



DEFENSE INFORMATION SYSTEMS AGENCY

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ARLINGTON, VIRGINIA 22204-4502

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

23 March 2009

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Nortel Optical Multiservice Edge (OME) 6500 with Software Release 5.12

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(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 Nortel OME 6500 with Software Release 5.12 is hereinafter referred to as the System Under Test (SUT). 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). Although the SUT offers European Basic Multiplex Rate (E1) access interfaces, these interfaces were not tested by JITC and are not authorized for use within the DSN by the DSN Program Management Office (PMO). The SUT offers a 10/100 Megabits per second Ethernet Interface; however, this interface was not tested and is not authorized for use within the DSN by the DSN PMO. The SUT one and ten Gigabits per second Ethernet interfaces were tested and certified for voice only. The SUT can be deployed within the DSN as an extension to any Assured Services Local Area Network that is on the Unified Capabilities (UC) Approved Products List (APL). No other configurations, features, or functions, except those cited within this report, are certified by the JITC, or authorized by the PMO for use within the DSN. This certification expires upon changes that affect interoperability, but no later than four years from the date of this memorandum.

3. This certification is based on interoperability testing of the SUT, review of the vendor's Letters of Compliance (LoC), and Defense Information System Network (DISN) Security Accreditation Working Group (DSAWG) accreditation. Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona from 13 October through 24 October 2008. Review of vendor's LoC was completed on 18 November 2008. 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 10 March 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 | | | | |
|--|---------------------------------|----------------------------------|---------------|--|
| DSN Switch Access | | Critical | Status | Remarks |
| T1 CAS (AMI/SF) DTMF, MFR1, DP | | No ¹ | Certified | Met all CRs and FRs. |
| T1 CAS (B8ZS/ESF) DTMF, MFR1, DP | | 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| DS3 | | No ¹ | Certified | Met all CRs and FRs. |
| DS3C | | No ¹ | Certified | Met all CRs and FRs. |
| Gigabit Ethernet | | No ¹ | Certified | Met all CRs and FRs. ² |
| 10 Gigabit Ethernet | | No ¹ | Certified | Met all CRs and FRs. ² |
| DSN Transport Interfaces | | | | |
| Optical Carrier Level | Transport Level | Critical | Status | Remarks |
| OC-3 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-12 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-48 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-192 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| DWDM | 2.5, 10 and 40 Gigabit Channels | No ³ | 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 4. |
| NOTES: | | | | |
| 1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element. | | | | |
| 2 The SUT 1 and 10 Gbps Ethernet interfaces were tested and certified for voice only as an extension to an ASLAN on the UC APL. | | | | |
| 3 The UCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element. | | | | |
| 4 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 | ITU-T | International Telecommunication Union – Telecommunication Standardization |
| ANSI | American National Standards Institute | Mbps | Megabits per second |
| APL | Approved Products List | MFR1 | Multi-frequency Recommendation 1 |
| ASLAN | Assured Services Local Area Network | MLPP | Multi-Level Precedence and Preemption |
| B8ZS | Bipolar Eight Zero Substitution | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| CAS | Channel Associated Signaling | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| CR | Capability Requirements | OC-48 | Optical Carrier Level 48 (2.448 Gbps) |
| DISA | Defense Information Systems Agency | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DP | Dial Pulse | PRI | Primary Rate Interface |
| DS3 | Digital Signal Level 3 (44.736 Mbps) | Q.955.3 | ISDN Signaling Standard for E1 MLPP |
| DS3C | Digital Signal Level 3 Concatenated (89.472 Mbps) | SF | Super Frame |
| DSN | Defense Switched Network | SS7 | Signaling System 7 |
| DTMF | Dual Tone Multi-Frequency | SUT | System Under Test |
| DWDM | Dense Wavelength Division Multiplexing | STS | Synchronous Transport Signal |
| E1 | European Basic Multiplex Rate (2.048 Mbps) | T1 | Digital Transmission Link Level 1 (1.544 Mbps) |
| ESF | Extended Super Frame | T1.619a | SS7 and ISDN MLPP Signaling Standard for T1 |
| FR | Feature Requirements | UC | Unified Capabilities |
| Gbps | Gigabits per second | UCR | Unified Capabilities Requirements |
| HDB3 | High Density Bipolar 3 | VT | Virtual Tributary |
| ISDN | Integrated Services Digital Network | | |

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) | <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, DS3C | 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. A9.5.1.1.2 |
| Gigabit 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 |
| 10 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 |

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) | <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 |
| OC-192 | No ² | <ul style="list-style-type: none"> • MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) | <ul style="list-style-type: none"> • UCR para. A9.5.1.1 |
| DWDM | No ² | <ul style="list-style-type: none"> • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • Voice Compression (C) | <ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1.3 • 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 | ISDN | Integrated Services Digital Network |
| ADIMSS | Advanced DSN Integrated Management Support System | ITU-T | International Telecommunication Union - Telecommunication Standardization Sector |
| AIS | Alarm Indication Signal | LSSGR | Local Access and Transport Area (LATA) Switching Systems Generic Requirements |
| ANSI | American National Standards Institute | Mbps | Megabits per second |
| BERT | Bit Error Rate Test | MLPP | Multi-Level Precedence and Preemption |
| C | Conditional | MOS | Mean Opinion Score |
| CAS | Channel Associated Signaling | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| DIACAP | DoD Information Assurance Certification and Accreditation Process | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| DS0 | Digital Signal Level 0 | OC-48 | Optical Carrier Level 48 (2.448 Gbps) |
| DS1 | Digital Signal Level 1 | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DS3 | Digital Signal Level 3 (44.736 Mbps) | para. | paragraph |
| DS3C | Digital Signal Level 3 Concatenated (89.472 Mbps) | 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 | VT | Virtual Tributary |
| | | UCR | Unified Capabilities Requirements |

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 Capt Oskar Widecki, DSN 879-5269, commercial (520) 538-5269, FAX DSN 879-4347, or e-mail oskar.widecki@disa.mil. The JITC’s mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 0812001.

