DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY REFER TO: Joint Interoperability Test Command (JTE) **6 Sept 12**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Cisco Systems, Inc., Optical Network System (ONS) 15310-Customer Location (CL) Synchronous Optical Network (SONET) Multi-Service Provisioning Platform (MSPP), ONS 15310-Metro Access (MA) MSPP, ONS 15454 MSPP, ONS 15454 Multi-Service Transport Platform (MSTP), ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP, Fixed Network Element (F-NE), all with Software Release 9.2.1

References: (a) Department of Defense (DoD) Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) DoD 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 Cisco Systems, Inc., ONS 15310- CL SONET MSSP, ONS 15310 MA, MSPP, ONS 15454 MSPP, and the MSTP family of products : ONS 15454 MSTP, with the: ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP, all with Software Release 9.2.1, is 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 Systems Network (DISN) as an F-NE. The SUT provides additional optical transport interfaces and functional capabilities. JITC has evaluated and certified the SUT for optical transport for the Optical Carrier interfaces detailed in Table 1. Additional sponsor functional capabilities are addressed in Table 2. The operational status of the SUT must 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) via a vendor Plan of Action and Milestones to address the concern(s) within 120 days of identification. JITC conducted testing using F-NE requirements within the Unified Capabilities Requirements (UCR) 2008, Change 2, Reference (c), and other sponsor requested requirements. JITC tested the SUT using F-NE test procedures, Reference (d) and test procedures developed to address the sponsor unique requirements. 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 Letter of Compliance, and Information Assurance (IA) Certification Authority approval of the IA

configuration. JITC conducted Interoperability testing at the Indian Head Maryland Test Facility from 1 August through 28 September 2011. DISA Field Security Operations has reviewed the JITC published IA Assessment Report for the SUT, Reference (e), and has accredited the IA configuration on 14 December 2011. The acquiring agency or site will be responsible for the Department of Defense (DoD) Information Assurance Certification and Accreditation Process (DIACAP) accreditation. The Army originally submitted the SUT as a DISN Optical Transport System under UCR 2008, Change 2, Section 5.5. Based on DISA guidance received 18 January 2012, this product was re-evaluated as a F-NE. Enclosure 2 documents the test results and describes the tested network and system configurations. Enclosure 3, System Functional and Capability Requirements, lists the F-NE Capability Requirements (CR) and Functional Requirements (FR).

4. Section 5.9 of the UCR establishes the interfaces and threshold CRs/FRs used to evaluate the interoperability of the SUT as an F-NE. Tables 1 and 2 list the F-NE, sponsor requested interfaces, CRs, FRs, and the component status of the SUT.

Table 1. SUT Interface Interoperability Status

Interface	Crit-ical (See note 1.)	Ref (UCR 2008 CH 2)	CR/FR Req. (See note 2.)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
NE									
Analog	No	5.9.2.3.1	1, 2, 4	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)
Serial	No	5.9.2.3.2	1, 2, 4	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3)
BRI ISDN	No	5.9.2.3.3	1, 2, 4	NA (See note 3.)	NA (See note 3)	NA (See note 3)	NA (See note 3)	NA (See note 3.)	NA (See note 3)
DS1	No	5.9.2.3.4	1, 2, 3, 4	Certified	Certified	Certified	NA (See note 4)	NA (See note 4)	NA (See note 4)
E1	No	5.9.2.3.5	1, 2, 3, 4	Certified	Not Tested (See note 5)	Not Tested (See note 5)	NA (See note 6)	NA (See note 6)	NA (See note 6)
DS3	No	5.9.2.3.6	1, 2, 3, 4	Certified	Certified	Certified	NA (See note 7)	NA (See note 7)	NA (See note 7)
OC- X	No	5.9.2.3.8	1, 2, 3, 4	Certified (See note 8)	Certified	Certified	Certified	Certified (See note 8)	Certified (See note 8)

Table 1. SUT Interface Interoperability Status (continued)

Interface	Critical (See note 1.)	Ref (UCR 2008 CH 2)	CR/FR Req. (See note 2.)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
NE (continued)									
IP (Ethernet) 10/100/1000	No	5.9.2.3.9	1, 2, 4, 7	Certified	Certified	Certified	Not Tested (See note 9)	Not Tested (See note 9)	Not Tested (See note 9)
IP (Ethernet) 1GbE	No	5.9.2.3.9	1, 2, 4, 7	Certified	Certified	Certified	Certified	Certified	Certified
NM									
10Base-X	Yes	5.3.2.4.4	8	Certified	Certified	Certified	Certified	Certified	Certified
100Base-X	Yes	5.3.2.4.4	8	Certified	Certified	Certified	Certified	Certified	Certified
OTHER									
10 Gigabit Ethernet-LAN	No	5.5.3.2.5.1	8	NA (See note 10)	NA (See note 10)	NA (See note 10)	Certified	Certified	Not Tested (See note 11)
10 Gigabit Ethernet-WAN	No	5.5.3.2.5.1	8	NA (See note 10)	NA (See note 10)	NA (See note 10)	Certified	Certified	Not Tested (See note 11)
OSC	No	5.5.3.2.8	8	NA (See note 10)	NA (See note 10)	NA (See note 10)	Certified	Certified	Certified

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.
3. Each of the SUT components does not support Analog, Serial, and BRI ISDN interfaces.
4. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support DS-1 interface.
5. The SUT components ONS 15310-CL MSPP and ONS 15310-MA MSPP have received Letters of Compliance from the vendor stating that the equipment meets the E1 Interface requirement.
6. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support E1 interface.
7. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support DS-3 interface.
8. OC-X refers to OC-3, OC-12, OC-48, OC-192, and OC-768 Optical Carrie interfaces. Each of the SUT components has undergone the specified interfaces testing. For the OC-192 interface, ONS 15454-M2 MSTP was the only SUT component that did not undergo lab testing. In addition, the ONS 15454 MSTP, ONS ONS15454- M6 MSTP, and ONS 15454- M2 MSTP did not undergo lab testing for an OC-768/STM-256 interface. The ONS 15454 MSTP 40Gb single port transponder was not available at the time of testing.
9. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do support Ethernet 10/100/1000 interfaces via copper SFP, but JITC did not test these interfaces due to unavailability of the copper SFPs in Advanced Technology Testbed lab.
10. The SUT components ONS 15454 MSPP, ONS 15310-CL MSPP, and ONS 15310-MA MSPP do not support 10GbE LAN, 10GbE WAN, and OSC interfaces.
11. The ONS 15454- M2 MSTP did not undergo lab testing for an OC-192/STM-64, 10GbE WAN PHY, or 10GbE LAN PHY interfaces.

Table 1. SUT Interface Interoperability Status (continued)

LEGEND:

100Base-X	100 Mbps Ethernet generic designation	Mbps	Megabits per second
10Base-X	10 Mbps Ethernet generic designation	MSPP	Multi-Service Provisioning Platform
BRI	Basic Rate Interface	MSTP	Multi-Service Transport Platform
CH	Change	NA	Not Applicable
CL	Customer Location	NE	Network Element
CR	Capability Requirement	NM	Network Management
DS1	Digital Signal Level 1 (1.544 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.)
DS3	Digital Signal Level 3 (44.736 Mbps)	ONS	Optical Network System
E1	European Interface Standard (2.048 Mbps)	OSC	Optical Supervisory Channel
FR	Functional Requirement	PHY	Physical Layer
Gb	Gigabit	Ref	Reference
GbE	Gigabit Ethernet	Req	Requirements
JITC	Joint Interoperability Test Command	SFP	Small Form -Factor Pluggable
IP	Internet Protocol	STM	Synchronous Transport Module
ISDN	Integrated Services Digital Network	SUT	System Under Test
LAN	Local Area Network	UCR	Unified Capabilities Requirements
MA	Metro Access	WAN	Wide Area Network

Table 2. SUT CRs and FRs Status

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
F-NE									
1	**General NE Requirements**								
	General Requirements	Required	5.9.2.1	Met	Met	Met	Met	Met	Met
	Alarms	Required	5.9.2.1.1	Met	Met	Met	Met	Met	Met
	Congestion Control & Latency	Required	5.9.2.1.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
2	**Compression**								
	G.726	Conditional	5.9.2.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
	G.728	Conditional	5.9.2.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
	G.729	Conditional	5.9.2.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
3	**Interface Requirements**								
	Timing	Required	5.9.2.3.7	Met	Met	Met	Met	Met	Met
4	**Device Management**								
	Management Options	Required	5.9.2.4.1	Met	Met	Met	Met	Met	Met
	Fault Management	Conditional	5.9.2.4.2	Met	Met	Met	Met	Met	Met
	Loop-Back Capability	Conditional	5.9.2.4.3	Met	Met	Met	Met	Met	Met
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	Met	Met	Met	Met	Met

Table 2. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
5	**DLoS**								
	DLoS Transport	Conditional	5.9.2.4.5	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
6	**IPv6 Requirements**								
	Product Requirements	Required	5.3.5.4	Met (See note 4.)	Met (See note 4.)	Met (See note 4.)	Met (See note 4.)	Met (See note 4.)	Met (See note 4.)
7	**NM Requirements**								
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	Met	Met	Met	Met	Met
	General Management Requirements	Required	5.3.2.17.2	Met	Met	Met	Met	Met	Met
Other Tested Requirements									
8	**Requirements Applicable to all OTS Elements**								
	Overall Requirements	Conditional	5.5.3.2.2.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 6.)	Partially Met (See note 6.)	Partially Met (See note 6.)
	Performance Requirements	Conditional	5.5.3.2.2.2	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Requirements Applicable to all OTS Elements								
	Reliability and Quality Assurance	Conditional	5.5.3.2.2.2.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Common Physical Design Requirements	Conditional	5.5.3.2.2.3	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 7.)	Partially Met (See note 7.)	Partially Met (See note 7.)
	Protection and Restoration	Conditional	5.5.3.2.2.4	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Optical Amplifier Requirements								
	Optical Amplifier	Conditional	5.5.3.2.3	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 8.)	Partially Met (See note 8.)	Partially Met (See note 8.)
	OLA Physical Design Requirements	Conditional	5.5.3.2.3.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Muxponder Requirements								
	Muxponder	Conditional	5.5.3.2.4	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 9.)	Partially Met (See note 9.)	Partially Met (See note 9.)
	Transponder Requirements								
	Transponder	Conditional	5.5.3.2.5	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 10.)	Partially Met (See note 10.)	Partially Met (See note 10.)
	Interface Requirements	Conditional	5.5.3.2.5.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 11.)	Partially Met (See note 11.)	Partially Met (See note 11.)

Table 2. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
8 (cont)	**ROADM Requirements**								
	ROADM Requirements	Conditional	5.5.3.2.6	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 12.)	Partially Met (See note 12.)	Partially Met (See note 12.)
	ROADM Specific Physical Design Requirements	Conditional	5.5.3.2.6.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Requirements Common to Transponder and ROADM								
	Framed Formats	Conditional	5.5.3.2.7.1	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 13.)	Partially Met (See note 13.)	Partially Met (See note 13.)
	Unframed Formats	Conditional	5.5.3.2.7.2	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Met	Met	Met
	Optical Supervisory Channel Requirements								
	Optical Supervisory Channel	Conditional	5.5.3.2.8	NA (See note 5.)	NA (See note 5.)	NA (See note 5.)	Partially Met (See note 14.)	Partially Met (See note 14.)	Partially Met (See note 14.)
	AGF Requirements								
	AGF SONET Interface Requirements	Required	5.5.3.4.2	Partially Met (See note 15.)	Partially Met (See note 15.)	Partially Met (See note 15.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	SDH Interface Requirements	Required	5.5.3.4.3	Partially Met (See note 15.)	Partially Met (See note 15.)	Partially Met (See note 15.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Electrical Interface Requirements	Required	5.5.3.4.4	Partially Met (See note 15.)	Partially Met (See note 15.)	Partially Met (See note 15.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Ethernet Interface Requirements	Required	5.5.3.4.4	Partially Met (See note 15.)	Partially Met (See note 15.)	Partially Met (See note 15.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Storage Area Network Interface Requirements	Required	5.5.3.4.6	Not Tested (See note 17.)	Not Tested (See note 17.)	Not Tested (See note 17.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Cross-Connect Requirements	Required	5.5.3.4.7	Partially Met (See note 18.)	Partially Met (See note 18.)	Partially Met (See note 18.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Performance Requirements	Required	5.5.3.4.8	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Equipment Redundancy Requirements	Required	5.5.3.4.9	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	General Protection Requirements	Required	5.5.3.4.10	Partially Met (See note 19.)	Partially Met (See note 19.)	Partially Met (See note 19.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Interoperability Requirements	Required	5.5.3.4.11	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Fault Management Requirements	Required	5.5.3.4.12	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Performance Monitoring Requirements	Required	5.5.3.4.13	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)

Table 2. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
8 (cont)	Functional Device Requirements	Required	5.5.3.4.14	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Interface Performance Requirements	Required	5.5.3.4.15	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	EMS Requirements	Required	5.5.3.4.16	Met	Met	Met	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Physical Design Requirements	Required	5.5.3.4.17	Partially Met (See note 20.)	Partially Met (See note 20.)	Partially Met (See note 20.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)
	Physical Design Requirements	Required	5.5.3.4.17	Partially Met (See note 20.)	Partially Met (See note 20.)	Partially Met (See note 20.)	NA (See note 16.)	NA (See note 16.)	NA (See note 16.)

NOTES:

1. Annotation of 'required' refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. The sponsor requested the SUT be assessed against UCR section 5.5 as an OTS device.
3. Not supported by the SUT.
4. SUTs are a layer 2 device and transports IPv4 and IPv6 transparently.
5. The SUT components ONS 15454 MSPP, ONS 15310-CL MSPP, and ONS 15310-MA MSPP do not support DISN-OTS functionality.
6. The OTS must support span lengths up to 150 km/50dB before amplification but SUT only supports up to A 38.5 dB spans.
7. The SUT must operate continuously in the environmental range of 0 to +50ºC with humidity to 95% without condensation. The Cisco 15454-M2 OTS does not comply with requirement 10 which requires A and B power cables shall have physically diverse routing within the bay cabinet.
8. The OTS must support the Raman amplifiers but the equipment was not delivered to the lab to undergo testing, and OTS must support internal Optical Spectrum Analyzer, but SUT does not support it.
9. The SUT does not support a 4:1 40Gb MUX, which takes up the same amount of slots as an OC-192 circuit pack.
10. The Cisco ONS 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP do not support 100 Gb at this time.
11. The 15454-M2 OTS did not undergo lab testing for an OC-192/STM-64, 10GbE WAN PHY, or 10GbE LAN PHY interfaces. The 15454- M2 does support all of the same cards as the other two chassis, but due to its small form factor, these interfaces were not tested in the lab. The 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP did not undergo lab testing for an OC-768/STM-256 interface. The 15454 MSTP 40Gb single port transponder was not available at the time of testing.
12. The SUT does not support optical multicasting capability.
13. The15454-M2 chassis did not have enough slots to support the 40Gb signal circuit pack.
14. The SUT has a maximum span loss of 38.5 dB. The 15454-M2 chassis does not have the space for a redundant OSC.
15. Each of the SUT components does not support OC-3 IR2, OC-3 LR-3, OC-12 IR2, OC-12 LR3, OC-48 IR2, OC-48 LR3, OC-192 LR1, and OC-192 LR-3 interfaces.
16. The Cisco ONS 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP do not support DISN-AGF functionality.
17. The SUT was not tested for this requirement, as the Sponsor did not consider this functionality important.
18. The AGF functional device shall support SDH/SONET container gateway functionalities. Cisco 15454 SDH chassis supports SONET to SDH, but does not support SDH to SONET. Cisco supports only 1152 STS-1 of cross connect fabric. The Cisco SDH Chassis does not support native DS1.
19. The Cisco 15454 MSPP does not support 1:N APS or 1:N OP for SONET/SDH.
20. The Cisco 15454 MSPP does not conform to the environment ranges of -40 to +70 degrees C, the Cisco 15454 MSPP can operate within the range of -40 to +65 degrees C.

Table 2. SUT CRs and FRs Status (continued)

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation
AGF	Access Grooming Function
APS	Automatic Protection Switching
dB	Decibel
C	Celsius
CH	Change
CL	Customer Location
CR	Capabilities Requirement
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction
Cont	Continued
DISN	Defense Information Systems Network
DLoS	Direct Line of Sight
DS	Digital Signal
EMS	Element Management System
F-NE	Fixed Network Element
FR	Functional Requirement
Gb	Gigabit
G.726	ITU-T speech codec for ADPCM (32 Kbps)
G.728	ITU-T speech codec for LD-CELP (16 Kbps)
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)
GbE	Gigabit Ethernet
ID	Identification
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IR	Intermediate Reach
ITU-T	International Telecommunication Union -Telecommunication
Kbps	Kilobits per second
km	kilometer
LAN	Local Area Network
LD-CELP	Low Delay-Code Excited Linear Prediction
LR	Long Reach
MA	Metro Access
MSPP	Multi-Service Provisioning Platform
MSTP	Multi-Service Transport Platform
MUX	Multiplexer
NA	Not Applicable
NE	Network Element
NM	Network Management
NMS	Network Management System
OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
OLA	Optical Line Amplifier
ONS	Optical Network System
OP	Optical Protection
OSC	Optical Supervisory Channel
OTS	Optical Transport System
PHY	Physical Layer
Ref	Reference
ROADM	Reconfigurable Optical Add-Drop Multiplexer
SDH	Synchronous Digital Hierarchy
SONET	Synchronous Optical Transport Network
STM	Synchronous Transport Module
STS	Synchronous Transport Signal
SUT	System Under Test
TDM	Time Division Multiplexing
UCR	Unified Capabilities Requirements
VVoIP	Voice and Video over Internet Protocol
WAN	Wide 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://jit.fhu.disa.mil (NIPRNet). Information related to Approved Products List (APL) testing is available on the DISA APL Testing and Certification website located at http://www.disa.mil/Services/Network-Services/UCCO. All associated test information is available on the DISA Unified Capability Certification Office APL Integrated Tracking System (APLITS) website located at https://aplits.disa.mil.

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Systems, Inc., Optical Network System (ONS) 15310-Customer Location (CL) Synchronous Optical Networking (SONET) Multi-Service Provisioning Platform (MSPP), ONS 15310-Metro Access (MA) MSPP, ONS 15454 MSPP, ONS 15454 Multi-Service Transport Platform (MSTP), ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP, Fixed Network Element (F-NE), all with Software Release 9.2.1

6. JITC testing point of contact is Ms. Fanny Lee-Linnick, commercial (301) 743-4259. Her e-mail address is Fanny.Lee-Linnick.civ@mail.mil, mailing address: 3341 Strauss Avenue, Suite 236, Indian Head, Maryland 20640-5149. The Unified Capabilities Certification Office (UCCO) Tracking Numbers (TN) are 1023001 for the Cisco ONS 15310-CL MSPP, 1023002 for the 15310-MA MSPP , 1023003 for the 15454 MSPP, and 1023004 for the 15454 MSTP.

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

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ADDITIONAL REFERENCES

(c) Office of the Assistant Secretary of Defense Document, "Department of Defense Unified Capabilities Requirements 2008, Change 2," December 2010
(d) Joint Interoperability Test Command Document, "Unified Capabilities Interoperability Test Plan," 4 February 2010
(e) Joint Interoperability Test Command, "Information Assurance Finding and Mitigations Summary for Cisco Optical Network System 15454 & 15310, software release 9.2.1 (TN1023001, TN1023002, TN1023003, TN1023004)," 21 November 2011

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CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Cisco Optical Network System (ONS) 15310-Customer Location (CL) Synchronous Optical Networking (SONET) Multi-Service Provisioning Platform (MSPP), ONS 15310-Metro Access (MA) MSPP, ONS 15454 MSPP; ONS 15454 Multi-Service Transport Platform (MSTP), ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP, Fixed Network Element (F-NE), all with Software Release 9.2.1 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, Email: Jordan.R.Silk.civ@mail.mil.

3. SYSTEM POC. Mr. Joshua Ament, Manager Engineering, Cisco Systems, Inc. 7025 Kit Creek Road, PO Box 14987, Research Triangle Park, NC 27709. Email: certteam@cisco.com.

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

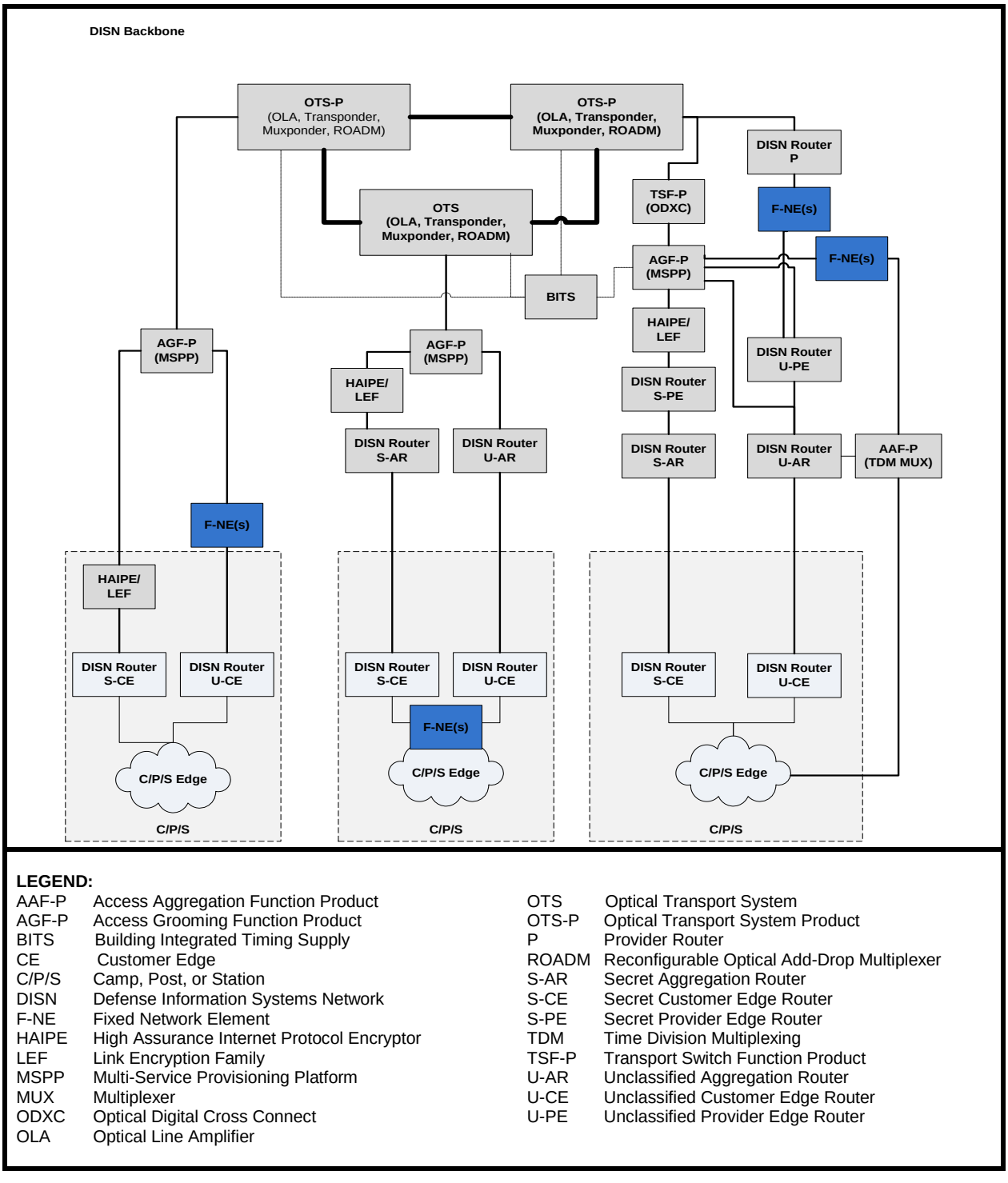
5. SYSTEM DESCRIPTION. The SUT consists of the Cisco ONS portfolio: ONS 15310-CL SONET MSPP, ONS 15310-MA, and ONS 15454 MSPP, as well as the ONS 15454 MSTP that also include the two new form factor chassis: M6 and M2, all with Software Release 9.2.1. The Cisco ONS with this updated software solution and the new hardware support the ONS portfolio including both Dense Wavelength Division Multiplexing (DWDM) and SONET technologies.

