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

IN REPLY REFER TO: Joint Interoperability Test Command (JTE) **13 Aug 12**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Tellabs 1134 and 1150 Multiservice Access Platform (MSAP) Optical Line Terminals (OLT) with Specified Tellabs 700 Series Optical Network Terminals (ONT) Passive Optical Network (PON) with Software Release FP25.7

References: (a) Department of Defense Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) Department of Defense Instruction 8100.04, "DoD Unified Capabilities (UC)," 9 December 2010
(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 Tellabs Gigabit Passive Optical Network (GPON) solution consists of a MSAP OLT and an ONT. The Tellabs 1134 and 1150 MSAP OLTs, combined with an OLT (Tellabs 704 Gigabit (G), 709 Gigabit and Power over Ethernet (GP), 714G, 728GP, 729, and 729GP) with Software Release FP25.7, are hereinafter referred to as the System Under Test (SUT). The SUT meets all its critical interoperability requirements, and JITC certifies the SUT for joint use in the Defense Information System Network (DISN) as a PON. The JITC evaluated and certified the SUT for PON interfaces detailed in Table 1. The operational status of the SUT will be verified during deployment. Any new discrepancies that are discovered in the operational environment will be evaluated for impact and adjudicated to the satisfaction of the Defense Information Systems Agency (DISA) in a vendor Plan of Action and Milestones to address the concern(s) within 120 days of identification. JITC conducted testing using PON requirements within the Unified Capabilities Requirements (UCR) 2008, Change 3,
Reference (c). JITC tested the SUT using PON 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 3 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, and Information Assurance (IA) Certification Authority (CA) approval of the IA configuration. JITC conducted Interoperability testing at its facility in Indian Head Maryland, from 21 February through 30 March 2012. JITC published the IA findings in a

separate report, Reference (e). The DISA IA CA reviewed the JITC published IA Assessment Report for the SUT and provided a positive recommendation on the IA configuration on 5 June 2012. The acquiring agency or site will be responsible for the Department of Defense IA Certification and Accreditation Process (DIACAP) accreditation. Enclosure 2 documents the test results and describes the tested network and system configurations. Enclosure 3 lists the PON Capability Requirements (CR) and Functional Requirements (FR).

4. Section 5.3 of the UCR establishes the interfaces and threshold CRs/FRs used to evaluate the interoperability of the SUT as a GPON. Tables 1 and 2 list the GPON, sponsor-requested interfaces, CRs, FRs, and component status of the SUT.

Table 1. SUT Interface Interoperability Status

Interface	Critical	Reference (UCR 2008, Change 3)	CR/FR Requirements	Tellabs 1134 MSAP OLT	Tellabs 1150 MSAP OLT	Specified Tellabs 700 Series ONTs (See note 1.)	Re-marks
NNI-NNI							
100 Mbps	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 22, 23, 24, 25, 26, 27	NA	NA	NA	See note 2.
GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27	Certified	Certified	NA	See note 2.
10 GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27	NA	Certified	NA	See note 2.
PON							
GPON	Yes	5.3.1.10.2.2	11, 17, 18	Certified	Certified	Certified	
NM							
10Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27	Certified	Certified	NA	See note 3.
100Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27	Certified	Certified	NA	See note 3.
UNI							
10 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.
100 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.
GbE	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.
OTHER							
VoIP	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Not Tested	See note 5.
POTS	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Not Tested	See note 6.

NOTES:
1. Specified Tellabs 700 Series ONTs consisted of Tellabs 704G, 709GP, 714G, 728GP, 729, and 729GP.
2. The OLT NNI-NNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).
3. The NM interfaces were available only on 1134 and 1150 OLTs and all the configuration, alarm, other event management for 700 series ONTs were performed via OLTs.
4. The ONT UNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).
5. The Tellabs 700 Series ONTs provide a VoIP interface that converts POTS analog voice to SIP. This interface was not tested and is not certified for use.
6. The Tellabs 700 Series ONTs provides a 2-wire analog POTS voice interface. The ONT POTS Voice interface ports are not tested and not certified.

LEGEND:

10Base-X	10 Mbps Ethernet generic designation	NM	Network Management
100Base-X	100 Mbps Ethernet generic designation	NNI	Network-to-Network Interface
CR	Capability Requirement	OLT	Optical Line Terminal
FR	Functional Requirement	ONT	Optical Network Terminal
G	Gigabit	PON	Passive Optical Network
GbE	Gigabits Ethernet	POTS	Plain Old Telephone Service
GP	Gigabit Power Over Ethernet	SIP	Session Initiation Protocol
GPON	Gigabit Passive Optical Network	SUT	System Under Test
IEEE	Institute of Electrical and Electronic Engineers	UCR	Unified Capabilities Requirements
Mbps	Megabits per second	UNI	User Network Interface
MSAP	Multi-Services Access Platform	VoIP	Voice over Internet Protocol
NA	Not Applicable		

Table 2. SUT CRs and FRs Status

CR/FR ID	Capability/Function	Applicability (See note 1.)	Reference (UCR 2008 Change 3)	Status	Remarks
GPON Requirements					
1	Interfaces	Required	5.3.1.10.2	Met	See notes 2 and 3.
2	Class of Service Markings	Required	5.3.1.10.3	Met	See notes 2 and 3.
3	Virtual LAN Capabilities	Required	5.3.1.10.4	Met	See notes 2 and 3.
4	Protocols	Conditional	5.3.1.10.5	Met	See notes 2 and 3.
5	Quality of Service Features	Required	5.3.1.10.6	Met	See notes 2 and 3.
6	Network Monitoring	Required	5.3.1.10.7	Met	See notes 2 and 3.
7	Voice Services	Required	5.3.1.10.8	Met	See note 2.
8	Video Services	Required	5.3.1.10.9	Met	See note 2.
9	Data Services	Required	5.3.1.10.10	Met	See note 2.
10	Information Assurance Requirements	Required	5.3.1.10.11	Met	See note 2.
11	PON Network Management Requirements	Required	5.3.1.10.12	Met	See notes 2 and 3.
12	Configuration Control	Required	5.3.1.10.13	Met	See notes 2 and 3.
13	Operational Changes	Required	5.3.1.10.14	Met	See notes 2 and 3.
14	Performance Monitoring	Required	5.3.1.10.15	Met	See notes 2 and 3.
15	Alarms	Required	5.3.1.10.16	Met	See notes 2 and 3.
16	Reporting	Required	5.3.1.10.17	Met	See notes 2 and 3.
17	Fiber Media	Required	5.3.1.10.18	Met	See notes 2 and 3.
18	RF-over-Glass	Conditional	5.3.1.10.19	Met	See notes 2 and 3.
19	Traffic Engineering	Required	5.3.1.10.20	Met	See notes 2 and 3.
20	VLAN Design and Configuration	Required	5.3.1.10.21	Met	See notes 2 and 3.
21	Power Backup	Required	5.3.1.10.22	Met	See notes 2 and 3.
22	Availability	Conditional	5.3.1.10.23	Met	See notes 2 and 3.
23	Redundancy	Required	5.3.1.10.24	Met	See notes 2 and 3.

Table 2. SUT CRs and FRs Status (continued)

CR/FR ID	Capability/Function	Applicability (See note 1.)	Reference (UCR 2008 Change 3)	Status	Remarks
GPON Requirements					
24	Survivability	Required	5.3.1.10.25	Met	See notes 2 and 3.
25	Summary of LAN Requirements by Subscriber Mission	Required	5.3.1.10.26	Met	See notes 2 and 3.
26	IPv6	Required	5.3.5.4	Met	See notes 2, 3, and 4.
27	Network Management	Required	5.3.2.4.4	Met	See note 5.

NOTES:
1. Annotation of "required" refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. Any Tellabs 704G, 709GP, 714G, 728GP, 729, and 729GP ONT combined with a Tellabs 1134 or 1150 OLT creates a GPON solution that meets the CRs and FRs set forth by UCR 2008, Change 3.
3. The SUT met the requirement via interoperability testing and review of vendor LoC.
4. This requirement was met via dual stack IPv4/IPv6 testing and review of vendor LoC.
5. The NM interface was available only on 1134 and 1150 OLTs, and all the configuration, alarm, other event management for 700 series ONTs were performed via OLT.

LEGEND:

CR	Capabilities Requirement	LoC	Letter of Compliance
FR	Functional Requirement	NM	Network Management
G	Gigabit	OLT	Optical Line Terminal
GP	Gigabit Power Over Ethernet	ONT	Optical Network Terminal
GPON	Gigabit Passive Optical Network	PON	Passive Optical Network
ID	Identification	RF	Radio Frequency
IPv4	Internet Protocol version 4	SUT	System Under Test
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
LAN	Local Area Network	VLAN	Virtual Local Area Network

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 Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program, which .mil/.gov users can access 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://jitc.fhu.disa.mil (NIPRNet). Information related to DISN testing is on the Telecommunications Switched Services Interoperability website at http://jitc.fhu.disa.mil/tssi. All associated data is available on the DISA Unified Capabilities Certification Office (UCCO) website located at https://aplits.disa.mil.

JITC Memo, JTE, Special Interoperability Test Certification of the Tellabs 1134 and 1150 Multiservice Access Platform (MSAP) Optical Line Terminals (OLT) with Specified Tellabs 700 Series Optical Network Terminals (ONT) Passive Optical Network (PON) with Software Release FP25.7

6. JITC testing point of contact is Mr. Son Pham, commercial (301) 743-4258. His e-mail address is Son.m.Pham2.civ@mail.mil; mailing address: 3341 Strauss Avenue, Suite 236, Indian Head, Maryland 20640-5149. The UCCO Tracking Number is 1126402.