FOR THE COMMANDER:

2 Enclosures a/s


 for RICHARD A. MEADOR
 Chief
 Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Nortel Optical Multiservice Edge (OME) 6500 with Software Release 5.12

Distribution (electronic mail):

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DOT&E, Net-Centric Systems and Naval Warfare

U.S. Coast Guard, CG-64

Defense Intelligence Agency

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 Networks Unified Capabilities Requirements," 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 Nortel Optical Multiservice Edge (OME) 6500 Release 5.12 Information Assurance (Tracking Number 0812001)," 10 March 2009

CERTIFICATION TESTING SUMMARY

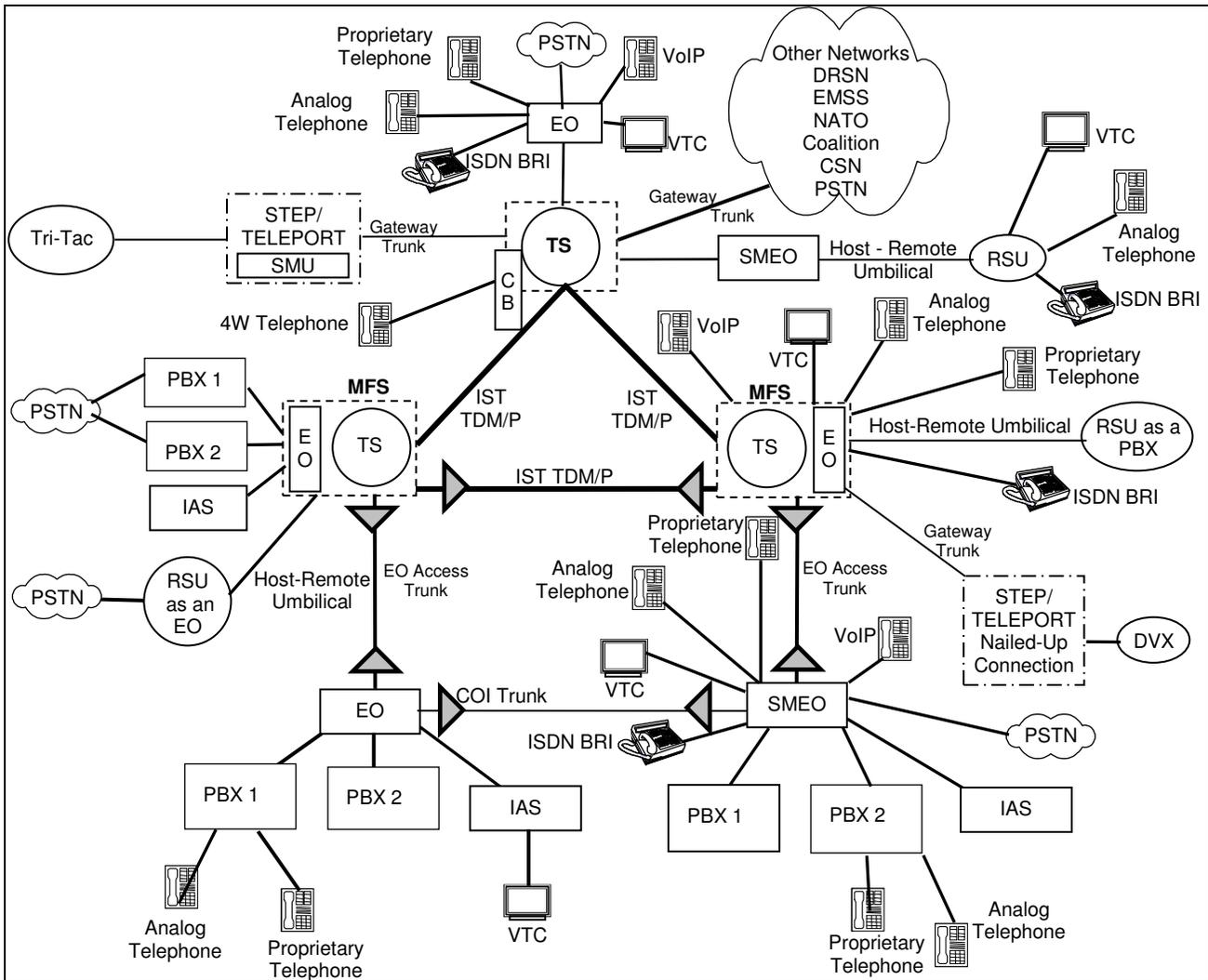
- 1. SYSTEM TITLE.** Nortel Optical Multiservice Edge (OME) 6500 with Software Release 5.12, hereinafter referred to as the System Under Test (SUT).
- 2. PROPONENTS.** Air Mobility Command (AMC).
- 3. PROGRAM MANAGER.** Ms. Mary Stovey, AMC, A6NI, 203 W Loset St., Scott Air Force Base, Illinois, 62225, e-mail: mary.stovey@scott.af.mil.
- 4. TESTER.** Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.
- 5. SYSTEM UNDER TEST DESCRIPTION.** The SUT combines and extends Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH) and metropolitan Dense Wavelength Division Multiplexing (DWDM) platforms for converged time division multiplexing (TDM), data, wavelength, and transparent services transport over a single consolidated multi-service optical platform. The optical networking platforms are capable of efficiently aggregating, switching, and managing a mix of global services ranging from the lower speed Digital Signal Level 1 (DS1), European Basic Multiplex Rate (E1), and Digital Signal Level 3 (DS3) electrical interfaces and the higher speed Optical Carrier Level 3 (OC-3), Optical Carrier Level 12 (OC-12), Optical Carrier Level 48 (OC-48), Optical Carrier Level 192 (OC-192) interfaces, 1 Gbps Ethernet, 10 Gbps Ethernet and 40 Gbps DWDM channels. Optical Carrier Level 48 (OC-48), and Optical Carrier Level 192 (OC-192) interfaces. The SUT is a global platform that can be deployed in both SONET and SDH environments. The SONET and SDH protocols are supported on the same circuit pack and can be provisioned by the user. The SUT also supports a 10 Gigabits per second (Gbps) Resilient Packet Ring (RPR), which is a ring based technology that enables bandwidth sharing across multiple 1 Gbps Ethernet ports. The SUT provides common transport for TDM and data interfaces to support voice transport.

