DEFENSE INFORMATION SYSTEMS AGENCY
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IN REPLY REFER TO: Joint Interoperability Test Command (JTE) **30 Aug 12**

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Fujitsu FLASHWAVE® 4100 Extension Shelf (ES), Micro Packet Optical Networking Platform, Fixed-Network Element (F-NE), with Software Release 8.3.2

References: (a) Department of Defense Directive 4630.05, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) Department of Defense Instruction 8100.04, "DoD Unified Capabilities (UC)," 9 December 2010
(c) through (e), see Enclosure 1

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

2. The Fujitsu FLASHWAVE® 4100 ES, Micro Packet Optical Networking Platform, F-NE, with Software Release 8.3.2, 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 Access Grooming Functional (AGF) device 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 will be verified during deployment. Any new discrepancies that are discovered in the operational environment will be evaluated for impact and adjudicated to the satisfaction of the Defense Information Systems Agency (DISA) 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 3, Reference (c), and the other sponsor-requested requirements. JITC tested the SUT using F-NE test procedures, Reference (d), that were 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 3 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 (CA) approval of the IA configuration. JITC conducted Interoperability testing at its test facility at Indian Head, Maryland, from 3 January through 13 February 2012. The DISA IA CA reviewed the JITC published IA Assessment Report for the SUT, Reference (e), and provided a positive

recommendation of the IA configuration on 23 March 2012. The acquiring agency or site will be responsible for the Department of Defense IA Certification and Accreditation Process (DIACAP) accreditation. The Army originally submitted the SUT as an AGF under UCR 2008, Change 3, Section 5.5. Enclosure 2 documents the test results and describes the tested network and system configurations. Enclosure 3 includes the System Functional and Capability Requirements and 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 component status of the SUT.

Table 1. SUT Interface Interoperability Status

Interface	Critical (See note 1.)	Reference (UCR 2008, Change 3)	Threshold CR/FR	Status	Remarks
NE					
Analog	No	5.9.2.2.1	1, 2, and 4	NA	See note 2.
Serial	No	5.9.2.3.2	1, 2, and 4	NA	See note 2.
BRI ISDN	No	5.9.2.3.3	1, 2, and 4	NA	See note 2.
DS1	No	5.9.2.3.4	1, 2, 3, and 4	Certified	See note 3.
E1	No	5.9.2.3.5	1, 2, 3, and 4	NA	See note 2.
DS3	No	5.9.2.3.6	1, 2, 3, and 4	Certified	See note 3.
OC-X	No	5.9.2.3.8	1, 2, 3, and 4	Certified	See notes 3 and 4.
IP (Ethernet)	No	5.9.2.3.9	1, 2, 4, 6 and 7	Certified	See notes 3 and 5.
NM					
10Base-X	Yes	5.3.2.4.4	7	Certified	See note 3.
100Base-X	Yes	5.3.2.4.4	7	Certified	
OTHER (See note 6.)					
OC-3	No	5.5.3.4.2	8	Certified	See note 3.
OC-12	No	5.5.3.4.2	8	Certified	See note 3.
OC-48	No	5.5.3.4.2	8	Certified	See note 3.
STM-1	No	5.5.3.4.3	8	Certified	See note 3.
STM-4	No	5.5.3.4.3	8	Certified	See note 3.
STM-16	No	5.5.3.4.3	8	Certified	See note 3.
DS1	No	5.5.3.4.4	8	Certified	See note 3.
DS3	No	5.5.3.4.4	8	Certified	See note 3.
1 GbE	No	5.5.3.4.4	8	Certified	See note 3.

NOTES:
1. UCR does not specify any minimum interfaces. The SUT must minimally provide one of the listed interfaces specified.
2. The SUT does not support Analog interface, Serial interface, ISDN BRI interface, or E1 and E3 interfaces; however, these interfaces are not critical for F-NE certification.
3. The SUT met UCR requirements for the specified interfaces.
4. The SUT supports OC-3, OC-12, and OC-48, but does not support SONET interfaces of OC-192/STM-64 and OC-768; however, these interfaces are not critical for F-NE certification.
5. The SUT supports the 1 GbE interface but does not support Ethernet interfaces of 10 Mbps, 100 Mbps, and 10 GbE for client and network sides interfaces; however, these interfaces are not critical for F-NE certification.
6. The SUT does not support conditional requirements for SONET interfaces: OC-192/768, STM-64, electrical interfaces: E1/E3, and Ethernet interfaces: 10/100 Mbps, and 10 GbE. In addition, the conditional requirements for FICON or ESCON are not supported.

Table 1. SUT Interface Interoperability Status (continued)

LEGEND:

10Base-X	10 Mbps Ethernet generic designation	GbE	Gigabit Ethernet
100Base-X	100 Mbps Ethernet generic designation	IP	Internet Protocol
BRI	Basic Rate Interface	ISDN	Integrated Services Digital Network
CR	Capability Requirement	Mbps	Megabits per second
DS1	Digital Signal Level 1 (1.544 Mbps)	NA	Not Applicable
DS3	Digital Signal Level 3 (44.736 Mbps)	NE	Network Element
E1	European Interface Standard (2.048 Mbps)	NM	Network Management
E3	European Interface Standard (34.368 Mbps)	OC-X	Optical Carrier-X (OC-3, OC-12, OC-48)
ESCON	Enterprise Services Connectivity	SONET	Synchronous Optical Networking
FICON	Fiber Connectivity	STM	Synchronous Transport Module
F-NE	Fixed-Network Element	SUT	System Under Test
FR	Functional Requirement	UCR	Unified Capabilities Requirements

Table 2. SUT CRs and FRs Status

CR/FR ID	Capability/Function	Applicability (See notes 1 and 2.)	Reference (UCR 2008, Change 3)	Status	Remarks
F-NE CR/FR					
1	**General NE Requirements**				
	General Requirements	Required	5.9.2.1	Met	
	Alarms	Required	5.9.2.1.1	Met	
	Congestion Control & Latency	Required	5.9.2.1.2	Met	
2	**Compression**				
	G.726	Conditional	5.9.2.2	NA	See note 3.
	G.728	Conditional	5.9.2.2	NA	See note 3.
	G.729	Conditional	5.9.2.2	NA	See note 3.
3	**Interface Requirements**				
	Timing	Required	5.9.2.3.7	Met	
4	**Device Management**				
	Management Options	Required	5.9.2.4.1	Met	
	Fault Management	Conditional	5.9.2.4.2	Met	
	Loop-Back Capability	Conditional	5.9.2.4.3	Met	
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	
5	**DLoS**				
	DLoS Transport	Conditional	5.9.2.4.5	NA	See note 4.
6	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Met	See note 5.
7	**NM Requirements**				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	
	General Management Requirements	Required	5.3.2.17.2	Met	

Table 2. SUT CRs and FRs Status (continued)

CR/FR ID	Capability/Function	Applicability (See notes 1 and 2.)	Reference (UCR 2008, Change 3)	Status	Remarks
Other Tested Requirements					
8	**AGF Requirements**				
	SONET Interface Requirements	Conditional	5.5.3.4.2	Partially Met	See note 6.
	SDH Interface Requirements	Conditional	5.5.3.4.3	Partially Met	See note 6.
	Electrical Interface Requirements	Conditional	5.5.3.4.4	Partially Met	See note 7.
	Ethernet Interface Requirements	Conditional	5.5.3.4.5	Partially Met	See note 7.
	SAN Interface Requirements	Conditional	5.5.3.4.6	Not Supported	See note 8.
	Cross-Connect Requirements	Conditional	5.5.3.4.7	Met	See note 9.
	Interface Performance Requirements	Conditional	5.5.3.4.8	Met	See note 9.
	Redundancy Requirements	Conditional	5.5.3.4.9	Met	See note 9.
	General Protection Requirements	Conditional	5.5.3.4.10	Met	See note 9.
	Interoperability Requirements	Conditional	5.5.3.4.11	Met	See note 9.
	Fault Management Requirements	Conditional	5.5.3.4.12	Met	See note 9.
	Performance Monitoring Requirements	Conditional	5.5.3.4.13	Met	See note 9.
	Functional Device Requirements	Conditional	5.5.3.4.14	Met	See note 9.
	Functional Device EMS Requirements	Conditional	5.5.3.4.15	Met	See note 9.
	Physical Design Requirements	Conditional	5.5.3.4.16	Met	See note 9.
	Standards Compliance Requirements	Conditional	5.5.3.4.17	Met	See note 9.

