DEFENSE INFORMATION SYSTEMS AGENCY
P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY
REFER TO: Joint Interoperability Test Command (JTE) **17 Mar 09**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Fujitsu FLASHWAVE 4100 Extension Shelf (ES) with Software Release 6.1

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 Fujitsu FLASHWAVE 4100 ES with Software Release 6.1 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). 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 finding is based on interoperability testing conducted by JITC, DISA adjudication of open test discrepancy reports, 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 7 July through 1 August 2008. Regression testing was conducted from 1 through 5 December 2008. Review of vendor's LoC was completed on 11 December 2008. DISA adjudication of outstanding test discrepancy reports was completed on 18 December 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)).

JITC Memo, JTE, Special Interoperability Test Certification of the Fujitsu FLASHWAVE 4100 Extension Shelf (ES) with Software Release 6.1

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	The SUT offers this interface; 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	The SUT offers this interface; 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 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this interface; 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.
DS3	No[1]	Certified	Met all CRs and FRs.
DS3C	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	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT 1.5	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	See note 3.	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 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

Table 1. SUT Interoperability Test Summary (continued)

LEGEND:

10/100BaseT	10/100 Mbps (Baseband Operation, Twisted Pair) Ethernet	ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
AMI	Alternate Mark Inversion	Mbps	Megabits per second
ANSI	American National Standards Institute	MFR1	Multi-frequency Recommendation 1
B8ZS	Bipolar Eight Zero Substitution	MLPP	Multi-Level Precedence and Preemption
CAS	Channel Associated Signaling	OC-3	Optical Carrier Level 3 (155 Mbps)
CR	Capability Requirements	OC-12	Optical Carrier Level 12 (622 Mbps)
DISA	Defense Information Systems Agency	PRI	Primary Rate Interface
DP	Dial Pulse	Q.955.3	ISDN Signaling Standard for E1 MLPP
DS3	Digital Signal Level 3 (44.736 Mbps)	SF	Super Frame
DS3C	Digital Signal Level 3 (89.472 Mbps)	SS7	Signaling System 7
DTMF	Dual Tone Multi-Frequency	SUT	System Under Test
DSN	Defense Switched Network	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	UCR	Unified Capabilities Requirements
HDB3	High Density Bipolar 3	VT1.5	Virtual Tributary 1.5
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]	• DS1 Interface Characteristics (C) • DS1 Supervisory Channel Associated Signaling (C)	• UCR para. A9.5.1.2.4 • UCR para. A9.5.1.2.4
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C)	• 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]	• E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C)	• 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)	• E1 Clear Channel Capability (C) • E1 Alarm and Restoral Requirements (C)	• UCR para. A9.5.1.2.5 • UCR para. A9.5.1.2.5
E1 CAS	No[1] (Europe only)	• MOS (R) • BERT (R) • Secure Transmission (Voice and Data) (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• Modem (R) • Facsimile (R) • Call Control Signals (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
DS3, DS3C	No[1]	• Delay (R) • Call Congestion Control (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Call Congestion (R) • Voice Compression (C)	• UCR para. A9.5.1.1.3 • UCR para. A9.5.1.1.4
Gigabit Ethernet	No[1]	• DS3 Interface Requirements (R) • IP Interface (C)	• 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 OC-12	No[2]	• MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT1.5 (R) • 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) • 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) • Modem (R) • Facsimile (R) • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • Voice Compression (C)	• UCR para. A5.5.1 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • 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 • 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 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • 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	• 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