The SUT is managed by either the Cisco Transport Controller using the Java Runtime Environment or standalone Cisco Transport Manager (CTM) client software in conjunction with a CTM Server. They support a number of existing fiber optic and electrical applications.

The SUT can be configured in the following two platforms: the SONET/Synchronous Digital Hierarchy (SDH) MSPP and MSTP. SONET and SDH are transport technologies. SONET is predominantly used in the United States and SDH is predominantly used overseas.

The SONET/SDH SUT platform is configured with universal expansion slots for adding Digital Signal Level 1 (DS1), DS3, 10/100 Megabytes per second (Mbps) Ethernet, Gigabit Ethernet, DS3/Virtual Tributary (VT) Transmux, Synchronous Transport Signal - 1 (STS-1), Optical Carrier Level 3 (OC-3), OC-12, OC-48, OC-192, and DWDM. The SONET/SDH platform supports limited DWDM capabilities.

6. OPERATIONAL ARCHITECTURE. Under the direction of the Unified Capabilities Certification Office (UCCO), the SUT is being tested and evaluated as a F-NE. Figure 2-1 shows the role of the SUT providing core transport for the Sycamore 16K, Cisco 15454, Juniper T320 routers, client Ethernet, client SONET, and client Synchronous Transport Module signals.



LEGEND:

AAF-P	Access Aggregation Function Product
AGF-P	Access Grooming Function Product
BITS	Building Integrated Timing Supply
CE	Customer Edge
C/P/S	Camp, Post, or Station
DISN	Defense Information Systems Network
F-NE	Fixed Network Element
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	Optical Transport System
OTS-P	Optical Transport System Product
P	Provider Router
ROADM	Reconfigurable Optical Add-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 F-NE products are established by Sections 5.4 and 5.9 of the Department of Defense (DoD) Unified Capabilities Requirements (UCR) 2008, Change 2.

7.1 Interfaces. The F-NE products use its interfaces to connect to Local Area Network (LAN) or Defense Information Systems Network (DISN) Wide Area Network (WAN) infrastructure. Table 2-1 lists the threshold requirements for interfaces specific to the F-NE products.

Table 2-1. F-NE Interface Requirements

Interface	Critical (See note 1.)	Reference (UCR 2008, Change 3)	Threshold CR/FR (See note 2.)	Criteria	Remarks
Ingress (LAN side)					
Analog	No	5.9.2.3.1	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.
2. CR/FR requirements are contained in Table 2-2. CR/FR numbers represent a roll-up of UCR requirements.

LEGEND:

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

7.2 CR and FR. The F-NE products have required and conditional features and capabilities that are established by UCR 2008, Change 2, Section 5.9. 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, 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	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.	
	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.	
	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.	
	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.	
6	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Meet UCR IPv6 requirements.	
7	**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.	
	General Management Requirements	Required	5.3.2.17.2		

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

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

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	ITU-T	ITU Telecommunications Union - Telecommunications Sector
CR	Capabilities Requirement	Kbps	Kilobits per second
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction	LD-CELP	Low Delay Code Excited Linear Prediction
DLoS	Direct Line of Sight	NE	Network Element
FR	Functional Requirement	NM	Network Management
G.726	ITU-T speech codec for ADPCM (32 Kbps)	NMS	Network Management System
G.728	ITU-T speech codec for LD-CELP (16 Kbps)	SUT	System Under Test
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)	TDM	Time Division Multiplexing
ID	Identification	UCR	Unified Capabilities Requirements
IPv6	Internet Protocol version 6	VVoIP	Voice and Video over Internet Protocol

7.3 Other. The SUT was originally submitted as an Optical Transport System (OTS) and an Access Grooming Function (AGF) via the UCCO process but based on DISA guidance received 18 January 2012, this product was re-evaluated as a F-NE. The SUT supports OTS and AGF features. JITC tested the SUT's functionalities and capabilities. Table 2-3 lists these requirements on the Other Requirements Section. The OTS products' with the designated interfaces can be used to interconnect the DISN WAN infrastructure.

Table 2-3. Other SUT Interface Requirements

Interface	Criteria	Remarks
OC-48/STM-16	Meet Commercial interface standards and sponsor information exchange requirements.	UCR specifies minimum requirements. These requirements represent the sponsors additional interfaces desired for fielding in US and Europe.
OC-192/STM-64		
OC-768/STM-256		
1 GbE		
10 GbE LAN		
10 GbE WAN		
OSC		

NOTE: The threshold CRs/FRs provides a high-level overview of applicable UCR requirements. For detailed applicability of UCR requirements, refer to Enclosure 3.

LEGEND:

CR	Capability Requirements	STM	Synchronous Transport Module
FR	Functional Requirements	SUT	System Under Test
GbE	Gigabit Ethernet	UCR	Unified Capabilities Requirements
LAN	Local Area Network	US	United States
OC	Optical Carrier	WAN	Wide Area Network
OSC	Optical Supervisory Channel		

Table 2-4. Other CR/FR Requirements

CR/FR ID	Capability/Function	Applicability	Reference (UCR 2008, Change 3)	Criteria	Remarks
Other Requirements					
8	**Requirements Applicable to all OTS Elements**				
	Overall Requirements	Conditional	5.5.3.2.2.1	Meet Sponsor requirements	
	Performance Requirements	Conditional	5.5.3.2.2.2	Meet Sponsor requirements	
	Reliability and Quality Assurance	Conditional	5.5.3.2.2.2.1	Meet Sponsor requirements	
	Common Physical Design Requirements	Conditional	5.5.3.2.2.3	Meet Sponsor requirements	
	Protection and Restoration	Conditional	5.5.3.2.2.4	Meet Sponsor requirements	
	Optical Amplifier Requirements				
	Optical Amplifier	Conditional	5.5.3.2.3	Meet Sponsor requirements	
	OLA Physical Design Requirements	Conditional	5.5.3.2.3.1	Meet Sponsor requirements	
	Muxponder Requirements				
	Muxponder	Conditional	5.5.3.2.4	Meet Sponsor requirements	
	Transponder Requirements				
	Transponder	Conditional	5.5.3.2.5	Meet Sponsor requirements	
	Interface Requirements	Conditional	5.5.3.2.5.1	Meet Sponsor requirements	
	ROADM Requirements				
	ROADM Requirements	Conditional	5.5.3.2.6	Meet Sponsor requirements	
	ROADM Specific Physical Design Requirements	Conditional	5.5.3.2.6.1	Meet Sponsor requirements	
	Requirements Common to Transponder and ROADM				
	Framed Formats	Conditional	5.5.3.2.7.1	Meet Sponsor requirements	
	Unframed Formats	Conditional	5.5.3.2.7.2	Meet Sponsor requirements	
	Optical Supervisory Channel Requirements				
	Optical Supervisory Channel	Conditional	5.5.3.2.8	Meet Sponsor requirements	
	AGF Requirements				
	SONET Interface Requirements	Required	5.5.3.4.2	Meet Sponsor requirements	
	SDH Interface Requirements	Required	5.5.3.4.3		
	Electrical Interface Requirements	Required	5.5.3.4.4		
	Ethernet Interface Requirements	Required	5.5.3.4.4		
	Storage Area Network Interface Requirements	Required	5.5.3.4.6		
	Cross-Connect Requirements	Required	5.5.3.4.7		

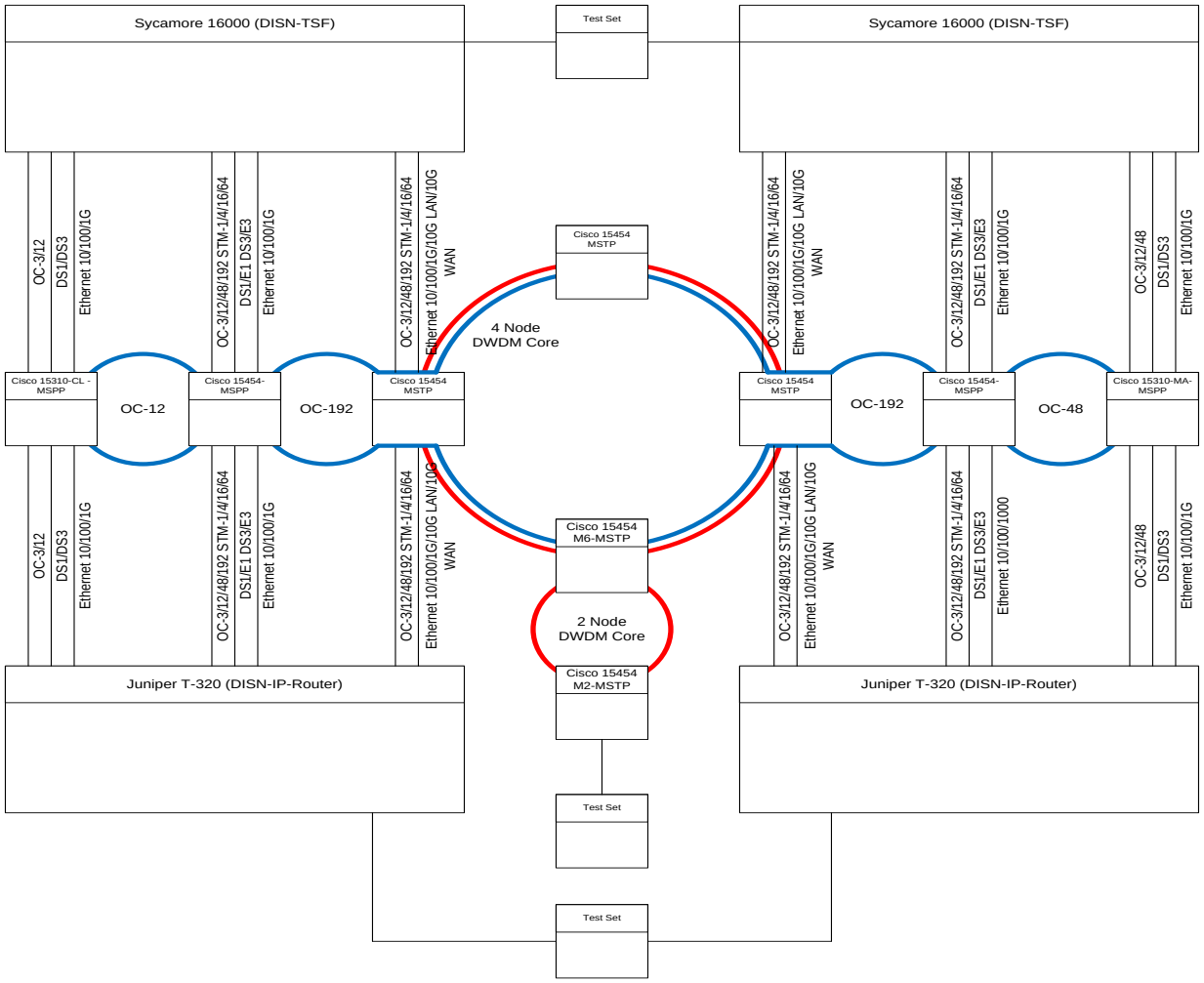
Table 2-4. Other CR/FR Requirements (continued)

CR/FR ID	Capability/Function	Applicability	Reference (UCR 2008, Change 3)	Criteria	Remarks
AGF Requirements (cont)					
8 (cont)	Performance Requirements	Required	5.5.3.4.8	Meet Sponsor requirements	
	Equipment Redundancy Requirements	Required	5.5.3.4.9		
	General Protection Requirements	Required	5.5.3.4.10		
	Interoperability Requirements	Required	5.5.3.4.11		
	Fault Management Requirements	Required	5.5.3.4.12		
	Performance Monitoring Requirements	Required	5.5.3.4.13		
	Functional Device Requirements	Required	5.5.3.4.14		
	Interface Performance Requirements	Required	5.5.3.4.15		
	EMS Requirements	Required	5.5.3.4.16		
	Physical Design Requirements	Required	5.5.3.4.17		

LEGEND:

AGF	Access Grooming Function	OLA	Optical Line Amplifier
cont	continued	OTS	Optical Transport System
CR	Capabilities Requirement	ROADM	Reconfigurable Optical Add-Drop Multiplexer
EMS	Element Management System	SDH	Synchronous Digital Hierarchy
FR	Functional Requirement	SONET	Synchronous Optical Transport Network
ID	Identification	UCR	Unified Capabilities Requirements

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



LEGEND:

CL	Customer Location	LAN	Local Area Network
DISN	Defense Information Systems Network	MA	Metro Access
DS1	Digital Signal 1 (1.544 Mbps)	Mbps	Megabits per second
DS3	Digital Signal 3 (44.736 Mbps)	MSPP	Multiservice Provisioning Platform
DWDM	Dense Wavelength Division Multiplexing	MSTP	Multiservice Transport Platform
E1	European Interface Standard (2.048 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.)
E3	European Interface Standard (34.368 Mbps)	SUT	System Under Test
G	Gigabit	STM	Synchronous Transport Module
IP	Internet Protocol	TSF	Transport Switch Function
		WAN	Wide Area Network

Figure 2-2. SUT's Test Configuration

9. SYSTEM CONFIGURATION. Table 2-5 lists the Tested SUT equipment shown in Figure 2-2. Table 2-6 lists the Non-SUT equipment used to test the Cisco ONS 15310-CL SONET MSPP; Cisco ONS 15310-MA MSPP; Cisco ONS 15454 MSPP; Cisco ONS 15454 MSTP, Cisco ONS 15454-M6 MSTP, and Cisco ONS 15454-M2 MSTP. Table 2-7 lists the test equipment used to generate voice, SONET, and IP traffic.

Table 2-5. Hardware/Software Tested SUT Equipment

Platform	Software Release	UC Product Type
Cisco ONS 15454 SDH MSPP	9.2.1	F-NE
Cisco ONS 15454 MSPP	9.2.1	F-NE
Cisco ONS 15310-CL MSPP	9.2.1	F-NE
Cisco ONS 15310-MA MSPP	9.2.1	F-NE
Cisco ONS 15454 MSTP OTS	9.2.1	F-NE
Cisco ONS 15454- M6 OTS	9.2.1	F-NE
Cisco ONS 15454- M2 OTS	9.2.1	F-NE
SUT-Equipments List		
Item/Card Name	**Part Number**	**Number of Items**
ONS 15454 SDH ETSI Chassis	15454E-SA-ETSI	2
ONS 15454 SDH CRAFT, TIMING	15454-CTP-MIC48V	2
ONS 15454 SDH ALARM	15454-AP-MIC48V	2
HD E-1 120 OHM FMEC	15454E-E1-120NP	2
12 PORT E-3/DS3 75 OHM FMEC	15454E-E3DS3-FMEC	2
TIMING COMMUNICAITONS CONTROL 2 PLUS, ITEMP-ANSI	15454E-TCC2-K9	4
SDH HO/LO XC, 60G VC-4, 5G VC12/11	15454E-XC-VXL-10G	4
15454 INTERNAL ETSI CHASSSIS 42 PART E-1 MODULE	15454E-E1-42	2
12 PORT E-3 MODUEL (1:1 ONLY)	15454E-E3-12	2
12 PORT E-3 MODULE (1:N<=4)	15454E-DS3IN-12	2
PATCH PANEL, MFT, 15216-MD-40-EVEN	703501C010102	2
ONS 15454 AIR RAMP/BAFFLE FOR THE ANSI CHASSIS	15454-AIR-RAMP=	4
6 SERVICE SLOT MSTP CHASSIS LCD DISPLAY WITH BACKUP MEMORY	15454-M6-LCD=	2
6 SERVICES SLOT MSTP CHASSIS FAN TRAY	15454-M6-FTA=	1
2RU 80 PORTS LC PATCH PANEL	15454-FBR-STRG=	4
MULTISHELF MANAGEMENT INTEGRATED SWTICH CARD	15454-MS-ISC-100T	2
SFP-OC3/STM1 CWDM, 1510NM	ONS-SE-155-1510=	4
TIMING COMMUNICATIONS CONTROL TWO PLUS, I-TEMP	15454-TCC2P-K9=	7
15454 ANSI MSTP REL 9.2.1 SW PRE LOADED	SF15454M-R9.2.1K9	12
15454 ANSI MSTP MSPP REL 9.2.1	15454-R9.2.1SWK9=	6
OPTICAL PROTECTION SWTICH MODULE	15454-PSM=	2
ONS 15454 COMBINER AND SEPARATOR WITH OSC MODULE	15454-OSC-CSM=	2
ONS 15454 OPTICAL SERVICE CHANNEL MODULE	15454-OSCM=	4
TRANSPORT NODE CONTROLLER FOR M2 AND M6 CHASSIS	15454-M-TNC-K9=	3
ONS 15454 ENHANCED OPTICAL AMP	15454-OPT-AMP-C=	1
ONS 15454 OPTICAL PRE-AMP MODULE	15454-OPT-AMP-C =	2
ONS 15454 OPTICAL BOOSTER AMP MODULE	15454-OPT-BST=	1
40 CHS DEMUX-C-BAND-ODD	15454-40-DMX-C=	1
40 CHS MUX-C-BAND-ODD	15454-40-MUX-C=	1
ONS 15454 OADM-4 CHN 100GHz	15454-AD-4C-58.1=[1]	1
ONS 15454 OADM-1 CHN 100GHz 1558.17	15454-AD-1C-58.1=[2]	0
ONS 15454 OADM-1 CHN 100GHz 1558.98	15454-AD-1C-58.9=[2]	1
ONS 15454 OADM-2 CHN 100GHz	15454-AD-2C-59.7=[3]	1
15454 EXTD PERF 10Gb MULTI-RATE TXP EFEC	15454-10EX-L1-C=	2
4 X OTN 10Gb MR TRANSPONDER	15454-OTU2-XP=	2
4X10GbE ENHANCED CROSSPONDER	15454-10GE-XPE=	1
XFP-OC192 SR	ONS-XC-10G-S1=	15
SFP GbE/1G SM-LC	ONS-SE-G2F-LX=	12
SFP GbE/1G MM-LC	ONS-SE-G2F-SX=	3
40 CHS BROADXASE WAVELENGTH CROSS CONNECT-C-BAND-ODD	15454-40-WXC-C=	1
15454E-E1-42 SDH Module	15454E-E1-42	2

Table 2-5. Hardware/Software Tested SUT Equipment (continued)

SUT-Equipments List		
Item/Card Name	**Part Number**	**Number of Items**
80 CHS COLORLESS WAVELENGTH CROSS CONNECT C-BAND	15454-80-WXC-C=	1
KIT-OSCM, SMR2	15454-MDEGROADM-SK	3
KIT OSCM, SMR1	15454-2DEGROADM-SK	3
XFP-10Gb MULTIRATE RULL C-BAND	ONS-XC-10G-C=	10
15454 SA HD NEBS3 ANSI With RCA AND SHIP KIT	15454-SA-HD	6
UNIVERSAL BACKPLANE INTERFACE	15454-EIA-UBICH-A	2
UNIVERSAL BACKPLANE INTERFACE	15454-EIA-UBICH-B	2
CROSS-CONNECT MOUDLE, HIGH CAP	15454-XC-VXC-10G	4
DS1/E-1	15454-DS1E1-56	2
DS3 48	15454-DS3EC1-48	2
CARRIER ETHERNET CARD	15454-CE-MR-10	2
8X10/100T CARRIER ETHERNET	15454-CE-100T-8	2
DS3, TRANSMUX	15454-DS3XM-12	3
GbE 4 CKT	15454-G1K-4	2
4 PORT 4 GbE	15454-CE-1000-4	1
ML-MR 10 MULTI RATE	15454-ML-MR-10	2
OC3/12/48	15454-MRC-2.5G4	2
OC3/12/48	15454-MRC-1-12	2
15454-10G-XR, OC-192 any Reach	15454-10G-XR	1
SFP OC48IR1	ONS-SE-Z1	4
GBIC-1000BASE-LX	ONS-GC-GE-LX	2
SFP – 10/100/1000	ONS-SE-Z1-EL	6
10Gb, SR	15454-10G-S1	4
METRO ACCESS CHASSIS BACKPLANE	15310-MA-SA	1
MA SHELF FAN TRAY ASSEMBLY	15310-MA-FTA	1
COMBINATION DS1 AND DS3/EC1 BACKPLANE	15310-EIA-HD-A	1
MA CONTROL SYNC CROSS CONNECT	15310-CTX-2500-K9	2
Software REL 9.2.1	15310M-R9.2.1 K9	2
28 PORT DS1 AND 3 PORT DS3E	15310-28WBE-3BBE	1
84 PORT DS1 AND 3 PORT DS3E	15310-84WBE-3BBE	1
CARRIER ETHERNET CARD 6 PORT	15310-CE-MR-6	1
15310 8 PORT 10/100 ETHERNET	15310-P-CE-100T-8	2
SFP – 1000BASE-SX	ONS-SI-GE-SX	1
15310-MA ANSI REL. 9.2.1	15310M-R9.2.1SWK9	1
Patch Panel, MFT, 15216-MD-40-ODD	15216-MD-40-ODD	2
Patch Panel, MFT, 26326-MD-40-EVEN	15216-MD-40-EVEN	2
Module 15216-ID-50=	15216-ID-50=	2
Software REL 9.2.1	SF15310C-R9.2.1K9	1
SFP OC12/STM4	ONS-S1-622-I1	8
15310 CL REL 9.2.1 REATCTIVE UNIT RE-PACKING CD	15310C-R9.2.1SWK9	1
1545 EXTTENDED PERFER 10Gbps DATA MXP EFEC FULL C-BAND TUNABLE	15454-10DMEX-C=	2
40Chs Single Module 2DEGROADM with integrated Optical PRE Amplifier	15454-40-SMR1-C=	3
40Chs Single Module 2DEGROADM with integrated Optical PRE, Boos	15454-40-SMR2-C=	3
ADM on a Blade OC192 3/12/48/GE 16-Client	15454-ADM-10G=	1
SHELF CONTROLLED COOLING FAN TARY, ANSI, HPCFM, I-TEMP	15454-CC-FTA=	4
DS3, TRANSMUX, 48 CKT, 1-TEMP	15454-DS3-12E	2
ETHERNET 20-GE/2-10GbE CROSSPONDER	15454-GE-XP=	1
20 GbE ENHANCED CROSSPONDER	15454-GE-XPE=	1
1 RU 4-DEGREE SM ROADM MESH PATCH PANEL	15454-PP-4-SMR=	1
2 RU 80 PORTS LC PATCH PANEL	15454-PP-80-LC=	1
2RU 8-DEGREE MESH PATCH PANEL	15454-PP-MESH-8=	1
40G MUXPONDER DQPSK	15454-40G-MXP-C=	2
2 SERVES SLOT MSTP CHASSIS FAN TRAY	15454-M2-FTA=	1
2 SERVES SLOT MSTP SHELF, INCLUDES M-SHIPKIT, M2-FTF	15454-M2-SA=	1

Table 2-5. Hardware/Software Tested SUT Equipment (continued)

ONS 15454 SDH CRAFT,TIMING, -48V POWER MANAGEMENT	15454E-CTP-MIC48V	2
ONS 15454 SHD 48V FAN TRAY WITH FILTER FOR ETSI CHASSIS	15454E-FTA-48V	2

NOTES:

1. ONS 15454 OADM-4 CHN 100GHZ, Part number: 15454-AD-4C-58.1=, frequency range: 30.3= to 58.1= (Tested frequency: 58.1= only).
2. ONS 15454 OADM-1 CHN 100GHZ 1558.17, Part number: 15454-AD-1C, frequency range: 30.3= to 60.6= (Tested Frequency: 58.1= and 58.9= only).
3. ONS 15454 OADM-2 CHN 100GHZ, Part number: 15454-AD-2C-59.7=, frequency range: 30.3= to 59.7= (Tested Frequency: 59.7=only).
4. JITC has reviewed the description provided by the vendor for the following Muxponder module cards: 15454-40EX-MXP-C=, 15454-40ME-MXP-C= and accepted these cards for similar application as comply via similarity to the 15454-40G-MXP-C= module card that was tested by Joint Interoperability Test Command during the test and evaluation.

