DEFENSE INFORMATION SYSTEMS AGENCY
P. O. BOX 549
FORT MEADE, MARYLAND 20755-0549

IN REPLY
REFER TO: Joint Interoperability Test Command (JTE) **15 Oct 12**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the LTI DataComm Fiber-Copper-Wire-Integrated Access (FCW-IA) Digital Loop Carrier Line Extender (DLCLE) Version 3.5

References: (a) Department of Defense Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) Chairman, Joint Chiefs of Staff Instruction 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(c) through (e), see Enclosure 1

1. References (a) and (b) establish Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The LTI DataComm FCW-IA DLCLE Version 3.5 is hereinafter referred to as the System Under Test (SUT). The SUT meets all of the critical interoperability requirements for the Defense Switched Network (DSN) and is certified for joint use. The SUT met the critical interoperability requirements for a Fixed Network Element set forth in Reference (c) using test procedures derived from Reference (d). The SUT supports a proprietary 40.96 Megabits per second (Mbps) digital signal over single-mode fiber between its Host Digital Terminals (HDT) and its Optical Network Units (ONU). This proprietary interface is not compatible with the 44.736 Mbps Digital Signal 3 (DS3) standards. This proprietary fiber interface requires a point-to-point single-mode fiber connection and cannot traverse a standard SONET network. The SUT supports a DS3 converter, which converts the proprietary 40.96 Mbps digital signal to a standard 44.736 Mbps at the SUT DS3 interface; however, this was not tested and is not certified for joint use. This certification expires upon changes that could affect interoperability, but no later than three years from the date of the Unified Capabilities (UC) Approved Products List (APL) memorandum.

3. This finding is based on interoperability testing, review of the vendor's Letters of Compliance (LoC), and DISA Certifying Authority (CA) Recommendation. Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona, from 7 through 10 August 2012. Review of the vendor's LoC was completed on 14 August 2012. The DISA CA provided a positive Recommendation on 1 October 2012 based on the security testing completed by DISA-led IA test teams and published in a separate report,

Reference (e). The Certification Testing Summary (Enclosure 2) documents the test results and describes the test network.

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

Table 1. SUT Interface Interoperability Status

Interface	Critical	UCR Reference	Threshold CR/FR Requirements[1]	Status	Remarks
Access Interfaces					
Analog	No[2]	5.9.2.3.1	1, 2	Certified	Met all critical CRs and FRs via this interface.
Serial	No[2]	5.9.2.3.2	1, 2	Not Tested	The SUT does not support this interface.
BRI ISDN-U	No[2]	5.9.2.3.3	1, 2	Certified	Met all critical CRs and FRs via this interface.
DS1[3]	No[2]	5.9.2.3.4	1, 2, 3	Certified	Met all critical CRs and FRs via this interface.
E1	No[2]	5.9.2.3.5	1, 2, 3	Not Tested	The SUT does not support this interface.
DS3	No[2]	5.9.2.3.6	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested.
OC-X	No[2]	5.9.2.3.8	1, 2, 3	Not Tested	The SUT does not support this interface.
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	Not Tested	The SUT does not support this interface.
Transport Interfaces					
Serial	No[2]	5.9.2.3.2	1, 2	Not Tested	The SUT does not support this interface.
DS1	No[2]	5.9.2.3.4	1, 2, 3	Certified	Met all critical CRs and FRs via this interface.
E1	No[2]	5.9.2.3.5	1, 2, 3	Certified	The SUT does not support this interface.
DS3	No[2]	5.9.2.3.6	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested
OC-X	No[2]	5.9.2.3.8	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested
40.96 Mbps Single Mode Fiber[4]	No[2]	5.9.2.3.9	1,2,3	Certified	Met all critical CRs and FRs via this interface.
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	Not Tested	The SUT does not support this interface.
DLoS	No[2]	5.9.2.3.9	1, 2, 5	Not Tested	The SUT does not support this interface.
Device Management Interfaces					
10/100-Mbps Ethernet	No[2]	5.9.2.4.1	4	Not Tested	The SUT does not support this interface
Serial	No[2]	5.9.2.4.1	4	Certified[5]	Met all critical CRs and FRs via this interface.

NOTES:
1. The SUT's specific capability and functional requirement ID numbers depicted in the CRs/FRs column can be cross-referenced in Table 2.
2. The UCR does not specify minimum required interfaces for access, transport, or management interfaces; however, the SUT must provide at least one for connectivity.
3. The SUT is certified with any DS1 protocols: T1CAS, PRI or SS7.
4. The SUT supports a proprietary 40.96 Mbps digital signal over single-mode fiber between the Host Digital Terminals (HDT) and Optical Network Units (ONU).
5. The SUT network management serial interface can only monitor the system status. The SUT is plug-n-play and requires no configuration.

Table 1. SUT Interface Interoperability Status (continued)

LEGEND:

BRI	Basic Rate Interface	ISDN	Integrated Services Digital Network
CAS	Channel Associated Signaling	Mbps	Megabits per second
CR	Capability Requirement	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
DLoS	Direct Line of Sight	PRI	Primary Rate Interface
DS1	Digital System Level 1 (1.544 Mbps)	SS7	Signaling System 7
DS3	Digital System Level 3 (44.736 Mbps)	SUT	System Under Test
E1	European Interface Standard (2.048 Mbps)	T1	Digital Transmission Link Level 1 (1.544 Mbps)
FR	Functional Requirement	U	ISDN BRI 2-wire interface
ID	Identification	UCR	Unified Capabilities Requirements
IP	Internet Protocol		

Table 2. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability[1]	UCR Reference[2]	Status
1	**General NE Requirements**			
	General Requirements	Required	5.9.2.1	Met
	Alarms	Required	5.9.2.1.1	Met
	Congestion Control & Latency	Required	5.9.2.1.2	Met[3]
2	**Compression**			
	ITU-T G.726	Conditional	5.9.2.2	Not Tested[4]
	ITU-T G.728	Conditional	5.9.2.2	Not Tested[4]
	ITU-T G.729	Conditional	5.9.2.2	Not Tested[4]
3	**Interface Requirements**			
	Timing	Required	5.9.2.3.7	Met[5]
4	**Device Management**			
	Management Options	Required	5.9.2.4.1	Met
	Fault Management	Conditional	5.9.2.4.2	Not Tested[4]
	Loop-Back Capability	Conditional	5.9.2.4.3	Not Tested[4]
	Operational Configuration Restoral	Required	5.9.2.4.4	Met
5	**DLoS**			
	DLoS Transport	Conditional	5.9.2.4.5	Not Tested[4]
6	**D-NE Requirements**			
	D-NE General Requirements	Required	5.9.3.1	Not Tested[6]
	D-NE TDM Requirements	Conditional	5.9.3.2	Not Tested[6]
	D-NE IP Requirements	Conditional	5.9.3.3	Not Tested[6]
	Encapsulated TDM Requirements	Conditional	5.9.3.4	Not Tested[6]
	Carrier Group Alarms	Required	5.9.3.5	Not Tested[6]
	Long-Local Requirements	Conditional	5.9.3.6	Not Tested[6]
	Proprietary IP Trunk Requirements	Conditional	5.9.3.7	Not Tested[6]
	Secure Call Handling	Required	5.9.3.8	Not Tested[6]
	Voice Packet Multiplexing	Conditional	5.9.3.9	Not Tested[6]
7	**IPv6 Requirements**			
	Product Requirements	Required	5.3.5.4	Not Tested[7]

NOTES:
1. The annotation of 'required' refers to a high-level requirement category. The applicability of each sub-requirement is provided in Enclosure 3.
2. The reference document is the UCR 2008, Change 3.
3. Congestion is not possible with the SUT.
4. This conditional feature is not supported by the SUT.
5. The SUT met the timing requirements with an external 64.8 Megahertz timing source.

Table 2. SUT Capability Requirements and Functional Requirements Status (continued)

NOTES:
6. The SUT was tested and certified for joint use as Fixed Network Element only. The UCR D-NE requirements are conditional and were not tested.
7. The SUT does not support IP. Therefore, the IPv6 requirement does not apply to the SUT.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IP	Internet Protocol
CR	Capability Requirement	IPv6	Internet Protocol version 6
CS-ACELP	Conjugate Structure Algebraic Code-Excited linear Prediction	ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
DLoS	Direct Line of Sight	kbps	kilobits per second
D-NE	Deployed Network Element	LD-CELP	Low Delay Code Excited Linear Prediction
FR	Functional Requirement	NE	Network Element
G.726	ITU-T speech codec for ADPCM (32 kbps)	SUT	System Under Test
G.728	ITU-T speech codec for LD-CELP (16 kbps)	TDM	Time Division Multiplexing
G.729	ITU-T speech codec for CS-ACELP (8 kbps)	UCR	Unified Capabilities Requirements
ID	Identification		

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). 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). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and deployment guide must be requested directly through government civilian or uniformed military personnel from the Unified Capabilities Certification Office (UCCO). All associated data is available on the DISA UCCO website located at http://www.disa.mil/Services/Network-Services/UCCO.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to edward.a.mellon.civ@mail.mil. JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 1214401.

FOR THE COMMANDER:

3 Enclosures a/s

for BRADLEY A. CLARK
Acting Chief
Battlespace Communications Portfolio

Distribution (electronic mail):
DoD CIO
Joint Staff J-6, JCS
USD(AT&L)
ISG Secretariat, DISA, JTA
U.S. Strategic Command, J665
US Navy, OPNAV N2/N6FP12
US Army, DA-OSA, CIO/G-6 ASA(ALT), SAIS-IOQ
US Air Force, A3CNN/A6CNN
US Marine Corps, MARCORSYSCOM, SIAT, A&CE Division
US Coast Guard, CG-64
DISA/TEMC
DIA, Office of the Acquisition Executive
NSG Interoperability Assessment Team
DOT&E, Netcentric Systems and Naval Warfare
Medical Health Systems, JMIS IV&V
HQUSAISEC, AMSEL-IE-IS
UCCO

ADDITIONAL REFERENCES

(c) Office of the Department of Defense Chief Information Officer, "Department of Defense Unified Capabilities Requirements 2008, Change 3," September 2011
(d) Joint Interoperability Test Command Document, "Unified Capabilities Test Plan," May 2009
(e) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01C, "Policy for Department of Defense Voice Services with Real Time Services (RTS)," 9 November 2007
(f) Joint Interoperability Test Command, "Information Assurance (IA) Assessment of LTI DataComm Fiber Copper Wireless-Integrated Access (FCW-IA) Digital Loop Carrier Line Extender Release (DLCLE) (Rel.) 3.5 (Tracking Number 2314401)," Draft

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. LTI DataComm Fiber-Copper-Wire-Integrated Access (FCW-IA) Digital Loop Carrier Line Extender (DLCLE) Version 3.5; hereinafter referred to as the System Under Test (SUT).