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 2008, Section 5.5, as an AGF device.
3. The SUT does not support these conditional features.
4. The SUT does not support conditional DLoS transport.
5. The SUT is a Layer-2 device and transports IPv4 and IPv6 transparently.
6. The SUT supports following SONET interfaces: OC-3, OC-12, and OC-48, but does not support OC-192/STM-64 and OC-768.
7. The SUT does not support conditional requirements for the electrical interfaces: E1/E3 and Ethernet interfaces: 10/100 Mbps, and 10 GbE.
8. The SUT does not support conditional requirements for FICON or ESCON.
9. The SUT met UCR requirements for the specified interfaces**.**

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	IPv4	Internet Protocol version 4
AGF	Access Grooming Function	IPv6	Internet Protocol version 6
CR	Capabilities Requirement	ITU-T	International Telecommunication Union - Telecommunication
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction	Kbps	Kilobits per second
DLoS	Direct Line of Sight	LD-CELP	Low Delay-Code Excited Linear Prediction
E1	European Interface Standard (2.048 Mbps)	Mbps	Megabits per second
E3	European Interface Standard (34.368 Mbps)	NA	Not Applicable
EMS	Element Management System	NE	Network Element
ESCON	Enterprise Services Connectivity	NM	Network Management
FICON	Fiber Connectivity	NMS	Network Management System
F-NE	Fixed-Network Element	OC-X	Optical Carrier-X (OC-3, OC-12, OC-48)
FR	Functional Requirement	SAN	Storage Area Network
G.726	ITU-T speech codec for ADPCM (32 Kbps)	SDH	Synchronous Digital Hierarchy
G.728	ITU-T speech codec for LD-CELP (16 Kbps)	SONET	Synchronous Optical Network
G.729	ITU-T speech codec for CS-ACELP (8 Kbps)	STM	Synchronous Transport Module
GbE	Gigabit Ethernet	SUT	System Under Test
ID	Identification	UCR	Unified Capabilities Requirements
		VVoIP	Voice and Video over Internet Protocol

5. In accordance with the Program Manager's request, JITC did not develop a detailed test report. JITC distributes interoperability information via the JITC Electronic Report Distribution system, which uses Unclassified-But-Secure 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.

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, MD 20640-5149. The tracking number for the SUT is 1125606.

FOR THE COMMANDER:

3 Enclosures a/s

for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

Distribution (electronic mail):
Joint Staff J-6
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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, "Department of Defense Unified Capabilities Requirements 2008, Change 3," September 2011
(d) Joint Interoperability Test Command, "Unified Capabilities Interoperability Test Plan," 4 February 2010
(e) Joint Interoperability Test Command, "Information Assurance Findings and Mitigations Summary for Fujitsu FLASHWAVE® 4100 ES, Software Release Version 8.3 (TN 1125606)," 21 February 2010

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CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Fujitsu FLASHWAVE® 4100 Extension Shelf (ES), Micro Packet Optical Networking Platform, Fixed-Network Element (F-NE) with Software Release 8.3.2, hereinafter referred to as the System Under Test (SUT).

2. SPONSOR. Mr. Steve Pursell, Program Manager, HQUSAISEC, AMSEL-IE-IS, Building 53302, Fort Huachuca, AZ 85613, e-mail: steven.d.pursell.civ@mail.mil.

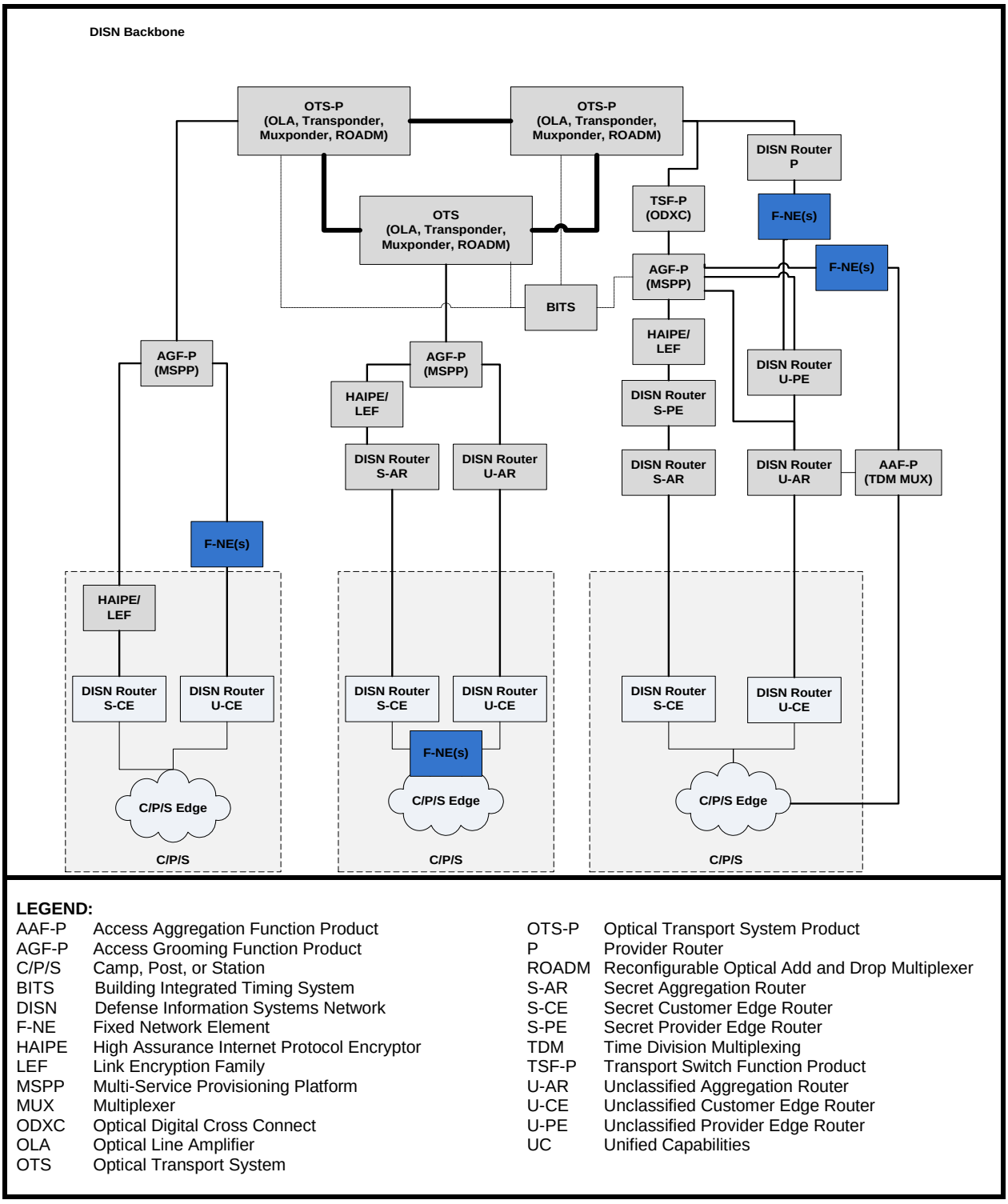
3. SYSTEM POC. Ms. Tere Zandy, 2801 Telecom Parkway, Richardson, TX 75082, e-mail: tere.zandy@us.fujitsu.com.

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

5. SYSTEM DESCRIPTION. The SUT combines and extends Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) platforms for converged time division multiplexing (TDM), data, wavelength, and transparent services transport over a single consolidated multi-service optical platform. The optical networking platforms are capable of efficiently aggregating, switching, and managing a mix of global services ranging from the lower speed Digital Signal (DS) Level 1, European Carrier (E1), and DS3 electrical interfaces; and the higher speed Optical Carrier (OC) Level 3, OC-12, and OC-48 interfaces.

The SUT is a global platform that can be deployed in both SONET and SDH environments. The SONET and SDH protocols are supported on the same circuit pack and can be provisioned by the user. The SUT provides common transport for TDM and data interfaces to support voice transport. Deployed in a ring transport topology, the SUT has a main shelf that has an Internet Protocol (IP) connection supporting Secure Shell (SSH). Although the SUT offers E1 access interfaces, JITC did not test these interfaces and they are not covered under this certification. The SUT is managed by either the NetSmart 500 or the NetSmart 1500, which is included as part of the SUT.

6. OPERATIONAL ARCHITECTURE. Under the direction of the Unified Capability (UC) Certification Office, JITC tested the SUT under the F-NE Unified Capabilities Requirements (UCR) product category. Figure 2-1 shows the role of the SUT as an F-NE in the UC architecture.



