DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY REFER TO: Joint Interoperability Test Command (JTE) 18 December 2019

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Joint Interoperability Certification of the Dell EMC Networking PowerSwitch S4100, S4200, and S5200 Series with Software Release SmartFabric Operating System (OS) 10.5

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 (CA) for the Department of Defense Information Network (DoDIN) products, Reference (b).

2. Conditions of Certification. The Dell EMC Networking PowerSwitch S4100, S4200, and S5200 Series with Software Release SmartFabric Operating System (OS) 10.5 is hereinafter referred to as the System Under Test (SUT). The SUT meets the critical requirements of the Unified Capabilities Requirements (UCR), Reference (b), as an Assured Services Local Area Network (ASLAN) Core, Distribution, and Access switch and is certified for joint use with the Conditions described in Table 1. 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
UCR Waivers			
None			
TDR#	**Conditions of Fielding**		
DEL-0730-002	EDG-000080: Per ASLAN testing and vendor documentation, the SUT does not support PoE IAW either 802.3af-2003 or 802.3at-2009. CoF: The SUT is certified for only data and VVoIP endpoints that do not require PoE, such as CCA, UCCS, and Soft Clients.	Minor with CoF	On 29 October 2019, DISA adjudicated this discrepancy as minor with vendor POA&M and CoF.

Table 1. Conditions (continued)

Description		Operational Impact	Remarks
TDR#	**Conditions of Fielding** (continued)		
DEL-0730-004	IP6-000490: Per Dell Letter of Compliance, Stateless Address Autoconfiguration and Manual Address Assignment, IAW IP6-000490: Non-Comply - User must select desired flag values when enabling router advertisements. CoF: Managed Address Configuration flags must be set to desired value when implemented by the user. Vendor to include configuration in deployment guide.	Minor with CoF	On 29 October 2019, DISA adjudicated this discrepancy as minor with CoF.
DEL-0730-005	EDG-000210: Per IO-3 ASLAN testing, SUT generates VRRPv3 checksums for IPv4 traffic in a different manner than other heterogeneous vendors. CoF: SUT must be configured with VRRPv2 to support Distribution switch failover in less than 5 seconds within an IPv4 infrastructure.	Minor with CoF and POA&M	On 29 October 2019, DISA adjudicated this discrepancy as minor with vendor POA&M.
DEL-0730-005	EDG-000210: Per IO-3 ASLAN testing, SUT recovery time exceeds 5 seconds. CoF: For failback recovery, site required to schedule ASI.	Minor with CoF	On 29 October 2019, DISA adjudicated this discrepancy as minor with CoF.
DEL-0730-006	EDG-000010: Per IO-17 ASLAN testing, S4148U has multiple port profiles, which enable/disable and configure the speed of the 40/100G uplink ports. CoF: S4148U-ON certified as Access Only with port profile 1; other port profiles are not certified.	Minor with CoF	On 29 October 2019, DISA adjudicated this discrepancy as minor with CoF.
TDR#	**Open Test Discrepancies**		
DEL-0730-003	IP6-000390: Per Dell Letter of Compliance, Router Advertisement inconsistencies are not logged.	Minor with POA&M	On 29 October 2019, DISA adjudicated this discrepancy as minor with vendor POA&M.
DEL-0730-007	EDG-000090: Per IO-13 ASLAN testing and only applying to S4248FBL-ON: SUT re-marks IPv4 DSCP values but does not re-mark IPv6 DSCP values.	Minor with POA&M	On 5 November 2019, DISA adjudicated this discrepancy as minor with vendor POA&M.

LEGEND:

802.3af-2003	Power over Ethernet up to 15.4 Watts	IP	Internet Protocol
802.3at-2003	Power over Ethernet up to 25.5 Watts	IPv4	Internet Protocol version 4
ASI	Authorized Service Interruption	IPv6/IP6	Internet Protocol version 6
ASLAN	Assured Services Local Area Network	POA&M	Plan Of Action and Milestones
CCA	Call Connection Agent	PoE	Power Over Ethernet
CoF	Condition of Fielding	SUT	System Under Test
DEL	Dell	TDR	Test Discrepancy Report
DISA	Defense Information Systems Agency	UCCS	Unified Capabilities Conference System
DSCP	Differentiated Services Code Point	UCR	Unified Capabilities Requirements
EDG	Edge	v	Version
G	Gigabit	VRRP	Virtual Router Redundancy Protocol
IAW	In Accordance With	VVoIP	Voice and Video over Internet Protocol
IO	Interoperability		

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 a DoDIN APL Product Summary, to include all subsequent Desktop Review (DTR) updates.

Table 2. Interface Status

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

NOTE(S):
1. The SUT high-level requirements are depicted in Table 3. These high-level requirements refer to a more detailed list of requirements provided in Enclosure 3, Table 3-2.
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. The SUT does not support this (conditional or optional) interface.
4. USAISEC-TIC tested the 10/25/40/50/100GBaseX interfaces, but not the 1000BaseT and 1GBaseX interfaces. Analysis determined the 1000BaseT and 1GBaseX interfaces are low risk for certification based on the vendor's Letters of Compliance to comply with the IEEE 802.3 standards and the testing data collected at all other data rates.

