DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY REFER TO: Joint Interoperability Test Command (JTE) 6 December 2023

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Joint Interoperability Certification of the Alcatel Lucent Enterprise (ALE) OmniSwitch (OS)6560, OS6860E, OS6860N, OS6865, and OS6900 Series with Software Release Alcatel Operating System (AOS) 8.9.R21

References: (a) Department of Defense Instruction 8100.04, "DoD Unified Capabilities (UC)," 9 December 2010
(b) Office of the Department of Defense Chief Information Officer, "Department of Defense Unified Capabilities Requirements 2013, Change 2," September 2017
(c) through (d), see Enclosure 1

1. Certification Authority. Reference (a) establishes the Joint Interoperability Test Command (JITC) as the Joint Interoperability Certification Authority for the Department of Defense Information Network (DoDIN) products, Reference (b).

2. Conditions of Certification. The Alcatel Lucent Enterprise (ALE) OmniSwitch (OS)6560, OS6860E, OS6860N, OS6865, and OS6900 Series with Software Release Alcatel Operating System (AOS) 8.9.R21 is hereinafter referred to as the System Under Test (SUT). The SUT meets the critical requirements of the Unified Capabilities Requirements, Reference (b), as an Assured Services Local Area Network (ASLAN) Core, Distribution, and Access switch and is certified for joint use with no conditions, as noted in Table 1. The OS6900 Series are certified as Core and Distribution switches. The OS6865, OS6860E, OS6860N, and OS6560 Series are certified as Access only switches.

This certification expires upon changes that affect interoperability, but no later than the expiration date specified in the DoDIN Approved Products List (APL) memorandum.

Table 1. Conditions

Description	Operational Impact	Remarks
None, the Alcatel Lucent Enterprise OmniSwitch OS6560, OS6860E, OS6860N, OS6865, and OS6900 Series with Software Release Alcatel Operating System 8.9.R21 meets all critical joint interoperability requirements in accordance with the Unified Capabilities Requirements, Reference (b).		

3. Interoperability Status. Table 2 provides the SUT interface interoperability status, Table 3 provides the Capability Requirements and Functional Requirements status, and Table 4 provides the DoDIN APL Product Summary, to include subsequent Desktop Review (DTR) updates.

Table 2. SUT Interface Status

Interface (See note 1.)	Applicability			Status	Remarks
	Co	D	A		
Network Management Interfaces (See note 2.)					
IEEE 802.3i (10BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseFX)	O	O	O	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	O	O	O	Not Tested	See note 4.
Access Interfaces (See note 2.)					
IEEE 802.3i (10BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseFX)	C	C	C	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	C	C	C	Met	See note 3.
IEEE 802.3bz (2.5/5GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ae (10GBaseX)	C	C	C	Met	See note 3.
IEEE 802.3by (25GBaseX	O	O	O	Met	See note 3.
IEEE 802.3ba (40GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3cd (50GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ba (100GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3bs (400GBaseX)	O	O	O	Not Tested	See note 4.
Uplink (Trunk) Interfaces (See note 2.)					
IEEE 802.3u (100BaseT UTP)	O	O	O	Met	See note 3.
IEEE 802.3u (100BaseFX)	O	O	O	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	C	C	C	Met	See note 3.
IEEE 802.3bz (2.5/5GBaseX)	C	C	C	Not Tested	See note 4.
IEEE 802.3ae (10GBaseX)	C	C	C	Met	See note 3.
IEEE 802.3by (25GBaseX)	O	O	O	Met	See note 3.
IEEE 802.3ba (40GBaseX)	O	O	O	Met	See note 3.
IEEE 802.3cd (50GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ba (100GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3bs (400GBaseX)	O	O	O	Not Tested	See note 4.

NOTE(S):
1. Table 3 depicts the SUT high-level requirements. Table 3-2 in Enclosure 3 provides a detailed list of requirements.
2. Core, Distribution, and Access products must minimally support one of the interfaces listed in this table as conditional for the given role. Other rates and standards may be provided as optional interfaces.
3. JITC tested the 1/10/25/40/100 Gbps interfaces but not the 10/100BaseT interfaces. JITC analysis determined the 10/100BaseT interfaces are low risk for certification without testing based on the Vendor's LoC to comply with the IEEE 802.3i/u standards and the testing data collected at all other data rates.
4. The SUT does not support this optional or conditional interface.

LEGEND:

A	Access	Gbps	Gigabits per second
BaseFX	Megabit Ethernet over Fiber	IEEE	Institute of Electrical and Electronics Engineers
BaseT	Megabit (Baseband Operation, Twisted Pair) Ethernet	JITC	Joint Interoperability Test Command
BaseX	Megabit Ethernet over Fiber or Copper	LoC	Letter of Compliance
C	Conditional	O	Optional
Co	Core	SUT	System Under Test
D	Distribution	UTP	Unshielded Twisted Pair
GBaseX	Gigabit Ethernet over Fiber or Copper		

Table 3. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/Function	Applicability (See note 1.)	UCR 2013 Change 2 Reference	Status
1	**General LAN Switch and Router Product**			
	Port Interface Rates	Required	7.2.1.1	Met
	Port Parameter	Required	7.2.1.2	Met
	Class of Service Markings	Required	7.2.1.3	Met
	Virtual LAN Capabilities	Required	7.2.1.4	Met
	Protocol Requirements	Required	7.2.1.5	Met
	Quality of Service Features	Required	7.2.1.6	Met
	Network Monitoring	Required	7.2.1.7	Met
	Security	Required	7.2.1.8	Met (See note 2.)
2	**LAN Switch and Router Redundancy**			
	Single Product Redundancy	Conditional	7.2.2.1	Not Tested (See note 3.)
	Dual Product Redundancy	Conditional	7.2.2.2	Met (See note 3.)
	Survivability	Required	7.2.2.3	Met
3	**LAN Product Requirements Summary**			
	LAN Product Requirements Summary	Optional	7.2.3	Met
4	**Multiprotocol Label Switching**			
	MPLS ASLAN	Optional	7.2.4.2	Not Tested (See note 4.)
	MPLS VPN Augmentation to VLANs	Optional	7.2.4.3	Not Tested (See note 4.)
5	Internet Protocol version 6 (IPv6)	Required	5.2	Met

NOTE(S):
1. The annotation of 'required' refers to a high-level requirement category. Refer to UCR 2013, Change 2, Reference (b), for the applicability of each sub-requirement.
2. A JITC-led Cybersecurity test team conduced Cybersecurity testing and published the results in a separate report, Reference (c).
3. The SUT does not support Single Product Redundancy. The SUT met the Dual Product Redundancy requirements with testing and the Vendor's LoC.
4. The SUT does not support this optional MPLS requirement.

LEGEND:

ASLAN	Assured Services Local Area Network	LoC	Letter of Compliance
CR	Capability Requirement	MPLS	Multiprotocol Label Switching
FR	Functional Requirements	SUT	System Under Test
ID	Identification	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command	VLAN	Virtual Local Area Network
LAN	Local Area Network	VPN	Virtual Private Network

Table 4. DoDIN APL Product Summary

Product Identification			
Product Name	OmniSwitch OS6560, OS6860E, OS6860N, OS6865, and OS6900 Series		
Software Release	AOS 8.9.R21		
UCR Product Type(s)	ASLAN Core, Distribution, and Access Switch		
Product Description	The OmniSwitch family represents a set of compact, high density, stackable and modular chassis, LAN switches offering high performance, low latency, QoS, and Layer 2 and Layer 3 switching capability.		
DoDIN Certified Function	**Component Name** (See notes 1 and 2.)	**Tested Version**	**Remarks**
ASLAN Switch Core/Distribution	**OS6900-C32E** OS6900-C32 OS6900-C32D	AOS 8.9.R21	OS6900 Series
	OS6900-X48 OS6900-X48D TA6900-X48 OS6900-X48E OS6900-X48E-D OS6900-T48 OS6900-T48D OS6900-V72 OS6900-V72D OS6900-V48 OS6900-V48D		
ASLAN Switch Access Only	**TA6865-P16X** OS6865-P16X OS6865-P16XD OS6865-U12X OS6865-U12XD TA6865-U12X TA6865-U28X OS6865-U28X OS6865-U28XD		OS6865 Series
	OS6860N-P48Z OS6860N-PH48Z OS6860N-P24Z OS6860N-P48M OS6860N-PH48M OS6860N-PX48M OS6860N-P24M OS6860N-PH24M OS6860N-PX24M OS6860N-U28 OS6860N-U28D TA6860N-U28		OS6560 Series
	TA6860E-P48 OS6860E-P48 OS6860E-P24 OS6860E-24 OS6860E-24D OS6860E-48 OS6860E-48D		
	OS6560-24X4 OS6560-48X4 OS6560-P48X4 OS6560-P24Z8 OS6560-P48Z16 OS6560-X10 OS6560-P24X4 OS6560-P24Z24 OS6560-PXZ24		

(Table continues next page.)

Table 4. DoDIN APL Product Summary (continued)

NOTE(S):
1. Table 3-3 in Enclosure 3 provides the detailed descriptions on the initially tested components/sub-components.
2. Components/Sub-components bolded and underlined were tested by JITC. The other components/sub-components in the family series were not tested; however, JITC certified the other components/sub-components for joint use because they utilize the same software and similar hardware as tested components and JITC analysis determined they were functionally identical for interoperability certification purposes.

