ACME Point-To-Point / Wifi Coverage

Project Proposal

Version 0.1.7

Urban Home Solutions
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Dec 2021

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Section 1 – Project Overview

1.1 Purpose of Document

The purpose of this document is to provide a secure, reliable, and cost effective solution for the Acme Corp Infrastructure Project. It details the physical and logical requirements and how to address those in the best manner possible.

1.2 Scope

Scope can be split into two parts; one being the establishment of a wireless point-to-point link between Landmark 3 and Landmark 2 buildings and the other creating a WLAN network at the CAT facility in Landmark 3 on the ground floor. However, the proposed solution was designed in such a way to address potential contingencies as they arise.

Section 2 – Equipment & Installation

2.1 Equipment / Pricing

2.1.1 Two (2) MikroTik mANTBox 52 15s Units (Antenna mounts included)	$456.85
2.1.2 Two (2) WC-44 Outdoor Enclosures	$211.38
2.1.3 Two (2) Pole Mounting Assemblies	$100.93
2.1.4 Two (2) Heavy Duty, High-speed Cat8 Ethernet Cables (150ft outdoor cables)	$165.98
2.1.5 One (1) UniFi EdgeSwitch 16XP	$425.00
2.1.6 One (1) Netgate 3100 MAX pfSense+ Firewall	$442.00
2.1.7 Nine (9) UniFi WiFi 6 Long-Range Access Points *	$1,611.00
TOTAL	**$3,413.14**

Prices are estimated based on current market costs as of Dec 2021 and are subject to change. Only includes hardware costs.

** Additional subcontractor Cat5 cabling charges may added*

Note: URLs and Data Sheets for equipment are referenced in Appendix A

2.2 Installation

2.2.1 Point-to-point Connection – Antenna Mounting Locations: There are two buildings that sit between the target locations. The Ecco supply building is one of them but poses no threat of interference with the point-to-point link as it is only 2 storeys tall, which sits well below the height of the antenna installations. The Landmark 6 building is taller than both Landmark 2 & 3 buildings but doesn't block the line of sight between them. However, Landmark 6 might encroach on the fresnel zone of the link if not properly placed. Therefore the antenna on Landmark 3 should be installed on the roof at the SE corner and the antenna on Landmark 2 should be installed on the roof at the NE corner. (Fig. 1 & 2)

Figure 1

Figure 2

2.2.2 Point-to-point Connection – Landmark 2: To connect services from the electrical room on the 3rd floor to the roof will require a minimum of 37m of Cat8 ethernet cable. A 150ft cable is suggested for this solution to give some extra leway. The pole mount will need to be installed on the NE corner of the roof. The enclosure that is included with the antenna/base station does not have a sufficient rating for the weather conditions experienced year round in Kelowna. Therefore, they should be held in a WC-44 enclosure that is included in this solution. Included with the antenna/base station is one (1) Gigabit PoE injector

cable with shielded connector. If there is no PoE device in the electrical room to connect to the base station then the PoE injector cable can be used in conjuction with a 50ft extension cord to reach a power supply located on the roof. Attach grounding wire to the grounding screw, then attach the other end of the grounding wire to the grounded mast. The antenna must be installed at an downtilt angle of 7.7244° degrees based on calculations below. (Fig. 3)

Downtilt Ang = $\tan^{-1}$ [(Landmark 2 Hgt + Ant. Hgt) - (Landmark 3 Hgt + Ant. Hgt)]/Distance

7.7244° deg = $\tan^{-1}$ [(50m + 2m) - (30m + 2m) / 145.45m]

2.2.3 Point-to-point Connection – Landmark 3: To connect services from the meet-me room on the basement floor to the roof will require a minimum of 35m of Cat8 ethernet cable. A 150ft cable is suggested for this solution to give some extra leway. The pole mount will need to be installed on the SE corner of the roof. It is suggested that one (1) PoE UniFi EdgeSwitch 16XP be installed in the wiring closet of the basement and this will serve as both a power source and data connection for the base station. During installation the base station should be connected to ethernet port 1 on the switch. Attach grounding wire to the grounding screw, then attach the other end of the grounding wire to the grounded mast. The antenna must be installed at an uptilt angle of -7.7244° degrees based on calculations below. (Fig. 3)

Uptilt Ang = $\tan^{-1}$ [(Landmark 3 Hgt + Ant. Hgt) - (Landmark 2 Hgt + Ant. Hgt)]/Distance

-7.7244° deg = $\tan^{-1}$ [(30m + 2m) - (50m + 2m) / 145.45m]

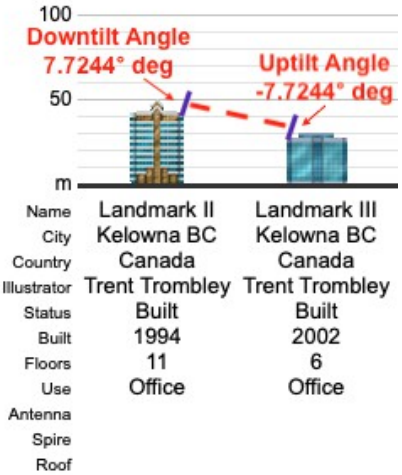


Figure 3

2.2.4 WLAN Network: WiFi coverage is needed on the ground floor of CAT facilities in the Landmark 3 building. Nine (9) UniFi WiFi 6 Long-Range Access Points mounted on the ceiling at the locations depicted in Figure 4 will provide superior coverage of the space. Each access point should be connected to the PoE switch located in the wiring closet with Cat5 cables. The access points should be connected to the switch starting from ethernet port 2 to ethernet port 10. The Netgate firewall device should be located in the wiring closet with the switch and connected to port 16 on the switch, leaving five (5) ports available for future additions if need be. For further discussion of access point configurations and coverage reference Section 3, items 3.2.2 and 3.2.3 of this document.

