



**Verizon NEBS™ Compliance: SFU-ONT
and MDU-ONT Design Guidelines and
Testing Requirements**

Verizon Technical Purchasing Requirements

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CHANGE CONTROL RECORD:

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1	2/2/2007	Reissue	Document reissued and updated into new format. Original issue date 3/27/06
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1.0 **PURPOSE**

The purpose of this Verizon Technical Purchasing Requirement document is to provide basic design guidelines and define the minimum required NEBS testing for SFU-ONTs and MDU-ONTs.

2.0 **SCOPE**

This Technical Purchasing Requirement document is intended to summarize Verizon's Environmental, Electromagnetic Compliance, and Electrical Safety requirements, as well as additional requirements for all of its SFU-ONT and MDU-ONT products.

The "punchlist" of tests contained herein shall be used by equipment suppliers and the Verizon approved Independent Test Laboratories as the baseline of tests to create the NEBS Test Plan. In all instances of test planning and test execution, the most recent and accepted versions of the GR standards shall be used.

Service and Architectural requirements, including power, are outside the scope of this document.

3.0 **REFERENCES**

GR-49-CORE	Generic Requirements for Outdoor Telephone Network Interface Devices (NIDs)
GR-63-CORE	NEBS™ Requirements: Physical Protection
GR-78-CORE	Generic Physical Design Requirements for Telecommunications Products and Equipment
GR-487-CORE	Generic Requirements for Electronic Equipment Cabinets
GR-950-CORE	Generic Requirements for Optical Network Unit (ONU) Closures
GR-1089-CORE	Electromagnetic Compatibility and Electrical Safety – Generic Criteria for Network Telecommunications Equipment
VZ.TPR.9305	NEBS Compliance Clarification Document
SIT.NEBS.TE.NPI.2004.015	Telecommunications Carrier Group NEBS Compliance Checklist



4.0 ACRONYMS

EMI	Electromagnetic Interference
ESD	Electro Static Discharge
EUT	Equipment Under Test
FTTP	Fiber To The Premise
ITL	Independent Testing Laboratory
MDU-ONT	Multi-Dwelling Unit - Optical Network Terminal
NEMA	National Electrical Manufacturers Association
ONT	Optical Network Terminal
SFU-ONT	Single Family Unit - Optical Network Terminal

5.0 DEFINITIONS

A SFU-ONT is an ONT located outside the customer's dwelling, capable of delivering voice, data and video services to a single residential customer.

A MDU-ONT is an ONT located outside the customer's dwelling, capable of delivering voice, data and video services to multiple residential customers.

6.0 GENERAL REQUIREMENTS

Verizon requires that manufacturers submit their EUT and associated documentation to a Verizon approved ITL for testing and verification of conformance to the qualification test requirements in this document. For a list of Verizon approved laboratories and locations, consult the Verizon web page at <http://www.verizonnebs.com/tcppage.html>.

In addition to the specific test requirements listed below, products must comply with GR-78-CORE, *Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment*. Vendors may self-declare their product's compliance to GR-78-CORE by submitting a completed copy of Appendix B of the Telecommunication Carrier Group Checklist. Current versions of the TCG Compliance Checklist and the Verizon NEBS Clarification document can be found on the Verizon web page (<http://www.verizonnebs.com/index.html#chklist>).

ONTs must be designed and tested to a qualification test plan that includes all of the applicable criteria. The SFU-ONT and MDU-ONT must meet the applicable criteria contained in GR-63-CORE, GR-1089-CORE, GR-950-CORE, GR-487-CORE and GR-49-CORE. In addition to these NEBS requirements, the ONT physical design must meet the requirements set forth in GR-78-CORE (*Generic Physical Design Requirements for Telecommunications Products and Equipment*). Verizon has created the 5 GR matrix, which outlines the minimum applicable requirements from each of the GRs. It should be noted however, that these are the minimum



requirements, and that each ONT manufacturer must carefully analyze its product against each of these GR requirements to determine if any additional testing is prudent.

7.0 NEBS QUALIFICATION PLAN GUIDELINES

7.1 Equipment Test Setup Guidelines

Test configuration: The Equipment Under Test (EUT) shall be fully configured and performing its designated functions during the application of NEBS testing. The EUT and all associated documentation (installation and operating manuals), mounting and grounding schemes shall be provided to the test laboratory by the vendor prior to test commencement. All equipment interfaces (voice, video and data) shall be monitored for functionality and the test plan shall include the pass/fail criteria for each interface or service type.

7.1.1 ESD

Apply “normal operation” test criteria for ESD on customer accessed surfaces behind the customer access door.

7.1.2 EMI

The Equipment Under Test shall demonstrate safe and reliable operation with both the network elements intended for use at a customer’s premises as well as standard consumer electronic products when operated together within close proximity. The EUT shall not cause unwanted interference to adjacent consumer electronics.

- The vendor is required to generate a test plan to demonstrate safe and reliable operation of both the network elements intended for use at customer’s premises as well as standard consumer electronic products when operated within close proximity.
- Wall mountable ONT types shall be installed on a flat, non-metallic surface such as wood or PVC at a 5’ height.
- Cables should be run vertically down and out through the turntable floor openings.
- Power is not to be split out if the equipment is powered via telecommunications cable. Conducted emissions are to be performed on a single lead for both power and signal.



7.1.3 Lightning Surge and AC Power Fault

First-Level lightning surge requirements shall apply to demonstrate performance and lightning protection. The ONT shall be designed to withstand lightning surges on the Telecommunications and AC Power ports. To demonstrate compliance, the vendor's equipment shall be able to withstand First-Level lightning surge levels up to $\pm 5000\text{V}$ on the Telecommunications Ports and AC Power Ports. The acceptance criteria is that the equipment be capable of resuming operation after a $\pm 5000\text{V}$ lightning strike without replacement of components, manual rebooting, or human intervention.

7.1.4 Vibration

Wall mountable ONT types shall be installed and tested on a stiff vertical surface having a natural frequency greater than 35 Hz as specified in Section 5.1.4.3 of GR-63-CORE.

7.1.5 Use of Fire Resistant Materials and Fire Resistance Testing

The ONT shall utilize fire resistant materials and components as described in GR-63-CORE Section 4.2.3 and GR-78-CORE. Fire resistance testing will be performed in the electronics compartment to demonstrate the ONT Fire Resistance and Self-Extinguishing characteristics. Fire resistance testing shall be performed per GR-63-CORE and the Verizon NEBS Clarification document. The ONT enclosures are not required to withstand the GR-487-CORE brush fire test requirement.

Design Requirement:

- Flames shall not exit the ONT at any time during the test, since any amount of flames exiting the equipment poses a significant safety hazard.



7.1.6 ONT Water Intrusion Requirements

The SFU-ONT and MDU-ONT shall resist water, dust, and insect intrusion as described in GR-950-CORE and GR-487-CORE and as shown in the 5 GRs Matrix, contained herein. A NEMA rating shall not be used as a substitute for the NEBS testing requirements.

Design Suggestions:

- To successfully pass these tests, the ONT design should incorporate grooves that channel water away from the electronics when the doors are closed during a rain storm, as well as when the doors are opened following a rain storm when the ONT's exterior surface has not dried completely.
- The ONT is not likely to withstand water and dust intrusion without a rubber or silicone gasketing around the ONT enclosure, specifically at cable entry points and around doors and covers. The amount of gasketing should not interfere with the opening and closing of the doors, and should stay in place and keep its shape even after exposure to harsh chemicals and thermal aging. Seals or gaskets around the cable entryways shall stay firmly in place when cables are changed or added to the ONT.
- The grommets used in the cable access area should be designed to prevent water, dust and insect intrusion without the use of any silicone material since this makes servicing of the ONT more difficult and time consuming. Furthermore, it necessitates putting new grommets in place and sealing them again with silicone after the service has been performed. Making cable entry channels longer will reduce the likelihood of water entering the product during a rain shower, although the design must also take into account water intrusion from lawn sprinklers.

8.0 TEST REQUIREMENTS – SFU-ONT

The SFU-ONT NEBS requirements need to account for the outdoor environment in which they will be located. SFU-ONTs will be tested to all applicable sections of the 5 GR matrix. The 5 GR matrix provides the minimum test requirements and it is the ONT manufacturers responsibility to analyze its product against each of the requirements to determine if any additional testing is prudent. If a specific requirement is not applicable, then rational must be provided to support the assertion. See Appendix for 5 GR Matrix.



9.0 TEST REQUIREMENTS – MDU-ONT

The MDU-ONT NEBS requirements need to account for the outdoor environment in which they will be located. SFU-ONTs will be tested to all applicable sections of the 5 GR matrix. The 5 GR matrix provides the minimum test requirements and it is the ONT manufacturers responsibility to analyze its product against each of the requirements to determine if any additional testing is prudent. If a specific requirement is not applicable, then rational must be provided to support the assertion. See Appendix for 5 GR Matrix.



Appendix – 5 GR Matrix



GR-63, "NEBS Requirements: Physical Protection"

Issue 3, March 2006

To be filled out by the vendor, since the requirements are dependent on the design
NOTES: parameters.