LEGEND:

AAF-P	Access Aggregation Function Product
AGF-P	Access Grooming Function Product
C/P/S	Camp, Post, or Station
BITS	Building Integrated Timing System
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 and Drop Multiplexer
S-AR	Secret Aggregation Router
S-CE	Secret Customer Edge Router
S-PE	Secret Provider Edge Router
TDM	Time Division Multiplexing
TSF-P	Transport Switch Function Product
U-AR	Unclassified Aggregation Router
U-CE	Unclassified Customer Edge Router
U-PE	Unclassified Provider Edge Router
UC	Unified Capabilities

Figure 2-1. UC Architecture

7. INTEROPERABILITY REQUIREMENTS. The interface, Capability Requirements (CR), Functional Requirements (FR), Information Assurance, and other requirements for F-NE products are established by Department of Defense (DoD) UCR 2008, Change 3, Section 5.4 and Section 5.9.

7.1 Interfaces. The F-NE products use its interfaces to connect to Local Area Network (LAN) or Defense Information System 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
NE					
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, 6, and 7		
NM					
10Base-X	Yes	5.3.2.4.4	7	Meet minimum CR/FRs and interface standards.	Provides access to local infrastructure.
100Base-X	Yes	5.3.2.4.4	7		

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	Mbps	Megabits per second
DS1	Digital Signal Level 1 (1.544 Mbps)	NE	Network Element
DS3	Digital Signal Level 3 (44.736 Mbps)	NM	Network Management
E1	European Interface Standard (2.048 Mbps)	OC-X	Optical Carrier-X (OC-3, OC-12, OC-48)
F-NE	Fixed-Network Element	UCR	Unified Capabilities Requirements

7.2 CR and FR. The F-NE products have required and conditional features and capabilities that are established by UCR 2008, Change 3, 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 and capabilities and their associated requirements for the SUT products. Table 3-1 of Enclosure 3 provides detailed CR/FR requirements.

Table 2-2. SUT CRs and FRs

CR/FR ID	Capability/Function	Applicability (See note.)	Reference (UCR 2008, Change 3)	Criteria	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		

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	International Telecommunication Union - Telecommunication
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 also supports Access Grooming Function (AGF) features. JITC tested the SUT's functionalities and capabilities based on sponsor's request. Table 2-3 lists these requirements in the Other Requirements Section. Table 2-4 lists the other CR/FR requirements. The AGF products with the designated interfaces can be used to interconnect the DISN WAN infrastructure indirectly.

Table 2-3. Other SUT Interface Requirements

Interface	Applicability	Criteria	Remarks
OC-3	Conditional	Meet Commercial interface standards and sponsor information exchange requirements.	UCR specifies minimum requirements. These requirements represent the sponsors' additional interfaces desired for fielding in U.S. and Europe.
OC-12	Conditional		
OC-48	Conditional		
STM-1	Conditional		
STM-4	Conditional		
STM-16	Conditional		
DS1	Conditional		
DS3	Conditional		
1 GbE	Conditional		

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 Requirement	OC	Optical Carrier (OC-3, OC-12, OC-48)
DS1	Digital Signal Level 1 (1.544 Mbps)	STM	Synchronous Transport Module
DS3	Digital Signal Level 3 (44.736 Mbps)	SUT	System Under Test
FR	Functional Requirement	UCR	Unified Capabilities Requirements
GbE	Gigabit Ethernet	U.S.	United States
Mbps	Megabits per second		

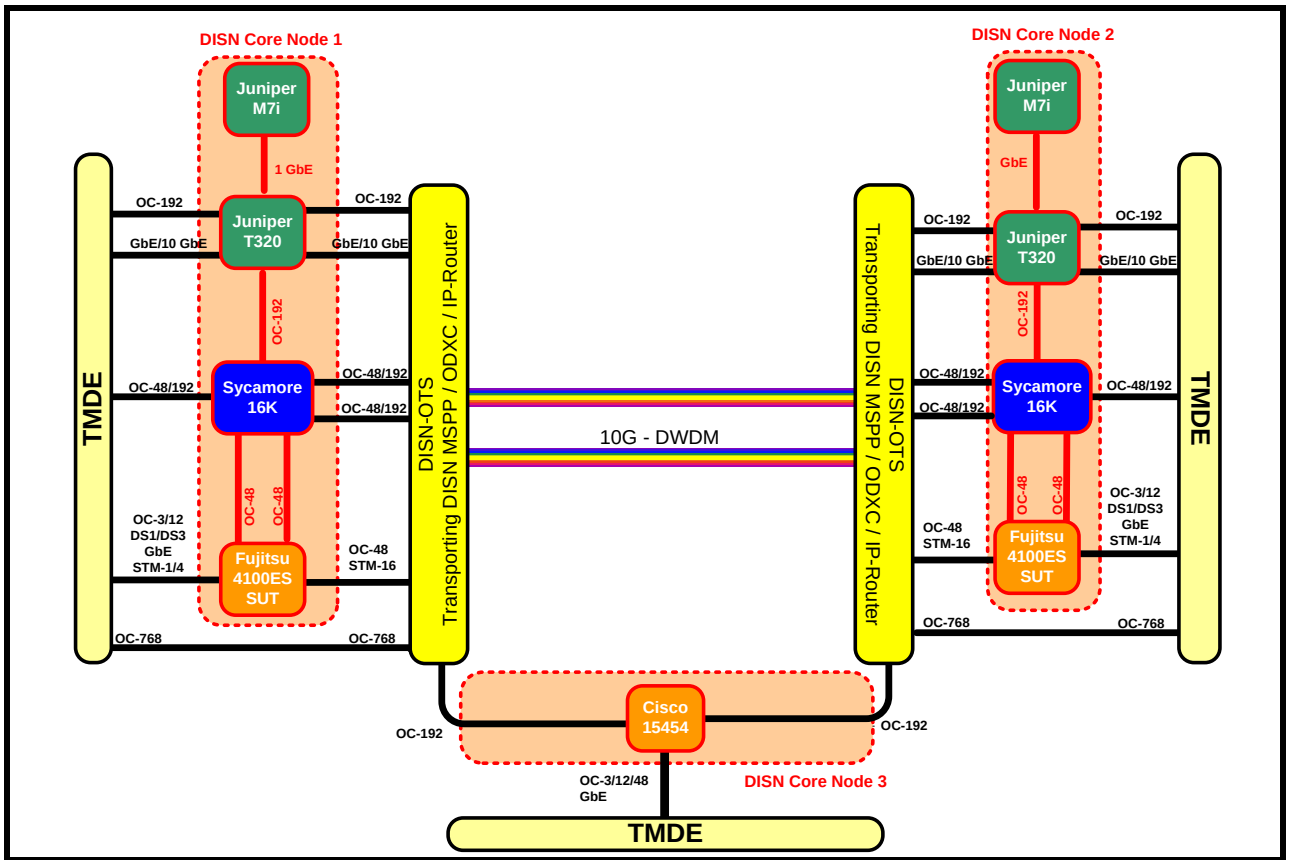
Table 2-4. Other CR/FR Requirements

CR/FR ID	Capability/Function	Applicability	Reference (UCR 2008, Change 3)	Criteria
AGF Requirements				
8	SONET Interface Requirements	Conditional	5.5.3.4.2	Meet appropriate UCR Requirements for Sponsor Requested capabilities and requests.
	SDH Interface Requirements	Conditional	5.5.3.4.3	
	Electrical Interface Requirements	Conditional	5.5.3.4.4	
	Ethernet Interface Requirements	Conditional	5.5.3.4.5	
	SAN Interface Requirements	Conditional	5.5.3.4.6	
	Cross-Connect Requirements	Conditional	5.5.3.4.7	
	Interface Performance Requirements	Conditional	5.5.3.4.8	
	Redundancy Requirements	Conditional	5.5.3.4.9	
	General Protection Requirements	Conditional	5.5.3.4.10	
	Interoperability Requirements	Conditional	5.5.3.4.11	
	Fault Management Requirements	Conditional	5.5.3.4.12	
	Performance Monitoring Requirements	Conditional	5.5.3.4.13	
	Functional Device Requirements	Conditional	5.5.3.4.14	
	Functional Device EMS Requirements	Conditional	5.5.3.4.15	
	Physical Design Requirements	Conditional	5.5.3.4.16	
	Standards Compliance Requirements	Conditional	5.5.3.4.17	

LEGEND:

AGF	Access Grooming Function	SAN	Storage Area Network
CR	Capabilities Requirement	SDH	Synchronous Digital Hierarchy
EMS	Element Management System	SONET	Synchronous Optical Network
FR	Functional Requirement	UCR	Unified Capabilities Requirements
ID	Identification		

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



LEGEND:

