



DEFENSE INFORMATION SYSTEMS AGENCY

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

23 June 2004

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of Avaya G3CSI (ProLogix) with Software Release Communications Manager (CM) 2.01 (R012i.00.1.221.1) and G3C with Software Release CM 2.01 (R012c.00.1.221.1) Digital Switching Systems (Includes Voice over Internet Protocol)

References: (a) DOD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(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, Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification. Additional references are provided in enclosure 1.
2. The Avaya G3CSI (ProLogix) Digital Switching System with Software Release CM 2.01 (R012i.00.1.221.1) including Voice Over Internet Protocol (VoIP), hereinafter referred to as the system under test (SUT), met all of its critical interoperability requirements and is certified as interoperable for joint use within the Defense Switched Network (DSN). The Avaya G3C digital switching system employs the same software and trunk/line card hardware as the SUT. JITC analysis determined the G3C to be functionally identical for interoperability certification purposes and the G3C with Software Release CM 2.01 (R012c.00.1.221.1) including VoIP is also certified for joint use within the DSN. The switching systems and their respective software releases covered under this certification are listed in table 1. 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 an overall minor operational impact. The SUT was tested and met the critical interoperability requirements for the following DSN switch types: Private Branch Exchange (PBX) 1 and PBX 2. This certification expires upon changes that could affect interoperability, but no later than three years from the date of this memorandum.
3. This finding is based on interoperability testing conducted by the JITC. Testing was conducted at the JITC facility at Ft. Huachuca, AZ, from 11 August through 20 December 2003. Enclosure 2 documents the test results and describes the tested network and systems configurations. System interoperability should be verified before deployment in an operational environment that varies significantly from the test environment.

JITC Memo, JTE, Special Interoperability Test Certification of Avaya G3CSI (ProLogix) with Software Release Communications Manager (CM) 2.01 (R012i.00.1.221.1) and G3C with Software Release CM 2.01 (R012c.00.1.221.1) Digital Switching Systems (Includes Voice over Internet Protocol)

4. The Command and Control (C2) Voice Grade (VG) Local Area Network (LAN) certified hardware and software components are listed 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 the DSN are listed in table 5. The Avaya switch product line offers a Remote Switch Unit capability referred to as the Survivable Remote Processor Expansion Port Network. Preliminary testing was performed on this capability but is not covered in this certification. This product line also offers a Voice over Internet Protocol capability. This capability was tested and is covered by this certification. This interoperability test status is based upon evaluation of:

- a. The following network interfaces as specified in reference (c): DSN and Public Switched Telecommunications Network.
- b. The interface and signaling requirements for trunk/line interfaces, and interoperability ERs and FRs derived from references (d) and (e).
- c. The overall system interoperability performance derived from test procedures listed in reference (f).
- d. A review of the Letters of Compliance submitted by Avaya.

Table 1. Certified Avaya Systems Software Releases

Software Release	Software Medium	Switch Platform
R012i.0.1.221.1 (See note)	PCMCIA	AVAYA G3CSI
R012c.0.1.221.1 (See note)	PCMCIA	AVAYA G3C
Legend: PCMCIA – Personal Computer Memory Card International Association Note: The software is the same; however, Avaya distinguishes the different mediums and platforms by the 5 th character of the Software Release (e.g., i or c).		

JITC Memo, JTE, Special Interoperability Test Certification of Avaya G3CSI (ProLogix) with Software Release Communications Manager (CM) 2.01 (R012i.00.1.221.1) and G3C with Software Release CM 2.01 (R012c.00.1.221.1) Digital Switching Systems (Includes Voice over Internet Protocol)

Table 2. C2 VG LAN Component Hardware and Software

Hardware	Software Release
Extreme Summit 48si	6.2.2B134
Extreme Summit 200-24	6.2E2B16
Extreme Alpine 3804	6.2.2B134
Extreme Alpine 3808	6.2.2B134
Card SMMi (45014)	See Note.
Card GM – 4X (45112)	See Note.
Card GM – 4S (45110)	See Note.
Extreme Black Diamond 6804	6.2.2B134
Extreme Black Diamond 6808	6.2.2B134
Card MSM64 (50015)	See Note.
Card G8X (51032)	See Note.
Card F48T (52011)	See Note.
Phone – 4620IP	DEF 20R2_0

Legend:

C2	- Command and Control	MSM	- Management Switch Module
F	- Fast Ethernet	SMM	- Switch Management Module
G	- Gigabit	s	- Small Profile
GM	- Gigabit Module	T	- Twisted pair copper
i	- Inferno Chip Set	VG	- Voice Grade
IP	- Internet Protocol	X	- Gigabit interface converter based
LAN	- Local Area Network		

Note: There is no software version.

Table 3. Avaya G3CSI Digital Switching System Interoperability Summary

Network	Critical	Status	Remarks
DSN	Yes	Certified	- Certified for VoIP with C2 Voice Grade Local Area Network. ¹ - Certified as PBX1 and PBX2. - RSU not certified. - E1 CAS and CDC certified (DISN-E only). - The identified test discrepancies shown in enclosure 2 that remained open have an overall minor operational impact.
PSTN Gateway	No	Certified	

Legend:

C2	- Command and Control	Mbps	- Megabits per second
CAS	- Channel Associated Signaling	PBX1	- Private Branch Exchange 1
CDC	- Common Data Channel	PBX2	- Private Branch Exchange 2
DISN-E	- Defense Information System Network-Europe	PSTN	- Public Switched Telecommunications Network
DSN	- Defense Switched Network	RSU	- Remote Switching Unit
E1	- European Basic Rate (2.048 Mbps)	VG	- Voice Grade
LAN	- Local Area Network	VoIP	- Voice over Internet Protocol

Note:
1 Refer to table 2 for the C2 VG LAN certified components.

JITC Memo, JTE, Special Interoperability Test Certification of Avaya G3CSI (ProLogix) with Software Release Communications Manager (CM) 2.01 (R012i.00.1.221.1) and G3C with Software Release CM 2.01 (R012c.00.1.221.1) Digital Switching Systems (Includes Voice over Internet Protocol)

Table 4. Interoperability Status

Defense Switched Network	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	Certified	Met all ERs and FRs.
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS MFR1	No	Certified	Met all ERs and FRs.
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP	No	Certified	Met all ERs and FRs.
	PCM-30 E1 CAS HDB3 MFR1	No	Certified	Met all ERs and FRs.
	PCM-24 T1 (B8ZS/ESF) ISDN PRI	Yes	Certified	Met all ERs and FRs.
	Analog E&M Signaling Type I	No	Certified	Met all ERs and FRs.
	Line Interfaces			
	Interface & Signaling	Critical	Status	Remarks
TPC ISDN BRI ST and U Interface Q.931	Yes	Certified	Met all critical ERs and FRs. ISDN supplemental services ¹ and full compliance of DSN Announcements ² not met. Operational impact is minor.	
TPC 2-Wire Analog	Yes	Certified	Met all critical ERs and FRs. Full compliance of DSN Announcements ² not met. Operational impact is minor.	
TPC 2-Wire Digital (Proprietary)	No	Certified	Met all ERs and FRs except for full compliance of DSN Announcements. ² Operational impact is minor.	
Voice over Internet Protocol IEEE 802.3, H.323	No	Certified	Met all ERs and FRs except for IPv6 capability. ³ Operational impact is minor.	
Network Management Interfaces				
Interface & Signaling	Critical	Status	Remarks	
CAT 5 TPC IEEE 802.3 10BaseT Ethernet, TCP/IP	No	Certified	Met all ERs and FRs.	
TPC EIA-232 Asynchronous @ 9.6 kbps	No	Certified	Met all ERs and FRs.	
PSTN Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
Same Interfaces and Signaling as DSN	No	Certified	See note 4.	
Legend: 10BaseT - Ethernet Based Operation, Twisted Pair AMI - Alternate Mark Inversion B8ZS - Bipolar Eight Zero Substitution BRI - Basic Rate Interface CAS - Channel Associated Signaling CAT - Category DISN - Defense Information Systems Network DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multi-Frequency E1 - European Basic Rate (2.048 Mbps) 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 HDB3 - High Density Bi-Polar Three IEEE - Institute of Electrical and Electronic Engineers, Inc. IEEE 802.3 - IEEE 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 MFR1 - Multi-Frequency R1 PCM-24 - Pulse Code Modulation 24 Channels PCM-30 - Pulse Code Modulation 30 Channels PRI - Primary Rate Interface PSTN - Public Switched Telecommunications Network Q.931 - ITU Signaling Standard for ISDN SF - Superframe SS7 - Signaling System 7 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 VoIP - Voice over Internet Protocol				
Notes: 1 ISDN supplemental services are currently not used in the DISN. The operational impact is none. 2 Met all DSN Announcement requirements except for Isolation Code Announcement. The Avaya G3CSI provides this announcement only for precedence calls above ROUTINE. ROUTINE precedence calls receive a fast busy signal. 3 The SUT met all ER and FR requirements with the exception of IPv6 capability. 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. Operational impact is minor. 4 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. Exchange and Functional Requirements

