



DEFENSE INFORMATION SYSTEMS AGENCY

JOINT INTEROPERABILITY TEST COMMAND
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IN REPLY
REFER TO: Networks and Transport Division (JTE)

24 June 2004

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of Nortel Networks Succession Defense Switched Network (DSN) 1000M Single-Group, Half-Group, and Multi-Group with Software Release 3.0 and Product Enhancement Packages (Includes Voice over Internet Protocol)

References: (a) DOD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 11 January 2002
(b) CJCSI 6212.01C, "Interoperability and Supportability of Information Technology and National Security Systems," 20 November 2003

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. Additional references are provided in enclosure 1.

2. The Nortel Networks Succession DSN 1000M Single-Group with software release 3.0 and product enhancement packages including Voice over Internet Protocol (VoIP), hereinafter referred to as the system under test (SUT), meets all of its critical interoperability requirements and is certified as interoperable for joint use within the DSN. The Nortel Networks Succession DSN 1000M Half-Group and 1000M Multi-Group employ the same Voice over Internet Protocol (VoIP) Command and Control (C2) Voice Grade (VG) Local Area Network (LAN) solution, software, and trunk/line card hardware as the SUT. JITC analysis determined the Succession DSN 1000M Half-Group and Multi-Group including VoIP to be functionally identical to the SUT for interoperability certification purposes. All three products are certified for joint use within the DSN. The identified test discrepancies shown in the Certification Testing Summary (enclosure 2), which remained open after software patches were applied and regression testing was completed, have a minor operational impact. The SUT was tested and met the critical interoperability requirements for joint use within the DSN for the following switch types: Private Branch Exchange 1 (PBX 1) and PBX 2. This certification expires upon system changes that affect interoperability, but no later than three years from the date of this memorandum.

3. This finding is based on interoperability testing conducted by JITC at the Global Information Grid Network Test Facility, Ft. Huachuca, AZ, from 21 July 2003 through 12 September 2003, regression testing conducted 15 September 2003 through 15 January 2004, and review of the vendor's letters of compliance on 25 February 2004. Enclosure 2 documents the test results and describes the tested network and systems configurations. Enclosure 3 lists the product

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enhancement packages applied to the SUT for certification. System interoperability should be verified before deployment in an operational environment that varies significantly from the test environment.

4. Table 1 provides a comparison between the Nortel Networks product line as a standalone Time Division Multiplexer (TDM) switch versus a TDM switch enabled with VoIP. The VoIP C2 VG LAN certified hardware and software components are shown in table 2. The interoperability summary of the SUT is indicated in table 3. The interoperability status and criticality are listed in table 4, and the Exchange Requirements (ERs) and Functional Requirements (FRs) for each network interface are listed in table 5. Network Management (NM) capabilities of the SUT platform were tested in accordance with the DISA NS53 requirements as set forth in references (c) and (d). These references require that a switch provide NM capabilities via Ethernet Transmission Control Protocol/Internet Protocol (Institute of Electrical and Electronic Engineers, Inc. 802.3), asynchronous serial Electronic Industries Alliance (EIA), or synchronous serial International Telecommunications Union-Telecommunications Standardization Sector (X.25 or BX.25 variant). The SUT meets the NM requirements through the use of serial EIA-232 connections. This interoperability test summary is based upon evaluation of:

- a. The interface and signaling requirements for trunk/line interfaces, and interoperability ERs and FRs derived from references (f) and (g).
- b. The overall system interoperability performance derived from test procedures listed in reference (h).
- c. Review of the Letters of Compliance submitted by Nortel Networks.
- d. VoIP VG LAN interface and interoperability ERs and FRs derived from reference (i).

Table 1. SUT Product Line Comparison

TDM Switch	TDM Switch VoIP Enabled
Succession DSN Option 51C Digital Switching System	Succession DSN 1000M Half-Group
Succession DSN Option 61C Digital Switching System	Succession DSN 1000M Single-Group
Succession DSN Option 81C Digital Switching System	Succession DSN 1000M Multi-Group
Legend: DSN - Defense Switched Network SUT - System Under Test TDM - Time Division Multiplexer VoIP - Voice over Internet Protocol	

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Table 2. VoIP C2 VG LAN Certified Hardware and Software Components

Hardware	Software Release
BS 460-PWR	3.0.55
PP8600	3.5
Contivity	4.75
Signaling Server (see note)	2.10.81
Voice Media Gateway Card (PEC: NTVQ01BA)	IPL 3.1
I2004 – Instrument	1.58
I2002 – Instrument	1.58
I2050 – Instrument	V333
Legend: C2 - Command and Control BS - Bay Stack DSN - Defense Switched Network GUI - Graphical User Interface I - Internet IPL - Internet Protocol Line LAN - Local Area Network NM - Network Management PP - Passport PWR - Power over Ethernet STP - Signal Transfer Point VG - Voice Grade VoIP - Voice over Internet Protocol	
Note: Signaling Server was certified for GUI NM interface only.	

Table 3. SUT Interoperability Summary

Network	Critical	Status	Remarks
DSN	Yes	Certified	- Certified as a PBX1 and PBX2. - Certified for VoIP with C2 Voice Grade Local Area Network components as specified in enclosure 2, table 2-3. - The identified test discrepancies shown in enclosure 2 that remained open have an overall minor operational impact.
Tactical Gateway	No	Certified	- All requirements met.
NATO Gateway	No	Not Tested	
Commercial Network Gateway	Yes	Certified	- All requirements met
Legend: C2 - Command and Control DSN - Defense Switched Network NATO - North Atlantic Treaty Organization PBX - Private Branch Exchange SUT - System Under Test VoIP - Voice over Internet Protocol			

Table 4. SUT Interoperability Status

	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
Defense Switched Network	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP IN/DTMF OUT	No	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³
	PCM-24 T1 (B8ZS/ESF) ISDN PRI	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³ NI2 Protocol provides a Release Complete Message in lieu of a Disconnect Message for Unavailable Resources. ⁴
	Analog E&M Signaling Type I	No	Not Certified	Did not pass DSN preempt signals. ⁵

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Table 4. SUT Interoperability Status (continued)

	Line Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	TPC ISDN BRI ST and U Interface Q.931	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³ ISDN supplemental services not met. ⁶
	TPC 2-Wire analog	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³ Does not support intra-switch call waiting. ⁷
	TPC 2-Wire Digital (Proprietary)	No	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³
	Voice over Internet Protocol IEEE 802.3, TCP/IP (H.323)	No	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³ IPv6 not met. ⁸
Network Management Interfaces				
	Interface & Signaling	Critical	Status	Remarks
	TPC EIA Asynchronous @ 9.6 kbps	No	Certified	Met all ERs and FRs.
Tactical Network Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	Certified	Met all ERs and FRs.
NATO Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
		No	Not Tested	See note 9.
Commercial Network Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	Same Interfaces and Signaling as DSN	Yes	Certified	See note 10.
Legend: AMI - Alternate Mark Inversion B8ZS - Bipolar Eight Zero Substitution BRI - Basic Rate Interface CAS - Channel Associated Signaling DISN - Defense Information Systems Network DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multi-Frequency E&M - Ear and Mouth EIA - Electronic Industries Alliance ERs - Exchange Requirements ESF - Extended Superframe FRs - Functional Requirements GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan H.323 - Standard for multi-media communications on packet-based networks IEEE 802.3 - Institute of Electrical and Electronics Engineers, Inc., Ethernet protocol IPv4 - Internet Protocol Version 4 IPv6 - Internet Protocol Version 6 ISDN - Integrated Services Digital Network ITU - International Telecommunications Union kbps - kilobits per second Mbps - Megabits per second NATO - North Atlantic Treaty Organization NI2 - National ISDN 2 PCM-24 - Pulse Code Modulation 24 Channels PRI - Primary Rate Interface Q.931 - ITU Signaling Standard for ISDN SF - Superframe ST - ISDN BRI Four-Wire Interface SUT - System Under Test T1 - Digital Transmission Link level 1 (1.544 Mbps) TCP/IP - Transmission Control Protocol/ Internet Protocol TPC - Twisted Pair Copper U - ISDN BRI Two-Wire Interface				
Notes: 1 The SUT does not meet the GSCR exchange requirements for restoral to service from a local red alarm. SUT takes 30 seconds to recover versus 15 seconds. This is not a critical requirement. 2 The SUT does not meet the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement. 3 The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor. 4 ISDN T1 PRI trunkgroups using NI2 protocol send a Release Complete Message in lieu of a Disconnect Message with Cause 46 (Unavailable Resources). This is not considered a critical requirement as the user still receives a Blocked Precedence Announcement. 5 Analog E&M Signaling Type I did not pass the DSN preempt signals as required by the GSCR for the four types of preemption. Analog E&M Signaling Type I is not certified for use in the DSN. 6 ISDN supplemental services are currently not used in the DISN. The operational impact is none. 7 Analog instruments do not provide intra-switch call waiting. The operational impact is minor. 8 The SUT did not meet IPv6 requirements. The operational impact is minor. IPv6 is currently not used in the DSN and the DISN is scheduled to be completely converted from IPv4 to IPv6 in 2008. 9 NATO interface requirements are in accordance with the GSCR paragraph 10.8. Not all switches are required to perform this function. 10 The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR.				

