**CLIENT MINI**	**CLIENT MICRO**
Primary	An omnidirectional Hub to connect many cameras in any direction	A hub that is compatible with many different kinds of antennas	High gain client useful for tough climates, longer distances, or Industrial sites	Standard client, suitable for most conditions	Small form factor client for shorter distances
Alternate Use	None	None	None	Hub for connection to clients that are within a 15-degree Azimuth arc	Hub for connection to clients that are within a 30-degree Azimuth arc
Antennal Type	Omnidirectional	Connectorized	Flat Panel	Flat Panel	Flat Panel
Antennal Gain	9 dbi	NA	19 dBi	16 dBi	13 dBi
Antenna Beamwidth					
Azimuth	360 degrees	NA	3 dB - 14.5 degrees	3dB - 15 degrees	3dB - 30 degrees
Elevation	10 degrees	NA	3 dB - 12.5 degrees	3dB - 30 degrees	3dB - 28 degrees
Power Consumption	13 Watts	12 Watts	12 Watts	12 Watts	12 Watts
Input Voltage	56V Passive POE (37-56V) 4,5 +; 7,8 - |or| 4,5 -; 7,8 + 7W typical, 12W max or 802.3af	30V Passive POE (14-30V) 4,5 +; 7,8 – |or| 4,5 -; 7,8 + 7W typical, 12W max	30V Passive POE (14-30V) 4,5 +; 7,8 – |or| 4,5 -; 7,8 + 7W typical, 12W max	30V Passive POE (14-30V) 4,5 +; 7,8 – |or| 4,5 -; 7,8 + 7W typical, 12W max	30V Passive POE (14-30V) 4,5 +; 7,8 – |or| 4,5 -; 7,8 + 7W typical, 12W max
Frequency Band(s)	4.910 GHz to 5.970 GHz	4.910 GHz to 5.970 GHz	4.910 GHz to 5.970 GHz	4.910 GHz to 5.970 GHz	4.910 GHz to 5.970 GHz
Channel Size	20|40|80 Mhz	20|40|80 Mhz	20|40|80 Mhz	20|40|80 Mhz	20|40|80 Mhz
Max Tx Power	+29 dBm	+29 dBm	+29 dBm	+29 dBm	+28 dBm
Max Throughput	600 Mbps	600 Mbps	600 Mbps	600 Mbps	600 Mbps
Interface	Gigabit Ethernet, 100/1000BaseT				
Monitoring	VMS, ONVIF supported				
Configuration	Web GUI	Web GUI	Web GUI	Web GUI	Web GUI
Dimensions	30 x 20.4 x 6.5 cm (11.8 x 8 x 2.55 in)	22.2 x 12.4 x 4.5 cm (8.75 x 4.9 x 1.75 in) without brackets	27.8 x 27.8 x 4.5 cm (10.9 x 10.9 x 1.8 in) without mounting bracket	12.4 x 25.1 x 11.9 cm (4.9 x 9.9 x 4.7 in)	13.0 x 20.3 x 5.40 cm (5.1 x 8.0 x 2.1 inches)
Weight	0.9kg (2.0 lbs) without brackets	0.7 kg (1.5 lbs) without brackets	1.45 kg (3.2 lbs.)	0.50 kg (1.1 lb)	0.48 kg (1.05 lbs.)
Environmental	IP67	IP67	IP67	IP55	IP55

Temperature	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)	-30°C to +60°C (-22°F to +140°F)
Mounting	1-2" Pole Mount included - Wall Mount optional				
Wind Survival	224 kmph (139 Kmph)	NA	180 kmph (112 mph)	180 kmph (112 mph)	180 kmph (112 mph)
Certifications	FCCID - Z8H89FT0051, IC - 109W-005 CE - EN 301 893 V2.1.1 (5.4 GHz), EN 302 502 V2.1.1 (5.8 GHz)	FCCID - Z8H-89FT0047, IC - 109W-0047, CE - EN 301 893 V2.1.1 (5.4 GHz), EN 302 502 V2.1.1 (5.8 GHz)	FCCID - Z8H89FT0048; IC - 109W-0048; CE - EN 301 893 V2.1.1 (5.4 GHz), EN 302 502 V2.1.1 (5.8 GHz)	FCCID - Z8H-89FT0016, IC- 109W-0016, CE - EN 301 893 V2.1.1 (5.4 GHz), EN 302 502 V2.1.1 (5.8 GHz)	FCCID - Z8H89FT0048, IC - 109W-0048, CE - EN 301 893 V2.1.1 (5.4 GHz), EN 302 502 V2.1.1 (5.8 GHz)

cnVision Device Part Numbers

Table 1-2 cnVision Hubs and Clients part numbers

Part Number By Country					
	HUB 360r	**HUB FLEXr**	**CLIENT MAXr**	**CLIENT MINI**	**CLIENT MICRO**
FCC US cord	CV-H00RPUSA-US	CV-HC2RPUSA-US	CV-C19RPUSA-US	CV-D16SPUSA-US	CV-D13SPUSA-US
IC Canada/US cord	CV-H00RPUSA-IC	CV-HC2RPUSA-IC	CV-C19RPUSA-IC	CV-D16SPUSA-IC	CV-D13SPUSA-IC
EU EU cord	CV-H00RPEUA-EU	CV-HC2RPEUA-EU	CV-C19RPEUA-EU	CV-D16SPEUA-EU	CV-D13SPEUA-EU
EU UK cord	CV-H00RPUKA-EU	CV-HC2RPUKA-EU	CV-C19RPUKA-EU	CV-D16SPUKA-EU	CV-D13SPUKA-EU
ROW no cord	CV-H00RPXXA-RW	CV-HC2RPXXA-RW	CV-C19RPXXA- RW	CV-D16SPXXA-RW	CV-D13SPXXA-RW
ROW US cord	CV-H00RPUSA-RW	CV-HC2RPUSA-RW	CV-C19RPUSA-RW	CV-D16SPUSA-RW	CV-D13SPUSA-RW
ROW EU cord	CV-H00RPEUA-RW	CV-HC2RPEUA-RW	CV-C19RPEUA-RW	CV-D16SPEUA-RW	CV-D13SPEUA-RW
ROW UK cord	CV-H00RPUKA-RW	CV-HC2RPUKA-RW	CV-C19RPUKA-RW	CV-D16SPUKA-RW	CV-D13SPUKA-RW
ROW India cord	CV-H00RPINA-RW	CV-HC2RPINA-RW	CV-C19RPINA-RW	CV-D16SPINA-RW	CV-D13SPINA-RW
India India cord	CV-H00RPINA-IN	CV-HC2RPINA-IN	CV-C19RPINA-IN	CV-D16SPINA-IN	CV-D13SPINA-IN
ROW China cord	CV-H00RPCNA-RW	CV-HC2RPCNA-RW	CV-C19RPCNA-RW	CV-D16SPCNA-RW	CV-D13SPCNA-RW
ROW Brazil cord	CV-H00RPBRA-RW	CV-HC2RPBRA-RW	CV-C19RPBRA-RW	CV-D16SPBRA-RW	CV-D13SPBRA-RW
ROW Argentina cord	CV-H00RPARA-RW	CV-HC2RPARA-RW	CV-C19RPARA-RW	CV-D16SPARA-RW	CV-D13SPARA-RW
ROW ANZ cord	CV-H00RPANA-RW	CV-HC2RPANA-RW	CV-C19RPANA-RW	CV-D16SPANA-RW	CV-D13SPANA-RW

ROW South Africa cord	CV-H00RPSAA-RW	CV-HC2RPSAA-RW	CV-C19RPSAA-RW	CV-D16SPSAA-RW	CV-D13SPSAA-RW
ROW No PSU	CV-H00RX00A-RW	CV-HC2RX00A-RW	CV-C19RX00A-RW	CV-D16SX00A-RW	CV-D13SX00A-RW

ROW = Rest of World (multiple country options available in the software)

EU = European Union, for countries that full under EU regulations

cnVision Package Contents

The cnVision products package contains the following items in the box.

- 1 x Radio
- 1 x Pole mount bracket
- 1 x Quick start guide
- 1 x POE power supply (unless P/N shows “No PSU”)
- 1 x Power Cord (See P/N for type)

cnVision Hub software packages

cnVision Hub Access Point devices may be upgraded by downloading new software packages from the Cambium Networks website. The software packages applicable to cnVision integrated radios are named:

cnVision 4.5.2.image (or higher version number)

Power Supply

Power supply description

The supplied power supplies are indoor rated units that are connected to the cnVision modules and network terminating equipment using Cat5e cable with RJ45 connectors. They are also plugged into an AC or DC power supply so that it can inject Power over Ethernet (PoE) into the module.

Attention The cnVision modules require 30V and 56V power input. They should not be connected directly into PoE switches as that may cause permanent damage to the devices.

Power supply interfaces

The power supply interfaces are illustrated in Figure 10 and described in Table 11 and Table 12.

Figure 1 Power supply interfaces

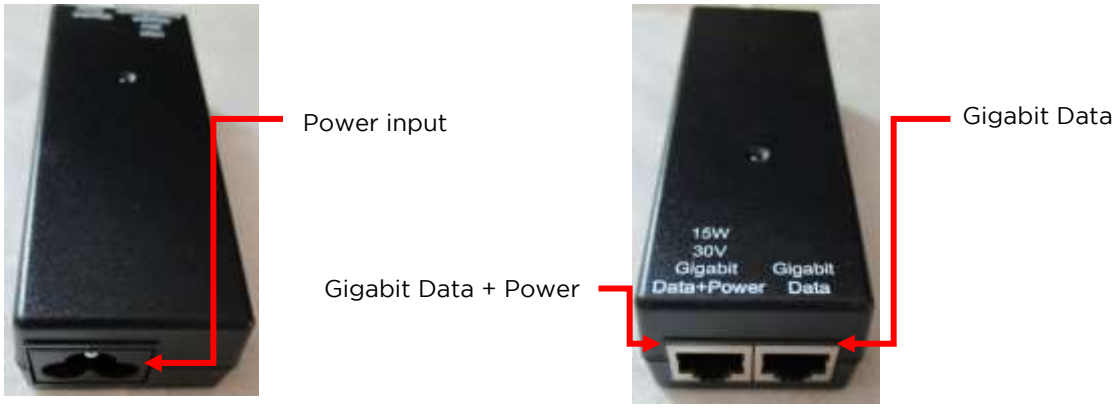


Table 2-2 Power supply interface functions - N000900L001

Interface	Function
Power input	Mains power input.
Power output	30V
Gigabit Data + Power	RJ45 socket for connecting Cat5e cable to the radio
Gigabit Data	RJ45 socket for connecting Cat5e cable to the network.

Table 2-3 Power supply interface functions - N000900L017A

Interface	Function
Power input	Mains power input.
Power output	56V
Gigabit Data + Power	RJ45 socket for connecting Cat5e cable to the radio
Gigabit Data	RJ45 socket for connecting Cat5e cable to the network.

Table 2-4 Power Supply LED functions

LED	Function
Power (green)	Power supply detection

Power supply Installation

In an indoor location, the power supply can be mounted on a wall or other flat surface. It must be kept dry from moisture, condensation, or flooding and accessible to view status indicators.

The power supply can be connected to the cnVision device drop cable and network terminating equipment. The power supply can be connected to a mains or DC power supply that meets the requirements defined in Table 2-9.

For outdoor installations, the power supplies must be housed in ruggedized weatherproof enclosures.

Figure 2-6 Outdoor Powe Supply installation

Power supply part numbers

Each module requires one power supply and one power supply line cord (line cord included with radio device, see Table 10).

Table 5 Power supply component part numbers

Cambium description	Cambium part number	Device Compatibility
cnVision Pwr Supply for GPS Radio - no cord (spare)	N000900L001	cnVision CLIENT MICRO cnVision CLIENT MINI cnVision CLIENT MAXr cnVision HUB FlexR
POWER SUPPLY, 15W, 56V – Gbps support	N000900L017A	cnVision HUB 360r

Attention Each cnVision device must be powered by the corresponding power supply.

Power supply specifications

The cnVision power supply conforms to the specifications listed in Table 14, Table 15, and Table 16.

Table 6 Power supply physical specifications

Category	Specification
Dimensions (H x W x D)	14 x 6.5 x 3.6 cm (5.5 x 2.55 x 1.42 in)
Weight	0.26 lbs

Table 7 Power supply environmental specifications

Category	Specification
Ambient Operating Temperature	0° C to +40° C
Humidity	20% - 90%

Table 8 Power supply electrical specifications

Category	Specification
AC Input	100 to 240 VAC
Efficiency	Meets Energy Level 6
Over Current Protection	Short circuit, with auto-recovery
Hold uptime	10 ms minimum at maximum load, 120 VAC

Ethernet cabling

For details of the Ethernet cabling components of a cnVision installation, see:

Ethernet standards and cable lengths

All configurations require a copper Ethernet connection from the power supply port to the power supply and network terminating equipment.

For each power supply, the maximum permitted drop cable length is specified in Table 35.

Table 9 Power supply drop cable length restrictions

Part number	Description	Maximum cable length (*1)
N000900L001 N000900L017A	Power Supply for Radio with Gigabit Ethernet (no cord)	330 feet (100m)

(*1) The maximum length of Ethernet cable from the device to the network device needs to follow 802.3 standards. If the power supply is not the network device the cable from the power supply to the network device must be included in the total maximum cable length.

Outdoor Cat5e cable

Cambium Industrial Cable

Cambium Industrial Cable uses 24-gauge solid bare copper conductors, covered by bonded-pair polymer insulation. The conductors are protected by double-layer shielding consisting of a solid foil layer under the braided tinned copper mesh, providing excellent shielding while maximizing flexibility. And, the cable is jacketed by industrial-grade UV-resistant, abrasion-resistant, and oil-resistant PVC.

Cambium's Industrial RJ45 connectors are specifically designed to work optimally with Cambium Industrial Cable.

The connectors are fully shielded with integrated strain relief for greater pull strength, utilize a staggered contact design that minimizes crosstalk and maximizes electrical performance, and the contacts are plated with 50 micro-inch thick 24-carat gold, exceeding TIA-1096 specifications and ensuring the best possible connection and oxidation resistance.

Cambium Networks' industrial-grade cable is well suited for high-quality durable installations of Hubs and Clients.

Table 10 Cambium Industrial Cable component part numbers

Cambium description	Cambium part number
Industrial Grade CAT 5 Cable 50 meter unterminated	N000000L106A
Industrial Grade CAT 5 Cable 100 meter unterminated	N000000L106A
Industrial Grade CAT 5 Cable 300 meter unterminated	N000000L108A
Industrial Grade RJ45 Connector 100 Pack	C000000L109A
Termination Tool for C000000L109A RJ45 connectors	C000000L110A

Surge suppression unit

Structures, equipment, and people must be protected against power surges (typically caused by lightning) by conducting the surge current to ground via a separate preferential solid path.

The actual degree of protection required depends on local conditions and applicable local regulations. To adequately protect a cnVision installation, both ground bonding and transient voltage surge suppression are required.

Network operators should always follow best practices for grounding and lightning protection. Doing so will minimize network outages and reduce the associated costs of tower climbs and equipment repair/replacement.

Note Lightning-prone installations can be improved by:

- Installing a surge suppressor near the device (transient surge suppression)
- Grounding the device to the pole (ground bonding)
- Lowering the device/dish such that it is not the highest metallic object on the pole.

Gigabit Ethernet Surge Suppressor

The Gigabit Ethernet Surge Suppressor is critical for lightning protection to minimize the potential for damage.

Table 11 Surge suppressor component part numbers

Cambium description	Cambium part number	Device Compatibility
Gigabit Surge Suppressor (30V)	C000000L065A	cnVision CLIENT MAXr cnVision CLIENT MINI cnVision CLIENT MICRO cnVision HUB FLEXr
Gigabit Surge Suppressor (56V)	C000000L033A	cnVision HUB 360r

Attention Choose the 30V or 56V surge suppressor option based on your installed device power rating. Installing a 30V surge suppressor for a 56V device or a 56V surge suppressor for a 30V device may result in inadequate surge protection.

Chapter 3: System planning

This chapter provides information to help the user to plan a cnVision installation.

The following topics are described in this chapter:

- Factors to consider when planning links such as range, line of sight, bandwidth considerations and grounding and lighting protection.
- Factors to consider for radar spectrum planning.

Site planning

Before you can determine which wireless devices will work for a particular installation, you should conduct a site survey. Site planning is crucial for a successful wireless-based solution. Conducting a site survey ensures that the proposed sites meet the requirements for a video surveillance system.

Site planning includes understanding and documenting the customer's requirements, evaluating the site conditions where the cameras are to be installed and taking inventory of any equipment already installed or will be reused. Use tools such as Google Maps™ and the Capacity Planning tool to help layout the plan and to document potential issues.

Key factors to consider for wireless video surveillance installations:

Pole Mount Installation

Area coverage

Determine the coverage area and the distances between camera locations and the central network. Scene activity in a high traffic area such as a parking lot with a constant car and people movement requires higher bandwidth.

Obstacles

Note if there are there any objects such as buildings, trees, masts, power lines, or other obstacles that may cause a line of sight issues or interference. Plan for any potential obstructions such as trees or vegetation that may grow over time.

Cameras

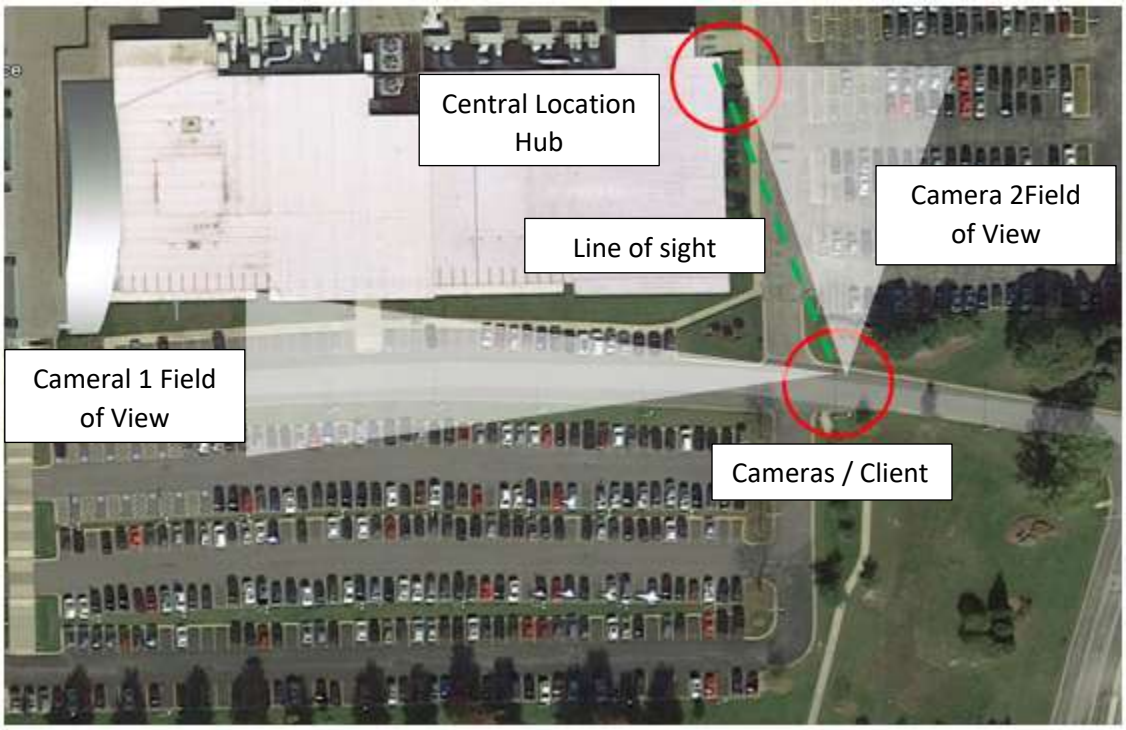
The number and types of cameras used can greatly affect the bandwidth requirements. Features such as high resolution, night vision, motion, and sound detection, etc. should be considered when planning for bandwidth capacity.

Power requirements

Determine where power will be needed and provided at the installation locations. Most IP cameras use Power over Ethernet (PoE), however, switches, wireless radios, and other devices require their own power source.

Network Infrastructure

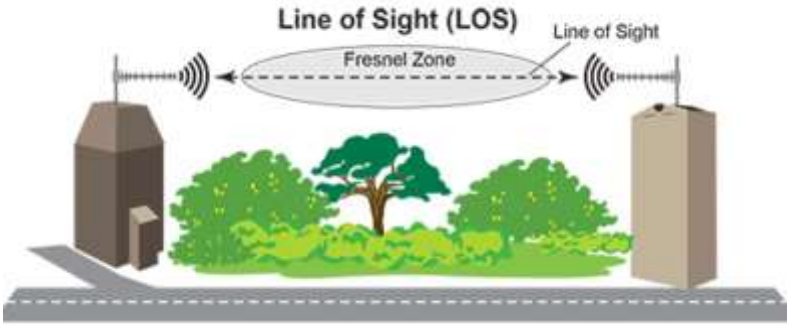
Determine if the wireless system will connect to a new or an existing video surveillance system. Understanding and documenting pre-existing networks will help you to plan and configure the wireless system.



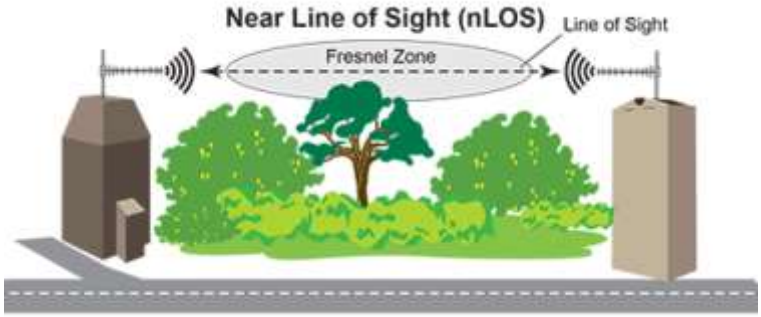
cnVision Installation Layout example

Line of Sight (LOS), Near Line of Sight (nLOS), No Line of Sight (NLOS)

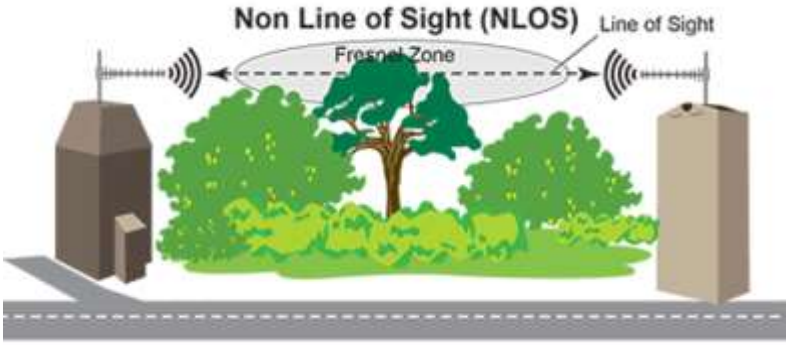
In wireless networking, it is crucial that there is a clear line of sight between the hubs and the clients. However, Line of sight (LoS) doesn't refer to a straight line between the two devices. There is what is known as the Fresnel Zone, in which the transmitting and receiving devices can effectively communicate within this region.



If there are trees or other obstacles blocking part of the Fresnel zone, the signals may be degraded affecting performance. This is known as Near Line of Sight (nLOS).



The Non-Line of Sight (NLOS) condition refers to a situation where the signals are completely blocked between the communicating devices. This can result in complete video data loss. In this case, the transmit and receive antennas may need to be mounted on higher poles to get above the trees or any other potential obstruction.



Bandwidth Consideration

Determining network and Wireless bandwidth requirements are important considerations for video surveillance systems. Understanding the bandwidth requirements will help in selecting the right cnVision devices for successful implementations.

key factors that can affect bandwidth requirements are:

- Coverage area and distances
- The number of cameras in use
- Camera types and supported features – cameras that are configured to record high qualtity images at high frame rates can consume anywhere from 3 to 4 Mbps of the bandwidth.
    - Image Resolution: 720P, 1080P, 4K, etc.
    - Video Compression: H.264, MPEG-4, MPEG-2, etc.
    - Frame Rates: 15, 20, 30fps
    - Point/Zoom, Night Vision, Sound Detection, etc.
- Scene activity: constant traffic and motion, lighting conditions, etc.
- Motion-based or continuous recording

Capacity Planning Tool

Use the capacity planning tool to help you plan, set up, and manage your camera network. (Coming soon).

Grounding and lightning protection

Structures, equipment, and people must be protected against power surges (typically caused by lightning) by conducting the surge current to ground via a separate preferential solid path. The actual degree of protection required depends on local conditions and applicable local regulations. To adequately protect a cnVision installation, both ground bonding and transient voltage surge suppression are required.

Warning Electro-magnetic discharge (lightning) damage is not covered under warranty. The recommendations in this guide, when followed correctly, give the user the best protection from the harmful effects of EMD. However, 100% protection is neither implied nor possible.

Details of lightning protection methods and requirements can be found in the international standards IEC 61024-1 and IEC 61312-1, the U.S. National Electric Code ANSI/NFPA No. 70-1984 or section 54 of the Canadian Electric Code.

Note International and national standards take precedence over the requirements in this guide.

Radio spectrum planning

This section describes how to plan cnVision links to conform to the regulatory restrictions that apply in the country of operation.

Attention The user must ensure cnVision product operates in accordance with local regulatory limits.

Note Contact the applicable radio regulator to check if the registration of the cnVision link is required.

Regulatory compliance

All applicable radio regulations must be followed while configuring the units and aligning the antennas. For more information, Compliance with safety standards.

Regulatory limits

The local regulator may restrict frequency usage and channel width and may limit the amount of conducted or radiated transmitter power.

Many countries impose EIRP limits (Allowed EIRP) on products operating in the bands used by the cnVision Series. For example, in the 5 GHz band, these limits are calculated as follows:

- In the 5.8 GHz band (5725 MHz to 5875 MHz), the EIRP must not exceed the lesser of 36 dBm or (23 + 10 x Log Channel width in MHz) dBm.

Some countries (for example the USA) impose conducted power limits on products operating in the 5 GHz band.

Conforming to the limits

Ensure the link is configured to conform to local regulatory requirements by configuring the correct country code (located in the web management interface, under **Configure** > **Radio**). In the following situations, the country code does not automatically prevent operation outside the regulations:

- When operating in ETSI regions, it is required to enter a license key in the cnVision web management interface to unlock valid country-specific frequencies. This key may be obtained from https://support.cambiumnetworks.com/licensekeys/cnVision.

Available spectrum

The available spectrum for the operation depends on the region. When configured with the appropriate country code, the unit will only allow operation on those channels which are permitted by the regulations.

Certain regulations have allocated certain channels as unavailable for use:

- Some European countries have allocated part of the 5.8 GHz band to Road Transport and Traffic Telematics (RTTT) systems.

Where regulatory restrictions apply to certain channels, these channels are barred automatically by the use of the correct country code. For example, at 5.8 GHz in some European countries, the RTTT band 5795 MHz to 5815 MHz is barred. With the appropriate country code configured for this region, the cnVision will not operate on channels within this band.

The number and identity of channels barred by the license key and country code is dependent on the channel bandwidth.

Channel bandwidth

Select the required channel bandwidth for the link. The selection depends upon the cnVision frequency variant and country code.

The wider a channel bandwidth the greater is its capacity. As narrower channel bandwidths take up less spectrum, selecting a narrow channel bandwidth may be a better choice when operating in locations where the spectrum is very busy.

Both ends of the link must be configured to operate on the same channel bandwidth.

Chapter 4: System Installation

This chapter provides information to help the user to plan a cnVision installation.

The following topics are described in this chapter:

- Understanding and observing the safety requirements for installing cnVision devices.
- Preparing the equipment prior to site installation.
- The grounding and lightning protection requirements of a cnVision installation are described under Grounding and lightning protection.

Safety

Warning
To prevent loss of life or physical injury, observe the following safety guidelines. In no event shall Cambium Networks be liable for any injury or damage caused during the installation of the cnVision devices.

Safety precautions

All national and local safety standards must be followed while configuring the units.

RF exposure near the antenna

Strong radio frequency (RF) fields will be present close to the antenna when the transmitter is on. Always turn off the power to the radio before undertaking maintenance activities in front of the antenna.

Minimum separation distances

Ensure that personnel is not exposed to unsafe levels of RF energy. The units start to radiate RF energy as soon as they are powered up. Never work in front of the antenna when the radio is powered. Install the radios so as to provide and maintain the minimum separation distances from all persons.

Warning Ensure that personnel is not exposed to unsafe levels of RF energy. The units start to radiate as soon as they are powered up. Respect the safety standards defined in Compliance with safety standards, in particular, the minimum separation distances.

Observe the following guidelines:

- Never work in front of the antenna when the device is powered.

Power lines

Exercise extreme care when working near power lines.

Working at heights

Exercise extreme care when working at heights.

PSU

Always use one of the Cambium supplied power supply units (PSU) to power the cnVision devices. Failure to use a Cambium supplied PSU could result in equipment damage and will invalidate the safety certification and may cause a safety hazard.

Warning The supplied indoor-rated power supply must be installed in a weatherproof NEMA enclosure to protect it from the elements.

Powering down before servicing

Before servicing cnVision equipment, always switch off the power supply and unplug it from the PSU. Always remove the AC or DC input power from the PSU.

Primary disconnect device

The main power supply is the primary disconnect device.

External cables

Safety may be compromised if outdoor rated cables are not used for connections that will be exposed to the outdoor environment. For outdoor copper Cat5e Ethernet interfaces, always use Cat5e cable that is gel-filled and shielded with copper-plated steel. Alternative types of drop cable are not supported by Cambium Networks.

Pre-Installation Preparation

We recommend completing the following tasks before the site installation.

- Create an inventory of all the necessary equipment and components required for the installation.
- Power up and test all the devices and the supporting components (cameras, switches, power supplies, etc.).
- Update the camera devices to the latest firmware.
- Configure the cameras, hubs and clients prior to site installation.
- Ensure all the necessary documentation is available for the project (user guides, installation layout, network configuration, etc.).

Configuring Key Settings on Hubs and Clients

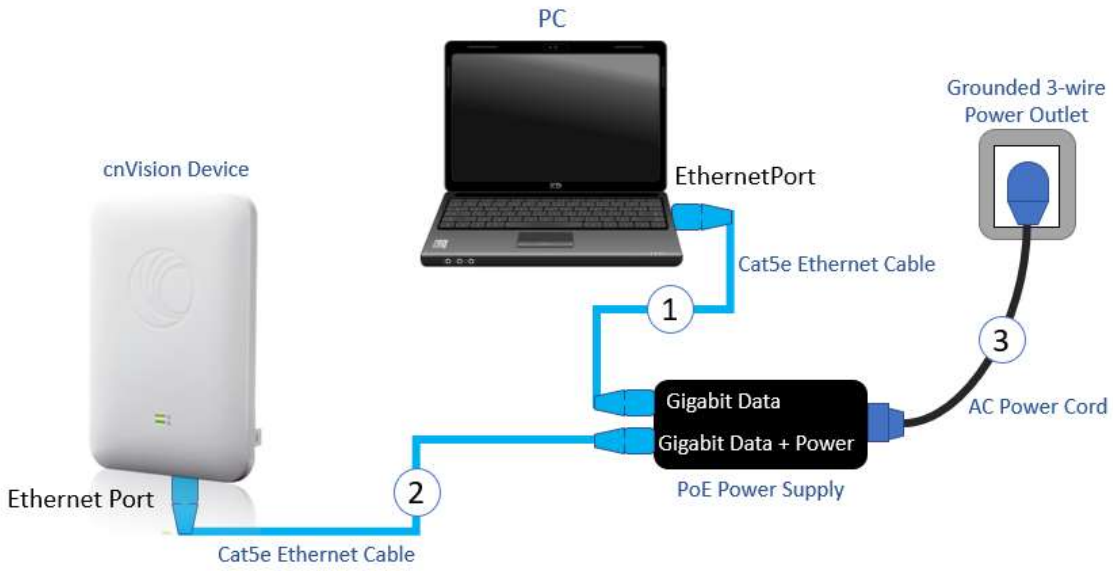
> **Note** Minimum supported browser version – Chrome v29, Firefox v24, Internet Explorer 11, Safari v5.

Connecting the Hub/Client to the PC and powering up

Use this procedure to connect a management PC directly to the cnVision for configuration and alignment purposes and to power up the cnVision device.

Procedure:

1. Connect the Gigabit Data + Power port to the Ethernet port on the cnVision device.
2. Connect the PC Ethernet port to the LAN (“Gigabit Data”) port of the power supply using a standard (not crossed) Cat5e Ethernet cable.
3. Apply mains or battery power to the power supply. The green Power LED on the power supply must illuminate continuously.



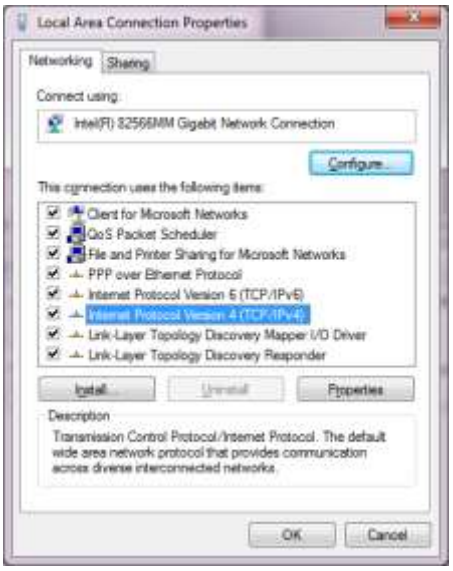
Configuring the management PC

Configure the management PC settings to communicate with the cnVision device.

Procedure:

1 Select **Properties** for the Ethernet port.

In Windows 7 and above, this is found in **Control Panel > Network and Internet > Network and Sharing > Change Adapter Settings > Ethernet > Properties**



2 Select the **Internet Protocol Version 4 (TCP/IP IPv4)** item:

3 Click **Properties**.

4 Enter an IP address that is valid for the 169.254.1.x network, avoiding 169.254.1.1. A good example is 169.254.1.100:

5 Enter a subnet mask of 255.255.255.0.

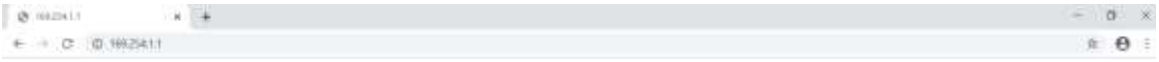
Leave the default gateway blank.

6 Click OK, then click Close

Logging into the Web User Interface

Procedure:

1 Open a web browser and enter the device's default IP address (for. ex 169.254.1.1.)



Note If **Device IP address Mode** is set to **DHCP** and the device is unable to retrieve IP address information via DHCP, the device management IP is set to 192.168.0.1 (Hub Mode), 192.168.0.2 (Client mode) or the previously configured static Device IP Address. Units may always be accessed via the Ethernet port at 169.254.1.1.

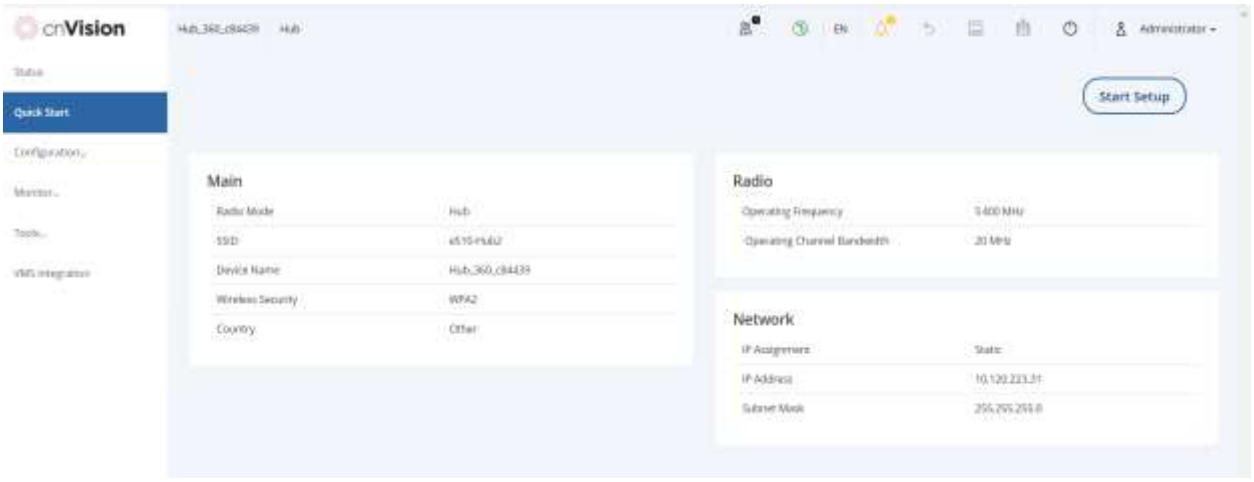
2 Log in to the Web User Interface using the default user name **admin** and password **admin**.

Note New cnVision devices contain default username and password configurations. It is recommended to change these password configurations immediately. These passwords may be configured in the management GUI in section **Configuration > System > Account Management**.

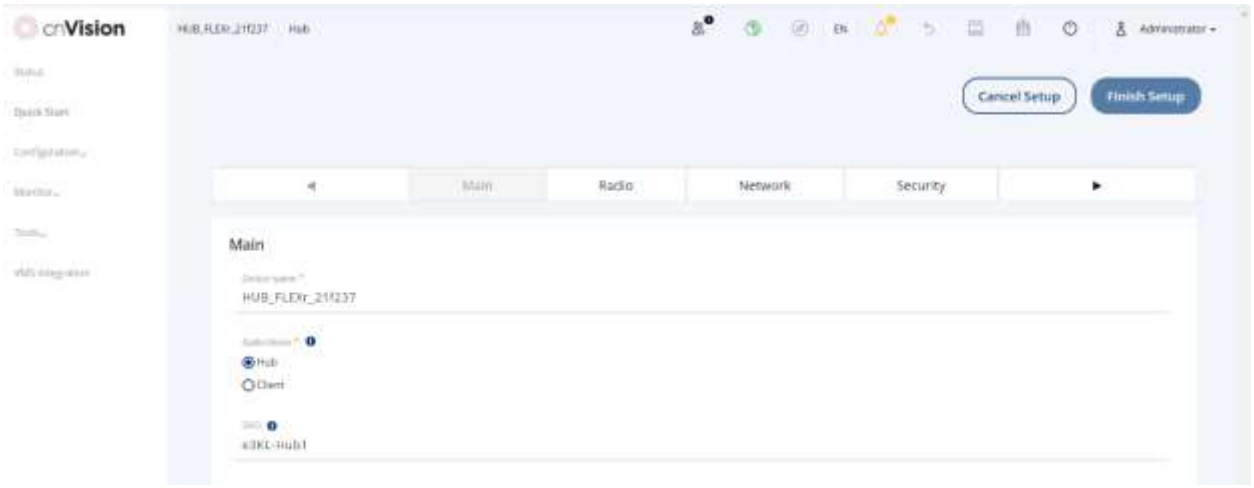
Configuring the Hub – Quick Start

The cnVision devices feature a Quick Setup wizard to configure the key parameters for wireless operations.

1. The setup is accessed from the **Quick Start** menu by clicking the **Start Setup** button.



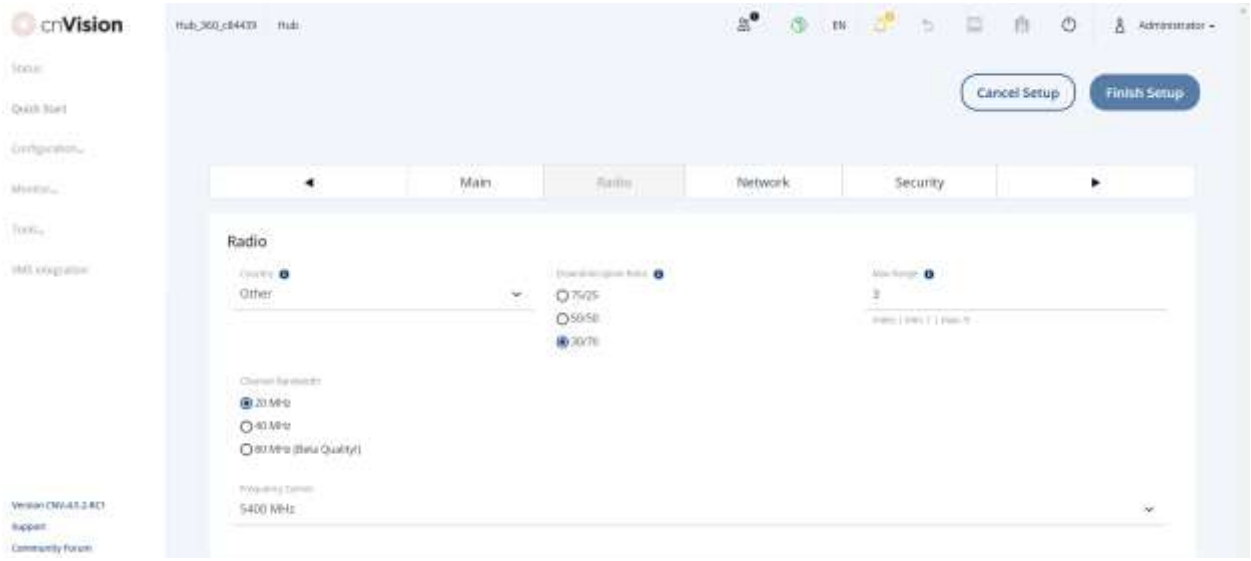
2. Click the **Main** tab. In the Main section, configure the following parameters.



Attribute	Meaning
Main	
Device Name	The configured identifier used in Network Management Systems.

Attribute	Meaning
Radio Mode	**Hub**: Set device as a Hub. **Client**: Set the device as a Client. (Not available on Hub 360r)
SSID	SSID is a unique identifier for a wireless LAN which is specified in the Hub's beacon. (Hub Mode). SSID must be the same at both ends and different to the site name.