	Trunk Interfaces	
	Interface & Signaling	Exchange & Functional Requirements
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	<ul style="list-style-type: none"> - MLPP - Hotline services - System Interface <ul style="list-style-type: none"> • Non-secure Voice and Data • Secure Voice and Data (STU-III and STE) • NX56 and NX64 Synchronous Data • Non-secure and Secure FAX • VTC • Alarms - Integrated Services Digital Network (<i>ISDN PRI only</i>) - Attendant services¹ - System Administration, Measurements, and Service Standards - Y2K (Rollover, Valid, and Invalid Dates) - Screening, Zone Restriction, and DSN Access Restriction - Automated Message Accounting - Network Integration - Common Data Channel (<i>TI and E1 CAS only</i>) - ANSI T1.619a (<i>TI ISDN PRI</i>)
PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS MFR1		
PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP		
PCM-30 E1 CAS HDB3 MFR1		
PCM-24 T1 B8ZS/ESF ISDN PRI		
Analog E&M Signaling Type I		
Defense Switched Network	Line Interfaces	
	Interface & Signaling	Exchange & Functional Requirements
	TPC ISDN BRI ST and U Interface Q.931	<ul style="list-style-type: none"> - MLPP - Hotline services - ANSI T1.619a - ISDN supplemental services - Call Treatments - DSN Announcements - Attendant services¹ - EKTS - VTC - NX56 and NX64 Synchronous Data - Non-secure Voice and Data - Secure Voice and Data (STE)
TPC 2-Wire Analog	<ul style="list-style-type: none"> - MLPP - Hotline services - DSN Announcements - Traffic Measurements - Attendant services¹ - Call Treatments - Non-secure Voice and Data - Non-secure and Secure FAX - Secure Voice and Data (STU-III and STE) 	

JITC Memo, JTE, Special Interoperability Test Certification of Avaya G3CSI (ProLogix) with Software Release Communications Manager (CM) 2.01 (R012i.00.1.221.1) and G3C with Software Release CM 2.01 (R012c.00.1.221.1) Digital Switching Systems (Includes Voice over Internet Protocol)

Table 5. Exchange and Functional Requirements (continued)

	Line Interfaces	
	Interface & Signaling	Exchange & Functional Requirements
Defense Switched Network (continued)	TPC 2-Wire Digital and Analog (Proprietary)	- MLPP - Hotline services - DSN Announcements - Traffic Measurements - Attendant services ¹ - Call Treatments - Non-secure Voice
	Voice over Internet Protocol IEEE 802.3, H.323	- MLPP - Hotline services - DSN Announcements - Traffic Measurements - Attendant services ¹ - Call Treatments - Non-secure Voice - C2 Voice Grade Local Area Network ²
	Network Management Interfaces	
	Interface & Signaling	Exchange & Functional Requirements
	CAT 5 TPC IEEE 802.3 10BaseT Ethernet, TCP/IP	- Automated Message Accounting - Traffic Measurements - Man Machine Language - Alarms
	TPC EIA-232 Asynchronous @ 9.6 kbps	- Automated Message Accounting - Traffic Measurements - Man Machine Language
Commercial Network Gateway	Trunk Interfaces	
	Interface & Signaling	Exchange & Functional Requirements
	Same Interfaces and Signaling as DSN	See note 3.
Legend: 10BaseT - Ethernet Based Operation, Twisted Pair 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 CAT - Category DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multi-Frequency E1 - European Basic Rate (2.048 Mbps) E&M - Ear and Mouth EIA - Electronic Industries Alliance EKTS - Electronic Key Telephone Service 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 HDB3 - High Density Bi-Polar Three IEEE - Institute of Electrical and Electronic Engineers, Inc. IEEE 802.3 - IEEE Ethernet protocol ISDN - Integrated Services Digital Network ITU - International Telecommunications Union kbps - kilobits per second LAN - Local Area Network Mbps - Megabits per second MFR1 - Multi-Frequency R1 MLPP - Multi-Level Precedence and Preemption 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 PCM-30 - Pulse Code Modulation 30 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 VG - Voice Grade VTC - Video Teleconferencing Y2K - Year 2000		
Notes: 1 The SUT meets all the GSCR exchange requirements for Attendant services with the following console: Lucent Attendant Console Model 302C. 2 Refer to enclosure 2, table 2-3, for the C2 VG LAN certified components. 3 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

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JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil/>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125/> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.

6. The JITC point of contact is Capt. Michel Roy, DSN 821-8575, commercial (520) 533-8575, FAX DSN 879-4347, or e-mail to roym@fhu.disa.mil.

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2 Enclosures a/s

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Commander, Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. Osman), Room 5w23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

- (c) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01B, "Policy for Department of Defense Voice Services," 23 September 2001
- (d) Defense Information Systems Agency (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
- (e) DISA NS53, Memorandum, "DSN Global Network Requirements for Small End Office and Private Branch Exchange Category of Switches," 18 March 2003
- (f) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP)," 17 June 1999
- (g) DISA NS53, Memorandum, "DSN Global Network Requirements for Tandem (Standalone), Multifunction, End Office, and Small End Office Switches," 30 January 2003
- (h) DISA, "GSCR, Appendix 3, DSN Voice over Internet Protocol (VoIP Requirements)," 08 September 2003

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Avaya G3CSI (ProLogix) Digital Switching System with Software Release Communication Manager (CM) 2.01 (R012i.00.1.221.1) (hereinafter referred to as the system under test [SUT]).

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

3. PROGRAM MANAGER. Mr. Howard Osman, 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 SUT has the maximum capacity of up to 600 ports. It supports a maximum of 500 lines and 400 trunks. As sophisticated as the larger Avaya switches, this switch provides call processing business applications such as voice messaging, shared voice mail, small call center-networking capabilities, and expert systems for remote diagnostics and self-healing. The Avaya G3C digital switching system with software release CM 2.01 (R012c.00.1.221.1) employs the same software and trunk/line card hardware as the SUT; JITC analysis determined the G3C to be functionally identical for interoperability certification purposes. The Avaya switch product line offers a Remote Switch Unit capability referred to as the Survivable Remote Processor Expansion Port Network. Preliminary testing was performed on this capability but is not covered in this certification. This product line also offers a Voice over Internet Protocol (VoIP) capability. This capability was tested and is covered by this certification. Avaya's product line of digital switches is currently in use within the Defense Switched Network (DSN) providing Small End Office Switch and Private Branch Exchange (PBX) functionality.