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Table 5. SUT Exchange and Functional Requirements

Defense Switched Network	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange & Functional Requirements
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - System Interface <ul style="list-style-type: none"> • Non-secure Voice and Data • Secure Voice and Data (STU-III and STE) • NX56 kbps and NX64 kbps Synchronous Data (<i>TI ISDN PRI only</i>) • Non-secure and Secure FAX • VTC (<i>TI ISDN PRI only</i>) • Alarms - Integrated Services Digital Network (<i>TI ISDN PRI only</i>) - Attendant services² - System Administration, Measurements, and Service Standards - Y2K (Rollover, Valid, and Invalid Dates) - Screening, Zone Restriction, and DSN Access Restriction - Automated Message Accounting - Network Integration ANSI T1.619a (<i>TI ISDN PRI</i>)³
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP IN/DTMF OUT	No	
	PCM-24 T1 B8ZS/ESF ISDN PRI	Yes	
ANALOG E&M SIGNALING TYPE I	No		
Line Interfaces			
Interface & Signaling	Critical	Exchange & Functional Requirements	
TPC ISDN BRI ST and U Interface Q.931	Yes	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - ANSI T1.619a - ISDN supplemental services - Call Treatments - DSN Announcements - Attendant services² - VTC - NX56 kbps and NX64 kbps Synchronous Data - Non-secure Voice and Data - Secure Voice and Data (STE) 	
TPC 2-Wire Digital and Analog (Proprietary)	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - DSN Announcements - Traffic Measurements - Attendant services² - Call Treatments - Non-secure Voice 	
Voice over Internet Protocol IEEE 802.3, TCP/IP (H.323)	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - DSN Announcements - Traffic Measurements - Attendant services² - Call Treatments - Non-secure Voice - C2 Voice Grade Local Area Network 	

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Table 5. SUT Exchange and Functional Requirements (continued)

	Network Management Interfaces		
	Interface & Signaling	Critical	Exchange & Functional Requirements
	TPC EIA Asynchronous @ 9.6 kbps	No	- Automated Message Accounting - Traffic Measurements - Alarms - Man Machine Language
Tactical Network Gateway	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange & Functional Requirements
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	- MLPP - Non-secure Voice
NATO Gateway	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange & Functional Requirements
	Not tested	No	See note 5.
Commercial Network Gateway	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange & Functional Requirements
	Same Interfaces and Signaling as DSN	Yes	See note 6.
Legend: AMI - Alternate Mark Inversion ANSI - American National Standards Institute B8ZS - Bipolar Eight Zero Substitution BRI - Basic Rate Interface C2 - Command and Control CAS - Channel Associated Signaling DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multi-Frequency E&M - Ear and Mouth EIA - Electronic Industries Alliance ESF - Extended Superframe FAX - Facsimile GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan H.323 - Standard for multi-media communications on packet-based networks IEEE 802.3 - Institute of Electrical and Electronics Engineers, Inc., Ethernet protocol ISDN - Integrated Services Digital Network ITU - International Telecommunications Union kbps - kilobits per second Mbps - Megabits per second MLPP - Multi-Level Precedence and Preemption NATO - North Atlantic Treaty Organization NI2 - National ISDN 2 NX56 - Data format is restricted to multiples of 56 kbps NX64 - Data format is restricted to multiples of 64 kbps PCM-24 - Pulse Code Modulation 24 Channels PRI - Primary Rate Interface Q.931 - ITU Signaling Standard for ISDN SF - Superframe SS7 - Signaling System 7 ST - ISDN BRI Four-Wire Interface STE - Secure Terminal Equipment STU-III - Secure Telephone Unit-III SUT - System Under Test T1 - Digital Transmission Link level 1 (1.544 Mbps) T1.619a - SS7 and ISDN Signaling Standard for T1 TCP/IP - Transmission Control Protocol/ Internet Protocol TPC - Twisted Pair Copper U - ISDN BRI Two-Wire Interface VTC - Video Teleconferencing Y2K - Year 2000			
Notes: 1 The SUT does not meet the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement. 2 The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor. 3 ISDN T1 PRI trunkgroups using NI2 protocol send a Release Complete Message in lieu of a Disconnect Message with Cause 46 (Unavailable Resources). This is not considered a critical requirement as the user still receives a Blocked Precedence Announcement. 4 Analog instruments do not provide intra-switch call waiting. The operational impact is minor. 5 NATO interface requirements are in accordance with the GSCR paragraph 10.8. Not all switches are required to perform this function. 6 The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR.			

5. 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>.

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6. The JITC point of contact is Mr. John Hooper, DSN 879-5041, commercial (520) 538-5041, FAX DSN 879-4347, or e-mail to hooperj@fhu.disa.mil.

FOR THE COMMANDER:

3 Enclosures a/s

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ADDITIONAL REFERENCES

- (c) Defense Information Systems Agency (DISA) NS53, Memorandum, "DSN Network Management Requirements for End Offices," 2 August 2001
- (d) DISA NS53, Memorandum, "DSN Switch Network Management Interface," 26 July 2001
- (e) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01B, "Policy for Department of Defense Voice Services," 23 September 2001
- (f) DISA, Joint Interoperability and Engineering Organization (JIEO), Technical Report 8249, "Defense Information Systems Network (DISN) Circuit Switched Subsystem, Defense Switched Network (DSN) Generic Switching Center Requirements (GSCR)," March 1997
- (g) DISA NS53, Memorandum, "DSN Global Network Requirements for Tandem (Standalone), Multifunction, End Office, and Small End Office Switches," 30 January 2003
- (h) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP)," 17 June 1999
- (i) GSCR DSN Voice over Internet Protocol (VoIP Requirements), Appendix 3, 8 September 2003

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Nortel Networks Succession Defense Switched Network (DSN) 1000M Single-Group, Half-Group, and Multi-Group with Software Release 3.0 and Product Enhancement Packages listed in enclosure 3 (hereinafter referred to as the system under test [SUT]).

2. PROPONENT. Defense Information Systems Agency (DISA).

3. PROGRAM MANAGER. Mr. Howard Osman, Global Information Grid Combat Support Directorate (GS23), Room 5W23, 5275 Leesburg Pike, Falls Church, VA 22041, E-mail: Osmanh@ncr.disa.mil.

4. TESTERS. Joint Interoperability Test Command (JITC), Fort Huachuca, AZ.

5. SYSTEM UNDER TEST DESCRIPTION. The Nortel Networks Succession DSN 1000M product line includes the 1000M Single-Group, the 1000M Half-Group, and the 1000M Multi-Group, which utilize the same Voice over Internet Protocol (VoIP) Command and Control (C2) Voice Grade (VG) Local Area Network (LAN), software, and trunk/line card hardware as the SUT. JITC analysis determined the Succession DSN 1000M Half-Group and Multi-Group to be functionally identical to the SUT for interoperability purposes and they are also certified for joint use within the DSN. The SUT offers the following features: VoIP C2 VG LAN solution, scalable, distributed platform for growth from 200 to 2000 lines, modular client/server architecture for flexibility, scalability, and a redundant call processing core for extra reliability in mission-critical enterprises. Table 2-1 provides a comparison between the Nortel Networks product line as a standalone Time Division Multiplexer (TDM) switch versus a TDM switch enabled with VoIP.

Table 2-1. SUT Nortel Networks Succession DSN Product Line Comparison

TDM Switch	TDM Switch VoIP Enabled
Succession DSN Option 51C Digital Switching System	Succession DSN 1000M Half-Group
Succession DSN Option 61C Digital Switching System	Succession DSN 1000M Single-Group
Succession DSN Option 81C Digital Switching System	Succession DSN 1000M Multi-Group
Legend: DSN - Defense Switched Network SUT - System Under Test TDM - Time Division Multiplexer VoIP - Voice over Internet Protocol	

6. OPERATIONAL ARCHITECTURE. The Generic Switching Center Requirements (GSCR) operational DSN Architecture is depicted in figure 2-1.