LEGEND:

ALE	Alcatel Lucent Enterprise	LAN	Local Area Network
AOS	Alcatel Operating System	OS	OmniSwitch
APL	Approved Products List	QoS	Quality of Service
ASLAN	Assured Services Local Area Network	TA	Trade Agreement Act (TAA) compliant
DoDIN	Department of Defense Information Network	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command		

4. Test Details. This certification is based on interoperability (IO) testing, review of the Vendor's Letter of Compliance (LoC), and the Defense Information Systems Agency (DISA) Certifying Authority Recommendation for inclusion on the DoDIN APL. JITC completed review of the Vendor's LoC on 29 August 2022 and conducted IO testing at the Fort Meade, Maryland, test lab from 25 September through 01 November 2023, using test procedures derived from Reference (d). A JITC-led Cybersecurity (CS) test team conducted CS testing and published the results in a separate report, Reference (c). Enclosure 2 documents the test results and describes the test network and system configurations. Enclosure 3 provides a detailed list of the interface, capability, and functional requirements.

5. Additional Information. JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Sensitive but Unclassified Internet Protocol Data (formerly known as NIPRNet) e-mail. Interoperability status information is available via the JITC System Tracking Program (STP). STP is accessible by .mil/.gov users at https://stp.jitc.disa.mil/. Test reports, lessons learned, and related testing documents and references are on the JITC Industry Toolkit (JIT) at https://jit.fhu.disa.mil/. Due to the sensitivity of the information, the CS Assessment Package that contains the approved configuration and deployment guide must be requested directly from the Approved Products Certification Office (APCO) via e-mail: disa.meade.ie.list.approved-products-certificationoffice@mail.mil. All associated information is available on the DISA APCO website located at https://aplits.disa.mil/.

JITC Memo, JTE, Joint Interoperability Certification of the Alcatel Lucent Enterprise (ALE) OmniSwitch (OS)6560, OS6860E, OS6860N, OS6865, and OS6900 Series with Software Release Alcatel Operating System (AOS) 8.9.R21

6. Point of Contact (POC). JITC POC: Mr. Son Pham, commercial telephone(301-225-7945, DSN telephone 312-375-7945; e mail address: son.m.pham2.civ@mail.mil; mailing address: Joint Interoperability Test Command, ATTN: JTE2 (Mr. Son Pham) 6910 Cooper Avenue, Fort Meade, MD 20755-7085. The APCO tracking number for the SUT is 2215701.

FOR THE COMMANDER:

DORN.LAWRENCE.T.1168371930 Digitally signed by DORN.LAWRENCE.T.1168371930 Date: 2023.12.06 14:02:33 -07'00'

3 Enclosures a/s

LAWRENCE T. DORN
Chief
Specialized Test Division

Distribution (electronic mail):
DoD CIO
Joint Staff J-6, JCS
ISG Secretariat, DISA, JT
U.S. Strategic Command, J66
USSOCOM J65
USTRANSCOM J6
US Navy, OPNAV N2/N6FP12
US Army, DA-OSA, CIO/G-6, SAIS-CBC
US Air Force, SAF/A6SA
US Marine Corps, MARCORSYSCOM, SEAL, CERT Division
US Coast Guard, CG-64
DISA/ISG REP
OUSD Intel, IS&A/Enterprise Programs of Record
DLA, Test Directorate, J621C
NSA/DT
NGA, Compliance and Assessment Team
DOT&E
Medical Health Systems, JMIS PEO T&IVV
HQUSAISEC, AMSEL-IE-ME
APCO

ADDITIONAL REFERENCES

(c) Joint Interoperability Test Command (JITC), "Cybersecurity Assessment Report Alcatel Lucent Enterprise (ALE) OmniSwitch (OS)6560, OS6860E, OS6860N, OS6865, and OS6900 Series, Software Release AOS 8.9.R21, Tracking Number (TN) 2215701," October 2023
(d) JITC, "Assured Services Local Area Network (ASLAN) and Non-ASLAN Test Procedures Version 1.1 for Unified Capabilities Requirements (UCR) 2013 Change 2," April 2022 (Draft)

CERTIFICATION SUMMARY

1. SYSTEM AND REQUIREMENTS IDENTIFICATION. The Alcatel Lucent Enterprise (ALE) OmniSwitch (OS)6560, OS6860E, OS6860N, OS6865, OS6900 Series with Software Release Alcatel Operating System (AOS) 8.9.R21 is hereinafter referred to as the System Under Test (SUT). Table 2-1 depicts the SUT identifying information and requirements source.

Table 2-1. System and Requirements Identification

System Identification	
Sponsor	United States Army
Sponsor Point of Contact	Director, Networks Services Directorate, P.O. Box 549, Fort Meade, Maryland 20755-0549
Vendor Point of Contact	Mr. Eric Tolliver, E-mail: eric.tolliver@al-enterprise.com Mr. Butch Jones, E-mail: butch.jones@al-enterprise.com (Alternate)
System Name	ALE OmniSwitch OS6560, OS6860E, OS6860N, OS6865, OS6900 Series
Increment and/or Version	AOS 8.9.R21
Product Category	ASLAN Core, Distribution, and Access Switch
System Background	
Previous certifications	None
Tracking	
APCO ID	Tracking Number 2215701
System Tracking Program ID	11679
Requirements Source	
Unified Capabilities Requirements	Unified Capabilities Requirements 2013, Change 2, Section 7.2
Remarks	None
Test Organization(s)	Join Interoperability Test Command Test Lab, Fort Meade, Maryland

LEGEND:

ALE	Alcatel Lucent Enterprise	ASLAN	Assured Services Local Area Network
AOS	Alcatel Operating System	ID	Identification
APCO	Approved Products Connection Office	OS	OmniSwitch

2. SYSTEM DESCRIPTION. The Unified Capabilities Requirements (UCR) 2013, Change 2, defines two types of Local Area Networks (LANs): Assured Services Local Area Networks (ASLANs) and non-ASLANS. The LANs are designated to meet traffic engineering and redundancy requirements, as required by applicable mission needs. The ASLAN and non-ASLANs may be designated to use any combination of the layers and functional capabilities. ASLANs support assured services and provide enhanced availability and backup power while non-ASLAN need not meet assured services requirements. The Department of Defense (DoD) Information Network (DoDIN) LAN components for both ASLAN and non-ASLAN are Core, Distribution, and Access switches. The core layer is a high-speed switching backbone designed to switch packets as quickly as possible. The distribution layer is the demarcation point between the access and core layers. The distribution layer helps to define and differentiate the core, provides boundary definition, and is the place at which packet manipulation can take place. The access layer is the point at which local end users are allowed into the network. This layer may use access list or filters to optimize further the needs of a particular set of users.
The SUT is an ASLAN Core, Distribution, and Access switch. The SUT represents a set of

compact, high density, stackable and modular chassis, LAN switches that offer high performance, low latency, Quality of Service (QoS), and Layer 2 (L2) and Layer 3 (L3) switching capabilities.

The ASLAN network is configured with traditional Core, Distribution, and Access layers. The distribution layer provides fully redundant connectivity between the access and the core devices by using Link Aggregation Control Protocol (LACP), Open Shortest Path First (OSPF), and Virtual Router Redundancy Protocol (VRRP) to create a robust architecture. Components enabled for L3 use OSPFv2 and OSPFv3 routing protocols for dynamic routing. ALE's ASLAN components utilize advanced QoS features to prioritize voice, video, and data traffic in accordance with (IAW) the (UCR) 2013, Change 2, requirements.

The system consists of the following components:

Component 1. OS6900-C32E – 100 Gigabit Ethernet (GE) L3 fixed configuration chassis in a 1 Rack Unit (RU) form factor with 32 Quad Small Form Factor Pluggable (QSFP) 28 ports. Ports operate as single 40/100GigE port or Quad-10/25GE.

Component 2. OS6900-X48 – 10Gigabit (G)/100GE L3 fixed configuration chassis in a 1RU form factor with 48 1/10G Small Form Factor Pluggable (SFP)+ ports and 6 40/100G QSFP28 ports. All QSFP28 ports operate as single 40/100GE port and 2 ports support splitter mode to 4x10GE or 4x25GE. Console and Ethernet management ports are RJ-45. The TA model is Trade Agreements Act (TAA) compliant.

Component 3. TA6865-P16X – Hardened GE L3 fixed configuration fan-less chassis with 12 Registered Jack (RJ)-45 10/100/1000 Base-T Power over Ethernet (PoE)+ ports of which 4 are 75W Institute of Electrical and Electronics Engineering (IEEE) 802.3bt ports, two 1000 Base-X SFP ports, two SFP+ (1G/10G) ports, Recommended Standard (RS)-232 Console (RJ-45), and USB port. The TA model is TAA compliant, while the D model is direct current (DC) power.

Component 4. OS6860N-P48Z – Fixed-configuration chassis in a 1RU form factor with 36x10/100/1000 Base-T 60W IEEE 802.3bt PoE ports, 2x100/1000/2500/5000 megabits per second (Mbps) multi-gigabit 95W 802.3 bt PoE ports, four SFP28 (1G/10G/25G) Media Access Control Security (MACsec) ports, and 2x 100G QSFP28 Virtual Chassis link ports. All PoE ports are IEEE 802.3bt compliant. All SFP28 25G ports are 256-bit are MACSec capable. The OS6860N-P48Z model is 920W alternating Current (AC), and the OS6860N-PH48Z model is 600W AC.