The SUT provides Voice and VoIP transport over DWDM interfaces at 2.5Gbps, 10Gbps and 40Gbps. The OME 6500 is capable of supporting SONET, SDH, Data and Wavelength DWDM services from a single shelf. The SUT uses optical amplifiers and ROADMs to support a total of 44 DWDM channels; with each DWDM channel capable of 2.5Gbps, 10Gbps and 40Gbps transport.

Deployed in a ring transport topology, the SUT has a main shelf that has an Internet Protocol (IP) connection supporting Secure Shell (SSH). This IP connection will allow a base to have each user first authenticate with a Remote Authentication Dial In User Service (RADIUS) server. After successful authentication, the user can then access the SUT network and perform assigned duties. Remote locations are visible from the secure SSH IP connection of the main shelf. At remote shelves, all access ports are turned off denying anyone access to the network. Each OME 6500 remote shelf will be contained in a protected enclave preventing unauthorized access to the site. This, in turn, prevents unauthorized personnel from attempting to access remote shelves. The

Preside Site Manager version 5.11 with Consolidated Craft Base 1.6 is the client Graphical User Interface used to monitor and control the SUT. All management and real-time visibility functions are available via this client. The client includes a visual representation of all SUT system hardware and each monitored circuit.

6. OPERATIONAL ARCHITECTURE. The Unified Capabilities 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 | Interswitch Trunk | VoIP | Voice over Internet Protocol |
| MFS | Multifunction Switch | VTC | Video Teleconferencing |
| NATO | North Atlantic Treaty Organization |  | 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 | | | | |
|--|---------------------------------|----------------------------------|---------------|--|
| DSN Switch Access | | Critical | Status | Remarks |
| T1 CAS (AMI/SF) DTMF, MFR1, DP | | No ¹ | Certified | Met all CRs and FRs. |
| T1 CAS (B8ZS/ESF) DTMF, MFR1, DP | | 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| 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, or authorized for use by the DSN PMO for use within the DSN. This is not a required interface for a Strategic Network Element. |
| DS3 | | No ¹ | Certified | Met all CRs and FRs. |
| DS3C | | No ¹ | Certified | Met all CRs and FRs. |
| Gigabit Ethernet | | No ¹ | Certified | Met all CRs and FRs. ² |
| 10 Gigabit Ethernet | | No ¹ | Certified | Met all CRs and FRs. ² |
| DSN Transport Interfaces | | | | |
| Optical Carrier Level | Transport Level | Critical | Status | Remarks |
| OC-3 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-12 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-48 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| OC-192 | VT 1.5 | No ³ | Certified | Met all CRs and FRs. |
| | STS-1 | No ³ | Certified | Met all CRs and FRs. |
| DWDM | 2.5, 10 and 40 Gigabit Channels | No ³ | 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 4. |
| NOTES: | | | | |
| 1 The UCR does not stipulate a minimum Access interface requirement for a Strategic Network Element. | | | | |
| 2 The SUT 1 and 10 Gbps Ethernet interfaces were tested and certified for voice only as an extension to an ASLAN on the UC APL. | | | | |
| 3 The UCR does not stipulate a minimum Transport interface requirement for a Strategic Network Element. | | | | |
| 4 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)

| LEGEND: | | | |
|----------------|--|---------|---|
| AMI | Alternate Mark Inversion | ITU-T | International Telecommunication Union – Telecommunication Standardization |
| ANSI | American National Standards Institute | Mbps | Megabits per second |
| APL | Approved Products List | MFR1 | Multi-frequency Recommendation 1 |
| ASLAN | Assured Services Local Area Network | MLPP | Multi-Level Precedence and Preemption |
| B8ZS | Bipolar Eight Zero Substitution | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| CAS | Channel Associated Signaling | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| CR | Capability Requirements | OC-48 | Optical Carrier Level 48 (2.448 Gbps) |
| DISA | Defense Information Systems Agency | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DP | Dial Pulse | PRI | Primary Rate Interface |
| DS3 | Digital Signal Level 3 (44.736 Mbps) | Q.955.3 | ISDN Signaling Standard for E1 MLPP |
| DS3C | Digital Signal Level 3 (89.472 Mbps) | SF | Super Frame |
| DSN | Defense Switched Network | SS7 | Signaling System 7 |
| DTMF | Dual Tone Multi-Frequency | SUT | System Under Test |
| DWDM | Dense Wavelength Division Multiplexing | STS | Synchronous Transport Signal |
| E1 | European Basic Multiplex Rate (2.048 Mbps) | T1 | Digital Transmission Link Level 1 (1.544 Mbps) |
| ESF | Extended Super Frame | T1.619a | SS7 and ISDN MLPP Signaling Standard for T1 |
| FR | Feature Requirements | UC | Unified Capabilities |
| Gbps | Gigabits per second | UCR | Unified Capabilities Requirements |
| HDB3 | High Density Bipolar 3 | VT | Virtual Tributary |
| ISDN | Integrated Services Digital Network | | |

Table 2-2. 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) | <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, DS3C | 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 |
| Gigabit 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 |
| 10 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 |