FOR THE COMMANDER:

3 Enclosures a/s

for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

Distribution (electronic mail):
Joint Staff J-6
Joint Interoperability Test Command, Liaison, TE3/JT1
Office of Chief of Naval Operations, CNO N6F2
Headquarters U.S. Air Force, Office of Warfighting Integration & CIO, AF/XCIN (A6N)
Department of the Army, Office of the Secretary of the Army, DA-OSA CIO/G-6 ASA (ALT), SAIS-IOQ
U.S. Marine Corps MARCORSYSCOM, SIAT, MJI Division I
DOT&E, Net-Centric Systems, and Naval Warfare
U.S. Coast Guard, CG-64
Defense Intelligence Agency
National Security Agency, DT
Defense Information Systems Agency, TEMC
Office of Assistant Secretary of Defense (NII)/DoD CIO
U.S. Joint Forces Command, Net-Centric Integration, Communication, and Capabilities Division, J68
HQUSAISEC, AMSEL-IE-IS

(This page left intentionally blank.)

ADDITIONAL REFERENCES

(c) Office of the Assistant Secretary of Defense, "Department of Defense Unified Capabilities Requirements 2008, Change 3," September 2011
(d) Joint Interoperability Test Command, "Passive Optical Network Test Procedures," 20 February 2012
(e) Joint Interoperability Test Command, "Information Assurance (IA) Assessment of Tellabs 1150 Multiservice Access Platform and Tellabs 1134 Multiservice Access Platform Gigabit Passive Optical Network (GPON), with Software Release FP25.7 (TN 1126402)," 23 March 2012

(This page intentionally left blank.)

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. The Tellabs 1134 and 1150 Multiservice Access Platform (MSAP) Optical Line Terminals (OLT) with Specified Tellabs 700 Series Optical Network Terminals (ONT) Gigabit Passive Optical Network (GPON) with Software Release FP25.7. The system is hereinafter referred to as the System Under Test (SUT).

2. SPONSOR. Mr. Jordan Silk, Program Manager, HQUSAISEC, AMSEL-IE-IS, Building 53302, Fort Huachuca, AZ 85613, e-mail: Jordan.R.Silk.civ@mail.mil.

3. SYSTEM POC. Mr. Russell Kulpins, Staff Product Manager, Tellabs, 1415 West Diehl Road, Naperville, IL 60563. E-mail: Russell.Kulpins@tellabs.com.

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

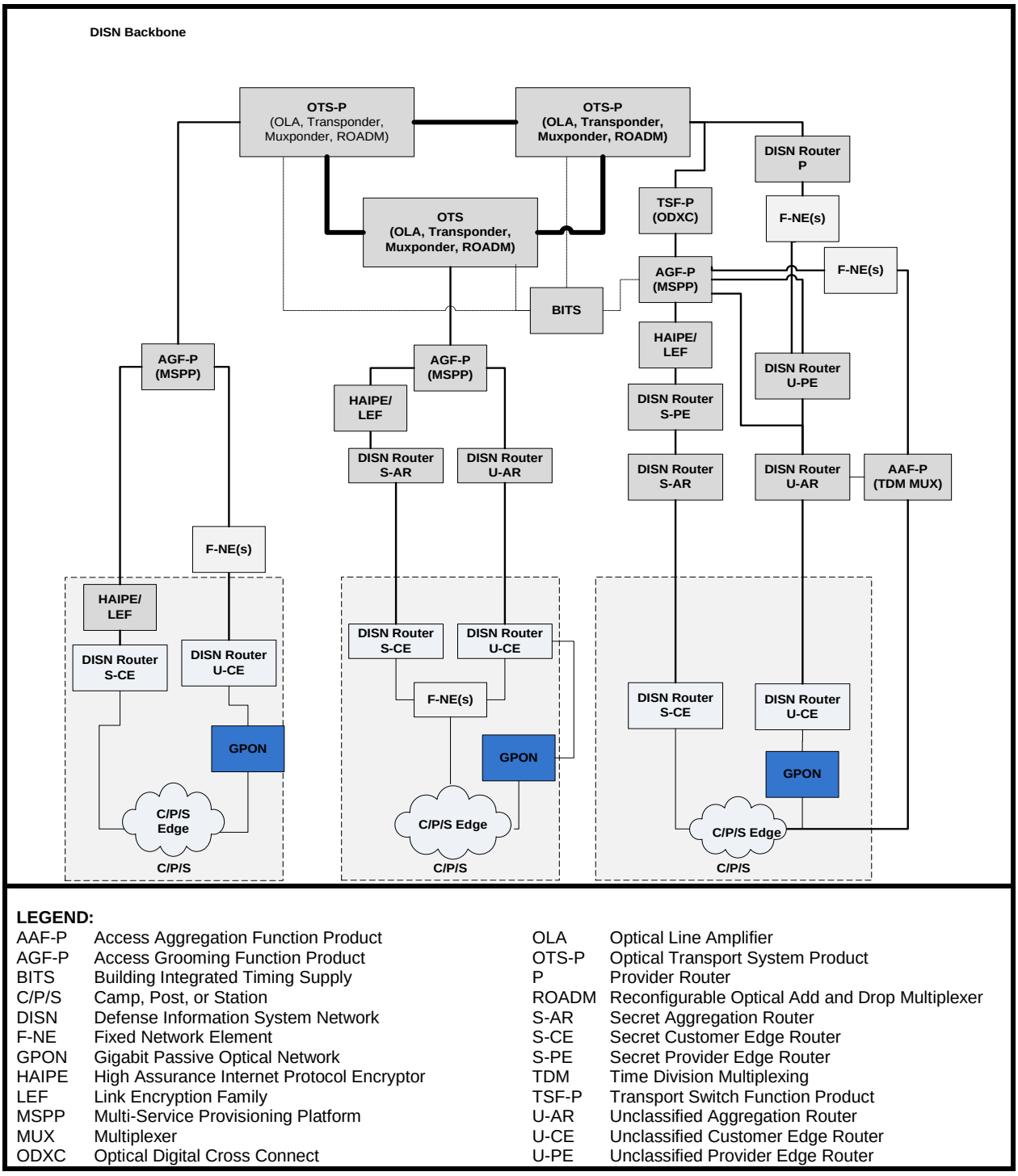
5. SYSTEM DESCRIPTION. There are three main components in a GPON, other than the fiber itself. The GPON OLT is the network concentrator, the splitter (or splitters) allows a single fiber to be shared among a number of subscribers, and the ONT serves a local site.

The Tellabs 1134 MSAP offers a medium-density, full-service option ideal for smaller "deep-fiber" (i.e., fiber-to-the desktop) applications. Tellabs designed the system to meet growing demands of high-bandwidth services, including voice, video, and data. The Tellabs 1150 MSAP is a native end-to-end Internet Protocol (IP)/Ethernet delivery platform that offers the packet-based, high-bandwidth technology required for current telecommunications services. The Tellabs 1150 MSAP is a high-density access platform focused on optimized, scalable, deep-fiber service delivery of voice, video, and data. The Tellabs 1134 and 1150 perform the function of the GPON OLT.

Tellabs designed the 700 series ONT to deliver narrowband and broadband subscriber services. The Tellabs 704 Gigabit (G), 709 Gigabit and Power Over Ethernet (GP), 714G, 728GP, 729, and 729GP ONTs are GPON access devices that provide service termination for the subscriber ports of the 1134/1150 MSAP platforms. The ONTs were tested peripherals to the 1134/1150 MSAP platforms. The Tellabs-1134/1150 MSAPs and 704G, 709GP, 714G, 728GP, 729, and 729GP ONTs are components of the GPON system International Telecommunication Union-Telecommunication (ITU-T) Standardization Sector G.984 standard.

The Oracle Database User Licensed Standard Edition and Tellabs Panorama are used for provisioning the SUT; and they were not part of the SUT.

6. OPERATIONAL ARCHITECTURE. Under the direction of the Unified Capabilities (UC) Certification Office, the SUT is being tested and evaluated as a GPON. Figure 2-1 shows the role of the SUT in a Defense Information System Network (DISN) architecture.



LEGEND:

AAF-P	Access Aggregation Function Product
AGF-P	Access Grooming Function Product
BITS	Building Integrated Timing Supply
C/P/S	Camp, Post, or Station
DISN	Defense Information System Network
F-NE	Fixed Network Element
GPON	Gigabit Passive Optical Network
HAIPE	High Assurance Internet Protocol Encryptor
LEF	Link Encryption Family
MSPP	Multi-Service Provisioning Platform
MUX	Multiplexer
ODXC	Optical Digital Cross Connect
OLA	Optical Line Amplifier
OTS-P	Optical Transport System Product
P	Provider Router
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
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), Information Assurance (IA), and other requirements for GPON products are established by the Department of Defense (DoD) Unified Capabilities Requirements (UCR) 2008, Change 3, Section 5.3.1.10.

7.1 Interfaces. The GPON products use their interfaces to connect to a Local Area Network (LAN) or DISN Wide Area Network infrastructure. The threshold requirements for interfaces specific to the GPON products are listed in Table 2-1.

Table 2-1. GPON Interface Requirements

Interface	Critical	Reference (UCR 2008 Change 3)	CR/FR Requirements	Criteria	Remarks
NNI-NNI					
100 Mbps	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 22, 23, 24, 25, 26, 27	Meet minimum CR/FRs and interface standards	See note 1.
GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27		
10 GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27		
PON					
GPON	Yes	5.3.1.10.2.2	11, 17, 18	Meet minimum CR/FRs and interface standards	
NM					
10Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27	Meet minimum CR/FRs and interface standards	
100Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27		
UNI					
10 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	Meet minimum CR/FRs and interface standards	See note 2.
100 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27		
GbE	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27		
OTHER					
VoIP	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	Meet minimum CR/FRs and interface standards	
POTS	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	Meet minimum CR/FRs and interface standards	

Table 2-1. GPON Interface Requirements (continued)

NOTES:
1. The OLT NNI-NNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).
2. The ONT UNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).