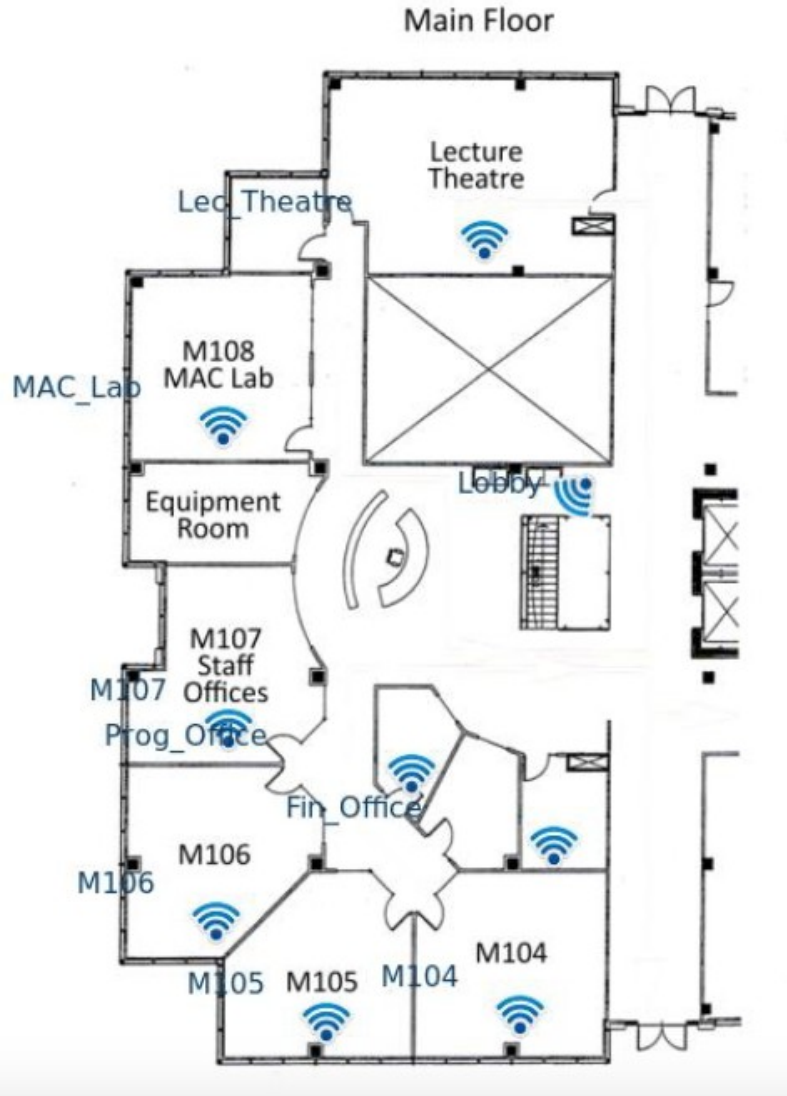


Figure 4

Section 3 – Network Overview

3.1 Network Topology

Proposed Network Design

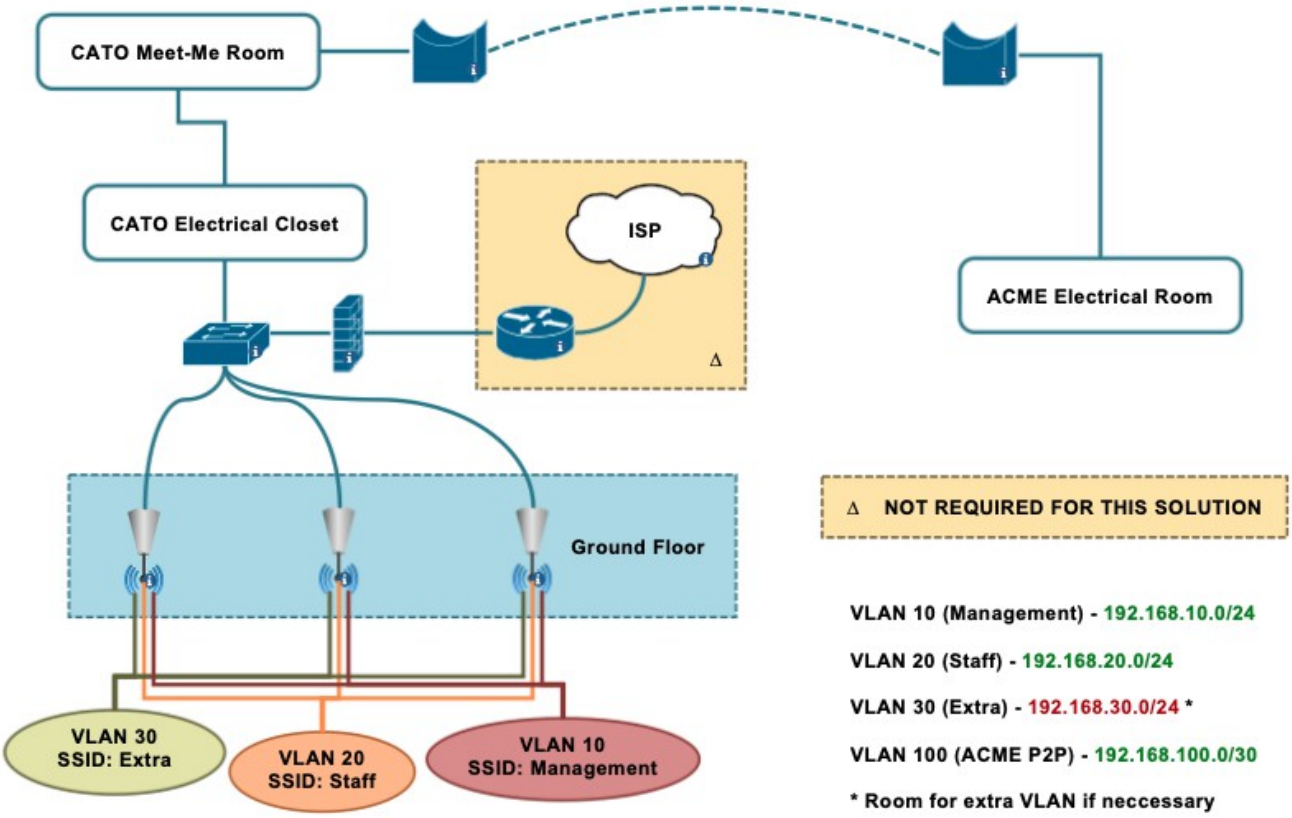


Figure 5

3.2 Proposed Network Configuration

Proposed layer 2 and layer 3 network topology depicted in Figure 5 demonstrates room for possible future contingencies. In the suggested solution, essential elements to be configured are three (3) VLANs with VLAN 10 being used for management, VLAN 20 for ACME staff access, and VLAN 100 for the point-to-point connection. The subnets assigned to these VLANs are detailed in Figure 5. All ports should be configured as trunk ports to allow management and staff VLANs the ability to reach ACME's ISP in Landmark 2 directly. VLAN 100 network addresses should be assigned to an interface on the firewall in Landmark 3 and whatever device is used to manage traffic in Landmark 2. The

Firewall device should be configured to manage/route VLAN traffic. If, in the future, ACME comes into an agreement with CAT to allow CAT staff to use the WLAN network then VLAN 30 can be activated and configured with the subnet provided in Figure 5. If this contigency is used then the Firewall device should be configured to route VLAN 30 traffic through the ACME point-to-point subnet.

3.2.1 Point-To-Point Configuration: The antenna/base station units should be set to auto-modulate to ensure that the highest possible data rates are achieved. In addition, ensuring that the signal is transmitted on 5 Ghz band will result in the fastest, most reliable connection. As per Table 1, as long as the signal received is higher than -72dBm the connection will run at the highest data rates supported by the base units. As referenced in the link budget in Figure 6, the transmit power should be set for 23dBm resulting in a receiving signal of -43.79dBm which is significantly higher than the minimum -72dBm needed. Finally the units should be configured to a dynamic power transmit setting so as to compensate for weather fluctuations that may interfere with the connection.

Link Budget

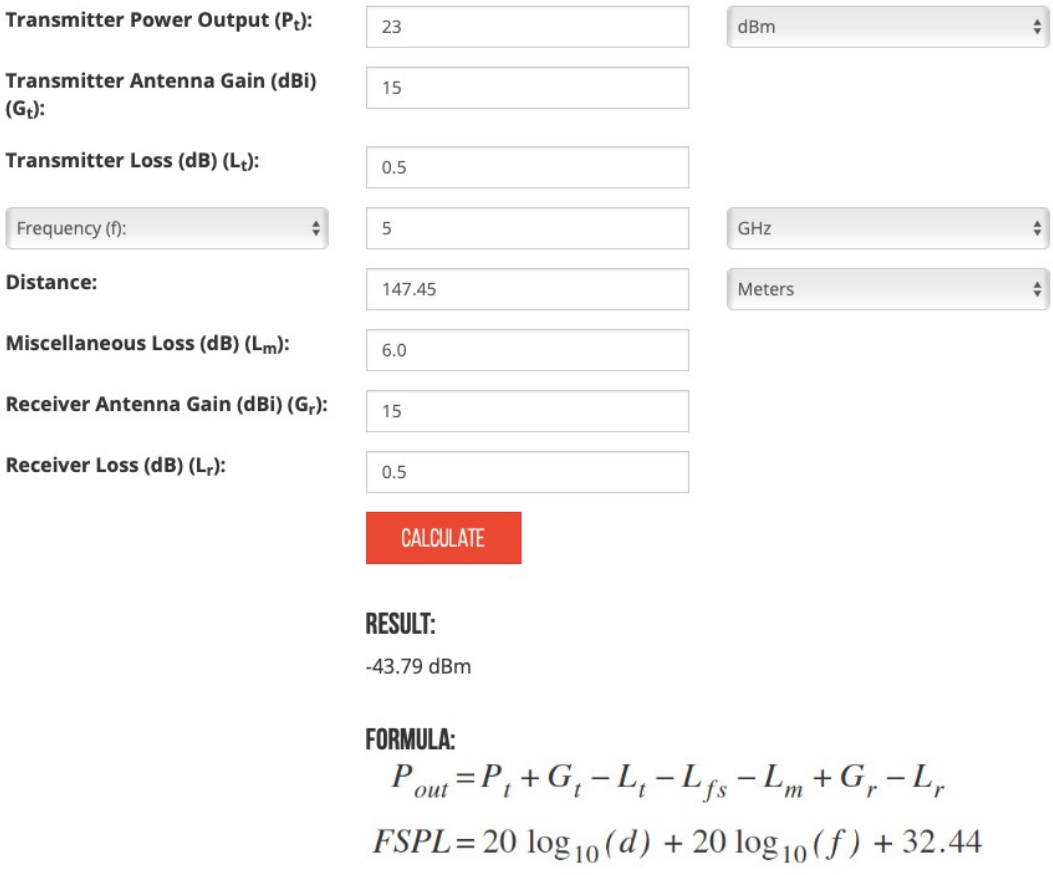


Figure 6

Rate (5 GHz)	Tx (dBm)	Rx (dBm)
6MBit/s	30	-96
54MBit/s	27	-80
MCS0	30	-96
MCS7	26	-75
MCS9	23	-72

Table 1

3.2.2 Access Point Configuration: All access points should be configured so as not to broadcast VLAN 10's network SSID "Management". However, it is advisable for all access points to broadcast VLAN 20's network SSID "Staff" to allow easier access for users trying to connect. All access points should enable automatic channel selection and be set to transmit in both 2.4 Ghz and 5 Ghz bands. Each access point should be configured to transmit at a power of 12dBm for the 2.4Ghz band and 23dBm for the 5Ghz band as shown in Table 2. Transmitting at these proposed levels will ensure all devices on premises will receive no lower than a -50dBm signal. The heat maps in item 3.2.2 illustrate signal strength at a -50dBm threshold. (Fig. 7 & 8)