Table 2-2. 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) | <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 |
| OC-192 | No ² | <ul style="list-style-type: none"> • MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R) • Modem (R) • Facsimile (R) | <ul style="list-style-type: none"> • UCR para. A9.5.1.1 |
| DWDM | No ² | <ul style="list-style-type: none"> • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • Voice Compression (C) | <ul style="list-style-type: none"> • UCR para. A9.5.1.1 • UCR para. A9.5.1.1.3 • 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 2-2. SUT Capability and Feature Interoperability Requirements (continued)

| LEGEND: | | | |
|----------------|--|-------------|---|
| A | Appendix | ISDN | Integrated Services Digital Network |
| ADIMSS | Advanced DSN Integrated Management Support System | ITU-T | International Telecommunication Union - Telecommunication Standardization Sector |
| AIS | Alarm Indication Signal | LSSGR | Local Access and Transport Area (LATA) Switching Systems Generic Requirements |
| ANSI | American National Standards Institute | Mbps | Megabits per second |
| BERT | Bit Error Rate Test | MLPP | Multi-Level Precedence and Preemption |
| C | Conditional | MOS | Mean Opinion Score |
| CAS | Channel Associated Signaling | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| DIACAP | DoD Information Assurance Certification and Accreditation Process | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| DS0 | Digital Signal Level 0 | OC-48 | Optical Carrier Level 48 (2.448 Gbps) |
| DS1 | Digital Signal Level 1 | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DS3 | Digital Signal Level 3 (44.736 Mbps) | para. | paragraph |
| DS3C | Digital Signal Level 3 Concatenated (89.472 Mbps) | 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 | VT | Virtual Tributary |
| | | UCR | Unified Capabilities Requirements |

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.

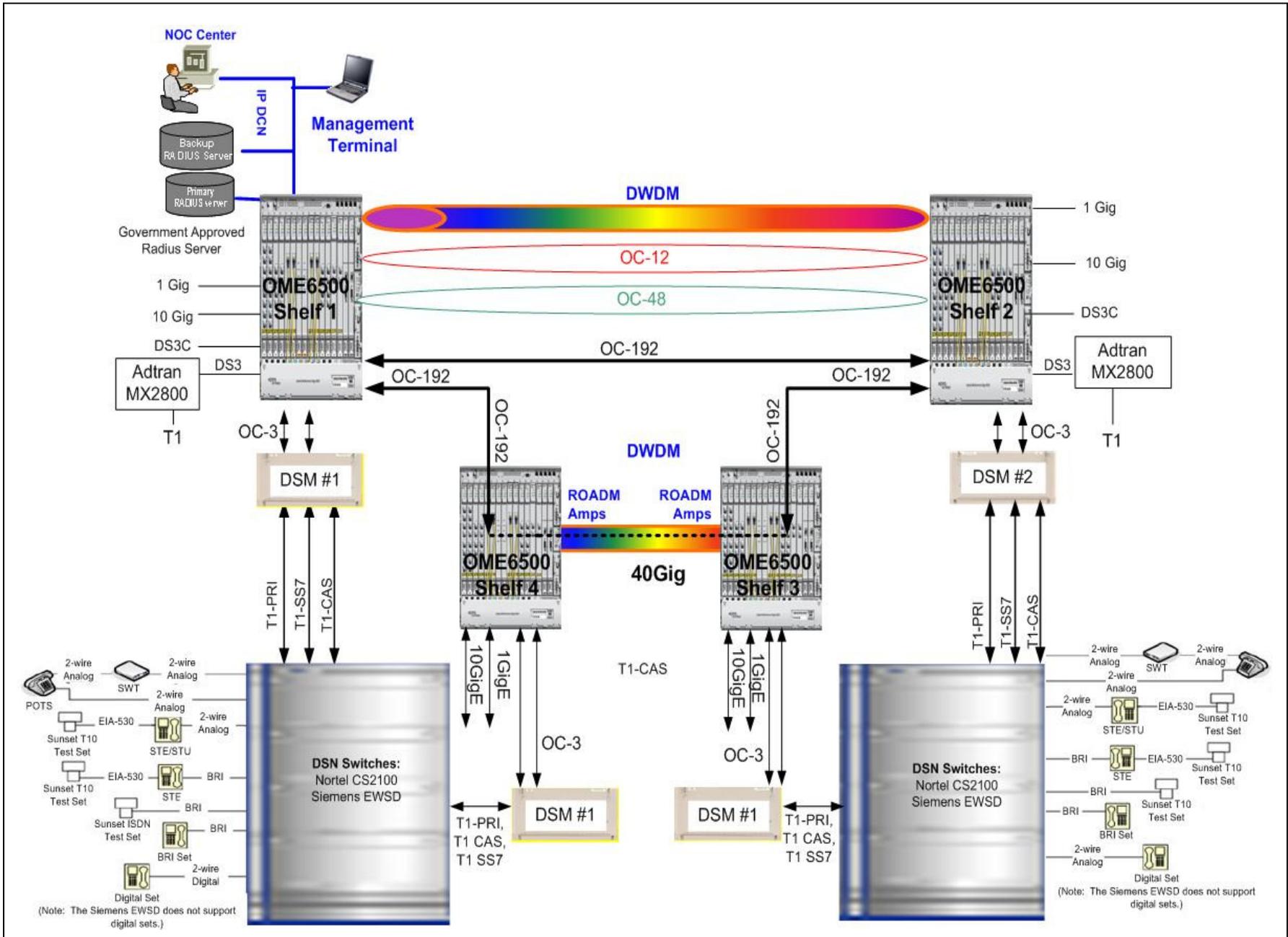


Figure 2-2. SUT Test Configuration

LEGEND:

| | | | |
|---------|--|--------|---|
| AMPS | Amplifiers | IP | Internet Protocol |
| BRI | Basic Rate Interface | Mbps | Megabits per second |
| CAS | Channel Associated Signaling | MX | Multiplexer |
| CS | Communication Server | NOC | Network Operations Center |
| DCN | Data Communications Network | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| DS1 | Digital Signal Level 1 | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| DS3 | Digital Signal Level 3 (44.736 Mbps) | OC-48 | Optical Carrier Level 48 (2.448 Gbps) |
| DS3C | Digital Signal Level 3 Concatenated (89.472 Mbps) | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DSM | DS1 Service Module | OME | Optical Multiservice Edge |
| DSN | Defense Switched Network | PRI | Primary Rate Interface |
| DWDM | Dense Wavelength Division Multiplexing | RADIUS | Remote Authentication Dial In User Service |
| EIA | Electronic Industries Alliance | ROADM | Reconfigurable optical add drop multiplexer |
| EIA-530 | Standard for 25-position interface for data terminal equipment and data circuit-terminating equipment employing serial binary data interchange | SS7 | Signaling System 7 |
| EWSD | Elektronisches Wählsystem Digital | STE | Secure Terminal Equipment |
| Gbps | Gigabits per second | STU | Secure Telephone Unit |
| Gig | Gigabyte | SUT | System Under Test |
| | | SWT | Secure Wireline Terminal |

Figure 2-2. SUT Test Configuration (continued)

9. SYSTEM CONFIGURATIONS. Table 2-3 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 2-3. Table 2-3 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 (CCA) | | Succession Enterprise (SE)09.1 | | |
| Siemens EWSD | | 19d with Patch Set 46 | | |
| Adtran MX2800 | | Code Version 3.20A | | |
| Hardware | | Card Name | Part Number | Version |
| SUT | OME 6500 (Shelf 1) | 19in. Optical/Rear Electrical Shelf Assembly | NTK503CA | 2 |
| | | Access Panel (SONET/J-SDH) | NTK505MA | 1 |
| | | Rear Cooling Fan Module | NTK507MB | 3 |
| | | Rear Venting Cooling Shelf | NTK507GB | 3 |
| | | Rear Cooling Fan Module | NTK507MB | 3 |
| | | 40A Power Input Card breakered_2wire | NTK505CE | 2 |
| | | Maintenance Interface Card | NTK505FA | 1 |
| | | 48xDS3 / E3 / EC-1 (1:N) Rear I/O Panel | NTK572QA | 3 |
| | | 24x DS3/EC-1 Working | NTK543NA | 2 |
| | | 4xGbE/GFP/p-p Optical | NTK535LA | 4 |
| | | GE SX/FC100 Mx 850nm LC SFP | NTTP01AF | 1 |
| | | 8x OC-3/12/STM-1/4 VT1.5/LO SFP | NTK513DA | 6 |
| | | OC-3/12/STM-1/4 SR-1/I-1 I-4 1310nm SFP | NTTP04BF | 1 |
| | | 1xOC-192/STM-64 VT1.5/LO DWDM C band AM1/AM2 | NTK527JA | 1 |
| | | X-CONN 80G (20G VT1.5/VC-12) SYNC-ST3 | NTK557PA | 4 |
| | | NGM WT 1x10GE LAN 1x11.1G | NTK530AB | 22 |
| | | 10GBASE-SR/SW, 850 nm, XFP, 0/70C, LC, MSA | NTTP81AA | 1 |
| | | 1x10GE EPL ¹ | NTK533AA | 2 |
| | | 10GBASE-LR/LW, 1310 nm, XFP, 0/70C, LC, MSA ² | NTTP81BA | 2 |
| | | 4xGE RPR 10G STS-1/HO SFP | NTK534BA | 06A |
| | | GE LX [10k]/FC100 SM 1310nm LC SFP | NTTP01CF | 1 |
| | | 2x OC-48/STM-16 VT1.5/LO SFP | NTK517BA | 3 |
| | | OC-48 SR-1/I-16.1,1310nm,3.3V,-10/+85C, SFP, 20pins, LC, EMSA | NTTP03BF | 1 |
| | | 2x OC-48/STM-16 VT1.5/LO SFP | NTK517BA | 3 |
| | | 24x DS3/EC-1 1:N Protection | NTK544NA | 2 |
| | | 10G OTSC 1x10G XFP 1x10G to 11.3G DWDM ³ | NTK528AA | 2 |
| | | 10GBASE-LR/LW, 1310 nm, XFP, 0/70C, LC, MSA ⁴ | NTTP81BA | 1 |
| | Processor SP | NTK555AA | 7 | |
| | DS1X84TM | NTN313AC | 4 | |
| | DSMIO - DSM 28 DS1 I/O | NTN312AA | 4 | |
| | DSMOAMEX- DSM OAM Adapter | NTN356AA | 7 | |
| | DSMFANX3- DSM FANx3 module | NTN355AA | 4 | |
| | DS1X84TM | NTN313AC | 4 | |
| | 19in. Optical/Rear Electrical Shelf Assembly | NTK503CA | 2 | |
| | Access Panel (SONET/J-SDH) | NTK505MA | 1 | |
| | Rear Cooling Fan Module | NTK507MB | 3 | |
| | Rear Venting Cooling Shelf | NTK507GB | 3 | |
| | 40A Power Input Card breakered_2wire | NTK505CE | 2 | |
| | Maintenance Interface Card | NTK505FA | 1 | |
| | 48xDS3 / E3 / EC-1 (1:N) Rear I/O Panel | NTK572QA | 3 | |
| | 24x DS3/EC-1 Working | NTK543NA | 2 | |
| | 4xGbE/GFP/p-p Optical | NTK535LA | 03A | |
| | OME 6500 (Shelf 2) | | | |