LEGEND:

10Base-X	10 Mbps Ethernet generic designation	NM	Network Management
100Base-X	100 Mbps Ethernet generic designation	NNI	Network-to-Network Interface
CR	Capability Requirement	OLT	Optical line Terminal
FR	Functional Requirement	ONT	Optical Network Terminal
GbE	Gigabits Ethernet	PON	Passive Optical Network
GPON	Gigabit Passive Optical Network	UCR	Unified Capabilities Requirements
IEEE	Institute of Electrical and Electronic Engineers	UNI	User Network Interface
Mbps	Megabits per second		

7.2 CRs and FRs. The GPON products have required and conditional features and capabilities that are established by UCR 2008, Change 3, Section 5.3.1.10. 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 the SUT products. Table 3-1 of Enclosure 3 provides detailed CR/FR requirements.

Table 2-2. SUT CRs and FRs

CR/FR ID	Capability/Function	Applicability (See note.)	Reference (UCR 2008 Change 3)	Criteria
GPON Requirements				
1	Interfaces	Required	5.3.1.10.2	Meet UCR Requirements
2	Class of Service Markings	Required	5.3.1.10.3	Meet UCR Requirements
3	Virtual LAN Capabilities	Required	5.3.1.10.4	Meet UCR Requirements
4	Protocols	Conditional	5.3.1.10.5	Meet UCR Requirements
5	Quality of Service Features	Required	5.3.1.10.6	Meet UCR Requirements
6	Network Monitoring	Required	5.3.1.10.7	Meet UCR Requirements
7	Voice Services	Required	5.3.1.10.8	Meet UCR Requirements
8	Video Services	Required	5.3.1.10.9	Meet UCR Requirements
9	Data Services	Required	5.3.1.10.10	Meet UCR Requirements
10	Information Assurance Requirements	Required	5.3.1.10.11	Meet UCR Requirements
11	PON Network Management Requirements	Required	5.3.1.10.12	Meet UCR Requirements
12	Configuration Control	Required	5.3.1.10.13	Meet UCR Requirements
13	Operational Changes	Required	5.3.1.10.14	Meet UCR Requirements
14	Performance Monitoring	Required	5.3.1.10.15	Meet UCR Requirements
15	Alarms	Required	5.3.1.10.16	Meet UCR Requirements
16	Reporting	Required	5.3.1.10.17	Meet UCR Requirements
17	Fiber Media	Required	5.3.1.10.18	Meet UCR Requirements
18	RF-over-Glass	Conditional	5.3.1.10.19	Meet UCR Requirements
19	Traffic Engineering	Required	5.3.1.10.20	Meet UCR Requirements
20	VLAN Design and Configuration	Required	5.3.1.10.21	Meet UCR Requirements
21	Power Backup	Required	5.3.1.10.22	Meet UCR Requirements
22	Availability	Conditional	5.3.1.10.23	Meet UCR Requirements
23	Redundancy	Required	5.3.1.10.24	Meet UCR Requirements
24	Survivability	Required	5.3.1.10.25	Meet UCR Requirements
25	Summary of LAN Requirements by Subscriber Mission	Required	5.3.1.10.26	Meet UCR Requirements

Table 2-2. SUT CRs and FRs (continued)

CR/FR ID	Capability/Function	Applicability (See note.)	Reference (UCR 2008 Change 3)	Criteria
26	IPv6	Required	5.3.5.4	Meet UCR Requirements
27	Network Management	Required	5.3.2.4.4	Meet UCR Requirements

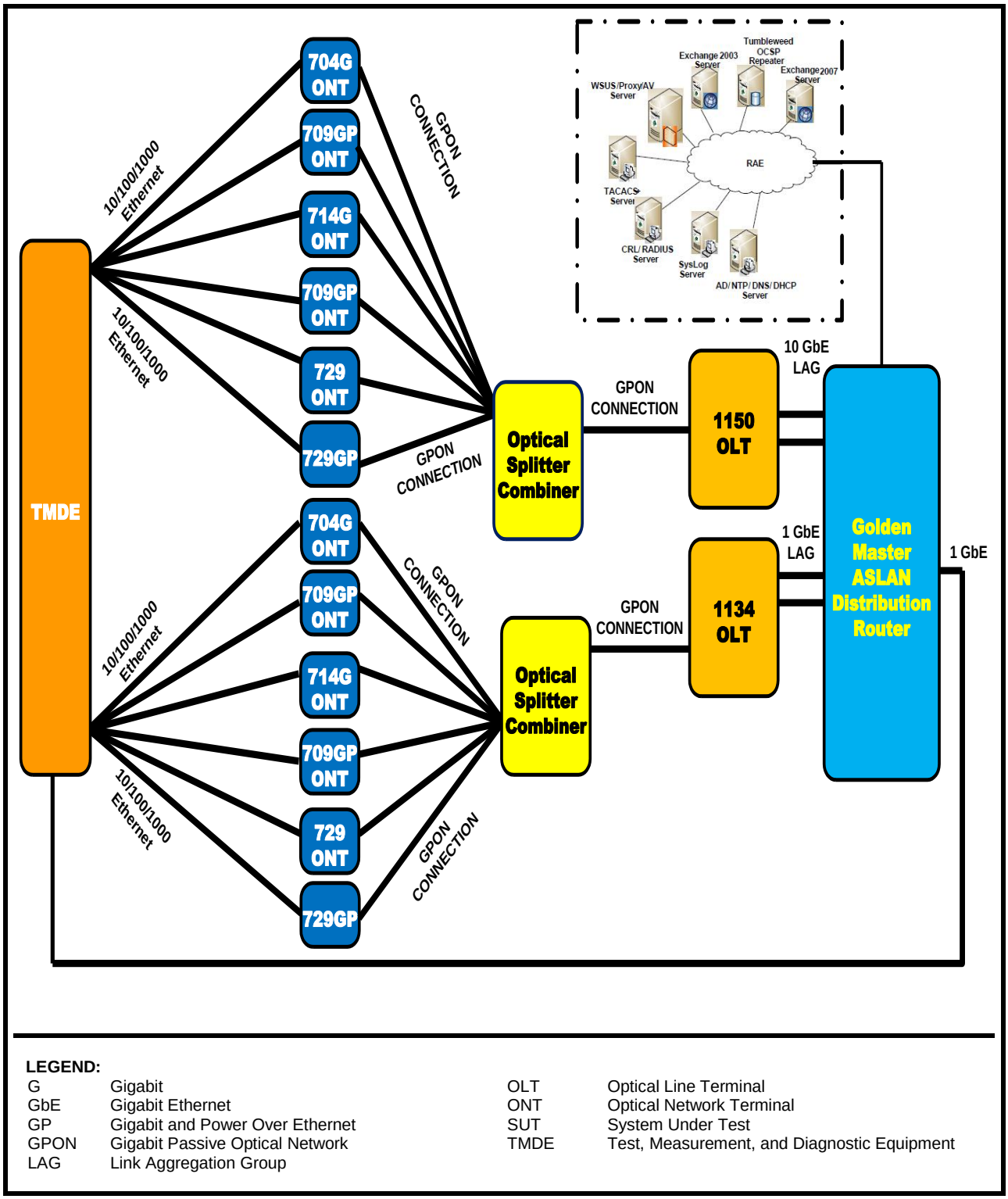
NOTE: Annotation of "required" refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.

LEGEND:

CR	Capabilities Requirement	PON	Passive Optical Network
FR	Functional Requirement	RF	Radio Frequency
ID	Identification	SUT	System Under Test
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
GPON	Gigabit Passive Optical Network	VLAN	Virtual Local Area Network
LAN	Local Area Network		

7.3 Other. None.

8. TEST NETWORK DESCRIPTION. JITC tested the SUT at its facility in Indian Head, Maryland. Figure 2-2 shows the SUT's Test Configuration.



LEGEND:

G	Gigabit	OLT	Optical Line Terminal
GbE	Gigabit Ethernet	ONT	Optical Network Terminal
GP	Gigabit and Power Over Ethernet	SUT	System Under Test
GPON	Gigabit Passive Optical Network	TMDE	Test, Measurement, and Diagnostic Equipment
LAG	Link Aggregation Group		

Figure 2-2. SUT's Test Configuration

9. SYSTEM CONFIGURATION. Table 2-3 lists the Hardware/Software Tested SUT Equipment shown in Figure 2-2, Table 2-4 lists the Non-SUT Equipment, and Table 2-5 lists the test equipment used to generate voice, video, and IP data traffic.