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		
BERT	Bit Error Rate Test	Mbps	Megabits per second
C	Conditional	MLPP	Multi-Level Precedence and Preemption
CAS	Channel Associated Signaling	MOS	Mean Opinion Score
DIACAP	DoD Information Assurance Certification and Accreditation Process	OC-3	Optical Carrier Level 3 (155 Mbps)
		OC-12	Optical Carrier Level 12 (622 Mbps)
DoD	Department of Defense	para	paragraph
DS0	Digital Signal Level 0	PRI	Primary Rate Interface
DS1	Digital Signal Level 1	Q.955.3	ISDN Signaling standard for E1 MLPP
DS3	Digital Signal Level 3	R	Required
DS3C	Digital Signal Level 3 - Concantenated	RAI	Remote Alarm Indication
DSN	Defense Switched Network	SONET	Synchronous Optical Network
DSS1	Digital Subscriber Signaling 1	SS7	Signaling System 7
DWDM	Dense Wavelength Division Multiplexing	STIGs	Secure Technical Implementation Guides
E1	European Basic Multiplex Rate (2.048 Mbps)	SUT	System Under Test
GR	Generic Requirement	T1	Digital Transmission Link Level 1 (1.544 Mbps)
GR-253-CORE	SONET Transport Systems: Common Generic Criteria	T1.105-2001	SONET – Basic Description include Multiplexer structure, rates, formats
GR-303-CORE	Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1.607	ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
GR-436-CORE	Digital Network Synchronization Plan	T1.619a	SS7 and ISDN MLPP Signaling Standard for T1
GR-518-CORE	LSSGR: Synchronization, Section 18	UCR	Unified Capabilities Requirements
GR-782-CORE	SONET Digital Switch Trunk Interface Criteria	VT1.5	Virtual Tributary 1.5
IP	Internet Protocol		

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. Joseph Roby, DSN 879-0507, commercial (520) 538-0507, FAX DSN 879-4347, or e-mail joseph.roby@disa.mil. The JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 0820403.

FOR THE COMMANDER:

2 Enclosures a/s

for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Fujitsu FLASHWAVE 4100 Extension Shelf (ES) with Software Release 6.1

Distribution (electronic mail):
Joint Staff J-6
Joint Interoperability Test Command, Liaison, TE3/JT1
Office of Chief of Naval Operations, CNO N6F2
Headquarters U.S. Air Force, Office of Warfighting Integration & CIO, AF/XCIN (A6N)
Department of the Army, Office of the Secretary of the Army, DA-OSA CIO/G-6 ASA (ALT), SAIS-IOQ
U.S. Marine Corps MARCORSYSCOM, SIAT, MJI Division I
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 Voice Networks Unified Capabilities Requirements (UCR), 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 Fujitsu FLASHWAVE 4100 Extension Shelf (ES) with Software Release 6.1 (Tracking Number 0820403)," 10 March 2009

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. The Fujitsu 4100 Extension Shelf (ES) with Software Release 6.1; hereinafter referred to as the System Under Test (SUT).

