DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY
REFER TO: Joint Interoperability Test Command (JTE) **27 Jan 11**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Motorola Gigabit Passive Optical Network (AXS1800 Optical Line Terminal and Motorola 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET Optical Network Terminals) Fixed Network Element, software release 7.0.1

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 the Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The Motorola AXS1800 Next Generation Optical Line Terminal and Motorola 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET Optical Network Terminals with software release 7.0.1, hereinafter referred to as the System Under Test (SUT) is certified for joint use in the Defense Information Systems Network as a Fixed Network Element. The Defense Information Systems Agency (DISA) adjudicated all open Test Discrepancy Reports (TDR) to have a minor operational impact. The SUT is a layer-2 device that transports Internet Protocol version 4 and Internet Protocol version 6 traffic transparently. The SUT supports the Congestion Control requirement for Internet Protocol transport only through its Virtual Local Area Network-Class of Service feature. The certification status of the SUT will be verified during operational deployment. Any new discrepancy noted in the operational environment will be evaluated for impact on the existing certification. These discrepancies will be adjudicated to the satisfaction of the DISA via a vendor Plan of Action and Milestones that will address all new critical TDRs within 120 days of identification. JITC conducted testing using Network Element requirements derived from the Unified Capabilities Requirements (UCR), Reference (c), and Network Element test procedures, Reference (d). JITC does not certify any other configurations, features, or functions, except those cited within this memorandum. This certification expires upon changes that affect interoperability, but no later than three years from the date of this memorandum.

3. This finding is based on interoperability testing conducted by JITC, review of the vendor's Letters of Compliance (LoC), and Defense Information Assurance (IA)/Security Accreditation Working Group (DSAWG) accreditation. Interoperability testing was conducted by JITC, Indian

Head, Maryland, from January through March 2010. Review of the vendor's LoCs was completed on 4 May 2010. DSAWG grants accreditation based on the security testing completed by DISA-led IA test teams that is published in a separate report, Reference (e). The DSAWG accreditation was granted on September 2010. The JITC certifies the SUT, software version 7.0.1, as meeting the UCR for Fixed Network Element. Enclosure 2 documents the test results and describes the tested network and system configurations.

4. Tables 1 and 2 lists the interface, Capability Requirements, Functional Requirements, and component status of the SUT. The threshold Capability/Functional requirements for Network Elements were established by Section 5.9 of Reference (c) and were used to evaluate the interoperability of the SUT.

Table 1. SUT Interface Interoperability Status

Interface	Critical (See note 1.)	UCR Reference	Threshold CR/FR Requirements (See note 2.)	Status	Remarks
Ingress (LAN side)					
Analog	No	5.9.3.2.1	1, 2, and 4	Not Certified	Not supported by the SUT.
Serial	No	5.9.2.3.2	1, 2, and 4	Not Certified	Not supported by the SUT.
BRI ISDN	No	5.9.2.3.3	1, 2, and 4	Not Certified	Not supported by the SUT.
DS1	No	5.9.2.3.4	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
E1	No	5.9.2.3.5	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS3	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
OC-X	No	5.9.2.3.8	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7	Certified	10/100/1000 Mbps Interfaces have been tested.
Egress (WAN side)					
Serial	No	5.9.2.3.2	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS1	No	5.9.2.3.4	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
E1	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS3	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.

Table 1. SUT Interface Interoperability Status (continued)

Interface	Critical (See note 1.)	UCR Reference	Threshold CR/FR Requirements (See note 2.)	Status	Remarks
Egress (WAN side - continued)					
OC-X	No	5.9.2.3.8	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7	Certified	1 Gigabit and 10 Gigabit Interfaces have been tested .
DLoS	No	5.9.2.3.9	1, 2, 3, 4, and 5	Not Certified	Not supported by the SUT.
NM					
10Base-X	Yes	5.3.2.4.4	8	Certified	NM client/server environment have been tested.
100Base-X	Yes	5.3.2.4.4	8	Certified	NM client/server environment have been tested.

NOTES:
1. UCR does not specify any minimum interfaces. The SUT must minimally provide one of the listed ingress and egress interfaces specified.
2. CR/FR requirements are contained in Table 2. CR/FR numbers represent a roll-up of UCR requirements.

LEGEND:

100Base-X	100 Mbps Ethernet generic designation	IP	Internet Protocol
10Base-X	10 Mbps Ethernet generic designation	ISDN	Integrated Services Digital Network
BRI	Basic Rate Interface	LAN	Local Area Network
CR	Capability Requirement	Mbps	Megabits per second
DLoS	Direct Line of Sight	NM	Network Management
DS1	Digital System Level 1 (1.544 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
DS3	Digital System Level 3 (44.736 Mbps)	SUT	System Under Test
E1	European Interface Standard (2.048 Mbps)	UCR	Unified Capabilities Requirements
FR	Functional Requirement	WAN	Wide Area Network

Table 2. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference (See note 2.)	Status	Remarks
1	**General NE Requirements**				
	General Requirements	Required	5.9.2.1	Met	
	Alarms	Required	5.9.2.1.1	Met	Met via layer-one link state.
	Congestion Control & Latency	Required	5.9.2.1.2	Partially Met	Supported for IP transport via VLAN CoS. TDM and DLoS transport are not supported.
2	**Compression**				
	G.726	Conditional	5.9.2.2	Not Met	Not supported by the SUT.
	G.728	Conditional	5.9.2.2	Not Met	Not supported by the SUT.
	G.729	Conditional	5.9.2.2	Not Met	Not supported by the SUT.
3	**Interface Requirements**				
	Timing	Required	5.9.2.3.7	Not Applicable	See note 3.

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

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference (See note 2.)	Status	Remarks

4	**Device Management**				
	Management Options	Required	5.9.2.4.1	Met	
	Fault Management	Conditional	5.9.2.4.2	Met	
	Loop-Back Capability	Conditional	5.9.2.4.3	Not Applicable	See note 3.
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	
5	**DLoS**				
	DLoS Transport	Conditional	5.9.2.4.5	Not Tested	Not supported by the SUT.
6	**D-NE Requirements**				
	D-NE General Requirements	Required (See note 4.)	5.9.3.1	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	D-NE TDM Requirements	Conditional	5.9.3.2	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	D-NE IP Requirements	Conditional	5.9.3.3	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Encapsulated TDM Requirements	Conditional	5.9.3.4	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Carrier Group Alarms	Required (See note 4.)	5.9.3.5	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Long-Local Requirements	Conditional	5.9.3.6	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Proprietary IP Trunk Requirements	Conditional	5.9.3.7	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Secure Call Handling	Required (See note 4.)	5.9.3.8	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Voice Packet Multiplexing	Conditional	5.9.3.9	Not Tested	Sponsor requested to test the SUT as a fixed NE.
7	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Met	SUT is a layer-2 device and transports IPv4 and IPv6 traffic transparently.
8	**NM Requirements**				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	
	General Management Requirements	Required	5.3.2.17.2	Met	

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 1.
3. Applies to TDM interfaces only.
4. Only applies if SUT seeking certification as an D-NE.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IP	Internet Protocol
CoS	Class of Service	IPv4	Internet Protocol version 4
CR	Capabilities Requirement	IPv6	Internet Protocol version 6
DLoS	Direct Line of Sight	NE	Network Element
D-NE	Deployed Network Element	NM	Network Management
FR	Functional Requirement	SUT	System Under Test
G.726	ITU-T speech codec for ADPCM (32 Kbps)	TDM	Time Division Multiplexing
G.728	ITU-T speech codec for LD-CELP (16 Kbps)	UCR	Unified Capabilities Requirements
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)	VLAN	Virtual Local Area Network
ID	Identification	VVoIP	Voice and Video over Internet Protocol

5. In accordance with the Program Manager's request, JITC did not develop a detailed test report. JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Non-secure 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 at http://jit.fhu.disa.mil (NIPRNet).

