Allied Telesis™

x540L Series

10 Gigabit Stackable Switches

Allied Telesis x540L Series 10 Gigabit Layer 3 stackable switches provide high-speed distribution or edge connectivity. All ports support up to 10G speed enabling seamless communication for modern applications, and Multi-Gigabit support ensures flexible deployment.

AMF PLUS **EPSRing**™

VCStack™ **ACTIVE** FIBER MONITORING™ **Allied**Ware Plus™ OPERATING SYSTEM

Overview

Allied Telesis x540L Series switches provide high performance with up to 10G connectivity on every port. At the distribution layer, the power of Virtual Chassis Stacking (VCStack™) enables a resilient solution where up to 4[1] units, whether copper of fiber models, can be managed as a single virtual device for simplicity and flexibility.

The x540L-28XTm supports Multi-Gigabit (1/2.5/5/10G) copper ports for flexible deployment, while the x540L-28XS has 1/10G SFP fiber ports for secure long distance connectivity.

High-speed for next generation networks

The x540L Series provides both copper and fiber connectivity options at up to 10G. Support next-generation networks, with their increasingly high bandwidth demands for modern applications like remote working and high-definition videoconferencing.

Device and network management

The Device GUI enables graphical monitoring of key switch features to support easy management.

Integrated into the Device GUI, Vista Manager™ mini supports visibility and management of AMF Plus wired and AWC wireless network devices, making it ideal as a one-stop solution for small to medium-sized networks.

AWC is an intelligent, easy to use Wireless LAN controller that automatically maintains optimal wireless coverage. Vista Manager mini includes AWC floor and heat maps showing wireless coverage. It also supports AWC Channel Blanket hybrid operation, providing maximum performance and seamless roaming, as well as AWC Smart Connect for simplified deployment, and a resilient Wi-Fi network solution using wireless uplink connectivity.

[1] Up to 2-units stacking is supported at initial release. 4-units stacking will be supported in a future software release

[2] Supported in a future software release

Resiliency

Converging network services means increasing demand for highly available networks with minimal downtime. VCStack, in conjunction with link aggregation, provides a network with no single point of failure, and provides access application resiliency.

Ethernet Protection Switched Ring (EPSRing™), and the standards-based G.8032 Ethernet Ring Protection, ensure distributed networks have high-speed access to online resources and applications.

Advanced Layer 3 performance

The x540L Series support both static routes and RIP, OSPF and BGP routing protocols. Easily manage Layer 3 environments, and increase routing capability when required with licensing.

Secure

The x530 Series offers powerful control over network traffic types, secure management options, loop guard to protect against cabling mistakes, and tri-authentication for comprehensive access control.

Network protection

Advanced storm protection features include bandwidth limiting, policy-based storm protection and packet storm protection.

Network storms are often caused by cabling errors that result in a network loop. The x540L Series provide features to detect loops as soon as they are created. Loop detection and thrash limiting take immediate action to prevent network storms.

Future-proof

x540L Series switches are Software Defined Networking (SDN) ready and support OpenFlow v1.3.

Powerful network management

Autonomous Management Framework™ Plus (AMF Plus) automates everyday management tasks, as the complete network can be managed as a single virtual device. Growing the network

is plug-and-play simple, and device recovery fully zero-touch.

Cybersecurity

The x540L Series acting as AMF Plus members are compatible with our AMF-Security solution, which enables a self-defending network. The AMF–Sec controller responds immediately to any internal malware threats by instructing the x540L Series to isolate the affected part of the network, and quarantine the suspect device. Vista Manager EX alerts networks administrators of threats that have been dealt with.

Key Features

- ▶ AlliedWare Plus fully featured OS
- ▶ Autonomous Management Framework Plus (AMF Plus)
- ▶ AMF-Security compatible
- ▶ 1/2.5/5/10G (Multi-Gigabit) connectivity on copper ports
- ▶ 1/10G (SFP and SFP+) connectivity on fiber ports
- ▶ VCStack 4 units[1] at any speed
- ▶ EPSR and G.8032 high-speed resilient rings
- ▶ Active Fiber Monitoring
- ▶ Link Monitoring
- ▶ VLAN ACLs
- ▶ Precision Time Protocol (PTP) transparent mode[2]
- ▶ VLAN mirroring (RSPAN)
- ▶ Upstream Forwarding Only (UFO)
- ▶ OpenFlow v1.3 for SDN
- ▶ Static and dynamic routing for L3 environments
- ▶ NETCONF/RESTCONF with YANG data modelling
- ▶ Vista Manager mini enables:
  - » Wired and wireless network visibility
  - » AWC wireless network management
  - » AWC-Channel Blanket hybrid wireless
  - » AWC-Smart Connect wireless uplinks

Key Features

Vista Manager mini

▶ Integrated into the Device GUI, Vista Manager mini provides full network visibility of AMF Plus wired and AWC wireless devices. Manage and simplify wireless deployment with AWC-Smart Connect, and support optimal wireless performance from AWC hybrid operation with maximum throughput and a seamless Wi-Fi user experience.

Allied Telesis Autonomous Management Framework™ Plus (AMF Plus)

▶ AMF Plus is a sophisticated suite of management tools that provide a simplified approach to network administration.

▶ The x540L Series can operate as the AMF Plus master, storing firmware and configuration backups for other network nodes. The AMF Plus master enables auto-backup and auto-recovery for zero-touch device replacement, while auto-provisioning and auto-upgrade provide appropriate files to new network members. New network devices can be pre-provisioned, making installation plug-and-play easy because no onsite configuration is required.

▶ An AMF Plus license provides all standard AMF network management and automation features, and also enables the AMF Plus intent-based networking features menu in Vista Manager EX (from version 3.10.1 onwards).

AWC Wireless Management

▶ Optimize wireless network performance with the Autonomous Wave Controller (AWC), built-in to the x540L Series. AWC analyzes wireless traffic patterns and automatically reconfigures access points to meet demand.

▶ Wireless network operation in multi-channel, single-channel (Channel Blanket), and hybrid (multi-channel and Channel Blanket) modes, supports maximum data throughput and seamless roaming for the most flexible wireless solution available.

▶ AWC-Smart Connect (AWC-SC) enables plug-and-play wireless network growth, as new APs only need a power connection, and will then automatically create resilient wireless uplink connections to other APs.