Access Point Information				
Name	**Model**	**Mounting**	**Band**	**Power (dBm)**
Lec_Theatre	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
MAC_Lab	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
M107	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
M106	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
M105	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
M104	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
Prog_Office	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
Fin_Office	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23
Lobby	Ubiquiti UAP-AC-LR	Ceiling	2.4 Ghz	12
			5 Ghz	23

Table 2

3.2.3 Heat Maps:

2.4 Ghz Band

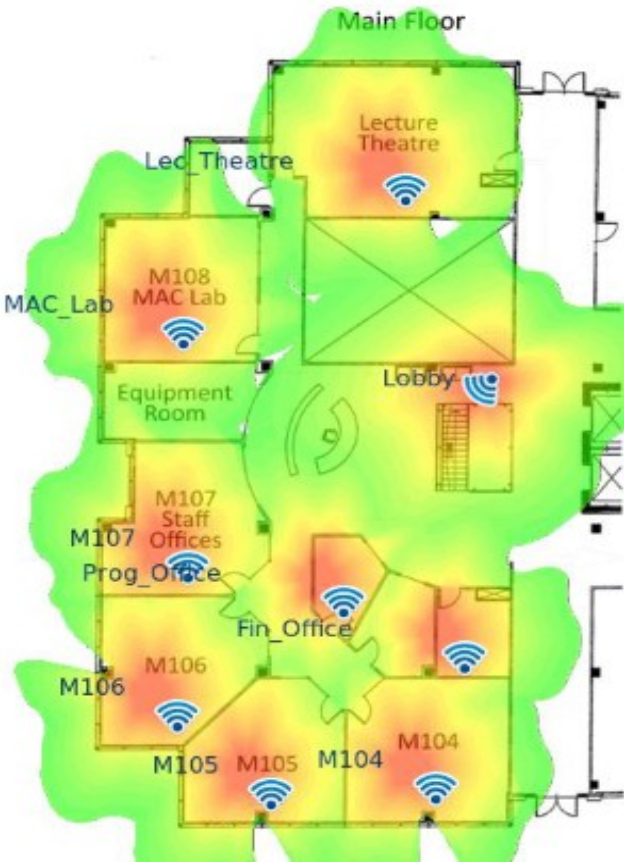


Figure 7

5 Ghz Band

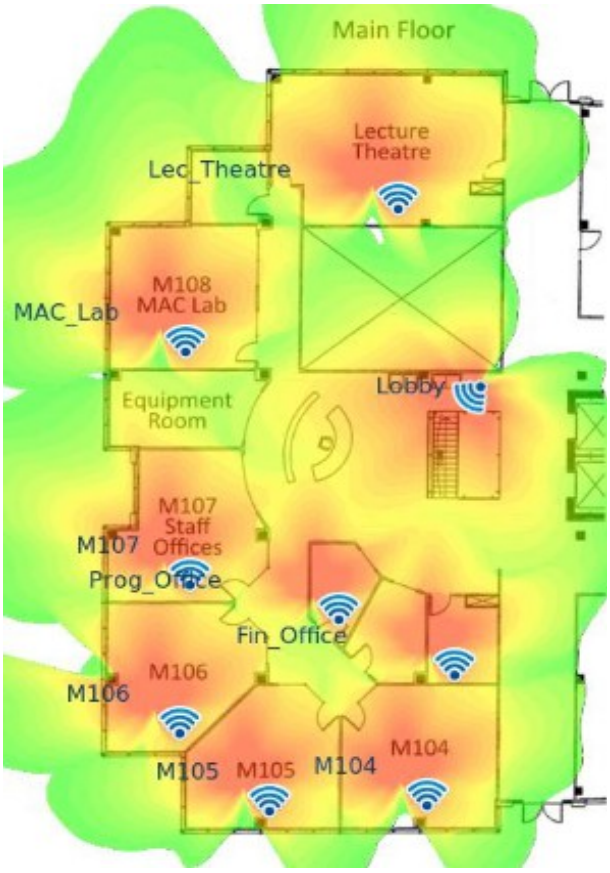


Figure 8

3.2.4 Firewall Configuration: A DHCP server should be configured to assign IP addresses to clients connecting to the access points. It would be recommend to enable the adblocking and website blocking features to protect the users and the network. If the VLAN 30 network is employed then the firewall should be configured to route traffic from VLAN 30 through VLAN 100 to reach services at ACME in Landmark 2. VPN features are available and may be taken advantage. Finally, it is highly recommended to enable/configure the intrusion prevension system (IPS) as this will provide an invaluable layer of security to the network.

3.2.5 Management IP Address Distribution: It is suggested to assign the management devices in this solution the IP addresses shown in Table 3. Table 3 can easily be referenced when there is a need to access a specific device from a web browser.

IP Address Distribution		
Location	**Device**	**IP Address**
Landmark 2	Bridge	192.168.10.150/24
Landmark 3	Bridge	192.168.10.151/24
Landmark 3	Firewall	192.168.10.1/24
Landmark 3	Switch	192.168.10.50/24
Landmark 3	Lec_Theatre Access Point	192.168.10.10/24
Landmark 3	MAC_Lab Access Point	192.168.10.11/24
Landmark 3	Staff_Offices Access Point	192.168.10.12/24
Landmark 3	M106 Access Point	192.168.10.13/24
Landmark 3	M105 Access Point	192.168.10.14/24
Landmark 3	M104 Access Point	192.168.10.15/24
Landmark 3	Prog_Office Access Point	192.168.10.16/24
Landmark 3	Fin_Office Access Point	192.168.10.17/24
Landmark 3	Lobby Access Point	192.168.10.18/24

Table 3

Section 4 – Security

4.1 Proposed Security Configuration

4.1.1 Use longer more complex passwords for wireless networks

4.1.2 Separate management access from general user access by creating a management VLAN

4.1.3 Don't broadcast the SSID for the management VLAN

4.1.4 Enable WPA2 and WPA3 protocols on the network and disable all other security protocols

4.1.5 Only allow the specific MAC addresses of installed access points to connect to network to deter rogue AP attacks

4.1.6 Configure the RF signal strength of access points in such a way that the network can only be reached and connected to inside the immediate premises. (Table 1)

4.1.7 Set access points to isolate clients

4.1.8 Enable automatic security updates for all devices

4.1.9 Enable IPS on the firewall

Appendix A

MikroTik “mANTBox 52 15s
https://mikrotik.com/product/mantbox_52_15s

WC-44 Outdoor Enclosure with Clear Cover
https://www.polycase.com/wc-44

Pole Mounting Assembly
https://wilsonamplifiers.ca/pole-mounting-assembly-for-outdoor-antennas-10-inch-901117/

150ft Cat8 Heavy Duty High-speed Cable
https://www.amazon.ca/Ethernet-Shielded-Lastest-2000Mhz-Weatherproof/dp/B087N2BBF6

UniFi EdgeSwitch 16XP
https://store.ui.com/collections/operator-edgemax-switches/products/es-16xp

Netgate 3100 MAX pfSense+ Security Gateway
https://shop.netgate.com/products/3100-max-pfsense?variant=32156745531507

UniFi Access Point WiFi 6 Long-Range
https://store.ui.com/products/unifi-6-long-range-access-point _pos=20&_sid=883e3e553&_ss=r

mANTBox 52 15s

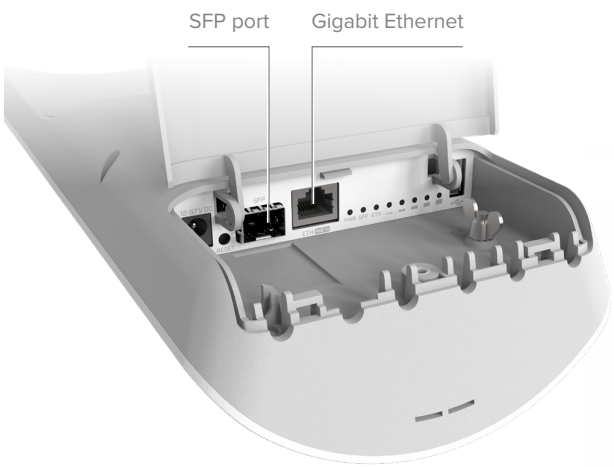
A dual-band 2.4/5 GHz base station with a powerful built-in sector antenna, PoE support, Gigabit Ethernet and SFP.

One powerful package for all your outdoor network needs, perfect for camps, stadiums and parks!

- Strong dual-chain dual-band 2.4/5 GHz Wireless
- Gigabit Ethernet
- SFP for fiber connectivity
- iOS/Android app for quick and easy configuration
- Quad-core CPU
- Powerful built-in dual polarization antenna
- 802.3af/at PoE-in
- Distance up to 20 km
- IPsec hardware offloading
- Extreme versatility with the powerful RouterOS

Are you managing an outdoor wireless network with a variety of access points and CPE devices? Then our brand new mANTBox 52 15s has got you covered – offering powerful built-in antennas, fascinating connectivity options and more!