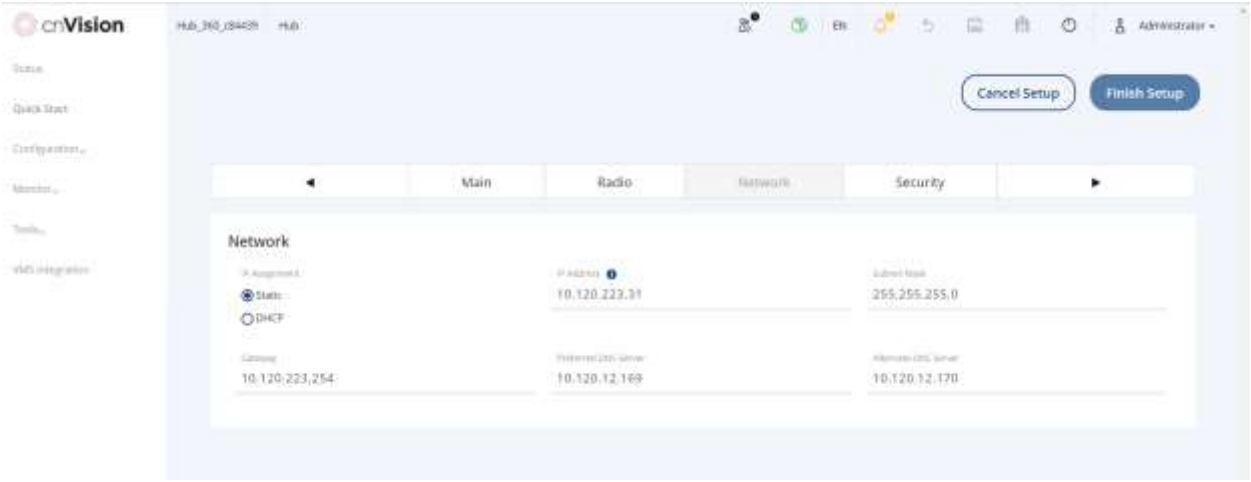
3. Click the **Radio** tab. configure the following parameters.



Attribute	Meaning
Radio	
Country	Defines the country code being used by the device. The country code of the Hubs and Clients follows the country code of the associated Hub unless it is an FCC SKU in which case the country code is the United States or Canada. Country code defines the regulatory rules in use for the device.
Downlink/Uplink Ratio	The schedule of downlink traffic to uplink traffic on the radio link. The three options, **75/25**, **50/50** and **30/70**, allow the radio to operate in a fixed ratio on every frame. In other words, this ratio represents the amount of the total radio link's aggregate throughput that will be used for downlink resources, and the amount of the total radio link's aggregate throughput that will be used for uplink resources.
Max Range	This parameter represents a cell coverage radius. Hubs and Clients outside the configured radius will not be able to connect. It is recommended to configure Max Range to match the actual physical distance of the farthest client.
Channel Bandwidth	Configure the channel size used by the radio for RF transmission.

Attribute	Meaning
Frequency Carrier	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the **Country** parameter. Ensure that a thorough spectrum analysis has been completed prior to configuring this parameter.

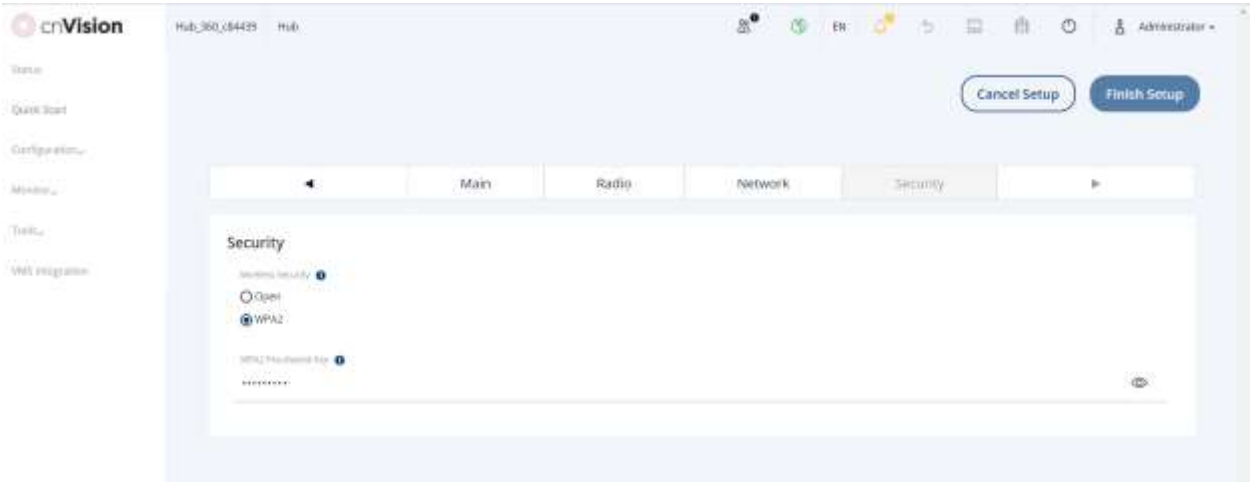
4. Click the **Network** tab. Configure the following parameters.



Attribute	Meaning
Network	
IP Assignment	**Static:** Device management IP addressing is configured manually in fields **IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server**. **DHCP:** Device management IP addressing (**IP address, Subnet Mask, Gateway, and DNS Server**) is assigned via a network DHCP server, and parameters **IP Address, Subnet Mask, Gateway, Preferred DNS Server,** and **Alternate DNS Server** are not configurable.
IP Address	Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network. If the IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (Hub) or 192.168.0.2 (Client).
Subnet Mask	Defines the address range of the connected IP network. For example, if the **IP Address** is configured to **192.168.2.1** and **Subnet Mask** is configured to **255.255.255.0**, the device will belong to subnet **192.168.2.X**.

Attribute	Meaning
Gateway	Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Preferred DNS Server	Configure the primary IP address of the server used for DNS resolution.
Alternate DNS Server	Configure the secondary IP address of the server used for DNS resolution.

5. Click the **Security** tab. Configure the following parameters.



Attribute	Meaning
Security	
Wireless Security	**Open:** All Hubs and Client devices requesting network entry are allowed registration. **WPA2:** The WPA2 mechanism provides AES radio link encryption and Client network entry authentication. When enabled, the Client must register using the Authentication Pre-shared Key configured on the Hub and Client.
WPA2 Pre-shared Key	Configure this key on the Hub, then configure the Client with this key to complete the authentication configuration. This key must be between 8 to 128 symbols.

6. Click the **Save** button to save the changes.

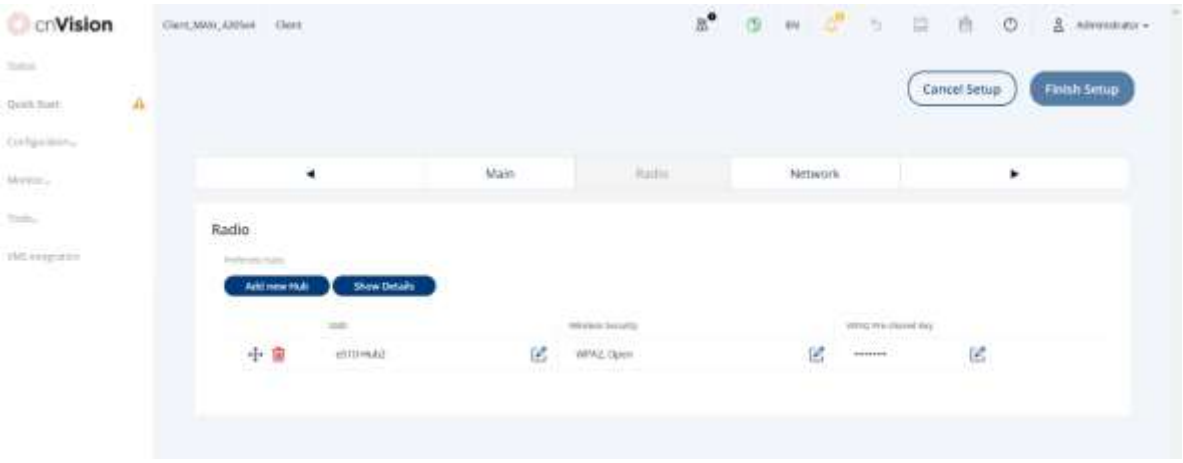
Configuring the Client – Quick Start

1. The setup is accessed from the **Quick Start** menu by clicking the **Start Setup** button.

2. Click the **Main** tab. Configure the following parameters.

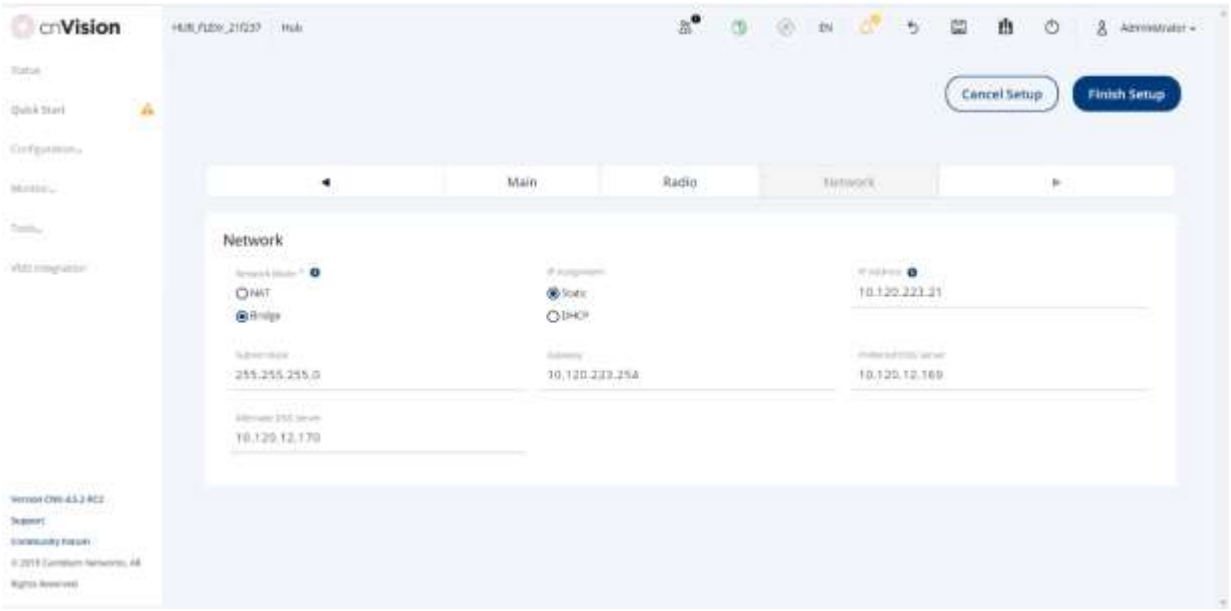
Attribute	Meaning
Main	
Device Name	The configured identifier used in an NMS.
Radio Mode	This parameter controls the function of the device – All cnVision devices may be configured to operate as a **Hub** or a **Client**. (Not available on Hub 360r)

3. Click the **Radio** tab. Configure the following parameters.



Attribute	Meaning
Radio	
Preferred Hubs	
Preferred Hubs	**Add new Hub:** Click the Add new Hub button to... **Show Details:** The Show Details button displays the hub details.
Wireless Security	**Wireless Security:** Enter text. **EAP-TTLS:** Configure the EAP-TTLS Username to match the credentials on the RADIUS server being used for the network. **WPA2**: The WPA2 mechanism provides AES radio link encryption and Client network entry authentication. When enabled, the Client must register using the Authentication Pre-shared Key configured on the Hub and Client. **Open:** All Client devices requesting network entry are allowed registration.
WPA2 Pre-shared Key	The **Preferred Hub's WPA2 Pre-shared Key** must be configured on the Client device to match the pre-shared key configured on the Hub for registration with WPA2 security.

4. Click the **Network** tab. Configure the following parameters.



Attribute	Meaning
Network	
Network Mode	**NAT:** Translates the IP addresses of computers in a local network to a single IP address. The Client acts as a router, and packets are forwarded or filtered based on their IP header (source or destination) which can be grouped into subnets for finer granularity. **Bridge:** The Client acts as a switch, and packets are forwarded or filtered based on their MAC destination address.
IP Assignment	**Static:** Device management IP addressing is configured manually in fields **IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server**. **DHCP:** Device management IP addressing (**IP address, Subnet Mask, Gateway, and DNS Server**) is assigned via a network DHCP server, and parameters **IP Address, Subnet Mask, Gateway, Preferred DNS Server,** and **Alternate DNS Server** are not configurable.
IP Address	Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network. If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (Hub) or 192.168.0.2 (Client).

Attribute	Meaning
Subnet Mask	Defines the address range of the connected IP network. For example, if the **IP Address** is configured to **192.168.2.1** and **Subnet Mask** is configured to **255.255.255.0**, the device will belong to subnet **192.168.2.X**.
Gateway	Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Preferred DNS Server	Configure the primary IP address of the server used for DNS resolution.
Alternate DNS Server	Configure the secondary IP address of the server used for DNS resolution.

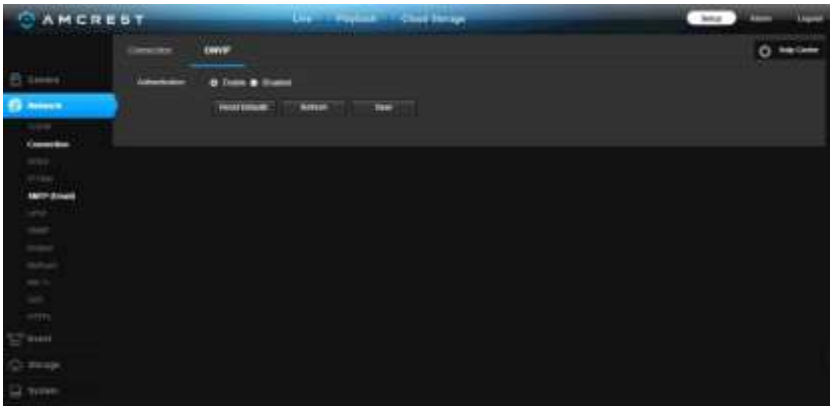
5. Click the **Save** button to save the changes.

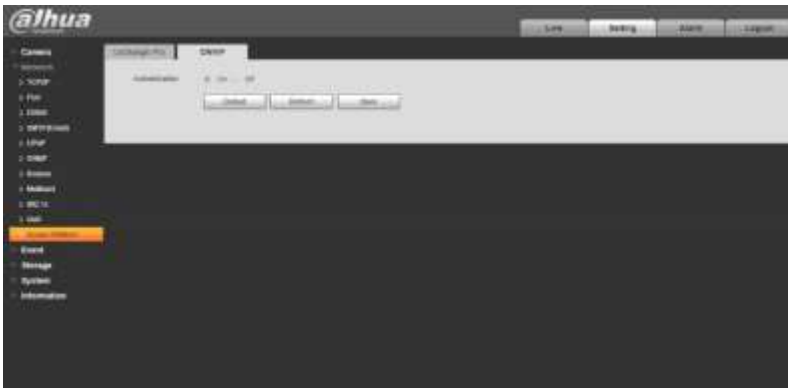
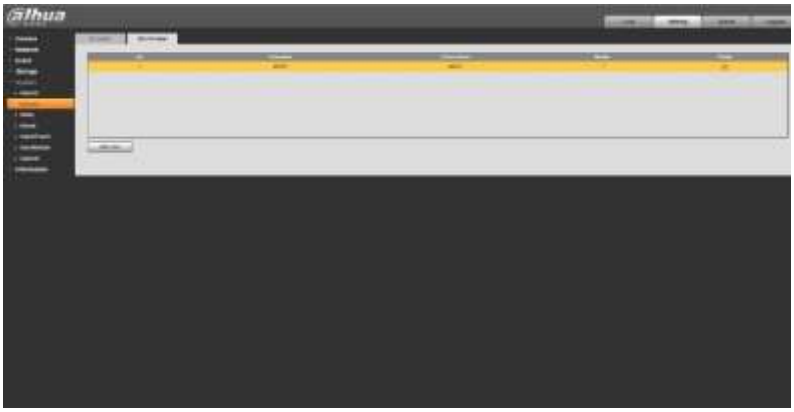
Configuring ONVIF Settings on Cameras

cnVision supports ONVIF compliant cameras by default. However, some camera manufacturers disable the “ONVIF” settings by default. Navigate to the camera’s configuration page and enable the “ONVIF” settings. Refer to the camera’s user guide for details or visit their support site for assistance.

Make sure the camera is ONVIF compliant. A list of ONVIF compliant devices can be found here.

https://www.onvif.org/conformant-products/

Camera Manufacturer	Configuration Screen	
Amcrest	Network > Connection > ONVIF	
Axis	System tab > ONVIF	

Dahua	1. Setting tab > ONVIF tab to enable ONVIF 2. Setting tab > Account > ONVIF User > Add ONVIF user	 
HKVision	Advanced Settings > Configuration	

Site installation

A cnVision site installation may consist of a high supporting structure such as a mast, tower or building for the devices.

Find a location for the device that meets the following requirements:

- The equipment is high enough to achieve a clear line of sight between the hubs and clients.
- People can be kept a safe distance away from the equipment when it is radiating.
- The equipment is lower than the top of the supporting structure (tower, mast or building) or its lightning air terminal.
- There is one Ethernet interface, a copper Cat5e connection from the device to the power supply and network terminating equipment.
- Grounding locations on masts, poles, buildings, or towers to ground the cnVision devices.

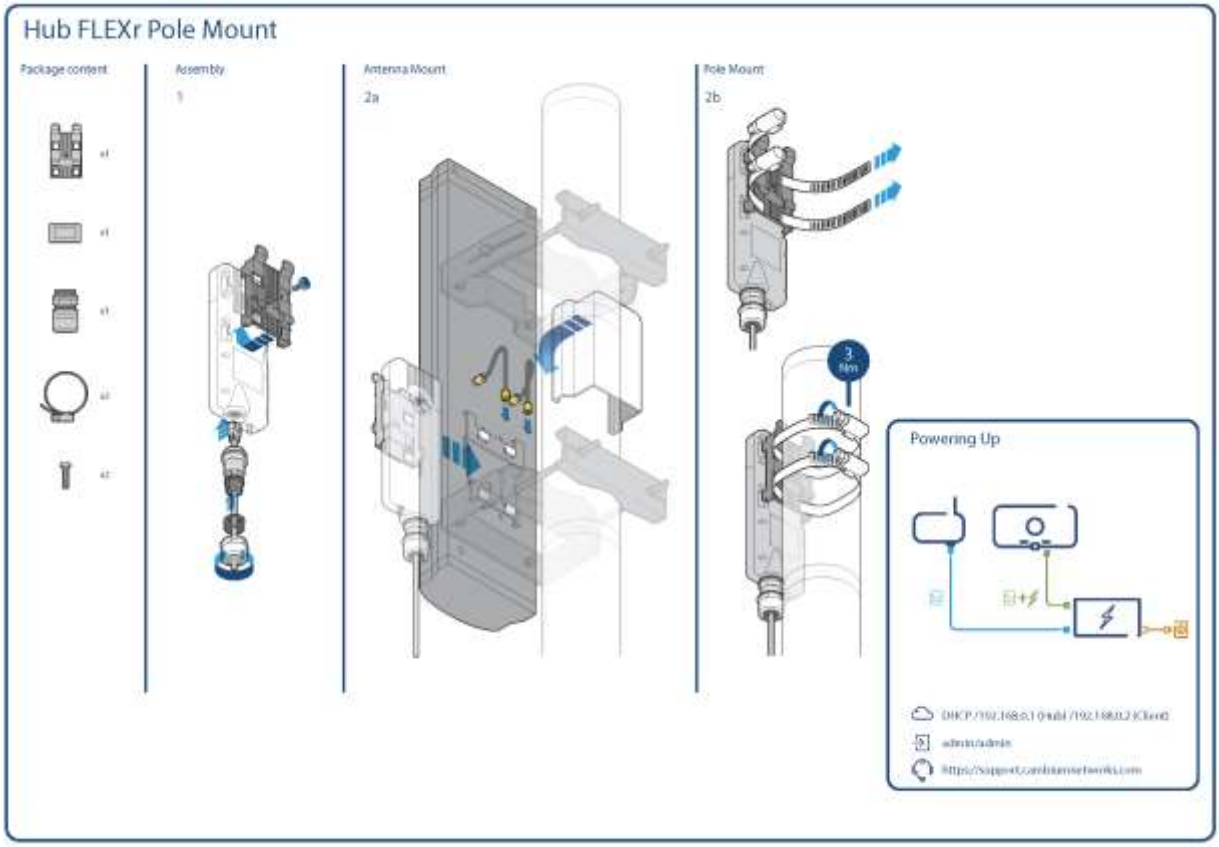
Mounting Instructions

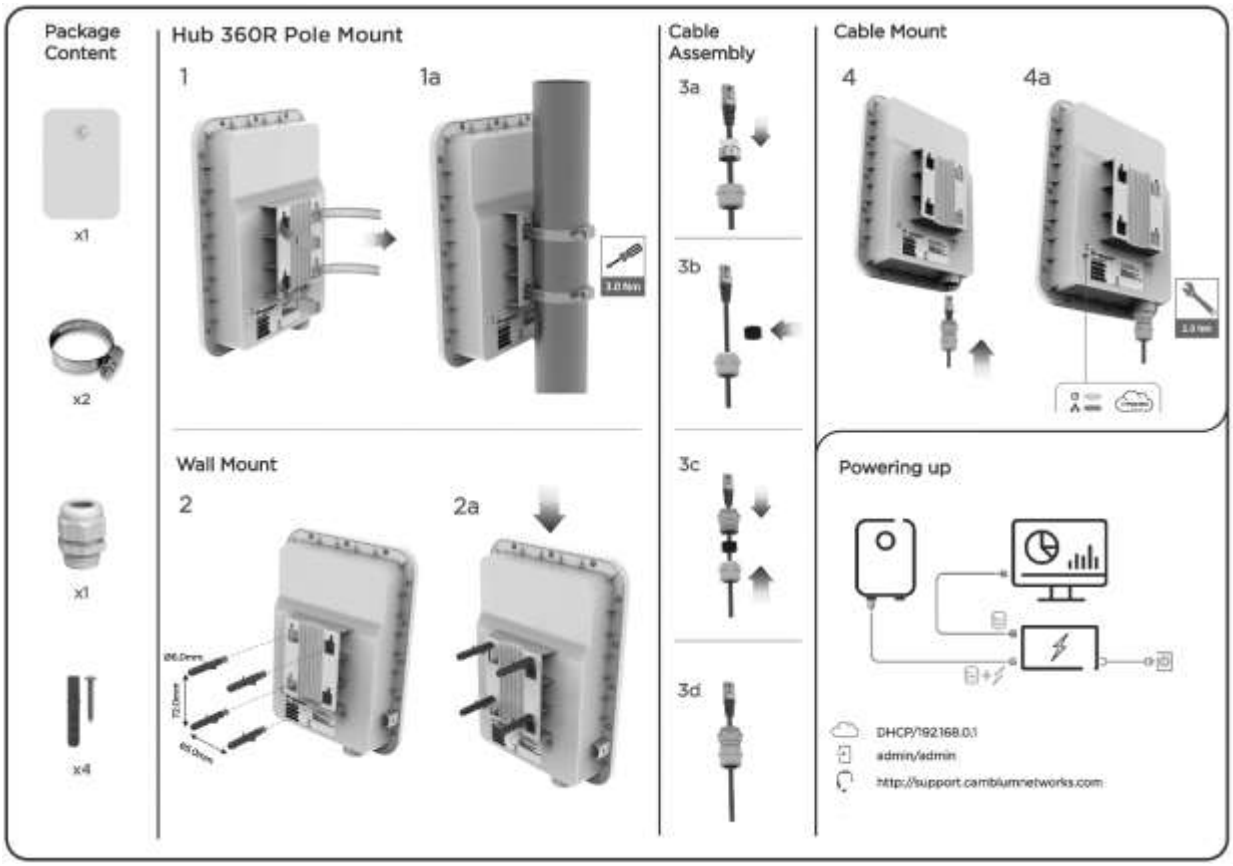
Pole or Tower Mount Guidelines

If you need to install the device to a metal tower or pole, then in addition to the general protection requirements, follow the below requirements:

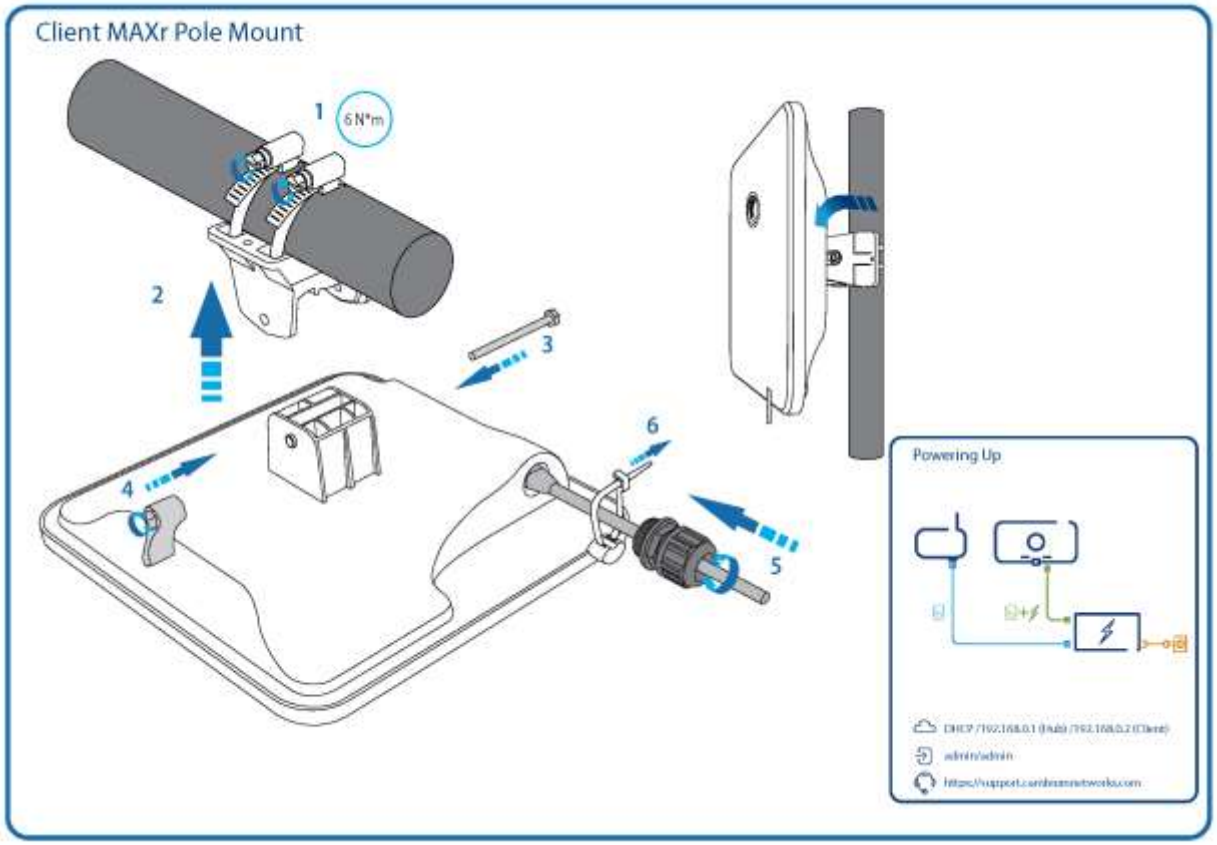
- Ensure that the position of the equipment is lower than the top of the tower or its lightning air terminal.
- Ensure that the metal tower or pole is correctly grounded.
- Install a NEMA enclosure to house sensitive components.
- Ground all devices and enclosures to the pole or structure.

HUB FLEXr Pole Mount

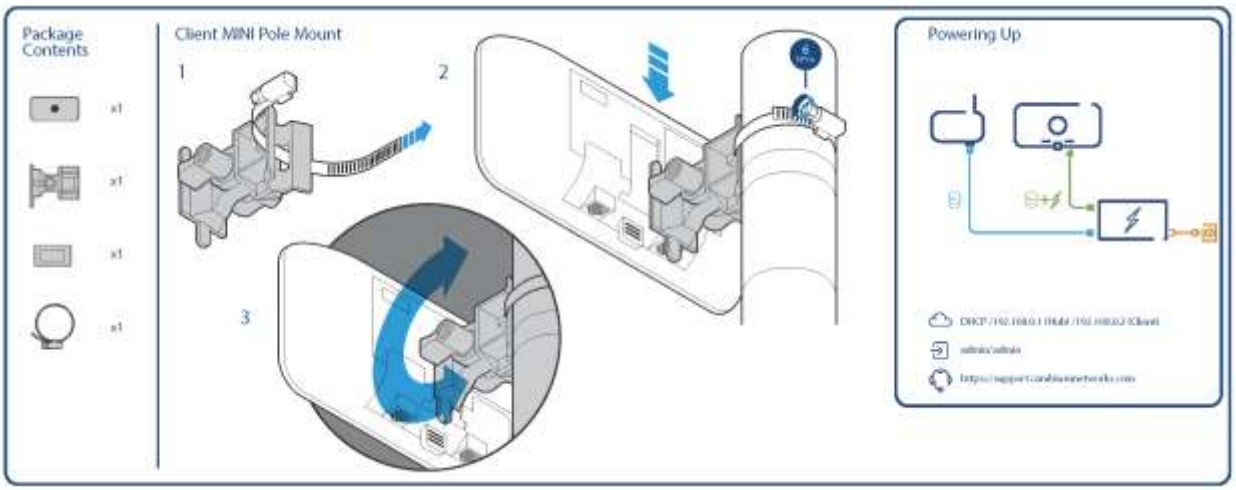



Package Content
x1
x2
x1
x4
Hub 360R Pole Mount
1
1a
Wall Mount
2
2a
Cable Assembly
3a
3b
3c
3d
Cable Mount
4
4a
Powering up
DHCP/192168.0.1
admin/admin
http://support.cambiumnetworks.com

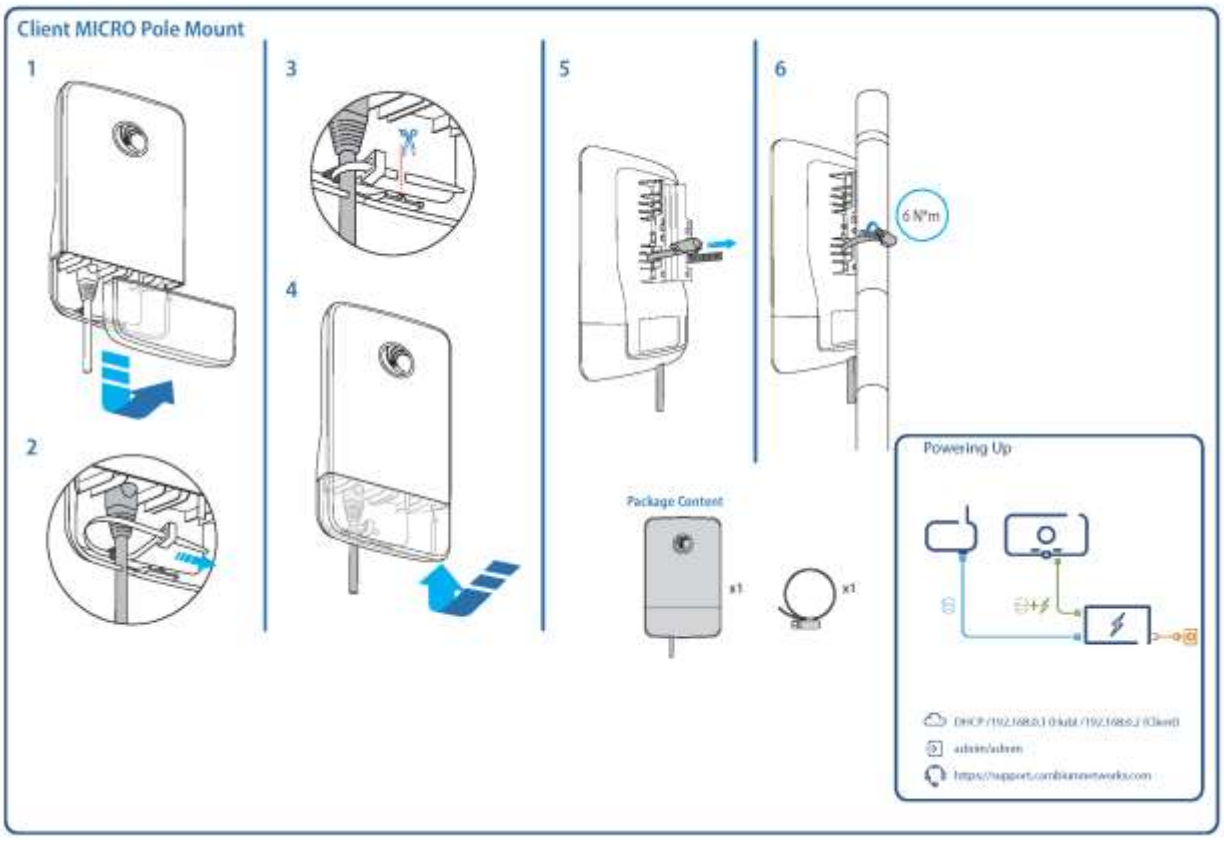
CLIENT MAXr Pole Mount



CLIENT MINI



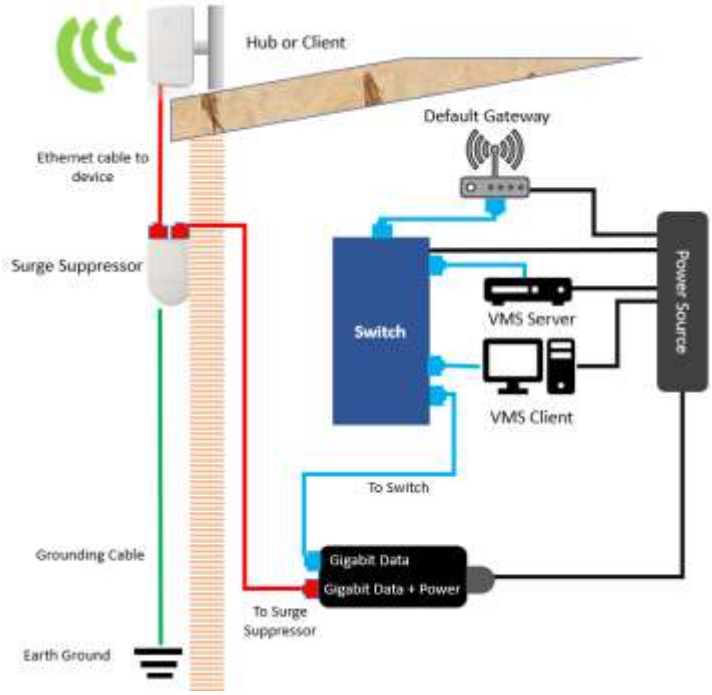
CLIENT MICRO



Wall or Roof Mount Guidelines

If you need to install the device on the wall or on the roof of a building, then in addition to the general protection requirements, follow the below requirements:

- Ensure that the position of the equipment is lower than the top of the building or its lightning air terminal.
- Ensure that the building/mounting location is properly grounded.
- Ground all devices and enclosures to the structure.



Connecting Devices

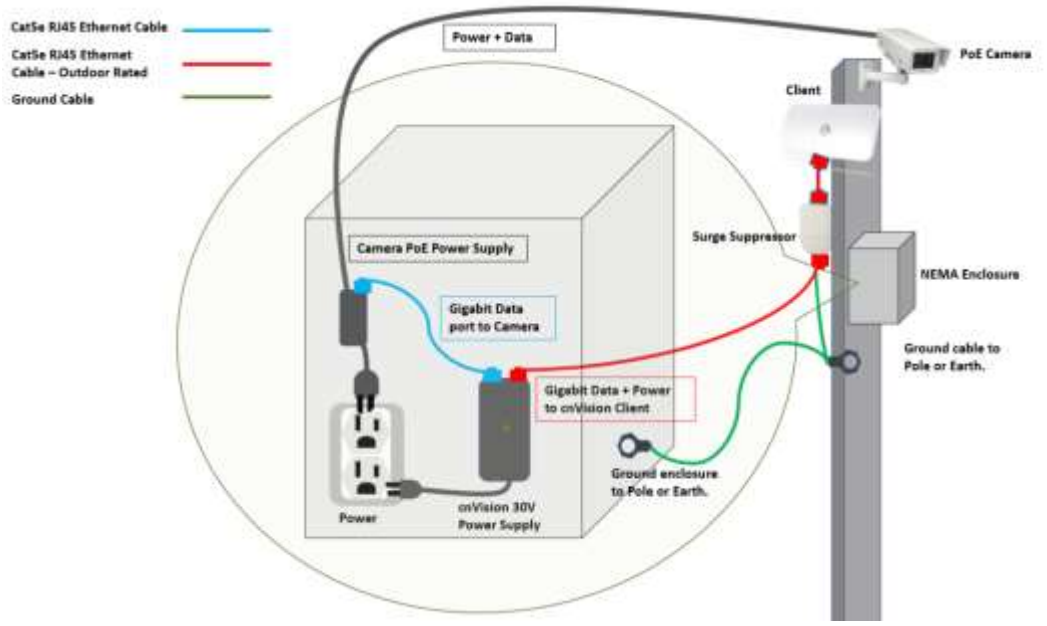
Connecting a single camera to a Client

Note:

- Use Outdoor rated Cat5e RJ45 cables if exposed to the elements.
- cnVision devices cannot provide enough power directly to the cameras. Use an external power supply provided by the camera manufacturer.
- Use a NEMA enclosure to house all devices and components that are not rated for outdoor use.

Procedure:

1. Connect a Cat5e Ethernet cable to the Gigabit Data port on the cnVision device power supply to the camera's LAN port.
2. Connect a Cat5e Ethernet cable to the Gigabit Data + Power port on the power supply to the surge suppressor
3. Connect a Cat5e Ethernet cable from the surge suppressor second LAN port to the client's LAN port.
4. Connect an external power supply to the camera's power input.
5. Connect the ground cable from the surge suppressor to the mounting structure.
6. Connect the ground cable from the NEMA enclosure to the mounting structure.
7. Connect the AC cords to the power supplies and the mains.



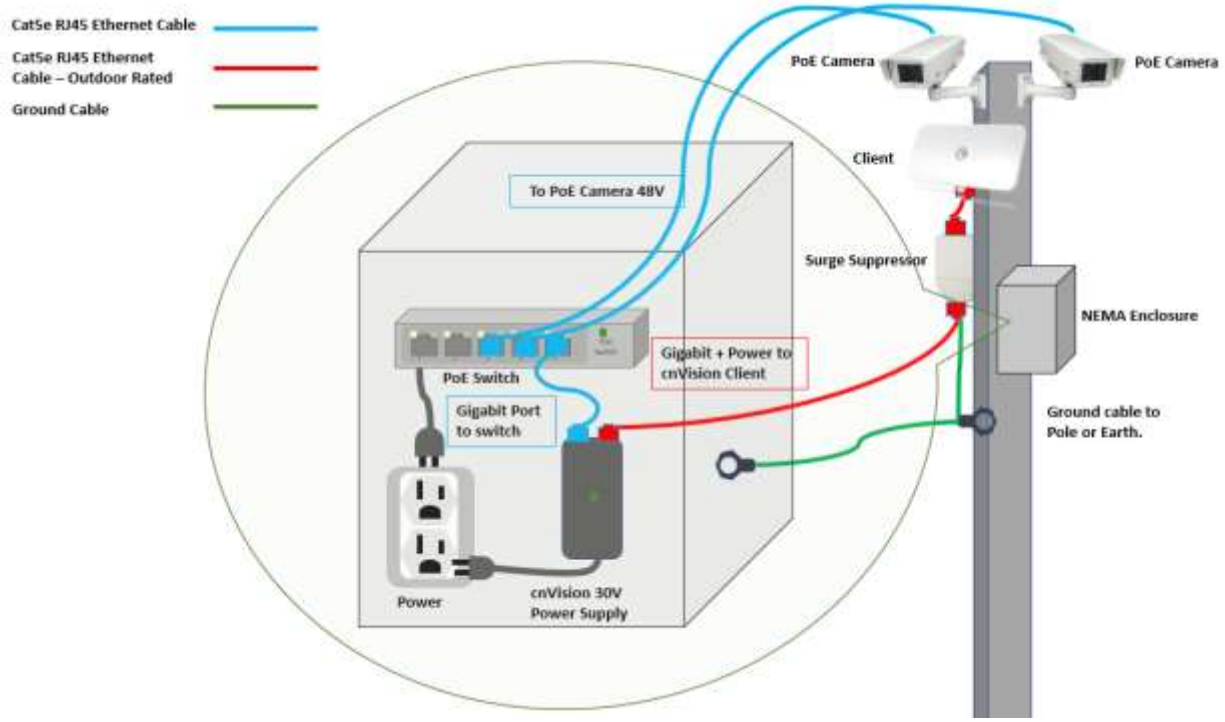
Connecting multiple cameras to a Client

Note:

- Use Outdoor rated Cat5e RJ45 cables if exposed to the elements.
- Use a NEMA enclosure to house all devices and components that are not rated for outdoor use.

Procedure:

1. Connect a Cat5e Ethernet cable to the Gigabit Data port on the cnVision device power supply to the PoE switch.
2. Connect a Cat5e Ethernet cable to the Gigabit Data + Power port on the power supply to the surge suppressor.
3. Connect a Cat5e Ethernet cable from the surge suppressor second LAN port to the client's LAN port.
4. Connect Cat5e cables from the PoE switch ports to each camera's LAN port.
5. Connect the ground cable from the surge suppressor to the grounding point on the mounting structure.
6. Connect the ground cable from the NEMA enclosure to the grounding point on the mounting structure.
7. Connect the AC cords to the power supplies and the mains.



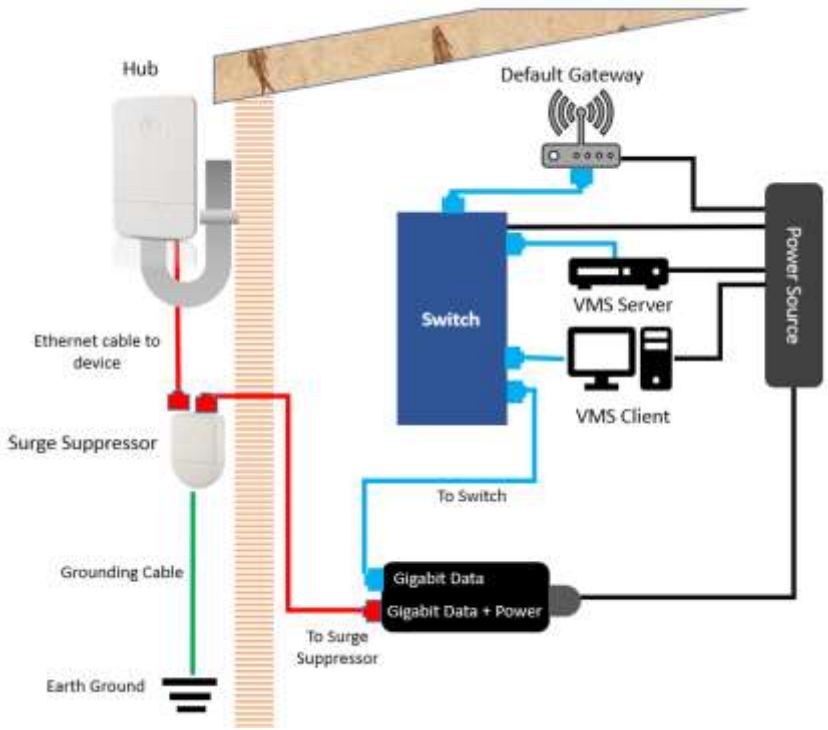
Connecting a Hub

Note:

- Use Outdoor rated Cat5e RJ45 cables if exposed to the elements.
- Use a NEMA enclosure to house all devices and components that are not rated for outdoor use.