High Speed

▶ The x540L Series supports Multi-Gigabit (1/2.5/5/10G) speeds on copper and SFP and SFP+ (1/10G) speeds on fiber, for flexible high-density high-speed distribution or edge connectivity in next-generation networks.

Virtual Chassis Stacking (VCStack™)

▶ Create a VCStack of up to four units[1] with 40Gbps stacking bandwidth to each unit, which has dual links for increased resiliency. VCStack provides a highly available system where network resources are spread out across stacked units, reducing the impact if one of the units fails. Aggregating switch ports on different units across the stack provides excellent network resiliency.

Ethernet Protection Switched Ring (EPSRing™)

▶ EPSRing allows several x540L switches to join a protected ring capable of recovery within as little as 50ms. This feature is perfect for high availability in enterprise networks.

G.8032 Ethernet Ring Protection

▶ G.8032 provides standards-based high-speed ring protection, that can be deployed stand-alone, or interoperate with Allied Telesis EPSR.

▶ Ethernet Connectivity Fault Monitoring (CFM) proactively monitors links and VLANs, and provides alerts when a fault is detected.

Advanced Layer 3 routing

▶ The x540L Series support both static routes and RIP, OSPF and BGP. Increased routing capacity can be added with the premium software license.

Access Control Lists (ACLs)

▶ ACLs filter network traffic to control whether routed packets are forwarded or blocked, and can be applied to a specific port or a VLAN. This provides a powerful network security mechanism to select the types of traffic to be analyzed, forwarded, or influenced in some way

NETCONF/RESTCONF

▶ NETCONF/RESTCONF with YANG data modeling provides a standardized way to represent data and securely configure devices.

Storm protection

Protect the network from broadcast storms::

▶ Bandwidth limiting minimizes the effects of the storm by reducing the amount of flooding traffic.

▶ Policy-based storm protection is more powerful than bandwidth limiting. It restricts storm damage to within the storming VLAN, with a defined traffic rate. The action the device should take when it detects a storm can be configured, such as disabling or shutting down the port..

Loop protection

▶ Thrash limiting, also known as Rapid MAC movement, detects and resolves network loops. It is highly user-configurable — from the rate of looping traffic to the type of action the switch should take when it detects a loop.

sFlow

▶ sFlow is an industry-standard technology for monitoring high-speed switched networks. It provides complete visibility into network use, enabling performance optimization, usage accounting/billing, and defense against security threats. Sampled packets sent to a collector (up to 5 collectors can be configured) ensure a real-time view of network traffic.

Tri-authentication

▶ Authentication options include 802.1x port authentication, web authentication for guest access, and MAC authentication for end points without an 802.1x supplicant. All three can be used simultaneously.

Upstream Forwarding Only (UFO)

▶ UFO lets you manage which ports in a VLAN can communicate with each other, and which only have upstream access to services, for secure multi-user deployment.

TACACS+ Command Authorization

▶ TACACS+ Command Authorization offers centralized control over which commands may be issued by each specific AlliedWare Plus device user. It complements authentication and accounting services for an AAA solution.

UniDirectional Link Detection

▶ UniDirectional Link Detection (UDLD) is useful for monitoring fiber-optic links between two switches that use two single-direction fibers to transmit and receive packets. UDLD prevents traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails.

Optical DDM

▶ Most SFP/SFP+/XFPs support Digital Diagnostics Monitoring (DDM) functions, which enables real time monitoring of transceiver parameters, such as optical output power, temperature, laser bias current and supply voltage. This simplifies diagnosing problems with optical modules and fiber connections.

Active Fiber Monitoring

▶ Active Fiber Monitoring prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent.

VLAN Mirroring (RSPAN)

▶ VLAN mirroring allows traffic from a port on a remote switch to be analyzed locally. Traffic being transmitted or received on the port is duplicated and sent across the network on a special VLAN.

Find Me

▶ In busy server rooms it can be quite a job finding the correct switch quickly. "Find Me" is a simple visual way to identify the switch by causing its LEDs to flash in a specified pattern.

Precision Time Protocol (PTP)[2]

▶ PTP (IEEE 1588v2) sychronizes clocks throughout the network with micro-second accuracy, supporting industrial automation and control systems.

Link Monitoring (Linkmon)

▶ Linkmon enables network health monitoring by regularly sending probes over key links to gather metrics comprising latency, jitter, and probe loss. This supports pro-active network management, and can also be used with triggers to automate a change to device or network configuration in response to the declining health of a monitored link.

Virtual Routing and Forwarding (VRF-Lite)

▶ VRF-Lite provides Layer 3 network virtualization by dividing a single switch into multiple independent virtual routing domains. With independent routing domains, IP addresses can overlap without causing conflict, allowing multiple customers to have their own secure virtual network within the same physical infrastructure. VRF-Lite supports IPv4 and IPv6 unicast and multicast traffic.

▶ The built-in DHCP Server on the x540L Series is VRF aware, enabling the supply of IP addresses to clients across multiple isolated networks.

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[2] Supported in a future software release

Key Solutions

Flexible edge connectivity

Modern networks require superior performance to support the latest high-bandwidth applications, as well as the increasing number of wireless devices accessing online business resources. A high-speed resilient EPSR ring ensures always-on connectivity.

As shown in diagram 1, the x540L Series supports multi-gigabit speeds of 2.5 and 5G, which are ideal for high-speed wireless, while 10G supports high performance server connectivity.

High performing network distribution

As shown in diagram 2, the x540L Series is provides up to 10G connectivity on every port for high performance. VCStack enables deploying a single virtual unit comprised of up to 4 physical copper and/or fiber switches for a fully resilient network distribution layer solution.

When combined with other advanced Allied Telesis products, such as x250/x240/x230 series edge switches, and the SBx908 GEN2 and x950 core switches, networks with high-capacity right to the edge can be deployed.

AMF Plus network management and automation provides an easy yet powerful solution. Simplified management of multiple devices, zero-touch replacement, and plug-and-play upgrades reduce administration time and effort.