Creating an efficient point-to-multipoint connection used to be tricky, but not anymore: mANTBox 52 15s works well in any setup. The dual-band wireless capability allows you to use both 2.4 GHz and 5 GHz devices at the same time. There is a Gigabit Ethernet port and an SFP port for fiber connections.

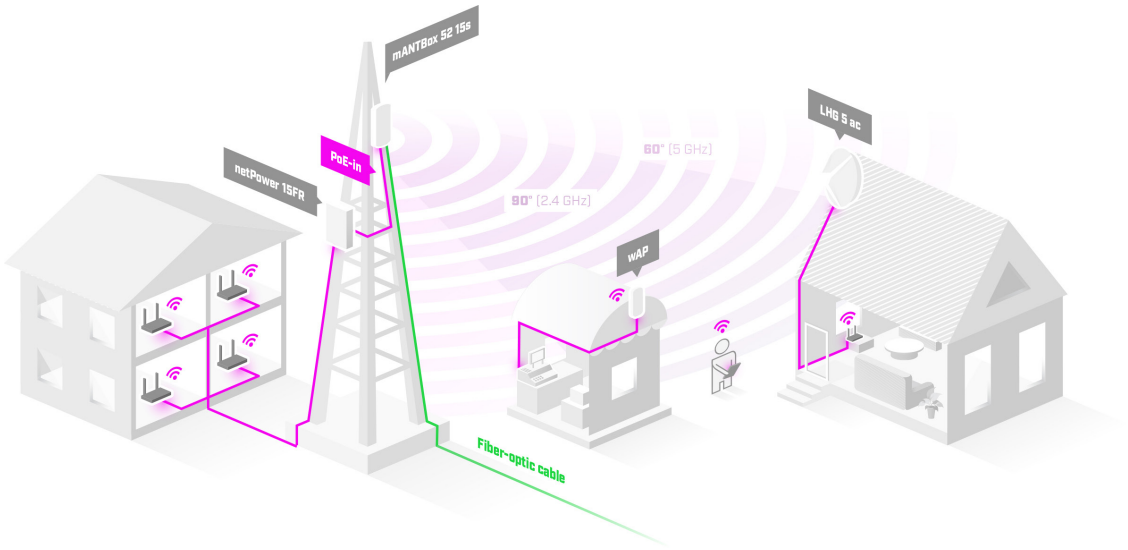


With mANTBox 52 15s you don't have to worry about power options – it supports 802.3af/at PoE-in. There is a Gigabit PoE injector and a standard DC power adapter included.

We have doubled the RAM and added a new quad-core CPU that can handle even the heaviest loads. mANTBox 52 15s can even provide IPsec hardware offloading without trouble. Depending on the rest of your setup, you can reach distance up to 20 km with the built-in dual polarization antenna.

You can't go wrong with the mANTBox 52 15s – it is fast, powerful and easy to use in any P2MP setup!

mANTBox package includes everything you need: a Gigabit PoE injector, a power supply, a hose clamp and a fastening set, and the MikroTik quickMOUNT pro. This advanced wall mount adapter allows turning antenna within 140° both horizontally and vertically. With the quickMOUNT pro it is possible to perfectly set antenna alignment using an integrated graduated scale.



RouterOS – extreme versatility

Run a secure VPN from the office directly to your home, enable parental control, Quality of Service (traffic prioritization for certain needs, such as streaming), specific firewall rules, IPsec hardware acceleration, VLAN, DHCP, e-mail or SMS notifications, and so on. With RouterOS scripting you can automate a lot:

- modify queues based on bandwidth usage;
- complex trigger notifications, such as “Your bandwidth has reached X for Y minutes!”
- backups and setup of additional devices, and so much more!

If you can imagine it – RouterOS can achieve it. You can even install RouterOS on a PC or a virtual machine for even more networking experiments!
We also include a free handy tool for centralized management of all your wireless MikroTik devices – the CAPsMAN. Unlike traditional controller software, CAPsMAN doesn’t require a separate device to run, it can use any existing RouterOS device in your network.
We have been making our own software since 1996. With each new version our priority remained the same: to provide users with the freedom to explore different setups and always have the right tools for the job. Without unnecessary paywalls.

Specifications

Product code	RBD22UGS-5HPacD2HnD-15S
CPU	4 core IPQ-4019 716 MHz
Size of RAM	256 MB
Storage	16 MB flash
Number of 1GbE ports	1
Number of 1G SFP ports	1
Wireless	2.4 GHz 802.11b/g/n dual-chain, 5 GHz 802.11a/n/ac dual-chain
Wireless regulations	Specific frequency range can be limited by country regulations
PCB temparature monitor	Yes
Voltage monitor	Yes
USB port	USB type A
Operating system	RouterOS, License level 4
Antenna gain	12 dBi (2.4 GHz), 15 dBi (5 GHz)
Antenna beam width	90° (2.4 GHz), 60° (5 GHz)
Polarization	Vertical and horizontal
Tested ambient temperature	-40°C to +70°C
Max power consumption without attachments	15 W
Max power consumption	21 W
Dimensions	140 x 348 x 82 mm

Powering

PoE-in	802.3af/at
PoE-in input voltage	12-57 V
Number of DC inputs	2 (PoE-in, DC jack)
DC jack input voltage	12-57 V
Power adapter nominal voltage	48 V
Power adapter nominal current	0.95 A

Certification & Approvals

Certification	CE, FCC, IC, IP

Included parts

48 V 0.95 A power adapter

K-41 fastening set

PoE injector

Hose clamp

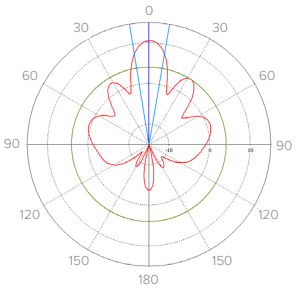
quickMOUNT pro

Wireless specifications

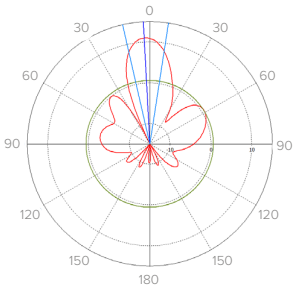
Rate (2.4 GHz)	Tx (dBm)	Rx (dBm)
1MBit/s	30	-100
11MBit/s	30	-94
6MBit/s	30	-96
54MBit/s	27	-80
MCS0	30	-96
MCS7	26	-75

Rate (5 GHz)	Tx (dBm)	Rx (dBm)
6MBit/s	30	-96
54MBit/s	27	-80
MCS0	30	-96
MCS7	26	-75
MCS9	23	-72

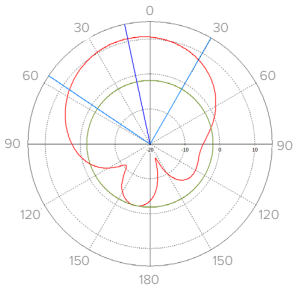
Antenna patterns 2.4 GHz



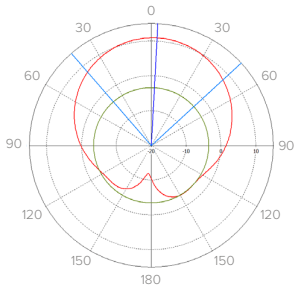
HP elevation



VP elevation

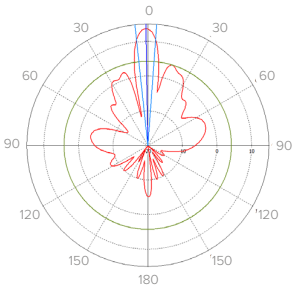


HP azimuth



VP azimuth

Antenna patterns 5 GHz



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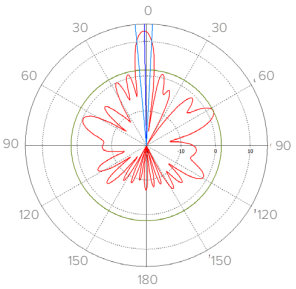