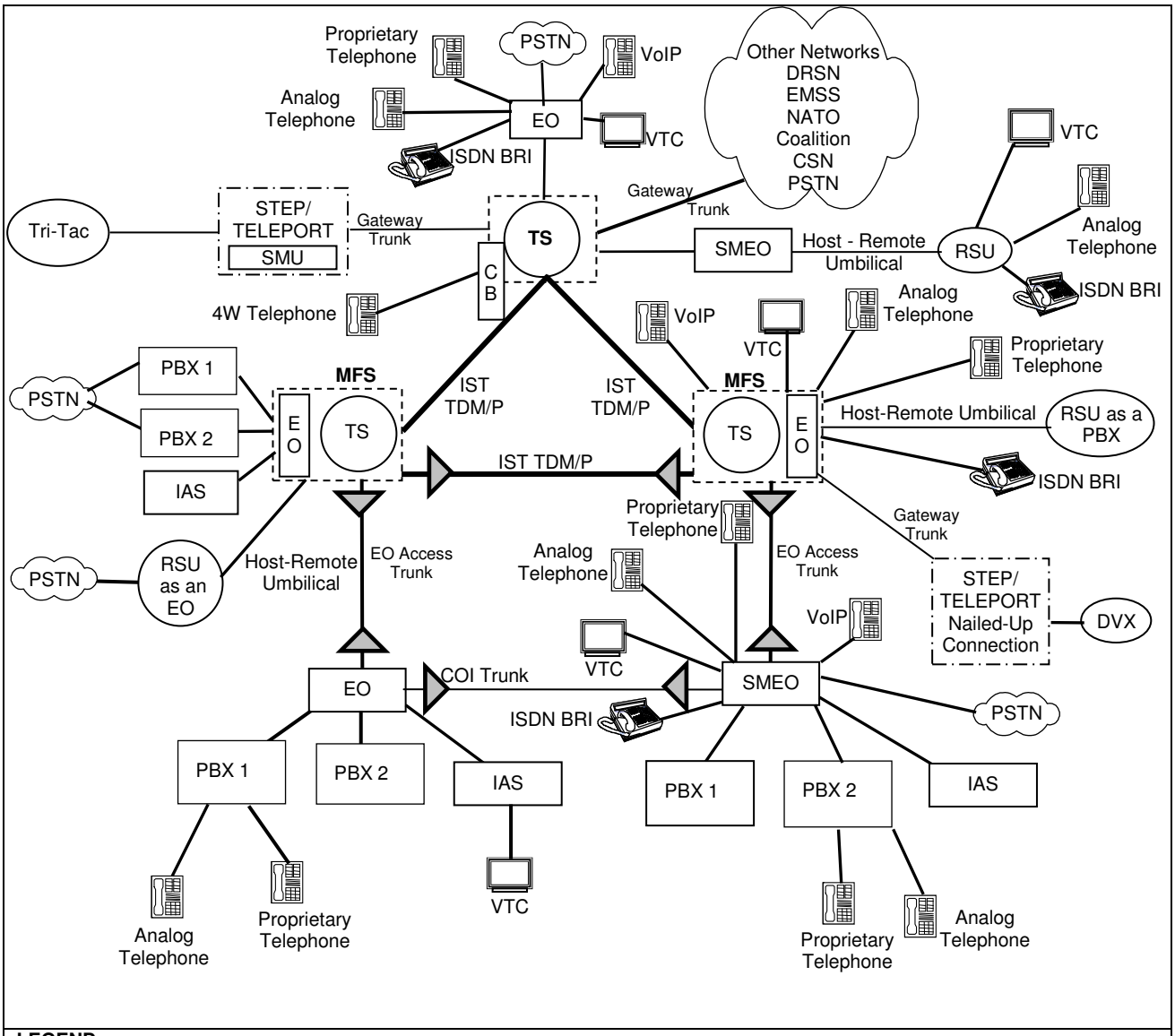
2. PROPONENTS. United States (US) Army, Headquarters (HQ) United States Army Information Security Electronics Command (USAISEC).

3. PROGRAM MANAGER. Mr. Gary Kitsmiller, AMSEL-IE-IS, Bldg 53301, Fort Huachuca, Arizona, 85613-5300, email: gary.kitsmiller@us.army.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) and Synchronous Digital Hierarchy (SDH) 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) and Optical Carrier Level 12 (OC-12) 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 provides common transport for TDM and data interfaces to support voice transport. Deployed in a ring transport topology, the SUT has a main shelf that has an Internet Protocol (IP) connection supporting Secure Shell (SSH). Although the SUT offers European Basic Multiplex Rate (E1) access interfaces this interface was not tested by JITC and is not authorized for use within the Defense Switched Network (DSN) by the DSN Program Management Office (PMO).

6. OPERATIONAL ARCHITECTURE. The Unified Capabilities Requirements (UCR) DSN operational architecture is depicted in Figure 2-1.



