



DEFENSE INFORMATION SYSTEMS AGENCY

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IN REPLY
REFER TO: Joint Interoperability Test Command (JITE)

12 Aug 09

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Cisco Optical Network System (ONS) 15454 with Software Release 8.5.2

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006
(c) through (e), see Enclosure 1

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.
2. The Cisco ONS 15454 with Software Release 8.5.2 is hereinafter referred to as the System Under Test (SUT). The ONS 15454 can be configured in the following two platforms: the Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) Multiservice Provisioning Platform (MSPP) and the Multiservice Transport Platform (MSTP). Only the SONET/SDH MSPP configuration was tested and is covered under this certification. The SUT meets all of the critical interoperability requirements for the Defense Switched Network (DSN) and is certified for joint use. The SUT met the critical interoperability requirements for a Strategic Network Element set forth in appendices 5 and 9 of reference (c) using test procedures derived from reference (d). No other configurations, features, or functions, except those cited within this report, are certified by the JITC. This certification expires upon changes that affect interoperability, but no later than three years from the date of this memorandum.
3. This finding is based on interoperability testing conducted by JITC, review of the vendor's Letters of Compliance (LoC), and Defense Information Assurance (IA)/Security Accreditation Working Group (DSAWG) accreditation. Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona from 5 through 23 January 2009. Review of the vendor's LoC was completed on 11 February 2009. DSAWG grants accreditation based on the security testing completed by DISA-led Information Assurance test teams and published in a separate report (reference (e)). DSAWG accreditation was granted on 11 August 2009. The Certification Testing Summary (Enclosure 2) documents the test results and describes the test network.

4. The SUT Interoperability Test Summary is shown in Table 1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in Table 2.

Table 1. SUT Interoperability Test Summary

DSN Access Interfaces				
Interface & Signaling		Critical	Status	Remarks
T1 CAS (AMI/SF) DTMF, DP, MFR1		No ¹	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, DP, MFR1		No ¹	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)		No ¹	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)		No ¹	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP		No ¹ (Europe only)	Not Tested	E1 CAS is supported by the SUT; however it was not tested. The SUT E1 CAS interface is therefore not certified by JITC. This is not a required interface for a S-NE.
E1 ISDN PRI (ITU-T Q.955.3)		No ¹ (Europe only)	Not Tested	E1 ISDN PRI is supported by the SUT; however it was not tested. The SUT E1 ISDN PRI interface is therefore not certified by JITC. This is not a required interface for a S-NE.
E1 SS7 (ANSI T1.619a)		No ¹ (Europe only)	Not Tested	E1 SS7 is supported by the SUT; however it was not tested. The SUT E1 SS7 interface is therefore not certified by JITC. This is not a required interface for a S-NE.
DS3		No ¹	Certified	Met all CRs and FRs.
10/100 Mbps Ethernet		No ¹	Certified	Met all CRs and FRs.
Gigabit Ethernet		No ¹	Certified	Met all CRs and FRs.
DSN Transport Interfaces				
Optical Carrier Level	Transport Level	Critical	Status	Remarks
OC-3	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-12	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-48	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-192	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
Features And Capabilities				
Features and Capabilities		Critical	Status	Remarks
Synchronization		Yes	Certified	Met all CRs and FRs.
Network Management		Yes	Certified	Met all CRs and FRs.
Security		Yes	Certified	See note 3.
NOTES:				
1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.				
2 The UCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.				
3 Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report, reference (e).				

Table 1. SUT Interoperability Test Summary (continued)

LEGEND:			
AMI	Alternate Mark Inversion	JITC	Joint Interoperability Test Command
ANSI	American National Standards Institute	Mbps	Megabits per second
B8ZS	Bipolar Eight Zero Substitution	MFR1	Multi-frequency Recommendation 1
CAS	Channel Associated Signaling	MLPP	Multi-Level Precedence and Preemption
CRs	Capability Requirements	OC-3	Optical Carrier Level 3 (155 Mbps)
DISA	Defense Information Systems Agency	OC-12	Optical Carrier Level 12 (622 Mbps)
DP	Dial Pulse	OC-48	Optical Carrier Level 48 (2.448 Gbps)
DS3	Digital Signal Level 3 (44.736 Mbps)	OC-192	Optical Carrier Level 192 (10 Gbps)
DSN	Defense Switched Network	PRI	Primary Rate Interface
DTMF	Dual Tone Multi-Frequency	Q.955.3	ISDN Signaling Standard for E1 MLPP
E1	European Basic Multiplex Rate (2.048 Mbps)	SF	Super Frame
ESF	Extended Super Frame	S-NE	Strategic Network Element
FRs	Feature Requirements	SS7	Signaling System 7
Gbps	Gigabits per second	SUT	System Under Test
UCR	Generic Switching Center Requirements	STS	Synchronous Transport Signal
HDB3	High Density Bipolar 3	T1	Digital Transmission Link Level 1 (1.544 Mbps)
ISDN	Integrated Services Digital Network	T1.619a	SS7 and ISDN MLPP Signaling Standard for T1
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector	VT1.5	Virtual Tributary

Table 2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	Critical	Requirements Required or Conditional	References
T1 CAS	No ¹	<ul style="list-style-type: none"> • DS1 Interface Characteristics (C) • DS1 Supervisory Channel Associated Signaling (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.4 • UCR para. A9.5.1.2.4
T1 SS7 (ANSI T1.619a)	No ¹	<ul style="list-style-type: none"> • DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.4 • UCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No ¹	<ul style="list-style-type: none"> • E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C) • E1 Clear Channel Capability (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.5 • UCR para. A9.5.1.2.5 • UCR para. A9.5.1.2.5
E1 ISDN PRI (ITU-T Q.955.3)	No ¹ (Europe only)	<ul style="list-style-type: none"> • E1 Alarm and Restoral Requirements (C) • MOS (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.5 • UCR para. A9.5.1.1
E1 CAS	No ¹ (Europe only)	<ul style="list-style-type: none"> • BERT (R) • Secure Transmission (Voice and Data) (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No ¹ (Europe only)	<ul style="list-style-type: none"> • Modem (R) • Facsimile (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
DS3	No ¹	<ul style="list-style-type: none"> • Call Control Signals (R) • Delay (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
10/100 Mbps Ethernet	No ¹	<ul style="list-style-type: none"> • Call Congestion Control (R) • Call Congestion (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1.2 • UCR para. A9.5.1.1.2
Gigabit Ethernet	No ¹	<ul style="list-style-type: none"> • Voice Compression (C) • DS3 Interface Requirements (R) • IP Interface (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1.4 • UCR para. A9.5.1.2.6 • UCR para. A9.5.1.2.9

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

DSN Transport Interfaces			
Interface	Critical	Requirements Required or Conditional	References
OC-3	No ²	<ul style="list-style-type: none"> • MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT 1.5 (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.1 • UCR para. A5.5.2
OC-12	No ²	<ul style="list-style-type: none"> • DS1 Rate Provisioning (R) • DS0 Call Processing (R) • DS0 to OC-3 Route Assignment (R) • Facility Alarms (R) • DS1 AIS/Yellow (R) • DS0 AIS/DS0 RAI (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.3 • UCR para. A5.5.4 • UCR para. A5.5.4 • UCR para. A5.5.4
OC-48	No ²	<ul style="list-style-type: none"> • Synchronization in accordance with GR-518-CORE (R) • Synchronization in accordance with GR-253-CORE (R) • Synchronization in accordance with GR-436-CORE (R) • Reliability (R) • Security (R) • MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.5 • UCR para. A5.5.5 • UCR para. A5.5.5 • UCR para. A5.5.6 • UCR para. A5.6 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
OC-192	No ²	<ul style="list-style-type: none"> • Modem (R) • Facsimile (R) • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • IP Congestion Control (C) • Voice Compression (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1.2a • UCR para. A9.5.1.1.2b • UCR para. A9.5.1.1.4
SUT Features And Capabilities			
Feature/Capability	Critical	Requirements Required or Conditional	References
Synchronization	Yes	<ul style="list-style-type: none"> • Timing (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.7
Network Management	Yes	<ul style="list-style-type: none"> • Management Option (R) <ul style="list-style-type: none"> - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.2.1 • UCR para. A9.5.2.2 • UCR para. A9.5.2.3 • UCR para. A9.5.3
Security	Yes	<ul style="list-style-type: none"> • DIACAP and STIGs (R) 	<ul style="list-style-type: none"> • UCR para. A9.6
NOTES:			
1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.			
2 The UCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.			