Information related to DSN testing is on the Telecom Switched Services Interoperability website at http://jitc.fhu.disa.mil/tssi. All associated data is available on the DISA Unified Capability Certification Office website located at https://aplits.disa.mil.

6. The JITC testing point of contact is Mr. Son Pham, commercial (301) 744-2636, or DSN 354-2636. His e-mail address is Son.Pham@disa.mil. The JITC mailing address is 3341 Strauss Avenue, Suite 236, Indian Head, Maryland 20640-5149. The Unified Capabilities Certification Office tracking number for the SUT is 0915902.

FOR THE COMMANDER:

3 Enclosures a/s

BRADLEY A. CLARK
Acting Chief
Battlespace Communications Portfolio

Distribution (electronic mail):
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Defense Information Systems Agency, TEMC
Office of Assistant Secretary of Defense (NII)/DoD CIO
U.S. Joint Forces Command, Net-Centric Integration, Communication, and Capabilities Division, J68
HQUSAISEC, AMSEL-IE-IS

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ADDITIONAL REFERENCES

(c) Office of the Assistant Secretary of Defense Document, "Department of Defense Unified Capabilities Requirements 2008, Change 1," 22 January 2010
(d) Joint Interoperability Test Command Document, "Unified Capabilities Test Plan," May 2009
(e) Joint Interoperability Test Command Document, "Information Assurance (IA) Assessment of Motorola Gigabit Passive Optical Network software version 7.0.1 (TN0915902)," 28 September 2010

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CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Motorola Gigabit Passive Optical Network (AXS1800 Optical Line Terminal and Motorola 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET Optical Network Terminals) Fixed Network Element, software release 7.0.1.

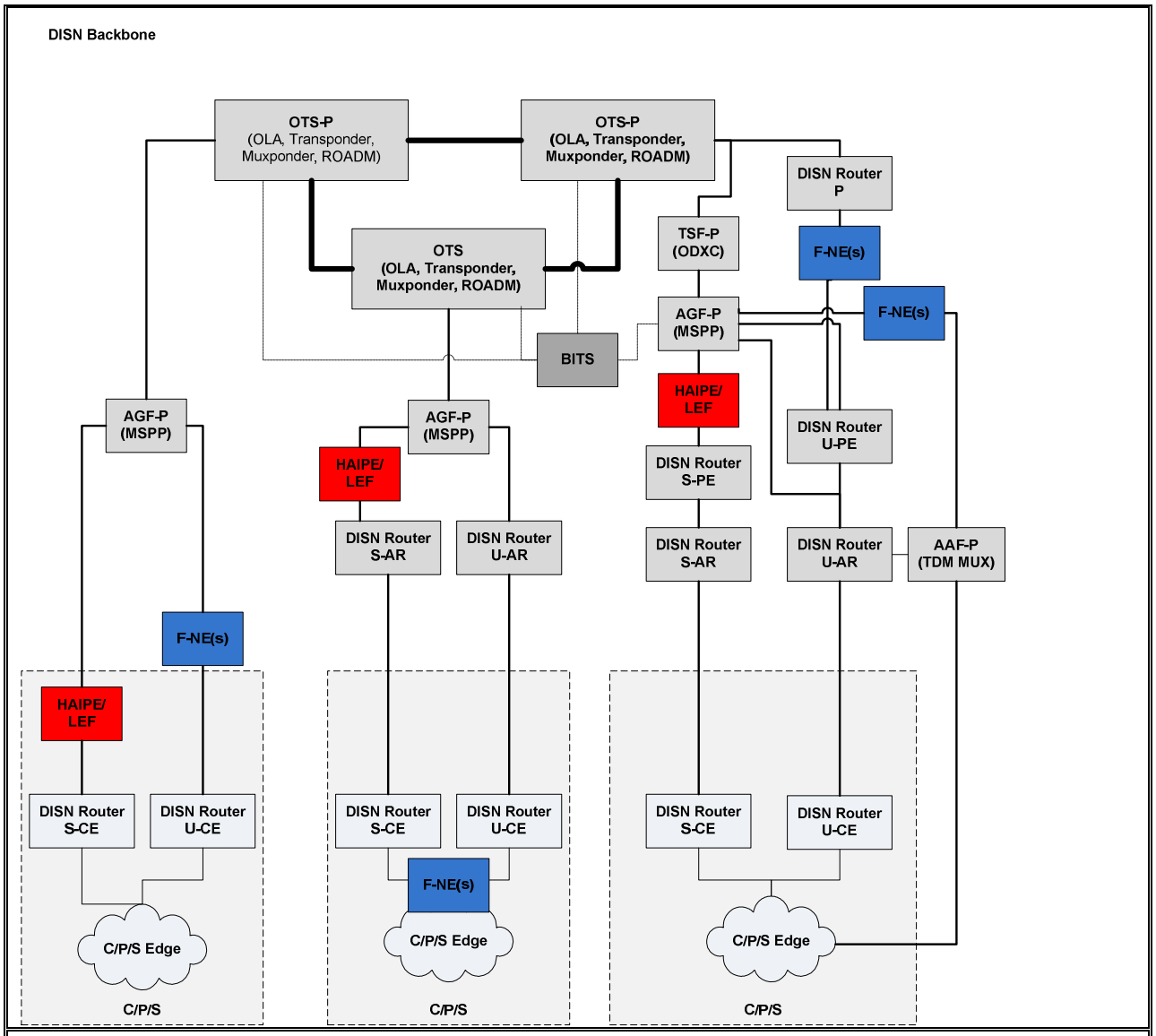
2. PROPONENT. Head Quarters United States Army Information Systems Engineering Command (HQUSAISEC).

3. PROGRAM MANAGER. Mr. Robert Wellborn, address: Commander, HQUSAISEC AMSEL-IE-IS Bldg 53301 Fort Huachuca, AZ 85613-5300
e-mail: robert-wellborn@us.army.mil

4. TESTER. Joint Interoperability Test Command (JITC), Indian Head, Maryland

5. SYSTEM UNDER TEST (SUT) DESCRIPTION. There are three main components in a Gigabit Passive Optical Network (GPON), other than the fiber itself. The GPON Optical Line Terminal (OLT) is the network concentrator, the splitter (or splitters) allows a single fiber to be shared among a number of subscribers, and the Optical Network Terminal (ONT) serves a local site. In terms of Unified Capabilities Requirements (UCR), a GPON falls within the definition and requirements of a Network Element. The Motorola GPON Network Element is comprised of the Motorola AXS1800 OLT and either Motorola 1120GE, 1400GTI-SC, 1400GT-SC, or 6000GET ONT. Motorola designed the AXS1800 Next Generation OLT to deliver end-to-end (E2E) data and video services. It features flexible and high-capacity GPON access and Wide Area Network uplinks, scalability, and line rate performance fully non-blocking switch fabric in a high-density chassis. Motorola designed the ONT to deliver data and video services over a single optical fiber from a single ONT. The Motorola 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET ONTs are GPON access devices that provide service termination for the subscriber ports of the AXS1800 OLT platform. The JITC tested the ONTs as peripherals to the AXS1800 OLT. The Motorola AXS1800 OLT and 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET ONTs are components of the GPON architecture defined in the International Telecommunications Union-Telecommunication Standardization Sector G.984 family of recommendations.

6. OPERATIONAL ARCHITECTURE. The JITC tested the Motorola AXS1800 OLT, with the accompanying 1120GE, 1400GTI-SC, 1400GT-SC, and 6000GET ONT peripheral under the Fixed Network Element (F-NE) UCR product category. A high-level Defense Information Systems Network (DISN) node architecture, as depicted in Figure 2-1, displays the role of the Optical Transport System's, Optical Digital Cross Connect, and Multi Services Provisioning Platform (MSPP) devices in the DISN architecture. The Motorola OLT can be connected to the MSPP Gigabit Ethernet (GE) ports and Internet Protocol (IP)-Provider Edge Router GE or 10 GE ports to extend DISN services on a camp, post, or station.