Table 2-3. Tested System Configurations (continued)

| Hardware | | Card Name | Part Number | Version |
|--|---|--|-------------|---------|
| SUT (continued) | OME 6500 (Shelf 2) (continued) | GE SX/FC100 Mx 850nm LC SFP | NTTP01AF | 1 |
| | | 8x OC-3/12/STM-1/4 VT1.5/LO SFP | NTK513DA | 4 |
| | | OC-3/12/STM-1/4 SR-1/I-1 I-4 1310nm SFP | NTTP04BF | 1 |
| | | 8x OC-3/12/STM-1/4 VT1.5/LO SFP | NTK513DA | 6 |
| | | OC-3/12/STM-1/4 SR-1/I-1 I-4 1310nm SFP | NTTP04BF | 1 |
| | | 1xOC-192/STM-64 VT1.5/LO DWDM C band AM1/AM2 | NTK527JA | 1 |
| | | 1xOC-192/STM-64 VT1.5/LO SR1/I64.1 | NTK524BA | 3 |
| | | X-CONN 80G (20G VT1.5/VC-12) SYNC-ST3 | NTK557PA | 4 |
| | | NGM WT 1x10GE LAN 1x11.1G | NTK530AB | 15 |
| | | 10GBASE-SR/SW, 850 nm, XFP, 0/70C, LC, MSA | NTTP81AA | 1 |
| | | 4xGE RPR 10G STS-1/HO SFP | NTK534BA | 6 |
| | | GE SX/FC100 Mx 850nm LC SFP | NTTP01AF | 1 |
| | | GE LX [10k]/FC100 SM 1310nm LC SFP | NTTP01CF | 1 |
| | | 2x OC-48/STM-16 VT1.5/LO SFP | NTK517BA | 3 |
| | | OC-48 SR-1/I-16.1,1310nm,3.3V,-10/+85C,SFP,20pins,LC,EMSA | NTTP03BF | 1 |
| | | 2x OC-48/STM-16 VT1.5/LO SFP | NTK517BA | 3 |
| | | OC-48 SR-1/I-16.1,1310nm,3.3V,-10/+85C,SFP,20pins,LC,EMSA | NTTP03BF | 1 |
| | | 24x DS3/EC-1 1:N Protection | NTK544NA | 2 |
| | | 48 Channel Trans Mux (Portless) | NTK558DA | 2 |
| | | Processor SP | NTK555AA | 7 |
| | DSM 2 | DS1X84TM | NTN313AC | 4 |
| | | DSMIO - DSM 28 DS1 I/O | NTN312AA | 4 |
| | | DSMOAMEX- DSM OAM Adapter | NTN356AA | 7 |
| | | DSMFANX3- DSM FANx3 module | NTN355AA | 4 |
| | | DS1X84TM | NTN313AC | 4 |
| | OME 6500 (Shelf 3) | 19in. Optical/Rear Electrical Shelf Assembly (Converged) | NTK503CD | 1 |
| | | Access Panel, Converged (SONET) | NTK505MB | 2 |
| | | Rear High Flow Cooling Fan Module | NTK507MD | 1 |
| | | 60A Power Input Card breaker | NTK505CA | 2 |
| | | Maintenance Interface Card | NTK505FB | 1 |
| | | eDC40G OCLD 1xOTU3+ DWDM with Enhanced PMD Compensation | NTK539PA | 3 |
| | | 4x10G MUX OCI 4xOC-192/STM-64/10GE/OTU2 XFP | NTK525CA | 3 |
| | | OC192 SR-1:I-64.1/10GBASE-LR/LW,1310 nm, XFP, 0/70C, LC, MSA | NTTP80BA | 4 |
| | | OC192 IR-2:S-64.2/10GBASE-ER/EW,1550 nm, XFP, 0/70C, LC, MSA | NTTP80DA | 1 |
| | | eDC40G OCLD 1xOTU3+ DWDM with Enhanced PMD Compensation | NTK539PA | 2 |
| | | SuperMux 10xSFP 10G DWDM | NTK535EA | 2 |
| | | OC-3/STM-1 SR-1/I-1 1310nm LC SFP | NTTP02BF | 1 |
| | | OC-3/12/STM-1/4 IR-1/S-1.1 S-4.1 1310nm SFP | NTTP04CF | 1 |
| | | OC-48 LR-1/L-16.1,1310nm,3.3V,-10/+85C,SFP,20pins,LC,EMSA | NTTP03EF | 1 |
| | | 1000BASE-BX10-U GE Bidi 10 km Upstream | NTTP58BD | 2 |
| | | 1000BASE-BX10-D GE Bidi 10 km Downstream | NTTP59BD | 2 |
| | | GE LX [10k]/FC100 SM 1310nm LC SFP | NTTP01CF | 1 |
| | | SuperMux 10xSFP 10G DWDM | NTK535EA | 2 |
| | | 1000BASE-BX10-U GE Bidi 10 km Upstream | NTTP58BD | 2 |
| | | 1000BASE-BX10-D GE Bidi 10 km Downstream | NTTP59BD | 2 |
| | | MLA C-Band | NTK552BA | 3 |
| | | SLA C-Band | NTK552AA | 3 |
| WSS w/OPM C-Band 100GHz (Double Slot Card) | | NTK553EA | 1 | |
| OSC w/WSC 2 Port SFP 2 Port 10BT | | NTK554BA | 1 | |
| OC-3 10-30dB CWDM 1511 nm | | NTK592NB | 2 | |
| Processor SP with I2C support | | NTK555AB | 1 | |
| 44 Ch Mux/Demux (CMD44) C-Band 100GHz | | NTT862AA | 2 | |