	10 Gigabit link
	5 Gigabit link
	1 Gigabit link

Diagram 1

| | 10 Gigabit link |
	5 Gigabit link
	1 Gigabit link
	Link aggregation
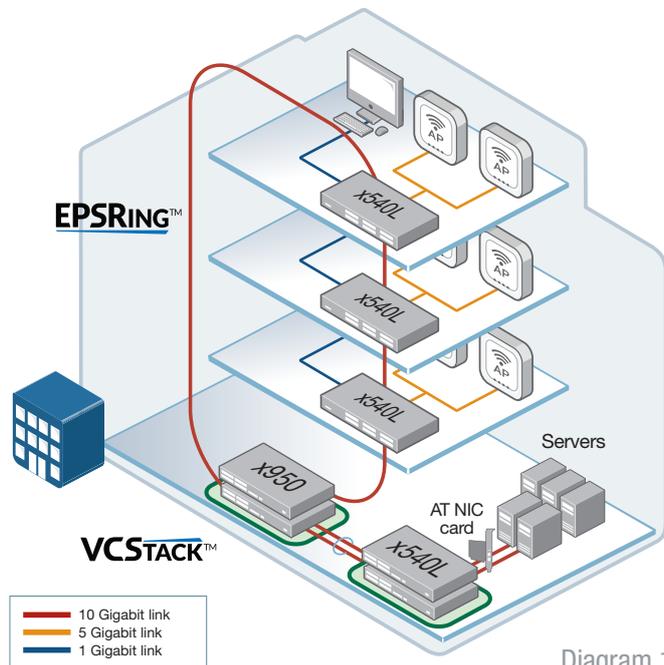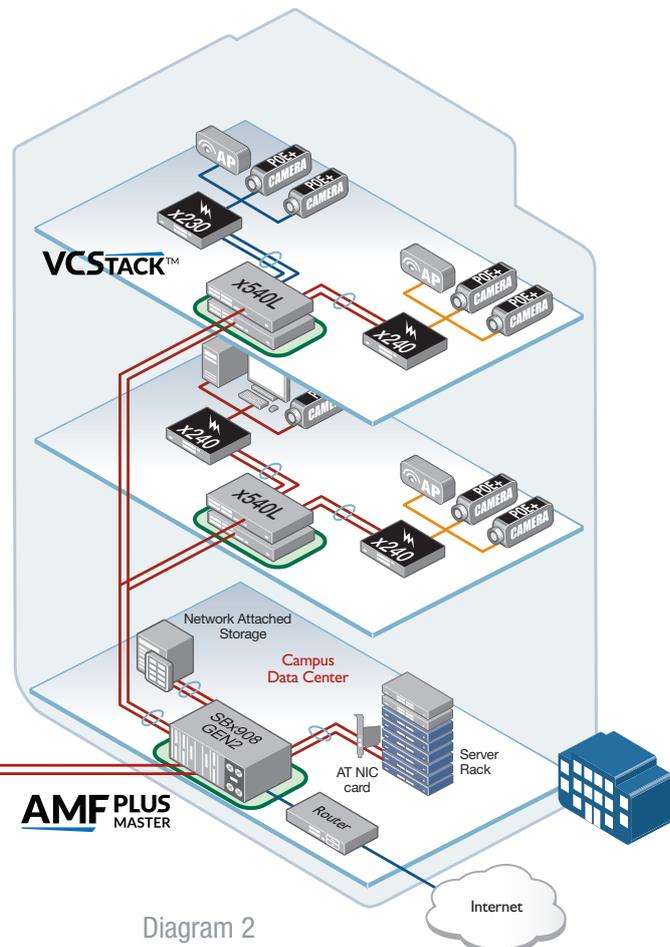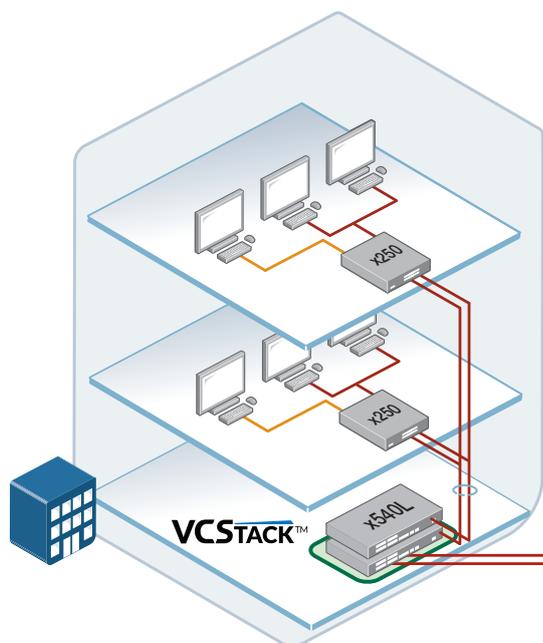
Diagram 2