2. SPONSOR. Mr. John McCain, 96 CS/SCTMS, Building 252, Avenue D, Eglin Air Force Base, Florida, 32542, e-mail: john.mccain@eglin.af.mil.

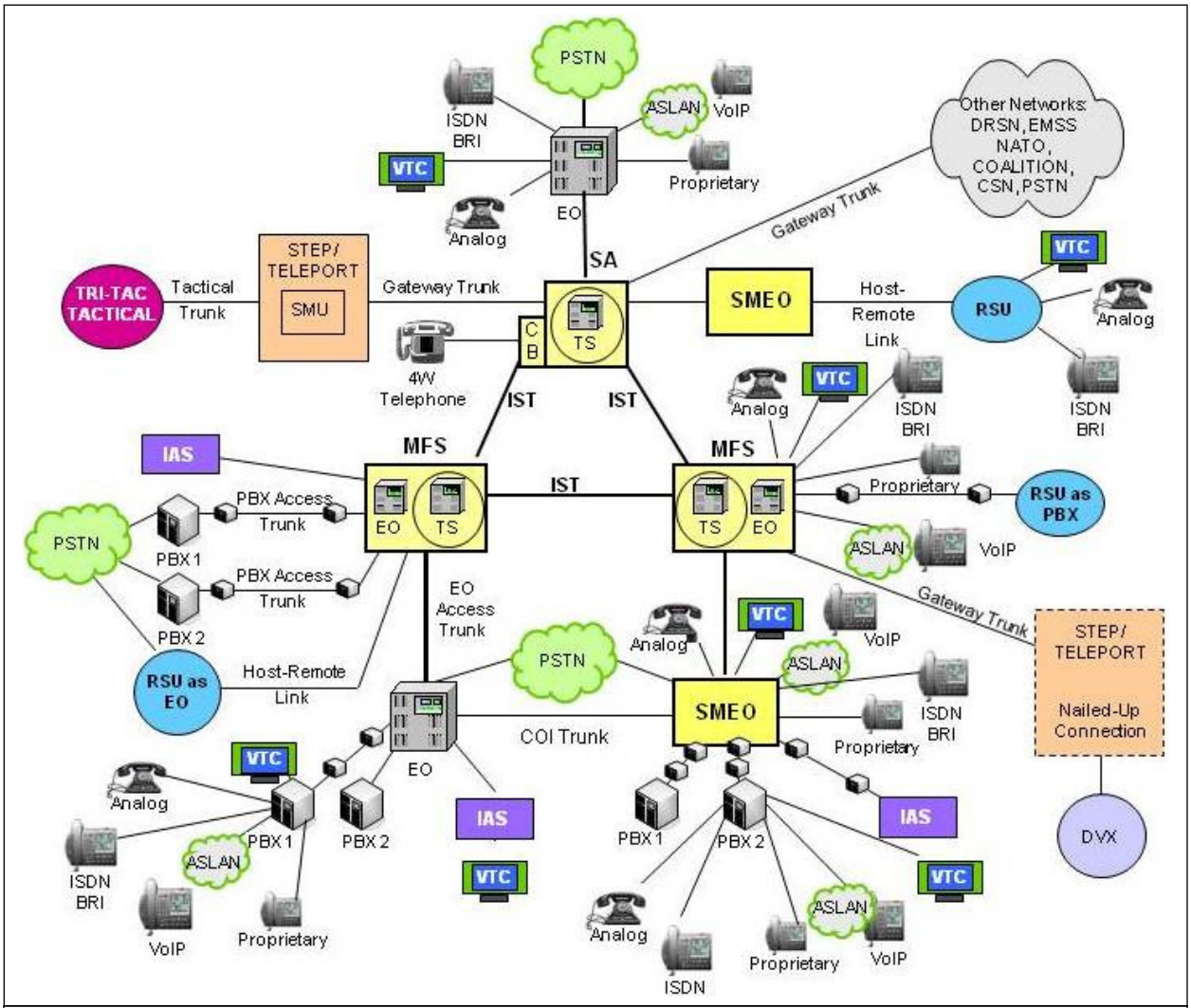
3. SYSTEM POC. Mr. Harold E. Ramey, LTI DataComm, 3605 Turner Road, Richmond Indiana 47374, email: Harold.ramey@ltidata.com.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM DESCRIPTION. The SUT is certified for joint use in the Defense Information Systems Network (DISN) in accordance with the requirements set forth in reference (c). The SUT and its associated applications met all the critical interoperability requirements as a customer premise equipment and were transparent to the switching systems interfaced, causing no degradation of service or negative impact when connected to the interfaces certified in this letter. The SUT is a Fixed Network Element (FNE). The SUT is composed of Host Digital Terminals (HDT) and Optical Network Units (ONU), which provide an extension of switch line and trunk access circuits via a proprietary 40.96 Megabits per second (Mbps) digital signal over single-mode fiber. This proprietary interface is not compatible with the 44.736 Mbps Digital Signal 3 (DS3) standards. This proprietary fiber interface requires a point-to-point single-mode fiber connection and cannot traverse a standard Synchronous Optical Network (SONET) network. The SUT supports a DS3 converter, which converts the proprietary 40.96 Mbps digital signal to a standard 44.736 Mbps to a DS3 interface however, this DS3 converter was not tested and is not certified for joint use.

The SUT extends Plain Old Telephone Service (POTS), 5000 Series Proprietary (P) Phones, Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) and Digital Signal Level 1 (DS1) interfaces from the Central Office (CO) via the HDT to ONU over the proprietary 40.96 Mbps digital signal over single-mode fiber. The SUT can support up to 192 lines from one HDT and can support up to 96 lines on each ONU. When fully populated with 2 HDT's and 4 ONU's, the SUT can support up to 384 lines plus the DS1 circuits.

6. OPERATIONAL ARCHITECTURE. JITC tested the SUT under the F-NE Unified Capabilities Requirements (UCR) product category. A high-level DISN node architecture, as depicted in Figure 2-1.



LEGEND:

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

Figure 2-1. DISN Architecture

7.0 INTEROPERABILITY REQUIREMENTS. The interface, Capability Requirements (CR), Functional Requirements (FR), Information Assurance (IA), and other

requirements for NE products are established by sections 5.4 and 5.9 of the Department of Defense UCR 2008, Change 3.

7.1 Interfaces. The NE products use its interfaces to connect to the DISN or PSTN infrastructure. The threshold requirements for interfaces specific to the NE products are listed in Table 2-1.

Table 2-1. NE Interface Requirements

Interface	Critical	UCR Reference	Threshold CR/FR Requirements[1]	Criteria
Access Interfaces				
Analog	No[2]	5.9.2.3.1	1, 2	Meet minimum CR/FRs and interface standards. .
Serial	No[2]	5.9.2.3.2	1, 2	
BRI ISDN	No[2]	5.9.2.3.3	1, 2	
DS1	No[2]	5.9.2.3.4	1, 2, 3	
E1	No[2]	5.9.2.3.5	1, 2, 3	
DS3	No[2]	5.9.2.3.6	1, 2, 3	
OC-X	No[2]	5.9.2.3.8	1, 2, 3	
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	
Transport Interfaces				
Analog	No[2]	5.9.2.3.1	1, 2	Meet minimum CR/FRs and interface standards.
Serial	No[2]	5.9.2.3.2	1, 2	
BRI ISDN	No[2]	5.9.2.3.3	1, 2	
DS1	No[2]	5.9.2.3.4	1, 2, 3	
E1	No[2]	5.9.2.3.5	1, 2, 3	
DS3	No[2]	5.9.2.3.6	1, 2, 3	
OC-X	No[2]	5.9.2.3.8	1, 2, 3	
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	
DLoS	No[2]	5.9.2.3.9	1, 2, 5, 7	
Device Management Interfaces				
10/100-Mbps Ethernet	No[2]	5.3.2.4.1	4	Meet minimum CR/FRs and interface standards.
Serial	No[2]	5.9.2.4.1	4	Meet minimum CR/FRs and interface standards.

NOTES:
1. The CR/FR requirements are contained in Table 2-2. The CR/FR numbers represent a roll-up of UCR requirements.
2. The UCR does not specify a minimum interfaces for access, transport, or device management interfaces.

LEGEND:

BRI	Basic Rate Interface	ISDN	Integrated Services Digital Network
CR	Capability Requirement	LAN	Local Area Network
DLoS	Direct Line of Sight	Mbps	Megabits per second
DS1	Digital System Level 1 (1.544 Mbps)	NM	Network Management
DS3	Digital System Level 3 (44.736 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
E1	European Interface Standard (2.048 Mbps)	SUT	System Under Test
FR	Functional Requirement	UCR	Unified Capabilities Requirements
IP	Internet Protocol	WAN	Wide Area Network

7.2 Capability Requirements (CR) and Functional Requirements (FR). The NE products have required and conditional features and capabilities that are established by section 5.9 of the UCR. The SUT does not need to provide non-critical (conditional) features and capabilities. If they are present, however, they must function according to the specified requirements. Table 2-2 lists the features and capabilities and their associated requirements for wireless products. Table 3-1 of Enclosure 3 provides detailed CR/FR requirements.