DISN	Defense Information Systems Network	OC	Optical Carrier
DS	Digital Signal	ODXC	Optical Digital Cross Connect
DWDM	Dense Wavelength Division Multiplexing	OTS	Optical Transport System
ES	Extension Shelf	STM	Synchronous Transport Module
G	Gigabit	SUT	System Under Test
GbE	Gigabit Ethernet	TMDE	Test, Measurement, and Diagnostic Equipment
IP	Internet Protocol		
MSPP	Multi-Service Provisioning Platform		

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 SUT, and 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
Fujitsu FLASHWAVE® 4100 ES	8.3.2	F-NE/AGF

Part Number	Description	Qty
FC9681ENX1	ES Layer 2 Ethernet Service unit	4
PL4100ECP1R0832A	Preloaded Rls.8.3.2 Software on MPE1-EPC1	3
FC95700020	OC-3 IR SFP	6
FC95700050	OC-12 IR SFP	6
FC95700160	OC-48 Multi-rate SR-1 SFP	6
FC95705030	1000Base-SX SFP	3
FC95705040	1000Base-LX SFP	3
FC95705090	100Base-LX SFP, 1310 nm, SMF (10 km)	2
FC95705110	100Base-EX SFP (40 km reach over SMF)	1
FC9681ECD1	I/O Panel - 56 DS1s (4 64-pin AMP CHAMP)	1
FC9681ECD2	I/O Panel - 28 DS1s / 3 DS3s (2 64-pin AMP CHAMP & 6 BNC)	1
FC9681ECD3	I/O Panel - 6 DS3s (12 BNC)	1
FC9681ECD4	16-port DS3 IOP	1
FC9681ECE1	I/O Panel - 8 10/100Base-T / 28 DS1s (8 RJ45 & 2 AMP CHAMP)	1
FC9681ECE2	I/O Panel - 16 10/100Base-T Ethernet (16 RJ45)	2
FC9681ECE3	I/O Panel - 8 10/100Base-T Ethernet / 3 DS3s (8 RJ45 & 6 BNC)	1
FC9681ED11	28-port DS1 Unit	2
FC9681ED12	28-port DS1 / NIU Service Unit	2
FC9681ED31	4100ES 3-port DS3 Unit	2
FC9681ED33	8-port DS3 Service Unit	2
FC9681EGX1	4100ES Ethernet SU (2 x 100/GbE 8 x 10/100)	2
FC9681EL21	OC-12 LU (SFP Base Unit)	2
FC9681EL22	ES OC-12 LU with BITS Output	2
FC9681EL31	Dual Port OC-3 LU (SFP Base Unit)	4
FC9681EL4M	Single Port OC-12/Dual Port OC-3 Service Unit	2
FC9681EL81	4100ES OC-48 LU, SFP Base	6
FC9681EL82	ES OC-48 LU with BITS Output	2
FC9681ELS3	4100ES OC-3 Service Unit, SFP base	2
FC9681ETM1	4100ES DS3 / Transmux Service Unit	2
FC9681FLE1	Extension Shelf Filler Panel (for IFE1 slots)	14
21-094-050	Straight Wired 4-PR Ethernet	3
21-195-015	Housekeeping Alarm	3
21-300-020	CA ASSY, 16 PR, 24 AWG, TIN, 25P M180/STUB	3
21-331-004	CA, Ethernet, STRT, PoE, SHLD, 24 AWG, GRN	8
21-331-005	CA, Ethernet, STRT, PoE, SHLD, 24 AWG, GRN	3
21-634-025	Primary External Clock	3
21-635-025	Secondary External Clock	3
27-100-001	1m LC/LC FBR JMPRs	12
27-100-003	3m LC/LC FBR JMPRs	12
27-100-006	6m LC/LC FBR JMPRs	20
27-100-1.5	FBR JMPR, 1-FBR, Yel SM, LC/LC UPC, XB, 1.5M	68
27-200DZ1.6-1.50	1.5m Duplex LC/LC Zip Cord FBR JMPR	26
36-418-001	SDS 60 AMP Circuit Breaker (Front Access Shelf)	1
HA660-1102-T015	Shelf Alarm Cable	3
HA660-1106-T003	Alarm Port: Rack Multi-Cable	3
27-98Y00-000	Y-Cable Kit	1

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

LEGEND:

10/100Base-T	10/100 (Baseband Operation, Twisted Pair) Ethernet	JMPR	Jumper
100Base-EX	100 Mbps GbE Transmission	km	kilometer
100Base-LX	100 Mbps Long Reach	LC	Line Connection
1000Base-LX	100 Mbps Fiber Optic GbE Standard	LU	Line Unit
1000Base-SX	1000 Mbps Fiber Optic GbE Over Multi-mode Fiber	M/m	Meter
		Mbps	Megabits per second
		MPE1	Vendor specific part name
AGF	Access Grooming Function	NIU	Network Interface Unit
AMP	Ampere	nm	nanometer
ASSY	Assembly	OC-X	Optical Carrier-X (OC-3, OC-12, OC-48)
AWG	American wire gauge	PoE	Power over Ethernet
BITS	Building Integrated Timing System	PR	Pair
BNC	Name of a video connector	Qty	Quantity
CA	Case	RJ	Registered Jack
CHAMP	Name of a connector (64-pin AMP connector)	Rls.	Release
		SDS	Signal Data System
DS1	Digital Signal Level 1	SHLD	Shield
DS3	Digital Signal Level 3	SFP	Small Form Factor
EPC1	Ethernet Port Connection 1	SM	Single Mode
ES	Extension Shelf	SMF	Single Mode Fiber
FBR	Fiber	SR	Short Reach
F-NE	Fixed Network Element	STRT	Start
GbE	Gigabit Ethernet	SU	Service Unit
GRN	Green	SUT	System Under Test
I/O	Input/Output	UC	Unified Capability
IOP	Input Output Port	UPC	Universal Product Code
IR	Intermediate Reach	XB	Connection Board
		Yel	Yellow

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 16K	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	10.4R7.5	DISN Router	4 x FE 100Base-TX, 10 x GbE LAN 1000Base-TX, 1x OC-192 SM SR2, 1 x 10GbE LAN, XENPAK
Juniper M7i	10.3R4.4	DISN Router	4 x GbE, 2 x 10/100
DISN OTS	4.2.4	DISN OTS	2 x GbE, 2 x OC-48, 8 X DWDM MUX/DMUX

LEGEND:

100Base-TX	100 Mbps Ethernet generic designation		
1000Base-TX	1000 Mbps Ethernet generic designation	Mbps	Megabits per second
DISN	Defense Information Systems Network	MSPP	Multi-Service Provisioning Platform
DMUX	Demultiplexer	MUX	Multiplexer
DS	Digital Signal	OC	Optical Carrier
DWDM	Dense Wavelength Division Multiplexing	ODXC	Optical Digital Cross Connect
ETH	Ethernet	OTS	Optical Transport System
FE	Fast Ethernet	R	Release
GbE	Gigabit Ethernet	SR	Short Reach
GPIC	Gigabit Port Interface Controller	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	X	Place holder for FX or TX

Table 2-7. Test Measurement and Diagnostic 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	
		1000Base-X	
Ixia	Traffic generator	10 G	5
		LM1000STX	
Digital Lightwave	Optical Wavelength Manager	Monitor Ports	2.4.0
Agilent	Rack Mounted Router Tester 900	10 G LAN/WAN	6.11
		10/100/1000Base-T	
		1000Base-X	
		OC-48c POS	
		OC-3/12/POS	
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:

1000Base-X	1000 Mbps Ethernet	LAN	Local Area Network
10/100/1000Base-T	10/100/1000 Mbps (Baseband Operation, Twisted Pair) Ethernet generic designation	Mbps	Megabits per second
		nm	nanometer
		OC	Optical Carrier
DSU	Data Services Unit	POS	Packet Over Synchronous Optical Network
G	Gigabit	STM	Synchronous Transport Module
JDSU	Vendor Product Name	WAN	Wide Area Network

10. TEST LIMITATIONS. The JITC Indian Head testers used Test, Measurement, and Diagnostic Equipment to simulate users and data.

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.)	Reference (UCR 2008, Change 3)	Status	Remarks
NE				
Analog	No	5.9.2.3.1	NA	See note 2.
Serial	No	5.9.2.3.2	NA	See note 2.
BRI ISDN	No	5.9.2.3.3	NA	See note 2.
DS1	No	5.9.2.3.4	Certified	See note 3.
E1	No	5.9.2.3.5	NA	See note 2.
DS3	No	5.9.2.3.6	Certified	See note 3.