LEGEND:

AAF-P	Access Aggregation Function Product
AGF-P	Access Grooming Function Product
AR	Aggregation Router
ATM	Asynchronous Transfer Mode
CE	Customer Edge Router
C-PE	Classified Provider Edge Router
C/P/S	Camp, Post, or Station
DISN	Defense Information System Network
F-NE	Fixed Network Element
HAIPE	High Assurance Internet Protocol Encryptor
MSPP	Multi-Service Provisioning Platform
MUX	Multiplexer
P	Provider Router
ODXC	Optical Digital Cross Connect
OLA	Optical Line Amplifier
OTS-P	Optical Transport System Product
ROADM	Reconfigurable Optical Add and Drop Multiplexer
S-AR	Secret Aggregation Router
S-CE	Secret Customer Edge Router
S-PE	Secret Provider Edge Router
TDM	Time Division Multiplexing
T-PE	Transport Provider Edge Router
TSF-P	Transport Switch Function Product
U-AR	Unclassified Aggregation Router
U-CE	Unclassified Customer Edge Router
U-PE	Unclassified Provider Edge Router

Figure 2-1. DISN Architecture

7. INTEROPERABILITY REQUIREMENTS. The interface, Capability Requirements (CR), Functional Requirements (FR), IA, and other requirements for NE products are established by Sections 5.4 and 5.9 of the Department of Defense Unified Capabilities UCR 2008, Change 1.

7.1 Interfaces. The NE products use its interfaces to connect to Local Area Network (LAN) or DISN Wide Area Network (WAN) 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 (See note 1.)	UCR Reference	Threshold CR/FR Requirements (See note 2.)	Criteria	Remarks
Ingress (LAN side)					
Analog	No	5.9.3.2.1	1, 2, and 4	Meet minimum CR/FRs and interface standards.	Provides access to local infrastructure.
Serial	No	5.9.2.3.2	1, 2, and 4		
BRI ISDN	No	5.9.2.3.3	1, 2, and 4		
DS1	No	5.9.2.3.4	1, 2, 3, and 4		
E1	No	5.9.2.3.5	1, 2, 3, and 4		
DS3	No	5.9.2.3.6	1, 2, 3, and 4		
OC-X	No	5.9.2.3.8	1, 2, 3, and 4		
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7		
Egress (WAN side)					
Serial	No	5.9.2.3.2	1, 2, 3, and 4	Meet minimum CR/FRs and interface standards.	Provides access to local infrastructure.
DS1	No	5.9.2.3.4	1, 2, 3, and 4		
E1	No	5.9.2.3.6	1, 2, 3, and 4		
DS3	No	5.9.2.3.6	1, 2, 3, and 4		
OC-X	No	5.9.2.3.8	1, 2, 3, and 4		
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7		
DLoS	No	5.9.2.3.9	1, 2, 3, 4, and 5		
NM					
10Base-X	Yes	5.3.2.4.4	8	Meet minimum CR/FRs and interface standards.	Provides access to local infrastructure.
100Base-X	Yes	5.3.2.4.4	8		

NOTES:
1. UCR does not specify any minimum interfaces. The SUT must minimally provide one of the listed ingress and egress interfaces specified.
2. CR/FR requirements are contained in Table 2. CR/FR numbers represent a roll-up of UCR requirements.

LEGEND:

100Base-X	100 Mbps Ethernet generic designation	IP	Internet Protocol
10Base-X	10 Mbps Ethernet generic designation	ISDN	Integrated Services Digital Network
BRI	Basic Rate Interface	LAN	Local Area Network
CR	Capability Requirement	Mbps	Megabits per second
DLoS	Direct Line of Sight	NM	Network Management
DS1	Digital System Level 1 (1.544 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
DS3	Digital System Level 3 (44.736 Mbps)	SUT	System Under Test
E1	European Interface Standard (2.048 Mbps)	UCR	Unified Capabilities Requirements
FR	Functional Requirement	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 (See note 1.)	UCR Reference (See note 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**				
	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.
	G.728	Conditional	5.9.2.2		
	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**				
	D-NE General Requirements	Required (See note 4.)	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 (See note 4.)	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 (See note 4.)	5.9.3.8		
	Voice Packet Multiplexing	Conditional	5.9.3.9		

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

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference (See note 2.)	Criteria	Remarks
7	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Meet UCR IPv6 requirements.	Applies to both F-NE and D-NE
8	**NM Requirements**				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	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.
	General Management Requirements	Required	5.3.2.17.2		

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 1.
3. Requirement applies to TDM interfaces only.
4. Only applies if SUT seeking certification as an D-NE.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IP	Internet Protocol
CoS	Class of Service	IPv4	Internet Protocol version 4
CR	Capabilities Requirement	IPv6	Internet Protocol version 6
DLoS	Direct Line of Sight	NE	Network Element
D-NE	Deployed Network Element	NM	Network Management
FR	Functional Requirement	SUT	System Under Test
G.726	ITU-T speech codec for ADPCM (32 Kbps)	TDM	Time Division Multiplexing
G.728	ITU-T speech codec for LD-CELP (16 Kbps)	UCR	Unified Capabilities Requirements
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)	VLAN	Virtual Local Area Network
ID	Identification	VVoIP	Voice and Video over Internet Protocol

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

Table 2-3. NE Products IA Requirements

Requirement	Critical (See Note.)	UCR Reference
General Requirements	Yes	5.4.6.2
Authentication	Yes	5.4.6.2.1
Integrity	Yes	5.4.6.2.2
Confidentiality	Yes	5.4.6.2.3
Non-repudiation	Yes	5.4.6.2.4
Availability	Yes	5.4.6.2.5

NOTE: Not all IA requirements from the referenced UCR section apply. Refer to Table 1 of the System Functional and Capability Requirements for the specific IA requirements.

LEGEND:

IA	Information Assurance	UCR	Unified Capabilities Requirements
NE	Network Element		

7.4 Other. The SUT also supports a GPON interface, and sponsor wanted JITC to test some of the applicable GPON requirements. The GPON requirements for SUT are listed in Table 2-4. These requirements were derived from the ITU-T G.984.x, RFC 2544 and SUT vendor's documents.