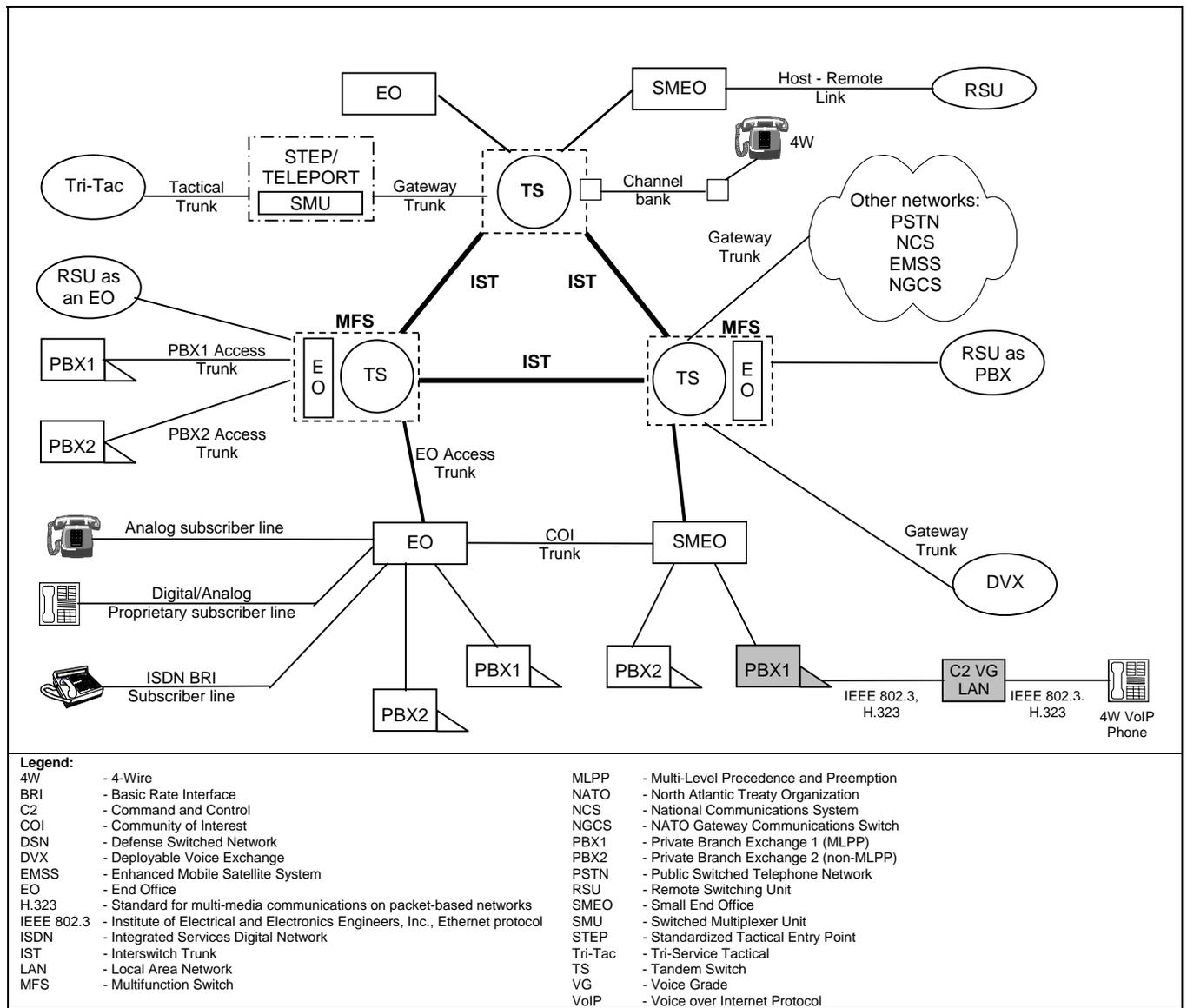


Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. This interoperability test status is based upon evaluation of the network interfaces as specified in:

- a. The Chairman of the Joint Chiefs of Staff (CJCS) policy for Department of Defense voice services: Tactical Network Gateway, North Atlantic Treaty Organization (NATO) Gateway, and Commercial Network Gateway.
- b. Interface and signaling requirements for trunk, line, and network management derived from the GSCR document.
- c. Interoperability Exchange Requirements (ERs) and Functional Requirements (FRs) derived from the GSCR.

d. The overall system interoperability performance derived from the Generic Switch Test Plan (GSTP).

The ERs and FRs for the CJCS network interfaces are indicated in table 2-2. The criticality and certification status of these interfaces can be found in paragraph 11. The test summary can be found in paragraph 11b.

Table 2-2. SUT Exchange and Functional Requirements

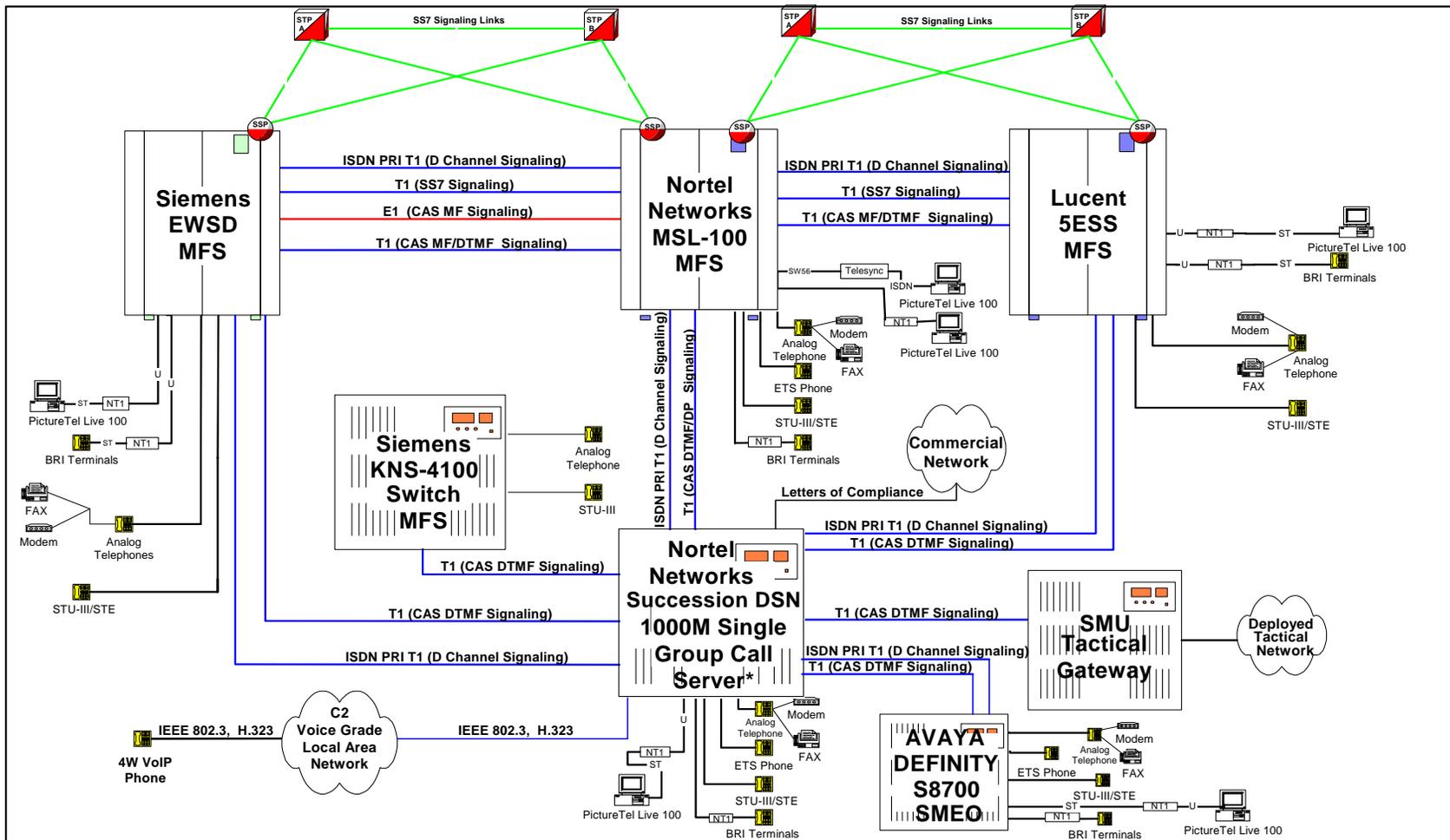
Defense Switched Network	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - System Interface <ul style="list-style-type: none"> • Non-secure Voice and Data • Secure Voice and Data (STU-III and STE) • NX56 kbps and NX64 kbps Synchronous Data (T1 ISDN PRI only) • Non-secure and Secure FAX • VTC (T1 ISDN PRI only) • Alarms - Integrated Services Digital Network (T1 ISDN PRI only) - Attendant services² - System Administration, Measurements, and Service Standards - Y2K (Rollover, Valid, and Invalid Dates) - Screening, Zone Restriction, and DSN Access Restriction - Automated Message Accounting - Network Integration - ANSI T1.619a (T1 ISDN PRI only)³
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP IN/DTMF OUT	No	
	PCM-24 T1 B8ZS/ESF ISDN PRI	Yes	
	Line Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
	TPC ISDN BRI ST and U Interface Q.931	Yes	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - ANSI T1.619a - ISDN Supplemental services - Call Treatments - DSN Announcements - Attendant services² - VTC - NX56 kbps and NX64 kbps Synchronous Data - Non-secure Voice and Data - Secure Voice and Data (STE)
	TPC 2-Wire analog	Yes	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - DSN Announcements - Traffic Measurements - Attendant services² - Call Treatments¹ - Non-secure Voice and Data - Non-secure and Secure FAX - Secure Voice and Data (STU-III and STE)
	TPC 2-Wire Digital and Analog (Proprietary)	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - DSN Announcements - Traffic Measurements - Attendant services² - Call Treatments - Non-secure Voice

Table 2-2. SUT Exchange and Functional Requirements (continued)