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

Interface	Critical (See note 1.)	Reference (UCR 2008, Change 3)	Status	Remarks
NE				
OC-X	No	5.9.2.3.8	Certified	See notes 3 and 4.
IP (Ethernet)	No	5.9.2.3.9	Certified	See notes 3 and 5.
NM				
10Base-X	Yes	5.3.2.4.4	Certified	See note 3.
100Base-X	Yes	5.3.2.4.4	Certified	

NOTES:
1. UCR does not specify any minimum interfaces. The SUT must minimally provide one of the listed interfaces specified.
2. The SUT does not support Analog interface, Serial interface, ISDN-BRI interface, or E1 and E3 interface; however, these interfaces are not critical for F-NE certification.
3. The SUT met UCR requirements for the specified interface.
4. The SUT supports OC-3, OC-12, and OC-48 but does not support SONET interfaces of OC-192/STM-64, and OC-768; however, these interfaces are not critical for F-NE certification.
5. The SUT supports the 1 GbE interface but does not support Ethernet interfaces of 10 Mbps, 100 Mbps, and 10 GbE for client and network sides interfaces; however, these interfaces are not critical for F-NE certification.

LEGEND:

10Base-X	10 Mbps Ethernet generic designation	ISDN	Integrated Services Digital Network
100Base-X	100 Mbps Ethernet generic designation	Mbps	Megabits per second
BRI	Basic Rate Interface	NA	Not Applicable
DS1	Digital Signal Level 1 (1.544 Mbps)	NE	Network Element
DS3	Digital Signal Level 3 (44.736 Mbps)	NM	Network Management
E1	European Interface Standard (2.048 Mbps)	OC-X	Optical Carrier - X (OC-3, OC-12, etc.)
F-NE	Fixed-Network Element	SONET	Synchronous Optical Network
GbE	Gigabit Ethernet	SUT	System Under Test
IP	Internet Protocol	UCR	Unified Capabilities Requirements

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	Applicability (See notes 1 and 2.)	Reference (UCR 2008, Change 3)	Status	Remarks
F-NE CR/FR					
1	**General NE Requirements**				
	General Requirements	Required	5.9.2.1	Met	
	Alarms	Required	5.9.2.1.1	Met	
	Congestion Control & Latency	Required	5.9.2.1.2	Met	
2	**Compression**				
	G.726	Conditional	5.9.2.2	NA	See note 3.
	G.728	Conditional	5.9.2.2	NA	See note 3.
	G.729	Conditional	5.9.2.2	NA	See note 3.

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

CR/FR ID	Capability/Function	Applicability (See notes 1 and 2.)	Reference (UCR 2008, Change 3)	Status	Remarks
3	**Interface Requirements**				
	Timing	Required	5.9.2.3.7	Met	
4	**Device Management**				
	Management Options	Required	5.9.2.4.1	Met	
	Fault Management	Conditional	5.9.2.4.2	Met	
	Loop-Back Capability	Conditional	5.9.2.4.3	Met	
	Operational Configuration Restoral	Required	5.9.2.4.4	Met	
5	**DLoS**				
	DLoS Transport	Conditional	5.9.2.4.5	NA	See note 4.
6	**IPv6 Requirements**				
	Product Requirements	Required	5.3.5.4	Met	See note 5.
7	**NM Requirements**				
	VVoIP NMS Interface Requirements	Required	5.3.2.4.4	Met	
	General Management Requirements	Required	5.3.2.17.2	Met	

NOTES:
1. Annotation of "required" refers to high-level requirement category. Applicability of each sub-requirement is provided in Enclosure 3.
2. The sponsor requested the SUT be assessed against UCR 2008, Section 5.5, as an AGF device.
3. The SUT does not support these conditional features.
4. The SUT does not support conditional DLoS transport.
5. The SUT is a Layer-2 device and transports IPv4 and IPv6 transparently.

LEGEND:

ADPCM	Adaptive Differential Pulse Code Modulation	ITU-T	International Telecommunication Union - Telecommunication
AGF	Access Grooming Function	kbps	kilobits per second
CR	Capabilities Requirement	LD-CELP	Low Delay-Code Excited Linear Prediction
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction	NA	Not Applicable
DLoS	Direct Line of Sight	NE	Network Element
F-NE	Fixed-Network Element	NM	Network Management
FR	Functional Requirement	NMS	Network Management System
G.726	ITU-T speech codec for ADPCM (32 kbps)	SUT	System Under Test
G.728	ITU-T speech codec for LD-CELP (16 kbps)	UCR	Unified Capabilities Requirements
G.729	ITU-T speech codec for CS-ACELP (8 kbps)	VVoIP	Voice and Video over Internet Protocol
ID	Identification		
IPv4	Internet Protocol version 4		
IPv6	Internet Protocol version 6		

a. General Network Element (NE) Requirements

(1) General Requirements. In accordance with (IAW) UCR 2008, Change 3, 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 3, 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 actual call control signals via 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 as either inbound or outbound NE traffic and/or transport between NEs shall support one or more of the following routing protocols: Link-State and/or Distance-Vector. Therefore, the NE can notify the IP network (e.g., LAN and 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 and IP link states transparently between connecting end equipment. It also 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) 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 (nonsecure calls) to non-transcoding G.711 TDM egress shall not increase delay more than 10 millisecond (ms) per NE pair as measured E2E.

b. TDM ingress G.711 (nonsecure calls) to transcoding TDM egress with compression codecs shall not increase delay by more than 100 ms per NE pair as measured E2E.

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

d. TDM ingress G.711 (secure calls) to transcoding TDM egress with compression codecs 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 that 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 the 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. According to UCR 2008, Change 3, this requirement is conditional and therefore is not applicable to the SUT.

f. Internet Protocol version 6 (IPv6) Requirements. Product Requirements. The SUT must meet UCR 2008, Change 3, Section 5.3.5.4, IPv6 requirements for Network Appliance/Simple Server. The SUT is a Layer-2 device and transports IPv4 and IPv6 traffic transparently; therefore, requirements 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 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 DISA 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 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 v3 format. A network appliance shall have Operations interfaces that provide a standard means by which management systems can directly or indirectly communicate with and, thus, manage the various network appliances in the DISN. The physical interface between the local EMS and the VVoIP network components shall be an Ethernet connection IAW UCR 2008, Change 3, paragraph 5.3.2.4.4, VoIP NMS Interface Requirements. The physical interface between the VVoIP EMS and the VVoIP network components shall also be an Ethernet connection IAW UCR 2008, Change 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 has conducted additional tests on the SUT. The Other Interface Interoperability Status and CR/FR status under UCR 2008, Change 3, Section 5.5.3.4, and the results under AGF requirements are listed in Table 2-10 and Table 2-11.

Table 2-10. Other SUT Interface Interoperability Status

Interface	Critical (See note 1.)	Reference (UCR 2008, Change 3)	Threshold CR/FR (See note 2.)	Status	Remarks
Other (See note 4.)					
OC-3	No	5.5.3.4.2	8	Certified	See note 3.
OC-12	No	5.5.3.4.2	8	Certified	See note 3.
OC-48	No	5.5.3.4.2	8	Certified	See note 3.
STM-1	No	5.5.3.4.3	8	Certified	See note 3.
STM-4	No	5.5.3.4.3	8	Certified	See note 3.
STM-16	No	5.5.3.4.3	8	Certified	See note 3.
DS1	No	5.5.3.4.4	8	Certified	See note 3.
DS3	No	5.5.3.4.4	8	Certified	See note 3.
1 GbE	No	5.5.3.4.4	8	Certified	See note 3.

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 2-11. CR/FR numbers represent a roll-up of UCR requirements.
3. The SUT met UCR requirements for the specified interfaces.
4. The SUT does not support conditional requirements for the following SONET, electrical, and Ethernet interfaces: OC-192/768, STM 64, E1/E3, 10/100 Mbps, and 10 GbE. In addition, the conditional requirements for FICON or ESCON are not supported.

LEGEND:

CR	Capability Requirement	FR	Functional Requirement
DS1	Digital Signal Level 1 (1.544 Mbps)	GbE	Gigabit Ethernet
DS3	Digital Signal Level 3 (44.736 Mbps)	Mbps	Megabits per second
E1	European Interface Standard (2.048 Mbps)	OC	Optical Carrier
E3	European Interface Standard (34.368 Mbps)	SONET	Synchronous Optical Network
ESCON	Enterprise Services Connectivity	STM	Synchronous Transport Module
FICON	Fiber Connectivity	SUT	System Under Test
		UCR	Unified Capabilities Requirements

Table 3-2 of Enclosure 3, provides the AGF System Functional and Capability Requirements provides the detailed CR/FR requirements.