Table 2-3. Hardware/Software Tested SUT Equipment

Platform	Software Release	UC Product Type
704G ONT	FP25.7	PON
709GP ONT	FP25.7	PON
714G ONT	FP25.7	PON
728GP ONT	FP25.7	PON
729 ONT	FP25.7	PON
729GP ONT	FP25.7	PON
Tellabs 1134 MSAP OLT	FP25.7	PON
Tellabs 1150 MSAP OLT	FP25.7	PON
Oracle Database 5 Named User License SE	Version 10 - Oracle Standard Edition	NM
Tellabs Panorama	Release 10.0.1	NM
SUT-Equipment List		
Quantity	**Description**	**Part Number**
1	MDS5 Chassis, 16 I/O Slot	4125053
2	ESU2- ESU- 2 x 10 GbE and 4 x 1 Gbps; 2 for redundancy	4115091
2	ESU11 - MSAP - Ethernet Switching Unit - 4 x 1 Gbps	4125062
3	QOIU7 QUAD GPON Card (4 SFPs included)	4125004
4	XFP, TDM, 10 Gbps, 1310 nm, industrial temp 5/3.3/1.8V - 10 km	4195098
1	1134 Chassis	4115093
1	1134 Fan Tray Assembly	4115094
2	ESU30 ESU	4115090
10	GbE SFP Wideband 850 nm (1000 base SX) 550 m	128211
3	ONT701, 1D, GPON TL - Includes encl and power supply. (Note this unit doesn't support a battery)	0915-0107
3	ONT709, 4 GbE Indoor	0915-0124
1	ONT729, MDU NID 24P, 24FE	0915-0126
2	ONT704G, 2P (ANSI), 4 GbE - Indoor desktop unit (A power cord)	81.16G-704G00PA-R6
2	ONT709GP, 4 GbE, PoE, No POTS, No-Plug	81.16G-709GP00X-R6
2	ONT714, 4 GbE, 2P, No-Plug TL NID	81.16G-714G00PX-R6
2	ONT728GP – 24 GbE with PoE; MDU; 1 RU 19-inch Rack. 100 to 240V AC powered (B power cord)	81.16G-728GP00B-R6
2	ONT729GP - 24P, 24 GbE with PoE; MDU; 1 RU 19-inch Rack. 100 to 240V AC powered (B power cord)	81.16G-729GP0PB-R6
1	Sun T2000 Sever	278-0063
1	MDS5 Chassis, 16 I/O Slot	4125053
2	ESU2- ESU - 2 x 10 GbE and 4 x 1 Gbps; 2 for redundancy	4115091
2	ESU11 - MSAP - Ethernet Switching Unit - 4 x 1 Gbps	4125062
3	QOIU7 QUAD GPON Card (4 SFPs included)	4125004
4	XFP, TDM, 10 Gbps, 1310 nm, industrial temp 5/3.3/1.8V - 10 Km	4195098

Table 2-3. Hardware/Software Tested SUT Equipment (continued)

LEGEND:

AC	Alternating Current	OLT	Optical Line Terminal
ANSI	American National Standards Institute	ONT	Optical Network Terminal
ESU	Ethernet Switch Unit	P	Port
FE	Fast Ethernet	PoE	Power over Ethernet
FP	Feature Package	PON	Passive Optical Network
G	Gigabit	POTS	Plain Old Telephone Service
GbE	Gigabit Ethernet	QOIU7	4-port GPON module
Gbps	Gigabits per second	QUAD	Quadruple
GP	Gigabit Power Over Ethernet	RU	Rack Unit
GPON	Gigabit Passive Optical Network	SE	Standard Edition
I/O	Input/Output	SFP	Small Form-Factor
km	kilometer	SUT	System Under Test
m	meters	SX	Short Haul Fiber
MDS	Multipoint Distribution Service	TDM	Time Division Multiplexing
MDU	Multiplexer Decoder Unit	TL	Transport Layer
MSAP	Multi-Services Access Platform	UC	Unified Capabilities
NID	Network Interface Device	V	volt
NM	Network Manager	XFP	X-Form Factor Pluggable
nm	nanometer		

Table 2-4. Non-SUT Equipment

Component	Software Version	Function	Subcomponent
Cisco 6509	Version 12.2	Router	1 GbE, 10 GbE LAG

LEGEND:

GbE	Gigabit Ethernet	SUT	System Under Test
LAG	Ling Aggregation Group		

Table 2-5. Test, Measurement, and Diagnostic Equipment

Manufacture	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	
		1000Base-X	
Ixia	Traffic generator	10 G	5
		LM1000STX	
Agilent	Rack Mounted Router Tester 900	10 G LAN/WAN	6.11
		10/100/1000Base-T	
		1000Base-X	
		OC-48c POS	
		OC-3/12/POS	

LEGEND:

10/100/1000 Base-T	10/100/1000 Mbps (Baseband Operation, Twisted Pair) Ethernet	Mbps	Megabits per second
		nm	Nanometer
1000Base-X	1000 Mbps Ethernet Generic Designation	OC	Optical Carrier
G	Gigabit	POS	Packet Over Synchronous Optical Network
LAN	Local Area Network	STX	Ixia Product Name
LM	Light Manager	WAN	Wide Area Network

10. TEST LIMITATIONS. The JITC Indian Head testers noted the following test limitations during testing of the system:

a. There were no real users connected to the GPON-ONTs so JITC test team simulated all the functionality of the real users using test equipments.

b. There were no real Local Session Controller and IP-enabled Voice switch connected to the GPON-OLTs so JITC test team simulated all the functionality of the Local Session Controller and the IP-enabled Voice switch using test equipments.

c. GPON systems acts as the Access-Layer of the ASLAN and connects directly to the Distribution-Layer of ASLAN and JITC-IHD ATT Lab does not have a fully function ASLAN, so JITC test team simulated the Distribution-Layer of the ASLAN using single Cisco 4507R layer-3 switch.

11. INTEROPERABILITY EVALUATION RESULTS. The SUT meets the critical interoperability requirements for PON, and JITC certifies its joint use within the DISN. Additional discussion regarding specific testing results is contained in subsequent paragraphs.

11.1 Interfaces. The SUT's GPON interface status is provided in Table 2-6.

Table 2-6. SUT GPON Interface Requirements Status

Interface	Critical	Reference (UCR 2008, Change 3)	CR/FR Requirements	Tellabs 1134 MSAP OLT	Tellabs 1150 MSAP OLT	Specified Tellabs 700 Series ONTs (See note 1.)	Re-marks
NNI-NNI							
100 Mbps	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 22, 23, 24, 25, 26, 27	NA	NA	NA	See note 2.
GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27	Certified	Certified	NA	See note 2.
10 GbE	No	5.3.1.10.2.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27	NA	Certified	NA	See note 2.
PON							
GPON	Yes	5.3.1.10.2.2	11, 17, 18	Certified	Certified	Certified	
NM							
10Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27	Certified	Certified	NA	See note 3.
100Base-X	Yes	5.3.2.4.4	1, 6, 23, 24, 26, 27	Certified	Certified	NA	See note 3.
UNI							
10 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.
100 Mbps	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.
GbE	No	5.3.1.10.2.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Certified	See note 4.

Table 2-6. SUT GPON Interface Requirements Status (continued)

Interface	Critical	Reference (UCR 2008, Change 3)	CR/FR Requirements	Tellabs 1134 MSAP OLT	Tellabs 1150 MSAP OLT	Specified Tellabs 700 Series ONTs (See note 1.)	Re-marks
OTHER							
VoIP	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Not Tested	See note 5.
POTS	No	NA	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 21, 22, 24, 25, 26, 27	NA	NA	Not Tested	See note 6.

NOTES:
1. Specified Tellabs 700 Series ONTs consisted of Tellabs 704G, 709GP, 714G, 728GP, 729, and 729GP.
2. The OLT NNI-NNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).
3. The NM interfaces were available only on 1134 and 1150 OLTs and all the configuration, alarm, other event management for 700 series ONTs were performed via OLTs.
4. The ONT UNI port shall support at least one of the required interface rates (other rates and IEEE standards may be provided as conditional interfaces).
5. The Tellabs 700 Series ONTs provide a VoIP interface that converts POTS analog voice to SIP. This interface was not tested and is not certified for use.
6. The Tellabs 700 Series ONTs provides a 2-wire analog POTS voice interface. The ONT POTS Voice interface ports are not tested and not certified.

LEGEND:

10Base-X	10 Mbps Ethernet generic designation	MSAP	Multi-Services Access Platform
100Base-X	100 Mbps Ethernet generic designation	NA	Not Applicable
CR	Capability Requirement	NM	Network Management
FR	Functional Requirement	NNI	Network-to-Network Interface
G	Gigabit	OLT	Optical Line Terminal
GbE	Gigabits Ethernet	ONT	Optical Network Terminal
GP	Gigabit Power Over Ethernet	PON	Passive Optical Network
GPON	Gigabit Passive Optical Network	SUT	System Under Test
IEEE	Institute of Electrical and Electronic Engineers	UCR	Unified Capabilities Requirements
Mbps	Megabits per second	UNI	User Network Interface

11.2 CRs and FRs. Table 2-7 lists the SUT's CR/FR statuses. The detailed CR/FR requirements are provided in Table 3-1 of the System Functional and Capability Requirements (Enclosure 3).

Table 2-7. SUT CRs and FRs Status

CR/FR ID	Capability/Function	Applicability (See note 1.)	Reference (UCR 2008 Change 3)	Status	Remarks
GPON Requirements					
1	Interfaces	Required	5.3.1.10.2	Met	See notes 2 and 3.
2	Class of Service Markings	Required	5.3.1.10.3	Met	See notes 2 and 3.
3	Virtual LAN Capabilities	Required	5.3.1.10.4	Met	See notes 2 and 3.
4	Protocols	Conditional	5.3.1.10.5	Met	See notes 2 and 3.
5	Quality of Service Features	Required	5.3.1.10.6	Met	See notes 2 and 3.
6	Network Monitoring	Required	5.3.1.10.7	Met	See notes 2 and 3.
7	Voice Services	Required	5.3.1.10.8	Met	See note 2.
8	Video Services	Required	5.3.1.10.9	Met	See note 2.
9	Data Services	Required	5.3.1.10.10	Met	See note 2.