Criteria	Section	Section Description	Y	N	N/A	Completion Date	Remarks
	4.1	Temperature, Humidity, and Altitude Criteria					
R4-1		[67] The equipment manufacturer shall be responsible to perform root cause analysis for each failure that occurs during NEBS product testing.					Minimum Test Requirement
R4-2		[68] Solution to the root cause problem shall be consistent with customers' reliability/ technical requirements.					Minimum Test Requirement
	4.1.1	Transportation and Storage Environmental Criteria					
R4-3		[69] The packaged equipment shall not sustain any damage or deteriorate in functional performance after it has been exposed to the environment described in Table 4- 1.					Minimum Test Requirement
R4-4		[70] The packaged equipment shall not sustain any damage or deteriorate in functional performance after it has been exposed to the environment described in Table 4- 2.					Minimum Test Requirement
R4-5		[71] The packaged equipment shall not sustain any damage or deteriorate in functional performance after it has been exposed to the environment described in Table 4-3.					Minimum Test Requirement
	4.1.2	Operating Temperature and Humidity Criteria					
R4-6		[72] The equipment shall not sustain any damage or deterioration of functional performance during its operating life when operated within the conditions of Table 4-4.					Perform modified temperature and humidity profile using GR-487-CORE temperature limits of -40C and 65C.
R4-7		[73] This requirement has been deleted per Issue 3.			N/A		
	4.1.3	Altitude					



R4-8	[74] All equipment shall be functional when installed at elevations between 60 m (197 ft) below sea level and 1800 m (6000 ft) above sea level at aisle-ambient temperatures of 40°C.				
R4-9	[136] All equipment shall be functional when installed at elevations between 1800 m (6000 ft) and 4000 m (13,000 ft) above sea level, at aisle-ambient temperatures of 30°C. At elevations greater than 1800 m above sea level, the cooling capacity of ambient air is reduced due to its reduced density. It may be necessary to work with the purchaser to provide adequate cooling.				
R4-10	[75] The manufacturer shall provide special requirements for installations above 1800 m (6000 ft) in the product documentation, if needed.				
O4-11	[137] All equipment should be functional when installed at elevations between 60 m (197 ft) below sea level and 1800 m (6000 ft) above sea level at aisle-ambient temperatures of 50°C.				
O4-12	[76] All equipment should be functional when installed at elevations between 1800 m (6000 ft) and 4000 m (13,000 ft) above sea level, at aisle-ambient temperatures of 40°C.				
	4.1.4 Temperature Margin Evaluation				
R4-13	[153] Equipment response to temperatures up to 10°C above the short-term high temperature extreme of Table 4-4, “Ambient1 Temperature and Humidity Limits,” shall be determined. Report the threshold temperature for deterioration of functional performance and/or equipment shutdown.		N/A		Test not required. Test covered by GR-63-CORE R4-6 with modified GR-487-CORE temperature extremes.
	4.1.5 Fan Cooled Equipment Criteria				
R4-14	[154] Equipment cooled by forced convection shall not sustain damage or deterioration of functional performance when operated with any single fan failure at a 40°C aisle ambient for a short-term of up to 96 hours per Table 4-4, “Ambient Temperature and Humidity Limits.”				Not applicable if unit does not contain fans.
R4-15	[155] Equipment cooled by forced convection shall have provisions for remote alarm notification of a fan failure.				Not applicable if unit does not contain fans.
O4-16	[156] Equipment cooled by forced convection should be designed and constructed such that any fan or cooling unit replacement can be performed with no service interruption.				Not applicable if unit does not contain fans.
R4-17	[157] The replacement procedure for fans and cooling units shall be included in the product documentation.				Not applicable if unit does not contain fans.
R4-18	[158] When a fan or cooling unit replacement requires service interruption, the estimated time of replacement by a skilled technician shall be reported.				Not applicable if unit does not contain fans.
	4.1.6 Heat Dissipation				



R4-19	[77] The maximum heat release and method of cooling (e.g., natural convection, forced-air fans) shall be documented for all equipment. For floor mounted equipment, document the heat release in Watts, as well as W/m2 or W/ft2 of floor area. For equipment shelves, document the heat release in Watts as well as W/m2 per meter or W/ft2 per foot of frame vertical height used.				
O4-20	[78] Equipment heat release should not exceed the values presented in Table 4-5, "Equipment Area Heat Release Objective." Heat release greater than these objectives must be clearly identified in product documentation along with a note indicating that special equipment room cooling may be required. The heat release objectives for an individual frame are based upon overall system heat release that does not exceed the system values Table 4-5 provides.				
4.1.7 Surface Temperature					
O4-21	[79] It is an objective that equipment surfaces that face aisles or surfaces where normal maintenance functions are anticipated shall not exceed 48°C (118°F) when the equipment is operating in a room with an ambient air temperature of 23°C (73°F). Passive equipment, wherein no heat is generated, are exempt from testing.				Test all exposed surfaces.
R4-22	[159] It is a requirement that equipment surfaces that face aisles or surfaces where normal maintenance functions are anticipated shall be in conformance to the temperature limits established in Table 4-6, "Temperature Limits of Touchable Surfaces," when the equipment is operating in a room with an ambient air temperature of 23°C (73°F). Passive equipment, wherein no heat is generated, is exempt from testing.				Test all exposed surfaces.
4.1.8 Equipment Airflow					
O4-23	[160] Equipment cooled by forced convection should be constructed with one of the following airflow schemes: <ul style="list-style-type: none"> • Bottom-front to top-rear airflow (EC class F1-R3) (preferred) • Bottom-front to top (EC class F1-T) • Mid-front to mid-rear (EC class F2-R2) • Mid-front to top-rear (EC class F2-R3) • Mid-front to top (EC class F2-T). 				Not applicable if unit does not contain fans.
O4-24	[161] The following equipment airflow schemes should not be used: <ul style="list-style-type: none"> • Bottom exhaust (EC class X-B) • Front exhaust (EC class X-FX) 				Not applicable if unit does not contain fans.



		• Side exhaust (EC class X-SRX or X-SLX).				
	4.2	Fire Resistance				
R4-25		[80] This requirement has been deleted per Issue 3			N/A	
R4-26		[81] When tested following the procedures of ANSI T1.319-2002 and the modifications of Section 5.2 of this GR, fire shall not spread beyond the confines of the equipment assembly being tested. In accordance with ANSI T1.319-2002, the fire shall be judged to have spread beyond the equipment under test if any of the following occur: • Sustain ignition to an adjacent equipment enclosure or printed circuit board material of an adjacent equipment shelf • Ignition of the Frame Level Ignition Indicator Module (FLIIM).				Test to shelf level criteria
R4-27		[162] When tested following the procedures of ANSI T1.319-2002 and the modifications of Section 5.2 of this GR, the equipment shall not demonstrate excessive surface burning or external flaming. The equipment shall be judged to have excessive surface burning or external flaming if the following occurs: • Flames (other than flames from the methane line burner) in excess of 50 mm in any dimension and extending beyond the top or bottom of the equipment under test for 30 seconds or more, after 170 seconds from the start of the line burner profile. • Flames (other than flames from the methane line burner) in excess of 50 mm in any dimension extending beyond any confines of the front, rear or sides of the equipment under test continuously for 30 seconds or more.				Test to shelf level criteria
R4-28		[82] The fire propagation hazard shall be characterized by measuring and recording the rate of heat release of the equipment fire as tested by the methods of Section 5.2, “Fire Test Methods.”				Test to shelf level criteria
O4-29		[83] The peak rate of heat release measured should not exceed 150 kW at any time during the test.				Test to shelf level criteria
O4-30		[84] The average rate of heat release should not exceed 100 kW over any 30-minute period during the test.				Test to shelf level criteria
R4-31		[85] This requirement has been deleted per Issue 3.			N/A	
R4-32		[86] When tested following the procedures of ANSI T1.319-2002 and the modifications of Section 5.2 of this GR, fire shall not spread beyond the confines of the equipment assembly being tested. In accordance with ANSI T1.319-2002, the fire shall be judged to have spread beyond the equipment under test if the following occurs:				Minimum Test Requirement



		• Ignition of the Shelf Level Ignition Indicator Module (SLIIM).					
R4-33		[163] When tested following the procedures of ANSI T1.319-2002 and the modifications of Section 5.2 of this GR, the equipment shall not demonstrate excessive surface burning or external flaming. The equipment shall be judged to have excessive surface burning or external flaming if any of the following occur:					Minimum Test Requirement
		• Flames (other than flames from the methane line burner) in excess of 50 mm in any dimension and extending beyond the top or bottom of the equipment under test for 30 seconds or more, after 170 seconds from the start of the line burner profile.					Minimum Test Requirement
		• Flames (other than flames from the methane line burner) in excess of 50 mm in any dimension extending beyond any confines of the front, rear or sides of the equipment under test continuously for 30 seconds or more.					Minimum Test Requirement
R4-34		[87] The fire propagation hazard shall be characterized by measuring and recording the rate of heat release of the equipment fire, as tested by the methods of Section 5.2, "Fire Test Methods."					Minimum Test Requirement
O4-35		[88] The peak rate of heat release measured should not exceed 50 kW at any time during the test.					Minimum Test Requirement
O4-36		[89] The average rate of heat release should not exceed 35 kW during any 15-minute period during the test.					Minimum Test Requirement
O4-37		[164] At 4 minutes and 30 seconds into the test, after the conclusion of the methane ignition line burn, the components in the equipment assembly should show evidence of beginning to self-extinguish.					Minimum Test Requirement
O4-38		[165] At 10 minutes into the test, there should be a significant flame reduction and a reduction in the visible smoke from the equipment assembly as determined by visual observations and supported by the video record and analytic smoke measurements.					Minimum Test Requirement
R4-39		[166] At 15 minutes into the test, flames shall be extinguished.					Minimum Test Requirement
O4-40		[167] At 15 minutes into the test, there should be no more than minimal wisps of smoke from the equipment assembly as determined by visible observations and supported by the video record and analytic smoke measurements.					Minimum Test Requirement
R4-41		[168] At 20 minutes into the test, there shall be no visible smoke from the equipment assembly as determined by visible observations and supported by the video record and analytic smoke measurements.					Minimum Test Requirement