Table 2-11. Other CRs and FRs

CR/FR ID	Capability/Function	Reference (UCR 2008, Change 3)	Status	Remarks
Other Tested Requirements				
8	**AGF Requirements**			
	SONET Interface Requirements	5.5.3.4.2	Partially Met	See note 1.
	SDH Interface Requirements	5.5.3.4.3	Partially Met	See note 1.
	Electrical Interface Requirements	5.5.3.4.4	Partially Met	See note 2.
	Ethernet Interface Requirements	5.5.3.4.5	Partially Met	See note 3.
	SAN Interface Requirements	5.5.3.4.6	Not Supported	See note 3.
	Cross-Connect Requirements	5.5.3.4.7	Met	See note 4.
	Interface Performance Requirements	5.5.3.4.8	Met	See note 4.
	Redundancy Requirements	5.5.3.4.9	Met	See note 4.
	General Protection Requirements	5.5.3.4.10	Met	See note 4.
	Interoperability Requirements	5.5.3.4.11	Met	See note 4.
	Fault Management Requirements	5.5.3.4.12	Met	See note 4.
	Performance Monitoring Requirements	5.5.3.4.13	Met	See note 4.
	Functional Device Requirements	5.5.3.4.14	Met	See note 4.
	Functional Device EMS Requirements	5.5.3.4.15	Met	See note 4.
	Physical Design Requirements	5.5.3.4.16	Met	See note 4.
	Standards Compliance Requirements	5.5.3.4.17	Met	See note 4.

Note:

1. The SUT does not support SONET interfaces: OC-192/STM-64 and OC-768.
2. The SUT does not support electrical interfaces: E1 and E3.
3. The SUT does not support conditional requirements for the following Ethernet interfaces: 10/100 Mbps, and 10 GbE. In addition, the conditional requirements for FICON or ESCON are not supported.
4. The SUT met UCR requirements for the specified interfaces.

LEGEND:

AGF	Access Grooming Function	Mbps	Megabits per second
CR	Capabilities Requirement	OC	Optical Carrier
E1	European Interface Standard (2.048 Mbps)	SAN	Storage Area Network
E3	European Interface Standard (34.368 Mbps)	SDH	Synchronous Digital Hierarchy
EMS	Element Management System	STM	Synchronous Transport Module
ESCON	Enterprise Services Connectivity	SONET	Synchronous Optical Network
FICON	Fiber Connectivity	SUT	System under test
FR	Functional Requirement	UCR	Unified Capabilities Requirements
GbE	Gigabit Ethernet		
ID	Identification		

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 have required and conditional features and capabilities that are established by the Unified Capabilities Requirements. The System Under Test does not need to meet conditional requirements. If they are provided, they must function according to the specified requirements. The detailed Functional requirements and Capability Requirements for NEs are listed in Table 3-1.

Table 3-1. NE Capability/Functional Requirements

ID	Requirement	Reference (UCR 2008 CH 3)	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 $1x10^{9}$ 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

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
8	The NE shall be able to propagate CGAs upon physical loss of the TDM interface. The NE shall provide the capability of detecting a 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
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 DISN switch per the following requirements: (1) The NE shall provide the capability to handle 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 DISN 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

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
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. TDM ingress G.711 (non-secure calls) to non-transcoding G.711 TDM egress shall not increase delay more than 10 ms per NE pair as measured E2E. b. TDM ingress G.711 (non-secure calls) to transcoding TDM egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 100 ms per NE pair as measured E2E. c. TDM ingress G.711 (secure calls) to non-transcoding TDM egress G.711 shall not increase delay by more than 50 ms per NE pair as measured E2E. d. TDM ingress G.711 (secure calls) to transcoding TDM egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 250 ms per NE pair as measured E2E.	5.9.2.1.2.1 (2A, 2B, 2C, 2D)	C
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 E2E 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 DISN 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 paragraph 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 paragraph 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

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
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 DISN 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
18C	3. Dual Frequency Trunk Circuits: The DFSU equipment used in the DISN 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 IAW 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 paragraph 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 ESF framing format. D5 is also referred to as 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) PCM encoding law. Supervisory and 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 IAW 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 3, Pages 1898 thru 1900)	5.9.2.3.4	C

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
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, DP digits, 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
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 DIU as defined in Table 5.9.2.3.4-4, PCM-24 Alarm and Restoral Requirements. (Please see UCR 2008, Change 3, 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 3, 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 DISN 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 3, 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 B3ZS IAW ANSI T1.102-1993.	5.9.1.5.3.6.2	R

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
27	The NE shall be able to derive a timing signal from an internal source, an incoming digital signal, or an external source IAW paragraph 5.3.2.12.14.1.1, Timing Modes (5.3.2.12.14.1.1 Timing Modes): [Required: 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. 5.3.2.12.14.1.2 Internal Clock Requirements 5.3.2.12.14.1.2.1 General - [Required: MG] The MGs shall provide internal clock requirements as described in the Telcordia Technologies GR-518-CORE, Paragraph 18.2. 5.3.2.12.14.1.2.2 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
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) TDM ingress G.711 (non-secure calls) to non-transcoding G.711 IP egress shall not increase delay more than 50 ms per NE pair as measured E2E. (2) TDM ingress G.711 (non-secure calls) to transcoding IP egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 100 ms per NE pair as measured E2E. (3) TDM ingress G.711 (secure calls) to non-transcoding G.711 IP egress shall not increase delay by more than 50 ms per NE pair as measured E2E. (4) TDM ingress G.711 (secure calls) to transcoding IP egress with compression codecs (Section 5.9.2.2, Compression) shall not increase delay by more than 250 ms per NE pair as measured E2E.	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 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

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
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 ADIMSS or similar NM systems developed by DoD Components. The following requirements apply: (1) [Required: Data Interface] The NE shall provide 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) ** NE access (to perform NE data fill administration and network controls) (2) [Required: Fault Management] The DISN 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 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.	5.9.2.4.1	R
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 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 DISN Connection Request, concerning guidelines on submitting the DLoS transport NE engineering analysis package.	5.9.2.4.5	R

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

ID	Requirement	Reference (UCR 2008 CH 3)	F-NE
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 DISN 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 according to the appropriate STIG(s).	5.9.2.7	C

LEGEND:

ADIMSS	Advanced DISN Integrated Management Support System	IAW	In Accordance With
ADPCM	Adaptive Differential Pulse Code Modulation	ID	Identification
AES	Advanced Encryption Standard	IEEE	Institute of Electrical and Electronics Engineers
ANSI	American National Standards Institute	IP	Internet Protocol
APL	Approved Products List	IPSec	IP Security
ASCII	American Standard Code for Information Interchange	ISDN	Integrated Services Data Network
AS-SIP	Assured Services Session Initiation Protocol	ITU-T	International Telecommunications Union – Telecommunications
B3ZS	Bipolar Three Zero Substitution	kbps	kilobits Per Second
B8ZS	Bipolar Eight Zero Substitution	LAN	Local Area Network
BER	Bit Error Rate	MAN	Metropolitan Area Network
BRI	Basic Rate Interface	Mbps	Megabits Per Second
C	Conditional	MG	Media Gateway
CCS7	Common Channel Signaling 7	MIL-STD	Military Standard
CGA	Carrier Group Alarm	MLPP	Multi-Level Precedence and Preemption
CH	Change	MOS	Mean Opinion Score
CS-ACELP	Conjugate Structure Algebraic Code-Excited Linear Prediction	ms	Millisecond
D-NE	Deployed-Network Element	MTR	Maximum Transmission Range
DC	Direct Current	NE	Network Element
DFSU	Dual Frequency Signaling Unit	NIST	National Institute of Standards and Technology
DISR	DoD Information Technology Standards Registry	NM	Network Management
DISN	Defense Information Systems Network	NMS	Network Management System
DIU	Digital Interface Unit	OC-X	Optical Carrier-X (OC-3, OC-12, OC-48)
DLoS	Direct Line of Sight	P2N	Point-to-Multipoint
DoD	Department of Defense	P2MP	Point-to-Multipoint
DP	Dial Pulse	P2P	Point-to-Point
DS	Digital Signal	PBX	Private Branch Exchange
E1	European 1 (2048 Gbps, 30-channel PCM)	PCM	Pulse Code Modulation
E2E	End to End	PKI	Public Key Infrastructure
E&M	Earth and Magneto	QoS	Quality of Service
EF	Extended Frame	R	Required
EIA	Enterprise Information Architecture	REV	Revision
ESF	Extended Superframe	SF	Superframe
F-NE	Fixed-Network Element	SMEO	Small End Office
FIPS	Federal Information Processing Standard	SNMP	Secure/Simple Network Management Protocol
G.726	ITU-T speech codec for ADPCM (32 kbps)	SONET	Synchronous Optical Network
G.728	ITU-T speech codec for LD-CELP (16 kbps)	SRTP	Secure Real-Time Transport Protocol
G.729	ITU-T speech codec for CS-ACELP (8 kbps)	STIG	Security Technical implementation Guide
Gbps	Gigabits per second	T1	Trunk 1 (1544 bps, 24-channel PCM)
GR	Generic Requirement	TDM	Time Division Multiplexer/Multiplexing
Hz	Hertz	TCP	Transmission Control Protocol
		TIA	Telecommunications Industry Association
		TLS	Transport Layer Security
		UCCO	Unified Capabilities Certification Office
		UCR	Unified Capabilities Requirements
		VF	Voice Frequency
		VVoIP	Voice and Video over Internet Protocol
		WIDS	Wireless Intrusion Detection System