LEGEND:

802.3ab	1000BaseT Gbps Ethernet over Twisted Pair	C	Conditional
802.3ae	10 Gbps Ethernet over Fiber	Co	Core
802.3ba	40 and 100 Gigabit Ethernet over Twisted pair and Fiber	D	Distribution
802.3by	25 Gbps Ethernet over Multi-Mode Fiber	GBaseX	Gigabit Ethernet over Fiber or Copper
802.3bz	2.5/5 Gbps Ethernet over balanced Twisted Pair	Gbps	Gigabits per second
802.3cd	50 Gigabit Ethernet Standard	IEEE	Institute of Electrical and Electronics Engineers
802.3i	10BaseT 10 Mbps Ethernet over Twisted Pair	Mbps	Megabits per second
802.3u	Fast Ethernet at 100 Mbps, copper and Fiber	O	Optional
802.3z	Gigabit Ethernet over Fiber	SUT	System Under Test
A	Access	TIC	Technology Integration Center
BaseFX	Megabit Ethernet over Fiber	USAISEC	U.S. Army Information Systems Engineering Command
BaseT	Megabit (Baseband Operation, Twisted Pair) Ethernet	UTP	Unshielded Twisted Pair
BaseX	Megabit Ethernet over Fiber or Copper		

Table 3. Capability Requirements and Functional Requirements Status

CR/FR ID	UCR Requirement (High-Level) (See note 1.)	UCR 2013 Change 2 Reference	Status
1	General LAN Switch and Router Product Requirements (R)	7.2.1	Partially Met (See note 2.)
2	LAN Switch and Router Redundancy Requirements (R)	7.2.2	Partially Met (See note 2.)
3	LAN Product Requirements Summary (R)	7.2.3	Partially Met (See notes 2 and 3.)
4	Multiprotocol Label Switching (O)	7.2.4	Not Tested (See note 4.)
5	IPv6	5.2	Partially Met (See note 2.)

NOTE(S):
1. The annotation of "required" refers to a high-level requirement category. Enclosure 3 addresses the applicability of each sub-requirement.
2. Reference Table 1 for conditions.
3. A USAISEC-TIC-led Cybersecurity test team conducted Security testing and published the results in a separate report, Reference (d).
4. The SUT does not support this optional requirement.

LEGEND:

CR	Capability Requirement	R	Required
FR	Functional Requirement	SUT	System Under Test
ID	Identification	TIC	Technology Integration Center
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
LAN	Local Area Network	USAISEC	U.S. Army Information Systems Engineering Command
O	Optional		

Table 4. DoDIN APL Product Summary

Product Identification			
Product Name	Dell EMC Networking PowerSwitch S4100, S4200, S5200 Series		
Software Release	SmartFabric OS 10.5		
UCR Product Type(s)	ASLAN Core/Distribution/Access Switch		
Product Description	The Dell EMC Networking PowerSwitch S4100, S4200, S5200 Series delivers voice-class availability, 1/10/25/40/50/100 GbE RJ-45/SFP+/QSFP+/QSFP28 for switching VoIP, video, and data traffic.		
DoDIN Certified Function	**Component/Sub-component Name** (See notes 1 and 2.)	**Tested Version**	**Remarks**
ASLAN Core/Distribution/Access	S4112F-ON S4112T-ON S4128F-ON S4128T-ON S4148F-ON S4148T-ON S4148FE-ON **S4148U-ON** S4248FB-ON **S4248FBL-ON** S5212F-ON S5224F-ON **S5232F-ON** S5248F-ON **S5296F-ON**	**SmartFabric OS 10.5**	Redundant power modules

NOTE(S):
1. Table 3-3 of Enclosure 3 provides the detailed component and subcomponent descriptions.
2. Components bolded and underlined were tested by USAISEC-TIC. 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 and certified components and JITC analysis determined they were functionally identical for interoperability certification purposes.

Table 4. DoDIN APL Product Summary (continued)

LEGEND:			
APL	Approved Products List	QSFP28	28Mbps Signaled Quad Small Form-factor Pluggable
ASLAN	Assured Services Local Area Network	RJ-45	Registered Jack 45
DoDIN	Department of Defense Information Network	SFP+	Small Form-factor Pluggable Plus
EMC	Egan, Marino & Curly	TIC	Technology Integration Center
GbE	Gigabit Ethernet	UCR	Unified Capabilities Requirements
JITC	Joint Interoperability Test Command	USAISEC	U.S. Army Information Systems Engineering Command
OS	Operating System	VoIP	Voice over Internet Protocol
QSFP+	Quad Small Form-factor Pluggable Plus		

4. Test Details. JITC based this certification on interoperability testing, review of the vendor's Letters of Compliance (LoC) and DISA adjudication of open Test Discrepancy Reports (TDRs) for inclusion on the DoDIN APL. The United States Army Information Systems Engineering Command (USAISEC) – Mission Engineering Directorate (MED), Technology Integration Center (TIC), hereafter referred to as USAISEC-TIC, conducted testing at Fort Huachuca, Arizona, from 19 August through 20 September 2019 using test procedures derived from Reference (c). Review of the vendor's LoC completed on 18 October 2019. DISA completed adjudication of outstanding TDRs on 5 November 2019. USAISEC-TIC-led Cybersecurity (CS) test teams conducted CS testing and published the results in a separate report, Reference (d). Enclosure 2 documents the test results and describes the tested network and system configurations. Enclosure 3 provides the detailed interface, capability, and functional requirements and test results.

5. Additional Information. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Sensitive but Unclassified IP 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.fhu.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 (CAP) containing 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-certification-office@mail.mil. All associated information is available on the DISA APCO website located at http://www.disa.mil/Network-Services/UCCO.

6. Point of Contact (POC). USAISEC-TIC testing POC: Mr. James Hatch; commercial telephone (520) 533-2860; DSN telephone 821-2860; e-mail address: james.d.hatch12.civ@mail.mil. JITC certification POC: Ms. Lisa Esquivel; commercial telephone (520) 538-5531; DSN telephone 879-5531; DSN FAX: 879-4347; e-mail address: lisa.r.esquivel.civ@mail.mil; mailing address: Joint Interoperability Test Command, ATTN: JTE (Ms. Lisa Esquivel), P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The APCO tracking number for the SUT is 1905804.