LEGEND:

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

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	The SUT offers this interface; 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	The SUT offers this interface; 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 SS7 (ANSI T1.619a)	No[1] (Europe only)	Not Tested	The SUT offers this interface; 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.
DS3	No[1]	Certified	Met all CRs and FRs.
DS3C	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	VT 1.5	No[2]	Certified	Met all CRs and FRs.
	STS-1	No[2]	Certified	Met all CRs and FRs.
OC-12	VT 1.5	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	See note 3.	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 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

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

LEGEND:

10/100BaseT	10/100 Mbps (Baseband Operation, Twisted Pair) Ethernet	ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
AMI	Alternate Mark Inversion	Mbps	Megabits per second
ANSI	American National Standards Institute	MFR1	Multi-frequency Recommendation 1
B8ZS	Bipolar Eight Zero Substitution	MLPP	Multi-Level Precedence and Preemption
CAS	Channel Associated Signaling	OC-3	Optical Carrier Level 3 (155 Mbps)
CR	Capability Requirements	OC-12	Optical Carrier Level 12 (622 Mbps)
DISA	Defense Information Systems Agency	PRI	Primary Rate Interface
DP	Dial Pulse	Q.955.3	ISDN Signaling Standard for E1 MLPP
DS3	Digital Signal Level 3 (44.736 Mbps)	SF	Super Frame
DS3C	Digital Signal Level 3 (89.472 Mbps)	SS7	Signaling System 7
DTMF	Dual Tone Multi-Frequency	SUT	System Under Test
DSN	Defense Switched Network	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	UCR	Unified Capabilities Requirements
HDB3	High Density Bipolar 3	VT1.5	Virtual Tributary 1.5
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]	• DS1 Interface Characteristics (C) • DS1 Supervisory Channel Associated Signaling (C)	• UCR para. A9.5.1.2.4 • UCR para. A9.5.1.2.4
T1 SS7 (ANSI T1.619a)	No[1]	• DS1 Clear Channel Capability (C) • DS1 Alarm and Restoral Requirements (C)	• 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]	• E1 Interface Characteristics (C) • E1 Supervisory Channel Associated Signaling (C) • E1 Clear Channel Capability (C)	• 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)	• E1 Alarm and Restoral Requirements (C) • MOS (R)	• UCR para. A9.5.1.2.5 • UCR para. A9.5.1.1
E1 CAS	No[1] (Europe only)	• BERT (R) • Secure Transmission (Voice and Data) (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1
E1 SS7 (ANSI T1.619a)	No[1] (Europe only)	• Modem (R) • Facsimile (R) • Call Control Signals (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1
DS3, DS3C	No[1]	• Delay (R) • Call Congestion Control (R)	• UCR para. A9.5.1.1 • UCR para. A9.5.1.1
10/100 Mbps Ethernet	No[1]	• Call Congestion (R) • Voice Compression (C)	• UCR para. A9.5.1.1.3 • UCR para. A9.5.1.1.4
Gigabit Ethernet	No[1]	• DS3 Interface Requirements (R) • IP Interface (C)	• 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 OC-12	No[2] No[2]	• MLPP (R) • GR-303-CORE (R) • GR-253-CORE (R) • GR-782-CORE (R) • ANSI T1.105-2001 (R) • DS1 Rate Transport via VT1.5 (R) • 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) • 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) • Modem (R) • Facsimile (R) • Call Control Signals (R) • Delay (R) • Call Congestion Control (R) • Voice Compression (C)	• UCR para. A5.5.1 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • UCR para. A5.5.2 • 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 • 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 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • UCR para. A9.5.1.1 • 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	• 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