Procedure:

1. Connect a Cat5e Ethernet cable to the Gigabit Data port on the cnVision device power supply to the switch.
2. Connect a Cat5e Ethernet cable to the Gigabit Data + Power port on the power supply to the surge suppressor LAN port.
3. Connect a Cat5e Ethernet cable from the surge suppressor second LAN port to the hub's LAN port.
4. Connect Cat5e cables from the PoE switch ports to each camera's LAN port.
5. Connect the ground cable from the surge suppressor to the grounding point on the mounting structure.
6. Connect the ground cable from the NEMA enclosure (if used) to the mounting structure.
7. Connect the AC cords to the power supplies and the mains.



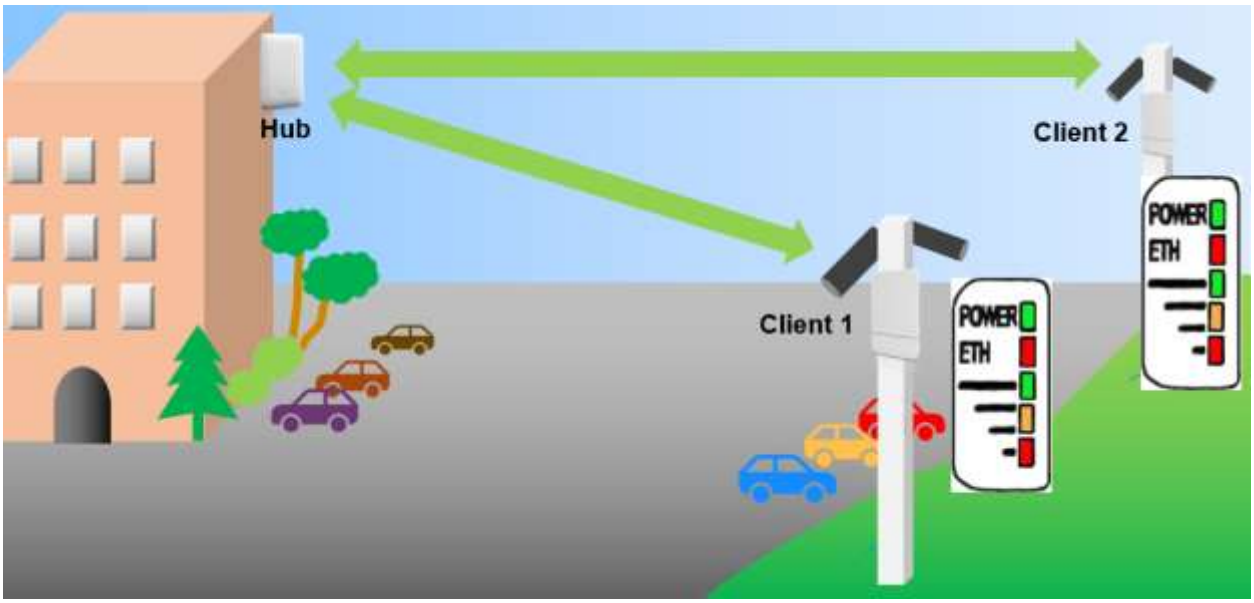
Antenna Alignment

The hub and client antennas should be aligned correctly for the best performance. Only align one device at a time.

Establishing Links

Hub 360r

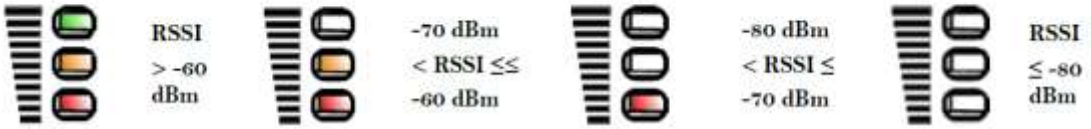
The Hub 360r uses an integrated Omnidirectional antenna and transmits in all directions, so no additional adjustments are required after the device has been mounted.



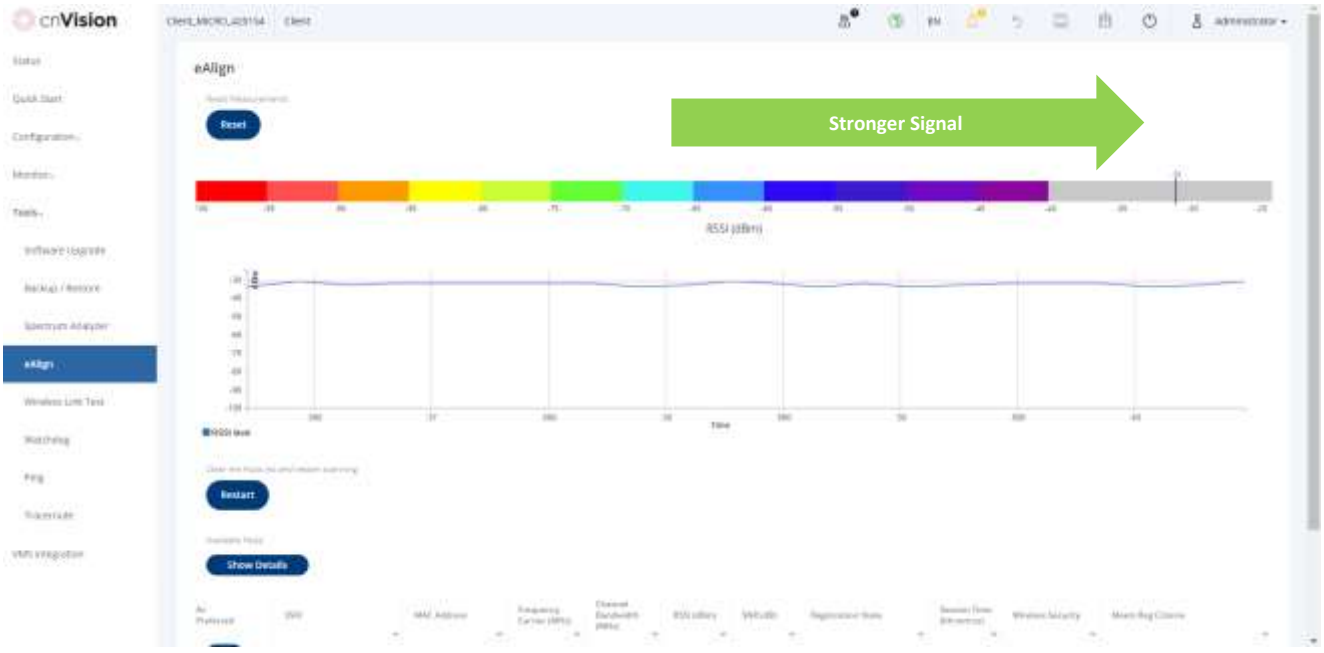
Client MAXr, Client MINI, Client MICRO

1. Visually point the Client antennas at the Hub to achieve the strongest signal. Each client contains LEDs that display the signal strength. Adjust the client up, down, left or right to achieve the highest signal level. Do not tighten the Client yet.

LED	Function
POWER	Green: Power is applied to the device Unlit: No power is applied to the device or improper power source
ETH	Ethernet port indicator Once lit, blinking indicates Ethernet activity Green: 10/100/1000 BaseTX link
RF SIGNAL	Radio scanning: LEDs light in an ascending sequence to indicate that the radio is scanning Radio registered: LEDs light to indicate the RSSI level at the device.



2. Connect a laptop to the Client. Open a web browser and enter the Client's IP Address in the Address bar. Log in to the Web User Interface.
3. Navigate to the **Tools > eAlign** screen. The RSSI bar displays the signal strength, adjust the Client to obtain the strongest signal. The further the signal bar moves to the right, the stronger the signal strength.



4. Tighten the device once the alignment is complete.

Chapter 5: Using the Web User Interface

This chapter describes all configuration and alignment tasks that are performed when a cnVision system is deployed.

Configure the units by performing the following tasks:

- Understanding the Tool menu
- Using the menu options

Tool Menu

The tool menu at the top of the Web User Interface page provides key information and administrator level functions.

Tool Menu

Icon	Name	Description
EN	**Language Settings**	Set the default language. • English (default) • Spanish • Turkish
	Active Users	Displays the total number of users logged in to the device's Web User Interface.
	Internet Connectivity	Indicates whether the device has internet connectivity. • Green: Internet connectivity • Gray: No Internet connectivity
	GPS (HUB FLEXr only)	Displays GPS connectivity.
	Notifcations	Displays system and action notifications.
	Undo Button	Undo **All** unsaved changes.
	Save Button	Saves changes.
	Temporary Save Button	Allows to temporarily save changes and test before applying them using the Save button.
	Reboot Device	Reboots the device.
Administrator	**Administrator > Log Out**	Logs out of the Web User Interface.

Using the menu options

Use the menu navigation bar in the left panel to navigate to each web page. Some of the menu options are only displayed for specific system configurations.

Menu options and web pages

Main menu	Menu option	Web page information
Status		Status page
Quick Start		Quick Start
Configuration		Configuration menu
	Radio	Configuration > Radio page
	System	Configuration > System page
	Network	Configuration > Network page
Monitor		Monitor menu
	Performance	Monitor > Performance page
	System	Monitor > System page
	Wireless	Monitor > Wireless Page
	Throughput Chart	Monitor > Throughput Chart
	GPS	Monitor > GPS page (Hub Mode)
	Network	Monitor > Network page
	System Log	Monitor > System Log Page
Tools		Tools menu
	Software Upgrade	Tools > Software Upgrade
	Backup / Restore	Tools > Backup/Restore page
	Spectrum Analyzer	Tools > Spectrum Analyzer page
	Wireless Link Test	Tools > Wireless Link Test page
	Watchdog	Tools > Watchdog page
	Ping	Tools > Ping page
	Traceroute	Tools > Traceroute page
VMS Integration		VMS Integration

Status page

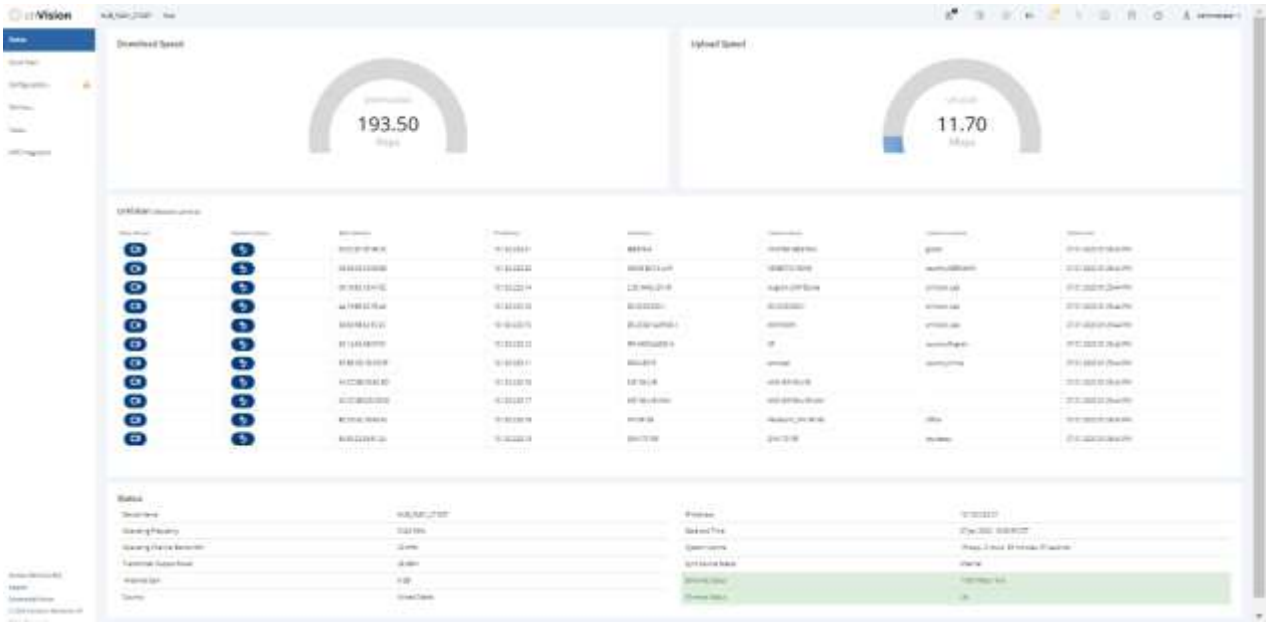


Table 5-9 Status page attributes

Attribute	Meaning
Status	
Download Speed	This is the total amount of traffic currently passing from Hub to Client in Kbits.
Upload Speed	This is the total amount of traffic currently passing from Client to Hub in Kbits
Detected Cameras	This section lists ONVIF compliant cameras connected to the system and provides the hardware and network details for each camera. You can perform the following camera operations: View the video stream Reboot the camera
Status	Displays key parameters such as the operating frequency , channel bandwidth, system time, uptime , ethernet & wireless status

Quick Start

See Configuring the Hub

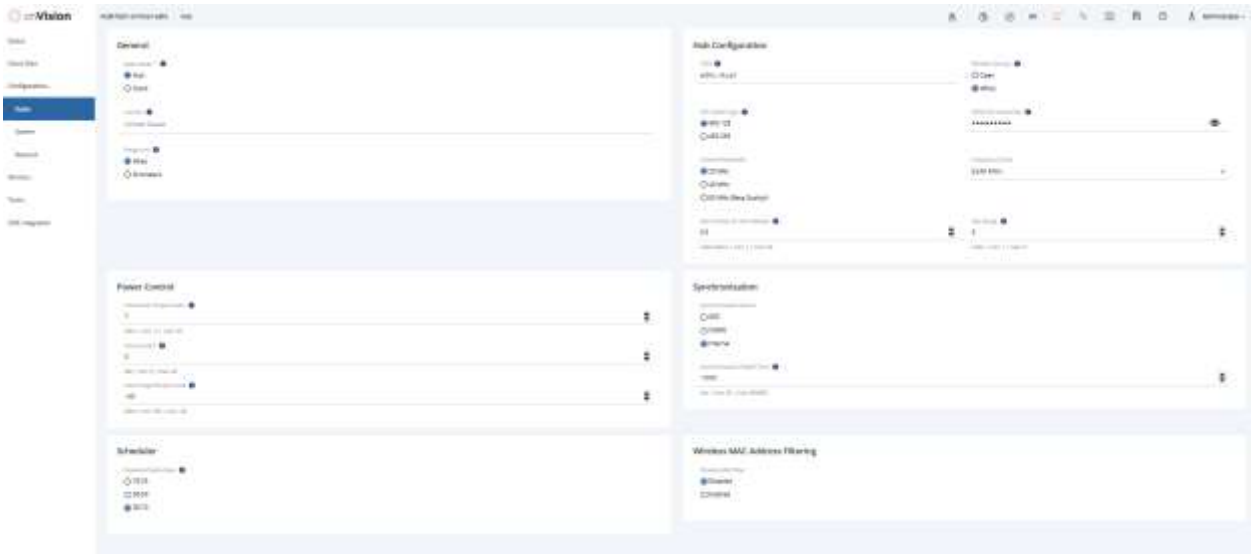
Configuring the Client

Configuration menu

Use the **Configuration** menu to access and change all device configuration parameters.

Configuration > Radio page

(Hub Mode)



Configuration > Radio page attributes

Attribute	Meaning
General	
Radio Mode	**Hub**: The unit controls the point-to-point link and its maintenance. On startup, the Hub transmits until a link with the Client is made. **Client**: The unit listens for its peer and only transmits when the peer has been identified.
Country (Hub Mode)	Defines the country code being used by the device. The country code of the Client follows the country code of the associated Hub unless it is an FCC SKU in which case the country code is the United States or Canada. Country code defines the regulatory rules in use for the device.
Range Unit (Hub Mode)	Units of measurement on the device are displayed in either miles (m) or kilometers (km).
Power Control (Hub)	
Transmitter Output Power (Hub)	**Transmitter Output Power** is the total transmit power of the device. The Hub 360R device has four transmit chains and total transmit power sums the power from all chains. The HUB FLEXr supports two chains. This does not include antenna gain. Transmitter Output Power may be limited by regulatory rules for the country in use.

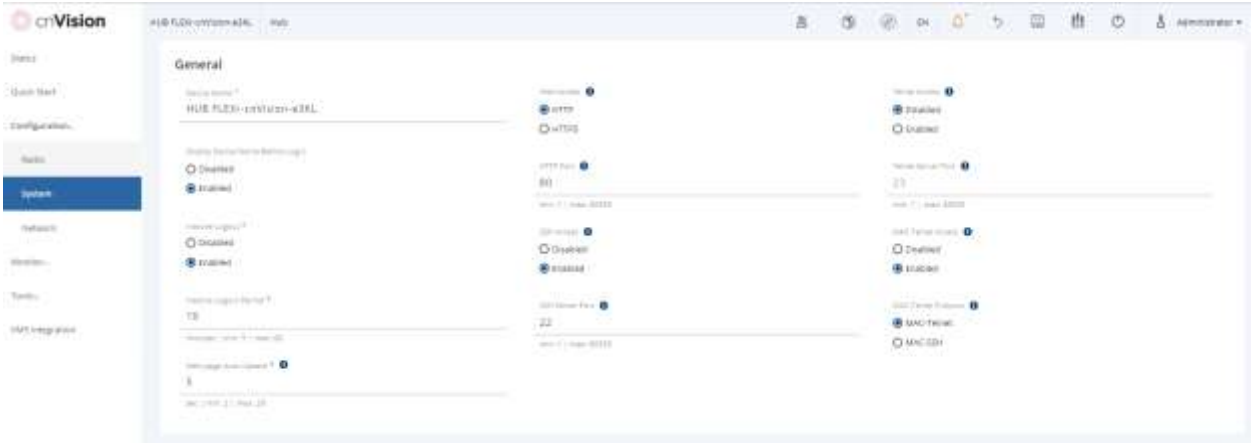
Attribute	Meaning
Scheduler (Hub)	
Downlink/Uplink Ratio	The schedule of downlink traffic to uplink traffic on the radio link. The three options, **75/25**, **50/50** and **30/70**, allow the radio to operate in a fixed ratio on every frame. In other words, this ratio represents the amount of the total radio link's aggregate throughput that will be used for downlink resources, and the amount of the total radio link's aggregate throughput that will be used for uplink resources.
Max Range (Hub Mode)	This parameter represents a cell coverage radius. Clients outside the configured radius will not be able to connect. It is recommended to configure Max Range to match the actual physical distance of the farthest client.
Channel Bandwidth (Hub Mode)	Configure the channel size used by the radio for RF transmission.
Frequency Carrier (Hub Mode)	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the **Country** parameter. Ensure that a thorough spectrum analysis has been completed prior to configuring this parameter.
Hub Configuration	
SSID	SSID is a unique identifier for a wireless network that is specified in the Hub's beacon (Hub mode). The SSID must be the same at both ends and different from the device name.
Wireless Security	There are two ways to authenticate a Client with a Hub. These are "WPA2" and "Open". The Hub via the beacon will specify the authentication method it uses, and this Client must have the matching authentication method selected in order for authentication to occur. The Client may allow any or all of the authentication methods to be selected. This allows the user to specify minimum levels of authentication security to the Hub.
	The "WPA2 Pre-shared Key" is used when the WPA2 authentication selection is utilized between the Client and the Hub. The key here must exactly match the key entered on the Hub. This key must be between 8 and 63 symbols.
Channel Bandwidth	Configure the channel size used by the radio for RF transmission.
Max Number of Clients allowed	Enter the number of Clients allowed to connect to the Hub. (min 1 ~ max 64).
Frequency Carrier (Hub mode)	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the **Country** parameter. Ensure that a thorough spectrum analysis has been completed prior to configuring this parameter.

Attribute	Meaning
Max Range	This parameter represents the cell coverage radius. Clients outside the configured radius will not be able to connect. It is recommended to configure Max Range to match the actual physical distance of the farthest Client.
Synchronization (Hub Mode) HUB FLEXr only	
Synchronization Source (Hub Mode)	**GPS**: Synchronization timing is received via the Hub's connected GPS antenna. Co-located or in-range Hubs receiving synchronization via GPS or CMM transmits and receives at the same time, thereby reducing self-interference. **CMM5**: Synchronization timing is received via the Hub's Ethernet port via a connected Cambium Cluster Management Module 5 (CMM5). Co-located or in-range Hubs receiving synchronization via GPS or CMM will transmit and receive at the same time, thereby reducing self-interference. If a CMM is being used, verify that the cables from the CMM to the network switch are at most 30 ft (shielded) or 10 ft (unshielded) and that the network switch is not PoE (802.3af). **Internal**: Synchronization timing is generated by the Hub and the timing is not based on GPS pulses. Hubs using Synchronization Source of **Internal** will not transmit and receive in sync with other co-located or in-range Hubs, which introduces self-interference into the system.
Synchronization Holdoff Time (Hub Mode)	The **Synchronization Holdoff Time** is designed to gracefully handle fluctuations/losses in the GPS synchronization signaling. After the Hub has received a reliable synchronization pulse for at least 60 seconds, if there is a loss of synchronization signal, the **Synchronization Holdoff** timer is started. During the holdoff interval, all Client registrations are maintained. If a valid GPS synchronization pulse is regained during the holdoff interval, then the Hub continues to operate normally. If a valid synchronization pulse is not regained from the GPS source during the holdoff interval, then the Hub ceases radio transmission. The default is **30 seconds**.
General (Client Mode)	
Radio Mode	
Preferred Hubs list (Client Mode)	The **Preferred Hubs List** is comprised of a list of up to 16 Hub devices to which the Client device sequentially attempts registration. For each Hub configured, if authentication is required, enter the **Wireless Security** type and **WPA2 Pre-shared Key** associated with the configured **SSID**.
Scheduler (Client Mode)	
Downlink Max Rate (Hub Mode)	Specifies the maximum downlink MCS value that the Rate Adapt algorithm will choose for Radio 1. If an installation is exhibiting packet loss due to downlink interference, modifying **Downlink Max Rate** to limit the device's maximum MCS rate may result in more reliable packet delivery. This is especially true in installations among changing and unpredictable interference.

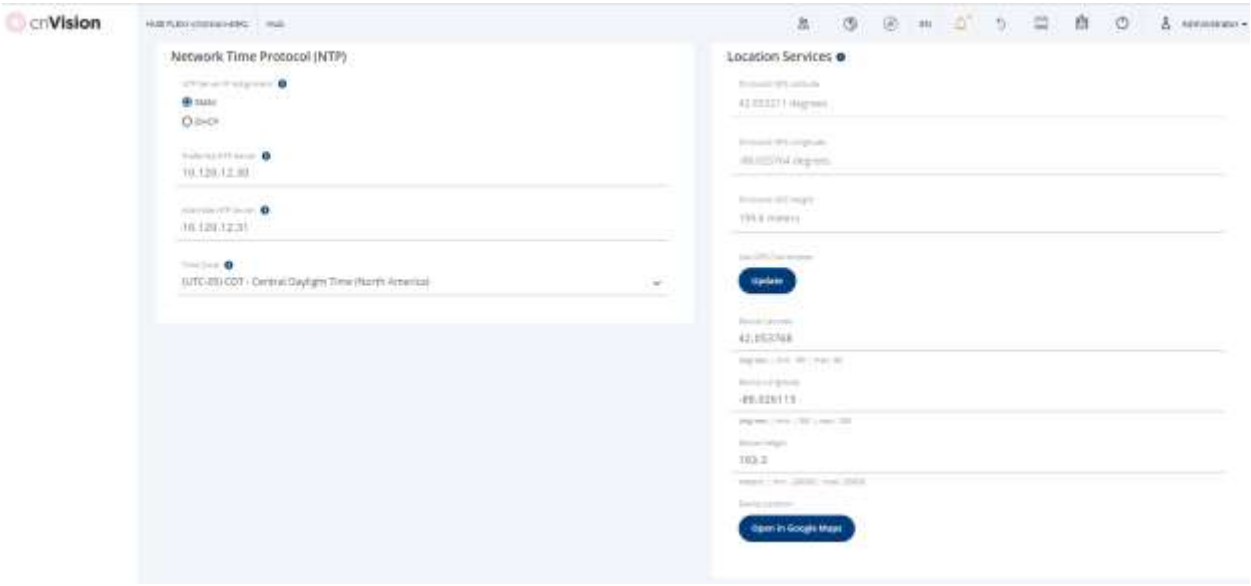
Attribute	Meaning
Power Control (Client Mode)	
Max Tx Power (Client Mode)	The Transmitter Output Power is the total transmit power of the Hub. The Hub has two transmit chains, and total transmit power sums the power from both chains. This does not include antenna gain. The Transmitter Output Power may be limited by regulatory rules for the country in use.
Antenna Gain	The total gain of the antenna in use by the device. Incorrect antenna value may impact total EIRP and Tx Power value due to the regulatory limit.
Uplink Max Rate (Client Mode)	Specifies the maximum uplink MCS value that the Rate Adapt algorithm will choose for Radio 1. If an installation is exhibiting packet loss due to uplink interference, modifying **Uplink Max Rate** to limit the device's maximum MCS rate may result in more reliable packet delivery. This is especially true in installations among changing and unpredictable interference.
Scan Channel Bandwidth (Client Mode)	The selected scan channel bandwidths are scanned by the Client. Any combination may be selected. When bandwidth is selected, a tab for the bandwidth appears and a listing of all available channels is presented once the tab for the bandwidth is selected. Each bandwidth tab may contain a number on the left side. This number defines how many channels have been selected for that bandwidth. If no channels are selected for bandwidth, then all channels are scanned.

Configuration > System page

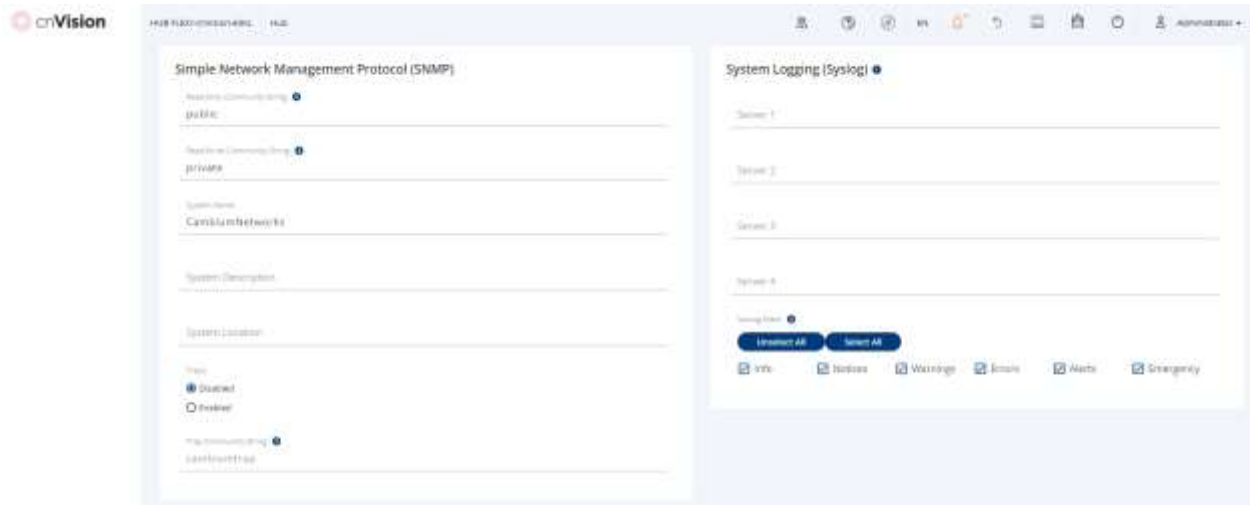
Configuration > System page - General



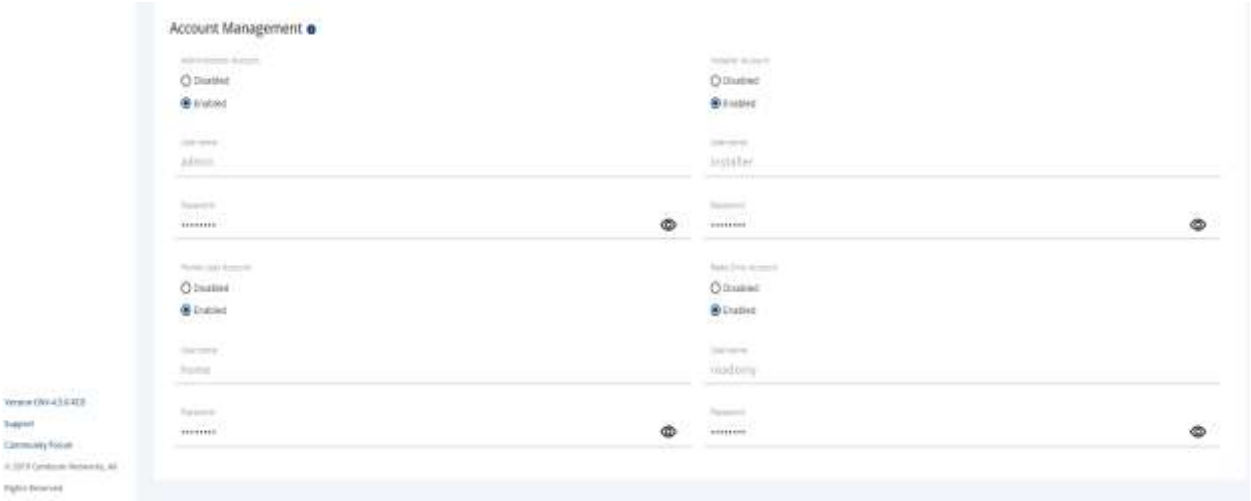
Configuration > System page – Network Time Protocol/Location Services



Configuration > System page – SNMP/System Logging (Syslog)



Configuration > System page – Account Management



Configuration > System page attributes

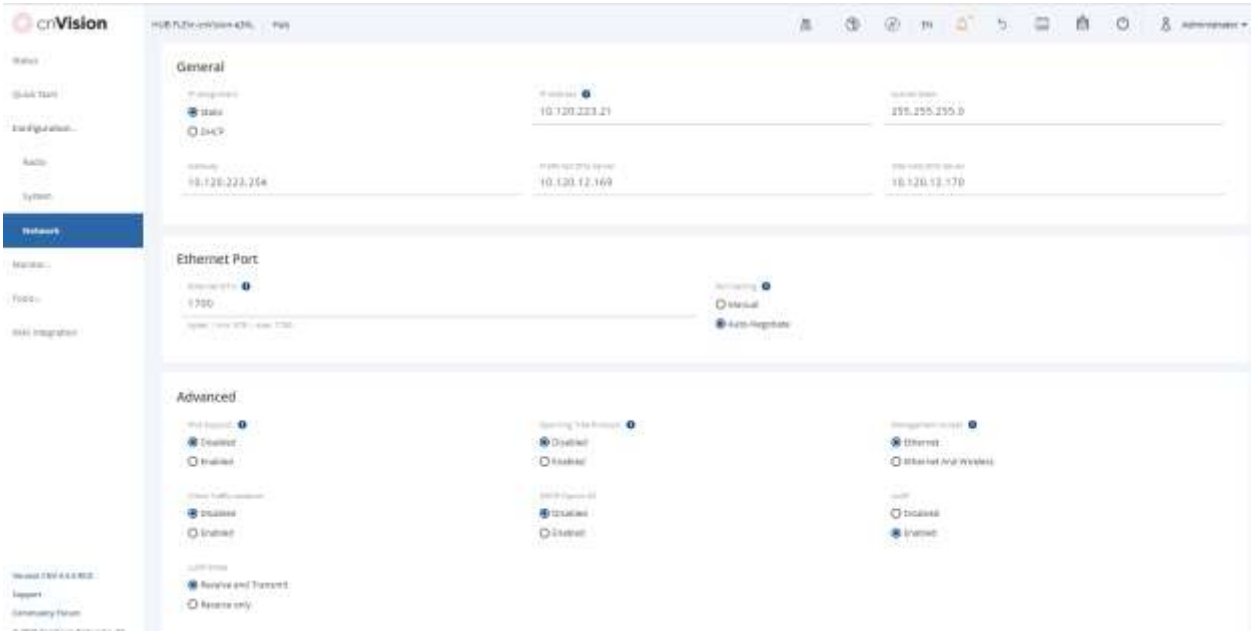
Attribute	Meaning
General	
Device Name	The configured identifier used in a Network Management Station (NMS).
Display Device Name Before Login	**Disabled**: For security, the configured **Device Name** is hidden on the device login screen. **Enabled**: The configured **Device Name** is displayed upper-left on the device login screen.
Inactive Logout	**Disabled**: The device will not automatically log out users after a period of inactivity. **Enabled**: After the period configured in the **Inactive Logout Period** has elapsed, the device will automatically log out the user.
Inactive Logout Period	Represents the amount of time for which a user will remain logged in. After this period has elapsed, the user will be automatically logged out.
Web-page Auto Update	Configure the interval for which the device retrieves system statistics for display on the management interface. For example, if this setting is configured to 5 seconds, the statistics and status parameters displayed on the management interface will be refreshed every 5 seconds (default). **Changes made to this field are effective immediately.**
Web Access	**HTTP**: The device web management interface is accessed via HTTP. **HTTPS:** The device web management interface may only be accessed via secure HTTPS.
HTTP Port	This specifies the TCP/UDP port to be used with HTTP or HTTPS. The default value for HTTP is 80 and HTTPS is 443.
SSH Access	**Disabled**: Access to the device through SSH is not possible.

Attribute	Meaning
	Enabled: Cambium engineers can access the device through SSH which enables them to log in to the radio and troubleshoot. **SSH Access** is **Enabled** by default.
SSH Server Port	This specifies the SSH port.
Telnet Access	**Disabled**: Command Line Interface access via Telnet is not allowed **Enabled:** Command Line Interface access via Telnet is allowed
MAC-Telnet Access	MAC-Telnet enables connections to the Radio on the link layer via MAC address from RouterOS or mactelnet enabled devices. In order to use MAC-Telnet the first time, the Administrator Account password must be changed on the GUI or the CLI. This password can then be used for MAC-Telnet.
MAC-Telnet Protocol	MAC-Telnet Protocol defines which subservience to use with MAC-Telnet for accessing device: • Secured MAC-SSH • Standard MAC-Telnet remote terminal
Network Time Protocol (NTP)	
NTP Server IP Assignment	**Static**: The device retrieves NTP time data from the servers configured in fields NTP Server IP Address. **DHCP**: The device retrieves NTP time data from the server IP issued via a network DHCP server.
Preferred NTP Server	Configure the primary NTP server IP addresses from which the device will retrieve time and date information.
Alternate NTP Server	Configure an alternate or secondary NTP server IP addresses from which the device retrieves time and date information.
Time Zone	The Time Zone option may be used to offset the received NTP time to match the operator's local time zone.
Location Services	
On-board GPS Latitude	GPS-retrieved Latitude information for the device in decimal format.
On-board GPS Longitude	GPS-retrieved Longitude information for the device in decimal format.
On-board GPS Height	GPS-retrieved height information for the device in meters.
Use GPS Coordinates 	Click **Update** to retrieve device location and height information via the connected GPS source.
Device Latitude	Configure Latitude information for the device in decimal format.
Device Longitude	Configure Longitude information for the device in decimal format.

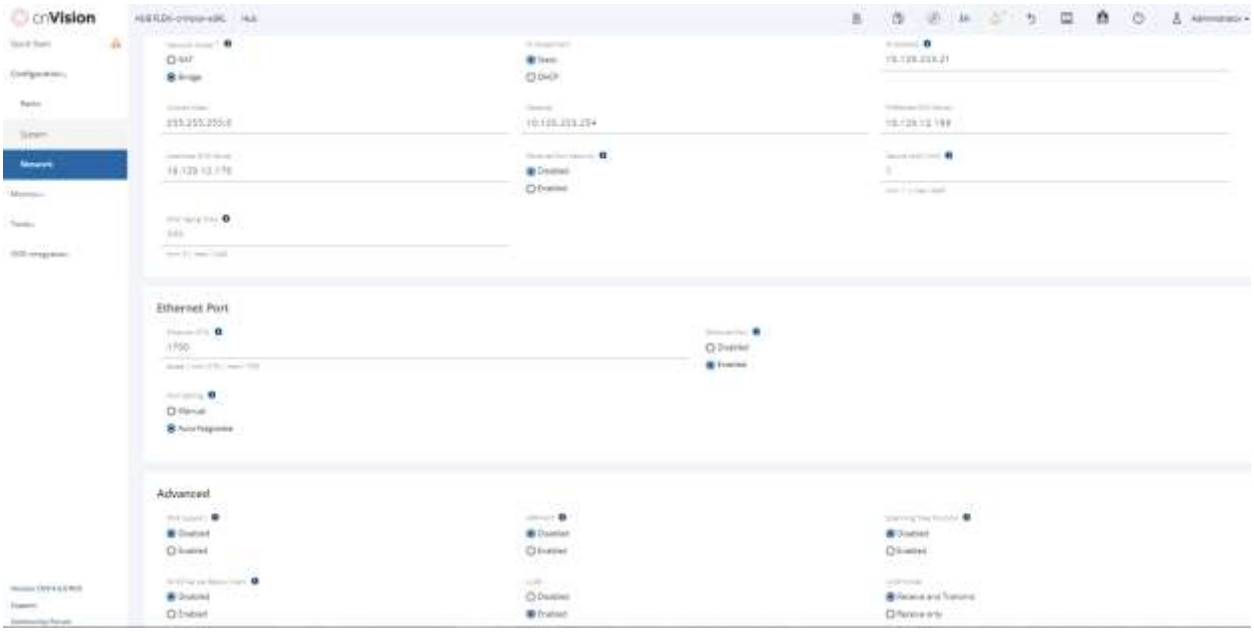
Attribute	Meaning
Device Height	Configure height above sea level for the device in meters.
Device Location 	Hyperlink to display the device location in Google Maps
Simple Network Management Protocol (SNMP)	
Read-Only Community String	Specify a control string that can allow a Network Management Station (NMS) to read SNMP information. No spaces are allowed in this string. This password will never authenticate an SNMP user or an NMS to read/write access. The **Read-only Community String** value is clear text and is readable by a packet monitor.
Read-Write Community String	Specify a control string that can allow a Network Management Station (NMS) to access SNMP information. No spaces are allowed in this string.
System Name	Specify a string to associate with the physical module. This parameter can be polled by the NMS. Special characters are supported.
System Description	Specify a description string to associate with the physical module. This parameter can be polled by the NMS. Special characters are supported.
System Location	Specify a description string to associate with the physical location. This parameter can be polled by the NMS. Special characters are supported.
Traps	**Disabled**: SNMP traps for system events are not sent from the device. **Enabled**: SNMP traps for system events are sent to the servers configured in table **Trap Servers**.
Trap Community String	Configure an SNMP Trap Community String which is processed by the servers configured in **Trap Servers**. This string is used by the trap server to decide whether or not to process the traps incoming from the device (i.e. for traps to successfully be received by the trap server, the community string must match).
System Logging (Syslog)	
Server 1-4	Specify up to four Syslog servers to which the device sends Syslog messages.
Syslog Mask	Configure the levels of Syslog messages which the devices send to the servers configured in parameters **Server 1-4.**  Caution Choose only the Syslog levels appropriate for your installation. Excessive logging can cause the device log file to fill and begin overwriting previous entries.
Account Management	
Administrator Account	The Administrator account has full read and write permissions for the device. **Disabled**: The disabled user is not granted access to the device management interface. The administrator user level cannot be disabled.

Attribute	Meaning
	Enabled: The user is granted access to the device management interface.
Username	The username associated with the administrator account used upon device login.
Password	Configure a custom password to secure the device. Only the 'Administrator' account can override this password. The password character display may be toggled using the visibility icon  .
Installer Account	The Installer account has permissions to read and write parameters applicable to unit installation and monitoring. **Disabled**: The disabled user is not granted access to the device management interface. **Enabled**: The user is granted access to the device management interface.
Username	The username associated with the installer account used upon device login.
Password	Configure a custom password to secure the device. Only the 'Administrator' account can override this password. The password character display may be toggled using the visibility icon  .
Home User Account	The Home User account has permission to access pertinent information for support purposes. **Disabled**: The disabled user is not granted access to the device management interface. **Enabled**: The user is granted access to the device management interface.
Username	The username associated with the home user account used upon device login.
Password	Configure a custom password to secure the device. Only the 'Administrator' account can override this password. The password character display may be toggled using the visibility icon  .
Read-Only Account	The Read-Only account has permissions to view the **Monitor** page only. **Disabled**: The disabled user is not granted access to the device management interface. **Enabled**: The user is granted access to the device management interface.
Username	The username associated with the read-only account used upon device login.
Password	Configure a custom password to secure the device. Only the 'Administrator' account can override this password. The password character display may be toggled using the visibility icon. 

Figure 2 Configuration > Network page (Hub)



Configuration > Network page (Client Mode)



Configuration > Network page attributes

Attribute	Meaning
General	
Network Mode	**NAT**: The Client acts as a router and packets are forwarded or filtered based on their IP header (source or destination). **Bridge**: The Client acts as a switch and packets are forwarded or filtered based on their MAC destination address.
IP Assignment	**Static:** Device management IP addressing is configured manually in fields **IP Address, Subnet Mask, Gateway, Preferred DNS Server,** and **Alternate DNS Server**. **DHCP:** Device management IP addressing (**IP address, Subnet Mask, Gateway, and DNS Server**) is assigned via a network DHCP server, and parameters **IP Address, Subnet Mask, Gateway, Preferred DNS Server,** and **Alternate DNS Server** are not configurable.
Wireless IP Assignment (NAT Mode)	Static: Wireless IP address is configured manually in fields **Wireless IP Address, Wireless IP Subnet Mask, Wireless Gateway IP Address, Preferred DNS IP Address** and **Alternate DNS IP Address**. DHCP: Device management IP addressing (**Wireless IP address, Wireless Subnet mask, Wireless Gateway,** and **DNS server**) is assigned via a network DHCP server.
IP Address Wireless IP Address (NAT Mode)	Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network. If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (Hub) or 192.168.0.2 (Client).
Subnet Mask Wireless IP Address (NAT Mode)	Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device will belong to subnet 192.168.2.X.
Gateway Wireless Gateway (NAT Mode)	Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Preferred DNS Server	Configure the primary IP address of the server used for DNS resolution.
Alternate DNS Server	Configure the secondary IP address of the server used for DNS resolution.
IPv6 Assignment	IPv6 Assignment specifies how the IPv6 address is obtained. Static: Device management IP addressing is configured manually in fields IPv6 Address and IPv6 Gateway.