Key Solutions

Integrated wireless LAN management
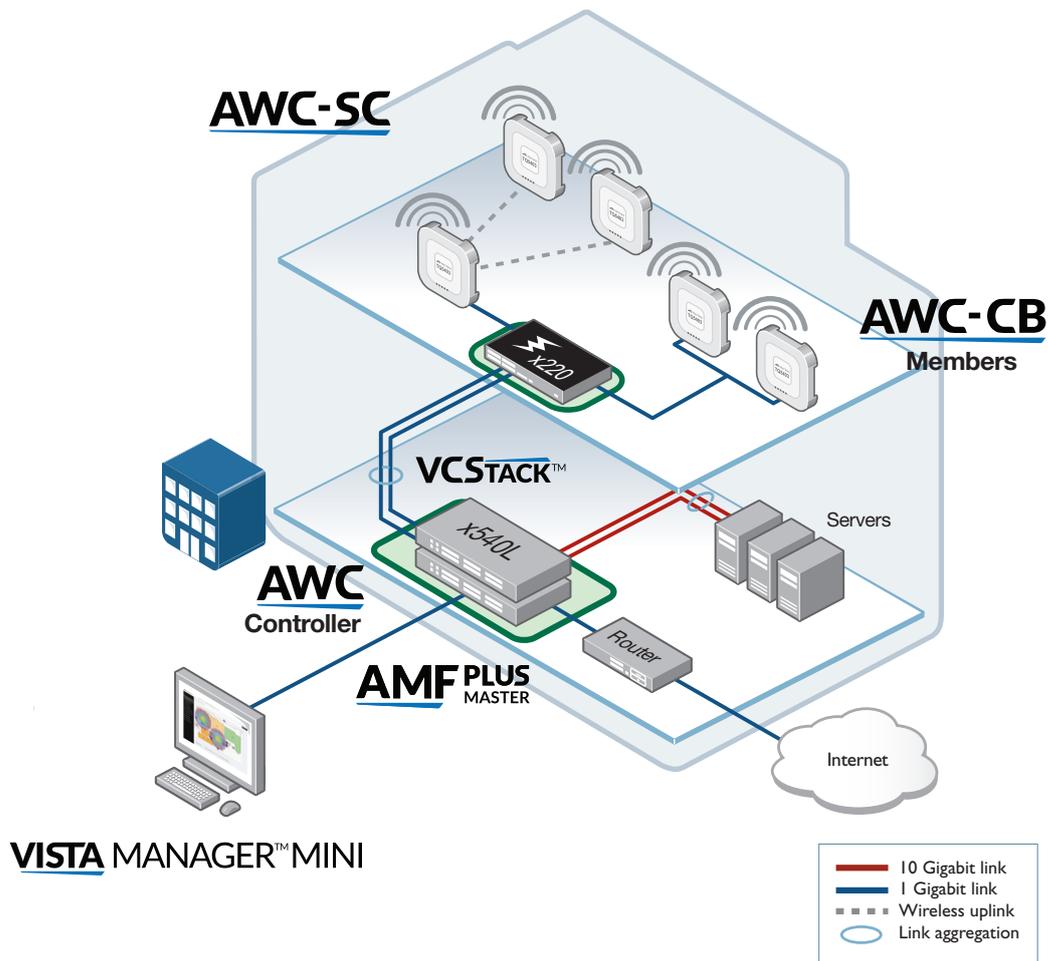
Allied Telesis Autonomous Wave Controller (AWC) offers solutions for two of the most common problems with Wireless LANs: initial setup complexity and on-going performance degradation. Initial WLAN set-up usually requires a site survey to achieve the best coverage; and performance of WLANs can often change over time as external sources of radio interference reduce coverage and bandwidth. These issues can be time-consuming to identify and resolve.

AWC features an intelligent process that automatically re-calibrates the signal strength and radio channel of each Access Point (AP) for optimal WLAN performance.

AWC Smart Connect (AWC-SC) uses wireless uplink connections between APs, so deployment is as easy as plugging in and powering on the new APs, which automatically extend the Wi-Fi network, creating a resilient solution.

Vista Manager mini is integrated into the Device GUI of the x540L Series and provides an ideal solution for modern enterprise networks, enabling management of both the wired (with AMF plus) and wireless (with AWC) networks to be automated. This reduces both the time and cost of network administration, as well as maximizing network performance for a superior user experience.

Up to 5 TQ Series wireless APs can be managed for free, and up to a further 50 APs (max 55) with feature licenses, available separately.

On some AP models, hybrid channel blanket enables multi-channel and single-channel WiFi operation simultaneously. This supports seamless roaming and maximum throughput. Channel Blanket licenses are available for up to 50 APs, which enable both Channel Blanket (AWC-CB) and Smart Connect (AWC-SC).

x540L Series | 10 Gigabit Stackable Switches

Product Specifications

PRODUCT	100/1000T/2.5/5/10G (RJ-45) COPPER PORTS	1/10G SFP+ PORTS	TOTAL PORTS	SWITCHING FABRIC	FORWARDING RATE
x540L-28XTm	24	4	28	560Gbps	416.7Mpps
x540L-28XS	-	28	28	560Gbps	416.7Mpps

Physical Specifications

PRODUCT	WIDTH X DEPTH X HEIGHT	WEIGHT
x540L-28XTm	440 x 290 x 44 mm (17.32 x 11.41 x 1.73 in)	4.0 kg (8.8 lb)
x540L-28XS	440 x 290 x 44 mm (17.32 x 11.41 x 1.73 in)	3.8 kg (8.3 lb)

Latency (microseconds)

PRODUCT	PORT SPEED (µs)			
	1GBPS	2.5GBPS	5GBPS	10GBPS
x540L-28XTm	4.48	8.43	5.72	2.73
x540L-28XS	3.59	-	-	1.60

Power and Noise Characteristics

	MAX POWER CONSUMPTION	MAX HEAT DISSIPATION	NOISE
x540L-28XTm	160W	540 BTU/h	46 - 63 db
x540L-28XS	86W	293 BTU/h	39 - 52 db

Noise: tested to ISO7779; front bystander position

Performance
- Up to 32K MAC addresses
- Up to 1,000 static routes
- Up to 256 dynamic routes
- 2GB DDR SDRAM
- 4094 configurable VLANs
- 256MB flash memory
- Packet Buffer memory: 8MB
- Supports 9KB L2 jumbo frames
- Wirespeed forwarding

Reliability
- Modular AlliedWare Plus operating system
- Full environmental monitoring of PSU internal temperature and internal voltages. SNMP traps alert network managers in case of any failure

Flexibility and compatibility
- 10G SFP+ ports will support any combination of Allied Telesis 1000Mbps SFP and 10GbE SFP+ modules and direct attach cables listed in this document under Ordering Information
- Flexi-stacking - use any port-speed to stack

Diagnostic Tools
- Active Fiber Monitoring detects tampering on optical links
- Cable fault locator (TDR)
- Find-me device locator
- Connectivity Fault Management (CFM) for use with G.8032 ERPS
- Link Monitoring
- Automatic link flap detection and port shutdown
- Optical Digital Diagnostic Monitoring (DDM)
- Ping polling for IPv4 and IPv6
- Port mirroring
  - » No limit on mirrored ports
  - » Up to 7 mirror (analyzer) ports
- VLAN mirroring (RSPAN)
- TraceRoute for IPv4 and IPv6
- Uni-Directional Link Detection (UDLD)

IPv4 Features
- Black hole routing
- DHCP client, relay and server for IPv4 and IPv6
- Directed broadcast forwarding
- DNS relay
- Equal Cost Multi Path (ECMP) routing
- Policy-based routing
- Route maps
- Route redistribution (OSPF, BGP, RIP)
- Static IPv4 multicast routing
- Static unicast routing for IPv4
- UDP broadcast helper (IP helper)
- Virtual Routing and Forwarding Lite (VRF-Lite) up to 64 domains