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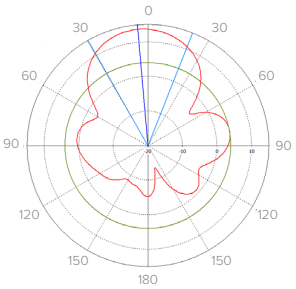
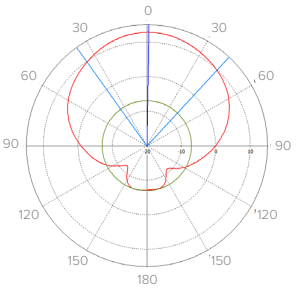
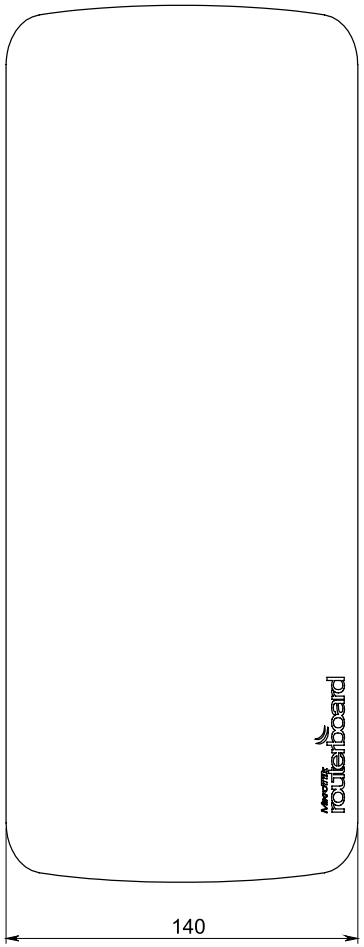
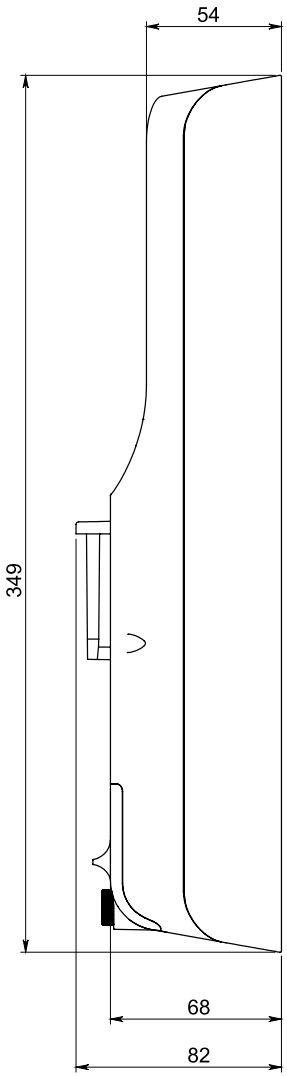


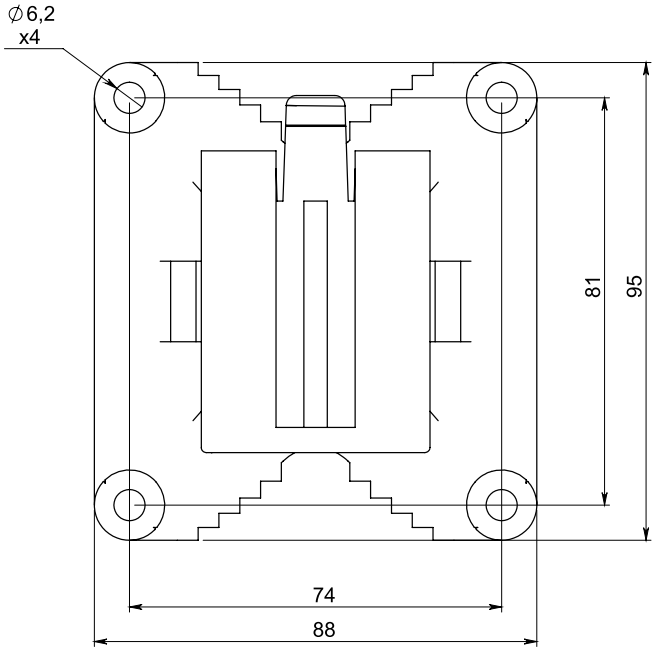
HP azimuth

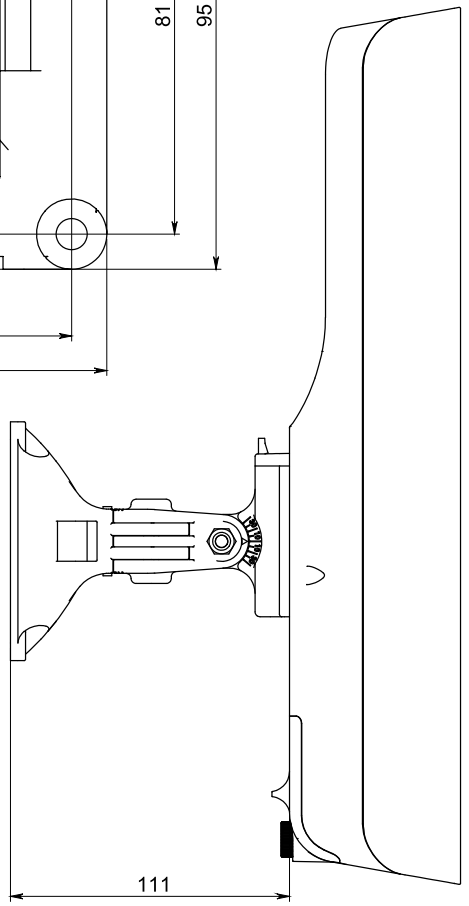


VP azimuth









PRODUCT DIMENSIONS

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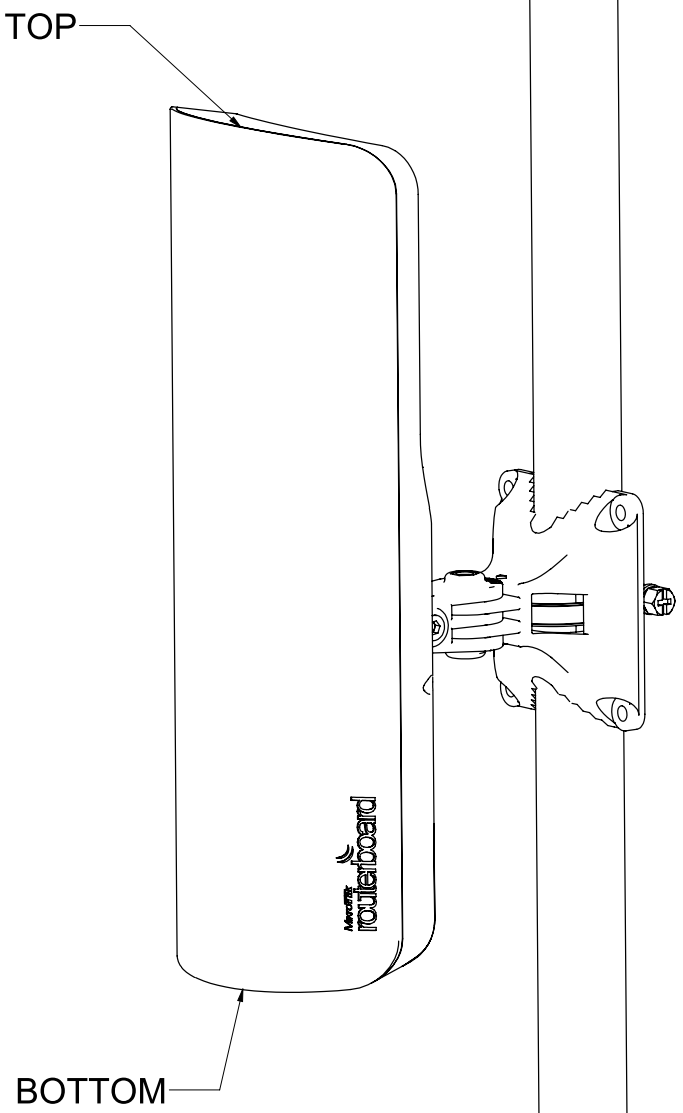
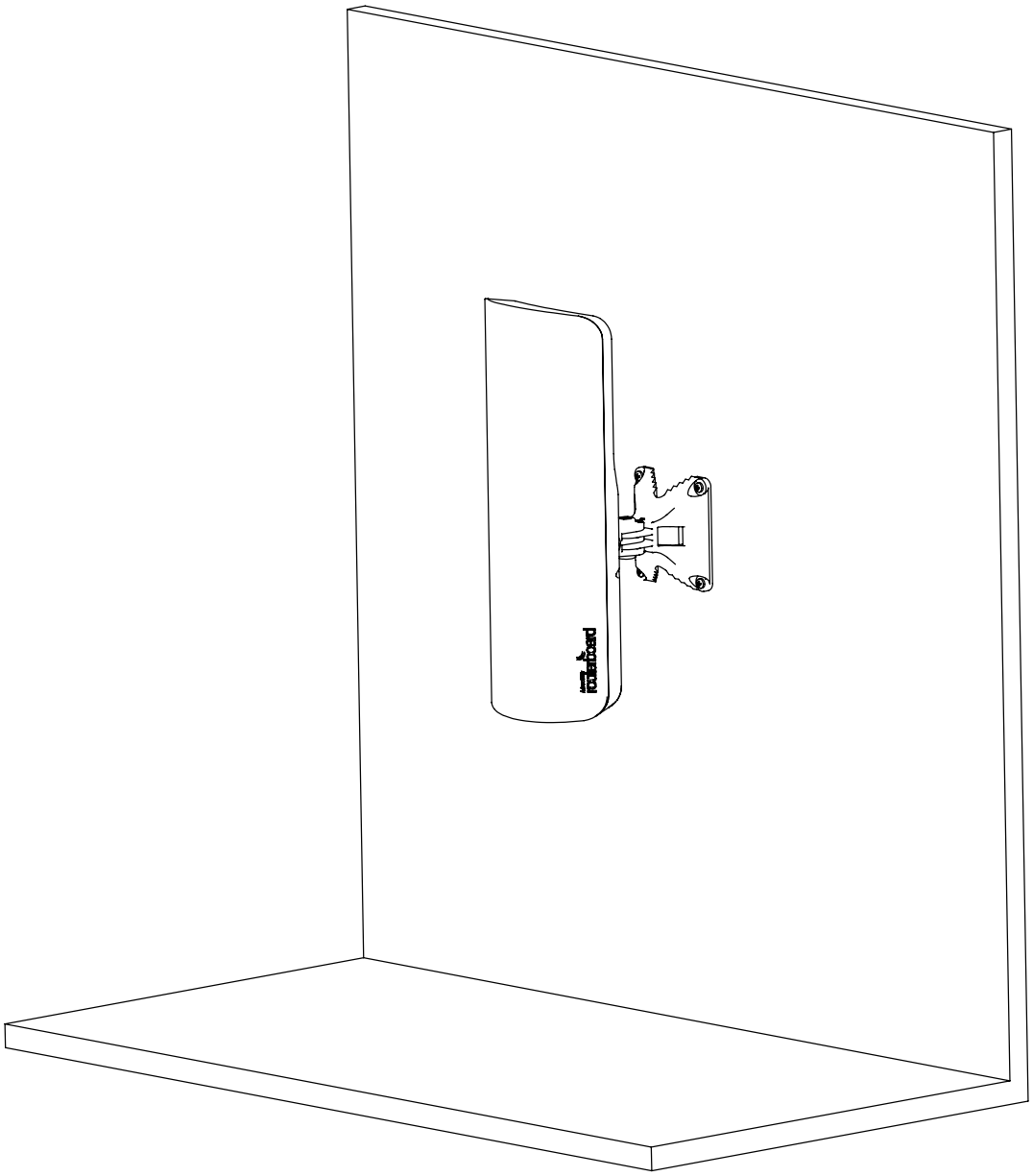