Table 2-2. NE Capability Requirements and Functional Requirements

CR/FR ID	Capability/Function	Applicability[1]	UCR Reference[2]	Criteria	Remarks
1	**General NE Requirements**				
	General Requirements	Required	5.9.2.1	Meet applicable UCR requirements. Detailed requirements and associated criteria are provided in Table 3-1 of Enclosure 3.	Applies to both F-NE and D-NE.
	Alarms	Required	5.9.2.1.1		
	Congestion Control & Latency	Required	5.9.2.1.2		
2	**Compression**				
	ITU-T G.726	Conditional	5.9.2.2	Meet applicable UCR requirements. Detailed requirements and associated criteria are provided in Table 3-1 of Enclosure 3.	Applies to both F-NE and D-NE.
	ITU-T G.728	Conditional	5.9.2.2		
	ITU-T G.729	Conditional	5.9.2.2		
3	**Interface Requirements**				
	Timing	Required	5.9.2.3.7	Meet UCR requirements.	Applicable to TDM interfaces.
4	**Device Management**				
	Management Options	Required	5.9.2.4.1	Meet applicable UCR requirements. Detailed requirements and associated criteria are provided in Table 3-1 of Enclosure 3.	Applies to both F-NE and D-NE.
	Fault Management	Conditional	5.9.2.4.2		
	Loop-Back Capability	Conditional	5.9.2.4.3		
	Operational Configuration Restoral	Required	5.9.2.4.4		
5	**DLoS**				
	DLoS Transport	Conditional	5.9.2.4.5	Meet UCR DLoS requirements.	Applies to both F-NE and D-NE.
6	**D-NE Requirements[3]**				
	D-NE General Requirements	Required	5.9.3.1	Meet applicable UCR requirements. Detailed requirements and associated criteria are provided in Table 3-1 of Enclosure 3.	Applies to D-NE.
	D-NE TDM Requirements	Conditional	5.9.3.2		
	D-NE IP Requirements	Conditional	5.9.3.3		
	Encapsulated TDM Requirements	Conditional	5.9.3.4		
	Carrier Group Alarms	Required	5.9.3.5		
	Long-Local Requirements	Conditional	5.9.3.6		
	Proprietary IP Trunk Requirements	Conditional	5.9.3.7		
	Secure Call Handling	Required	5.9.3.8		
	Voice Packet Multiplexing	Conditional	5.9.3.9		
7	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Meet UCR IPv6 requirements.	Applies to both F-NE and D-NE

NOTES:
1. Annotation of 'required' refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. Reference document is UCR 2008 Change 3.
3. The D-NE requirements only apply if the SUT is being considered for certification as a D-NE.

Table 2-2. NE Capability Requirements and Functional Requirements (continued)

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	ID	Identification
CR	Capability Requirement	IP	Internet Protocol
CS-ACELP	Conjugate Structure Algebraic Code-Excited linear Prediction	IPv6	Internet Protocol version 6
		ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
DLoS	Direct Line of Sight		
D-NE	Deployed Network Element	kbps	kilobits per second
F-NE	Fixed Network Element	LD-CELP	Low Delay Code Excited Linear Prediction
FR	Functional Requirement	NE	Network Element
G.726	ITU-T speech codec for ADPCM (32 kbps)	SUT	System Under Test
G.728	ITU-T speech codec for LD-CELP (16 kbps)	TDM	Time Division Multiplexing
G.729	ITU-T speech codec for CS-ACELP (8 kbps)	UCR	Unified Capabilities Requirements

7.3 Information Assurance. The IA requirements for NE products are listed in Table 2-3. The IA requirements were derived from the UCR 2008, Change 3, section 5.9, Network Element Requirements, and UCR 2008, Change 3, section 5.4, IA Requirements.

Table 2-3. NE Products IA Requirements

Requirement	Applicability (See note.)	UCR Reference	Criteria
General Requirements	Required	5.4.6.2	Detailed requirements and associated criteria for Network Elements are listed in Reference (e).
Authentication	Required	5.4.6.2.1	
Integrity	Required	5.4.6.2.2	
Confidentiality	Required	5.4.6.2.3	
Non-Repudiation	Required	5.4.6.2.4	
Availability	Required	5.4.6.2.5	

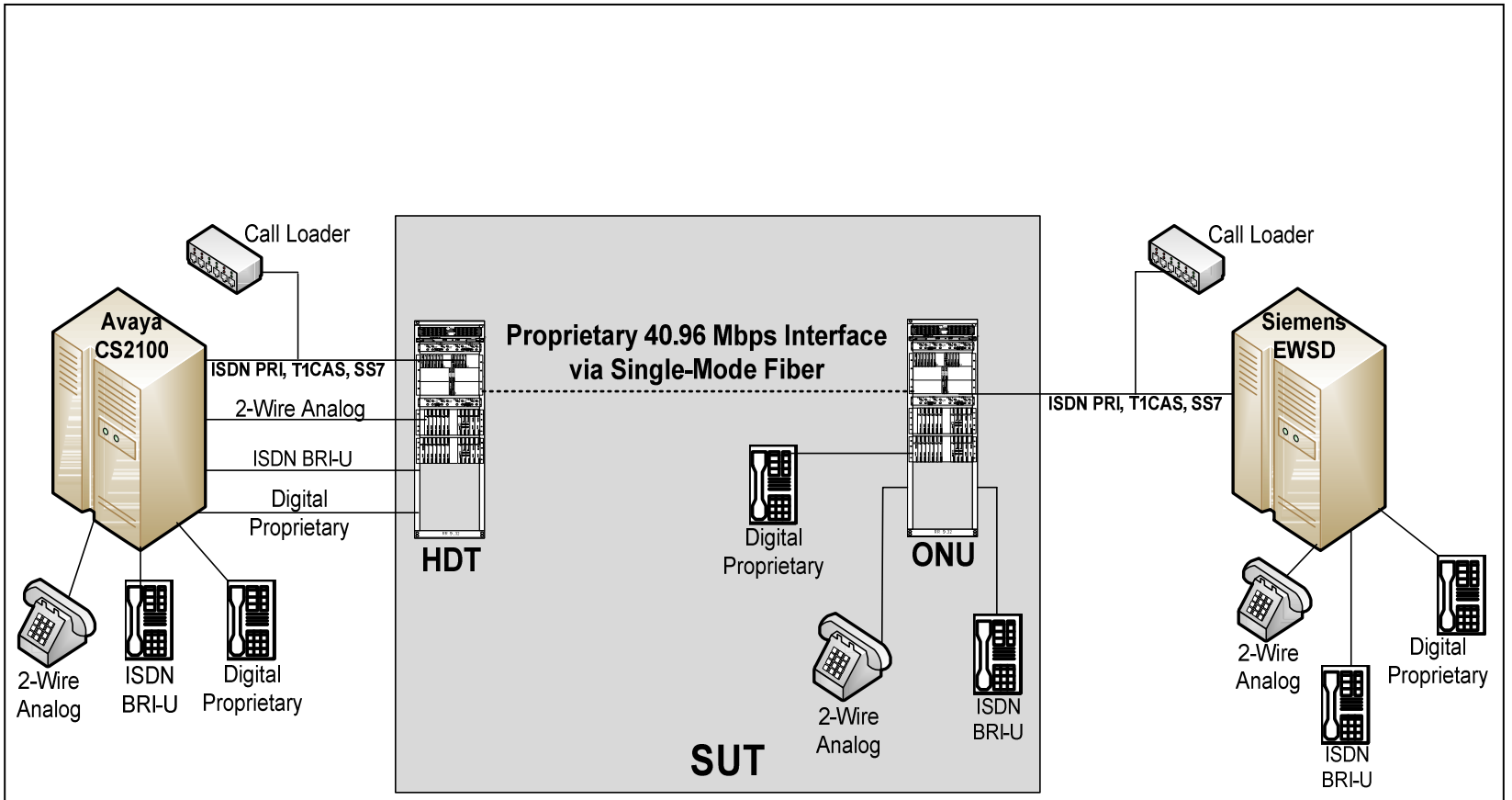
NOTE: The annotation of 'required' refers to a high-level requirement category of IA requirements from the UCR 2008, Change 3, section 5.4. The detailed IA requirements are included in Reference (e).

LEGEND:

CER	Customer Edge Router	NE	Network Element
IA	Information Assurance	UCR	Unified Capabilities Requirements

7.4 Other. None.

8. TEST NETWORK DESCRIPTION. The JITC tested the SUT at its Fort Huachuca, Arizona Global Information Grid Network Test Facility using test configurations shown in Figures 2-2.



LEGEND:

BRI	Basic Rate Interface
CAS	Channel Associated Signaling
CS	Communication Server
EWSD	Elektronisches Wählsystem Digital
HDT	Host Digital Terminal
ISDN	Integrated Services Digital Network
Mbps	Megabits per second
ONU	Optical Network Unit
PRI	Primary Rate Interface
SS7	Signaling System 7
SUT	System Under Test
T1	Digital Transmission Link Level 1 (1.544 Mbps)
U	ISDN BRI 2-wire interface

Figure 2-2. SUT Test Configuration

9. SYSTEM CONFIGURATION. Table 2-4 provides the system hardware and software components tested with the SUT as shown in Figure 2-2. The SUT is certified with switching systems listed on the Unified Capabilities (UC) Approved Products List (APL) that offer the same certified interfaces.