IPv6 Features
- DHCPv6 client and relay
- DNSv6 client, DNSv6 relay
- IPv4 and IPv6 dual stack
- IPv6 aware storm protection and QoS
- IPv6 hardware ACLs
- Device management over IPv6 networks with SNMPv6, Telnetv6 and SSHv6
- IPv6 QoS support
- NTPv6 client and server
- Static and dynamic IPv6 multicast routing
- Static and dynamic unicast routing for IPv6
- Log to IPv6 hosts with Syslog v6
- VRF-Lite

Management
- Autonomous Management Framework Plus (AMF plus) enables powerful centralized management and zero-touch device installation and recovery
- Try AMF Plus for free with the built-in Starter license (includes network management and automation features, but not Vista Manager AMF Plus menu features)
- NETCONF/RESTCONF northbound interface with YANG data modelling
- Console management port on the front panel for ease of access
- Eco-friendly mode allows ports and LEDs to be disabled to save power
- Industry-standard CLI with context-sensitive help
- Powerful CLI scripting engine
- Comprehensive SNMP MIB support for standards-based device management
- Built-in text editor
- Event-based triggers allow user-defined scripts to be executed upon selected system events
- USB interface allows software release files, configurations and other files to be stored for backup and distribution to other devices
- Vista Mini for easy network-wide management
- Web-based Graphical User Interface (GUI)

Quality of Service (QoS)
- 8 priority queues with a hierarchy of high priority queues for real time traffic, and mixed scheduling, for each switch port
- Limit bandwidth per port or per traffic class down to 64kbps
- Wirespeed traffic classification with low latency essential for VoIP and real-time streaming media applications
- Policy-based QoS based on VLAN, port, MAC and general packet classifiers
- Policy-based storm protection
- Extensive remarking capabilities
- Taildrop for queue congestion control
- Queue scheduling options for strict priority, weighted round robin or mixed scheduling
- IP precedence and DiffServ marking based on layer 2, 3 and 4 headers

Resiliency Features
- Control Plane Prioritization (CPP) ensures the CPU always has sufficient bandwidth to process network control traffic
- Dynamic link failover (host attach)
- EPSR (Ethernet Protection Switched Rings)
- EPSRing SuperLoop Protection (SLP)
- Ethernet Ring Protection Switching (ITU-T G.8032 ERPS)
- Link aggregation (LACP) on LAN ports
- Loop protection: loop detection and thrash limiting
- PVST+ compatibility mode
- Spanning Tree Protocols (STP, RSTP, MSTP)

▶ STP root guard

▶ VCStack fast failover minimizes network disruption

▶ Flexi-stacking - use any port-speed to stack

▶ Long-distance stacking with 10G SFP+ modules (LD-VCStack)

▶ Virtual Router Redundancy Protocol (VRRP)

Security Features

▶ Access Control Lists (ACLs) based on layer 3 and 4 headers

▶ Auth fail and guest VLANs

▶ RADIUS and TACACS+ Authentication, Authorisation and Accounting (AAA)

▶ Bootloader can be password protected for device security

▶ BPDU protection

▶ DHCP snooping, IP source guard and Dynamic ARP Inspection (DAI)

▶ Dynamic VLAN assignment

▶ Local RADIUS server for user and device authentication

▶ MAC-based authentication

▶ MAC address filtering and MAC address lock-down

▶ Network Access and Control (NAC) features manage endpoint security

▶ Port-based learn limits (intrusion detection)

▶ RADIUS group selection per VLAN or port

▶ RADIUS proxy

▶ Secure Copy (SCP)

▶ Secure File Transfer Protocol (SFTP) client

▶ Strong password security and encryption

▶ Tri-authentication: MAC-based, web-based and IEEE 802.1x

VLAN Support

▶ Private VLANs provide security and port isolation for multiple customers using the same VLAN

▶ Upstream Forwarding Only (UFO)

▶ VLAN ID translation

▶ Voice VLAN

Environmental Specifications

▶ Operating temperature range:
  0°C to 50°C (32°F to 122°F)
  Derated by 1°C per 305 meters (1,000 ft)

▶ Storage temperature range:
  -25°C to 70°C (-13°F to 158°F)

▶ Operating relative humidity range:
  5% to 90% non-condensing

▶ Storage relative humidity range:
  5% to 95% non-condensing

▶ Operating altitude:
  3,000 meters maximum (9,843 ft)

Electrical approvals and compliances

▶ EMC: ETSI EN300-386, EN300-132-2, FCC class A, VCCI class A

▶ Immunity: EN55024, EN61000-3-levels 2 (Harmonics), and 3 (Flicker) – AC models only

Safety

▶ Standards: UL62368-1, CAN/CSA-C22.2 No. 60950-1-03, EN60950-1, EN60825-1, AS/NZS 60950.1

▶ Certifications: UL, cUL, UL-EU

Restrictions on Hazardous Substances (RoHS) Compliance

▶ EU RoHS compliant

▶ China RoHS compliant-1

Standards and Protocols

AlliedWare Plus Operating System
Version 5.5.4-2

Authentication
RFC 1321   MD5 Message-Digest algorithm
RFC 1828   IP authentication using keyed MD5

Border Gateway Protocol (BGP)
BGP dynamic capability
BGP outbound route filtering
RFC 1772   Application of the Border Gateway Protocol (BGP) in the Internet
RFC 1997   BGP communities attribute
RFC 2385   Protection of BGP sessions via the TCP MD5 signature option
RFC 2439   BGP route flap damping
RFC 2545   Use of BGP-4 multiprotocol extensions for IPv6 inter-domain routing
RFC 2918   Route refresh capability for BGP-4
RFC 3882   Configuring BGP to block Denial-of-Service (DoS) attacks
RFC 4271   Border Gateway Protocol 4 (BGP-4)
RFC 4360   BGP extended communities
RFC 4456   BGP route reflection - an alternative to full mesh iBGP
RFC 4724   BGP graceful restart
RFC 4760   BGP multiprotocol extensions
RFC 5065   Autonomous system confederations for BGP
RFC 5492   Capabilities advertisement with BGP-4
RFC 5925   The TCP authentication option
RFC 6793   BGP support for four-octet AS number space
RFC 7606   Revised error handling for BGP UPDATE messages

Cryptographic Algorithms
FIPS Approved Algorithms
Encryption (Block Ciphers):

▶ AES (ECB, CBC, CFB and OFB Modes)

▶ 3DES (ECB, CBC, CFB and OFB Modes)