Table 2. SUT Capability and Feature Interoperability Requirements (continued)

LEGEND:			
A	Appendix	ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
ADIMSS	Advanced DSN Intergraded Management Support System	LSSGR	Local Access and Transport Area (LATA) Switching Systems Generic Requirements
ANSI	American National Standards Institute	Mbps	Megabits per second
AIS	Alarm Indication Signal	MLPP	Multi-Level Precedence and Preemption
BERT	Bit Error Ratio Test	MOS	Mean Opinion Score
C	Conditional	OC-3	Optical Carrier Level 3 (155 Mbps)
CAS	Channel Associated Signaling	OC-12	Optical Carrier Level 12 (622 Mbps)
DIACAP	Department of Defense Information Assurance Certification and Accreditation Process	OC-48	Optical Carrier Level 48 (2.448 Gbps)
DS0	Digital Signal Level 0	OC-192	Optical Carrier Level 192 (10 Gbps)
DS1	Digital Signal Level 1	Para	paragraph
DS3	Digital Signal Level 3	PRI	Primary Rate Interface
DSN	Defense Switched Network	Q.955.3	ISDN Signaling standard for E1 MLPP
DSS1	Digital Subscriber Signaling 1	R	Required
DWDM	Dense Wavelength Division Multiplexing	RAI	Remote Alarm Indication
E1	European Basic Multiplex Rate (2.048 Mbps)	SONET	Synchronous Optical Network
Gbps	Gigabits per second	SS7	Signaling System 7
GR	Generic Requirement	STIGs	Security Technical Implementation Guides
GR-253-CORE	SONET Transport Systems: Common Generic Criteria	SUT	System Under Test
GR-303-CORE	Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1	Digital Transmission Link Level 1 (1.544 Mbps)
GR-436-CORE	Digital Network Synchronization Plan	T1.105-2001	SONET – Basic Description include Multiplexer structure, rates, formats
GR-518-CORE	LSSGR: Synchronization, Section 18	T1.607	ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
GR-782-CORE	SONET Digital Switch Trunk Interface Criteria	T1.619a	SS7 and ISDN MLPP Signaling Standard for T1
IP	Internet Protocol	UCR	Unified Capabilities Requirements
ISDN	Integrated Services Digital Network	VT1.5	Virtual Tributary 1.5

5. No detailed test report was developed in accordance with the Program Manager’s request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to edward.mellon@disa.mil. The JITC’s mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 0822401.

FOR THE COMMANDER:



for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

2 Enclosures a/s

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Optical Network System (ONS) 15454 with Software Release 8.5.2

Distribution (electronic mail):

Joint Staff J-6

Joint Interoperability Test Command, Liaison, TE3/JT1

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National Security Agency, DT

Defense Information Systems Agency, TEMC

Office of Assistant Secretary of Defense (NII)/DOD CIO

U.S. Joint Forces Command, Net-Centric Integration, Communication, and Capabilities Division, J68

Defense Information Systems Agency, GS23

ADDITIONAL REFERENCES

- (c) Defense Information Systems Agency, "Department of Defense Voice Networks Unified Capabilities Requirement," 21 December 2007
- (d) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006
- (e) Joint Interoperability test Command, "Information Assurance (IA) Assessment of Cisco Optical Network System (ONS) with Software Release 8.5 (Tracking Number 0822401)," 11 August 2009

CERTIFICATION TESTING SUMMARY

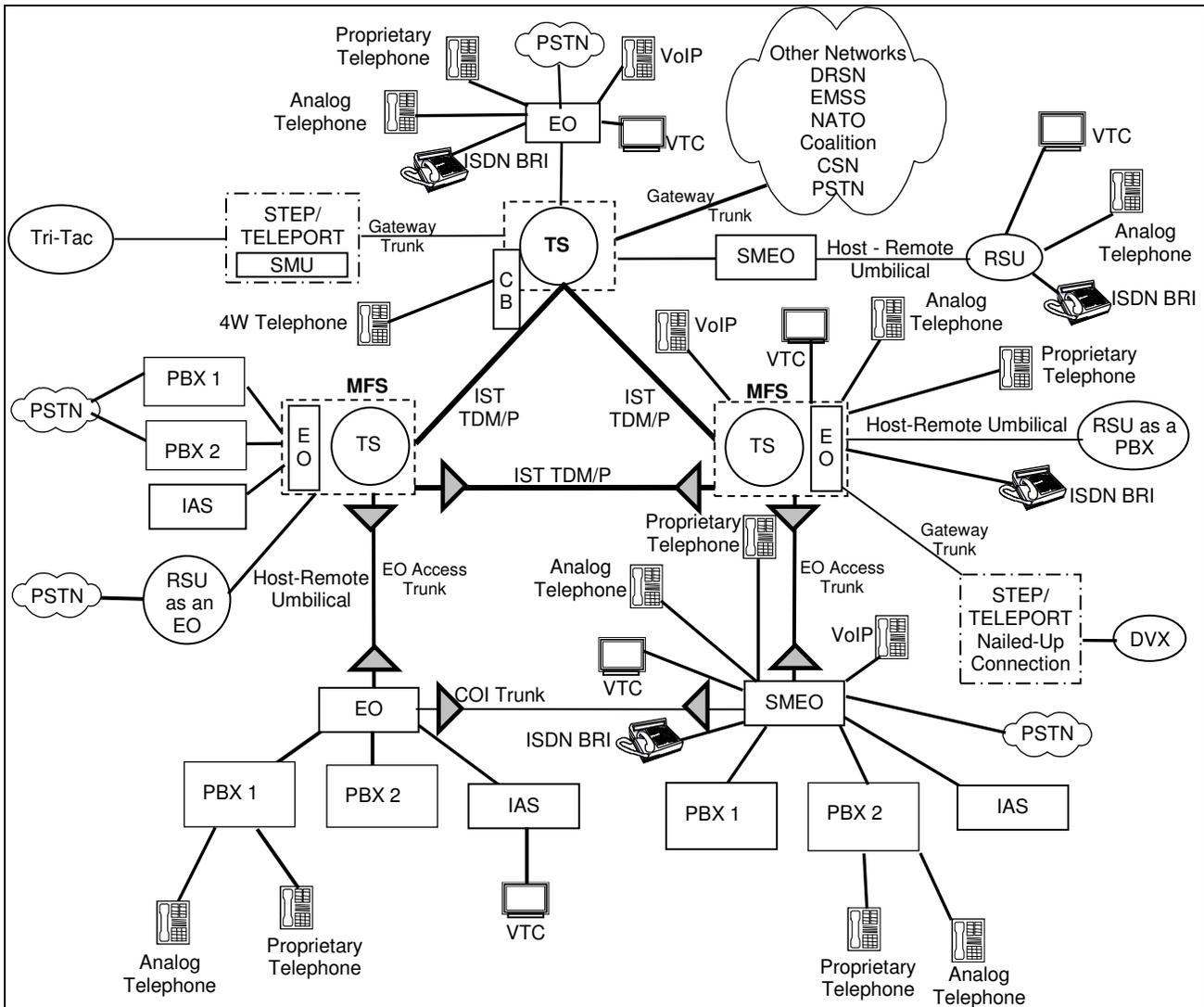
- 1. SYSTEM TITLE.** Cisco Optical Network System (ONS) 15454 with Software Release 8.5.2, hereinafter referred to as the System Under Test (SUT).
- 2. PROPONENTS.** Defense Information Systems Agency (DISA).
- 3. PROGRAM MANAGER.** Mr. Anthony Mazzuchi, MSPP Service Manager, GS222, 5275 Leesburg, Pike Falls Church, Virginia 22042, e-mail: Anthony.Mazzuchi@disa.mil.
- 4. TESTER.** Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.
- 5. SYSTEM UNDER TEST DESCRIPTION.** The SUT includes expandable, managed systems, which are deployed as Strategic Network Elements (S-NE)s. These systems are controlled by either the Cisco Transport Controller (CTC) using Java Runtime Environment (JRE) or by standalone Cisco Transport Manager (CTM) client software and support a number of existing fiber optic and electrical applications.

The SUT can be configured in the following two platforms: the Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) Multiservice Provisioning Platform (MSPP) and the Multiservice Transport Platform (MSTP). SONET and SDH are transport technologies, SONET is predominantly used in the United States and SDH is predominantly used overseas. The MSPP was the only platform tested and covered under this certification.

The SUT SONET/SDH platform is configured with universal expansion slots for adding Digital Signal Level 1 (DS1), Digital Signal Level 3 (DS3), 10/100 Megabits per second (Mbps) Ethernet, Gigabit Ethernet, DS3/Virtual Tributary (VT) Transmux, Synchronous Transport Signal -1 (STS-1), Optical Carrier Level 3 (OC-3), Optical Carrier Level 12 (OC-12), Optical Carrier Level 48 (OC-48), and Optical Carrier Level 192 (OC-192).