PRODUCT OUTDOOR MOUNTING

MikroTik	mANTBox 2 12s, mANTBox 15s, mANTBox 52 15s	
	DIMENSIONS ARE IN MILLIMETERS	Printed: 09.01.2020

LEXAN* 143R Resin
Polycarbonate
SABIC Innovative Plastics Web | Portal

Product Description
UL rated HB as of 10/97. 200 series recommended when V-2 rating required. Nonhalogenated. 10.5 MFR. UV-stabilized. Internal mold release.

General		
Material Status	• Commercial: Active	
Literature [1]	• Technical Datasheet • Processing - Extrusion Blow Molding (English) • Processing - Lexan (English) • Processing - Injection Molding (English) • Processing - Thermoforming (English)	
Availability	• North America	
Additive	• Mold Release	• UV Stabilizer
Features	• Halogen Free	
Forms	• Pellets	
Processing Method	• Injection Molding	
Multi-Point Data	• Coefficient of Thermal Expansion vs. Temperature (ASTM E831) • Flexural DMA (ASTM D4065) • Pressure-Volume-Temperature (PVT - Zoller Method) • Shear DMA (ASTM D4065) • Tensile Fatigue • Tensile Stress vs. Strain (ASTM D638) • Thermal Conductivity vs. Temperature (ASTM E1530) • Viscosity vs. Shear Rate (ASTM D3835)	

Physical	Nominal Value	Unit	Test Method
Specific Gravity	1.20		ASTM D792
Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)	11	g/10 min	ASTM D1238
Molding Shrinkage - Flow (0.126 in)	0.0050 to 0.0070	in/in	ASTM D955
Water Absorption			ASTM D570
24 hr	0.15	%	
Equilibrium, 73°F	0.35	%	
Equilibrium, 212°F	0.58	%	

Hardness	Nominal Value	Unit	Test Method
Rockwell Hardness			ASTM D785
M-Scale	70		
R-Scale	118		

Mechanical	Nominal Value	Unit	Test Method
Tensile Strength [2]			ASTM D638
Yield	9000	psi	
Break	9500	psi	
Tensile Elongation [2]			ASTM D638
Yield	7.0	%	
Break	110	%	
Flexural Modulus [3] (1.97 in Span)	340000	psi	ASTM D790
Flexural Strength [3] (Yield, 1.97 in Span)	13500	psi	ASTM D790
Taber Abrasion Resistance (1000 Cycles, 1000 g, CS-17 Wheel)	10.0	mg	ASTM D1044

Impact	Nominal Value	Unit	Test Method

Notched Izod Impact (73°F)	15.0	ft·lb/in	ASTM D256
Unnotched Izod Impact (73°F)	60.0	ft·lb/in	ASTM D4812
Gardner Impact (73°F)	1500	in·lb	ASTM D3029
Tensile Impact Strength [4]	260	ft·lb/in²	ASTM D1822
Thermal	**Nominal Value**	**Unit**	**Test Method**
Deflection Temperature Under Load			ASTM D648
66 psi, Unannealed, 0.252 in	280	°F	
264 psi, Unannealed, 0.252 in	270	°F	
Vicat Softening Temperature	310	°F	ASTM D1525 [5]
CLTE - Flow (-40 to 203°F)	0.000038	in/in/°F	ASTM E831
Specific Heat	0.300	Btu/lb/°F	ASTM C351
Thermal Conductivity	1.3	Btu·in/hr/ft²/°F	ASTM C177
Electrical	**Nominal Value**	**Unit**	**Test Method**
Volume Resistivity	> 1.0E+17	ohm·cm	ASTM D257
Dielectric Strength (0.126 in, in Air)	380	V/mil	ASTM D149
Dielectric Constant			ASTM D150
50 Hz	3.17		
60 Hz	3.17		
1E+6 Hz	2.96		
Dissipation Factor			ASTM D150
50 Hz	0.00090		
60 Hz	0.00090		
1E+6 Hz	0.010		
Flammability	**Nominal Value**	**Unit**	**Test Method**
Flame Rating - UL (0.0300 in)	HB		UL 94
Oxygen Index	25	%	ASTM D2863
UL 746	**Nominal Value**	**Unit**	**Test Method**
RTI Str	266	°F	UL 746
RTI Imp	266	°F	UL 746
RTI Elec	266	°F	UL 746
Comparative Tracking Index (CTI) (PLC)	PLC 2		UL 746
High Voltage Arc Tracking Rate (HVTR) (PLC)	PLC 2		UL 746
Hot-wire Ignition (HWI) (PLC)	PLC 4		UL 746
High Amp Arc Ignition (HAI) (PLC)	PLC 1		UL 746
Outdoor Suitability	f1		UL 746C
Optical	**Nominal Value**	**Unit**	**Test Method**
Refractive Index	1.586		ASTM D542
Transmittance	88.0	%	ASTM D1003
Haze	1.0	%	ASTM D1003
Additional Information	**Nominal Value**	**Unit**	**Test Method**
Specific Volume	0.830	cm³/g	ASTM D792
Injection	**Nominal Value**	**Unit**	
Drying Temperature	250	°F	
Drying Time	3.0 to 4.0	hr	
Drying Time, Maximum	48	hr	
Suggested Max Moisture	0.020	%	
Suggested Shot Size	40 to 60	%	
Rear Temperature	423 to 559	°F	
Middle Temperature	540 to 579	°F	
Front Temperature	559 to 601	°F	
Nozzle Temperature	550 to 590	°F	
Processing (Melt) Temp	559 to 601	°F	
Mold Temperature	160 to 199	°F	
Back Pressure	50.0 to 100	psi	
Screw Speed	40 to 70	rpm	

Vent Depth	0.0010 to 0.0030 in

Notes

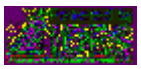
[1] These links provide you with access to supplier literature. We work hard to keep them up to date, however you may find the most current literature from the supplier.

[2] Type I, 2.0 in/min

[3] 0.051 in/min

[4] Type S

[5] Rate B (120°C/h), Loading 2 (50 N)



Revision History
Added to Prospector: November, 1995
Last Updated: 4/8/2008

Component - Plastics **E121562**

SABIC INNOVATIVE PLASTICS US L L C

AMERICAS - RESIN, 1 PLASTICS AVE, PITTSFIELD MA 01201

103(f1), 103R(f1), 143(f1), 143R(f1), ML6622(f1), FXD143(f1), FXD143R (f1), FXD103(f1), FXD103R(f1)

Polycarbonate (PC), "Lexan", furnished as pellets

Color	Min Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
ALL	0.75	HB	-	-	120	120	120
	1.5	HB	4	2	130	125	125
	3.0	HB	4	1	130	130	130

Comparative Tracking Index (CTI): **2**

Dimensional Stability (%): **0**

High-Voltage Arc Tracking Rate (HVTR): **2**

High Volt, Low Current Arc Resis (D495): **-**

Dielectric Strength (kV/mm): **-**

Volume Resistivity (10^x ohm-cm) : **-**

(f1) - Suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and Immersion in accordance with UL 746C.