Table 2-4. Tested SUT Configuration

System Name			Software	
Avaya CS2100			Succession Enterprise (SE)09.1	
Siemens EWSD			Release 19d with Patch Set 46	
System Name		**Hardware**	**Part Number**	**Release**
SUT	LTI DataComm Fiber-Copper-Wireless-Integrated Access (FCW-IA) Digital Loop Carrier Line Extender (DLCLE) 3.5	HDT Shelf	M192-04	A1-3
		Power Supply Card	P100-01	C0
		Fiber Optic Card	P145-02	B0
		DeMux Card	P130-02	B2
		System Monitor Card	P120-03	A1
		Dual DS1 Card	P152-01	C0
		Channel Access Card	P190-02	A1
		ISDN BRI + POTS Card	P180-01	A0
		POTS Card	P182-02	A2
		P-Phone Card	P186-01	A3
		ONU Base Shelf	M232-01	A1-1
		Power Supply/Ring Generator Card	P300-02	C0
		Fiber Optic Card	P345-02	C2
		Subscriber Drop Test Card	P391-02	A4
		ISDN BRI + POTS Card	P380-01	A2
		POTS Card	P382-02	B2
		P-Phone Card	P386-01	A3
		DS1 Card	P350-01	A4
		DS1 Connector Card	M350-01	A5
		Management Application		**Release**
		SAT S100-03 (System Administrative Terminal Software installed on a site-provided computer with Windows XP SP3)		3.2.3L

LEGEND:

BRI	Basic Rate Interface	HDT	Host Digital Terminal
CCLK	Composite Clock	ISDN	Integrated Services Digital Network
CS	Communication Server	ONU	Optical Network Unit
DeMux	Demultiplexer	P-Phone	Proprietary Telephone
DS1	Digital Signal Level 1	POTS	Plain Old Telephone Service
DS3	Digital Signal Level 3	SAT	System Administrative Terminal
EWSD	Elektronisches Wählsystem Digital	SUT	System Under Test

10. TEST LIMITATIONS. None.

11. INTEROPERABILITY EVALUATION RESULTS. The SUT meets the critical interoperability requirements for F-NE and is certified for joint use within the DISN. Additional discussion regarding specific testing results is contained in subsequent paragraphs.

11.1 Interfaces. The interface status of the SUT is provided in Table 2-5.

Table 2-5. SUT Interface Interoperability Status

Interface	Critical	UCR Reference	Threshold CR/FR Requirements[1]	Status	Remarks
Access Interfaces					
Analog	No[2]	5.9.2.3.1	1, 2	Certified	Met all critical CRs and FRs via this interface.
Serial	No[2]	5.9.2.3.2	1, 2	Not Tested	The SUT does not support this interface.
BRI ISDN-U	No[2]	5.9.2.3.3	1, 2	Certified	Met all critical CRs and FRs via this interface.
DS1[3]	No[2]	5.9.2.3.4	1, 2, 3	Certified	Met all critical CRs and FRs via this interface.
E1	No[2]	5.9.2.3.5	1, 2, 3	Not Tested	The SUT does not support this interface.
DS3	No[2]	5.9.2.3.6	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested.
OC-X	No[2]	5.9.2.3.8	1, 2, 3	Not Tested	The SUT does not support this interface.
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	Not Tested	The SUT does not support this interface.
Transport Interfaces					
Serial	No[2]	5.9.2.3.2	1, 2	Not Tested	The SUT does not support this interface.
DS1	No[2]	5.9.2.3.4	1, 2, 3	Certified	Met all critical CRs and FRs via this interface.
E1	No[2]	5.9.2.3.5	1, 2, 3	Certified	The SUT does not support this interface.
DS3	No[2]	5.9.2.3.6	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested
OC-X	No[2]	5.9.2.3.8	1, 2, 3	Not Tested	The SUT supports this interface; however, it was not tested
40.96 Mbps Single Mode Fiber[4]	No[2]	5.9.2.3.9	1,2,3	Certified	Met all critical CRs and FRs via this interface.
IP (Ethernet)	No[2]	5.9.2.3.9	1, 2, 7	Not Tested	The SUT does not support this interface.
DLoS	No[2]	5.9.2.3.9	1, 2, 5	Not Tested	The SUT does not support this interface.
Device Management Interfaces					
10/100-Mbps Ethernet	No[2]	5.9.2.4.1	4	Not Tested	The SUT does not support this interface
Serial	No[2]	5.9.2.4.1	4	Certified[5]	Met all critical CRs and FRs via this interface.

NOTES:
1. The SUT's specific capability and functional requirement ID numbers depicted in the CRs/FRs column can be cross-referenced in Table 2-6.
2. The UCR does not specify minimum required interfaces for access, transport, or management interfaces; however, the SUT must provide at least one for connectivity.
3. The SUT is certified with any DS1 protocols: T1CAS, PRI or SS7.
4. The SUT supports a proprietary 40.96 Mbps digital signal over single-mode fiber between the Host Digital Terminals (HDT) and Optical Network Units (ONU).
5. The SUT network management serial interface can only monitor the system status. The SUT is plug-n-play and requires no configuration.

Table 2-5. SUT Interface Interoperability Status (continued)

LEGEND:

BRI	Basic Rate Interface	ISDN	Integrated Services Digital Network
CAS	Channel Associated Signaling	Mbps	Megabits per second
CR	Capability Requirement	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
DLoS	Direct Line of Sight	PRI	Primary Rate Interface
DS1	Digital System Level 1 (1.544 Mbps)	SS7	Signaling System 7
DS3	Digital System Level 3 (44.736 Mbps)	SUT	System Under Test
E1	European Interface Standard (2.048 Mbps)	T1	Digital Transmission Link Level 1 (1.544 Mbps)
FR	Functional Requirement	U	ISDN BRI 2-wire interface
ID	Identification	UCR	Unified Capabilities Requirements
IP	Internet Protocol		

11.2 CR and FR. The SUT CR and FR status is depicted in Table 2-6. Detailed CR/FR requirements are provided in Enclosure 3, Table 3-1.

Table 2-6. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability[1]	UCR Reference[2]	Status
1	**General NE Requirements**			
	General Requirements	Required	5.9.2.1	Met
	Alarms	Required	5.9.2.1.1	Met
	Congestion Control & Latency	Required	5.9.2.1.2	Met[3]
2	**Compression**			
	ITU-T G.726	Conditional	5.9.2.2	Not Tested[4]
	ITU-T G.728	Conditional	5.9.2.2	Not Tested[4]
	ITU-T G.729	Conditional	5.9.2.2	Not Tested[4]
3	**Interface Requirements**			
	Timing	Required	5.9.2.3.7	Met[5]
4	**Device Management**			
	Management Options	Required	5.9.2.4.1	Met
	Fault Management	Conditional	5.9.2.4.2	Not Tested[4]
	Loop-Back Capability	Conditional	5.9.2.4.3	Not Tested[4]
	Operational Configuration Restoral	Required	5.9.2.4.4	Met
5	**DLoS**			
	DLoS Transport	Conditional	5.9.2.4.5	Not Tested[4]
6	**D-NE Requirements**			
	D-NE General Requirements	Required	5.9.3.1	Not Tested[6]
	D-NE TDM Requirements	Conditional	5.9.3.2	Not Tested[6]
	D-NE IP Requirements	Conditional	5.9.3.3	Not Tested[6]
	Encapsulated TDM Requirements	Conditional	5.9.3.4	Not Tested[6]
	Carrier Group Alarms	Required	5.9.3.5	Not Tested[6]
	Long-Local Requirements	Conditional	5.9.3.6	Not Tested[6]
	Proprietary IP Trunk Requirements	Conditional	5.9.3.7	Not Tested[6]
	Secure Call Handling	Required	5.9.3.8	Not Tested[6]
	Voice Packet Multiplexing	Conditional	5.9.3.9	Not Tested[6]
7	**IPv6 Requirements**			
	Product Requirements	Required	5.3.5.4	Not Tested[7]

NOTES:
1. The annotation of 'required' refers to a high-level requirement category. The applicability of each sub-requirement is provided in Enclosure 3.
2. The reference document is the UCR 2008, Change 3.
3. Congestion is not possible with the SUT.
4. This conditional feature is not supported by the SUT.

Table 2. SUT Capability Requirements and Functional Requirements Status (continued)

NOTES (continued):
5. The SUT met the timing requirements with an external 64.8 Megahertz timing source.
6. The SUT was tested and certified for joint use as Fixed Network Element only. The UCR D-NE requirements are conditional and were not tested.
7. The SUT does not support IP. Therefore, the IPv6 requirement does not apply to the SUT

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IP	Internet Protocol
CR	Capability Requirement	IPv6	Internet Protocol version 6
CS-ACELP	Conjugate Structure Algebraic Code-Excited linear Prediction	ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
DLoS	Direct Line of Sight	kbps	kilobits per second
D-NE	Deployed Network Element	LD-CELP	Low Delay Code Excited Linear Prediction
FR	Functional Requirement	NE	Network Element
G.726	ITU-T speech codec for ADPCM (32 kbps)	SUT	System Under Test
G.728	ITU-T speech codec for LD-CELP (16 kbps)	TDM	Time Division Multiplexing
G.729	ITU-T speech codec for CS-ACELP (8 kbps)	UCR	Unified Capabilities Requirements
ID	Identification		

a. General NE Requirements

(1) General Requirements. The call loader was used to generate calls over each of the respective digital interfaces through the SUT. Call load scenarios included simulated 56 kilobits per second (kbps) data, facsimile, modem, and 3-tone voice over each interface. A total number of 65.937 calls (includes fax, modem, 3-tone, and synchronous data) were placed using the call loader with a recorded 100 percent call completion rate. The UCR 2008, Change 3, section 5.9.2.1, includes the general requirements in the following paragraphs.

(a) The introduction of an NE(s) shall not cause the End-to-End (E2E) average MOS to fall below 4.0 as measured over any five-minute time interval. Voice calls were placed over the interfaces through the SUT and measured a Mean Opinion Score of 4.0 or better with an average of 4.3 as required by the UCR. The SUT had no adverse effects, which met this requirement.

(b) The introduction of an NE(s) shall not degrade the E2E measured bit error rate (BER) to no more than .03 percent from the baseline minimum E2E digital BER requirement which is not more than one error in $1x10^{9}$ bits (averaged over a 9-hour period). The SUT met the requirement as measured through testing. The introduction of the NE did not cause a measureable degradation from the baseline, 0.0 percent. The SUT had a measured baseline of $0x10^{-10}$ during 22 hours of a 64 kbps

data BERT. The SUT had a measured baseline of $0x10^{-10}$ during 18 hours of a 56 kbps data BERT, which meet these requirements.

(c) The introduction of an NE(s) shall not degrade secure transmission for secure end devices as defined by section 5.2.2. The SUT met the requirement through testing. Over 240 secure calls were placed over the different interfaces using like and unlike devices with no failures, which met this requirement.