The SUT is managed via the CTC application. CTC is a JRE application that is stored on a card internal to the chassis. The workstation with the CTC application served as a management console, and it managed all nodes in the test network via in-band management.

- 6. OPERATIONAL ARCHITECTURE.** The Generic Switching Center Requirements (UCR) Defense Switched Network (DSN) operational architecture is depicted in Figure 2-1.



LEGEND:

- | | | | |
|------|-------------------------------------|---------|---|
| 4W | 4-Wire | PBX | Private Branch Exchange |
| BRI | Basic Rate Interface | PBX 1 | Private Branch Exchange 1 |
| CB | Channel Bank | PBX 2 | Private Branch Exchange 2 |
| COI | Community of Interest | PSTN | Public Switched Telephone Network |
| CSN | Canadian Switch Network | RSU | Remote Switching Unit |
| DRSN | Defense Red Switch Network | SMEO | Small End Office |
| DSN | Defense Switched Network | SMU | Switched Multiplex Unit |
| DVX | Deployable Voice Exchange | STEP | Standardized Tactical Entry Point |
| EMSS | Enhanced Mobile Satellite System | SUT | System Under Test |
| EO | End Office | TDM/P | Time Division Multiplex/Packetized |
| IAS | Integrated Access Switch | Tri-Tac | Tri-Service Tactical Communications Program |
| ISDN | Integrated Services Digital Network | TS | Tandem Switch |
| IST | Inter-switch Trunk | VoIP | Voice over Internet Protocol |
| MFS | Multifunction Switch | VTC | Video Teleconferencing |
| NATO | North Atlantic Treaty Organization | SUT | SUT |

Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT Interoperability Test Summary is shown in Table 2-1 and the Capability and Feature Requirements used to evaluate the interoperability of the SUT are indicated in Table 2-2. These requirements are derived from the UCR and verified through JITC testing and review of vendor Letters of Compliance (LoC).

Table 2-1. SUT Interoperability Test Summary

DSN Access Interfaces				
Interface & Signaling		Critical	Status	Remarks
T1 CAS (AMI/SF) DTMF, DP, MFR1		No ¹	Certified	Met all CRs and FRs.
T1 CAS (B8ZS/ESF) DTMF, DP, MFR1		No ¹	Certified	Met all CRs and FRs.
T1 PRI (ANSI T1.619a)		No ¹	Certified	Met all CRs and FRs.
T1 SS7 (ANSI T1.619a)		No ¹	Certified	Met all CRs and FRs.
E1 CAS (HDB3) DTMF, MFR1, DP		No ¹ (Europe only)	Not Tested	E1 CAS is supported by the SUT; however it was not tested. The SUT E1 CAS interface is therefore not certified by JITC. This is not a required interface for a S-NE.
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10/100 Mbps Ethernet		No ¹	Certified	Met all CRs and FRs.
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DSN Transport Interfaces				
Optical Carrier Level	Transport Level	Critical	Status	Remarks
OC-3	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-12	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-48	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
OC-192	VT1.5	No ²	Certified	Met all CRs and FRs.
	STS-1	No ²	Certified	Met all CRs and FRs.
Features And Capabilities				
Features and Capabilities		Critical	Status	Remarks
Synchronization		Yes	Certified	Met all CRs and FRs.
Network Management		Yes	Certified	Met all CRs and FRs.
Security		Yes	Certified	See note 3.
NOTES:				
1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.				
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3 Information assurance testing is accomplished via DISA-led Information Assurance test teams and published in a separate report, reference (e).				

Table 2-1. SUT Interoperability Test Summary (continued)

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DTMF	Dual Tone Multi-Frequency
E1	European Basic Multiplex Rate (2.048 Mbps)
ESF	Extended Super Frame
FRs	Feature Requirements
Gbps	Gigabits per second
UCR	Generic Switching Center Requirements
HDB3	High Density Bipolar 3
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
JITC	Joint Interoperability Test Command
Mbps	Megabits per second
MFR1	Multi-frequency Recommendation 1
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PRI	Primary Rate Interface
Q.955.3	ISDN Signaling Standard for E1 MLPP
SF	Super Frame
S-NE	Strategic Network Element
SS7	Signaling System 7
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STS	Synchronous Transport Signal
T1	Digital Transmission Link Level 1 (1.544 Mbps)
T1.619a	SS7 and ISDN MLPP Signaling Standard for T1
VT1.5	Virtual Tributary

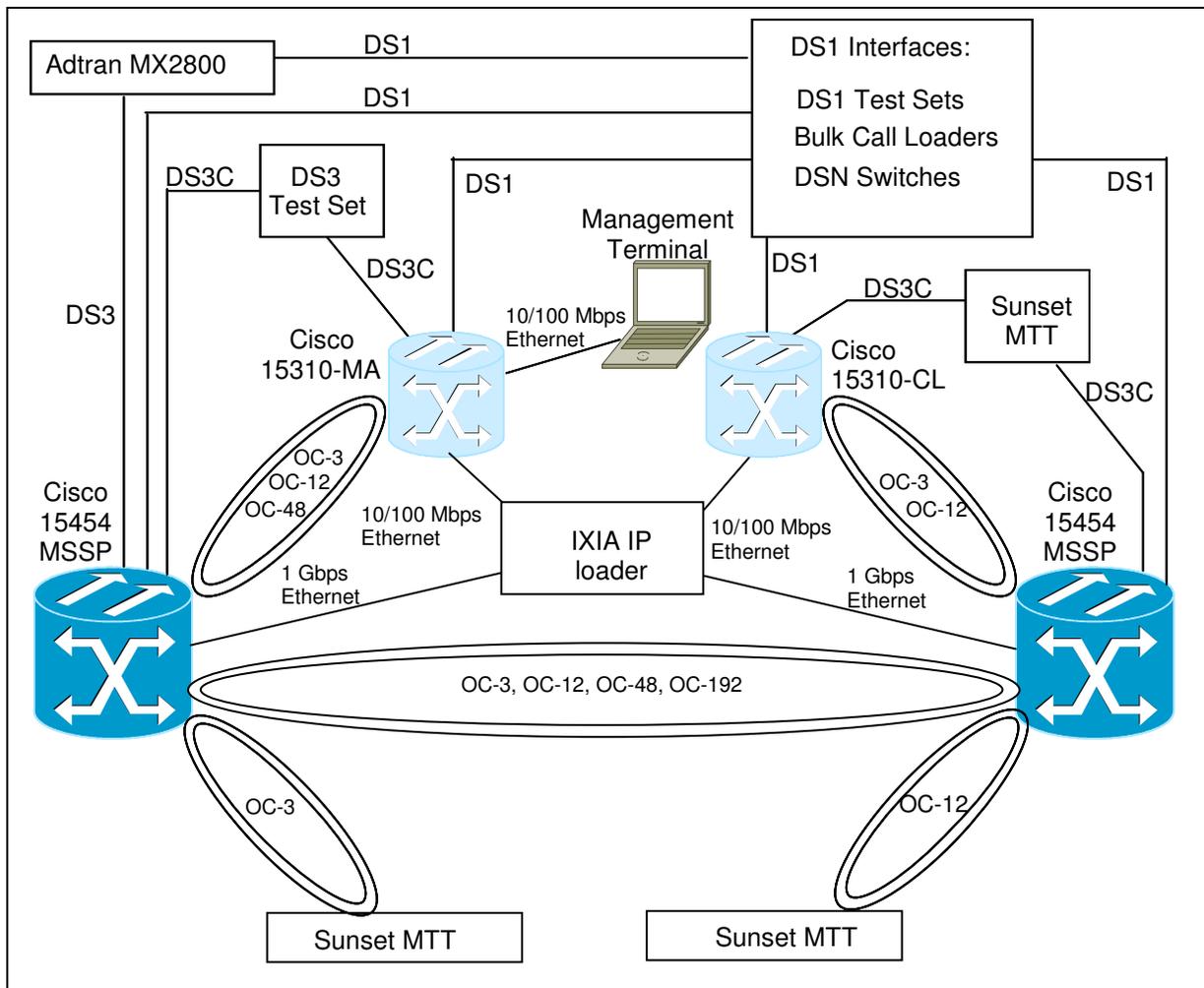
Table 2-2. SUT Capability and Feature Interoperability Requirements