Attribute	Meaning
	DHCPv6: Device management IP addressing (IP address and gateway) is assigned via a network DHCP server, and parameters IPv6 Address and IPv6 Gateway are unused. If the DHCPv6 server is not available previous static IPv6 address will be used as a fallback IPv6 address. If no previous static IPv6 address is available, no IPv6 address will be assigned. DHCPv6 will occur over the wireless interface by default.
IPv6 Address	Internet protocol version 6 (IPv6) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network. IPv6 addresses are represented by eight groups of four hexadecimal digits separated by colons.
IPv6 Gateway	Configure the IPv6 address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Ethernet Port Security (Client Mode)	**Disabled:** No MAC address limit/gaining timers are imposed for bridging at the Client device Ethernet port. **Enabled:** By configuring **Secure MAC Limit** and **MAC Aging Time**, a limit is imposed on the number and duration of bridged devices connected to the Client Ethernet port.
Secure MAC Limit (Client Mode)	Configure the number of simultaneous secure MAC addresses that will be allowed at the Ethernet interface of the Client
MAC Aging Time (Client Mode)	Configure the time for which the secure MAC addresses should be allowed to age. Once the Aging timer expires for a MAC address, it will be removed from the internal table and no longer count as an active MAC. Set the time to 0 to disable aging.
Ethernet Interface (Client NAT Mode)	
IP Address (Client NAT Mode, Bridge Mode)	Ethernet interface Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.
Subnet Mask (Client NAT Mode, Bridge Mode)	Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device will belong to subnet 192.168.2.X.
DHCP Server (Client NAT Mode, Bridge Mode)	Disabled: Use this setting when the Client is in NAT or Router mode if there is an existing DHCP Server below the Client handing out IP Addresses or if all devices below the Client will be configured with static IP Addresses. Enabled: Use this setting when the Client is in NAT or Router mode, to use the Client's local/onboard DHCP server to hand out IP addresses to its clients.
DHCP Start IP (Client NAT Mode, Bridge Mode)	A pool or range of IP addresses needed by the DHCP server to provide IP Addresses to requesting devices. This is the first IP address in the range.

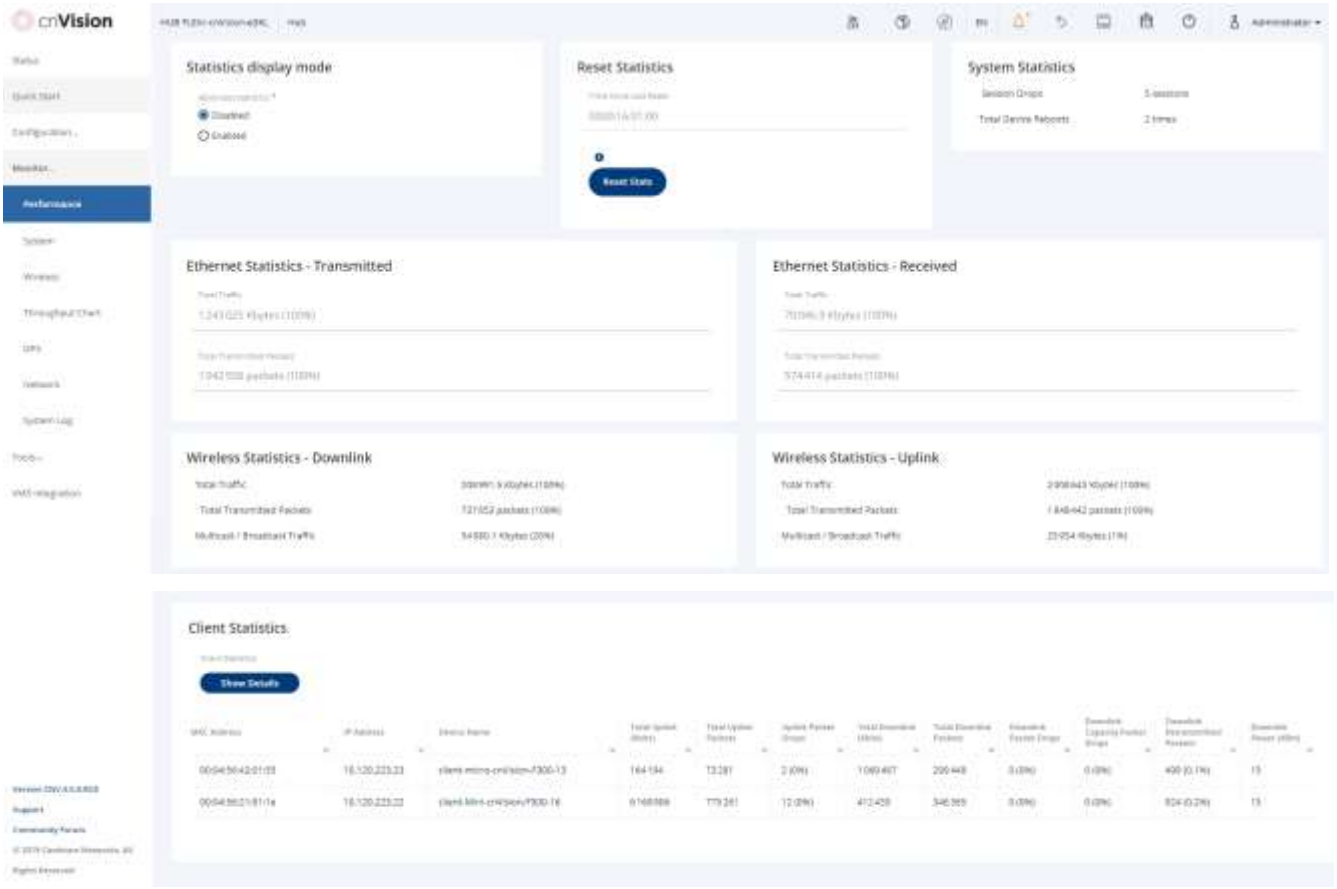
Attribute	Meaning
DHCP End IP (Client NAT Mode, Bridge Mode)	The Client acts as a DHCP server to the subnet associated with the ethernet interface and provides IP addresses to devices in the subnet requesting IP addresses via DHCP.
Ethernet Port	
Ethernet MTU	Specify the device MTU or Maximum Transmission Unit; the size in bytes of the largest data unit that the device is configured to process. Larger MTU configurations can enable the network to operate with greater efficiency, but in the case of retransmissions due to packet errors, efficiency is reduced since large packets must be resent in the event of an error.
Advanced	
IPv6 Support	System-wide IPv6 Protocol Support. When enabled, appropriate IPv6 modules and services will be loaded.
Spanning Tree Protocol	Disabled: When disabled, Spanning Tree Protocol (802.1d) functionality is disabled at the Hub. Enabled: When enabled, Spanning Tree Protocol (802.1d) functionality is enabled at the Hub, allowing for the prevention of Ethernet bridge loops.
DHCP Server Below Client (Client Mode)	Disabled: This blocks DHCP servers connected to the Client device LAN side from handing out IP addresses to DHCP clients above the Client device (wireless side). Enabled: This allows DHCP servers connected to the Client device LAN side to assign IP addresses to DHCP clients above the Client device (wireless side). This configuration is typical in PTP links.
Management Access (Hub Mode)	Ethernet: Only allow access to the Hub's web management interface via a local Ethernet (LAN) connection. In this configuration, the Hub's web management interface may not be accessed from over the air (i.e. from a device situated below the Client). Ethernet and Wireless: Allow access to the Hub's web management interface via a local Ethernet (LAN) connection and from over the air (i.e. from a device situated below the Client). Hubs configured with Management Access Interface set to Ethernet and Ethernet and Wireless are susceptible to unauthorized access.
Client Traffic Isolation (Hub Mode)	**Disabled**: This is the default mode. When Client isolation is disabled, an Client is able to communicate with another Client, when both the Clients are associated to the same Hub. **Enabled**: When Client Isolation feature is **Enabled**, a Client is unable to communicate with another Client (peer-to-peer traffic) when both the Clients are associated with the same Hub. This feature essentially enables the Hub to drop the packets to avoid peer-to-peer traffic scenarios.
DHCP Option 82 (Hub Mode)	**Disabled:** The device does not insert the "remote-id" (option ID 0x2) and the "circuit-id" (ID 0x01). DHCP Option 82 is 'Disabled' by default.

Attribute	Meaning
	Enabled: The device inserts “remote-id” (option ID 0×2) to be the Client MAC address and the “circuit-id” (ID 0×01) to be the Hub’s MAC address. Those two fields are used to identify the remote device and connection from which the DHCP request was received.
LLDP	The Link Layer Discovery Protocol (LLDP) is a vendor-neutral link layer protocol (as specified in IEEE 802.1AB) used by cnVision for advertising its identity, capabilities, and neighbors on the Ethernet/wired interface. **Disabled:** cnVision does not receive or transmit LLDP packets from/to its neighbors. **Enabled:** cnVision can receive LLDP packets from its neighbors and send LLDP packets to its neighbors, depending on the LLDP Mode configuration below.
LLDP Mode	**Receive and Transmit**: cnVision sends and receives LLDP packets to/from its neighbors on the Ethernet/LAN interface. **Receive Only**: cnVision receives LLDP packets from its neighbors on the Ethernet/LAN interface and discovers them.
De-Militarized Zone (Client NAT Mode)	
DMZ (Client NAT Mode)	**Disabled:** Packets arriving on the wireless interface destined for the Ethernet side of the network are dropped if a session does not exist between the Source IP (Wireless) and Destination IP (Ethernet). By default, NAT requires the sessions to be initiated from the Ethernet side before a packet is accepted from the Wireless to the Wired side. **Enabled:** Any packets with an unknown destination port (not associated with an existing session or not defined in the port forwarding rules) are automatically sent to the device configured with DMZ IP Address.
IP Address (Client NAT Mode)	Configure the IP address of a Client-connected device that is allowed to provide network services to the wide-area network.
Allow ICMP to DMZ (Client NAT Mode)	**Enabled:** ICMP packets are forwarded to the DMZ IP **Disabled:** Client answers ICMP requests, and Client **Wireless IP Address** becomes reachable by ping when DMZ enabled

Monitor menu

Use the **Monitor** menu to access device and network statistics and status information. This section may be used to analyze and troubleshoot network performance and operation.

Monitor > Performance page (Hub)

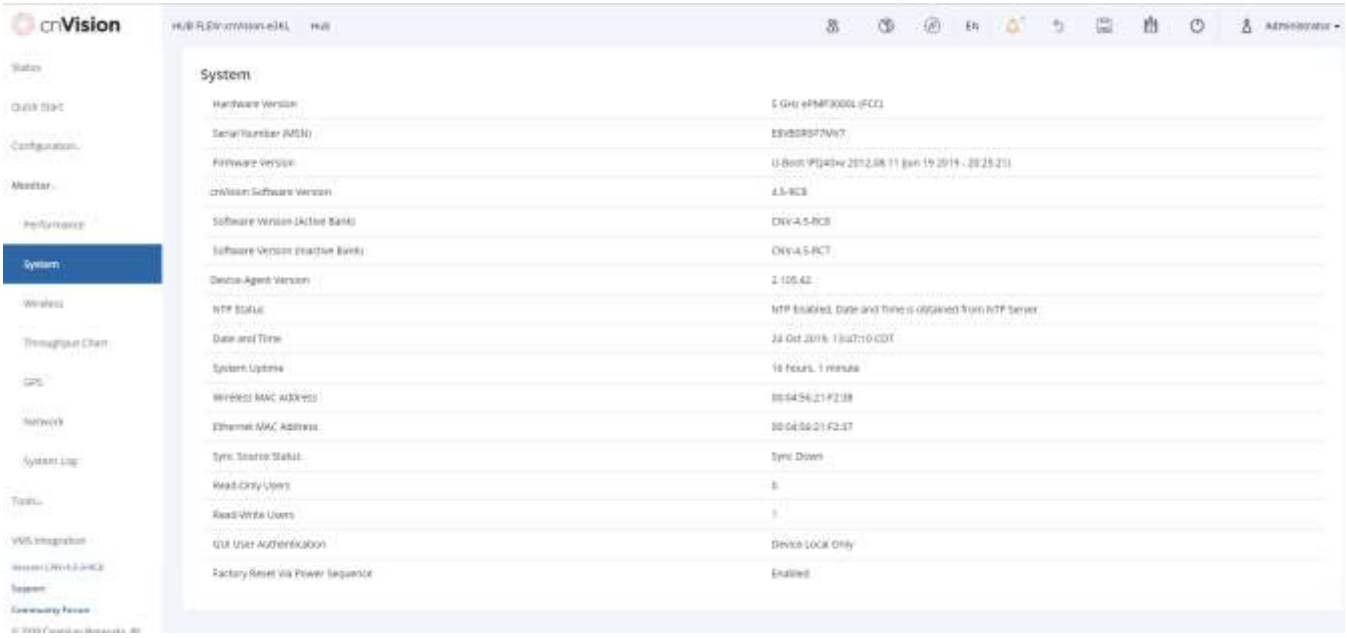


Monitor > Performance page attributes

Attribute	Meaning
Statistics display mode	
Advanced Statistics	**Disabled**: Displays only minimum statistics from system, wireless, and ethernet interfaces **Enabled**: Displays advanced statistics from system, wireless, and ethernet interfaces
Ethernet Statistics – Transmitted	
Total Traffic	Total amount of traffic in Kbits transferred from the device Ethernet interface.
Total Transmitted Packets	Total number of packets transferred from the device Ethernet interface.
Ethernet Statistics – Received	
Total Traffic	Total amount of traffic in Kbits received by the device Ethernet interface.

Attribute	Meaning
Total Received Packets	Total number of packets received by the device Ethernet interface.
Wireless Statistics – Downlink	
Total Traffic	Total amount of traffic transmitted out of the device wireless interface in Kbits.
Total Packets	Total number of packets transmitted out of the device wireless interface.
Multicast / Broadcast Traffic	Total amount of multicast and broadcast traffic transmitted out of the device wireless interface in Kbits.
Wireless Statistics – Uplink	
Total Traffic	Total amount of traffic received via the device wireless interface in Kbits.
Total Packets	Total number of packets received via the device wireless interface.
Multicast / Broadcast Traffic	Total amount of multicast and broadcast traffic received on the device wireless interface in Kbits.
Client Statistics	
MAC Address	MAC Address of the Client connected to the Hub.
Total Uplink (Kbits)	Total amount of traffic received via the Hub wireless interface from the Client in Kbits.
Total Uplink Packets	Total number of packets received via the Hub wireless interface from this Client.
Uplink Packet Drops	Total number of packets dropped prior to sending out of the Hub Ethernet interface due to RF errors (packet integrity error and other RF related packet error) from the Client.
Total Downlink (Kbits)	Total amount of traffic transmitted out of the Hub wireless interface in Kbits.
Total Downlink Packets	Total number of packets transmitted out of the Hub wireless interface.
Downlink Packet Drops	Total number of packets dropped after transmitting out of the Hub wireless interface due to RF errors (No acknowledgment and other RF related packet error).
Downlink Capacity Packet Drops	Total number of packets dropped after transmitting out of the Hub Wireless interface due to capacity issues (data buffer/queue overflow or other performance or internal packet errors).
Downlink Retransmitted Packets	Total number of packets re-transmitted after transmitting out of the Hub Wireless interface due to the packets not being received by the Client.
Downlink Power (dBm)	The transmit power of the Hub for the downlink packets to the Client.

Monitor > System page



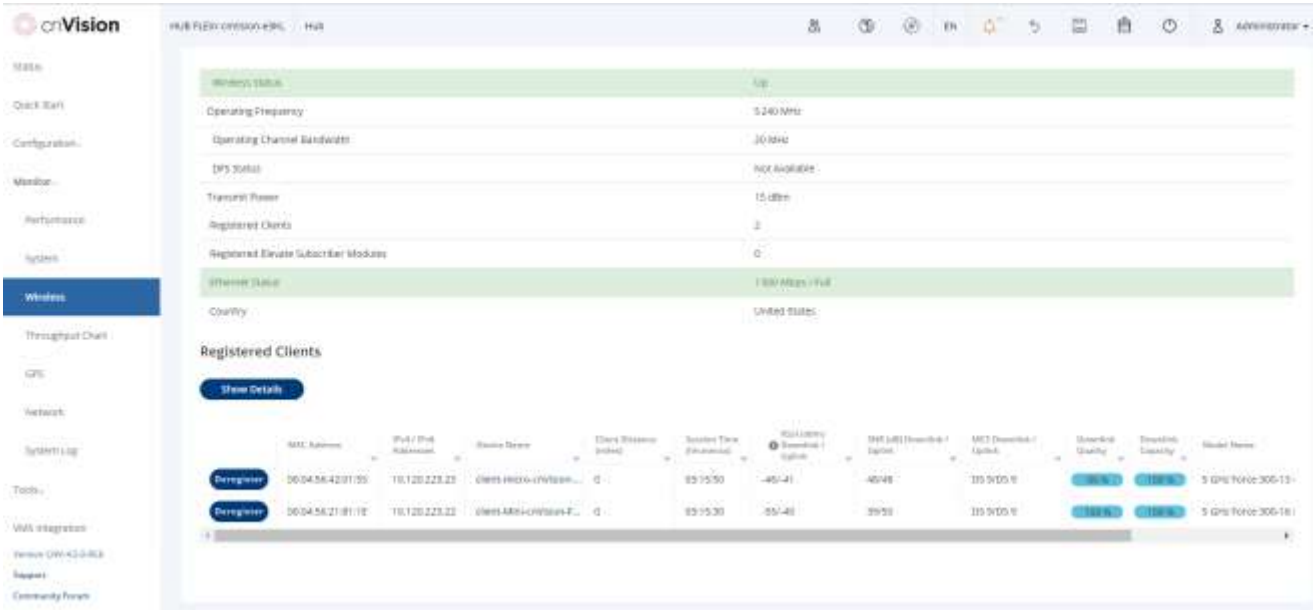
Monitor > System page attributes

Attribute	Meaning
Hardware Version	Board hardware version information.
Serial Number (MSN)	Serial Number information.
Firmware Version	U-Boot version information.
Software Version	The currently operating version of software on the device.
Software Version (Active Bank)	The currently operating version of software on the device.
Software Version (Inactive Bank)	The backup software version on the device used upon failure of the active bank. Two software upgrades in sequence will update both the **Active Software Bank Version** and the **Inactive Software Bank Version**.
Device-Agent Version	The operating version of the device agent.
NTP Status	Indicates whether time and date have been obtained from NTP server.
Date and Time	Current date and time, subject to time zone offset introduced by the configuration of the device **Time Zone** parameter. Until a valid NTP server is configured, this field will display the time configured from the factory.
System Uptime	The total system uptime since the last device reset.

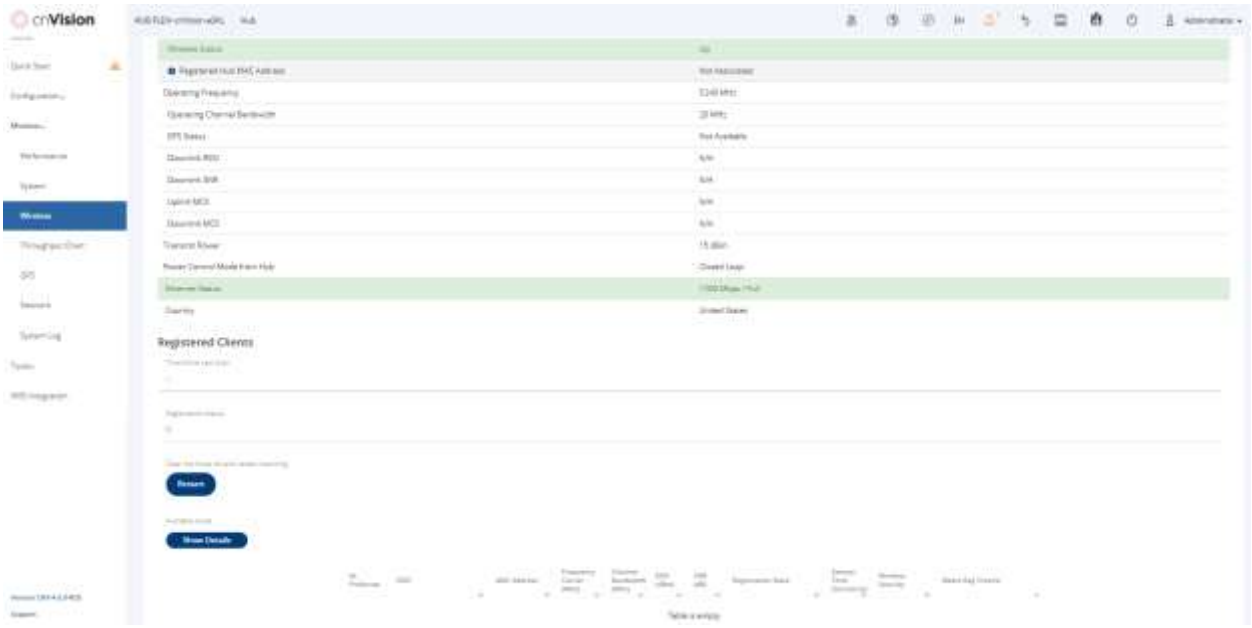
Attribute	Meaning
Wireless MAC Address	The hardware address of the device wireless interface.
Ethernet MAC Address	The hardware address of the device LAN (Ethernet) interface.
SFP Port MAC Address	The hardware address of the device SFP interface.
Sync Source Status	The status of the configured GPS synchronization source.
Read-Only Users	Displays the number of active Read-Only users logged into the radio.
Read-Write Users	Displays the number of active Read-Write users logged into the radio.
GUI User Authentication	The method by which users are authenticated when logging into the device management interface.
Factory Reset Via Power Sequence	**Enabled**: When Enabled under **Tools** > **Backup/Restore** > **Reset Via Power Sequence**, it is possible to reset the radio's configuration to factory defaults using the power cycle sequence explained under Resetting cnVision to factory defaults by power cycling **Disabled**: When Disabled, it is not possible to factory default the radio's configuration using the power cycle sequence.

Monitor > Wireless Page

Monitor > Wireless page (Hub Mode)



Monitor > Wireless page (Client Mode)



Monitor > Wireless page attributes

Attribute	Meaning
Wireless Status (Hub Mode)	**Up**: The device wireless interface is functioning and sending beacons. **Down**: The device wireless interface has encountered an error disallowing full operation. Reset the device to reinitiate the wireless interface.
Wireless Status (Client Mode)	**Up**: The device wireless interface is functioning and the device has completed network entry. **Down**: The device wireless interface has encountered an error disallowing full operation. Evaluate radio and security configuration on the Hub and Client device to determine the network entry failure.
Registered Hub MAC Address (Client Mode)	Wireless MAC address of the Hub to which the Client is registered.
Range (Client Mode)	The calculated distance from the Hub, determined by radio signal propagation delay.
Operating Frequency	The current frequency at which the device is operating.
Operating Channel Bandwidth	The current channel size at which the device is transmitting and receiving.
DFS Status	**Not Available:** DFS operation is not required for the region configured in parameter **Country Code.**

Attribute	Meaning
	Channel Availability Check: Prior to transmitting, the device must check the configured **Frequency Carrier** for radar pulses for 60 seconds). If no radar pulses are detected, the device transitions to state **In-Service Monitoring.** **In-Service Monitoring**: Radio is transmitting and receiving normally while monitoring for radar pulses which require a channel move. **Radar Signal Detected**: The receiver has detected a valid radar pulse and is carrying out detect-and-avoid mechanisms (moving to an alternate channel). **In-Service Monitoring at Alternative Channel**: The radio has detected a radar pulse and has moved the operation to a frequency configured in **DFS Alternative Frequency Carrier 1** or **DFS Alternative Frequency Carrier 2.** **System Not In Service due to DFS**: The radio has detected a radar pulse and has failed channel availability checks on all alternative frequencies. The non-occupancy time for the radio frequencies in which radar was detected is 30 minutes.
Transmitter Power	The current power level at which the device is transmitting.
Ethernet Status	The speed and duplex at which the configured LAN port is operating.
Country	Defines the country code being used by the device. The country code of the Client follows the country code of the associated Hub unless it is an FCC SKU in which case the country code is United States or Canada. Country code defines the regulatory rules in use for the device.
Registered Clients (Hub Mode) Deregister	Use the **Registered Clients** table to monitor the registered Client device, their key RF status, and statistics information. The client management interface may also be accessed by clicking the hyperlinks in the **IPv4 / IPv6 Addresses** and **Device Name** columns. Click the **Deregister** button to disassociate the client device from the Hub.
MAC Address (Hub Mode)	The MAC address of the Client wireless interface.
IPv4 / IPv6 Addresses (Hub Mode)	The IP address of the Client wireless interface.
Device Name (Hub Mode)	The configured device name of the Client wireless interface.
Client Distance (miles)	Indicates the calculated distance of the Client from the Hub.
Session Time (hh:mm:ss) (Hub Mode)	Time duration for which the Client has been registered and in session with the Hub.

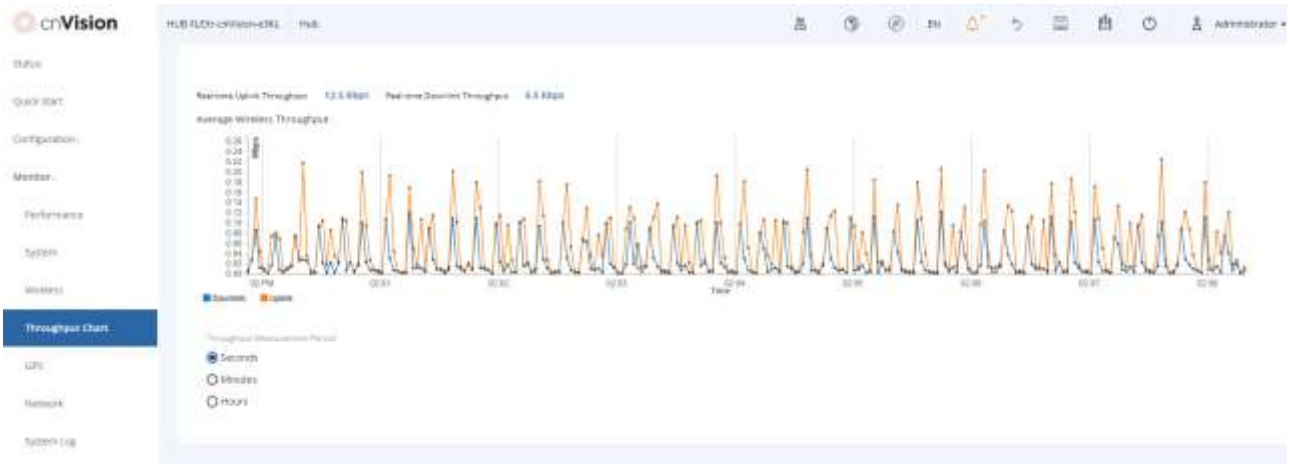
Attribute	Meaning
RSSI (dBm) Downlink / Uplink	Indicates the estimated RSSI of the Hub at the Client (first value) and the RSSI of the Client measured at the Hub (second value).
SNR (dB) Downlink / Uplink	Indicates the estimated SNR of the Hub at the Client (first value) and the SRN of the Client measured at the Hub (second value).
MCS Downlink / Uplink (Hub Mode)	Current MCS at which the downlink (first value) and uplink (second value) are operating.
Downlink Quality (Hub Mode)	The downlink quality based on the current MCS and PER (Packet Error Rate) for this Client.
Downlink Capacity (Hub Mode)	The downlink capacity based on the current DL MCS with respect to the highest supported MCS (DS 9). The downlink capacity based on the current DL MCS with respect to the highest supported MCS (DS 9).
Model Name	Model of Client.
Restart (Hub Mode)	Click the **Restart**  button to Clear the Hubs list and restart scanning.
SSID (Hub Mode)	The SSID of the visible Hub.
MAC Address (Hub Mode)	The MAC address of the visible Hub.
Frequency Carrier (MHz) (Hub Mode)	The current operating frequency of the visible Hub.
Channel Bandwidth (MHz) (Hub Mode)	The current operating channel bandwidth of the visible Hub.
RSSI (dBm) (Hub Mode)	The current measured Received Signal Strength Indicator at the Hub.
SNR (dB) (Hub Mode)	The current measured Signal-to-Noise Ratio of the Client to Hub link.
Registration State (Client Mode)	The indication of the result of the Client device network entry attempt: **Successful**: Client registration is successful **Failed**: **Out of Range**: The Client is out of the Hub's configured maximum range (**Max Range** parameter) **Failed**: **Capacity limit reached at Hub**: The Hub is no longer allowing Client network entry due to capacity reached

Attribute	Meaning
	Failed: No Allocation on Hub: The Client to Hub handshaking failed due to a misconfigured pre-shared key between the Client and Hub **Failed: SW Version Incompatibility:** The version of software resident on the Hub is older than the software version on the Client **Failed: PTP Mode: ACL Policy**: The Hub is configured with **PTP Access** set to **MAC Limited** and the Client's MAC address is not configured in the Hub's **PTP MAC Address** field **Failed: Other**: The Hub does not have the required available memory to allow network entry
Session Time (hh:mm:ss) (Client Mode)	This timer indicates the time elapsed since the Client registered to the Hub.
Wireless Security (Client Mode)	This field indicates the security state of the Hub to Client link.
Meets Reg Criteria (Client Mode)	**Yes**: The scanned Hub meets the Network Entry criteria defined by the internal Network Algorithm. **No:** The scanned Hub does not meet the Network Entry criteria defined by the internal Network Algorithm.

Monitor > Throughput Chart page

Use the Throughput Chart page to reference a line chart visual representation of system throughput over time. The blue line indicates downlink throughput and the orange line indicates uplink throughput. The X-axis may be configured to display data over seconds, minutes, or hours, and the Y-axis is adjusted automatically based on average throughput. Hover over data points to display details.

Monitor > Throughput Chart page



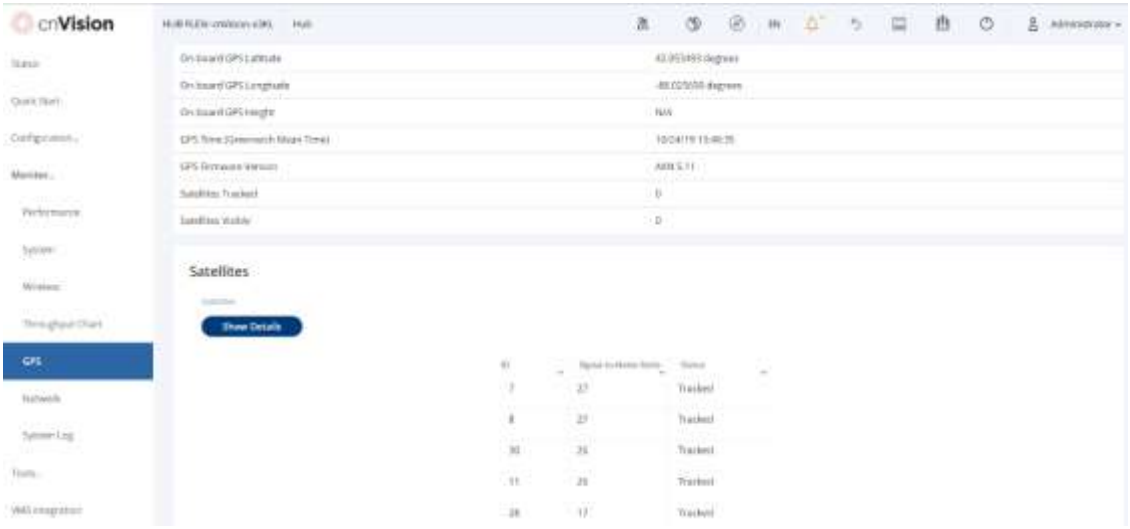
Monitor > Throughput Chart page attributes

Attribute	Meaning
Throughput Measurement Period	Adjust the X-axis to display throughput intervals in seconds, minutes, or hours

Monitor > GPS page (Hub Mode – Only available on HUB FLEXr)

Use the GPS Status page to reference key information about the device GPS readings, tracked satellites, and firmware version.

Monitor > GPS page attributes (Hub Mode)



Monitor > GPS page attributes (Hub Mode)

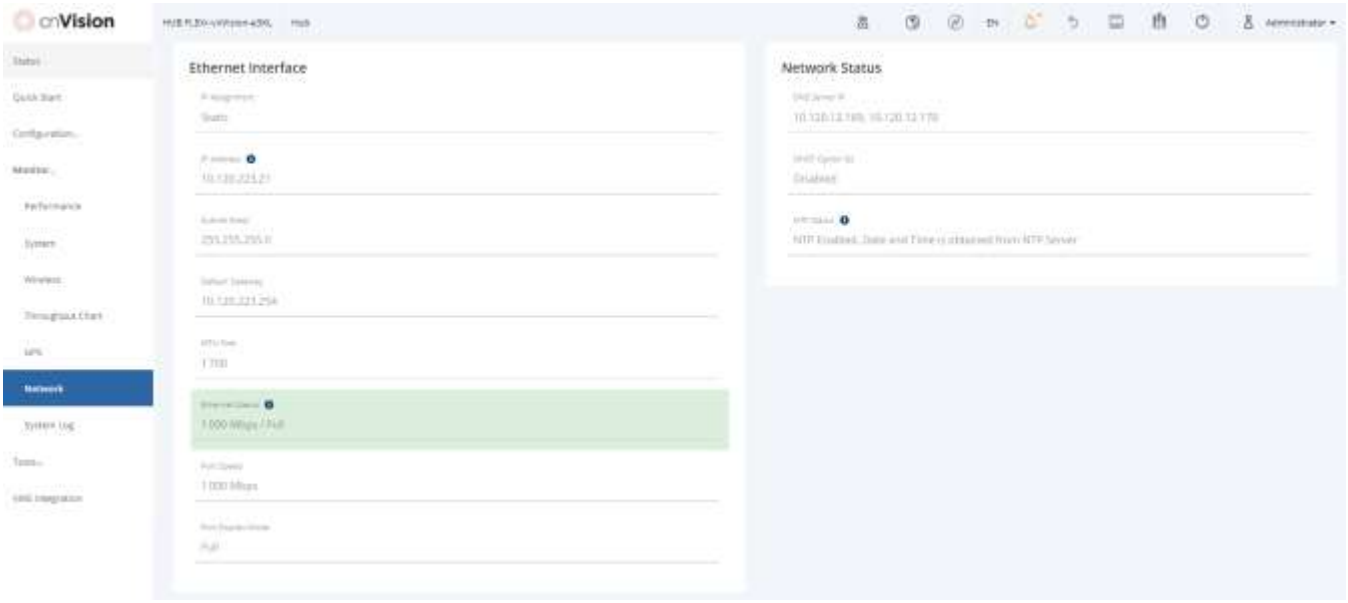
Attribute	Meaning
On-board GPS Latitude (Hub Mode)	On a GPS Synchronized cnVision radio, the field is automatically populated with the Device Latitude information from the on-board GPS chip.
On-board GPS Longitude (Hub Mode)	On a GPS Synchronized cnVision radio, the field is automatically populated with the Device Longitude information from the on-board GPS chip.
On-board GPS Height (Hub Mode)	On a GPS Synchronized cnVision radio, the field is automatically populated with the Device height above sea level from the onboard GPS chip.

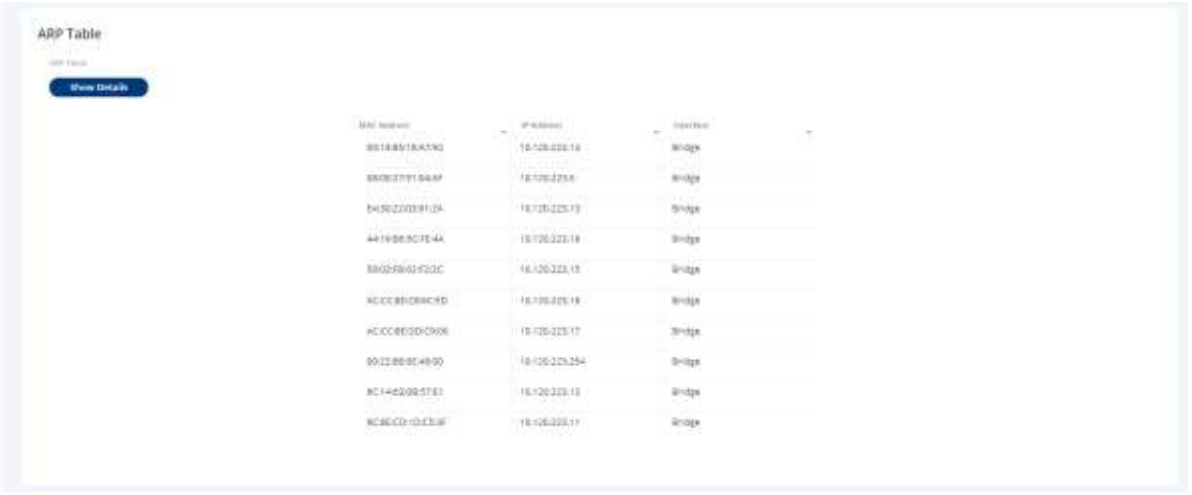
Attribute	Meaning
GPS Time (Greenwich Mean Time) (Hub Mode)	On a GPS Synchronized cnVision radio, the field is automatically populated with the time from the onboard GPS chip.
GPS Firmware version (Hub Mode)	On a GPS Synchronized cnVision radio, the field indicates the current firmware version of the onboard GPS chip.
Satellites Tracked (Hub Mode)	On a GPS Synchronized cnVision radio, the field indicates the number of satellites current tracked by the onboard GPS chip.
Satellites Visible (Hub Mode)	On a GPS Synchronized cnVision radio, the field indicates the number of satellites visible to the on-board GPS chip.
Satellites (Hub Mode)	The **Satellites** table provides information about each satellite that is visible or tracked along with the Satellite ID and Signal to Noise Ratio (SNR) of the satellite.
ID (Hub Mode)	Represents the Satellite ID.
Signal-to-Noise Ratio (Hub Mode)	This is an expression of the carrier signal quality with respect to signal noise.
Status (Hub Mode)	Status of each Satellite available.

Monitor > Network page

Use the Network Status page to reference key information about the device network status.

Monitor > Network page (Hub)





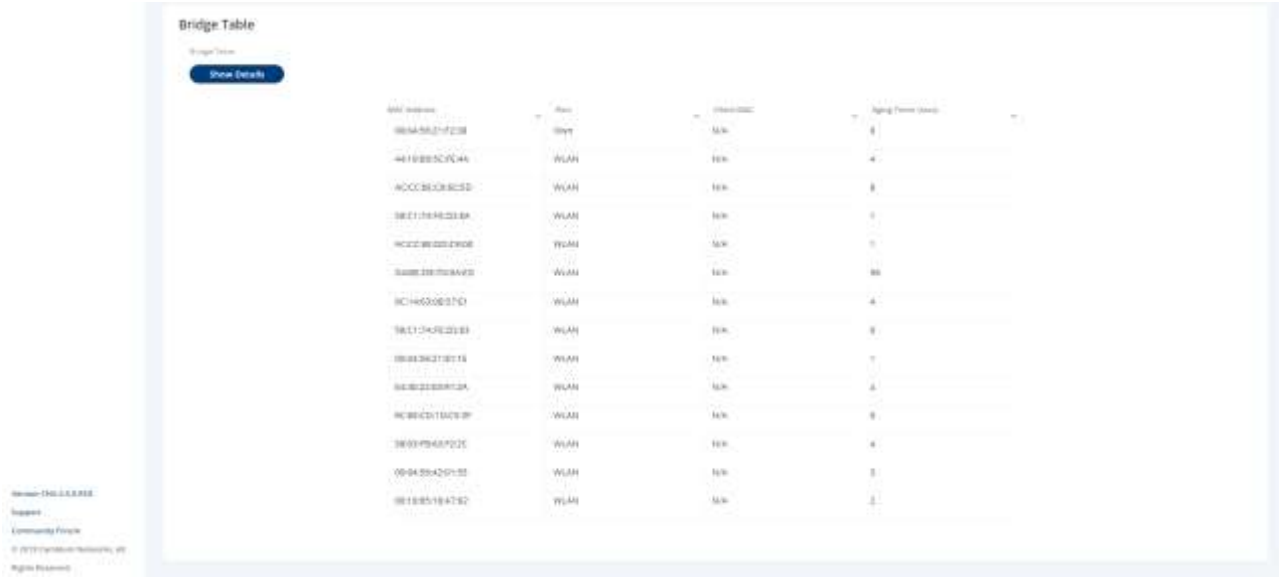


Table 12 Monitor > Network page attributes

Attribute	Meaning
Ethernet Interface	
IP Assignment	Static: Device management IP addressing is configured manually in fields **IP Address, Subnet Mask, Gateway, Preferred DNS Server**, and **Alternate DNS Server**. DHCP: Device management IP addressing (**IP Address, Subnet Mask, Gateway**, and **DNS Server**) is assigned via a network DHCP server, and parameters **IP Address, Subnet Mask, Gateway, Preferred DNS Server,** and **Alternate DNS Server** are not configurable.
IP Address	Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network. If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (Hub) or 192.168.0.2 (Client).
Subnet Mask	Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device will belong to subnet 192.168.2.X.
Default Gateway	Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
MTU Size	The currently configured Maximum Transmission Unit for the device Ethernet (LAN) interface. Larger MTU configurations can enable the network to operate with greater efficiency, but in the case of retransmissions due to packet errors, efficiency is reduced since large packets must be resent in the event of an error.

Attribute	Meaning
Main PSU Port	The speed and duplex at which the configured LAN port is operating.
Port Speed	The speed at which the configured LAN port is operating.
Port Duplex Mode	The duplex at which the configured LAN port is operating.
Network Status	
DNS Server IP	The configured IP address(es) of the network DNS servers.
DHCP Option 82	Status of DHCP Option 82 operation in the network.
NTP Status	Represents the status of NTP retrieval in the network.
ARP Table	
MAC Address	MAC Address of the devices on the bridge.
IP Address	IP Address of the devices on the bridge.
Interface	The interface on which the cnVision identified the devices on.
Bridge Table	
MAC Address	The hardware address of the cnVision device.
Port	The port to which the device is connected.
Client MAC	MAC Address for the connected Client device.
Aging Timer (secs)	Time set for the MAC addresses in the Bridge table before renewal.

Monitor > System Log Page

Use the System Log page to view the device system log and to download the log file to the accessing PC/device.