Block Cipher Modes:

▶ CCM

▶ CMAC

▶ GCM

▶ XTS

Digital Signatures & Asymmetric Key Generation:

▶ DSA

▶ ECDSA

▶ RSA

Secure Hashing:

▶ SHA-1

▶ SHA-2 (SHA-224, SHA-256, SHA-384. SHA-512)

Message Authentication:

▶ HMAC (SHA-1, SHA-2(224, 256, 384, 512)

Random Number Generation:

▶ DRBG (Hash, HMAC and Counter)

Non FIPS Approved Algorithms
RNG (AES128/192/256)
DES
MD5

Ethernet
IEEE 802.2   Logical Link Control (LLC)
IEEE 802.3   Ethernet
IEEE 802.3ab 1000BASE-T
IEEE 802.3ae 10 Gigabit Ethernet
IEEE 802.3an 10GBASE-T
IEEE 802.3az Energy Efficient Ethernet (EEE)
IEEE 802.3bz 2.5GBASE-T and 5GBASE-T ("multi-gigabit")

IEEE 802.3x   Flow control - full-duplex operation
IEEE 802.3z   1000BASE-X

IPv4 Features
RFC 768   User Datagram Protocol (UDP)
RFC 791   Internet Protocol (IP)
RFC 792   Internet Control Message Protocol (ICMP)
RFC 793   Transmission Control Protocol (TCP)
RFC 826   Address Resolution Protocol (ARP)
RFC 894   Standard for the transmission of IP datagrams over Ethernet networks
RFC 919   Broadcasting Internet datagrams
RFC 922   Broadcasting Internet datagrams in the presence of subnets
RFC 932   Subnetwork addressing scheme
RFC 950   Internet standard subnetting procedure
RFC 951   Bootstrap Protocol (BootP)
RFC 1027   Proxy ARP
RFC 1035   DNS client
RFC 1042   Standard for the transmission of IP datagrams over IEEE 802 networks
RFC 1071   Computing the Internet checksum
RFC 1122   Internet host requirements
RFC 1191   Path MTU discovery
RFC 1256   ICMP router discovery messages
RFC 1518   An architecture for IP address allocation with CIDR
RFC 1519   Classless Inter-Domain Routing (CIDR)
RFC 1542   Clarifications and extensions for BootP
RFC 1591   Domain Name System (DNS)
RFC 1812   Requirements for IPv4 routers
RFC 1918   IP addressing
RFC 2581   TCP congestion control
RFC 3021   Using 31-Bit Prefixes on IPv4 Point-to-Point Links

IPv6 Features
RFC 1981   Path MTU discovery for IPv6
RFC 2460   IPv6 specification
RFC 2464   Transmission of IPv6 packets over Ethernet networks
RFC 3484   Default address selection for IPv6
RFC 3587   IPv6 global unicast address format
RFC 3596   DNS extensions to support IPv6
RFC 4007   IPv6 scoped address architecture
RFC 4193   Unique local IPv6 unicast addresses
RFC 4213   Transition mechanisms for IPv6 hosts and routers
RFC 4291   IPv6 addressing architecture
RFC 4443   Internet Control Message Protocol (ICMPv6)
RFC 4861   Neighbor discovery for IPv6
RFC 4862   IPv6 Stateless Address Auto-Configuration (SLAAC)
RFC 5014   IPv6 socket API for source address selection
RFC 5095   Deprecation of type 0 routing headers in IPv6
RFC 5175   IPv6 Router Advertisement (RA) flags option
RFC 6105   IPv6 Router Advertisement (RA) guard

Management
AT Enterprise MIB including AMF Plus MIB and SNMP traps
Optical DDM MIB
SNMPv1, v2c and v3
ANSI/TIA-1057 LLDP-Media Endpoint Detection
IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
RFC 1155   Structure and identification of management information for TCP/IP-based Internets
RFC 1157   Simple Network Management Protocol (SNMP)
RFC 1212   Concise MIB definitions
RFC 1213   MIB for network management of TCP/IP-based Internets: MIB-II
RFC 1215   Convention for defining traps for use with the SNMP
RFC 1227   SNMP MUX protocol and MIB
RFC 1239   Standard MIB
RFC 1724   RIPv2 MIB extension
RFC 2578   Structure of Management Information v2 (SMIv2)
RFC 2579   Textual conventions for SMIv2
RFC 2580   Conformance statements for SMIv2

RFC 2674   Definitions of managed objects for bridges with traffic classes, multicast filtering and VLAN
RFC 2741   Agent extensibility (AgentX) protocol
RFC 2787   Definitions of managed objects for VRRP
RFC 2819   RMON MIB (groups 1,2,3 and 9)
RFC 2863   Interfaces group MIB
RFC 3176   sFlow: a method for monitoring traffic in switched and routed networks
RFC 3411   An architecture for describing SNMP management frameworks
RFC 3412   Message processing and dispatching for the SNMP
RFC 3413   SNMP applications
RFC 3414   User-based Security Model (USM) for SNMPv3
RFC 3415   View-based Access Control Model (VACM) for SNMP
RFC 3416   Version 2 of the protocol operations for the SNMP
RFC 3417   Transport mappings for the SNMP
RFC 3418   MIB for SNMP
RFC 3635   Definitions of managed objects for the Ethernet-like interface types
RFC 3636   IEEE 802.3 MAU MIB
RFC 4022   MIB for the Transmission Control Protocol (TCP)
RFC 4113   MIB for the User Datagram Protocol (UDP)
RFC 4188   Definitions of managed objects for bridges
RFC 4292   IP forwarding table MIB
RFC 4293   MIB for the Internet Protocol (IP)
RFC 4318   Definitions of managed objects for bridges with RSTP
RFC 4560   Definitions of managed objects for remote ping, traceroute and lookup operations
RFC 5424   The Syslog protocol
RFC 6527   Definitions of managed objects for VRRPv3