Table 2-7. SUT CRs and FRs Status (continued)

CR/FR ID	Capability/Function	Applicability (See note 1.)	Reference (UCR 2008 Change 3)	Status	Remarks
10	Information Assurance Requirements	Required	5.3.1.10.11	Met	See note 2.
11	PON Network Management Requirements	Required	5.3.1.10.12	Met	See notes 2 and 3.
12	Configuration Control	Required	5.3.1.10.13	Met	See notes 2 and 3.
13	Operational Changes	Required	5.3.1.10.14	Met	See notes 2 and 3.
14	Performance Monitoring	Required	5.3.1.10.15	Met	See notes 2 and 3.
15	Alarms	Required	5.3.1.10.16	Met	See notes 2 and 3.
16	Reporting	Required	5.3.1.10.17	Met	See notes 2 and 3.
17	Fiber Media	Required	5.3.1.10.18	Met	See notes 2 and 3.
18	RF-over-Glass	Conditional	5.3.1.10.19	Met	See notes 2 and 3.
19	Traffic Engineering	Required	5.3.1.10.20	Met	See notes 2 and 3.
20	VLAN Design and Configuration	Required	5.3.1.10.21	Met	See notes 2 and 3.
21	Power Backup	Required	5.3.1.10.22	Met	See notes 2 and 3.
22	Availability	Conditional	5.3.1.10.23	Met	See notes 2 and 3.
23	Redundancy	Required	5.3.1.10.24	Met	See notes 2 and 3.
24	Survivability	Required	5.3.1.10.25	Met	See notes 2 and 3.
25	Summary of LAN Requirements by Subscriber Mission	Required	5.3.1.10.26	Met	See notes 2 and 3.
26	IPv6	Required	5.3.5.4	Met	See notes 2, 3, and 4.
27	Network Management	Required	5.3.2.4.4	Met	See note 5.

NOTES:
1. Annotation of "required" refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. Any Tellabs 704G, 709GP, 714G, 728GP, 729, and 729GP ONT, combined with Tellabs 1134 or 1150 OLT creates a GPON solution that meets the CRs and FRs set forth by UCR 2008, Change 3.
3. This requirement was met via interoperability testing and review of vendor LoC.
4. This requirement was met via dual stack IPv4/IPv6 testing and review of vendor LoC.
5. The NM interface was available only on 1134 and 1150 OLTs, and all the configuration, alarm, other event management for 700 series ONTs were performed via OLT.

LEGEND:

CR	Capabilities Requirement	LoC	Letter of Compliance
FR	Functional Requirement	NM	Network Management
G	Gigabit	OLT	Optical Line Terminal
GP	Gigabit Power Over Ethernet	ONT	Optical Network Terminal
GPON	Gigabit Passive Optical Network	PON	Passive Optical Network
ID	Identification	RF	Radio Frequency
IPv4	Internet Protocol version 4	SUT	System Under Test
IPv6	Internet Protocol version 6	UCR	Unified Capabilities Requirements
LAN	Local Area Network	VLAN	Virtual Local Area Network

a. Interfaces: Overall Interfaces Requirements. In Accordance With (IAW) UCR 2008, Change 3, paragraph 5.3.1.10.2, Passive Optical Networks (PON) can be composed of Broadband PON, Ethernet PON, and GPON, and the requirements do not delineate between the different types. The UCR defines four types of interfaces in a typical PON: the Network to Network Interface (NNI); the interface from network to OLT; the interface from OLT to ONT Network Management (NMI) interface; and the User to Network Interface (UNI) interface.

(1) NNI-NNI Interface.

(a) The NNI-NNI interface is composed of the uplink between the OLT and the Core network. This interface is composed of Institute of Electrical and Electronics Engineers (IEEE) 802.3 interfaces and may provide a Fiber channel interface IAW American National Standard Institute (ANSI) International Committee for Information Technology Standards T11.2 and T11.3 (previously known as X3T9.3). At this time, no minimum rate or type of IEEE 802.3 interface is specified and commercial-off-the-shelf interfaces are accepted. If the Fiber Channel Interface is provided the interface must meet the following requirements: Request For Comment (RFC) 4338 Transmission of IP version (v)6, IPv4, and Address Resolution Protocol; Packets over Fiber channel; and RFC 4044 Fiber Channel Management. The SUT met the requirement via IA testing, Letter of Complaince (LoC), and interoperability testing using test equipment and simulated information exchanges.

(b) The OLT NNI-NNI port shall support at least one of the following interface rates (other rates and IEEE standards may be provided as conditional interfaces): 100 Megabits per second (Mbps) IAW IEEE 802.3u, 1 Gigabit per second (Gbps) IAW IEEE 802.3z, and 10 Gbps IAW IEEE 802.3ae. The NNI ports shall provide the following parameters on a per port basis as specified: Auto-negotiation IAW IEEE 802.3, Force mode IAW IEEE 802.3; Flow control IAW IEEE 802.3x, Filtering IAW RFC 1812; Link Aggregation IAW IEEE 802.1AX (formerly 802.3ad); Spanning Tree Protocol IAW IEEE 802.1D; and Multiple Spanning Tree IAW IEEE 802.1s, Rapid Configuration of Spanning Tree IAW IEEE 802.1. The SUT met the requirement via IA testing, LoC, and interoperability testing using test equipment and simulated information exchanges.

(2) OLT to ONT PON Interface.

The GPON OLT to ONT interface is defined by the ONT Management Control Interface protocol and was standardized and defined by the ITU-T standard G.984.4. This interface is composed of the PON port on the OLT and the Fiber port on the ONT. Between these ports are a single strand of Single Mode Fiber and one or more optical splitters. Bi-directional transmission is accomplished by use of separate wavelengths (1310 nanometer (nm) and 1490 nm) for transmission. The number of splitters is driven by local requirements and does not exceed the ITU-T G.984 specification for fiber loss per PON port between the OLT and ONT. There may be 1 to 64 (some vendors support more) ONTs on a single PON port. The number of ONTs is driven by the required bandwidth for each user and IAW the traffic engineering guidelines in paragraph 5.3.1.7.3, Traffic Engineering. The SUT met the requirement via IA testing and vendor LoC.

(3) Network Monitoring.

The GPON products shall support the following network monitoring features: Simple Network Management Protocol (SNMP) IAW RFCs 1157, 3410, 3411, 3412, 3413, and 3414; SNMP Traps IAW RFC 1215, Remote Monitoring IAW RFC 2819; Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework IAW RFC 3584; and The Advanced Encryption

Standard Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826. The SUT met the requirement via IA testing, vendor LoC, and interoperability testing using test equipment and simulated information exchanges.

(4) UNI Interface.

(a) PON products shall provide at least one of the following interface rates: 10 Mbps IAW IEEE 802.3i, 100 Mbps IAW IEEE 802.3u, 1000 Mbps IAW IEEE 802.3z, and 1000 Mbps IAW IEEE 802.3ab. The PON must also support traffic conditioning, which will ensure that the required bandwidth is available for all network users. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(b) UNI Ports. The UNI ports shall provide the following parameters on a per port basis as specified: Auto-negotiation IAW IEEE 802.3, Force mode IAW IEEE 802.3, Flow control IAW IEEE 802.3x, Filtering IAW RFC 1812, Port-Base Access Control IAW 802.1x, and Link Layer Discover – Media Endpoint Discovery IAW ANSI-Telecommunications Industry Association (TIA)-1057. The SUT met the requirement via IA testing, vendor LoC, and interoperability testing using test equipment and simulated information exchanges.

(c) Link Aggregation. IAW IEEE 802.1AX (formerly 802.3ad). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(d) Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI). The UNI ports may provide the following feature parameter on a per port basis as specified: DTE Power via MDI. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(e) Power-over-Ethernet (PoE) Plus. PoE Plus or DTE Power via MDI for Conditional Interfaces IEEE 802.3af. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

b. Class of Service Markings. The PON network shall comply with access product requirements, paragraph 5.3.1.3.3, #1 and #3. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

c. Virtual LAN (VLAN) Capabilities. The NNI and UNI PON ports shall comply with paragraph 5.3.1.3.4, VLAN Capabilities. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

d. Protocols. The PON network shall support bridging at Layer-2 of the Open Systems Interconnection model. Bridging will provide for higher survivability and will

reduce traffic congestion on the uplinks to the Distribution or Core Layers of the network. Bridging at Layer-2 will be supported for packets that do not require Layer-3 handling. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

e. Quality of Service Features (QoS). The PON shall comply with the Access product requirements listed in paragraph 5.3.1.3.6, QoS Features. PON products targeted for non-assured services are not subject to the Layer-3 queuing requirements in this section and the conditions of fielding will state whether the PON can support Assured Services or not. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

f. Network Monitoring. The PON shall comply with the product requirements listed in paragraph 5.3.1.3.7, Network Monitoring. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

g. Voice Services. GPON product shall comply with the following:

(1) Latency. The PON shall have the capability to transport voice IP packets, media, and signing with no more than 6 milliseconds (ms) latency end-to-end across the PON SUT as measured under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent IP video, 25 percent preferred data, and 25 percent best effort traffic). The latency shall be achievable over any 5-minute measured period under congested conditions. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(2) Jitter. The PON shall have the capability to transport voice IP packets across the PON SUT with no more than 3 ms of jitter. The jitter shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent IP video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(3) Packet Loss. The PON shall have the capability to transport voice IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the PON shall not exceed 0.045 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

h. Video Services. GPON product shall comply with the following:

(1) Latency. The PON shall have the capability to transport video IP packets with no more than 30 ms latency across the PON SUT. Latency is increased over voice IP packets because of the increased size of the packets (230 bytes for voice packets and up to 1518 bytes for video). The latency shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/ signaling, 25 percent video, 25 percent-preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(2) Jitter. The LAN shall have the capability to transport video IP packets across the PON SUT with no more than 30 ms of jitter. The jitter shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(3) Packet Loss. The PON shall have the capability to transport video IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the PON shall not exceed 0.15 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

i. Data Services. GPON product shall comply with the following:

(1) Latency. The PON shall have the capability to transport prioritized data IP packets with no more than 45 ms latency across the PON SUT. Latency is increased over voice IP packets because of the increased size of the packets (230 bytes for voice packets and up to 1518 bytes for data). The latency shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(2) Jitter. There are no jitter requirements for preferred data IP packets. JITC tested this IAW the video service jitter requirement, and the SUT met the requirement via interoperability testing using test equipment and simulated information exchanges.