Monitor > System Log page

Monitor > System Log page attributes

Attribute	Meaning
Syslog Display	**Enabled**: The system log file is displayed on the management GUI. **Disabled**: The system log file is hidden on the management GUI.
Device Agent Logging	**Enabled:** The log from Device Agent is displayed on the management GUI. **Disabled:** The log from Device Agent is hidden on the management GUI.
Syslog File	Use the Download button to download the full system log file to a connected PC or device.

Tools menu

The **Tools** menu provides several options for upgrading device software, configuration backup/restore, managing licenses, analyzing RF spectrum, testing the wireless link, testing network connectivity, and analyzing interferers.

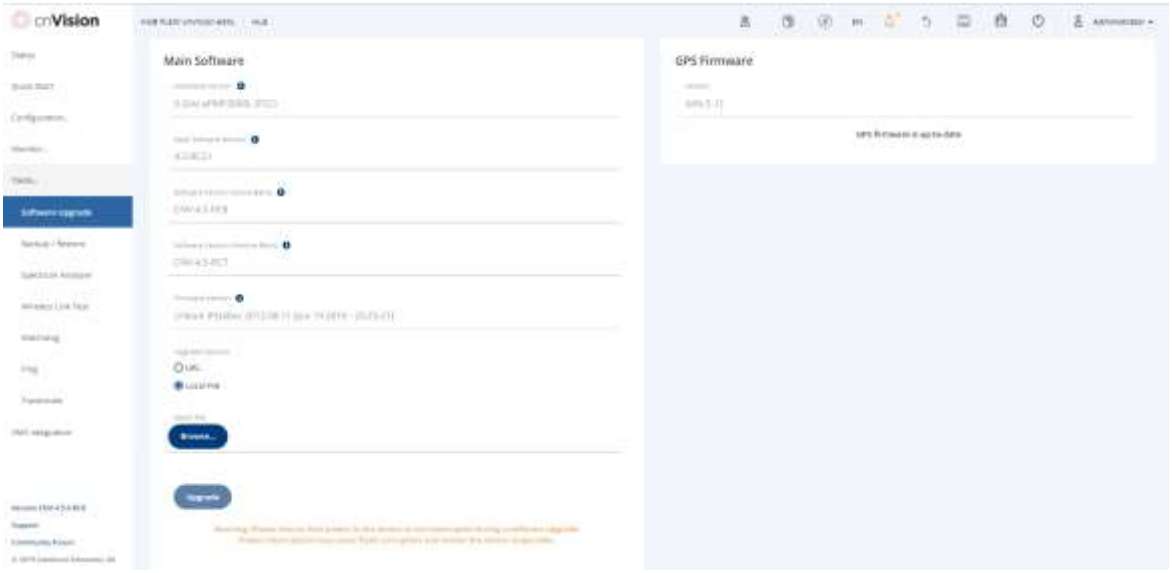
Tools > Software Upgrade page

Use the **Software Upgrade** page to update the device radio software to take advantage of new software features and improvements.

Attention Please read the Release Notes associated with each software release for special notices, feature updates, resolved software issues, and known software issues.

The Release Notes may be accessed at the Cambium Support Center.

Tools > Software Upgrade page



Tools > Software Upgrade page attributes

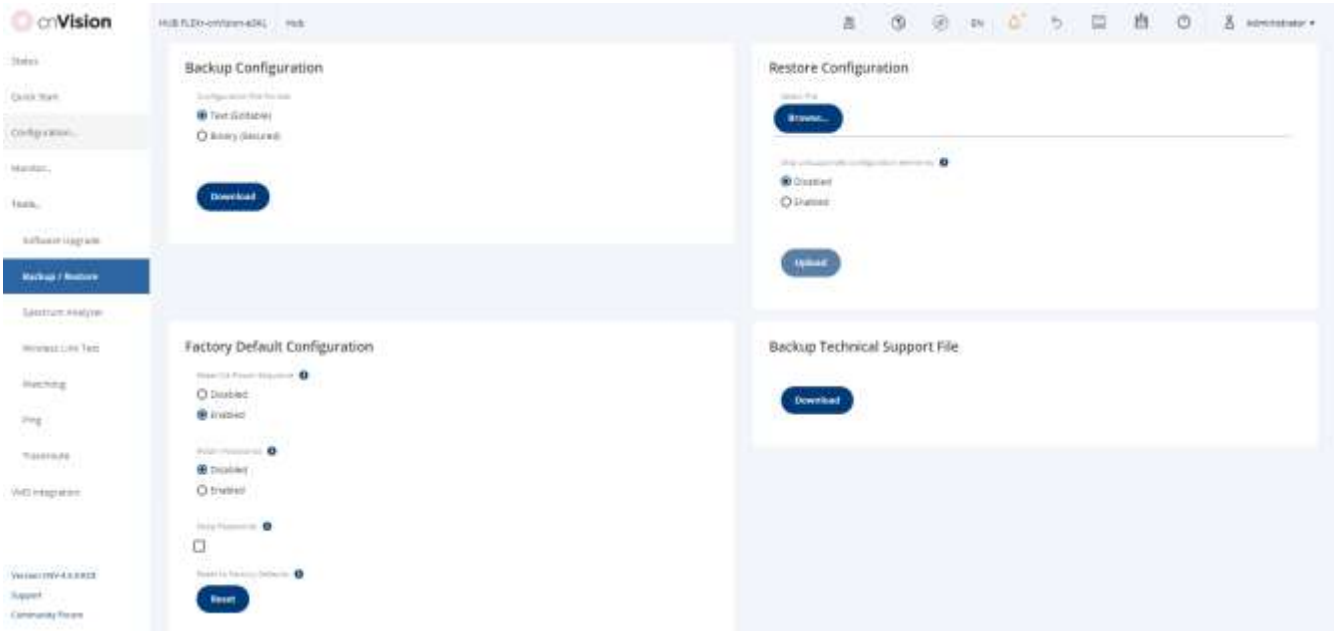
Attribute	Meaning
Main Software	
Hardware Version	Defines the board type and frequency band of operation.
Software Version	Defines the current operating software version.
Software Version (Active Bank)	cnVision devices two banks of flash memory which each contain a version of the software. The version of the software last upgraded onto the Flash memory is made the Active Bank. This software will be used by the device when rebooted.
Software Version (Inactive Bank)	The version of the software that was the Active Bank is made the Inactive Bank when another version of the software is upgraded onto the Flash memory. The Inactive Bank of software will be used by the device in case the Active Bank cannot be used due to a failure condition.
Firmware Version	The current U-boot version.
Upgrade Options	**URL**: A web server may be used to retrieve software upgrade packages (downloaded to the device via the webserver). For example, if a web server is running at IP address 192.168.2.1 and the software upgrade packages are located in the home directory, an operator may select an option **From URL** and configure the **Software Upgrade Source** field to **http://192.168.2.1/<software_upgrade_package>.** **Local File**: Click Browse to select the local file containing the software upgrade package.
Select File	Click **Browse** to select a local file (located on the device accessing the web management interface) for upgrading the device software.

Attribute	Meaning
Upgrade	Click the **Upgrade** button to begin the software upgrade process. Please ensure that power to the device is not interrupted during a software upgrade. Power interruption may cause flash corruption and render the device inoperable.
GPS Firmware (HUB FLEXr Only)	
Firmware Version	The current firmware of the on-board GPS chip.

Tools > Backup/Restore page

Use the **Backup/Restore** page to update the device radio software to take advantage of new software features and improvements.

Tools > Backup/Restore page



Tools > Backup/Restore page attributes

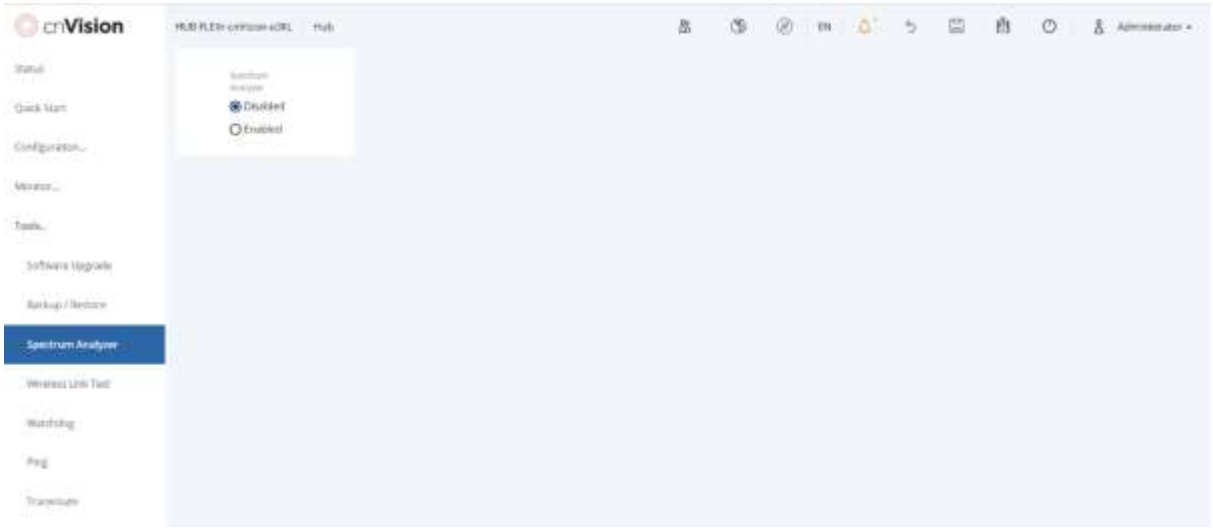
Attribute	Meaning
Backup Configuration	
Configuration File Format	**Text (Editable)**: Choosing this option will download the configuration file in the `.json` format and can be viewed and/or edited using a standard text editor. **Binary (Secured)**: Choosing this option will download the configuration file in the .bin format, and cannot be viewed and/or edited using an editor. Use this format for a secure backup.

Attribute	Meaning
Restore Configuration	
Select File	Click **Browse** to select a local file (located on the device accessing the web management interface) for restoring the device configuration.
Skip unsupported configuration elements	In the case of configuration incompatibility, the unsupported configuration elements can be ignored and skipped.
Factory Default Configuration	
Reset Via Power Sequence	**Enabled**: When Enabled, it is possible to reset the radio's configuration to factory defaults using the power cycle sequence explained under Resetting cnVision to factory defaults by power cycling on page 154. **Disabled**: When Disabled, it is not possible to factory default the radio's configuration using the power cycle sequence.
Retain Passwords	When set to **Enabled**, then after a factory default of the radio for any reason, the passwords used for GUI and CLI access will not be defaulted and will remain unchanged. The default value of this field is **Disabled**. If the passwords cannot be retrieved after the factory default, access to the radio will be lost/unrecoverable. This feature prevents unauthorized users from gaining access to the radio for any reason, including theft.
Keep Passwords	When the **Keep Passwords** checkbox is selected, the passwords used for GUI and CLI access will not be defaulted and will remain unchanged. This is a one-time option, and it does not apply to factory default procedures completed by power cycling (Reset Via Power Sequence).
Reset to Factory Defaults	Use this button to reset the device to its factory default configuration. A reset to factory default configuration resets all device parameters. With the Client device in the default configuration, it may not be able to register to a Hub device configured for your network.
Backup Technical Support File	
Download	The Backup Technical Support File is a compressed archive of the applied statistics and configuration parameters used by Cambium Support for troubleshooting. This file is downloaded from the cnVision device to the accessing device.

Tools > Spectrum Analyzer page

Use the **Spectrum Analyzer** page to enable or disable the Spectrum Analyzer feature.

Tools > Spectrum Analyzer page



Tools > Spectrum Analyzer page attributes

Attribute	Meaning
Spectrum Analyzer	**Disabled**: The Spectrum Analyzer process is not running on the device. **Enabled**: The Spectrum Analyzer process is running on the device, necessary for displaying results in the web management interface.

Attention cnVision supports Automatic Transmit Power Control (ATPC) where the Client devices are instructed by the Hub to adjust their Tx power in order for the Client device signal (UL RSSI) to arrive at the Hub at a predetermined RSSI level (configurable on the Hub under Configuration>Radio>Power Control>Client Target Receive Level). This feature is beneficial to keep the overall noise floor in the sector to an acceptable level. However, the feature negates the purpose of eAlign measurements on the Hub device since, during the alignment, the Client may constantly change its Tx power. It is recommended to turn off ATPC and set the Client Tx power to maximum allowable power during alignment.

While aligning the link using eAlign, please follow these steps:

Procedure:

1 On the Client, set Configuration > Radio > Power Control > Max Tx Power to Manual.

2 Set Configuration > Radio > Power Control > Transmitter Power to 26 dBm (or maximum value allowed by regulations).

3 Click the Save button

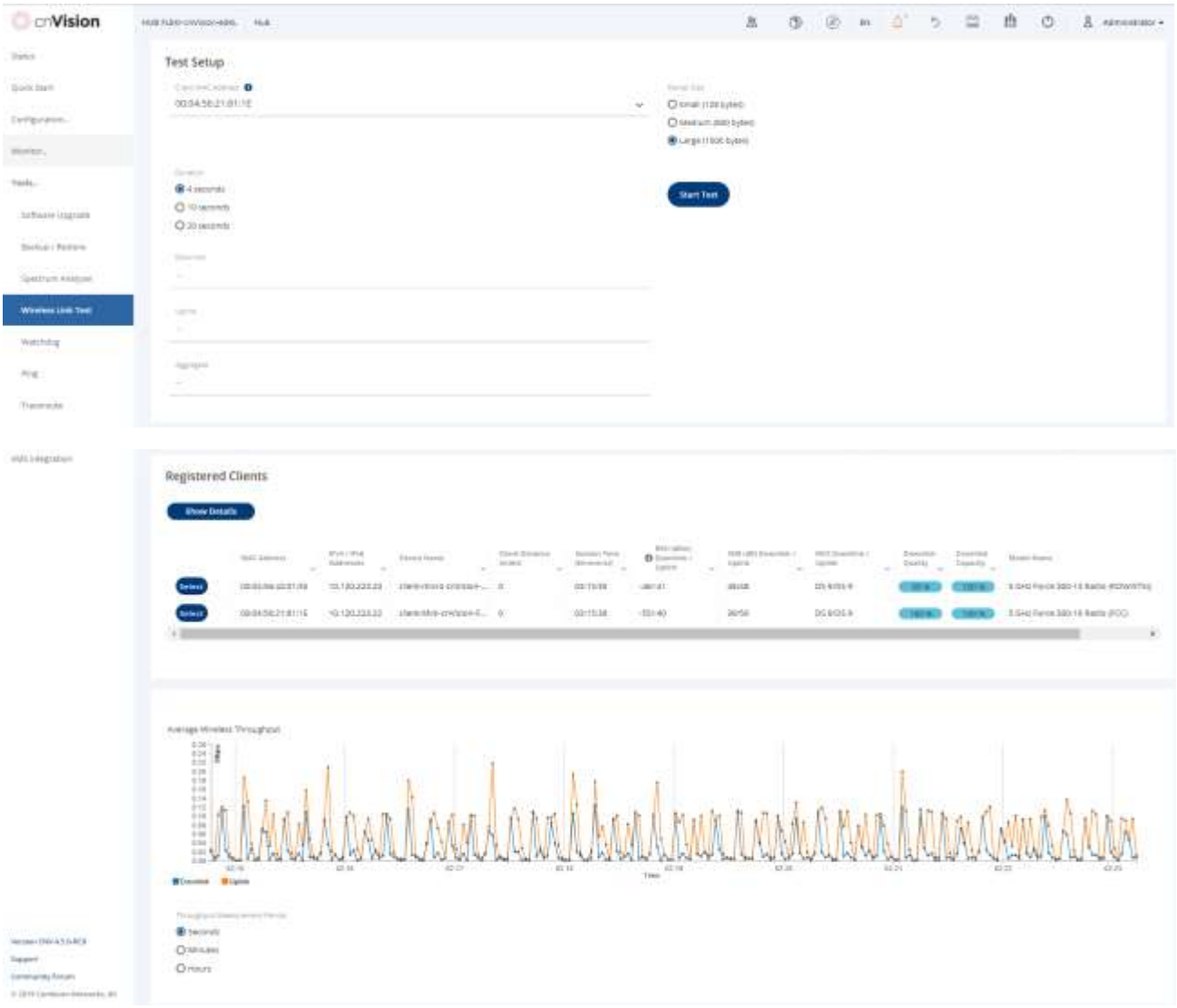
4 Perform link alignment using eAlign

5	Once alignment is complete, set Configuration>Radio>Power Control>Max Tx Power back to Auto
6	Click the Save button

Tools > Wireless Link Test page

Use the Wireless Link Test page to conduct a simple test of wireless throughput. This allows the user to determine the throughput that can be expected on a particular link without having to use external tools.

Tools > Wireless Link Test page



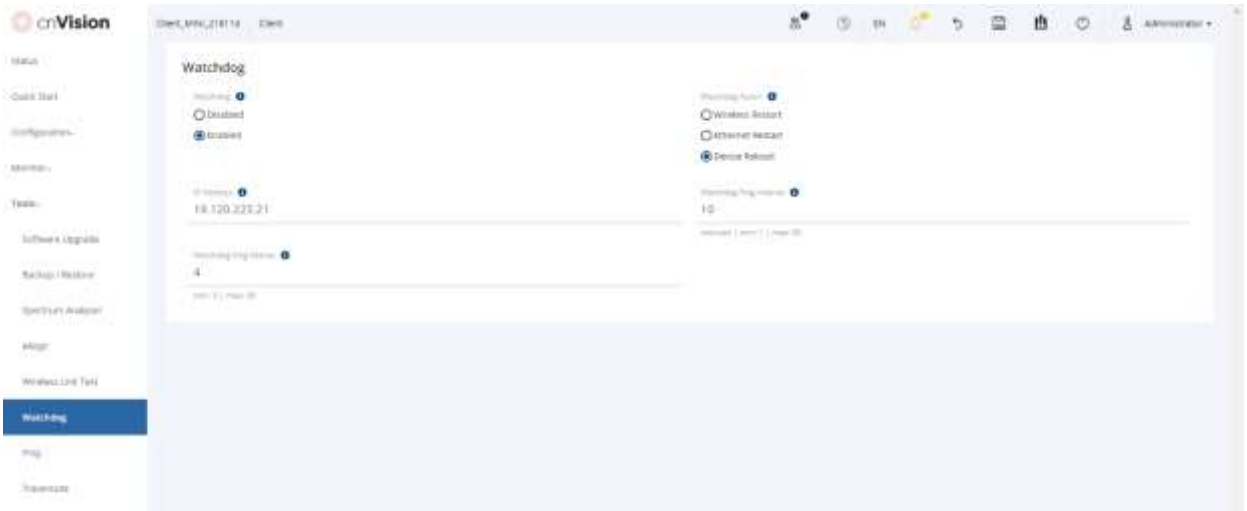
Tools > Wireless Link Test page attributes

Attribute	Meaning
Test Setup	
Client MAC Address	Choose the MAC Address of the Client with which the wireless link test will be conducted.
Packet Size	Choose the Packet Size to use for the throughput test (small/medium/large)
Duration	Choose the time duration in seconds to use for the throughput test (4/10/20secs)
Downlink	This field indicates the result of the throughput test on the downlink, in Mbps
Uplink	This field indicates the result of the throughput test on the uplink, in Mbps
Average	An auto-adjusting chart displaying the average throughput of the link
Registered Clients	This table provides information about the wireless link of each registered Client.

Tools > Watchdog page

Watchdog performs ping checks to determine the reachability of a target IP address. If the target IP address is unreachable, a chosen action is performed.

Tools > Watchdog page



Tools > Watchdog page attributes

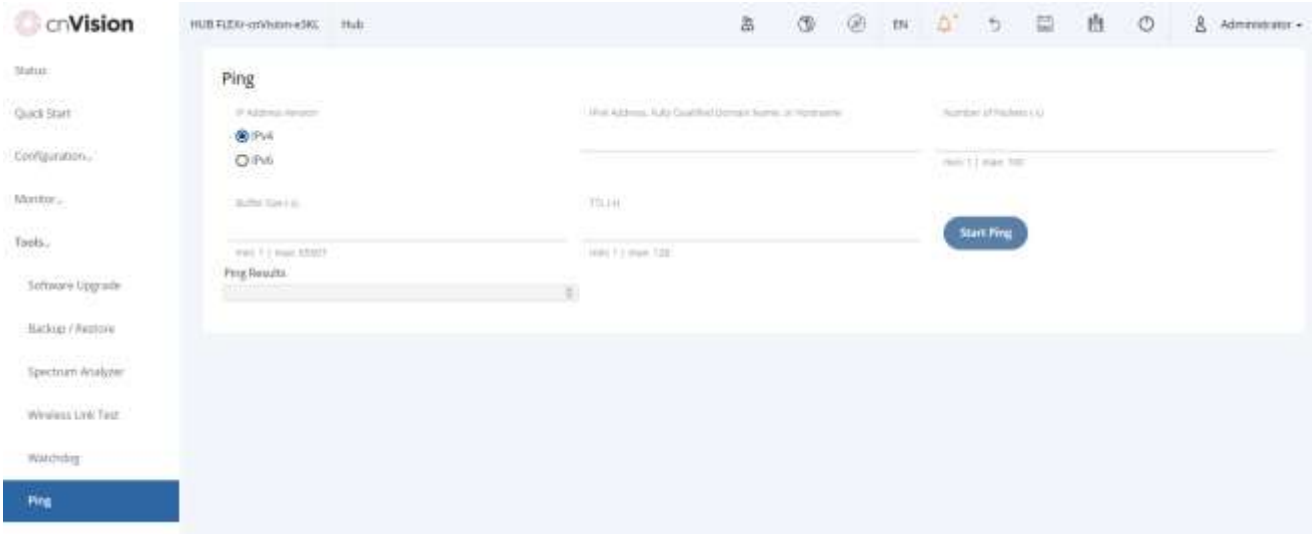
Attribute	Meaning
Test Setup	
Watchdog	**Disabled**: The device does not ping a specified IP address periodically for verification of connectivity

Attribute	Meaning
	Enabled: The device periodically pings the IP address specified. If IP connectivity is lost, the action defined in **Watchdog Action** is performed.
Watchdog Action	**Wireless Restart**: In case of lost ping connectivity to the specified IP address, the device automatically restarts the wireless interface. **Ethernet Restart**: In case of lost ping connectivity to the specified IP address, the device automatically restarts the Ethernet interface. **Device Reboot**: In case of lost ping connectivity to the specified IP address, the device automatically reboots.
IP Address	Indicates the target IP address for which the device attempts ping connectivity diagnostics.
Watchdog Ping Interval	Indicates the interval in minutes between each ping connectivity diagnostic.
Watchdog Ping Retries	Indicates the number of ping retries executed by the device prior to considering the test failed (and conducting the action defined in **Watchdog Action**).

Tools > Ping page

Use the Ping page to conduct a simple test of IP connectivity to other devices that are reachable from the network. If no ping response is received or if "Destination Host Unreachable" is reported, the target may be down, there may be no route back to the device, or there may be a failure in the network hardware (i.e. DNS server failure).

Tools > Ping page



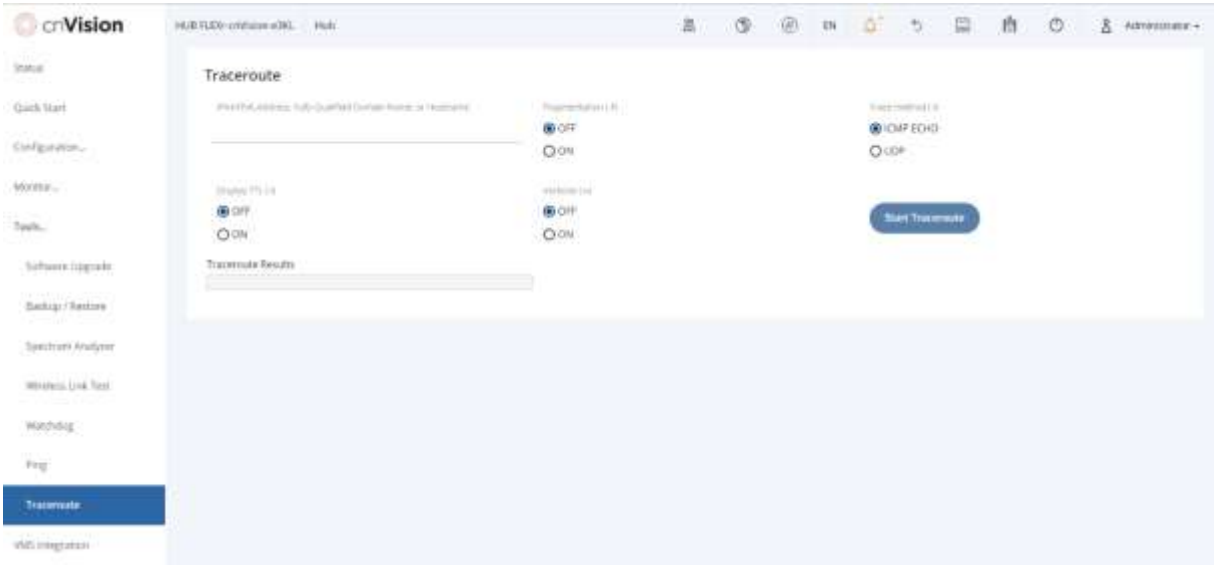
Tools > Ping page attributes

Attribute	Meaning
Ping	
IP Address Version	**IPv4:** The ping test is conducted via the IPv4 protocol. **IPv6**: The ping test is conducted via the IPv6 protocol.
IP Address	Enter the IP address of the ping target.
Number of packets (-c)	Enter the total number of ping requests to send to the target.
Buffer size (-s)	Enter the number of data bytes to be sent.
TTL (-t)	Set the IP Time-To-Live (TTL) for multicast packets. This flag applies if the ping target is a multicast address.
Ping results	The results of the ping test are displayed in the box.

Tools > Traceroute page

Use the Traceroute page to display the route (path) and associated diagnostics for IP connectivity between the device and the destination specified.

Tools > Traceroute page



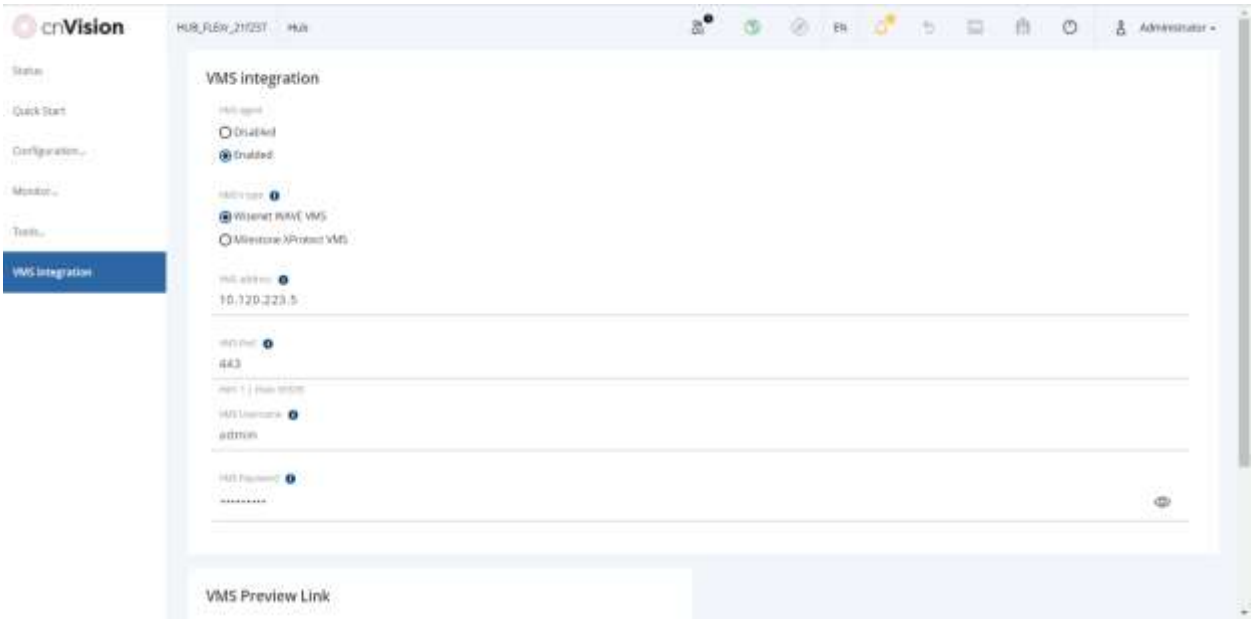
Tools > Traceroute page attributes

Attribute	Meaning
Traceroute	
IP4/IPV6 Address	Enter the IP address of the target of the traceroute diagnostic.
Fragmentation (-F)	**ON:** Allow the source and target to fragment probe packets. **OFF:** Do not fragment probe packets (on the source or target).
Trace method (-I)	**ICMP ECHO:** Use ICMP ECHO for traceroute probes. **UDP:** Use UDP for traceroute probes.
Display TTL (-I)	**ON:** Display TTL values for each hop on the route. **OFF:** Suppress display of TTL values for each hop on the route.
Verbose (-v)	**ON:** ICMP packets other than TIME_EXCEEDED and UNREACHABLE are displayed in the output. OFF: Suppress display of extraneous ICMP messaging.
Traceroute Results	Traceroute test results are displayed in the box.

VMS Integration

The **VMS Integration** screen provides several options for configuring the Video Management System settings. Refer to the VMS Integration section for Configuring the devices for Wisenet Wave VMS and Milestone XProtect VMS systems. Refer to the VMS integration chapter for detailed steps.

Tools > VMS Integration page



VMS Integration > VMS Integration attributes

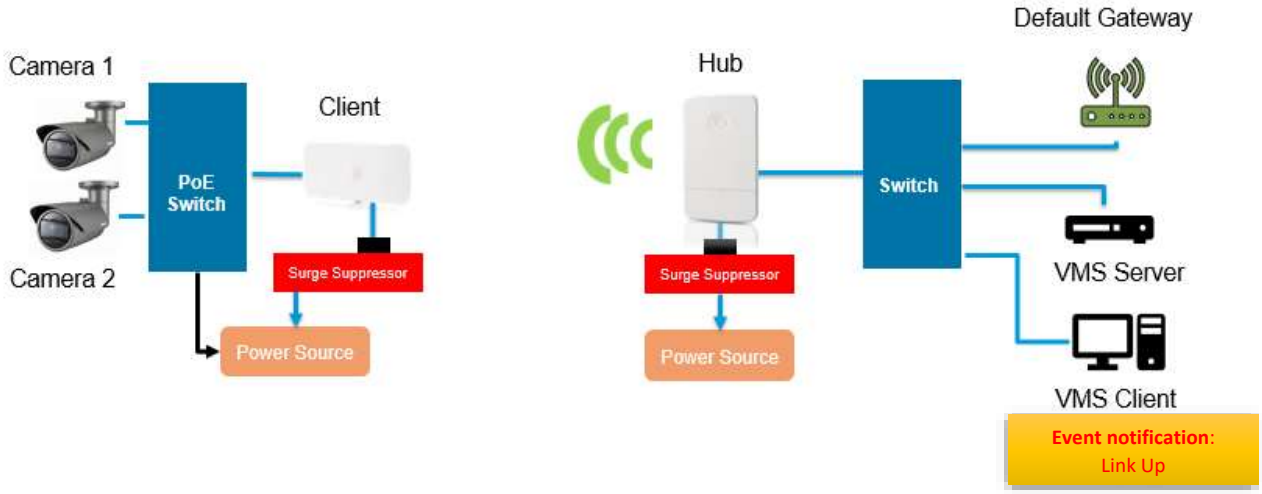
Attribute	Meaning
VMS Integration	
VMS agent	**Enabled:** The VMS Integration settings are displayed. **Disabled:** The VMS Integration settings are hidden.
VMS type	**Wisenet Wave VMS**: Select this option if you are using Wisenet Wave VMS **Milestone XProtect VMS**: Select this option if you are using Milestone Xprotect VMS.
VMS address	Enter the VMS IP address or the fully qualified domain name (FQDN).
VMS port	Enter the VMS port.
VMS username	Enter the VMS username.
VMS password	Enter the VMS password.

Chapter 6: Configuring VMS Integration

VMS Integration Overview

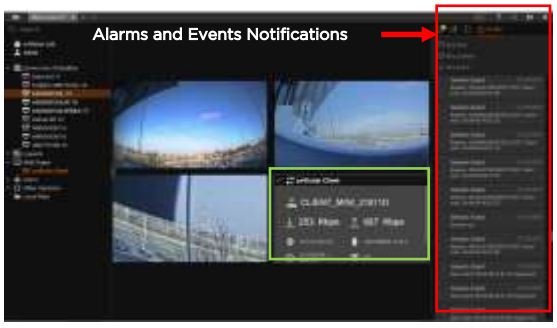
The cnVision devices can be integrated with Video Management Systems (VMS) to display device statistics and to send event and alarm messages within the VMS consoles. This feature allows users to monitor device status and performance within the VMS console instead of having to connect to each device individually.

Depending on the VMS systems in use, you can set up alarms to notify the user of key events such as when a new device is registered or removed from the system, or if it has been disconnected or rebooted, and so forth.

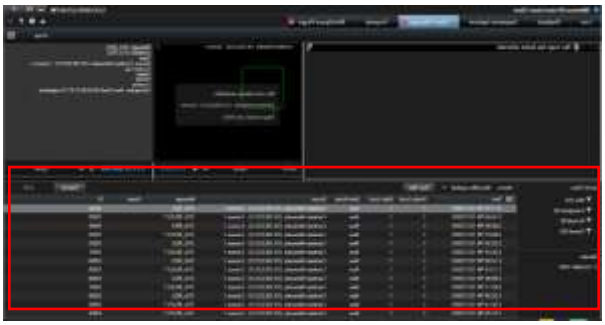


The cnVision devices currently support two Video Management Systems out of the box, Wisenet Wave VMS, and Milestone XProtect VMS.

Here is an example of the Wisenet Wave VMS and the Milestone XProtect VMS systems integrated with a cnVision Client. The device statistics and the event messages generated by the device are displayed within the consoles.



Wisenet Wave VMS



Milestone XProtect VMS

Events and Alarms

cnVision devices support the following event messages for the VMS systems. Depending on the type of VMS system being used, additional configurations may be required to display these messages. The Wisenet Wave VMS system displays these messages automatically. The Milestone XProtect VMS system requires additional configuration to map and display these messages.

Event Type	Description
SYS_UP (N)	System up
STA_REG (N)	Station registration
STA_DROP(A)	Station Drop
SA_MODE(?)	Spectrum Analyzer mode
CFG_IMP(N)	Configuration import status
CFG_EXP(N)	Configuration export status
FW_UPD_ST(A/N)	Software update status
GPS_FW_UPD_ST(A/N)	GPS Software update status
GPS_SYNC_ST(A/N)	GPS Sync status
DFS_ST(A/N)	Change in DFS Status
LINK_ST(N)	Link up/down events
BSA_ST(N)	BSA state
SYSTEM_CONFIG_APPLIED(N)	Configuration successful
CFG_RESTORE(A/N)	Configuration restore
CFG_BACKUP(N)	Configuration backup
STA_REJECT(A)	STA Reject reason

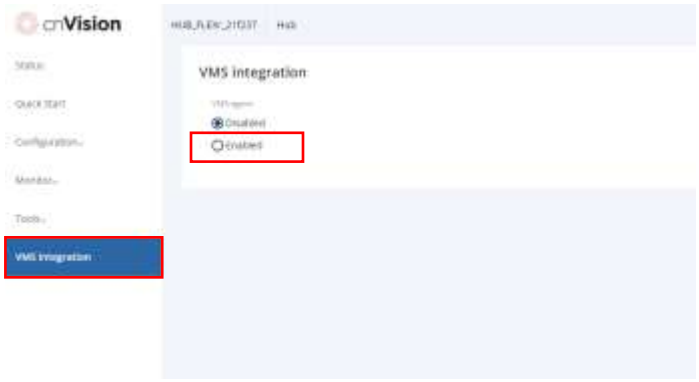
Configuring Hubs and Clients for VMS Integration

Prerequisites:

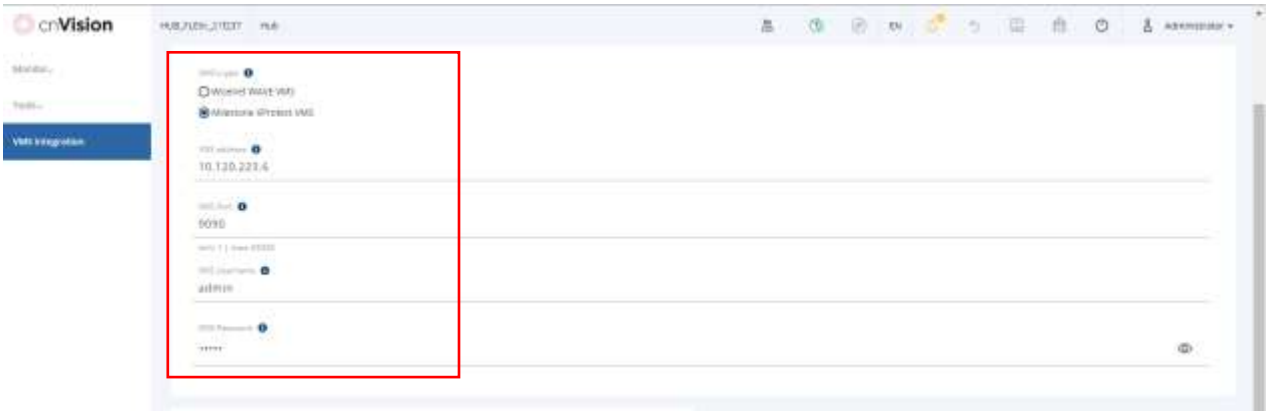
- Install and configure the VMS software (Server and Client) in your environment.
- Document the VMS IP address and port number, the VMS username, and the password.

The following steps are required to configure the VMS settings for the cnVision Hubs and Clients. **Note**: the integration steps are the same for the supported VMS systems.

1. Navigate to the VMS Integration screen.
2. Click the Enabled radio button to enable the VMS Integration settings.



3. Select the VMS system type. The options are **Wisenet Wave VMS** or **Milestone XProtect VMS**.
4. Enter the VMS IP address.
5. Enter the VMS port number.
6. Enter the VMS system's username and password credentials.



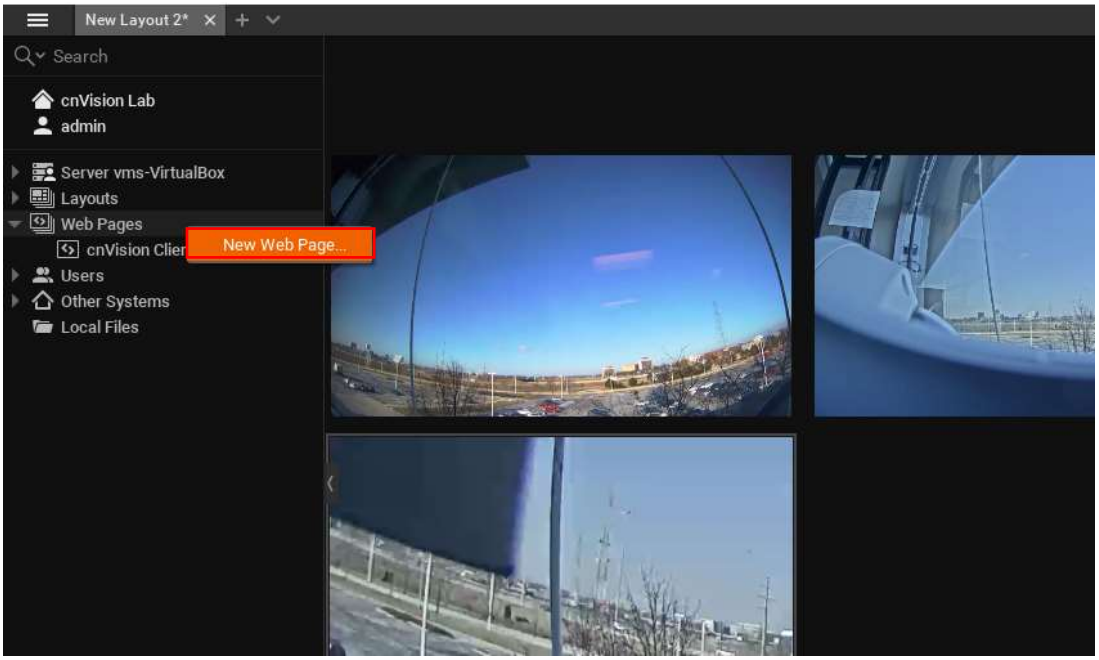
7. Click the Save button to save the settings.

The device will now automatically connect to the Wisenet Wave VMS system. The VMS system will display event messages sent by the device under the Events and Notifications tabs in the VMS. The device statistics tile can be displayed by creating and configuring a web page in the Wisenet Wave VMS system.

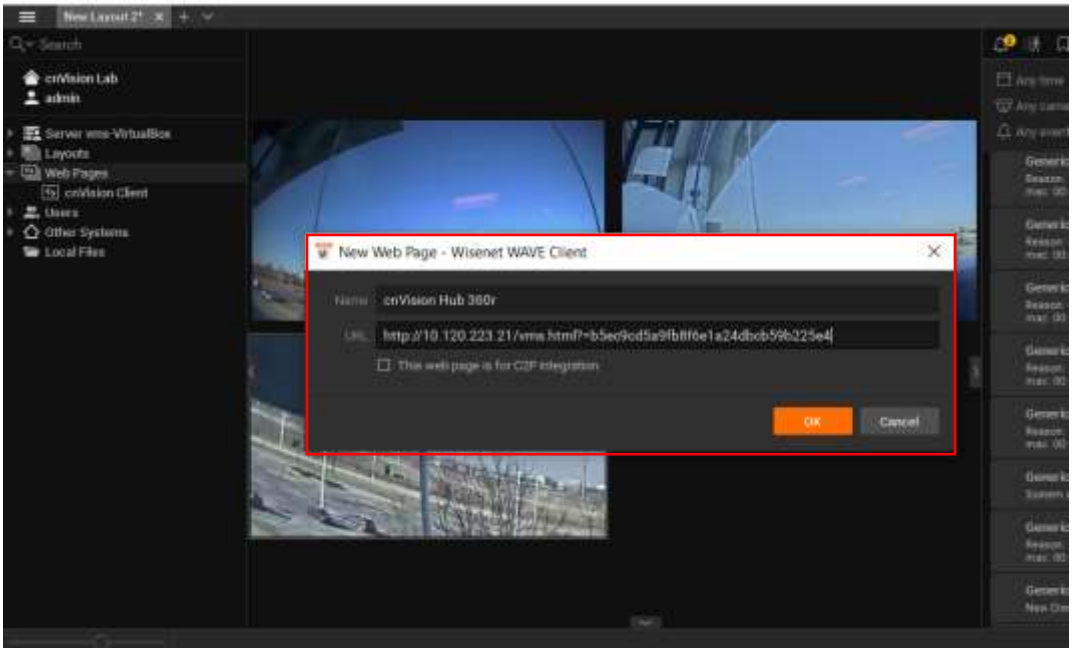
Configuring Device Statistics Tile in Wisenet Wave VMS

1. From the VMS Integration screen, click the **Generate Link button** to generate a preview link.
2. Select and copy the link.