1. Secure Terminal Equipment (STE) Secure Voice Calls. Secure voice call scenarios (STE to STE calls @ 6.4 & 32 kbps) were conducted over the interfaces through the SUT with a 100-percent success rate with no adverse effects. Secure calls were also successfully completed using various other Defense Communications Secure Device (DSCD) units on the UC APL for call scenarios.

2. STE Secure Data Calls. The Fireberd 8000 test set was used to conduct an asynchronous Bit Error Rate Test (BERT) using a 511 test pattern in the secure data mode for periods of at least 30 minutes per call over the interfaces through the SUT with no adverse effects. Secure Data call scenarios (STE to STE calls @ 19.2, 64, and 128 kbps) were conducted with no bit errors. Secure data calls ranged from 30 minutes to 89 hours.

3. Secure FAX. Manually placed secure FAX calls were placed over each of the digital interfaces through the SUT with a 100-percent success rate with no adverse effects, which met this requirement.

(d) The NE(s) shall support a minimum modem transmission speed of 9.6 kbps across the associated NE(s). The SUT met this requirement with testing. The minimum modem transmission speed tested was 26.4 kbps. All asynchronous modem calls were placed over the interfaces through the SUT with a 100-percent success rate with no adverse effects, which met this requirement.

(e) The NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s). The SUT met this requirement with testing. The minimum facsimile transmission speed tested was 14.4 kbps. Manual non-secure FAX calls were placed over the interfaces through the SUT with a 100-percent success rate and no adverse effects, which met this requirement.

(f) The NE shall transport all call control signals transparently on an E2E basis. The SUT met this requirement through testing for supervisory, Assured Services and Multi-Level Precedence and Preemption (MLPP) signaling. The four types of MLPP call scenarios listed below were tested over each interface. Each preemption scenario met the UCR MLPP requirements with no adverse effects, which met this requirement.

1. Answered Call; Circuit to be Reused

2. Unanswered Call; Circuit to be Reused

3. Answered Call; Circuit not to be Reused

4. Unanswered Call; Circuit not to be Reused

(2) Alarms. The UCR 2008, Change 3, section 5.9.2.1.1, states the NE shall be able to propagate Carrier Group Alarms (CGAs) upon physical loss of the TDM interface. The NE shall provide the capability of detecting a CGA. When the CGA is detected, all outgoing trunks shall be made busy automatically and call attempts on associated incoming trunks shall not be processed. NEs that support Internet Protocol (IP) ingress/egress traffic either as inbound or outbound NE traffic and/or transport between NE(s) shall support one or more of the following routing protocols: Link-State and/or Distance-Vector, such that the NE can notify the IP network (e.g., LAN, MAN) the condition of its link state for transporting ingress IP traffic, namely operational or down. The SUT met the requirements for Red (Loss of Signal) and yellow (Remote Alarm Indication) CGAs on the TDM interfaces. The alarms were propagated through the SUT transparently. The SUT does not support an IP interface, which is not required.

(3) Congestion Control. The UCR 2008, Change 3, section 5.9.2.1.2, states the NE shall assure that congestion between paired NEs does not affect DISN calls in progress or subsequent calls. Congestion is not possible with the SUT which met this requirement. In accordance with this requirement, call congestion handling shall be met in one or more of the following ways:

(a) TDM Transport. The UCR 2008, Change 3, section 5.9.2.1.2.1 states the NE shall implement TDM congestion control via one of the methods below. The SUT met this requirement because congestion is not possible in the SUT. Because the SUT has TDM interfaces, transport cannot be oversubscribed regardless of how the network is engineered.

1. A dynamic load control signal (e.g., contact closure) shall be provided to the DSN switch.

2. Congestion is not possible in the NE by nature of its functioning (e.g., a TDM multiplexer or transcoder).

3. TDM Transport Latency. The addition of NEs with TDM transports shall not increase the one-way latency per NE pair when measured from end to end over any five-minute period specified as follows:

a. TDM ingress G.711 (non-secure calls) to non-transcoding G.711 TDM egress shall not increase delay more than 10 ms per NE pair as measured E2E. The SUT latency was measured at 1 ms which met this requirement.

b. TDM ingress G.711 (non-secure calls) to transcoding TDM egress with compression codecs (section 5.9.2.2) shall not increase delay by more than 100 ms per NE pair as measured E2E. The SUT does not support transcoding.

c. TDM ingress G.711 (secure calls) to non-transcoding TDM egress G.711 shall not increase delay by more than 50 ms per NE pair as measured E2E.

d. TDM ingress G.711 (secure calls) to transcoding TDM egress with compression codecs (section 5.9.2.2) shall not increase delay by more than 250 ms per NE pair as measured E2E.

(b) IP Transport. The UCR 2008, Change 3, section 5.9.2.1.2.2, states the NE(s) utilizing IP transport shall implement IP congestion control. Congestion may be controlled by using Differentiated Services, which shall be capable of providing preferential treatment for call congestion over other media types in accordance with section 5.3.3, and a capability to limit the provisioning of input, and output interfaces so congestion is impossible under the worst transport congestion scenario. The SUT does not support the conditional IP interface and therefore, this requirement does not apply.

(c) Direct Line of Sight (DLoS) Transport. The UCR 2008, Change 3, section 5.9.2.1.2.3, states the NE shall implement DLoS congestion control based on the DSN traffic and signaling type to be transported. The SUT does not support DLoS Transport. Therefore, the following DLoS congestion control requirements are not applicable.

1. The NE transporting only TDM bearer and signaling traffic shall implement DLoS congestion control via one or more of the following methods:

a. A dynamic load control signal (e.g., contact closure) shall be provided to the DSN switch in accordance with UCR 2008.

b. Congestion is not possible in the NE such that the maximum ingress throughput into the NE is configured such that it does not exceed the DLoS link maximum egress transport capability to include all DLoS overhead control traffic between the transport devices.

2. The NE transporting only ingress IP traffic, and not using DLoS transport comprised of 802.11 a/b/g, 802.16-2004 (formerly 802.16d), or 802.16e-2005, shall implement DLoS IP congestion control per section 5.9.2.1.2.2. Additionally, IP congestion control may include a standards based or proprietary protocol between the NEs that will adjust the Quality of Service of the NE based on DLoS transport monitoring feedback to the NE to accommodate for changing environmental link conditions.

3. The NE transporting both TDM and IP ingress traffic simultaneously over the same DLoS transport link shall meet the following requirements:

a. The NE shall provide congestion control so it provides the same level of capability, respectively, for the appropriate traffic type, TDM and IP, per the requirements for single traffic type ingress/egress to the NE. Additionally, the congestion control may include a standards based or proprietary protocol between the NEs that will adjust the Quality of Service of the NE based on DLoS transport monitoring feedback to the NE to accommodate for changing environmental link conditions.

b. The use of DLoS transport shall not increase the one-way latency or packet delay per the requirements for TDM ingress and TDM or IP egress interfaces per the appropriate section 5.9.2.1.2.1, For TDM Transport, and section 5.9.2.3.9, IP Interface, respectively.

b. Compression. The UCR 2008, Change 3, section 5.9.2.2, states the NE used for voice compression shall support at least one of the following standards: ITU-T G.726, ITU-T G.728, or ITU-T G.729. The SUT does not support Compression. This is a conditional requirement for an NE.

c. Interface Requirements. The UCR 2008, Change 3, section 5.9.2.3, details the interface requirements for a NE. The UCR does not specify minimum required interfaces for access, transport, or management interfaces; however, the SUT must provide at least one for connectivity.

(1) Analog. The UCR 2008, Change 3, section 5.9.2.3.1, states that if an analog interface is provided, the NE shall provide for a 2-wire and/or 4-wire analog trunk circuit interface that interfaces using industry standard signaling and facility arrangements per one or more of the following trunk circuits: E&M, Single Frequency, or Dual Frequency. The SUT met all critical CRs and FRs for 2 wire analog interfaces using industry standard signaling. The SUT met this requirement through testing.

(2) Serial. The UCR 2008, Change 3, section 5.9.2.3.2, states that if a serial interface is provided, the NE shall use one of the following standards: ITU-T V.35, EIA-232, EIA-449, or EIA-530. The SUT does not support a serial interface for access or transport.

(3) BRI Integrated Services Digital Network (ISDN). The UCR 2008, Change 3, section 5.9.2.3.3, states that if an ISDN BRI interface is provided, the NE shall meet the requirements and conditions IAW section 5.3.2.31.2. The SUT met all critical CRs and FRs for an ISDN BRI-U interface. The SUT met these requirements through testing.

(4) Digital Transmission Link Level 1 (T1). The UCR 2008, Change 3, section 5.9.2.3.4, states that if a T1 interface is provided, the NE shall meet the requirements and conditions of a PCM-24 digital trunk interface. The SUT met all critical CRs and FRs through testing for the following T1 interfaces: CAS Multi-Frequency Recommendation 1 (MFR1), Dual Tone Multi-Frequency (DTMF), Dial Pulse (DP), ISDN PRI, and SS7. In addition, a pulse mask analysis was conducted on the T1 interfaces to verify the SUT met the required T1 electrical interface characteristics. The pulse mask analysis met the UCR requirement.

(5) E1. The UCR 2008, Change 3, section 5.9.2.3.5, states that if an E1 interface is provided, the NE shall meet the requirements and conditions of a PCM-30 digital trunk interface. The SUT does not support E1 interfaces.

(6) DS3. The UCR 2008, Change 3, section 5.9.2.3.6, states that if a DS3 interface is provided, the NE shall meet the requirements and conditions for framing and line coding. The SUT supports a DS3 converter, which converts the proprietary 40.96 Mbps digital signal to a standard 44.736 Mbps to a DS3 interface; however, this interface was not tested and not certified for joint use.

(7) Timing. The UCR 2008, Change 3, section 5.9.2.3.7, states the NE shall be able to derive timing signal from an internal source, an incoming digital signal, or an external source in accordance with UCR 2008, section 5.2.10.1. This requirement only applies to TDM interfaces, IP interfaces need not meet this requirement. The SUT met this requirement by deriving timing from an external 64.8 Megahertz (MHz) composite timing source.