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

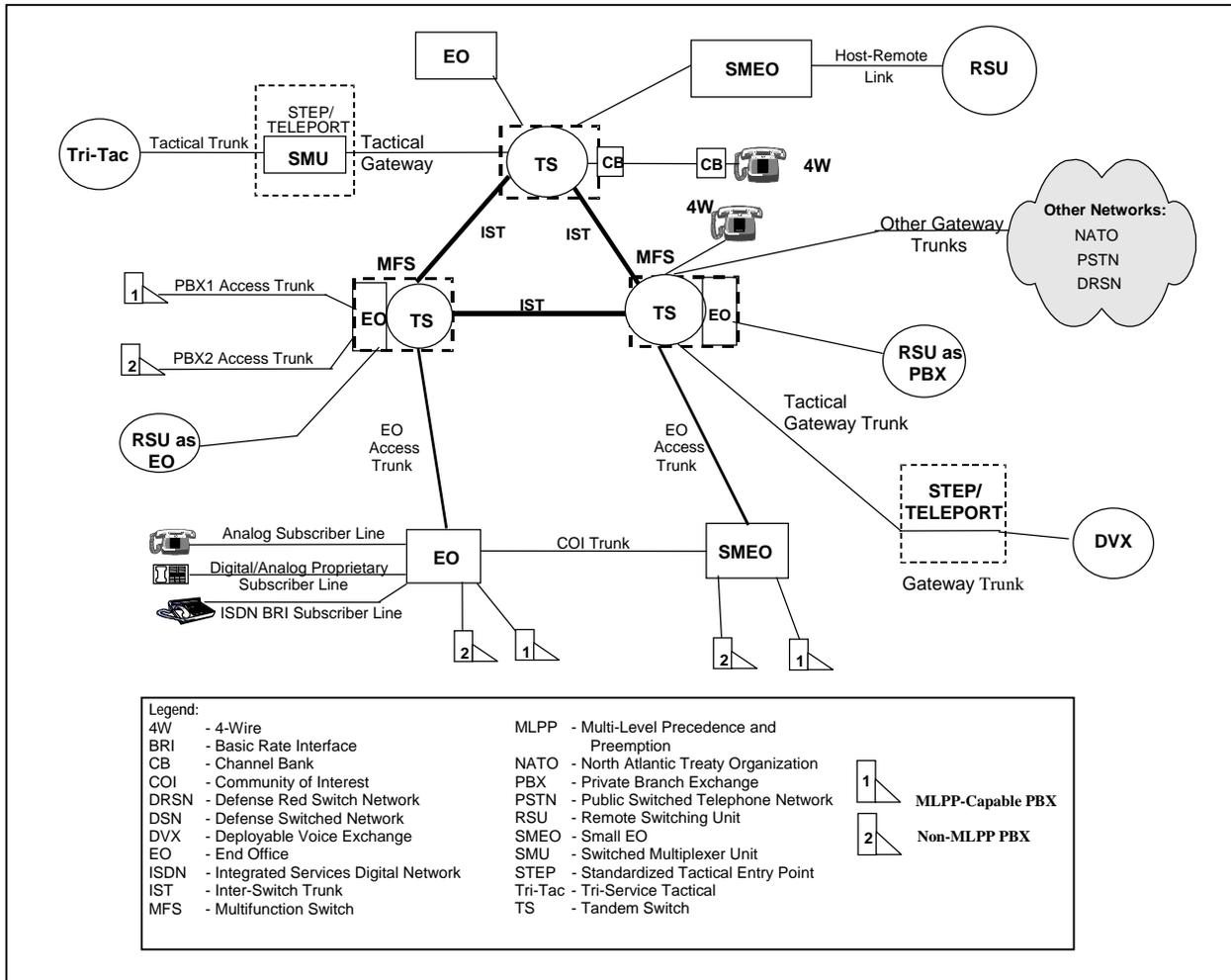


Figure 2-1. DSN Architecture

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 Instructions (CJCSI) 6215.01B, policy for Department of Defense voice services requirements for the DSN.
- b. Interface and signaling requirements for trunk, line, and network management derived from the GSCR document, and DISA Network Services (NS) 53, Memorandum, "DSN Global Network Requirements for Small End Office and Private Branch Exchange Category of Switches," dated 18 March 2003.
- 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 DSN network interfaces are indicated in table 2-1. The criticality and certification status of these interfaces can be found in paragraph 11. The test summary can be found in paragraph 11b.

Table 2-1. Exchange and Functional Requirements

	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 services - System Interface <ul style="list-style-type: none"> • Non-secure Voice and Data • Secure Voice and Data (STU-III and STE) • NX56 and NX64 Synchronous Data • Non-secure and Secure FAX • VTC • Alarms - Integrated Services Digital Network (<i>ISDN PRI only</i>) - Attendant services¹ - System Administration, Measurements, and Service Standards - Y2K (Rollover, Valid, and Invalid Dates) - Screening, Zone Restriction, and DSN Access Restriction - Automated Message Accounting - Network Integration - Common Data Channel (<i>T1 and E1 CAS only</i>) - ANSI T1.619a (<i>T1 ISDN PRI only</i>)
PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS MFR1	No		
PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP	No		
PCM-30 E1 CAS HDB3 MFR1	No		
PCM-24 T1 B8ZS/ESF ISDN PRI	Yes		
Analog E&M Signaling Type I	No		
Defense Switched Network	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 services - ANSI T1.619a - ISDN supplemental services - Call Treatments - DSN Announcements - Attendant services¹ - EKTS - VTC - NX56 and NX64 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 services - DSN Announcements - Traffic Measurements - Attendant services¹ - Call Treatments - Non-secure Voice and Data - Non-secure and Secure FAX - Secure Voice and Data (STU-III and STE) 	

Table 2-1. Exchange and Functional Requirements (continued)

	Line Interfaces		
	Interface & Signaling	Critical	Exchange and Functional Requirements
	Defense Switched Network (continued) TPC 2-Wire Digital and Analog (Proprietary)	No	- MLPP - Hotline services - DSN Announcements - Traffic Measurements - Attendant services ¹ - Call Treatments - Non-secure Voice
Voice over Internet Protocol IEEE 802.3, H.323	No	- MLPP - Hotline services - DSN Announcements - Traffic Measurements - Attendant services ¹ - Call Treatments - Non-secure Voice - C2 Voice Grade Local Area Network ²	
Network Management Interfaces			
Interface & Signaling	Critical	Exchange and Functional Requirements	
CAT 5 TPC IEEE 802.3 10BaseT Ethernet, TCP/IP	No	- Automated Message Accounting - Traffic Measurements - Alarms (TCP/IP interface only) - Man Machine Language	
TPC EIA-232 Asynchronous @ 9.6 kbps	No		
PSTN Gateway	Interface & Signaling	Critical	Exchange and Functional Requirements
	Same Interfaces and Signaling as DSN	Yes	See note 3.
Legend: 10BaseT - Ethernet Based Operation, Twisted Pair 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 CAT - Category DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multi-Frequency E1 - European Basic Rate (2.048 Mbps) E&M - Ear and Mouth EIA - Electronic Industries Alliance EKTS - Electronic Key Telephone Service 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 HDB3 - High Density Bi-Polar Three IEEE - Institute of Electrical and Electronics Engineers, Inc. IEEE 802.3 - IEEE Ethernet protocol ISDN - Integrated Services Digital Network ITU - International Telecommunications Union kbps - kilobits per second LAN - Local Area Network Mbps - Megabits per second MFR1 - Multi-Frequency R1 MLPP - Multi-Level Precedence and Preemption 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 PCM-30 - Pulse Code Modulation 30 Channels PRI - Primary Rate Interface PSTN - Public Switched Telecommunications Network 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 VG - Voice Grade VTC - Video Teleconferencing Y2K - Year 2000			
Notes: 1 SUT meets all the GSCR exchange requirements for attendant services with the following console: Lucent Attendant Console Model 302C. 2 Refer table 2-3 for the C2 VG LAN certified components. 3 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 test facility in a manner and configuration similar to that of the DSN operational environment. This test was conducted using the four test configurations shown in figures 2-2 through 2-5. Testing of the system's required functions and features was conducted using the test

configuration depicted in figure 2-2, and network integration testing was conducted using the test configuration depicted in figure 2-3. These configurations accurately emulate the DSN operational environment. The Advanced Defense Switched Network Integrated Management Support System network management functions and features were tested using the network configuration depicted in figure 2-4. Testing of the system's Command and Control (C2) Voice Grade (VG) Local Area Network (LAN) features was conducted using the test configuration depicted in figure 2-5.