Table 2-3. Tested System Configurations (continued)

| Hardware | | Card Name | Part Number | Version | |
|--------------------|--|--|-------------|---------|--|
| SUT (continued) | OME 6500 (Shelf 4) | 19in. Optical/Rear Electrical Shelf Assembly (Converged) | NTK503CD | 1 | |
| | | Access Panel, Converged (SONET) | NTK505MB | 2 | |
| | | Rear High Flow Cooling Fan Module | NTK507MD | 1 | |
| | | 60A Power Input Card breakered | NTK505CA | 2 | |
| | | Maintenance Interface Card | NTK505FB | 1 | |
| | | eDC40G OCLD 1xOTU3+ DWDM with Enhanced PMD Compensation | NTK539PA | 3 | |
| | | 4x10G MUX OCI 4xOC-192/STM-64/10GE/OTU2 XFP | NTK525CA | 3 | |
| | | OC192 SR-1:I-64.1/10GBASE-LR/LW,1310 nm, XFP, 0/70C, LC, MSA | NTTP80BA | 4 | |
| | | OC192 IR-2:S-64.2/10GBASE-ER/EW,1550 nm, XFP, 0/70C, LC, MSA | NTTP80DA | 1 | |
| | | eDC40G OCLD 1xOTU3+ DWDM with Enhanced PMD Compensation | NTK539PA | 3 | |
| | | 4xGE RPR 10G STS-1/HO SFP | NTK534BA | 9 | |
| | | GE SX/FC100 Mx 850nm LC SFP | NTTP01AF | 1 | |
| | | SuperMux 10xSFP 10G DWDM | NTK535EA | 2 | |
| | | OC-3/STM-1 SR-1/I-1 1310nm LC SFP | NTTP02BF | 1 | |
| | | OC-3/12/STM-1/4 IR-1/S-1.1 S-4.1 1310nm SFP | NTTP04CF | 1 | |
| | | OC-48 LR-1/L-16.1,1310nm, 3.3V,-10/+85C, SFP, 20pins, LC, EMSA | NTTP03EF | 1 | |
| | | 1000BASE-BX10-U GE Bidi 10 km Upstream | NTTP58BD | 2 | |
| | | 1000BASE-BX10-D GE Bidi 10 km Downstream | NTTP59BD | 2 | |
| | | GE LX [10k]/FC100 SM 1310nm LC SFP | NTTP01CF | 1 | |
| | | X-CONN 80G VT1.5/VC-12 SYNC-ST3 | NTK557NA | 7 | |
| | | 1xOC-192/STM-64 VT1.5/LO DWDM C band AM1/AM2 | NTK527JA | 1 | |
| | | 1xOC-192/STM-64 VT1.5/LO SR1/I64.1 | NTK524BA | 3 | |
| | | MLA C-Band | NTK552BA | 3 | |
| | | WSS w/OPM C-Band 100GHz (Double Slot Card) | NTK553EA | 1 | |
| | | OSC w/WSC 2 Port SFP 2 Port 10BT | NTK554BA | 1 | |
| | | OC-3 10-30dB CWDM 1511 nm | NTK592NB | 2 | |
| | | Processor SP with I2C support | NTK555AB | 1 | |
| | | 44 Ch Mux/Demux (CMD44) C-Band 100GHz | NTT862AA | 2 | |
| | | Fan | NTN355AA | 04 | |
| | | OAM Extender | NTN31112 | 02 | |
| | | DS-1 | NTN312AA | 04 | |
| | | 84xDS1TM | NTN313AC | 01 | |
| | | Fan | NTN355AA | 04 | |
| | OAM Extender | NTN31112 | 02 | | |
| | DS-1 | NTN312AA | 04 | | |
| | 84xDS1TM | NTN313AC | 04 | | |
| | Management Terminal | Windows XP with Service Pack 2, RAM=512 MB, Hard Drive Size=80 GB, Processor Type=Intel Celeron, Processor Speed=2.80 GHz Preside Site Manager Release 5.11 | | | |
| | NOTES: | | | | |
| | 1 This card was installed for IP testing and replaced the NGM WT 1x10GE LAN 1x11.1G card | | | | |
| | 2 This card was installed for IP testing and replaced the 10 GBASE-SR/SW, 850 nm, XFP, 0/70c, LC, MSA card | | | | |
| | 3 This card was installed for IP testing and replaced the 24x DS3/EC-1 1:N Protection card | | | | |
| | 4 This card was installed for IP testing. | | | | |

Table 2-3. Tested System Configurations (continued)

| LEGEND: | | | |
|----------------|--|----------|--|
| 5ESS | Class 5 Electronic Switching System | OAM | Operations, Administration, and Maintenance |
| CCA | Compact Call Agent | OC | Optical Carrier |
| CS | Communication Server | OC-3 | Optical Carrier Level 3 (155 Mbps) |
| DS-1 | Digital Signal Level 1 | OC-12 | Optical Carrier Level 12 (622 Mbps) |
| DS1 | Digital Signal Level 1 | OC-48 | Optical Carrier Level 48 (2.488 Gbps) |
| DS3 | Digital Signal Level 3 | OC-192 | Optical Carrier Level 192 (10 Gbps) |
| DSM | DS1 Service Module | OME | Optical Multi-service Edge |
| DWDM | Dense Wavelength Division Multiplexing | R | Release |
| EC | Electrical Carrier | RAM | Random Access Memory |
| EC1 | Electrical Carrier Level 1 | RPR | Resilient Packet Ring |
| EPL | Ethernet Private Line | SFP | Small Form Factor Pluggable |
| EWSD | Elektronisches Wählsystem Digital | SP | Shelf Processor |
| G.709 | ITU-T Recommendation for Interfaces for the Optical Transport Network (OTN) | STM | Synchronous Transport Module |
| G | Gigabit | STM-1/4 | Synchronous Transport Mode ¼ (38.88 Mbps) |
| GB | Gigabyte | STM-16 | Synchronous Transport Mode 16 (2488.32 Mbps) |
| Gbps | Gigabits per second | STM-64 | Synchronous Transport Mode 64 (9953.28 Mbps) |
| GE | Gigabit Ethernet | STS | Synchronous Transport Signal |
| GHz | Gigahertz | Sync-ST3 | Synchronous Traceable Stratum 3 (Accuracy 4.6×10^{-6}) |
| HO | High Order | TM | Terminal Multiplexer |
| ITU-T | International Telecommunication Union - Telecommunication Standardization Sector | VC-12 | Virtual Containers 12 (2.048 Mbps) |
| LAN | Local Area Network | VT1.5 | Virtual Tributary 1.5 |
| LO | Low Order | WAN | Wide Area Network |
| MB | Megabyte | WT | Wavelength Translators |
| Mbps | Megabits per second | X-Conn | Cross Connect |
| NGM | Next Generation Modem | XFP | 10 Gigabit Small Form Factor Pluggable Module |
| NTK | Nortel Networks | XP | Experience |
| NTN | Nortel Networks | | |