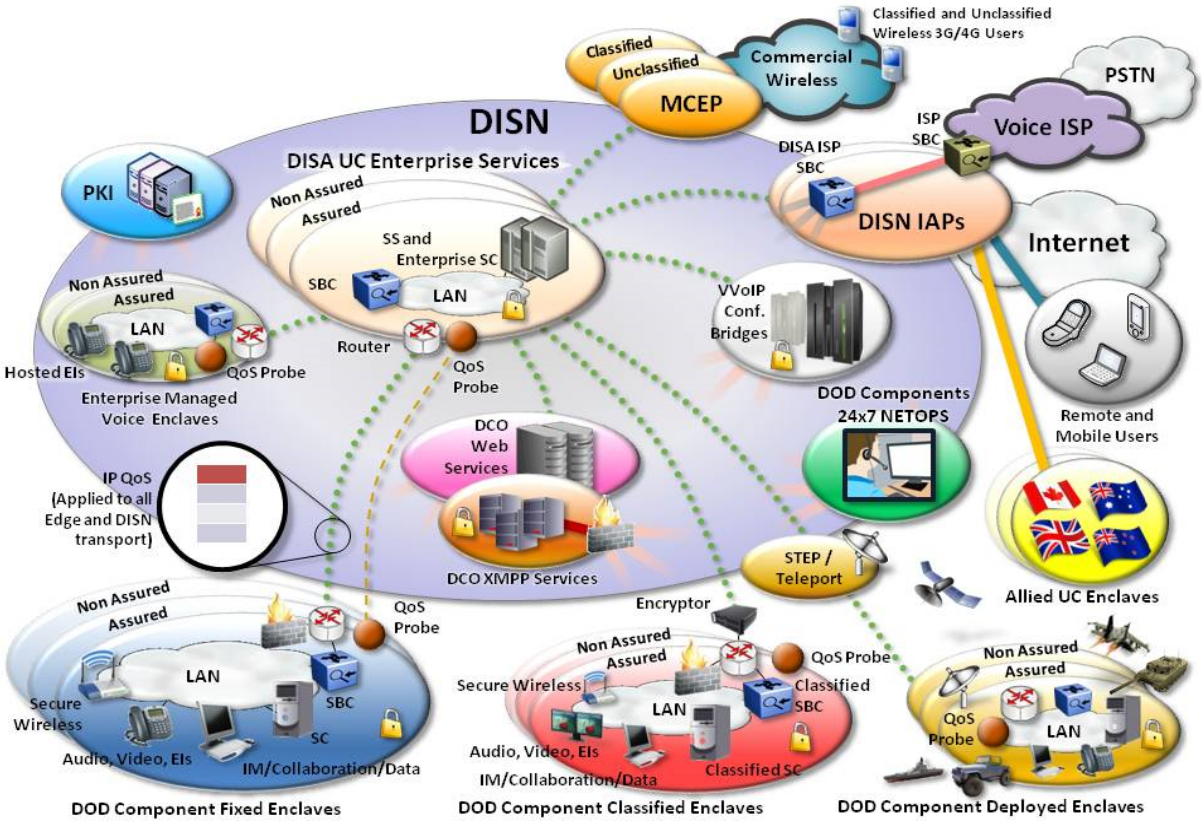
Component 5. TA6860E-P48 – GE L3 fixed configuration chassis in a 1U form factor with 48 RJ-45 10/100/1000 Base-T PoE+ ports of which 4 are 60 Watt (W), 4 fixed SFP+ (1G/10G) ports, USB, Ethernet Management Port, and two Visual Fault Locator/stacking ports. The TA model is TAA compliant.

Component 6. OS6560-24X4 – Gigabit fixed chassis in 1RU size. Includes 24 RJ-45 10/100/1G BaseT, 2xSFP(1G), 4xSFP+ (1G/10G) uplink/stacking ports, and internal AC supply.

Management Description. The OmniSwitch family in the Joint Interoperability Test Command (JITC) configuration can be accessed via Secure Shell (SSH), Secure File Transfer Protocol (SFTP), and Hypertext Transfer Protocol Secure (HTTPS), using either local or Remote Authentication Dial-In User Service (RADIUS) authentication. OmniSwitch allows sending notices to a remote System Log (Syslog) server.

3. OPERATIONAL ARCHITECTURE. The DoDIN architecture is a two-level network hierarchy consisting of Defense Information Systems Network backbone switches and Service/Agency installation switches. The DoD Chief Information Officer and Joint Staff policy and subscriber mission requirements determine the type of switch allowable at a particular location. The DoDIN architecture, therefore, consists of several categories of switches. Figure 2-1 depicts the notional operational DoDIN architecture in which the SUT may be used.

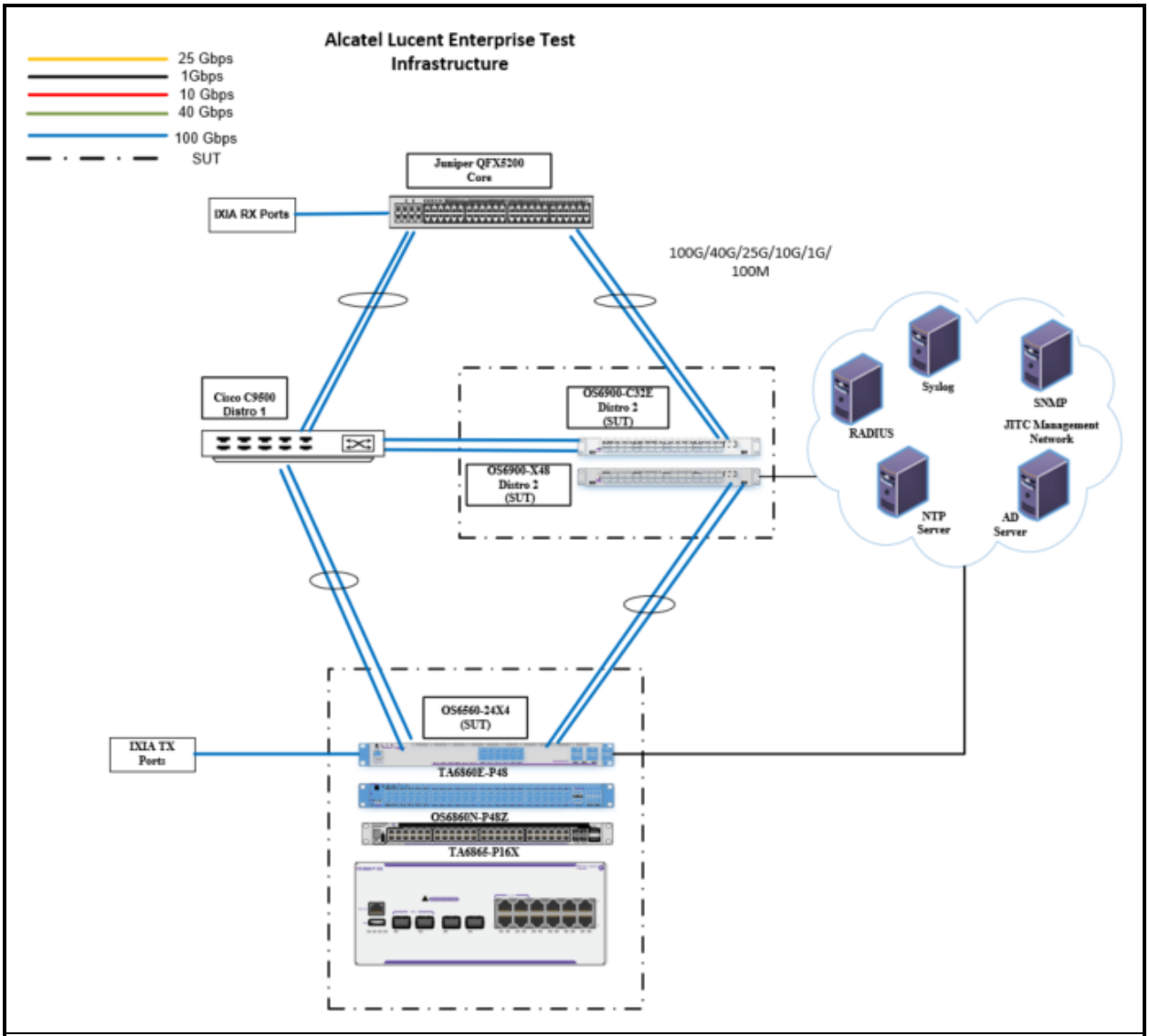
4. TEST CONFIGURATION. The JITC test team tested the SUT at the Fort Meade, Maryland test lab in a manner and configuration like that of the notional operational environment depicted in Figure 2 1. The test team tested the SUT's required interoperability functions and features using the test configuration depicted in Figure 2-2. The test configuration used for CS testing is documented in separate report, Reference (c).



LEGEND:

3G/4G	generation of mobile technology	MCEP	Multi Carrier Entry Point
Conf.	Conference	NETOPS	Network Operations
DCO	Defense Connection Online	PKI	Public Key Infrastructure
DISA	Defense Information Systems Agency	PSTN	Public Switched Telephone Network
DISN	Defense Information Systems Network	QoS	Quality of Service
DoD	Department of Defense	SBC	Session Border Controller
DoDIN	DoD Information Network	SC	Session Controller
EI	End Instrument	SS	Softswitch
IAP	Internet Access Point	STEP	Standardized Tactical Entry Point
IM	Instant Messaging	UC	Unified Capabilities
IP	Internet Protocol	VVoIP	Voice and Video over IP
ISP	Internet Service Provider	XMPP	Extensible Messaging and Presence Protocol
LAN	Local Area Network		

Figure 2-1. Notional DoDIN Network Architecture



LEGEND:

AD	Active Directory	RX	Receive
Distro	Distribution	RADIUS	Remote Authentication Dial-In User Service
Gbps	Gigabits Per Second	SNMP	Simple Network Management Protocol
G	Gigabit	SUT	System Under Test
JITC	Joint Interoperability Test Command	Syslog	System Log
M	Megabit	TA	Trade Agreement Act (TAA) compliant
NTP	Network Time Protocol	TX	Transmit
OS	OmniSwitch		

Figure 2-2. SUT Test Configuration

5. METHODOLOGY. JITC conducted testing using LAN requirements derived from the UCR 2013, Change 2, Reference (b), and the ASLAN test procedures, from Reference (d). In addition to testing, an analysis of the Vendor's Letter of Compliance (LoC) verified that letter "R" requirements have been met. No discrepancies were noted during this test event. Any discrepancies noted in the operational environment will be evaluated for impact on the existing certification. The Defense Information Systems Agency (DISA) will adjudicate these new discrepancies to the satisfaction of DISA via a Vendor Plan of Action and Milestones (POA&M), which will address all new critical Test Discrepancy Reports (TDRs) within 120 days of identification.