FOR THE COMMANDER:

CLARK.BRADLEY.ALAN.1231466564 Digitally signed by CLARK.BRADLEY.ALAN.1231466564 Date: 2019.12.18 15:55:03 -07'00'

3 Enclosures a/s

for RIC HARRISON
Chief
Networks/Communications &
DoDIN Capabilities Division

Distribution (electronic mail):
DoD CIO
Joint Staff J-6, JCS
USD (AT&L)
ISG Secretariat, DISA, JTA
U.S. Strategic Command, J665
US Navy, OPNAV N2/N6FP12
US Army, DA-OSA, CIO/G-6 ASA (ALT), SAIS-IOQ
US Air Force, A3CNN/A6CNN
US Marine Corps, MARCORSYSCOM, SIAT, A&CE Division
US Coast Guard, CG-64
DISA/TEMC
DIA, Office of the Acquisition Executive
NSG Interoperability Assessment Team
DOT&E, Netcentric Systems and Naval Warfare
Medical Health Systems, JMIS IV&V
HQUSAISEC, ELIE-ISE-ME
APCO

ADDITIONAL REFERENCES

(c) Joint Interoperability Test Command, "Assured Services Local Area Network (ASLAN) and Non-ASLAN Test Procedures Version 1.0 for Unified Capabilities Requirements (UCR) 2013 Change 2," October 2017
(d) Joint Interoperability Test Command, "Cybersecurity Assessment Report for Dell EMC Networking PowerSwitch S-Series Switches Software Release Dell EMC Networking SmartFabric OS 10.5 (Tracking Number TN 1905804)," October 2019

CERTIFICATION SUMMARY

1. SYSTEM AND REQUIREMENTS IDENTIFICATION. The PowerSwitch S4100, S4200, and S5200 Switch Series with Software Release SmartFabric Operating System (OS) 10.5 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	Mr. Jordan Silk, USAISEC MED, Building 53302, Fort Huachuca, Arizona 85613, e-mail: jordan.r.silk.civ@mail.mil.
Vendor Point of Contact	Dell EMC Networking, Yin, Jeff email: jeff.yin@dell.com website: www.dellemc.com
System Name	Dell EMC Networking, PowerSwitch S4100, S4200, S5200 Series
Increment and/or Version	SmartFabric OS 10.5
Product Category	ASLAN Core/Distribution/Access Switch
System Background	
Previous certifications	None
Tracking	
APCO ID	1905804
System Tracking Program ID	8432
Requirements Source	
DoDIN Capabilities Requirements	Unified Capabilities Requirements 2013, Change 2 Sections 4.2, 5.2, and 7.2
Remarks	None
Test Organization(s)	USAISEC-MED, TIC, Fort Huachuca, Arizona

LEGEND:

APCO	Approved Products Connection Office	MED	Mission Engineering Directorate
ASLAN	Assured Services Local Area Network	OS	Operating System
DoDIN	Department of Defense Information Network	TIC	Integration Center
EMC	Egan, Marino & Curly	USAISEC	U.S. Army Information Systems Engineering Command
ID	Identification		

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 designed to meet traffic engineering and redundancy requirements, as required by applicable mission needs. The ASLANs and non-ASLANs may be designed 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 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

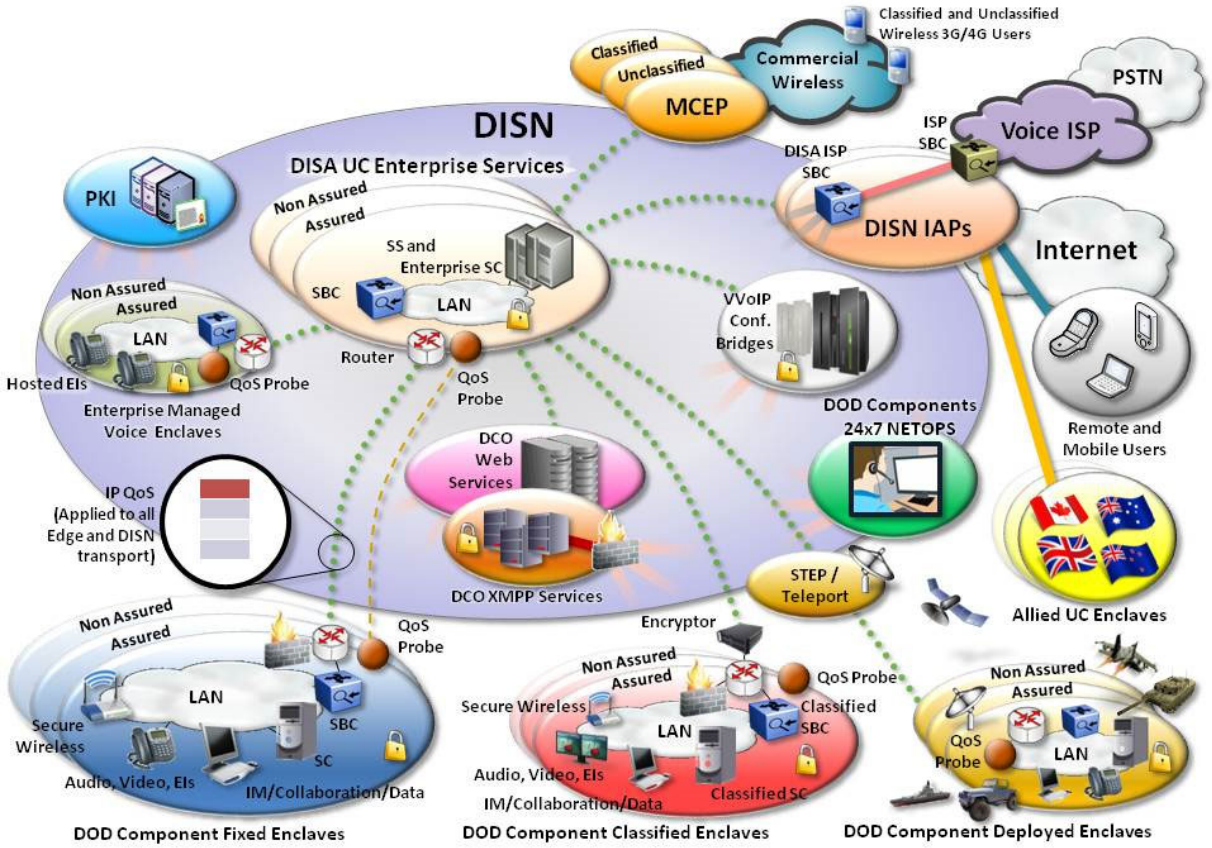
access layer is the point at which local end users are allowed into the network. This layer may use access lists or filters to optimize further the needs of a particular set of users.