R4-42	[90] All materials, components, and interconnect wire and cable used within equipment assemblies shall meet the requirements of Section 4.1 of ANSI T1.307-2003, Fire-Resistance Criteria - Ignitability Requirements for Equipment Assemblies, Ancillary Non-Metallic Apparatus, and Fire Spread Requirements for Wire and Cable.					Minimum Test Requirement
R4-43	[91] Mechanical components (examples include circuit boards, backplanes, connectors, and plastic covers and handles) shall be either:					Minimum Test Requirement
	• Rated SC 0, SC 1, SC-TC 0 or SC-TC 1, or					Minimum Test Requirement
	• Formed of materials that, in the minimum thickness as used in the component, are rated UL 94 V-0 as determined by ANSI/UL 94-1996, Test for flammability of plastic materials for parts in devices and appliances, or					Minimum Test Requirement
	• Formed of materials that, in the minimum thickness as used in the component, are rated UL 94 V-1 and have an oxygen index of 28% or greater as determined by ASTM D2863-00, Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index), or					Minimum Test Requirement
	• Conforming to the needle flame test of ANSI T1.307-2003 (Section 5.1), or					Minimum Test Requirement
	• Conforming to the in-situ needle flame test of ANSI T1.307-2003 (Section 5.2), or					Minimum Test Requirement
	• Conforming to the Telcordia needle flame test of Section 5.2.3.1 of this GR, or					Minimum Test Requirement
R4-44	• Conforming to the Telcordia in-situ needle flame test of Section 5.2.3.2 of this GR					Minimum Test Requirement
	[92] Small discrete structural components, grouped in close proximity, as described in the second paragraph of R4-43 [91], shall be tested to the needle flame test, as described in ANSI T1.307-2003 (Section 5.2), or the Telcordia needle flame test of Section 5.2.3. The ignition of one component by the test flame shall not ignite any adjacent component.					Minimum Test Requirement
R4-45	[93] Foamed polymers shall meet the HF-1 requirements of ANSI/UL 94-1996. NOTE: Foamed polymer air filter assemblies must also meet the firespread requirements of Section 4.5, "Airborne Contaminants."					Minimum Test Requirement
R4-46	[94] This requirement has been deleted per Issue 2.					Minimum Test Requirement
R4-47	[95] Insulating tapes shall meet the flammability requirements of UL 510-2005, Insulating Tape.					Minimum Test Requirement
R4-48	[96] Sleeving and tubing flammability shall meet the VW-1 requirements of ANSI/UL 1441-1995, Coated Electrical Sleeving.					Minimum Test Requirement
R4-49	[97] Discrete electronic components shall be either:					Minimum Test Requirement
	• Conforming to the needle flame test of ANSI T1.307-2003, Section 5.1, or					



	<ul style="list-style-type: none"> • Conforming to the in-situ needle flame test of ANSI T1.307-2003, Section 5.2, or • Conforming to the Telcordia needle flame test of Section 5.2.3.1 of this GR, or • Conforming to the Telcordia in-situ needle flame test of Section 5.2.3.2 of this GR, or • Be rated SC 0, SC 1, SC-TC 0 or SC-TC 1, or • Formed of materials that, in the minimum thickness as used in the component, are rated UL 94 V-0 as determined by ANSI/UL 94-1996, or • Formed of materials that, in the minimum thickness as used in the component, are rated UL 94 V-1 and have an oxygen index of 28% or greater as determined by ASTM D2863-2000. 					
R4-50	[98] Interconnect wire shall satisfy the VW-1 requirements contained in ANSI/UL 1581-2001, Reference standard for electrical wires, cables, and flexible cords.					Minimum Test Requirement
O4-51	[99] This objective has been deleted per Issue 3.			N/A		
R4-52	[100] This requirement has been deleted per Issue 3. It is incorporated into other Section 4 requirements of this GR.			N/A		
R4-53	[101] Communications wiring used in air-handling ducts and plenums shall have a maximum flame spread of 1.5 m, a maximum peak optical smoke density smoke value of 0.5, and a maximum average optical density value of 0.15 when tested in accordance with ANSI/NFPA 262-2002, Test for fire and smoke characteristics of wires and cables. Power wire and cable used in air handling ducts and plenums shall comply with Article 300-22 of ANSI/NFPA 70-2002, National electrical code.					Minimum Test Requirement
R4-54	[102] Wire and cable used in riser shafts shall satisfy the flammability requirements of ANSI/UL 1666-2000, Test for flame propagation height of electrical and optical-fiber cables installed vertically in shafts. Wire and cable suitable for use in duct or plenum spaces conform to this requirement.					Minimum Test Requirement
R4-55	[103] Communication and power wire and cables running either horizontally or vertically in other spaces including dedicated cable pathways or cross-connect equipment, shall meet one of the following requirements:					Minimum Test Requirement
	<ul style="list-style-type: none"> • UL 1685 -1997, Vertical-tray fire-propagation and smoke-release test for electrical and optical-fiber cable, or • CAN/CS-C22.2 No. 0.3-01, Test methods for electrical wires and cables, or • ANSI/IEEE 1202-1991, Flame testing of cables for use in cable tray in industrial and commercial occupancies. 					



	Wire and cable suitable for use in duct or plenum spaces or riser shafts conform to this requirement.					
O4-56	[104] Communication, power, and riser wire and cable should satisfy the requirements for smoke emission levels of UL 1685-1997, Vertical-tray fire propagation and smoke-release test for electrical and optical-fiber cable.					Minimum Test Requirement
R4-57	[105] All ac-powered wiring and fittings in equipment shall meet the flammability requirements referenced by the National Electrical Code (NEC) for their specific use in the equipment.					Minimum Test Requirement
O4-58	[106] This objective has been deleted per Issue 3.			N/A		
R4-59	[169] Optical fiber cable tray/raceway used in air handling ducts and plenums shall have a maximum flame spread of 5 ft (1.52 m), a maximum peak optical smoke density smoke value of 0.5, and a maximum average optical density value of 0.15 when tested in accordance with the Test for Flame Propagation and Smoke Density Values (Plenum) of UL 2024A-2002, Outline of Investigation for Optical Fiber Cable Routing Assemblies.					Minimum Test Requirement
R4-60	[170] Optical fiber cable tray/raceway used in riser shafts shall satisfy the flammability requirements of the Test for Flame Propagation (Riser) of UL 2024A-2002, Outline of Investigation for Optical Fiber Cable Routing Assemblies.					Minimum Test Requirement
R4-61	[171] Optical fiber cable tray/raceway used in spaces other than duct, plenum or riser spaces shall comply with the Vertical Tray Flame Test (General) of UL 2024A-2002, Outline of Investigation for Optical Fiber Cable Routing Assemblies.					Minimum Test Requirement
R4-62	[172] Products having an exposed surface area < 1 ft2 (0.09 m2) shall be formed from materials having a fire-resistance characteristic equivalent to or better than UL 94 V-0 as determined by ANSI/UL 94-1996.					Minimum Test Requirement
R4-63	[173] Products having an exposed surface area > 1 ft2 (0.09 m2) to 10 ft2 (0.93 m2) shall be formed from materials having a fire-resistance characteristic equivalent to or better than UL-94 5V as determined by ANSI/UL 94-1996.					Minimum Test Requirement
R4-64	[174] Products having an exposed surface area > 10 ft2 shall be formed from materials having a fire-resistance characteristic equivalent to or better than UL-94 5VA as determined by ANSI/UL 94-1996, and shall have a flame-spread rating of < 200.					Minimum Test Requirement
	4.3 Equipment Handling Criteria					
	4.3.1 Packaged Equipment Shock					



R4-65	[107] The packaged equipment shall not sustain any physical damage or deteriorate in functional performance when subjected to free- fall shock levels of Table 4-7.					Minimum Test Requirement
R4-66	[108] The packaged equipment shall not sustain any physical damage or deteriorate in functional performance when subjected to free-fall shock levels of Table 4-8.					Minimum Test Requirement
	4.3.2 Unpackaged Equipment Shock					
R4-67	[109] The unpackaged equipment shall not sustain any physical damage or deteriorate in functional performance when subjected to applicable shock levels of Table 4-9. Minor cosmetic damage, such as scratches, dings, and nicks, do not necessarily constitute nonconformance.					Minimum Test Requirement
	4.4 Earthquake, Office Vibration, and Transportation Vibration					
	4.4.1 Earthquake Environment and Criteria					
R4-68	[110] All equipment shall be constructed to sustain the waveform testing of Section 5.4.1, "Earthquake Test Methods," without permanent structural or mechanical damage.					Minimum Test Requirement
R4-69	[111] Frame-level equipment shall be constructed so that during the waveform testing of Section 5.4.1, the maximum single- amplitude deflection at the top of the framework, relative to the base, does not exceed 75 mm (3 in).					
R4-70	[112] Frame-level equipment shall have a natural mechanical frequency greater than 2.0 Hz as determined by the swept sine survey of Section 5.4.1.					
O4-71	[113] Frame-level equipment should have a natural mechanical frequency greater than 6.0 Hz as determined by the swept sine survey of Section 5.4.1.					
R4-72	[114] All equipment shall be constructed to meet applicable functionality requirements immediately before and after each axis of waveform testing of Section 5.4.1. The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.					Minimum Test Requirement
O4-73	[115] All equipment should be constructed to meet applicable functionality requirements continuously during waveform testing of Section 5.4.1. These functionality criteria shall demonstrate that the equipment has sustained operation without loss of service during the testing.					Minimum Test Requirement
	4.4.2 Framework and Anchor Criteria					
O4-74	[116] Framework should be of welded construction.					
R4-75	[117] Framework shall be constructed for base mounting to the floor without auxiliary support or bracing from the building walls or ceilings.					



O4-76	[118] For framework used in earthquake risk zones, the static pull testing procedures of Section 5.4.1.4 should be followed, meeting these objectives:				
	· The maximum single amplitude deflection at the top of the framework should not exceed 75 mm (3 in).				
	· The top of the framework should return to its original position, within 6 mm (0.24 in) when the load is removed.				
	· The framework should sustain no permanent structural damage during static framework testing.				
R4-77	[119] Concrete expansion anchors used to base mount framework to the floor shall meet the following requirements:				
	· Maximum embedment depth of 90 mm (3.5 in)				
	· Maximum bolt diameter of 13 mm (0.5 in).				
O4-78	[120] Concrete expansion anchors used to base mount the framework to the floor should be suitable for earthquake (dynamic) applications, as specified by the manufacturer.				
O4-79	[121] Concrete expansion anchors should use steel construction to minimize creep.				
	4.4.3 Wall-Mounted Equipment Anchor Criterion				
R4-80	[175] Fastening systems used for wall-mounted equipment shall withstand a force of 3 times the weight of the equipment applied to the equipment in any direction.				Minimum Test Requirement
	4.4.4 Office Vibration Environment and Criteria				
R4-81	[122] All equipment shall be constructed to sustain the office vibration testing of Section 5.4.2 without permanent structural or mechanical damage.				Minimum Test Requirement
R4-82	[123] All equipment shall be constructed to meet applicable functionality requirements continuously during each axis of the office vibration testing of Section 5.4.2. The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.				Minimum Test Requirement
	4.4.5 Transportation Vibration Criteria				
R4-83	[124] Equipment shall not sustain any physical damage or deteriorate in functional performance when subjected to vibration levels expected during transportation.				Minimum Test Requirement
	4.5 Airborne Contaminants				