3. Log in to the Wisenet Wave VMS client. Right-click on the **Web Pages** option on the left navigation pane and click the New Web Page button.

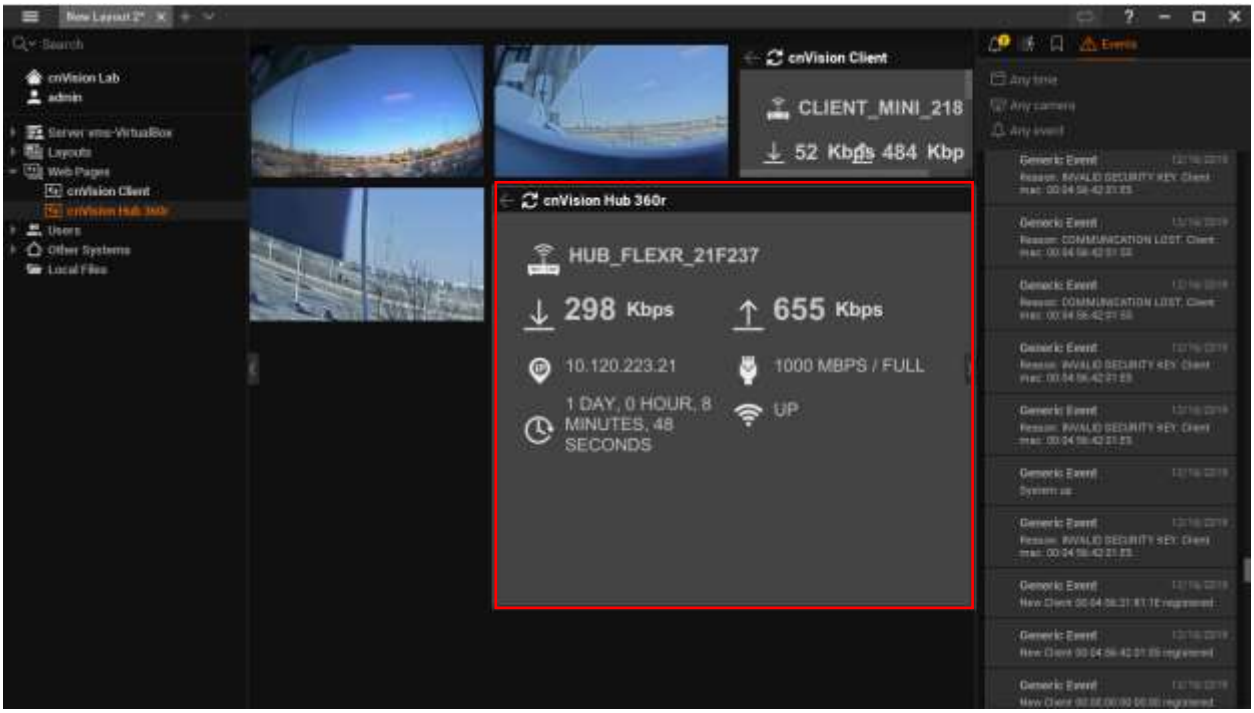


4. Enter a descriptive name in the **Name** field for the device. Next, paste the link in the URL field. Click the **OK** button to save the settings.



5. The new device should be listed under the Web Pages menu.

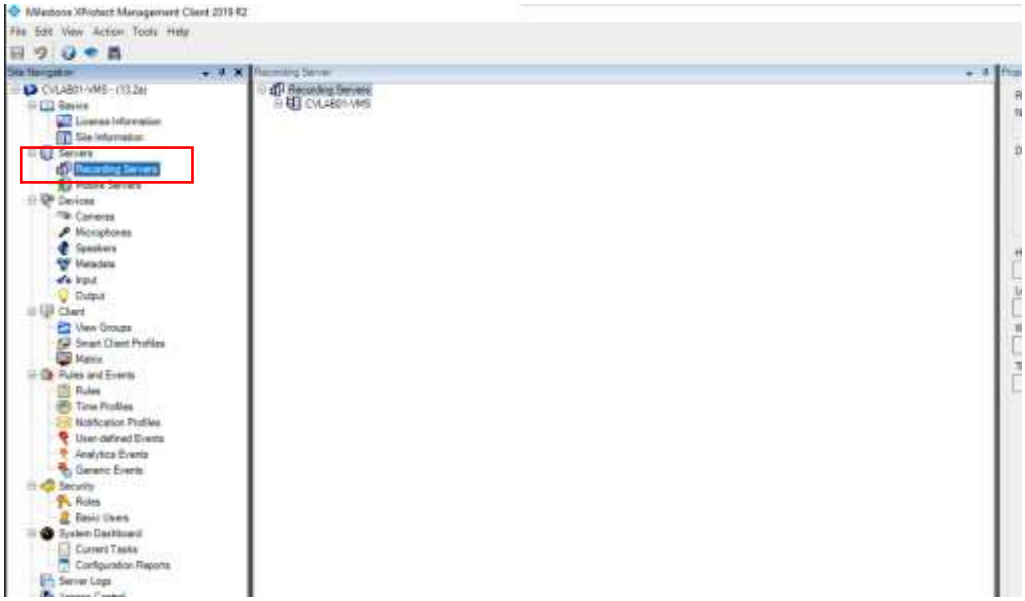
6. Double-click the device name to launch the statistics tile.



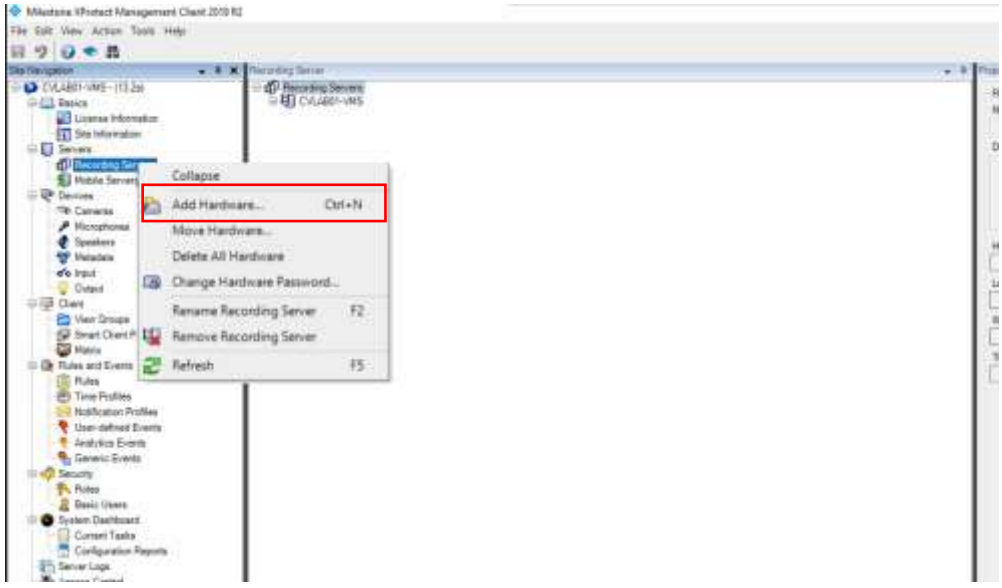
Configuring cnVision Device in Milestone XProtect VMS

cnVision devices are manually configured in the Milestone XProtect Management Client. To configure devices, you will require the device username and password credentials.

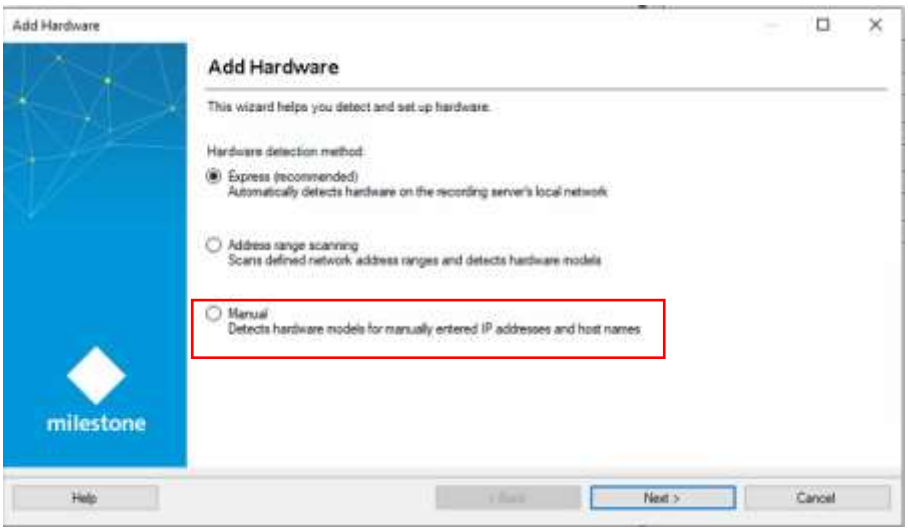
1. Log in to the Management Client. Navigate to the **Servers** option and select **Recording Servers**.



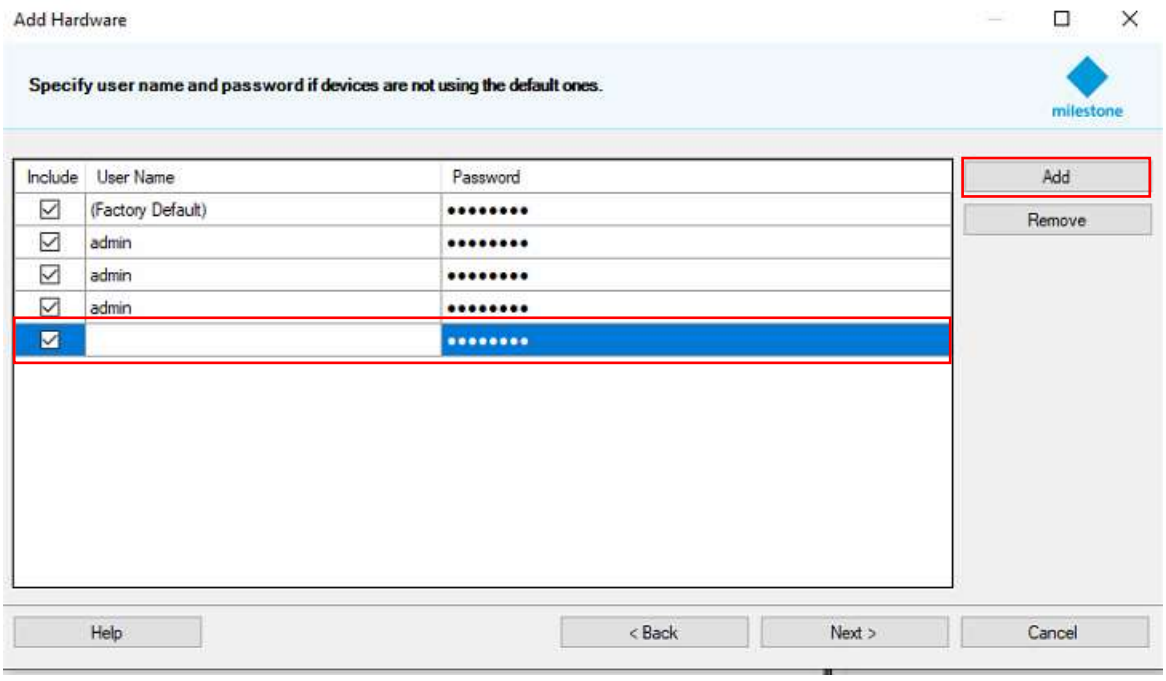
2. Right-click on the Recording Server option to open the context menu. Click the **Add Hardware** option from the list.



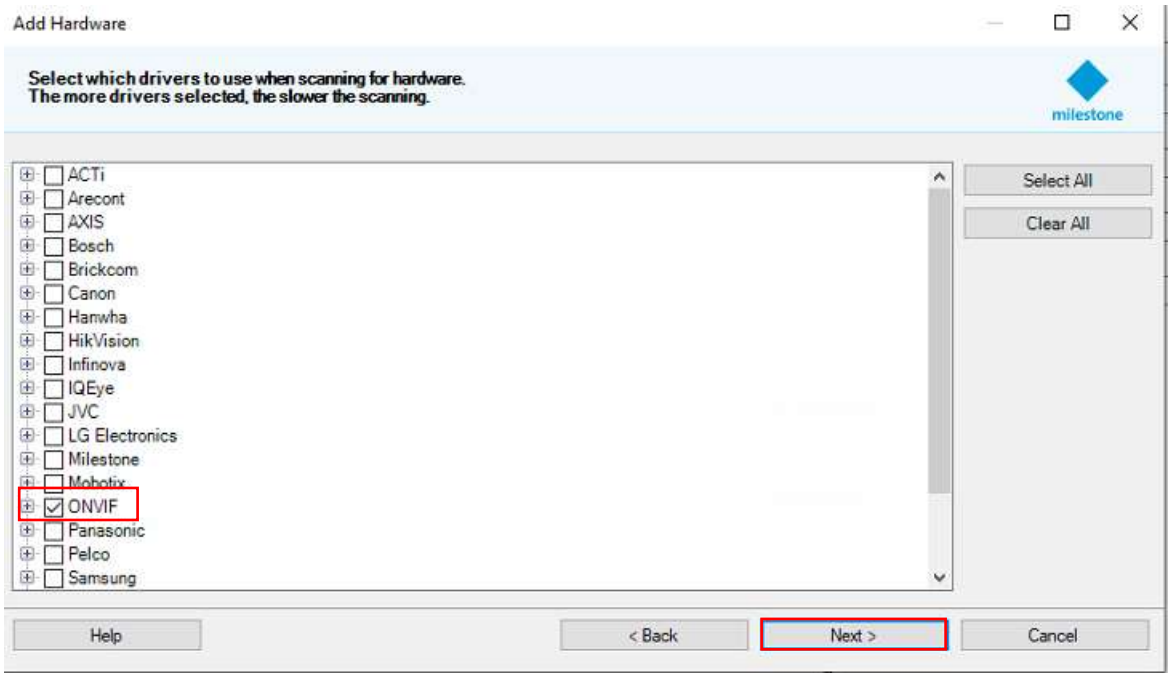
3. The Add Hardware dialog box opens. Select from one of the available options. In this example, we will use the **Manual** option. Click the **Next** button to Continue.



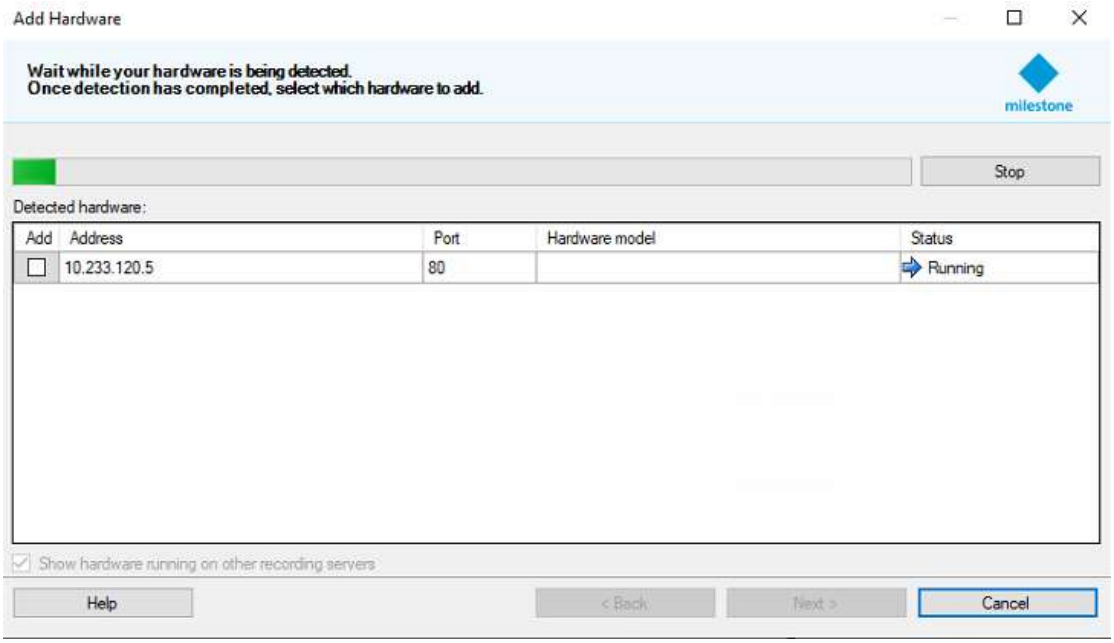
4. Click the **Add** button to specify the user name and password for the device. These are credentials you have configured to log in to the cnVision device's Web User Interface (eg. admin, admin). Click the **Next** button to continue.



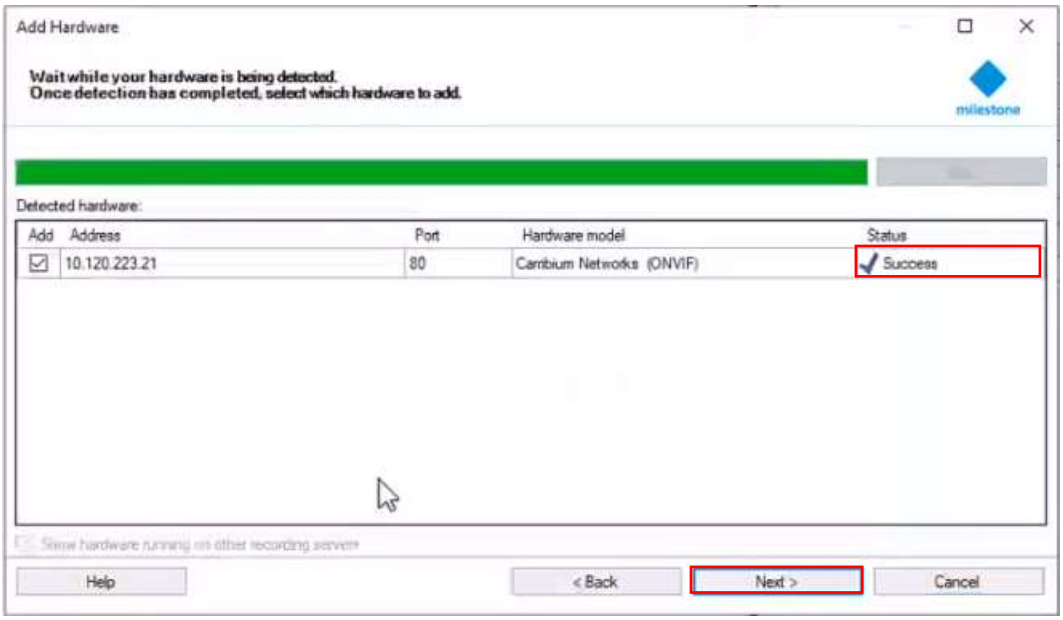
5. Next, select the hardware devices by checking the respective boxes. The cnVision devices are ONVIF compliant. Click the **ONVIF** checkbox and click the **Next** button to continue.



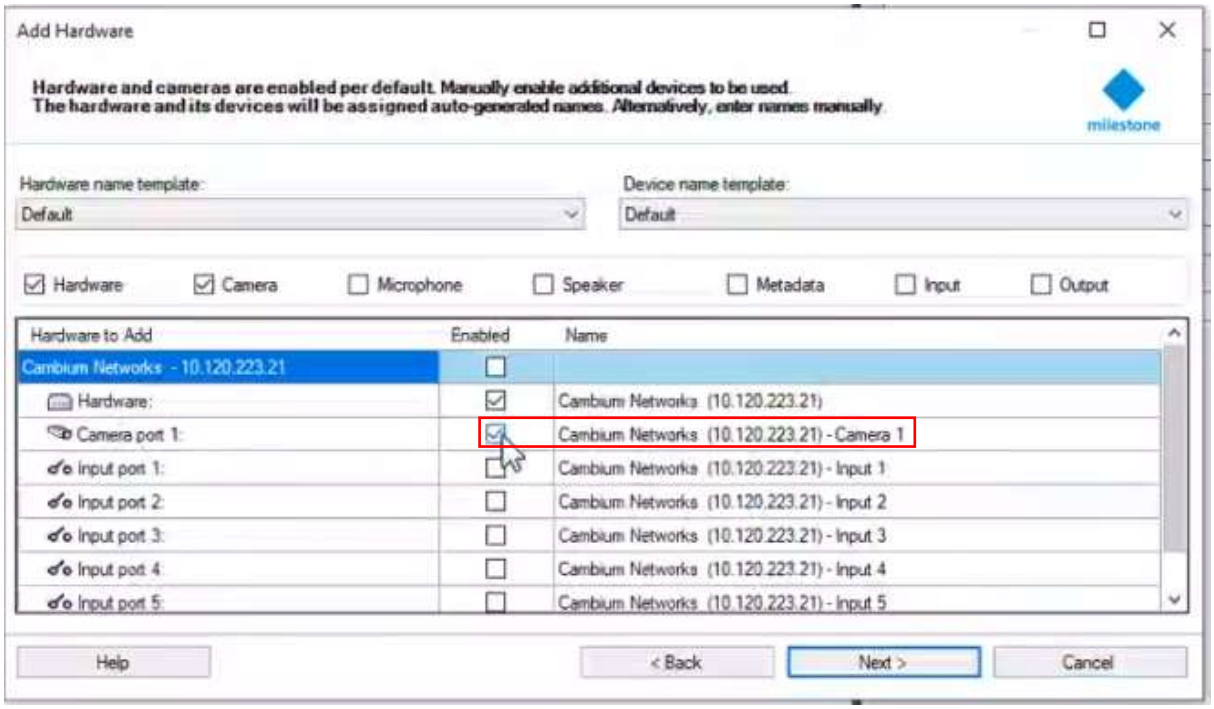
6. The system will scan the network to detect the device.



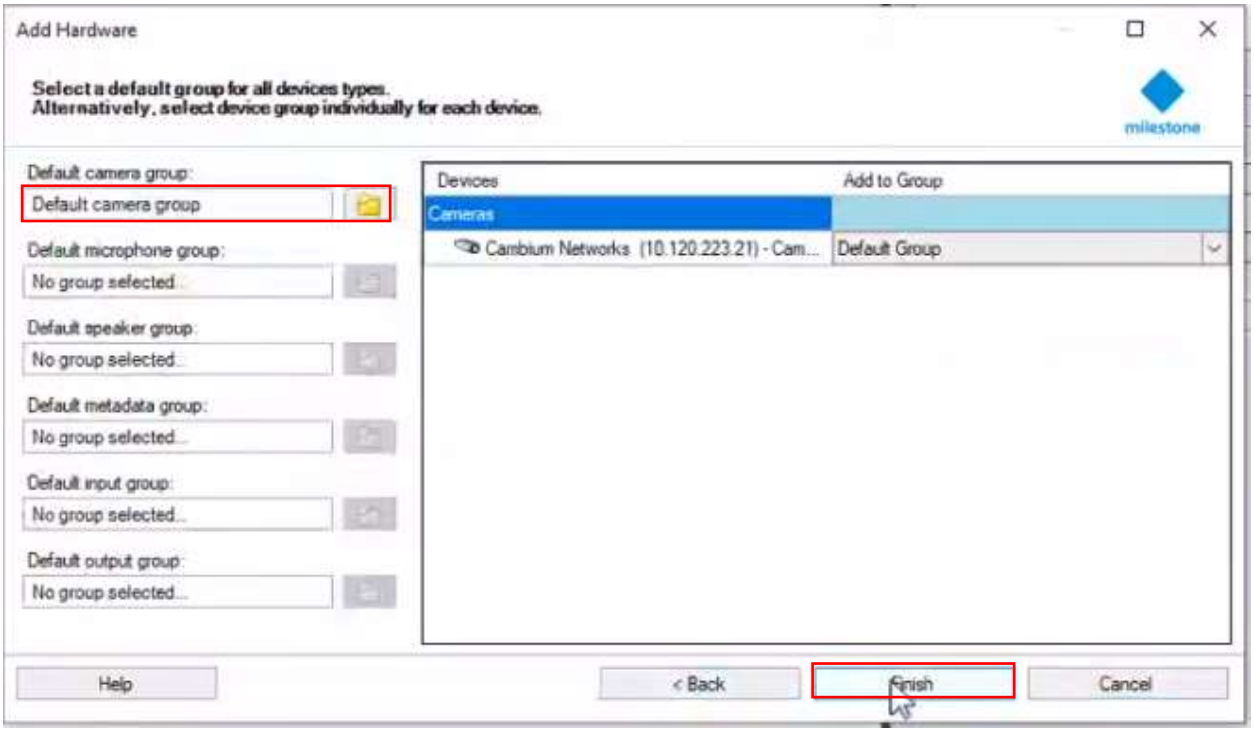
7. The status message will display the results. In case of failure, check and confirm the IP address and the port number is entered correctly. Click the **Next** button to continue.



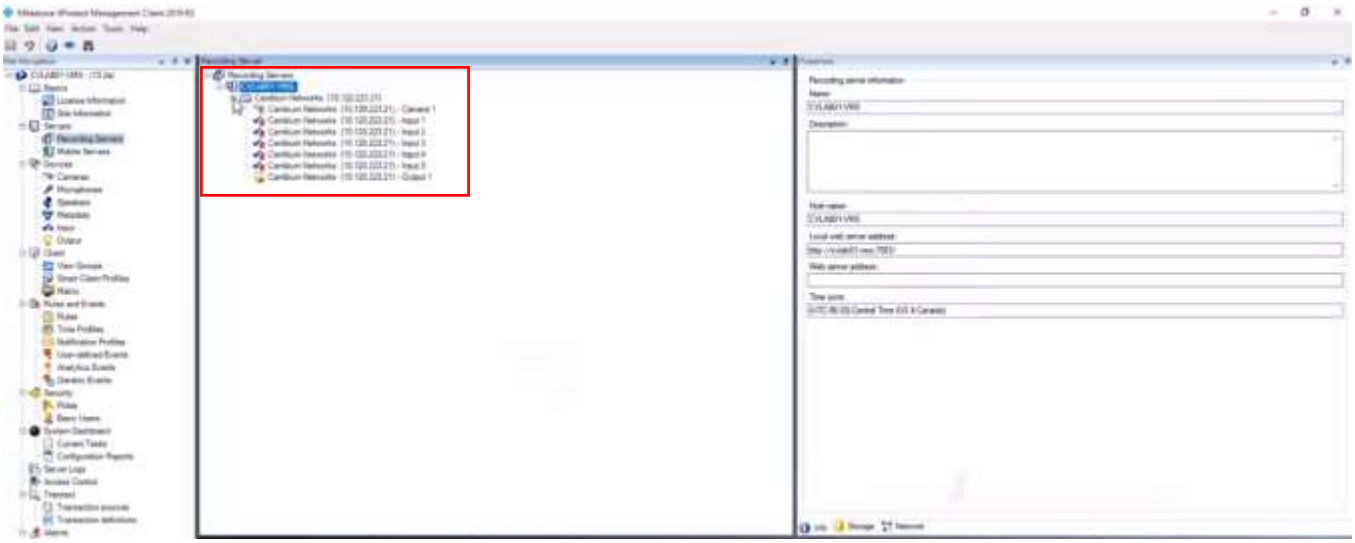
8. The system detects cnVision devices as Cameras. Click the box next to the Camera item to **enable** the device.



9. The device is added to the **Default camera group**. Click the **Finish** button to continue.



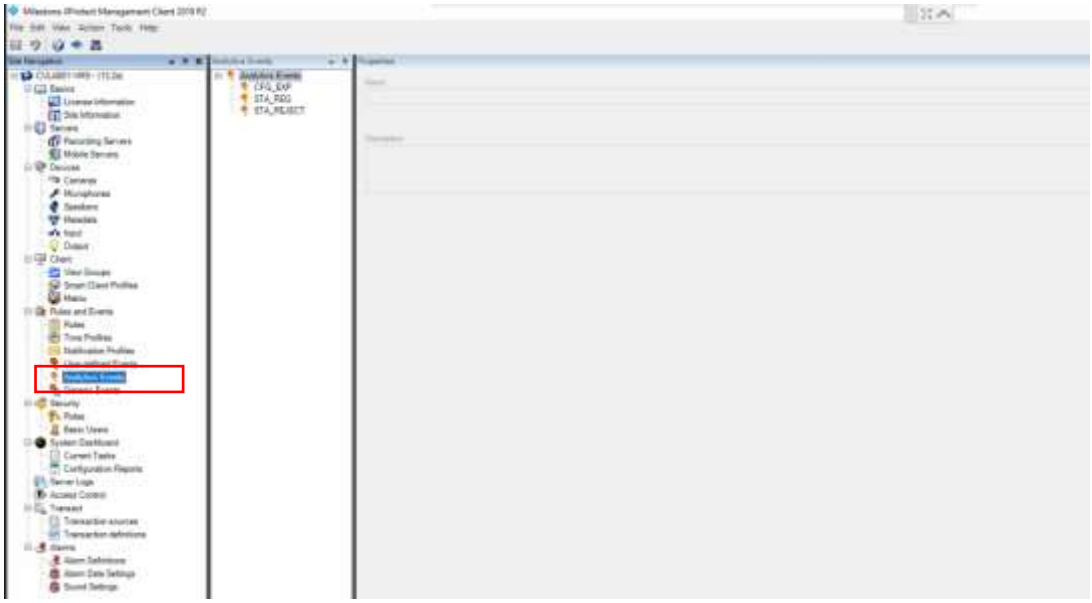
10. The device has been added and is now displayed in the **Recording Server** pane.



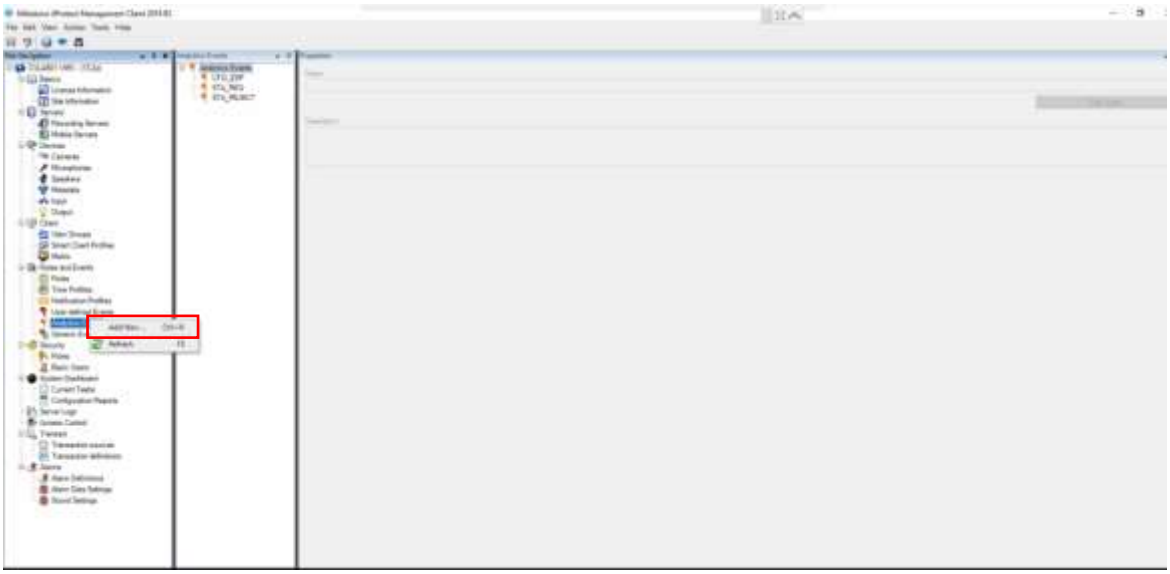
Configuring Event Messages in Milestone XProtect VMS

Configuring Event Messages

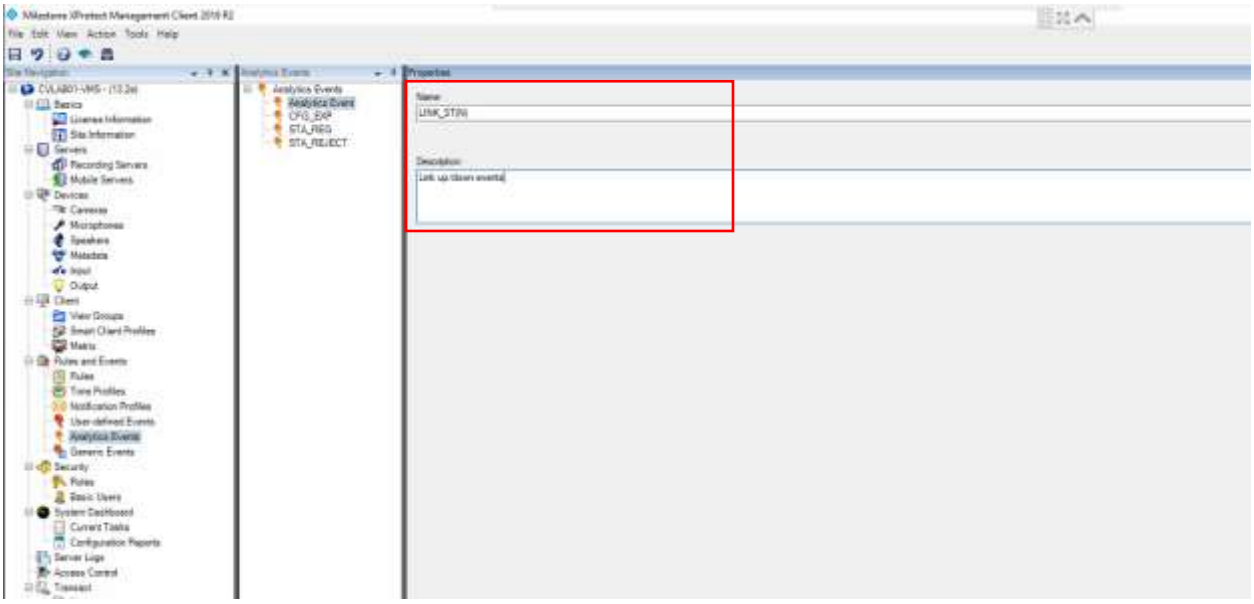
1. Log in to the Milestone XProtect Management Client. Navigate to the **Analytics Events** option under the **Rules and Events** section in the left navigation pane.



2. Right-Click on the **Analytics Events** item to open the context menu. Click the **Add New** menu item to add a new Event Message.

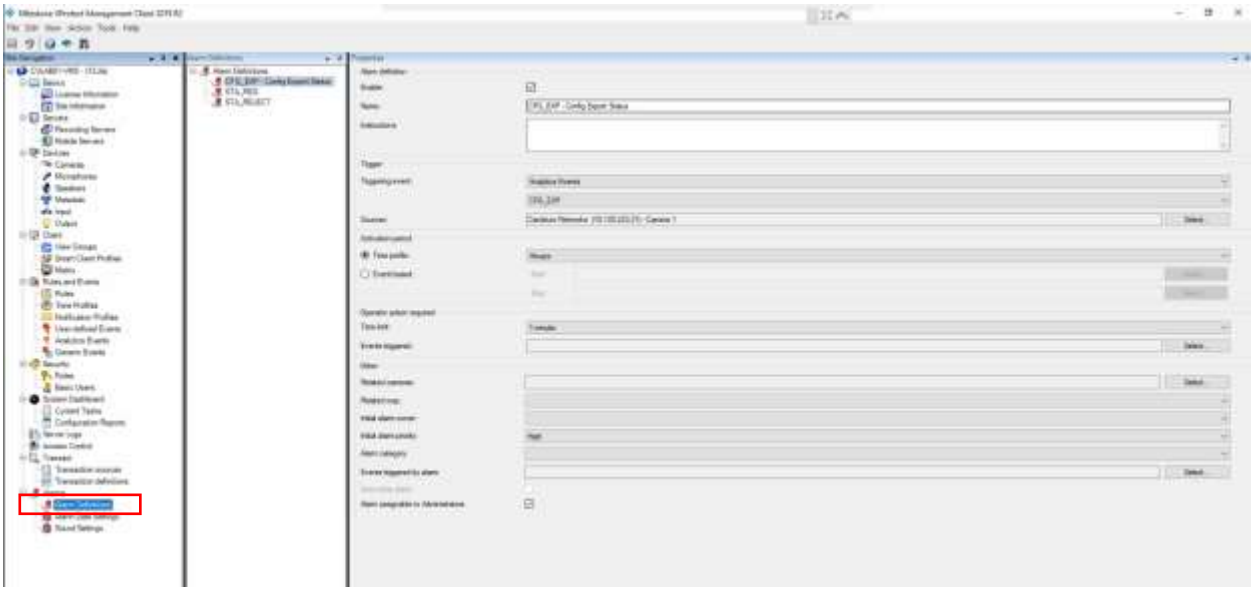


3. Enter the **name** and **description** for the new Event in the Properties pane. Next, the Event messages have to be linked to Alarms.

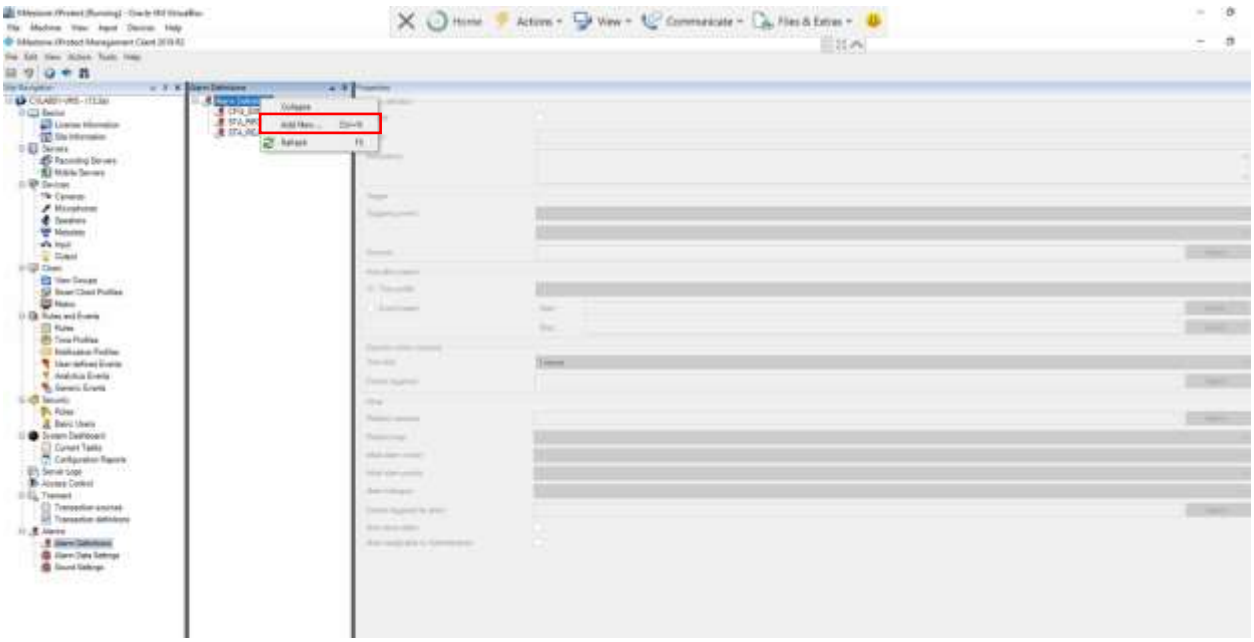


Linking Event Messages to Alarms

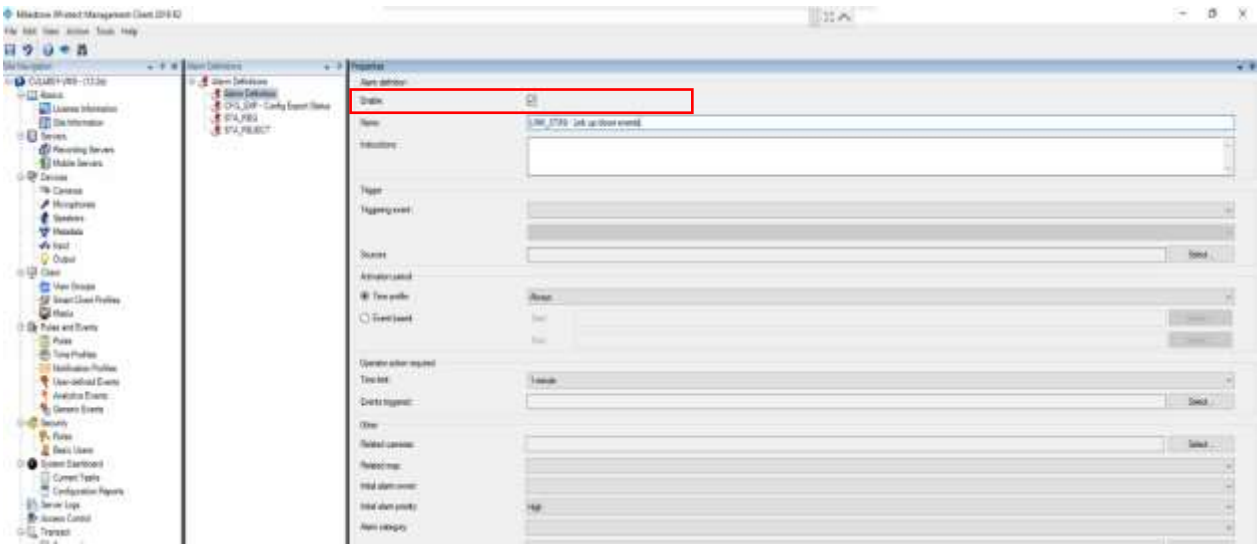
1. Navigate to the **Alarm Definitions** option under the Alarms section.