	Line Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
Defense Switched Network	Voice over Internet Protocol IEEE 802.3, TCP/IP (H.323)	No	<ul style="list-style-type: none"> - MLPP - Hotline services¹ - DSN Announcements - Traffic Measurements - Attendant services² - Call Treatments - Non-secure Voice - C2 Voice Grade Local Area Network
	Network Management Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
	TPC EIA Asynchronous @ 9.6 kbps	Yes	<ul style="list-style-type: none"> - Automated Message Accounting - Traffic Measurements - Alarms - Man Machine Language
Tactical Network Gateway	Trunk Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	<ul style="list-style-type: none"> - MLPP - Non-secure Voice
NATO Gateway	Interface & Signaling	Critical	Exchange and Functional Requirements
	Not tested	No	See note 5.
Commercial Network Gateway	Interface & Signaling	Critical	Exchange and Functional Requirements
	Same Interfaces and Signaling as DSN	Yes	See note 6.
Legend: AMI - Alternate Mark Inversion H.323 - Standard for multi-media communications on packet-based networks ANSI - American National Standards Institute B8ZS - Bipolar Eight Zero Substitution BRI - Basic Rate Interface IEEE 802.3 - Institute of Electrical and Electronics Engineers, Inc., Ethernet protocol C2 - Command and Control CAS - Channel Associated Signaling ISDN - Integrated Services Digital Network DP - Dial Pulse kbps - kilobits per second DSN - Defense Switched Network Mbps - Megabits per second DTMF - Dual Tone Multi-Frequency MLPP - Multi-Level Precedence and Preemption EIA - Electronic Industries Alliance NATO - North Atlantic Treaty Organization ESF - Extended Superframe NI2 - National ISDN 2 FAX - Facsimile NX56 - Data restricted to multiples of 56 kbps GSCR - Generic Switching Center Requirements NX64 - Data restricted to multiples of 64 kbps GSTP - Generic Switch Test Plan Notes: 1 The SUT does not meet all the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement. 2 The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor. 3 ISDN T1 PRI trunkgroups using NI2 protocol send a Release Complete Message in lieu of a Disconnect Message with Cause 46 (Unavailable Resources). This is not considered to be a critical requirement as the user still receives a Blocked Precedence Announcement (BPA). 4 Analog instruments do not meet the GSCR exchange requirements for intra-switch call waiting. The operational impact is minor. 5 NATO interface requirements are in accordance with the GSCR paragraph 10.8. Not all switches are required to perform this function. 6 The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR.			

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 four test configurations as shown in figures 2-2 through 2-5. Testing of the system's required functions and features was conducted using the notional test configuration depicted in figure 2-2. Per this configuration, the SUT was tested as the end-point in relation to the other switches. Network integration testing was conducted using the test configuration depicted in figure 2-3. These configurations accurately emulate the DSN operational environment. Figure 2-4 depicts the test configuration used to test the Advanced DSN

Integrated Management Support System network management required functions and features. Figure 2-5 depicts the C2 VG LAN configuration used to provide connectivity for VoIP.



Legend:

4W - 4-wire	H.323 - Standard for multi-media communications on packet-based networks	SMEO - Small End Office
BRI - Basic Rate Interface	IEEE 802.3 - Institute of Electrical and Electronics Engineers, Inc., Ethernet Protocol	SMU - Switch Multiplexer Unit
CAS - Channel Associated Signaling	ISDN - Integrated Services Digital Network	SS7 - Signaling System Number 7
C2 - Command and Control	Mbps - Megabits per second	ST - ISDN BRI 4-wire interface
DP - Dial Pulse	MF - Multi-Frequency	STE - Secure Terminal Equipment
DSN - Defense Switched Network	MFS - Multifunction Switch	STP - Signal Transfer Point
DTMF - Dual Tone Multi-Frequency	MSL - Meridian Switching Load	STU-III - Secure Telephone Equipment-III
E1 - European Basic Multiplex Rate (2.048 Mbps)	NT1 - Network Termination 1	SW56 - Switched 56
ETS - Electronic Telephone Set	PRI - Primary Rate Interface	T1 - Digital Transmission Link Level 1 (1.544 Mbps)
EWSD - Electronishes Wahl-System Digital		U - ISDN BRI 2-wire Interface
FAX - Facsimile		VoIP - Voice over Internet Protocol

* Although the Nortel Networks Succession DSN 1000M Single-Group Call Server was the system tested, the certification applies to the Nortel Networks Succession DSN 1000M Half-Group Call Server and 1000M Multi-Group Call Server.