LEGEND:

1000Base-X	1000 Mbps Ethernet generic designation
2RU	2 Rack Unit
AD	Add/Drop
ADM	Add-Drop Multiplexer
AMP	Amplifier
ANSI	American National Standards Institute
ASE	Adaptive Server Enterprise
CAP	Capacity
CE	Customer Edge
CD	Compact Disk
CHN/CHS	Channel(s)
Ckt	Circuit
CL	Customer Location
CWDM	Coarse Wavelength Division Multiplexer
DEGROADM	Degree Reconfigurable Optical Add-Drop Multiplexer
DEMUX	De-Multiplexer
DS1	Digital Signal Level 1 (1.544 Mbps)
DS3	Digital Signal Level 3 (44.736 Mbps)
E-X	European Interface Standard (level X)
EFEC	Enhanced Forward Error Correction
ETSI	European Telecommunications Standards Institute
EXTD	Extended
FMEC	Front-Mount Electrical Connection
F-NE	Fixed Network Element
G	Gigabit
Gb	Gigabit
GBIC	Gigabit Interface Converter
GbE	Gigabit Ethernet
Gbps	Gigabit per second
GHz	Gigahertz
HD	High Density
HO/LO	High-Order/Low-Order
IC	Integrated Circuit
ID	Identification
IR	Intermediate Reach
LC	Line Connection
LCD	Liquid Crystal Display
MA	Metro Access
MD	Module
MFT	Manufacture
ML	Multi-Link
MM	Multi Mode
MR	Multi Rate
MSPP	Multi-Service Provisioning Platform
MSTP	Multi-Service Transport Platform
MUX	Multiplexer
MXP	Muxponder
NEBS	Network **E**quipment **B**uilding **S**ystems
NM	Network Management
OADM	Optical Add-Drop Multiplexer
OC-X	Optical Carrier - X (OC-3, OC-12, etc.)
OHM	Ohm Meter
ONS	Optical Network System
OSC	Optical Supervisory Channel
OSCM	Optical Supervisory Channel Module
OTN	Optical Transport Network
OTS	Optical Transport System
PRE-AMP	Pre-Amplify
PKG	Package
RCA	Rear Cover Assembly
REL	Release
SA	Signal Access
SDH	Synchronous Digital Hierarchy
SFP	Small Form-Factor
SM	Single Mode
SMR	Single Mode Ratio
SR	Short Reach
STM	Synchronous Transport Module
SUT	System under Test
SW	Software
SX	Multi-mode fiber
SYNC	System Network Connection
TXP	Transponder
UC	Unified Capabilities
V	Volt
VC	virtual concatenation
XC	Cross Connect
XFP	X-Form Factor Pluggable
XR	Cross Reach

Table 2-6. Non-SUT Equipment

Component	Software Version	Function	Subcomponent
Cisco 15454	09.00-008I-17.17	MSPP	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	ODXC	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	DISN Router	4 x FE 100 Base Tx, 10 x GbE LAN 1000 Base TX, 1x OC-192 SM SR2, 1 x 10GbE LAN, XENPAK
Cisco Catalyst 6500	12.1 (13)	Router	48 Ethernet ports, 8 ports GbE, 2 port 10GbE

LEGEND:

DISN	Defense Information Systems Network	OC	Optical Carrier
DS	Digital Signal	ODXC	Optical Digital Cross Connect
FE	Fast Ethernet	SH	Vendor specific subcomponent's name
ETH	Ethernet	SM	Single Mode
GbE	Gigabit Ethernet	SR	Short Reach
GPIC	Group Primary Interexchange Carrier	STM	Synchronous Transport Module
IR	Intermediate Reach	SUT	System Under Test
LAN	Local Area Network	TX	Fast Ethernet Twisted Wires
LIM	Line Interface Module	USC	Universal Services Card
LR	Long Reach	MSPP	Multiservice Provisioning Platform

Table 2-7. Test Equipment

Manufacture	Type	Port Type	Software Version
Anritsu	Tunics Plus – Tunable Laser	C-Band	1.00
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	
Ixia	Traffic generator	10 Gig	5
		LM1000STX	
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	
		OC-192	
		STM-1/STM-4/STM-16/STM-64	

LEGEND:

DSU	Data Services Unit	OC	Optical Carrier
Gig	Gigabit	POS	Packet Over Synchronous Optical Network
JDSU	Vendor Name	STM	Synchronous Transport Module
LAN	Local Area Network	STX	Ixia Product Name
LM	Load Modules	WAN	Wide Area Network
nm	nanometer	TX	Fast Ethernet over Twisted Wires
		X	Place holder for TX

10. TEST LIMITATIONS. None

11. INTEROPERABILITY EVALUATION RESULTS. The SUT meets the critical interoperability requirements for F-NE 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 interface status is provided in Table 2-8.

Table 2-8. SUT F-NE Interface Requirements Status

Interface	Critical (See note 1.)	Ref (UCR 2008 CH 2)	CR/FR Req. (See note 2.)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
NE									
Analog	No	5.9.2.3.1	1, 2, 4	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
Serial	No	5.9.2.3.2	1, 2, 4	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
BRI ISDN	No	5.9.2.3.3	1, 2, 4	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)
DS1	No	5.9.2.3.4	1, 2, 3, 4	Certified	Certified	Certified	NA (See note 4)	NA (See note 4)	NA (See note 4.)
E1	No	5.9.2.3.5	1, 2, 3, 4	Certified	Not Tested (See note 5)	Not Tested (See note 5)	NA (See note 6)	NA (See note 6)	NA (See note 6)
DS3	No	5.9.2.3.6	1, 2, 3, 4	Certified	Certified	Certified	NA (See note 7)	NA (See note 7)	NA (See note 7)
OC-X	No	5.9.2.3.8	1, 2, 3, 4	Certified (See note 8)	Certified	Certified	Certified	Certified (See note 8)	Certified (See note 8)
IP (Ethernet) 10/100/1000	No	5.9.2.3.9	1, 2, 4, 7	Certified	Certified	Certified	Not Tested (See note 9)	Not Tested (See note 9)	Not Tested (See note 9)
IP (Ethernet) 1GbE	No	5.9.2.3.9	1, 2, 4, 7	Certified	Certified	Certified	Certified	Certified	Certified
NM									
10Base-X	Yes	5.3.2.4.4	8	Certified	Certified	Certified	Certified	Certified	Certified
100Base-X	Yes	5.3.2.4.4	8	Certified	Certified	Certified	Certified	Certified	Certified

Table 2-8. SUT F-NE Interface Requirements Status (continued)

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.
3. Each component of the SUT does not support Analog, Serial, and BRI of ISDN interfaces.
4. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support DS-1 interface.
5. The SUT components ONS 15310-CL MSTP and ONS 15310-MA MSPP have received Letters of Compliance from the vendor stating that the equipment meets the E1 Interface requirement.
6. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support E1 interface.
7. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do not support DS-3 interface.
8. OC-X refers to OC-3, OC-12, OC-48, OC-192, and OC-768 Optical Carrie interfaces. Each of the SUT components has undergone the specified interfaces testing. For the OC-192 interface, ONS 15454-M2 MSTP was the only SUT component that did not undergo lab testing. In addition, the ONS 15454 MSTP, ONS15454-M6 MSTP, and ONS 15454-M2 MSTP did not undergo lab testing for an OC-768/STM-256 interface. The ONS 15454 MSTP 40Gb single port transponder was not available at the time of testing.
9. The SUT components ONS 15454 MSTP, ONS 15454-M6 MSTP, and ONS 15454-M2 MSTP do support Ethernet 10/100/1000 Interfaces via copper SFP, but Joint Interoperability Test Command did not test these interfaces due to unavailability of the copper SFPs in the Advanced Technology Testbed lab.

LEGEND:

10Base-X	10 Mbps Ethernet generic designation
100Base-X	100 Mbps Ethernet generic designation
BRI	Basic Rate Interface
CH	Change
CL	Customer Location
CR	Capabilities Requirement
DS1	Digital Signal Level 1 (1.544 Mbps)
DS3	Digital Signal Level 3 (44.736 Mbps)
E1	European Interface Standard (2.048 Mbps)
F-NE	Fixed-Network Element
FR	Functional Requirements
Gb	Gigabit
GbE	Gigabit Ethernet
IP	Internet Protocol
ISDN	Integrated Services Digital Network
MA	Metro Access
LAN	Local Area Network
Mbps	Megabits per second
MSPP	Multi-Service Provisioning Platform
MSTP	Multi-Service Transport Platform
NA	Not Applicable
NE	Network Element
NM	Network Management
OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
ONS	Optical Network System
PHY	Physical Layer
Ref	Reference
SFP	Small Form-Factor
STM	Synchronous Transport Module
SUT	System Under Test
UCR	Unified Capabilities Requirements
WAN	Wide area network

11.2 CR and FR. Table 2-9 lists the SUT's CR/FR statuses. Table 3-1 of the System Functional and Capability Requirements (Enclosure 3) provides the detailed CR/FR requirements.

Table 2-9. SUT CRs and FRs Status

CR/ FR ID	Capability /Function	Applic-ability (See notes 1.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
F-NE									
1	**General NE Requirements**								
	General Requirements	Required	5.9.2.1	Met	Met	Met	Met	Met	Met
	Alarms	Required	5.9.2.1.1	Met	Met	Met	Met	Met	Met
	Congestion Control & Latency	Required	5.9.2.1.2	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)
2	**Compression**								
	G.726	Conditional	5.9.2.2	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)
	G.728	Conditional	5.9.2.2	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)
	G.729	Conditional	5.9.2.2	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)

Table 2-9. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
3	**Interface Requirements**								
	Timing	Required	5.9.2.3.7	Met	Met	Met	Met	Met	Met
	Device Management								
4	Management Options	Required	5.9.2.4.1	Met	Met	Met	Met	Met	Met
	Fault Management	Conditional	5.9.2.4.2	Met	Met	Met	Met	Met	Met
	Loop-Back Capability	Conditional	5.9.2.4.3	Met	Met	Met	Met	Met	Met
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	Met	Met	Met	Met	Met
5	**DLoS**								
	DLoS Transport	Conditional	5.9.2.4.5	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)	NA (See note 2.)
6	**IPv6 Requirements**								
	Product Requirements	Required	5.3.5.4	Met (See note 3.)	Met (See note3.)	Met (See note3.)	Met (See note 3.)	Met (See note3.)	Met (See note3.)
7	**NM Requirements**								
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	Met	Met	Met	Met	Met
	General Management Requirements	Required	5.3.2.17.2	Met	Met	Met	Met	Met	Met

NOTES:
1. Annotation of 'required' refers to high-level requirement category. Enclosure 3 provides the applicability of each sub-requirement.
2. This SUT does not support this conditional requirement.
3. SUTs are a Layer 2 device and transports IPv4 and IPv6 transparently.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation
CH	Change
CL	Customer Location
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction
CR	Capabilities Requirement
DLoS	Direct Line of Sight
F-NE	Fixed Network Element
FR	Functional Requirement
G.726	ITU-T speech codec for ADPCM (32 Kbps)
G.728	ITU-T speech codec for LD-CELP (16 Kbps)
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)
ID	Identification
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ITU-T	ITU Telecommunications Union – Telecommunications Sector
Kbps	Kilobits per second
LD-CELP	Low Delay Code Excited Linear Prediction
MA	Metro Access
MSPP	Multi-Service Provisioning Platform
MSTP	Multi-Service Transport Platform
NA	Not Applicable
NE	Network Element
NM	Network Management
NMS	Network Management System
Ref	Reference
SUT	System Under Test
UCR	Unified Capabilities Requirements
VVoIP	Voice and Video over Internet Protocol

a. General NE Requirements

(1) General Requirements. In accordance with (IAW) UCR 2008, Change 2, 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 End-to-End (E2E) average Mean Opinion Score (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, Change 2, Section 5.2.12.6, and DoD Secure Communications Devices. JITC tested secure information exchanges by using DoD Secure Communications Devices such as Secure Telephone Unit/Secure Terminal Equipment devices with no noted issues.

(d) The NE(s) shall support a minimum modem transmission speed of 9.6 kilobits per second (kbps) across the associated NE(s). JITC tested this information exchange by using a modem and simulated information exchange with no noted issues.

(e) The NE(s) shall support a minimum facsimile transmission speed of 9.6 kbps across the associated NE(s). JITC tested this information exchange by using a facsimile and simulated information exchanges with no noted issues.

(f) The NE shall transport all call control signals transparently on an E2E basis. JITC tested this information exchange by using an actual call control signals via a Private Branch Exchange Transmission Link Level 1 calls and simulated information exchanges with no noted issues.

(2) Alarms. The NE shall provide the capability of detecting a Carrier Group Alarm (CGA). 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. That allows the NE to notify the Internet Protocol (IP) network (e.g., LAN, Metropolitan Area Network) the condition of its link state for transporting ingress IP traffic, namely operational or down. The SUT is a Layer-2 device and it passes all the routing protocols, IP link states transparently between connecting end equipments, and it propagates all CGA with no noted issues. In addition, it provides loss of signal alarm in case of loss of connectivity events for connecting end equipment.

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

(a) Time Division Multiplexer/Multiplexing (TDM) Transport. The SUT is a Layer-2 device and SUT provides transparent TDM Transport. Therefore, the following TDM transport requirements are not applicable to the SUT. These requirements are the responsibility of connecting end equipment.

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

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 E2E 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 milliseconds (ms) per NE pair as measured E2E.

b. TDM ingress G.711 (non-secure calls) to transcoding TDM egress with compression codes 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 codes shall not increase delay by more than 250 ms per NE pair as measured E2E.

(b) IP Transport. The NE(s) using 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 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. The SUT is a Layer-2 device and it passes all IP traffic transparently, therefore, none of the above IP transport requirement is applicable to the SUT, instead those are responsibility of connecting end equipment.

(c) Direct Line of Sight (DLoS) Transport. The SUT does not provide DLoS Transport.

b. Compression. The SUT does not support Compression.

c. Interface Requirements. Timing. The NE shall be able to derive timing signal from an internal source, an incoming digital signal, or an external source. This requirement applies to TDM interfaces only; IP interfaces do not need to meet this requirement.

d. Device Management. 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 an external console capability.

(b) Remote monitoring and management by the Advanced DISN Integrated Management Support System (ADIMSS). 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 Network Management System (NMS). JITC verified this conditional capability via Network Management (NM) testing.

(3) Loop-Back Capability. This requirement applies to TDM interfaces only; the SUT does provide loop-back capabilities via its all interfaces.

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

f. IP version 6 (IPv6) Requirements. Product Requirements. The SUT must meet UCR 2008, Change 2, 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 so requirements specific relating to Layer-3 do not apply.

g. NM Requirements. JITC verified the following NM requirements by connecting the NMS to the SUT via all required interfaces and in addition verified via

utilization of NMS for performing test configurations, for performing alarms monitoring, and for performing fault management.

(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-megabits per second (Mbps) Ethernet interface. The interface will work in either of the two following modes using auto-negotiation: Institute of Electrical and Electronics Engineers (IEEE), Ethernet Standard 802.3, 1993; or IEEE, Fast Ethernet Standard 802.3u, 1995.

(2) General Management Requirements. The SUT must support Simple Network Management Protocol version 3 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 2, 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 2, paragraph 5.3.2.4.4. There shall be a local craftsperson interface (Craft Input Device for Operations Administration & Management) for all VVoIP network components.

11.3 Other. JITC conducted additional tests on the SUT. Table 2-10 shows the Additional Interface Requirements under UCR 2008, Change 2, Section 5.5.3.4, and test results**.** Table 2-11 lists the SUT's CR/FR status based on Optical Transport System requirements. Table 3-1 of Enclosure 3, the System Functional and Capability Requirements provides the detailed CR/FR requirements.

Table 2-10. Additional Interface Requirements Status

Interface	Critical (See note 1.)	Ref (UCR 2008 CH 2)	CR/FR Req. (See note 2.)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
OTHER									
STM-1/4/16	NO	5.5.3.4.3	8	Certified	Certified	Certified	Certified	Certified	Certified
STM-64	NO	5.5.3.2.5.1	8	NA	NA	NA	Certified	Certified	Not Tested (See note 4)
STM-256	NO	5.5.3.2.5.1	8	NA	NA	NA	Not Tested (See note 4)	Not Tested (See note 4)	Not Tested (See note 4)
10 Gigabit Ethernet-LAN	NO	5.5.3.2.5.1	8	NA (See note 3)	NA (See note 3)	NA (See note 3)	Certified	Certified	Not Tested (See note 4)
10 Gigabit Ethernet-WAN	NO	5.5.3.2.5.1	8	NA (See note 3)	NA (See note 3)	NA (See note 3)	Certified	Certified	Not Tested (See note 4.)

Table 2-10. Additional Interface Requirements Status (continued)

OSC	NO	5.5.3.2.8	8	NA (See note 3)	NA (See note 3)	NA (See note 3)	Certified	Certified	Certified

NOTES:

1. The threshold CRs/FRs provides a high-level overview of applicable UCR requirements. For detailed applicability of UCR requirement, refer to Enclosure 3.
2. CR/FR requirements are contained in Table 2. CR/FR numbers represent a roll-up of UCR requirements.
3. The SUT components ONS 15454-MSPP, ONS 15310-CL MSPP, and ONS 15310-MA MSPP do not support 10GbE LAN, 10GbE WAN, and OSC interfaces.
4. The SUT component ONS 15454-M2 MSTP did not undergo lab testing for OC-192/STM-64, 10GbE WAN PHY, or 10GbE LAN PHY interfaces. Moreover, ONS 15454 MSTP, ONS 15454-M6 MSTP and ONS 15454-M2 MSTP did not undergo laboratory testing for STM-256 interface.

LEGEND:

CH	Change	OC	Optical Carrier
CL	Customer Location	ONS	Optical Networking System
CR	Capability Requirements	OSC	Optical Supervisory Channel
FR	Functional Requirement	PHY	Physical Layer
GbE	Gigabit Ethernet	Ref	Reference
LAN	Local Area Network	Req.	Requirements
MA	Metro Access	SUT	System Under Test
MSPP	Multi-Service Provisioning Platform	STM	Synchronous Transport Module
MSTP	Multi-Service Transport Platform	UCR	Unified Capabilities Requirements
NA	Not Applicable	WAN	Wide Area Network

Table 2-11. SUT CRs and FRs Status

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
Other Tested Requirements									
8	**Requirements Applicable to all OTS Elements**								
	Overall Requirements	Conditional	5.5.3.2.2.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 4.)	Partially Met (See note 4.)	Partially Met (See note 4.)
	Performance Requirements	Conditional	5.5.3.2.2.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met
	Requirements Applicable to all OTS Elements								
	Reliability and Quality Assurance	Conditional	5.5.3.2.2.2.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met
	Common Physical Design Requirements	Conditional	5.5.3.2.2.3	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 5.)	Partially Met (See note 5.)	Partially Met (See note 5.)
	Protection and Restoration	Conditional	5.5.3.2.2.4	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met
	Optical Amplifier Requirements								
	Optical Amplifier	Conditional	5.5.3.2.3	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 6.)	Partially Met (See note 6.)	Partially Met (See note 6.)
	OLA Physical Design Requirements	Conditional	5.5.3.2.3.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met

Table 2-11. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
8 (cont)	**Muxponder Requirements**								
	Muxponder	Conditional	5.5.3.2.4	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 7.)	Partially Met (See note 7.)	Partially Met (See note 7.)
	Transponder Requirements								
	Transponder	Conditional	5.5.3.2.5	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 8.)	Partially Met (See note 8.)	Partially Met (See note 8.)
	Interface Requirements	Conditional	5.5.3.2.5.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 9.)	Partially Met (See note 9.)	Partially Met (See note 9.)
	ROADM Requirements								
	ROADM Requirements	Conditional	5.5.3.2.6	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 10.)	Partially Met (See note 10.)	Partially Met (See note 10.)
	ROADM Specific Physical Design Requirements	Conditional	5.5.3.2.6.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met
	Requirements Common to Transponder and ROADM								
	Framed Formats	Conditional	5.5.3.2.7.1	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 11.)	Partially Met (See note 11.)	Partially Met (See note 11.)
	Unframed Formats	Conditional	5.5.3.2.7.2	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Met	Met	Met
	Optical Supervisory Channel Requirements								
	Optical Supervisory Channel	Conditional	5.5.3.2.8	NA (See note 3.)	NA (See note 3.)	NA (See note 3.)	Partially Met (See note 12.)	Partially Met (See note 12.)	Partially Met (See note 12.)
	AGF Requirements								
	AGF SONET Interface Requirements	Required	5.5.3.4.2	Partially Met (See note 13.)	Partially Met (See note 13.)	Partially Met (See note 13.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	SDH Interface Requirements	Required	5.5.3.4.3	Partially Met (See note 13.)	Partially Met (See note 13.)	Partially Met (See note 13.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Electrical Interface Requirements	Required	5.5.3.4.4	Partially Met (See note 13.)	Partially Met (See note 13.)	Partially Met (See note 13.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Ethernet Interface Requirements	Required	5.5.3.4.4	Partially Met (See note 13.)	Partially Met (See note 13.)	Partially Met (See note 13.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Storage Area Network Interface Requirements	Required	5.5.3.4.6	Not Tested (See note 15.)	Not Tested (See note 15.)	Not Tested (See note 15.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)

Table 2-11. SUT CRs and FRs Status (continued)

CR/ FR ID	Capability /Function	Applic-ability (See notes 1 and 2.)	Ref (UCR 2008 CH 2)	15454 MSPP	15310-CL MSPP	15310-MA MSPP	15454 MSTP	15454 M6 MSTP	15454 M2 MSTP
8 (cont)	**AGF Requirements (continued)**								
	Cross-Connect Requirements	Required	5.5.3.4.7	Partially Met (See note 16.)	Partially Met (See note 16.)	Partially Met (See note 16.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Performance Requirements	Required	5.5.3.4.8	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Equipment Redundancy Requirements	Required	5.5.3.4.9	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	General Protection Requirements	Required	5.5.3.4.10	Partially Met (See note 17.)	Partially Met (See note 17.)	Partially Met (See note 17.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Interoperability Requirements	Required	5.5.3.4.11	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Fault Management Requirements	Required	5.5.3.4.12	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Performance Monitoring Requirements	Required	5.5.3.4.13	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Functional Device Requirements	Required	5.5.3.4.14	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Interface Performance Requirements	Required	5.5.3.4.15	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	EMS Requirements	Required	5.5.3.4.16	Met	Met	Met	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Physical Design Requirements	Required	5.5.3.4.17	Partially Met (See note 18.)	Partially Met (See note 18.)	Partially Met (See note 18.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)
	Physical Design Requirements	Required	5.5.3.4.17	Partially Met (See note 18.)	Partially Met (See note 18.)	Partially Met (See note 18.)	NA (See note 14.)	NA (See note 14.)	NA (See note 14.)