The SUT was tested as a Core, Distribution, and Access switch with Ethernet switching capabilities and provides Core, Distribution, and Access layer functionality with Quality of Service (QoS) capabilities for voice, video, and data networking environments. The SUT is available in a 1U half-width, 1U and 2U fixed-port switch configurations that support 1/10/25/40/50/100GbE interfaces rates. The SUT is certified as Core, Distribution, and Access. Reference Table 1 for limitations and conditions and Table 3-3 in Enclosure 3 for a list of individual components and descriptions.

3. OPERATIONAL ARCHITECTURE. The Department of Defense Information Network (DoDIN) architecture is a two-level network hierarchy consisting of Defense Information Systems Network (DISN) backbone switches and Service/Agency installation switches. The Department of Defense (DoD) Chief Information Officer (CIO) and Joint Staff policy and subscriber mission requirements determine which type of switch can be used 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 USAISEC-TIC team tested the SUT at Fort Huachuca, Arizona in a manner and configuration similar to that of a notional operational environment, depicted in Figure 2.1. The test team conducted interoperability testing of the ASLAN components by testing the SUT with different vendor DoDIN APL certified products as illustrated in Figure 2-2. Cybersecurity testing used the same configuration.

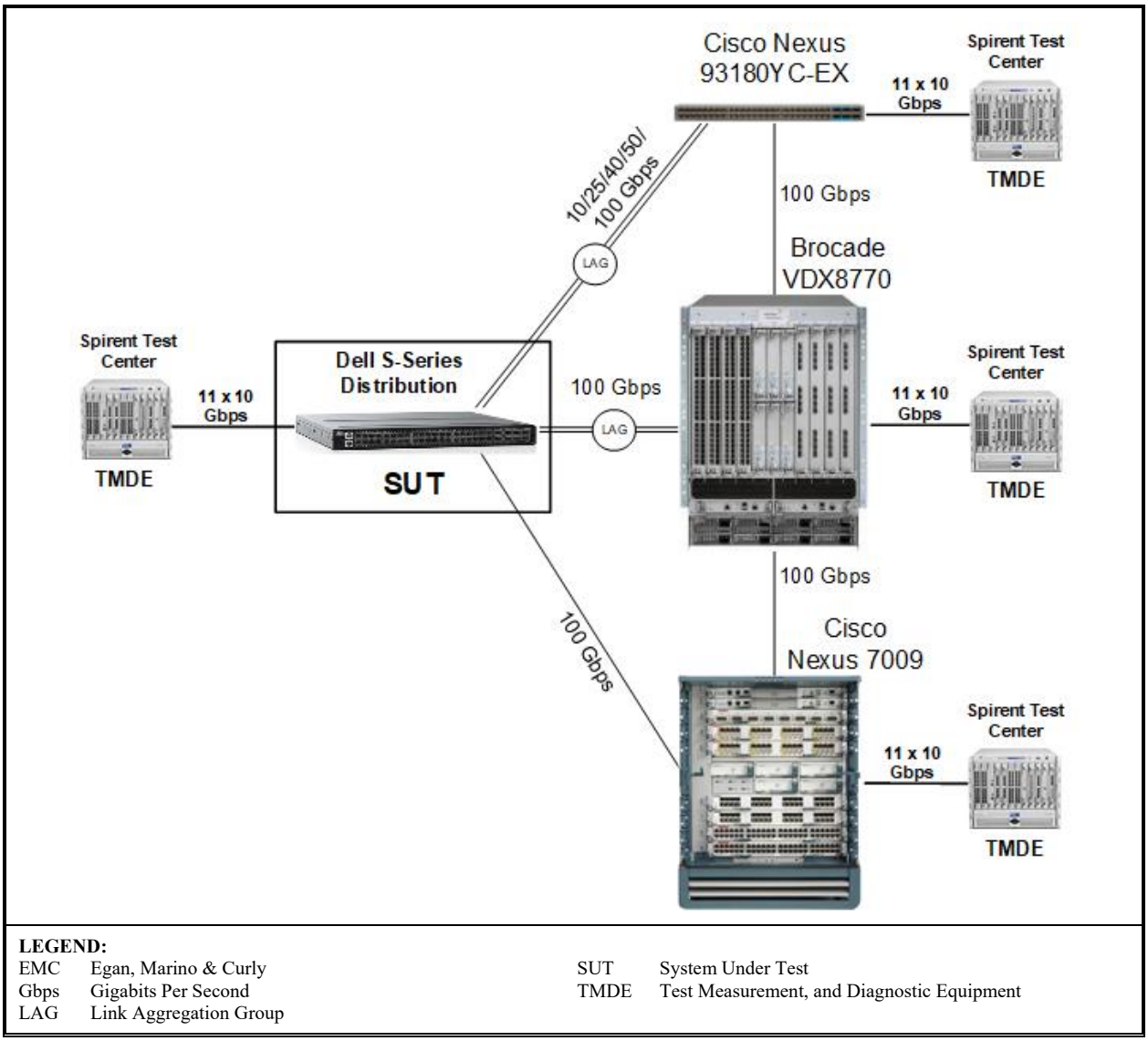
5. METHODOLOGY. USAISEC-TIC conducted testing of the ASLAN components IAW UCR 2013, Change 2 LAN requirements, Reference (b), using corresponding test procedures, Reference (c). Heterogeneous testing (Figure 2-2) was performed by placing the SUT components in a LAN comprised of multi-vendor LAN products. This configuration verified the interoperability of the LAN components within a Voice and Video over IP network (VVoIP). In addition to testing, an analysis of the vendor's Letters of Compliance (LoC) verified that letter "R" requirements were met. Any discrepancies noted were documented in Test Discrepancy Reports (TDRs). The vendor submitted Plan of Action and Milestones (POA&M) as required. Any new discrepancy noted in the operational environment will be evaluated for impact on the existing interoperability certification. These discrepancies will be adjudicated to the satisfaction of DISA via a vendor POA&M, which will address all new critical TDRs within 120 days of identification.