DSN Access Interfaces			
Interface	Critical	Requirements Required or Conditional	References
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T1 SS7 (ANSI T1.619a)	No ¹	<ul style="list-style-type: none"> • DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.4 • UCR para. A9.5.1.2.4
T1 ISDN PRI (ANSI T1.607/ANSI T1.619a)	No ¹	<ul style="list-style-type: none"> • E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.5 • UCR para. A9.5.1.2.5
E1 ISDN PRI (ITU-T Q.955.3)	No ¹ (Europe only)	<ul style="list-style-type: none"> • E1 Clear Channel Capability (C) • E1 Alarm and Restoral Requirements (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.5 • UCR para. A9.5.1.2.5
E1 CAS	No ¹ (Europe only)	<ul style="list-style-type: none"> • MOS (R) • BERT (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No ¹ (Europe only)	<ul style="list-style-type: none"> • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
DS3	No ¹	<ul style="list-style-type: none"> • Call Control Signals (R) • Delay (R) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
10/100 Mbps Ethernet	No ¹	<ul style="list-style-type: none"> • Call Congestion Control (R) • Call Congestion (R) • Voice Compression (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1.2 • UCR para. A9.5.1.1.2 • UCR para. A9.5.1.1.4
Gigabit Ethernet	No ¹	<ul style="list-style-type: none"> • DS3 Interface Requirements (R) • IP Interface (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.2.6 • UCR para. A9.5.1.2.9
DSN Transport Interfaces			
Interface	Critical	Requirements Required or Conditional	References
OC-3	No ²	<ul style="list-style-type: none"> • MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT 1.5 (R) • DS1 Rate Provisioning (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.1 • UCR para. A5.5.2
OC-12	No ²	<ul style="list-style-type: none"> • DS0 Call Processing (R) • DS0 to OC-3 Route Assignment (R) • Facility Alarms (R) • DS1 AIS/Yellow (R) • DS0 AIS/DS0 RAI (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.2 • UCR para. A5.5.3 • UCR para. A5.5.4 • UCR para. A5.5.4 • UCR para. A5.5.4
OC-48	No ²	<ul style="list-style-type: none"> • Synchronization in accordance with GR-518-CORE (R) • Synchronization in accordance with GR-253-CORE (R) • Synchronization in accordance with GR-436-CORE (R) • Reliability (R) • Security (R) • MOS (R) • BERT (R) 	<ul style="list-style-type: none"> • UCR para. A5.5.5 • UCR para. A5.5.5 • UCR para. A5.5.6 • UCR para. A5.6 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
OC-192	No ²	<ul style="list-style-type: none"> • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • IP Congestion Control (C) • Voice Compression (C) 	<ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1.2a • UCR para. A9.5.1.1.2b • UCR para. A9.5.1.1.4

Table 2-2. SUT Capability and Feature Interoperability Requirements (continued)

SUT Features And Capabilities																																																																																																			
Feature/Capability	Critical	Requirements Required or Conditional	References																																																																																																
Synchronization	Yes	• Timing (R)	• UCR para. A9.5.1.2.7																																																																																																
Network Management	Yes	• Management Option (R) - Local Management (Front Panel and/or External Console) (C) - ADIMSS (C) • Fault Management (C) • Loop Back Capability (C) • Operational Configuration Restoral (R)	• UCR para. A9.5.2.1 • UCR para. A9.5.2.2 • UCR para. A9.5.2.3 • UCR para. A9.5.3																																																																																																
Security	Yes	• DIACAP and STIGs (R)	• UCR para. A9.6																																																																																																
<p>NOTES:</p> <p>1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element.</p> <p>2 The UCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element.</p> <p>LEGEND:</p> <table border="0"> <tr> <td>A</td> <td>Appendix</td> <td>ITU-T</td> <td>International Telecommunication Union - Telecommunication Standardization Sector</td> </tr> <tr> <td>ADIMSS</td> <td>Advanced DSN Intergraded Management Support System</td> <td>LSSGR</td> <td>Local Access and Transport Area (LATA) Switching Systems Generic Requirements</td> </tr> <tr> <td>ANSI</td> <td>American National Standards Institute</td> <td>Mbps</td> <td>Megabits per second</td> </tr> <tr> <td>AIS</td> <td>Alarm Indication Signal</td> <td>MLPP</td> <td>Multi-Level Precedence and Preemption</td> </tr> <tr> <td>BERT</td> <td>Bit Error Ratio Test</td> <td>MOS</td> <td>Mean Opinion Score</td> </tr> <tr> <td>C</td> <td>Conditional</td> <td>OC-3</td> <td>Optical Carrier Level 3 (155 Mbps)</td> </tr> <tr> <td>CAS</td> <td>Channel Associated Signaling</td> <td>OC-12</td> <td>Optical Carrier Level 12 (622 Mbps)</td> </tr> <tr> <td>DIACAP</td> <td>Department of Defense Information Assurance Certification and Accreditation Process</td> <td>OC-48</td> <td>Optical Carrier Level 48 (2.448 Gbps)</td> </tr> <tr> <td>DS0</td> <td>Digital Signal Level 0</td> <td>OC-192</td> <td>Optical Carrier Level 192 (10 Gbps)</td> </tr> <tr> <td>DS1</td> <td>Digital Signal Level 1</td> <td>Para</td> <td>paragraph</td> </tr> <tr> <td>DS3</td> <td>Digital Signal Level 3</td> <td>PRI</td> <td>Primary Rate Interface</td> </tr> <tr> <td>DSN</td> <td>Defense Switched Network</td> <td>Q.955.3</td> <td>ISDN Signaling standard for E1 MLPP</td> </tr> <tr> <td>DSS1</td> <td>Digital Subscriber Signaling 1</td> <td>R</td> <td>Required</td> </tr> <tr> <td>DWDM</td> <td>Dense Wavelength Division Multiplexing</td> <td>RAI</td> <td>Remote Alarm Indication</td> </tr> <tr> <td>E1</td> <td>European Basic Multiplex Rate (2.048 Mbps)</td> <td>SONET</td> <td>Synchronous Optical Network</td> </tr> <tr> <td>Gbps</td> <td>Gigabits per second</td> <td>SS7</td> <td>Signaling System 7</td> </tr> <tr> <td>GR</td> <td>Generic Requirement</td> <td>STIGs</td> <td>Security Technical Implementation Guides</td> </tr> <tr> <td>GR-253-CORE</td> <td>SONET Transport Systems: Common Generic Criteria</td> <td>SUT</td> <td>System Under Test</td> </tr> <tr> <td>GR-303-CORE</td> <td>Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface</td> <td>T1</td> <td>Digital Transmission Link Level 1 (1.544 Mbps)</td> </tr> <tr> <td>GR-436-CORE</td> <td>Digital Network Synchronization Plan</td> <td>T1.105-2001</td> <td>SONET – Basic Description include Multiplexer structure, rates, formats</td> </tr> <tr> <td>GR-518-CORE</td> <td>LSSGR: Synchronization, Section 18</td> <td>T1.607</td> <td>ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1</td> </tr> <tr> <td>GR-782-CORE</td> <td>SONET Digital Switch Trunk Interface Criteria</td> <td>T1.619a</td> <td>SS7 and ISDN MLPP Signaling Standard for T1</td> </tr> <tr> <td>IP</td> <td>Internet Protocol</td> <td>UCR</td> <td>Unified Capabilities Requirements</td> </tr> <tr> <td>ISDN</td> <td>Integrated Services Digital Network</td> <td>VT1.5</td> <td>Virtual Tributary 1.5</td> </tr> </table>				A	Appendix	ITU-T	International Telecommunication Union - Telecommunication Standardization Sector	ADIMSS	Advanced DSN Intergraded Management Support System	LSSGR	Local Access and Transport Area (LATA) Switching Systems Generic Requirements	ANSI	American National Standards Institute	Mbps	Megabits per second	AIS	Alarm Indication Signal	MLPP	Multi-Level Precedence and Preemption	BERT	Bit Error Ratio Test	MOS	Mean Opinion Score	C	Conditional	OC-3	Optical Carrier Level 3 (155 Mbps)	CAS	Channel Associated Signaling	OC-12	Optical Carrier Level 12 (622 Mbps)	DIACAP	Department of Defense Information Assurance Certification and Accreditation Process	OC-48	Optical Carrier Level 48 (2.448 Gbps)	DS0	Digital Signal Level 0	OC-192	Optical Carrier Level 192 (10 Gbps)	DS1	Digital Signal Level 1	Para	paragraph	DS3	Digital Signal Level 3	PRI	Primary Rate Interface	DSN	Defense Switched Network	Q.955.3	ISDN Signaling standard for E1 MLPP	DSS1	Digital Subscriber Signaling 1	R	Required	DWDM	Dense Wavelength Division Multiplexing	RAI	Remote Alarm Indication	E1	European Basic Multiplex Rate (2.048 Mbps)	SONET	Synchronous Optical Network	Gbps	Gigabits per second	SS7	Signaling System 7	GR	Generic Requirement	STIGs	Security Technical Implementation Guides	GR-253-CORE	SONET Transport Systems: Common Generic Criteria	SUT	System Under Test	GR-303-CORE	Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1	Digital Transmission Link Level 1 (1.544 Mbps)	GR-436-CORE	Digital Network Synchronization Plan	T1.105-2001	SONET – Basic Description include Multiplexer structure, rates, formats	GR-518-CORE	LSSGR: Synchronization, Section 18	T1.607	ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1	GR-782-CORE	SONET Digital Switch Trunk Interface Criteria	T1.619a	SS7 and ISDN MLPP Signaling Standard for T1	IP	Internet Protocol	UCR	Unified Capabilities Requirements	ISDN	Integrated Services Digital Network	VT1.5	Virtual Tributary 1.5
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8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC’s Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. This test was conducted using the test configuration shown in Figure 2-2.