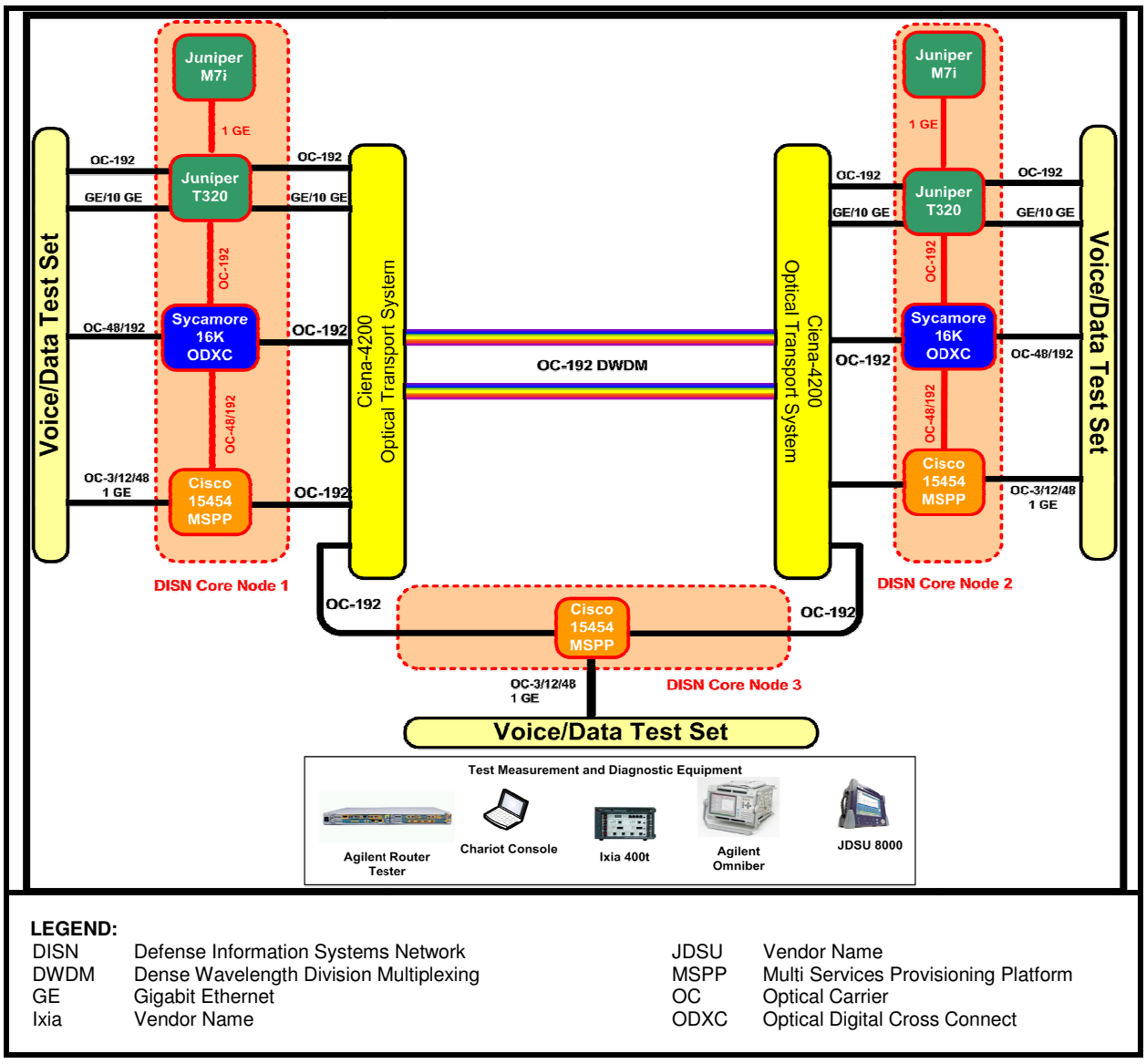
Table 2-4. GPON Requirements

ID	Requirement	Reference	Remarks
1	Hardware Design	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
2	Initial System Turn-up	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
3	Inventory Recording	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
4	Network Discovery	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
5	GPON Link Throughput Measurement	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
6	GigE Throughput Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
7	GigE Frame Loss Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
8	GigE Latency Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
9	10GigE Throughput of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
10	10GigE Frame Loss of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
11	10GigE Latency of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
12	Ethernet Throughput of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
13	Ethernet Frame Loss of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
14	Ethernet Latency of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
15	OLT Equipment Module Redundancy	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
16	Recovery from Total Electrical Power Failure	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
17	Management Application Usability	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
18	Remote Device Configuration and Control	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
19	Software Upgrade	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
20	Node Database Backup and Restore	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
21	Alarm Reporting Ability	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	
22	Operation of the ONT Range Feature	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
23	Place an ONT in ESTOP	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
24	Verify GPON Distances	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
25	Multicast Throughput-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
26	Multicast Frame Loss-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
27	Multicast Latency-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	
28	Multicast Video Capability Through OLT's GE Port.	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
29	Multicast Video Capability Through OLT's 10 GE Port.	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	
30	OLT Link Aggregation Support – GE	IEEE 802.3ad and RFC 2544	
31	OLT Link Aggregation Support – 10 GE	IEEE 802.3ad and RFC 2544	
32	DISN Equipment Interoperability	UCR 2008 Section 5.5	

Table 2-4. GPON Requirements (continued)

LEGEND:			
DISN	Defense Information Systems Network	ITU-T	International Telecommunication Union-Telecommunication
ESTOP	Emergency Stop	OLT	Optical Line Termination
GigE/GE	Gigabit Ethernet	ONT	Optical Network Terminal
GPON	Gigabit Passive Optical Network	RFC	Request For Comments
IEEE	Institute of Electrical and Electronics Engineers	UCR	Unified Capabilities Requirement

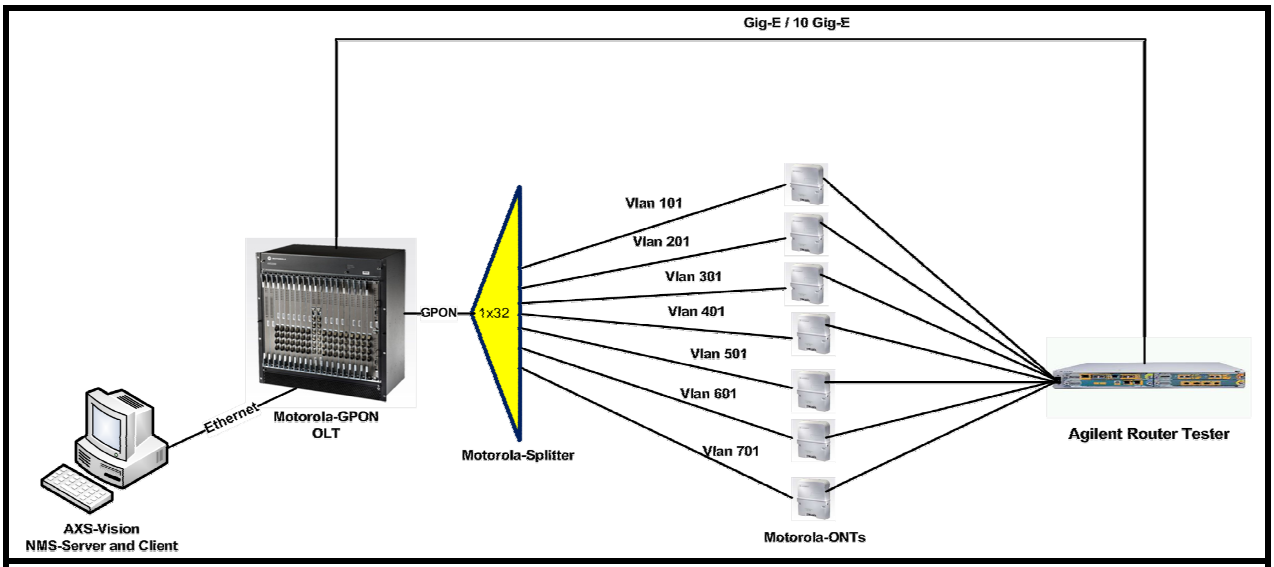
8. TEST NETWORK DESCRIPTION. The JITC tested the SUT at its Indian Head, Maryland Advanced Technology Testing Laboratory using test configurations shown in Figures 2-2 through 2-6. Figure 2-2 shows the Indian Head, Maryland Advanced Technology Test Bed, and Figure 2-3 shows the Motorola ONTs and OLT in a standalone configuration for feature testing. Figure 2-4 shows the Motorola ONTs and OLT connected via Cisco 6509 router for feature testing with Cisco. Figure 2-5 shows the Motorola ONTs and OLT connected to Video and File Transfer Protocol servers via Cisco 6509 router for Video and data testing and Figure 2-6 shows the Motorola ONTs, OLT, and Cisco 6509 router connected to DISN equipments for testing interoperability with the DISN.