Multicast Support

Bootstrap Router (BSR) mechanism for PIM-SM
IGMP query solicitation
IGMP snooping (IGMPv1, v2 and v3)
IGMP snooping fast-leave
IGMP/MLD multicast forwarding (IGMP/MLD proxy)
MLD snooping (MLDv1 and v2)
PIM and PIM SSM for IPv6
RFC 1112   Host extensions for IP multicasting (IGMPv1)
RFC 2236   Internet Group Management Protocol v2 (IGMPv2)
RFC 2710   Multicast Listener Discovery (MLD) for IPv6
RFC 2715   Interoperability rules for multicast routing protocols
RFC 3306   Unicast-prefix-based IPv6 multicast addresses
RFC 3376   IGMPv3
RFC 3590   Source address selection for the Multicast Listener Discovery (MLD) protocol
RFC 3618   Multicast Source Discovery Protocol (MSDP)
RFC 3810   Multicast Listener Discovery v2 (MLDv2) for IPv6
RFC 3956   Embedding the Rendezvous Point (RP) address in an IPv6 multicast address
RFC 3973   PIM Dense Mode (DM)
RFC 4541   IGMP and MLD snooping switches
RFC 4604   Using IGMPv3 and MLDv2 for source-specific multicast

RFC 4607   Source-specific multicast for IP
RFC 7761   Protocol Independent Multicast - Sparse Mode (PIM-SM)

Open Shortest Path First (OSPF)

OSPF link-local signaling
OSPF MD5 authentication
Out-of-band LSDB resync
RFC 1245   OSPF protocol analysis
RFC 1246   Experience with the OSPF protocol
RFC 1370   Applicability statement for OSPF
RFC 1765   OSPF database overflow
RFC 2328   OSPFv2
RFC 2370   OSPF opaque LSA option
RFC 2740   OSPFv3 for IPv6
RFC 3101   OSPF Not-So-Stubby Area (NSSA) option
RFC 3509   Alternative implementations of OSPF area border routers
RFC 3623   Graceful OSPF restart
RFC 3630   Traffic engineering extensions to OSPF
RFC 4552   Authentication/confidentiality for OSPFv3
RFC 5329   Traffic engineering extensions to OSPFv3
RFC 5340   OSPFv3 for IPv6 (partial support)

Quality of Service (QoS)

IEEE 802.1p   Priority tagging
RFC 2211   Specification of the controlled-load network element service
RFC 2474   DiffServ precedence for eight queues/port
RFC 2475   DiffServ architecture
RFC 2597   DiffServ Assured Forwarding (AF)
RFC 2697   A single-rate three-color marker
RFC 2698   A two-rate three-color marker
RFC 3246   DiffServ Expedited Forwarding (EF)

Resiliency Features

ITU-T G.8032 / Y.1344 Ethernet Ring Protection Switching (ERPS)
IEEE 802.1ag Connectivity Fault Management (CFM), Continuity Check Protocol (CCP)
IEEE 802.1AX Link aggregation (static and LACP)
IEEE 802.1D   MAC bridges
IEEE 802.1s   Multiple Spanning Tree Protocol (MSTP)
IEEE 802.1w   Rapid Spanning Tree Protocol (RSTP)
IEEE 802.3ad Static and dynamic link aggregation
RFC 5798   Virtual Router Redundancy Protocol version 3 (VRRPv3) for IPv4 and IPv6

Routing Information Protocol (RIP)

RFC 1058   Routing Information Protocol (RIP)
RFC 2080   RIPng for IPv6
RFC 2081   RIPng protocol applicability statement
RFC 2082   RIP-2 MD5 authentication
RFC 2453   RIPv2

Security Features

SSH remote login
SSLv2 and SSLv3
IEEE 802.1X authentication protocols (TLS, TTLS, PEAP and MD5)
IEEE 802.1X multi-supplicant authentication
IEEE 802.1X port-based network access control
RFC 2560   X.509 Online Certificate Status Protocol (OCSP)

RFC 2818   HTTP over TLS ("HTTPS")
RFC 2865   RADIUS authentication
RFC 2866   RADIUS accounting
RFC 2868   RADIUS attributes for tunnel protocol support
RFC 2986   PKCS #10: certification request syntax specification v1.7
RFC 3546   Transport Layer Security (TLS) extensions
RFC 3579   RADIUS support for Extensible Authentication Protocol (EAP)
RFC 3580   IEEE 802.1x RADIUS usage guidelines
RFC 3748   PPP Extensible Authentication Protocol (EAP)
RFC 4251   Secure Shell (SSHv2) protocol architecture
RFC 4252   Secure Shell (SSHv2) authentication protocol
RFC 4253   Secure Shell (SSHv2) transport layer protocol
RFC 4254   Secure Shell (SSHv2) connection protocol
RFC 5176   RADIUS Change of Authorization (CoA)
RFC 5246   Transport Layer Security (TLS) v1.2
RFC 5280   X.509 certificate and Certificate Revocation List (CRL) profile
RFC 5425   Transport Layer Security (TLS) transport mapping for Syslog
RFC 5656   Elliptic curve algorithm integration for SSH
RFC 6125   Domain-based application service identity within PKI using X.509 certificates with TLS
RFC 6614   Transport Layer Security (TLS) encryption for RADIUS
RFC 6668   SHA-2 data integrity verification for SSH

Services

RFC 854   Telnet protocol specification
RFC 855   Telnet option specifications
RFC 857   Telnet echo option
RFC 858   Telnet suppress go ahead option
RFC 1091   Telnet terminal-type option
RFC 1350   Trivial File Transfer Protocol (TFTP)
RFC 1985   SMTP service extension
RFC 2049   MIME
RFC 2131   DHCPv4 (server, relay and client)
RFC 2132   DHCP options and BootP vendor extensions
RFC 2616   Hypertext Transfer Protocol - HTTP/1.1
RFC 2821   Simple Mail Transfer Protocol (SMTP)
RFC 2822   Internet message format
RFC 3046   DHCP relay agent information option (DHCP option 82)
RFC 3315   DHCPv6 (server, relay and client)
RFC 3396   Encoding long options in DHCPv4
RFC 3633   IPv6 prefix options for DHCPv6
RFC 3646   DNS configuration options for DHCPv6
RFC 3993   Subscriber-ID suboption for DHCP relay agent option
RFC 4330   Simple Network Time Protocol (SNTP) version 4
RFC 4954   SMTP service extension for authentication
RFC 5905   Network Time Protocol (NTP) version 4

VLAN Support

IEEE 802.1ad Provider bridges (VLAN stacking, Q-in-Q)
IEEE 802.1Q   Virtual LAN (VLAN) bridges
IEEE 802.1v   VLAN classification by protocol and port
IEEE 802.3ac VLAN tagging