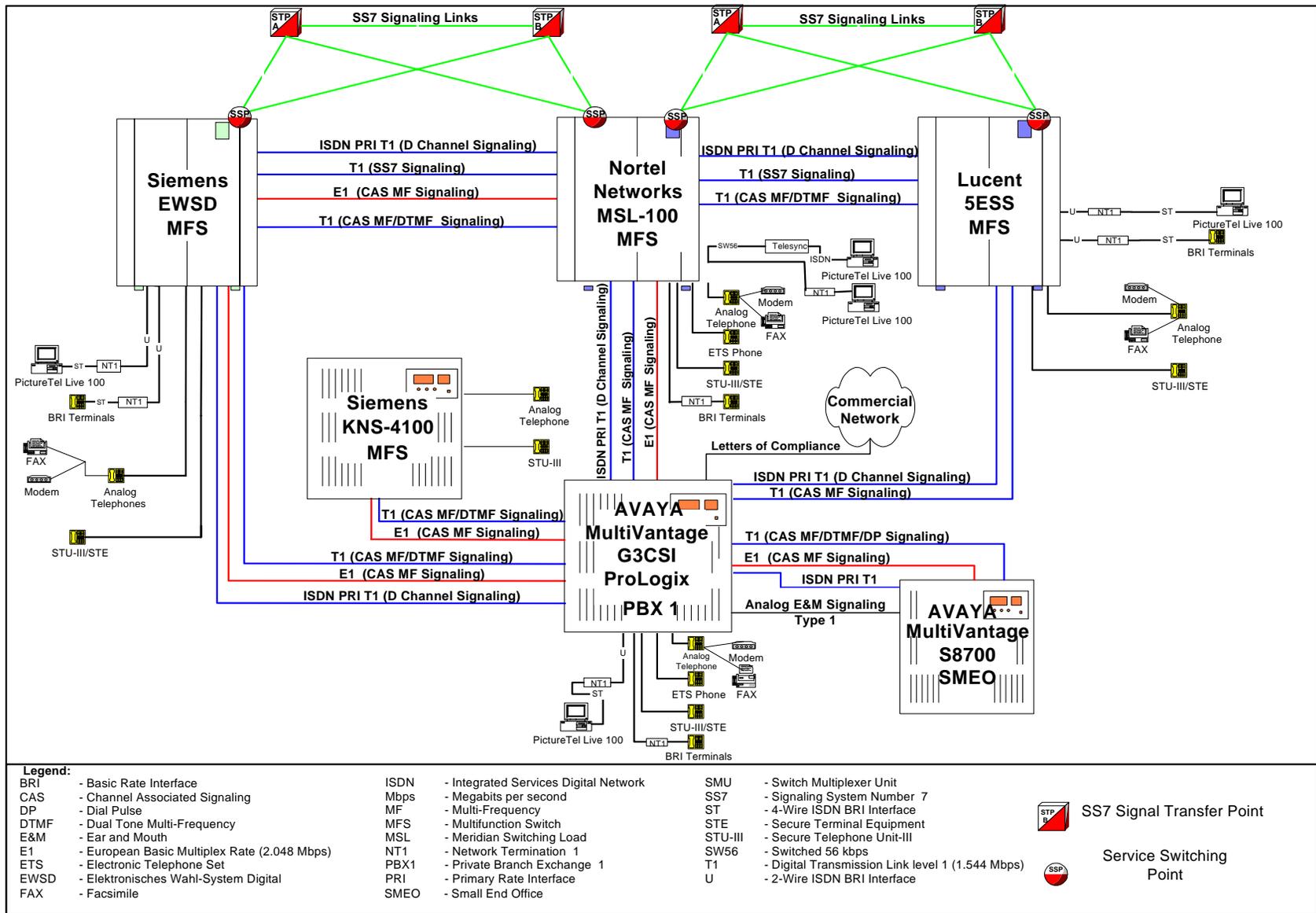


Figure 2-2. Test Configuration

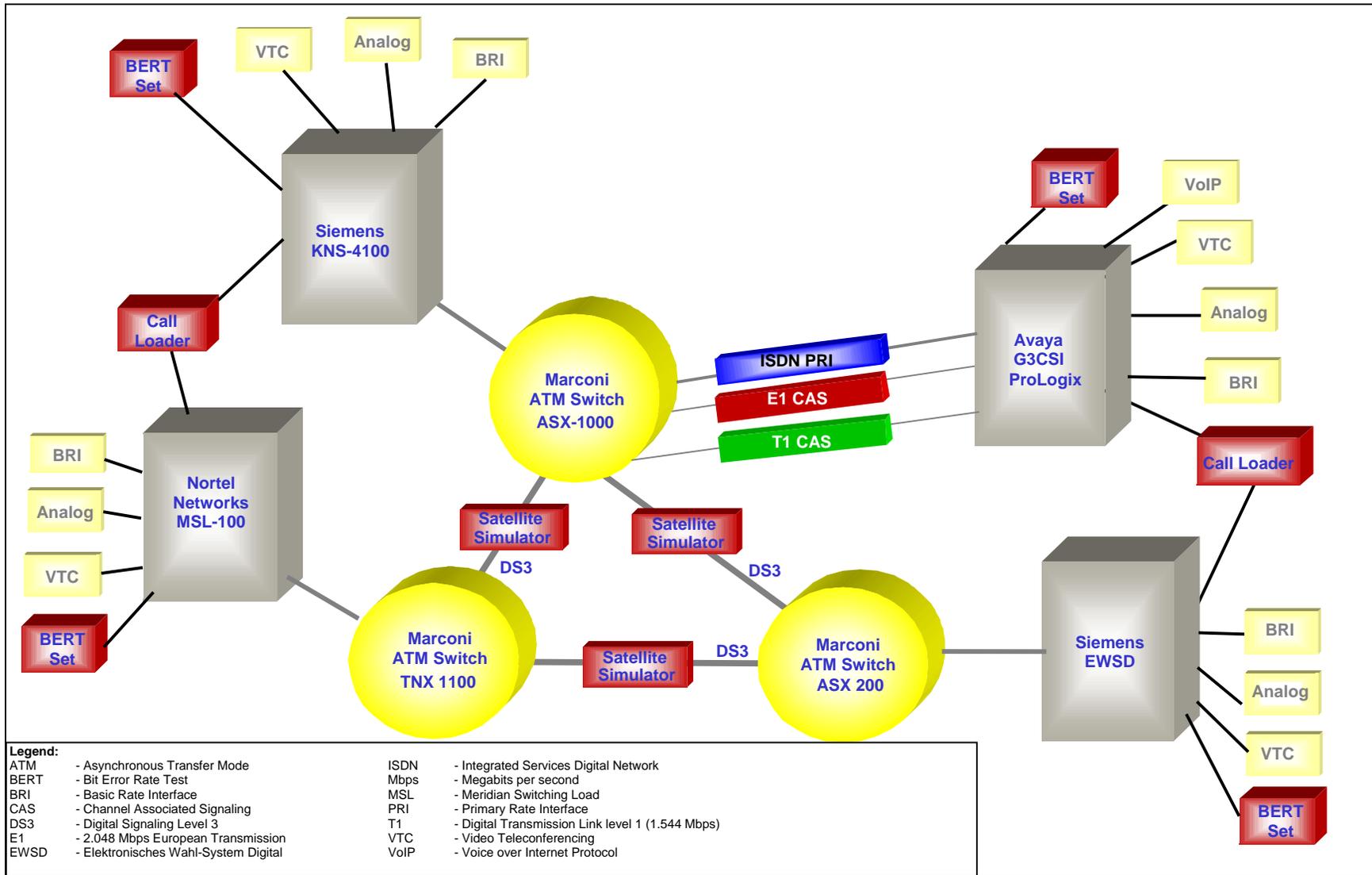


Figure 2-3. Network Integration Test Configuration

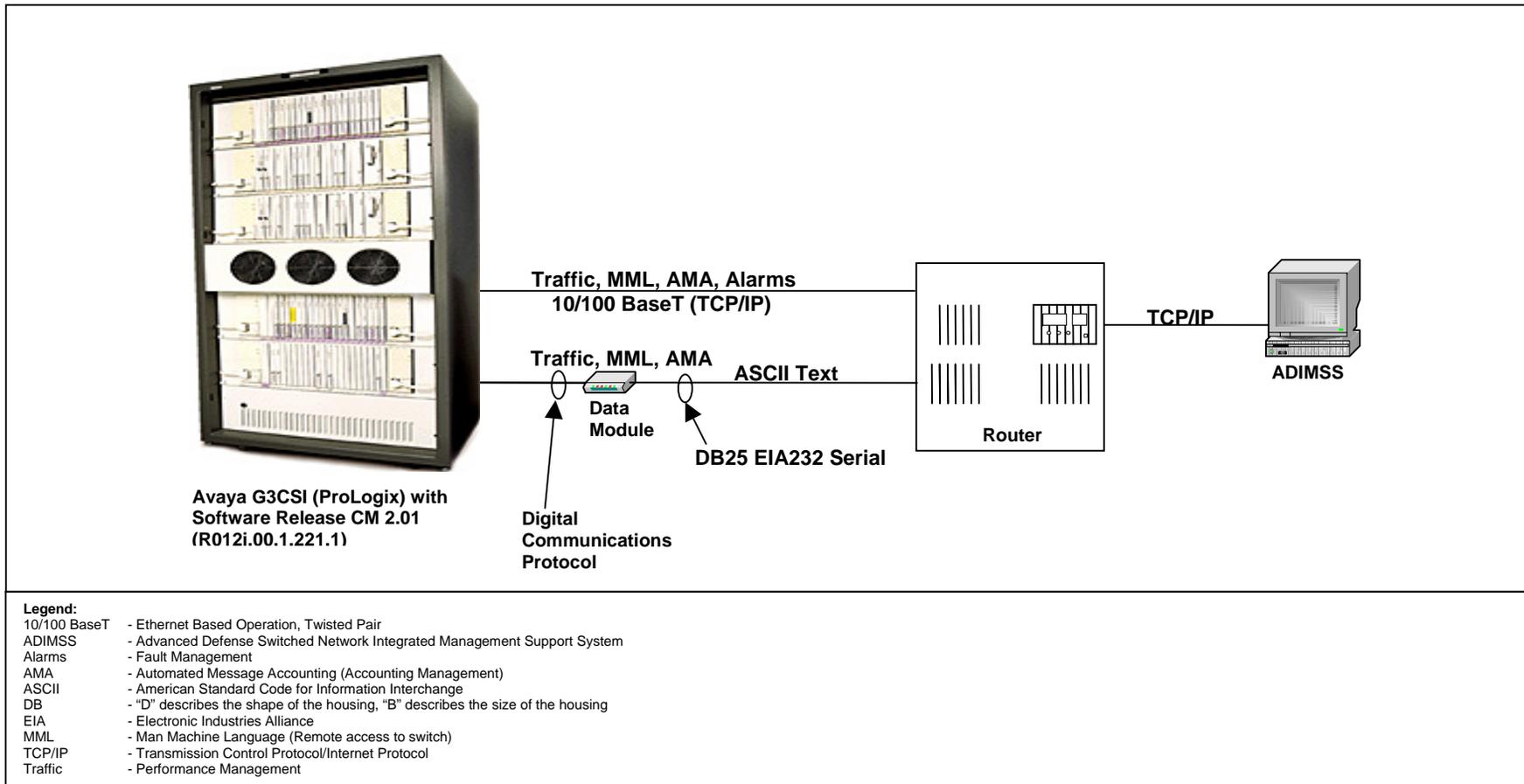


Figure 2-4. Avaya G3CSI ADIMSS Network Management System Interface

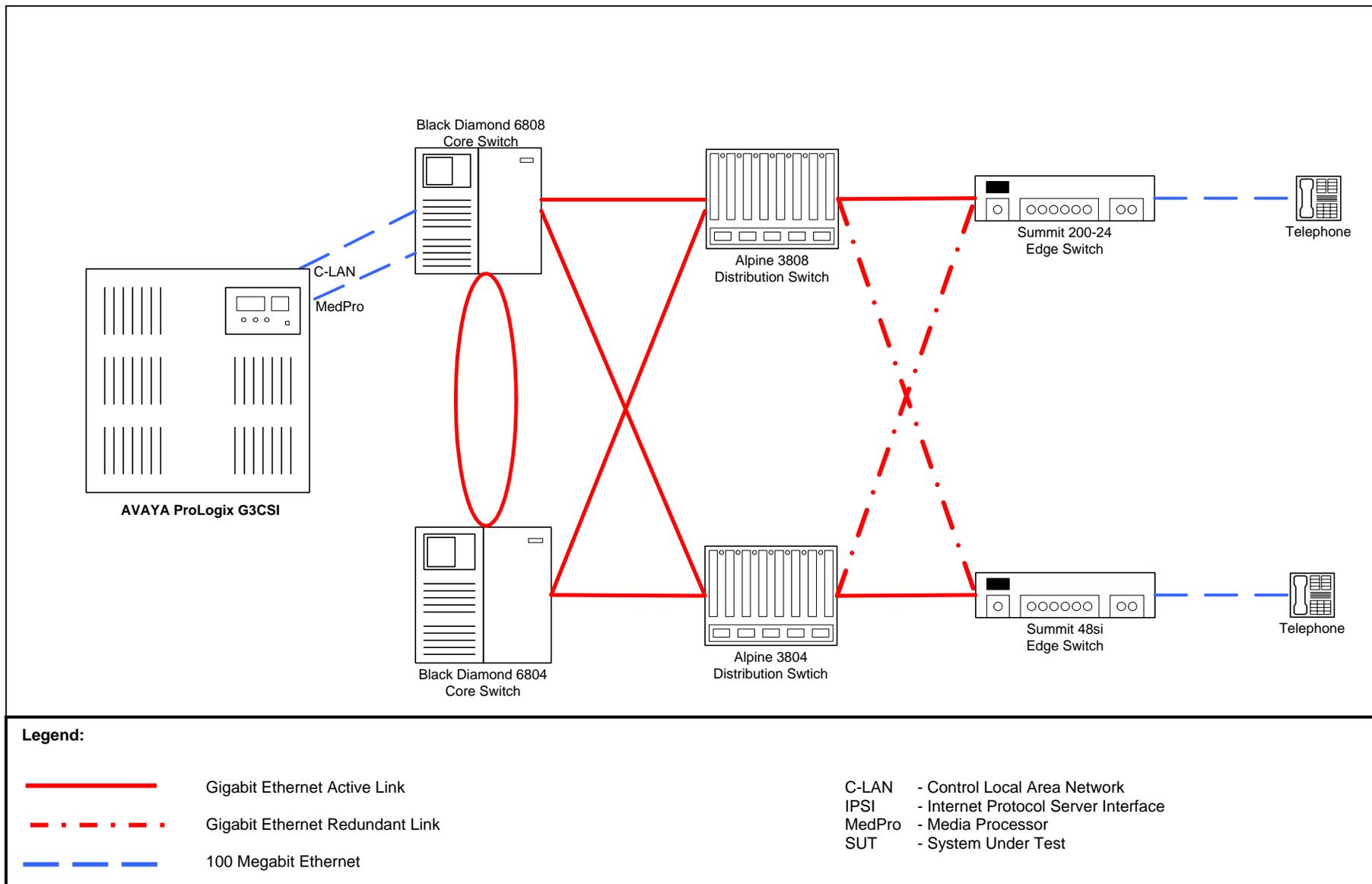


Figure 2-5. The SUT Command and Control Voice Grade Local Area Network

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

Table 2-2. Tested System Configurations

System Name	Software Release
Nortel Networks MSL-100	MSL-17
Avaya G3CSI, ProLogix	Vintage
Expansion Interface Card TN570D	000005
Expansion Interface Card TN570C	000003
Tone Detector Card TN748D	000007
Tone Clock Card TN2182C	000002
Media Processor Board TN2302AP	HW03 FW071 HW15 FW072 HW13 FW051
Announcement Card TN2501AP	HW01 FW007
Control LAN Card TN799DP	HW01 FW009 HW00 FW010 HW01 FW010
Analog Card TN793B	000006 000002 000007
ATM Trunk Card TN2305	HW03 FW007
DS1 Interface Card TN464GP	HW06 FW120 HW02 FW120
Call Classifier Card TN744E	000002
BRI Line Card TN2198	000003
Tie Trunk Card TN760E	000002
Digital Line Card TN754B	000002
Digital Line Card TN2224B	000011 000018
Avaya S8700 ¹	CM 2.01 (R012x.00.1.221.1)
Siemens EWSD	19d with Patch Set 32
Siemens KNS-4100	APS4V2.3
Lucent 5ESS	5E15
SMU 96 Tactical Gateway	RD302185
Tekelec STP	23.1
Nortel Networks Broad Band STP	3.0.3.18d
DSS Red Switch	8.03
MARCONI ATM switches	Versions 6.2 and 7.1
Legend: ATM - Asynchronous Transfer Mode BRI - Basic Rate Interface DSS - Digital Small Switch EWSD - Elektronisches Wahl-System Digital FW - Firmware HW - Hardware LAN - Local Area Network MSL - Meridian Switching Load SMU - Switch Multiplexer Unit STP - Signal Transfer Point	
Notes: 1 All cards listed under the DEFINITY G3CSI, ProLogix switch are applicable with the exception the S8700 uses an Internet Protocol Server Interface Card TN2312AP. 2 All cards listed under the DEFINITY G3CSI, ProLogix switch are applicable.	

Table 2-3. Command and Control Voice Grade Local Area Network Component Hardware and Software

Hardware	Software Release
Extreme Summit 48si	6.2.2B134
Extreme Summit 200-24	6.2E2B16
Extreme Alpine 3804	6.2.2B134
Extreme Alpine 3808	6.2.2B134
Card SMMi (45014)	See Note.
Card GM – 4X (45112)	See Note.
Card GM – 4S (45110)	See Note.
Extreme Black Diamond 6804	6.2.2B134
Extreme Black Diamond 6808	6.2.2B134
Card MSM64 (50015)	See Note.
Card G8X (51032)	See Note.
Card F48T (52011)	See Note.
Phone – 4620IP	DEF 20R2_0
Legend: F - Fast Ethernet G - Gigabit GM - Gigabit Module i - Inferno Chip Set IP - Internet Protocol MSM - Management Switch Module SMMs - Switch Management Module s - Small Profile T - Twisted pair copper X - Gigabit interface converter based	