LEGEND:

DISN	Defense Information Systems Network	JDSU	Vendor Name
DWDM	Dense Wavelength Division Multiplexing	MSPP	Multi Services Provisioning Platform
GE	Gigabit Ethernet	OC	Optical Carrier
Ixia	Vendor Name	ODXC	Optical Digital Cross Connect

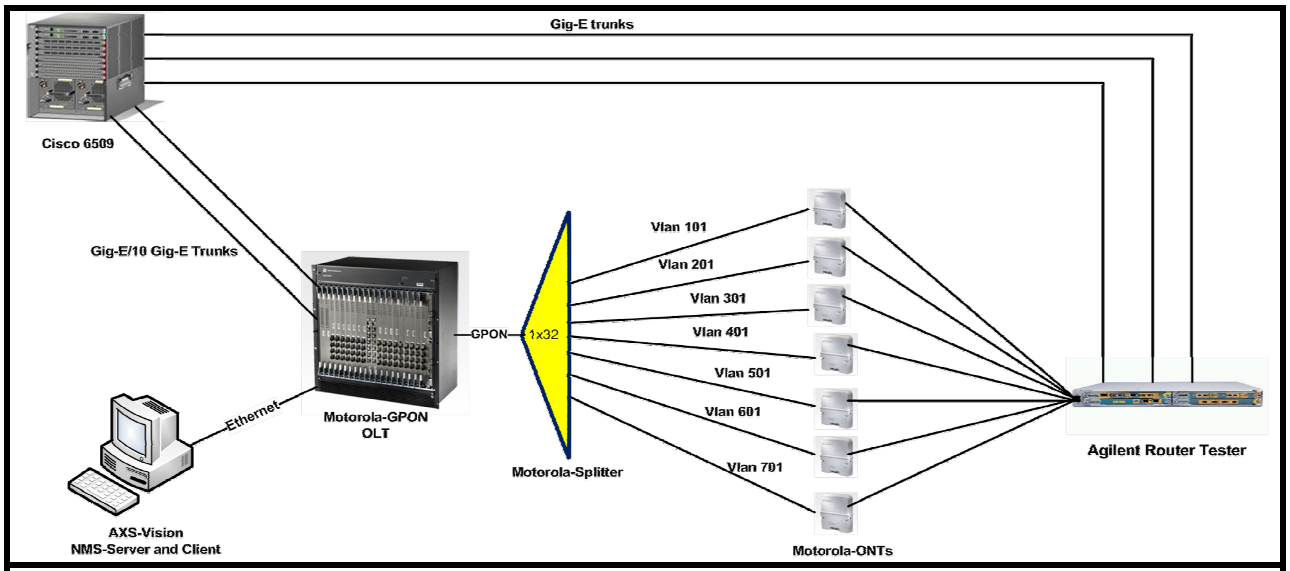
Figure 2-2. Indian Head Advanced Technologies Test Bed



LEGEND:

Gig-E	Gigabit Ethernet	OLT	Optical Line Terminal
GPON	Gigabit Passive Optical Network	ONT	Optical Network Terminal
NMS	Network Management System	VLAN	Virtual Local Area Network

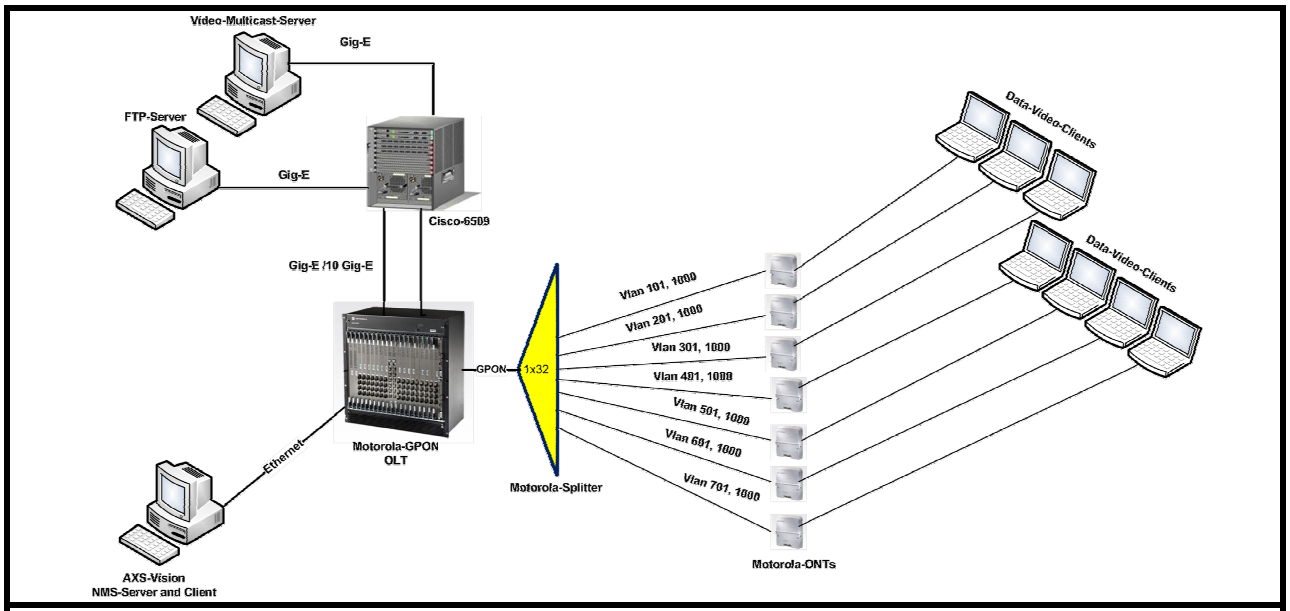
Figure 2-3. Motorola Configuration 1



LEGEND:

Gig-E	Gigabit Ethernet	OLT	Optical Line Terminal
GPON	Gigabit Passive Optical Network	ONT	Optical Network Terminal
NMS	Network Management System	VLAN	Virtual Local Area Network

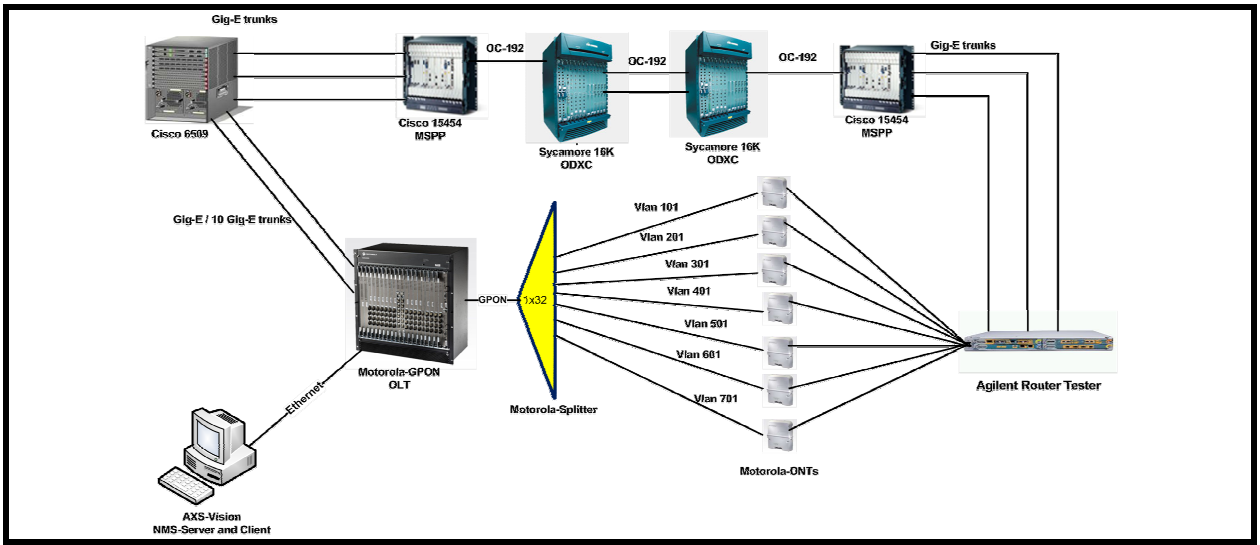
Figure 2-4. Motorola Configuration 2



LEGEND:

FTP	File Transfer Protocol	OLT	Optical Line Terminal
Gig-E	Gigabit Ethernet	ONT	Optical Network Terminal
GPON	Gigabit Passive Optical Network	VLAN	Virtual Local Area Network
NMS	Network Management System		

Figure 2-5. Motorola Configuration 3



LEGEND:

Gig-E	Gigabit Ethernet	OC	Optical Carrier
GPON	Gigabit Passive Optical Network	OLT	Optical Line Terminal
NMS	Network Management System	ONT	Optical Network Terminal
MSPP	Multi Services Provisioning Platform	VLAN	Virtual Local Area Network

Figure 2-6. Motorola Configuration 4

9. SYSTEM CONFIGURATION. Table 2-5 lists the tested software configuration shown in Figure 2-1, Table 2-6 lists the DISN Core Equipment used to test the Motorola GPON, and Table 2-7 lists the test equipment used to generate voice, Synchronous Optical Network, and IP traffic.