6. INTEROPERABILITY REQUIREMENTS, RESULTS, AND ANALYSIS.
The UCR 2013, Change 2, Section 7.2, established the interface, Capability Requirements (CR) and Functional Requirements (FR), CS, and other requirements for DoDIN ASLANs. Table 3-1 provides the SUT interface interoperability status and Table 3-2 provides the CR and FR status. Testing details and results are provided in the following sub-paragraphs. Optional and/or conditional requirements are not included in the test results unless otherwise noted.

a. The UCR 2013, Change 2, section 7.2.1 includes the General LAN Switch and Router Product Requirements. Core, Distribution, and Access products shall be capable of meeting the following parameters:

1) The general requirements are listed in the subparagraphs below.

a) Non-blocking: Non-blocking is defined as the capability to send and receive a mixture of 64-to-1518-byte packets at full duplex across all ports, through the component's backplane without losing any packets. In a non-blocking switch, all ports can run at full wire speed without any loss of packets.

b) Blocking: Blocking factor is defined as the ratio of all traffic to non-blocked traffic (i.e., a blocking factor of 8 to 1 means that 12.5 percent of the traffic must be non-blocking.)

1. Access Products. Access products (including PONs used as access devices) shall not have a blocking factor that exceeds 8 to 1.

2. Distribution and Core Products: Distribution and Core products shall not have a blocking factor that exceeds 2 to 1.

The SUT met this requirement with testing and the Vendor's LoC. Table 3-3 in Enclosure provides the results for all tested components.

c) Latency. All Core, Distribution, and Access products shall have the capability to transport prioritized packets (media and signaling) as follows. The latency shall be achievable over any 5-minute period measured from ingress ports to egress ports under congested conditions. A congested condition is defined as 100 percent bandwidth utilization. Prioritized packets are defined as packets having a service class above best effort. Voice packets may have no more than 2 milliseconds (ms) latency. Voice and video signaling packets may have no more than 2 ms latency. Video packets may have no more than 10 milliseconds (ms) latency. The SUT met this requirement with testing. Table 2-2 shows the SUT measured latencies for each interface.

Table 2-2. SUT Measured Latency

Interface	SUT Measured Latency	UCR Requirement for Voice/Video
10BaseX	Not Tested (See note.)	2 ms / 10 ms
100BaseX	Not Tested (See note.)	2 ms / 10 ms
1000BaseX	0.016 ms voice/.016 ms video latency	2 ms / 10 ms
10GBaseX	0.016 ms voice/.016 ms video latency	2 ms / 10 ms
25GBaseX	0.016 ms voice/.016 ms video latency	2 ms / 10 ms
40GBaseX	0.016 ms voice/.016 ms video latency	2 ms / 10 ms
100GBaseX	0.016 ms voice/.016 ms video latency	2 ms / 10 ms

NOTE(S): JITC tested the 1/10/25/40/100 Gbps interfaces but not the 10/100BaseX interfaces. JITC analysis determined the 10/100BaseX interfaces are low risk for certification without testing based on the Vendor's LoC to comply with the IEEE 802.3i/u standards and the testing data collected at all other data rates.

LEGEND:

BaseX	Megabit Ethernet over Fiber or Copper	LoC	Letter of Compliance
GBaseX	Gigabit Ethernet over Fiber or Copper	ms	milliseconds
Gbps	Gigabits per seconds	SUT	System Under Test
IEEE	Institute of Electrical and Electronics Engineers	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command		

d) Jitter. All Core, Distribution, and Access products shall have the capability to transport prioritized packets (media and signaling) as follows. The jitter shall be achievable over any five-minute period measured from ingress ports to egress ports under congested conditions. Congested condition is defined as 100 percent bandwidth utilization. Voice packets may have no more than 1 ms jitter. Video packets may have no more than 10 ms jitter. The SUT met this requirement with testing. Table 2-3 shows the SUT measured jitter for each interface.

Table 2-3. SUT Measured Jitter

Interface	SUT Measured Jitter	UCR Requirement for Voice/Video
10BaseX	Not Tested (See note.)	1 ms / 10 ms
100BaseX	Not Tested (See note.)	1 ms / 10 ms
1000BaseX	0.032 ms voice/.029 ms video	1 ms / 10 ms
10GBaseX	0.032 ms voice/.029 ms video	1 ms / 10 ms
25GBaseX	0.032 ms voice/.029 ms video	1 ms / 10 ms
40GBaseX	0.032 ms voice/.029 ms video	1 ms / 10 ms
100GBaseX	0.032 ms voice/.029 ms video	1 ms / 10 ms

NOTE(S): JITC tested the 1/10/25/40/100 Gbps interfaces but not the 10/100BaseT interfaces. JITC analysis determined the 10/100BaseT interfaces are low risk for certification without testing based on the Vendor's LoC to comply with the IEEE 802.3i/u standards and the testing data collected at all other data rates.

(Table continues next page.)

Table 2-3. SUT Measured Jitter (continued)

LEGEND:			
BaseX	Megabit Ethernet over Fiber or Copper	LoC	Letter of Compliance
GBaseX	Gigabit Ethernet over Fiber or Copper	ms	milliseconds
Gbps	Gigabits per seconds	SUT	System Under Test
IEEE	Institute of Electrical and Electronics Engineers	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command		

e) Packet Loss. All Core, Distribution and Access products shall have the capability to transport prioritized packets (media and signaling) as follows. The packet loss shall be achievable over any 5-minute period measured from ingress ports to egress ports under congested conditions. Congested condition is defined as 100 percent bandwidth utilization. The SUT met this requirement with testing. Table 2-4 shows the SUT measured packet loss for each interface.

Table 2-4. SUT Measured Packet Loss

Interface	SUT Measured Packet Loss				UCR Requirement			
	Voice	Video	Preferred Data	Best Effort Data	Voice	Video	Preferred Data	Best Effort Data
10BaseX	Not Tested (See note.)				0.015%	0.05%	0.05%	No minimum requirement in the UCR.
100BaseX	Not Tested (See note.)				0.015%	0.05%	0.05%	
1000BaseX	0.00%	0.00%	0.00%	0.00%	0.015%	0.05%	0.05%	
10GBaseX	0.00%	0.00%	0.00%	0.00%	0.015%	0.05%	0.05%	
25GBaseX	0.00%	0.00%	0.00%	0.00%	0.015%	0.05%	0.05%	
40GBaseX	0.00%	0.00%	0.00%	0.00%	0.015%	0.05%	0.05%	
100GBaseX	0.00%	0.00%	0.00%	0.00%	0.015%	0.05%	0.05%	

NOTE(S): JITC tested the 1/10/25/40/100 Gbps interfaces but not the 10/100BaseT interfaces. JITC analysis determined the 10/100BaseT interfaces are low risk for certification without testing based on the Vendor's LoC to comply with the IEEE 802.3i/u standards and the testing data collected at all other data rates.

LEGEND:			
BaseX	Megabit Ethernet over Fiber or Copper	JITC	Joint Interoperability Test Command
GBaseX	Gigabit Ethernet over Fiber or Copper	LoC	Letter of Compliance
Gbps	Gigabits per second	SUT	System Under Test
IEEE	Institute of Electrical and Electronics Engineers	UCR	Unified Capabilities Requirements

2) Port Interface Rates Requirements

a) Minimally, Core and Distribution products shall support the following interface rates [other rates and Institute of Electronics and Electrical Engineers (IEEE) standards maybe provided as optional interfaces]. Rates specified are the theoretical maximum data bit rate specified for Ethernet; link capacity and effective throughput is influenced by many factors. For calculation purposes, link capacities are to be calculated in IAW definitions contained in Request for Comments (RFC) 2330 and RFC 5136. Network Management (NM) interfaces are defined in Section 2.19. Core products that support assured services shall have a minimum of 4 interfaces for connecting to WAN and Distribution products. Distribution products that support assured services shall have a minimum of 4 fiber interfaces for interconnecting to the core, peer distribution, and access products.

The product must minimally support one or more of the following fiber interfaces. The SUT met this requirement with testing and the Vendor's LoC.

- 1 Gigabit per second (Gbps) IAW IEEE 802.3ab
- 1 Gbps IAW IEEE 802.3z
- 10 Gbps IAW IEEE 802.3ae
- 10 Gbps IAW IEEE 802.3an
- 40 Gbps IAW IEEE 802.3ba (single mode fiber)
- 100 Gbps IAW IEEE 802.3ba (single mode fiber)

b) Minimally, Access products shall provide one of the following user-side interface rates (other rates and IEEE standards may be provided as optional interfaces). The SUT met this requirement with testing and the Vendor's LoC.

- 10 Mbps IAW IEEE 802.3i
- 10 Mbps IAW IEEE 802.3j
- 100 Mbps IAW IEEE 802.3u
- 1000 Mbps IAW IEEE 802.3z
- 1000 Mbps IAW IEEE 802.3ab
- 10 Gbps IAW IEEE 802.3ae

c) Minimally, Access products shall provide one of the following access to distribution interface rates (other rates and IEEE standards may be provided as optional interfaces). The SUT met this requirement with testing and the Vendor's LoC.