Note: There is no software version.	

10. TESTING LIMITATIONS. None

11. TEST RESULTS. Tables 2-4 through 2-7 synopsize the SUT interface ER and FR status and criticality. The test discrepancies identified in tables 2-4 through 2-7 denote only those test discrepancies that remained open after software patches were applied and regression testing was completed. A detailed description of these discrepancies can be found in paragraph 11a.

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	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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	No	Met
		Network Integration	No	II-20.2	10	No	Met
		CDC	No	II-24.2	See Note	No	Met ²

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) MFR1	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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	No	Met
		Network Integration	No	II-20.2	10	No	Met
		CDC	No	II-24.2	See note	No	Met ²

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	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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	No	Met
		Network Integration	No	II-20.2	10	No	Met
		CDC	No	II-24.2	See Note	No	Met ²

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-30 E1 CAS HDB3 MFR1	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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	No	Met
		Network Integration	No	II-20.2	10	No	Met
		CDC	No	II-24.2	See Note	No	Met ²

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	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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	No	Met
		Network Integration	No	II-20.2	10	No	Met
		ANSI T1.619a	No	II-6.2	21.3.1	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
Analog E&M Signaling Type I	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4.3 through 4.9	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		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	No	II-7.2	2.1.3	No	Met ¹
		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

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 (continued)	Certified	AMA	No	II-14.2	8.1	No	Met
		Network Integration	No	II-20.2	10	No	Met
Legend: AMA - Automated Message Accounting AMI - Alternate Mark Inversion ANSI - American National Standards Institute B8ZS - Bipolar Eight Zero Substitution CAS - Channel Associated Signaling CDC - Common Data Channel DISN - Defense Information Systems Network DP - Dial Pulse DSN - Defense Switched Network DTMF - Dual Tone Multiple-Frequency E1 - European Basic Multiplex Rate (2.048 Mbps) E&M - Ear and Mouth ER - Exchange Requirements ESF - Extended Superframe FAX - Facsimile FR - Functional Requirements GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan HDB3 - High Density Bi-Polar Three IEEE - Institute of Electrical and Electronics Engineers, Inc. ISDN - Integrated Services Digital Network Mbps - Megabits per second MFR1 - Multi-Frequency R1 MLPP - Multi-Level Precedence and Preemption PCM - Pulse Code Modulation 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 VTC - Video Teleconferencing Y2K - Year 2000							