Table 2-5. Tested SUT Configuration

Platform	Software Release	Application
Motorola AXS1800 Optical Line Terminal	7.0.1	Optical Line Terminal
Motorola 1120GE Optical Network Terminal	7.0.1	Optical Network Terminal
Motorola 1400GTI-SC Optical Network Terminal	7.0.1	Optical Network Terminal
Motorola 1400GT-SC Optical Network Terminal	7.0.1	Optical Network Terminal
Motorola 6000GET Optical Network Terminal	7.0.1	Optical Network Terminal
Motorola 1x32 Optical Splitter	Not Applicable	Passive Optical Splitter
Motorola 1x4 Optical Splitter	Not Applicable	Passive Optical Splitter

LEGEND:
SC SUT System Under Test

Table 2-6. Non-SUT Equipment

Voice and Data Test Set	Software Version	Interface Cards
Cisco 15454	09.00-008I-17.17	ETH 100T-12-G, OC-3IR-STM-1 SH-1310-8, OC-12IR-STM-4-1310-4, DS-1N-14, G1K-4, OC-192SR/STM-64, OC-48 AS-IR-1310, DS-3N-12E
Sycamore ODXC	7.6.21 Build 0562.26.27.57.14	GPIC2 2 X OC-192/STM-64, GPIC 24 x OC-3-12/STM-1-4IR, GPIC2 8 x OC-48/STM-16, USC - OC-192 LR 2c LIM 1
Juniper T320 Router	9.2.R2.15	4 x FE 100 Base Tx, 10 x GigE LAN 1000 Base, 1x OC-192 SM SR2, 1 x 10GigE LAN, XENPAK
Cisco Catalyst 6500	12.1 (13)	48 E ports, 8 ports GigE, 2 port 10GigE
Motorola AXSvision Network Manager Server	7.0.1	Node Management Server Software
Motorola AXSvision Client	7.0.1	Node Management Client Software
Motorola AXSvision Network Manager Server	7.0.1	Node Management Server Software
Motorola AXSvision Client	7.0.1	Node Management Client Software

LEGEND:

DS	Digital Signal	R	Revision
ETH	Ethernet	SM	Single Mode
GigE	Gigabit Ethernet	SR	Short Reach
LAN	Local Area Network	STM	Synchronous Transport Module
LIM	Line Interface Module	SUT	System Under Test
OC	Optical Carrier	Tx	Transmit
ODXC	Optical Digital Cross Connect	USC	Universal Services Card

Table 2-7. Test Equipment

Manufacturer	Type	Port Type	Software Version
Agilent	Optical Tester	1550 nm	A.06.01
		1310 nm	
	Router Tester 900	OC-3/OC-12 /POS	6.11
		OC-48 Multilayer	
		1000 Base X	
Agilent	Rack Mounted Router Tester 900	10 Gig LAN/WAN	6.11
		10/100/1000 Base-T	
		1000 Base-X	
		OC-48c POS	
		OC-3/12/POS	
Agilent JDSU	T-Berd 8000	OC-192 POS	6.11
		DSU	6.4
		10/100/1000	
		OC-3-12	
		DS-3	
		OC-192	

LEGEND:

DS	Digital Signal	OC	Optical Carrier
DSU	Data Services Unit	POS	Packet Over Synchronous Optical Network
Gig	Gigabit	WAN	Wide Area Network
JDSU	Vendor Name	LAN	Local Area Network
nm	nanometer		

10. TEST LIMITATIONS. The following test limitations were noted during testing of the system:

a. There were no DoD Secure Communication Devices in the test lab to test the secure transmission capability. The JITC tested this capability by using simulated information exchanges. This limitation poses a low risk to interoperability because the GPON is layer 2 optical transport that does not manipulate its transported signals.

b. There were no modem transmission, facsimile transmission, and call control signal transparency test capability in the test lab to test these capabilities directly. The JITC tested these capabilities by using simulated information exchanges. This limitation poses a low risk to interoperability because the GPON is layer 2 optical transport that does not manipulate its transported signals.

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 SUT's interface status is provided in Table 2-8.

Table 2-8. SUT Interface Requirements Status

Interface	Critical (See note 1.)	UCR Reference	Threshold CR/FR Requirements (See note 2.)	Status	Remarks
Ingress (LAN side)					
Analog	No	5.9.3.2.1	1, 2, and 4	Not Certified	Not supported by the SUT.
Serial	No	5.9.2.3.2	1, 2, and 4	Not Certified	Not supported by the SUT.
BRI ISDN	No	5.9.2.3.3	1, 2, and 4	Not Certified	Not supported by the SUT.
DS1	No	5.9.2.3.4	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
E1	No	5.9.2.3.5	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS3	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
OC-X	No	5.9.2.3.8	1, 2, 3, and 4	Not Certified	Not supported by the SUT
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7	Certified	10/100/1000 Mbps Interfaces have been tested.
Egress (WAN side)					
Serial	No	5.9.2.3.2	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS1	No	5.9.2.3.4	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
E1	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
DS3	No	5.9.2.3.6	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
OC-X	No	5.9.2.3.8	1, 2, 3, and 4	Not Certified	Not supported by the SUT.
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, and 7	Certified	1 Gigabit and 10 Gigabit Interfaces have been tested .
DLoS	No	5.9.2.3.9	1, 2, 3, 4, and 5	Not Certified	Not supported by the SUT.
NM					
10Base-X	Yes	5.3.2.4.4	8	Certified	NM client/server environment have been tested.
100Base-X	Yes	5.3.2.4.4	8	Certified	NM client/server environment have been tested.

NOTES:
1. UCR does not specify any minimum interfaces. The SUT must minimally provide one of the listed ingress and egress interfaces specified.
2. CR/FR requirements are contained in Table 2. CR/FR numbers represent a roll-up of UCR requirements.

LEGEND:

100Base-X	100 Mbps Ethernet generic designation	IP	Internet Protocol
10Base-X	10 Mbps Ethernet generic designation	ISDN	Integrated Services Digital Network
BRI	Basic Rate Interface	LAN	Local Area Network
CR	Capability Requirement	Mbps	Megabits per second
DLoS	Direct Line of Sight	NM	Network Management
DS1	Digital System Level 1 (1.544 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
DS3	Digital System Level 3 (44.736 Mbps)	SUT	System Under Test
E1	European Interface Standard (2.048 Mbps)	UCR	Unified Capabilities Requirements
FR	Functional Requirement	WAN	Wide Area Network

11.2 Capability Requirements (CR) and Functional Requirements (FR). The SUT's CR/FR statuses are listed in Table 2-9. The detailed CR/FR requirements are provided in Table 3-1 of the System Functional and Capability Requirements (Enclosure 3).