NOTE - Material designation may be followed by a color nomenclature consisiting of either an alpha/numeric or numeric/alpha combination.

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date:1995-09-29
Last Revised:2003-10-24

Underwriters Laboratories Inc®

IEC and ISO Test Methods

Test Name	Test Method	Units	Thickness Tested (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	0.75	HB75 (ALL)
			1.5	HB75 (ALL)
			3.0	HB40 (ALL)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-2	kJ/m^2	-	-

Underwriters Laboratories Inc®

DATASHEET

EdgeSwitch® XP

Advanced Power over Ethernet Switches

Models: ES-5XP, ES-8-XP, ES-16XP

Gigabit PoE Ports

Intuitive Configuration Interface

Advanced Switch Management Features

UBIQUITI® NETWORKS

EdgeSwitch XP

Advanced Gigabit PoE Managed Switch

Introducing the Advanced Power over Ethernet Switches, EdgeSwitch™ XP from Ubiquiti Networks. EdgeSwitch XP delivers reliable passive PoE and fast 10/100/1000 Mbps connectivity to attached Ubiquiti devices and other devices that support passive PoE.

To connect your PoE devices, simply enable PoE in the easy-to-use EdgeSwitch XP Configuration Interface. Each port can be individually configured to provide PoE, so both PoE and non-PoE devices can be connected.

EdgeSwitch XP is available in multiple versions to meet your deployment needs.

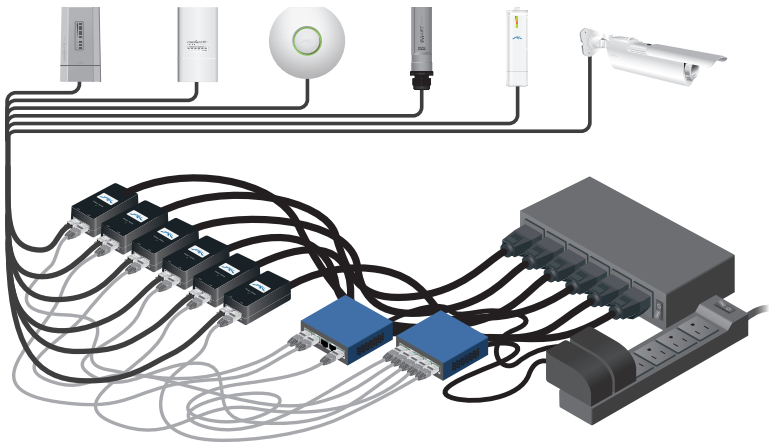
- EdgeSwitch 5XP is a cost-effective, 5-port Gigabit switch with 24V PoE support.
- EdgeSwitch 8XP is an industrial-strength, 8-port Gigabit switch with 150 watts of power capable of powering 24V or 48V devices. Output voltage is controlled by the software.
- EdgeSwitch 16XP features dual EdgeSwitch 8XP systems in a rack-mountable, 1U form factor with 300 watts of power supporting up to 16 devices.

Simplify Your Deployment

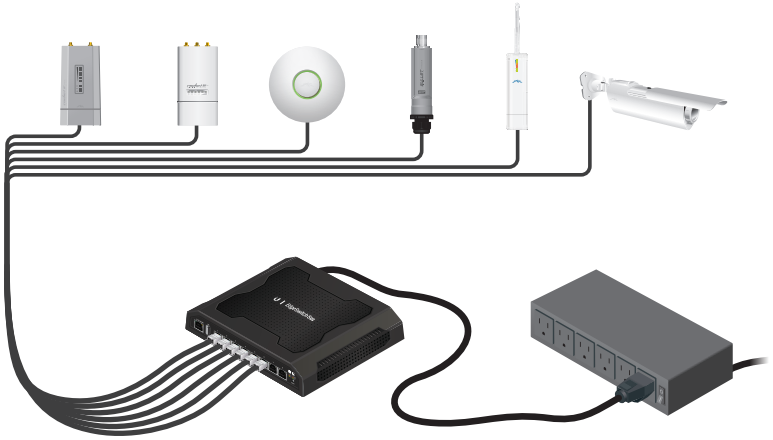
EdgeSwitch XP allows network architects to design cleaner, less cluttered deployments. For example, integrating one EdgeSwitch 8XP can eliminate the need for the following:

- 8 PoE adapters
- 8 power cords
- 8 power outlets
- 8 Ethernet patch cables

EdgeSwitch XP deployments increase efficiency and greatly reduce potential failure points – resulting in faster installations and less maintenance and troubleshooting.



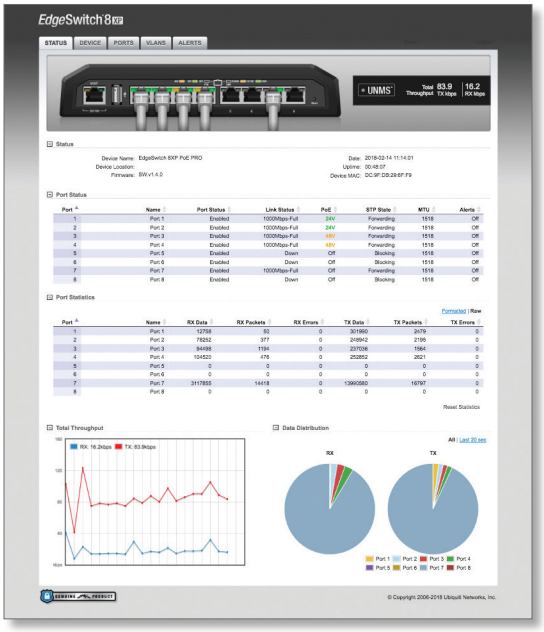
Deployment without EdgeSwitch XP



EdgeSwitch 8XP Deployment

Intuitive Configuration Interface

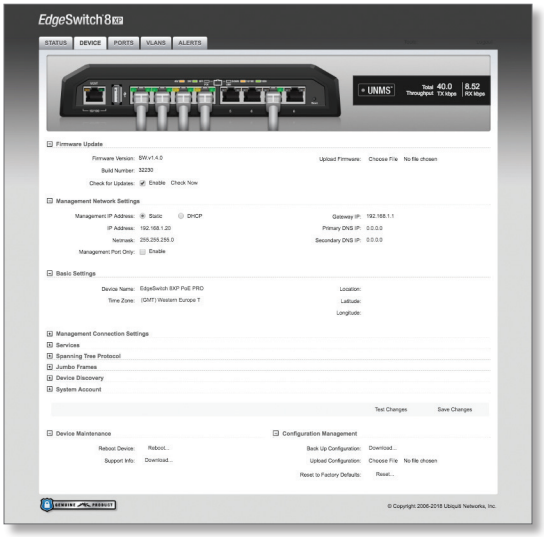
EdgeSwitch XP provides a user-friendly configuration interface designed for efficient setup and control. Accessed via a secured management port and web browser, the EdgeSwitch XP Configuration Interface provides intuitive management with a virtual view of the ports, showing physical connectivity, speed, and PoE status.



Advanced Features

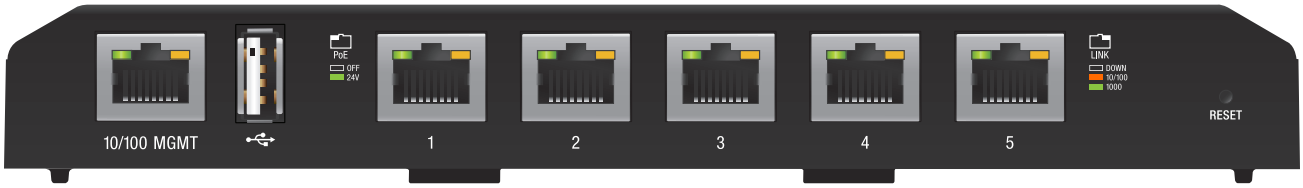
EdgeSwitch XP is loaded with a variety of advanced features, including:

- Port monitoring
- System connection and management services
- Virtual Local Area Network (VLAN) configuration
- Spanning Tree Protocol (STP)/ Rapid Spanning Tree Protocol (RSTP)
- Jumbo Frame Support
- Ping Watchdog
- Configurable alerts



Models

EdgeSwitch 5 XP



Features:

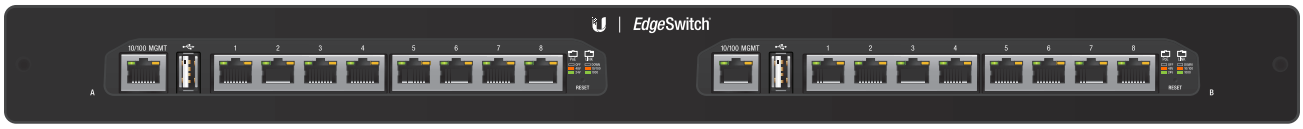
- 5 Gigabit PoE Ports
- 24V Configurable Passive PoE
- EdgeSwitch XP Configuration Interface
- Wall-Mountable