R4-84	[125] It is a requirement that equipment intended for installation in controlled environmental space operate reliably for its intended service life within the average yearly levels of contamination listed in Table 4- 12. Conformance to this requirement for reactive gases and hygroscopic fine particulate can be demonstrated through the test methods given in Section 5.5.				
R4-85	[126] This objective has been deleted per Issue 2.			N/A	
R4-86	[127] It is a requirement that equipment intended to function in outdoor air, such as cabinets installed on pads or poles, with little or no filtration should operate reliably for the intended service life at the contaminant levels listed in Table 4-11. Conformance to this requirement for reactive gases and hygroscopic fine particulates can be demonstrated through the test methods given in Section 5.5.				Minimum Test Requirement
R4-87	[138] All fan cooled equipment shall be equipped with filters. Fan filters shall be replaceable with equipment operating. Fans used to cool the outside of sealed equipment cabinets need not be fitted with particulate filters.				Not applicable if unit does not contain fans.
R4-88	[139] All equipment fan filters used in equipment occupying over 2U of vertical rack space (90 mm or 3.5 in) shall have either a:				Not applicable if unit does not contain fans.
	• Minimum dust arrestance of 80%, per ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter, 1992, or				Not applicable if unit does not contain fans.
	• Minimum Efficiency Rating Value (MERV) of 4, per ASHRAE Standard 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size, 1999.				Not applicable if unit does not contain fans.
R4-89	[176] All equipment fan filters used in equipment occupying 2U of vertical rack space (90 mm or 3.5 in) or less shall have either a:				Not applicable if unit does not contain fans.
	• Minimum dust arrestance of 65%, per ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter, 1992, or				Not applicable if unit does not contain fans.
	• Minimum Efficiency Rating Value (MERV) of 2, per ASHRAE Standard 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size, 1999.				Not applicable if unit does not contain fans.
R4-90	[140] Fan filters shall have a minimum fire rating of Class 2 per UL 900, Standard Air Filter Units, 1994.				Not applicable if unit does not contain fans.



R4-91	[141] Construction and system fit of equipment fan filters shall prevent any air bypass. Inadvertent leakage that may result from mechanical fits or tolerances, (examples may include spaces between circuit pack face plates, connector or cable matrices, chassis screw or mounting holes, etc.), is not considered bypass.					Not applicable if unit does not contain fans.
R4-92	[142] Equipment shall have provision for fan-filter replacement with the fans shut down or blocked to prevent handling contamination. Some designs where the filters are withdrawn from the airflow for removal (e.g., door mounted filters) satisfy the intent of this requirement.					Not applicable if unit does not contain fans.
R4-93	[143] The equipment manufacturer shall provide a method for determining equipment fan filter replacement schedules.					Not applicable if unit does not contain fans.
O4-94	[144] If possible, active alarming should be provided to indicate the need for fan filter replacement.					Not applicable if unit does not contain fans.
O4-95	[145] It is an objective that equipment fan filters are disposable and not the types that require removal and cleaning.					Not applicable if unit does not contain fans.
	4.6 Acoustic Noise					
R4-96	[128] Under normal operation, equipment shall not produce declared A-weighted sound power level (LWAd) above the limits shown in Table 4-13.					Not applicable if unit does not contain fans.
R4-97	[177] The sound power level produced by equipment while operating at maximum fan speed shall be measured and provided.					Not applicable if unit does not contain fans.
	4.7 Illumination					
R4-98	[129] CO lighting systems shall maintain the minimum levels of illumination in CO equipment areas according to Table 4- 14, "Minimum Maintained Illumination Level.".					
O4-99	[130] New lighting systems should provide initial illumination levels at least 25% higher (to account for losses due to lamp lumen depreciation and dirt accumulation in the luminaire), but no more than 50% higher (to account for modularity of the lighting equipment) than the levels listed in Table 4- 14, "Minimum Maintained Illumination Levels.".					
R4-100	[131] The lighting system shall use energy efficient components (lamps, ballasts, etc.).					
O4-101	[134] The luminances of surfaces immediately adjacent to the visual task should be at least one- third that of the task, and they should not exceed the luminance of the task. For more remote surfaces, the luminance of any significant surface normally viewed directly should be between one- third and five times the luminance of the task.					



O4-102	[135] In all new installations, fluorescent lamps should be used in equipment and operating areas because of their relatively high light output per watt. As a standard practice, it is recommended that fluorescent lamps with good color rendition be used.					
O4-103	[132] The surface reflectance of equipment should be treated as elements of the lighting system. Light (high reflectance) surfaces should be used as they are much more efficient than dark surfaces in conserving light and distributing it uniformly. Finish textures should be matte or flat rather than glossy; this aids in distributing light evenly and minimizing reflected glare.					Minimum Test Requirement
O4-104	[133] Equipment designers and lighting designers should take steps to control glare.					Minimum Test Requirement



GR-487-CORE, "Generic Requirements for Electronic Equipment Cabinets"

Issue 2, March 2000

NOTES: To be filled out by the vendor, since the requirements are dependent on the design parameters.

R #	Description	Y	N	N/A	Completion Date	Remarks
3. Detailed Requirements						
3.1 Product Samples						
R3-1	Representative Sample					Minimum Test Requirement
R3-2	Identification					Minimum Test Requirement
R3-3	Cabinet ID					Minimum Test Requirement
3.2 Product Changes						
R3-4	Change Notification					Minimum Test Requirement
3.3 Safety and Reliability Considerations						
R3-5	No hazards					Minimum Test Requirement
R3-6	Product integrity					Minimum Test Requirement
R3-7	Standards					Minimum Test Requirement
R3-8	Environmental Hazard					Minimum Test Requirement
R3-9	Exposed Surf Temp					Minimum Test Requirement
3.4 Metallic Materials						
CR3-10	Metallic Materials					Minimum Test Requirement
R3-11	Zinc-plated Hardware					Minimum Test Requirement
R3-12	Passivation					Minimum Test Requirement



3.5 Polymeric & Non-Metallic Materials						
CR3-13	Identification			N/A		
R3-14	Chemical Resistance					Include any additional chemicals listed in GR-49 and GR-950 Chemical Tests
CR3-15	Compound Resist					Minimum Test Requirement
R3-16	Compatibility					Minimum Test Requirement
R3-17	Flammability					Minimum Test Requirement
R3-18	Wire and Cable					Minimum Test Requirement
R3-19	Foam Gaskets					Minimum Test Requirement
R3-20	Exterior Housing					Minimum Test Requirement
R3-21	Fungus Growth					Minimum Test Requirement
R3-22	UV Resistance					Test per GR-950, R5-34
R3-23	Seal and Gaskets					Test per GR-950, R5-19
R3-24	Rubber Compounds; ASTM D 518, 40C for 70 hrs					Minimum Test Requirement
R3-25	Adhesives					Minimum Test Requirement
3.6.1 Color						
R3-26	Master Color Schedule					Minimum Test Requirement
R3-27	Measurement					Minimum Test Requirement
R3-28	Touch-up Paint					Minimum Test Requirement
R3-29	Gloss Level					Minimum Test Requirement
R3-30	Unit Color/Texture					Minimum Test Requirement
R3-31	Polymer Gloss/Haze					Minimum Test Requirement
3.6.3 Paint Adhesion						
R3-32	Scrape Adhesion					Minimum Test Requirement
3.6.4 Flexibility						
R3-33	Impact Test					Minimum Test Requirement
3.6.5 Paint Adhesion After Exposure						



R3-34	Salt Fog					Minimum Test Requirement
3.6.6 Ultraviolet Resistance						
R3-35	UV Exposure					Test per GR-950, R5-35
3.7 Screen and Filters						
R3-36	Filter Replacement					Minimum Test Requirement
R3-37	Filter Material					Minimum Test Requirement
R3-38	Water Intrusion					Minimum Test Requirement
R3-39	Moisture Drains					Minimum Test Requirement
3.8 Door Restrainers (Vertically Hinged Doors)						
R3-40	Door Restraint					
R3-41	Self-Activation					
R3-42	Wind Resistance					
R3-43	Wind Resistance (Dyn)					
O3-44	Wind Resist, 50mph					
3.9 Horizontally Hinged Doors						
R3-45	Lift/Close Force					
R3-46	Mechanical Assist					
R3-47	Mechanical Assist Wear					
R3-48	Mech Assist Failure					
R3-49	Door Support					
R3-50	Door Support Engage					
R3-51	Door Support Operation					
R3-52	Door Opening					
R3-53	Minimum Clearance					
R3-54	Reachable Height					
CR3-55	Curtain					
R3-56	Gutters					
3.10 Lifting Details						
R3-57	Lifting Details					



R3-58	Interior Intrusion					
R3-59	Deformation					
3.12 Alarms						
3.12.1 General						
R3-70	Intrusion, AC Fail Alarm					
CR3-71	Audible Local Alarm					
R3-72	Active Cooling Fail Alarm					
CR3-73	High Temp Alarm					
CR3-74	Batt Heater Fail Alarm					
R3-75	High H ₂ Alarm					
CR3-76	H ₂ Rect Shut-down					
3.12.2 Engine Generator						
R3-77	Generator Failure (Major)					
R3-78	Generator Failure (Minor)					
R3-79	Proper Operation					
R3-80	Load Transfer					
3.13 Condensation						



R3-81	Proc to Minimize					
R3-82	Dripping on Equip					
3.14 Fans						
R3-83	40K Hr Life					Not applicable if unit does not contain fans
O3-84	80K Hr Life					Not applicable if unit does not contain fans
O3-85	Door Open Operation					Not applicable if unit does not contain fans
O3-86	Override					Not applicable if unit does not contain fans
R3-87	Guards					Not applicable if unit does not contain fans
3.15 Bonding and Grounding						
R3-88	Buss Bar					Minimum Test Requirement
R3-89	Buss Bar X-Section					Minimum Test Requirement
R3-90	Individual Cable Bonds					Minimum Test Requirement
R3-91	Doors					Minimum Test Requirement
3.16 AC Power						
3.16.1 Commercial Power						
R3-92	120/240 Single Phase					
CR3-93	Expansion					
R3-94	Certified Dist Panel					
R3-95	Schematic					
R3-96	NEMA Service Entrance					
R3-97	Surge Suppressor					
O3-98	Surge Suppressor					
R3-99	Convenience Outlet					
R3-100	Power Meter Mtg					
R3-101	Power Routing					
CR3-102	Integrated Power Distribution					
3.16.2 Auxiliary Power						
R3-103	TR-NWT-001293					
R3-104	Auto Transfer Switch					