Table 2-9. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR Reference (See note 2.)	Status	Remarks
1	**General NE Requirements**				
	General Requirements	Required	5.9.2.1	Met	
	Alarms	Required	5.9.2.1.1	Met	Met via layer-one link state.
	Congestion Control & Latency	Required	5.9.2.1.2	Partially Met	Supported for IP transport via VLAN CoS. TDM and DLoS transport are not supported.
2	**Compression**				
	G.726	Conditional	5.9.2.2	Not Tested	Not supported by the SUT.
	G.728	Conditional	5.9.2.2	Not Tested	Not supported by the SUT.
	G.729	Conditional	5.9.2.2	Not Tested	Not supported by the SUT.
3	**Interface Requirements**				
	Timing	Required	5.9.2.3.7	Not Applicable	See note 4.
4	**Device Management**				
	Management Options	Required	5.9.2.4.1	Met	
	Fault Management	Conditional	5.9.2.4.2	Met	
	Loop-Back Capability	Conditional	5.9.2.4.3	Not Applicable	See note 4.
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	
5	**DLoS**				
	DLoS Transport	Conditional	5.9.2.4.5	Not Tested	Not supported by the SUT.
6	**D-NE Requirements**				
	D-NE General Requirements	Required (See note 3.)	5.9.3.1	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	D-NE TDM Requirements	Conditional	5.9.3.2	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	D-NE IP Requirements	Conditional	5.9.3.3	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Encapsulated TDM Requirements	Conditional	5.9.3.4	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Carrier Group Alarms	Required (See note 3.)	5.9.3.5	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Long-Local Requirements	Conditional	5.9.3.6	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Proprietary IP Trunk Requirements	Conditional	5.9.3.7	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Secure Call Handling	Required (See note 3.)	5.9.3.8	Not Tested	Sponsor requested to test the SUT as a fixed NE.
	Voice Packet Multiplexing	Conditional	5.9.3.9	Not Tested	Sponsor requested to test the SUT as a fixed NE.
7	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Met	SUT is a layer-2 device and transports IPv4 and IPv6 traffic transparently.
8	**NM Requirements**				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	
	General Management Requirements	Required	5.3.2.17.2	Met	

Table 2-9. SUT Capability Requirements and Functional Requirements Status (continued)

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 1.
3. Only applies if SUT seeking certification as a D-NE.
4. This applies to TDM interfaces only and SUT does not support any TDM interface.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IP	Internet Protocol
CoS	Class of Service	IPv4	Internet Protocol version 4
CR	Capabilities Requirement	IPv6	Internet Protocol version 6
DLoS	Direct Line of Sight	NE	Network Element
D-NE	Deployed Network Element	NM	Network Management
FR	Functional Requirement	SUT	System Under Test
G.726	ITU-T speech codec for ADPCM (32 Kbps)	TDM	Time Division Multiplexing
G.728	ITU-T speech codec for LD-CELP (16 Kbps)	UCR	Unified Capabilities Requirements
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)	VLAN	Virtual Local Area Network
ID	Identification	VVoIP	Voice and Video over Internet Protocol

a. General NE Requirements

(1) General Requirements. In Accordance With (IAW) UCR 2008 Change 1 Section 5.9.2.1 all NEs shall meet the following general requirements and conditions:

(a) 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. The SUT met the MOS requirement as measured using test equipment and simulated voice information exchanges.

(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 using test equipment and simulated information exchanges.

(c) The introduction of an NE(s) shall not degrade secure transmission for secure end devices as defined by UCR 2008, Section 5.2.12.6, and DoD Secure Communications Devices. The JITC did not test secure information exchanges by using DoD Secure Communications Devices, instead JITC tested this with test equipment and simulated information exchanges with no noted issues, and based on this test limitation there is low risk to interoperability.

(d) The NE(s) shall support a minimum modem transmission speed of 9.6 kbps across the associated NE(s). The JITC did not test this information exchanges by using a modem, instead JITC tested this with test equipment and simulated information exchanges with no noted issues, and based on this test limitation there is low risk to interoperability.

(e) The NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s). The JITC did not test this information exchanges by using a facsimile, instead JITC tested this with test equipment and simulated information exchanges with no noted issues, and based on this test limitation there is low risk to interoperability.

(f) The NE shall transport all call control signals transparently on an E2E basis. The JITC did not test this information exchanges by using an actual call control signals, instead JITC tested this with test equipment and simulated information exchanges with no noted issues, and based on this test limitation there is low risk to interoperability.

(2) Alarms. IAW UCR 2008 Change Section 5.9.2.1.1, the NE shall be able to propagate Carrier Group Alarms (CGAs) in accordance with UCR 2008, Section 5.2.1.5.7, Carrier Group Alarm, upon physical loss of the TDM interface. 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) the condition of its link state for transporting ingress IP traffic, namely operational or down.

(3) Congestion Control and Latency. IAW UCR 2008 Change 1 Sections 5.9.2.1.2, the NE shall assure that congestion and latency between paired NEs does not affect DSN calls in progress or subsequent calls. Call congestion and latency requirements are as follows:

(a) TDM Transport. The SUT does not provide TDM Transport. Therefore, the following TDM congestion Control and Latency requirements are not applicable.

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

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.

4. 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 5-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.

b. 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 E2E.

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, Compression) shall not increase delay by more than 250 ms per NE pair as measured E2E.

(b) IP Transport. The SUT supports IP Transport via VLAN CoS. 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, 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. The IP interface parameters subject to ingress/egress requirements shall be met IAW Section 5.9.2.3.9, IP Interface.

(c) DLoS Transport. The SUT does not provide 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.

c. 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.

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 SUT does not support Compression. Therefore, the following Compression requirements are not applicable.

(1) G.726.

(2) G.728.

(3) G.729.

c. Interface Requirements.

(1) Timing. IAW UCR 2008 Change 1 Section 5.9.2.3.7, 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, Timing Modes. This requirement applies to TDM interfaces only, IP interfaces need not meet this requirement. Te SUT does not support TDM interfaces only IP interfaces.

d. Device Management. IAW UCR 2008 Change 1 Section 5.9.2.4, the SUT shall provide the following device management functions:

(1) Management Options. 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 and SUT supports only external console control capability. The SUT provides a external console capability.

(b) Remote monitoring and management by the ADIMSS as described in the UCR 2008, Section 5.2.8, Network Management, Section 5.2.8.3, Fault Management, and Section 5.2.8.4, Configuration Management. The JITC did not verify management of the SUT by ADIMSS.

(2) Fault Management. The SUT may (conditional) report any failure of self-test diagnostic function on non-active and active channels on a noninterference basis to the assigned NMS. JITC verified this conditional capability via NM testing.

(3) Loop-Back Capability. This applies to TDM interfaces only; the SUT does not support any TDM interface.

(4) Operational Configuration Restoral. 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. JITC verified this capability via NM testing.

e. DLoS.

(1) DLoS Transport. The SUT does not provide DLoS Transport. Therefore, the following DLoS congestion interface requirements are not applicable.

(a) 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.

(b) 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

(c) A 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. D-NE Requirements. 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. JITC have not verified this capability because Sponsor requested to test the SUT as a fixed NE. Therefore, none of the following conditional D-NE requirements are applicable.

(1) D-NE General Requirements.

(a) 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.

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

(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. IAW UCR 2008 Change 1 Section 5.9.3.5, the D-NE shall be able to propagate CGAs in accordance with UCR 2008, Section 5.2.6, System Interfaces, upon physical loss of the ingress TDM interface. 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.

(6) Long-Local Requirements. IAW UCR 2008 Change 1 section 5.9.3.6, 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.

(7) Proprietary IP Trunk Requirements. IAW UCR 2008 Change 1 Section 5.9.3.7, 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 5.2.2.7, Integrated Services Digital Network Multi-Level Precedence and Preemption (MLPP) PRI (i.e., Precedence, Preemption, MLPP Service Domain, Look Forward for Busy, Network Identifiers, and Coding Standard).

(8) Secure Call Handling. 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 V.150.1 standards implementation IAW NSA SCIP-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 secure call shall complete

successfully as a minimum equal to or better than 85 percent of the time when used in the Deployed environment

(9) Voice Packet Multiplexing. 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.