Notes: 1 SUT meets all the GSCR exchange requirements for Attendant services with the following console: Lucent Attendant Console Model 302C. 2 CDC is a requirement only for DISN-Europe. Switches that have a requirement to interface to the DSN European KNS-4100 switches must be capable of passing CDC traffic transparently.							

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	No	II-3.2	21.3.10	No	Met
		ANSI T1.619a	Yes	II-6.2	21.3.1	Yes	Met
		ISDN supplemental services	Yes	II-6.2	21.3	No	Not Met ¹
		Attendant services	No	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	Yes	II-19.2	5.6	Yes	Met ³
		Electronic Key Telephone Service	Yes	II-25.5	21.2	No	Met
2-Wire Analog, TPC	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		Attendant services	No	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	Yes	II-19.2	5.6	Yes	Met ³

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
2-Wire Proprietary Digital	Certified	MLPP	No	II-2.2	2.2.1, 5.3.4	Yes	Met
		Hotline services	No	II-3.2	21.3.10	No	Met
		Attendant services	No	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	Yes	II-19.2	5.6	Yes	Met ³
Voice over Internet Protocol IEEE 802.3 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 ¹
		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 ⁴	Yes	D-26	Appendix 3	No	Met ⁵

Legend:
ANSI - American National Standards Institute
BRI - Basic Rate Interface
C2 - Command and Control
DISN - Defense Information Systems Network
DSN - Defense Switched Network
ER - Exchange Requirements
FR - Functional Requirements
GSCR - Generic Switching Center Requirements
GSTP - Generic Switch Test Plan
H.323 - Standard for multi-media communications on packet-based networks
IEEE - Institute of Electrical and Electronics Engineers, Inc.
IEEE 802.3 - IEEE Ethernet protocol
IPv4 - Internet Protocol version 4
IPv6 - Internet Protocol version 6
ISDN - Integrated Services Digital Network
ITU - International Telecommunications Union
LAN - Local Area Network
Mbps - Megabits per second
MLPP - Multi-Level Precedence and Preemption
Q.931 - ITU Signaling Standard for ISDN
SS7 - Signaling System 7
ST - Four-Wire ISDN BRI Interface
SUT - System Under Test
T1 - Digital Transmission Link level 1 (1.544 Mbps)
T1.619a - SS7 and ISDN Signaling Standard for T1
TPC - Twisted Pair Copper
U - Two-Wire ISDN BRI Interface
VG - Voice Grade