LEGEND:

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

Figure 2-1. Notional DoDIN Network Architecture



LEGEND:

EMC	Egan, Marino & Curly	SUT	System Under Test
Gbps	Gigabits Per Second	TMDE	Test Measurement, and Diagnostic Equipment
LAG	Link Aggregation Group		

Figure 2-2. Dell EMC Networking PowerSwitch S4100, S4200, and S5200 Interoperability Distribution Heterogeneous Tested Configuration

6. INTEROPERABILITY REQUIREMENTS, RESULTS, AND ANALYSIS. The interface, Capability Requirements (CR) and Functional Requirements (FR), Cybersecurity, and other requirements for DoDIN ASLAN and non-ASLANs are defined by UCR 2013, Change 2, Sections 4.2, 5.2, and 7.2. Table 3-1 provides the SUT interface interoperability status, and Table 3-2 provides the Capability Requirements (CR) and Functional Requirements (FR) status. Testing details and results are provided in the following sub-paragraphs.

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 that are 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. The non-blocking results for all tested components are listed in Enclosure 3, Table 3-3.

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. The SUT measured latencies are shown in Table 2-2.

Table 2-2. SUT Measured Latency

Interface	SUT Measured Latency	UCR Requirement for Voice/Video
10BaseX	Not Tested (See note 1.)	2 ms / 10 ms
100BaseX	Not Tested (See note 1.)	2 ms / 10 ms
1000BaseX	Not Tested (See note 2.)	2 ms / 10 ms
10GBaseX	0.006 ms voice/0.006 ms video latency	2 ms / 10 ms
25GBaseX	0.008 ms voice/0.009 ms video latency	2 ms / 10 ms
40GBaseX	0.013 ms voice/0.014 ms video latency	2 ms / 10 ms
50GBaseX	0.006 ms voice/0.007 ms video latency	2 ms / 10 ms
100GBaseX	0.007 ms voice/0.007 ms video latency	2 ms / 10 ms

NOTE(S):
1. The SUT does not support this interface.
2. USAISEC-TIC tested the 10/25/40/50/100Gbps interfaces but not the 1000BaseX interface. JITC analysis determined the 1000BaseX interface is low risk for certification based on the vendor's Letters of Compliance to comply with the IEEE 802.3z standards and the testing data collected at all other data rates.

LEGEND:

802.3z	Gigabit Ethernet over Fiber	ms	millisecond
BaseX	Megabit Ethernet over Fiber or Copper	SUT	System Under Test
GBaseX	Gigabit Ethernet over Fiber or Copper	TIC	Technology Integration Center
Gbps	Gigabits Per Second	UCR	Unified Capabilities Requirements
IEEE	Institute of Electrical and Electronics Engineers	USAISEC	U.S. Army Information Systems Engineering Command
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. The SUT measured jitter for each interface is shown in Table 2-3.

Table 2-3. SUT Measured Jitter

Interface	SUT Measured Jitter	UCR Requirement for Voice/Video
10BaseX	Not Tested (See note 1.)	1 ms / 10 ms
100BaseX	Not Tested. (See note 1.)	1 ms / 10 ms
1000BaseX	Not Tested. (See note 2.)	1 ms / 10 ms
10GBaseX	0.001 ms voice/0.001 ms video	1 ms / 10 ms
25GBaseX	0.016 ms voice/0.011 ms video	1 ms / 10 ms
40GBaseX	0.014 ms voice/0.013 ms video	1 ms / 10 ms
50GBaseX	0.009 ms voice/0.005 ms video	1 ms / 10 ms
100GBaseX	0.003 ms voice/0.002 ms video	1 ms / 10 ms

NOTE(S):
1. The SUT does not support this interface.
2. USAISEC-TIC tested the 10/25/40/50/100Gbps interfaces but not the 1000BaseX interface. JITC analysis determined the 1000BaseX interface is low risk for certification based on the vendor's Letters of Compliance to comply with the IEEE 802.3z standards and the testing data collected at all other data rates.