(1) Product Requirements. The SUT must meet UCR 2008 Change 1 Section 5.3.5.4 IPv6 requirements for Network Appliance /Simple Server (NA/SS). The SUT is a layer-2 device and transports IPv4 and IPv6 traffic transparently so requirements specific relating to layer 3 do not apply. The SUT is capable of mapping layer 2 class of service to Layer 3 DSCPs.

h. NM Requirements. JITC verified the following NM requirements via a combination of testing and reviewing of the vendor submitted NM Letter of Compliance (LoC).

(1) Voice and Video over Internet Protocol (VVoIP) NMS Interface Requirements. IAW UCR 2008 Change 1 Section 5.3.2.4.4 the physical interface between the Defense Information Systems Agency VVoIP EMS and the network components (i.e., LSC, MFSS, EBC, CE Router) is a 10/100-Mbps Ethernet interface. The interface will work in either of the two following modes using auto-negotiation: IEEE, Ethernet Standard 802.3, 1993; or IEEE, Fast Ethernet Standard 802.3u, 1995.

(2) General Management Requirements. IAW UCR 2008 Change 1 Section 5.3.2.17.2, the SUT must support SNMPv3 format. A network appliance shall have Operations interfaces that provide a standard means by which management systems can directly or indirectly communicate with and, thus, manage the various network appliances in the DISN. The physical interface between the Local EMS and the VVoIP network components shall be an Ethernet connection as specified in Section 5.3.2.4.4, VoIP NMS Interface Requirements. The physical interface between the VVoIP EMS and the VVoIP network components shall also be an Ethernet connection as specified in, Section 5.3.2.4.4. There shall be a local craftsperson interface (Craft Input Device for OA&M for all VVoIP network components.

11.3 Information Assurance. The IA Assessment Report is published as a separate report.

11.4 Other. The SUT meets all applicable tested GPON requirements. The SUT's GPON requirements status is listed in Table 2-10.

Table 2-10. GPON Requirements Status

ID	Requirement	Reference	Status	Remarks
01	Hardware Design	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
02	Initial System Turn-up	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
03	Inventory Recording	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
04	Network Discovery	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
05	GPON Link Throughput Measurement	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
06	GigE Throughput Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
07	GigE Frame Loss Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
08	GigE Latency Measurement of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
09	10GigE Throughput of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
10	10GigE Frame Loss of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
11	10GigE Latency of OLT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
12	Ethernet Throughput of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
13	Ethernet Frame Loss of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
14	Ethernet Latency of ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
15	OLT Equipment Module Redundancy	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
16	Recovery from Total Electrical Power Failure	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
17	Management Application Usability	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
18	Remote Device Configuration and Control	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
19	Software Upgrade	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
20	Node Database Backup and Restore	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
21	Alarm Reporting Ability	Motorola AXS1800 OLT Installation and Maintenance Guide PN:544100-004-00	Met	
22	Operation of the ONT Range Feature	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
23	Place an ONT in ESTOP	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
24	Verify GPON Distances	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
25	Multicast Throughput-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
26	Multicast Frame Loss-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
27	Multicast Latency-ONT	ITU-T G.984.1, G.984.2, G.984.3, G.984.4 and RFC 2544	Met	
28	Multicast Video Capability Through OLT's GE Port.	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
29	Multicast Video Capability Through OLT's 10 GE Port.	ITU-T G.984.1, G.984.2, G.984.3, G.984.4	Met	
30	OLT Link Aggregation Support – GE	IEEE 802.3ad and RFC 2544	Met	
31	OLT Link Aggregation Support – 10 GE	IEEE 802.3ad and RFC 2544	Met	
32	DISN Equipment Interoperability	UCR 2008 Section 5.5	Met	

LEGEND:

DISN	Defense Information Systems Network	ITU-T	International Telecommunication Union-Telecommunication
ESTOP	Emergency Stop	OLT	Optical Line Termination
GigE/GE	Gigabit Ethernet	ONT	Optical Network Terminal
GPON	Gigabit Passive Optical Network	RFC	Request For Comments
IEEE	Institute of Electrical and Electronics Engineers	UCR	Unified Capabilities Requirement

12. TEST AND ANALYSIS REPORT. In accordance with the Program Manager's request, no detailed test report was developed. JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Non-secure 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 at http://jit.fhu.disa.mil (NIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability website at http://jitc.fhu.disa.mil/tssi.

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 CH1)	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 1x109 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, Section 5.2.12.6, 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) in accordance with UCR 2008, Section 5.2.1.5.7, Carrier Group Alarm, upon physical loss of the TDM interface.	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 DSN 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 DSN switch in accordance with UCR 2008. 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 CH1)	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 DSN 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 DSN 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 (2)	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 (3)	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 (4)	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	The NE for an analog 2-wire or 4-wire trunk interface shall be in accordance with UCR 2008, Section 5.2.6.4, Analog Trunk Interface.	5.9.2.3.1	C	C

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

ID	Requirement	UCR Ref (UCR 2008 CH1)	F-NE	D-NE
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
21	The ISDN BRIe interface shall meet the requirements and conditions in accordance with UCR 2008, Section 5.2.1.3.3, National ISDN 1/2 Basic Access.	5.9.2.3.3	C	C
22	The T1 interface shall meet the requirements and conditions in accordance with UCR 2008, Section 5.2.6.1, PCM-24 Digital Trunk Interface.	5.9.2.3.4	C	C
23	The E1 interface shall meet the requirements and conditions in accordance with UCR 2008, Section 5.2.6.2, 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 timing signal from an internal source, an incoming digital signal, or an external source in accordance with UCR 2008, Section 5.2.10.1, Timing Modes.	5.9.2.3.7	R	R
28	OC-X interface shall be in accordance with UCR 2008, Section 5.2.12.2, DSN Switch SONET Digital Trunk 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

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

ID	Requirement	UCR Ref (UCR 2008 CH1)	F-NE	D-NE
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 ADIMSS as described in the UCR 2008, Section 5.2.8, Network Management, Section 5.2.8.3, Fault Management, and Section 5.2.8.4, Configuration Management.	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
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

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

ID	Requirement	UCR Ref (UCR 2008 CH1)	F-NE	D-NE
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 Wireless Intrusion Detection System (WIDS) exists for the DLoS transport technology used, the NE DLoS transport link shall be monitored. The system will have the following capabilities: 1. Continuous scanning. The WIDS will scan continuously around-the-clock to detect authorized and unauthorized activity. 2. Deployed systems shall be properly engineered so that the DLAB products achieve the required performance requirements in their specific structural environment. Users shall submit their network design with their request for DSN connection. The UCCO submittal shall include wireless security compliancy FIPS 140 and proposed accessibility as well as WIDS National Information Assurance Partnership (NIAP) Common Criteria validation for basic robustness. Medium robustness will be applied, as determined by the DAA, when the NIAP Common Criteria for that level is approved.	5.9.2.7	C	C
44	The D-NEs shall meet all NE requirements specified in Section 5.9.2, DSN 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
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

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

ID	Requirement	UCR Ref (UCR 2008 CH1)	F-NE	D-NE
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 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).	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, DSN 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 in accordance with UCR 2008, Section 5.2.6, System Interfaces, upon physical loss of the ingress TDM interface.	5.9.3.5	NA	R
60	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 CH1)	F-NE	D-NE
61	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
62	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 5.2.2.7, 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
63	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
64	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
65	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
66	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
DSN	Defense Switch Network
DVX	Deployed Voice Exchange
E1	European 1 (2048 bps, 30-channel PCM)
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	Trunk 1 (1544 bps, 24-channel PCM)
TDM	Time Division Multiplexing
UCCO	Unified Capabilities Certification Office
UCR	Unified Capabilities Requirements
VVoIP	Voice and Video over Internet Protocol

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