Notes:
1 ISDN supplemental services currently not used in the DISN. The operational impact is none.
2 SUT meets all the GSCR exchange requirements for attendant services with the following console: Lucent Attendant Console Model 302C.
3 Met all DSN Announcement requirements except for Isolation Code Announcement. The Avaya G3CSI provides this announcement only for precedence calls above ROUTINE. ROUTINE precedence calls receive a fast busy signal. The operational impact is minor.
4 Refer table 2-4 for the C2 VG LAN certified components.
5 The SUT met all ER and FR requirements with the exception of IPv6 capability. 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
CAT 5 TPC, IEEE 802.3 10BaseT Ethernet, TCP/IP	Certified	Alarms	No	II-23.2	2.1.10, 16.1	No	Met
		AMA	No	II-23.2	2.1.10, 16.1	No	Met
		Traffic Measurements	No	II-23.2	2.1.10, 16.1	No	Met
		MML	No	II-23.2	2.1.10, 16.1	No	Met
TPC EIA-232 Asynchronous @ 9.6 kbps	Certified	AMA	No	II-23.2	2.1.10, 16.1	No	Met
		Traffic Measurements	No	II-23.2	2.1.10, 16.1	No	Met
		MML	No	II-23.2	2.1.10, 16.1	No	Met
Legend: 10BaseT - 10 megabits per second Ethernet twisted pair AMA - Automated Message Accounting CAT 5 - Category 5 cable (rated @ 100 megahertz of bandwidth) EIA - Electronic Industries Alliance ER - Exchange Requirements FR - Functional Requirements GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan IEEE - Institute of Electrical and Electronic Engineers, Inc. IEEE 802.3 - IEEE Ethernet protocol kbps - kilobits per second MML - Man Machine Language TPC - Twisted Pair Copper TCP/IP - Transmission Control Protocol/Internet Protocol							

Table 2-7. Public Switched Telecommunications 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 and Signaling as DSN	Certified	See Note	No	See Note	See Note	No	Met
<p>Legend: DSN - Defense Switched Network ER - Exchange Requirements FR - Functional Requirements GSCR - Generic Switching Center Requirements GSTP - Generic Switch Test Plan</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.** The SUT meets all the exchange requirements for Network Management (NM) over Institute of Electrical and Electronic Engineers, Inc. (IEEE) 802.3 (10BaseT Ethernet) Transmission Control Protocol/Internet Protocol (TCP/IP) and EIA-232 asynchronous serial interfaces. It was verified that these interfaces pass required NM data elements per reference (c). All critical interface ERs and FRs for DSN were met. The following minor exceptions are noted:

(a) 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 DISN that support ISDN BRI supplemental services. The operational impact is none.

1. Conference Calling. GSCR Para. 21.3.2
2. User-to-User Signaling. GSCR Para. 21.3.3
3. Call Hold. GSCR Para. 21.3.4
4. Call Waiting. GSCR Para. 21.3.5
5. Normal Call Transfer. GSCR Para. 21.3.6
6. Explicit Call Transfer. GSCR Para. 21.3.7
7. ISDN Call Deflection. GSCR Para. 21.3.8
8. Preset Conference Calling. GSCR Para. 21.3.11

(b) The SUT does not support the Isolation Code Announcement (ICA) for ROUTINE precedence calls. ROUTINE precedence calls receive a fast busy tone rather than the required ICA. The ICA is received by calls above ROUTINE precedence. The operational impact is minor.

(c) The SUT does not support precedence ring cadence on a Call Transfer. When a routine call is transferred at a precedence level, the far end instrument will not receive a precedence ring although the call still connects at the correct precedence level. The operational impact is minor.

(d) The SUT does not support correct preemption of a three-way call. After establishing a three-way call at a routine precedence level, when one of the three legs is preempted all three legs receive precedence notification tone and are dropped. The operational impact is minor.

(e) The SUT does not support ten-digit interswitch dialing without dialing the "94" access code. When a user dials a ten digit number, the access code "94" must prefix the number. The operational impact is minor.

(f) When the connection is broken to the active internet protocol server interface, all active calls (e.g., VoIP, analog, digital, and ISDN) remain connected, however, any new attempted calls placed immediately after the link is restored fail to receive dial tone for a period of 5-15 seconds. The operational impact is minor.

(g) The SUT sends “Restart” messages when busying out ANSI T.619a PRI. The SUT should only send out a “Restart” message on an idle request or re-establishment of the T1 span. The operational impact is minor.

(2) Commercial 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, specified in tables 2-1 through 2-15 of the GSCR, with minor exceptions. Exceptions were reviewed and assessed by DISA NS 53, the Development and Operational Engineering Department, and were determined to have a minor operational impact.

(3) VoIP. The SUT VoIP solution comprises of the S8700 Time Division Multiplexing (TDM) circuit switch and the LAN as shown in figure 2-5. The LAN infrastructure was made up of the Extreme Networks equipment listed in table 2-4. The results for the overall VoIP system and LAN, as defined by the GSCR, appendix 3, are presented below.

(a) **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 LAN). The following paragraphs detail the results of the SUT VoIP solution.

1. **Voice Quality.** In accordance with (IAW) 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 had a MOS of 4.28. Inter-switch calls had a MOS of 4.29. This average was based a total of 50 intra-switch and inter-switch calls.

2. **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.

3. **MLPP.** The GSCR, section 3, details the requirements for Multi-Level Precedence and Preemption. All critical MLPP features and functions were met by the SUT VoIP system. There currently there are no mature standards for MLPP over Internet Protocol, requiring the vendor to implement proprietary IP signaling.

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

5. **Network Management.** The GSCR, appendix 3, defines the overall Network Management (NM) requirements that VoIP systems 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.

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

7. 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 60 calls was measured to be 50.15 msec.

8. 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.

(b) **Local Area Network.** The SUT/Extreme LAN solution as shown in figure 2-5 and table 2-4 met the minimum interoperability requirements of the GSCR, appendix 3. The network consisted of three main components: the core switches, distribution switches and access switches. The Extreme networks LAN solution used several industry standards to provide resiliency and quality of service.

1. Design

a. 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 2.5 msec.

b. Jitter. The SUT utilizes a dynamic jitter buffer in both the 4620IP phones and its IP Media Processor (MedPro) boards. These buffers automatically adjust depending on the amount of jitter within the network. With a 40% bandwidth load, no jitter was measured.

c. 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 5-minute period. With 40% bandwidth load, the measured packet loss was 0.00% for the Extreme Networks LAN infrastructure utilized.

d. Class of Service (CoS) and Quality of Service (QoS). The GSCR, appendix 3, outlines several methodologies to implement CoS and QoS. 802.1p/Q at the Data Link Layer (L2) and Differentiated Services Code Point (DSCP) at

the Network Layer (L3) were two CoS mechanisms that the Extreme Networks products employed. The SUT/Extreme solution provides CoS by assignment of an 802.1p/Q tag. Switches within the topology were configured with multiple Virtual VLANs to separate data from voice traffic. 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. For DSCP, L2 audio/signaling was set for 6 and L3 audio/signaling was set for 46 in the tested configuration.