LEGEND:

802.3z	Gigabit Ethernet over Fiber	ms	millisecond
BaseX	Megabit Ethernet over Fiber or Copper	SUT	System Under Test
GBaseX	Gigabit Ethernet over Fiber or Copper	TIC	Technology Integration Center
Gbps	Gigabits Per Second	UCR	Unified Capabilities Requirements
IEEE	Institute of Electrical and Electronics Engineers	USAISEC	U.S. Army Information Systems Engineering Command
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. The SUT measured packet loss for each interface is shown in Table 2-4.

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 1.)				0.015%	0.05%	0.05%	No minimum requirement in the UCR
100BaseX	Not Tested. (See note 1.)				0.015%	0.05%	0.05%	
1000BaseX	Not Tested. (See note 2.)				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%	
50GBaseX	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):
1. The SUT does not support this interface.
2. USAISEC-TIC tested the 10/25/40/50/100Gbps interfaces but not the 1000BaseX interface. JITC analysis determined the 1000BaseX interface is low risk for certification based on the vendor's Letters of Compliance to comply with the IEEE 802.3z standards and the testing data collected at all other data rates.

LEGEND:

802.3z	Gigabit Ethernet over Fiber	JITC	Joint Interoperability Test Command
BaseX	Megabit Ethernet over Fiber or Copper	SUT	System Under Test
GBaseX	Gigabit Ethernet over Fiber or Copper	TIC	Technology Integration Center
Gbps	Gigabits Per Second	UCR	Unified Capabilities Requirements
IEEE	Institute of Electrical and Electronics Engineers	USAISEC	U.S. Army Information Systems Engineering Command

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 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.

- 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).

The SUT met this requirement with testing, analysis and the vendor's LoC. The SUT met this requirement with 1/10/40/100Gigabit per second (Gbps) interfaces.

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).

- 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.

The SUT met this requirement with testing, analysis and the vendor's LoC for 1000 Megabits per second (Mbps) and 10 Gbps interfaces, with the limitations and conditions identified in Table 1. See Table 3-3 in Enclosure 3 for a list of individual components and descriptions. The SUT met this requirement with 1000Mbps and 10Gbps interfaces.

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).

- 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).

The SUT met this requirement with testing, analysis and the vendor's LoC for 1/10/40/100Gbps interfaces.

d) Access product that support assured services and more than 96 telephony subscribers shall have a minimum of two 1 Gbps fiber interfaces to connect to the distribution layer. Reference Table 1 for limitations and conditions and Table 3-3 in Enclosure 3 for a list of

individual components and descriptions. The SUT met this requirement with testing, analysis 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). Fibre channel was not submitted for certification. 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 Layer 2 (L2)/Layer 3 (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 the vendor's LoC, with the limitations and conditions identified in Table 2.

b) Force mode IAW IEEE 802.3. The SUT met this requirement with the vendor's LoC, with the limitations and conditions identified in Table 2.

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 output/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 the 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 testing and 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) Power over Ethernet (PoE) IAW either 802.3af-2003 or 802.3at-2009. (Required only for VVoIP solutions; for data applications or non-Assured Services (AS) solutions, PoE is optionally required.) Per testing and the vendor's LoC, the SUT does not support PoE 802.3af-2003 or 802.at-2009 for VVoIP hard phones and other PoE-dependent subtending equipment. The SUT was not submitted with PoE interfaces. DISA adjudicated this discrepancy as minor with the condition of fielding noted in Table 1.

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.) This optional requirement was not submitted for this SUT; therefore, it was not tested and is not included in this certification.

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.) This optional requirement was not submitted for this SUT; therefore, it was not tested and is not included in this certification.

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 Internet Protocol (IP) 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 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 met this requirement with testing and the vendor's LoC, with the limitations and conditions identified in Table 1.

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 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. Layer 3 CoS. Layer 3 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 met this requirement with testing and the vendor's LoC.

b. Layer 2 CoS. Layer 2 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 met this requirement with 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 met this requirement with 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 met this requirement with 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 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 demonstrated support for all protocols through 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 supports six queues.

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], MAC, 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 SUT met this with testing and supports six queues.

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 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 Version 3 (SNMPv3) IAW RFCs 3411, 3412, 3413, 3414, 3415, 3416, and 3417. The SUT met this requirement with testing and vendor's LoC.

1. 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.

2. 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 the vendor's LoC.

3. The Advanced encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826. The SUT met this requirement with 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 cybersecurity requirements annotated for LS. In addition to wireless cybersecurity requirements previously specified, Wireless Local Area Network Access Systems (WLASs) and Wireless Access Bridges (WABs) shall meet all cybersecurity requirements for LSs. Wireless End Instruments (WEIs) shall meet all cybersecurity requirements annotated for End Instruments (EIs). When conflicts exist between the Unified Capabilities Requirements (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 USAISEC-TIC-led Cybersecurity test team tested Security and published the results in a separate report, Reference (d).

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 is a fixed port switch without Dual Processors or Dual Switch Fabric/Backplane Redundancy. The SUT did not meet this requirement for 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 do not need to meet any redundancy requirements because they are non-assured.

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 Dual-Product Redundancy Requirements with testing and the vendor's LoC, with the limitations and conditions identified in Table 1.

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 testing and the vendor's LoC.
- If the Intermediate System to Intermediate System (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. Per the vendor LoC, the SUT does not support the IS-IS protocol.

- 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 RFC 5798 - to provide redundancy to Layer 2 switches that lose connectivity to a Layer 3 router. The Distribution product shall employ VRRP to provide survivability to any product running Layer 2 (normally the Access Layer). The SUT met this requirement with testing and the vendor's LoC, with the limitations and conditions described in Table 1. Per IO-3 ASLAN testing, SUT generates VRRP v3 checksums for IPv4 traffic in a different manner than other heterogeneous vendors. DISA adjudicated this discrepancy as minor with vendor POA&M and Condition of Fielding that the switch must be configured with VRRPv2 to support Distribution switch failover in less than 5 seconds within an IPv4 infrastructure. Per IO-3 ASLAN testing, SUT recovery time exceeds 5 seconds. Condition of Fielding: For failback recovery, site required to schedule Authorized Service Interruption (ASI). On 29 October 2019, DISA adjudicated this discrepancy as minor with CoF.