LEGEND:

CL	Customer Location	MSSP	Multiservice Provisioning Platform
DS1	Digital Signal Level 1	MX	Multiplexer
DS3	Digital Signal Level 3 (44.736 Mbps)	OC-3	Optical Carrier Level 3 (155 Mbps)
DS3C	Digital Signal Level 3 (44.736 Mbps) Concatenated	OC-12	Optical Carrier Level 12 (622 Mbps)
DSN	Defense Switched Network	OC-48	Optical Carrier Level 48 (2.488 Gbps)
Gbps	Gigabits per second	OC-192	Optical Carrier Level 192 (10 Gbps)
MA	Metro Access	SUT	System Under Test
Mbps	Megabits per second		

Figure 2-2. SUT Test Configuration

9. SYSTEM CONFIGURATIONS. Table 2-2 provides the system configurations, hardware, and software components tested with the SUT. The SUT was tested in an operationally realistic environment to determine interoperability with a complement of DSN switches noted in Table 2-2. Table 2-2 lists the DSN switches which depict the tested configuration and is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the Unified Capabilities (UC) Approved Products List (APL) that offer the same certified interfaces.

Table 2-3. Tested System Configurations

System Name		Software Release	
Nortel CS2100		Succession Enterprise (SE)09.1	
Siemens EWSD		19d with Patch Set 46	
Alcatel-Lucent 5ESS		5E16.2 Broadcast Warning Message (BWM) 07-0003	
Avaya S8710		Communication Manager (CM) 4.0 (R014x.00.2.731.7: Super Patch 14419)	
Nortel CS1000M Single Group		4.5W	
Adtran OPTI-6100 (NE)		R3.3	
Adtran 2800MX (NE)		Code Version 3.20A	
Cisco ONS 15310-MA		8.5.1	
Cisco ONS 15310-CL		8.5.1	
Component	Sub-component Type	Sub-component	Description
ONS 15454 MSPP with Software Release 8.5.2	ONS 15454 Chassis	15454-SA-HD	Shelf Assembly, High Density
		ETA	Fan Tray Assembly
		AIP	Alarm Interface panel
		15454-EIA-UBICH-A	Electrical Interface Assembly
		15454-EIA-UBICH-B	Electrical Interface Assembly
	Common Control Modules	15454-XC-VXC-10G	Cross-Connect Module, High Cap. Tributary
		15454-XC-10G	Xconn, 1152 STS, 672 VT
		15454-XC-VT	Xconn, 576 STS, 672 VT, I-Temp
		TCC2P	Timing Communications Control Two Plus, I-Temp
		TCC2	Timing Communications Control Two
	Electrical Interface Modules	15454-DS1E1-56	DS1/ E1, 1:N, 56 ports, I-Temp
		15454-DS1-14	DS1, 14 Ckt., I-Temp
		15454-DS1N-14	DS1, 1:N, 14 Ckt, I-Temp
		15454-DS3EC1-48	DS3, 48 Ckt., reqs SA-HD shelf assembly
		15454-DS3-12E	DS3, Enhanced PM, 12 Ckt, I-Temp
		15454-DS3N-12E	DS3, 1:N, Enhanced PM, 12 Ckt, I-Temp
	SONET Interface Modules	15454-DS3XM-12	DS3, Transmux 12 Circuit
		15454-MRC-4 2.5G	OC3/12/48, 2.5G Max, 4 ports, IOF
		15454-MRC-12	OC3/12/48, 12 ports, IOF
		OC192SR1 STM64IO Short Reach	OC-192/STM-64 optics card, one port, short-reach Inter Office, 1310-nm, single-mode SC connector, SONET platform
	Ethernet Interface Modules	15454-CE-1000-4	4 port GE Carrier Edge card
		15454-CE-100T-8	8x10/100T Carrier Ethernet
		15454-G1K-4	Gigabit Ethernet, 4 Ckt., L1, GBIC, XC/XC-VT/XC-10G
		15454-CE-MR-10	Carrier Ethernet card – 10 port multirate 10/100/1000 Mbps
		15454-ML-MR-10	ML2 10-port multirate L2/RPR card
		ONS-GC-GE-SX	GBIC- 1000Base-SX, SC, MM
		ONS-GC-GE-LX	GBIC- 1000Base-LX, SC, SM or MM

Table 2-3. Tested System Configurations

Component	Sub-component Type	Sub-component	Description																																																
ONS 15454 MSPP with Software Release 8.5.2	Ethernet Interface Modules	ONS-GC-GE-ZX	GBIC- 1000Base-ZX, SM																																																
		<u>ONS-SE-ZE-EL</u>	<u>SFP - 10/100/1000 Ethernet BaseT Multi-rate Copper RJ45</u>																																																
		ONS-SE-GE-ZX	1000BASE-ZX Gigabit Ethernet SFP, 1550, SM																																																
		<u>ONS-SI-622-I1</u>	<u>SFP -OC12/STM4 and OC3/STM1 IR, S-4.1, S-1.1, 1310 nm, ITEMP</u>																																																
		ONS-SI-622-SR-MM	SFP - OC12, SR, 1310 NM, MULTI MODE, I-TEMP																																																
		ONS-SI-622-L1	SFP -OC12/STM4 LR, L-4.1, 1310 nm, SM, LC, ITEMP																																																
		ONS-SI-622-L2	SFP -OC12/STM4 LR, L-4.2, 1550 nm, SM, LC, ITEMP																																																
		<u>ONS-SE-Z1</u>	<u>SFP-OC48IR1.12/3SR1,GE LX STM S-16.1,I-4,I-1,1310nm EXT-TEMP</u>																																																
		ONS-SI-2G-I1	SFP - OC48/STM16, IR1, S-16.1,1310nm, SM, LC, ITEMP																																																
		<u>ONS-SI-2G-S1</u>	<u>SFP - OC48/STM16, SR1, I-16.1,1310nm, SM, LC, ITEMP</u>																																																
		ONS-SI-2G-L1	SFP - OC48/STM16, LR1, L-16.1, 1310nm,SM, LC, ITEMP																																																
		ONS-SI-2G-L2	SFP - OC48/STM16, LR2, L-16.2, 1550nm, SM, LC, ITEMP																																																
		ONS-SE-2G-S1	SFP - OC48/STM16, SR1, I-16.1, 1310nm, SM, LC, EXT-TEMP																																																
ONS-SE-2G-L2	SFP - OC48/STM16, LR2, L-16.2, 1550nm, SM, LC, EXT-TEMP																																																		
ONS 15454 MSPP with Software Release 8.5.2	Ethernet Interface Modules	<u>ONS-XC-10G-S1</u>	<u>XFP - OC192/STM64/10GE - 1310 SR - SM LC</u>																																																
		ONS-XC-10G-I2	XFP - OC192/STM64/10GE - 1550 IR/SH2																																																
		ONS-XC-10G-L2=	XFP - OC192/STM64 - 1550 LR2 - SM LC																																																
	Management Terminal	<u>GLC-SX-MM</u>	<u>Gigabit Ethernet Interface GBIC</u>																																																
		Sun Server: 80 GB hard drive, 512 MB RAM, Intel Celeron Processor 2.80 GHz, Windows XP with Service Pack 2, Cisco Transport Controller Running Release 8.5, Cisco Transport Manager Release 8.5																																																	
<p>NOTE: Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.</p> <p>LEGEND:</p> <table> <tr> <td>5ESS</td> <td>Class 5 Electronic Switching System</td> <td>Mbps</td> <td>Megabits per second</td> </tr> <tr> <td>CL</td> <td>Customer Location</td> <td>MSPP</td> <td>Multiservice Provisioning Platform</td> </tr> <tr> <td>CS</td> <td>Communication Server</td> <td>MSTP</td> <td>Multiservice Transport Platform</td> </tr> <tr> <td>DS1</td> <td>Digital Signal Level 1</td> <td>MX</td> <td>Multiplexer</td> </tr> <tr> <td>DS3</td> <td>Digital Signal Level 3</td> <td>NE</td> <td>Network Element</td> </tr> <tr> <td>EWSD</td> <td>Elektronisches Wählsystem Digital</td> <td>ONS</td> <td>Optical Network System</td> </tr> <tr> <td>GB</td> <td>Gigabytes</td> <td>OPTI</td> <td>Optical</td> </tr> <tr> <td>Gbps</td> <td>Gigabits per second</td> <td>RAM</td> <td>Random Access Memory</td> </tr> <tr> <td>GHz</td> <td>Gigahertz</td> <td>SFP</td> <td>Small Form Factor Pluggable</td> </tr> <tr> <td>JITC</td> <td>Joint Interoperability Test Command</td> <td>SUT</td> <td>System Under Test</td> </tr> <tr> <td>MA</td> <td>Metro Access</td> <td>TCC2P</td> <td>Timing, Communications, and Control version 2 Plus</td> </tr> <tr> <td>MB</td> <td>Megabytes</td> <td></td> <td></td> </tr> </table>				5ESS	Class 5 Electronic Switching System	Mbps	Megabits per second	CL	Customer Location	MSPP	Multiservice Provisioning Platform	CS	Communication Server	MSTP	Multiservice Transport Platform	DS1	Digital Signal Level 1	MX	Multiplexer	DS3	Digital Signal Level 3	NE	Network Element	EWSD	Elektronisches Wählsystem Digital	ONS	Optical Network System	GB	Gigabytes	OPTI	Optical	Gbps	Gigabits per second	RAM	Random Access Memory	GHz	Gigahertz	SFP	Small Form Factor Pluggable	JITC	Joint Interoperability Test Command	SUT	System Under Test	MA	Metro Access	TCC2P	Timing, Communications, and Control version 2 Plus	MB	Megabytes		
5ESS	Class 5 Electronic Switching System	Mbps	Megabits per second																																																
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Gbps	Gigabits per second	RAM	Random Access Memory																																																
GHz	Gigahertz	SFP	Small Form Factor Pluggable																																																
JITC	Joint Interoperability Test Command	SUT	System Under Test																																																
MA	Metro Access	TCC2P	Timing, Communications, and Control version 2 Plus																																																
MB	Megabytes																																																		