R3-105	Gen Conn, Transfer Switch					
R3-106	Transfer Switch Rating					
R3-107	Gen Connector					
R3-108	Power Interlock					
CR3-109	Indicator Lamp					
3.17 Splicing Compartment						
R3-110	Splice Storage					
R3-111	Equip Protection					
CR3-112	Encapsulation					
CR3-113	Outside Door/Panel					
R3-114	2 Cable Access Ports					
R3-115	Safety					
R3-116	Sealing					
R3-117	Coax Cable Support					
R3-118	Coax Cable Prep Sp					
R3-119	Coax Routing/Store					
R3-120	Fiber Tie-Down					
CR3-121	50 Ft Fiber Store					
R3-122	Fiber Term Storage					
CR3-123	Fiber Spl Storage					
3.18 Electronic Equipment Compartment						
R3-124	Outside Door					
CR3-125	Panels for Doors					
R3-126	No Ext Air Cooling					
3.19 Battery Compartment						
R3-127	H ₂ Evolution Rate					
R3-128	Battery Location					
R3-129	Separate Compartment					
R3-130	Ventilation					



O3-121	Temperature					
R3-132	Heaters					
R3-133	Access					
CR3-134	Drawer Openings					
R3-135	Safety					
CR3-136	Visual Inspection					
R3-137	Insulation					
R3-138	Protection					
3.20 Engine-Generator Compartment						
R3-139	Security					
R3-140	Control Location					
R3-141	TR-NWT-001293					
R3-142	Marking, Packaging					
R3-143	QA Requirements					
R3-144	Documentation, Training					
R3-145	Head Losses					
R3-146	Intake/Exh Port Locations					
R3-147	Port Protection					
R3-148	Port Shutters					
R3-149	Wind Vel Heads					
R3-150	Periodic Service Access					
R3-151	Cooling					
R3-152	Exh Temperature					
3.21 Pole Mounted, Aerial Cabinets						
R3-153	Cable Strain Relief					
R3-154	Cable Shield Bonding					
CR3-155	Safety Strap					
R3-156	Two Pole Mounting					



3.22 Documentation						
R3-157	Documentation Set					Minimum Test Requirement
R3-158	Decals					
CR3-159	Training Packages					
3.23 Marking, Packaging and Shipping						
R3-160	Marking					
R3-161	Marking Height					
R3-162	Shipping Container					
R3-163	Packaging					
R3-164	Moisture Damage					
R3-165	Forklift					
R3-166	Shipping Damage					
R3-167	Non-Metallic Tie-Downs					
3.24 Installation and Maintenance						
R3-168	Installation Hardware					
R3-169	Shims					
R3-170	Integrated Leveling					
R3-171	Pad Mounting Inserts					
R3-172	10 Yr Replacement					
R3-173	Maintenance Schedule					
R3-174	Repl Parts Ordering Info					
O3-175	Parts Availability					
O3-176	Equiv Parts					
R3-177	Install Instructions					
R3-178	Pad Materials					
CR3-179	Pwr Ped on Pad					
R3-180	Template					
R3-181	Pad Install Instructions					
R3-182	Non-Metallic Gasket					



O3-183	Gasket for Steel					
CR3-184	Pad Size					
3.25 Quality						
R3-185	Processes, Procedures					Minimum Test Requirement
R3-186	Surveillance Program					Minimum Test Requirement
3.26 Exposure to High Temperature						
R3-187	Critical Thermal Loc					Minimum Test Requirement
CR3-188	65°C Limit					
CR3-189	No Solar Load					
CR3-190	No Cooling Rise					
3.27 Thermal Shock						
R3-191	Thermal Cycle Ops					Use GR-950-CORE, Section 5.5.3 to test. 144 hour test - test hinges after test.
3.28 Water and Dust Intrusion						
3.28.1 Wind Driven Rain						
CR3-192	Wind Driven Rain					Minimum Test Requirement
3.28.2 Rain Intrusion						
R3-193	Water Intrusion					Minimum Test Requirement
3.28.3 Lawn Sprinklers						
O3-194	Water Intrusion					Minimum Test Requirement
3.28.4 Weather tightness						
R3-195	Intrusion, Dust/Snow					Minimum Test Requirement
3.29 Acoustical Noise Suppression						
R3-196	Noise Limit					Not applicable if unit does not contain fans.
3.30 Wind Resistance						
R3-197	Unbalanced Forces due to wind					Minimum Test Requirement
R3-198	Pad Overturning					
3.31 Impact Resistance						



R3-199	Impact Resistance					Test to GR-49 R5-12
3.32 Firearms Resistance						
R3-200	Shotgun Test					
CR3-201	Other Firearms Test					
3.33 Fire Resistance						
R3-202	Brush Fire Test					Test to GR-63, Section 4.2.2
3.34 Corrosion Resistance						
3.34.1 Salt Fog						
R3-203	Salt Fog Exposure					Minimum Test Requirement
3.34.2 Temperature Cycling/High Humidity						
R3-204	Temp/Humidity Cycle					Test to GR-950 R5-24. **Check the hinges for operation at the temperature extremes during test cycle.
3.35 Shock and Vibration						
3.35.1 Transportation Shock						
R3-205	Packaged Drop Test					Test to GR-63-CORE
3.35.2 Transportation Shock (Rail)						
R3-206	Rail Shock Test			N/A		The ONT weighs less than 200 lbs
3.35.3 Transportation Vibration						
R3-207	Packaged Vibration Test					Test to GR-63-CORE
3.35.4 Installation Shock						
R3-208	Unpackaged Drop Test					Test to GR-63-CORE
R3-209	Environmental Vibe Test					Test to GR-63-CORE
3.35.6 Earthquake Resistance						
R3-210	Earthquake Test					Test to GR-63-CORE



GR-950-CORE, "Generic Requirements for Optical Network Unit (ONU) Closures"

Issue 2, December 1998

NOTES: To be filled out by the vendor, since the requirements are dependent on the design parameters.

R #	Description	Y	N	N/A	Completion Date	Remarks
3. Detailed Requirements						
R3-1	Documentation					
R3-2	Audio-Visual Training Packages					
R3-3 to CR3-7	Identification					
R3-8 to O3-10	Shipping Container and Packaging Arrangement					
R3-11, R3-12	Package Label					
R3-13 to R3-16	Consumable Materials					
4. Functional Design Features						
R4-1 to R4-4	Deployment Configurations					
R4-5	Mounting Hardware					
R4-6 to R4-8	Components					
R4-9 to CR4-10	Installation Size and Weight					
R4-11	Maintenance					
R4-12	Tools					
R4-13 to R-14	Safety					
R4-15 to CR4-16	Security					
R4-17 to O4-24	Termination Compartments					
R4-25 to R4-30	Cable Compatibility					
R4-31 to O4-39	Cable Capacity					
R4-40 to R4-42	Cable Termination Hardware					



R4-43 to O4-46	Fiber Splice Capacity					
R4-47 to R4-52	Fiber Protection					
R4-53 to O4-65	Cable Management - Stubbed ONU Closures					
R4-66 to R4-67	DC Power Interface Connection					
CR4-68 to CR4-70	AC Power Interface Connection					
R4-71 to R4-73	Back-up Power Source Environment					
R4-74	Electrical Safety					Minimum Test Requirement
R4-75 to R4-79	Bonding and Grounding					Minimum Test Requirement
R4-80 to R4-85	Surge Protection					
5. Global Product Requirements						
5.2 Closure Surface Criteria						
5.2.1 Appearance						
R5-1	Uniform Color and Texture for Coated Closure					
R5-2	Uniform Surface Appearance for Plastic Enclosure					
5.2.2 Color and Surface Gloss						
R5-3	Color Notation					
CR5-1	Bell Gary-Green					
R5-4	Gloss					
5.2.3 Coating Defects						
R5-5	Film Defects					Minimum Test Requirement
5.2.4 Coating Adhesion						
R5-6	ASTM D 2197					
5.2.5 Coating Impact Resistance						
R5-7	ASTM D 2794					
5.2.6 Secondary Finish Protection						
R5-8	Finish Protection					
5.3 Electrical Criteria						
5.3.1 Bond Clamp Retention						
R5-9	Tensile Load of 9 kg					



5.3.2 AC Fault Test						
R5-10	1000A for 20 seconds					
5.4 Mechanical Criteria						
5.4.1 Cable Clamping						
R5-11	Optical attenuation					Minimum Test Requirement
5.4.2 Sheath Retention						
R5-12	Axial Load of 100 lbs to cable					Minimum Test Requirement
5.4.3 Cable Flexing						
R5-13	90 Deg Flexing at -18C & 40C					Minimum Test Requirement
5.4.4 Cable Torsion						
R5-14	Torsional Loading at -18C and 40C					Minimum Test Requirement
5.4.5 Vertical Drop						
R5-15	30 Inches Drop at -18C and 40C					Minimum Test Requirement
5.4.6 Compression						
R5-16	Dimension Deformation					Minimum Test Requirement
5.4.7 Impact						
R5-17	Mechanical Impact at -18 and 40C					Minimum Test Requirement
5.4.8 Central Member (CM) Protrusion						
R5-18	Preventing Movement					Minimum Test Requirement
5.5 Environmental Criteria						
5.5.1 Accelerated Thermal Aging						
R5-19	Sealing; 90C for 30 days					Following test, unit to be used for GR-487-CORE Thermal Shock and Water Intrusion Tests
5.5.2 Assembly						
R5-20	Assembled at 0 and 40C					Minimum Test Requirement
5.5.3 Temperature and Humidity						
R5-21	Solar Load Calculation					