Table 2-11. SUT CRs and FRs Status (continued)

NOTES:
1. Annotation of 'required' refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. The sponsor requested the SUT be assessed against UCR section 5.5 as an OTS device.
3. The SUT components ONS 15454 MSPP, ONS 15310-CL MSPP, and ONS 15310-MA MSPP do not support DISN-OTS functionality.
4. The OTS must support span lengths up to 150 km/50dB before amplification but SUT only supports up to A 38.5 dB spans.
5. The SUT must operate continuously in the environmental range of 0 to +50ºC with humidity to 95% without condensation. The Cisco 15454-M2 OTS does not comply with requirement 10 which requires A and B power cables shall have physically diverse routing within the bay cabinet.
6. The OTS must support the Raman amplifiers but the equipment was not delivered to the lab to undergo testing, and OTS must support internal Optical Spectrum Analyzer, but SUT does not support it.
7. The SUT 4:1 40Gb MUX, does not take up the same amount of slots as an OC-192 circuit pack.
8. The Cisco ONS 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP do not support 100 Gb at this time.
9. The 15454-M2 OTS did not undergo lab testing for an OC-192/STM-64, 10GbE WAN PHY, or 10GbE LAN PHY interfaces. The 15454- M2 does support all of the same cards as the other two chassis, but due to its small form factor, these interfaces were not tested in the lab. The 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP did not undergo lab testing for an OC-768/STM-256 interface. The 15454 MSTP 40Gb single port transponder was not available at the time of testing.
10. The SUT does not support optical multicasting capability.
11. The SUT component 15454-M2 supports OC-768/STM-256 but without ROADM capability.
12. The SUT has a maximum span loss of 38.5 dB. The 15454-M2 chassis does not have the space for a redundant OSC.
13. Each of the SUT components does not support OC-3 IR2, OC-3 LR-3, OC-12 IR2, OC-12 LR3, OC-48 IR2, OC-48 LR3, OC-192 LR1, and OC-192 LR-3 interface.
14. The Cisco ONS 15454 MSTP, 15454-M6 MSTP, and 15454-M2 MSTP do not support DISN-AGF functionality.
15. The SUT was not tested for this requirement, as the Sponsor did not consider this functionality important.
16. The AGF functional device shall support SDH/SONET container gateway functionalities. Cisco 15454 SDH chassis supports SONET to SDH, but does not support SDH to SONET. Cisco supports only 1152 STS-1 of cross connect fabric. The Cisco SDH Chassis does not support native DS1.
17. The Cisco 15454 MSPP supports 1:N APS for electrical interfaces but not optical interfaces.
18. The Cisco 15454 MSPP does not conform to the environment ranges of -40 to +70 degrees C, the Cisco 15454 MSPP can operate within the range of -40 to +65 degrees C.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation
AGF	Access Grooming Function
APS	Automatic Protection Switching
dB	Decibel
C	Celsius
CH	Change
cont	continued
CL	Customer Location
CR	Capabilities Requirement
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction
DLoS	Direct Line of Sight
DISN	Defense Information Systems Network
DS	Digital Signal
EMS	Element Management System
FR	Functional Requirement
G	Gigabit
G.726	ITU-T speech codec for ADPCM (32 Kbps)
G.728	ITU-T speech codec for LD-CELP (16 Kbps)
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)
Gb	Gigabit
GbE	Gigabit Ethernet
ID	Identification
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IR	Intermediate Reach
ITU-T	International Telecommunication Union -Telecommunication
Kbps	Kilobits per second
Km	Kilometer
LAN	Local Area Network
LR-3	Long Reach
LD-CELP	Low Delay-Code Excited Linear Prediction
MA	Metro Access
MSPP	Multi-Service Provisioning Platform
MSTP	Multi-Service Transport Platform
MUX	Multiplexer
NA	Not Applicable
NE	Network Element
NM	Network Management
NMS	Network Management System
OC-X	Optical Carrier - X (OC-3, OC-12, etc.,)
OLA	Optical Line Amplifier
ONS	Optical Network System
OP	Optical Protection
OSC	Optical Supervisory Channel
OTS	Optical Transport System
PHY	Physical Layer
Ref	Reference
ROADM	Reconfigurable Optical Add-Drop Multiplexer
SDH	Synchronous Digital Hierarchy
SONET	Synchronous Optical Transport Network
STM	Synchronous Transport Module
STS	Synchronous Transport Signal
SUT	System Under Test
TDM	Time Division Multiplexing

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 Unclassified-But Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool at http://jit.fhu.disa.mil (NIPRNet). Information related to APL testing is available on the APL Testing and Certification website at http://www.disa.mil/Services/Network-Services/UCCO.

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The Network Elements (NE) and Fixed Network Elements (F-NE) have required and conditional features and capabilities that are established by the Unified Capabilities Requirements (UCR). The System Under Test (SUT) does not need to meet 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.

Table 3-1. NE Capability/Functional Requirements Table

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-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
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
3	The introduction of an NE(s) shall not degrade secure transmission for secure end devices as defined by UCR 2008, Section 5.2.2, DoD Secure Communications Devices.	5.9.2.1 (3)	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
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
6	The NE shall transport all call control signals transparently on an E2E basis.	5.9.2.1 (6)	R
7	[Conditional] The NEs that support a P2N capability shall meet the following additional requirements when deployed in a P2N architectural configuration:	5.9.2.1 (7)	C
7A	The aggregate egress from all NEs in the P2NP architecture must be identical to the aggregate ingress of all NEs in the same P2N architecture. However, if all or part of the P2N is operating in a P2MP mode that is applying multicast from a centrally designated NE to one or more of the associated peripheral NEs, the aggregate of the additional multicast traffic must be accounted for in the egress sum total.	5.9.2.1 (7A)	R
7B	Excluding latency, the P2N AP shall be measured as though it is a P2P architecture at the P2N AP NE endpoints ingress and egress points. As such, the P2N AP must meet all the other stated requirements of a P2P.	5.9.2.1 (7B)	R
7C	For a given P2N AP, the maximum latency allowed E2E, as measured over any 5-minute period at the P2N AP NE ingress and egress points, shall be 5 ms or less, when added in addition to the expected P2P latency. Hence, as an example, if the expected P2P latency requirement for a P2N AP is 50 ms, then P2N AP maximum latency, regardless of the number of NE hops between the ingress and egress NEs, the measured value shall not exceed 55 ms.	5.9.2.1 (7C)	R
8	The NE shall be able to propagate Carrier Group Alarms (CGAs) upon physical loss of the TDM interface. The NE shall provide the capability of detecting a carrier group alarm (CGA). When this alarm is detected, all associated outgoing trunks shall be made busy automatically to subsequent customer call attempts. Call attempts on associated incoming trunks shall not be processed. When possible, the Reverse Make Busy feature shall be exercised on incoming trunks. Voice switching systems using a TDM connection to an 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. The NEs that support IP ingress or 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, so the NE can notify the IP network (e.g., LAN, MAN), using one of these routing protocols, the condition of its link state for transporting ingress IP traffic, namely operational or down.	5.9.2.1.1	R

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
9	The NE shall assure that congestion between paired 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.	5.9.2.1.2	R
9A	The NE shall implement TDM congestion control via one of the following methods: A. A dynamic load control signal (e.g., contact closure) shall be provided to the DSN switch per the following requirements: (1) The NE shall provide the capability to handle Carrier Group Alarm (CGA) indications from the carrier systems/equipment using the E-telemetry interface (scan points) for the TDM interfaces provided (e.g., DS0, DS1, and/or OC-X), and, comply to the Telcordia Technologies GR-303-CORE, System Generic Requirements, Objectives, and Interface, December 2000, Issue 4 and Telcordia Technologies TR-NWT-000057 that specifies the use of an COT generated DC contact closure alarm to indicate an "all-accessible-channels busy" condition.	5.9.2.1.2.1 (1A1)	C
9B	(2) The NE when interfaced to the network that provides an E-telemetry interface type (scan points) for alarm management shall be capable of CGA management that is used to minimize the effects of carrier failures on switching systems and on service. CGA scan point (binary condition, i.e., "closed" contact for active and "opened" for inactive states) when "closed" should busy out the failed circuits, release customers from the failed circuits, and prevent the failed circuits from seizing the DSN trunk equipment and prevent the NE from seizing the failed circuits.	5.9.2.1.2.1 (1A2)	C
9C	(3) The DSN CGA System Operation can be divided into three parts, i.e., detection of the carrier failure, conditioning the failed trunk, and reaction of the switching equipment to the processing of the failure. Requirements for scan point CGA are: (a) Sense Point Interface: The switching system shall provide sense points to which external CGAs can be interfaced to, so that failure of the carrier equipment shall cause the trunks to be removed from service. (b) Call Processing Actions: Receipt of a CGA shall cause call processing to be aborted on associated trunks that are not in the talking state. (c) Trunk Conditioning: Receipt of a CGA shall cause the following actions on the affected trunks: (i) Idle trunks shall be removed from the idle list. Subsequent calls for service must be ignored for the duration of the CGA. Busy-back shall be returned on those incoming trunks, which are optioned for busy-back while in the out-of-service state and proper MLPP treatment shall be applied. (ii) Trunks in the talking state shall be monitored for disconnect, after which they are to be placed in the same state as described above for idle trunks.	5.9.2.1.2.1 (1A3)	C
9D	(4) Restoration of Service: All trunks affected shall be returned to their previous state after the CGA is removed. B. Congestion is not possible in the NE by nature of its functioning (e.g., a TDM multiplexer or transcoder). 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.	5.9.2.1.2.1 (1A4, 1B, 1C)	C
10	2. 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. Time Division Multiplexing 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. b. Time Division Multiplexing 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. c. Time Division Multiplexing 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. d. Time Division Multiplexing 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 (2A, 2B, 2C, 2D)	C

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
11	The NE(s) using IP transport shall implement IP congestion control. Congestion may be controlled by using DiffServ, which shall be capable of providing preferential treatment for call congestion over other media types IAW Section 5.3.3, Network Infrastructure End-to-End Performance 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 or egress requirements shall be met IAW Section 5.9.2.3.9, IP Interface.	5.9.2.1.2.2	C
12	The NE shall implement DLoS congestion control based on the DSN traffic and signaling type to be transported. (Please see Following)	5.9.2.1.2.3	C
13	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). b. Congestion is not possible in the NE so the maximum ingress throughput into the NE is configured so 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.	5.9.2.1.2.3 (1A, 1B, 1C)	C
14	The NE transporting only ingress IP traffic, and using a DLoS transport, excluding 802.11, and/or 802.16 series standards, -shall implement DLoS IP congestion control per Section 5.9.2.1.2.2, For IP Transport. Additionally, IP congestion control may include a standards-based or proprietary protocol between the NEs that will adjust the QoS of the NE based on DLoS transport monitoring feedback to the NE to accommodate for changing environmental link conditions.	5.9.2.1.2.3 (2)	C
15	The NE transporting both TDM and IP ingress traffic simultaneously over the same DLoS transport link shall meet the following requirements: a. [Required] 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 or egress to the NE. Additionally, the congestion control may include a standards-based or proprietary protocol between the NEs that will adjust the QoS of the NE based on DLoS transport monitoring feedback to the NE to accommodate for changing environmental link conditions. b. [Conditional] 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 (3A, 3B)	C
16	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
17	If provided, the NE shall provide for a 2-wire and/or 4-wire analog trunk circuit(s) interface that interfaces using industry standard signaling and facility arrangements per one or more of the following:	5.9.2.3.1	C
18A	1. E&M Trunk Circuits: The NE shall interface with exchange carriers using industry standard E&M signaling. The switching system shall interface with Type I and Type II E&M signaling in accordance with paragraph 9 and subparagraphs of GR-506-CORE. The switching system shall interface with Type V E&M signaling as defined in Paragraphs 6.8.5, 6.8.6, 6.8.7.2, 6.8.8.2, and 6.8.8.3 of Telcordia Technologies Document SR-2275. The DSN switch analog trunk interface shall always originate on the M-lead.	5.9.2.3.1 (1)	C
18B	2. Single Frequency Trunk Circuits: The NE will interface with external switching facility (SF) equipment using a 4-wire E&M trunk circuit, either Type I or II. The DSN in-band signaling equipment utilizing SF will place a 2600 Hz tone on the circuit to indicate the idle state (on-hook) and the tone will be removed from the circuit to indicate the busy state (off-hook). Signaling states will be conveyed via E and M leads (Type I or II) to the telephone equipment terminating the circuit on the equipment side of the interface. The SF trunk interface consists of only the voice path conductors (T, R, T1, R1), but at a point between this transmission facility interface and the switching function the SF signal will be translated back to the two-state dc signals.	5.9.2.3.1 (2)	C

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
18C	3. Dual Frequency Trunk Circuits: The Dual Frequency Signaling Unit (DFSU) equipment used in the DSN operates in much the same way as an SF unit, except that whenever the 2600 Hz tone is removed from the circuit a 2800 Hz tone is applied for a short period (175 ms maximum). The 2800 Hz tone burst will serve as a confirmation tone; the receiving signaling unit will only transition from on-hook to off-hook if the loss of the 2600 Hz tone is followed by the 2800 Hz tone. This prevents false on-hook to off-hook transitions from occurring due to a break in the communications circuit. Like the SF trunk interface, the DF trunk interface will consist of only the voice path conductors (T, R, T1, R1). The NE shall interface an external DFSU using a 4-wire E&M trunk circuit with Type I or II E&M signaling. This connection is on the equipment-side of a DF trunk interface.	5.9.2.3.1 (3)	C
19	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
20	The ISDN BRI interface shall meet the requirements and conditions IAW Section 5.3.2.31.2, National ISDN 1/2 Basic Access.	5.9.2.3.3	C
21	If provided, the NE shall meet the following DS1 (T1) interface requirements and conditions of a PCM-24 Digital Trunk Interface. PCM-24 Digital Trunk Interface: An NE shall provide a PCM-24 channel digital interface with a 1.544 Mbps T1 bit stream configured in either the D3/D4 (Superframe) framing format or the D5 Extended Superframe (ESF) framing format. D5 is also referred to as Extended Frame (EF). The same framing format shall be used in both directions of transmission. Voice signals shall be encoded in the 8-bit μ (255 quantized values) pulse code modulation (PCM) encoding law. Supervisory and dial pulse (DP) signals shall utilize the A and B bits of the D3/D4 format or the A, B, C, and D bits of the D5 format for pre-CCS7 configurations. Voice channel address in-band signaling shall be provided on individual channels. The D5 format shall be the preferred and system "goal" digital framing format and shall be provided in accordance with MIL-STD-187-700. 1. Interface Characteristics: The NE shall use the DS1 24 channel standard interface as specified in ANSI T1.102, "Digital Hierarchy – Electrical Interfaces." Table 5.9.2.3.4-1, PCM-24 Electrical Interface Characteristics, provides the electrical characteristics at the interface. Table 5.9.2.3.4-2 and Table 5.9.2.3.4-3 provide a listing of the framing characteristics. (Please see UCR 2008, Change 2-Pages 1898 thru 1900)	5.9.2.3.4	C
22A	2. Supervisory Channel Associated Signaling: On-hook and off-hook status of each channel is transmitted and derived from the coding of the "A" and "B" signaling bits. Trunk seizure, answer supervision, dial pulse digits (DPs), preemption signals, and all other trunk supervisory information shall be sent and received on a per-channel basis using this scheme. Per-trunk signaling in the DSN switching system shall control the value of the "A" and "B" bits to indicate an on-hook ("A" = 0, "B" = 0) or an off-hook ("A" = 1, "B" = 1) condition. When receiving supervisory status on digital trunks using the PCM-24 format, the DSN switching system shall interpret the combination of the "A" bit = 0 andthe "B" bit = 0 as on-hook, and the combination bit = 1 and "B" bit = 1 as an off-hook indication. When signaling on Voice Frequency (VF) channels using the PCM-24 format, the least significant bit of each channel, every six frames, shall carry signaling information. Utilizing the four-state signaling option of the Superframe (D3) format, frame 6 shall contain the "A" channel signaling information and frame 12 shall contain the "B" channel signaling information. The switching system shall also interpret the combination of "A" bit = 1, "B" bit = 0, with bit position 2 in all 24 channels in the Superframe (D3) format equal to "0" as a channel alarm indication and shall also interpret the combination of "A" bit = 1, "B" bit = 0 as a remote make busy. In the ESF format ANSI defines a sixteen-state signaling option that labels the signaling bits "A" (frame 6), "B" (frame 12), "C" (frame 18), and "D" (frame 24). Because DSN does not require the "C" and "D" signaling channels the four-state option shall be used to allow changes in "A" and "B" signaling states to be transmitted twice as often. Utilizing Frames 6 and 18 in the 24-frame Extended Superframe shall contain the "A" channel signaling information; frames 12 and 24 shall contain the "B" channel signaling information.	5.9.2.3.4 (2)	C

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
22B	3. Clear Channel Capability: The NE shall be capable of transmitting and receiving B8ZS line coding in accordance with MIL-STD-187-700.	5.9.2.3.4 (3)	C
22C	4. Alarm and Restoral Requirements: The NE shall provide the alarm and restoral features on the digital interface unit (DIU) as defined in Table 5.9.2.3.4-4, PCM-24 Alarm and Restoral Requirements. (Please see UCR 2008, Change 2-Page 1901)	5.9.2.3.4 (4)	C
23	If provided, the NE shall meet the following E1 interface requirements and conditions of a PCM-30 Digital Trunk Interface: PCM-30 Digital Trunk Interface: The NE shall provide PCM-30 digital interfaces at a data rate of 2.048 Mbps. The PCM-30 interfaces shall meet the requirements of ITU-T Recommendation G.703 and ITU-T Recommendation G.732. Voice signals in the PCM-30 framing format shall utilize the A-law encoding technique in accordance with ITU-T Recommendation G.772 (REV), "Protected Monitoring Points on Digital Transmission Systems." The pertinent requirements for the PCM-30 interface are summarized in Table 5.9.2.3.5-1, PCM-30 Electrical Interface Characteristics. (Please see UCR 2008, Change 2-Page 1902)	5.9.2.3.5	C
23A	1. Supervisory Channel Associated Signaling: When receiving supervisory status on digital trunks using the PCM-30 format, the DSN switching system shall interpret the combination of the "A" signaling channel bit = 1 and the "B" signaling channel bit = 1 as on-hook, and shall interpret the combination of the "A" signaling channel bit = 0 and the "B" signaling channel bit = 1 as an off-hook indication. The DSN switching system shall also interpret the combination of "A" bit = 1 and "B" bit = 0 as a channel alarm indication and a remote make busy. Bits "C" and "D" are not used in the DSN for signaling or control and therefore shall be set to the values "C" = 0 and "D" =1 in accordance with ITU-T Recommendation G.704.	5.9.2.3.5 (1)	C
23B	2. Alarm and Restoral Requirements: The NE shall provide the alarm and restoral features on the DIU in order to be compatible with PCM-30 facilities and terminal equipment, as shown in Table 5.9.2.3.5-3, PCM-30 Alarm and Restoral Requirements. (Please see UCR 2008, Change 2-Page 1903)	5.9.2.3.5 (2)	C
24	The DS3 interface shall meet the following requirements and conditions. Frame structure shall include M13 framing in accordance with ANSI T1.107-2002.	5.9.2.3.6.1 (1)	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
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
27	The NE shall be able to derive a timing signal from an internal source, an incoming digital signal, or an external source IAW Section 5.3.2.12.14.1.1, Timing Modes (5.3.2.12.14.1.1 Timing Modes): [Required: Media Gateway (MG)] The MGs shall meet the external timing mode requirements specified in the Telcordia Technologies GR-518-CORE, Paragraph 18.1. Most SMEOs and PBX1s will only support line timing 5.3.2.12.14.1.1.1 External Timing Mode - [Required: MG] The MGs shall support external timing modes as defined in Telcordia Technologies TR-NWT-001244. 5.3.2.12.14.1.1.2 Line Timing Mode - [Required: MG] The MGs shall support line timing modes as defined in Telcordia Technologies TR-NW-001244. 5.3.2.12.14.1.1.2 Internal Clock Requirements 5.3.2.12.14.1.1.2.1 General - [Required: MG] The MGs shall provide internal clock requirements as described in the Telcordia Technologies GR-518-CORE, Paragraph 18.2. 5.3.2.12.14.1.1.2.2 Stratum 4 Clock - [Required: MG] The MGs shall provide a stratum 4 or better internal clock. 5.3.2.12.14.1.2 Synchronization Performance Monitoring Criteria - [Required: MG] The MGs shall meet the synchronization performance monitoring criteria as described in Telcordia Technologies GR-518-CORE, Paragraph 18.3	5.9.2.3.7	R
28	The OC-X interface shall be IAW Section 5.5.3.2, Optical Transport System Interface, and/or appropriate SONET commercial standards. (NOTE: X stands for the capacity (e.g., 3, 48, 192 and higher)	5.9.2.3.8	C
29	The NE having an IP interface and using DLoS transport comprised of 802.11 and/or 802.16 series standards shall instead meet the requirements for a WAB contained in Section 5.3.1.7.2, Wireless. All other IP configurations shall meet the following:	5.9.2.3.9	C

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
29A	a. 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 specified as follows: (1) Time Division Multiplexing 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. (2) Time Division Multiplexing 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. (3) Time Division Multiplexing 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. (4) Time Division Multiplexing 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.	5.9.2.3.9	C
29B	b. Jitter. The addition of an NE shall not cause jitter measured from ingress to egress to increase by more than 5 ms averaged over any 5-minute period.	5.9.2.3.9	C
29C	c. Packet Loss. The addition of an NE shall not cause packet loss measured from ingress to egress to increase by more than 0.05 percent averaged over any 5-minute period.	5.9.2.3.9	C
29D	d. [Required: F-NE, D-NE] For VVoIP systems, if the system decrypts the VVoIP traffic and applies a proprietary encryption approach before 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 NOTE: For example, if the NE decrypts the AS-SIP with TLS packets between the NEs and re-encrypts it using NE proprietary encryption methods, then the proprietary method must be one of the cryptographic methods defined in Section 5.4, Information Assurance Requirements, (e.g., IPSec with AES-128 bit encryption, HMAC-SHA1 for integrity, and DoD PKI for authentication). All Section 5.4, Information Assurance Requirements, approved encryption and integrity approaches use FIPS PUB 140-2 cryptographic modules (or have been granted a formal waiver by National Institute of Standards and Technology (NIST)). Importantly, proprietary only refers to the lack of interoperability with a different vendor's NE and all cryptographic approaches used in Section 5.4, Information Assurance Requirements, are standards based.	5.9.2.3.9	R
29E	e. [Required: F-NE, D-NE] The VVoIP systems that use 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	R
29F	2. [Conditional] 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	C
30	The NE devices are to be managed by at least one of the following: A front or back panel and/or external console control capability shall be provided for local management. Remote monitoring and management by the Advanced DSN Integrated Management Support System (ADIMSS) or similar Network Management (NM) systems developed by DoD Components. The following requirements apply: (1) [Required: Data Interface] The NE shall provide network management (NM) data/monitoring via one or more of the following physical interfaces: ** Ethernet/TCP/IP (IEEE 802.3) ** Serial (RS-232)/Asynchronous ** Serial/Synchronous (X.25 and/or BX.25 variant) All data that is collected shall be accessible through these interfaces. For NM purposes, the NE must provide no less than two separate data channels. They may be physically separate (e.g., two distinct physical interface points) or logically separate (e.g., two user sessions through a single Ethernet interface). The data may be sent in ASCII, binary, or hexadecimal data or ASCII text designed for screen/printer display. The data channels shall be used for and, as such, must be capable of providing: ** Alarm/Log Data ** Performance Data (e.g., traffic data)	5.9.2.4.1	R

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

ID	Requirement	UCR Ref (UCR 2008 CH 2)	F-NE
	** NE access (to perform NE data fill administration and network controls) (2) [Required: Fault Management] The DSN telephone switching systems shall detect fault (alarm) conditions and generate alarm notifications. The alarm messages must be sent to the assigned NM Alarm channel in near-real time. No alarm restriction/filtering is necessary. In addition to the data formats in Section 5.3.2.17, Management of Network Appliances, alarms may be sent as Simple Network Management Protocol (SNMP) traps. If this channel is also used to output switch administrative log information, the alarm messages must be distinguishable from an administrative log message (3) [Required: Configuration Management] Requirements for this feature shall be in accordance with Telcordia Technologies GR-472-CORE, Section 4.		
31	The NE shall report any failure of self-test diagnostic function on non-active and active channels on a noninterference basis to the assigned NMS.	5.9.2.4.2	C
32	The NE shall provide loopback capability on each of the trunk-side interfaces IAW ITU-T Recommendation V.54.	5.9.2.4.3	C
33	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
34	The NEs using DLoS transport shall support the following: a. A minimum MOS score as defined in Section 5.9.2.1, General Requirements, performance requirement or better as measured in any 5-minute interval using ITU-T Recommendation P.862 testing standard. b. [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 a, shall hereby be referred to as the NE DLoS transport MTR. 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. 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. The NEs may be tested with attenuation inserted to simulate the actual NE DLoS transport capability from which the maximum MOS performance range MTR can be extrapolated. The value determined shall be included in the APL report. Refer to Section 5.9.2.5.3, Submission of DLoS Transport NEs to UCCO for DSN Connection Request, concerning guidelines on submitting the DLoS transport NE engineering analysis package.	5.9.2.4.5	R
35	The DLoS transport NEs shall be engineered properly so that the DLoS transport transmitting or receiving devices achieve the required performance requirements in their specific deployed environment. The user shall submit a network design and engineering performance analysis with supporting calculations to meet minimum MOS performance with the request for DSN connection. Included is the calculation and data required for determining the MDR, as defined in Section 5.9.2.5.1, DLoS Transport NE Maximum Deployment Range. For certification procedures, the UCCO submittal shall also include wireless security compliancy as identified in Section 5.9.2.6, Security.	5.9.2.5.3	C
36	All components of the NE shall meet security requirements, for each supported mode, as outlined in DoDI 8510.01 and the applicable STIG(s).	5.9.2.6	R
37	1. If a DoD-approved WIDS exists for the DLoS transport technology used, the NE DLoS transport link(s) shall be monitored in according with the appropriate STIG(s).	5.9.2.7	C

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

LEGEND:

ADIMSS	Advanced DSN Integrated Management Support System	ISDN	Integrated Services Data Network
ANSI	American National Standards Institute	ITU	International Telecommunications Union
APL	Approved Product List	ITU-T	ITU Telecommunications Union - Telecommunications Sector
ASLAN	Assured Services LAN	LAN	Local Area Network
BER	Bit Error Rate	MAN	Metropolitan Area Networks
BRI	Basic rate Interface		
C	Conditional		
CE	Customer Edge	MLPP	Multi-Level Precedence and Preemption
CGA	Carrier Group Alarm	MOS	Mean Opinion Score
CH	Change	Ms	Millisecond
D-NE	Deployed-Network Element	NE	Network Element
DAA	Designated Approving Authority	NMS	Network Management System
DISR	DoD Information technology Standards and Profile Registry	NSA	National Security Agency
		PCM	Pulse Code Modulation
DoD	Department of Defense	PRI	Primary rate Interface
DoDI	DoD Instruction	R	Required
DSN	Defense Switched Network	Ref	Reference
DVX	Deployed Voice Exchange	SCIP	Secure Communication Interoperability Protocol
E1	European 1 (2048 bps, 30-channel PCM)	SONET	Synchronous Optical Network
E2E	End to End	STIG	Security Technical implementation Guide
F-NE	Fixed-Network Element	T1	Trunk 1 (1544 bps, 24-channel PCM)
FIPS	Federal Information Processing Standard	TDM	Time Division Multiplexing
IAW	In Accordance With	UCCO	Unified Capabilities Certification Office
ID	Identification	UCR	Unified Capabilities Requirements
IP	Internet Protocol	VVoIP	Voice and Video over Internet Protocol

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The Optical Transport Switch, and Aggregated Grooming Functions have required and conditional features and capabilities that are established by the Unified Capabilities Requirements. The System Under Test need not provide conditional or desired requirements. If they are provided, they must function according to the specified requirements. The detailed Functional requirements and Capability Requirements for Network Elements are listed in Table 3-2. Detailed Information Assurance requirements are included in Reference (e) and are not listed below.