10. TEST LIMITATIONS. None.

11. TEST RESULTS

a. Discussion

(1) DSN Access Interfaces. The SUT supports both DS1 and DS3 interfaces. Channel Associated Signaling (CAS) and Common Channel Signaling trunks were provisioned and tested. In addition, the SUT supports 10/100 Mbps and Gigabit Ethernet interfaces, which were also tested. All of the interface types were mapped through the test network via VT1.5 and STS-1 transport levels over all of the supported SONET interfaces described in paragraph (5). Although the SUT offers E1 access interfaces, these interfaces were not tested by JITC. All Access interface characteristics were met through both vendor LoC and testing. The specific requirements and test results of the DSN Access Interface testing are described below.

(a) Interface Characteristics. The DS1 and DS3 interface characteristics were tested in accordance with UCR, Appendix 9, paragraphs A9.5.1.2.4 and A9.5.1.2.6. The DS1 interface supports both Alternate Mark Inversion (AMI) and Bipolar Eight Zero Substitution (B8ZS) line coding. The DS3 interface supports Bipolar Three Zero Substitution (B3ZS) line coding. The DS3 interface supports both C-bit and M13 framing.

(b) Supervisory Channel Associated Signaling. Trunk seizure, answer supervision, preemption signals, and all other trunk supervisory information sent and received on a per channel basis was passed transparently through the SUT as required in the UCR, appendix 9.

(c) Clear Channel Capability. The SUT is capable of transmitting and receiving B8ZS line coding in accordance with UCR, appendix 9.

(d) Mean Opinion Score (MOS). The UCR, appendix 9, paragraph A9.5.1.1, states that the introduction of network element(s) (NEs) shall not cause the end-to-end average MOS to fall below 4.0 as measured over any five-minute time interval. The Ixia IxChariot was used to generate simulated voice traffic across the access interfaces. There were 1600 calls across the access interfaces, with all calls placed via the SUT having a MOS of at least 4.0. The IXIA data loader was also used to generate voice traffic over the 100 Mbps Ethernet interface mapped through the SONET test network. The IXIA voice traffic had a minimum MOS of 4.34 with an average MOS of 4.35, which met the requirement.

(e) Bit Error Rate Test (BERT). The UCR, appendix 9, paragraph A9.5.1.1, states that the introduction of an NE shall exceed the end-to-end digital bit error rate requirement of less than 1 error in 1×10^9 (averaged over a nine-hour period). BERTs were conducted across DS1 and DS3 interfaces. The SUT met this requirement for all interfaces with a recorded bit error ratio of 1×10^{-12} for all DSN access interfaces.

(f) Secure Transmission (Voice and Data). The UCR, appendix 9, paragraph A9.5.1.1, states that the introduction of NE(s) shall not degrade secure transmission for secure end devices as defined by UCR, appendix 10. There were 126 secure calls placed between Secure Terminal Equipment (STEs) and Secure Wireline

Terminals (SWTs) without degrading transmissions between end devices, which meets the requirement.

(g) Modem. The UCR, appendix 9, paragraph A9.5.1.1, states that the NE(s) shall support a minimum modem transmission speed of 9.6 kilobits per second (kbps) across the associated NE(s). There were 50,216 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kbps, which meets the requirement.

(h) Facsimile. The UCR, appendix 9, paragraph A9.5.1.1, states that the NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s). There were 8,466 facsimile calls placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps, which meets the requirement.

(i) Call Control Signals. The UCR, appendix 9, paragraph A9.5.1.1, states that the NE shall transport all call control signals transparently on an end-to-end basis. This requirement was verified via testing and the vendor's LoC. The SUT transparently transported all MLPP call control signals, which meets the requirement.

(j) Delay. Delay occurs when packets take more time than expected to reach their destination. The UCR, appendix 9, paragraph A9.5.1.1, states that the addition of S-NEs shall not cause the one-way delay measured from ingress to egress to increase by more than 5 milliseconds (ms) for each S-NE used, averaged over any five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 0.6 ms, with a maximum delay of 1.3 ms, which met the requirement.

(k) Alarm and Restoral Requirements. The UCR, appendix 9, paragraph A9.5.1.1.1, states that the NE shall be able to propagate Carrier Group Alarms (CGAs) in accordance with UCR, section 7, upon physical loss of the TDM interface. Voice switching systems shall receive the proper CGAs from the NE upon loss of the transport link between NEs, regardless of whether it is TDM or IP. The SUT is capable of transparently passing the alarm and restoral features of the DSN switch's digital interface unit, which met the requirement.

(l) Call Congestion. The UCR, appendix 9, paragraph A9.5.1.1.2, states that the NE shall assure that congestion between NEs does not impact DSN calls in progress or subsequent calls. Call congestion handling shall be met in one or more of the following three ways: dynamic load control signal; software capability which makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible, which meets the requirement.

(m) Voice Compression. UCR appendix 9, paragraph A9.5.1.1.4, states that the NE may include voice compression and if so must support at least one of the following standards:

- International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) Recommendation G.726, 32 kbps Adaptive Differential Pulse Code Modulation (ADPCM)
- ITU-T Recommendation G.728, 16 kbps Low-Delay Code Excited Linear Prediction (LD-CELP)
- ITU-T Recommendation G.729, 9.6 kbps Conjugate-Structure Algebraic-Code-Excited Linear-Prediction (CS-A CELP)

Voice compression is not a feature provided by the SUT. This requirement is conditional and has no operational impact on network interoperability.

(n) Internet Protocol (IP) interface. The UCR, appendix 9, paragraph A9.5.1.2.9, states that S-NEs using IP shall meet all of the following requirements in the subparagraphs below. All IP interface characteristics were verified through both vendor LoC and testing.

1. Delay. Delay occurs when packets take more time than expected to reach their destination. The UCR, appendix 9, paragraph A9.5.1.2.9, states that the addition of S-NEs shall not increase the one-way packet delay for each S-NE used, when measured from ingress to egress and averaged over any five-minute period more than that which is specified under the following conditions:

a. TDM Ingress to Non-Transcoding Packet Egress shall not increase delay by more than a maximum total delay of 50 ms as measured from end-to-end as a pair.

b. TDM Ingress to Transcoding Packet Egress shall not increase delay by more than a maximum total delay of 100 ms as measured from end-to-end as a pair.