- 1 Gbps IAW IEEE 802.3ab
- 1 Gbps IAW IEEE 802.3z
- 10 Gbps IAW IEEE 802.3ae
- 10 Gbps IAW IEEE 802.3an
- 40 Gbps IAW IEEE 802.3ba (single mode fiber)
- 100 Gbps IAW IEEE 802.3ba (single mode fiber)

d) Access product that supports assured services and more than 96 telephony subscribers shall have a minimum of two 1 Gbps fiber interfaces to connect to the distribution layer. The SUT met this requirement with testing and the Vendor's LoC.

e) The Core, Distribution, and Access products may provide a fibre channel interface IAW American National Standards Institute (ANSI) International Committee for Information Technology Standards (INCITS) T11.2 and T11.3 (previously known as X3T9.3). If provided, the interface must meet the following RFCs:

- RFC 4338, Transmission of IPv6, IPv4, and Address Resolution Protocol (ARP) Packets over Fibre Channel
- RFC 4044, Fibre Channel Management

The SUT does not support the optional fibre channel interfaces.

f) The Core, Distribution, and Access products may provide one or more of the following wireless LAN interface rates:

- 54 Mbps IAW IEEE 802.11a
- 11 Mbps IAW IEEE 802.11b
- 54 Mbps IAW IEEE 802.11g
- 300–600 Mbps IAW IEEE 802.11n
- 500 – 1000 Mbps IAW IEEE 802.11ac
- IEEE 802.16-2012: Broadband wireless communications standards for MANs
- Other approved IEEE wireless interfaces may be implemented as optional interfaces.

The SUT does not support the optional wireless interfaces.

g) If any of the above wireless interfaces are provided, then the interfaces must support the requirements of Section 7.3, Wireless LAN. The SUT does not support the optional wireless interfaces.

3) Port Parameter Requirements. The Core, Distribution, and Access products shall provide the parameters on a per port basis as specified in the following subparagraphs. These are required for Core, Distribution, and L2/L3 Access unless specified otherwise.

a) Auto-negotiation IAW IEEE 802.3. All interfaces shall support auto-negotiation even when the IEEE802.3 standard has it as optional. This applies to 10/100/1000-T Ethernet standards (i.e., IEEE Ethernet Standard 802.3, 1993; or IEEE, Fast Ethernet Standard 802.3u, 1995; and IEEE, Gigabit Ethernet Standard 802.3ab, 1999). The SUT met this requirement with testing and the Vendor's LoC.

b) Force mode IAW IEEE 802.3. The SUT met this requirement with testing and the Vendor's LoC.

c) Flow control IAW IEEE 802.3x (Optional: Core). The SUT met this requirement with the Vendor's LoC.

d) Filtering IAW appropriate RFC 1812 sections (sections applying to filtering). The SUT met this requirement with the Vendor's LoC.

e) Link Aggregation IAW IEEE 802.1AX (applies to outputs/egress trunk-side ports only) (Optional Access). For non-ASLAN product certification, Core, Distribution, or Access products do not have to meet link aggregation failover requirements. The SUT met this requirement with testing and Vendor's LoC.

f) Spanning Tree Protocol IAW IEEE 802.1D (Optional: Core). The SUT met this requirement with testing and the Vendor's LoC.

g) Multiple Spanning Tree IAW IEEE 802.1s (Optional: Core). The SUT met this requirement with testing and the Vendor's LoC.

h) Rapid Reconfiguration of Spanning Tree IAW IEEE 802.1w (Optional: Core). The SUT met this requirement with the Vendor's LoC.

i) Port-Based Access Control IAW IEEE 802.1x (Optional: Core, Distribution, and Access). The SUT met this requirement with the Vendor's LoC.

j) Link Layer Discovery Protocol (LLDP) IAW IEEE 802.1AB (Optional Core, Distribution, and Access). The SUT met this requirement with the Vendor's LoC.

k) Link Layer Discovery – Media Endpoint Discovery IAW ANSI/ Telecommunications Industry Association (TIA)-1057 (Optional Core, Distribution, and Access). The SUT met this requirement with the Vendor's LoC.

l) PoE IAW either 802.3af-2003 or 802.3at-2009. (Required only for Access Switches supporting VVoIP solutions (AS and non-AS); for data applications, PoE is optional.). The SUT does not support this optional requirement.

m) Shortest Path Bridging (SPB) [Optional]. If supported, the product shall provide shortest path bridging (SPB) IAW RFC 6329 and IEEE 802.1aq. (Note: Requires IS-IS as routing protocol.). The SUT does not support this optional requirement.

n) Transparent Interconnection of Lots of Links (TRILL) [Optional]. If supported, the product shall provide TRILL IAW RFCs 6325, 6326, 6327, 6349, and 6350. Devices may support conditional interfaces (FCoE and PPP). If the conditional interfaces are provided RFCs 6847 (FCoE) and 6361 (PPP) shall be applicable. (Note: Requires IS-IS as routing protocol.) The SUT does not support this optional requirement.

4) Class of Service Markings Requirements

a) The Core, Distribution, and Access products shall support Differentiated Services Code Points (DSCPs) IAW RFC 2474 for both IPv4 and IPv6 Packets, as follows:

1. Core and Distribution Products. The Core and Distribution products shall be capable of accepting any packet tagged with a DSCP value (0-63) on an ingress port and assign that packet to a Quality of Service (QoS) behavior listed in Section 7.2.1.6, Quality of Service Features. The SUT OS6900-C32E and OS6900-T48 components met this requirement with testing and the Vendor's LoC.

2. Core and Distribution Products. The Core and Distribution products shall be capable of accepting any packet tagged with a DSCP value (0-63) on an ingress port and reassign that packet to any new DSCP value (0-63). Current DSCP values are provided in Section 6.3.2, Traffic Conditioning Specification. (Optional: Access products). The SUT OS6900-C32E and OS6900-T48 components met this requirement with testing and the Vendor's LoC.

3. Core and Distribution Products. The Core and Distribution products must be able to support the prioritization of aggregate service classes with queuing according to Section 7.2.1.6, Quality of Service Features. The SUT OS6900-C32E and OS6900-T48 components met this requirement with testing and the Vendor's LoC.

4. Access products. Access products shall be capable of supporting the prioritization of aggregate service classes with queuing according to Section 7.2.1.6, Quality of Service Features. Queuing may be supported in either of the two following class of service (CoS) methods.

a. L3 CoS. L3 CoS involves support for DSCP IAW RFC 2474 for IPv4 and IPv6. Within this CoS method, the access product shall support queuing by either: a) queuing directly based on the DSCP within the IP header (IPv4 and IPv6). The original DSCP value must also be preserved and passed unaltered through the product; or, b). The product shall inspect the IP header (IPv4 and IPv6). Based on the DSCP value contained within the IP header, the product may map the DSCP value (0-63) to the Ethernet priority field (decimal values 0-7). Queuing may be based on the mapping of the DSCP to a layer 2 priority field value. Any received DSCP value (0-63) must be able to be mapped to any priority value (0-7). The original DSCP value must be preserved and passed unaltered through the product. The SUT OS6865-P16X, OS6860N-P48Z, 0S6860E-P48, and OS6560-24X4 components met this requirement with testing and the Vendor's LoC.

b. L2 CoS. L2 CoS shall use the Virtual LAN identification (VLAN ID), see Section 7.2.1.4, defined in IEEE 802.1Q to perform queuing assignment. Access devices shall be capable of assigning any VLAN ID (either directly or through the 3 Ethernet priority bits (decimal values 0 through 7) to any of the 4 queues. The SUT OS6865-P16X, OS6860N-P48Z, 0S6860E-P48, and OS6560-24X4 components met this requirement with testing and the Vendor's LoC.

b) The Core, Distribution, and Access products may support the 3-bit user priority field of the IEEE 802.1Q 2-byte Tag Control Information (TCI) field (see Figure 7.2-1, IEEE 802.1Q Tagged Frame for Ethernet, and Figure 7.2-2, TCI Field Description). Default values are provided in Table 7.2-1, 802.1Q Default Values. If provided, the following Class of Service (CoS) requirements apply.

1. Core, Distribution, and Access Products. The Core, Distribution, and Access products shall be capable of accepting any frame tagged with a user priority value (0–7) on an ingress port and assign that frame to a QoS behavior listed in Section 7.2.1.6, Quality of Service Features. The SUT components OS6900-C32E, OS6865-P16X, OS6860N-P48Z, OS6860E-P48, and OS6560-24X4 met this requirement with testing and the Vendor's LoC

2. Core and Distribution Products. The Core and Distribution products shall be capable of accepting any frame tagged with a user priority value (0-7) on an ingress port and reassign that frame to any new user priority value (0-7) (Optional: Distribution and Access). The SUT OS6900-C32E, OS6865-P16X, OS6860N-P48Z, OS6860E-P48, and OS6560-24X4 components met this requirement with testing and the Vendor's LoC.

5) Virtual LAN Capabilities Requirements

a) The Core, Distribution, and Access products shall be capable of the following:

1. Accepting Virtual Local Area Network (VLAN) tagged frames according to IEEE 802.1Q (see Figure in UCR 2013 Change 2, 7.2-1, IEEE 802.1Q Tagged Frame for Ethernet, and Figure 7.2-2, TCI Field Description). The SUT met this requirement with testing and the Vendor's LoC.

2. Configuring VLAN IDs (VIDs). VIDs on an ingress port shall be configurable to any of the 4094 values (except 0 and 4095). The SUT met this requirement with testing and the Vendor's LoC.

3. Supporting VLANs types IAW IEEE 802.1Q. The SUT met this requirement with testing and the Vendor's LoC.

b) The DoDIN products must be capable of accepting VLAN tagged frames and assigning them to the VLAN identified in the 802.1Q VID field (see Figure 7.2-4, IEEE 802.1Q-Based VLANs). The SUT met this requirement with testing and the Vendor's LoC.

6) Protocol Requirements. The Core, Distribution, and Access products shall meet protocol requirements for IPv4 and IPv6. The RFC requirements are listed in UCR 2013, Change 2, Table 7.2-2, ASLAN Infrastructure RFC Requirements. Additional IPv6 requirements by product profile are listed in UCR 2013, Change 2, Section 5, IPv6. These RFCs are not meant to conflict with Department of Defense (DoD) Cybersecurity policy [e.g., Security Technical Implementation Guidelines (STIGs)]. Whenever a conflict occurs, DoD Cybersecurity policy takes precedence. If a conflict occurs with Section 5, RFCs applicable to IPv6 in Section 5 take precedence. The SUT met this requirement with testing and the Vendor's LoC.