R5-22	Max Power Dissipation					
R5-23	No Externally Vented Fans					
R5-24	-40 to 65C, 30 days					Test performed on a fully operational EUT
5.5.4 Freeze / Thaw						
R5-25	10 cycles					
5.5. Weathertightness						
R5-26	Dust Accumulation					Test per GR-487 Section 3.28.4
R5-27	Wind Driven Rain; MIL-STD-810E, Method 506.3, Procedure 1, 30 min per surface					Test per GR-487 Section 3.28.1
5.5.6 Corrosion Resistance						
R5-28	Salt Fog (normal use)					Test per GR-487, R3-203
5.5.7 Chemical Resistance						
5.5.7.1 Material Degradation						
R5-29	Exposure - no cracking					Test per GR-487, R3-14
5.5.7.2 Chamber Immersion						
R5-30	Submersion					
R5-31	Change in Weight					
R5-32	Change in Tensile and Elongation					
5.5.8 Insect Resistance						
R5-33	Insect Intrusion					
5.5.9 Ultraviolet Resistance						
R5-34	UV-B source for 90 days - Change in Tensile and Elongation					Minimum Test Requirement
R5-35	UV-B source for 90 days - No Cracking, Blistering, etc					Minimum Test Requirement
R5-36	ASTM G 21, Rating 0					Test per GR-487, R3-21
5.5.11 Brush Fire Resistance						
R5-37	Brush Fire Test					Test per GR-63, Section 4.2.2
5.6 Conditional Requirements						
5.6.1 Bullet Resistance						



CR5-2	Shotgun Blast					
5.6.2 Cable Core Blocking Ability						
CR5-3	Damaged Cable Sheath - Water Intrusion					
5.6.3 Steam Resistance						
CR5-4	Enclosure					
5.6.4 Fire Resistance						
CR5-5	NRTL Listing					Minimum Test Requirement
CR5-6	ASTM D2863, Oxygen Index of 28					Test per GR-63 Section 4.2
CR5-7	94 V-1					Test per GR-63 Section 4.2
CR5-8	Fire test; 5 min					Test per GR-63 Section 4.2
CR5-9	Fire test - cable					Test per GR-63 Section 4.2
5.6.5 Rodent Resistance						
	Design features for non-metallic closures					Minimum Test Requirement



GR-49-CORE, "Generic Requirements for Outdoor Telephone Network Interface Devices (NIDs)"

Issue 2, November 1998.

NOTES: To be filled out by the vendor, since the requirements are dependent on the design parameters.

R #	Description	Y	N	N/A	Completion Date	Y, N/A, MR (Mod Req)	Remarks
1. Introduction							
1.8 Test Equipment and Ambient Conditions							
R1-1	Measurements						
1.9 Sample Selection and Retest							
O1-2	Production Sample						
O1-3	Test Error						
O1-4	Retest Sample Size						
2. General Requirements							
2.1 Features							
R2-1	Compartments						
R2-2	Telco Comp Size						
R2-3	Cust Comp Size						
R2-4	Additional						
2.2 Listing							
R2-5	NRTL Listing						See GR-1089, R7-1



2.3 Materials							
2.3.1 Outdoor NID							
R2-6	Construction materials						
2.3.2 Coaxial F-Ports							
R2-7	Materials						
R2-8	Finishes						
R2-9	Finishes - Contamination						
2.4 Construction Safety							
R2-10	Safety criteria						
2.6 Marking							
R2-11	Instructions						
R2-12	Marking						
2.7 Packaging and Shipping							
R2-13	Packing						
2.8 Quality Assurance and Reliability Reqs							
2.8.1 Quality Program Analysis							
CR2-14	Procedures						
CR2-15	Documentation						
O2-16	On-Site Analysis						
2.8.2 Product Quality Surveillance							
CR2-17	On-Site Program						
2.8.3 Reliability Predictions							
CR2-18	Reliability Predictions						
2.9 Additional Components							
R2-19	Telcordia Compliance						
2.10 Product Design Change							
R2-20	Documentation						



2.11 Toxic Materials						
R2-21	No Toxic Materials					
R2-22	MSDS					
3. Electrical Requirements						
3.1 Insulation Resistance						
R3-1	Any terminal to Gnd					Minimum Test Requirement
3.2 Series Resistance						
R3-2	Series Resistance					
3.3 Dielectric Withstand						
R3-3	Normal Conditions; 1000 Vrms					Minimum Test Requirement
CR3-4	Severe Conditions; 1500 Vrms					
3.4 Dielectric Withstand to Mounting Surfaces						
R3-5	Terminal to Mtg Surf; 2500 Vrms					Minimum Test Requirement
3.5 High-Current Capacity						
R3-6	Connector Current Cap; 5A for 15 min					Minimum Test Requirement
3.6 Lightning Surge						
R3-7	Normal Conditions; GR-1089					
CR3-8	Severe Conditions; additional 1st and 2nd level surges					Test per GR-1089
3.7 Coaxial F-Port Electrical Performance						
3.7.1 Insertion Loss						
R3-9	Cable Splice Attenuation					
3.7.2 Return Loss						



R3-10	Cable Splice VSWR						
3.7.3 Shielding Effectiveness							
R3-11	Cable Transfer Impedance						
R3-12	GTEM Cell Method						
R3-13	OATS Method						
3.7.4 Fused Coaxial NID							
3.7.4.1 General Fusing Requirements							
R3-14	Fuse Location						
R3-15	Voltage Limiting Device						
R3-16	Fuse Rating						
R3-17	Replacement Instructions						
3.7.4.2 Electrical Performance Requirements							
R3-18	Fuse Fire/Frag Safety						
R3-19	Replaceable Fuse						
R3-20	Functionality Verification						
3.7.4.2.1 Steady-State Current							
R3-21	Current-Carrying Ability						
3.7.4.2.2 Surge Resistibility							
R3-22	Surge Survival						
4. Mechanical Requirements of Conductors							



4.1 Conductor Pull-Out						
R4-1	Conductor Pull-Out					Minimum Test Requirement
4.2 Inside Wire Installation Spacing						
R4-2	Tip/Ring Spacing					Minimum Test Requirement
4.3 Wiring						
R4-3	Wire Size and Insulation					
4.4 Bonding and Grounding						
R4-4	TR-NWT-001075					Generic Requirements for Outside Plant Bonding and Grounding Systems Hardware. Any wire provided for grounding shall be solid copper minimum 6 AWG.
5. Environmental Requirements						
5.1 High-Temp Storage/Mold Stress						
R5-1	Normal Aging Conditions, 70C					Minimum Test Requirement
R5-2	Passing Criteria					Minimum Test Requirement
CR5-3	Severe Aging Conditions, 80C					
5.2 Temperature Cycling						
R5-4	Normal Temperature; 360 2-hr cycles					Test to GR-950 R5-24. Add the resistance measurement once per day to obtain a trend line.
CR5-5	Severe Temperature; 1000 2-hr cycles					
5.3 Temperature Cycling With Humidity						
R5-6	Normal Conditions; 60 12-hr cycles					Test to GR-950, R5-24
CR5-7	Severe Conditions; 300 12-hr cycles					
CR5-8	Passing Criteria; 300 12-hr cycles					
R5-9	Pass Criteria, during					Minimum Test Requirement
R5-10	Pass Criteria, after test					Minimum Test Requirement



5.4 Operation Life						
R5-11	50 Subscriber Cycles					Minimum Test Requirement
5.5 Impact						
R5-12	Impact Resistance					Minimum Test Requirement
5.6 Drop Test						
R5-13	Drop Damage; 4 drops from 5 ft, at -40C					Test to GR-950, R5-15
5.7 Vibration						
R5-14	Packaging Vibration; GR-63					Test to GR-63-CORE
5.8 Torque						
R5-15	20 in-lb Torque					Minimum Test Requirement
5.9 Sand and Dust						
R5-16	GR-13-CORE					Test to GR-487, R3-195
5.10 Rain						
R5-17	Rain test					Test to GR-487, CR3-192
5.11 Salt Fog						
R5-18	30 Day Salt Fog					Test to GR-487, R3-203
CR5-19	60 Day Salt Fog					
5.12 Salt Fog With Open Covers						
CR5-20	30 Day Salt Fog					
5.13 Sunshine						
R5-21	Solar Rad Damage; ASTM G26-93, Method B, 60 days					Test to GR-487-CORE R3-22
R5-22	Post Solar Impact Test					
5.14 Fungus Resistance						
R5-23	Fungus Growth					Test to GR-487, R3-21
5.15 Flammability						
R5-24	Flammability Criteria, Oxygen Index of 28% and UL746C					Test to GR-63, Section 4.2



5.16 Chemical Resistance						
R5-25	Physical Damage; 30 days					Test to GR-487, R3-14
R5-26	Tip/Ring Resistance					
R5-27	Post Exp Impact Test					
CR5-28	Metal Corrosion					
5.17 Longitudinal Balance Following Salt Fog						
R5-29	Post S/F Long Bal					
5.18 Immersion (Flooded Environment)						
CR5-30	3 Day Immersion					
5.19 Loosening Torque (Temperature)						
R5-31	Coax Conn Torque					Test at conclusion of GR-950, R5-24
5.20 F-Port Vibration						
R5-32	Coax Conn Torque					Test at conclusion of GR-63, R4-81
6. Modular Jacks						
6.1 Mechanical Requirements						
6.1.1 Contact Construction						
R6-1	Construction					Minimum Test Requirement
6.1.2 Contacts						
R6-2	Modular Jack Const.					Minimum Test Requirement
R6-3	Contact Force					Minimum Test Requirement
R6-4	Contact Metallization					Minimum Test Requirement
R6-5	Metal Adhesion					Minimum Test Requirement
R6-6	Metal Porosity					Minimum Test Requirement
R6-7	Contact Appearance					Minimum Test Requirement
6.1.3 Insertion Criteria						
R6-8	700 Insertions					Minimum Test Requirement
O6-9	1000 Insertions					
6.1.4 Go/No Go						
R6-10	Interface Dimensions					



6.2 Environmental						
6.2.3 Aging Pretreatment						
R6-11	Normal Conditions; 70C for 14 days					Test to GR-950-CORE R5-19
CR6-12	Severe Climate Conditions; 80C for 14 days					
6.2.4 Operational Life Pretreatment						
R6-13	Mod Jack - 50 Insertions after aging					Minimum Test Requirement
6.2.5 Dipping (Severe Climatic Conditions) Pretreat						
CR6-14	Jack Immersion					
6.2.6 Immersion (Flooded Conditions) Pretreat						
CR6-15	Jack Immersion					
6.2.7 Mounting Pretreat						
R6-16	Mount Pretreated Unit					
6.2.8 Temperature Cycling With Humidity						
R6-17	Leakage Current and Res					Minimum Test Requirement



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Issue 4, June 2006

NOTES: To be filled out by the vendor, since the requirements are dependent on the design parameters.