SYSTEM FUNCTIONAL AND CAPABILITY REQUIREMENTS

The Aggregation Grooming Function (AGF) products have required and conditional features and capabilities that are established by the Unified Capabilities Requirements (UCR). The System Under Test need not provide conditional requirements. If they are provided, they must function according to the specified requirements. The detailed Functional requirements and Capability Requirements for AGF products are listed in Table 3-2. Detailed Information Assurance requirements are included in Reference (e) and are not listed below. These requirements were extracted from the UCR; given the volume of requirements, acronyms are not provided. Refer to the UCR for acronyms.

Table 3-2. AGF Capability/Functional Requirements Table

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
1	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
2	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
3	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
4	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
5	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
6	The OC-3/OC-3c 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 (6)	R
7	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
8	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)	C
9	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
10	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
11	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
12	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
13	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
14	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
15	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
16	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
17	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)	C
18	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
19	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
20	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
21	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
22	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
23	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
24	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
25	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
26	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)	C
27	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)	C
28	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)	C
29	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
30	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
31	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
32	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
33	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
34	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
35	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
36	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)	C
37	All SONET OC-N interfaces shall be software-provision to SDH STM-N.	5.5.3.4.2 (37)	C

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
38	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 and move 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)	C
39	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
40	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
41	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
42	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
43	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
44	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
45	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)	C
46	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
47	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
48	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
49	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
50	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
51	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
52	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
53	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)	C
54	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
55	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)	R
56	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
57	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
58	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
59	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
60	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.	5.5.3.4.3 (22)	R

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
61	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.	5.5.3.4.3 (23)	C
62	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.	5.5.3.4.3 (24)	C
63	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.	5.5.3.4.3 (25)	C
64	The STM-64 Optical interface shall conform to ITU-T Recommendation G.691 optical interfaces for Single-Channel STM-64 systems.	5.5.3.4.3 (26)	R
65	The STM-64 Optical interface shall conform to ITU-T Recommendation G.691.	5.5.3.4.3 (27)	C
66	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.	5.5.3.4.3 (28)	R
67	The AGF functional device shall be able to provision, monitor, and detect faults, and restore optical services in a standardized and automated fashion.	5.5.3.4.3 (29)	R
68	The AGF functional device shall have Lambda interfaces at the 10 Gigabit rates. These shall be compatible with the transport requirements in Section 5.5.3.3, Transport Switch Function.	5.5.3.4.3.1 (1)	C
69	Lambda interfaces shall be compliant with the ITU-T Recommendation G.694.1 grid if an AGF functional device supports Lambda interfaces.	5.5.3.4.3.1 (2)	R
70	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.	5.5.3.4.4 (1)	C
71	The AGF functional device shall support DS1 electrical interfaces that comply with ANSI T1.102.	5.5.3.4.4 (2)	R
72	The AGF functional device shall support DS1 pseudowire transport via gateway SFPs	5.5.3.4.4 (3)	C
73	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
74	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
75	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
76	The AGF functional device shall support FDL status messages and respond as specified in ANSI T1.403.	5.5.3.4.4 (7)	R
77	The AGF functional device shall support unframed DS1 electrical signals.	5.5.3.4.4 (8)	R
78	The electrical interface shall comply with ITU-T Recommendation G.703.	5.5.3.4.4 (9)	R
79	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
80	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
81	The AGF functional device shall support E1 electrical interfaces shall comply with ITU-T Recommendation G.711.	5.5.3.4.4 (12)	R

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
82	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
83	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
84	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
85	The AGF functional device shall support DS3 electrical tributary interfaces that comply with ANSI T1.102-1993.	5.5.3.4.4 (16)	R
86	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
87	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
88	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
89	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
90	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
91	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
92	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
93	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
94	The AGF functional device shall provide interfaces for Ethernet, FE, and GbE services in conformance with IEEE 802.3 for Ethernet LAN interfaces.	5.5.3.4.5 (1)	R
95	The AGF functional device shall provide interfaces for 10GbE Services in conformance with IEEE 802.3 for Ethernet LAN/WAN interfaces.	5.5.3.4.5 (2)	C
96	The Logical Link IWF shall terminate the MAC layer of Ethernet as described in Ethernet Standard IEEE 802.3.	5.5.3.4.5 (3)	R
97	Ethernet interfaces shall accommodate Ethernet packets greater than 4470 bytes.	5.5.3.4.5 (4)	R
98	Ethernet services shall support port-based and flow-based VLANS for multiple rates and customer interfaces as per IEEE 802.1Q.	5.5.3.4.5 (5)	R
99	The AGF functional device shall support transparent VLAN tagging for Ethernet on SONET/SDH service.	5.5.3.4.5 (6)	R
100	The AGF functional device shall not, by default, perform any Layer 3 IP routing.	5.5.3.4.5 (7)	R
101	The AGF functional device shall be able to provision, monitor, and detect faults, and restore Ethernet services in a standardized and automated fashion.	5.5.3.4.5 (8)	R
102	The AGF functional device shall selectively provide QoS/CoS for Ethernet services according to IEEE 802.1Q.	5.5.3.4.5 (9)	R
103	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).	5.5.3.4.5 (10)	C
104	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.	5.5.3.4.5 (11)	R
105	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.	5.5.3.4.5 (12)	C

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
106	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.	5.5.3.4.5 (13)	R
107	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.	5.5.3.4.5 (14)	R
108	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.	5.5.3.4.5 (15)	C
109	The AGF functional device shall selectively provide point-to-point Ethernet services with dedicated non-shared bandwidth without queuing or buffering Ethernet frames.	5.5.3.4.5 (16)	R
110	Gigabit Ethernet and 10GbE interfaces shall be auto-sensing/auto-detecting and auto-configuring between incoming GbE and 10GbE signals.	5.5.3.4.5 (17)	R
111	Ethernet and FE interfaces shall be auto-sensing/auto-detecting and auto-configuring between incoming Ethernet and FE signals.	5.5.3.4.5 (18)	R
112	The AGF functional device shall provide Fiber Connectivity (FICON) tributary interfaces and services as per ANSI X3.230.	5.5.3.4.6 (1)	R
113	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)	R
114	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
115	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
116	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
117	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)	C
118	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
119	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
120	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
121	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
122	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
123	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
124	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
125	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)	C
126	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
127	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
128	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
129	The AGF functional device shall support SONET provisioning of OC-768c CCAT formats.	5.5.3.4.7 (16)	C
130	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
131	The AGF functional device shall support SDH provisioning of VC-4-256c CCAT formats.	5.5.3.4.7 (18)	C
132	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
133	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
134	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
135	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
136	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
137	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 of GR-499.	5.5.3.4.8 (6)	R
138	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
139	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
140	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
141	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
142	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
143	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
144	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
145	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
146	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
147	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
148	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
149	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
150	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
151	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
152	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
153	A PDH (DS1, DS3, E1, E3) card shall support a 1:1 configuration.	5.5.3.4.9 (3)	R
154	A PDH (DS1, DS3, E1, E3) card should support a 1:N configuration.	5.5.3.4.9 (4)	C
155	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
156	The AGF functional device shall support redundant power supply and electrical feeds.	5.5.3.4.9 (6)	R
157	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
158	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
159	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
160	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
161	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
162	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
163	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
164	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)	R
165	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
166	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
167	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
168	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
169	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
170	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, ARs.	5.5.3.4.11 (3)	R
171	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
172	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
173	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)	R
174	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
175	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
176	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
177	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
178	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
179	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
180	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
181	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, transient).	5.5.3.4.12 (11)	R
182	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
183	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
184	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
185	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
186	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
187	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
188	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
189	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
190	The AGF functional device shall perform drop ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (2)	R
191	The AGF functional device shall perform continued ADM functions in accordance with Telcordia Technologies GR-496-CORE.	5.5.3.4.14 (3)	R
192	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)	C
193	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
194	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)	C
195	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
196	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
197	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
198	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
199	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