(8) OC-X. The UCR 2008, Change 3, section 5.9.2.3.8, states that if an OC-X interface is provided, the interface shall be IAW section 5.5.3.2 and/or appropriate SONET commercial standards. The SUT does not support an OC-X interface.

(9) IP. The UCR 2008, Change 3, section 5.9.2.3.9, states that if an IP interface is provided using DLoS transport comprised of IEEE 802.11 and/or IEEE 802.16 series standards the interface shall instead meet the requirements for a WAB contained in section 5.3.1.7.2. All other IP configurations shall meet the following requirements. The SUT does not support this interface; therefore, this requirement does not apply.

(a) Delay.

1. TDM ingress of ITU-T G.711 (nonsecure calls) to non-transcoding ITU-T G.711 IP egress shall not increase delay more than 50 ms per NE pair as measured end-to-end.

2. TDM ingress of ITU-T G.711 (nonsecure calls) to transcoding IP egress with compression codecs shall not increase delay more than 100 ms per NE pair as measured end-to-end.

3. TDM ingress of ITU-T G.711 (secure calls) to non-transcoding ITU-T G.711 IP egress shall not increase delay more than 50 ms per NE pair as measured end-to-end.

4. TDM ingress of ITU-T G.711 (secure calls) to transcoding IP egress with compression codecs shall not increase delay more than 250 ms per NE pair as measured end-to-end.

(b) Jitter. The addition of an NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any 5-minute period.

(c) Packet Loss. The addition of an NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any 5-minute period.

d. Device Management.

(1) Management Options. The UCR 2008, Change 3, section 5.9.2.4.1, states the NE devices are to be managed by at least one of the following:

(a) A front or back panel and/or external console control capability shall be provided for local management. The SUT is managed locally from a client, which can be used to monitor multiple units.

(b) Remote monitoring and management by the ADIMSS or similar NM system developed by DoD components.

(2) Fault Management. The UCR 2008, Change 3, section 5.9.2.4.2, states the NE shall report any failure of self-test diagnostic function on non-active and active channels on a noninterference basis to the assigned NMS. The SUT does not support this conditional requirement.

(3) Loop-Back Capability. The UCR 2008, Change 3, section 5.9.2.4.3, states the NE shall provide loopback capability on each of the trunk-side interfaces IAW ITU-T V.54. The SUT does not support this conditional requirement.

(4) Operational Configuration Restoral. The UCR 2008, Change 3, section 5.9.2.4.4, states loss of power should not remove configuration settings. The SUT shall restore to the last customer-configured state before the power loss, without intervention when power is restored. The SUT met this requirement through testing.

e. DLoS. The UCR 2008, Change 3, section 5.9.2.5, includes the DLoS requirements. The SUT does not provide DLoS Transport. Therefore, the following DLoS congestion interface requirements are not applicable.

(1) Minimum MOS scores as defined in section 5.9.2.1, General Requirements, performance requirement or better as measured in any 5-minute interval using P.862 testing standard.

(2) The minimum acceptable Maximum Transmission Range (MTR) shall be 300 feet based on operating in an open air-minimal obstruction, clear line-of-sight environment with the DLoS transport device operating at or near full power mode. Based on the testing results, the estimated maximum performance range while still maintaining MOS requirements shall be referred to as the NE DLoS transport MTR.

(3) An NE with only TDM interfaces that uses a DLoS transport link can be used to transport TDM only or IP over TDM access traffic.

f. Deployed Network Element (D-NE) Requirements. The UCR 2008, Change 3, section 5.9.3, states that the D-NEs shall meet all NE requirements specified in section 5.9.2, DSN F-NE Generic Requirements, except as modified by the following paragraphs. The SUT was not tested as a D-NE, therefore the following requirements are not applicable.

(1) D-NE General Requirements.

(a) The D-NEs may include voice compression, as specified in section 5.9.2.2, to include the following additional compression standard: ITU-T Recommendation G.723.

(b) Network element latency requirements for various codecs are defined in section 5.9.2. The D-NE allows for one additional codec, ITU-T G.723.1. The latency introduced by a single D-NE using the ITU-T G.723.1 codec shall be less than 90 ms. The latency introduced by a pair of D-NEs using the ITU-T G.723.1 codec shall be less than 180 ms.

(c) Voice calls placed through a set of D-NEs shall support a minimum MOS of 3.6 or better as measured in any 5-minute interval using the Perceptual Speech Quality Measure testing standard.

(d) The introduction of a D-NE shall not cause the E2E digital BER to degrade the Tactical BER below $1x10^{-5}$ by more than 0.03 percent as measured over a 9-hour period. This value does not include the application of Forward Error Correction (FEC) but is the minimum acceptable value for Tactical transmission before FEC is applied.

(e) The D-NE (when implemented in pairs) shall apply error correction to correct the errors interjected by the transport network between the two D-NEs such that the resulting BER of the external facing D-NE interface shall be better than $1x10^{-5}$ as measured over a 9-hour period.

(f) The NE shall assure congestion within NEs does not affect DSN calls in progress or subsequent calls. Call congestion handling shall be met in one or more of the following ways:

1. A dynamic load control signal (e.g., contact closure) shall be provided to the DSN switch in accordance with section 5.9.2.1.2, Congestion Control.

2. A software capability in limiting the provisioning the input and/or output interfaces such that makes congestion impossible even under the worst congestion scenario.

3. Congestion is not possible in the NE by nature of its functioning (e.g., a TDM multiplexer or transcoder).

(2) D-NE TDM Requirements. IAW UCR 2008 Change 1 section 5.9.3.2, the D-NE shall support at least one of the interfaces listed in section 5.9.2, DSN F-NE Generic Requirements. To be certified for use, TDM interfaces shall meet the interface requirements for that specified interface. For interfaces provided, congestion control shall be provided as specified in section 5.9.2.1.2, Congestion Control.

(3) D-NE IP Requirements. The D-NEs may use IP as a means to transport voice communications between D-NEs. The IP transport of voice services shall be one or more of the following methods: encapsulated TDM, long local, or Proprietary IP Trunks (PIPT). For any IP transport methods used, D-NEs using IP interfaces shall meet the following parameters: 1) The addition of D-NEs shall meet the latency criteria specified in section 5.9.3.1. 2) The addition of a D-NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any 5-minute period. 3) The addition of a D-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any 5-minute period.

(4) Encapsulated TDM Requirements. The D-NEs that use encapsulated TDM shall meet all the following requirements: 1) The D-NE shall use either differentiated services or integrated services to provide preferential treatment over IP transport. 2) The D-NE shall provide an IP bandwidth reservation/allocation mechanism to allow for the user-specified allocation of bandwidth to support the full non- blocking voice services requirement. 3) The D-NE shall implement IP congestion control. Congestion may be controlled by using differentiated services that shall be capable of providing preferential treatment for call congestion over other media types in accordance with section 5.3.3, Network Infrastructure E2E Requirements, and a capability to limit the provisioning of input and output interfaces, so congestion is impossible under the worst transport congestion scenario.

(5) Carrier Group Alarms. The UCR 2008, Change 3, section 5.9.3.5, states the D-NE shall be able to propagate CGAs IAW section 5.9.2.1.1, upon physical loss of the ingress TDM interface.

(6) Voice switching systems, DSN or Deployed Voice Exchange (DVX), shall receive the proper CGAs from the D-NE upon loss of the IP transport link between D-NEs.

(7) Long-Local Requirements. The UCR 2008, Change 3, section 5.9.3.6, states the D-NEs that provide a long local shall meet all the following requirements: 1) The D-NE shall provision features and functions to support the long-local device. 2) The D-NE shall allocate enough bandwidth to support the long-local device to ensure assured services and non-blocking requirements are met.

(8) Proprietary IP Trunk Requirements. The UCR 2008, Change 3, section 5.9.3.7, states the DVX VD-NE may use Proprietary IP signaling for this solution, and this interface shall support E2E ANSI T1.619a features and functions IAW UCR 2008, Change 3, section 5.3.2.31.3.7.

(9) Secure Call Handling. The UCR 2008, Change 3, section 5.9.3.8, states that in processing Secure Communication Interoperability Protocol (SCIP) across conversion boundaries such as TDM to IP and/or IP to TDM, the D-NE shall utilize the ITU-T V.150.1 standards implementation IAW NSA SCIP-215 and SCIP 216 for said ingress and egress conversions respectively. The secure call shall complete successfully as a minimum equal to or better than 85 percent of the time when used in the Deployed environment

(10) Voice Packet Multiplexing. The UCR 2008, Change 3, section 5.9.3.9, states that a D-NE that is equipped with voice packet multiplexing, where individual small IP voice packets (from either the same or multiple sources) may be combined into a single larger IP packet. The D-NE shall be configurable to allow the operator to specify the maximum latency and/or packet size to provide flexibility in the actual implementation. The intent is to allow the system to trade off additional latency incurred by this process for the gain in packet processing efficiency.

g. IPv6 Requirements. The UCR 2008, Change 3, section 5.3.5.4 states that an NE must be IPv6 capable using the guidance in Table 5.3.5-4 for Network Appliance /Simple Server (NA/SS). The SUT does not support IP access or transport interfaces and the IPv6 requirements are not applicable.

11.3 Information Assurance. Security is tested by DISA-led Information Assurance test teams and published in a separate report, Reference (f).

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents

and references are on the JITC Joint Interoperability Tool (JIT) at http://jit.fhu.disa.mil (NIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and deployment guide must be requested directly through government civilian or uniformed military personnel from the Unified Capabilities Certification Office (UCCO). All associated data is available on the DISA UCCO website located at http://www.disa.mil/Services/Network-Services/UCCO.

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The Network Elements (NEs), fixed (F-NE) and deployed (D-NE), have required and conditional features and capabilities that are established by the Unified Capabilities Requirements (UCR). The System Under Test (SUT) need not provide conditional requirements. If they are provided, they must function according to the specified requirements. The detailed Functional requirements (FR) and Capability Requirements for NEs are listed in Table 3-1. Detailed Information Assurance (IA) requirements are included in Reference (e) and are not listed below.