Figure 2-2. Test Configuration

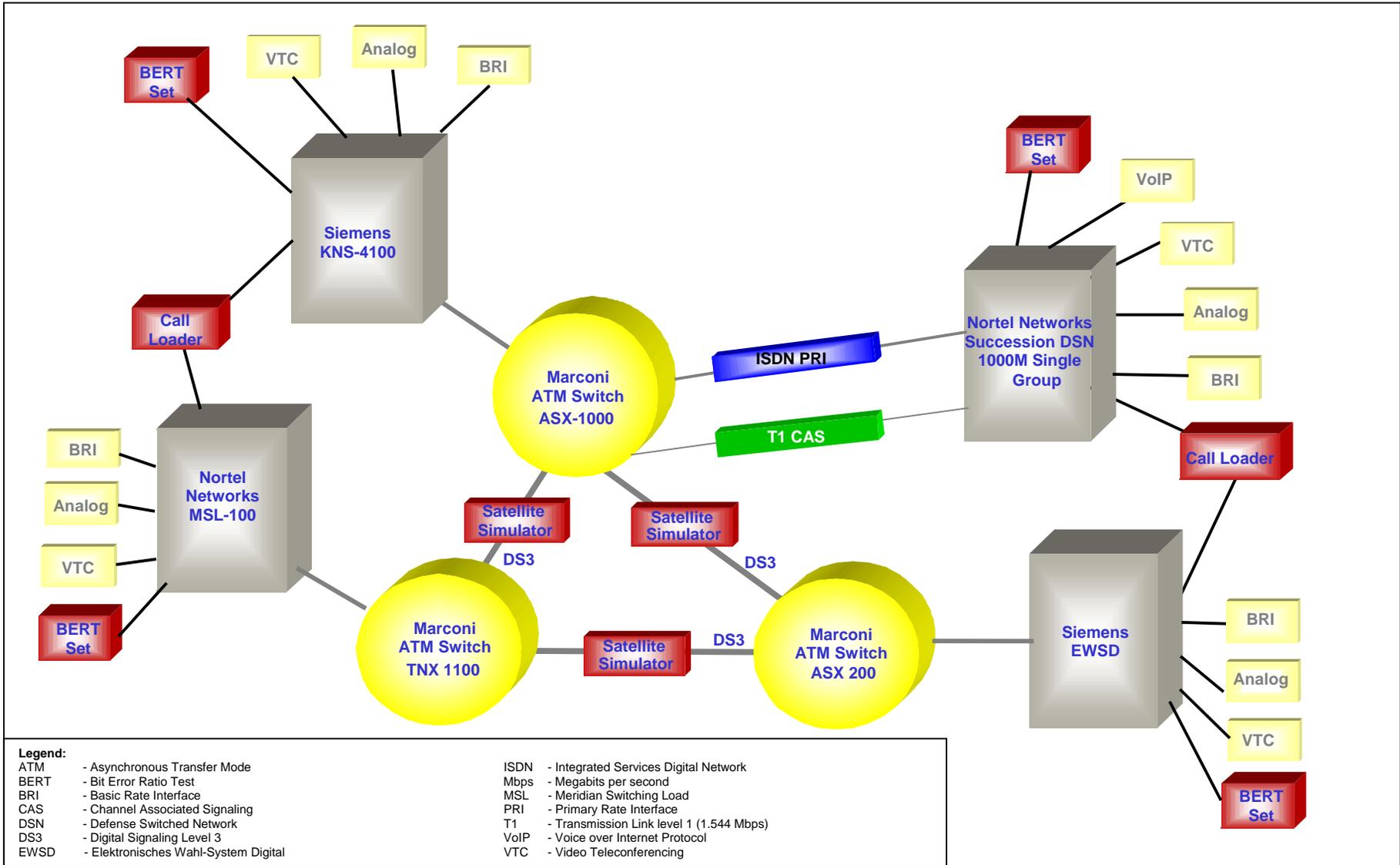


Figure 2-3. Network Integration Test Configuration

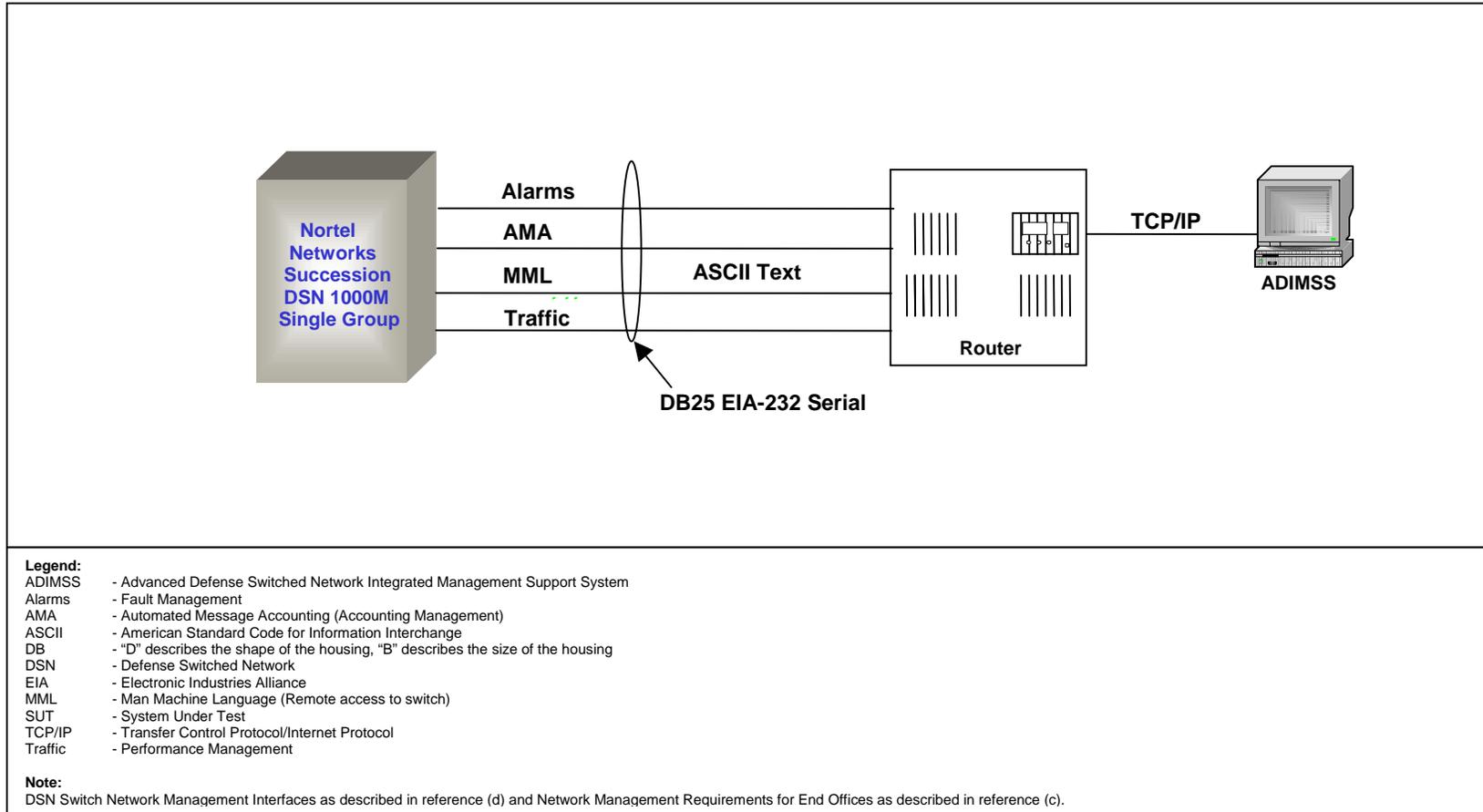


Figure 2-4. Test Configuration of the SUT ADIMSS Network Management System Interface

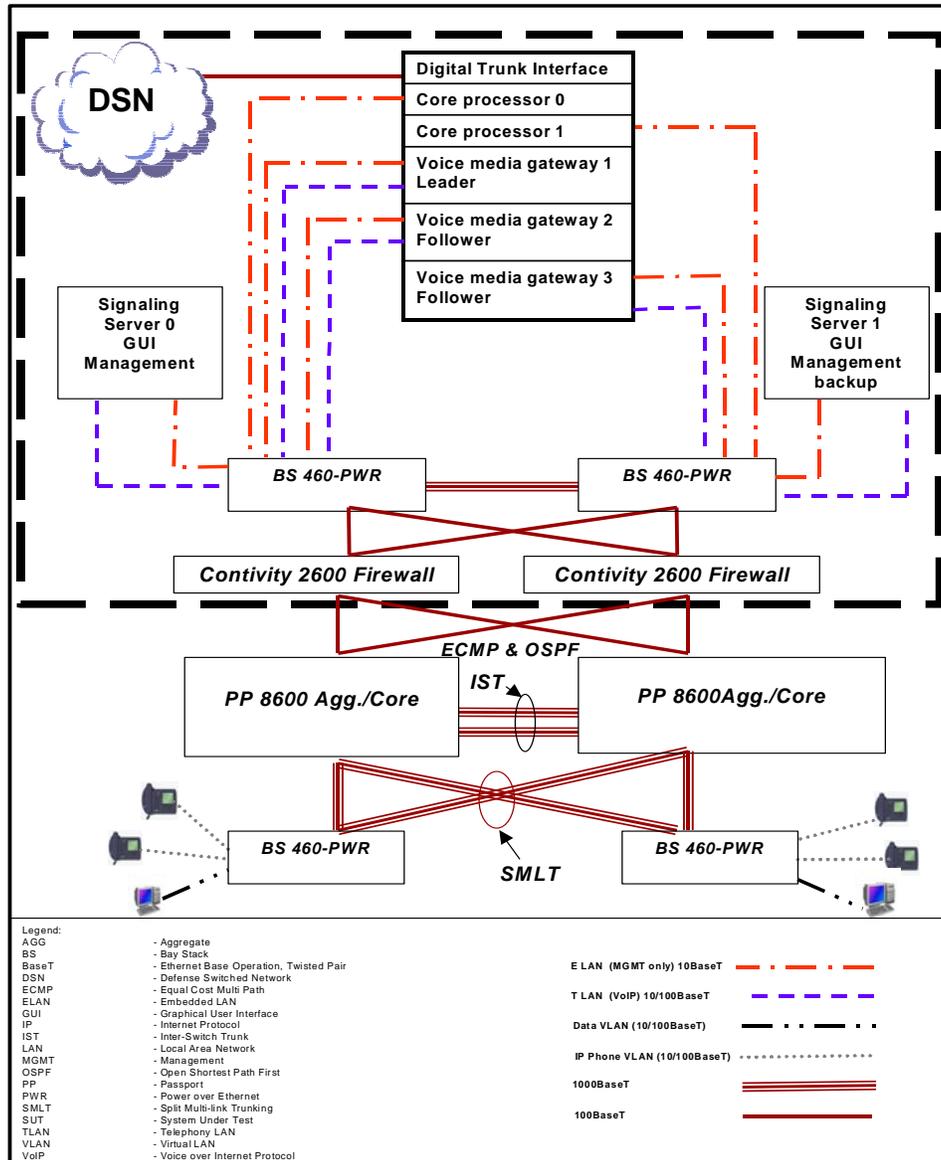


Figure 2-5. Test Configuration of the SUT Command and Control Voice Grade Local Area Network

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the system configurations and the C2 VG LAN hardware and associated software used in the test.

Table 2-3. Tested System Configurations

System Name	Software Release	
Nortel Networks Succession DSN 1000M Single Group	Product Engineering Code	Software Release
CORE Processor	NT5D03FB	3.0
Dual PRI Card	NT5D12AH	
Analog Line Card	NT8D09AK	
Digital Line Card	NT8D02GA	
Multipurpose ISDN Signaling Processor Card	NT6D73AA	
S/T BRI Interface Line Card	NT6D70AA	
Siemens EWSD	19d with Patch Set 32	
Nortel Networks MSL-100	SEO6	
Avaya MultiVantage S8700	R011x.7585.7.0.2	
Nortel Networks Succession DSN 1000M Cabinet	3.0	
Siemens KNS-4100	APS4V2.3	
Lucent Technologies 5ESS	5E16.2	
SMU 96 Tactical Gateway	RD302185	
MARCONI ATM switches	Versions 6.2 and 7.1	
Command and Control Voice Grade Local Area Network Components and Software		
Hardware	Software Release	
BS 460-PWR	3.0.55	
PP8600	3.5	
Contivity	4.75	
Signaling Server ¹	2.10.81	
Voice Media Gateway Card (PEC: NTVQ01BA)	IPL 3.1	
I2004 – Instrument	1.58	
I2002 – Instrument	1.58	
I2050 – Instrument	V333	
Legend:		
ATM - Asynchronous Transfer Mode	M - Meridian 1	
BS - Bay Stack	MSL - Meridian Switching Load	
DSN - Defense Switched Network	NM - Network Management	
EWSD - Elektronisches Wahl-System Digital	PP - Passport	
GUI - Graphical User Interface	PWR - Power over Ethernet	
I - Internet	SMU - Switch Multiplexer Unit	
IPL - Internet Protocol Line	STP - Signal Transfer Point	
Note:		
1. Signaling Server was certified for GUI NM interface only.		

10. TESTING LIMITATIONS. The Nortel Networks Succession DSN 1000M Single-Group was the only switch platform tested by JITC; however, the test results are applicable to the 1000M Half-Group and 1000M Multi-Group. The Nortel Networks Succession DSN 1000M Single-Group employs the same C2 VG LAN solution, software, and trunk/line card hardware as the 1000M Half-Group and 1000M Multi-Group. JITC analysis determined it to be functionally identical for certification purposes.

11. TEST RESULTS. Tables 2-4 through 2-8 synopsise the SUT interface ER and FR status and criticality. The identified test discrepancies detailed in paragraph 11a denote only those test discrepancies that remained open after software patches were applied and regression testing was completed.