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	IP	Internet Protocol
ADIMSS	Advanced DSN Integrated Management Support System	ISDN	Integrated Services Digital Network
		ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
AIS	Alarm Indication Signal		
ANSI	American National Standards Institute	LSSGR	Local Access and Transport Area (LATA) Switching Systems Generic Requirements
BERT	Bit Error Rate Test		
C	Conditional	Mbps	Megabits per second
CAS	Channel Associated Signaling	MLPP	Multi-Level Precedence and Preemption
DIACAP	DoD Information Assurance Certification and Accreditation Process	MOS	Mean Opinion Score
		OC-3	Optical Carrier Level 3 (155 Mbps)
DoD	Department of Defense	OC-12	Optical Carrier Level 12 (622 Mbps)
DS0	Digital Signal Level 0	para	paragraph
DS1	Digital Signal Level 1	PRI	Primary Rate Interface
DS3	Digital Signal Level 3	Q.955.3	ISDN Signaling standard for E1 MLPP
DS3C	Digital Signal Level 3 - Concantenated	R	Required
DSN	Defense Switched Network	RAI	Remote Alarm Indication
DSS1	Digital Subscriber Signaling 1	SONET	Synchronous Optical Network
DWDM	Dense Wavelength Division Multiplexing	SS7	Signaling System 7
E1	European Basic Multiplex Rate (2.048 Mbps)	STIGs	Secure Technical Implementation Guides
GR	Generic Requirement	SUT	System Under Test
GR-253-CORE	SONET Transport Systems: Common Generic Criteria	T1	Digital Transmission Link Level 1 (1.544 Mbps)
		T1.105-2001	SONET – Basic Description include Multiplexer structure, rates, formats
GR-303-CORE	Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface	T1.607	ISDN – Layer 3 Signaling Specification for Circuit Switched Bearer Service for DSS1
GR-436-CORE	Digital Network Synchronization Plan	T1.619a	SS7 and ISDN MLPP Signaling Standard for T1
GR-518-CORE	LSSGR: Synchronization, Section 18	UCR	Unified Capabilities Requirements
GR-782-CORE	SONET Digital Switch Trunk Interface Criteria	VT1.5	Virtual Tributary 1.5

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.