7) Quality of Service Features Requirements

a) The Core, Distribution, and Access products shall be capable of the following QoS Features:

1. Providing a minimum of four queues. The SUT met this requirement with testing and the Vendor's LoC.

2. Assigning any incoming access/user-side "tagged" session to any of the queues for prioritization onto the egress (trunk-side/network-side) interface. The SUT met this requirement with testing and the Vendor's LoC.

3. Supporting Differentiated Services (DS), Per-Hop Behaviors (PHBs), and traffic conditioning IAW RFCs 2474, 2597, and 3246. The SUT met this requirement with testing and the Vendor's LoC.

4. All queues shall be capable of having a bandwidth (BW) assigned (i.e., queue 1: 200 Kbps, queue 2: 500 kbps) or percentage of traffic (queue 1: 25 percent, queue 2: 25 percent). The BW or traffic percentage shall be fully configurable per queue from 0 to full BW or 0 to 100 percent. The sum of configured queues shall not exceed full BW or 100 percent of traffic. The SUT met this requirement with testing and the Vendor's LoC.

5. Core, Distribution, and Access products shall meet the traffic conditioning (policing) requirements of Section 6.2.4. The product shall calculate the bandwidth associated with traffic conditioning, which requires that the queue size should account for the Layer 3 header (i.e., IP header), but not the Layer 2 headers (i.e., Point-to-Point Protocol [PPP], Media Access Control, and so on) within a margin of error of plus or minus10 percent. When the other queues are not saturated, the Best Effort traffic may surge beyond its traffic-engineered limit. The SUT met this requirement with testing and the Vendor's LoC.

6. Optionally provide a minimum of six queues (see Six-Queue Design). The optional six-queue was not tested during this test event.

b) The product shall support the Differentiated Services Code Point (DSCP) plan, as shown in Table 7.2-3, DSCP Assignments. DS assignments shall be software configurable for the full range of six-bit values (0-63 Base10) for backwards compatibility with IP precedence environments that may be configured to use the Type of Service (TOS) field in the IP header but do not support DSCP. The SUT met this requirement with testing and the Vendor's LoC.

8) Network Monitoring Requirements. The Core, Distribution, and Access products shall support the following network monitoring features:

a) Simple Network Management Protocol (SNMP) v3 (SNMPv3) IAW RFCs 3411, 3412, 3413, 3414, 3415, 3416, and 3417. The Solarwinds SNMP Network Performance Monitor was used to capture SNMP traps. The SUT met this requirement with testing and the Vendor's LoC.

b) Remote Monitoring (RMON) IAW RFC 2819. The product shall minimally support the following RFC 2819 groups: Ethernet statistics, history control, Ethernet history, and alarm. The SUT met this requirement with the Vendor's LoC.

c) Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework IAW RFC 3584. The SUT met this requirement with testing and the Vendor's LoC.

d) The Advanced encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826. The SUT met this requirement with testing and the Vendor's LoC.

9) Security Requirements. The Core, Distribution, and Access products shall meet the security protocol requirements listed in Section 4, Cybersecurity, as follows: Core and Distribution products shall meet all requirements annotated as Router (R) and LAN Switch (LS). Access switches shall meet the CS requirements annotated for LS. In addition to wireless CS requirements previously specified, Wireless Local Area Network Access Systems and Wireless Access Bridges shall meet all CS requirements for LSs. Wireless end instruments shall meet all CS requirements annotated for end instruments. When conflicts exist between the UCR and STIG requirements, the STIG requirements will take precedence. The SUT met the requirements in the UCR 2013, Change 2, Section 4, with the Vendor's LoC. In addition, a JITC-led CS test team conducted CS testing and published the results in a separate report, Reference (c).

b. The UCR 2013, Change 2, section 7.2.2 includes the LAN Switch and Router Redundancy Requirements. The ASLAN (High and Medium) shall have no single point of failure that can cause an outage of more than 96 IP telephony subscribers. A single point of failure up to and including 96 subscribers is acceptable; however, to support mission-critical needs, FLASH/FLASH OVERRIDE (F/FO) subscribers should be engineered for maximum availability. To meet the availability requirements, all switching/routing platforms that offer service to more than 96 telephony subscribers shall provide redundancy in either of two ways:

- The product itself (Core, Distribution, or Access) provides redundancy internally.
- A secondary product is added to the ASLAN to provide redundancy to the primary product (redundant connectivity required).

1) Single Product Redundancy Requirements. If a single product is used to meet the redundancy requirements, then the following requirements are applicable to the product.

- Dual Power Supplies
- Dual Processors (Control Supervisors)
- Termination Sparing
- Redundancy Protocol
- No Single Failure Point
- Switch Fabric or Backplane Redundancy

- In the event of a component failure in the product, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and all traffic flows shall be restored within 5 seconds.

The SUT does not support Single Product Redundancy.

2) Dual Product Redundancy Requirements. If the SUT provides redundancy through dual products, then the requirements in the following subparagraphs are applicable. Non-ASLAN products are not required to meet any redundancy requirements because they are non-assured. The SUT meets this requirement when deployed in a stack configuration IAW the SUT Military Unique Deployment Guide condition of fielding.

a) The failover over to the secondary product must not result in any lost calls (loss of existing connection requiring redialing).

b) Failover to the secondary product shall complete within 5 seconds with all traffic flows restored.

The SUT met the Dual Product Redundancy requirements with testing and the Vendor's LoC.

3) Survivability. An ASLAN product is required to use routing protocols IAW the DoD Information Technology (IT) Standards Registry (DISR) to provide survivability. The minimum routing protocols that must be supported are as follows:

- The product shall support Border Gateway Protocol (BGP) for inter-domain routing. The SUT met this requirement with the Vendor's LoC.
- The product shall support Open Shortest Path First (OSPF), Version 2, for IPv4 and OSPF Version 3 for IPv6, July 2008, and IAW RFC 5340. The SUT met this requirement with testing and the Vendor's LoC.
- If OSPF is Supported, the product shall support OSPFv2 Graceful restart (RFC 3623) and OSPFv3 Graceful Restart (RFC 5187). The SUT met this requirement with the Vendor's LoC.
- If the IS-IS protocol is supported, IS-IS shall be compliant with RFC 1195 – "Use of OSI IS-IS for Routing in TCP/IP and Dual Environments", 1990; RFC 2763 – "Dynamic Host Name Exchange Mechanism for IS-IS", 2000; RFC 2966 – "Domain-wide Prefix Distribution with Two-Level IS-IS", 2000; and RFC 3373 – "Three-Way Handshake for Intermediate System to Intermediate System (IS-IS) Point-to-Point Adjacencies", 2002. For IPv6, IS-IS shall meet RFC 5340, Routing Ipv6 with IS-IS. If OSPF is Supported, the product shall support OSPFv2 Graceful restart (RFC 3623) and OSPFv3 Graceful Restart (RFC 5187). The SUT met this requirement with the Vendor's LoC.
- Graceful Restart for BGP (RFC 4724) is required for core and distribution infrastructure products. The SUT met this requirement with the Vendor's LoC.

- The product shall support Virtual Router Redundancy Protocol (VRRP) – RFCs 2787 and 5798 - to provide redundancy to L2 switches that lose connectivity to an L3 router. The Distribution product shall employ VRRP to provide survivability to any product running L2 (normally the Access Layer). The SUT met this requirement with testing and the Vendor's LoC.

c. The UCR 2013, Change 2, section 7.2.3 includes the LAN Product Requirements Summary. Table 7.2-4 summarizes the LAN product requirements. These requirements were verified via a combination of Letter(s) of Compliance (LoCs) and as addressed in other sections of this document. The SUT met these requirements with testing and the Vendor's LoC.

d. The UCR 2013, Change 2, section 7.2.4 includes the Multiprotocol Label Switching Requirements in ASLANs. The implementation of ASLANs sometimes may cover a large geographical area. For large ASLANs, a data transport technique referred to as Multiprotocol Label Switching (MPLS) may be used to improve the performance of the ASLAN core layer.

1) MPLS ASLAN. An ASLAN product that implements MPLS must still meet all the ASLAN requirements for jitter, latency, and packet loss. The addition of the MPLS protocol must not add to the overall measured performance characteristics with the following caveats: The MPLS device shall reroute data traffic to a secondary pre-signaled Label Switched Path (LSP) in less than 5 seconds upon indication of the primary LSP failure. The ASLAN Core and Distribution products that will be used to provide MPLS services must support the RFCs contained in Table 7.2-5, ASLAN Product MPLS Requirements. The SUT does not support this optional MPLS requirement.

2) MPLS VPN Augmentation to VLANs. If an ASLAN product supports MPLS, it shall support MPLS layer 2 VPNS IAW RFC 4762. The product may additionally support RFC 4761 and RFC 5501. ASLAN products that support MPLS shall also support MPLS layer 3 VPNs IAW RFC 4364, RFC 4382, RFC 4577, RFC 4659, and RFC 4684. The MPLS device must support QoS in order to provide for assured services. The product must support one of the following QoS mechanisms: DSCP mapping to 3-bit EXP field (E-LSP) or Label description of PHB (L-LSP). The SUT does not support this optional MPLS requirement.

7. HARDWARE/SOFTWARE/FIRMWARE VERSION IDENTIFICATION: Table 3-3 provides the SUT components' hardware, software, and firmware tested. JITC, Fort Meade, Maryland tested the SUT in an operationally realistic environment to determine its interoperability capability with associated network devices and network traffic. Table 3-4 provides the hardware, software, and firmware of the components used in the test infrastructure.

8. TESTING LIMITATIONS. None.

9. CONCLUSION(S). The SUT meets the critical interoperability requirements for ASLAN Core, Distribution, and Access switches IAW the UCR 2013, Change 2 and is certified for joint use with other products listed on the DoDIN Approved Products List (APL).