VoIP pairs were generated through the SUT using the Ixia. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 0.6 ms, with a maximum delay of 1.3 ms, which met the requirement.

2. Jitter. Jitter occurs when packets are sent and received with timing variations. The UCR, appendix 9, paragraph A9.5.1.2.9, states the addition of S-NE shall not cause jitter measured from ingress to egress to increase by more than five ms averaged over any five-minute period. The Ixia test set was used to generate traffic and measure jitter. With a full bandwidth load, jitter was measured to be 1.0 ms or less over any five-minute period, which met the requirement.

3. Packet Loss. Packet loss occurs when packets are sent, but not received at the final destination. The UCR, appendix 9, paragraph A9.5.1.2.9, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any five-minute period.

The Ixia test set was used to generate traffic and measure delay. With bandwidth load, the measured packet loss was 0.00 percent over a five-minute period, which met the requirement.

(2) DSN Transport Interfaces. The SUT supports SONET standard optical carrier link levels of OC-3, OC-12, OC-48, OC-192, and DWDM. The SONET interfaces were tested in accordance with the UCR, appendix 5. The optical carrier links were tested in a direct-connect configuration and a fully redundant ring configuration. The SUT's SONET interfaces supported switching at the VT1.5 and STS-1 transport levels. The specific requirements and results of the DSN Transport Interface testing are described in the paragraphs below. The respective optical carrier links were tested and certified for the architectures depicted in Table 2-4.

Table 2-4. SUT Certified SONET Architectures

Optical Carrier Link Level	Certified Architecture
OC-192	UPSR, BLSR, LAPS (1+1)
OC-48	UPSR, BLSR, LAPS (1+1)
OC-12	UPSR, LAPS (1+1)
OC-3	UPSR, LAPS (1+1)
LEGEND:	
BLSR	Bidirectional Line Switched Ring
LAPS	Linear Automatic Protection Switching
OC-3	Optical Carrier Level 3
OC-12	Optical Carrier Level 12
OC-48	Optical Carrier Level 48
OC-192	Optical Carrier Level 192
SONET	Synchronous Optical Network
SUT	System Under Test
UPSR	Unidirectional Path Switch Ring

(a) Military Unique Features. The SUT supports the full complement of Military Unique Features including CAS and CCS trunks as required in the UCR, appendix 5. The following types of MLPP calls were placed over all the SUT transport and access interfaces between the switching systems listed in Table 2-3. All calls were completed successfully and met the following MLPP interactions as required by the UCR, appendix 5.

1. Circuit for Reuse; Answered Call
2. Circuit for Reuse; Unanswered Call
3. Circuit not for Reuse; Answered Call
4. Circuit not for Reuse; Unanswered Call
5. Resources not Available (Intra- and inter-switch)
6. Circuit for Reuse; Answered Call (simultaneous preemption of line and trunk)
7. Circuit for Reuse; Unanswered Call (simultaneous preemption of line and trunk)

(b) Generic Requirement (GR)-303 CORE. The UCR, appendix 5, paragraph A5.5.2, states the SONET interface shall be in compliance to GR-303-CORE for an OC-3 interface between an Integrated Digital Loop Carrier (IDLC) system's remote digital terminal and the line side of a local digital switch. This requirement was verified via the vendor's LoC. The SUT was compliant with GR-303 CORE, which meets the requirement.

(c) GR-253 CORE. The UCR, appendix 5, paragraph A5.5.2, states the SONET interface shall meet the requirements of GR-253-CORE. This requirement was verified via the vendor's LoC. The SUT was compliant with GR-253 CORE, which meets the requirement.

(d) GR-782 CORE. The UCR, appendix 5, paragraph A5.5.2, states the SONET interface shall meet the requirements of GR-782-CORE. This requirement was verified via the vendor's LoC. The SUT was compliant with GR-782 CORE, which meets the requirement.

(e) American National Standards Institute (ANSI) T1.105-2001. The UCR, appendix 5, paragraph A5.5.2, states the SONET digital trunk interface shall, as a minimum, comply to ANSI T1.105-2001, "Synchronous Optical Network (SONET) - Basic Description including Multiplex Structure, Rates, and Formats ". This requirement was verified via testing and the vendor's LoC. The SUT was compliant with ANSI T1.105-2001, which meets the requirement.

(f) DS1 Rate Transport via VT1.5. The UCR, appendix 5, paragraph A5.5.2, states all features and functions that are defined in the UCR 2007 to operate at a DS1 rate shall work transparently at the VT1.5 rate over the SONET interface. This requirement was verified via testing and the vendor's LoC. All features and functions that are defined to operate at the DS1 rate worked transparently at the VT1.5 rate over the SUT's SONET interfaces, which meets the requirement.

(g) DS1 Rate Provisioning. The UCR, appendix 5, paragraph A5.5.2, states the SONET digital interface shall support provisioning of transport levels as low as the DS1 rate for separately grouping of various categories of traffic such as voice, data, satellite, and terrestrial transmission. This requirement was verified via testing and the vendor's LoC. The SUT supports the provisioning of transport levels as low as the DS1 rate, which meets the requirement.

(h) DS0 to OC-3 Route Assignment. The UCR, appendix 5, paragraph A5.5.3, states the SONET digital trunk interface shall support "ROUTE" assignment of trunk group(s) at the OC-3 (highest) and down to DS0 (lowest) rates as defined in UCR Section 4.2 and shall support the signaling requirements as defined in UCR Table 1-3. This requirement was verified via testing and the vendor's LoC. The SUT supported transparently passed all trunk group(s) mapped through the test network, which meets the requirement.

(i) Facility Alarms. The UCR, appendix 5, paragraph A5.5.4, states the SONET digital trunk interface shall provide maintenance signals that include the following failure states as defined in GR-253-CORE for loss of signal, loss of frame, loss of pointer, and equipment failures: Line Alarm Indication Signal (AIS), Line Remote Defect Indication (RDI-L), STS Path AIS, STS path Yellow, VT Path AIS, and VT path

Yellow. This requirement was verified via testing and the vendor's LoC. The SUT supported all facility alarms, which meets the requirement.

(j) DS1 Alarm Indication Signal (AIS: Blue Alarm) and DS1 Remote Alarm Indication (RAI:Yellow Alarm). The UCR, appendix 5, paragraph A5.5.4, states the SONET digital trunk interface shall conform to Section 7.2 of GR-782-CORE for AIS and Yellow signal processing to include signal processing for rates as low as DS1. This requirement was verified via testing and the vendor's LoC. The SUT transparently transported all DS1 Alarm Indication Signals and Yellow alarms, which meets the requirement.

(k) DS0 AIS/DS0 RAI/Yellow). The UCR, appendix 5, paragraph A5.5.4, states the SONET digital trunk interface shall process DS0 AIS and transmit DS0 RAI (Yellow) in accordance with GR-253-CORE. This requirement was verified via testing and the vendor's LoC. The SUT transparently passed all DS0 level alarms, which meets the requirement.

(l) Synchronization. The UCR, appendix 5, paragraph A5.5.5, states the SONET digital trunk interface shall meet the common synchronization requirements specified in GR-253-CORE and GR-518-CORE, "*LSSGR: Synchronization Section 18,*" Issue 1, May 1994, and GR-436-CORE, "*Digital Network Synchronization Plan,*" Issue 1, June 1994, Revision 1, June 1996. This requirement was verified via testing and the vendor's LoC. The SUT was compliant with Synchronization GR- 253 CORE, GR-436 CORE, and GR-518 CORE, which meets the requirement.

(m) Reliability. The UCR, appendix 5, paragraph A5.5.6, states the SONET digital trunk interface shall meet the requirements contained in GR-874-CORE, "*An Introduction to the Reliability and Quality Generic Requirements (RQGR),*" Issue 3, April 1997 and the requirements for switching systems specified in TR-NWT-000284, "*Reliability and Quality Switching Systems Generic Requirements (RQSSGR),*" Issue 2, October 1990. Additionally, the SONET digital trunk interface shall conform to the reliability objectives for switching systems, including integrated digital terminations, as specified in GR-512-CORE, "*LSSGR: Reliability, Section 12,*" Issue 2, January 1998. This requirement was verified via the vendor's LoC. The SUT was compliant with the reliability requirement, which meets the requirement.

(n) Security. The UCR, appendix 5, paragraph A5.6, states the SONET digital trunk interface shall not affect the switch meeting the requirements contained in Telcordia Technologies GR-815-CORE, "Generic Requirements for Network Element/Network System (NE/NS) Security", Issue 2, March 2002, and conform to the requirements outlined in DoDI 8510.bb, "DoD Information Assurance Certification and Accreditation Process (DIACAP)," and the applicable DSN Security Technical Implementation Guides (STIGs). Security is tested as part of the Information Assurance testing and is covered under a separate report, reference (e).