Table 2-4. Defense Switched Network Trunk Interface and Exchange Requirements

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
PCM-24 T1 CAS (B8ZS/ESF) (AMI/SF) DTMF	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		System Interface (Alarms, non-secure voice and data, secure voice and data, FAX)	No	II-4.2	10.1 through 10.12	Yes	Met
		Attendant services	Yes	II-7.2	2.1.3	No	Met ²
		System Administration, Measurements, and Service Standards	No	II-8.2	9.1 through 9.5	Yes	Met
		Y2K (Rollover, Valid, Invalid) Dates	No	II-9.2, II-10.2, II-11.2	9.1	Yes	Met
		Screening, Zone Restriction, and DSN Access Restriction	No	II-12.2	5.3.4	Yes	Met
		AMA	No	II-14.2	8.1	Yes	Met
		Network Integration	No	II-20.2	10	Yes	Met

Table 2-4. Defense Switched Network Trunk Interface and Exchange Requirements (continued)

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
PCM-24 T1 CAS (B8ZS/ESF) (AMI/SF) DP IN/DTMF OUT	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		System Interface (Alarms, non-secure voice and data, secure voice and data, FAX, VTC)	No	II-4.2	10.1 through 10.12	Yes	Met
		Attendant services	Yes	II-7.2	2.1.3	No	Met ²
		System Administration, Measurements, and Service Standards	No	II-8.2	9.1 through 9.5	Yes	Met
		Y2K (Rollover, Valid, Invalid) Dates	No	II-9.2, II-10.2, II-11.2	9.1	Yes	Met
		Screening, Zone Restriction, and DSN Access Restriction	No	II-12.2	5.3.4	Yes	Met
		AMA	No	II-14.2	8.1	Yes	Met
		Network Integration	No	II-20.2	10	Yes	Met

Table 2-4. Defense Switched Network Trunk Interface and Exchange Requirements (continued)

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
PCM-24 T1 (B8ZS/ESF) ISDN PRI	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		System Interface (Alarms, non-secure voice and data, secure voice and data, FAX, VTC)	No	II-4.2	10.1 through 10.12	Yes	Met
		ISDN	No	II-6.2	6.6, 21.1, 21.2, 21.3	Yes	Met
		Attendant services	Yes	II-7.2	2.1.3	No	Met ²
		System Administration, Measurements, and Service Standards	No	II-8.2	9.1 through 9.5	Yes	Met
		Y2K (Rollover, Valid, Invalid) Dates	No	II-9.2, II-10.2, II-11.2	9.1	Yes	Met
		Screening, Zone Restriction, and DSN Access Restriction	No	II-12.2	5.3.4	Yes	Met
		AMA	No	II-14.2	8.1	Yes	Met
		Network Integration	No	II-20.2	10	Yes	Met
		ANSI T1.619a	No	II-6.2	21.3.1	Yes	Met ³

Table 2-4. Defense Switched Network Trunk Interface and Exchange Requirements (continued)

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
Analog E&M Signaling Type I	Not Certified	MLPP	Yes	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Not Met ⁴
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		System Interface (Alarms, non-secure voice and data, secure voice and data, FAX, VTC)	No	II-4.2	10.1 through 10.12	Yes	Met
		Attendant services	Yes	II-7.2	2.1.3	No	Met ²
		System Administration, Measurements, and Service Standards	No	II-8.2	9.1 through 9.5	Yes	Met
		Y2K (Rollover, Valid, Invalid) Dates	No	II-9.2, II-10.2, II-11.2	9.1	Yes	Met
		Screening, Zone Restriction, and DSN Access Restriction	No	II-12.2	5.3.4	Yes	Met
		AMA	No	II-14.2	8.1	Yes	Met
		Network Integration	No	II-20.2	10	Yes	Met

Legend:

AMA - Automated Message Accounting
 AMI - Alternate Mark Inversion
 ANSI - American National Standards Institute
 B8ZS - Bipolar Eight Zero Substitution
 CAS - Channel Associated Signaling
 DP - Dial Pulse
 DSN - Defense Switched Network
 DTMF - Dual Tone Multi-Frequency
 E&M - Ear and Mouth
 ER - Exchange Requirement
 ESF - Extended Superframe
 FAX - facsimile
 FR - Functional Requirement
 GSCR - Generic Switching Center Requirements
 GSTP - Generic Switch Test Plan
 ISDN - Integrated Services Digital Network

ITU - International Telecommunications Union
 Mbps - Megabits per second
 MLPP - Multi-Level Precedence and Preemption
 NI2 - National ISDN 2
 Para - Paragraph
 PCM-24 - Pulse Code Modulation 24 Channels
 PRI - Primary Rate Interface
 Q.931 - ITU Signaling Standard for ISDN
 SF - Superframe
 SS7 - Signaling System 7
 SUT - System Under Test
 T1 - Digital Transmission Link Level 1 (1.544 Mbps)
 T1.619a - SS7 and ISDN Signaling Standard for T1
 TCP/IP - Transmission Control Protocol/ Internet Protocol
 VTC - Video Teleconferencing
 Y2K - Year 2000

Notes:

- The SUT does not meet the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement.
- The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor.
- ISDN T1 PRI trunkgroups using NI2 protocol send a Release Complete Message in lieu of a Disconnect Message with Cause 46 (Unavailable Resources). This is not considered a critical requirement as the user still receives a Blocked Precedence Announcement.
- Analog E&M Signaling Type I did not pass the DSN preempt signals as required by the GSCR for the four types of preemption. This is not a critical requirement for a Private Branch Exchange. Analog E&M Signaling Type I is not certified for use in the DSN.

Table 2-5. Defense Switched Network Line Interface and Exchange Requirements

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
TPC, ISDN BRI ST and U, Q.931	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	Yes	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		ANSI T1.619a	No	II-6.2	21.3.1	Yes	Met
		ISDN supplemental services	Yes	II-6.2	21.3	No	Not Met ²
		Attendant services	Yes	II-7.2	2.1.3	No	Met ³
		Call Treatments	No	II-15.2	5.2.1.1, 5.2.2.1	Yes	Met
		DSN Announcements	No	II-19.2	5.6	Yes	Met
TPC, 2-Wire Analog	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	Yes	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		Attendant services	Yes	II-7.2	2.1.3	No	Met ²
		Call Treatments	No	II-15.2	5.2.1.1, 5.2.2.1	Yes	Met
		DSN Announcements	No	II-19.2	5.6	Yes	Met

Table 2-5. Defense Switched Network Line Interface and Exchange Requirements (continued)

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
TPC 2-Wire Digital (Proprietary)	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	No	Met
		Hotline services	Yes	II-3.2	21.3.10	No	Not Met ¹
		Attendant services	Yes	II-7.2	2.1.3	No	Met ³
		Call Treatments	No	II-15.2	5.2.1.1, 5.2.2.1	No	Met
		DSN Announcements	No	II-19.2	5.6	No	Met
Voice over Internet Protocol IEEE 802.3, TCP/IP (H.323)	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	No	Met
		Attendant services	Yes	II-7.2	2.1.3	No	Met ³
		Call Treatments	No	II-15.2	5.2.1.1, 5.2.2.1	No	Met
		DSN Announcements	No	II-19.2	5.6	No	Met
		Command and Control Voice Grade Local Area Network	Yes	Appendix D-26	Appendix 3, GSCR 08 Sep 03	No	Met ⁴

Legend:

ANSI	- American National Standards Institute	ITU	- International Telecommunications Union
BRI	- Basic Rate Interface	Mbps	- Megabits per second
DSN	- Defense Switched Network	MLPP	- Multi-Level Precedence and Preemption
DISN	- Defense Information Systems Network	Para	- Paragraph
ER	- Exchange Requirement	Q.931	- ITU Signaling Standard for ISDN
FR	- Functional Requirement	SS7	- Signaling System 7
GSCR	- Generic Switching Center Requirements	ST	- ISDN BRI 4-Wire Interface
GSTP	- Generic Switch Test Plan	SUT	- System Under Test
H.323	- Standard for multi-media communications for packet-based networks	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
IEEE 802.3	- Institute of Electrical and Electronics Engineers, Inc., Ethernet protocol	T1.619a	- SS7 and ISDN Signaling Standard for T1
IPv4	- Internet Protocol Version 4	TCP/IP	- Transmission Control Protocol/ Internet Protocol
IPv6	- Internet Protocol Version 6	TPC	- Twisted Pair Copper
ISDN	- Integrated Services Digital Network	U	- ISDN BRI 2-Wire Interface

Notes:

- SUT does not meet all the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement.
- ISDN supplemental services currently not used in the DISN. The operational impact is minor.
- The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor.
- The SUT did not meet IPv6 requirements. The operational impact is minor. IPv6 is currently not used in the DSN and the DISN is scheduled to be completely converted from IPv4 to IPv6 in 2008.