EdgeSwitch 8 XP

Features:

- 8 Gigabit PoE Ports
- 24V/48V Configurable Passive PoE
- 150 W Power
- EdgeSwitch XP Configuration Interface
- Tough Full Metal and Rubber Casing

EdgeSwitch 16 XP



Features:

- 16 Gigabit PoE Ports
- 24V/48V Configurable Passive PoE
- 300 W Power
- EdgeSwitch XP Configuration Interface
- 1U Rack-Mount Form Factor

EdgeSwitch 5XP

Specifications

ES-5XP	
Dimensions	197 x 87.5 x 27.3 mm
Weight	250 g
Power Input	24VDC, 2.5A Power Adapter (Included)
Max. Power Consumption	60 W
PoE Out Voltage Range	22-24VDC
Max. PoE Wattage Per Data Port	11.5 W
ESD Rating	24 kV Air / 24 kV Contact
PoE Method	Passive
Button	Reset
USB Port	2.0 Type A (Reserved for Future Use)
Processor	MIPS 24K, 400 MHz
System Memory	64 MB
Code Storage	8 MB
Certifications	CE, FCC, IC
Wall-Mount	Yes
Operating Temperature	-25 to 55°C (-13 to 131° F)
Operating Humidity	90% Non-Condensing

PoE Configurable Per Port	
Management Port	N/A
Data Ports	Off/24V

LEDs Per Port	
Management Port	Power /Link/Activity
Data Ports	PoE, Speed/Link/Activity

Networking Interfaces	
Management Port	(1) 10/100 Ethernet Port
Data Ports	(5) 10/100/1000 Ethernet Ports

Front Panel

Back Panel

Top View

EdgeSwitch 8 XP

Specifications

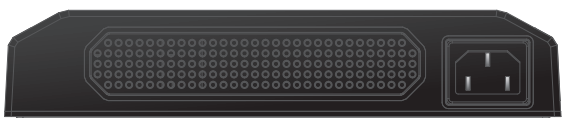
ES-8XP	
Dimensions	210 x 185 x 41 mm
Weight	1.24 kg
Power Input	110-120VAC / 210-230VAC
Max. Power Consumption	150 W
PoE Out Voltage Range	45-48VDC / 22-24VDC
Max. PoE Wattage Per Data Port	11.5 W (24 V), 23 W (48V)
ESD Rating	24 kV Air / 24 kV Contact
PoE Method	Passive
Button	Reset
USB Port	2.0 Type A (Reserved for Future Use)
Processor	MIPS 24K, 400 MHz
System Memory	64 MB
Code Storage	8 MB
Certifications	CE, FCC, IC
Operating Temperature	-25 to 55°C (-13 to 131° F)
Operating Humidity	90% Non-Condensing

PoE Configurable Per Port	
Management Port	N/A
Data Ports	Off/24V/48V

LEDs Per Port	
Management Port	Power/Link/Activity
Data Ports	PoE, Speed/Link/Activity

Networking Interfaces	
Management Port	(1) 10/100 Ethernet Port
Data Ports	(8) 10/100/1000 Ethernet Ports

Front Panel



Back Panel

Top View

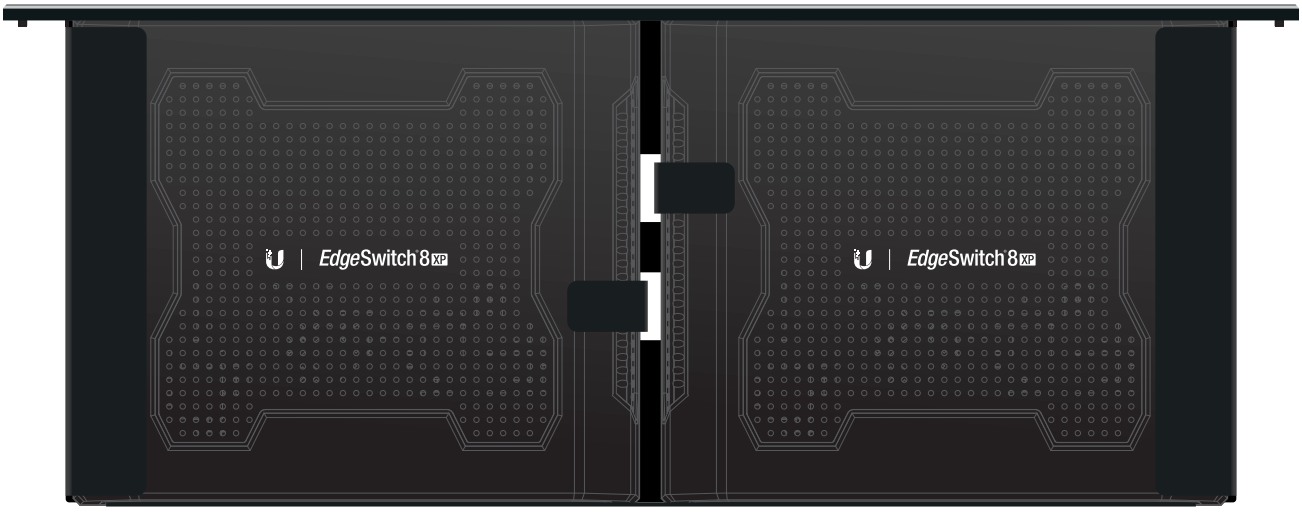
EdgeSwitch 16 XP

Specifications

ES-16XP	
Dimensions	480 x 44.5 x 186 mm
Weight	3.95 kg
Hardware Configuration	(2) EdgeSwitch 8XPs
Mounting	Integrated 1U Rack-Mount

Front Panel

Back Panel



Top View

www.ubnt.com

RR021518

UniFi® 6 Long-Range

Datasheet
U6-LR

UniFi® Network

Access Point WiFi 6 Long-Range

Enterprise-grade WiFi 6 access point with 4X4 MIMO and OFDMA functionality.

The Access Point WiFi 6 Long-range (U6 LR) is a high-performance access point that brings powerful, four-stream WiFi 6 coverage to enterprise networks. The U6 LR can reach an aggregate throughput rate up to 3 Gbps with its 5 GHz (4x4 MU-MIMO and OFDMA) and 2.4 GHz (4x4 MIMO) bands. It also has a sideways, down-tilted antenna pattern to expand its coverage area. The water and dust-resistant U6 LR can be mounted either indoors or outside, blending seamlessly into virtually any environment so you'll never have to disrupt your space's aesthetic to enjoy excellent wireless coverage. The U6 LR simplifies the process of bringing WiFi 6 to enterprise networks that support a large number of clients. It can be set up in minutes and fully managed with the UniFi Network web application or mobile app.

Mechanical

Dimensions	Ø220 x 48 mm (Ø8.66 x 1.89")
Weight	Without mount: 800 g (1.76 lb) With mount: 930 g (2.05 lb)
Enclosure material	Plastic
Mount material	SGCC Steel
Weatherproofing	IP54

Hardware

Management interfaces	Ethernet Bluetooth
Networking interface	(1) GbE RJ45 port
Button	Factory reset
LED	White/Blue
Power method	802.3at PoE+, passive PoE (48V)
Power supply	UniFi PoE switch 48V, 0.5A PoE adapter (not included)
Supported voltage range	44 to 57VDC
Max. power consumption	16.5W
Max. TX power	2.4 GHz: 26 dBm 5 GHz: 26 dBm
MIMO	2.4 GHz: 4 x 4 5 GHz: 4 x 4
Throughput rate	2.4 GHz: 600 Mbps 5 GHz: 2400 Mbps
Antenna gain	2.4 GHz: 4 dBi 5 GHz: 5.5 dBi
Mounting	Wall/ceiling (included)
Operating temperature	-30 to 60° C (-22 to 140° F)
Operating humidity	5 - 95% noncondensing
Certifications	CE, FCC, IC

Software

WiFi standards	802.11a/b/g WiFi 4/WiFi 5/WiFi 6
Wireless security	WPA-PSK, WPA-Enterprise (WPA/WPA2/WPA3)
BSSID	8 per radio
VLAN	802.1Q
Advanced QoS	Per-user rate limiting
Guest traffic isolation	Supported
Concurrent clients	300+

Supported Data Rates

802.11a	6, 9, 12, 18, 24, 36, 48, 54 Mbps
802.11b	1, 2, 5.5, 11 Mbps
802.11g	6, 9, 12, 18, 24, 36, 48, 54 Mbps
802.11n (WiFi 4)	6.5 Mbps to 600 Mbps (MCS0 - MCS31, HT 20/40)
802.11ac (WiFi 5)	6.5 Mbps to 1.7 Gbps (MCS0 - MCS9 NSS1/2/3/4, VHT 20/40/80/160)
802.11ax (WiFi 6)	7.3 Mbps to 2.4 Gbps (MCS0 - MCS11 NSS1/2/3/4, HE 20/40/80/160)