DATA TABLES

Table 3-1. SUT Interface Status

Interface (See note 1.)	Applicability			Status	Remarks
	Co	D	A		
Network Management Interfaces (See note 2.)					
IEEE 802.3i (10BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseFX)	O	O	O	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	O	O	O	Not Tested	See note 4.
Access Interfaces (See note 2.)					
IEEE 802.3i (10BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3u (100BaseFX)	C	C	C	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	C	C	C	Met	See note 3.
IEEE 802.3bz (2.5/5GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ae (10GBaseX)	C	C	C	Met	See note 3.
IEEE 802.3by (25GBaseX	O	O	O	Met	See note 3.
IEEE 802.3ba (40GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3cd (50GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ba (100GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3bs (400GBaseX)	O	O	O	Not Tested	See note 4.
Uplink (Trunk) Interfaces (See note 2.)					
IEEE 802.3u (100BaseT UTP)	O	O	O	Met	See note 3.
IEEE 802.3u (100BaseFX)	O	O	O	Met	See note 3.
IEEE 802.3ab (1000BaseT UTP)	C	C	C	Met	See note 3.
IEEE 802.3z (1000BaseX Fiber)	C	C	C	Met	See note 3.
IEEE 802.3bz (2.5/5GBaseX)	C	C	C	Not Tested	See note 4.
IEEE 802.3ae (10GBaseX)	C	C	C	Met	See note 3.
IEEE 802.3by (25GBaseX)	O	O	O	Met	See note 3.
IEEE 802.3ba (40GBaseX)	O	O	O	Met	See note 3.
IEEE 802.3cd (50GBaseX)	O	O	O	Not Tested	See note 4.
IEEE 802.3ba (100GBaseX Fiber)	O	O	O	Met	See note 3.
IEEE 802.3bs (400GBaseX)	O	O	O	Not Tested	See note 4.

NOTE(S):
1. Table 3 depicts the SUT high-level requirements. Table 3-2 in Enclosure 3 provides a detailed list of requirements.
2. Core, Distribution, and Access products must minimally support one of the interfaces listed in this table as conditional for the given role. Other rates and standards may be provided as optional interfaces.
3. JITC tested the 1/10/25/40/100 Gbps interfaces but not the 10/100BaseT interfaces. JITC analysis determined the 10/100BaseT interfaces are low risk for certification based on the Vendor's LoC to comply with the IEEE 802.3i/u standards and the testing data collected at all other data rates.
4. The SUT does not support this optional or conditional interface.

LEGEND:

A	Access	Gbps	Gigabits per second
BaseFX	Megabit Ethernet over Fiber	IEEE	Institute of Electrical and Electronics Engineers
BaseT	Megabit (Baseband Operation, Twisted Pair) Ethernet	JITC	Joint Interoperability Test Command
BaseX	Megabit Ethernet over Fiber or Copper	LoC	Letter of Compliance
C	Conditional	O	Optional
Co	Core	SUT	System Under Test
D	Distribution	UTP	Unshielded Twisted Pair
GBaseX	Gigabit Ethernet over Fiber or Copper		

Table 3-2. Capability and Functional Requirements and Status

CR/FR ID	Capability/Function	Applicability (See note 1.)	UCR 2013 Change 2 Reference	Status
1	**General LAN Switch and Router Product**			
	Port Interface Rates	Required	7.2.1.1	Met
	Port Parameter	Required	7.2.1.2	Met
	Class of Service Markings	Required	7.2.1.3	Met
	Virtual LAN Capabilities	Required	7.2.1.4	Met
	Protocol Requirements	Required	7.2.1.5	Met
	Quality of Service Features	Required	7.2.1.6	Met
	Network Monitoring	Required	7.2.1.7	Met
	Security	Required	7.2.1.8	Met (See note 2.)
2	**LAN Switch and Router Redundancy**			
	Single Product Redundancy	Conditional	7.2.2.1	Not Tested (See note 3.)
	Dual Product Redundancy	Conditional	7.2.2.2	Met (See note 3.)
	Survivability	Required	7.2.2.3	Met
3	**LAN Product Requirements Summary**			
	LAN Product Requirements Summary	Optional	7.2.3	Met
4	**Multiprotocol Label Switching**			
	MPLS ASLAN	Optional	7.2.4.2	Not Tested (See note 4.)
	MPLS VPN Augmentation to VLANs	Optional	7.2.4.3	Not Tested (See note 4.)
5	Internet Protocol version 6 (IPv6)	Required	5.2	Met

NOTE(S):
1. The annotation of 'required' refers to a high-level requirement category. Refer to the UCR 2013, Change 2, Reference (b), for the applicability of each sub-requirement.
2. A JITC-led Cybersecurity test team conduced Cybersecurity testing and published the results in a separate report, Reference (c).
3. The SUT does not support Single Product Redundancy. The SUT met the Dual Product Redundancy requirements with testing and the Vendor's LoC.
4. The SUT does not support this optional MPLS requirement.

LEGEND:

ASLAN	Assured Services Local Area Network	LoC	Letter of Compliance
CR	Capability Requirement	MPLS	Multiprotocol Label Switching
FR	Functional Requirements	SUT	System Under Test
ID	Identification	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command	VLAN	Virtual Local Area Network
LAN	Local Area Network	VPN	Virtual Private Network

Table 3-3. SUT Hardware/Software/Firmware Version Identification with Interface Card Blocking Factors

Component (See note 1.)	Tested Version	Component Name (See notes 2 and 3.)	Description	Blocking Factor (See note 4.)	
				C/D	A
ASLAN Switch - Core/Distribution					
OS6900 Series	AOS 8.9.R21	**OS6900-C32E**	100 GE L3 fixed configuration chassis in a 1RU form factor with 32 QSFP28 ports. Ports operate as single 40/100GigE port or Quad-10/25GigE.	Met	NA
		OS6900-C32 OS6900-C32D	100 GE L3 fixed configuration chassis in a 1RU form factor with 32 QSFP28 ports. Ports operate as single 40/100GigE port or Quad-10/25GigE. The D model is DC power supply.		
		OS6900-X48 OS6900X48D TA6900X48	10 G/100 GE L3 fixed configuration chassis in a 1RU form factor with 48 1/10G SFP+ ports and 6 40/100G QSFP28 ports. All QSFP28 ports operate as single 40/100GE port and 2 ports support splitter mode to 4x10GE or 4x25GE. Console and Ethernet management ports are RJ-45. The TA model is TAA compliant. The D model is DC power supply.		
		OS6900-X48E OS6900-X48E-D	25 G/100 GE L3 fixed configuration chassis in a 1RU form factor with 48 1/10/25G SFP28 ports and 8 40/100G QSFP28 ports. QSFP28 ports operate as single 40/100GE port or Quad-10/25GE. The D model is DC power supply.		
		OS6900-T48 OS6900-T48D	10 G/100 GE L3 fixed configuration chassis in a 1RU form factor with 48 1/10G 10GBaseT ports and 6 40/100GQSFP28 ports. All QSFP28 ports operate as single 40/100GE port and 2 ports support splitter mode to 4x10GE or 4x25GE. The D model is DC power supply.		
		OS6900-V72 OS6900-V72D	25 G/100 GE L3 fixed configuration chassis in a 1RU form factor with 48 10/25G SFP28 ports and 6 40/100G QSFP28 ports. QSFP28 ports operate as single 40/100GE port or Quad-10/25GE. The D model is DC power supply.		
		OS6900-V48 OS6900-V48D	25 G/100 GE L3 fixed configuration chassis in a 1RU form factor with 48 1/10/25G SFP28 ports and 8 40/100G QSFP28 ports. QSFP28 ports operate as single 40/100GE port or Quad-10/25GE. The OS6900-V48 is AC power supply and the OS6900-V48D is DC power supply.		
ASLAN Switch – Access Only					
OS6865 Series	AOS 8.9.R21	**TA6865-P16X** OS6865-P16X OS6865-P16XD	Hardened GE L3 fixed configuration fan-less chassis with 12 RJ-45 10/100/1000 Base-T PoE+ ports of which 4 are 75W IEEE 802.3bt ports, two are 1000 Base-X SFP ports, two are SFP+ (1G/10G) ports, an RS-232 Console (RJ-45), and a USB port. The TA model is TAA compliant. The D model is DC power supply.	NA	Met
		OS6865-U12X OS6865-U12XD TA6865-U12X	Hardened GE L3 fixed configuration fan-less chassis with four 100/1000 Base-X SFP ports, two 1000 Base-X SFP ports, four 10/100/1000 Base-T 75W IEEE 802.3bt ports, two SFP+ (1G/10G) ports, RS232 Console (RJ-45) and USB port. The TA model is TAA. The D model is DC power supply.		
		TA6865-U28X OS6865-U28X OS6865-U28XD	Hardened Gigabit Ethernet L3 fixed configuration fan-less chassis in a 1U form factor with 20 100/1000 Base-X SFP ports, four SFP+ (1G/10G) ports, four 10/100/1000 Base-T 75W IEEE 802.3bt ports, RS-232 Console (RJ45), USB, and two 20G VFL QSFP+ ports. The TA model is TAA compliant. The D model is DC power supply.		

(Table continues next page.)