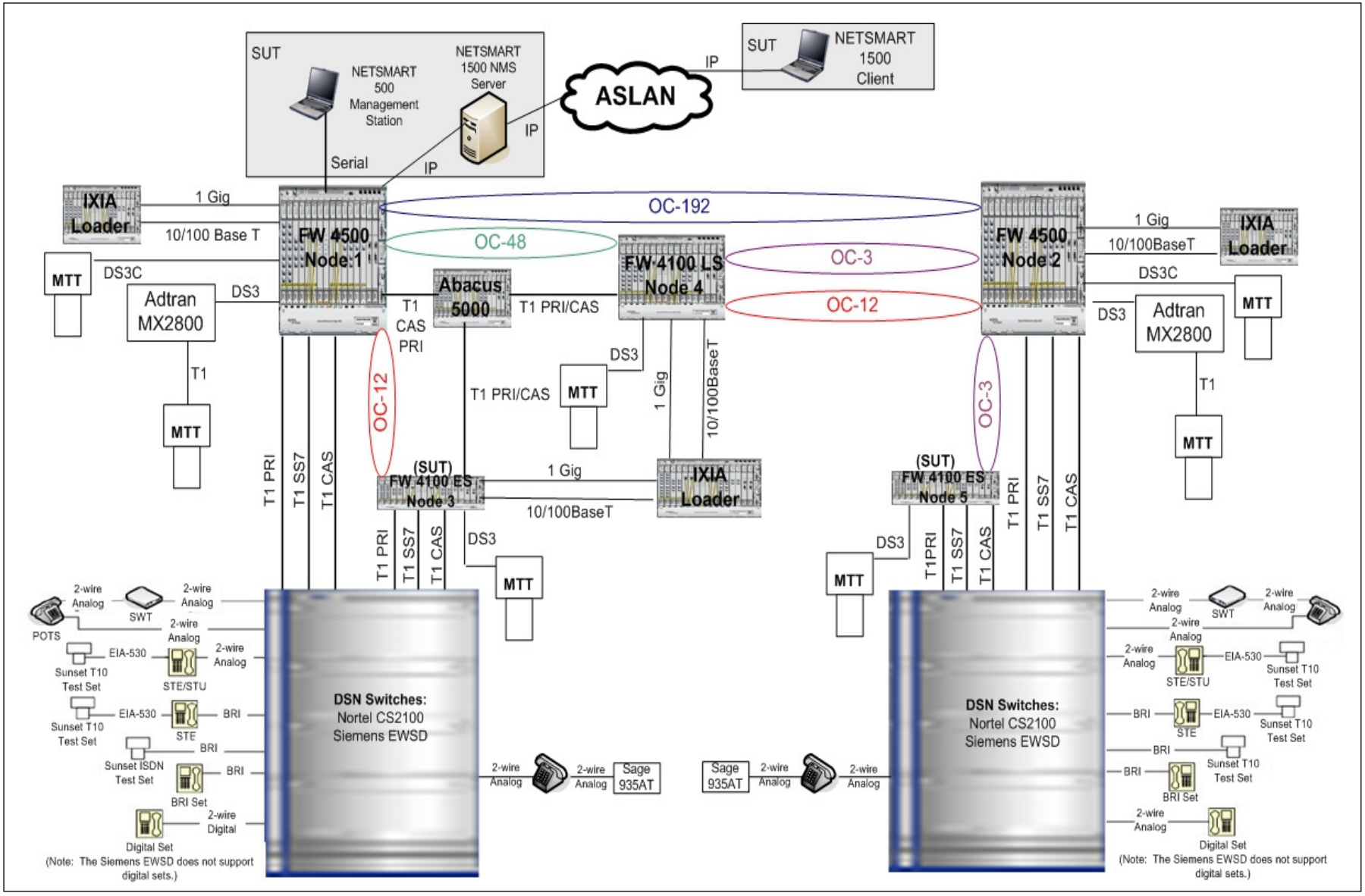


Figure 2-2. SUT Test Configuration

LEGEND:

10/100BaseT	10/100 Mbps (Baseband Operation, Twisted Pair) Ethernet	LS	Large Shelf
ASLAN	Assured Services Local Area Network	Mbps	Megabits per second
BRI	Basic Rate Interface	NMS	Network Management System
CAS	Channel Associated Signaling	OC-3	Optical Carrier Level 3 (155 Mbps)
CS	Communication Server	OC-12	Optical Carrier Level 12 (622 Mbps)
DS3	Digital Signal Level 3	OC-48	Optical Carrier Level 48 (2.448 Gbps)
DS3C	Digital Signal Level 3 – Concantenated	OC-192	Optical Carrier Level 192 (10 Gbps)
EIA	Electronic Industries Alliance	POTS	Plain Old Telephone Service
EIA-530	Standard for 25-position interface for data terminal equipment (DTE) and data circuit-terminating equipment (DCE) employing serial binary data interchange	PRI	Primary Rate Interface
		SS7	Signaling System 7
ES	Extension Shelf	STE	Secure Terminal Equipment
EWSD	Elektronisches Wählsystem Digital	STU	Secure Telephone Unit
Gbps	Gigabits per second	SUT	System Under Test
Gig	gigabit	SWT	Secure Wireline Terminal
IP	Internet Protocol	T1	Digital Transmission Link Level 1 (1.544 Mbps)

Figure 2-2. SUT Test Configuration (Continued)