(3) Packet Loss. The PON shall have the capability to transport prioritized data IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the LAN shall not exceed 0.15 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute period measured under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic). The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

j. Information Assurance Requirements. All systems must comply with the applicable Security Technical Implementation Guides (STIGs). The SUT met the requirement via IA testing, vendor LoC, and all IA Requirement testing done by the JITC IA test team. All IA related requirements status was reported separately.

k. PON Network Management Requirements. Network managers must be able to monitor, configure, and control all aspects of the network and observe changes in network status.

(1) Secure Shell version 2 (SSHv2). The PON products shall support RFC 4251 through RFC 4254 inclusive. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(2) Telnet. The PON product shall be configured by default not to accept Telnet. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(3) Hypertext Transfer Protocol, Secure (HTTPS). HTTPS shall be used instead of Hypertext Transfer Protocol due to its increased security as described in RFC 2660. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(4) RFC 3414. The LAN products shall support RFC 3414 for SNMP. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(5) LAN Interface. If other methods are used for interfacing between LAN products and the NM System (NMS), they shall be implemented in a secure manner. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

l. Configuration Control. Configuration Control identifies controls, accounts for, and audits all changes made to a site or information system during its design, development, and operational life cycle (DoD Chief Information Officer Guidance IA6-8510 IA). LANs shall have an NM capability that leverages existing and evolving technologies and has the ability to perform remote network product configuration/reconfiguration of objects that have existing DoD Global Information Grid management capabilities. The NMS shall report configuration change events in near-real-time (NRT), whether or not the change was authorized. The system shall report the success or failure of authorized configuration change attempts in NRT. NRT is defined as within 5 seconds of detecting the event, excluding transport time. The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

m. Operational Changes. The PON shall meet the requirements in paragraph 5.3.1.6.2, Operational Changes. The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

n. Performance Monitoring. The PON shall meet the requirements in paragraph 5.3.1.6.3, Performance Monitoring. The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

o. Alarms. The PON shall meet the requirements in paragraph 5.3.1.6.4, Alarms. In addition to the alarms defined in this section, the OLT shall support the alarms as defined by International Telecommunication Union (ITU) G994.4. The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

p. Reporting. The PON shall meet the requirements in paragraph 5.3.1.6.5, Reporting. In addition, the PON system must report optical errors including degraded optical conditions. The SUT met the requirement via vendor LoC and interoperability testing using test equipments and simulated information exchanges.

q. Fiber Media. Fiber Optic Cable used for the PON shall be Single Mode Fiber. The single mode fiber shall be in compliance with ITU G.652/TIA OS1/International Electrotechnical Commission B1.1. The SUT met the requirement via vendor LoC.

r. Radio Frequency (RF)-over-Glass (RFoG). The PON network shall support RFoG via PON and its RF overlay framework. ITU-T G.984.5 defines this band as an Enhancement band for video distribution services. This ITU-T forum also specifies a wavelength of 1150 nm to 1560 nm. This video capacity is in addition to the 2.4 Gbps downstream and 1.2 Gbps upstream capacity of GPON. It is the responsibility of the ONT to either block or separate the RFoG from the downstream GPON signal of 1480 nm to 1500 nm. The SUT met the requirement via vendor LoC. The spectrum is allocated as follows:

- 40 Analog channels at 54 to 550 Megahertz (MHz)

- 63 Digital 256 Quadrature Amplitude Modulation channels at 225 to 870 MHz
- One Quadrature Phase-Shift Keying Out-of-Band channel at 71 to 125 MHz (R)

s. Traffic Engineering. Bandwidth required per subscriber must be in compliance with paragraph 5.3.1.7.3, Traffic Engineering, and additional DoD regulations as applicable. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

t. VLAN Design and Configuration. VLAN Design and Configuration for all PON networks must be in compliance with Distribution and Access Layer Network Elements (NE) as defined in paragraph 5.3.1.7.4, VLAN Design and Configuration. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

u. Power Backup. To meet Chairman of the Joint Chiefs of Staff requirements, the PON network must be in compliance with paragraph 5.3.1.7.5, Power Backup and Figure 5.3.1-14, Assured Services Local Area Network (ASLAN) Uninterruptible Power Supply Power Requirements. Required or Conditional adherence shall be based on whether the PON NE is being placed into an ASLAN or a Non-ASLAN. The SUT met the requirement via vendor LoC.

v. Availability. PON NEs that are used in ASLANs and Non-ASLANs must meet the availability requirements for the appropriate LAN. The PON platform shall support Type B PON Protection as defined in ITU-T G.984.1 3/2008 to provide increased reliability for all services carried on the PON, including data. The SUT met the requirement via vendor LoC.

w. Redundancy. The PON network shall have no single point of failure that can cause an outage of more than 96 IP telephone subscribers. It should be noted that a PON may be used with a single point of failure for more than 96 subscribers if 96 or fewer are IP telephone subscribers (i.e., 50 data, 20 video, and 50 IP telephony = 120 subscribers). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(1) Single Product Redundancy. Single product redundancy may be met with a modular chassis that at a minimum provides the following:

(a) Dual Power Supplies. The platform shall provide a minimum of two power inputs each with the power capacity to support the entire chassis. Loss of a single power input shall not cause any loss of ongoing functions within the chassis.

(b) Dual Processors (Control Supervisors). The chassis shall support dual control processors. Failure of any one processor shall not cause loss of any ongoing functions within the chassis (e.g., no loss of active calls). Failure of the primary processor to secondary must meet 5-second failover without loss of active calls.

(c) Redundancy Protocol. PON equipment shall support a protocol that allows for dynamic rerouting of IP packets so that no single point of failure exists in the PON that could cause an outage to more than 96 IP subscribers. It should be noted that a PON may be used with a single point of failure for more than 96 subscribers if 96 or fewer are IP telephone subscribers (i.e., 50 data, 20 video, and 50 IP telephony = 120 subscribers). Redundancy protocols will be standards based as specified in this document.

(d) Backplane/Bridging Redundancy. Bridging platforms within the PON shall support a redundant (1+1) switching fabric or backplane. The second fabric's backplane shall be in active standby so that failure of the first shall not cause loss of ongoing events within the OLT. NOTE: In the event of a component failure in the network, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and the path through the network shall be restored within 5 seconds. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

(2) Dual Product Redundancy. In the case where a secondary product has been added to provide redundancy to a primary product, the failover to the secondary product must not result in any lost calls. The secondary product may be in "standby mode" or "active mode," regardless of the mode of operation the traffic engineering of the links between primary and secondary links must meet the requirements provided in paragraph 5.3.1.7.3, Traffic Engineering. NOTE: In the event of a primary product failure, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and the failover to the secondary product must be restored within 5 seconds. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

x. Survivability. For PON Survivability, the PON shall support a Layer-2 Dynamic Rerouting protocol. Failover shall occur in no more than 50 ms. The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

y. Summary of LAN Requirements by Subscriber Mission. The PON NEs shall meet the same requirements as specified in Table 5.3.1-2, Summary of LAN Requirements by Subscriber Mission, as applicable for the LAN. The NE will be included within to include meeting the IPv6 requirements as defined in Section 5.3.5, IPv6 Requirements. The PON shall meet all IPv6 requirements applicable as defined for a LAN access switch (Table 5.3.5-6, LAN Switch). The SUT met the requirement via vendor LoC and interoperability testing using test equipment and simulated information exchanges.

z. IPv6 Requirements, Product Requirements. The SUT must meet UCR 2008, Change 3, Section 5.3.5.4 IPv6 requirements for Network Appliance/Simple Server. The SUT is a Layer-2 device and transports IPv4 and IPv6 traffic transparently;

therefore, requirements specific relating to Layer-3 do not apply. The SUT met the requirement via vendor LoC and interoperability testing using IPv4/IPv6 dual stack test equipments and IPv4/IPv6 dual stack simulated information exchanges.

aa. NM Requirements. JITC verified the following NM requirements by connecting the NMS to the SUT via all required interfaces. JITC verified performing test configurations, performing alarms monitoring, and performing fault management via utilization of the NMS.

(1) Voice and Video over Internet Protocol (VVoIP) NMS Interface Requirements. The physical interface between the Defense Information Systems Agency VVoIP Element Management System (EMS) and the network components (i.e., Local Session Controller, Multifunction Soft Switch, Edge Boundary Controller, Customer Edge 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. 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 IAW UCR 2008, Change 3, paragraph 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 IAW UCR 2008, Change 3, paragraph 5.3.2.4.4. There shall be a local craftsperson interface (Craft Input Device for Operations Administration and Management) for all VVoIP network components.

11.3 Other. None.

12. TEST AND ANALYSIS REPORT. In accordance with the Program Manager's request, JITC did not prepare a detailed test report. JITC distributes interoperability information via the JITC Electronic Report Distribution 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, which .mil/gov users can access 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 DISN testing is on the Telecommunications Switched Services Interoperability website at http://jitc.fhu.disa.mil/tssi.

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The Passive Optical Network (PON) has required and conditional features and capabilities that are established by the Unified Capabilities Requirements. The System Under Test does not need to meet conditional requirements. If they are provided, they must function according to the specified requirements. The detailed Functional Requirements and Capability Requirements for PON's are listed in Table 3-1.