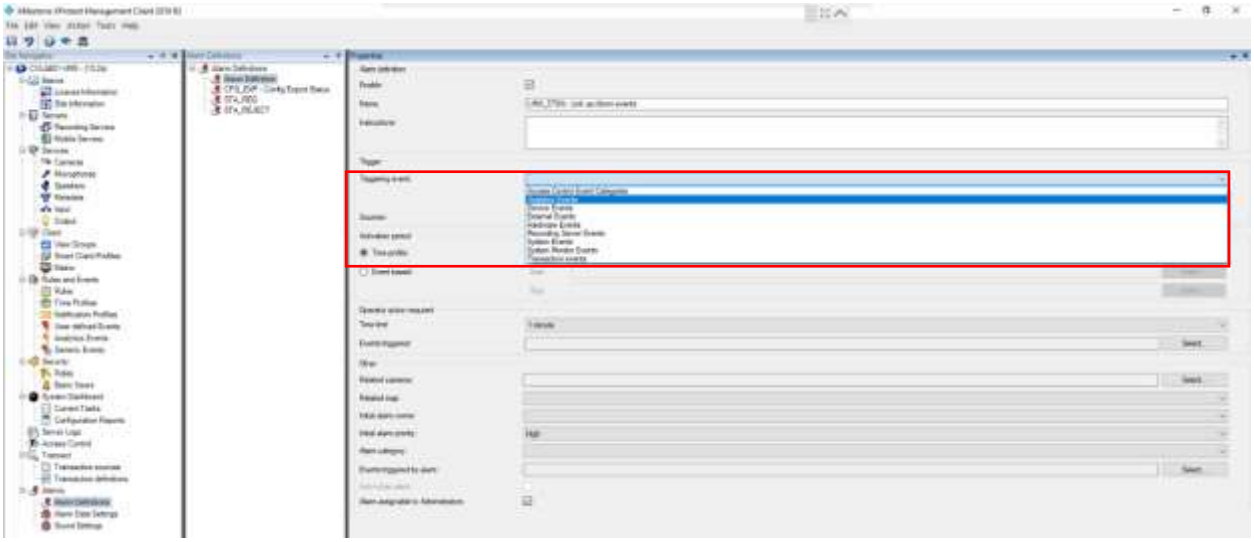
2. Right-click on the Alarms Definitions to open the context menu. Click the Add New menu item.



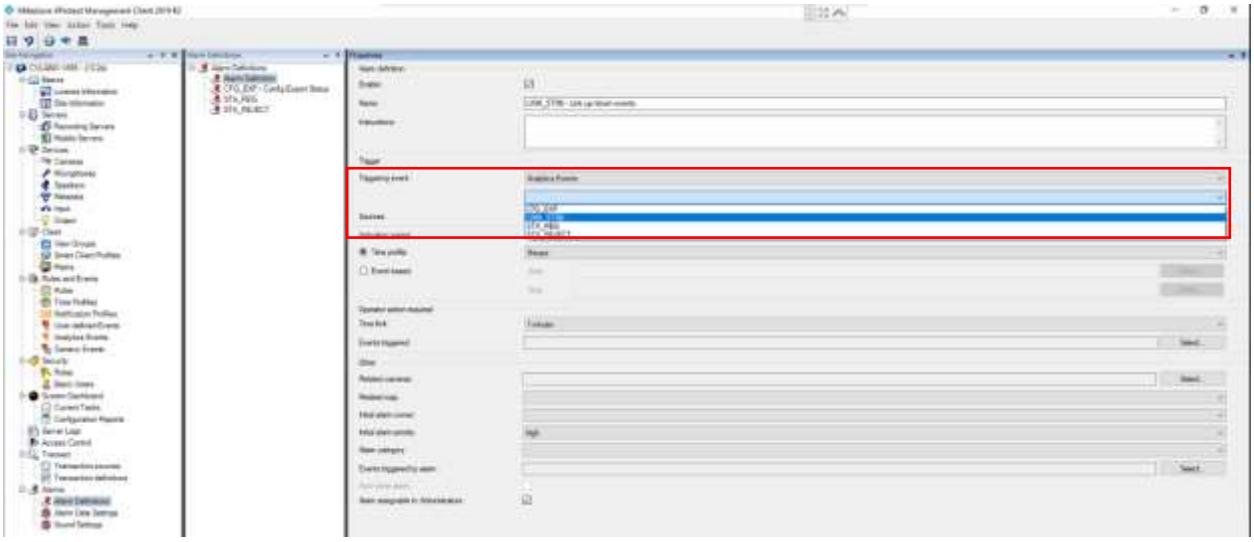
3. Configure the parameters in the Properties pane for the new Alarm. Enter a **name** for the Alarm.



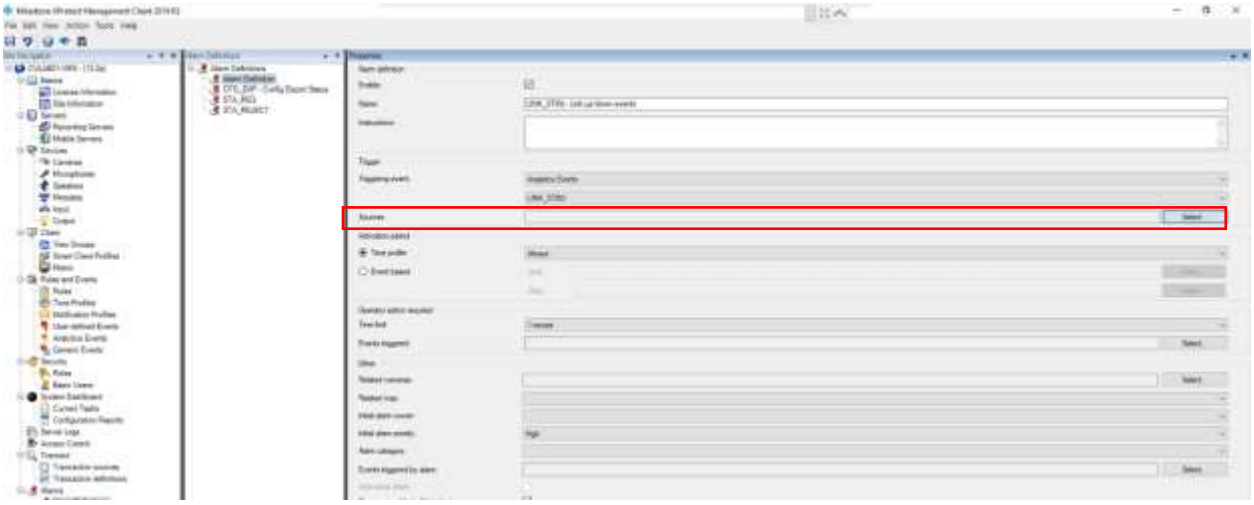
4. Select the tagging event from the list (**Analytics Events**).



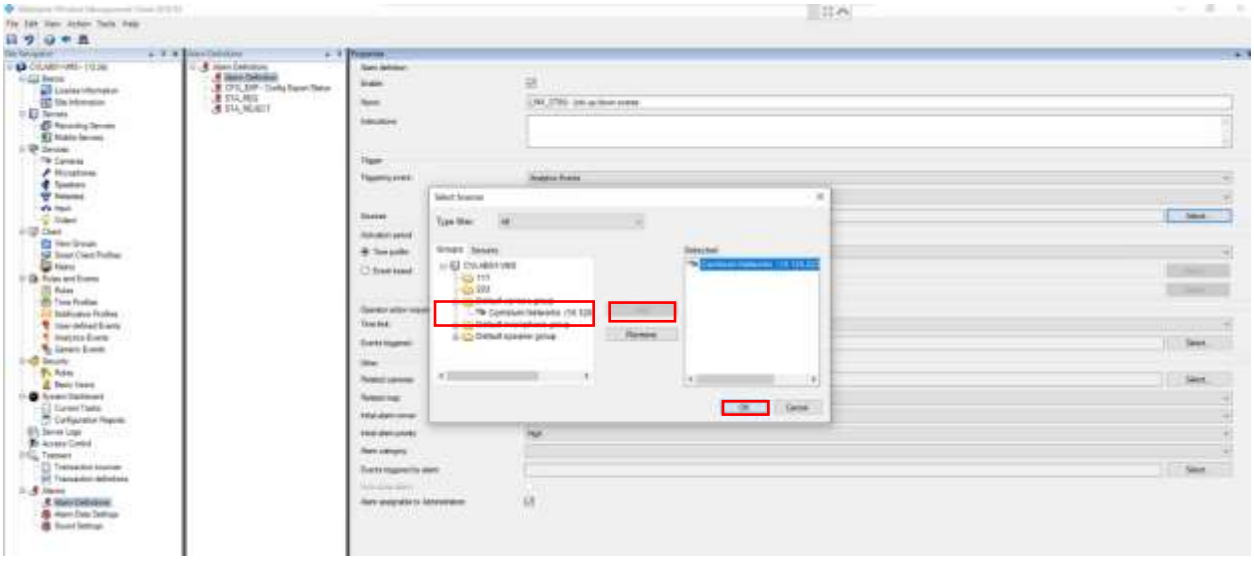
5. Next, select the trigger event from the list (the new Event created earlier).



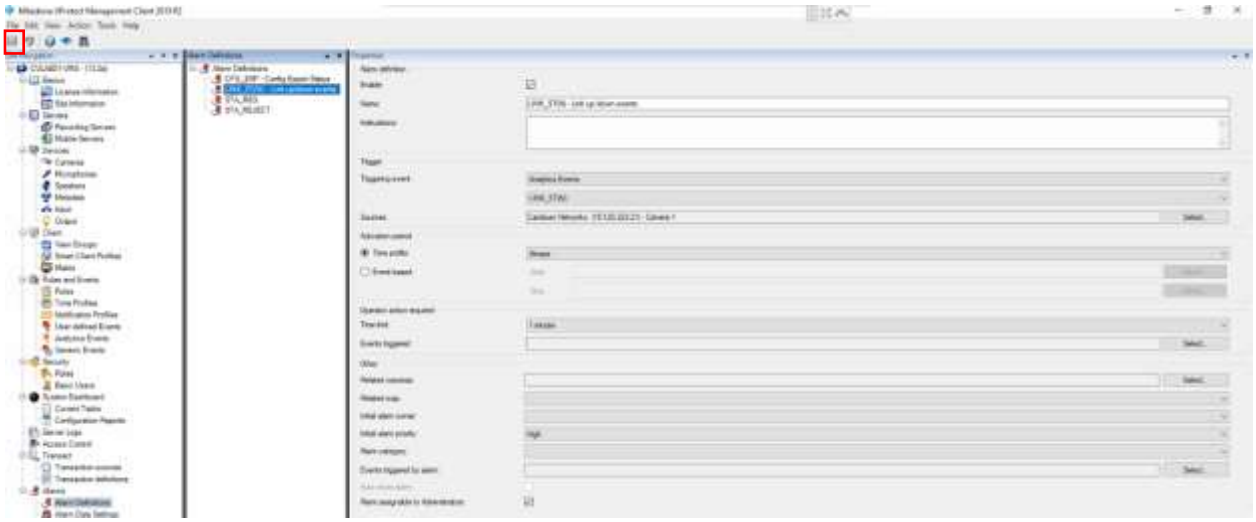
6. Next, click the **Select** button to choose the source that is going to send this Event trigger (cnVision device).



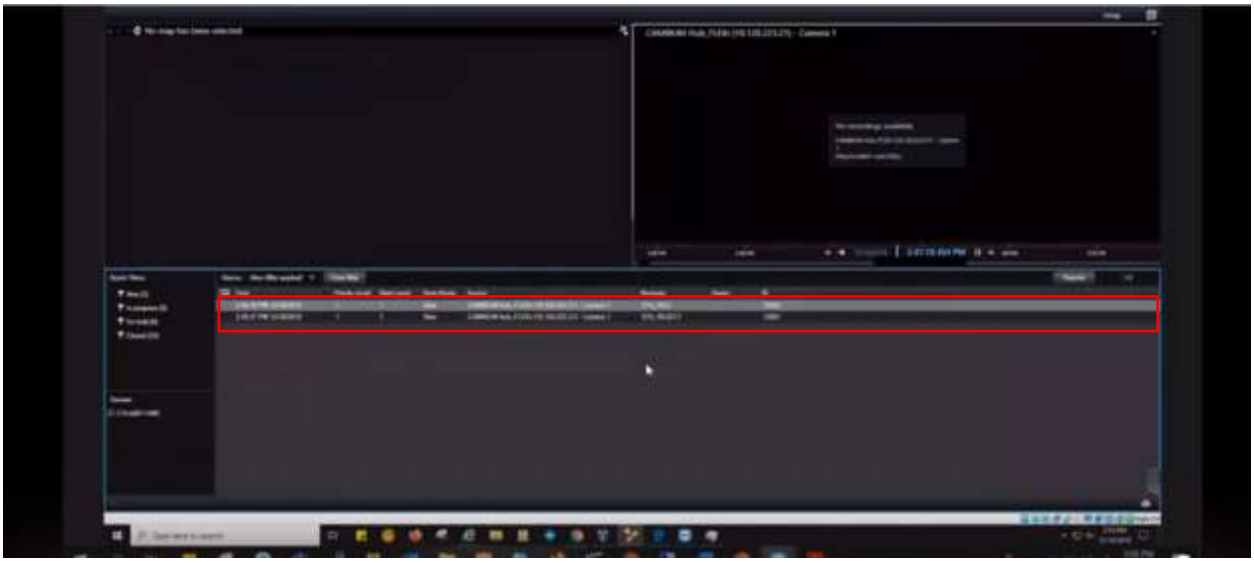
7. Expand the list and select the device from the list. Click the **Add** button and then the **OK** button to continue.



8. Click the **Save** button to save the settings. Repeat these steps to create Events and link them to Alarms.



The new Alarm should display in the VMS when triggered by the device.

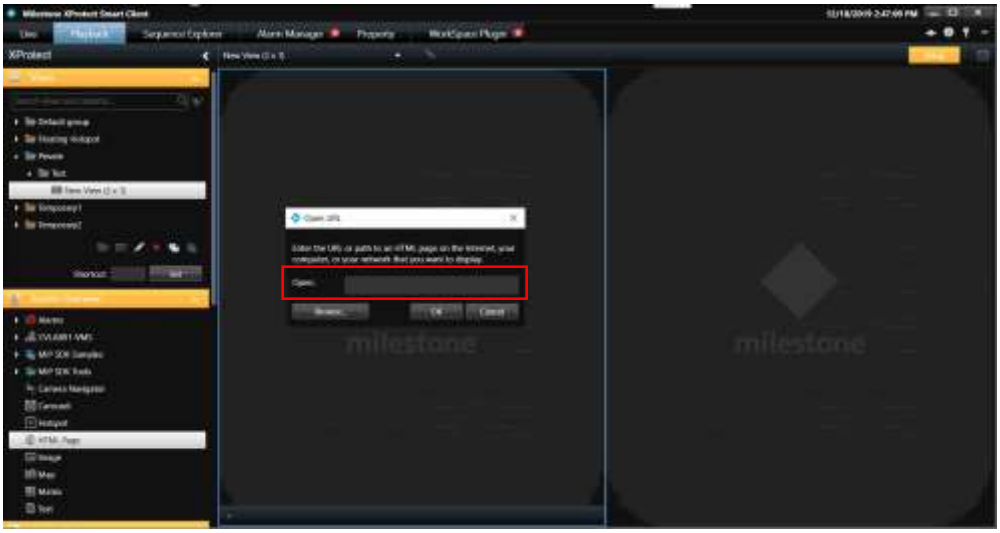


Configuring Device Statistics Tile in Milestone XProtect VMS

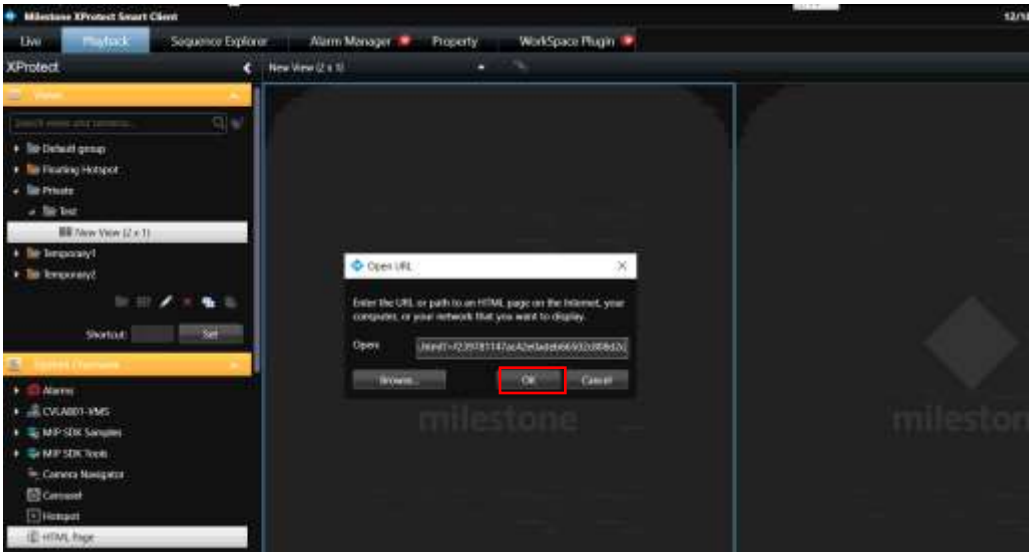
1. From the VMS Integration screen, click the **Generate Link button** to generate a preview link.
2. Select and copy the link.

3. Log in to the Milestone XProtect Smart Client application. Navigate to the **HTML Page**.

4. The Open URL dialog box opens. Paste the device's URL link copied earlier.



5. Click the **OK** button to save the settings.



The new cnVision device should be available under the HTML Page option. Double-click to launch the device tile.

Chapter 7: General Maintenance and Troubleshooting

This chapter provides instructions for operators of cnVision networks. The following topics are described:

- General Planning for Troubleshooting
- Upgrading device software
- Testing hardware
- Troubleshooting the radio link
- Using the Ping and Traceroute utilities
- Resetting cnVision to factory defaults by power cycling

General Planning for Troubleshooting

Effective troubleshooting depends in part on measures that you take before you experience trouble in your network. Cambium recommends the following measures for each site:

Procedure:

1. Refer to the installation documents and logs for the site, including:
    - Operating procedures
    - Site-specific configuration records
    - Network topology
    - Software releases
    - Types of hardware deployed
    - Site-specific troubleshooting process
    - Escalation procedures
    - GPS latitude/longitude of each network element

2. Use the tools available within the device's interface that can be used for troubleshooting connectivity and data throughput issues.
    - Ping
    - Taceroute
    - System
    - Wireless
    - Throughput data
    - eAlign (Client)
    - Wireless Link Test
    - System logs

3. Keep the cnVision devices updated with the latest software.
4. Perform visual site inspections as part of routine maintenance.

Upgrading the Hub/Client software

The key to ensuring cnVision devices are working at an optimum level and taking advantage of the latest features is by updating the software to the latest version. Monitor the Cambium Networks software website for updates: https://support.cambiumnetworks.com/files/cnVision_cnVision

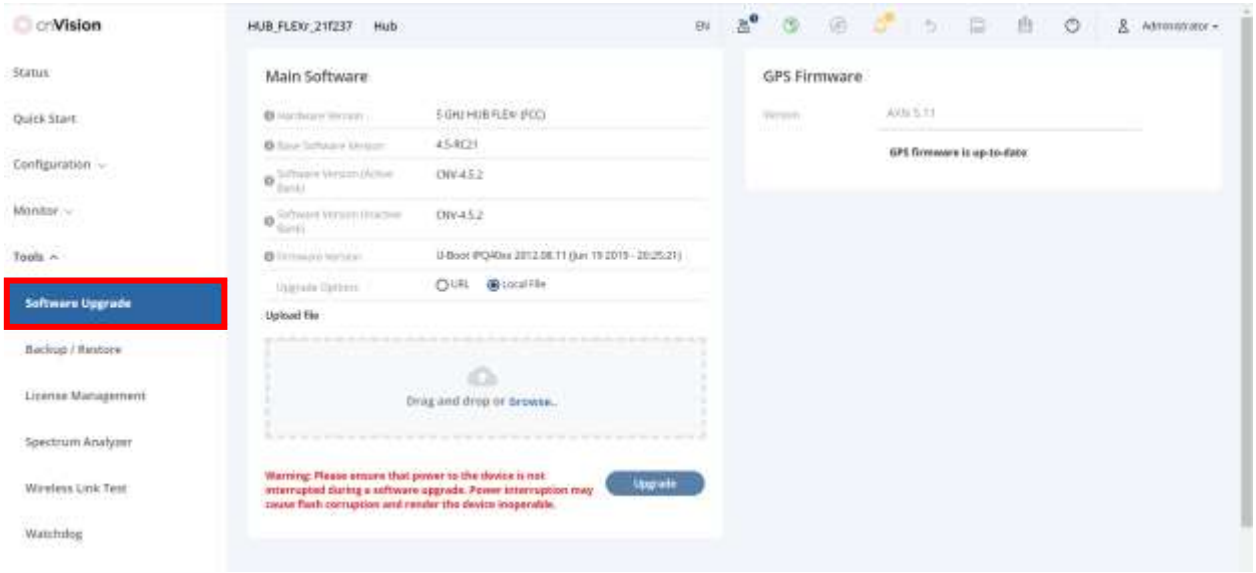
To upgrade the device software, follow this procedure:

Procedure:

1. Log in to the device Web UI.
2. Navigate to page **Tools** > **Software Upgrade.**
3. Under the Main Software section, set the Upgrade Option to URL to pull the software file from a network software server or select Local File and browse to the file location, or drag and drop the file in the Upload a file box. If **URL** is selected, enter the server IP address, Server Port, and File path.
4. If **Local File** is selected, click **Browse** to launch the file selection dialogue.
5. Click **Upgrade.**

   Do not power off the unit in the middle of an upgrade process.

6. Once the software upgrade is complete, click the **Reset** icon.

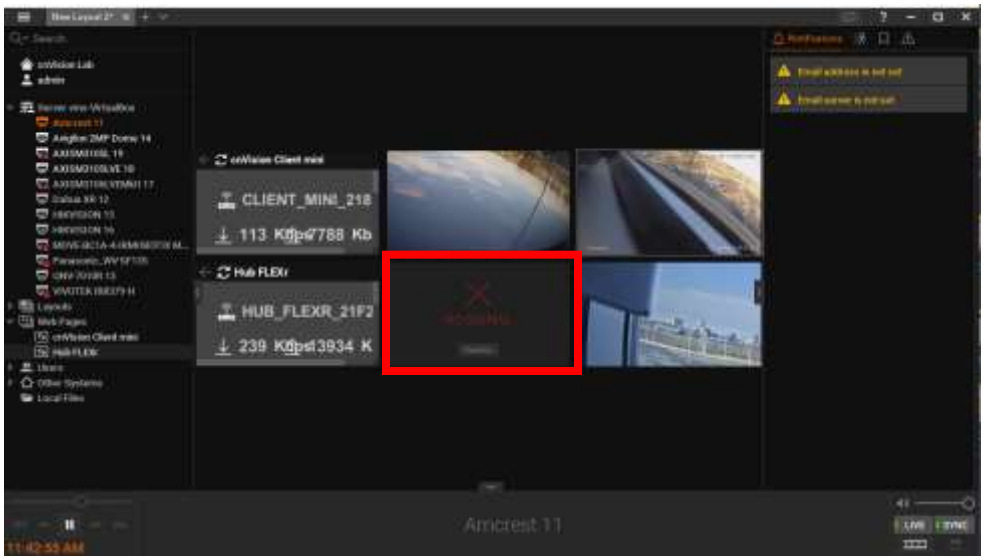


Video Issues

This section focuses on video-related issues.

Camera feed is missing in the VMS

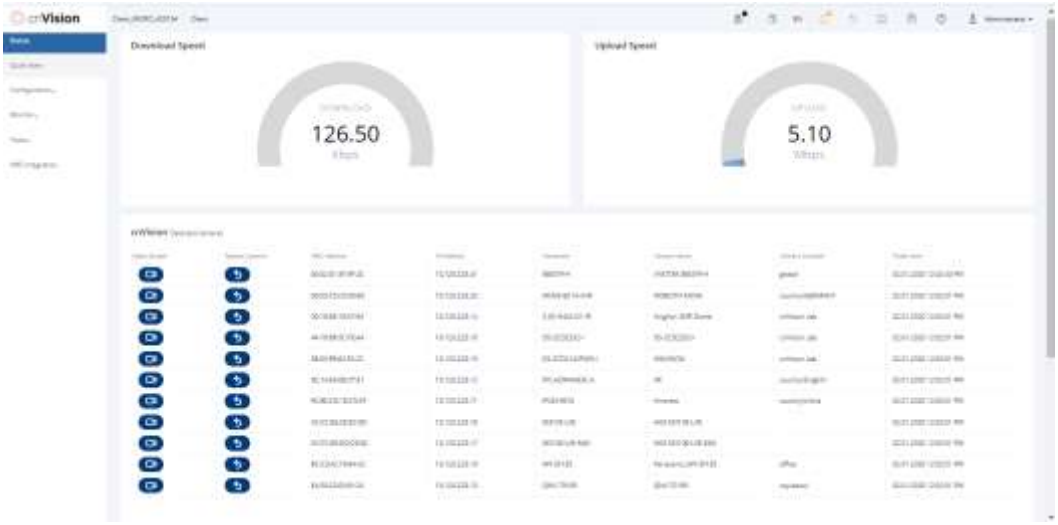
If a camera feed is missing in the Video Management System, try the following:



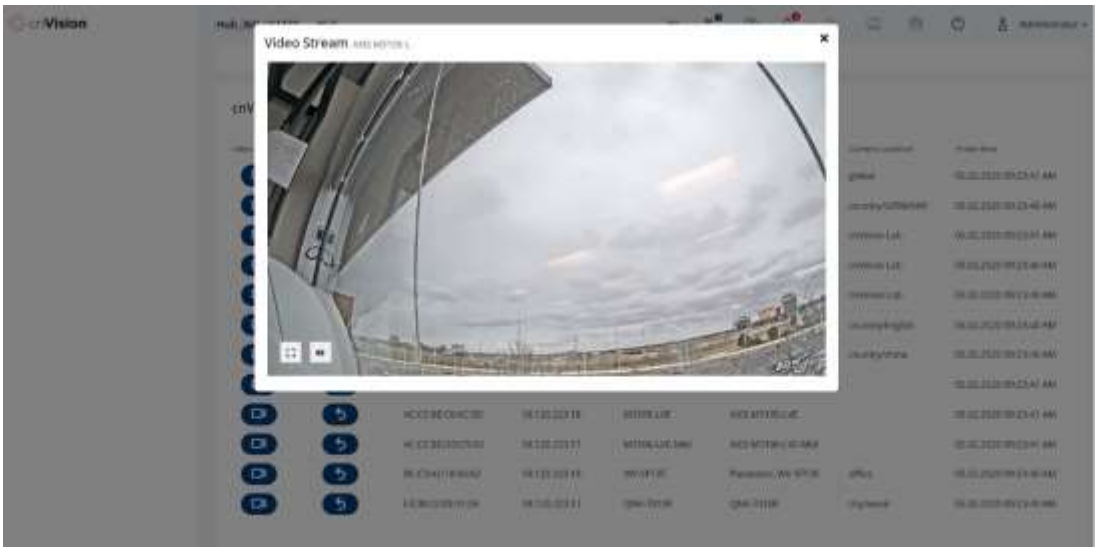
Solutions:

Open the Video Stream

1. Log in to the cnVision client or hub. The **Status** screen displays all ONVIF compliant cameras and lists them on this screen. Ensure the camera is displayed in the list if it's not displayed, the problem may be with the camera itself.



2. Click the video stream  button to log directly into the camera. Enter the login credentials for the camera. A dialog box will be displayed streaming the video if the camera is functioning.



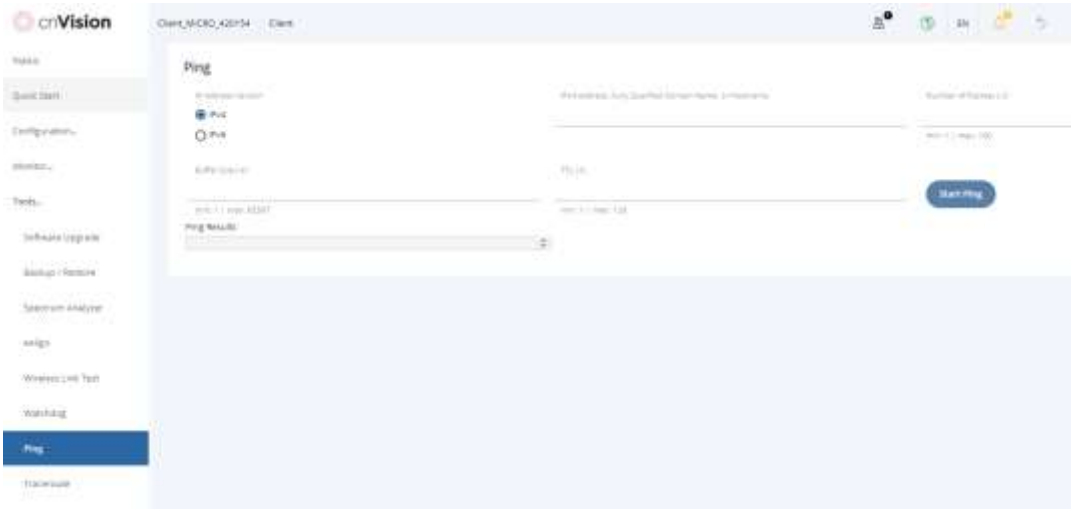
3. If the video stream is not displayed, make sure you are entering the correct login credentials for the camera.

Reboot the Camera

4. Click the reboot  button to restart the camera and try to open the video stream again.

Ping the Camera

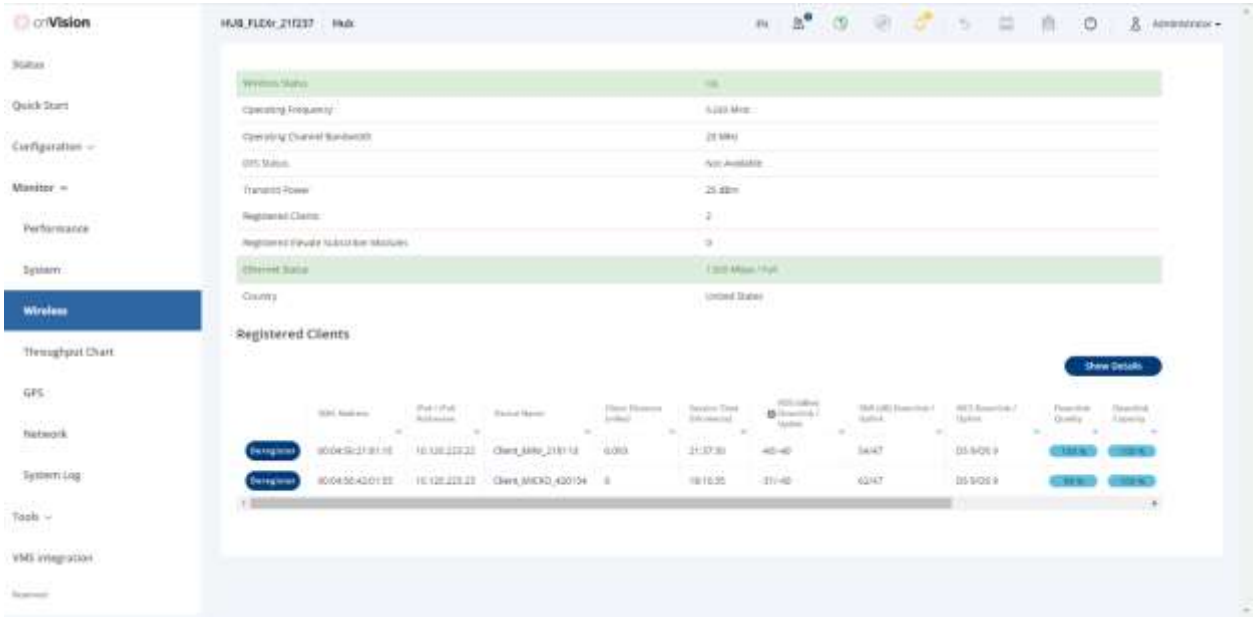
1. Locate the camera's IP address from the list and ping the camera to see if it's connectable. You can ping cameras and other network devices from **Tools > Ping**.



2. Enter the camera's IP address. Click the **Start Ping** button. The ping results will be displayed after the test is complete. If you see replies from the camera such as "Destination Host Unreachable" or "Request Timed Out", the camera may be unavailable for various reasons.

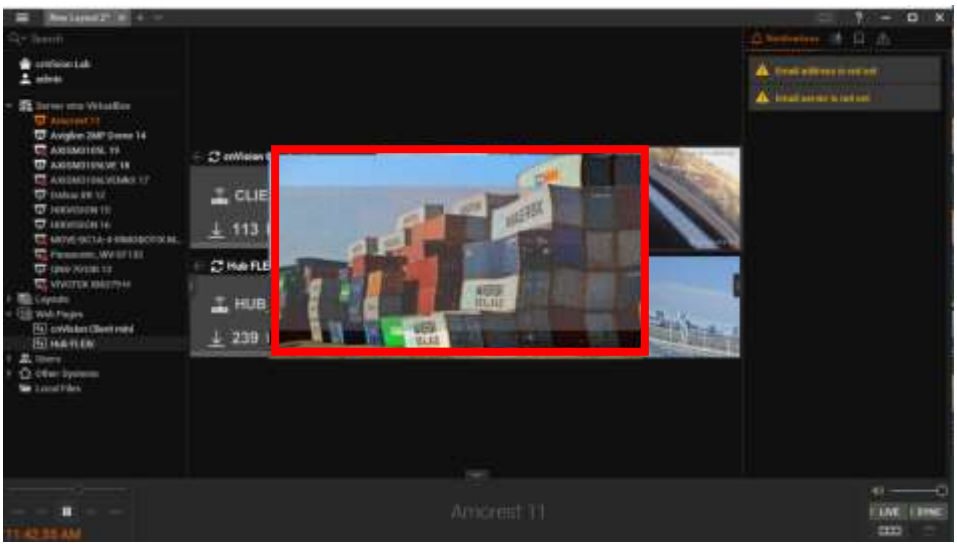
Check Hub and Client Status

1. Check that the hub and client are working correctly. Go to **Monitor** > **Wireless** to check the status. Ping the hub and the client to make sure they are working correctly from **Tools** > **Ping**.



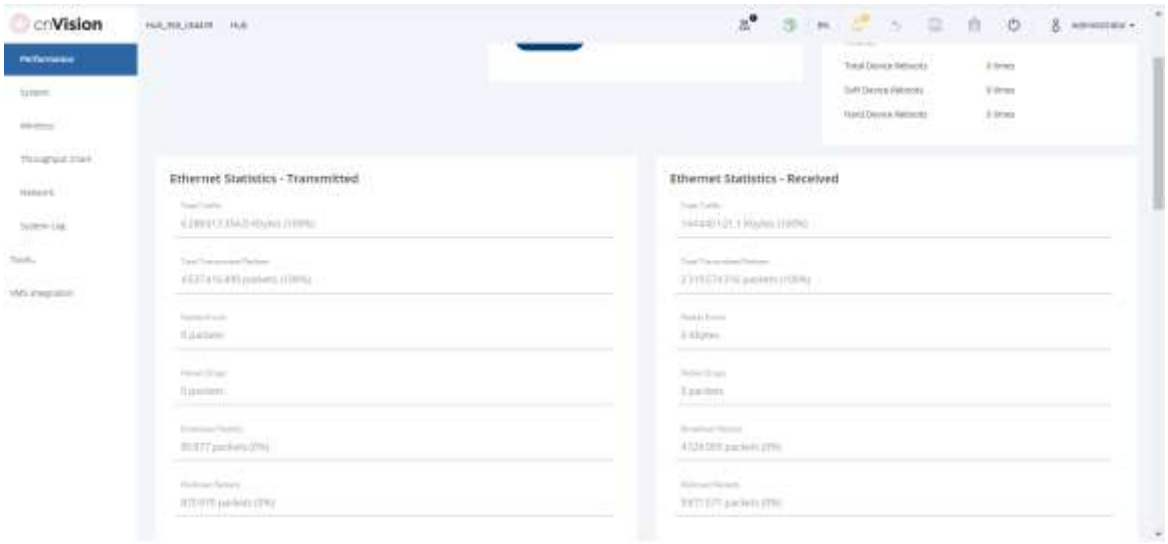
Link quality has degraded

There may be instances where the image quality has degraded but the hub and client are still operating.

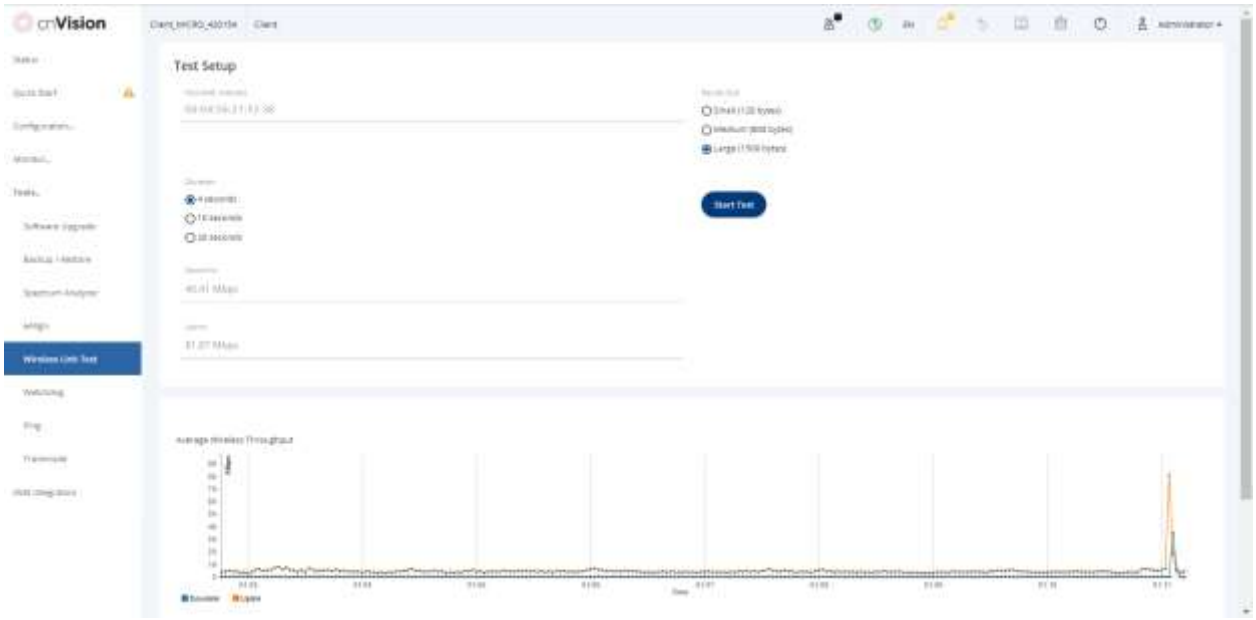


Solutions:

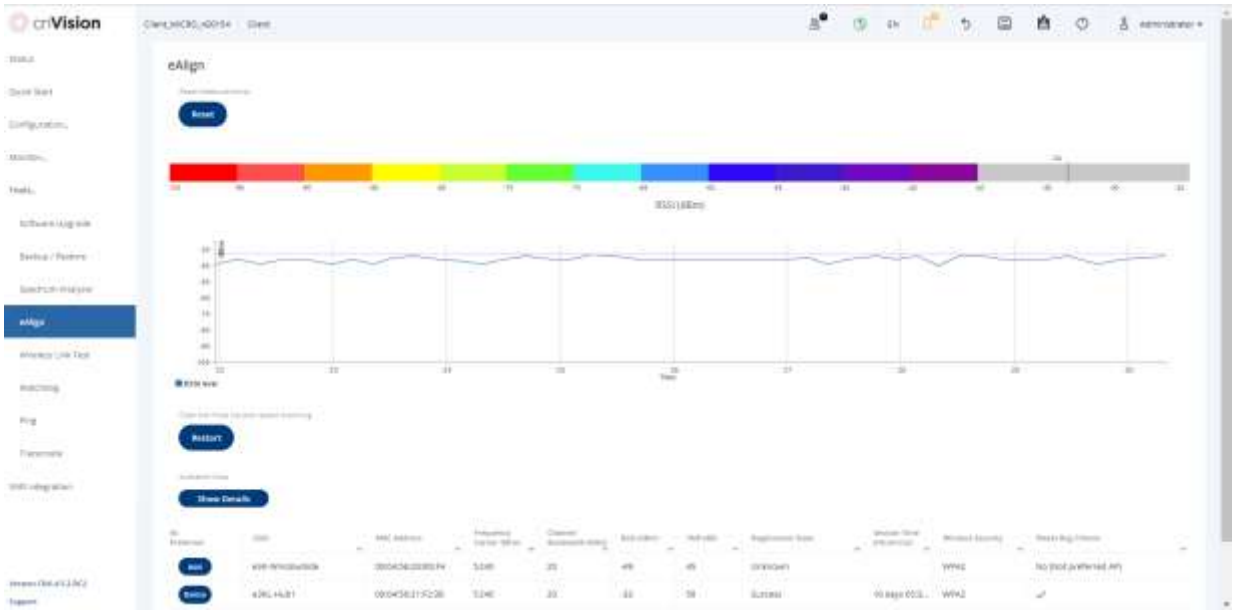
1. Check if there are high numbers of packet errors or packet drops on the client or the hub. These statistics can be found under the Ethernet Statistics - Transmitted and Ethernet Statistics - Received tiles from **Monitor** > **Performance.**



2. Check the wireless link with the client or hub from **Tools** > **Wireless Link Test**. The test will check the uplink and downlink speed. A high number of errors or drops may indicate a line of sight issues due to an obstacle or the radio antennas may have become misaligned.



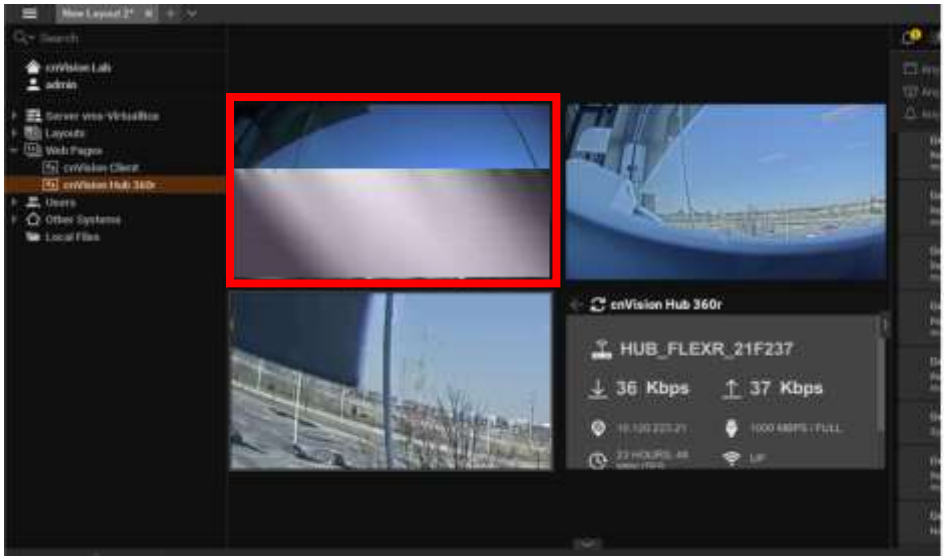
3. Use the eAlign tool to help align the antennas for optimal signal.