Table 3-2. OTS/AGF Capability/Functional Requirements Table

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
	Optical Transport System (OTS)	**5.5.3.2.2.1**	
1	The OTS family of equipment shall be currently available, commercial-off-the-shelf (COTS) equipment.	5.5.3.2.2.1 (1)	R
2	The OTS shall support a minimum of 80 ITU-T G.694.1 grid wavelengths per line-side optical fiber.	5.5.3.2.2.1 (2)	R
3	The OTS shall support a minimum of 160 ITU-T G.694.1 grid wavelengths per line-side optical fiber	5.5.3.2.2.1 (3)	C
4	The OTS shall support mixed bit rate signals: 2.5 Gbps, 10 Gbps, and 40 Gbps.	5.5.3.2.2.1 (4)	R
5	The OTS shall support mixed bit rate signals: 2.5 Gbps, 10 Gbps, 40 Gbps, and 100 Gbps.	5.5.3.2.2.1 (5)	C
6	The OTS shall utilize the ITU-T specified Optical Supervisory Channel (OSC) for in-band management communication.	5.5.3.2.2.1 (6)	R
7	The OTS shall support all specified wavelengths for all specified bit rate and signal format.	5.5.3.2.2.1 (7)	R
8	The OTS shall support at least SSMF (ITU-T G.652), Enhanced Large Effective Area Fiber, TW-RS, and TW-C (ITU-T G.655).	5.5.3.2.2.1 (8)	R
9	The OTS shall support the ability of 80, 40G wavelengths to traverse a minimum of five ROADM using fibers specified above for a minimum reach of 1,500 km without regeneration (O-E-O conversion) at BER less than 1x 10-15.	5.5.3.2.2.1 (9)	R
10	The OTS shall support the ability of 80, 40G wavelengths to traverse a minimum of five ROADM using fibers specified above for a minimum reach of 1,500 km without regeneration (O-E-O conversion) at BER less than $1x\ 10^{-15}$.	5.5.3.2.2.1 (10)	R
11	The OTS shall support the ability of 80, 100G wavelengths to traverse a minimum of five ROADM using fibers specified above for a minimum reach of 1,200 km without regeneration (O-E-O conversion) at BER less than 1x 10-15.	5.5.3.2.2.1 (11)	R
12	The OTS shall support span length up to 150 km and span loss up to 50 dB. The reach shall not be limited by optical supervisory channel performance.	5.5.3.2.2.1 (12)	R
13	The OTS shall allow the remote configuration of wavelengths added or dropped from the system.	5.5.3.2.2.1 (13)	R
14	Client interfaces available on the OTS shall meet the generally accepted standards or specifications for the interface (e.g., OC-192) Telcordia Technologies GR-253 standards, Synchronous Transport Module (STM)-16 and STM-64 International Telecommunications Union (ITU)-T G.707 standards, and Gigabit Ethernet (GE) and 10 GE IEEE 802.3 standards).	5.5.3.2.2.1 (14)	R
15	The OTS shall support remote shelf location with up to 6 dB optical power budget between terminal and remote locations.	5.5.3.2.2.1 (15)	R
16	The OTS shall support universal (or single part code) MUX/DEMUX circuit-packs at all Terminals and ROADM nodes.	5.5.3.2.2.1 (16)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
17	The OTS T&S requirements are defined in Section 5.5.4.2.3, General DISN NE Requirements, and Section 5.5.4.2.4, Optical Transport System.	5.5.3.2.2.1 (18)	
	Performance Requirements	**5.5.3.2.2.2**	
18	Jitter tolerance shall comply with Telcordia Technologies GR-253 Type II and ITU-T G.958.	5.5.3.2.2.2 (1)	R
19	Jitter transfer shall comply with Telcordia Technologies GR-253 and ITU-T G.958.	5.5.3.2.2.2 (2)	R
20	In a single vendor environment, a wavelength shall traverse up to at least 20 transponders before termination of the signals is required at a terminal site. This shall be true for all data rates specified.	5.5.3.2.2.2 (3)	R
21	The OTS shall tolerate a persistent input channel signal timing deviation of at least +/- 20 parts per million (ppm). This implies that the OTS must (1) operate properly in normal condition (i.e., without alarms) when any or all tributaries have long-term frequency offsets of up to +/- 20 ppm, and (2) maintain the system performance objectives for concatenated OTS systems.	5.5.3.2.2.2 (4)	R
22	When a signal passes through concatenated OTS sections, the output jitter shall not exceed the network interface limits of ITU-T Recommendation G.825.	5.5.3.2.2.2 (5)	R
23	When one or more channel (up to 90 percent) fails or is removed (either instantaneously or sequentially), the remaining channels shall not experience increasing bit errors or loss of operating margin. In addition, when failed channels are restored or new channels are added, the existing channels shall not experience any transient or long-term performance deterioration.	5.5.3.2.2.2 (6)	R
24	The maximum uncompensated PMD the system can tolerate at 40/100 Gbps shall not exceed that tolerated at 10 Gbps.	5.5.3.2.2.2 (7)	R
	Reliability and Quality Assurance	**5.5.3.2.2.2.1**	
25	The OTS equipment shall meet the following quality program requirements, unless specifically overridden or modified by another requirement in this document: • Telcordia Technologies GR-282-CORE • Telcordia Technologies GR-2911-CORE • Telcordia Technologies TR-NWT-000179 • Telcordia Technologies TR-NWT-000418 • Telcordia Technologies SR-NWT-002419	5.5.3.2.2.2.1 (1)	R
26	A list shall be available of country of origin of the critical components as well as final assembly location of the system.	5.5.3.2.2.2.1 (2)	R
27	Each OTS element shall meet requirements addressed in this document and shall have met European Community (EC) or Pacific Host Nation approvals required for foreign countries. Provide information on the countries that currently approve the equipment, including equipment part numbers and other applicable documentation.	5.5.3.2.2.3 (1)	R
28	The vendor shall have a program underway to obtain approvals and permits for connection and operation of the equipment to the public networks in the EC and Pacific areas. A list of counties where such approval has been obtained or where it is actively working toward approval. (Note: this list will change with time.)	5.5.3.2.2.3 (2)	R
29	Each NE shall meet requirements addressed in this section and shall be compliant, at a minimum, without future hardware and/or memory upgrades or replacements.	5.5.3.2.2.3 (3)	R
30	Equipment racks' weight shall be within acceptable standards defined for raised floor application.	5.5.3.2.2.3 (4)	R
31	Equipment racks shall allow cable installation above and below each rack.	5.5.3.2.2.3 (5)	R
32	Each OTS element shall be able to receive all types of cables from the top or bottom of the bay or cabinets. When receiving from the bottom, it shall be able to accommodate a raised floor environment.	5.5.3.2.2.3 (6)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
33	All interbay cabling shall be routed above and below each rack allowing various different cable lengths up to 100 meters. If the equipment cannot support 100 meters, the vendor shall state the maximum cable length supported.	5.5.3.2.2.3 (7)	R
34	Within a OTS element, all intrasystem cabling shall maximize separation of redundant cables and fibers (i.e., working/protection, east/west, timing cables, switch cables).	5.5.3.2.2.3 (8)	R
35	All working signal cables shall be routed on separate physical paths from the protection cables within the system. Between systems, all separations shall be maintained. All intersystem connections shall be able to support a minimum distance of 100 meters.	5.5.3.2.2.3 (9)	R
36	A and B power cables shall have physically diverse routing within the bay or cabinet.	5.5.3.2.2.3 (10)	R
37	Current drain information shall be provided to outline current draws in both normal and worst case voltage scenarios. (The latter information shall also address impacts of failed feeds and temperature where variable speed fans or other factors make such considerations appropriate. When multiple configurations are possible because of card variety, test data on several "generic" configurations shall be provided with a table of power numbers to help the user interpolate the approximate values of other configurations.	5.5.3.2.2.3 (11)	R
38	Each OTS element, shelf, or circuit pack, whichever is the smallest independent load device of the OTS element shall obtain power from two completely independent power units. Furthermore, the return path from the power units shall remain completely independent (Telcordia TechnologiesTR-NWT-000295). If one of the power units fails, an alarm shall be generated and the load shall be carried by the other unit without manual intervention and without interruption of service or functionality. The other power unit shall support the operation of the element, shelf, or circuit pack until the problem with the faulty unit is corrected.	5.5.3.2.2.3 (12)	R
39	All OTS elements shall conform to the spatial and environmental criteria specified in Telcordia Technologies FR 796 and GR-63-CORE.	5.5.3.2.2.3 (13)	R
40	All OTS elements, along with its power distribution panel and all associated or ancillary hardware, shall be capable of being mounted in a standard EIA 310C 23-inch relay rack, 84-inch in height.	5.5.3.2.2.3 (14)	R
41	All OTS elements shall be capable of being operated and maintained with access only to the front of the unit.	5.5.3.2.2.3 (15)	R
42	All OTS elements shall be capable of being mounted in a back-to-back arrangement or directly against a building wall.	5.5.3.2.2.2.3 (16)	R
43	All OTS elements, along with their power distribution panel and all associated or ancillary hardware, shall be capable of being mounted in a standard EIA 310C 23-inch relay rack, 78 inches in height.	5.5.3.2.2.2.3 (17)	R
44	All OTS elements, along with their power distribution panel and all associated or ancillary hardware, shall be capable of being mounted in standard EIA 19-inch relay rack, 78 inches in height.	5.5.3.2.2.2.3 (18)	R
45	All OTS elements, along with their power distribution panel and all associated or ancillary hardware, shall be capable of being mounted in X-Mark/CDT cabinets, part number XSL78-4-1S0002, size 78 inches x 23 inches x 30 inches.	5.5.3.2.2.2.3 (19)	R
46	All OTS elements shall demonstrate an operational availability of all functions and services of 99.9997 percent.	5.5.3.2.2.2.3 (20)	R
47	All OTS elements shall comply with the earthquake, office vibration, and transportation vibration criteria specified in Telcordia Technologies GR-63-CORE, Section 4.4, Earthquake, Office Vibration, and Transportation Vibration.	5.5.3.2.2.2.3 (21)	R
48	All OTS elements shall be fully Network Equipment-Building System (NEBS), Level 3 compliant.	5.5.3.2.2.2.3 (22)	R
49	All OTS elements shall meet the environmental conditions described in Telcordia Technologies GR-63-CORE.	5.5.3.2.2.2.3 (23)	R
50	All OTS elements shall meet the environmental conditions described in European Telecommunications Standards Institute (ETSI) ETSI 300 019.	5.5.3.2.2.2.3 (24)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
51	All OTS elements shall be designed to operate in a communication equipment environment, adjacent to or in the vicinity of others types of equipment that may include digital radio equipment, fiber optic terminal equipment, frequency-division multiplexing (FDM) analog microwave, very high frequency (VHF)/ultra high frequency (UHF) base stations, satellite ground terminals, transfer trip and power line carrier equipment, and telephone signaling equipment.	5.5.3.2.2.2.3 (25)	R
52	All OTS elements shall meet the Electromagnetic Compatibility (EMC)/electromagnetic interference (EMI) requirements defined in Telcordia Technologies GR-1089-CORE.	5.5.3.2.2.2.3 (26)	R
53	All OTS elements shall meet the EMC/EMI requirements defined in Federal Communications Commission (FCC) Part 15 Class A.	5.5.3.2.2.2.3 (27)	R
54	All OTS elements shall meet the EMC/EMI requirements defined in ETSI EN 50082.	5.5.3.2.2.2.3 (28)	R
55	All OTS elements shall meet the EMC/EMI requirements defined in ETSI EN 55022.	5.5.3.2.2.2.3 (29)	R
56	All OTS elements shall meet the EMC/EMI requirements defined in ETSI EN 300-386.	5.5.3.2.2.2.3 (30)	R
57	All OTS elements shall be designed to operate continuously in the following environment ranges without degradation: Temperature: 0 to +50°C; Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.2.2.2.3 (31)	R
58	All OTS elements shall be designed to be fully operational after transportation and/or storage in the following environment ranges: Temperature: -40 to +70°C; Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.2.2.2.3 (32)	R
59	All OTS elements shall be designed to operate continuously in the following environment range without degradation: Altitude: -100 to 15,000 ft above mean sea level (AMSL).	5.5.3.2.2.2.3 (33)	R
60	All OTS elements shall be designed to be fully operational after transportation and/or storage in the following environment range: Transport Altitude: -100 ft to +40,000 ft AMSL.	5.5.3.2.2.2.3 (34)	R
61	All OTS elements shall adhere to NEBS Level 3 compliance standards for acceptable voltage ranges, EMI, and electrostatic discharge (ESD) safety, and shall be operable using standard 48V direct current (dc) power as well as having redundant isolated power input feeds. For certain sites, an alternative alternating current (ac)/dc rectifier may need to be supplied to power the system and shall be able to switch 110/220V with redundant isolated power modules.	5.5.3.2.2.2.3 (35)	R
62	All OTS elements shall be fully operational throughout the battery voltage range of -41.5 to -56 volts direct current (VDC).	5.5.3.2.2.2.3 (36)	R
63	All OTS elements shall not be damaged and recover to normal performance following application of the following maximum transient voltages for the duration's given (nominal voltage 48 VDC): 75 VP-P for 1 msec, 60 VP-P for 500 msec.	5.5.3.2.2.2.3 (37)	R
64	All OTS elements in the transport layer primary operating system interface shall provide the capability for reporting alarms of external equipment and general housekeeping alarms. A minimum of 16 user-defined alarms shall be provided, with the option to expand to 32 user-defined alarm points. Capability shall be provided for a minimum of eight user-defined remote control points for external functions. This capability shall be provided by relays, not Transistor-Transistor Logic	5.5.3.2.2.2.3 (38)	R
65	The OTS shall support having all data cross connects stored locally and redundantly; and automatically restored without user intervention, in the case of failure, within a period of 5 minutes.	5.5.3.2.2.2.3 (39)	R
66	The OTS shall provide the capability to roll back to the previous operational version of software.	5.5.3.2.2.2.3 (40)	R
67	The OTS shall conform to memory administration, and system administration and security standards as documented. (Telcordia Technologies GR-472-CORE and GR-253-CORE (issue 4, December 2005).	5.5.3.2.2.2.3 (41)	R
68	All future software for the OTS shall interoperate with the previous deployed GIG–Bandwidth Expansion (GIG-BE) system operational software version/release.	5.5.3.2.2.2.3 (42)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
69	The OTS shall support software upgrades that directly use or translate the previous version's configuration database.	5.5.3.2.2.2.3 (43)	R
70	The software of the OTS shall be designed and upgraded in a modular fashion so that an entire code does not have to be replaced when a portion is upgraded.	5.5.3.2.2.2.3 (44)	R
71	The OTS shall be designed with an accessible file system to allow for multiple versions of software, logs, and file manipulation or integrity checks to be performed before upgrading or downgrading software and/or firmware.	5.5.3.2.2.2.3 (45)	R
72	All equipment shall have been tested and registered as compliant to the following electrical safety standards: UL-1950, EN60950, and International Electrotechnical Commission (IEC) 60950.	5.5.3.2.2.2.3 (46)	R
	Protection and Restoration	**5.5.3.2.2.4**	
73	The OTS shall support 1+1 wavelength protection and restoration.	5.5.3.2.2.4 (1)	R
74	The "Active" and "Standby" wavelengths shall be diversely routed.	5.5.3.2.2.4 (2)	R
	Optical Amplifier	**5.5.3.2.3**	
75	The system shall support the use of an optical connector for connecting an optical amplifier (OA) to the outside plant fiber; Raman amplifiers may not be directly spliced to the transmission fiber and must be field-replaceable, without the need for special equipment.	5.5.3.2.3 (1)	R
76	The total optical power emitted from the OTS to be coupled into the fiber, shall not exceed the power limit of IEC Class 3B (+27 dBm).	5.5.3.2.3 (2)	R
77	The OTS shall monitor and report on the operation of the Raman pumping lasers including power on, off, optical output power, operating current, and total ORL.	5.5.3.2.3 (3)	R
78	Once detecting the failure of Raman pumping lasers, the OTS shall generate an alarm, but shall not shut off the system.	5.5.3.2.3 (4)	R
79	The Raman pumping lasers shall automatically shut off if a fiber is broken or a connector disconnected in the span pumped by the Raman amplifier.	5.5.3.2.3 (5)	R
80	The OTS shall have an integrated power management algorithm, which invokes power monitoring and adjustment devices to compensate for power variations across the optical wavelengths.	5.5.3.2.3 (6)	R
81	The OLA system shall be able to balance individual wavelengths so that power output levels exhibit less than 0.5 dB variance from the mean output level without remote or direct intervention from a network operator.	5.5.3.2.3 (7)	R
82	When one or more channels fail or are removed, the remaining channels shall not experience increased bit errors or loss of operating margin.	5.5.3.2.3 (8)	R
83	When failed channels are restored or new channels are added, the existing channels shall not experience any transient or long-term performance deterioration.	5.5.3.2.3 (9)	R
84	The power management algorithm shall cause no interruptions in OSC communications at any time.	5.5.3.2.3 (10)	R
85	OSC signals shall experience no increased errors at any time up to EOL, including during wavelength provisioning or line equalization.	5.5.3.2.3 (11)	R
86	Amplifiers shall require less than 1 ms to return all wavelength power output levels to within 1 dB of pre-insertion/drop levels – transient suppression statistics shall be provided for OLA systems.	5.5.3.2.3 (12)	R
87	The OA shall maintain safe (Hazard level 1) system operation in the event of input signal loss or fiber cut.	5.5.3.2.3 (13)	R
88	Chromatic dispersion compensation shall be able to fully compensate a 150 km span for each fiber type, as specified in the fiber requirements section.	5.5.3.2.3 (14)	R
89	Chromatic dispersion compensation shall be provided for different fiber lengths in 10, 20, or 30 km increments, if the technique requires the compensation to be periodically dispersed.	5.5.3.2.3 (15)	R
90	The OTS shall enable pre- and post- dispersion compensation options.	5.5.3.2.3 (16)	R
91	A secured external monitor port is required at each OA. For devices that contain a full-featured internal Optical Spectrum Analyzer (OSA), an external monitor port shall still be required.	5.5.3.2.3 (17)	R
92	Internal OSA functionality shall support 25 GHz ITU grid spacing with minimum 5 percent wavelength accuracy.	5.5.3.2.3 (18)	C
93	Internal OSA functionality shall provide a minimum accuracy of 0.2 dB for each wavelength.	5.5.3.2.3 (19)	R
94	Internal OSAs shall provide sweep times of less than 1 second.	5.5.3.2.3 (20)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
95	Internal OSAs shall provide the ability to display all wavelengths simultaneously.	5.5.3.2.3 (21)	R
96	Internal OSAs shall provide the ability to retrieve data to be stored at a remote storage site.	5.5.3.2.3 (22)	R
97	Internal OSAs shall provide the ability to view various calculated data such as gain tilt, output tilt, gain variation, gain difference, noise level, total received power, total launched power, etc.	5.5.3.2.3 (23)	R
98	Internal OSAs shall provide the ability to report Q factor (not critical).	5.5.3.2.3 (24)	R
99	Internal OSAs shall have the ability to show eye diagrams (not critical).	5.5.3.2.3 (25)	R
100	Internal OSAs shall have the ability to estimate Optical Signal to Noise Ratio (OSNR) for each wavelength.	5.5.3.2.3 (26)	R
101	All measurements made available at the internal OSA shall be available at the external OSA port (not critical).	5.5.3.2.3 (27)	R
	OLA Physical Design Requirements	**5.5.3.2.3.1**	
102	The total optical power emitted from the OTS to be coupled into the fiber, shall not exceed the power limit of IEC Class 3B (+27 dBm).	5.5.3.2.3 (2)	R
103	The OTS shall monitor and report on the operation of the Raman pumping lasers including power on, off, optical output power, operating current, and total ORL.	5.5.3.2.3 (3)	R
104	The OLA shall support hot swappable modular components, including but not limited to fans, amplifier modules, in-band/out-of-band management interfaces, power supplies, and control processor.	5.5.3.2.3.1 (1)	R
105	The OLA shall support redundant Fans Management Interfaces Power Supplies Control Processors	5.5.3.2.3.1 (2)	R
106	The OA shall be able to fit into either a 19" or a 23" rack with depth no greater than 30" and height no more than 84".	5.5.3.2.3.1 (3)	R
107	The OLA overall dimensions shall be no more than one 7.2-foot standard Telco rack for a full 80 wavelengths bi-directionally, or two racks for 160 wavelengths, including out-of-band management functions.	5.5.3.2.3.1 (4)	R
108	The OLA power consumption shall be kept below 2,000 watts for all equipment at an OLA site.	5.5.3.2.3.1 (5)	R
109	The vendor shall identify their OLA power and space requirements for all specified configurations.	5.5.3.2.3.1 (6)	R
	Muxponder Requirements	**5.5.3.2.4**	
110	Transponders shall support a four-to-one muxponder (4-10G signals multiplexed into one 40G signal). If the vendor equipment supports this functionality, the equipment shall meet the requirements listed in this section (3.2.1.3).	5.5.3.2.4 (1)	R
111	The OTS shall support a 4:1 40G multiplexer (MUX). The 4:1 40G MUX shall receive four standards compliant OC-192/STM-64 signals, from one to four sources, and multiplex them onto a signal for transport over a 40G wavelength on the system.	5.5.3.2.4 (2)	R
112	The 4:1 40G MUX shall transmit a 40G channel in each of the operating bands specified by the vendor. The vendor shall indicate any excluded band.	5.5.3.2.4 (3)	R
113	The 4:1 40G MUX shall occupy no more physical space than an OC-192/STM-64 transmit/receive pack.	5.5.3.2.4 (4)	R
114	The 4:1 40G MUX shall transfer the OC-192/STM-64 signals through the system transparently.	5.5.3.2.4 (5)	R
115	The engineering rules for the 4:1 40G MUX configuration shall be the same as the standard OC-768/STM-256 configuration without the need to change any system components, including dispersion compensation.	5.5.3.2.4 (6)	R
116	The OC-192/STM-64 interface (i.e. SR, etc.) for a 4:1 40G MUX shall have identical compliance to all of the requirements for an OC-192/STM-64 interface to an OC-192/STM-64 standard transponder as specified in this document.	5.5.3.2.4 (7)	R
117	An OC-48/STM-64 through the OTS that is multiplexed and demultiplexed through the 4:1 10G MUX shall meet the same performance requirements as an OC-192/STM-64 signal through the OTS using OC-192/STM-64 transponders. Performance requirements include, but are not limited to BER, Errored Seconds (ES), Severely Errored Seconds (SES), and Availability.	5.5.3.2.4 (8)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
118	An OC-192/STM-64 through multiple concatenated systems containing 4:1 10G MUX shall meet the same performance requirements as an OC-192/STM-64 signal through concatenated OTSs using OC-192/STM-64 transponders. The same number of concatenated 4:1 10G MUX shall be supported as the number of concatenated OC-192/STM-64 transponders. Performance requirements include, but are not limited to Jitter Generation and Tolerance.	5.5.3.2.4 (9)	R
119	The maximum number of 40G channels equipped with 4:1 40G MUX in an OTS must be equal to the maximum number of OC-768/STM-256 channels supported in an OTS.	5.5.3.2.4 (10)	R
120	The 4:1 10G MUX shall operate without degradation if less than four of the OC-192/STM-64s have a valid OC-192/STM-64 signal.	5.5.3.2.4 (11)	R
121	The loss of one or more provisioned OC-192/STM-64 inputs to a 4:1 10G MUX shall not affect the performance of any other provisioned OC-192/STM-64 on that multiplexed channel.	5.5.3.2.4 (12)	R
	Transponder Requirements	**5.5.3.2.5**	
122	Transponders shall comply with the DWDM wavelength grid as specified in ITU-T G.694.1.	5.5.3.2.5 (1)	R
123	Transponders shall support tunable lasers, which are tunable over whole band.	5.5.3.2.5 (2)	R
124	All transponders shall support built-in self BER test function	5.5.3.2.5 (3)	R
125	All transponders shall support local and remote loop-back capability on the line side for built-in self-BER test.	5.5.3.2.5 (4)	R
126	All transponders shall support total end-to-end (E2E) signal propagation delay (at transponder ingress to egress) reporting function.	5.5.3.2.5 (5)	C
127	All transponders shall support User selectable line side FEC (Forward Error Correction), i.e., no FEC, ITU-T G.709 compliant standard FEC, and enhanced FEC SFEC or EFEC modes.	5.5.3.2.5 (6)	R
128	Transponders shall support ITU-T G.709 specifications for OTN services.	5.5.3.2.5 (7)	R
129	Transponders shall support switching of framing protocols (OTN, SONET, 10GBE, etc.) without requiring downloading or switching firmware/software and physical removal of the transponder from the slot.	5.5.3.2.5 (8)	R
130	Transponders shall have non-intrusive SONET/SDH B1 monitoring capability	5.5.3.2.5 (9)	R
131	Transponder shall have integrated EDC (Electronic Dispersion Compensation) for all specified fiber types to support minimum un-regenerated reach of 2000 kms.	5.5.3.2.5 (10)	C
132	The vendor shall supply through-transponder(s) to eliminate unnecessary O/E conversions for wavelength regeneration at ROADM, OXC, and regenerator sites.	5.5.3.2.5 (11)	R
133	The vendor shall provide a transponder to interface with 10/40/100Gbps unframed wavelength services.	5.5.3.2.5 (12)	R
134	A transponder shelf shall support all types of transponders, or a combination of them. No slot shall be bit-rate specific.	5.5.3.2.5 (13)	R
135	There shall be no human (manual) tuning or intervention (such as power or wavelength adjustment) involved after adding transponders.	5.5.3.2.5 (14)	R
136	A transponder shall support all wavelengths and required transmission rates with a minimum reach of 2000 kilometers without O-E-O regeneration on all specified fiber types (e.g., ITU-T G.652, G.655).	5.5.3.2.5 (15)	R
	Interface Requirements	**5.5.3.2.5.1**	
137	Transponders shall support an OC-48/STM-16 interface.	5.5.3.2.5.1 (1)	R
138	Transponders shall support an OC- 192/STM64 interface.	5.5.3.2.5.1 (2)	R
139	Transponders shall support a GigE interface.	5.5.3.2.5.1 (3)	R
140	Transponders shall support a 10GigE WAN PHY interface.	5.5.3.2.5.1 (4)	R
141	Transponders shall support a 10GigE LAN PHY interface.	5.5.3.2.5.1 (5)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
142	The transponders shall support OC- 768/STM256 interfaces.	5.5.3.2.5.1 (6)	R
143	The transponder shall support all OTN rates including ODU1/ODU2/ODU3 and 100Gbs in future.	5.5.3.2.5.1 (7)	R
144	The transponders shall support Short Reach (SR), Long Reach (LR-1, LR-2, LR-3), and Intermediate Reach (IR-1, IR-2), client interface types per Telcordia Technologies GR-253-CORE.	5.5.3.2.5.1 (8)	R
145	The transponders shall support client interfaces at 1310 and 1550 nm.	5.5.3.2.5.1 (9)	R
146	The transponders shall support client interface at 850 and 1310 nm for GigE signals.	5.5.3.2.5.1 (10)	R
	ROADM	**5.5.3.2.6**	
147	The ROADM shall be capable of supporting a minimum of eight network-side interfaces, perform both optical bypass, and add/drop functions.	5.5.3.2.6 (1)	R
148	The ROADM shall support direction-less wavelength routing.	5.5.3.2.6 (2)	R
149	The ROADM shall be capable of colorless wavelength routing.	5.5.3.2.6 (3)	R
150	The system shall support cascading of minimum eight ROADMs for a total un-regenerated reach of 2000 kms.	5.5.3.2.6 (4)	R
151	Any wavelength not explicitly dropped or added shall be passed through the ROADM.	5.5.3.2.6 (5)	R
152	It shall be possible to reuse wavelength at ROADM.	5.5.3.2.6 (6)	R
153	There shall be no restrictions on ADD/DROP and EXPRESS (pass through) wavelengths at ROADM site.	5.5.3.2.6 (7)	R
154	It shall be possible to add/drop, or pass express, any of the optical channels at an ROADM site in any order.	5.5.3.2.6 (8)	R
155	If a wavelength is dropped at an ROADM site, then the same wavelength shall be able to be added at that site. However, there shall be no requirement that the wavelength that is dropped must be matched by a corresponding wavelength that is added, and vice versa, implying wavelength translation capability at the ROADM. At a ROADM it shall be possible to drop an incoming wavelength and not add a new corresponding outgoing wavelength including the following: a. Accepting a non-provisioned incoming wavelength and adding a new outgoing wavelength. b. Dropping an incoming wavelength and adding a new corresponding outgoing wavelength	5.5.3.2.6 (9)	R
156	The ROADM shall be capable of supporting dynamic wavelength selection without pre-cabling being required.	5.5.3.2.6 (10)	R
157	The ROADM shall be capable of dropping all wavelengths from each of eight line-side fiber connections to tributary side optics.	5.5.3.2.6 (11)	R
158	The ROADM shall be capable of adding all wavelengths to each of eight line-side fiber connections from tributary side optics	5.5.3.2.6 (12)	R
159	The ROADM shall be capable of dropping any specific wavelength, independent of other wavelengths to be dropped.	5.5.3.2.6 (13)	R
160	The ROADM shall be capable of adding any specific wavelength, independent of other wavelengths to be added.	5.5.3.2.6 (14)	R
161	The ROADM shall support wavelength hair-pinning capability.	5.5.3.2.6 (15)	R
162	The ROADM shall support wavelength regeneration, including wavelength conversion, using back-to-back transponders or through-transponders via hair pinning.	5.5.3.2.6 (16)	R
163	The activation of additional services on interfaces in the ROADM shall be non-service affecting to existing traffic and shall not cause any increase in bit-errors.	5.5.3.2.6 (17)	R
164	The deletion of active services on interfaces in the ROADM shall be non-service affecting to the remaining traffic and shall not cause any increase in bit-errors.	5.5.3.2.6 (18)	R
165	Hardware upgrades of the ROADM to support higher tributary interface density shall not disrupt operational traffic.	5.5.3.2.6 (19)	R
166	Hardware upgrades of the ROADM to support higher line interface density shall not disrupt operational traffic.	5.5.3.2.6 (20)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
167	The ROADM shall provide latching capability. (Latching is the ability of the ROADM to maintain its current state in the event of power failure.)	5.5.3.2.6 (21)	R
168	The ROADM shall provide optical multicasting capability. (Multicasting is the ROADM's ability to allow one input wavelength to be duplicated on multiple outputs tributary and line ports).	5.5.3.2.6 (22)	R
169	The ROADM shall support dynamic per-wavelength power leveling.	5.5.3.2.6 (23)	R
170	The addition or deletion of a wavelength service on the ROADM shall not cause an increase in BER or data loss on other wavelengths.	5.5.3.2.6 (24)	R
171	The ROADM shall not incur increased bit errors associated with wavelength provisioning or line equalization.	5.5.3.2.6 (25)	R
172	The failure of an upstream line system shall not cause the ROADM to increase in BER or lose data on the remaining active wavelengths.	5.5.3.2.6 (26)	R
173	The OSNR (optical signal to noise ratio) penalty for any signal passing thru a ROADM shall be < 0.5 dB.	5.5.3.2.6 (27)	R
174	The system is required to automatically redirect working paths to available spare fibers/wavelengths in the event of a primary path failure. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (28)	R
175	The ROADM shall support 1+1 protection functionality with fully diverse routing. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (29)	R
176	The switching time for 1+1 protection shall be ≤ 50 ms. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (30)	R
177	The switching time for 1+1 protection shall be ≤ 20 ms. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (31)	R
178	The ROADM shall support redirection of light paths via the EMS/NMS.	5.5.3.2.6 (32)	R
179	The ROADM shall support linear protection topologies. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (33)	R
180	The ROADM shall support ring protection topologies. The ROADM shall not inhibit ring or linear protection switching initiated by ODXC, MSPP or other electronic device.	5.5.3.2.6 (34)	R
	ROADM Specific Physical Design Requirements	**5.5.3.2.6.1**	
181	The vendor shall comply with all requirements listed in General Physical Requirements of this document. The vendor shall list all discrepancies.	5.5.3.2.6.1 (1)	R
182	The ROADM shall support hot swappable modular components, including but not limited to: Fans Switch Fabric Interface Ports Power Supplies Control Processor.	5.5.3.2.6.1 (2)	R
183	The ROADM shall support redundant: Fans Switching Fabrics Power Supplies Control Processors.	5.5.3.2.6.1 (3)	R
184	The ROADM equipment shall be able to fit in either a 19" or a 23" rack with depth no greater than 32" and height no more than 84".	5.5.3.2.6.1 (4)	R
185	The fully configured ROADM (excluding the transponder shelves) shall not exceed two full 84" racks.	5.5.3.2.6.1 (5)	R
186	The fully configured ROADM shall not exceed one full 84" rack.	5.5.3.2.6.1 (6)	R
187	The ROADM shall not require contiguous rack locations.	5.5.3.2.6.1 (7)	R
188	The ROADM weight shall be such that the device can be mountable in a standard Telco™ rack or secure cabinet with standard rack screws and not require unusual hardware.	5.5.3.2.6.1 (8)	R
	Requirements Common to Transponder and ROADM	**5.5.3.2.7**	
	Framed Formats	**5.5.3.2.7.1**	