Table 3-1. PON CRs/FRs

ID	Requirement	Reference (UCR 2008 Change 3)	PON
1	[Required: PON] The NNI-NNI interface is composed of the uplink between the OLT and the Core network. This interface is composed of IEEE 802.3 interfaces and may provide a Fiber channel interface IAW ANSI INICITS T11.2 and T11.3 (previously known as X3T9.3). At this time, no minimum rate or type of IEEE 802.3 interface is specified and COTS interfaces are accepted. If the Fiber Channel Interface is provided the interface must meet: RFC 4338 Transmission of IPv6, IPv4 and ARP Packets over Fiber channel, and RFC 4044 Fiber Channel Management	5.3.1.10.2.1	R
1A	[Required: PON] The OLT NNI-NNI port shall support at least one of the following interface rates (other rates and IEEE standards may be provided as conditional interfaces)): • 100 Mbps IAW IEEE 802.3u • 1 Gbps IAW IEEE 802.3z • 10 Gbps IAW IEEE 802.3ae The NNI ports shall provide the following parameters on a per port basis as specified: • Auto-negotiation IAW IEEE 802.3 • Force mode IAW IEEE 802.3 • Flow control IAW IEEE 802.3x • Filtering IAW RFC 1812 • Link Aggregation IAW IEEE 802.1AX (formerly 802.3ad) • Spanning Tree Protocol IAW IEEE 802.1D • Multiple Spanning Tree IAW IEEE 802.1s • Rapid Configuration of Spanning Tree IAW IEEE 802.1w		R
2	5.3.1.10.2.2 OLT to ONT PON Interface [Required: PON] The GPON OLT to ONT interface is defined by the OMCI protocol and was standardized and defined by the ITU standard G.984.4. This interface is composed of the PON port on the OLT and the Fiber port on the ONT. Between these ports are a single strand of Single Mode Fiber and one or more optical splitters. Bi-directional transmission is accomplished by use of separate wavelengths (1310 nm and 1490 nm) for transmission. The number of splitters is driven by local requirements, and does not exceed the ITU-T G.984 specification for fiber loss per PON port between the OLT and ONT. There may be one to 64 (some vendors support more) ONTs on a single PON port. The number of ONTs is driven by the required bandwidth for each user and IAW the traffic engineering guidelines in Section 5.3.1.7.3, Traffic Engineering. The OLT to ONT interface will support the Telcordia Standards shown in Table 5.3.1-17, OLT to ONT Signaling Standards.	5.3.1.10.2.2	R
3	5.3.1.10.2.3 Network Monitoring [Required: PON] The GPON products shall support the following network monitoring features: • SNMP IAW RFCs 1157, 3410, 3411, 3412, 3413, and 3414 • SNMP Traps IAW RFC 1215 • RMON IAW RFC 2819 • Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard NM Framework IAW RFC 3584 • The AES Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826	5.3.1.10.2.3	R

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

ID	Requirement	UCR Reference (UCR 2008 Change 3)	PON
4	5.3.1.10.2.4 UNI Interface [Required: PON] PON products shall provide at least one of the following interface rates: • 10 Mbps IAW IEEE 802.3i • 100 Mbps IAW IEEE 802.3u • 1000 Mbps IAW IEEE 802.3z • 1000 Mbps IAW IEEE 802.3ab In addition, PON must support traffic conditioning, which will insure that the required bandwidth is available for all network users.	5.3.1.10.2.4	R
4A	5.3.1.10.2.4.1 UNI Ports [Required: PON] The UNI ports shall provide the following parameters on a per port basis as specified: • Auto-negotiation IAW IEEE 802.3 • Force mode IAW IEEE 802.3 • Flow control IAW IEEE 802.3x • Filtering IAW RFC 1812 • Port-Base Access Control IAW 802.1x • Link Layer Discover – Media Endpoint Discovery IAW ANSI-TIA-1057	5.3.1.10.2.4.1	R
4B	[Conditional: PON] Link Aggregation IAW IEEE 802.1AX (formerly 802.3ad)	5.3.1.10.2.4.1	C
4C	[Conditional: PON] The UNI ports may provide the following features parameters on a per port basis as specified: DTE Power via MDI PoE for Conditional Interfaces IEEE 802.3af.	5.3.1.10.2.4.1	C
4D	• PoE Plus or DTE Power via MDI for Conditional Interfaces IEEE 802.3af	5.3.1.10.2.4.1	C
5	5.3.1.10.3 Class of Service Markings [Required: PON] The PON network shall comply with access product requirements, Section 5.3.1.3.3, #1 and #3.	5.3.1.10.3	R
6	5.3.1.10.4 Virtual LAN Capabilities [Required: PON] The NNI and UNI PON ports shall comply with Section 5.3.1.3.4, VLAN Capabilities	5.3.1.10.4	R
7	5.3.1.10.5 Protocols [Conditional: PON] The PON network shall support bridging at Layer-2 of the OSI model. Bridging will provide for higher survivability as well as reducing traffic congestion on the uplinks to the Distribution or Core Layers of the network. Bridging at Layer-2 will be supported for packets that do not require Layer-3 handling.	5.3.1.10.5	C
8	5.3.1.10.6 Quality of Service Features [Required: PON] The PON shall comply with the Access product requirements listed in Section 5.3.1.3.6, QoS Features. PON products targeted for non-assured services are not subject to the Layer-3 queuing requirements in this section and the conditions of fielding will state whether the PON can support Assured Services or not.	5.3.1.10.6	R
9	5.3.1.10.7 Network Monitoring [Required: PON] The PON shall comply with the product requirements listed in Section 5.3.1.3.7, Network Monitoring.	5.3.1.10.7	R
10A	5.3.1.10.8.1 Latency [Required: PON] The PON shall have the capability to transport voice IP packets, media, and signing, with no more than 6 ms latency E2E across the PON SUT as measured under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent IP video, 25 percent preferred data, and 25 percent best effort traffic). The latency shall be achievable over any 5-minute measured period under congested conditions.	5.3.1.10.8.1	R
10B	5.3.1.10.8.2 Jitter [Required: PON] The PON shall have the capability to transport voice IP packets across the PON SUT with no more than 3 ms of jitter. The jitter shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering 25 percent voice/signaling, 25 percent IP video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.8.2	R

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

ID	Requirement	UCR Reference (UCR 2008 Change 3)	PON
10C	5.3.1.10.8.3 Packet Loss [Required: PON] The PON shall have the capability to transport voice IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the PON shall not exceed 0.045 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.8.3	R
11A	5.3.1.10.9.1 Latency [Required: PON] The PON shall have the capability to transport video IP packets with no more than 30 ms latency across the PON SUT. Latency is increased over voice IP packets because of the increased size of the packets (230 bytes for voice packets and up to 1518 bytes for video). The latency shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.9.1	R
11B	5.3.1.10.9.2 Jitter [Required: PON] The LAN shall have the capability to transport video IP packets across the PON SUT with no more than 30 ms of jitter. The jitter shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic)	5.3.1.10.9.2	R
11C	5.3.1.10.9.3 Packet Loss [Required: PON] The PON shall have the capability to transport video IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the PON shall not exceed 0.15 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.9.3	R
12A	5.3.1.10.10.1 Latency [Required: PON] The PON shall have the capability to transport prioritized data IP packets with no more than 45 ms latency across the PON SUT. Latency is increased over voice IP packets because of the increased size of the packets (230 bytes for voice packets and up to 1518 bytes for data). The latency shall be achievable over any 5-minute measured period under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.10.1	R
12B	5.3.1.10.10.2 Jitter There are no jitter requirements for preferred data IP packets.		
12C	5.3.1.10.10.3 Packet Loss [Required: PON] The PON shall have the capability to transport prioritized data IP packets across the PON SUT with packet loss not to exceed configured traffic engineered (queuing) parameters. Actual measured packet loss across the LAN shall not exceed 0.15 percent within the defined queuing parameters. The packet loss shall be achievable over any 5-minute period measured under congested conditions. Congested conditions are defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic).	5.3.1.10.10.3	R
13	5.3.1.10.11 Information Assurance Requirements [Required: PON] All systems must comply with the applicable STIGs.	5.3.1.10.11	R