2. Traffic Engineering

a. The SUT's IP MedPro cards have a limitation in that they can only support 64 IP subscribers and still meet DSN assured connectivity requirements. To determine the number of MedPro cards per switch, the following formula must be used:

$$\textbf{Total number of Media Processor cards = total VoIP users / 64.}$$

For redundancy purposes, the number of MedPro cards shall be implemented on an n+1 basis (i.e., for 64 users require 2 MedPro cards).

b. To determine the number of C-LAN cards needed to support IP subscribers use:

$$\textbf{Total number of C-LAN cards = number of VoIP users / 250.}$$

This based on the manufacturer recommendation that no more than 250 users per C-LAN Card be assigned. CLAN cards shall also be implemented on an n+1 basis to meet redundancy requirements.

c. Core to Core. Ethernet Automatic Protection Switching (EAPS) RFC 3619, was implemented between the two core routers allowing the redundant transport of layer 2 VLAN traffic while providing sub second fail over. EAPS is a ring technology that is designed to minimize network re-convergence time. EAPS utilize master and transit nodes that are physically connected into a ring configuration. The master sends a hello packet out the primary port and blocks the secondary port upon receiving the packet, thus ensuring the ring is complete. If a transit node detects a failed link, a packet is sent to the master, which in turn unblocks the master port and sends a signal for all nodes to flush their forwarding databases.

d. Core to Distribution. The Extreme Networks LAN used Open Shortest Path First, Equal Cost Multi-Path (OSPF ECMP). This protocol allowed all routers to share traffic loads, while having active paths to all routers in the core. This protocol played a key role under the failed conditions testing because the routing tables were pre-populated alleviating the time needed to learn alternate paths.

e. **Distribution 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. Extreme Stand by Router Protocol layer 2 traffic is blocked, preventing loops within the network. The technology exists between the two distribution switches, so any edge switch will be compatible with the topology.

3. **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. This requirement was verified via a letter of compliance because of the numerous third party systems and applications capable of performing this function.

4. **Phones.** The only SUT phone which met all requirements for certification was the 4620IP phone. 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).

5. **Scalability.** The SUT can support 200 MedPro cards, which limits the maximum IP subscribers to 12,800. However, the manufacturer recommendation for release 2.01 is not to exceed 12,000 users. The SUT LAN solution tested consisted of one Black Diamond 6808, one Black Diamond 6804, one Alpine 3808, one Alpine 3804, one Summit 48si, and one Summit 200-24, as shown in figure 2-5. For implementation purposes, the C2VGLAN can be scaled to meet the 12,800 IP phone subscribers as long as it is comprised of the equipment and software listed, and meets the traffic engineering constraints contained in the GSCR, appendix 3.

b. Test Summary. The Avaya G3CSI (ProLogix) Digital Switching System with software release CM 2.01 (R012i.00.1.221.1) is certified for joint use in the DSN as a PBX1 in accordance with the requirements set forth in the GSCR and the DISA NS53 Memorandum, "DSN Global Network Requirements for Small End Office and Private Branch Exchange Category of Switches" dated 18 March 2003. The overall expected operational impact of the discrepancies is minor. The interoperability summary and status, to include criticality for each interface, is shown in tables 2-8 and 2-9.

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 2-8. Interoperability Summary

Network	Status	Remarks
DSN	Certified	<ul style="list-style-type: none"> - Certified for VoIP with C2 Voice Grade Local Area Network (see note). - Certified as PBX1 and PBX2. - RSU not certified. - E1 CAS and CDC certified (DISN-E only). - The identified test discrepancies shown in enclosure 2 that remained open have an overall minor operational impact.
Commercial Gateway	Certified	
Legend: C2 - Command and Control CAS - Channel Associated Signaling CDC - Common Data Channel DISN-E - Defense Information System Network Europe DSN - Defense Switched Network E1 - European Basic Rate (2.048 Mbps) LAN - Local Area Network Mbps - Megabits per second PBX - Private Branch Exchange RSU - Remote Switching Unit VG - Voice Grade VoIP - Voice over Internet Protocol		
Note: Refer to table 2-4 for the C2 VG LAN certified components.		

Table 2-9. Interoperability Status

Defense Switched Network	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DTMF	No	Certified	Met all ERs and FRs.
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS MFR1	No	Certified	Met all ERs and FRs.
	PCM-24 T1 (B8ZS/ESF) (AMI/SF) CAS DP	No	Certified	Met all ERs and FRs.
	PCM-30 E1 CAS HDB3 MFR1	No	Certified	Met all ERs and FRs
	PCM-24 T1 (B8ZS/ESF) ISDN PRI	Yes	Certified	Met all ERs and FRs.
	Analog E&M Signaling Type I	No	Certified	Met all ERs and FRs.
	Line Interfaces			
	Interface & Signaling	Critical	Status	Remarks
TPC ISDN BRI ST and U Interface Q.931	Yes	Certified	Met all critical ERs and FRs. ISDN supplemental services ¹ and full compliance of DSN Announcements ² not met. Operational impact is minor.	
TPC 2-Wire analog	Yes	Certified	Met all critical ERs and FRs. Full compliance of DSN Announcements ³ not met. Operational impact is minor.	
TPC 2-Wire Digital (Proprietary)	No	Certified	Met all ERs and FRs except for full compliance of DSN Announcements. ² Operational impact is minor.	
Voice over Internet Protocol IEEE 802.3, H.323	No	Certified	Met all ERs and FRs except for IPv6. ³	
Network Management Interfaces				
Interface & Signaling	Critical	Status	Remarks	
CAT 5 TPC IEEE 802.3 10BaseT Ethernet, TCP/IP	Yes	Certified	Met all ERs and FRs.	
TPC EIA-232 Asynchronous @ 9.6 kbps	Yes	Certified	Met all ERs and FRs.	

Table 2-9. Interoperability Status (continued)

PSTN Gateway	Trunk Interfaces			
	Interface & Signaling	Critical	Status	Remarks
	Same Interfaces and Signaling as DSN	Yes	Certified	See note 4.
Legend:				
10BaseT	- Ethernet Based Operation, Twisted Pair	IEEE	- Institute of Electrical and Electronic Engineers, Inc.	
AMI	- Alternate Mark Inversion	IEEE 802.3	- IEEE Ethernet protocol	
ANSI	- American National Standards Institute	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	
CAT	- Category	kbps	- kilobits per second	
DP	- Dial Pulse	Mbps	- Megabits per second	
DISN	- Defense Information Systems Network	MFR1	- Multi-Frequency R1	
DSN	- Defense Switched Network	PCM-24	- Pulse Code Modulation 24 Channels	
DTMF	- Dual Tone Multi-Frequency	PCM-30	- Pulse Code Modulation 30 Channels	
E1	- European Basic Multiplex Rate (2.048 Mbps)	PRI	- Primary Rate Interface	
E&M	- Ear and Mouth	PSTN	- Public Switched Telecommunications Network	
EIA	- Electronic Industries Alliance	Q.931	- ITU Signaling Standard for ISDN	
ERs	- Exchange Requirements	SF	- Superframe	
ESF	- Extended Superframe	ST	- ISDN BRI Four-Wire Interface	
FRs	- Functional Requirements	T1	- Digital Transmission Link level 1 (1.544 Mbps)	
GSCR	- Generic Switching Center Requirements	TPC	- Twisted Pair Copper	
GSTP	- Generic Switch Test Plan	TCP/IP	- Transmission Control Protocol/Internet Protocol	
H.323	- Standard for multi-media communications on packet-based networks	U	- ISDN BRI Two-Wire Interface	
HDB3	- High Density Bi-Polar Three			
Notes:				
1 ISDN supplemental services currently not used in the DISN. There is no operational impact.				
2 Met all DSN Announcement requirements except for Isolation Code Announcement. The Avaya G3CSI provides this announcement only for precedence calls above ROUTINE. ROUTINE precedence calls receive a fast busy signal.				
3 The SUT met all ER and FR requirements with the exception of IPv6 capability. 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.				
4 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.				