(o) MOS. The UCR, appendix 9, paragraph A9.5.1.1, states the introduction of NE(s) shall not cause the end-to-end average MOS to fall below 4.0 as measured over any five-minute time interval. This requirement was verified via testing and the vendor's LoC. The Ixia IxChariot was used to generate simulated voice traffic across the access interfaces. There were 1600 calls across the access interfaces, with all calls placed via the SUT having a MOS of at least 4.0. The IXIA data loader was also used to generate voice traffic over the 100 Mbps Ethernet interface mapped through the SONET test network. The IXIA voice traffic had a minimum MOS of 4.34 with an average MOS of 4.35, which met the requirement.

(p) BERT. The UCR, appendix 9, paragraph A9.5.1.1, states the introduction of an NE shall exceed the end-to-end digital bit error rate requirement of less than 1 error in 1×10^9 (averaged over a nine-hour period). This requirement was verified via testing and the vendor's LoC. BERTs were conducted across DS1 and DS3 interfaces. The SUT met this requirement for all interfaces with a recorded bit error ratio of 1×10^{-12} for all DSN access interfaces.

(q) Secure Transmission (Voice and Data). The UCR, appendix 9, paragraph A9.5.1.1, states the introduction of NE(s) shall not degrade secure transmission for secure end devices as defined by UCR. This requirement was verified via testing and the vendor's LoC. There were 126 secure calls placed between STEs and SWTs without degrading transmissions between end devices, which meets the requirement.

(r) Modem. The UCR, appendix 9, paragraph A9.5.1.1, states the NE(s) shall support a minimum modem transmission speed of 9.6 kbps across the associated NE(s). This requirement was verified via testing and the vendor's LoC. There were 50,216 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 26.4 kbps, which meets the requirement.

(s) Facsimile. The UCR, appendix 9, paragraph A9.5.1.1, states the NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s). This requirement was verified via testing and the vendor's LoC. There were 8,466 facsimile calls placed through the SUT using the Abacus call loader. All facsimile calls had a transmission rate of 14.4 kbps, which meets the requirement.

(t) Call Control Signals. The UCR, appendix 9, paragraph A9.5.1.1, states the NE shall transport all call control signals transparently on an end-to-end basis. This requirement was verified via testing and the vendor's LoC. The SUT transparently transported all MLPP call control signals, which meets the requirement.

(u) Call Congestion. The UCR, appendix 9, paragraph A9.5.1.1.2, states that the NE shall assure that congestion between NEs does not impact DSN calls in progress or subsequent calls. Call congestion handling shall be met in one or more of the following three ways: dynamic load control signal; software capability which

makes congestion impossible; or congestion is not possible in the SUT. Call congestion in the SUT is not possible, which meets the requirement.

(v) Voice Compression. UCR appendix 9, paragraph A9.5.1.1.4, states that the NE may include voice compression and if so must support at least one of the following standards:

- ITU-T Recommendation G.726, 32 kbps ADPCM
- ITU-T Recommendation G.728, 16 kbps LD-CELP
- ITU-T Recommendation G.729, 9.6 kbps CS-A CELP

Voice compression is not a feature provided by the SUT. This requirement is conditional and has no operational impact on network interoperability.

(w) Delay. Delay occurs when packets take more time than expected to reach their destination. The UCR, appendix 9, paragraph A9.5.1.1, states that the addition of S-NEs shall not cause the one-way delay measured from ingress to egress to increase by more than 5 ms for each S-NE used, averaged over any five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 0.6 ms, with a maximum delay of 1.3 ms, which met the requirement.

(x) Jitter. Jitter occurs when packets are sent and received with timing variations. The UCR, appendix 9, paragraph A9.5.1.2.9, states the addition of S-NE shall not cause jitter measured from ingress to egress to increase by more than five ms averaged over any five-minute period. The Ixia test set was used to generate traffic and measure jitter. With a full bandwidth load, jitter was measured to be 1.0 ms or less over any five-minute period, which met the requirement.

(y) Packet Loss. Packet loss occurs when packets are sent, but not received at the final destination. The UCR, appendix 9, paragraph A9.5.1.2.9, states that the addition of an S-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any five-minute period. The Ixia test set was used to generate traffic and measure delay. With bandwidth load, the measured packet loss was 0.00 percent over a five-minute period, which met the requirement.

(3) Synchronization. Synchronization is a network level application that ensures all nodes across a network can trace back to the same clock source. The SUT provides system synchronization using 1+1 redundant synchronization hardware on the cross-connect circuit pack for both timing generation and timing distribution. The SUT supports an external synchronization mode parameter, which allows the signal format of the External Synchronization Input/External Synchronization Output (ESI/ESO) ports and Synchronization Status Messages (SSM) support to be provisioned independently from the NE mode. The external synchronization mode allows for global gateway applications, where an NE in one NE mode can be timed with signals from a different

external synchronization mode (for example, an SDH NE timed with DS1 signals). The external synchronization mode sets the signal format of the ESI and ESO ports as follows:

- SONET: DS1
- SDH: E1 or 2 Megahertz (MHz)
- SDH-J: 64 kilohertz (kHz) CC (ESI) and 6 MHz (ESO)

The UCR, para 11.1, states the SUT must meet synchronization with one of the following three methods: external timing, line timing, or an internal clock. The SUT meets requirement with internal timing. This was verified by testing and vendor's submission of an LoC. The SUT has the ability to extract and use the synchronization reference from any of the defined synchronization inputs. The SUT generates shelf timing signals based on external, line, or internal (free run or holdover) references. The SUT supports a timing generation hierarchy of up to four timing references. The SUT is capable of generating a redundant Stratum 3 (+/-4.6 parts per million) quality clock internally (internal timing mode). This clock is the default synchronization reference. The SUT also supports synchronizing to a reference clock signal derived from the following sources (provisioned by the user as defined by the network synchronization plan):

- external timing
- line timing
- mixed timing

(4) Device Management

(a) Management Option. The UCR, appendix 9, paragraph A9.5.2.1, states NE devices must be managed by at least one of the following: The device may be managed locally by a front or back panel and/or external console control capability shall be provided for local management. NE devices in the DSN may be monitored and managed by the Advanced DSN Integrated Management Support System (ADMISS) as described in the UCR, section 9. The NE may be able to be centrally monitored and managed in accordance with UCR, sections 9.3 and 9.4. The SUT is managed via the CTC application. CTC is a Java application that is stored on the Timing, Communications, and Control version 2 (TCC2) or the Timing, Communications, and Control version 2 Plus (TCC2P) card. After logging into the ONS 15454 for the first time, the CTC application is downloaded to the workstation. The workstation tested was running the Windows XP operating system and connected to the gateway node via a Category 5 network cable. The workstation with the CTC application served as a management console, and it managed all nodes in the test network via in-band management.

(b) Fault Management. The UCR, appendix 9, paragraph A9.5.2.2, states that NEs may be capable of performing a self-test diagnostic function on non-active and active channels on a noninterference basis and report any failures to the assigned

network management system. The SUT does not support fault management as defined in the UCR, appendix 9. This requirement is conditional and has no major operational impact on network interoperability.

(c) Loop Back Capability. The UCR, appendix 9, paragraph A9.5.2.3, states that NE shall provide loop back capability on each of the trunk side interfaces in accordance with ITU-T Recommendation V.54, "Loop Test Devices For Modems." The SUT does not support ITU-T Recommendation V.54. This requirement is conditional and has no major operational impact on network interoperability.

(d) Operational Configuration Restoral. The UCR, appendix 9, paragraph A9.5.2.4, states that loss of power should not remove configuration settings. The unit should be restored to the last customer configured state prior to the power loss, without intervention when power is restored. The SUT was placed into a power failure condition. The SUT returned to the last customer configured state prior to the power failure, which meets the requirement.

(5) Security. The UCR, appendix 9, paragraph A9.6, states that the network element shall conform to the requirements outlined in Department of Defense Instruction (DoDI) 8510.bb, "DoD Information Assurance Certification and Accreditation Process (DIACAP)," and the applicable DSN STIGs. Security is tested as part of the Information Assurance testing and is covered under a separate report, reference (e).

b. Summary. The SUT is certified for joint use within the DSN as a S-NE in accordance with the requirements set forth in reference (c). The SUT can be deployed within the DSN as an extension to any ASLAN that is on the UC APL. When connected to the interfaces certified in this letter, the SUT and its associated applications were transparent to the switching systems interfaced causing no degradation of service or negative impact, and met all the critical interoperability requirements.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.