Table 3-1. NE Capability/Functional Requirements Table

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
1	The introduction of an NE(s) shall not cause the E2E average MOS to fall below 4.0 as measured over any 5-minute time interval.	5.9.2.1 (1)	R	R
2	The introduction of an NE(s) shall not degrade the E2E measured BER to no more than .03 percent from the baseline minimum E2E digital BER requirement which is not more than one error in $1x10^9$ bits (averaged over a 9-hour period).	5.9.2.1 (2)	R	R
3	The introduction of an NE(s) shall not degrade secure transmission for secure end devices as defined by UCR 2008, Change 3, section 5.2.2, DoD Secure Communications Devices.	5.9.2.1 (3)	R	R
4	The NE(s) shall support a minimum modem transmission speed of 9.6 kbps across the associated NE(s).	5.9.2.1 (4)	R	R
5	The NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s).	5.9.2.1 (5)	R	R
6	The NE shall transport all call control signals transparently on an E2E basis.	5.9.2.1 (6)	R	R
7	The NE shall be able to propagate Carrier Group Alarms (CGAs) upon physical loss of the TDM interface. The NE shall provide the capability of detecting a CGA.	5.9.2.1.1	R	R
8	Voice switching systems utilizing a TDM connection to a NE shall receive the proper CGAs from the NE upon loss of the transport link between NEs, regardless of whether the transport link is TDM, IP, or DLoS between the NEs.	5.9.2.1.1	R	R
9	NEs that support IP ingress/egress traffic either as inbound or outbound NE traffic and/or transport between NE(s) shall support one or more of the following routing protocols: Link-State and/or Distance-Vector, such that the NE can notify the IP network (e.g., LAN, MAN), using one of the above routing protocols, the condition of its link state for transporting ingress IP traffic, namely operational or down.	5.9.2.1.1	R	R
10	The NE shall assure that congestion between paired NEs does not affect DISN calls in progress or subsequent calls.	5.9.2.1.2	R	R
11	The NE shall implement TDM congestion control via one of the following methods: 1. A dynamic load control signal (e.g., contact closure) shall be provided to the DISN switch in accordance with UCR 2008, Change 3. 2. Congestion is not possible in the NE by nature of its functioning (e.g., a TDM multiplexer or transcoder). 3. A software capability in limiting the provisioning the ingress and egress interfaces making congestion impossible even under the worst congestion scenario. This can be done by limiting the bearer or aggregate provisioning.	5.9.2.1.2.1 (1)	C	C

Table 3-1. NE Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
12	The addition of NEs with TDM transports shall not increase the one-way latency per NE pair when measured from end to end over any 5-minute period specified as follows: 1. TDM ingress G.711 (non-secure calls) to non-transcoding G.711 TDM egress shall not increase delay more than 10 ms per NE pair as measured end-to-end. 2. TDM ingress G.711 (non-secure calls) to transcoding TDM egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 100 ms per NE pair as measured end-to-end. 3. TDM ingress G.711 (secure calls) to non-transcoding TDM egress G.711 shall not increase delay by more than 50 ms per NE pair as measured end-to-end. 4. TDM ingress G.711 (secure calls) to transcoding TDM egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 250 ms per NE pair as measured end-to-end.	5.9.2.1.2.1 (2)	C	C
13	The NE(s) utilizing IP transport shall implement IP congestion control.	5.9.2.1.2.2	C	C
14	The NE shall implement DLoS congestion control based on the DISN Traffic and signaling type to be transported.	5.9.2.1.2.3	R	R
15	The NE transporting only TDM bearer and signaling traffic shall implement DLoS congestion control via one or more of the following methods: 1. A dynamic load control signal (e.g., contact closure) shall be provided to the DISN switch in accordance with UCR 2008. 2. Congestion is not possible in the NE such that the maximum ingress throughput into the NE is configured such that it does not exceed the DLoS link maximum egress transport capability to include all DLoS overhead control traffic between the transport devices. 3. A software capability in limiting the provisioning of the ingress and egress interfaces making congestion impossible even under the worst congestion scenario. This can be done by limiting the bearer or aggregate provisioning.	5.9.2.1.2.3 (1)	C	C
16	The NE transporting only ingress IP traffic, and not using DLoS transport comprised of 802.11 a/b/g, 802.16-2004 (formerly 802.16d), or 802.16e-2005, shall implement DLoS IP congestion control per Section 5.9.2.1.2.2, For IP Transport.	5.9.2.1.2.3 (2)	C	C
17	The NE transporting both TDM and IP ingress traffic simultaneously over the same DLoS transport link shall meet the following requirements: 1. The NE shall provide congestion control so it provides the same level of capability, respectively, for the appropriate traffic type, TDM and IP, per the requirements for single traffic type ingress/egress to the NE. Additionally, the congestion control may include a standards based or proprietary protocol between the NEs that will adjust the Quality of Service of the NE based on DLoS transport monitoring feedback to the NE to accommodate for changing environmental link conditions. 2. The use of DLoS transport shall not increase the one-way latency or packet delay per the requirements for TDM ingress and TDM or IP egress interfaces per the appropriate Section 5.9.2.1.2.1, For TDM Transport, and Section 5.9.2.3.9, IP Interface, respectively.	5.9.2.1.2.3 (3)	C	C
18	The NE used for voice compression shall support at least one of the following standards: • ITU-T Recommendation G.726 • ITU-T Recommendation G.728 • ITU-T Recommendation G.729	5.9.2.2	C	C
19	If provided, the NE shall provide for a 2-wire and/or 4-wire analog trunk circuit(s) interface that interfaces using industry standard signaling and facility arrangements.	5.9.2.3.1	C	C
20	The NE used for serial interface connections shall be in accordance with one of the following standards: • ITU-T Recommendation V.35 • TIA-232-F • EIA-449-1 • TIA-530-A	5.9.2.3.2	C	C

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
21	The ISDN BRI interface shall meet the requirements and conditions IAW UCR 2008, Change 3, section 5.3.2.31.2, National ISDN 1/2 Basic Access.	5.9.2.3.3	C	C

Table 3-1. NE Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
22	If provided, the NE shall meet the following DS1 (T1) interface requirements and conditions of a PCM-24 Digital Trunk Interface.	5.9.2.3.4	C	C
23	If provided, the NE shall meet the following E1 interface requirements and conditions of a PCM-30 Digital Trunk Interface.	5.9.2.3.5	C	C
24	Frame structure shall include M13 framing in accordance with ANSI T1.107-2002.	5.9.2.3.6.1 (1)	R	R
25	Frame structure may include C-bit parity application in accordance with ANSI T1.107-2002.	5.9.2.3.6.1 (2)	C	C
26	The line coding shall be bipolar 3 zero substitution (B3ZS) in accordance with ANSI T1.102-1993.	5.9.1.5.3.6.2	R	R
27	The NE shall be able to derive a timing signal from an internal source, an incoming digital signal, or an external source IAW UCR 2008, Change 3, 5.3.2.12.14.1.1, Timing Modes.	5.9.2.3.7	R	R
28	The OC-X interface shall be IAW UCR 2008, Change 3, 5.5.3.2, Optical Transport System Interface, and/or appropriate SONET commercial standards. (NOTE: X stands for the capacity (e.g., 3, 48, 192 and higher).	5.9.2.3.8	C	C
29	The NE having an IP interface and using DLoS transport comprised of 802.11 a/b/g, 802.16-2004 (formerly 802.16d), and/or 802.16e-2005 instead shall meet the requirements for a Wireless Access Bridge in Section 5.3.1.7.2, Wireless. All other IP configurations shall meet the following: 1. Delay. The addition of NEs with IP transports shall not increase the one-way latency per NE pair when measured from end to end over any 5-minute period as specified below: a. TDM ingress G.711 (non-secure calls) to non-transcoding G.711 IP Egress shall not increase delay more than 50 ms per NE pair as measured end-to-end. b. TDM ingress G.711 (non-secure calls) to transcoding IP egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 100 ms per NE pair as measured end-to-end. c. TDM ingress G.711 (secure calls) to non-transcoding G.711 IP egress shall not increase delay by more than 50 ms per NE pair as measured end-to-end. d. TDM ingress G.711 (secure calls) to transcoding IP egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 250 ms per NE pair as measured end-to-end. 2. Jitter. The addition of an NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any 5-minute period. 3. Packet Loss. The addition of an NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any 5-minute period.	5.9.2.3.9	C	C
30	For VVoIP systems, if the system decrypts the VVoIP traffic and applies a proprietary encryption approach prior to transmittal between the two components of the single vendor system, then the system proprietary encryption approach shall be one of the encryption and integrity approved approaches defined in Section 5.4, Information Assurance Requirements.	5.9.2.3.9 (4)	R	R
31	VVoIP systems that utilize proprietary encryption approaches within the system shall restore the VVoIP packets to their original format (e.g., AS-SIP with TLS and SRTP) upon exiting from the system to ensure the VVoIP session can complete successfully.	5.9.2.3.9 (5)	R	R
32	The IP interface shall meet the IP requirements detailed in the DISR and Section 5.3, IP-Based Capabilities and Features, inclusive.	5.9.2.3.9 (6)	C	C
33	The NE devices are to be managed by at least one of the following: 1. A front or back panel and/or external console control capability shall be provided for local management. 2. Remote monitoring and management by the Advanced DSN Integrated Management Support System (ADIMSS) or similar Network Management (NM) systems developed by DoD Components.	5.9.2.4.1	R	R
34	Shall report any failure of self-test diagnostic function on non-active and active channels on a noninterference basis to the assigned NMS.	5.9.2.4.2	C	C