Criteria	Section	Section Name	Y	N	N/A	Completion Date	Remarks
	2	System-Level Electrostatic Discharge (ESD) and Electrical Fast Transient (EFT)					
	2.1	System-Level Electrostatic Discharge					
	2.1.1	Overview					
	2.1.2	ESD Immunity Criteria					
R2-1 [1]	2.1.2	ESD Immunity Criteria					Minimum Test Requirement
R2-2 [2]	2.1.2	ESD Immunity Criteria					Minimum Test Requirement
R2-3 [3]	2.1.2.1	Immunity Criteria – Normal Operation					Minimum Test Requirement
O2-4 [4]	2.1.2.2	Immunity Criteria – Installation and Repair					Minimum Test Requirement
R2-5 [5]	2.1.2.3	ESD Warning Label Requirements					Minimum Test Requirement
R2-6 [6]	2.1.2.4	Equipment Specific Requirements					Minimum Test Requirement
R2-7 [7]	2.1.2.4	Equipment Specific Requirements					Minimum Test Requirement
	2.1.3	Service-Affecting Responses and Manual Interventions					
	2.1.4	ESD Test Methods and Procedures					
	2.2	Electrical Fast Transients (EFT)					
O2-8 [126]	2.2	Electrical Fast Transient					Minimum Test Requirement
	2.2.1	EFT Test Methods and Procedures					



	3	Electromagnetic Interference					
	3.1	General					
	3.1.1	Overview					
	3.1.2	Intent of EMI Criteria					
	3.1.3	FCC Part 15 Criteria					
	3.1.4	FCC Part 68 and ACTA Technical Criteria					
	3.1.5	Documentation					
R3-1 [159]	3.1.5	Documentation					Minimum Test Requirement
	3.2	Emission Criteria					
	3.2.1	Radiated Emissions Criteria					
R3-2 [8]	3.2.1.1	Electric Fields Radiated Emission Criteria for Unintentional Radiators					Minimum Test Requirement
O3-3 [9]	3.2.1.1	Electric Fields Radiated Emission Criteria for Unintentional Radiators					Minimum Test Requirement
R3-4 [10]	3.2.1.1	Electric Fields Radiated Emission Criteria for Unintentional Radiators					Minimum Test Requirement
R3-5 [160]	3.2.1.2	Electric Fields Radiated Emission Criteria for Intentional Radiators					Minimum Test Requirement
R3-6 [161]	3.2.1.2	Electric Fields Radiated Emission Criteria for Intentional Radiators					Minimum Test Requirement
R3-7 [162]	3.2.1.2	Electric Fields Radiated Emission Criteria for Intentional Radiators					Minimum Test Requirement
O3-8 [163]	3.2.1.2	Electric Fields Radiated Emission Criteria for Intentional Radiators					Minimum Test Requirement
R3-9 [11]	3.2.1.3	Magnetic Fields Radiated Emission Requirement					Minimum Test Requirement
	3.2.2	Conducted Emission Criteria for Power Ports					
R3-10 [12]	3.2.2.1	Conducted Emission Requirements for AC Power Ports – Voltage					Minimum Test Requirement
R3-11 [13]	3.2.2.2	Conducted Emission Requirements for AC and DC Power Ports – Current					Minimum Test Requirement
	3.2.3	Conducted Emission Criteria for Telecommunications Ports					
R3-12	3.2.3.1	Conducted Emissions Requirements for Signal Leads – Current					Minimum Test Requirement



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R3-13 [14]	3.2.3.2	Conducted Emission Requirements For Analog Voiceband Leads						N/A	Not a requirement for inside wiring.
O3-14 [129]	3.2.3.3	Conducted Emissions Objectives for Telecommunication Leads							Minimum Test Requirement
	3.3	Immunity Criteria							
	3.3.1	Radiated Immunity Criteria							
R3-15 [15]	3.3.1.1	Electric Fields Radiated Immunity Criteria with Doors and Covers Closed							This requirement has been deleted
R3-16 [16]	3.3.1.1	Electric Fields Radiated Immunity Criteria with Doors and Covers Closed							Minimum Test Requirement
R3-17 [17]	3.3.1.2	Electric Fields Radiated Immunity Criteria with Doors and Covers Open							This requirement has been deleted
R3-18 [18]	3.3.1.2	Electric Fields Radiated Immunity Criteria with Doors and Covers Open							Minimum Test Requirement
	3.3.2	Conducted Immunity Criteria for AC and DC Power Ports							
R3-19 [19]	3.3.2	Conducted Immunity Criteria for AC and DC Power Ports							This requirement has been deleted
R3-20 [130]	3.3.2	Conducted Immunity Criteria for AC and DC Power Ports							
	3.3.3	Conducted Immunity Criteria for Telecommunications Ports							
R3-21 [131]	3.3.3.1	Conducted Immunity Requirement for Signal Leads							
O3-22 [164]	3.3.3.2	Conducted Immunity Objectives for Voiceband and Telecommunications Leads							
	4	Lightning and AC Power Fault							
	4.1	Overview							
	4.2	Electrical Protection on Paired-Conductor Systems							
	4.2.1	Voltage-Limiting Protectors							
	4.2.2	Current-Limiting Protectors							
	4.2.3	Fuse Links							
	4.3	Lightning on Paired-Conductor Cables							



	4.3.1	Longitudinal Surges					
	4.3.2	Metallic Surges					
	4.4	AC Power Fault on Paired-Conductor Cables					
	4.4.1	Power Contact to Telecommunications OSP					
	4.4.2	Fault Induction From Electric Power Lines					
	4.5	Characterization of Test Generators					
R4-1 [26]	4.5	Characterization of Test Generators					Minimum Test Requirement
	4.6	Criteria for Equipment Interfacing With Telecommunications Ports					
	4.6.1	First-Level and Second-Level Criteria					
	4.6.2	Testing Conditions of Telecommunications Ports					
R4-2 [20]	4.6.2	Testing Conditions of Telecommunications Ports					This Requirement has been deleted
O4-3 [165]	4.6.2.4	Test Setup for Equipment Providing or Receiving Remote Power					
O4-4 [166]	4.6.2.4	Test Setup for Equipment Providing or Receiving Remote Power					
	4.6.3	Number of Samples To Be Tested					
	4.6.4	Fire Hazard Indicator for Second-Level Criteria					
	4.6.5	Short-Circuit Tests (Telecommunications Port)					
R4-5 [25]	4.6.5	Short-Circuit Tests (Telecommunications Port)					
	4.6.6	First-Level Lightning Surge Tests (Telecommunications Type 1, 3, and 5 Ports)					
R4-6 [27]	4.6.6	First-Level Lightning Surge Tests (Telecommunications Type 1, 3, and 5 Ports)					
R4-7 [167]	4.6.6.1	Equipment Ports with Secondary Protection					
	4.6.7	First-Level Lightning Protection Tests (Telecommunications Type 1, 3, and 5 Ports)					
O4-8 [133]	4.6.7	First-Level Lightning Protection Tests (Telecommunications Type 1, 3, and 5 Ports)					This Objective has been deleted



R4-9 [134]	4.6.7	First-Level Lightning Protection Tests (Telecommunications Type 1, 3, and 5 Ports)					
	4.6.8	Second-Level Lightning Surge Tests (Telecommunications Type 1, 3, and 5 Ports)					
R4-10 [29]	4.6.8	Second-Level Lightning Surge Tests (Telecommunications Type 1, 3, and 5 Ports) -					Equipment must be capable of resuming operation after a ±5000V lightning strike without replacement of components, manual rebooting, or human intervention.
R4-11 [168]	4.6.8.1	Equipment Ports with Secondary Protection					
	4.6.9	First-Level Intra-Building Lightning Surge Tests (Telecommunications Type 2 and 4 Ports)					
R4-12 [30]	4.6.9.1	Ports Connected to Unshielded Cables					Equipment must be capable of resuming operation after a ±5000V lightning strike without replacement of components, manual rebooting, or human intervention.
R4-13 [31]	4.6.9.1	Ports Connected to Unshielded Cables					Minimum Test Requirement
R4-14 [169]	4.6.9.1.1	Equipment Ports with Secondary Protection					Minimum Test Requirement
O4-15 [170]	4.6.9.2	Ports Connected to Shielded Cables					Minimum Test Requirement
R4-16 [171]	4.6.9.2	Ports Connected to Shielded Cables					Minimum Test Requirement
	4.6.10	First-Level AC Power Fault Tests (Telecommunications Type 1, 3, and 5 Ports)					
R4-17 [35]	4.6.10	First-Level AC Power Fault Tests (Telecommunications Type 1, 3, and 5 Ports)					
R4-18 [172]	4.6.10.1	Equipment Ports with Secondary Protection					
R4-19 [173]	4.6.10.1	Equipment Ports with Secondary Protection					



	4.6.11	Current-Limiting Protector Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
R4-20 [34]	4.6.11	Current-Limiting Protector Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
CR4-21 [135]	4.6.11	Current-Limiting Protector Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
CO4-22 [136]	4.6.11	Current-Limiting Protector Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
	4.6.12	Second-Level AC Power Fault Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
R4-23 [36]	4.6.12	Second-Level AC Power Fault Tests for Equipment To Be Located at Network Facilities (Type 1 Telecommunications Port)				
R4-24 [174]	4.6.12.1	Equipment Ports with Secondary Protection				
R4-25 [175]	4.6.12.1	Equipment Ports with Secondary Protection				
	4.6.13	Second-Level AC Power Fault Tests for Series-Type Non-Customer-Premises Equipment (Type 1 Telecommunications Port)				
R4-26 [37]	4.6.13	Second-Level AC Power Fault Tests for Series-Type Non-Customer-Premises Equipment (Telecommunications Port)				
	4.6.14	Fusing Coordination Tests for Network Equipment to be Located on Customer Premises (Type 3 and 5 Telecommunications Port)				
R4-27 [39]	4.6.14	Fusing Coordination Tests for Network Equipment to be Located on Customer Premises (Telecommunications Port)				
	4.6.15	Second-Level AC Power Fault Tests for Equipment To Be Located on Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Port)				
R4-28 [137]	4.6.15	Second-Level AC Power Fault Tests for Equipment To Be Located on Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Port)				
R4-29	4.6.15.1	Equipment Ports with Secondary Protection				