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) are addressed in other sections of this document. The SUT met these requirements with the limitations and conditions identified in Table 1. See Table 3-3 in Enclosure 3 for a list of individual components and descriptions.

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 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. USAISEC-TIC tested the SUT in an operationally realistic environment to determine its interoperability capability with associated network devices and network traffic. Enclosure 3, Table 3-4 provides the hardware, software, and firmware of the components used in the test infrastructure.

8. TESTING LIMITATIONS. USAISEC-TIC test teams noted the following testing limitations. The Test, Measurement, and Diagnostic Equipment does not have a sufficient number of 10/25/100 GbE test ports to fully load the port interfaces on the SUT. Testing on 10/25/100 (fiber only) interface ports was limited to 42 test ports of 10GbE, 24 test ports of 25GbE and 6 test ports of 100GbE. Therefore, the Snake Testing was conducted at the Layer 3 VRF level. No packet loss occurred during the blocking test at the Maximum blocking requirement for Core, Distribution, and Access Layer 2/3. The non-blocking results for all tested components are listed in Enclosure 3, Table 3-3.

9. CONCLUSION(S). The SUT meets the critical interoperability requirements for Core/Distribution/Access switches in accordance with the UCR, Reference (b), and is certified for joint use with other DoDIN Products listed on the Approved Products List (APL) with the conditions described in Table 1.

DATA TABLES

Table 3-1. Interface Status

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

NOTE(S):
1. The SUT high-level requirements are depicted in Table 3. These high-level requirements refer to a more detailed list of requirements provided in Enclosure 3, Table 3-2.
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. The SUT does not support this (conditional or optional) interface.
4. USAISEC-TIC tested the 10/25/40/50/100GBaseX interfaces, but not the 1000BaseT and 1GBaseX interfaces. Analysis determined the 1000BaseT and 1GBaseX interfaces are low risk for certification based on the vendor's Letters of Compliance to comply with the IEEE 802.3 standards and the testing data collected at all other data rates.

LEGEND:

802.3ab	1000BaseT Gbps Ethernet over Twisted Pair	BaseX	Megabit Ethernet over Fiber or Copper
802.3ae	10 Gbps Ethernet over Fiber	C	Conditional
802.3ba	40 and 100 Gigabit Ethernet over Twisted pair and Fiber	Co	Core
802.3by	25 Gbps Ethernet over Multi-Mode Fiber	D	Distribution
802.3bz	2.5/5 Gbps Ethernet over balanced Twisted Pair	GBaseX	Gigabit Ethernet over Fiber or Copper
802.3cd	50 Gigabit Ethernet Standard	Gbps	Gigabits per second
802.3i	10BaseT 10 Mbps Ethernet over Twisted Pair	IEEE	Institute of Electrical and Electronics Engineers
802.3u	Fast Ethernet at 100 Mbps, copper and Fiber	Mbps	Megabits per second
802.3z	Gigabit Ethernet over Fiber	O	Optional
A	Access	SUT	System Under Test
BaseFX	Megabit Ethernet over Fiber	UTP	Unshielded Twisted Pair
BaseT	Megabit (Baseband Operation, Twisted Pair) Ethernet		

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 (See note 2.)
	Class of Service Markings	Required	7.2.1.3	Met (See note 3.)
	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 4.)
2	**LAN Switch and Router Redundancy**			
	Single Product Redundancy	Optional	7.2.2.1	Not Met (See note 5.)
	Dual Product Redundancy	Optional	7.2.2.2	Met (See note 6.)
	Survivability	Required	7.2.2.3	Partially Met (See note 7.)
3	**LAN Product Requirements Summary**			
	LAN Product Requirements Summary	Optional	7.2.3	Met
4	**Multiprotocol Label Switching**			
	MPLS ASLAN	Optional	7.2.4.1	Not Tested (See note 8.)
	MPLS VPN Augmentation to VLANs	Optional	7.2.4.2	Not Tested (See note 8.)

NOTE(S):
1. The annotation of 'required' refers to a high-level requirement category. The applicability of each sub-requirement is provided in UCR 2013, Change 2, Reference (b). The system under test does not need to provide conditional requirements; however, if the system provides a capability, it must function according to the specified requirements.
2. Power over Ethernet is optionally required and not supported by the SUT.
3. The S4248FBL-ON does not support DSCP re-marking of IPv6 traffic. DISA adjudicated this discrepancy as Minor with the condition of fielding described in Table 1.
4. A USAISEC-TIC-led Cybersecurity test team conduced Security testing and published the results in a separate report, Reference (d).
5. The SUT is a fixed port switch without Dual Processors or Dual Switch Fabric/Backplane Redundancy.
6. The SUT requires a scheduled ASI to recovery after a failover. DISA adjudicated this discrepancy as Minor with the condition of fielding described in Table 1.
7. SUT generates VRRP v3 checksums for IPv4 traffic in a different manner than other heterogeneous vendors. DISA adjudicated this discrepancy as Minor with POA&M and Condition of Fielding the SUT must be configured with VRRPv2 to support Distribution switch failover in less than 5 seconds within an IPv4 infrastructure.
8. The SUT does not support this optional requirement.