Table 3-3. SUT Hardware/Software/Firmware Version Identification with Interface Card Blocking Factors (continued)

Component (See note 1.)	Tested Version	Component Name (See notes 2 and 3.)	Description	Blocking Factor (See note 4.)	
				C/D	A
ASLAN Switch – Access Only (Continued)					
OS6860 Series	AOS 8.9.R21	**OS6860N-P48Z** OS6860N-PH48Z	Fixed configuration chassis in a 1U form factor with 36x10/100/1000 Base-T 60W IEEE 802.3bt PoE ports, 2x100/1000/2500/5000 Mbps multi-gigabit 95W 802.3bt PoE ports, four SFP28 (1G/10G/25G) MACsec ports, and 2x 100G QSFP28 Virtual Chassis link ports. All PoE ports are IEEE 802.3bt compliant. All SFP28 25G ports are 256-bit MACsec capable. The OS6860N-P48Z model is 920W AC power supply. The OS6860N-PH48Z model is 600W AC power supply.	NA	Met
		OS6860N-P24Z	Fixed configuration chassis in a 1U form factor with 12x10/100/1000 Base-T 60W PoE ports, 12x100M/1G/2.5G/5G multi-gigabit 95W PoE ports, four SFP28 (10G/25G) MACsec ports, and 2x 100G QSFP28 Virtual Chassis link ports. All PoE ports are IEEE 802.3bt compliant. All SFP28 25G ports are 256-bit MACsec capable. The OS6860N-P24Z model is 920W AC power supply.		
		OS6860N-P48M OS6860N-PH48M OS6860N-PX48M	Fixed configuration chassis in a 1U form factor with 36x100/1000/2500 Mbps multi-gigabit 95W 802.3bt PoE ports, 12x100/1000/2500/5000/10000 Mb/s multi-gigabit 95W 802.3bt PoE MACsec ports, and 2x100G QSFP28 Virtual Chassis link ports with an uplink module expansion slot. All PoE ports are IEEE 802.3bt compliant. The OS6860N-P48M model is 920W AC power supply. The OS6860-PH48M model is 600W AC power supply. The OS6860-PX48M model is 2000W AC power supply.		
		OS6860N-P24M OS6860N-PH24M OS6860N-PX24M	Fixed configuration chassis in a 1U form factor with 24x100M/1G/2.5G/5G/10G multi-gigabit 95W PoE ports and 2x100G QSFP28 Virtual Chassis link ports with an uplink module expansion slot. All ports are IEEE 802.3bt compliant and support 256-bit MACsec. The OS6860-P24M model is 920W AC power supply. The OS6860-PH24M model is 600W AC power supply. The OS6860-PX24M model is 2000W AC power supply.		
		OS6860N-U28 OS6860N-U28D TA6860N-U28	Fixed configuration chassis in a 1U form factor with 24x100/1000 Base-X SFP ports, 4x1G/10G SFP+ ports, four SFP28 (10G/25G) ports, and 2 x 100G QSFP28 Virtual Chassis link ports. All ports are MACsec capable. The D model is DC power supply.		
		TA6860E-P48 OS6860E-P48	GE L3 fixed configuration chassis in a 1U form factor with 48 RJ-45 10/100/1000 Base-T PoE+ ports of which four provide 60 W, four fixed SFP+ (1G/10G) ports, USB, EMP, and two VFL/stacking ports. The TA model is TAA compliant.		
		OS6860E-P24	GE L3 fixed configuration chassis in a 1U form factor with 24 RJ-45 10/100/1000 Base-T PoE+ ports of which four provide 60 W, four fixed SFP+ (1G/10G) ports, USB, EMP, and two VFL/stacking ports.		
		OS6860E-24 OS6860-24D	GE L3 fixed configuration chassis in a 1U form factor with 24 RJ-45 10/100/1000 Base-T ports, four fixed SFP+ (1G/10G) ports, USB, and two VFL/stacking ports. The D model is DC power supply.		
		OS6860E-48 OS6860E-48D	GE L3 fixed configuration chassis in a 1U form factor with 48 RJ-45 10/100/1000 Base-T ports, four fixed SFP+ (1G/10G) ports, USB, EMP, and two VFL/stacking ports. The D model is DC power supply.		

(Table continues next page.)

Table 3-3. SUT Hardware/Software/Firmware Version Identification with Interface Card Blocking Factors (continued)

Component (See note 1.)	Tested Version	Component Name (See notes 2 and 3.)	Description	Blocking Factor (See note 4.)	
				C/D	A
ASLAN Switch – Access Only (continued)					
OS6560 Series	AOS 8.9.R21	**OS6560-24X4**	Gigabit fixed chassis in 1RU size. Includes 24 RJ-45 10/100/1G BaseT, 2xSFP(1G) and 4xSFP+ (1G/10G) uplink/stacking ports, and internal AC power supply.	NA	Met
		OS6560-48X4	Gigabit fixed chassis in 1RU size. Includes 48 RJ-45 10/100/1G BaseT, 2xSFP(1G) and 4xSFP+ (1G/10G) uplink/stacking ports, and internal AC power supply.		
		OS6560-P48X4	Gigabit fixed chassis in 1RU size. Includes 48 RJ-45 10/100/1G BaseT PoE+, 2xSFP(1G) and 4xSFP+ (1G/10G) uplink/stacking ports, and 920W AC power supply.		
		OS6560-P24Z8	Multi-GigE fixed chassis in 1RU size. Includes 8 RJ-45 100/1G/2.5G BaseT HPoE, 16 RJ-45 10/100/1G BaseT PoE and 2xSFP+ (1G/10G) ports, and 300W AC power supply.		
		OS6560-P48Z16	Multi-GigE fixed chassis in 1RU size. Includes 8 RJ-45 100/1G/2.5G BaseT HPoE, 16 RJ-45 10/100/1G BaseT PoE and 2xSFP+ (1G/10G) ports, and 300W AC power supply.		
		OS6560-X10	10GigE fixed chassis with 8 SFP+ 10GigE, 2 QSFP+ (20G) stacking ports, 1RU size, and internal AC power supply.		
		OS6560-P24X4	Gigabit fixed chassis in 1RU size. Includes 24 RJ-45 10/100/1G BaseT PoE+, 2xSFP(1G) and 4xSFP+ (1G/10G) uplink/stacking ports, 600W AC supply		
		OS6560-P24Z24 OS6560-PXZ24	Multi-GigE fixed chassis in 1RU size. Includes 24 RJ-45 100/1G/2.5G BaseT HPoE, 4xSFP+ (1G/10G) and 2x20G stacking ports, and 600W AC power supply. The OS6560-PXZ24 model is 920W AC power supply.		

NOTE(S):

1. ALE OS series switches were loaded with full line rate Layer 2 traffic in order to stress the port ASICs. The OS switches were tested as described in Test-Procedure IO-17c of the ASLAN Test Procedures, Reference (c), for standalone configurations. Based on the DoD architecture as defined in Reference (b), Figure 7.1-2, the FPF for an Access switch is based upon the ratio of the total bandwidth of all SUT Access ports at maximum line rate to the bandwidth of all uplink ports (at max data rate) in a LAG.
2. Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, JITC certified the other components for joint use because they utilize the same software and similar hardware as tested components and JITC analysis determined they were functionally identical for interoperability certification purposes.
3. Refer to Table 4 for a detailed list of SUT Hardware and Software components certified based on actual testing and based on similarity to other tested and certified components.
4. Blocking factor is defined as the ratio of all traffic to non-blocked traffic (i.e., a blocking factor of 8 to 1 means that 12.5 percent of the traffic must be non-blocking). Access products shall not have a blocking factor that exceeds 8 to 1. Distribution and Core products shall not have a blocking factor that exceeds 2 to 1.

LEGEND:

A	Access	L3	Layer 3
AC	Alternative Current	LAG	Link Aggregation Group
AOS	Alcatel Operating System	MACsec	Media Access Control Security
ASIC	Application Specific Integrated Circuit	Mbps	Megabits per second
ASLAN	Assured Services Local Area Network	Mb/s	Megabits per second
Base-T	Baseband Operation, Twisted Pair	NA	Not Applicable
Base-X	Mbps Ethernet over Fiber or Copper	OS	OmniSwitch
C	Core	PoE	Power Over Ethernet
D	Distribution	QSFP28	Quad Small Form Factor Pluggable
DC	Direct Current	RJ	Registered Jack
DoD	Department of Defense	RU	Rack Unit
EMP	Ethernet Management Port	SFP	Small Form Factor Pluggable
FPF	Forwarding Performance Factor	SFP+	Enhanced Small Form-Factor Pluggable
G	Gigabit	SUT	System Under Test
GBaseT	Gigabit Ethernet over Copper	TAA	Trade Agreement Act
GE	Gigabit Ethernet	U	Unit
GigE	Gigabit Ethernet	USB	Universal Serial Bus
HPoE	High-Power Power Over Ethernet	VFL	Visual Fault Locator
IEEE	Institute of Electrical and Electronics Engineers	W	Watt
IO	Interoperability		

Table 3-4. Test Infrastructure Hardware/Software/Firmware Version Identification

System Name	Software Release	Function
Required Ancillary Equipment (Site-Provided)		
Active Directory/Windows Server	Windows Server 2016 VM	Centralized Accounts
RADIUS Server	Windows Server 2016 VM	Authentication, Authorization, Accounting
NTP Server	RHEL 6.8	Network Time Protocol
Syslog Server	Red Hat Linux 6.9 VM	Logging
SolarWinds	Windows Server 2016	SNMP
Test Network Components		
Juniper QFX5200	Junos 15 1X53-D2331	Core Switch
Cisco C9500	17.8.1r	Distribution Switch 1
OS6900-C32E	AOS 8.9.R21	Distribution Switch 2
OS6900-X48		Distribution Switch 2
OS6560-24X4		Access Switch
TA6860E-P48		Access Switch
OS6860N-P48Z		Access Switch
TA6865-P16X		Access Switch
Ixia XGS12	Ixia IxOS 9.01.1910.6 Ixia IxNetwork	TMDE

LEGEND:

AD	Active Directory	RADIUS	Remote Authentication Dial-In User Service
AOS	Alcatel Operating System	RHEL	Red Hat Enterprise Linux
C	Cisco	SNMP	Simple Network Management Protocol
IxOS	Ixia Operating System	Syslog	System log
Junos	Juniper Operating System	TA	Trade Agreement Act (TAA) compliant
NTP	Network Time Protocol	TMDE	Test, Measurement, & Diagnostic Equipment
OS	OmniSwitch	VM	Virtual Machine