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
200	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)	C
201	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
202	The AGF functional device with DS1/E1 line terminations shall provide both DS1/E1 terminal and service loopback capabilities as per Telcordia Technologies GR-253-CORE, (O) 6-397.	5.5.3.4.14 (14)	R
203	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
204	The AGF functional device should support BER Testing using standard test patterns: PRBS15, PRBS20, PRBS23, QRSS, and ATL1s0s.	5.5.3.4.14 (16)	C
205	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.	5.5.3.4.15 (1)	R
206	The AGF functional device EMS shall be able to track frame errors, P-Bit parity errors, C-Bit parity errors, and FEBE.	5.5.3.4.15 (2)	R
207	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).	5.5.3.4.15 (3)	R
208	The AGF functional device EMS shall be able to build protection topologies APS 1+1, UPSR, and BLSR.	5.5.3.4.15 (4)	R
209	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.	5.5.3.4.15 (5)	R
210	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).	5.5.3.4.15 (6)	R
211	The AGF functional device EMS shall be able to review and retrieve alarm and administration logs.	5.5.3.4.15 (7)	R
212	The AGF functional device EMS shall be able to set the alarm threshold on any interface (i.e., SD and SF).	5.5.3.4.15 (8)	R
213	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).	5.5.3.4.15 (9)	R
214	All MSPP elements shall meet the EMC/EMI requirements defined in FCC Part 15 Class A.	5.5.3.4.16 (1)	R
215	All MSPPelements shall meet the EMC/EMI requirements defined in Telcordia Technologies GR-1089-CORE.	5.5.3.4.16 (2)	R
216	Required] All MSPP elements shall meet the EMC/EMI requirements defined in ETSI EN 50082.	5.5.3.4.16 (3)	R
217	All MSPP elements shall meet the EMC/EMI requirements defined in ETSI EN 55022.	5.5.3.4.16 (4)	R
218	All MSPP elements shall meet the EMC/EMI requirements defined in ETSI EN 300-386.	5.5.3.4.16 (5)	R
219	All MSPP 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.	5.5.3.4.16 (6)	R
220	All MSPP 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.	5.5.3.4.16 (7)	R
221	All MSPP elements shall be designed to operate continuously in the following environment range without degradation. Altitude: -100 to 15,000 ft AMSL.	5.5.3.4.16 (8)	R
222	All MSPP 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.	5.5.3.4.16 (9)	R

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
223	All MSPP 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.	5.5.3.4.16 (10)	R
224	All TSF elements shall be fully operational throughout the battery voltage range of -41.5 to -56 VDC.	5.5.3.4.16 (11)	R
225	All MSPP 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.	5.5.3.4.16 (12)	R
226	All MSPP elements shall be fully NEBS, Level 3 compliant.	5.5.3.4.16 (13)	R
227	All MSPP 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.	5.5.3.4.16 (14)	R
228	All MSPP 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.	5.5.3.4.16 (15)	R
229	All MSPP elements shall be designed to operate continuously in the following environment range without degradation. Altitude: -100 to 15,000 ft AMSL.	5.5.3.4.16 (16)	R
230	All MSPP 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.	5.5.3.4.16 (17)	R
231	All MSPP 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.	5.5.3.4.16 (18)	R
232	All MSPP elements shall be fully operational throughout the battery voltage range of: -41.5 to -56 VDC.	5.5.3.4.16 (19)	R
233	All MSPP equipment shall have been tested and registered as compliant to the following electrical safety standards: UL-1950, EN60950, and IEC 60950.	5.5.3.4.16 (20)	R
234	ITU-T Recommendation G.651.1 (2007)	5.5.3.4.17 (1)	R
235	ITU-T Recommendation G.652 (10/2000) (Revised in 2005)	5.5.3.4.17 (2)	R
236	ITU-T Recommendation 694.1 (2002)	5.5.3.4.17 (3)	R
237	ITU-T Recommendation G.703 (2001)	5.5.3.4.17 (4)	R
238	ITU-T Recommendation G.707/Y.1322 (2007)	5.5.3.4.17 (5)	R
239	ITU-T Recommendation G.709/Y.1331	5.5.3.4.17 (6)	R
240	ITU-T Recommendation G.711 (1988)	5.5.3.4.17 (7)	R
241	ITU-T Recommendation G.732 (1988).	5.5.3.4.17 (8)	R
242	ITU-T Recommendation G.783 (2006)	5.5.3.4.17 (9)	R
243	ITU-T Recommendation G.825 (2000)	5.5.3.4.17 (10)	R
244	ITU-T Recommendation G.829	5.5.3.4.17 (11)	R
245	ITU-T Recommendation G.841 (1998)	5.5.3.4.17 (12)	R
246	ITU-T Recommendation G.842 (1997)	5.5.3.4.17 (13)	R
247	ITU-T Recommendation G.872 (2001)	5.5.3.4.17 (14)	R
248	ITU-T Recommendation G.957 (2006)	5.5.3.4.17 (15)	R
249	ITU-T Recommendation G.7041/Y-1303 (2003) (Revised in 2008)	5.5.3.4.17 (16)	R
250	ANSI T1.101	5.5.3.4.17 (17)	R
251	ANSI T1.102-1999	5.5.3.4.17 (18)	R
252	ANSI T1.105.1-2000	5.5.3.4.17 (19)	R
253	ANSI T1.105.03-1994 (Revised 2003 (R2008))	5.5.3.4.17 (20)	R
254	ANSI T1.105.06 – 2002 (R2007)	5.5.3.4.17 (21)	R
255	ANSI T1.107-2002 (R2006)	5.5.3.4.17 (22)	R
256	ANSI T1.231-1993 (Revised 2003 (R2007))	5.5.3.4.17 (23)	R
257	ANSI T1.403-1999 (R2007)	5.5.3.4.17 (24)	R
258	ANSI T1.404-2002 (R2006)	5.5.3.4.17 (25)	R

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

ID	Requirement	Reference (UCR 2008 CH3)	Required (R)/ Conditional (C)
259	Telcordia Technologies GR-253-CORE, Issue 3, September 2000 (Issue 4, December 2005)	5.5.3.4.17 (26)	R
260	Telcordia Technologies GR-496-CORE, Issue 1, December 1998, (Issue 2, August 2007)	5.5.3.4.17 (27)	R
261	Telcordia Technologies GR-499-CORE, Issue 2, December 1998 (Issue 3, September 2004)	5.5.3.4.17 (28)	R
262	Telcordia Technologies GR-820-CORE, Issue 2, December 1997	5.5.3.4.17 (29)	R
263	IEEE 802.3-2008	5.5.3.4.17 (30)	R
264	IEEE 802.1Q-2003	5.5.3.4.17 (31)	R
265	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	5.5.3.4.17 (32)	C
266	X3-230. ANSI FC-SB-3 and INCITS 230:1994 [R2004]	5.5.3.4.17 (33)	R
267	British Standards Institute BS EN 60950-1 August 6, 2006	5.5.3.4.17 (34)	R
268	IEC 60950-1, 2006	5.5.3.4.17 (35)	R
269	CFR FCC Part 15, Class A	5.5.3.4.17 (36)	R
270	Network Equipment - Building System (NEBS), Level 3	5.5.3.4.17 (37)	R
271	Underwriters Laboratories, Inc. UL-1950, First Edition 1989	5.5.3.4.17 (38)	R

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-NE	Deployed-Network Element
DAA	Designated Approving Authority
DC	Direct Current
DCN	Data Communications Network
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
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
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
OC	Optical Carrier
ODU	Optical Channel Data Unit
ODXC	Optical Digital Cross Connect
OSP	Open Shortest Path
OXC	Optical Cross Connect
PCM	Pulse Code Modulation
PRI	Primary rate Interface
R	Required
SCIP	Secure Communication Interoperability Protocol
SDH	Synchronous Digital Hierarchy
SONET	Synchronous Optical Transport Network

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

LEGEND:

L 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
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
STIG	Security Technical implementation Guide
STM	Synchronous Transport Module
T1	Trunk 1 (1544 bps, 24-channel PCM)
TDM	Time Division Multiplexing
TSF	Transport Switch Function
TTL	Transistor-transistor logic
UCCO	Unified Capabilities Certification Office
UCR	Unified Capabilities Requirement
UHF	Ultra high frequency
UNI	User Network Interface
VHF	Very High Frequency
VVoIP	Voice and Video over Internet Protocol
WAN	Wide Area Network