LEGEND:

ASI	Authorized Service Interruption	MPLS	Multiprotocol Label Switching
ASLAN	Assured Services Local Area Network	POA&M	Plan of Action and Milestones
CR	Capability Requirement	SUT	System Under Test
DISA	Department of Information Services	TIC	Technology Integration Center
DSCP	Differentiated Services Code Point	UCR	Unified Capabilities Requirements
FR	Functional Requirements	USAISEC	U.S. Army Information Systems Engineering Command
ID	Identification	v3	Version 3
IPv4	Internet Protocol version 4	VLAN	Virtual Local Area Network
IPv6	Internet Protocol version 6	VPN	Virtual Private Network
LAN	Local Area Network	VRRP	Virtual Router Redundancy Protocol

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

Component (See note 1.)	Tested Version	Sub-component (See note 1.)	Description	Blocking Factor (See note 2 and 3.)		
				C	D	A
PowerSwitch S4100, S4200, and S5200 Series Switches	**SmartFabric OS 10.5.0**	S4112F-ON	12x 10GbE SFP+ Ports + 3x 100GbE QSFP28 Ports	Met	Met	Met
		S4112T-ON	12x 10GBASE-T RJ45 Ports + 3x 100GbE QSFP28 Ports	Met	Met	Met
		S4128F-ON	28x 10GbE SFP+ Ports + 2x 100GbE QSFP28 Ports	Met	Met	Met
		S4128T-ON	28x 10GBASE-T RJ45 Ports + 2x 100GbE QSFP28 Ports	Met	Met	Met
		S4148F-ON	48x 10GbE SFP+ Ports + 2x 40GbE QSFP+ Ports + 4x 100GbE QSFP28 Ports	Met	Met	Met
		S4148T-ON	48x 10GBASE-T RJ45 Ports + 2x 40GbE QSFP+ Ports + 4x 100GbE QSFP28 Ports	Met	Met	Met
		S4148FE-ON	48x 10GbE SFP+ Ports (w/LRM optics support) + 2x 40GbE QSFP+ Ports + 4x 100GbE QSFP28 Ports	Met	Met	Met
		S4148U-ON (See note 3 and 4.)	**24x 10GbE SFP+ Ports + 24x 10GbE or FC8/16 SFP+ Ports + 2x 40GbE QSFP+ Ports + 4x10/25/40/50/100GbE or FC8/16/32 Ports**	**Met**	**Met**	**Met**
		S4248FB-ON	40x 10GbE SFP+ + 2x 40GbE QSFP+ + 6x 100GbE QSFP28	Met	Met	Met
		S4248FBL-ON (See note 3.)	**40x 10GbE SFP+ + 2x 40GbE QSFP+ + 6x 100GbE QSFP28**	**Met**	**Met**	**Met**
		S5212F-ON	12x 25GbE (SFP28) Ports + 3x 100GbE (QSFP28) Ports 1 RU, Half-Width Form Factor	Met	Met	Met
		S5224F-ON	24x 25GbE (SFP28) Ports **+ 4x 100GbE (QSFP28) Ports**	Met	Met	Met
		S5232F-ON (See note 3.)	32x 100GbE (QSFP28) Ports	**Met**	**Met**	**Met**
		S5248F-ON	48x 25GbE (SFP28) Ports **+ 6x 100GbE (QSFP28) Ports**	Met	Met	Met
		S5296F-ON (See note 3.)	**96x 25GbE (SFP28) Ports + 8x 100GbE (QSFP28) Ports 2RU Form Factor**	**Met**	**Met**	**Met**

NOTE(S):
1. Components bolded and underlined were tested by USAISEC-TIC. 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 and certified components and JITC analysis determined they were functionally identical for interoperability certification purposes.
2. 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.

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

NOTE(S): (continued)
3. USAISEC-TIC tested this device using port-pairs and Layer3 Snaking as described in the "Preface" of the ASLAN Test Procedures IO-17. This switch successfully achieved 100% throughput non-blocking, which meets non-blocking requirements for Core, Distribution, and Access switches.
4. Although this model of SUT supports Fiber Channel, it was not tested and is not certified for use.

LEGEND:

A	Access	Mbps	Megabits per second
ASLAN	Assured Services Local Area Network	OS	Operating System
C	Core	QSFP/+	Quad Small Form-factor Pluggable/Plus
D	Distribution	QSFP28	28Mbps Signaled Quad Small Form-factor Pluggable
GBASE-T	Gigabit Ethernet over Twisted Pair Copper	RJ45	Registered Jack 45
GbE	Gigabit Ethernet	RU	Rack Unit
FC	Fiber Channel	SFP/+	Small Form-factor Pluggable/Plus
IO	Interoperability	SUT	System Under Test
JITC	Joint Interoperability Test Command	TIC	Technology Integration Center
LRM	Long Reach Multimode	USAISEC	U.S. Army Information Systems Engineering Command

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

System Name	Software Release	Function
Required Ancillary Equipment (Site-Provided)		
Windows Server	2012 Enterprise SP1 UGM Army Server 2012R2	Active Directory
Windows 10 Enterprise SP1 Army Golden Master Windows 10	Kiwi v9.6	SysLog Server
Test Network Components		
Cisco Nexus 93180YC-EX	NX-OS 7.0(3)	Heterogeneous Interoperability
Cisco Nexus 7009	NX-OS 7.3(0)	Heterogeneous Interoperability
Brocade VDX8770	NOS 7.0.0b	Heterogeneous Interoperability
Spirent TestCenter	v4.95	TMDE

LEGEND:

NOS	Network Operating System	SysLog	System Log
NX-OS	Nexus Operating System	TMDE	Test, Measurement & Diagnostic Equipment
R	Release	UGM	Universal Golden Master
SP	Service Pack	v	Version