Table 3-1. NE Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
35	The NE shall provide loop-back capability on each of the trunk side interfaces in accordance with ITU-T Recommendation V.54.	5.9.2.4.3	C	C
36	Loss of power should not remove configuration settings. Unit should be restored to the last customer-configured state before the power loss, without intervention when power is restored.	5.9.2.4.4	R	R
37	The NEs using DLoS transport shall support the following: 1. Minimum MOS scores as defined in Section 5.9.2.1, General Requirements, performance requirement or better as measured in any 5-minute interval using P.862 testing standard. 2. [Required] The minimum acceptable Maximum Transmission Range (MTR) shall be 300 feet based on operating in an open air-minimal obstruction, clear line-of-sight environment with the DLoS transport device operating at or near full power mode. Based on the testing results, the estimated maximum performance range while still maintaining MOS requirements, as required in item 1, shall hereby be referred to as the NE DLoS transport MTR.	5.9.2.4.5	R	R
38	The MTR baseline-testing environment shall be while operating in an open air-minimal obstruction, clear line-of-sight environment with the DLoS transport device operating at or near full power mode.	5.9.2.4.5 (3)	R	R
39	The NE shall be tested at a minimum operating height of 25 feet with a clear unobstructed line of sight between NEs at a minimum range of 150 feet.	5.9.2.4.5 (3)	R	R
40	The NE TDM only or IP over TDM Access interfaces can transport IP traffic provided it is deployed per the following conditions: 1. The IP device is listed on the APL either as a component of an ASLAN and/or CE Router. 2. The IP device meets the appropriate IP congestion controls for that IP device. 3. The connection from the IP device to the NE meets one or more of the NE interface requirements, other than IP, as described in Section 5.9.2.3, Interface Requirements. 4. The physical or configured capacity of the interface link (e.g., Section 5.9.2.3, Interface Requirements) from the IP device to the NE shall not exceed the transport capacity of the NE DLoS transport link, as determined in and modified per, or the portion thereof the transport link allocated to transport the IP traffic. The DLoS transport control traffic overhead will be included in traffic capacity determination. 5. Upon DLoS transport link loss in either direction between the NEs for IP over TDM connections, either the generated alarm from the NE shall be interpreted by the IP device as link failure and/or signaling packets, such as keep-alive packets or other standard routing protocol/proprietary control means between the IP devices fails, will also be interpreted by the IP device as failure of the link connected to the NE.	5.9.2.5.2 (2)	R	R
41	The DLoS transport NEs shall be engineered properly so that the DLoS transport transmitting/receiving devices achieve the required performance requirements in their specific deployed environment.	5.9.2.5.3	C	C
42	All components of the NE shall meet security requirements, for each supported mode, as outlined in DoDI 8510.01 and the applicable STIG.	5.9.2.6	R	R
43	If a DoD-approved WIDS exists for the DLoS transport technology used, the NE DLoS transport link(s) shall be monitored in according with the appropriate STIG(s).	5.9.2.7	C	C
44	The D-NEs shall meet all NE requirements specified in Section 5.9.2, DISN F-NE Generic Requirements	5.9.3	NA	R
45	The D-NE being tested shall continue to function as specified in Section 5.9.2.1, General Requirements, and Section 5.9.3.1, D-NE General Requirements, during such testing: • Error Burst Density: The D-NE measured error burst density shall be $1x10^{-6}$. • Error Burst Gap (gap between error bursts in ms): The measured D-NE error burst gap shall be 600 ms. • Error Burst Length (length of error burst in ms): The measure D-NE error burst length shall be 500 ms.	5.9.3	NA	R

Table 3-1. NE Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
46	The D-NEs may include voice compression, as specified in Section 5.9.2.2, Compression, to include the following additional compression standard: ITU-T Recommendation G.723.	5.9.3.1 (1)	NA	C
47	The latency introduced by a single D-NE using the G.723.1 codec shall be less than 90 ms.	5.9.3.1 (2)	NA	R
48	The latency introduced by a pair of D-NEs using the G.723.1 codec shall be less than 180 ms.	5.9.3.1 (2)	NA	R
49	Voice calls placed through a set of D-NEs shall support a minimum MOS of 3.6 or better as measured in an**y** 5-minute interval using the Perceptual Speech Quality Measure (PSQM) testing standard.	5.9.3.1 (3)	NA	R
50	The introduction of a D-NE shall not cause the E2E digital BER to degrade the Tactical BER below $1x10^{-5}$ by more than 0.03 percent as measured over a 9-hour period.	5.9.3.1 (4)	NA	R
51	The D-NE (when implemented in pairs) shall apply error correction to correct the errors interjected by the transport network between the two D-NEs such that the resulting BER of the external facing D-NE interface shall be better than $1x10^{-5}$ as measured over a 9-hour period.	5.9.3.1 (5)	NA	R
52	The NE shall assure congestion within NEs does not affect DISN calls in progress or subsequent calls. Call congestion handling shall be met in one or more of the following ways: 1. A dynamic load control signal (e.g., contact closure) shall be provided to the DISN switch in accordance with Section 5.9.2.1.2, Congestion Control. 2. A software capability in limiting the provisioning the input and/or output interfaces such that makes congestion impossible even under the worst congestion scenario. 3. Congestion is not possible in the NE by nature of its functioning (e.g., a TDM multiplexer or transcoder).	5.9.3.1 (6)	NA	R
53	The D-NE shall support at least one of the interfaces listed in Section 5.9.2, DISN F-NE Generic Requirements.	5.9.3.2	NA	C
54	The D-NEs may use IP as a means to transport voice communications between D-NEs.	5.9.3.3 (2)	NA	C
55	For any IP transport methods used, D-NEs using IP interfaces shall meet the following parameters: 1. The addition of D-NEs shall meet the latency criteria specified in Section 5.9.3, D-NE General Requirements. 2. The addition of a D-NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any 5-minute period. 3. The addition of a D-NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any 5-minute period.	5.9.3.3 (3)	NA	R
56	The D-NE shall use either differentiated services or integrated services to provide preferential treatment over IP transport.	5.9.3.4 (1)	NA	R
57	The D-NE shall provide an IP bandwidth reservation/allocation mechanism to allow for the user-specified allocation of bandwidth to support the full nonblocking voice services requirement.	5.9.3.4 (2)	NA	R
58	The D-NE shall implement IP congestion control. Congestion may be controlled by using differentiated services that shall be capable of providing preferential treatment for call congestion over other media types in accordance with Section 5.3.3, Network Infrastructure E2E Requirements, and a capability to limit the provisioning of input and output interfaces, so congestion is impossible under the worst transport congestion scenario.	5.9.3.4 (3)	NA	R
59	The D-NE shall be able to propagate CGAs IAW Section 5.9.2.1.1, Alarms, upon physical loss of the ingress TDM interface. Voice switching systems, DSN or DVX, shall receive the proper CGAs from the D-NE upon loss of the IP transport link between D-NEs.	5.9.3.5	NA	R

Table 3-1. NE Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH3)	F-NE	D-NE
60	The D-NEs that provide a long local shall meet all the following requirements: 1. The D-NE shall provision features and functions to support the long local device. 2. The D-NE shall allocate enough bandwidth to support the long-local device to ensure assured services and nonblocking requirements are met.	5.9.3.6	NA	R
61	The DVX VD-NE may use Proprietary IP signaling for this solution, and this interface shall support E2E ANSI T1.619a features and functions IAW UCR 2008, Section 5.3.2.31.3.7, ISDN MLPP PRI (i.e., Precedence, Preemption, MLPP Service Domain, Look Forward for Busy, Network Identifiers, and Coding Standard).	5.9.3.7 (1)	NA	C
62	For DVX VD-NE switches that do not support MLPP, this interface shall support end-to-end ISDN PRI NI 1/2 features and functions (i.e., Bearer, Calling Number Delivery)	5.9.3.7 (2)	NA	C
63	In processing secure calls (SCIP) across conversion boundaries such as TDM to IP and/or IP to TDM, the D-NE shall utilize the V.150.1 standards implementation IAW NSASCIP-215 "U.S. Secure Communication Interoperability Protocol (SCIP) over IP Implementation Standard and Minimum Essential Requirements (MER) Publication" and SCIP 216 "Minimum Essential Requirements (MER) for V.150.1 Gateways Publication" for said ingress and egress conversions respectively. The D-NE shall support this NSA V.150.1 implementation capability on all D-NE interface ports where secure call conversion can occur. The secure call handling implementation on the D-NE shall also meet the requirements of Section 5.9.2.1, Sub-Requirement 3.	5.9.3.8 (1)	NA	R
64	The secure call shall complete successfully as a minimum equal to or better than 85-percent of the time when used in the Deployed environment.	5.9.3.8 (2)	NA	R
65	A D-NE that is equipped with voice packet multiplexing, where individual small IP voice packets (from either the same or multiple sources) may be combined into a single larger IP packet. The D-NE shall be configurable to allow the operator to specify the maximum latency and/or packet size to provide flexibility in the actual implementation.	5.9.3.9	NA	C

LEGEND:

ADIMSS	Advanced DSN Integrated Management Support System
ANSI	American National Standards Institute
APL	Approved Product List
ASLAN	Assured Services LAN
BER	Bit Error Rate
BRI	Basic rate Interface
C	Conditional
CE	Customer Edge
CGA	Carrier Group Alarm
CH	Change
D-NE	Deployed-Network Element
DAA	Designated Approving Authority
DISR	DoD Information technology Standards and Profile Registry
DoD	Department of Defense
DODI	DoD Instruction
DISN	Defense Information Systems Network
DSN	Defense Switched Network
DVX	Deployed Voice Exchange
E1	European Basic Multiplex Rate (2.048 Mbps)
E2E	End to End
F-NE	Fixed-Network Element
FIPS	Federal Information Processing Standard
IAW	In Accordance With
IP	Internet Protocol
ISDN	Integrated Services Data Network
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Union - Telecommunications Sector
LAN	Local Area Network
MAN	Metropolitan Area Networks
MLPP	Multi-Level Precedence and Preemption
MOS	Mean Opinion Score
Ms	Millisecond
NMS	Network Management System
NSA	National Security Agency
PCM	Pulse Code Modulation
PRI	Primary rate Interface
R	Required
SONET	Synchronous Optical Network
STIG	Security Technical implementation Guide
T1	Digital Transmission Link Level 1 (1.544 Mbps)
TDM	Time Division Multiplexing
UCCO	Unified Capabilities Certification Office
UCR	Unified Capabilities Requirements
VVoIP	Voice and Video over Internet Protocol