9. SYSTEM CONFIGURATIONS. Table 2-3 lists the system configurations used in the test. The SUT was tested in an operationally realistic environment to determine interoperability with a complement of DSN switches noted in Table 2-3. The DSN switches listed in Table 2-3 only depict the tested configuration. Table 2-3 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			
Fujitsu Flashwave 4100ES	Release 6.1			
Fujitsu Flashwave 4500	Release 8.2			
SUT	**Hardware**	**Card Name**	**Part Number**	**Version**
	Fujitsu FLASHWAVE 4100ES, OC-3, (Node/NE 5)	IFA1-OC3DSMX (2ea)	FC9681EL31	02
		IFA1-OC3IR1 (2ea)	FC95700020	01
		IFA1-DS1TSUES (2ea)	FC9681ED11	04
		IFA1-DS3TSUES	FC9681ED31	02
		IFA1-DS3TMUXES	FC9681ETM1	01
		FNA1-FAN	FC9681FAN4	04
	Fujitsu FLASHWAVE 4100ES, OC-12, (Node/NE 3)	IFA1-OC12SMXES (3ea)	FC9681EL21	01
		IFA1-OC12IR1	FC95700050	01
		IFA1-DS1NIUES (2ea)	FC9681ED12	01
		IFA1-DS3TSUES	FC9681ED31	02
		IFA1-LANHMS1	FC9681EGX1	01
		IFA1-1000X (2ea)	FC95705040	01
		FNA1-FAN	FC9681FAN4	04
	Management Terminals	Windows XP with Service Pack 2, RAM=512 MB, Hard Drive Size=80 GB, Processor Type=Intel Celeron, Processor Speed=2.80 GHz NETSMART 500, Version 3.7		
		NETSMART 1500 NMS Server, Version 5, SP 520		
		NETSMART 1500 Client, Windows XP,		

LEGEND:

5ESS	Class 5 Electronic Switching System	Mbps	Megabits per second
CCA	Compact Call Agent	NE	Network Element
CS	Communication Server	NMS	Network Management System
ES	Extension Shelf	OC	Optical Carrier
EWSD	Elektronisches Wählsystem Digital	OC-3	Optical Carrier Level 3 (155 Mbps)
GB	Gigabyte	OC-12	Optical Carrier Level 12 (622 Mbps)
LS	Large Shelf	RAM	Random Access Memory
MB	Megabyte	SUT	System Under Test
Mbps	Megabits per second		

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 on the DSM and Adtran 2800 M13 Multiplexer. In addition, the SUT supports 10/100 Megabit and 1 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). 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 60,982 calls placed over the DS1 interfaces, with all calls placed via the SUT having a MOS of at least 4.5. The IXIA data loader was also used to generate voice traffic over the 1 Gbps Ethernet Private Line (EPL), 10 Gbps EPL and 1 Gbps Resilient Packet Ring (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 $1x10^{9}$ (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 $1x10^{-9}$. The measured bit error ratio was $1x10^{-9}$, 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 302 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 55,758 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 14,048 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 Sage 935AT test set was used to generate traffic and measure delay. 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. All of the IP interfaces were non-transcoding. 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 and OC-12. 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-12	UPSR, 1+1
OC-3	UPSR, 1+1

LEGEND:

Mbps	Megabits per second	SONET	Synchronous Optical Network
OC-3	Optical Carrier Level 3 (155 Mbps)	SUT	System Under Test
OC-12	Optical Carrier Level 12 (622 Mbps)	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 Intitute (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 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.

(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 1 Gbps EPL, 10 Gbps EPL, and 1 Gbps 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 $1x10^9$ (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 into the test network, did not cause the end-to-end digital bit error rate requirement of less than 1 error in $1x10^9$ (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 $1x10^{-9}$. The measured bit error ratio was $1x10^{-9}$, 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-IIIs, 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 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 milliseconds (ms) for each S-NE used, averaged over any five-minute period. The Sage 935AT test set was used to generate traffic and measure delay. The average one-way delay for each of the sampled five-minute periods, measured between NE devices, was 1 ms, which meets the requirement.

(x) 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.

(y) Differentiated Services. The NE that offers IP interfaces shall be able to classify the DSN traffic by either Institute of Electrical and Electronics Engineers (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 either the NetSmart 500, Version 3.7 application running on a Windows XP personal computer, or the NetSmart 1500 Network Management Server, Version 5, which meets the requirement. The management console was connected to the SUT via the craft interface on Node/NE1. 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 NE 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). 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.