4. Try lowering the camera's resolution to see if that fixes the issues.

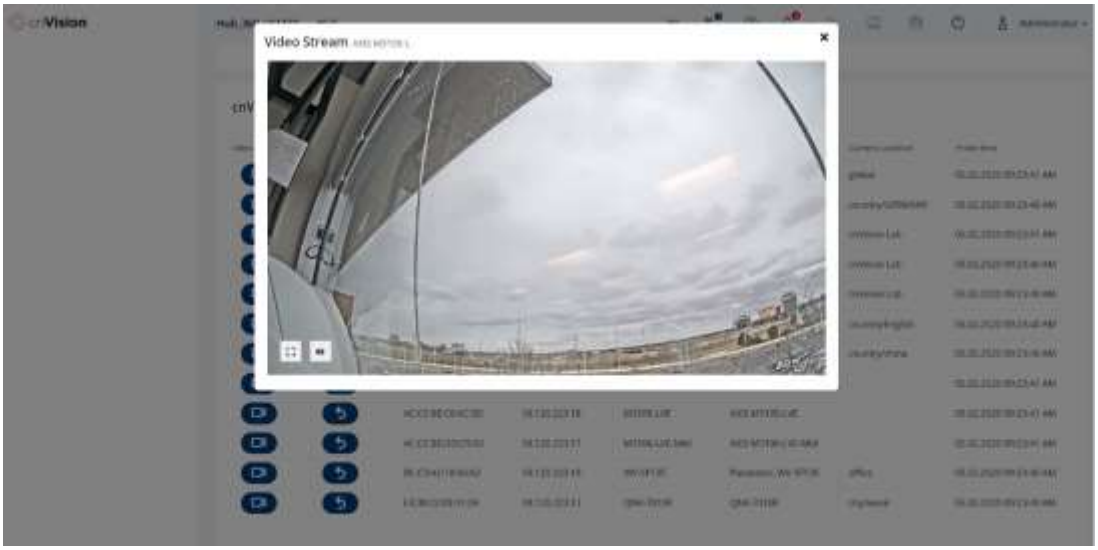
Video is pixelated or skipping frames in VMS

Choppy video or frames being dropped in the Video Management System could be related to various issues. Increased activity in a scene can suddenly cause an increase in data output data the camera.



Solutions:

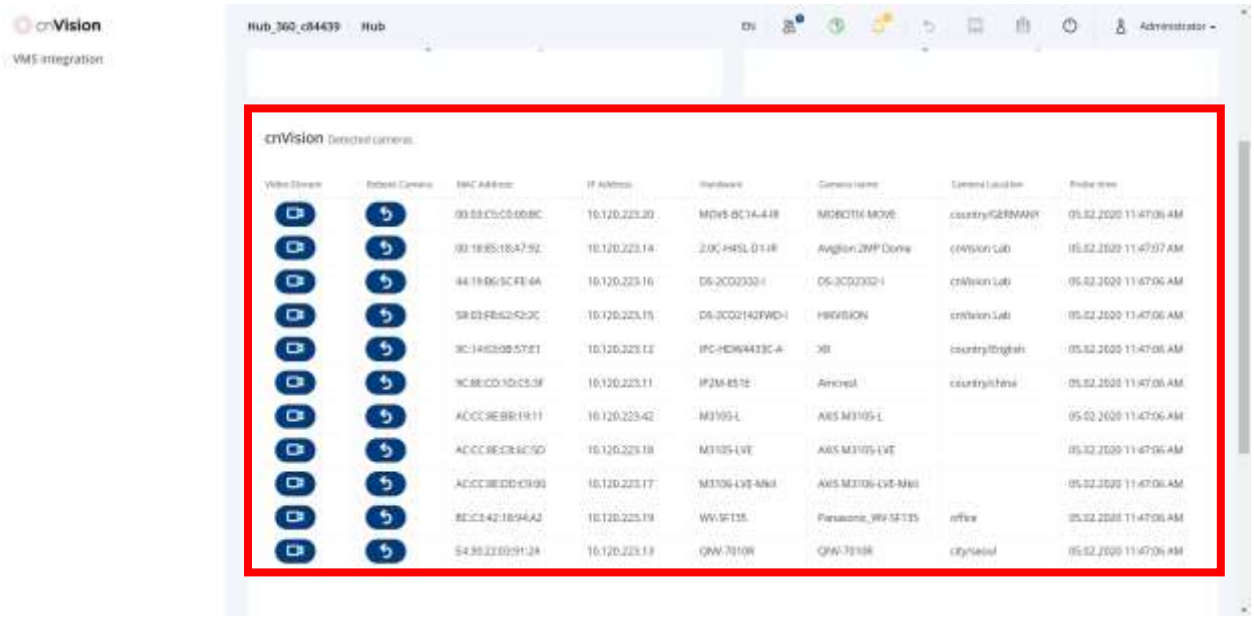
1. Check the camera's video stream from the device's Web UI > **Status** > **Detected cameras** section. If the video is streaming without any issues, the problem may be related to other network devices (switch, NVR, etc.).



2. If the video stream is choppy from the Web UI, perform the wireless link test from **Tools** > **Wireless Link Test** to determine the uplink and downlink speed.
3. Use the eAlign utility to check the received signal strength to ensure the device has a strong signal. Obstacles blocking the device's line of sight can cause Interference and signal to degrade. Antennas can become misaligned if not mounted properly. Check the hub and client and correct any issues.

Camera is connected but not detected in cnVision

A camera is powered and connected to the cnVision system, however, the camera is not displayed in the VMS or listed in the **Detected Cameras** section in the Hub/Client Web User Interface.



Solutions:

Some camera manufacturers disable the “ONVIF” settings by default. Navigate to the camera’s configuration page and enable the “ONVIF” settings.

Camera is detected in cnVision but can’t open a video stream

A camera is detected in the cnVision system, however, the video stream pop-up box doesn’t open.

Solutions:

Check the “ONVIF” settings on the camera. Navigate to the camera’s configuration page and enable the “ONVIF” settings.

Testing hardware

Before testing hardware, confirm that all outdoor cables, that is those that connect the device to equipment inside the building, are of the supported type.

Device has stopped transmitting or receiving.

Checking the power supply LED

When the power supply is connected to the main power supply, the expected LED behavior is:

- The Power (green) LED illuminates steadily.

If the expected LED operation does not occur, or if a fault is suspected in the hardware, check the LED states and choose the correct test procedure:

Power LED is off

Meaning: Either the power supply is not receiving power from the AC/DC outlet, or there is a wiring fault in the unit.

Action: Remove the device cable from the PSU and observe the effect on the Power LED. If the Power LED does not illuminate, confirm that the mains power supply is working, for example, check the plug. If the power supply is working, report a suspected power supply fault to Cambium Networks.

Ethernet LED is off

Meaning: There is no Ethernet traffic between the device and the power supply.

Action: The fault may be in the LAN or device cable:

- Remove the LAN cable from the power supply, examine it and confirm it is not faulty.
- If the PC connection is working, remove the Hub/Client cable from the power supply, examine it, and check that the wiring to pins 1,2 and 3,6 is correct and not crossed.

Test Ethernet packet errors reported by the device

Log in to the device and click **Monitor** > **Performance**. Check if there are packet errors in the Ethernet Statistics -Transmitted, Ethernet Statistic – Received tiles. The test has passed if the ***Packet error counter*** is less than 10 in one million ***Total packet counter***

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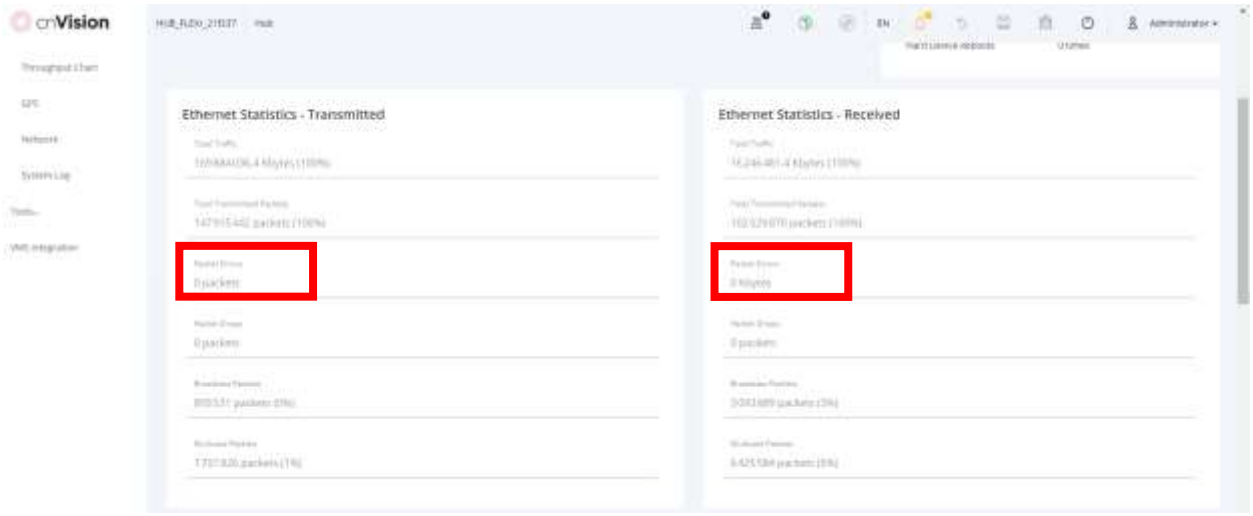


Test Ethernet packet errors reported by managed switch or router

If the device is connected to a managed Ethernet switch or router, it may be possible to monitor the error rate of Ethernet packets. Please refer to the user guide of the managed network equipment. The test has passed if the rate of packet errors reported by the managed Ethernet switch or router is less than 10 in 1 million packets.

The device has lost or does not establish radio connectivity

If there is no wireless activity, follow this:

Procedure:

1. Check that the devices are configured with the same **Frequency Carrier**.
2. Verify the authentication settings on the devices. If **Authentication Type** is set to **WPA2**, verify that the **Pre-shared Key** matches between the Hub and the Client **Preferred Hubs List**.
3. Check that the software at each end of the link is the same version.
4. Check that the desired Hub SSID is configured in the Client **Preferred Hubs List**.
5. Check Tx Power on the devices.

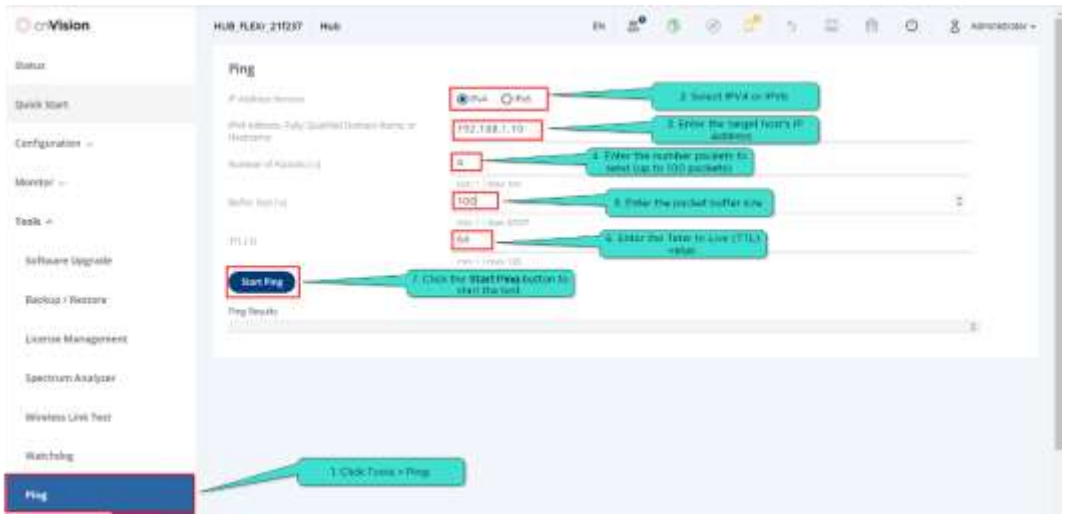
6 Check that the link is not obstructed or misaligned.

7 If there are no faults found in the configuration and there is absolutely no wireless signal, retry the installation procedure.

Using Ping and Traceroute Utilities

Test ping for packet loss

The ping utility uses ICMP packets to check the link quality and packet loss between two network devices. You can ping devices on the network directly from the cnVision device's Web UI > **Tools** > **Ping**.



Attention This procedure disrupts network traffic carried by the device under test.

Procedure:

1. Enter the remote device's IPv4 Address, Fully Qualified Domain Name, or Hostname.
2. Enter the number of packets to send for the ping test (up to 100).
3. Enter the packet buffer size in the Buffer size field (for example, 64).
4. Enter the Time-to-Live value in the TTL field. This value tells the router whether the packet has been in the network too long and should be discarded.
5. Click the Start Ping button to start the test.

   The results are displayed after the test is complete. The test has passed if the number of lost packets is less than 2.

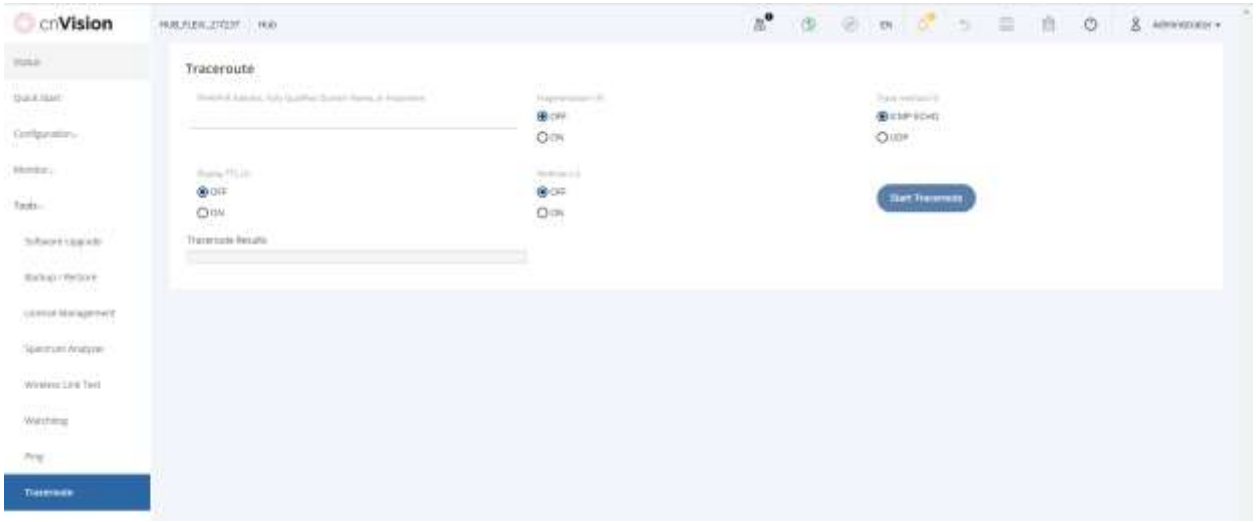
Ping Results

```
PING 10.120.223.31 (10.120.223.31) 64(92) bytes of data.
72 bytes from 10.120.223.31: icmp_req=1 ttl=64 time=0.605 ms
72 bytes from 10.120.223.31: icmp_req=2 ttl=64 time=0.428 ms
72 bytes from 10.120.223.31: icmp_req=3 ttl=64 time=0.484 ms
72 bytes from 10.120.223.31: icmp_req=4 ttl=64 time=0.481 ms

--- 10.120.223.31 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2997ms
rtt min/avg/max/mdev = 0.428/0.499/0.605/0.068 ms
```

Using Traceroute Utility

The Traceroute utility shows the path the ICMP packets take from the device to the destination device you specify. It will list all the routers the packets pass through to reach its destination and any that have failed or been discarded, and how long each hop took.



Procedure:

1. Enter the destination IP Address, Fully Qualified Name, or the hostname in the **IPv4/IPv6 Address, Fully Qualified Domain Name, or Hostname field**.
2. Enable the other options if needed.
3. Click the  button to start the test.
4. The results are displayed after the test is complete.

Traceroute Results

```
traceroute to 10.120.223.22 (10.120.223.22), 30 hops max, 38 byte packet
 1  10.120.223.22  3.503 ms  3.495 ms  4.134 ms
```

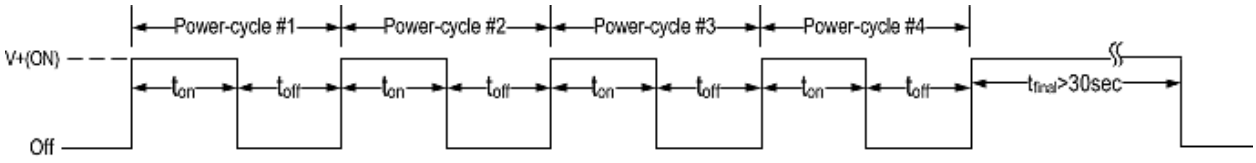
Resetting cnVision Devices to factory defaults

Operators may reset a cnVision radio to the default factory configuration by a sequence of power cycling (removing and re-applying power to the device). This procedure allows operators to perform a factory default reset without a tower climb or additional tools.

Procedure:

1. Remove the Ethernet cable from PoE jack of the power supply for at least 10 seconds.
2. Reconnect the Ethernet cable to re-supply power to the cnVision device for **3-5 seconds** and disconnect cable to power off the cnVision device for **3-5 seconds**. (1st power cycle)
3. Reconnect the Ethernet cable to re-supply power to the cnVision device for **3-5 seconds** and disconnect cable to power off the cnVision device for **3-5 seconds**. (2nd power cycle)
4. Reconnect the Ethernet cable to re-supply power to the cnVision device for **3-5 seconds** and disconnect cable to power off the cnVision device for **3-5 seconds**. (3rd power cycle)
5. Reconnect the Ethernet cable to re-supply power to the cnVision device for **3-5 seconds** and disconnect cable to power off the cnVision device for **3-5 seconds**. (4th power cycle)
6. Reconnect the Ethernet cable to re-supply power to the cnVision device for at least **30 seconds** and allow it to go through the boot-up procedure (Note: Device will go through an additional reset automatically). This will reset the current configuration files to factory default configuration (e.g. IP addresses, Device mode, RF configuration etc.). The device can be pinged from a PC to check if boot up is complete (Successful ping replies indicates boot-up is complete).
7. Access the cnVision device using the default IP address of 192.168.0.1 (Hub) or 192.168.0.2 (Client).

Power cycle timings



Where:	Is:
V+(ON)	Power through PoE has been applied to the device
Off	Power through PoE has been removed from the device
t_{on}	Time duration for which the device has been powered on. This should be 3-5 seconds.
t_{off}	Time duration for which the device has been powered off. This should be 3-5 seconds.

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- Limit of liability
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ubi-utils

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 */

/*
 * An utility to create UBI volumes.
 *
 * Authors: Artem Bityutskiy <dedekind@infradead.org>
 *          Frank Haverkamp <haver@vnet.ibm.com>
 */
```

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  The data format used by the zlib library is described by RFCs
(Request for
  Comments) 1950 to 1952 in the files http://tools.ietf.org/html/rfc1950
  (zlib format), rfc1951 (deflate format) and rfc1952 (gzip format).
*/
```

Hardware warranty

Cambium's standard hardware warranty is for one (3) years from date of shipment from Cambium Networks or a Cambium Point-To-Multipoint Distributor. Cambium Networks warrants that hardware will conform to the relevant published specifications and will be free from material defects in material and workmanship under normal use and service. Cambium Networks shall within this time, at its own option, either repair or replace the defective product within thirty (30) days of receipt of the defective product. Repaired or replaced product will be subject to the original warranty period but not less than thirty (30) days.

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IN NO EVENT SHALL CAMBIUM NETWORKS BE LIABLE TO YOU OR ANY OTHER PARTY FOR ANY DIRECT, INDIRECT, GENERAL, SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY OR OTHER DAMAGE ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION OR ANY OTHER PECUNIARY LOSS, OR FROM ANY BREACH OF WARRANTY, EVEN IF CAMBIUM NETWORKS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you.) IN NO CASE SHALL CAMBIUM'S LIABILITY EXCEED THE AMOUNT YOU PAID FOR THE PRODUCT.

System threshold, output power and link loss

For up-to-date data, please refer to:

- LINKPlanner

Compliance with safety standards

This section lists the safety specifications against which the cnVision has been tested and certified. It also describes how to keep RF exposure within safe limits.

Electrical safety compliance

The cnVision hardware has been tested for compliance to the electrical safety specifications listed in Table 62.

Table 13 cnVision safety compliance specifications

Region	Standard
USA	UL 60950-1, 2nd Edition
Canada	CSA C22.2 No.60950 2nd Edition
International	International CB certified and certified to IEC 60950-1:2005 (modified) plus EN60950-1:2006 + A1:2010

Electromagnetic compatibility (EMC) compliance

The cnVision complies with European EMC Specification EN301 489-1 with testing carried out to the detailed requirements of EN301 489-4.

The EMC specification type approvals that have been granted for cnVision are listed under Table 63.

Table 14 EMC emissions compliance

Region	Specification (Type Approvals)
USA	FCC CFR 47 Part 15 class B
Canada	RSS210, Issue 8 RSS247, Issue 1 (May 2015)
Europe	ETSI EN301 489-4

Human exposure to radio frequency energy

Standards

Relevant standards (USA and EC) applicable when working with RF equipment are:

- ANSI IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations.
- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004* on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).
- US FCC limits for the general population. See the FCC web site http://www.fcc.gov and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65.
- Health Canada limits for the general population. See the Health Canada web site http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/99ehd-dhm237/limits-limites_e.html and Safety Code 6.
- EN 50383:2016 Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base Clients and fixed terminal Clients for wireless telecommunication systems (110 MHz - 40 GHz).
- BS EN 50385:2017 Product standard to demonstrate the compliances of radio base Clients and fixed terminal Clients for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110 MHz – 40 GHz) – general public.
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site http://www.icnirp.de/ and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

Power density exposure limit

Install the radios for the cnVision family of PMP wireless solutions so as to provide and maintain the minimum separation distances from all persons.

The applicable power density exposure limit from the standards (see Human exposure to radio frequency energy on page 242) is:

- 10 W/m² for RF energy in the 5 GHz frequency band.

Calculation of power density

Peak power density in the far field of a radio frequency point source is calculated as follows:

Note The following calculation is based on the ANSI IEEE C95.1-1991 method, as that provides a worst case analysis. Details of the assessment to EN50383:2002 can be provided, if required.

$$S = \frac{P.G}{4\pi d^2}$$

Where:	Is:
S	power density in W/m²
P	maximum average transmit power capability of the radio, in W
G	total Tx gain as a factor, converted f dB
d	distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{\frac{P.G}{4\pi.S}}$$

Calculated distances and power compliance margins

The calculated minimum separation distances, recommended distances and resulting margins for each frequency band and antenna combination is shown in the tables below. These are conservative distances that include compliance margins. At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

Explanation of terms used:

Tx burst – maximum average transmit power in burst (Watt)

P – maximum average transmit power capability of the radio (Watt)

G – total transmit gain as a factor, converted from dB

S – power density (W/m²)

d – minimum distance from point source (meters)

R – recommended distances (meters)

Table 64 through Table 69 below list the power compliance margins for the following cnVision HUB FLEXr Hub devices:

Part Number	FCC ID	Industry Canada
C058910A102A C050910A104A	Z8H89FT0024	109W-0024

Table 15 cnVision HUB FLEXr Hub Power compliance margins, 5.1 GHz, FCC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)
AP	20 MHz	Sector, 18 dBi	0.031	63	10	0.12	0.3
AP	80 MHz	Sector, 18 dBi	0.018	63	10	0.09	0.1

Table 16 cnVision HUB FLEXr Hub Power compliance margins, 5.8 GHz, FCC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)
AP	20 MHz	Sector, 18 dBi	0.062	63	10	0.18	0.3
AP	80 MHz	Sector, 18 dBi	0.017	63	10	0.09	0.1

Table 17 cnVision HUB FLEXr Hub Power compliance margins, 5.8 GHz, ISEDC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)	S @ 20 cm (W/m²)
AP	20 MHz	Sector, 18 dBi	0.062	63	9.69	0.18	0.3	7.72
AP	80 MHz	Sector, 18 dBi	0.017	63	9.69	0.10	0.3	2.20

Note Gain of antenna in dBi = 10*log (G).

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

At EU 5.8 GHz the products are generally limited to a fixed EIRP which can be achieved with the Integrated Antenna. The calculations above assume that the maximum EIRP allowed by the regulations is being transmitted.

Table 18 cnVision HUB FLEXr Hub Power compliance margins, 5.8 GHz (EIRP 36 dBm)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)
AP	20 MHz	Sector, 18 dBi	0.063	63	10	0.18	0.3
AP	80 MHz	Sector, 18 dBi	0.063	63	10	0.18	0.3

Note If there are no EIRP limits in the country of installation, use the distance calculations in Table 68 and Table 69.

Table 19 cnVision HUB FLEXr Hub Power compliance margins, 5.1 GHz (full Tx power)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)
AP	20 MHz	Sector, 18 dBi	1.585	63	10	1.41	2.0
AP	80 MHz	Sector, 18 dBi	1.585	63	10	1.41	2.0

Table 20 cnVision HUB FLEXr Hub Power compliance margins, 5.8 GHz (full Tx power)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)

AP	20 MHz	Sector, 18 dBi	1.585	63	10	1.41	2.0
AP	80 MHz	Sector, 18 dBi	1.585	63	10	1.41	2.0

Table 21 cnVision Client MINI Power compliance margins, 5.1 GHz, FCC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)
PTP SM	20 MHz	Patch Array, 16 dBi	0.021	40	10	0.08	0.1
PTP SM	80 MHz	Patch Array, 16 dBi	0.013	40	10	0.06	0.1
PTP SM	20 MHz	On-board, 2 dBi	0.678	2	10	0.09	0.1
PTP SM	80 MHz	On-board, 2 dBi	0.089	2	10	0.03	0.1

Table 22 cnVision Client MINI Power compliance margins, 5.8 GHz, FCC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)
PTP SM	20 MHz	Patch Array, 16 dBi	0.830	40	10	0.51	0.7
PTP SM	80 MHz	Patch Array, 16 dBi	0.1	40	10	0.18	0.3
PTP SM	20 MHz	On-board, 2 dBi	0.830	2	10	0.11	0.3
PTP SM	80 MHz	On-board, 2 dBi	0.389	2	10	0.07	0.1

Table 23 cnVision Client MINI Power compliance margins, 5.1 GHz, ISEDC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)	S @ 20 cm (W/m^2)
PTP SM	20 MHz	Patch Array, 16 dBi	0.021	40	9.01	0.09	0.1	1.69
PTP SM	80 MHz	Patch Array, 16 dBi	0.013	40	9.01	0.07	0.1	1.02
PTP SM	20 MHz	On-board, 2 dBi	0.678	2	9.01	0.10	0.3	2.14
PTP SM	80 MHz	On-board, 2 dBi	0.089	2	9.01	0.04	0.1	0.28

Table 24 cnVision Client MINI Power compliance margins, 5.8 GHz, ISEDC

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m^2)	d (m)	R (m)	S @ 20 cm (W/m^2)
PTP SM	20 MHz	Patch Array, 16 dBi	0.830	40	9.69	0.18	0.3	65.72
PTP SM	80 MHz	Patch Array, 16 dBi	0.1	40	9.69	0.18	0.3	7.92
PTP SM	20 MHz	On-board, 2 dBi	0.830	2	9.69	0.10	0.2	2.62
PTP SM	80 MHz	On-board, 2 dBi	0.389	2	9.69	0.07	0.1	1.23

Note Gain of antenna in dBi = 10*log (G).

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

At EU 5.8 GHz the products are generally limited to a fixed EIRP which can be achieved with the Integrated Antenna. The calculations above assume that the maximum EIRP allowed by the regulations is being transmitted.

Table 25 cnVision Client MINI Power compliance margins, 5.8 GHz (EIRP 36 dBm)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)
PTP SM	20 MHz	Patch Array, 16 dBi	0.1	40	10	0.18	0.3
PTP SM	80 MHz	Patch Array, 16 dBi	0.1	40	10	0.18	0.3

Note If there are no EIRP limits in the country of installation, use the distance calculations in Table 82 and Table 83.

Table 26 cnVision Client MINI Power compliance margins, 5.1 GHz (full Tx power)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)
PTP SM	20 MHz	Patch Array, 16 dBi	0.794	40	10	0.5	1.0
PTP SM	80 MHz	Patch Array, 16 dBi	0.794	40	10	0.5	1.0

Table 27 cnVision Client MINI Power compliance margins, 5.8 GHz (full Tx power)

Conn Type	Channel Bandwidth	Antenna	P (W)	G	S (W/m²)	d (m)	R (m)
PTP SM	20 MHz	Patch Array, 16 dBi	0.794	40	10	0.5	1.0
PTP SM	80 MHz	Patch Array, 16 dBi	0.794	40	10	0.5	1.0

Compliance with radio regulations

This section describes how the cnVison complies with the radio regulations that are encnVisiond in various countries.

Attention Changes or modifications not expressly approved by Cambium Networks could void the user's authority to operate the system.

Type approvals

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be unlicensed and, in these bands, the system can be used provided it does not cause interference. The system is not guaranteed protection against interference from other products and installations.

The radio specification type approvals that have been granted for cnVision frequency variants are listed under Table 8-1.

Table 28 cnVision Radio certifications

Frequency band	Region	Regulatory approvals
5 GHz	USA	FCC Part 15 Class B
	Canada	IC RSS-210 Issue 8, Annex 8 (or latest)
		IC RSS247 Issue 1 (May 2015)
	Europe	ETSI EN302 502 v1.2.1
		ETSI EN301 893 v1.7.1

FCC and ETSI compliance testing

The system has been tested for compliance to both US (FCC) and European (ETSI) specifications. It has been shown to comply with the limits for emitted spurious radiation for a Class B digital device, pursuant to Part 15 of the FCC Rules in the USA and appropriate European ENs. These limits have been designed to provide reasonable protection against harmful interference. However the equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other radio communications. There is no guarantee that interference will not occur in a particular installation. To comply with FCC RF exposure limits for general population or uncontrolled exposure, the antenna(s) used for the cnVison transmitter must be installed to ensure a separation distance specified in Table 64 through Table 83 from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM Responsibilities to comply with FCC and Industry Canada Regulations

The cnVison Module is certified for integration into products only by OEM integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance specified in Table 64 through Table 83 is maintained between the radiator (antenna) and all persons at all times.

2. The transmitter module must not be co-located or operate in conjunction with any other antenna or transmitter. As long as the two conditions above are met, further transmitter testing is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Note In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID cannot be used.

Note A Class B Digital Device is a device that is marketed for use in a residential environment, notwithstanding use in commercial, business and industrial environments.

Notwithstanding that Cambium Networks has designed (and qualified) the cnVison products to generally meet the Class B requirement to minimize the potential for interference, the cnVison product range is not marketed for use in a residential environment.

End Product Labelling

The cnVison Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

Table 29-2 cnVison Product labeling

Device	Label
cnVision Hub Hub	“Contains Transmitter Module FCC ID: Z8H89FT0024” or “Contains FCC ID: Z8H89FT0024”
cnVision Client MINI	“Contains Transmitter Module FCC ID: Z8H89FT0016” or “Contains FCC ID: Z8H89FT0016”

Notifications

This section contains notifications of compliance with the radio regulations that are encnVisiond in various regions.

5.1 GHz regulatory compliance

The cnVison complies with the regulations that are encnVisiond in the USA, Canada and Europe. The relevant notifications are specified in this section.

5.1 GHz FCC and IC notification

U.S. Federal Communication Commission (FCC) and Industry Canada (IC) Notification.

This device complies with part 15.407 of the US FCC Rules and Regulations and with RSS-210 Issue 8 of Industry Canada. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. In Canada, users must be cautioned to take note that high power radars are allocated as primary users (meaning they have priority) of 5250 – 5350 MHz and 5470 – 5725 MHz and these radars could cause interference and/or damage to license-exempt local area networks (LELAN). To comply with FCC/IC RF exposure limits for general population or uncontrolled exposure, the antenna(s) used for the cnVison transmitter must be installed at a separation distance specified in Table 64 through Table 83.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the US FCC Rules and with RSS-210 of Industry Canada. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

FCC IDs and Industry Canada Certification Numbers are reproduced on the product label (Figure 8-1).

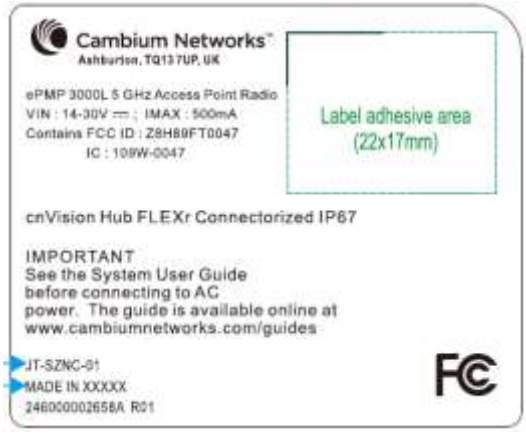
End Product Labelling

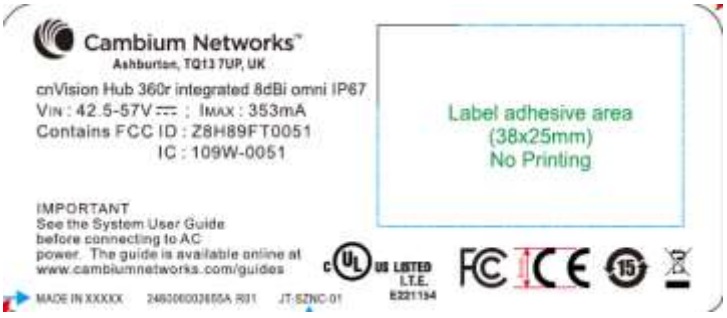
The cnVison Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

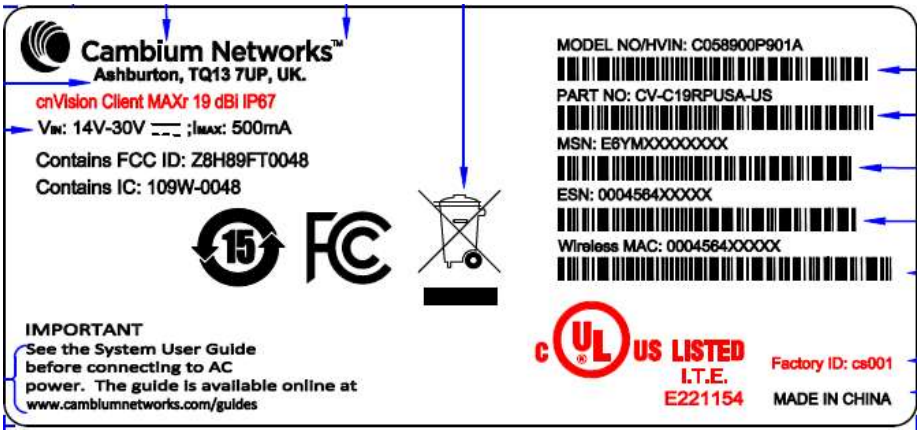
Table 30 Product labeling

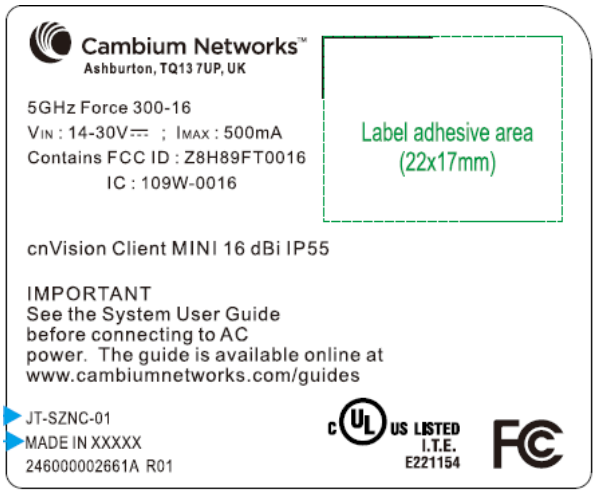
Device	Label
cnVision HUB FLEXr Hub	“Contains Transmitter Module FCC ID: Z8H89FT0047” or “Contains FCC ID: Z8H89FT0047”
cnVision HUB 360r	“Contains Transmitter Module FCC ID: Z8H89FT0051” or “Contains FCC ID: Z8H89FT0051”
cnVision CLIENT MAXr	“Contains Transmitter Module FCC ID: Z8H89FT0048” or “Contains FCC ID: Z8H89FT0048”
cnVision CLIENT MINI	“Contains Transmitter Module FCC ID: Z8H89FT0016” or “Contains FCC ID: Z8H89FT0016”
cnVision CLIENT MICRO	“Contains Transmitter Module FCC ID: Z8H89FT0048” or “Contains FCC ID: Z8H89FT0048”

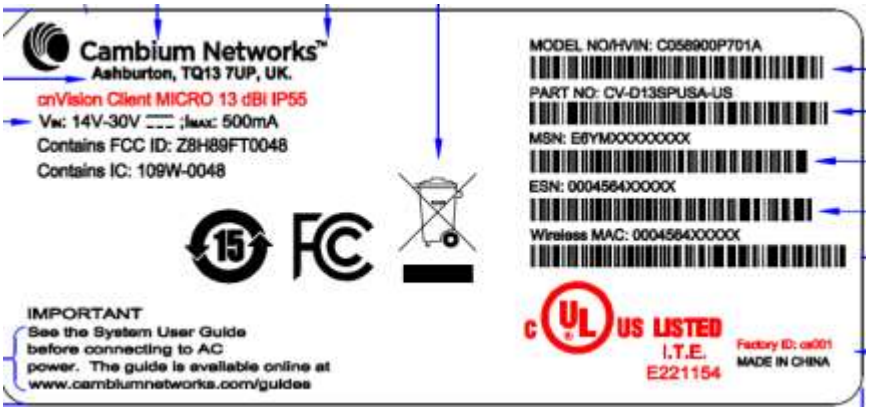
Figure 3 FCC and IC certifications on 5 GHz product labels











Wherever necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply.

5.8 GHz regulatory compliance

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency band in which the system operates is "license exempt" and the system is allowed to be used provided it does not cause interference. The licensing authority does not guaranteed protection against interference from other products and installations.

U.S. Federal Communication Commission (FCC)

This device complies with part 15 of the US FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the US FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to correct the interference by one or more of the following measures:

- Increase the separation between the affected equipment and the unit;
- Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to;
- Consult the dealer and/or experienced radio/TV technician for help.

Industry Canada (IC)

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B conforme á la norme NMB-003 du Canada.

RSS-GEN issue 3 (7.1.3) Licence-Exempt Radio Apparatus:

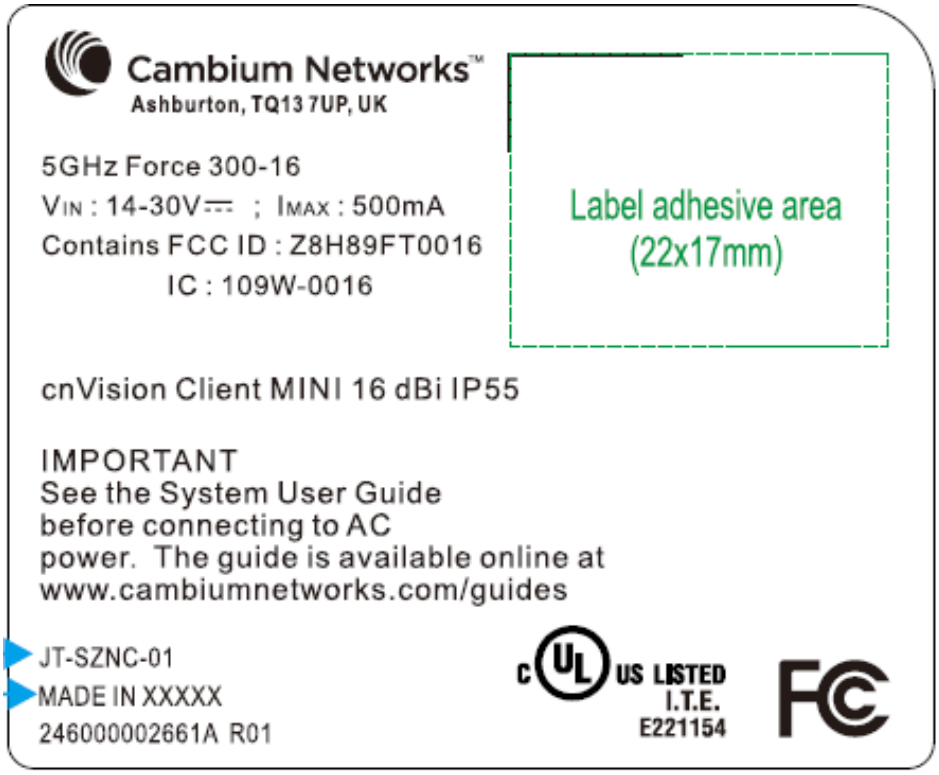
> This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
>
> *Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

In Canada, high power radars are allocated as primary users (meaning they have priority) of the 5650 – 5850 MHz spectrum. These radars could cause interference or damage to license-exempt local area network (LE-LAN) devices.

Product labels

FCC IDs and Industry Canada Certification Numbers are reproduced on the product label (Figure 41).

Figure 4 FCC and IC certifications on 5.8 GHz product label



Wherever necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details on the conditions of use for the bands in question and any exceptions that might apply.

Product Specifications

For up-to-date performance and mechanical specifications for cnVison products, please visit:

https://www.cambiumnetworks.com/cnVision

Glossary

Term	Definition
AES	Advanced Encryption Standard
ANSI	American National Standards Institute
CINR	Carrier to Interference plus Noise Ratio
CMM	Cluster Management Module
DFS	Dynamic Frequency Selection
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
EMD	Electromagnetic Discharge
ETH	Ethernet
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FEC	Forward Error Correction
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
IC	Industry Canada
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LOS	Line of Sight
MIMO	Multiple In Multiple Out
MU-MIMO	Multi-User Multiple In Multiple Out
MTU	Maximum Transmission Unit
nLOS	Near Line of Sight

NTP	Network Time Protocol
OFDM	Orthogonal Frequency Division Multiplexing
PC	Personal Computer
PMP	Point to Multipoint
PTP	Point to Point
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keyed
RF	Radio Frequency
RMA	Return Merchandise Authorization
RSSI	Received Signal Strength Indication
RTTT	Road Transport and Traffic Telematics
RX	Receive
SAR	Standard Absorption Rate
SNMP	Simple Network Management Protocol
SW	Software
TDD	Time Division Duplex
TDWR	Terminal Doppler Weather Radar
TX	Transmit
UNII	Unlicensed National Information Infrastructure
URL	Uniform Resource Locator