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

ID	Requirement	UCR Reference (UCR 2008 Change 3)	PON
14	5.3.1.10.12 PON NM Requirements [Required: PON] NMs must be able to monitor, configure, and control all aspects of the network and observe changes in network status. The PON infrastructure components shall have a NM capability that leverages existing and evolving technologies and has the ability to perform remote network product configuration/reconfiguration of objects that have existing DoD GIG management capabilities. The PON infrastructure components must be able to be centrally managed by an overall NMS. In addition, MIB II shall be supported for SNMP. In addition, if other methods are used for interfacing between PON products and the NMS, they shall be implemented in a secure manner, such as with the following methods:	5.3.1.10.12	R
14A	5.3.1.10.12.1. [Required: PON] SSHv2. The PON products shall support RFC 4251 through RFC 4254 inclusive.	5.3.1.10.12.1	R
14B	5.3.1.10.12.2 [Required: PON] The PON product shall be configured by default, not to accept Telnet.	5.3.1.10.12.2	R
14C	5.3.1.10.12.3 [Conditional: PON] HTTPS. HTTPS shall be used instead of HTTP due to its increased security as described in RFC 2660.	5.3.1.10.12.3	C
14D	5.3.1.10.12.4 [Conditional: PON] The LAN products shall support RFC 3414 for SNMP.	5.3.1.10.12.4	C
14E	5.3.1.10.12.5 [Conditional: PON] If other methods are used for interfacing between LAN products and the NMS, they shall be implemented in a secure manner.	5.3.1.10.12.5	C
15	5.3.1.10.13 Configuration Control [Required: PON] Configuration Control identifies, controls, accounts for, and audits all changes made to a site or information system during its design, development, and operational life cycle (DoD CIO Guidance IA6-8510 IA). LANs shall have an NM capability that leverages existing and evolving technologies and has the ability to perform remote network product configuration/reconfiguration of objects that have existing DoD GIG management capabilities. The NMS shall report configuration change events in NRT, whether or not the change was authorized. The system shall report the success or failure of authorized configuration change attempts in NRT. NRT is defined as within 5 seconds of detecting the event, excluding transport time.	5.3.1.10.13	R
16	5.3.1.10.14 Operational Changes [Required: PON] The PON shall meet the requirements in Section 5.3.1.6.2, Operational Changes.	5.3.1.10.14	R
17	5.3.1.10.15 Performance Monitoring [Required: PON] The PON shall meet the requirements in Section 5.3.1.6.3, Performance Monitoring.	5.3.1.10.15	R
18	5.3.1.10.16 Alarms [Required: PON] The PON shall meet the requirements in Section 5.3.1.6.4, Alarms. In addition to the alarms defined in this section, the OLT shall support the alarms as defined by ITU G994.4.	5.3.1.10.16	R
19	5.3.1.10.17 Reporting [Required: PON] The PON shall meet the requirements in Section 5.3.1.6.5, Reporting. In addition, the PON system must also report optical errors to include degraded optical conditions.	5.3.1.10.17	R
20	5.3.1.10.18 Fiber Media [Required: PON] Fiber Optic Cable used for the PON shall be Single Mode Fiber. The single mode fiber shall be in compliance with ITU G.652/TIA OS1/IEC B1.1.	5.3.1.10.18	R
21	5.3.1.10.19 RFoG Video [Conditional: PON] The PON network shall support RFoG via PON and its RF overlay framework. ITU-T G.984.5 defines this band as an Enhancement band for video distribution services. This ITU forum also specifies a wavelength of 1150 nm to 1560 nm. This video capacity is in addition to the 2.4 Gbps downstream and 1.2 upstream capacity of GPON. It is the responsibility of the ONT to either block or separate the RFoG from the downstream GPON signal of 1480 to 1500 nm. The spectrum is allocated as follows: • 40 Analog channels at 54 to 550 MHz • 63 Digital 256 QAM channels at 225 to 870 MHz • One QPSK OOB channel at 71 to 125 MHz	5.3.1.10.19	C

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

ID	Requirement	UCR Reference (UCR 2008 Change 3)	PON
22	5.3.1.10.20 Traffic Engineering [Required: PON] Bandwidth required per subscriber must be in compliance with Section 5.3.1.7.3, Traffic Engineering and additional DoD regulations as applicable.	5.3.1.10.20	R
23	5.3.1.10.21 VLAN Design and Configuration [Required: PON] VLAN Design and Configuration for all PON networks must be in compliance with Distribution and Access Layer Network Elements as defined in Section 5.3.1.7.4, VLAN Design and Configuration.	5.3.1.10.21	R
24	5.3.1.10.22 Power Backup [Required: ASLAN Network PON – Conditional: Non-ASLAN Network PON] To meet CJCS requirements the PON network must be in compliance with Section 5.3.1.7.5, Power Backup, and Figure 5.3.1-14, ASLAN UPS Power Requirements. Required or Conditional adherence shall be based on whether the PON Network Element is being placed into an ASLAN or a Non-ASLAN.	5.3.1.10.22	R
25	5.3.1.10.23 Availability Availability of a PON network will be determined the same as for active Ethernet networks as defined in Section 5.3.1.7.6, Availability, and Table 5.3.1-12, Methods of Expressing Availability. PON Network Elements that are utilized in ASLANs and Non-ASLANs must meet the availability requirements for the appropriate LAN. [Conditional: PON] The PON platform shall support Type B PON Protection as defined in ITU-T G.984.1 3/2008 to provide increased reliability for all services carried on the PON, including data.	5.3.1.10.23	C
26	5.3.1.10.24 Redundancy The following paragraphs outline the redundancy requirements for the PON Network: [Required: PON in ASLAN – Conditional: PON in Non-ASLAN] The PON network shall have no single point of failure that can cause an outage of more than 96 IP telephone subscribers. It should be noted that a PON may be used with a single point of failure for more than 96 subscribers if 96 or less are IP telephone subscribers (i.e., 50 data, 20 video, and 50 IP telephony = 120 subscribers).	5.3.1.10.24	R
26A	5.3.1.10.24.1 Single Product Redundancy [Conditional: PON] Single product redundancy may be met with a modular chassis that at a minimum provides the following: 1. Dual Power Supplies. The platform shall provide a minimum of two power inputs each with the power capacity to support the entire chassis. Loss of a single power input shall not cause any loss of ongoing functions within the chassis. 2. Dual Processors (Control Supervisors). The chassis shall support dual control processors. Failure of any one processor shall not cause loss of any ongoing functions within the chassis (e.g., no loss of active calls). Failure of the primary processor to secondary must meet 5-second failover without loss of active calls. 3. Redundancy Protocol. PON equipment shall support a protocol that allows for dynamic rerouting of IP packets so that no single point of failure exists in the PON that could cause an outage to more than 96 IP subscribers. It should be noted that a PON may be used with a single point of failure for more than 96 subscribers if 96 or less are IP telephone subscribers (i.e., 50 data, 20 video, and 50 IP telephony = 120 subscribers). Redundancy protocols will be standards based as specified in this document. 4. Backplane/Bridging Redundancy. Bridging platforms within the PON shall support a redundant (1+1) switching fabric or backplane. The second fabric's backplane shall be in active standby so that failure of the first shall not cause loss of ongoing events within the OLT. NOTE: In the event of a component failure in the network, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and the path through the network shall be restored within 5 seconds.	5.3.1.10.24.1	C

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

ID	Requirement	UCR Reference (UCR 2008 Change 3)	PON
26B	5.3.1.10.24.2 Dual Product Redundancy [Conditional: PON] In the case where a secondary product has been added to provide redundancy to a primary product, the failover over to the secondary product must not result in any lost calls. The secondary product may be in "standby mode" or "active mode," regardless of the mode of operation the traffic engineering of the links between primary and secondary links must meet the requirements provided in Section 5.3.1.7.3, Traffic Engineering. NOTE: In the event of a primary product failure, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and the failover to the secondary product must be restored within 5 seconds.	5.3.1.10.24.2	C
27	5.3.1.10.25 Survivability Network survivability refers to the capability of the network to maintain service continuity in the presence of faults within the network. This can be accomplished by recovering quickly from network failures and maintaining the required QoS for existing services. [Required: PON] For PON Survivability, the PON shall support a Layer-2 Dynamic Rerouting protocol. Failover shall occur in no more than 50 ms.	5.3.1.10.25	R
28	5.3.1.10.26 Summary of LAN Requirements by Subscriber Mission [Required: PON] The PON Network Elements shall meet the same requirements as specified in Table 5.3.1-14, Summary of LAN Requirements by Subscriber Mission, as applicable for the LAN the Network Element will be included within to include meeting the IPv6 requirements as defined in Section 5.3.5, IPv6 Requirements. The PON shall meet all IPv6 requirements applicable as defined for a LAN access switch (Table 5.3.5-6, LAN Switch).	5.3.1.10.26	R

LEGEND:

AES	Advanced Encryption Standard	MDI	Media Dependent Interface
ANSI	American National Standards Institute	MIB	Management Information Base
ARP	Address Resolution Protocol	ms	Millisecond
ASLAN	Assured Services LAN	nm	nanometer
C	Conditional	NM	Network Management
CIO	Chief Information Officer	NMS	NM System
CJCS	Chairman of the Joint Chiefs of Staff	NNI	Network-to-Network Interface
COTS	Commercial Off the Shelf	NRT	Near Real Time
CR	Capability Requirement	OLT	Optical Line Terminal
DoD	Department of Defense	OMCI	ONT Management Control Interface
DTE	Data Terminal Equipment	ONT	Optical Network Terminal
E2E	End-to-End	OOB	Out-of-Band
FR	Functional Requirement	OSI	Open Systems Interconnect
Gbps	Gigabits per second	PoE	Power-Over-Ethernet
GIG	Global Information Grid	PON	Passive Optical Network
GPON	Gigabit Passive Optical Network	QAM	Quadrature Amplitude Modulation
HTTP	Hypertext Transfer Protocol	QoS	Quality of Service
HTTPS	Hypertext Transfer Protocol over SSL	QPSK	Quadrature Phase-Shift Keying
IAW	In Accordance With	R	Required
ID	Identification	RF	Radio Frequency
IEC	International Electrotechnical Commission	RFC	Request For Comment
IEEE	Institute of Electrical and Electronic Engineers	RFoG	Radio Frequency over Glass
INICITS	International Committee for Information Technology Standards	RMON	Remote Monitoring
		SNMP	Simple Network Management Protocol
IP	Internet Protocol	SSHv2	Secure Shell version 2
IPv4	Internet Protocol version 4	SSL	Secure Socket Layer
IPv6	Internet Protocol version 6	STIG	Security Technical Implementation Guideline
ITU	International Telecommunications Union	SUT	System Under Test
ITU-T	International Telecommunications Union - Telecommunications Sector	TIA	Telecommunications Industry Association
		UCR	Unified Capabilities Requirements
LAN	Local Area Network	UNI	User Network Interface
Mbps	Megabits per second	UPS	Uninterruptible Power Supply
MHz	Megahertz	VLAN	Virtual Local Area Network