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R4-30 [177]	4.6.15.1	Equipment Ports with Secondary Protection				
R4-31 [138]	4.6.15.2	Test for Ungrounded Exposed Conductive Surfaces				
R4-32 [139]	4.6.15.2	Test for Ungrounded Exposed Conductive Surfaces				This Requirement has been deleted
	4.6.16	Second-Level AC Power Fault Tests for Series-Type Network Equipment to be Located on Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Port)				
R4-33 [140]	4.6.16	Second-Level AC Power Fault Tests for Series-Type Network Equipment to be Located on Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Port)				
	4.6.17	Second-Level Intra-Building AC Power Fault Tests for Network Equipment to be Located on Customer Premises (Type 4 Telecommunications Port)				
R4-34 [40]	4.6.17	Second-Level Intra-Building AC Power Fault Tests for Network Equipment to be Located on Customer Premises (Type 4 Telecommunications Port)				Minimum Test Requirement
R4-35 [125]	4.6.17	Second-Level Intra-Building AC Power Fault Tests for Network Equipment to be Located on Customer Premises (Type 4 Telecommunications Port)				Minimum Test Requirement
R4-36 [41]	4.6.17	Second-Level Intra-Building AC Power Fault Tests for Network Equipment to be Located on Customer Premises (Type 4 Telecommunications Port)				Minimum Test Requirement
	4.7	Lightning Protection Tests for Equipment To Be Located in High-Exposure Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Ports)				
CO4-37 [178]	4.7	Lightning Protection Tests for Equipment To Be Located in High-Exposure Customer Premises and OSP Facilities (Type 3 and 5 Telecommunications Ports)				
	4.8	Criteria for Equipment Interfacing With Agreed Primary Protection				
R4-38 [179]	4.8	Criteria for Equipment Interfacing With Agreed Primary Protection				Minimum Test Requirement
R4-39 [180]	4.8	Criteria for Equipment Interfacing With Agreed Primary Protection				Minimum Test Requirement



R4-40 [181]	4.8	Criteria for Equipment Interfacing With Agreed Primary Protection							Minimum Test Requirement
	4.9	Criteria for Equipment With Integrated Primary Protection							
R4-41 [182]	4.9	Criteria for Equipment With Integrated Primary Protection							
	4.9.1	Equipment Classification							
R4-42 [183]	4.9.1	Equipment Classification							
R4-43 [184]	4.9.1	Equipment Classification							
	4.9.2	Protector Requirements							
R4-44 [185]	4.9.2	Protector Requirements							
R4-45 [186]	4.9.2	Protector Requirements							
R4-46 [187]	4.9.2	Protector Requirements							
R4-47 [188]	4.9.2	Protector Requirements							
R4-48 [189]	4.9.2	Protector Requirements							
R4-49 [190]	4.9.2	Protector Requirements							
	4.9.3	Lightning Surge and Power Fault Tests for Protected Circuits							
R4-50 [191]	4.9.3	Lightning Surge and Power Fault Tests for Protected Circuits							
R4-51 [192]	4.9.3.1	Overcurrent Protection Coordination Test for Protected Circuits							
	4.9.4	Fusing Coordination Test for Circuits Suitable for Fusing							
R4-52 [193]	4.9.4.1.1	Fusing Coordination Test for Circuits Suitable for Fusing							
R4-53 [194]	4.9.4.1.2	Enclosure Suitable for Fusing							



R4-54 [195]	4.9.4.1.2	Enclosure Suitable for Fusing					
R4-55 [196]	4.9.4.1.2	Enclosure Suitable for Fusing					
R4-56 [197]	4.9.4.1.2	Enclosure Suitable for Fusing					
R4-57 [198]	4.9.4.1.2	Enclosure Suitable for Fusing					
R4-58 [199]	4.9.4.2	Fusing Coordination Test for Circuits Not Acting as Fuse Links					
	4.9.5	Dielectric Withstand					
R4-59 [200]	4.9.5	Dielectric Withstand					
	4.9.6	Stub Cable Requirements					
R4-60 [201]	4.9.6	Stub Cable Requirements					
R4-61 [202]	4.9.6	Stub Cable Requirements					
	4.9.7	AC Power Fault Immunity					
R4-62 [203]	4.9.7	AC Power Fault Immunity					
	4.9.8	Lightning Surge Tests					
R4-63 [204]	4.9.8	Lightning Surge Tests					
CR4-64 [205]	4.9.8.1	Lightning Surge Tests for Severe Climatic Conditions					
CR4-65 [206]	4.9.8.1	Lightning Surge Tests for Severe Climatic Conditions					
	4.10	Criteria for Equipment Interfacing With Coaxial Cable Ports					
R4-66 [94]	4.10	Criteria for Equipment Interfacing With Coaxial Cable Ports					
R4-67	4.10	Criteria for Equipment Interfacing With Coaxial Cable Ports					



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R4-68 [96]	4.10	Criteria for Equipment Interfacing With Coaxial Cable Ports				
R4-69 [97]	4.10	Criteria for Equipment Interfacing With Coaxial Cable Ports				
	4.10.1	Number of Samples To Be Tested				
	4.10.2	Short-Circuit Tests				
R4-70 [99]	4.10.2	Short-Circuit Tests				
	4.10.3	Broadband Communications Equipment Intended for Use Without External Protectors				
R4-71 [100]	4.10.3	Broadband Communications Equipment Intended for Use Without External Protectors				
R4-72 [101]	4.10.3	Broadband Communications Equipment Intended for Use Without External Protectors				
CR4-73 [102]	4.10.3	Broadband Communications Equipment Intended for Use Without External Protectors				
R4-74 [103]	4.10.3.1	First Level Lightning and Power Fault Tests				
R4-75 [104]	4.10.3.2	Second-Level Lightning and Power Fault Tests				
R4-76 [105]	4.10.3.2	Second-Level Lightning and Power Fault Tests				
O4-77 [106]	4.10.3.2	Second-Level Lightning and Power Fault Tests				
R4-78 [107]	4.10.3.2	Second-Level Lightning and Power Fault Tests				
	4.10.4	Broadband Communications Equipment Intended for Use With an External Protector				
R4-79 [108]	4.10.4.1	First-Level Lightning and Power Fault Tests				
R4-80	4.10.4.2	Second-Level Lightning and Power Fault Tests				



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R4-81 [110]	4.10.4.2	Second-Level Lightning and Power Fault Tests				
O4-82 [111]	4.10.4.2	Second-Level Lightning and Power Fault Tests				
R4-83 [112]	4.10.4.2	Second-Level Lightning and Power Fault Tests				
	4.10.5	First-Level Intrabuilding Surge Tests				
O4-84 [207]	4.10.5	First-Level Intrabuilding Surge Tests				Minimum Test Requirement
R4-85 [208]	4.10.5	First-Level Intrabuilding Surge Tests				Minimum Test Requirement
	4.10.6	Additional Criteria for Equipment Intended for the OSP				
R4-86 [113]	4.10.6	Additional Criteria for Equipment Intended for the OSP				Minimum Test Requirement
R4-87 [114]	4.10.6	Additional Criteria for Equipment Intended for the OSP				Minimum Test Requirement
	4.11	Lightning Criteria for Equipment Interfacing With Antennas				
R4-88 [209]	4.11	Lightning Criteria for Equipment Interfacing With Antennas				
	4.12	Lightning Criteria for Equipment Interfacing With AC Power Port(s)				
R4-89 [210]	4.12	Lightning Criteria for Equipment Interfacing With AC Power Port(s)				
	4.12.1	Equipment Used in Facilities With an External SPD				
R4-90 [32]	4.12.1	Equipment Used in Facilities With an External SPD				Minimum Test Requirement
R4-91 [33]	4.12.1	Equipment Used in Facilities With an External SPD				Minimum Test Requirement
	4.12.2	Equipment Used in Facilities Without an External SPD				
R4-92 [211]	4.12.2	Equipment Used in Facilities Without an External SPD				Minimum Test Requirement
	4.13	Lightning Criteria for Equipment Interfacing With DC Power Port(s)				



	4.13.1	Tests Directly on DC Power Ports					
CO4-93 [212]	4.13.1	Tests Directly on DC Power Ports					
	5	Steady-State Power Induction					
	5.1	Overview					
	5.2	Longitudinal Induction Criteria for Long (>20 kft) Loops					
	5.2.1	Longitudinal Induction Test Circuit for Long (>20 kft) Loops					
	5.2.2	Calibration Procedure					
	5.2.3	Test Procedures					
	5.2.4	Performance Criteria					
R5-1 [42]	5.2.4	Performance Criteria					
CR5-2 [43]	5.2.4	Performance Criteria					
	5.2.5	Noise Performance for Voiceband Circuits					
R5-3 [44]	5.2.5	Noise Performance for Voiceband Circuits					
CR5-4 [45]	5.2.5	Noise Performance for Voiceband Circuits					
	5.3	Longitudinal Induction Criteria for Short (<20 kft) Loops					
	5.3.1	Longitudinal Induction Test Circuit for Short (<20 kft) Loops					
	5.3.2	Calibration Procedure					
	5.3.3	Test Procedures					
R5-5 [46]	5.3.3.1	Test Procedure for ISDN Technology					
	5.3.4	Performance Criteria					
R5-6 [47]	5.3.4	Performance Criteria					
	5.3.5	Noise Performance for Voiceband Circuits					
R5-7 [48]	5.3.5	Noise Performance for Voiceband Circuits					



	5.4	Longitudinal Induction Criteria for Analog Trunks					
	5.4.1	Longitudinal Induction Test Circuit for Trunks					
	5.4.2	Calibration Procedure					
	5.4.3	Test Procedure					
	5.4.4	Performance Criteria					
R5-8 [49]	5.4.4	Performance Criteria					
CR5-9 [50]	5.4.4	Performance Criteria					
	5.4.5	Noise Performance for Voiceband Circuits					
R5-10 [51]	5.4.5	Noise Performance for Voiceband Circuits					
CR5-11 [52]	5.4.5	Noise Performance for Voiceband Circuits					
	5.5	Longitudinal Induction Criteria for Coaxial Cables					
	5.5.1	Longitudinal Induction Test Circuit for Coaxial Cables					
	5.5.2	Test Procedure					
	5.5.3	Performance Criteria					
R5-12 [141]	5.5.3	Performance Criteria					
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