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
189	The OTS shall support the transport of the following SONET/SDH services: OC-192/STM-64, OC-48/STM-16, and OC-768/STM256.	5.5.3.2.7.1 (1)	R
190	The OTS shall support the transport of the following Ethernet services: GigE (via 10:1 Muxponder), 10GigE WAN PHY, and 10GigE LAN PHY.	5.5.3.2.7.1 (2)	R
191	The OTS shall support the transport of the following OTN services: OTU-1, OTU-2, and OTU-3.	5.5.3.2.7.1 (3)	C
192	The OTS shall be transparent to the bit pattern of all optical channels (i.e., the OTS shall not modify the payload bit pattern of any signal that traverses it).	5.5.3.2.7.1 (4)	R
193	Framed wavelength services shall be supported for 2.5, 10, and 40 Gbps SONET/SDH and OTN transport (ITU-T G.709).	5.5.3.2.7.1 (5)	R
194	Framed wavelength services shall be supported for GigE/10 GigE signals, and signals formatted for OTN transport (ITU-T G.709).	5.5.3.2.7.1 (6)	R
195	Framed wavelength services shall be supported for 40 (ITU-T G.709) and 100 Gbps (STD TBD) signals.	5.5.3.2.7.1 (7)	R
196	The OTS shall support, in hardware and in software, the possibility to feed a specified ITU-T grid wavelength, with undefined framing, directly into the multiplexer through a “colored interface” that shall verify the wavelength and power levels (commonly known as ALIEN wavelength). Identify other characteristics of the tributary signal required to be known and monitored for proper OTS system operation with such tributary signals.	5.5.3.2.7.1 (8)	R
197	Alien wavelength” regeneration shall be supported.	5.5.3.2.7.1 (9	R
	Unframed Formats	**5.5.3.2.7.2**	
198	The OTS shall support unframed wavelength services.	5.5.3.2.7.2 (1)	R
199	The OTS shall support mixed framed service unframed wavelength service	5.5.3.2.7.2 (2)	R
	Optical Supervisory Channel	**5.5.3.2.8**	
200	The OLA, ROADM, end terminal (ET) elements shall terminate/insert an Optical Supervisory Channel (OSC) with a wavelength that adheres to ITU-T specifications.	5.5.3.2.8 (1)	R
201	The OLA, ROADM, and ET elements shall utilize the ITU-T specified OSC for out-of-band management communications.	5.5.3.2.8 (2)	R
202	The OLA, ROADM, and ET elements shall use the same OSC wavelength.	5.5.3.2.8 (3)	R
203	The internal diagnostics for OLA, ROADM, and ET elements shall report OSC failure.	5.5.3.2.8 (4)	R
204	It shall be possible to turn-up and sustain transmission between two nodes in the absence of an OSC.	5.5.3.2.8 (5)	R
205	The OLA, ROADM, and ET elements shall report any OSC channel input/output failure (via out-of-band DCN).	5.5.3.2.8 (6)	R
206	The OLA, ROADM, and ET elements shall report any OSC channel BER threshold violation.	5.5.3.2.8 (7)	R
207	The OLA, ROADM, and ET elements shall provide OSC interfaces that allow for interoperability with all adjacent equipment within the optical network (wavelength, modulation, protocol, etc) from the same vendor.	5.5.3.2.8 (8)	R
208	The OSC shall be able to operate error-free across 150 km of each specified fiber type with a span loss of 50 dB at the OSC frequency/wavelength. The span loss shall not be inclusive of the OSC insertion loss.	5.5.3.2.8 (9)	R
209	The OSC circuit-pack shall report optical span-loss between two adjacent nodes.	5.5.3.2.8 (10)	R
210	The OSC shall operate at 2 Mb/s or higher data rates.	5.5.3.2.8 (11)	R
211	Architecturally, the OSC shall be passively and optically separated from the transport optical signals immediately after input connection of the OTS.	5.5.3.2.8 (12)	R
	OTS Standards Compliance Requirements	**5.5.3.2.9**	
212	ITU-T G.652, “Characteristics of a single-mode optical fiber and cable.”	5.5.3.2.9 (1)	R
213	ITU-T G.655, “Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable.”	5.5.3.2.9 (2)	R
214	ITU-T 694.1, “Spectral grids for WDM applications: DWDM frequency grid.”	5.5.3.2.9 (3)	R
215	ITU-T G.709/Y.1331, “Network node interface for the optical transport network (OTN).”	5.5.3.2.9 (4)	R
216	ITU-T G.958, “Digital line systems based on the synchronous digital hierarchy for use on optical fiber cables.” [Withdrawn]	5.5.3.2.9 (5)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
217	ITU-T G.8251 (G.otnjit), "The control of jitter and wander within the optical transport network (OTN)."	5.5.3.2.9 (6)	R
218	Telcordia Technologies GR-63-CORE, Network Equipment-Building System (NEBS™) Generic Equipment Requirements.	5.5.3.2.9 (7)	R
219	Telcordia Technologies TR-NWT-000179, Quality Systems Generic Requirements for Software.	5.5.3.2.9 (8)	R
220	Telcordia Technologies GR-253-CORE, Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria.	5.5.3.2.9 (9)	R
221	Telcordia Technologies GR-282-CORE, Software Reliability and Quality Acceptance Criteria (SRQAC).	5.5.3.2.9 (10)	R
222	Telcordia Technologies TR-NWT-000295, Isolated Ground Planes: Definition and Application to Telephone Central Offices.	5.5.3.2.9 (11)	R
223	Telcordia Technologies NWT-000418, Reliability Assurance for Fiber Optic Systems.	5.5.3.2.9 (12)	R
224	Telcordia Technologies GR-472-CORE, Network Element Configuration Management.	5.5.3.2.9 (13)	R
225	Telcordia Technologies FR-796, Reliability and Quality Generic Requirements (RQGR).	5.5.3.2.9 (14)	R
226	Telcordia Technologies GR-1089-CORE, Electromagnetic Compatibility, and Electrical Safety - Generic Criteria for Network Telecommunications Equipment.	5.5.3.2.9 (15)	R
227	Telcordia Technologies SR-NWT-002419, Software Architecture Review Checklists.	5.5.3.2.9 (16)	R
228	Telcordia Technologies GR-2911-CORE, Software Inventory for Network Element Software Management.	5.5.3.2.9 (17)	R
229	ETSI ETS 300 019, "Equipment Engineering (EE); Environmental Conditions and Environmental Tests for Telecommunications Equipment."	5.5.3.2.9 (18)	R
230	ETSI ETS EN 50022, "Specification for low voltage switchgear and control gear for industrial use."	5.5.3.2.9 (19)	R
231	ETSI EN 50082, "Electromagnetic compatibility. Generic immunity standard. Residential, commercial and light industry."	5.5.3.2.9 (20)	R
232	ETSI EN 300 386, "Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; Electromagnetic Compatibility (EMC) requirements."	5.5.3.2.9 (21)	R
233	BS EN 60950-1 Information Technology Equipment – Safety – Part 1: General Requirements.	5.5.3.2.9 (22)	R
234	IEC 60950-1 Information Technology Equipment – Safety – Part 1: General Requirements.	5.5.3.2.9 (23)	R
235	CFR FCC Part 15, Class A.	5.5.3.2.9 (24)	R
236	NEBS, Level 3.	5.5.3.2.9 (25)	R
237	Underwriters Laboratories, Inc. UL-1950, Standard for Safety, Information Technology Equipment Including Electrical Business Equipment.	5.5.3.2.9 (26)	R
238	EIA 310C, 19-inch rack mounting equipment specification.	5.5.3.2.9 (27)	R
	Access Grooming Function (AGF)	**5.5.3.4**	
	AGF Functional Device SONET Interface Requirements	5.5.3.4.2	
239	The OC-3/OC-3c optical interface shall conform to the standard SONET rates and formats documented in ANSI T1.105.	5.5.3.4.2 (1)	R
240	The OC-3/OC-3c optical interface shall conform to optical parameters for application category SR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (2)	R
241	The OC-3/OC-3c optical interface shall conform to optical parameters for application category IR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (3)	R
242	The OC-3/OC-3c optical interface shall conform to optical parameters for application category IR-2 per Telcordia Technologies, GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2(4)	R
243	The OC-3/OC-3c optical interface shall conform to optical parameters for application category LR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (5)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
244	The OC-3/OC-3c optical interface shall conform to optical parameters for application category LR-2 per Telcordia Technologies GR-253-CORE, Section 4.1 and 4.2 and Tables 4-1 through 4-11.	5.5.3.4.2 (6)	R
245	The OC-3/OC-3c optical interface shall conform to optical parameters for application category LR-3 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (7)	R
246	The OC-3/OC-3c interfaces shall be capable of having a multi-mode fiber (MMF) interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651 and ANSI 105.06-2002.	5.5.3.4.2 (8)	D
247	The OC-3/OC-3c interfaces shall be capable of using Single Mode Fiber (SMF) as described in ITU-T Recommendation G.652 and ANSI 105.06-2002.	5.5.3.4.2 (9)	R
248	The OC-12/OC-12c optical interface shall conform to the standard SONET rates and formats documented in ANSI T1.105.	5.5.3.4.2 (10)	R
249	The OC-12/OC-12c optical interface shall conform to optical parameters for application category SR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (11)	R
250	The OC-12/OC-12c optical interface shall conform to optical parameters for application category IR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (12)	R
251	The OC-12/OC-12c optical interface shall conform to optical parameters for application category IR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (13)	R
252	The OC-12/OC-12c optical interface shall conform to optical parameters for application category LR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (14)	R
253	The OC-12/OC-12c optical interface shall conform to optical parameters for application category LR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (15)	R
254	The OC-12/OC-12c optical interface shall conform to optical parameters for application category LR-3 per Telcordia Technologies GR-253-CORE Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (16)	R
255	The OC-12/OC-12c interfaces shall be capable of having an MMF interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651 and ANSI 105.06-2002.	5.5.3.4.2 (17)	D
256	The OC-12/OC-12c interfaces shall be capable of using SMF as described in ITU-T Recommendation G.652 and ANSI 105.06-2002.	5.5.3.4.2 (18)	R
257	The OC-48/OC-48c optical interface shall conform to the standard SONET rates and formats documented in ANSI T1.105.	5.5.3.4.2 (19)	R
258	The OC-48/OC-48c optical interface shall conform to optical parameters for application category SR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (20)	R
259	The OC-48/OC-48c optical interface shall conform to optical parameters for application category IR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (21)	R
260	The OC-48/OC-48c optical interface shall conform to optical parameters for application category IR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (22)	R
261	The OC-48/OC-48c optical interface shall conform to optical parameters for application category LR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (23)	R
262	The OC-48/OC-48c optical interface shall conform to optical parameters for application category LR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (24)	R
263	The OC-48/OC-48c optical interface shall conform to optical parameters for application category LR-3 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (25)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
264	Software programmable SFP that supports OC-3/OC-12 optical interface shall conform to optical parameters for application category per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (26)	D
265	Programmable SFP that supports OC-3/OC-3c and OC-12/OC-12c optical interfaces shall be capable of having an MMF interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651 and ANSI 105.06-2002.	5.5.3.4.2 (27)	D
266	Software programmable SFP that supports OC-3/OC-12/OC-48 and OC-3c/OC12c/OC-48c optical interface shall conform to optical parameters for application category per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (28)	D
267	The OC-192 optical interface shall conform to the standard SONET rates and formats documented in ANSI T1.105.	5.5.3.4.2 (29)	R
268	The OC-192 optical interface shall conform to optical parameters for application category SR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (30)	R
269	The OC-192 optical interface shall conform to optical parameters for application category IR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (31)	R
270	The OC-192 optical interface shall conform to optical parameters for application category IR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (32)	R
271	The OC-192 optical interface shall conform to optical parameters for application category LR-1 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (33)	R
272	The OC-192 optical interface shall conform to optical parameters for application category LR-2 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (34)	R
273	The OC-192 optical interface shall conform to optical parameters for application category lR-3 per Telcordia Technologies GR-253-CORE, Sections 4.1 and 4.2, and Tables 4-1 through 4-11.	5.5.3.4.2 (35)	R
274	The OC-768 optical interface shall conform to the standard SONET rates and formats documented in ANSI T1.105.	5.5.3.4.2 (36)	D
275	All SONET OC-N interfaces shall be software-provision to SDH STM-N.	5.5.3.4.2 (37)	D
276	The software has to provide options for the OC-3 through OC-48 optical interfaces and the upgrade capability to the next higher optical rate by changing cards unless the optics is software programmable. If the optics is software programmable, then this capability must be allowed by changing the software setting to the next higher rate. Both procedures must preserve the customer data provisioned on the optical interface andmove to the equivalent bandwidth slot starting at the beginning STS. Example: OC-3 upgrade to OC-12, OC-12 to OC-48, and OC-48 to OC-192. Customer provisioned on OC-3 (STS-1 through 3) will occupy STS-1 through 3 on the OC-12 after the upgrade is completed.	5.5.3.4.2 (38)	D
277	**AGF Functional Device SDH Interface Requirements**	5.5.3.4.3	R
278	The STM-1/STM-1c optical interface shall conform to optical parameters for application code I-1 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (1)	R
279	The STM-1/STM-1c optical interface shall conform to optical parameters for application code S-1.1 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (2)	R
280	The STM-1/STM-1c optical interface shall conform to optical parameters for application code S-1.2 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (3)	R
281	The STM-1/STM-1c optical interface shall conform to optical parameters for application code L-1.1 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (4)	R
282	The STM-1/STM-1c optical interface shall conform to optical parameters for application code L-1.2 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (5)	R
283	The STM-1/STM-1c optical interface shall conform to optical parameters for application code L-1.3 per ITU–T Recommendation G.957, Table 2.	5.5.3.4.3 (6)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
284	The STM-1 interfaces shall be capable of having an MMF interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651.	5.5.3.4.3 (7)	D
285	The STM-1/STM-1c interfaces shall be capable of using SMF as described in ITU-T Recommendation G.652.	5.5.3.4.3 (8)	R
286	The STM-4/STM-4c optical interface shall conform to optical parameters for application code I-4 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (9)	R
287	The STM-4/STM-4c optical interface shall conform to optical parameters for application code S-4.1 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (10)	R
288	The STM-4/STM-4c optical interface shall conform to optical parameters for application code S-4.2 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (11)	R
289	The STM-4/STM-4c optical interface shall conform to optical parameters for application code L-4.1 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (12)	R
290	The STM-4/STM-4c optical interface shall conform to optical parameters for application code L-4.2 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (13)	R
291	The STM-4/STM-4c optical interface shall conform to optical parameters for application code L-4.3 per ITU–T Recommendation G.957, Table 3.	5.5.3.4.3 (14)	R
292	The STM-4/STM-4c interfaces shall be capable of having an MMF interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651.	5.5.3.4.3 (15)	D
293	The STM-4/STM-4c interfaces shall be capable of using SMF as described in ITU-T Recommendation G.652.	5.5.3.4.3 (16)	R
294	The STM-16/STM-16c optical interface shall conform to optical parameters for application code I-16 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.3 (17)	D
295	The STM-16/STM-16c optical interface shall conform to optical parameters for application code S-16.1 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.3 (18)	R
296	The STM-16/STM-16c optical interface shall conform to optical parameters for application code S-16.2 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.3 (19)	R
297	The STM-16/STM-16c optical interface shall conform to optical parameters for application code L-16.1 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.3 (20)	R
298	The STM-16/STM-16c optical interface shall conform to optical parameters for application code L-16.2 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.3 (21)	R
299	The STM-16/STM-16c optical interface shall conform to optical parameters for application code L-16.3 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.2 (22)	R
300	Software programmable SFP that supports STM-1/STM-4 and STM-1c/STM-4c Optical interface shall conform to optical parameters for application Code L-16.2 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.2 (23)	D
301	Programmable SFP that supports STM-1/STM-4 optical interfaces shall be capable of having an MMF interface option for both transmit and receive using MMF as described in ITU-T Recommendation G.651.	5.5.3.4.2 (24)	D
302	Software programmable SFP that supports STM-1/STM-4/STM-16 optical interface shall conform to optical parameters for application code L-16.2 per ITU-T Recommendation G.957, Table 4.	5.5.3.4.2 (25)	D
303	The STM-64 Optical interface shall conform to ITU-T Recommendation G.691 optical interfaces for Single-Channel STM-64 systems.	5.5.3.4.2 (26)	R
304	The STM-64 Optical interface shall conform to ITU-T Recommendation G.691.	5.5.3.4.2 (27)	D
305	The software has to provide options from the STM-1 through STM-16 optical interfaces and the upgrade capability to the next higher optical rate by changing cards unless the optics is software programmable. If the optics is software programmable, then this capability must be allowed by changing the software setting to the next higher rate. Both procedures must preserve the customer data provisioned on the optical interface and move to the equivalent bandwidth slot starting at the beginning STM. Example: STM-1 upgrade to STM-4, STM-4 to STM-16, and STM-16 to STM-64. Customer provisioned on STM-1 (VC3-1 through VC3-3) will occupy STM-1 VC3-1 through 3 on the STM-4 after the upgrade is completed.	5.5.3.4.2 (28)	R
306	The AGF functional device shall be able to provision, monitor, and detect faults, and restore optical services in a standardized and automated fashion.	5.5.3.4.2 (29)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
307	**AGF Functional Device Lambda Interface Requirements**	5.5.3.4.3.1	
308	The AGF functional device shall support STS-1 (EC-1) electrical interfaces that comply with specifications and pulse masks as defined in Telcordia Technologies GR-253-CORE, Chapter 4.4 and ANSI T1.102.	5.5.3.4.3.1 (1)	C
309	The AGF functional device shall support DS1 electrical interfaces that comply with ANSI T1.102.	5.5.3.4.3.1 (2)	R
310	**AGF Functional Device Electrical Interface Requirements**	*5.5.3.4.4*	
311	The AGF functional device shall support DS1 pseudowire transport via gateway SFPs.	5.5.3.4.4 (1)	C
312	The AGF functional device shall support DS1 electrical interfaces that comply with ANSI T1.102.	5.5.3.4.4 (2)	R
313	The AGF functional device shall support DS1 pseudowire transport via gateway SFPs.	5.5.3.4.4 (3)	D
314	The AGF functional device shall support channelized and unchannelized DS1 Superframe (SF) format and Extended Superframe (ESF) format as specified in ANSI T1.403. The ability to read or write the ESF data link is required. The selection of format for any particular DS1 interface shall be user-selectable.	5.5.3.4.4 (4)	R
315	The AGF functional device shall support Alternate Mark Inversion (AMI) and Bipolar with Eight-Zero Substitution (B8ZS) line coding formats and unframed, D4, SF, and ESF framing format as specified in ANSI T1.403. The selection of framing format for any particular DS1 interface shall be user-selectable	5.5.3.4.4 (5)	R
316	The AGF functional device shall support both in-band and out-band Facility Data Link (FDL) loop-up and loop-down codes as specified in ANSI T1.403.	5.5.3.4.4 (6)	R
317	The AGF functional device shall support FDL status messages and respond as specified in ANSI T1.403.	5.5.3.4.4 (7)	R
318	The AGF functional device shall support unframed DS1 electrical signals.	5.5.3.4.4 (8)	R
319	The electrical interface shall comply with ITU-T Recommendation G.703.	5.5.3.4.4 (9)	R
320	The AGF functional device shall support DS1 bit rate of 1.544 Mbps +/- 32 ppm as specified in ANSI T1.101.	5.5.3.4.4 (10)	R
321	The AGF functional device shall support DS1 100 ohms cable with maximum length of 655 feet as specified in ITU-T Recommendation G.703.	5.5.3.4.4 (11)	R
322	The AGF functional device shall support E1 electrical interfaces shall comply with ITU-T Recommendation G.711.	5.5.3.4.4 (12)	R
323	The AGF functional device shall support both channelized and unchannelized E1 as specified in ITU-T Recommendation G.711.	5.5.3.4.4 (13)	R
324	The E1 electrical interface format shall support both 30 and 31 channels when channelized with and without Cyclical Redundancy Check (CRC) as specified in ITU-T Recommendation G.711. The selection of format for any particular E1 interface shall be user-selectable.	5.5.3.4.4 (14)	R
325	The AGF functional device shall support E1 bit rate of 2.048 Mbps +/- 50 ppm as specified in ITU-T Recommendation G.703 and G.704.	5.5.3.4.4 (15)	R
326	The AGF functional device shall support DS3 electrical tributary interfaces that comply with ANSI T1.102-1993.	5.5.3.4.4 (16)	R
327	The AGF functional device DS3 interface shall support DS3 pulse shape that meets both ITU-T Recommendation G.703 and Telcordia Technologies GR-499-CORE.	5.5.3.4.4 (17)	R
328	The AGF functional device shall support channelized and unchannelized DS3 signals in either unframed, M13, or C-bit parity formats per ANSI T1.101 and T1.404. The selection of format for any particular DS3 interface shall be user-selectable.	5.5.3.4.4 (18)	R
329	The AGF functional device shall support DS3 C-bit far-end alarm and control signal to support alarm/status messages and loopback control on the DS3 and/or individual DS1 as specified in ANSI T1.101 and T1.404.	5.5.3.4.4 (19)	R
330	The AGF functional device shall support DS3 bit rate of 44.736 Mbps +/- 20 ppm as specified in ANSI T1.101.	5.5.3.4.4 (20)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
331	The AGF functional device shall support E3 electrical tributary interfaces that comply with ITU-T Recommendation G.703.	5.5.3.4.4 (21)	R
332	The AGF functional device shall support channelized and unchannelized E3 signals using line coding of High Density Bipolar 3 Code (HDB-3).	5.5.3.4.4 (22)	R
333	The AGF functional device shall support E3 bit rate of 34.368 Mbps +/- 20 ppm as specified in ITU-T Recommendation G.703.	5.5.3.4.4 (23)	R
334	The AGF functional device shall be able to provision, monitor, and detect faults, and restore electrical (DS1, E1, DS3, E3) services in a standardized and automated fashion.	5.5.3.4.4 (24)	R
335	**AGF Functional Device Ethernet Interface Requirements**	5.5.3.4.4	
336	The AGF functional device shall provide interfaces for Ethernet, FE, and GbE services in conformance with IEEE 802.3 for Ethernet LAN interfaces.	5.5.3.4.4 (1)	R
337	The AGF functional device shall provide interfaces for 10GbE Services in conformance with IEEE 802.3 for Ethernet LAN/WAN interfaces.	5.5.3.4.4 (2)	D
338	The Logical Link IWF shall terminate the MAC layer of Ethernet as described in Ethernet Standard IEEE 802.3.	5.5.3.4.4 (3)	R
339	Ethernet interfaces shall accommodate Ethernet packets greater than 4470 bytes	5.5.3.4.4 (4)	R
340	Ethernet services shall support port-based and flow-based VLANS for multiple rates and customer interfaces as per IEEE 802.1Q.	5.5.3.4.4 (5)	R
341	The AGF functional device shall support transparent VLAN tagging for Ethernet on SONET/SDH service.	5.5.3.4.4 (6)	R
342	The AGF functional device shall not, by default, perform any Layer 3 IP routing.	5.5.3.4.4 (7)	R
343	The AGF functional device shall be able to provision, monitor, and detect faults, and restore Ethernet services in a standardized and automated fashion.	5.5.3.4.4 (8)	R
344	The AGF functional device shall selectively provide QoS/CoS for Ethernet services according to IEEE 802.1Q.	5.5.3.4.4 (9)	R
345	Available Ethernet services shall include RPR (IEEE 802.17b), Generic Framing Procedure (GFP) (ITU-T Recommendation G.7041/Y.1303), Hardware Link Capacity Adjustment Scheme (LCAS), and Virtual Concatenation (VCAT).	5.5.3.4.4 (10)	D
346	Ethernet and FE Services on SONET shall support GFP (ITU-T Recommendation G.7041/Y.1303), hardware LCAS, low order VCAT (VT1.5), high order (STS-1) VCAT, and CCAT; STS-1 and STS-3c.	5.5.3.4.4 (11)	R
347	10GbE services on SONET shall support GFP (ITU-T Recommendation G.7041/Y.1303), hardware LCAS, high order (STS-1 or STS-3c) VCAT, and CCAT; STS-1, STS-3c, STS-12c, STS-48c, and STS-192c.	5.5.3.4.4 (12)	D
348	Ethernet and FE services on SDH shall support GFP (ITU-T Recommendation G.7041/Y.1303), hardware LCAS, low order VCAT (VC-12 and VC-3, and CCAT; VC-3 and VC-4.	5.5.3.4.4 (13)	R
349	Gigabit Ethernet services on SDH shall support GFP (ITU-T Recommendation G.7041/Y.1303), hardware LCAS, low order VCAT (VC-3), high order (VC-4) VCAT, and CCAT; VC-3, VC-4, VC-4-3, and VC-4-16.	5.5.3.4.4 (14)	R
350	Ten GbE services on SDH shall support GFP (ITU-T Recommendation G.7041/Y.1303), hardware LCAS, high order (VC-4) VCAT, and CCAT; VC-3, VC-4, VC-4-3, and VC-4-16, and VC-4-64.	5.5.3.4.4 (15)	D
351	The AGF functional device shall selectively provide point-to-point Ethernet services with dedicated non-shared bandwidth without queuing or buffering Ethernet frames.	5.5.3.4.4 (16)	R
352	Gigabit Ethernet and 10GbE interfaces shall be auto-sensing/auto-detecting and auto-configuring between incoming GbE and 10GbE signals.	5.5.3.4.4 (17)	R
353	Ethernet and FE interfaces shall be auto-sensing/auto-detecting and auto-configuring between incoming Ethernet and FE signals.	5.5.3.4.4 (18)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
354	**AGF Functional Device Storage Area Network Interface Requirements**	5.5.3.4.6	
355	The AGF functional device shall provide Fiber Connectivity (FICON) tributary interfaces and services as per ANSI X3.230.	5.5.3.4.6 (1)	D
356	The AGF functional device shall provide Enterprise Services Connectivity (ESCON) tributary interfaces and services as per ANSI X3.296.	5.5.3.4.6 (2)	D
357	***AGF Functional Device Cross-Connect* Requirements**	5.5.3.4.7	
358	The AGF functional device shall cross connect with the granularity of STS-1 and VT1.5 on a SONET AGF functional device.	5.5.3.4.7 (1)	R
359	The STS-1 (high order) cross-connect fabric shall be capable of supporting at least 320 G of cross connects at the STS-1/STM-0 level.	5.5.3.4.7 (2)	R
360	The VT1.5 (low order) cross-connect fabric shall be scalable and capable of supporting at least 10 G of traffic at the VC-11/VC-12 level.	5.5.3.4.7 (3)	R
361	The AGF functional device shall have an Ethernet switch fabrics separate from its STS-1 or VT1.5 TDM fabric.	5.5.3.4.7 (4)	R
362	The IP Ethernet switch fabrics shall be scalable and capable of supporting at least 20 G of IP traffic.	5.5.3.4.7 (5)	R
363	The AGF functional device shall cross connect with the granularity of VC-12, VC-3, and VC-4 on a SDH AGF functional device (not necessarily simultaneously with STS-1 and VT1.5).	5.5.3.4.7 (6)	R
364	The AGF functional device shall perform Time Slot Interchange (TSI) and Time Slot Assignment (TSA) cross connect between DS1 interfaces and channelized DS3 interfaces into a SONET VT1.5 formatted within the STS containers.	5.5.3.4.7 (7)	R
365	The AGF functional device shall support structured Administrative Unit-4 (AU-4) mapping for SDH applications using the ITU multiplexing structure in ITU-T Recommendation G.707.	5.5.3.4.7 (8)	R
366	The AGF functional device shall be able to map T1, E1, T3, and E3 signals into an AU-4 mapping structure as per ITU-T G.707.	5.5.3.4.7 (9)	R
367	The AGF functional device shall support VC-11, VC-12, VC-3, and VC-4 cross-connect capability for SDH AU-4-based system.	5.5.3.4.7 (10)	R
368	The AGF functional device shall support SDH/SONET container gateway functionalities (i.e., VC-3 to STS-1 and VC-11 to VT1.5).	5.5.3.4.7 (11)	R
369	The AGF functional device shall have the ability to retime signals from either VT1.5 or DS1 formats, as well as pass timing through the matrix directly to provide timing up to Stratum 1 via DS1 ports.	5.5.3.4.7 (12)	D
370	The AGF functional device cross-connects and interfaces shall be compatible with network-side STS or Lambda cross-connects at the DISN switch or the DISN Transport Element.	5.5.3.4.7 (13)	R
371	The AGF functional device cross-connects and interfaces at the AGF functional device shall be transparent to all protection switching at the DISN switch or the DISN Transport Element.	5.5.3.4.7 (14)	R
372	The AGF functional device shall support SONET provisioning of CCAT formats; OC-3c, OC-12c, OC-48c, and OC-192c.	5.5.3.4.7 (15)	R
373	The AGF functional device shall support SONET provisioning of OC-768c CCAT formats.	5.5.3.4.7 (16)	D
374	The AGF functional device shall support SDH provisioning of CCAT formats; VC-4-3c, VC-4-16c, and VC-4-64c.	5.5.3.4.7 (17)	R
375	The AGF functional device shall support SDH provisioning of VC-4-256c CCAT formats.	5.5.3.4.7 (18)	D
376	**AGF Functional Device Interface Performance Requirements**	5.5.3.4.8	
377	The AGF functional device shall meet the jitter criteria for SONET systems in Telcordia Technologies GR-253-CORE, Section 5.6.	5.5.3.4.8 (1)	R
378	The AGF functional device shall meet the jitter criteria for SDH systems according to ITU-T Recommendation G.825 and ITU-T G.732.	5.5.3.4.8 (2)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
379	The AGF functional device shall meet the interface jitter criteria specified for UNI interfaces for ITU-T OTN.	5.5.3.4.8 (3)	R
380	The jitter tolerance measured at the OC-N interface on the AGF functional device shall meet Figure A.1 input jitter tolerance specification documented in ANSI T1.105.03.	5.5.3.4.8 (4)	R
381	The jitter tolerance measured at the DS3 interface on the AGF functional device shall be at least 5 Unit Interval peak-to-peak (UIpp) between 10 Hertz (Hz) and 2.3 x 103 Hz, and at least 0.1 UIpp between 60 x 103 and 200 x 103 Hz as per Figure 7-1 in GR-499.	5.5.3.4.8 (5)	R
382	The jitter transfer measured between an input DS3 interface and the corresponding output DS3 interface on an AGF functional device (with its OC-12 or OC-3 signal looped-back) shall be less than the jitter transfer mask shown in Figure 7-4 GR-499.	5.5.3.4.8 (6)	R
383	The jitter generation measured at the OC-N interface on the AGF functional device shall be less than 0.01 UIrms, when measured using a high-pass filter with 12-kHz cut-off frequency per ANSI T1.105.03, Section A.3.3.	5.5.3.4.8 (7)	R
384	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than 0.4 UIpp, without pointer adjustments as per ANSI T1.105.03, Section 6.1.2.1.	5.5.3.4.8 (8)	R
385	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than A1 equals A0 plus .3 UIpp for a single pointer adjustment as shown in Table 2 of ANSI T1.105.03-1994.	5.5.3.4.8 (9)	R
386	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than 1.3 UIpp for pointer adjustment bursts as shown in Table 3 of ANSI T1.105.03.	5.5.3.4.8 (10)	R
387	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than 1.2 UIpp for phase transient pointer adjustment bursts as shown in Table 4 of ANSI T1.105.03.	5.5.3.4.8 (11)	R
388	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than 1.3 UIpp for periodic pointer adjustments as shown in Table 6 of ANSI T1.105.03-1994.	5.5.3.4.8 (12)	R
389	The jitter generation due to DS3/STS-1 payload mapping for the DS3 interface on the AGF functional device shall be less than 5 UIpp between 10 Hz and 500 Hz, and at least 0.1 UIpp between 8x10 3 and 40x10 3 Hz per Figure 7-1 of Telcordia Technologies GR-499-CORE.	5.5.3.4.8 (13)	R
390	The jitter transfer measured between an input DS1 interface and the corresponding output DS1 interface on the AGF functional device (with its OC-12 or OC-3 signal looped back) shall be less than the jitter transfer mask shown in Figure 7-4 of Telcordia Technologies GR-499-CORE.	5.5.3.4.8 (14)	R
391	The jitter generation due to DS1/VT-1.5 payload mapping without pointer adjustments for the DS1 interface on the AGF functional device shall be less than 0.7 UIpp per ANSI T1.105.03s, Section 6.1.1.1.	5.5.3.4.8 (15)	R
392	The jitter generation due to DS1/VT1.5 payload mapping and a single pointer adjustment for the DS1 interface on the AGF functional device shall meet the single VT pointer adjustment Maximum Time Interval Error (MTIE) mask shown on Figure 8 of the ANSI T1X1.3/94-001R5 supplement to ANSI T1.105.03.	5.5.3.4.8 (16)	R
393	The jitter generation due to DS1/VT1.5 payload mapping and periodic pointer adjustments for the DS1 interface on the AGF functional device shall meet the periodic VT pointer adjustment MTIE mask shown on Figure 10 of the ANSI T1X1.3/94-001R5 supplement to ANSI T1.105.03.	5.5.3.4.8 (17)	R
394	The maximum delay for a full STS passed through the AGF functional device (OC-N to OC-N), or for an STS add/drop shall not exceed 25 microseconds (µs) as per Telcordia Technologies TR-496, (R) [3-45].	5.5.3.4.8 (18)	R
395	The maximum delay for a floating VT passed through a DISN Access element (OC-N to OC-N), or for a floating VT add/drop (OC-N to low-speed or low-speed to OC-N) shall not exceed 50 microseconds (µs) as per Telcordia Technologies, TR-496, (R) [3-46].	5.5.3.4.8 (19)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
396	**AGF Functional Device Equipment Redundancy Requirements**	5.5.3.4.9	
397	No single failure in the switch fabric shall affect service. The AGF functional device shall meet Telcordia Technologies GR-2996-CORE requirements for fabric availability.	5.5.3.4.9 (1)	R
398	The interface cards shall be capable of switching between the working and protection switch fabric in an errorless manner for manual operation, and in a hitless manner for automated operation. No bits shall be lost or corrupted with errorless switching. Bit errors are allowed with hitless switching. However, hitless switching shall not cause downstream reframing to occur.	5.5.3.4.9 (2)	R
399	A PDH (DS1, DS3, E1, E3) card shall support a 1:1 configuration.	5.5.3.4.9 (3)	R
400	A PDH (DS1, DS3, E1, E3) card should support a 1:N configuration.	5.5.3.4.9 (4)	D
401	The AGF functional device shall support redundant processor and cross-connect matrix working in an active/standby mode.	5.5.3.4.9 (5)	R
402	The AGF functional device shall support redundant power supply and electrical feeds.	5.5.3.4.9 (6)	R
403	**AGF Functional Device General Protection Requirements**	5.5.3.4.10	
404	It shall be possible to provision any SONET port for 1+1 APS, 1:N APS; 1:N OP, 2-Fiber UPSR per Telcordia Technologies GR-1400-CORE, or 2/4-Fiber BLSR per Telcordia Technologies GR-1230-CORE.	5.5.3.4.10 (1)	R
405	It shall be possible to provision any SDH port for 1+1 APS, 0:1 APS, 1:N APS, 1+1 2/4-Fiber Unidirectional Ring, or 2-Fiber MS Shared Protection Ring per ITU-T Recommendation G.841.	5.5.3.4.10 (2)	R
406	When the AGF functional device participates in point-to-point UPSR or BLSR protection, switching shall take place in 50 ms. These protection mechanisms shall be definable and selectable from the EMS, and shall offer the selection of revertive and non-revertive restoration mechanisms.	5.5.3.4.10 (3)	R
407	When the AGF functional device participates in point-to-point UPSR or BLSR protection and the selection of revertive restoration mechanisms shall have a revertive timer that is software programmable in a 30-second increment from 0 to 5 minutes, at a minimum.	5.5.3.4.10 (4)	R
408	The service restoration for a protection switch shall be automatic and accomplished without human or central management system intervention.	5.5.3.4.10 (5)	R
409	The protection switching mechanism shall be independent among separately managed network domains. A protection switch in one separately managed network domain shall not propagate or relay to another separately managed network domain.	5.5.3.4.10 (6)	R
410	The maximum detection time to determine if a signal's BER threshold is exceeded shall comply with Telcordia Technologies GR-253-CORE and ITU-T Recommendation G.783.	5.5.3.4.10 (7)	R
411	Once a decision is made to switch, the terminal circuit pack switching shall take place within 50 ms, as described in Telcordia Technologies GR-253-GORE and ITU-T Recommendation G.783.	5.5.3.4.10 (8)	Critical
412	Catastrophic failures on a user-definable Excessive BER (EBER) condition shall be detected by an equipment-protected circuit pack in a terminal within 10 ms as described in Telcordia Technologies GR-253-GORE and ITU-T Recommendation G.783.	5.5.3.4.10 (9)	R
413	When equipped, the AGF functional device shall be compliant with types and characteristics of SDH network protection architectures as defined in ITU-T G.841.	5.5.3.4.10 (10)	R
414	When equipped, the AGF functional device shall be compliant with interworking of SDH network protection architectures as defined in ITU-T Recommendation G.842.	5.5.3.4.10 (11)	R
415	**AGF Functional Device Interoperability Requirements**	5.5.3.4.11	
416	The AGF functional device user interfaces, software, firmware, and hardware shall be fully compatible and interoperable with and without protection mechanisms of the OTS muxponder, OTS ROADM, ODXC, M13, STI, DSN MFS, encryption devices, and DISN Provider (P), Provider Edge (PE), Aggregation Routers (ARs).	5.5.3.4.11 (1)	R
417	The AGF functional device cross-connects and interfaces shall be compatible with network-side STS, STM, or Lambda cross-connects at the OTS muxponder, OTS ROADM, and ODXC.	5.5.3.4.11 (2)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
418	The AGF functional device cross-connects and interfaces at the AGF functional device shall be compatible with all protection switching at OTS muxponder, OTS ROADM, ODXC, M13, STI, DSN MFS, encryption devices, and DISN P, PE, and ARs.	5.5.3.4.11 (3)	R
419	**AGF Functional Device Fault Management Requirements**	5.5.3.4.12	
420	The AGF functional device shall send the appropriate AIS and RDI to adjacent systems, the EMS, and/or the higher level management system after detecting signal failure or degraded conditions for a specified alarm or indication activation time, as described in ANSI T1.231, Tables 2, 6, and 11.	5.5.3.4.12 (1)	R
421	The AGF functional device shall remove the appropriate AIS and RDI after the source system has cleared the signal failure or degraded condition for a specified alarm or indication activation time, as described in ANSI T1.231, Tables 2, 6, and 11.	5.5.3.4.12 (2)	R
422	Alarms shall indicate circuit-level or signal alarms, as well as alarms in the AGF functional device itself, such as Span Failure, LOS, Path Switch Complete/Fail, Laser Degradation, Card Failure, and Card Mismatch.	5.5.3.4.12 (3)	
423	Standard SONET alarms shall be supported by the system, including LOS, LOP, LOF, Rx AIS, RDI, and RFI.	5.5.3.4.12 (4)	R
424	The AGF functional device shall indicate SONET timing synchronization failures. The AGF functional device shall give an alarm showing the inability to establish a PLL. The AGF functional device shall have the ability to monitor the BITS incoming references (BITS-A and BITS-B). The AGF functional device shall give an alarm when there is any timing change, e.g., a switch from BITS-A to BITS-B.	5.5.3.4.12 (5)	R
425	Each NE shall detect, report, and clear the following signal failure events or conditions: LOS, LOF, LOP, SEF, AIS, and OOF, according to ANSI T1.231.	5.5.3.4.12 (6)	R
426	The AGF functional device shall provide the following DS3 alarms and report them to the EMS: LOS and AIS (or blue alarm). Definitions are the same as with DS1. The AGF functional device shall be able to transmit and receive the Far-End Out Of Frame (FEOOF) alarm for those AGF functional devices that transmit them. In addition, the AGF functional device shall be able to transmit and receive Far-End Alarm and Control (FEAC) signals. The FEAC option allows the AGF functional device to display far-end alarm and status information via the FEAC channel and to transmit FEAC messages from the near end to the far end.	5.5.3.4.12 (7)	R
427	The AGF functional device shall provide the following SONET VT alarms and report them to the EMS: include signal label mismatch, receive unequipped, and Rx AIS. Signal label mismatch tells whether the VT payload is locked or floating. Receive unequipped indicates that the far-end SONET port has not been provisioned.	5.5.3.4.12 (8)	R
428	The AGF functional device shall provide the following DS1 alarms and report them to the EMS: AIS or yellow alarm, LOS, Remote Alarm Indication (RAI)/yellow alarm, and excess zeroes. Alarm Indication Signal is transmitted as a result of a received LOS. The RAI or yellow alarm is transmitted upstream to indicate a red alarm or LOS downstream. Alarms shall indicate which physical port is receiving or transmitting the alarm. The yellow or RAI alarm is for ESF circuits only. Excess zeroes alarm only applies to D4/Superframe circuits.	5.5.3.4.12 (9)	R
429	The AGF functional device shall have LEDs for minor, major, and critical alarms and the LED must be set and cleared when a alarm of the defined category is present or cleared as defined by Telcordia Technologies GR.253-CORE.	5.5.3.4.12 (10)	R
430	The AGF functional device shall provide alarm status with at least the following minimum information: reference number, date and time of occurrence, node name, card type/slot, severity (i.e., minor, major, critical, informational), and alarm status (set, clear, and transient).	5.5.3.4.12 (2)	R
431	**AGF Functional Device Performance Monitoring Requirements**	5.5.3.4.13	
432	The AGF functional device shall provide a performance monitoring capability of all the supported interfaces (i.e., PDH, SONET, SDH) in accordance with Telcordia Technologies GR-253-CORE, and ITU-T Recommendation G.829.	5.5.3.4.13 (1)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
433	The PDH performance monitoring shall provide ES, Severally SES, Unavailable Seconds, BP or CV, LOS, and AIS in accordance with Telcordia Technologies GR-820-CORE and ITU-T Recommendations G.826.	5.5.3.4.13 (2)	R
434	The SONET performance monitoring shall provide ES, SES, unavailable seconds, CV, LOS, AIS, and pointer adjustments in accordance with Telcordia Technologies GR-499-CORE.	5.5.3.4.13 (3)	R
435	The SDH performance monitoring shall provide ES, SES, unavailable seconds, CV, LOS, AIS, and pointer adjustments in accordance with ITU-T G.829.	5.5.3.4.13 (4)	R
436	The Ethernet performance monitoring shall provide Link availability time, various pack sizes, undersize packets, jumbo frames, frame alignment errors, frame check sequence errors, fragmentation, and CRC alignment errors in accordance with IEEE 802.3.	5.5.3.4.13 (5)	R
437	The optical card performance monitoring shall provide receive power, transmit power, bias current, low power threshold, and high power threshold in accordance with Telcordia Technologies GR-253-CORE.	5.5.3.4.13 (6)	R
438	All interfaces shall provide alarm thresholds for error rates that are determine to be degraded (10E-6) and failed (10E-3) and declare alarms based on the error rates to the user via the alarm in accordance with Telcordia Technologies GR-253-CORE and ITU-T Recommendation G.829.	5.5.3.4.13 (7)	R
439	**AGF Functional Device Requirements**	5.5.3.4.14	
440	The AGF functional device shall perform hair-pinning and ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (1)	R
441	The AGF functional device shall perform drop ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (2)	R
442	The AGF functional device shall perform continued ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (3)	R
443	The AGF functional device shall perform drop and continue ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (4)	D
444	The AGF functional device shall provide the ability to hub or nest lower DISN Access elements in a linear or ring configuration from user-side interfaces.	5.5.3.4.14 (5)	R
445	The AGF functional device shall not use external connections for ring interconnection. Where multiple rings can be supported by a single shelf, connectivity between rings shall be accomplished via the switch matrix. No external connection between tributary interfaces shall be used to cross connect rings in the same bay.	5.5.3.4.14 (6)	D
446	The AGF functional device shall be protocol-transparent to incoming bit streams. Except for internetworking functions associated with Ethernet services within the AGF functional device, the AGF functional device shall not perform any user protocol conversions.	5.5.3.4.14 (7)	R
447	The AGF functional device shall not impart any errors onto the connections during cross-connects, grooming, or multiplexing.	5.5.3.4.14 (8)	R
448	The AGF functional device shall perform hair-pinning cross-connects without affecting the line capacity rate of the AGF functional device.	5.5.3.4.14 (9)	R
449	The AGF functional device shall send the appropriate AIS and RDI to adjacent AGF functional devices, the EMS, and/or higher level management systems after detecting signal failure or degraded conditions for a specified alarm or indication activation time per ANSI T1.231, Tables 2, 6 and 11.	5.5.3.4.14 (10)	R
450	The AGF functional device shall remove appropriate AIS and RDI after another AGF functional device has cleared the signal failure or degraded conditions for a specified alarm or indication activation time per ANSI T1.231, Tables 2, 6, and 11.	5.5.3.4.14 (11)	R
451	The AGF functional device shall have internal local and remote terminal loopback capability per Telcordia Technologies GR-253-CORE, (R) 6-380.	5.5.3.4.14 (12)	D
452	The AGF functional device shall have a local and remote service loopback capability as per Telcordia Technologies GR-253-CORE, (R) 6-389.	5.5.3.4.14 (13)	R
453	The AGF functional device shall have a local and remote service loopback capability as per Telcordia Technologies GR-253-CORE, (R) 6-389.	5.5.3.4.14 (14)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
454	The AGF functional device with DS3 line terminations shall provide both DS3 terminal and service loopback capabilities per Telcordia Technologies GR-253-CORE, (O) 6-397.	5.5.3.4.14 (15)	R
455	The AGF functional device should support BER Testing using standard test patterns: PRBS15, PRBS20, PRBS23, QRSS, and ATL1s0s.	5.5.3.4.14 (16)	D
456	**AGF Functional Device Interface Performance Requirements**	5.5.3.4.15	
457	The AGF functional device shall meet the jitter criteria for SONET systems in Telcordia Technologies GR-253-CORE, Section 5.6.	5.5.3.4.15 (1)	R
458	The AGF functional device shall meet the jitter criteria for SDH systems according to ITU-T Recommendations G.825 and ITU-T Recommendations	5.5.3.4.15 (2)	R
459	The AGF functional device shall meet the interface jitter criteria specified for UNI interfaces for ITU-T OTNs.	5.5.3.4.15 (3)	R
460	The jitter tolerance measured at the OC-N interface on the AGF functional device shall meet Figure A.1 input jitter tolerance specification documented in ANSI T1.105.03.	5.5.3.4.15 (4)	R
461	The jitter tolerance measured at the DS3 interface on a DISN Access element shall be at least 5 UIpp between 10 Hz and 2.3 x 103 Hz, and at least 0.1 UIpp between 60 x 103 and 200 x 103 Hz per Figure 7-1 in TR-499.	5.5.3.4.15 (5)	R
462	**AGF Functional Device EMS Requirements**	5.5.3.4.16	
463	The AGF functional device EMS shall report PHY (Layer 1) statistics. Further, it shall report Layer 2 errors. It shall report all QoS parameters defined for the RPR as described in IEEE 802.17.	5.5.3.4.16 (1)	R
464	The AGF functional device EMS shall be able to track frame errors, P-Bit parity errors, C-Bit parity errors, and FEBE.	5.5.3.4.16 (2)	R
465	The AGF functional device EMS shall be able to provision the AGF functional device on all interfaces (i.e., PDH/SONET/SDH/Ethernet) and be able to provision a circuit using the different types of cross-connects (VT1.5, VC-11, VC-12, VC-3, VC-4, STS-1, STM-1, STS-3c, STM-4, STS-12c, STM-16, STS-48c, STM-64, and STS-192c).	5.5.3.4.16 (3)	R
466	The AGF functional device EMS shall be able to build protection topologies APS 1+1, UPSR, and BLSR.	5.5.3.4.16 (4)	R
467	The AGF functional device EMS shall be able to provision card parameters required for interoperability to interconnecting carrier systems; and interface framing format, and line type, line build out.	5.5.3.4.16 (5)	R
468	The AGF functional device EMS shall be able to provision alarms profiles according to network requirements (i.e., minor, major, critical, none service affecting, and none reporting).	5.5.3.4.16 (6)	R
469	The AGF functional device EMS shall be able to review and retrieve alarm and administration logs.	5.5.3.4.16 (7)	R
470	The AGF functional device EMS shall be able to set the alarm threshold on any interface (i.e., SD and SF).	5.5.3.4.16 (8)	R
471	The AGF functional device EMS shall be able to provision all administrated and security screens based on password level (i.e., network IP address, NE name, user accounts, and radius server).	5.5.3.4.16 (9)	R
472	All TSF elements shall meet the EMC/EMI requirements defined in FCC Part 15 Class A.	5.5.3.4.17 (1)	R
473	All TSF elements shall meet the EMC/EMI requirements defined in Telcordia Technologies GR-1089-CORE.	5.5.3.4.17 (2)	R
474	Required] All TSF elements shall meet the EMC/EMI requirements defined in ETSI EN 50082.	5.5.3.4.17 (3)	R
475	All TSF elements shall meet the EMC/EMI requirements defined in ETSI EN 55022.	5.5.3.4.17 (4)	R
476	All TSF elements shall meet the EMC/EMI requirements defined in ETSI EN 300-386.	5.5.3.4.17 (5)	R
477	All TSF elements shall be designed to operate continuously in the following environment ranges without degradation. Temperature: 0 to +50°C, Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.4.17 (6)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
478	All TSF elements shall be designed to be fully operational after transportation and/or storage in the following environment ranges: Temperature: -40 to +70°C, Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.4.17 (7)	R
479	All TSF elements shall be designed to operate continuously in the following environment range without degradation. Altitude: -100 to 15,000 ft AMSL.	5.5.3.4.17 (8)	R
480	All TSF elements shall be designed to be fully operational after transportation and/or storage in the following environment range: Transport Altitude: -100 ft to +40,000 ft AMSL.	5.5.3.4.17 (9)	R
481	All TSF elements shall adhere to NEBS Level 3 compliance standards for acceptable voltage ranges, EMI, and ESD safety, and shall be operable using standard 48V dc power as well as having redundant isolated power input feeds. For certain sites, an alternative ac/dc rectifier may need to be supplied to power the system and shall be able to switch 110/220 V with redundant isolated power modules.	5.5.3.4.17 (10)	R
482	All TSF elements shall be fully operational throughout the battery voltage range of -41.5 to -56 VDC.	5.5.3.4.17 (11)	R
483	All TSF elements shall not be damaged and shall recover to normal performance following application of the following maximum transient voltages for the durations given (nominal voltage 48 VDC): 75 VP-P for 1 msec, 60 VP-P for 500 msec.	5.5.3.4.17 (12)	R
484	All TSF elements shall be fully NEBS, Level 3 compliant.	5.5.3.4.17 (13)	R
485	All TSF elements shall be designed to operate continuously in the following environment ranges without degradation. Temperature: 0 to +50°C, Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.4.17 (14)	R
486	All TSF elements shall be designed to be fully operational after transportation and/or storage in the following environment ranges: Temperature: -40 to +70°C, Humidity: 5 to 95 percent relative humidity, without condensation.	5.5.3.4.17 (15)	R
487	All TSF elements shall be designed to operate continuously in the following environment range without degradation. Altitude: -100 to 15,000 ft AMSL.	5.5.3.4.17 (16)	R
488	All TSF elements shall be designed to be fully operational after transportation and/or storage in the following environment range: Transport Altitude: -100 ft to +40,000 ft AMSL.	5.5.3.4.17 (17)	R
489	All TSF elements shall adhere to NEBS level 3 compliance standards for acceptable voltage ranges, EMI, and ESD safety, and shall be operable using standard 48V dc power as well as having redundant isolated power input feeds. For certain sites, an alternative ac/dc rectifier may need to be supplied to power the system and shall be able to switch 110/220 V with redundant isolated power modules.	5.5.3.4.17 (18)	R
490	All TSF elements shall be fully operational throughout the battery voltage range of: -41.5 to -56 VDC.	5.5.3.4.17 (19)	R
491	All equipment shall have been tested and registered as compliant to the following electrical safety standards: UL-1950, EN60950, and IEC 60950.	5.5.3.4.17 (20)	R
492	ITU-T Recommendation G.651.1 (2007)	5.5.3.4.18 (1)	R
493	ITU-T Recommendation G.652 (10/2000) (Revised in 2005)	5.5.3.4.18 (2)	R
494	ITU-T Recommendation 694.1 (2002)	5.5.3.4.18 (3)	R
495	ITU-T Recommendation G.703 (2001)	5.5.3.4.18 (4)	R
496	ITU-T Recommendation G.707/Y.1322 (2007)	5.5.3.4.18 (5)	R
497	ITU-T Recommendation G.709/Y.1331	5.5.3.4.18 (6)	R
498	ITU-T Recommendation G.711 (1988)	5.5.3.4.18 (7)	R
499	ITU-T Recommendation G.732 (1988).	5.5.3.4.18 (8)	R
500	ITU-T Recommendation G.783 (2006)	5.5.3.4.18 (9)	R
501	ITU-T Recommendation G.825 (2000)	5.5.3.4.18 (10)	R
502	ITU-T Recommendation G.829	5.5.3.4.18 (11)	R
503	ITU-T Recommendation G.841 (1998)	5.5.3.4.18 (12)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