Feature Licenses

NAME	DESCRIPTION	INCLUDES	STACK LICENSING
AT-FL-x540L-01	x540L premium license	▶ OSPFv2 (256 routes)[3] ▶ BGP4 (256 routes)[3] ▶ PIMv4-SM, DM and SSM v4 ▶ RIPng (256 routes) ▶ OSPFv3 (256 routes) ▶ MLDv1/v2 ▶ PIM-SMv6/SSMv6 ▶ VLAN doube tagging (Q-in-Q) ▶ VLAN Translation ▶ PTP Transparent Mode[4] ▶ RADIUS Full ▶ VRF-Lite (64 domains)	▶ One license per stack member
AT-SW-APM10-1YR[5, 6]	Cumulative AMF Plus Master license	▶ AMF Plus Master license for up to 10 nodes for 1 year	▶ One license per stack
AT-SW-APM10-5YR[5, 6]	Cumulative AMF Plus Master license	▶ AMF Plus Master license for up to 10 nodes for 5 years	▶ One license per stack
AT-SW-AWC10-1YR[7]	Cumulative AWC license	▶ Autonomous Wave Control (AWC) license for up to 10 access points for 1 year	▶ One license per stack
AT-SW-AWC10-5YR[7]	Cumulative AWC license	▶ Autonomous Wave Control (AWC) license for up to 10 access points for 5 years	▶ One license per stack
AT-SW-CB10-1YR-2022[8]	Cumulative AWC-CB and AWC-SC license	▶ AWC Channel Blanket and AWC Smart Connect license for up to 10 access points for 1 year	▶ One license per stack
AT-SW-CB10-5YR-2022[8]	Cumulative AWC-CB and AWC-SC license	▶ AWC Channel Blanket and AWC Smart Connect license for up to 10 access points for 5 years	▶ One license per stack
AT-FL-x540L-OF13-1YR	OpenFlow license for 1 year	▶ OpenFlow v1.3 for 1 year	▶ Not supported on a stack
AT-FL-x540L-OF13-5YR	OpenFlow license for 5 years	▶ OpenFlow v1.3 for 5 years	▶ Not supported on a stack

[3] 64 OSPFv2 and BGP4 routes are provided free in the base license

[4] Supported in a future software release

[5] From AW+ version 5.5.2-2 onwards, AMF Plus licenses provide all standard AMF network management and automation features. They also enable the AMF Plus intent-based networking features menu in Vista Manager EX (from version 3.10.1 onwards)

[6] Purchase one license per 10 nodes (up to 50 nodes maximum)

[7] 5 APs can be managed for free. Purchase one license per 10 additional APs (up to 50 APs maximum)

[8] Channel Blanket and Smart Connect are not available as free services. Both an AWC-CB license and an AWC license are required for Channel Blanket and/or Smart Connect to operate. Purchase one AWC-CB license per 10 APs (up to 50 APs maximum).

x540L Series | 10 Gigabit Stackable Switches

Ordering Information

AT-x540L-28XTm
24-port 100M/1/2.5/5/10G stackable copper switch with 4 x SFP/SFP+ports, and a single fixed PSU

AT-x540L-28XS
28-port SFP/SFP+ stackable fiber switch, with a single fixed PSU

10G SFP+ Modules
Any 10G SFP+ module or cable can be used for stacking with the front panel 10G ports

AT-SP10SR
10GSR 850 nm short-haul, 300 m with MMF

AT-SP10SR/I
10GSR 850 nm short-haul, 300 m with MMF industrial temperature

AT-SP10LR20/I
10GER 1310 nm long-haul, 20 km with SMF industrial temperature

AT-SP10ER40/I
10GER 1310 nm long-haul, 40 km with SMF industrial temperature

AT-SP10ZR80/I
10GER 1550 nm long-haul, 80 km with SMF industrial temperature

AT-SP10TM
1G/2.5G/5G/10G, 100m copper, TAA[9]
(note that 2.5G/5G speeds are not supported)

AT-SP10BD10/I-12
10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 10 km industrial temperature, TAA[9]

AT-SP10BD10/I-13
10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 10 km industrial temperature, TAA[9]

AT-SP10BD20-12
10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 20 km, TAA[9]

AT-SP10BD20-13
10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 20 km, TAA[9]

AT-SP10BD40/I-12
10 GbE Bi-Di (1270 nm Tx, 1330 nm Rx) fiber up to 40 km industrial temperature, TAA[9]

AT-SP10BD40/I-13
10 GbE Bi-Di (1330 nm Tx, 1270 nm Rx) fiber up to 40 km industrial temperature, TAA[9]

AT-SP10BD80/I-14
10 GbE Bi-Di (1490 nm Tx, 1550 nm Rx) fiber up to 80 km industrial temperature, TAA[9]

AT-SP10BD80/I-15
10 GbE Bi-Di (1550nm Tx, 1490 nm Rx) fiber up to 80 km industrial temperature, TAA[9]

AT-SP10TW1
1 meter SFP+ direct attach cable

AT-SP10TW3
3 meter SFP+ direct attach cable

1000Mbps SFP Modules

AT-SPSX
1000SX GbE multi-mode 850 nm fiber up to 550 m

AT-SPLX10a
1000LX GbE single-mode 1310 nm fiber up to 10 km

AT-SPLX10/I
1000LX GbE single-mode 1310 nm fiber up to 10 km, industrial temperature

AT-SPBD10-13
1000LX (LC) GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 10 km

AT-SPBD10-14
1000LX (LC) GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 10 km

AT-SPBD20-13/I
1000BX GbE Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 20 km

AT-SPBD20-14/I
1000BX GbE Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 20 km

AT-SPBD40-13/I
1000LX (LC) GbE single-mode Bi-Di (1310 nm Tx, 1490 nm Rx) fiber up to 40 km, industrial temperature

AT-SPBD40-14/I
1000LX (LC) GbE single-mode Bi-Di (1490 nm Tx, 1310 nm Rx) fiber up to 40 km, industrial temperature

AT-SPLX40
1000LX GbE single-mode 1310 nm fiber up to 40 km

AT-SPZX80
1000ZX GbE single-mode 1550 nm fiber up to 80 km

AT-SPTXc
10/100/1000 TX (RJ45), up to 100 m

[9] Trade Agreement Act compliant

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