Table 2-6. Defense Switched Network Network Management Interface and Exchange Requirements

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
TPC EIA Asynchronous @ 9.6 kbps	Certified	AMA	No	II-23.2	2.1.10, 16.1	Yes	Met
		Traffic Measurements	No	II-23.2	2.1.10, 16.1	Yes	Met
		MML	No	II-23.2	2.1.10, 16.1	Yes	Met
		Alarms	No	II-23.2	2.1.10, 16.1	Yes	Met
Legend: AMA - Automated Message Accounting EIA - Electronic Industries Alliance ER - Exchange Requirement FR - Functional Requirement GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan kbps - kilobits per second MML - Man Machine Language Para - Paragraph TPC - Twisted Pair Copper							

Table 2-7. Tactical Network Gateway Interface and Exchange Requirements

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
PCM-24 T1 (B8ZS/ESF) (AMI/SF) DTMF	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	No	Met
		Non-secure Voice	Yes	NA	2.2.1, 5.3.4	No	Met
Legend: AMI - Alternate Mark Inversion B8ZS - Bipolar Eight Zero Substitution DTMF - Dual Tone Multi-Frequency ER - Exchange Requirement ESF - Extended Superframe FR - Functional Requirement GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan Mbps - Megabits per second MLPP - Multi-Level Precedence and Preemption NA - Not Applicable Para - Paragraph PCM-24 - Pulse Code Modulation 24 channels SF - Superframe T1 - Digital Transmission Link level 1 (1.544 Mbps)							

Table 2-8. Commercial Network Gateway Interface and Exchange Requirements

Interface & Signaling	Interface Status	Exchange and Functional Requirements	Test Discrepancies	GSTP Para(s)	GSCR Para(s)	Critical Yes/No	ER/FR Status
Same Interfaces Signaling as DSN	Certified	See Note	No	See Note	See Note	Yes	Met
<p>Legend: DSN - Defense Switched Network ER - Exchange Requirement FR - Functional Requirement GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan Para - Paragraph</p> <p>Note: The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR.</p>							

a. Discussion

(1) DSN

(a) All critical interface ERs and FRs for DSN were met. The following minor exceptions are noted:

1. The SUT does not meet the following GSCR requirement: recovery from a local red alarm within the allowed time period on a Pulse Code Modulation-24 channel (PCM-24) interface. It takes approximately 30 seconds for a PCM-24 interface on the SUT to recover from a red alarm. The GSCR requirement for recovery from a local red alarm is 15 seconds plus or minus 5 seconds. The operational impact is minor.

2. The SUT Analog Ear and Mouth (E&M) Signaling Type I trunking is not certified. The SUT's E&M trunks do not meet the GSCR requirements for DSN preempt signals. This is not a critical requirement for a Private Branch Exchange (PBX).

3. The SUT does not meet the Bellcore standard for American National Standards Institute (ANSI) T1.619a Primary Rate Interface (PRI) Interface Identifier Present Value. Bellcore SR-NWT-002343 P.8-72 requires that when the Digital Signal Level 1 identified contains the data channel carrying this information element the interface should be identified as value "0" (implicitly identified). The SUT ANSI T1.619a PRI Interface sends the incorrect interface identifier, present value of "1" (explicitly identified). There was no noted discrepancy during interoperability certification testing. The operational impact is minor.

4. The SUT Attendant Console does not meet the following requirement: Automatic Recall of Attendant Console, "camp-on" feature as required in table 2-3 Attendant Features, GSCR para 2.1.3. The operational impact is minor.

5. The SUT does not support route digit 5 or 6 for hotline services. This is not a critical requirement for a PBX.

6. The SUT does not support the following unique Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) Supplemental Services as specified in the respective GSCR paragraphs listed below. There are currently no switches in the Defense Information Systems Network that support ISDN BRI Supplemental Services. The operational impact is minor.

a. Conference Calling. GSCR Para. 21.3.2

b. User-to-User Signaling. GSCR Para. 21.3.3

c. Call Hold. GSCR Para. 21.3.4

- d. Call Waiting. GSCR Para. 21.3.5
- e. Normal Call Transfer. GSCR Para. 21.3.6
- f. Explicit Call Transfer. GSCR Para. 21.3.7
- g. ISDN Call Deflection. GSCR Para. 21.3.8
- h. Preset Conference Calling. GSCR Para. 21.3.11

7. The SUT does not support intra-switch call waiting on analog instruments. Inter-switch precedence call waiting is supported on all instrument types on the SUT. The operational impact is minor.

8. The SUT's Dual Rate Interface card (NT5D12AG) deactivates itself after a period of inactivity. PRI trunkgroups on the SUT that have been inactive for a period of two weeks or longer go into a "sleep" mode. In order to restore the trunkgroup it is necessary to physically reseal the associated Dual Rate Interface card. This issue is not considered to be a critical exception because the SUT's PRI trunkgroup sends a yellow alarm towards the distant node switch until it is restored. The operational impact is minor.

9. The SUT does not meet the ANSI T1.619 1992, ANSI T1.619a 1994, standards for ISDN ANSI T1.619a PRI National ISDN 2 (NI2) protocol with unavailable resources, Blocked Precedence Announcement. The SUT's ANSI T1.619a ISDN PRI trunkgroups using NI2 protocol send a release complete message in lieu of a disconnect message with cause value 46 (unavailable resources). There was no noted discrepancy during interoperability testing with this anomaly. The operational impact is minor.

(b) VoIP. The SUT VoIP solution is comprised of the 1000M Option 61C (TDM) circuit switch and the C2 VG LAN as shown in figure 2-5. The C2 VG LAN infrastructure consists of the equipment listed in table 2-3. The results for the overall VoIP system and C2 VG LAN, as defined by the GSCR Appendix 3, are presented below.

1. VoIP System. GSCR appendix 3, section A3.2, outlines the requirements for the VoIP system. The VoIP system requirements encompass end-to-end VoIP requirements (i.e., encompasses both the circuit switch and C2 VG LAN). The following paragraphs detail the results of the SUT VoIP solution.

a. Voice Quality. Per the GSCR, appendix 3, VoIP calls shall have an average Mean Opinion Score (MOS) score of at least 4.0 as measured over a 5-minute period. For intra-switch calls, the SUT VoIP solution measured MOS of 4.14. Inter-switch calls measured MOS of 4.30. This average was based a total of 50 intra-switch and inter-switch calls.

b. Codec. Per the GSCR, appendix 3, section A3.2.2, the G.711 Pulse-Code Modulation (PCM) codec was required and was met by the SUT VoIP solution.

c. Multi-Level Precedence and Preemption (MLPP). The GSCR section 3 details the requirements for MLPP. All critical MLPP features and functions were met by the SUT VoIP system. There are no mature standards for MLPP over Internet Protocol (IP); as a result the vendor is required to implement proprietary IP signaling.

d. Security. Security requirements per the GSCR appendix 3, were verified using the Information Assurance Test Plan. Results of the security testing are reported in a separate test report generated by the DISA Information Assurance test personnel.

e. Network Management (NM). The GSCR Appendix 3 defines the overall NM requirements that the VoIP system must meet. The SUT VoIP system met these NM requirements. The switching system NM requirements per the GSCR section 9 were also met by the SUT.

f. Synchronization. Synchronization is required for overall voice platforms to include VoIP systems. For the SUT VoIP solution, synchronization per the GSCR, section 11, was met. The SUT VoIP solution derived synchronization with line timing mode via traditional TDM based interfaces (i.e., T1 or E1 digital).

g. Latency. The requirement for one-way system latency for the VoIP system is 60 milliseconds (msec) or less as averaged over any 5-minute period. The latency requirement is measured from IP handset to the egress trunk. The SUT average latency over 50 calls was measured at 50.1 msec.

h. Internet Protocol version 6 (IPv6). The GSCR, appendix 3, states that the C2LAN components must be IPv6 capable. The VoIP components provided did not support this requirement. The operational impact is minor due to the fact that IPv6 is not currently implemented within the DSN and is not scheduled to be fully implemented until 2008.

2. Local Area Network. The SUT/Nortel LAN solution as shown in figure 2-5 and table 2-3 met the minimum interoperability requirements of the GSCR, appendix 3. The network consisted of two main components: the core switches and the access switches. The Nortel Networks LAN solution used several industry standards to provide resiliency and quality of service.

a. Design

(i) Delay. Per the GSCR, appendix 3, section A3.3.1.1, the one-way packet delay, the amount of time a packet takes to traverse the network, will

be 5 msec or less, as measured over a 5 minute period. The averaged one-way delay measured in the SUT VoIP solution was 1.12 msec.

(ii) Jitter. Jitter buffer in all IP phones and on the Voice Gateway Media Card (VGMC), are set to hold one 20-msec packet. With a 40% bandwidth load, no jitter was measured.

(iii) Packet Loss. Network packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 3, states that LANs shall be engineered so the measured voice packet loss within the LAN shall not exceed 0.05% averaged over any five-minute period. With 40% bandwidth load, the measured packet loss was 0.0005% for the Nortel Networks LAN infrastructure utilized.

(iv) Class of Service (CoS) and Quality of Service (QoS). The GSCR, appendix 3, outlines several methodologies to implement CoS and QoS. Differentiated Services Code Point (DSCP) at the Network Layer (L3) was employed. DSCP L3 signaling was set for 40 and voice was set at 46. The SUT/Nortel solution provides CoS by assignment of 802.1p/Q tags. These tags are implemented on all tagged trunks between the baystack and Passport 8600 core switch. Switches within the topology were configured with multiple Virtual LANs (VLANs) to separate data, voice and management traffic. The 802.1Q tags were used to uniquely identify and separate traffic as it passed through network connections. Voice VLAN traffic was assigned to a high priority queue, ensuring voice traffic took precedence over data traffic.

b. Traffic Engineering

(i) The SUT IP VGMC cards have a can only support 64 IP subscribers and still meet DSN redundancy requirements assured connectivity requirements. To determine the number of VGMCs per switch, the following formula must be used:

$$\text{Total number of Voice Gateway Media Cards} = \text{total VoIP users} / 64.$$

For redundancy purposes, the number of VGMCs shall be implemented on an n+1 basis (i.e., for 64 users, the system requires two VGMCs).