ID	Requirement	UCR Ref (UCR 2008 CH 2)	R/C/D
504	ITU-T Recommendation G.842 (1997)	5.5.3.4.18 (13)	R
505	ITU-T Recommendation G.872 (2001)	5.5.3.4.18 (14)	R
506	ITU-T Recommendation G.957 (2006)	5.5.3.4.18 (15)	R
507	ITU-T Recommendation G.7041/Y-1303 (2003) (Revised in 2008)	5.5.3.4.18 (16)	R
508	ANSI T1.101	5.5.3.4.18 (17)	R
509	ANSI T1.102-1999	5.5.3.4.18 (18)	R
510	ANSI T1.105.1-2000	5.5.3.4.18 (19)	R
511	ANSI T1.105.03-1994 (Revised 2003 (R2008))	5.5.3.4.18 (20)	R
512	ANSI T1.105.06 – 2002 (R2007)	5.5.3.4.18 (21)	R
513	ANSI T1.107-2002 (R2006)	5.5.3.4.18 (22)	R
514	ANSI T1.231-1993 (Revised 2003 (R2007))	5.5.3.4.18 (23)	R
515	ANSI T1.403-1999 (R2007)	5.5.3.4.18 (24)	R
516	ANSI T1.404-2002 (R2006)	5.5.3.4.18 (25)	R
517	Telcordia Technologies GR-253-CORE, Issue 3, September 2000 (Issue 4, December 2005)	5.5.3.4.18 (26)	R
518	Telcordia Technologies GR-496-CORE, Issue 1, December 1998, (Issue 2, August 2007)	5.5.3.4.18 (27)	R
519	Telcordia Technologies GR-499-CORE, Issue 2, December 1998 (Issue 3, September 2004)	5.5.3.4.18 (28)	R
520	Telcordia Technologies GR-820-CORE, Issue 2, December 1997	5.5.3.4.18 (29)	R
521	IEEE 802.3-2008	5.5.3.4.18 (30)	R
522	IEEE 802.1Q-2003	5.5.3.4.18 (31)	R
523	IEEE 802.17-2004, IEEE standard for information technology-telecommunications and information exchange between systems-local and metropolitan area networks-specific requirements-part 17: resilient packet ring (RPR) access method and physical layer specifications	5.5.3.4.18 (32)	C
524	X3-230. ANSI FC-SB-3 and INCITS 230:1994 [R2004]	5.5.3.4.18 (33)	R
525	British Standards Institute BS EN 60950-1 August 6, 2006	5.5.3.4.18 (34)	R
526	IEC 60950-1, 2006	5.5.3.4.18 (35)	R
527	CFR FCC Part 15, Class A	5.5.3.4.18 (36)	R
528	Network Equipment - Building System (NEBS), Level 3	5.5.3.4.18 (37)	R
529	Underwriters Laboratories, Inc. UL-1950, First Edition 1989	5.5.3.4.18 (38)	R