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. All trunk types were provisioned and tested on the DSM and Adtran 2800 M13 Multiplexer. In addition, the SUT supports Gigabit and 10 Gigabit Ethernet interfaces. All of the interface types were mapped through the test network via Virtual Tributary (VT)1.5 and Synchronous Transport Signal (STS)-1 transport levels over all of the supported SONET interfaces described in paragraph (5). The gigabit SuperMux access interface (Part Number: NTK535EA) does not support auto-negotiation. Although the SUT offers E1 access interfaces, these interfaces were not tested by JITC and are not authorized for use within the DSN by the DSN Program Management Office (PMO). 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. All Access interface characteristics were verified through both vendor LoC and testing.

(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 Abacus call loader was used to generate voice traffic across the DS1 links mapped through the SUT test network as depicted in Figure 2-2. There were 107,926 calls placed over the DS1 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 1Gbps Ethernet Private Line (EPL), 10Gbps EPL and 1Gbps RPR mapped through the SONET test network. The IXIA voice traffic had a minimum MOS of 4.37 with an average MOS of 4.6, which meets 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 an end-to-end bit error rate of less than one error in 1×10^9 averaged over a nine-hour period, which meets the requirement.

(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 284 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 29,894 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 23.7 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 44,494 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. The SUT transparently transported all Multi-level Precedence and Preemption (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 1 ms, which meets 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 meets 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.

There were IXIA VoIP pairs 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 1 ms, which meets 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 bandwidth load, jitter was measured to be 0 ms over a five-minute period, which meets 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 meets 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 interfaces of 2.5 Gbps, 10 Gbps and 40 Gbps. The SONET and DWDM 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 SUT, when configured at maximum capacity, provides for 44- channel DWDM each separated by 100 GHz for a rate of 2.5 Gbps, 10 Gbps and 40 Gbps per channel.

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, 1+1 |
| OC-48 | UPSR, BLSR, 1+1 |
| OC-12 | UPSR, 1+1 |
| OC-3 | UPSR, 1+1 |
| LEGEND: | |
| BLSR Bidirectional Line Switched Ring | OC-192 Optical Carrier Level 192 |
| OC-3 Optical Carrier Level 3 | SONET Synchronous Optical Network |
| OC-12 Optical Carrier Level 12 | SUT System Under Test |
| OC-48 Optical Carrier Level 48 | 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 SUTs 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 Abacus call loader was used to generate voice traffic across the DS1 links mapped through the SONET test network as depicted in Figure 2-2. There were 107,926 calls placed over the DS1 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 1Gbps Ethernet Private Line (EPL), 10Gbps EPL and 1Gbps RPR

mapped through the SONET test network. The IXIA voice traffic had a minimum MOS of 4.37 with an average MOS of 4.6, which meets 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 trunk type interfaces, which were mapped through the SONET test network. The SUT, when introduced in to the test network, did not cause the end-to-end digital bit error rate requirement of less than 1 error in 1×10^9 (averaged over a nine hour period) to be exceeded. The SUT met this requirement for all interfaces with an end-to-end bit error rate of less than one error in 1×10^9 averaged over a nine-hour period, which meets the requirement.

(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 284 secure calls placed between STU-III, STEs, and SWTs. The SUT did not degrade secure transmission of 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 29,894 modem calls placed through the SUT using the Abacus call loader. All modem calls had a transmission rate of 23.7 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 44,494 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 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.

(w) Delay. There were IXIA VoIP pairs generated through the SUT using the Ixia. Per the UCR, appendix 9, the SUT supported the requirement that the S-NE shall not cause the one-way packet delay measured from ingress to egress to increase by more than five ms for each S-NE used, averaged over any five-minute period. The IXIA VoIP pairs measured an average latency of 1ms, which meets the requirement.

(x) Jitter. With IXIA VoIP pairs generated through the SUT using the Ixia, the SUT supports the requirement that the addition of an S-NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any five-minute period. The IXIA VoIP pairs measured 0ms of jitter, which meets 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. With bandwidth load, the measured packet loss was 0.00 percent over a five minute period, which meets the requirement.

(z) Call Congestion. In accordance with the UCR, appendix 9, call congestion handling can be met one 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.

(aa) Differentiated Services. The NE that offers IP interfaces shall be able to classify the DSN traffic by either IEEE 802.1p prioritization bits and/or Differentiated Services Code Point (DSCP) values. The NE shall be capable of assigning any value of prioritization to the DSN traffic, 0 through 7 for 802.1p, or 0 through 63 for DSCP. If the bearer and signaling sessions are different streams, the NE shall be capable of marking them independently. The SUT is only capable of

prioritization based on IEEE 802.1p and any circuit utilizing the RPR must be configured to utilize and provide IEEE 802.1p, which meets 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

Preside Site Manager Release 5.11 application running on a Windows XP personal computer, which meets the requirement. The management console was connected to the gateway node via IP. The management console, via in-band management, managed all other nodes in the test network.

(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 Strategic Network Element in accordance with the requirements set forth in reference (c). The SUT offers a 10/100 Megabits per second Ethernet Interface; however, this interface was not tested and is not authorized for use within the DSN by the DSN PMO. The SUT one and ten Gigabits per second Ethernet interfaces were tested and certified for voice only. The SUT can be deployed within the DSN as an extension to any Assured Services Local Area Network that is on the Unified Capabilities (UC) Approved Products List (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>.