(ii) Core to Core. Redundant Inter-Switch Trunks, are implemented between the two core switches allowing the redundant transport of layer 2 VLAN traffic and layer 3 routed traffic while providing sub-second fail over.

(iii) Core to Access. Access switches require layer 2 and 3 redundancy to ensure traffic integrity. The GSCR, appendix 3, requires that LAN devices provide a redundancy protocol for the distribution and core devices. For this Layer 2 solution, Nortel implemented Split Multi Link Trunking (SMLT). SMLT will be used for sub-second Layer 2 recovery. Spanning Tree Protocol will not be supported

and thus must be turned off on any existing edge to core links. For Layer 3, Virtual Router Redundancy Protocol (VRRP) will be used for sub-second failover.

(iv) Core to Firewall. Equal Cost Multi Path routed links using Open Shortest Path First is used to route traffic.

(v) Firewall to Access (Switch). VRRP (active-active) will be used for stateful firewall failover.

c. Management. The GSCR, appendix 3, requires that the vendor provide a management system to monitor the performance of the LAN portion of the VoIP system. Due to numerous third party systems and applications capable of performing this function, this requirement was verified via vendor letter of compliance. Signaling Servers in figure 2-5 are used for Graphical User Interface only. These servers cannot be used for phone registration; they do not meet the requirements set forth by the GCSR, appendix 3. Phone registration must be accomplished on the VGMC.

d. Phones. The SUT VoIP phones that met all critical interoperability requirements were the i2002 and i2004 phones. Although the phones are capable of shared access (i.e., same switch port is shared by Personal Computer (PC) and IP phone), the dedicated access was tested (separate ports for phones and PCs).

e. Scalability. The SUT can support 14 VGMC cards, which limits the maximum IP subscribers to 896. The SUT VoIP solution tested consisted of two Passport 8600s, four Baystack 460-24T-PWR Switches (two as phone access switches and two as access switches for the C2 VG LAN to connect to the TDM switch), and two Contivity 2600s (used as firewalls) as shown in figure 2-5. For implementation purposes, the C2 VG LAN can be scaled to meet the maximum number of IP phone subscribers as long as it's comprised of the equipment and software listed, and meets the traffic engineering constraints contained in the GSCR, appendix 3.

(2) Tactical Network Gateway. All interface ERs and FRs for the tactical network gateway were met.

(3) NATO Gateway. The NATO Gateway interfaces were not tested.

(4) Commercial Network Gateway. The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR, with minor exceptions. Exceptions were reviewed and assessed by DISA GS23, the Development and Operational Engineering Department, and determined to have a minor operational impact.

b. Test Summary. The Nortel Networks Succession DSN 1000M Single-Group, 1000M-Half Group, and 1000M Multi-Group with software release 3.0 and product enhancement packages listed in enclosure 3, are certified for joint use as a PBX1 and PBX2 in the DSN in accordance with the GSCR. Minor discrepancies identified during testing and the GSCR requirements not tested will have a minor operational impact. The interoperability summary and status to include criticality for each interface are shown in tables 2-9 and 2-10.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed per 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>.

Table 2-9. SUT Interoperability Summary

Network	Status	Remarks
DSN	Certified	- Certified as a PBX1 and PBX2. - Certified for VoIP with C2 Voice Grade Local Area Network. - The identified test discrepancies shown in enclosure 2 that remained open have an overall minor operational impact.
Tactical Gateway	Certified	- All requirements met.
NATO Gateway	Not Tested	
Commercial Gateway	Certified	- All requirements met.
Legend: C2 - Command and Control DSN - Defense Switched Network NATO - North Atlantic Treaty Organization PBX - Private Branch Exchange SUT - System Under Test VoIP - Voice over Internet Protocol		

Table 2-10. SUT Interoperability Status

	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
Defense Switched Network	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP IN/DTMF OUT	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³
	PCM-24 T1 (B8ZS/ESF) ISDN PRI	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Restoral to service from a local red alarm not met. ¹ Hotline services not met. ² Attendant services automatic recall not met. ³ NI2 Protocol provides a Release Complete Message in lieu of a Disconnect Message for Unavailable Resources. ⁴
	Analog E&M Signaling Type I	No	Not Certified	Did not pass DSN preempt signals. ⁵

Table 2-10. SUT Interoperability Status (continued)

	Line Interfaces			
	Interface & Signaling	Critical	Status	Remarks
Defense Switched Network (continued)	TPC ISDN BRI ST and U Interface Q.931	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ¹ ISDN Supplemental services not met. ⁶ Attendant services automatic recall not met. ³
	TPC 2-Wire analog	Yes	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³ Does not support Intra-switch call waiting. ⁷
	TPC 2-Wire Digital (Proprietary)	No	Certified	Met all ERs and FRs with the following minor exceptions: Hotline services not met. ² Attendant services automatic recall not met. ³
	Voice over Internet Protocol IEEE 802.3, H.323	No	Certified	Met all ERs and FRs with the following minor exceptions: Attendant services automatic recall not met. ³ IPv6 not met. ⁸
	Network Management Interfaces			
Interface & Signaling	Critical	Status	Remarks	
TPC EIA Asynchronous @ 9.6 kbps	Yes	Certified	Met all critical ERs and FRs.	
Tactical Network Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	Certified	Met all ERs and FRs.	
NATO Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	No	Not Tested		
Commercial Network Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
Same Interfaces and Signaling as DSN	Yes	Certified	See note 8.	

Legend:

AMI - Alternate Mark Inversion	IPv4 - Internet Protocol Version 4
B8ZS - Bipolar Eight Zero Substitution	IPv6 - Internet Protocol Version 6
BRI - Basic Rate Interface	ISDN - Integrated Services Digital Network
CAS - Channel Associated Signaling	ITU - International Telecommunications Union
DP - Dial Pulse	kbps - kilobits per second
DISN - Defense Information Systems Network	Mbps - Megabits per second
DSN - Defense Switched Network	NATO - North Atlantic Treaty Organization
DTMF - Dual Tone Multi-Frequency	Ni2 - National ISDN 2
E&M - Ear and Mouth	PCM-24 - Pulse Code Modulation 24 Channels
EIA - Electronic Industries Alliance	PRI - Primary Rate Interface
ERs - Exchange Requirements	Q.931 - ITU Signaling Standard for ISDN
ESF - Extended Superframe	SF - Superframe
FRs - Functional Requirements	ST - ISDN BRI Four-Wire Interface
GSCR - Generic Switching Center Requirements	SUT - System Under Test
GSTP - Generic Switch Test Plan	T1 - Digital Transmission Link level 1 (1.544 Mbps)
H.323 - Standard for multi-media communications for packet-based networks	TPC - Twisted Pair Copper
IEEE 802.3 - Institute of Electrical and Electronics Engineers, Inc., Ethernet protocol	U - ISDN BRI Two-Wire Interface

Notes:

- The SUT does not meet the GSCR exchange requirements for restoral to service from a local red alarm. SUT takes 30 seconds to recover versus 15 seconds. This is not a critical requirement.
- The SUT does not meet the GSCR exchange requirements for Hotline services. Hotline services are not a critical requirement.
- The SUT's attendant console does not support automatic recall of attendant. The operational impact is minor.
- ISDN T1 PRI trunkgroups using Ni2 protocol send a Release Complete Message in lieu of a Disconnect Message with Cause 46 (Unavailable Resources). This is not considered a critical requirement as the user still receives a Blocked Precedence Announcement.
- Analog E&M Signaling Type I did not pass the DSN preempt signals as required by the GSCR for the four types of preemption. Analog E&M Signaling Type I is not certified for use in the DSN.
- ISDN supplemental services are currently not used in the DISN. The operational impact is none.
- Analog instruments do not provide intra-switch call waiting. The operational impact is minor.
- The SUT did not meet IPv6 requirements. The operational impact is minor. IPv6 is currently not used in the DSN and the DISN is scheduled to be completely converted from IPv4 to IPv6 in 2008.
- The certification of interoperability with commercial networks was verified based on the review of the vendor's letter of compliance to requirements identified as the "Letter" and "Verify" items listed in appendix E of the GSTP and specified in tables 2-1 through 2-15 of the GSCR.

Table 3-1. SUT Product Enhancement Packages

Core Software Patch List		
Patch ID Number	CR Number	Description
MPLR17817	Q00758895	DSN: Tandem ATVN MCDN trunk 2nd call fails after preemption
MPLR18070	Q00786849	Preemption of a partially dialed routine precedence call
MPLR18220	Q00802114	DSN: Bug 30 messages during Tandem calls
MPLR18263	Q00817316	Option 11C switch reinitializes due to CDR-Q procedure
MPLR18302	Q00841477	NI2 DID Tandem to ATVN
MPLR18622	Q00888789	This patch was developed to suppress password information on the switches in LD 22.
Legend: ATVN - Autovon CDR-Q - Call Detail Recording-Queue CR - Call Report DID - Direct Inward Dial DSN - Defense Switched Network ID - Identification ISDN - Integrated Services Digital Network LD - Overlay MCDN - Meridian Customer Defined Network MPLR - Meridian Patch Library Reference NI2 - National ISDN 2 SUT - System Under Test		