Table 3-2. OTS/AGF Capability/Functional Requirements Table (continued)

LEGEND:

ADIMSS	Advanced DSN Integrated Management Support System
AGF	Access Grooming Function
ANSI	American National Standards Institute
APL	Approved Product List
ASLAN	Assured Services LAN
BER	Bit Error Rate
BRI	Basic rate Interface
dB	Decibel
C	Conditional
CE	Customer Edge
CGA	Carrier Group Alarm
CH	Change
D	Desired
DAA	Designated Approving Authority
DC	Direct Current
DCN	Data Communications Network
D-NE	Deployed-Network Element
DISN	Defense Information Systems Network
DISR	DoD Information technology Standards and Profile Registry
DoD	Department of Defense
DoDI	DoD Instruction
DSN	Defense Switched Network
DVX	Deployed Voice Exchange
DWDM	Dense Wavelength Division Multiplexing
E1	European 1 (2048 bps, 30-channel PCM)
E2E	End to End
EDC	Electronic Dispersion Compensation
EIA	Electronic Industries Alliance
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOL	End of Life
F-NE	Fixed-Network Element
FCC	Federal Communications Commission
FDM	frequency-division multiplexing
FIPS	Federal Information Processing Standard
GIG-BE	Global Information Grid-Bandwidth Expansion
GigE	Gigabit Ethernet
GR	Generic Requirement
IAW	In Accordance With
ID	Identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IP	Internet Protocol
IR	Intermediate Reach
ISDN	Integrated Services Data Network
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union-Telecommunication
km	Kilometer
LAN	Local Area NetworkMAN Metropolitan Area Networks
Mbps	Megabits per second
MOS	Mean Opinion Score
Ms	Millisecond
msec	millisecond
MSPP	Multiservice Provisioning Platform
MLPP	Multi-Level Precedence and Preemption
NE	Network Element
NEBS	Network Equipment-Building System
nm	nanometer
NMS	Network Management System
NSA	National Security Agency
OA	Optical Amplifier
OC	Optical Carrier
ODU	Optical Channel Data Unit
ODXC	Optical Digital Cross Connect
OLA	Optical Line Amplifier
ORL	Optical Return Loss
OSC	Optical Supervisory Channel
OSP	Open Shortest Path
OTS	Optical Transport System
OTU	Optical Transport Unit
OXC	Optical Cross Connect
PCM	Pulse Code Modulation
PRI	Primary rate Interface
R	Required
Ref	Reference
ROADM	Reconfigurable Optical Add/Drop Multiplexor
SCIP	Secure Communication Interoperability Protocol
SDH	Synchronous Digital Hierarchy
SONET	Synchronous Optical Transport Network
STIG	Security Technical implementation Guide
STM	Synchronous Transport Module
T1	Trunk 1 (1544 bps, 24-channel PCM)
TSF	Transport Switch Function
TTL	Transistor-transistor logic
UCCO	Unified Capabilities Certification Office
UCR	Unified Capabilities Requirement
T UHF	Ultra high frequency
UNI	User Network Interface
VHF	Very High Frequency
VVoIP	Voice and Video over Internet Protocol
WAN	Wide Area Network
DM	Time Division Multiplexing